HAMILTON Hamilton Company
P.O. Box 10030
Reno, Nevada 89510

MICRO LAB® M

The Programmable
Microprocessor Controlled
Diluter/Dispenser

manual

CONTENTS

KEY-WORD INDEX

CERTIFICATION

The Hamilton Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory.

Warranty:

Your Microlab M is warranted to be free of defects in material and workmanship for a period of 18 months from the date indicated on the back of the instrument. Hamilton Company agrees to repair or replace at their option, free of charge to the buyer, any part or parts which under proper and normal use prove to be defective during the warranty period. Electro-mechanical parts, modifications or adjustments made by other than the Hamilton Company or its assigned representatives are not covered under this warranty. It is recognized that some parts by their nature may not function throughout the entire warranty period, therefore, excluded from the foregoing warranty are the PTF E aspirating and dispensing tubings, syringe plunger tips and external or internal teflon component parts of the dispensing valve.

Hamilton Company reserves the right to refuse to accept the return of any syringe or instrument which has been used with radioactive or microbiological substances, or any other material which may be deemed hazardous to our employees. No other warranties, expressed or implied, including implications of warranties of merchantability and fitness for a particular purpose are made. Hamilton Company's liability on the sale of all products shall be limited to repair, replacement or refund of cost price of any defective product. Hamilton Company shall not be liable nor responsible for any incidental or consequential damages.

The Hamilton Company will endeavor to make all efforts possible to achieve prompt and satisfactory service.

MLM 81. 06. 600

Warranty Registration Card

To validate your warranty, fill out and mail this card within ten (10) days.

Company Name _____

Address _____

City _____ State _____ Zip _____

Your Name _____

Department _____ Phone _____

Model _____

Diluter/Dispenser Serial No. _____

Controller Serial No. _____

Purchased from _____

Installation Date: Month _____ Day _____ Year _____

Application or Area of Use _____

Please keep me regularly informed on Hamilton products.
Address information to:

Name: _____

Institute / Company: _____

Street / P.O. Box: _____

City _____ State _____ Zip _____

Department _____

Phone no.: _____

My major interest is in:

☐ Syringes
☐ Dispensers / Diluters
☐ Valves / Tubing / Fittings
☐ GC/LC products

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INTRODUCTION

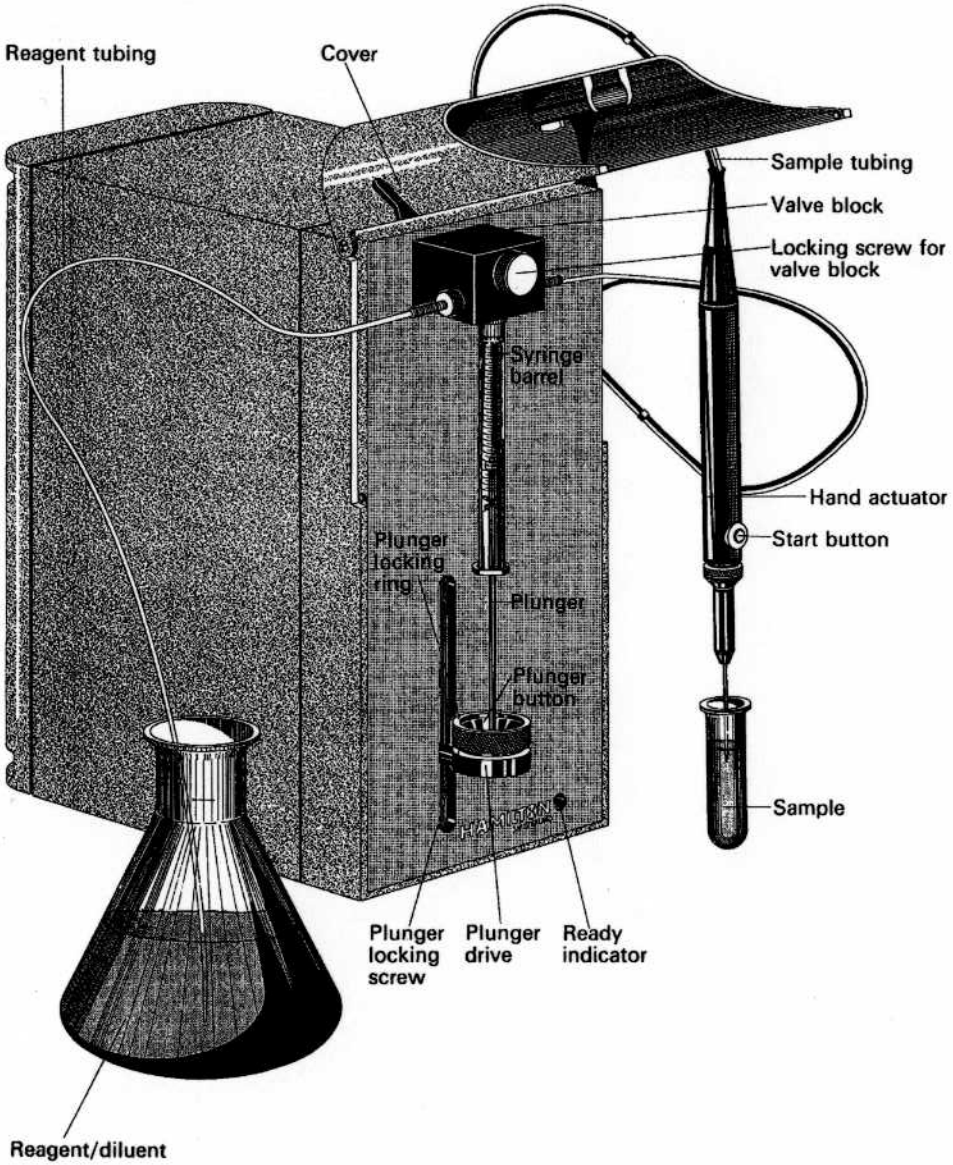
MICROLAB M The programmable microprocessor controlled Diluter/Dispenser for fast, accurate diluting and dispensing

MICROLAB M means unsurpassed precision, speed and convenience in diluting, dispensing or pipetting applications.

