MICROLAB® 1000

INSTRUCTION MANUAL

2988

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SECTION 1

Forword

1.1 Precision and accuracy in measuring microlitre volumes are difficult to obtain in a convenient manner. That is why HAMILTON produced the MICROLAB 1000. Its performance and simplicity of operation when used for diluting, pipetting, or distributing samples and reagents brings microlitre liquid handling problems down to earth.

With the MICROLAB 1000 complete methods may be stored to be recalled at anytime. The built in microprocessor will carry out the task with the same high degree of precision and accuracy expected from HAMILTON products, bringing a new dimension to sample processing.

HAMILTON have been manufacturing microlitre syringes for nearly 30 years and have built up a world wide reputation with literally millions of products in use including much instrumentation. The MICROLAB 1000 is one of a series of instruments culminating from this vast experience. May we congratulate you on becoming the owner of this most up to date, microprocessor controlled liquid handling system.

Warranty

1.2 HAMILTON warrants all instruments to be free from any defects in construction, material or workmanship for a period of 18 months from the date of shipment ex factory.

HAMILTON will repair any defective instrument or part thereof if the device is returned within the warranty period to the factory or an authorized dealer. Seller shall not be liable nor responsible for any incidental or consequential damages.

HAMILTON shall be relieved of any liability under this warranty if the instrument is not used in accordance with manufacturer's instructions, not regularly maintained or used for a purpose for which it was not designed. Any product which has been mechanically or electronically altered without specific authorization is excluded from this warranty.

Expendable items such as syringes, tubing and valves are warranted at the time of delivery only.

Please return defective instruments carefully packed in the original boxes to the authorized dealer or to the factory. Freight charges are at buyer's expense.

For any assistance contact your nearest HAMILTON dealer.

Manufactured by Hamilton Bonaduz AG, CH-7402 Bonaduz, Switzerland

ML 1000/10.84.150
610 047

Warranty Registration Form

Please fill in this form carefully and mail it to the address listed below:

MICROLAB 1000 Serial No._____

Date of installation:_____

Purchased from:_____

My specific application is following:_____

Name:_____

Address:_____

_____

Country:_____

Mailing address:

Hamilton Bonaduz AG
P.O. Box 26

CH-7402 Bonaduz
Switzerland

SECTION 2

Description and location of components

Refer to figures 9.1.1 and 9.1.2

2.1	Fuses	The instrument is equipped with two fuses, located in the main socket, one in the line and the other in the neutral. In case of a short circuit, the fuse in the line will blow first. The line fuse is located in the mains filter unit and is accessible by pulling down mains adjustment panel. With mains connector removed insert a small screwdriver in slot and pull panel out horizontally. The fuse holder assembly is indicated with an arrow. Remove the assembly by pulling out the unit. After inserting the fuse make certain that the arrow marked on the holder assembly is directed according to the indication on the cover. Fuse rating for 220-240 volt operation is 1 amp and for 100-120 volt 2 amp.
2.2	Mains voltage adjust.	Situated on the mains filter unit at the back panel, four nominal voltages can be selected. 100-120-220-240 input voltage must not exceed + 10 % of nominal. To change operating voltage pull out the panel using a small screwdriver in the slot above mains socket and remove the voltage selector drum, turn it to the desired mains voltage. After closing the panel, the selected voltage is indicated in the window. Fuse ratings change with voltage see under fuses 2.1.
2.3	Mains connector	A 3-pin moulded plug is supplied with each unit, polarised to ensure correct connection to line (phase) and neutral inputs.
2.4	Mains switch	The mains switch is a double pole type controlling both line and neutral inputs. Press the top to switch on. When read circle is visible switch is in the off position.
2.5	Display	20 character, alpha-numeric, fluorecent display, used to perform dialogue between user and microprocessor.
2.6	Display-cover	This carries a special filter for the display. It can be lifted to give access to the valve block and volume control for audible signal.
2.7	Touch-board	Touch type key-board is used to enter numbers and answer dialogue questions.
2.8	Valveblock	Situated under the display-cover. Two types are used depending on volumes used and designated MICRO and MACRO. The built in microprocessor will inform the user which valve should be used, for any application.

Important: The valveblock must only be changed when the microprocessor requests it. The type fitted is retained in memory and will be taken into account before each run.

