

COMPUDIL MANUAL

Every effort has been made to make your COMPUDIL easy to use and understand. It is recommended that this instruction manual is read totally before operating the instrument, and then reference can be made to the various sections whilst obtaining hands-on experience.

Examples are provided for all functions using both text and flow diagrams. These may be used separately or together as required.

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FRONT PANEL

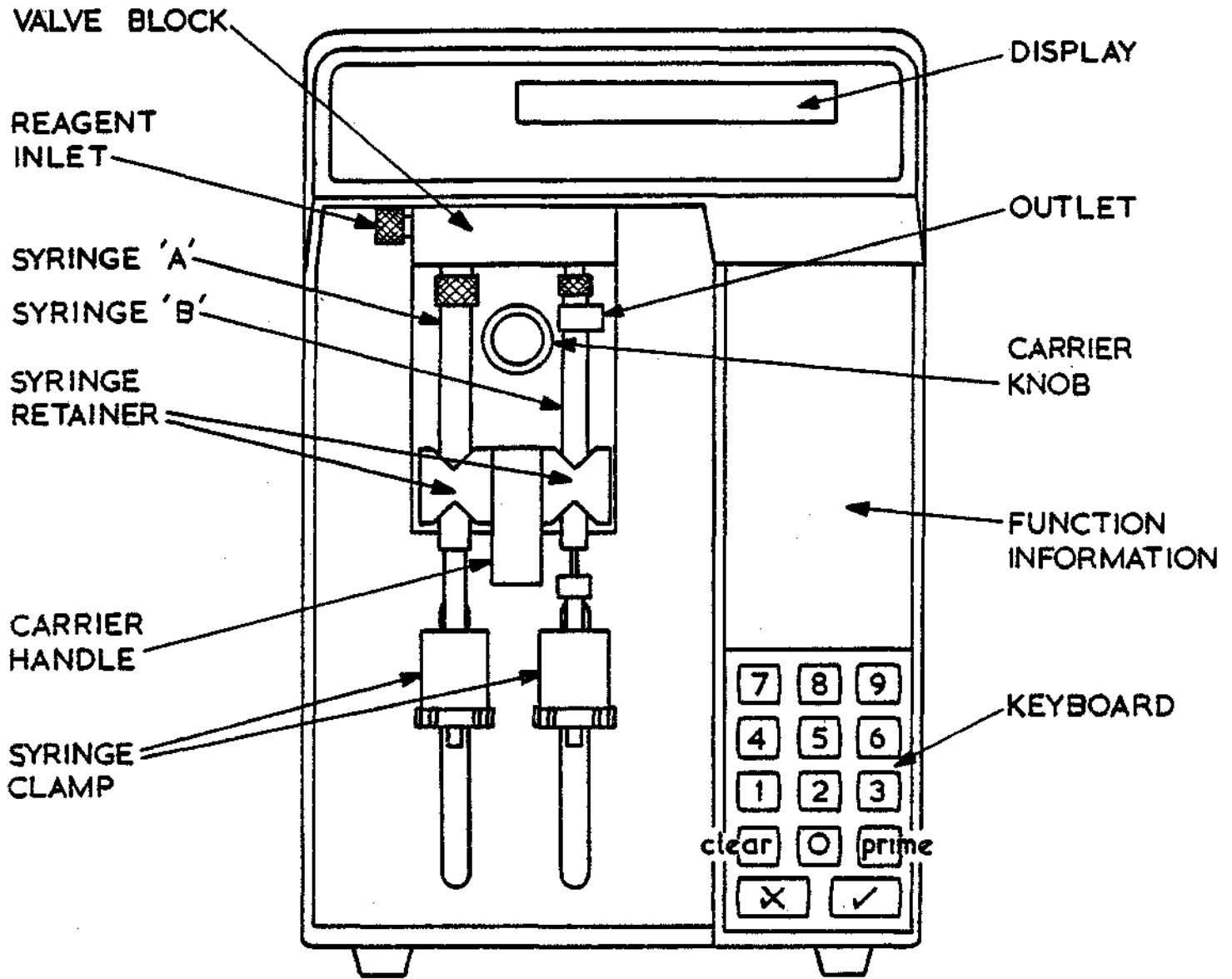


Fig. 1

INTRODUCTION

- * The COMPUDIL can be programmed by the user to perform any of the following functions:- *
 - 1 Dilute
 - 2 Dilute with Airgap
 - 3 Dilute with 2 Reagents
 - 4 Dilute with 2 Reagents and Airgaps
 - 5 Dispense
 - 6 Titrate
 - 7 Pipette
 - 8 Distribute
-
- * The COMPUDIL is computer operated and any values can be selected to be written into 21 programmes. These programmes can be erased easily and rewritten when necessary. *
 - * A choice of 3 sample and 3 diluent syringes is available to give a wide range of ratios, volumes and speed selection. *
 - * The action of the syringes is such that the sample is always emptied slightly ahead of the diluent to provide maximum "wash through" no matter what volumes are selected. *
 - * The keyboard operation has been reduced to the minimum and an interactive display gives prompts for error free simple operation. *
 - * The COMPUDIL is self checking and will automatically reject unacceptable values. Faulty operations are signalled by 'error' displays. *
 - * Operation is via a light weight handset with a 'liquid dispense' warning light, or a footswitch for handfree operation. *
 - * Facilities for priming before use, and emptying afterwards to save valuable reagents are selectable. *
 - * All programmes are retained without battery back-up even when the power is switched off. *
 - * An RS 232 link is available for remote programming and operation by other computers. *

SECTION 1

INSTALLATION

- 1.1 Unpacking
- 1.2.1 Voltage Selection
- 1.2.2. Fuse selection
Voltage Selector Drawing
- 1.3.1. Cassette Tubing
- 1.3.2. Handset Tubing
- 1.3.3. Handset Park Support
- 1.4 Initialisation

SECTION 1

INSTALLATION

1.1 UNPACKING ✓

Check that the carton and its contents have not been damaged in transit. If damage has occurred do not use the instrument and inform your supplier or Hook & Tucker Instruments Limited immediately.

The carton should contain the following items:-

1. CompuDil Instrument
2. Instruction Manual
3. Cassette with 2 syringes fitted (see note below)
4. Handset
5. Handset park support and screws
6. Power Cable
7. 60 cm x 1.6 mm inlet tubing
8. 60 cm x 1.6 mm outlet tubing with fixing nut
9. 60 cm x 0.76 mm outlet tubing with fixing nut
10. Outlet nozzle for 0.76 mm outlet tubing
11. 2 spare fuses (see paragraph 1.2.2)
12. Hexagonal key for syringe adjustment.

Note

The standard cassette is fitted with a 0.1ml sample syringe and a 2.5ml diluent syringe.

These syringes may be substituted with other sizes if they have been specified at the time of order.

VOLTAGE SELECTION & LINE FUSES

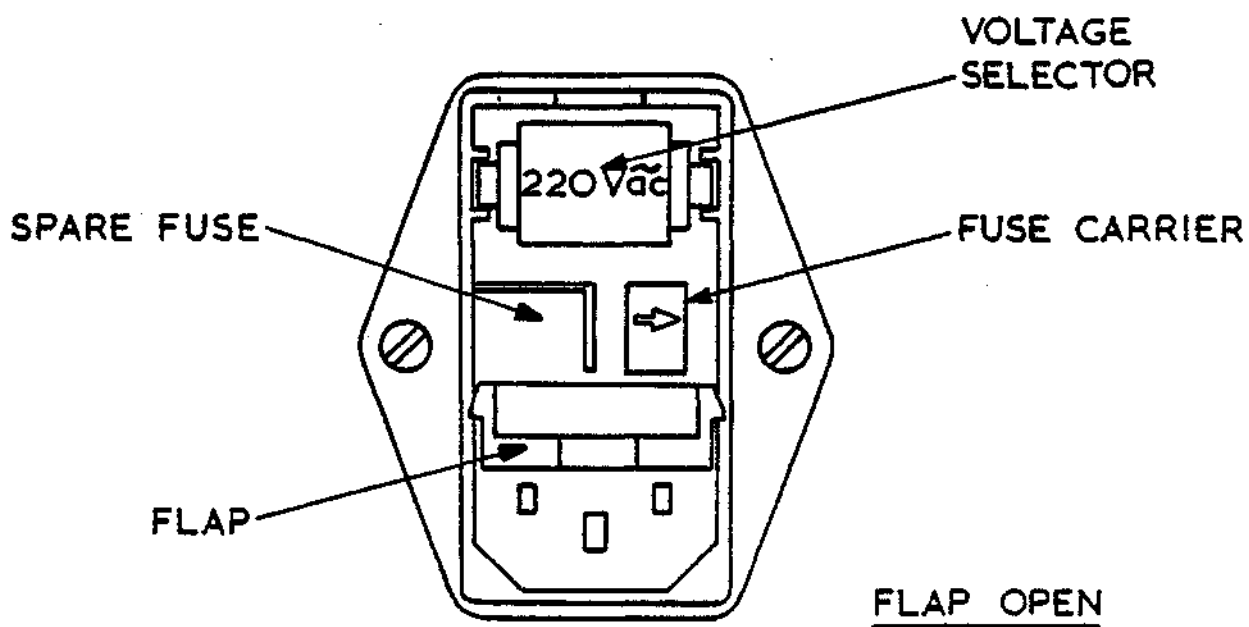
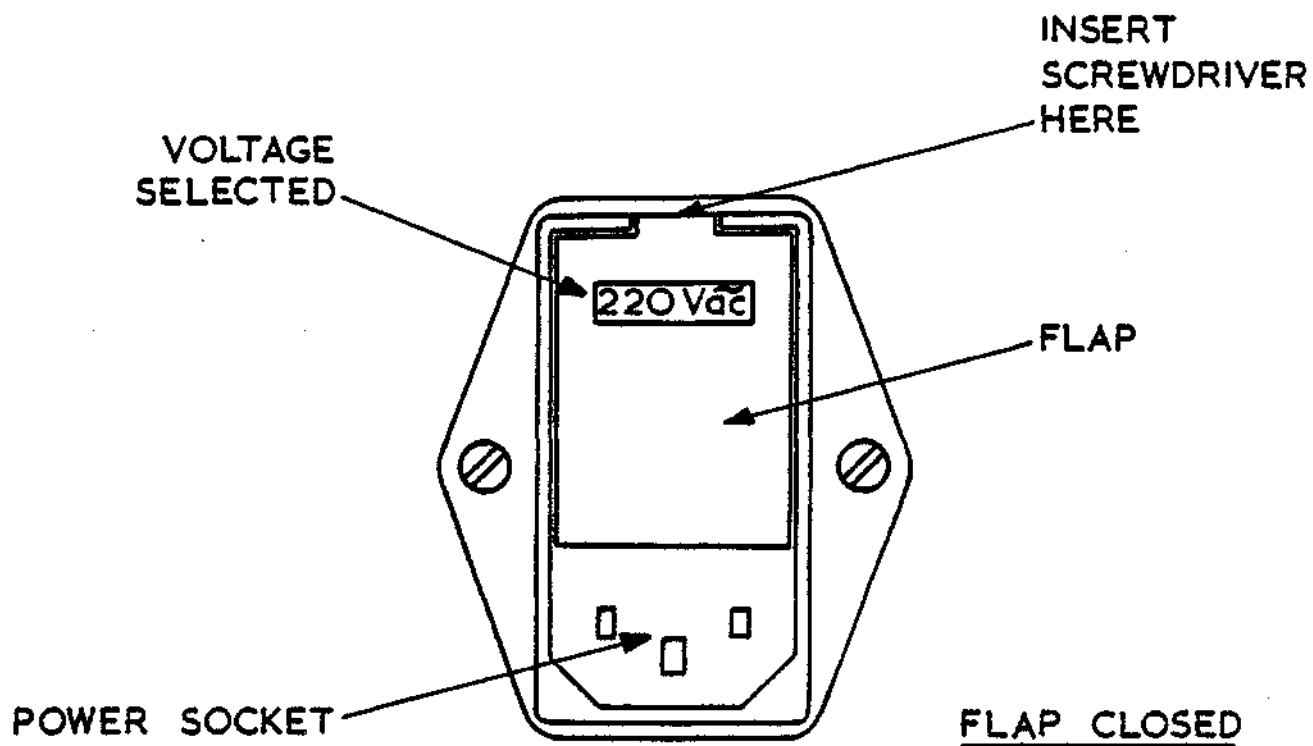