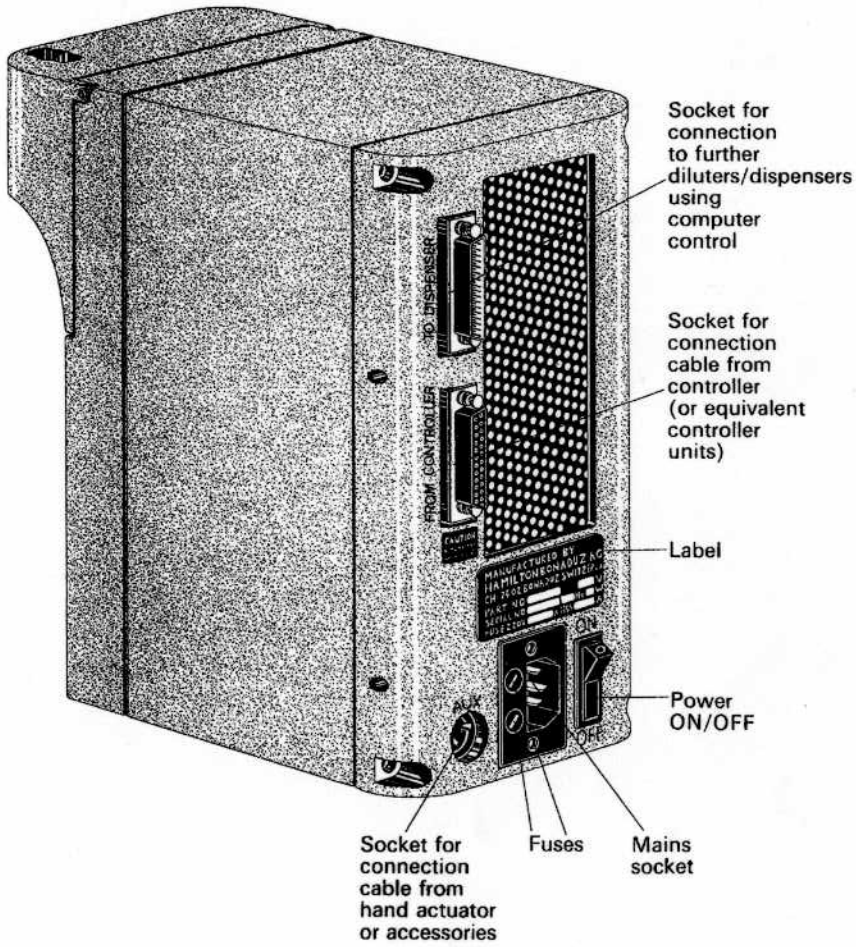
MICROLAB M is all of the following:

Diluter
Multireagent Diluter (RIA)
Transferpipette
Dispenser
Repeating Dispenser
Repeating Aspirator

ILLUSTRATIONS Diluter/Dispenser unit



CONNECTIONS (on back of Diluter/Dispenser)



DISPLAY

PROG. Indicates programme number

STEP Indicates programme steps. The decimal point after the last digit indicates a bracket function. Each expression within the bracket is counted as one programme step.

VOLUME Under Volume is indicated:

1. The programme number (during allocation).
2. The volumes in microlitres of each individual programme step.
3. ? asks for total capacity of installed syringe in µl.
4. The multiplication factor for bracket functions.
5. The flashing decimal point indicates that the volume is equal to or less than 1% of the total capacity of the syringe. This is an indication that for optimal results the syringe should be replaced by a syringe of smaller volume.
6. Low battery voltage is indicated by a row of decimal points.
7. When programming the speed, it is indicated by a following S (under [⇧]).
8. When stopping operation, speed is indicated by a following S (under [⇧]).
9. During programming the sum of aspirated or dispensed volume, is displayed after pressing the «pick-up» or «dispense» button.
10. When succesively pressing the P button, already stored (occupied) programme numbers are displayed.
11. When succesively pressing the P button, finally the remaining programme steps are displayed as follows:
    e. g. 292 P
12. Error code

Volume correction

a) In case keyed in total capacity of syringe does not correspond to syringe types available the controller will not accept it. The display will ask (?) again for another capacity input.

b) In case keyed in volume is not a multiple of one step, the microprocessor will round it off.

Example: Capacity of syringe 1000 µl, volume input 50,8 µl, corrected and displayed volume 50,0 µl.

INDICATORS

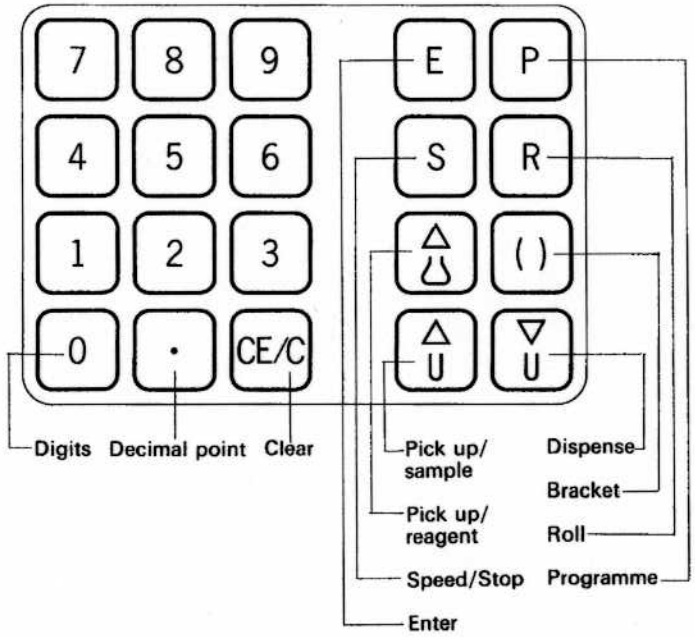
- → Aspirate through diluent tubing (flashing means automatic execution)
- → Dispense through sample tubing (flashing means automatic execution)
- → Aspirate through sample tubing (flashing means automatic execution)
- → Error (flashing)
- → Speed/Stop
- → Remaining available programme steps

KEYBOARD

[1] [2] [3] [4] [5] [6] [7] [8] [9] [0]	Digits	Key in the number for volumes, speed and programme.
[.]	Decimal point	
[CE/C]	Clear Entry/ Clear	Clears faulty volume input(s), changes automatic operation of plunger movement into manual operation. Clears individual programme steps in reverse sequence.
[E]	Enter	Transfers numbers from display to memory.
[P]	Programme	Selects the programme. Shows the occupied programme numbers. Indicates remaining programme steps.
[S]	Speed/Stop	Selects plunger speeds from 2–15 seconds. Speed 4 is automatically selected, meaning that the total volume of the syringe is filled or dispensed within 4 seconds. [S] [0] for external speed control. Stops the automatic operation at next volume step.
[R]	Roll	Rolls up content of programme for viewing in display.
[⇧]	Pick up diluent	Selects valve position to aspirate through diluent tubing. Selects manual or automatic operation of plunger movement.
[⇧]	Pick up sample	Selects valve position to aspirate through sample tubing. Selects manual or automatic operation of plunger movement.

▽△ U	Dispense	Selects valve position to dispense through sample tubing. Selects manual or automatic operation of plunger movement.
( )	Brackets	Expressions in brackets are used for repeated operation.
START		Start button on hand actuator releases plunger movement and controls valve position.
BLEEP		Announces that keyboard buttons are pushed correctly (Acustic signal).

KEYBOARD



ERROR INDICATION

Please note: E1 – E6 and E8 are programming errors,
E7 and E9 hardware errors.

ERROR INDICATION ON THE DISPLAY BY INDICATING THE RESPECTIVE NUMBER IN THE VOLUME FIELD AND FLASHING E

E1	Occupied programme
E2	Memory overflow
E3	Programme number or multiplicator > 99
E4	Last volume > syringe capacity
E5	Sum negative or > syringe capacity
E6	Sum > 0
E7	Transmission error
E8	Step overflow (> 99)
E9	Overload protection of plunger drive activated

E1 In case an already stored programme is called to be programmed this will be displayed as error function 1.

E2 In case more than 383 individual steps (total storage capacity) are programmed, this will be displayed as error function 2.