2.9 Syringe drives

Are controlled only by the computer and must never be forced manually. The left hand side is designated as A-syringe for reagent/diluent measurement and the right hand side as B-syringe for sample measurement. Each drive has a resolution of

$$\frac{\text{syringe total capacity}}{1000}$$

Important: The syringes must only be changed when the microprocessor requests it. The types fitted are retained in memory and will be taken into account before each run.

2.10 Handactuator

Unit containing the delivery tip, ready light and START button. It is used to control directly the aspiration and dispensing of solutions in normal operation. A small lamp indicates when instrument is ready to proceed. The start button is also used during setting-up, to install the syringes, for zero-setting and to control the flush cycle. All operations are indicated on the display. The handactuator is plugged-in in the rear panel socket marked AUX.

2.11 Serial interface

RS 232-C

2.12 Audio Signal

Acceptance of key-board commands are indicated by sounding a short bleep. Errors are announced by a long bleep with an indication of the cause briefly shown on the display. The volume of this signal may be adjusted using the control located to the right of the display. Clockwise rotation will increase volume.

2.13 Syringes

Various combinations of syringes are possible and may be selected by the user, but the microprocessor will, for any application, inform the user of the selection for optimum performance.
Important: The syringes must only be changed when the microprocessor requests it. The types fitted are retained in memory and will be taken into account before each run.

2.14 Tubing

Standard tubing is supplied, a reagent aspirate tubing 2 x 1 mm dia, 500 mm long and a delivery tubing 2 x 1 mm, 900 mm long and are fitted to the left side of the valveblock and to the sample syringe respectively. If larger samples than 700 ul are contemplated then a 2 x 3 mm, 900 mm long sample tubing should be used. In any event it is not recommended that samples be taken into the sample syringe as unacceptable carry-over may result.

Note

- Capital letters in display indicate operator activity - lower case indicate instrument activity.
- ? on the display indicates yes or no response is required by the user.
- Flashing word indicates option can be selected with yes response or rejected by no. Response, also when start button should be used.
- Green light on handactuator indicates start button is active, extinguishes when command accepted.
- Short audible bleep indicates key-board command accepted.
- Long audible bleep indicates error detected or overload has occured.

SECTION 3

3.1 Unpacking

The MICROLAB 1000 is a precision instrument, therefore, the packing material has been selected carefully to provide maximum protection during transportation. Upon receipt, the packing material should be examined for indications of damage. In the case of damage occuring during transportation, contact the carrier immediately otherwise contact your HAMILTON dealer.

3.2 Electrical installation

Unpack the MICROLAB 1000 and all accessories from the box and inspect for physical damage. Report any shipping damage immediately.

Place the MICROLAB 1000 in the position where it is to be operated, but not directly over heat sources or in direct sunlight (temperature extremes).

Ensure mains voltage is set correctly, refer to 2.2.
Ensure correct fuse is fitted, refer to 2.1.
Fit handactuator plug into AUX socket on rear panel, see 2.10.
Connect mains supply, cable supplied with polarised input, see 2.3.
Serial interface connection, see 10.1.

SECTION 4

4.1 Introduction

The MICROLAB 1000 has eight basic functions. It can operate as a diluter, double diluter, serial diluter, dispenser, multiple dispenser, serum distributor or in multiple pick up mode. In the diluter mode it will deliver diluted samples in a pre-determined ratio using one diluent/reagent, as a double diluter by using two diluents/reagents, and as serial diluter selecting up to ten different dilution ratios. In the dispenser mode the instrument will accurately pipette aliquots of reagent from a stock solution. When used as a serum distributor it will deliver the sample into up to ten receptacles, each of different volume if required, and in multiple pick up mode up to ten different samples can be aspirated and dispensed together.

Premature mixing of reagents and sample is avoided by physical separation of liquids by using a programmed air gap, with cross contamination minimised in the serum distributor mode by including a wash after each cycle.

To obtain the highest performance the unit uses two measuring syringes operating in a completely hydraulic system. Two syringes allow large ratio dilutions to be made, up to 1:5000, without loss of performance. The diluent syringe, left hand side, can be large, up to 25000 ul and the sample syringe, right hand side, small, thus preserving good resolution for small sample. It is not intended that the sample should ever be drawn into the syringe, but that it be contained within the delivery tubing. The standard tubing, 900 mm in length, will hold up to 700 ul. This method of operation practically eliminates carry-over by the washing action of the diluent each time a dilution is made.