Fig. 2

1.2.1. VOLTAGE SELECTION

Power to the COMPUDIL is supplied via a moulded plug and lead to the power socket at the rear of the instrument. This socket incorporates a voltage selector, line fuse and a built-in interference filter.

The COMPUDIL will operate from the following voltages:-
100/110/220/240v AC at 50/60Hz.

The selected voltage can be read through the flap cover. See Fig.2.

To adjust the voltage selector to suit local power supplies:

- a) Remove the moulded power plug
- b) Gently lever open the flap in the socket by inserting a screw driver blade into the top, above the voltage reading.
- c) Twisting the screw driver will force the flap to swing downwards, revealing the fuse carrier and selector.
- d) Pull out the voltage selector gently, rotate it so that the correct voltage can be read through the flap window, then re-insert.
- e) Close the flap and reconnect the moulded power plug.

1.2.2 LINE FUSE

The COMPUDIL is protected by two fuses:-

- 1) AC Line fuse rating 1 amp at 240 volts. A 2 amps fuse is required for 100/110 volts operation.
- 2) DC 5v fuse rating 2 amps slow blow.

The AC fuse can be reached by following steps a-c above; then:-

- d) Slide out the carrier from the right hand slot. Replace the cartridge fuse with a correctly rated fuse.
- e) Slide the carrier back into the slot observing that the arrow on the carrier must point in the same direction as the arrow on the inside of the flap.
- f) Close the flap and replace the moulded plug.

The DC fuse can be reached only by opening the COMPUDIL. See the servicing directions for details.

Note:-

A spare AC fuse is located in the recess on the left side of the voltage selector.

1.3 TUBING

WARNING

Great care must be taken when handling the cassette as the syringes are delicate and break easily.

1.3.1 CASSETTE TUBING

As the performance of the COMPUDIL depends upon the correct selection of tubing it is advisable to refer to section 2.6

The COMPUDIL is normally delivered with the 0.76 mm tubing attached to the handset. Connect this tubing to the outlet on syringe B. Do not use force to tighten the nut as it needs to be finger tight only.

Connect the inlet tubing to the left side of the valve block. Note that this tubing should pass through an 'O' ring inside the gland nut and then be inserted 5 mm into the threaded section of the valve. Use finger pressure only to tighten the gland nut.

1.3.2. HANDSET TUBING

To change the size of the outlet tubing the handset must be dismantled as follows:-

1. Unscrew the nozzle from the bottom of the probe.
2. Unscrew the feed through knob from the top of the probe.
3. Separate the two halves of the handset and remove the original tubing.
4. Remove and save the rubber 'O' ring that fits on the tube inside the handset.
5. Gently remove the original tubing, through the feed-through knob and the bands on the handset lead.
6. Feed the new tubing back into the handset in the same manner.
7. Refit the correct size 'O' ring onto the tube so that it fits into the space provided at the lower end of the handset printed circuit board.
8. Re-assemble the handset making sure not to overtighten the end pieces.

1.3.3. HANDSET PARK SUPPORT

To fit the handset park support remove the cover of the COMPUDIL by unscrewing the 4 chromium screws on the sides of the instrument.

The park support should be mounted so that the handset hangs vertically.

Mount the park support using the screws provided and the pre-drilled holes on the side nearest the keyboard so that the screws cannot be seen from above.

The 5 pin DIN plug on the handset lead is inserted into the matching socket on the rear of the COMPUDIL.

1.4 INITIALISATION

Your COMPUDIL has been carefully checked and tested before delivery and consequently may contain some of the factory test programmes within its memory.

It is advisable to remove all these before attempting to write or run your own programmes.

These test programmes can be cleared without the use of a cassette as follows:-

1. Check that the voltage selector at the rear of the instrument matches the local power supply.
2. Plug the power cable into the rear of the COMPUDIL.
3. Switch on the COMPUDIL by pressing down the rocker switch at the rear of the instrument.
4. Select the first programme by pressing number "1" on the keyboard and the display will read PROGRAM ? 1.
5. Press the "CLEAR" key on the keyboard and the display will change to read "CLEAR ? 1."
6. Press the keyboard "✓" sign and the display will return to showing PROGRAM ? 0.
7. Repeat steps 4, 5 and 6 selecting each of the programmes from 2 through to 21 in turn.
8. Switch off and read the remainder of this instruction manual.

SECTION 2

- 2.1 Controls
- 2.2 Definitions
- 2.3 Functions
- 2.4 Error Messages
- 2.5 Display Format
- 2.6 Speed and Tubing Selections
- 2.7 Minimum Volume and Steps
- 2.8 Accuracy and Speed Considerations
- 2.9 Operational Aids
- 2.10 Flammable Liquids

KEYBOARD

This consists of 14 buttons arranged as follows:-
figures (0-9),
prime,
clear,
yes/ok/proceed (✓)
no/wrong (✗)

Figures (0-9)

These are used for :-
a) selecting the functions
b) selecting the programmes
c) entering values

Prime

This is used to :-
a) jump from read to run
b) start and stop priming

Clear

This is used solely to erase complete programmes.

Yes (✓)

This is used for :-
a) accepting what is written on the display
b) to proceed
c) to jump into the emptying cycle from run

No. (✗)

This is used for :-
a) rejecting what is written on the display
b) to return to the start position

HANDSET

This supports 2 sizes of outlet tubing and incorporates:-
a) a switch/button that will signal the COMPUDIL to operate once a programme has been selected. Note that the switch must be released between operations.
b) a warning lamp that indicates when liquid will be dispensed from the outlet tubing.
The Handset must be connected to the 5 pin socket at the rear of the COMPUDIL.

FOOTSWITCH

This replaces the handset when hand-free operation is required. In this case the handset may be clamped to a stand but the warning light is inoperative as the Footswitch uses the same socket as the Handset.

DISPLAY

This combined with the keyboard provides an interactive series of prompts and statements so that the operator can monitor each step of the programming and operation of the COMPUDIL.

- a) question marks indicate that a yes, no or value is to be entered.
- b) statements are normally followed by (=) and usually require a proceed (✓) command.

See flow charts section for exact details.

DEFINITIONSSYR A = Syringe A

This is the left hand syringe and is used as follows:-

- a) as the diluent syringe on any dilute function
- b) as the waste/wash syringe on the pipette and distribute functions
- c) as the sole syringe on dispense and titrate functions

The following size syringes are acceptable:-

5000uL (5ml) 2500uL (2.5ml) 1000uL (1ml)

SYR B = Syringe B

This is the right hand syringe and is used as follows:-

- a) as the sample syringe on any dilute function
- b) as the dispensing syringe on the pipette function
- c) as the pick-up and dispensing syringe in the distribute function

The following size syringes are acceptable:-

250uL (0.25ml) 100uL (0.1ml) 50uL (0.05ml)

VOL A1

This is the volume of liquid to be aspirated by syringe A.

VOL A2

In the TITRATE function this is the volume of each aliquot required from the total volume aspirated.

VOL B1

This is the first volume of liquid to be aspirated by syringe B on a dilute programme, or dispensed on a pipette programme, or the total volume aspirated for a distribute programme

VOL B2

This is the second volume of liquid to be aspirated by syringe B on dilute functions 3 and 4 only. It is also the volume of each aliquot required in the distribute function.

AIR

This is the volume of air required to separate 2 liquids on a dilute programme. It can be used in 2 manners:-

- a) as an AIRGAP to separate two samples.
- b) as a SUCKBACK to remove any droplet of liquid remaining on the tubing at the end of a dilute cycle.

SPEED

This is the delivery rate of the syringes on any programme and is selected according to the viscosity of the liquids involved, the size of the syringe and the diameter of tubing.

Speed 1 Fastest speed = approx 3 seconds full stroke
Speed 9 Slowest speed = approx 10 seconds full stroke

PRIME

This is the continuous operation of both syringes over their full strokes to clear the fluid lines of air bubbles prior to using a programme. Liquid will be dispensed from the outlet tubing during PRIMING.

EMPTY

This is the operation of syringe A only over its full stroke, to return any liquid back to the reagent reservoir to avoid wastage of expensive liquids.

CLEAR

This is the procedure to erase a programme from the COMPUDIL memory. Once accepted the action is irrevocable. It is necessary to clear a programme before another can be written in the same place.

DIST = Distribute Volume

This is the volume of liquid that will be dispensed upon each operation of the handset button or footswitch in a distribute programme only.

FUNCTION DESCRIPTIONSFUNCTION 1. DILUTE

- Step 1) The COMPUDIL will pick up the Sample volume with syringe B and the Diluent volume with syringe A and stop.
- 2) Both volumes will then be Dispensed together, and then stop.