E3 In case more than 99 steps are programmed (Repeating Dispenser), error function 3 is displayed

Example: Aspirate 1000 µl
Dispense 10 µl × 100 times
Display: 3 E (flashing E)

E4 In case selected volume of an individual programme step is higher than syringe capacity (overflow), the microprocessor will not accept volume and signal this by error function 4.
A volume 2% higher than the syringe's capacity will be accepted.

Example: Capacity of syringe 1000 µl, volume input 1020 µl will be accepted, however volume input of 1030 µl will be rejected.

E5 In case the sum of programmed volumes is negative this will be displayed by the error function 5. In case sum of keyed in volume is bigger than syringe's capacity, the same error message appears on display.

Example: Capacity of syringe 1000 µl
1. Volume input: aspirate 100 µl
dispense 200 µl
Display: 5 E
2. Volume input: aspirate 600 µl
aspirate 500 µl
Display: 5 E

E6 In case the sum of programmed volumes is larger than zero this will be display by the error function 6.

Example: Capacity of syringe 1000 µl
Volume input: aspirate 1000 µl
dispense 990 µl, [E]
Display: 6 E

E7 In case a transmission error to or from controller to dispensing unit occurs, this is indicated by the error function 7. Normally when keying in the same programme again it will be accepted.

E8 In case a programme contains more than 99 individual steps this will be indicated by error function 8.

E9 If plunger drive has exceeded 80 N (Newton) driving force due to mechanical blockage or too high liquid pressure the stepper motor is switched off automatically. Reduce plunger speed and/or use dispensing tubing with a larger orifice. To restart select the used programme number again and press start button.

INSTALLATION

SELECTION OF SYRINGE

Depending on the liquid volumes to be handled, the appropriate gas-tight Hamilton syringe with TLL (Teflon Luer Lock) has to be installed.
To obtain optimum reproducibility and accuracy the smallest part of the entire syringe volume should not be less than 2%. Smaller parts will result in a deterioration of the results.
However, if reproducibilities of 1,5% are satisfactory, aliquots of 0,4% of entire syringe volume can be selected. e. g. If a 10 µl sample has to be diluted with 1000 µl diluent, a 1001 TLL (1000 µl) syringe is recommended, since the total syringe volume can be overfilled up to 2%. If a 30 µl sample has to be diluted with 1000 µl diluent, the next larger available syringe the 1002 TLL (2500 µl) is the right choice.

SELECTION OF TUBING

The Microlab M is equipped with a ⌀ 2 × 1 mm aspiration tubing (diluent) of 500 mm and the hand actuator with a 900 mm, ⌀ 2 × 1 mm sample tubing. This tubing is suitable to handle liquids with syringes up to 5 ml satisfactorily.
If larger syringes are installed, such as the 1010 TLL (10 ml) or 1025 TLL (25 ml), larger aspiration tubing (diluent) has to be used, e. g. ga. 12. The same applies to the tubing with the handactuator. Too high a resistance from the tapered tip or from too fine an inner diameter tubing may result in an automatic switch off of the stepper motor. This «overload» feature in the Microlab M will prevent any possible damage of the instrument or breakage of the syringe.
In the case of handling expensive reagents, the aspiration (diluent) tubing may be reduced to shorter lengths.

INSTALLATION AND EXCHANGE OF THE SYRINGE

To install or exchange a syringe, the instrument must be switched off. The plunger-driver can now be gently moved to a downward position by manual force.
The selected Hamilton syringe is connected to the valve block by carefully inserting the teflon luer of the syringe into the Kel-F female hub of the valve block and is then twisted clock-wise until the syringe is securely fastened.
Then move the plunger-driver manually upwards until the plunger button fits into the appropriate recess of the Teflon plunger locking ring. Then fasten the plunger locking screw securely around the plunger button.
When removing the syringe, follow these instructions in reverse order.

INSTALLATION OF THE FEP TUBING

The instrument is supplied with one aspiration (diluent) tubing and a tubing installed in the hand actuator. Before installation of the tubing, the cover over the valve-block has to be lifted upwards. The sample tubing with the hand actuator has to be mounted into the right side of the valve block using the M 6 screw connector. The 500 mm tubing has to be installed in the same manner on the left hand side of the valve block. The 8-pin connector of the hand actuator has to be plugged into the rear socket of the instrument.

CLEANING OF THE FEP TUBING

After using the Diluter/Dispenser for a longer period, the innerwall contamination of the dispensing tubing installed in the hand actuator may disturb the clean separation of the programmed air gap between the sample and reagent. The entire liquid system shall than be cleaned, by flushing several times with a fresh solution of 8–13% sodium hypochlorite. A infinite washing or priming cycle could be used, as described on page 18. After cleaning flush system at least 5 times with distilled water before using again with reagents.

EXCHANGE OF VALVE-BLOCK

Switch off the instrument and remove the syringe and the tubing. Loosen the locking screw in the valve block. Next pull out the valve block and insert the replacement valve block and tighten screw. The motor drive of the valve-block has a specially designed clutch. Therefore the valve-block can be installed disregarding its plug position.
When operating the instrument with expensive reagents, the tubing and the syringe can be left installed in the valve-block and the entire liquid system can be removed and stored in a cooled environment.

POWER CONNECTION

Before connecting the unit to the mains supply check the line voltage and verify it with the voltage marked on the back label of the controller.

EXCHANGE OF BUFFER BATTERIES

The controller has three UM-3 1,5 V leak-proof alkaline batteries installed, to continuously store the data in the memory. The lifetime of these batteries is approx. 1–2 years.
When the voltage of the batteries gets low, a row of decimal points will appear on the display. Then you must insert 3 new batteries. The memory content will be kept stored for 5 minutes, without batteries.
Unscrew the metal cover on the back side of the controller with a coin and remove the batteries. Insert the new ones in the same position and screw the cover back to its original position.
Caution:Controller can be damaged using non leak-proof batteries.

AUTOMATIC ZERO SETTING

Prior to the start of any programme, the syringe plunger will search and set its zero position automatically.
Note: During this cycle some fluid will be dispensed from the tip of the hand actuator.

READY INDICATOR

As long as the unit is connected to the mains and the diluter/dispenser is switched on the red photodiode is illuminated and the instrument is ready for the start. During plunger movement and valve operation the red photodiode is switched off.

PROGRAMMING PROCEDURE

POWER ON

- Switch on mains on back of Diluter/Dispenser unit.
- Key in total capacity of installed syringe, e.g. 2500 [E]
- In case keyed in total capacity of syringe does not correspond to syringe types available, the controller will not accept it. The display will ask (?) again for another input.

PROGRAMMING

- Select programme number X (1–99)
  [P] [X] [E]
- X cannot be an occupied (previously programmed) programme number.
- First programme step can now be keyed in.
- Each programme step is consisting of an operand and the volume, where the operand has to be keyed in first.
  Exception: At the first programme step, the display already shows [A]. Therefore [A] has not to be keyed in again, unless automatic operation is required.
- Operands are [A] [↑] [↓] . For all syringes (50 µl–25000 µl) volumes are always keyed in (µl).
- The last programme step will be transferred into memory, when pressing an operand and the display is showing the accumulated volume (equal to syringe volume at this moment).
- Volume entry can be performed either by keying in the volume or by taking over the accumulated volume already displayed. The latter is specially useful for the last programme step. Therefore only [↓] [E] has to be pressed and the entire remaining volume in the syringe will be dispensed.
- By pressing an operand twice, the execution of this programme step will be automatically (start button has not to be depressed).
- If a function has to be repeated the entire expression must be in brackets (parenthesis). Such an expression can be of several volume steps. Following the second parenthesis the multiplicator has to be keyed in. Nested bracket functions are not permitted, but consecutive bracket functions can be programmed.
- Within a programme, the sum total has to be always between zero and the maximum volume (plus 2%) of the installed syringe.
- The last programme step has to be terminated by [E] and the total sum must be zero.
- Now, at this point the programme execution can be started.