All quantities and instructions are entered through the touch-key-board and memorised for future use. This information will be filed under a method number allocated by the user to enable immediate recall at any time. The data will be retained even if the power is removed from the instrument.

Up to fifty methods can be permanently stored at one time, but it is a simple process to delete or amend methods, should the need arise. An overview of each of the stored methods can easily be displayed.

The operator controls the MICROLAB 1000 by answering YES or NO to options offered, which are indicated by causing the option to flash in the display, and by answering questions indicated by a question mark. If the option offered is the one required, it can be selected by using the YES key. The NO key will reject this option and present the next. When the start button on the handactuator should be used, it is indicated in the same way, using a flashing word. When a command from the user is accepted a short bleep will sound but if an error or overload occurs a long bleep will sound together with a brief indication of the cause on the display.
To become familiar with this technique, proceed with the following exercise:

Switch on the MICROLAB 1000 at the rear panel. On the display "SELFTEST COMPLETED" will appear for a few seconds. The instrument is now ready for use. If the instrument has been switched off during programming, the display will indicate "USER MEMORY FAILURE". Press the CE-key to reset the instrument. It should show now [RUN] OR PROG OR AID. The box around a word will be used throughout this text to indicate that this is the flashing word. Touch the NO key, when the command is accepted a short bleep will sound and the display will change to RUN OR [PROG] OR AID. This means NO the RUN channel is not required, so now the microprocessor is asking do you want PROG mode? Touch NO again to change option to RUN OR PROG OR [AID]. Assume this mode is required, so touch YES. Display will change to REVIEW OR DELETE. Touch YES meaning the REVIEW feature is required. Since no methods as yet have been entered the microprocessor will inform the user - location 1 "NO METHOD". Each time YES is touched the location will advance, allowing an overview of the content of each of the fifty locations, so touch YES fifty more times to return to [REVIEW] OR DELETE. Touch NO twice to instruct the microprocessor that they are not wanted and return the dialogue to the starting point: [RUN] OR PROG OR AID.

SECTION 5

5.1 Operating instructions (new user)

In general the MICROLAB 1000 will lead the user through a simple procedure as discussed in the introduction above. This procedure follows a pattern and is easily learned. The operation is divided in three channels. The RUN channel will be used each time the instrument is asked to routinely perform one of the stored programmes. PROG channel will be used to store new methods or to amend the existing ones, and the AID channel allows the user to look at an overview on the display of each method stored, or to delete an entire method, freeing that location for storing a new method.

With many alternative sub-routines possible the easiest way to understand the MICROLAB 1000 is by example. The following example is designed to teach a new user how to program and run the instrument. After working through this exercise it should be possible, using the procedures under section 6, to use the instrument in its other functions. The operator can be confident in operating this unit since any errors will be detected and announced.

When first switched on, the microprocessor will perform a selfcheck, if all is in order the display will briefly inform user - SELF TEST COMPLETED - if an error is found the message will read - USER MEMORY FAILURE. Simply touch any key and the offending method will be deleted from memory.

5.2 Programming as a multiple dispenser

		DISPLAY
5.2.1	Switch on mains supply and select PROG mode. Touch NO and then YES (brackets show user activity)	RUN OR [PROG] OR AID (NO) (YES)
5.2.2	Enter a number between 1 and 50 to identify this method for future recall. It should be an unocuppied location, say 20, so touch "2", "0", "YES" keys.	METHOD #. (2,0,YES)
5.2.3	Select dispenser (DISP) from the four functions offered. DILuter, Double DiLuter, DISPenser and DISTributor. Touch NO twice and YES once.	DIL DDL [DISP] DIST (NO) (NO) (YES)
5.2.4	Select REP.DISP. Select aspiration automatically. The filling of the syringe is executed automatically, or manually, by touching NO. Touch YES.	[REP.DISP]/SERIAL DISP. (YES)
5.2.5	Select dispensing automatically. In automatic operation the aliquots will be dispensed after a set time between 0.1 sec. to 9.9 sec. without user indicating each one. Touch YES	(YES)
5.2.6	Select the time delay between each dispensing. One second is shown as a default. Enter "0" "." "8". A delay of 0.8 sec. is now programmed.	(0, ., 8, YES)

5.2.7 Enter the desired size of each aliquot - say 100 µL. Touch "1", "0", "0", "YES".

REAGENT 100 µL
(1,0,0 YES)

5.2.8 Enter number of aliquots required up to 100 - say 10. Touch "1", "0", "YES".

#OF ALIQUOTS
(1,0, YES)

5.2.9 MICROLAB 1000 is now programmed to aspirate 1000 ul of reagent and dispense it in 10 steps of 100 µL each.

5.2.10 The microprocessor has calculated the size of the liquid system required for optimum performance and is now giving the user the opportunity to accept or change these values. Select parameter verification by YES.