FUNCTION 2. DILUTE WITH AIR

- Step 1) Syringe B will automatically suck an air bubble into the outlet tubing and stop.
- 2) The Sample volume will be picked up by syringe B and the Diluent volume by syringe A and then stop.
- 3) Both volumes will be dispensed together, and then after a short delay syringe B will aspirate an air bubble. Steps 2 + 3 are then repeated.

FUNCTION 3. DILUTE 2

- Step 1) The COMPUDIL will pick up the first Sample volume with syringe B and the Diluent volume with syringe A and stop.
- 2) The second Sample volume (or second reagent) will then be picked up by syringe B and stop.
- 3) All three volumes will be dispensed together and then stop.

FUNCTION 4 DILUTE 2 WITH AIRGAPS.

- Step 1) Syringe B will automatically suck an air bubble into the outlet tubing and stop.
- 2) The first Sample volume will then be picked up by syringe B and the Diluent volume by syringe A and stop.
- 3) A second air bubble will be then sucked into the outlet tubing to separate the two samples and stop.
- 4) The second Sample volume (or second reagent) will be picked up by syringe B and stop.
- 5) Both volumes from syringe B and the Diluent volume will be dispensed together.
The COMPUDIL will automatically return to step 1 above.

NOTE:

In the Dilute functions, syringe B (Sample) will always finish before syringe A no matter what volumes have been selected. This applies only when syringes are discharging but not when filling.

FUNCTION 5. DISPENSE

- Step 1) The COMPUDIL will automatically fill syringe A with the required volume via the Reagent Inlet Tubing and stop.
- 2) This volume will then be dispensed and the COMPUDIL will re-fill syringe A and return to step 2.

FUNCTION 6. TITRATE

- Step 1) Syringe 'A' aspirates via the Reagent Inlet tubing and then stops.
- 2) With each subsequent operation of the COMPUDIL an aliquot will be delivered by partial movement of syringe A. This will continue until syringe A is empty or until the correct aliquot volume is not available.
- 3) Further operation of the handset switch will cause syringe A to refill.

FUNCTION 7. PIPETTE

- Step 1) The combined volumes of syringes A and B will be aspirated via the outlet tubing and then stop.
- 2) Syringe B volume will then be dispensed via the outlet tubing, whilst syringe A will dispose its volume to waste via the reagent inlet tubing and stop.

FUNCTION 8. DISTRIBUTE

- Step 1) The COMPUDIL will automatically fill syringe A with wash liquid and the total volume of the Sample to be distributed will be aspirated by syringe 'B'.
- 2) Upon each operation of the handset switch the distribute volume will be dispensed by syringe B through the outlet tubing and stop.
- This will continue until syringe B is empty or cannot supply the correct aliquot volume. The COMPUDIL will then empty syringe A to wash the fluid lines before returning to step 1. Wash liquid is discharged by Syringe A through the outlet tubing.

ERROR MESSAGES

Any errors detected by the COMPUDIL will be displayed with the word "ERROR" followed by a number.

Errors 1, 2, and 3 will be shown for a couple of seconds and then the display will repeat the preceding question.

Errors 4 and 5 will be flashed continually to gain the operators attention.

The errors are specified below:-

ERROR 1 "SYRINGES"

This means the syringe size entered into the programme is not one of the standard types available for use with this instrument.

The following syringe sizes are standard:-

| | | | | |
|-----------|---------|--------|--------|--------|
| Syringe A | Diluent | 1000uL | 2500uL | 5000uL |
| Syringe B | Sample | 50uL | 100uL | 250uL |

ERROR 2 "VOLUMES"

This will be displayed when the selected volume exceeds the size of the syringe.

Select a different syringe or an alternative volume. The display will return automatically for re-selection of a new volume.

ERROR 3 "COMBINED VOLUMES"

This is displayed when the combined volumes selected for the B syringe (Sample) exceed the size of the syringe. This applies only to functions 2 and 4.

The display will return automatically to the first volume entered for re-selection.

In programmes involving an airgap or suckback the maximum total volume permitted is 115% of the syringe nominal volume, but total liquid volumes cannot exceed 100% of the syringe nominal volume.

ERROR 4 "SYSTEM FAULT"

This error will occur if the computer itself fails to assess the information correctly.

It will be necessary to disconnect the power and restart the COMPUDIL.

If this fault re-occurs after two or three attempts, switch off and refer the problem to your supplier.

ERROR 5 "OVERLOAD"

This occurs if either of the motors stalls (due to overloading) indicating that the measurement is incorrect. This will usually be due to selecting a speed that is too fast or by a blockage causing excess pressure in the fluid lines.

The cure is to select a slower speed of delivery and clear any blockages.

DISPLAY FORMATSWRITING

The following are some of the displays that will be encountered when writing a programme:-

| FUNCTION | DISPLAY | MEANING |
|----------|-------------|--|
| 1 | Dilute | Dilute One Sample |
| 2 | Dil & Air | as above but with Suckback (air bubble) |
| 3 | Dilute 2 | Dilute with 2 reagents |
| 4 | Dil 2 & Air | as above but with 2 airgaps |
| 5 | Dispense | Dispense |
| 6 | Titrate | Deliver multiple aliquots |
| 7 | Pipette | Transfer a single sample with excess used as wash. |
| 8 | Distribute | Transfer aliquots of a sample with a final wash |

READING

A different type of display will be encountered when reading a programme. In general the following format has been adopted:-

PROGRAMME TYPE = SAMPLE VOLUME/S + DILUENT VOLUME.

The following examples are typical :-

| <u>FUNCTION</u> | <u>PROG</u> | <u>TYPE</u> | <u>SAMPLE 1</u> | <u>SAMPLE 2</u> | <u>DILUENT</u> | <u>COMMENT</u> |
|-----------------|-------------|-------------|-----------------|-----------------|----------------|----------------|
| 1 | DIL | = | 25 | | + 750ml | |
| 2 | DIL A | = | 25 | | + 750ml | with airgap |
| 3 | DIL | = | 50 | + 25 | + 750ml | |
| 4 | DIL A | = | 50 | + 25 | + 750ml | with airgaps |
| 5 | DISP | = | | | 750ml | |
| 6 | | | | | | |
| 7 | PIP | = | 50 | | + 500ml | |
| 8 | DIST | = | 500 | | 50ml | |

Note the difference between DIL for DILUTE and DIL A for DILUTE with AIRGAP.

2.6 SPEED & TUBING SELECTION

The selection of a speed for any syringe depends upon:-

- a) the viscosity of the liquid
- b) the diameter of the tubing used
- c) the length of the tubing being used (both inlet and outlet)
- d) the condition of the outlet tip
- f) the tightness and age of the syringe piston.

The following maximum speeds are recommended for syringe A with 2 sizes of tubing. The size of syringe B does not normally affect the COMPUDIL'S operation.

0.76mm outlet tubing

| SYRINGE 'A' | SPEED | | | | | | | | |
|-------------|-------|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1.0ml | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.5ml | X | O | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5.0ml | X | X | X | X | X | X | X | X | X |

1.6mm outlet tubing

| SYRINGE 'A' | SPEED | | | | | | | | |
|-------------|-------|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1.0ml | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.5ml | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5.0ml | X | O | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Where :-

- 1 = OK to be used
- O = Check if satisfactory before using routinely
- X = Not to be used

The above speeds are a general guide only and apply to aqueous solutions. Lower speeds will be essential for higher viscosity or density liquids.

Speed 1 will give a full stroke in approx 3 seconds
Speed 9 will give a full stroke in approx 10 seconds

Any intermediate speed may be used but it is generally advisable to select a speed as fast as convenient for splash free operation.

e.g. If a 2.5ml diluent syringe is being used with a 0.1ml sample syringe the maximum speed is number 3 when 0.76mm diameter outlet tubing is used. However, this can be increased to speed 1 when 1.6mm diameter outlet tubing is used.

When large diluent syringes are used at the faster speeds it is possible that "air-bubbling" may occur during aspiration. In this case use a programme with a slower speed.

It should be noted that speed 9 is particularly slow and the heat generated by each drive motor is considerably increased at this speed. Avoid prolonged use at speed 9. Overheating will cause a significant reduction in precision and accuracy: it can also harm the instrument.

2.7

MINIMUM VOLUME AND STEPS

2.7.1 STEPS AND RESOLUTION

The full stroke of a syringe is divided into 1000 steps, therefore the resolution of each syringe is different:-

| | | | | | | |
|---|------|----|-------|---------|---|-------|
| 1 | step | on | 1ml | syringe | = | 1uL |
| 1 | step | on | 2.5ml | syringe | = | 2.5uL |
| 1 | step | on | 5ml | syringe | = | 5uL |

2.7.2. ROUNDING UP OF STEPS

If the COMPUDIL is programmed to give a volume that is part of a step, the computer will automatically round-up the volume to the next full step:

201uL programmed on a 1ml syringe will give 201uL
201uL programmed on a 2.5ml syringe will give 202.5ml
201uL programmed on a 5ml syringe will give 205uL

2.7.3 MINIMUM VOLUMES

It is advisable to keep the minimum volume from any syringe to 1% of full volume ie 10 steps.

| <u>Syringe</u> | <u>Minimum volume</u> |
|----------------|-----------------------|
| 5ml | 50uL |
| 2.5ml | 25uL |
| 1ml | 10uL |
| 0.25ml | 2.5uL |
| 0.1ml | 1uL |
| 0.05ml | 1uL |

With these points in mind any volume from minimum to full syringe can be programmed into the COMPUDIL, the computer automatically rounding up to the nearest full step. Rounding up applies only to syringes larger than 1ml.

2.8 ACCURACY AND SPEED CONSIDERATIONS

A full syringe is inherently more accurate than a partially filled one due to the tolerance within the system.

Therefore a more accurate result will be obtained by using the smallest syringe for the volume required.

However, a full syringe will take 3 to 9 seconds to fill or empty.

A partially filled syringe will take a percentage of the full time to fill or empty.

Therefore if speed is a greater priority than absolute accuracy a larger syringe is recommended.

e.g. 800uL from a 1000uL syringe set at speed 1
will take $3 \times 800/1000 = \text{approx } 2.5 \text{ seconds}$

800uL from a 2500uL syringe set at speed 1
will take $3 \times 800/2500 = \text{approx } 1 \text{ second}$

2.9

OPERATIONAL AIDS

2.9.1. BLEEPER

When the COMPUDIL finishes an action e.g. aspiration or dispense, an audible warning is given by a bleeper in the rear of the instrument. This sound will save the operator from continually watching the display to monitor the position. If this warning is not required, or found to be distracting, it can be switched off by pressing up the slide switch at the rear of the instrument beside the loudspeaker.