PROGRAMME REVIEW

- Recall a programme, key in
  [P] [×] [E] X = 1–99
- Pressing [R] transfers programme step after programme step to display.
- To modify a stored programme the entire programme has to be cleared and keyed in again.
- At any reviewed programme step the execution can be started, whereby first step is allocated.

RECALL PROGRAMME

- A stored programme is recalled by:
  [P] [×] [E] X = 1–99
- The execution can be followed directly.

CLEAR DURING PROGRAMMING

- During programming each entry can be cleared as long as [E] is not being keyed in.
- First [CE/C] clears only the volume displayed. Thus a new volume is accepted in same programme step.
- Second pressing of [CE/C] clears also the operand and transfers the previous step to the display.
- Consecutive pressing of [CE/C] clears each time one entire programming step and transfers the previous step to the display.

CLEAR PROGRAMME

- Keying in [P] [CE/C] [×] [E] clears the entire programme X.
- This procedure has to be executed before modifying a programme.

CLEAR ENTIRE MEMORY

- Keying in [P] [CE/C] [·] [E] clears the entire memory contents.

DIRECTORY OF MEMORY

- To receive the information on already occupied programmes [P] [P] has to be pressed. The lowest occupied programme number is displayed. Each consecutive [P] is showing the next higher occupied programme number.
- After the highest programme number, the display is showing the number of still available programme steps. This number is followed by a «P».
- The content of the actual displayed programme number can be loaded any time by pressing [E].

GENERAL PROGRAMMING EQUATIONS

General programming procedure **without** repeating function:
(1) $V_1 \pm V_2 \pm \ldots\ldots\ldots \pm V_n = \varnothing$

General programming procedure **with** repeating function:
(2) $(V_1 \pm V_2 \pm \ldots\ldots\ldots \pm V_n)\ Mi = \varnothing$

Where

$V_1 \ldots\ldots V_n$	→	volumes	M →	1–99
$M_1 \ldots\ldots M_i$	→	multiplicators	i →	1–99
			n →	1–99
+	→	[△U] or [△△]	}	operands
−	→	[▽U]	}	operands
(.....)	→	[( )]		
$= \varnothing$	→	[E]		

Up to i bracket function can be programmed consecutively. (1) and (2) can be used together in the same programme.

Each volume step together with an operand results in a programming step and can be executed by pressing start.

By pressing an operand twice the programming step is executed automatically.

PROGRAMMING EXAMPLES

1. **Manual Dispenser**
   Capacity of syringe: 1000 µl
   Aspirate (manual operation): 1000 µl
   Dispense (manual operation): 1000 µl

   Programme: ON
   1000 [E] (Syringe capacity)
   [P] 1 [E] (Selection of a programme number)
   1000 [▽] [E]

2. **Semiautomatic Dispenser**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation): 1000 µl
   Dispense (manual operation): 1000 µl

   Programme: [P] 2 [E] (Selection of a programme number)
   [△] 1000 [▽] [E]

3. **Automatic Dispenser** (continuous operation)
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation): 1000 µl
   Dispense (automatic operation): 1000 µl
   (continuous operation until ‹S› is depressed)

   Programme: [P] 3 [E] (Selection of programme number)
   [△] 1000 [▽] [▽] [E]

4. **Repeating Dispenser**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation): 1000 µl
   Dispense (manual operation): 200 µl 5 times

   Programme: [P] 4 [E] (Selection of a programme number)
   [△] 1000 [↓] [▽] 200 [↓] 5 [E]

5. **Automatic Repeating Dispenser**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation): 1000 µl
   Dispense (automatic operation): 200 µl 5 times
   (continuous operation until ‹S› is depressed)

   Programme: [P] 5 [E] (Selection of a programme number)
   [△] 1000 [↓] [▽] [▽] 200 [↓] 5 [E]

6. **Diluter**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation: reagent/diluent): 800 µl
   Aspirate (automatic operation: air gap): 10 µl
   Aspirate (manual operation: sample): 100 µl
   Dispense (manual operation: total volume): 910 µl

   Programme: [P] 6 [E] (Selection of programme number)
   [△] 800 [△] [△] 10 [△] 100 [▽] [E]

7. **Repeating Diluter**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation: diluent): 900 µl
   Aspirate (manual operation: air gap): 5 µl
   Aspirate (manual operation: sample): 20 µl
   Dispense (manual operation: total volume for 1 dilution): 125 µl } 9 times

   Programme: [P] 7 [E] (Selection of a programme number)
   [△] 900 [↓] [△] 5 [△] 20 [▽] 125 [↓] 9 [E]

8. **Multireagent Dispenser/Diluter**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation: diluent): 450 µl
   Aspirate (automatic operation: air gap): 20 µl
   Aspirate (manual operation: reagent): 200 µl
   Aspirate (manual operation: air gap): 20 µl
   Aspirate (manual operation: reagent): 150 µl
   Dispense (manual operation: total volume): 840 µl

   Programme: [P] 8 [E] (Selection of a programme number)
   [△] 450 [△] [△] 20 [△] 200 [△] 20 [△] 150 [▽] [E]

9. **Dilution of sample diluent ratio with intermediate washing cycle**
   Capacity of syringe: 1000 µl
   Aspirate (automatic operation: diluent): 400 µl
   Aspirate (manual operation: sample): 500 µl
   Dispense (manual operation: total volume): 900 µl

   Washing cycle:
   Aspirate (automatic operation: diluent): 1000 µl } 3 times
   Dispense (automatic operation: diluent): 1000 µl

   Programme: [P] 9 [E] (Selection of a programme number)
   [△] 400 [△] 500 [▽] 900
   [↓] [△] [△] 1000 [▽] [▽] 1000 [↓] 3 [E]

10. **Exponential Dispensing**

Capacity of syringe: 2500 µl
Aspirate (automatic operation: reagent): 2550 µl
Dispense (manual operation: reagent): 1280 µl
Dispense (manual operation: reagent): 640 µl
Dispense (manual operation: reagent): 320 µl
Dispense (manual operation: reagent): 160 µl
Dispense (manual operation: reagent): 80 µl
Dispense (manual operation: reagent): 40 µl
Dispense (manual operation: reagent): 20 µl
Dispense (manual operation: reagent): 10 µl

Programme: ON
2500 [E] (Selection of syringe capacity)
[P] 10 [E] (Selection of a programme number)
[▲] 2550 [▼] 1280 [▼] 640 [▼] 320 [▼] 160
[▼] 80 [▼] 40 [▼] 20 [▼] 10 [E]