VERIFY?
(YES)

5.2.11 Select syringe verfication by YES. Values can be accepted without verification by YES.

FUNCT VOL [SYR] SPEED
(NO) (NO) (YES)

5.2.12 Display shows optimal computed syringe size of 1.0 mL, by responding with NO next suitable syringe size will be substituted but some performance will be lost.

A-SYRINGE AD
1.0 mL
(NO)

5.2.13 Accept this size by YES. The NO key can be pressed again and again until a suitable size for user is shown, use YES to accept.

A-SYRINGE AD 2.5 mL
(YES)

5.2.14 Accept with YES. NO will substitute alternative but some performance will be lost.

MICRO-VALVE
(YES)

5.2.15 In the same way computed times for syringe movement can be verified or changed. If bubbles form in liquid system during aspiration, the speed should be reduced. Touch YES.

FUNCT VOL SYR [SPEED]
(YES)

5.2.16 The time indicated on the display is the time taken to aspirate the total syringe volume. In this case only 1 mL will be aspirated into a 2.5 mL syringe, so the time taken will be 4 sec. x $\frac{1.0\ mL}{2.5\ mL}$ = 1.6 secs. To increase the speed a shorter time should be selected. Change this parameter by entering "3". Aspirate now will be 3 sec. x $\frac{1.0\ mL}{2.5\ mL}$ = 1,2 secs.

asp REAGENT 4 sec
(NO, 3, YES)

5.2.17 Accept dispense speed of 2 sec. x $\frac{1.0\ mL}{2.5\ mL}$ = 0,8 secs by touching YES. This could be changed as in 5.2.16 above.

disp REAGENT 2 sec
(YES)

5.2.18 The microprocessor is offering the opportunity to check or change the parameters set for this method. Touch NO and exit the PROG mode. YES would allow verification or ammendment to be made.

VERIFY?
(NO)

5.2.19 Programming as a multiple dispenser is now completed and filed under method number 20.

[RUN] OR PROG OR AID

		DISPLAY
5.3	**Running a stored method (in conjunction with 5.2)**	
5.3.1	Select run channel	RUN OR PROG OR AID (YES)
5.3.2	YES to run method shown and NO to run another method	METHOD NO 20 20 RDISP aut 10x100 (YES)
5.3.3	This means syringes already fitted are of the incorrect size and must be replaced. Press START button on handactuator to lower drives to allow syringes to be fitted. If syringes are already fitted and are suitable, programme will continue at 5.3.7 or 5.3.8	START TO CHANGE SYR (Press START)
5.3.4	Install MICRO-VALVE (see section 7.1.1/7.1.2). Touch YES to indicate when valve is installed.	INST MICRO VALVE (YES)
5.3.5	Install 2.5 mL syringe in left hand drive (see 7.2.1-7.2.3). Touch YES to indicate when syringe is installed.	INST A SYR AD 2.5 mL (YES)
5.3.6	This syringe is not used so any B-syringe may be in the right hand drive for this application. Touch YES.	INST ANY B-SYRINGE (YES)
5.3.7	Microprocessor will find the zero position of the syringes when start button on hand unit is pressed.	START → zero set (Press START)
5.3.8	The whole system must be primed with liquid and all air removed, to prevent errors in volume due to compression and expansion of entrapped gas. Put aspiration tubing in reagent and delivery tip in empty beaker. Press start button. Syringe will cycle continuously until start button is pressed again.	START → prime N → CONT (Press START) endprime → press START
5.3.9	MICROLAB 1000 is now ready to run method no. 20. 1 mL reagent has been aspirated.	asp 1.0 mL
5.3.10	First aliquot will be dispensed when start button is pressed.	disp # 1 10 ul (Press START)
5.3.11	Second to tenth aliquots will be dispensed automatically and syringe refilled automatically.	
5.3.12	Cycle will repeat as many times as required. Touch NO to enter stop routine.	
5.3.13	Programme will terminate when YES is touched with possibility to continue when NO is used.	STOP OR CONTINUE (YES)
5.3.14	MICROLAB 1000 ready to function in any mode.	RUN OR PROG OR AID
5.4	**Deleting a stored method (in conjunction with 5.2 and 5.3)**	DISPLAY
5.4.1	Select AID channel.	RUN OR PROG OR AID (YES)