2.9.2. HANDSET LIGHT

A small light is situated in the handset to warn the operator that the next action of the COMPUDIL will be to dispense liquid via the handset probe.

The only exception to this is on the distribute programme. When all the sample has been distributed the next action will be to wash the probe and tubing with the liquid from syringe A. The handset light does NOT illuminate at this point even though liquid will be dispensed via the probe.

SECTION 3 OPERATION

- 3.1 Obtaining Start
- 3.2 Fitting a Cassette
 FIG 3
- 3.3 Syringe
- 3.4 Adjusting the Dead Volume
- 3.5 Clearing a Programme
- 3.6.1 Writing Programmes
- 3.6.2 Reading Programmes
- 3.6.3. Running Programmes

TO OBTAIN THE START POSITION

When initially switched on the COMPUDIL will automatically reset itself to the start position and display :-

(PROGRAM ? 0)

This display indicates that the COMPUDIL can be directed into one of the four main sequences:-

- a) Clearing = Erasing an existing programme no longer required
- b) Reading = Check the parameters of an existing programme.
- c) Writing = Creating a new programme in a cleared space.
- d) Running = Using an existing programme

In the CLEARING sequence pressing (X) once returns the COMPUDIL to start position without erasing a programme.

In the READING sequence pressing (X) once returns the COMPUDIL to the start position.

In the WRITING sequence pressing (X) twice always returns the COMPUDIL to the start position. The abandoned/incomplete programme will not be accepted as written.

The RUNNING sequence can be terminated only at the start of an operation (ie when the syringes are at the starting position for the function being used). At this point pressing (X) once will bypass the emptying sequence and return the COMPUDIL to the start position.

If the (✓) or (X) is pressed during mid cycle the COMPUDIL will remember it and obey the command at the next appropriate position. The (✓) will automatically put the COMPUDIL into its emptying routine, and the (X) will automatically bypass it and bring the instrument back to PROGRAM? 0.

In general pressing (X) once or twice will make the COMPUDIL return to the start position in most situations.

The three exceptions being:-

- 1) If prime has been initiated by pressing PRIME, then re-press this key to stop priming.
- 2) If the display shows "FUNCTION", press any number (8 or below followed by (X)).
- 3) When the COMPUDIL is in the running sequence. Press (X) followed by the handset button until (PROGRAM ? 0) is displayed.

CASSETTE REPLACEMENT

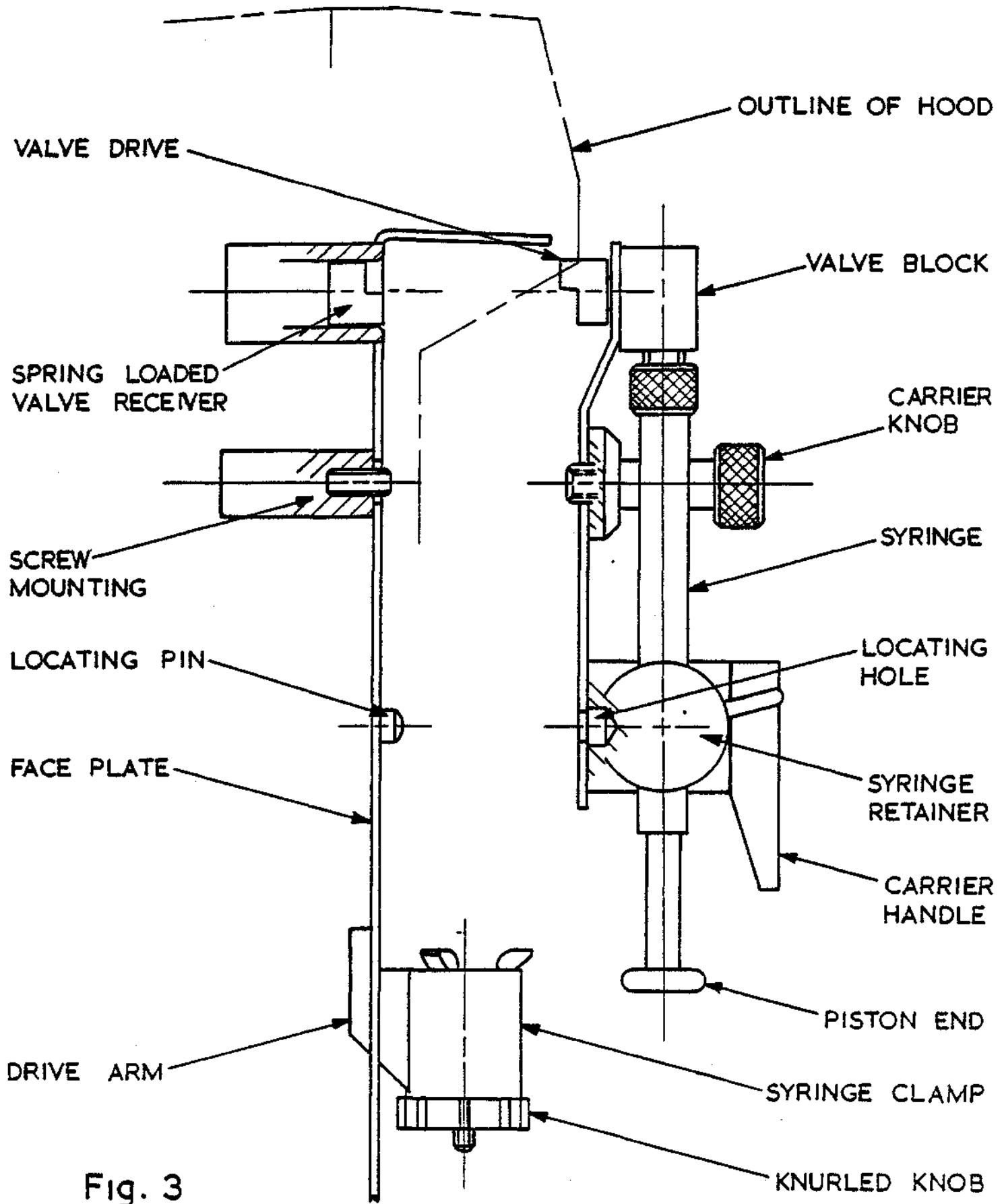


Fig. 3

FRONT PLATE SCREW

CASSETTE RETAINING SCREW

'D' COUPLING

CASSETTE LOCATING SPIGOT

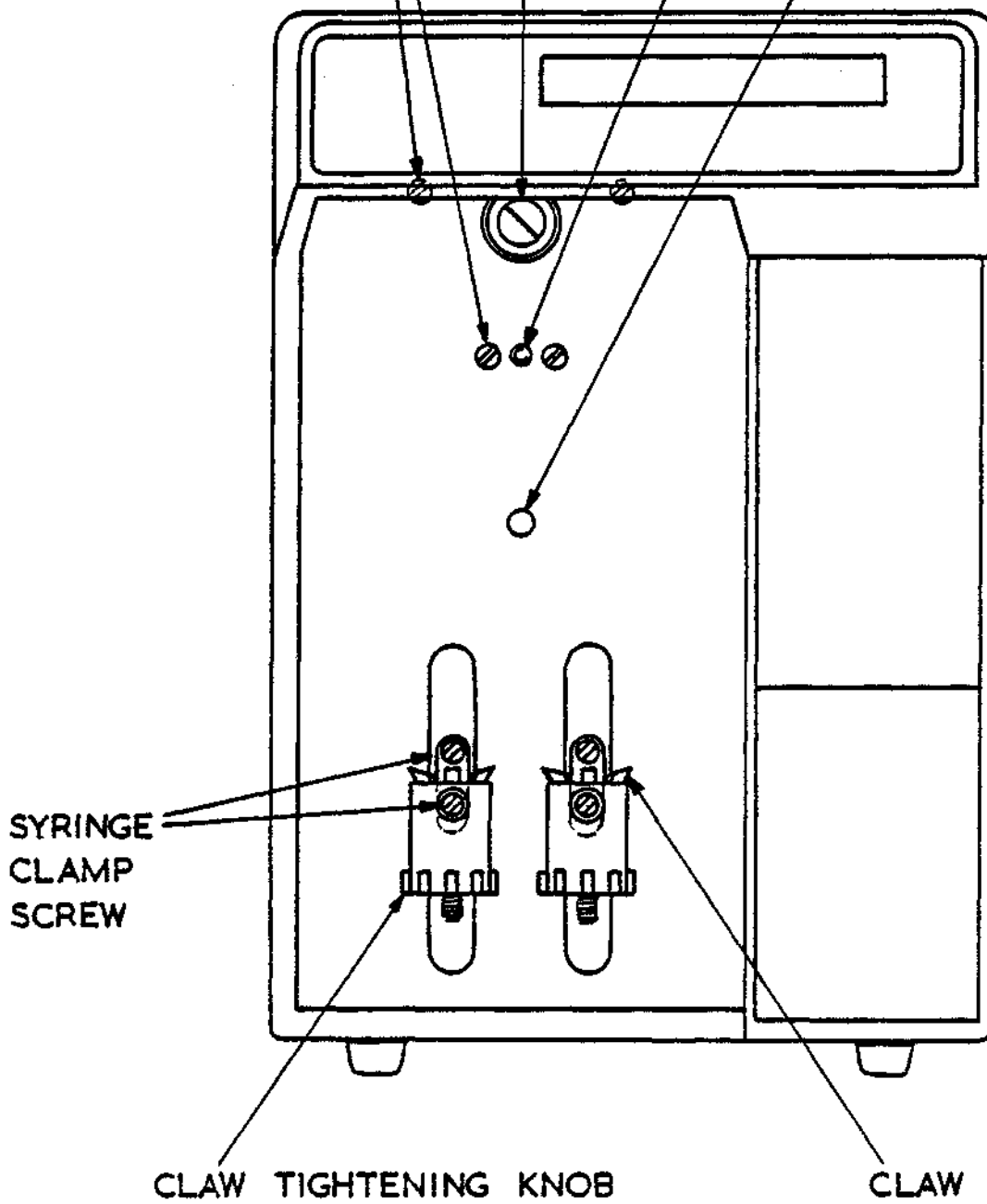


Fig. 4

3.2

FITTING A CASSETTE

1. Obtain the start position with the display showing PROGRAM ? 0.
2. Press (✓). The display will change to FIT CASSETTE and both syringes will drive down to their lowest positions.
3. Wait until the syringes have stopped.
4. Release each syringe clamp by gently unscrewing the captive knurled knob at the base of each clamp assembly.
5. Holding the cassette by the carrier handle and carrier knob, offer the assembly to the front panel at a slight angle so that the valve block goes just under the display, as the bottom of the cassette is held out.
6. Locate the valve drive into the spring loaded receiver. Do not attempt to turn the valve drive to the correct position as the COMPUDIL will correct itself automatically.
7. Gently push the carrier handle towards the face plate and insert the locating pin into the hole behind the carrier handle. Finger tighten the carrier knob. The stainless steel plate of the cassette must be flat against the painted front panel of the COMPUDIL.
8. Slide down each piston end into the clamps. Finger tighten both knurled knobs so that the piston ends are gripped firmly by the clamp assemblies.
9. Press (X) The pistons should drive upwards and stop. The display should read (PROGRAM? 0)

3.3

FITTING A SYRINGE TO A CASSETTE

THE SYRINGES ARE DELICATE AND MUST BE HANDLED WITH CARE

To replace a syringe the cassette must be removed from the COMPUDIL, see section 3.2.