11. **Priming after installation of syringe or changing of diluent** (automatic stop after 3 cycles)

Capacity of syringe: 1000 µl
Aspirate (automatic operation: liquid): 600 µl
Dispense (automatic operation: liquid): 600 µl } 3 times

Programme: ON
1000 [E] (Selection of syringe capacity)
[P] 11 [E] (Selection of a programme number)
0 [↕] [▲] 600 [▼] [▼] [↕] 3 [E]

12. **Infinite washing or priming cycle**

Capacity of syringe: 1000 µl
Aspirate (automatic operation: diluent): 800 µl until stopped
Dispense (automatic operation: diluent): 800 µl
(Continuous operation until «[S]» is depressed)

Programme: [P] 12 [E] (Selection of a programme number)
[▲] 800 [▼] [▼] [E]

13. **Repeating Aspirator**

Capacity of syringe: 1000 µl
Aspirate (manual operation: reagent): 50 µl 10 times
Dispense (manual operation: total volume): 500 µl

Programme: [P] 13 [E] (Selection of a programme number)
[↕] [▲] 50 [↕] 10 [▼] [E]

14. **RIA-Dilutor** (double reagent)

Speed: 8 sec
Capacity of syringe: 1000 µl
Aspirate (automatic operation: buffer) 700 µl
Aspirate (automatic operation: air gap) 10 µl
Aspirate (manual operation: antibody) 100 µl
Aspirate (manual operation: air gap) 10 µl
Aspirate (manual operation: serum) 20 µl
Dispense (manual operation: total volume) 840 µl

Programme: P 14 [E] (Selection of a programme number)
[▲] 700 [▲] [▲] 10 [▲] 100 [▲] 10 [▲] 20 [▼] [E]
[S] 8 [E]

15. **Automatic repeating dispenser** with time delay (air gap)

Capacity of syringe: 2500 µl
Aspirate (automatic operation: reagent): 2500 µl
Aspirate (manual operation: air gap): 20 µl
Dispense (automatic operation: air gap): 20 µl
Aspirate (automatic operation: air gap): 20 µl 20 times
Dispense (automatic operation: air gap): 20 µl 20 times
Dispense (automatic operation: reagent): 125 µl 20 times

Programme: [P] 15 [E] (selection of programming number)
[▲] 2500 [▲] 20 [▼] [▼] 20 [↕] [▲] [▲] 20 [▼] [▼] 20
[▼] [▼] 125 [↕] 20 [↕]

16. **Manual dispenser** over 99 times

Capacity of syringe: 2500 µl
Aspirate (automatic operation: reagent): 2400 µl
Dispense (manual operation: reagent): 20 µl 120 times

Programme: [P] 16 [E] (selection of programming number)
[▲] 2400 [↕] [▼] 20 [↕] 60 [↕] 20 [↕] 60 [E]

17. **Serum distributor**

Capacity of syringe: 2500 µl
Aspirate (automatic operation: reagent): 2000 µl
Aspirate (automatic operation: air gap): 20 µl
Aspirate (manual operation: sample): 430 µl
Dispense (manual operation: sample): 100 µl 4 times
Dispense (manual operation: reag./sample): 2050 µl

Programme: [P] 17 [E] (selection of programming number)
[▲] 2000 [▲] [▲] 20 [▲] 430 [↕] [▼] 100 [↕] 4 [▼] [E]

18. **Serum transfer**
Capacity of syringe: 1000µl
Aspirate (automatic operation: reagent): 500 µl
Aspirate (automatic operation: air gap): 20 µl
Aspirate (manual operation: sample): 110 µl
Dispense (manual operation: sample): 100 µl
Dispense (manual operation: reag./sample): 530 µl

Programme: [P] 18 [E] (selection of programming number)
[▲] 500 [▲] [▲] 20 [▲] 110 [▼] 100 [▼] [E]

19. **Repeating Dispenser** (with 2 secs pause)
Capacity of syringe: 1000 µl
Aspirate (automatic operation): 200 µl } 2 secs pause before
Dispense (automatic operation): 200 µl } dispense cycle

Programme: [P] 19 [E] (selection of programme number)
[▲] 200 [1] [▲] [▲] 0 [▼] [▼] 0 [1] 5 [▼] [▼] [E]

Note: By integrating the function [1] [▲] [▲] 0 [▼] [▼] 0 [1] x a pause of 1 to 40 secs before dispense cycle can be realized.
If x is = 1 and speed 2 has been keyed in, the pause will be 1 sec.
If x is = 99 and speed 2 has been keyed in, the pause will be 30 secs.
The pause is depending on speed keyed in.

20. **Clear individual programme location**
e. g. programme 14

Programme: [P] [CE/C] 14 [E]

21. **Clear all programme locations simultaneously**
Programme: [P] [CE/C] [.] [E]

TROUBLE SHOOTING

1. **Controller**

– Display blank	Check if connection cable to dispenser is correctly plugged in. Check fuses on dispenser.
– Display shows all decimal points	Low battery voltage. Replace batteries
– Programming not possible	Controller to repair service
– Programming possible, but after pressing «Enter» display is blank	Controller and dispenser to repair service
– Error message appears	Refer to error section

2. **Dispenser**

– Ready indicator not illuminated after power on	Check fuses
– Instrument cannot be started after programme was loaded	Replace handactuator
– Bad reproducibility	Check tubing and syringe connection Replace dispensing tubing
Air in liquid system	Check tubing and syringe connection Replace syringe Replace valve

If the instrument still malfunctions, please contact your Hamilton dealer for service assistance.

TECHNICAL SPECIFICATIONS

SYRINGE VOLUMES:	50 µl–25 ml
VOLUMES:	Keyboard input in microlitres. Resolution of syringe capacity 1/1000. (Total capacity of syringe equal to 1000 steps of the high resolution step motor) Recommended minimal volume: not less than 1% of syringe's capacity.
SPEED RANGES FOR HALF CYCLE	2–15 seconds in steps of 1 second. Variable external speed control.
VALVE DRIVE	Synchronous motor: 0,5 seconds per revolution
LIQUID SYSTEM:	Completely inert uses only glass, Teflon and Kel-F.
REPRODUCIBILITY	Better than 0,2% down to a minimum of 10% of the syringe capacity, or a maximum dilution ratio of 1:10. Better than 0,4% down to a minimum of 2% of the syringe capacity, or a maximum dilution ratio of 1:50. Better than 0,8% down to a minimum of 1% of the syringe capacity, or a maximum dilution ratio of 1:100. Better than 1,5% down to a minimum of 0,4% of the syringe capacity, or a maximum dilution ratio of 1:250. Note: Values for dispenser do only apply with ≥ 2% of syringe capacity. (all values refer to diluter function).
ACCURACY	Better than 0,5% dispensing at least 30% of syringe capacity. Better than 1,0% dispensing at least 10% of syringe capacity. Note: The quoted values apply only with syringes of more than 500 µl.
PROGRAMMABLE FUNCTIONS:	Up to 99 programmes with a total of 383 volume steps or bracket functions for dilutor, periodical dispenser, multireagent diluter, dispenser and transferpipette. Programmes will not be lost, when the instrument is switched off (battery buffered C-MOS memory).
DISPLAY	Digital display of volumes in µl, speed, programme number, direction of plunger movement and valve position, number of steps and remaining capacity of memory.