5.4.2	Select DELETE.	REVIEW (NO) OR DELETE (YES)
5.4.3	Either all methods or one method can be deleted. To delete this exercise enter method # 20.	DEL ALL METHODS? Y/N (NO) (2,0,YES) RUN (NO) OR PROG (NO) OR AID (YES)
5.4.4	Method 20 now deleted as can be seen by looking at the content of location 20. Select REVIEW.	REVIEW (YES) OR DELETE
5.4.5	Each time YES is touched, location will advance, so to location 20. Touch YES again.	20 NO METHOD (YES)
5.4.6	Touch NO twice to exit this channel (see flow chart)	REVIEW (NO) OR DELETE (NO)
5.4.7	MICROLAB 1000 ready to function in any mode.	RUN OR PROG OR AID

SECTION 6 - OPERATING PROCEDURE

6.1 Symbols used

Description	Symbol	Mode of operation	Programmable range
Method number	n		1 - 50
Dilution ratio	x	Diluter	1 : 1 - 1 : 5000
	$x_1 - x_{10}$	Serial diluter	1 : 1 - 1 : 1000
Number of aliquots	y	Repeating Dispenser	1 - 100
Diluent volume	v_D	Diluter/Double diluter	2.5 µL - 25 mL
Reagent volume	v_R	Dispenser / Repeating Dispenser	2.5 µL - 25 mL
		Double Diluter (Reagent + Sample + Air gaps)	0 µL - 5 mL
	$V_{R1} - V_{R10}$	Serial Dispenser	2.5 µL - 5 mL
Sample volume	v_S	Diluter	1 µL - 5 mL
	$v_{S1} - v_{S10}$	Multiple aspiration	1 µL - 5 mL
Total volume	v_T	Serial Diluter	25 µL - 5 mL
Wash volume	v_W	Serum Distributer/Multiple aspiration	0 µL - 25 mL
Total reagent volume	v_{RT}	Serial Dispenser	2.5 µL - 25 mL
A-Syringe volume	v_1		250 µL - 25 mL
B-Syringe volume	v_2		50 µL - 5 mL
Aspiration speed B-syringe	s_1		
Dispense speed B-syringe	s_2		1 - 20 sec.
Aspiration speed A-syringe	s_3		
Dispense speed A-syringe	s_4		

6.2 Program as diluter

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power	-	Comment	BRIEFLY DISPLAYED
6.2.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	RUN channel selected
6.2.2	RUN OR [PROG] OR AID	YES	Select programme channel	NO	PROG channel rejected
6.2.3	METHOD #	Enter unoccupied location number	Number displayed		
6.2.4	METHOD (n)	YES	Location referenced for method being entered	NO	No effect
6.2.5	[DIL] DDL DISP DIST	YES	Select DIL function	NO	Reject DIL function
6.2.6	[DILUTER] / SERIAL DIL	YES	Select DIL function	NO	Select SERIAL DIL function.
6.2.7	AIR GAP 10 µL	YES	Volume entered in memory	NO	Enter alternative air gap volume (v_A) 0 - 30 µL
6.2.8	autom pick up? Y/N	YES	Automatic pick up of diluent	NO	manual pick up of diluent by activating start button.
6.2.9	SAMPLE µL	Enter volume (x)		NO	No effect
6.2.10	SAMPLE (v_S) µL 0-5000 µL	YES	Volume entered in memory		