Sample Syringe (B)

Carefully unscrew the knurled nut holding the syringe to the valve block. When the syringe is free, release the spring tension of the syringe retainer by turning the centraliser release downwards. This will enable the syringe to be removed upwards at an angle.

DO NOT use the syringe to turn the retainer.

Take care not to push the piston fully into the sample syringes as damage to the seal can occur, thus making the syringe leak.

Inserting the syringe is the reverse of the above procedure. Care must be taken not to cross-thread the syringe into the valve block. The syringe needs to be finger tight only.

Diluent Syringe (A)

The procedure here is the same as above except for the 5ml syringe.

On removing or inserting the 5ml syringe, the piston must be removed first and re-inserted last. When replacing the piston ensure that it is clean and take care not to damage it otherwise leakage will occur.

3.4

ADJUSTING THE DEAD VOLUME

Dead Volume

The zero position of each syringe piston is adjustable to minimise dead volume. Although this is a factory adjustment, when certain sizes of replacement syringes are fitted it may be necessary to make an adjustment to ensure that the dead volume is maintained at its minimum level, and also to prevent damage to the syringe piston due to an excessive stroke.

"A" Side Syringes (Diluent)

The diameter of the base of the pistons is different on all three sizes of the syringe used on the "A" side of the COMPUDIL. The instrument is factory adjusted to give minimum dead volume with a 5ml syringe. As the clamp grips the piston of the 2 smaller syringes it will pull down each piston by a small amount so that the dead volume is increased. To overcome this, a ring should be placed over the base of the 2,5ml syringe piston. This permits the clamp to grip it firmly before it pulls the piston down. This ring is simply pushed over the original piston and can be transferred from one piston to another when replacements are fitted.

The 1ml syringe has an extension collar attached to the piston. See Fig 5. This size of syringe should be fitted to a cassette, and then adjusted by loosening the hexagonal screw holding the collar to the piston to allow the piston to be positioned so that there is approximately 1-2 millimetres gap between the piston and the top of the glass barrel. After checking that the collar is firmly gripped by the clamp, the hexagonal screw should be re-tightened.

"B" Side Syringes (Sample)

Each of these syringes has an adjustable collar attached to the piston. Adjust the total length of the piston when a syringe is mounted in a cassette on the COMPUDIL in such a way that when the COMPUDIL drive is at the top of its stroke the top of the piston is in line with the side arm of the syringe barrel. If the adjustment is too low it will be difficult to fully prime this syringe, and a small air bubble may remain immediately above the piston. If the adjustment is made too high the piston will block the flow path of liquid being pumped by the syringe on the "A" side and damage may occur to the seal resulting in leakage.

3.5

CLEARING A PROGRAMME

1. Obtain the start position ie (PROGRAM ? 0).
2. Select the programme number required e.g. (7)
3. The display should now show the programme selected e.g. (PROGRAM ? 7).
4. Press the Clear button
5. The display will ask if this is the programme that you wish to clear ie (CLEAR ? 7).
6. Press (✓) to continue, otherwise press (✗) and the programme will be saved.
7. In either case the display will return to the start position.

NOTE :

If a programme is cleared there is no way that it can be recalled later. Clearing means erasing, and is permanent.

3.6.1.

WRITING A PROGRAMME

General.

After selecting a function the COMPUDIL will ask for the following information in sequence.

- 1) The size of syringe A (Diluent)
- 2) The size of syringe B (Sample)
- 3) The volume required from syringe A
- 4) The first volume required from syringe B
- 5) The second volume required from syringe B (certain functions only)
- 6) The volume of the airgap and suckback (certain functions only)
- 7) Speed of delivery

Only the minimum relevant information will be requested for each function selected to avoid repetition and entry errors.

Thus a programme for dispensing will ask only for 3 pieces of information:-

Syringe A,
Volume A
Speed.

A more involved programme such as Diluting with two reagents and 2 airgaps will require all 7 pieces of information. (see below).

3.6.1

WRITING SEQUENCE

The following is a summary of the information required by the COMPUDIL for each function when writing a programme:-

| FUNCTION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------|-----|---------|-------|-----------|------|---------|---------|------|
| DISPLAY | DIL | DIL+AIR | DIL 2 | DIL 2+AIR | DISP | TITRATE | PIPETTE | DIST |
| SYR A | * | * | * | * | * | * | * | * |
| SYR B | * | * | * | * | | | * | * |
| VOL A | * | * | * | * | * | * | * | * |
| TITRATE | | | | | | * | | |
| VOL B1 | * | * | * | * | | | * | * |
| VOL B2 | | | * | * | | | | * |
| AIR | | * | | * | | | | |
| SPEED | * | * | * | * | * | * | * | * |

Each function will request the minimum amount of information. If the programme is aborted before all of this information is entered then it will not be accepted as written correctly. Half written programmes are not acceptable and will not be remembered.