DIMENSIONS	Diluter/Dispenser: Height 255 mm, width 120 mm, depth 200 mm, weight 5,0 kg Controller: Height 50 mm, width 126 mm, length 250 mm, weight 0,6 kg Mains supply: 115/ 220 V/50 Hz/60 VA

SPARE PARTS

	Part-number
Aspiration tubing, ⌀ 2 × 1 mm, 50 cm long	240 330
Dispensing tubing, ⌀ 2 × 1 mm, 90 cm long without screw connectors (set of three)	240 092
Hand actuator assy	230 209
Valve-Block	108 510
* Fuse 2A (~~Europe~~)(US)	363011 ~~363 009~~
Front cover	108 232
Locking screw for valve block	108 229
Plunger locking screw	100 483
PTFE plunger locking ring	100 484
* Fuse 1A (Europe)	363009

OPTIONAL ACCESSORIES

External speed control unit	230 410
Foot pedal	230 560

SYRINGES AND SPARE PARTS

Syringes

1705 TLL, 50 µl syringe	80 922
1710 TLL, 100 µl syringe	81 022
1725 TLL, 250 µl syringe	81 122
1750 TLL, 500 µl syringe	81 222
1001 TLL, 1000 µl syringe	81 322
1002 TLL, 2500 µl syringe	81 420
1005 TLL, 5000 µl syringe	81 520
1010 TLL, 10000 µl syringe	81 620
1025 TLL, 25000 µl syringe	200 760

Replacement barrel

1705 TLL	10 222
1710 TLL	10 223
1725 TLL	10 224
1750 TLL	10 225
1001 TLL	10 360
1002 TLL	10 361
1005 TLL	10 362
1010 TLL	10 363
1025 TLL	200 790

Replacement teflon plunger tips

1705	13 407
1710	13 208
1725	13 409
1750	13 419
1001	13 460
1002	13 461
1005	13 462
1010	13 463
1025	200 776

INFORMATION TO OPERATE DILUTER/DISPENSER WITHOUT CONTROLLER

1. Interface Hardware

1.1 Interface Specifications

RS 232 C

Baudrate:	2400 (1200, 4800, 9600 jumper selectable)
Parity:	even
Character length:	11 Bits (1 start, 7 data, 1 parity, 2 stop)

1.2 Pin Assignments

DB 25-plug from controller/ computer (female)

Pin number	Signal	Pin number	Signal
1		14	GND
2	DATA TRANS	15	
3	DATA REC	* 16	5 V
4		* 17	5 V
5		18	
6		* 19	–19 V
7	GND	20	
8		* 21	3,6 V
* 9	+12 V	* 22	3,6 V
* 10	–12 V	* 23	GND
11		24	
12		25	
13			

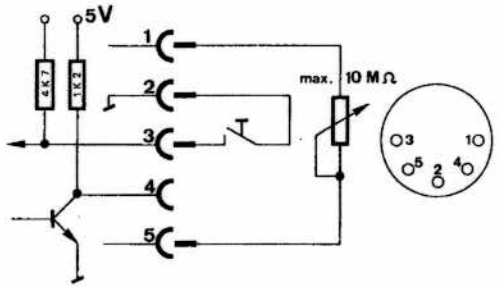
DB 25-plug to optional dispenser (male)

Pin number	Signal	Pin number
1		14
2	DATA TRANS	15
3	DATA REC	16
4		17
5		18
6		19
7	GND	20
8		21
9		22
10		23
11		24
12		25
13		

* **Attention:** Supply voltage for controller

1.2 Auxiliary plug

1 Potentiometer for external speed
2 GND
3 START
4 READY signal
5 Potentiometer for external speed



2. PROTOCOLL

2.1 Instruction set

2.1.1 Valve instructions

I	turns valve to INPUT position (left side)
O	turns valve to OUTPUT position (right side)

2.1.2 Syringe instructions

P [dddd]	PICK UP
D [dddd]	DISPENSE
S [dd]	plunger SPEED
L [dd]	slow down before stop
	[d] indicates one digit

2.1.3 Values

0.....9	digits

2.1.4 Control

R	Run (start)
F	Querry: MICROLAB M ready?
Z	Querry: Zeropoint or overload?
N	Numbers the different MICROLAB M's (addressing)
C	Clear string, applicable only before ‹CR›
CR	Carriage Return; terminates command string
LF	Line Feed (optional)

2.1.5 Echo

Each character is echoed by MICROLAB M immediately after receiving, i.e. same character is transmitted with the following exceptions:

*	echo to each character while the MICROLAB M is running
?	received character is not acceptable
#	after C (Clear)
Y	YES } echo to F, Z
N	NO }

2.2 Detailed explanations of instructions

2.2.1 Valve

I	Valve turns into a position which allows a liquid connection between syringe and left side of valve block.
O	Valve turns into a position which allows a liquid connection between syringe and right side of valve block

2.2.2 **Syringe**

P [dddd] Plunger downward movement allows aspirating of liquids. The volume always has to be transmitted as steps. Each full stroke of a syringe is divided into 1000 steps.
To convert the volume (in µl) into steps, use the following equation:

$$\text{STEPS} = \frac{\text{VOL}}{\text{SYR}} \cdot 1000 \quad \text{where}$$

VOL = volume in (µl)
SYR = Syringe capacity in (µl)
STEPS ≦ 1000

Example:
VOL = 200 µl using a 250 µl syringe 800 steps
VOL = 200 µl using a 1000 µl syringe 200 steps

D [dddd] Plunger upward movement allows dispensing of liquids. Volume see P (PICK UP).

S [dd] Sets plunger speed
[1] means about 2 sec per full stroke
[15] means about 15 sec per full stroke
[0] allows continuous external speed regulation.
Any number between 0 and 15 may be transmitted. After power-on, preprogrammed speed is 4 until otherwise selected. Selected speed remains the same until changed again.

L [dd] Slows the plunger speed down before stopping. Possible range is 0 to 99, meaning the remaining number of steps (counted back), where the slow-down process beginns. After power-on 8 steps are automatically programmed. Selected range remains the same until changed. Time constant of slow-down curve is not affected. Selecting slow-down range allows:
– dropless dispensing
– avoiding overshooting of liquid column (higher range)

2.2.3 **Control**

R Starts execution immediately after ‹CR›. The MICROLAB M can also be started by an external switch connected to the auxiliary plug. In this case, a command string should be transmitted without ‹R›.

F Checks, if a command is executed and, therefore the MICROLAB M is ready, to receive a new command (echo ‹Y›). Or, checks if the MICROLAB M is already loaded but not started (echo ‹N›).

Z Checks if zeropoint of syringe has been reached during initializing, or if system was overloaded (echo ‹Y›). In both cases the MICROLAB M will stop immediately. If no overload has occurred, ‹N› will be returned as echo. If an overload has occurred, the information will be stored until ‹Z› is transmitted. ‹Z› clears this information.

N If more than one MICROLAB M is connected, each MICROLAB M must have its own individual address. The command ‹N CR› automatically allocates a number between 0 and 9 to each MICROLAB M. The MICROLAB M, which is connected directly to the computer, gets the address 0, the next the address 1 and so on. The address has to proceed a command string. Once an address is transmitted, the specific MICROLAB M remains selected, until ‹CR› is transmitted.

C This command clears a transmitted string before it is terminated by ‹CR›. The addressed MICROLAB M remains selected.

CR Terminates a command string and enables execution. ‹CR› deselects an addressed MICROLAB M.

LF Does not affect the operation of the MICROLAB M. This command can be helpful, when the data are shown on a CRT.

3. PROGRAMMING TIPS

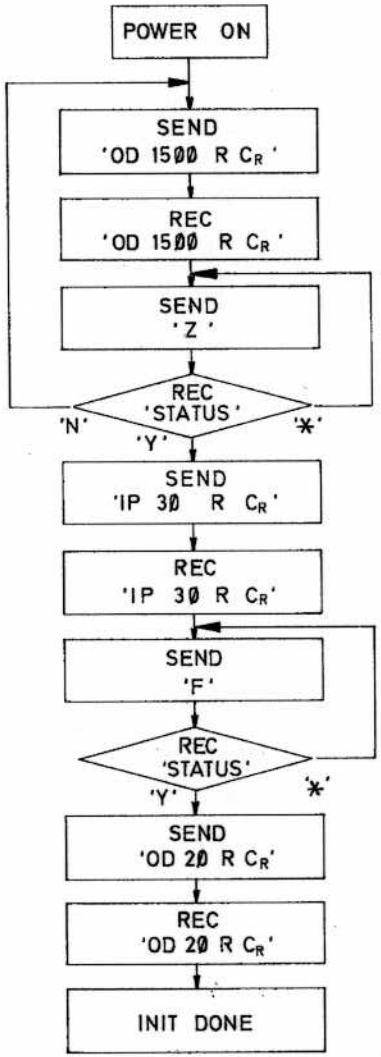
- Echo ‹*› and ‹N› after ‹F› indicate, that MICROLAB M is not selected. No string termination by ‹CR› is required, as long as the same or a higher address is transmitted in the next string. Before transmitting a lower address, clear the interface by sending a ‹CR›.
  NOTE: In this case ‹CR› will not be echoed.
- ‹N› after ‹F› means, that the MICROLAB M has been loaded. Sending a new string overwrites the previous information.
- Before a string is terminated by ‹CR›, it can be cleared by sending a ‹C›. This command does not deselect the MICROLAB M, meaning the instrument is still addressed.
- Echo ‹Y› indicates that MICROLAB M is selected and expects a following command string. The string has to be terminated by ‹CR›. If no command string will be transmitted, MICROLAB M must be deselected by ‹R CR›.
- Valve command ‹I› or ‹O› before ‹P› or ‹D› executes before the plunger is moved.
  Valve command ‹I› or ‹O› after ‹P› [dddd] or ‹D› [dddd] executes after the plunger is moved.
  Both possibilities can be used within one string.
- The following ASCII control characters are reserved for automatic addressing and should never be transmitted:
  ‹SO›, ‹SI›, ‹DLE›, ‹DC1›, ‹DC2›, ‹DC3›, ‹DC4›, ‹NAK›, ‹SY›, ‹EB›.
- Do not check the echo after sending ‹N CR›, because it may be different, depending on the sequence, in which the different MICROLAB M's were switched on.
  A good way, to check how many MICROLAB M's are connected, is the following:
  ‹N› ‹CR› no echo check
  wait 100 ms
  ‹0 CR› check until
  ‹1 CR› no more echo is returned

4. EXAMPLES

4.1 For single MICROLAB M control

INIT

- Initializes MICROLAB M after power on.
- Syringe will be set to zeropoint.
- This routine must be always implemented after power on.



Move plunger to zeropoint

Optional echo check indicates power on

Status querry
‹*› still running
‹Y› zeropoint reached

Retract plunger tip from syringe bottom

Optional echo check

Status querry

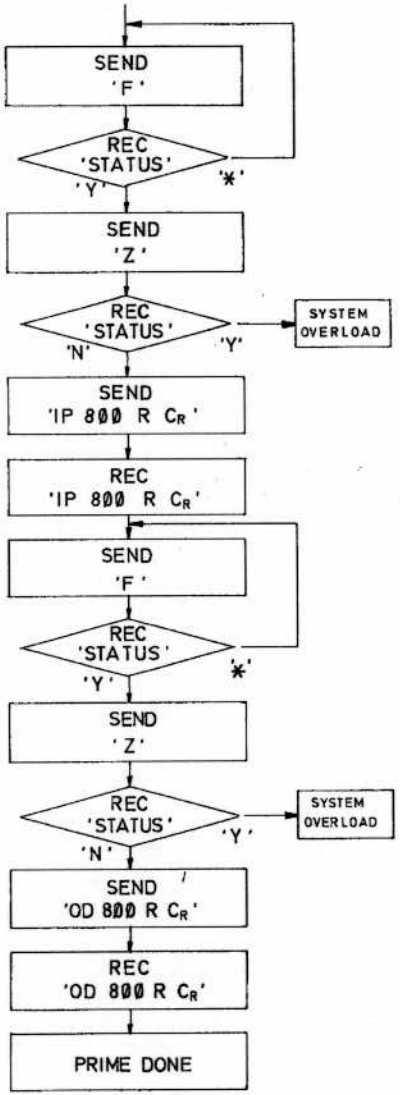
‹*› still running
‹Y› executed

Remove air in tubing tip

Optional echo check

PRIME

- Filling of liquid system
- Syringe 2500 µl
- Pick up 2000 µl from left side
- Dispense 2000 µl to right side
- Automatic execution



Status querry

‹*› previous execution not terminated
‹Y› ready

Overload check

‹Y› go to INIT and reduce speed

Pick up prime volume

Optional echo check

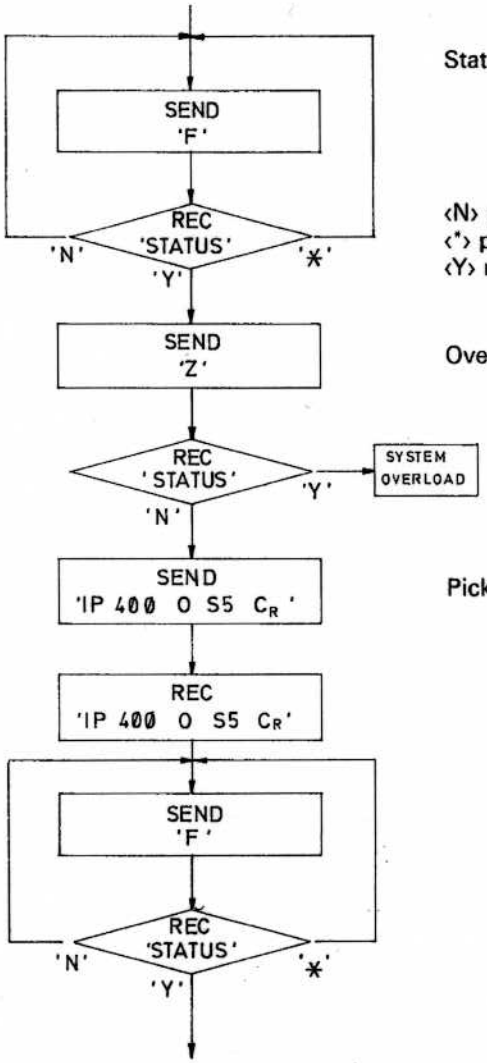
Status querry

‹*› still running
‹Y› ready

Dispense prime volume

DILUTER

- Syringe 500 µl
- Pick up diluent 200 µl from left side and turn valve immediately afterwards.
- Pick up sample 50 µl from right side. Speed 5
- Dispense 250 µl to right side. Speed 5
- Manual execution by actuating an external switch.