LAYOUT OF FLOWCHARTS

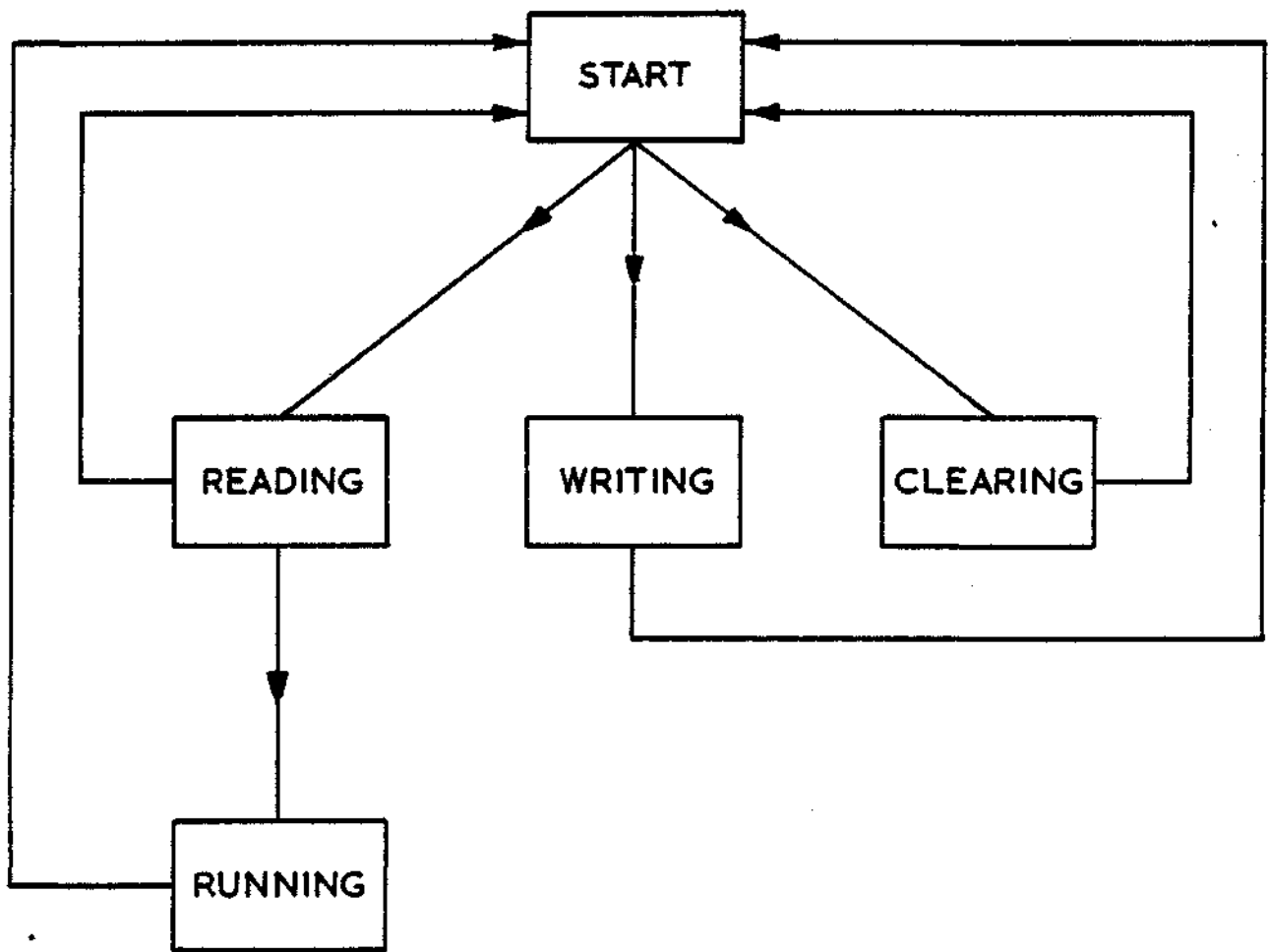


Fig. 6

TO FIT OR REPLACE A CASSETTE

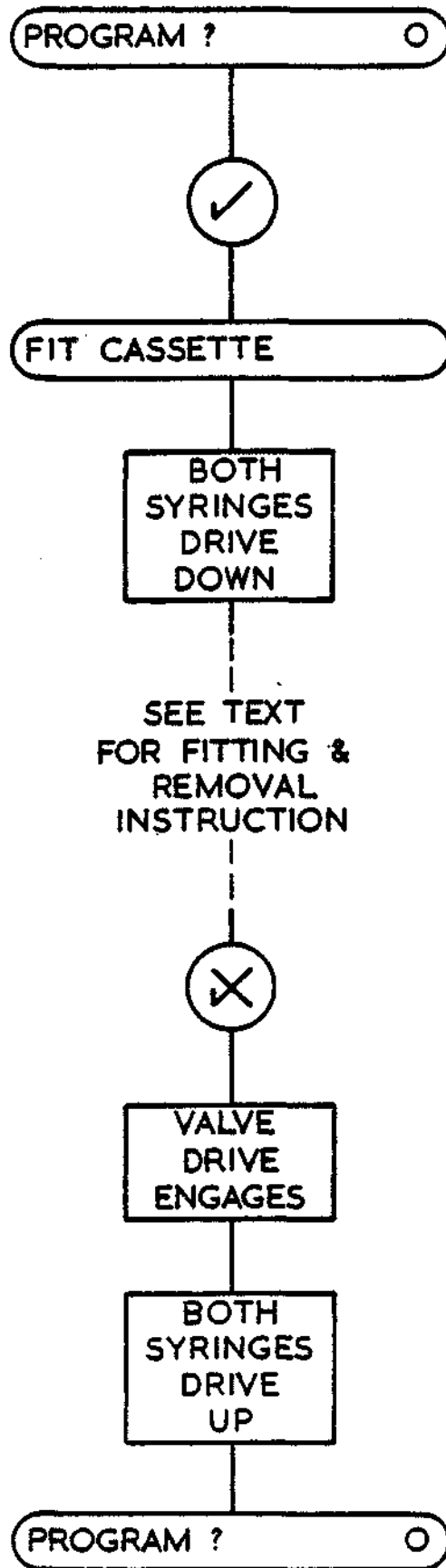


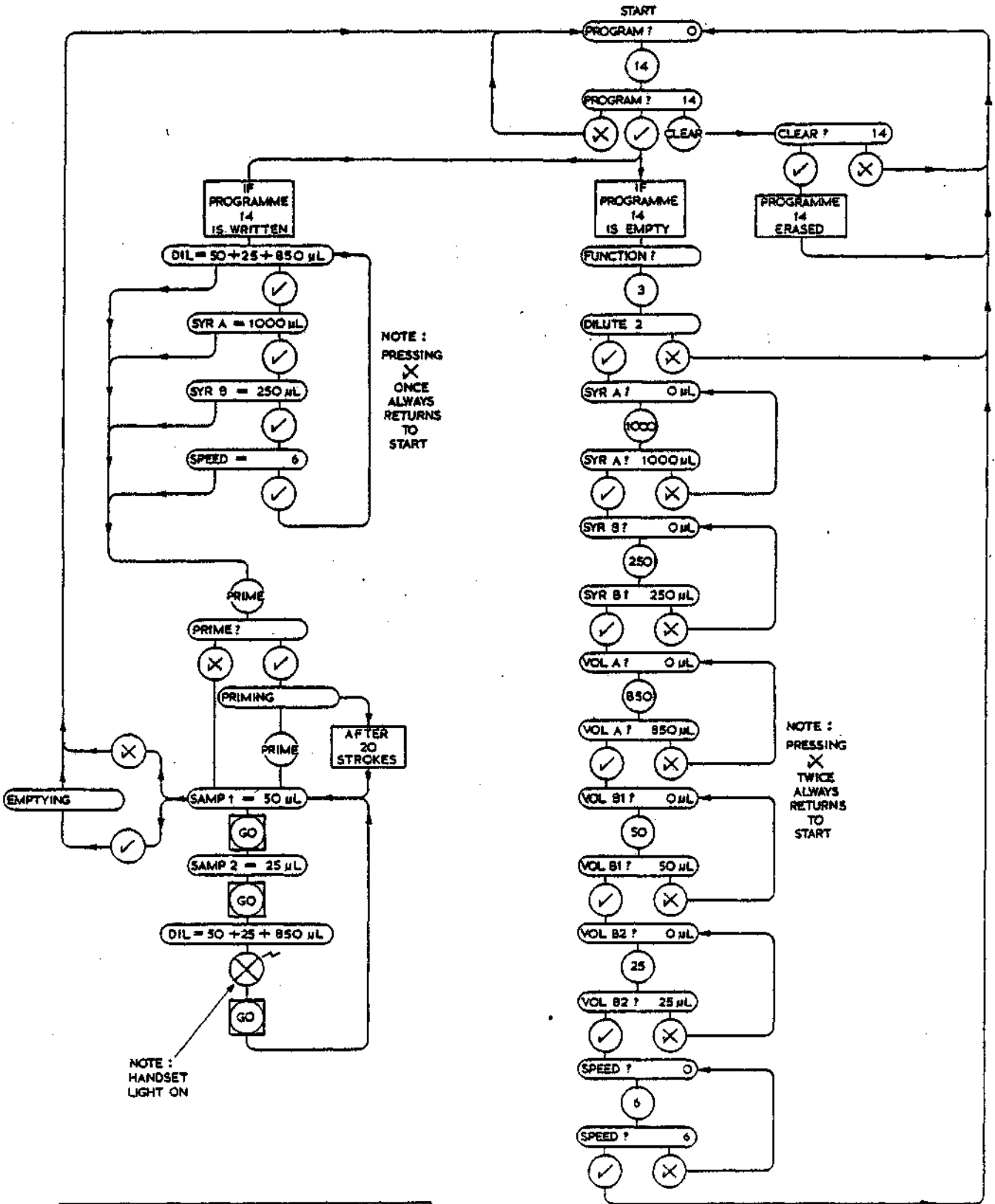
Fig. 7

SECTION 4

FLOWCHARTS

- 4.1 Layout of Charts
- 4.2 Fitting or Replacing a Cassette
- 4.3 Function 1 - Dilute
- 4.4 Function 2 - Dilute with Airgap
- 4.5 Function 3 - Dilute with 2 Reagents
- 4.6 Function 4 - Dilute with 2 Reagents with Airgaps
- 4.7 Function 5 - Dispense
- 4.8 Function 6 - Titrate
- 4.9 Function 7 - Pipette
- 4.10 Function 8 - Distribute