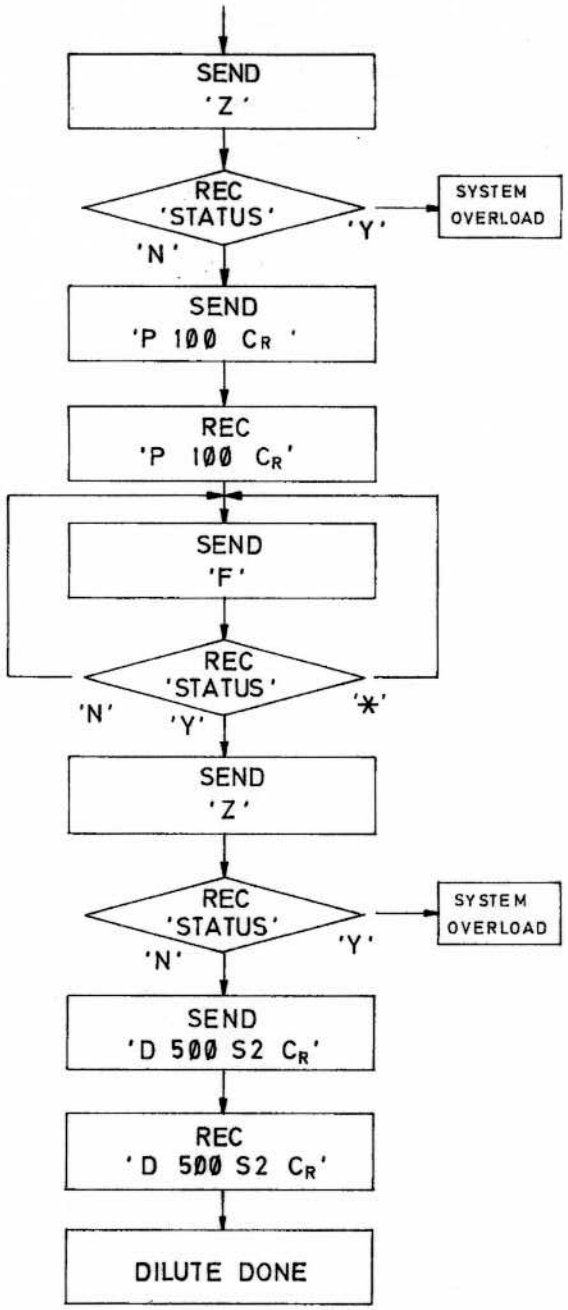


Status querry

‹N› previous command not started
‹*› previous execution not terminated
‹Y› ready

Overload check

Pick up diluent

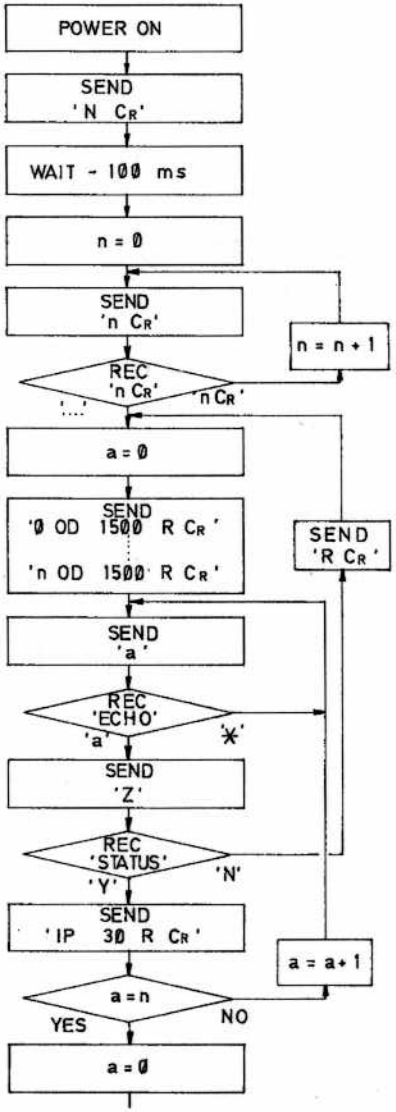


Pick up sample

Dispense diluent + sample

4.2 For multiple MICROLAB M control

INIT – Initializes 1 . . . . 10 MICROLAB M after power on.
– Any power on sequence possible
‹n› = number of connected MICROLAB M's (0 . . . 9)
‹a› = address between 0 and n



Numbers the different MICROLAB M's

Pause instead of echo check

Counts the connected MICROLAB M's until no echo is returned.

No echo: n = number of connected MICROLAB M's

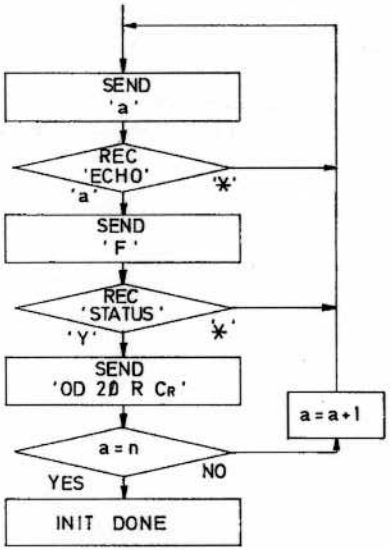
Move plungers to zeropoint

Check status ‹Z› beginning with a = 0

‹N› indicates zeropoint not reached; restart and clear interface by ‹R C_R›

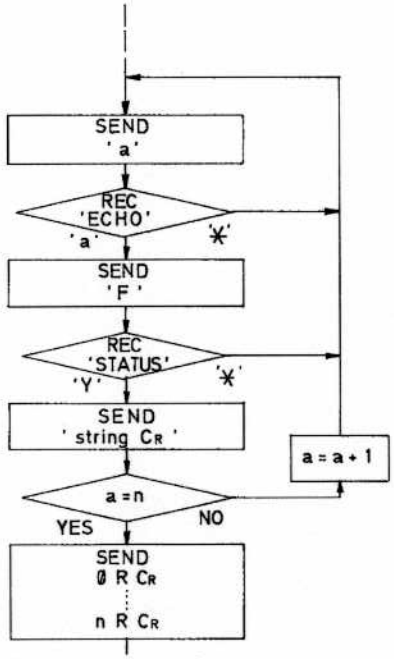
Transmit new command since MICROLAB M is already addressed.

a = n all connected MICROLAB M's are serviced.



‹*› should not appear at this point

SIMULT – Starts n MICROLAB M's simultaneously



Check status ‹F› beginning with a = 0

Load each MICROLAB M while addressed. No ‹R› is transmitted

Start all MICROLAB M's at the same time