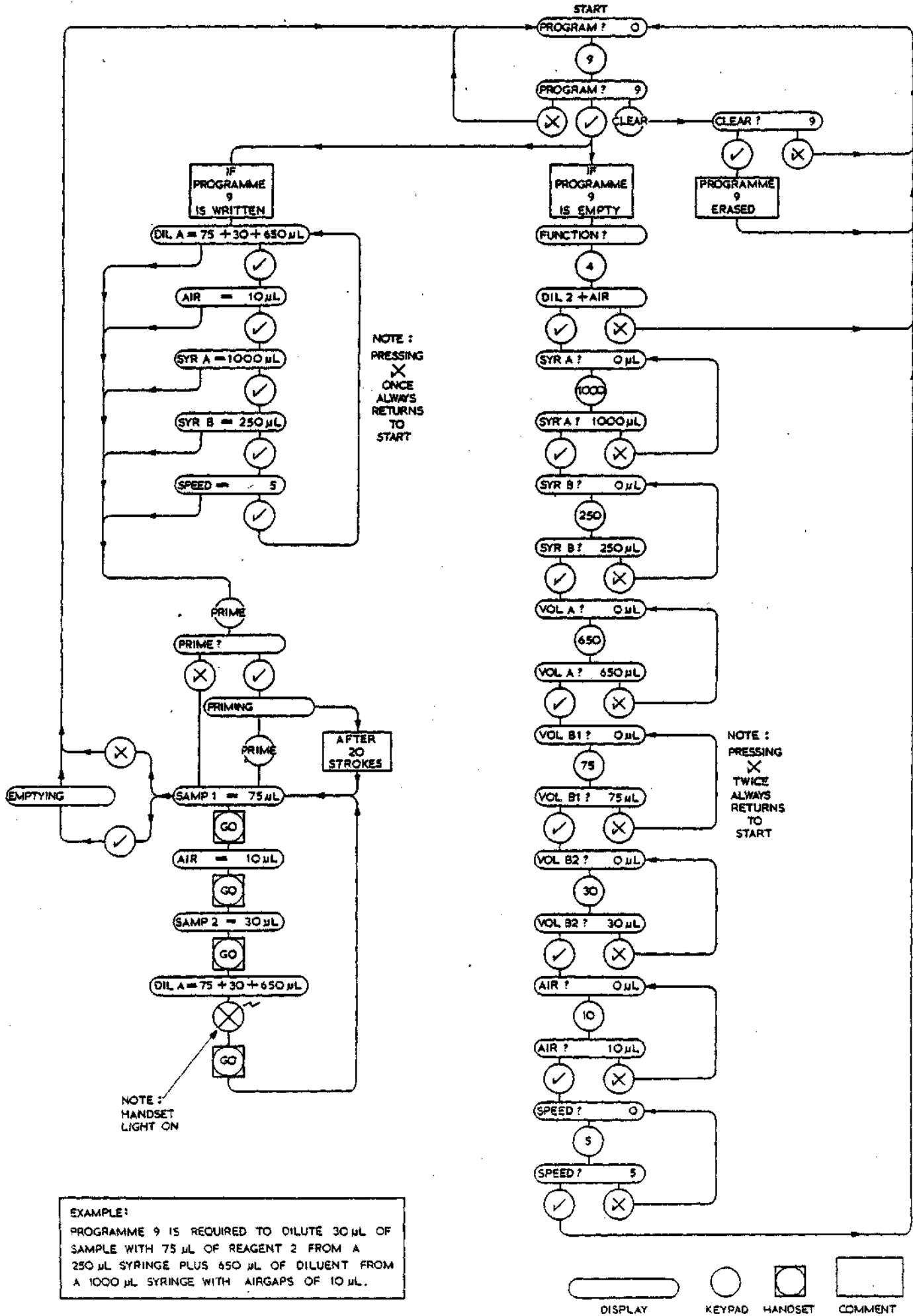
FUNCTION 3 - DILUTE WITH 2 REAGENTS



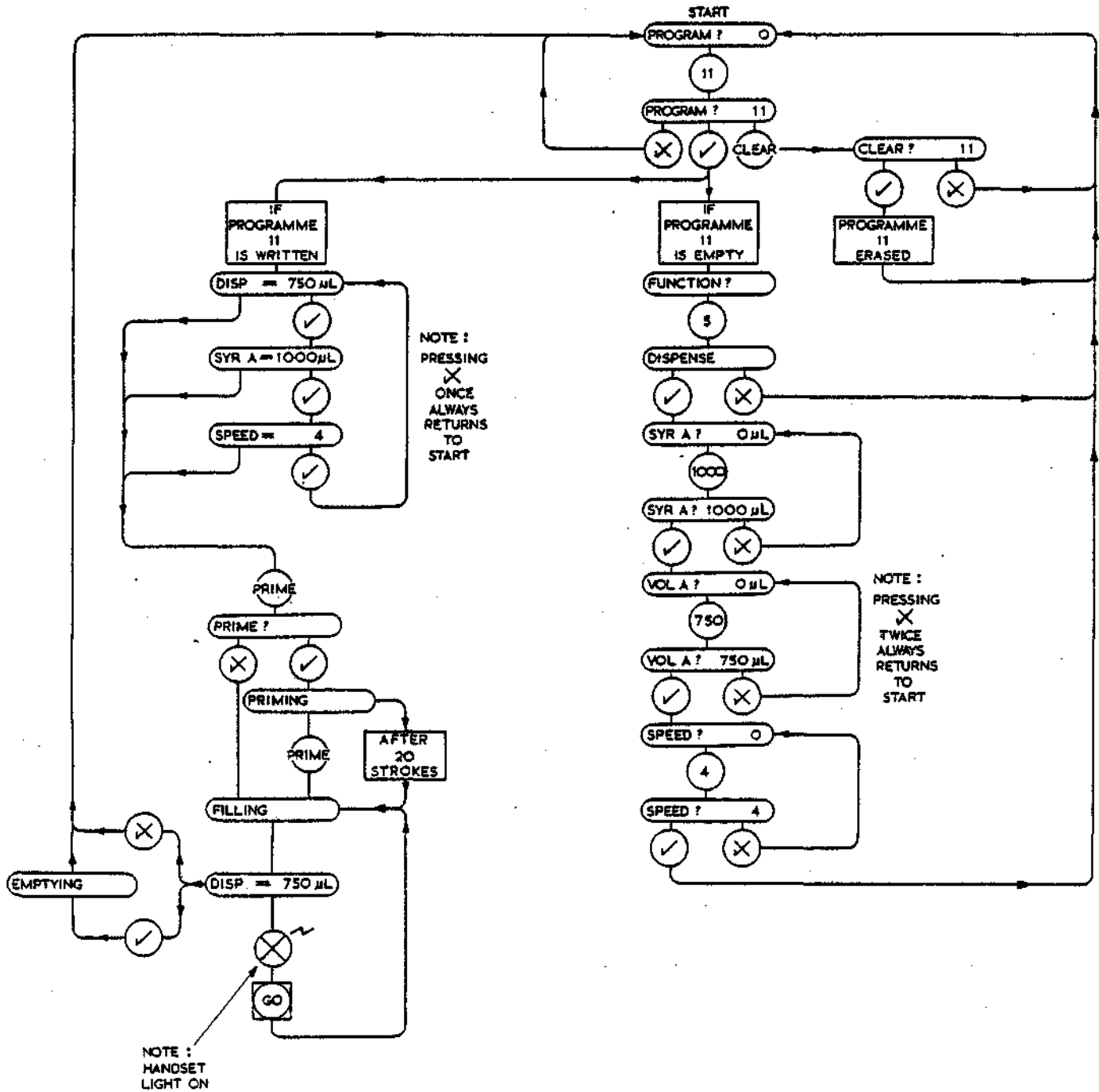
EXAMPLE :
PROGRAMME 14 IS REQUIRED TO DILUTE 25 µL OF
SAMPLE WITH 50 µL OF REAGENT 2 FROM A
250 µL SYRINGE PLUS 850 µL OF DILUENT FROM
A 1000 µL SYRINGE.



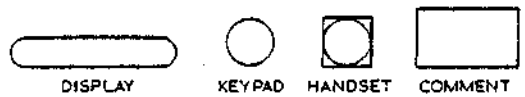
FUNCTION 4 - DILUTE WITH 2 REAGENTS PLUS AIRGAPS



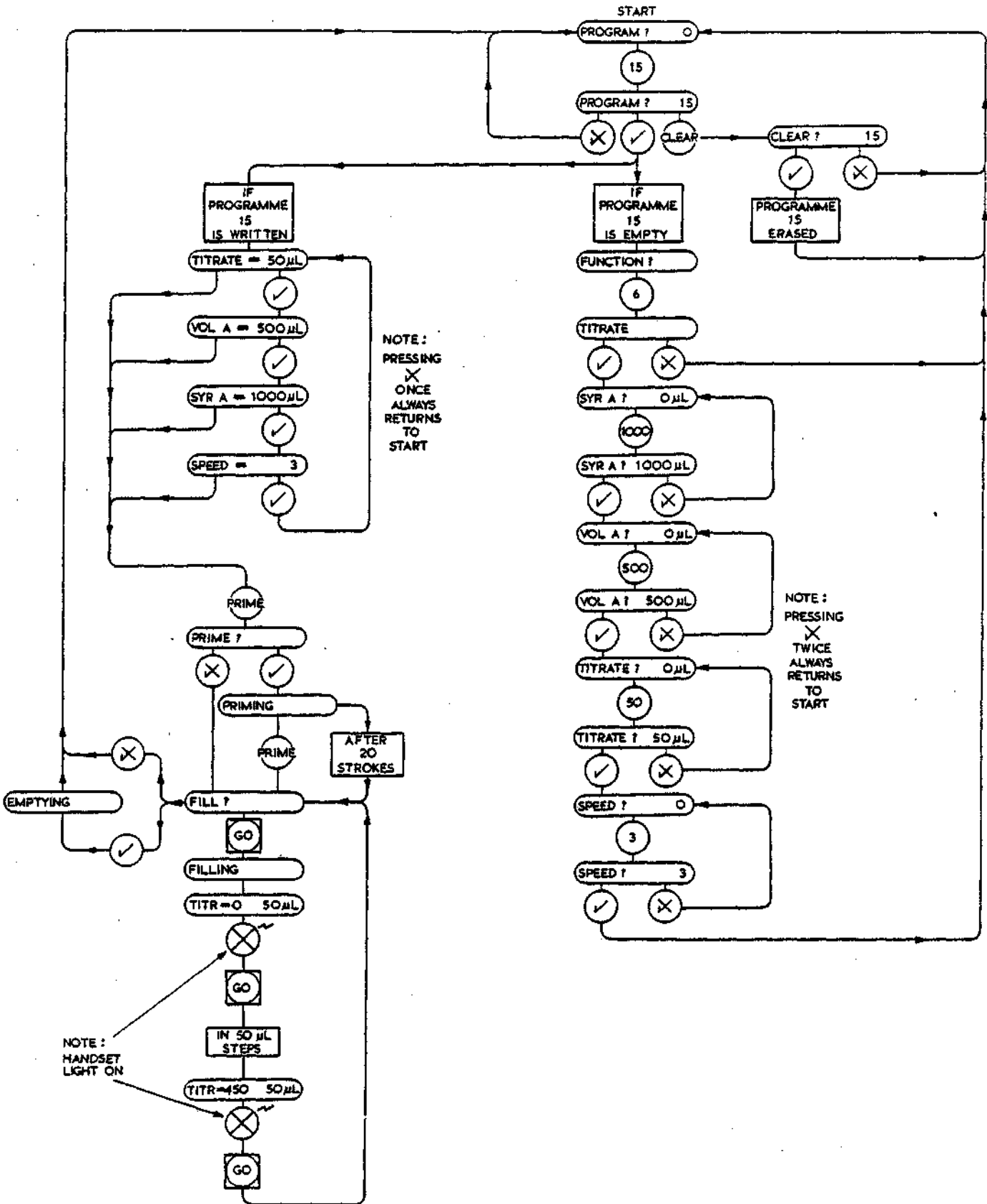
FUNCTION 5 — DISPENSE



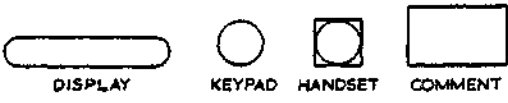
EXAMPLE :
 PROGRAMME 11 IS REQUIRED TO DISPENSE 750 µL
 FROM A 1000 µL SYRINGE.



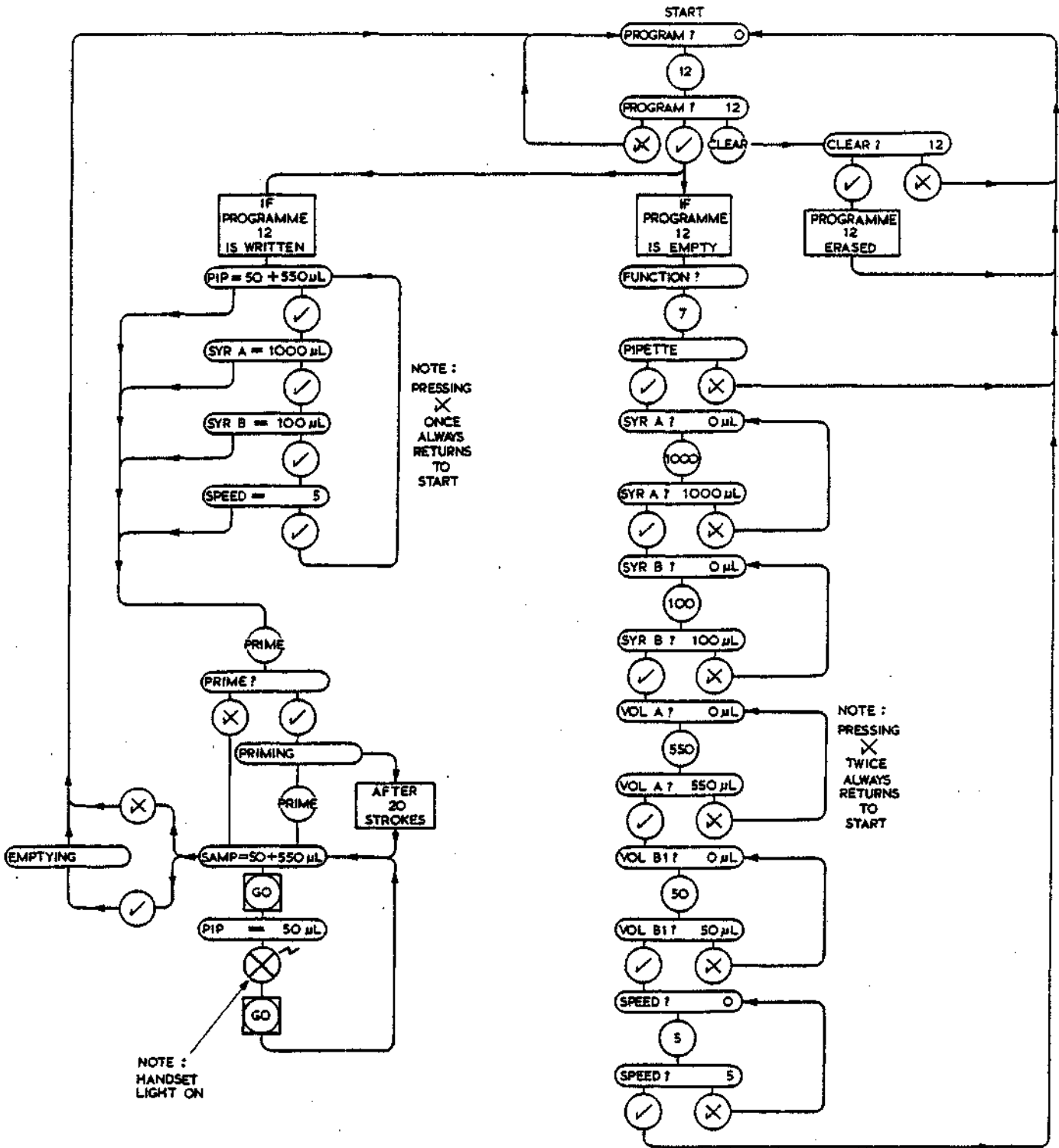
FUNCTION 6 - TITRATE



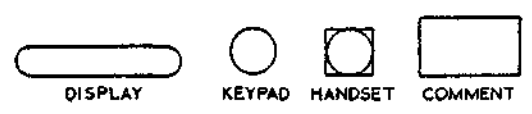
EXAMPLE:
PROGRAMME 15 IS REQUIRED TO ASPIRATE 500µL INTO A 1000µL SYRINGE & THEN TITRATE IT IN ALIQUOTS OF 50µL



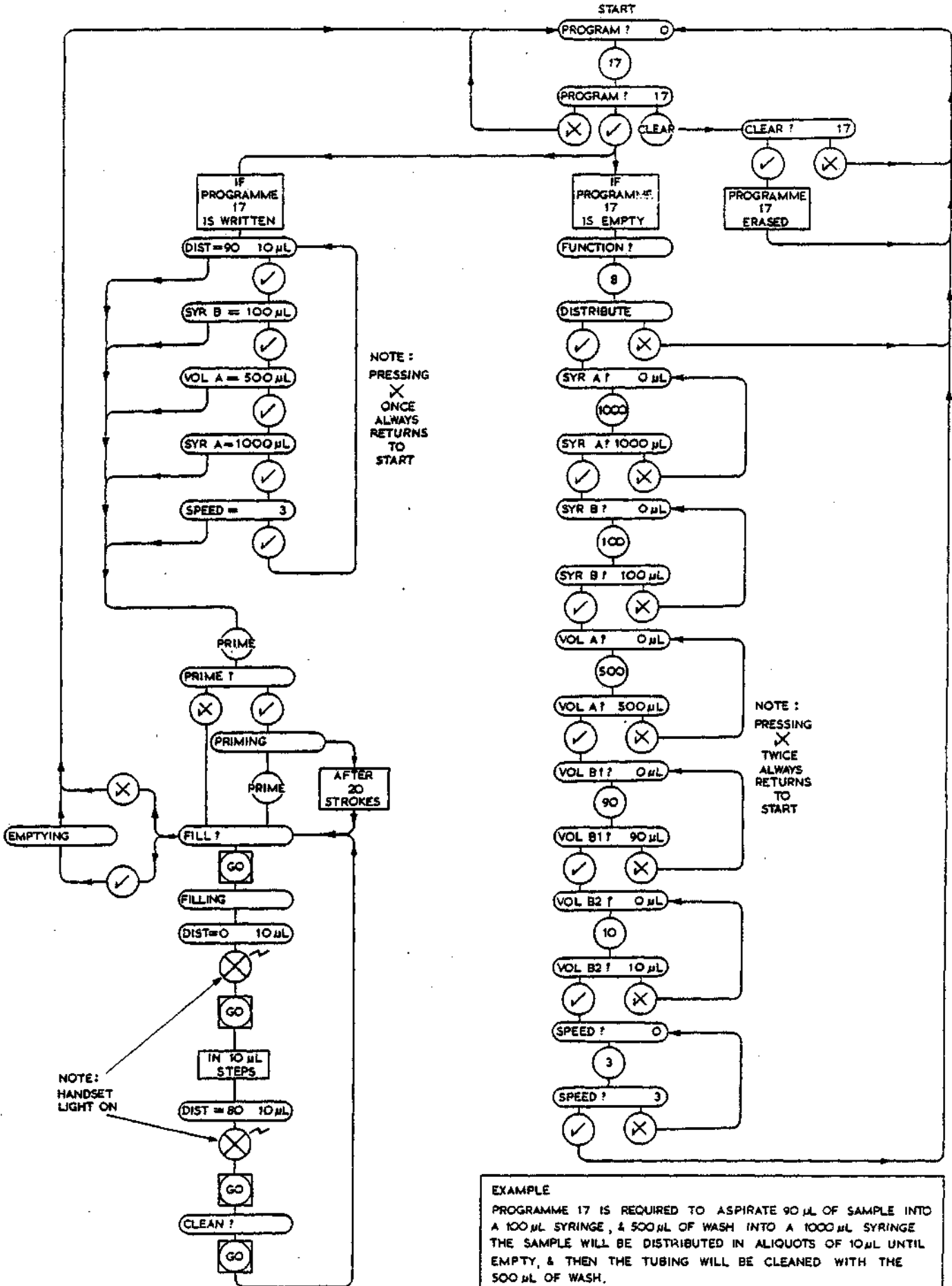
FUNCTION 7 - PIPETTE



EXAMPLE :
 PROGRAMME 12 IS REQUIRED TO SAMPLE 550 µL + 50 µL, THEN PIPETTE THE LAST 50 µL OF IT, WITH 550 µL DISCHARGED TO WASTE.



FUNCTION 8 - DISTRIBUTE



SECTION 5

SERVICING

5.1 Routine Care

5.2 Liquid Spillage

5.3 Tubing

5.4 Exchange Items

Servicing

5.1 ROUTINE CARE

As the COMPUDIL has few moving parts little is required in the way of servicing. It cannot be over-emphasised that cleanliness is the key to reliability and a trouble free life.

The only entry for contamination is via the front slots for the carriage slides. Behind these are carriages with roller bearings and the guide rods. Neither of these require oiling, but they must kept clean. Any ingress of dirt can jam the mechanism.

5.2 LIQUID SPILLAGE

Both the case and the waterproof keyboard are resistant to most chemicals, although some solvents could possibly damage them.

Any liquid spillage should be mopped up immediately as this invariably precedes faulty operation, sooner or later. Always turn off the power supply before cleaning up any substantial liquid spillage.

5.3 TUBING

A regular check on the condition of the tubing is recommended, and any cracked, crushed or kinked tubing should be discarded and replaced with new tubing.

At the same time check that the inlet tubing 'O' ring is in good condition. Deformed or damaged rings can lead to leaks and blockages, and consequently faulty operation and wrong volumes.

5.4 EXCHANGE ITEMS

Certain replacements are available on an exchange basis to keep service costs to a minimum. Exact details will vary from market to market and precise details should be obtained from your supplier.

An exchange/repair service for the valve block is an example of items that are covered.

However, a replacement and/or the repair of syringes can be arranged directly with Hamilton or their dealer in your area. Refer to separate notes provided in each syringe package.

| PART NO. ----- | DESCRIPTION ----- | REMARKS ----- |
|-------------------|---------------------------------|---------------------------|
| 5550/038 | Inlet Tube 1.6mm | 60cms long |
| 5550/043 | Inlet Tube 0.76mm | 60cms long |
| 5550/040 | Outlet Tube 1.6mm | excludes nut |
| 5550/039 | Outlet Tube 0.76mm | excludes nut |
| 7000/030 | Inlet Gland Nut | for 1.6mm tube |
| 7000/031 | Inlet Gland Nut | for 0.76mm tube |
| 2640/001 | Inlet Gland Nut 'O' Ring | for 1.6mm tube |
| 2640/007 | Inlet Gland Nut 'O' Ring | for 0.76mm tube |
| 7000/028 | Outlet Tube Nut | for 0.76mm tube |
| 7000/027 | Outlet Tube Nut | for 1.6mm tube |
| 9965/202 | Handset Complete | excludes tubing |
| 5950/003 | Handset Lower Nozzle | for 0.76mm tube |
| 5950/002 | Handset Lower Nozzle | for 1.6mm tube |
| 2640/010 | 'O' Ring for Lower Nozzle | for 0.76mm tube |
| 2640/008 | 'O' Ring for Lower Nozzle | for 1.6mm tube |
| 5950/004 | Upper Nozzle | |
| 2220/012 | Pack of 20 Sleeves | for Handset tubing |
| 6000/252 | *Valve Block | standard model |
| 6000/259 | *Valve Block | for 10ml syringe |
| 7300/009 | Valve Piston | |
| 7050/017 | Sealing Ring | valve/syringe connections |
| 6305/001 | Collar for 2.5ml Syringe Piston | |
| 6305/002 | Adaptor for 10ml Piston | |
| 2070/001 | Fuse (AC) - 0.5 amp | 220v operation |
| 2070/002 | Fuse (AC) - 1 amp | 110v operation |
| 2070/002 | Fuse (DC) - 1 amp | all models |
| 8325/001 | Power Cable | European model |
| 8325/002 | Power Cable | U.S. model only |
| 2190/010 | Power Socket and Filter | includes voltage selector |
| 2240/024 | Power Switch (On/Off) | |
| 2190/011 | Handset/Footswitch Socket | 5 pin DIN |
| 2240/027 | Switch for Buzzer | |
| 5150/012 | Display Filter | |
| 6650/002 | Keyboard | with cable |
| 2570/001 | Foot | |
| 2610/223 | Case Screws | for top cover |
| 9965/201 | Syringe Clamp Assembly | holds syringe piston |
| 7500/037 | Spring (Lefthand) | for syringe retainer |
| 7500/038 | Spring (Righthand) | for syringe retainer |
| 2140/055 | Drive Motor | |
| 2670/004 | Drive Belt | |
| 2240/025 | "Start" Position Microswitch | |
| 2140/061 | Valve Drive Motor | 30 rpm |
| 2140/056 | Valve Drive Motor | 20 rpm |
| 7750/001 | *Complete Valve Driver Board | |
| 7750/002 | *Complete Power Supply Board | |
| 7750/005 | *Complete Display Board | |
| 7750/003 | *Complete Computer Board | |

| | | |
|----------|---------------------------|-----|
| 7750/008 | Bleeper Circuit Board | |
| 7750/006 | Circuit Board for Handset | |
| 2160/044 | LED for Handset | Red |
| 2130/003 | Buzzer Only | |

* Indicates item is available on exchange/repair basis