	Display	Action	Result	Alternative Action	Alternative Comment
6.2.11	DILUENT [µL] 1+1÷	NO	Reject diluent as a vol.	YES	Select diluent as volume
6.2.12	DILUENT µL [1+] 1÷	NO	Reject diluent as a ratio 1 part sample + (x) parts diluent.	YES	Select ratio 1 part sample + (x) parts diluent.
6.2.13	DILUENT µL 1 + [1 ÷]	YES	Select diluent as ratio of 1 part sample in (x) parts total volume	NO	Reject diluent as a ratio of 1 part sample in (x) parts total volume.
6.2.14	DILUTION 1÷	Enter ratio			
6.2.15	DILUTION 1÷ (x)	YES	Ratio of 1 part sample in (x) parts total vol. stored	NO	No effect
6.2.16	VERIFY ?	YES	Accepts verification	NO	RUN without verification or modification.
6.2.17	[FUNCT] VOL SYR SPEED	YES	idem	NO	Selects VOL
6.2.18	DILUTER	YES	idem	NO	Selects DIL DDL DISP DIST to restart programming.
6.2.19	FUNCT [VOL] SYR SPEED	YES	Verify air gap volume	NO	Change air gap volume
6.2.20	autom. pick up YES	YES	verifies automatic pick up	NO	Selection of autom. or manual pick up.
6.2.21	SAMPLE (v_S) µL	YES	Volume entered in memory	NO	Change sample volume
6.2.22	DILUTION 1- (x)	YES	Ratio entered in memory	NO	Change dilution ratio
6.2.23	FUNCT VOL [SYR] SPEED	YES	Shows computed A-syringe size	NO	Selects SPEED channel

	Display	Action	Result	Alternative Action	Alternative Comment
6.2.24	A-SYRINGE AD (v_1) µL, mL	YES	A-Syringe AD value accepted	NO	Shows next suitable syringe size.
6.2.25	B-SYRINGE DAD (v_2) µL, mL	YES	B-Syringe DAD entered in memory	NO	idem
6.2.26	MICRO(MACRO)-VALVE	YES	Micro valve memorized	NO	Shows alternative valve
6.2.27	FUNCT VOL SYR [SPEED]	YES	Shows microprocessor selected speeds	NO	VERIFY ?
6.2.28	asp SAMPLE (s) sec. (s = computed time)	YES	Accepts computed time to aspirate sample	NO	Change computed time
6.2.29	disp SAMPLE (s_1) sec. (s_1 = computed time)	YES	Accepts computed time to dispense sample	NO	idem
6.2.30	asp DILUENT (s_2) sec. (s_2 = computed time)	YES	Accepts computed time to aspirate diluent	NO	idem
6.2.31	disp. DILUENT (s_3) sec. (s_3 = computed time)	YES	Accepts computed time to dispense diluent	NO	idem.
6.2.32	VERIFY ?	NO	Selects RUN channel	YES	FUNCT VOL SYR SPEED see 6.2.17
6.2.33	[RUN] OR PROG OR AID	YES	Selects RUN channel	NO	Rejects RUN channel
6.2.34	METHOD #(n)	YES	Accepts method (n) just programmed	NO	Rejects to run method#(n) and enables entering of another method #.
6.2.35	(n) DIL (v_S) µL 1÷ (x)	YES	Displays method with volumes	NO	RUN OR PROG OR AID
6.2.36	START TO CHANGE SYR	Press start button	Lower drives to allow syringe fitting	Comment	If syringes already in place are ok, prog continues at 6.2.40 or 6.2.41

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.2.37	INST MICRO(MACRO)-VALVE	Install valve and indicate by YES	Microprocessor memorizes which valve fitted	Comment/NO	Only ever change valve when indicated to do so/NO - continue at 6.2.26
6.2.38	INST ASYR AD (v_1) µL	Install A-Syringe indicate by YES	Microprocessor memorizes which A-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so/NO - continue at 6.2.24
6.2.39	INST BSYR DAD (v_2) µL	Install B-Syringe indicate by YES	Microprocessor memorizes which B-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so/NO - continue at 6.2.24
6.2.40	START→zero set	Press start button	MICROLAB 1000 finds zero position of syringes		
6.2.41	START→prime/N→cont	Press start button	A-syringe cycles continuously until start button is pressed	NO	No prime cycle required
6.2.42	endprime PRESS START	Press start button	Prime cycle stops		
6.2.43	asp AIR GAP (v_A) µL	automatically	B-Syringe aspirates (v_a) µL of air	YES/NO Comment	Enters stop routine If no air gap, continue at 6.2.44
6.2.44	asp (v_D) + (v_S) µL	Put probe tip in sample and press start button	B-Syringe aspirates sample and A-syringe aspirates (v_D) µL diluent from stock diluent	YES/NO	Enters stop routine
6.2.45	disp (v_D) + (v_S) µL	Put probe tip in receptacle + press start button	Diluted sample is dispensed	YES/NO	Enters stop routine
6.2.46	As 6.2.43 above	continuous operation		Comment	Operation repeats until YES/NO is touched

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.2.47	As 6.2.44 above	NO/YES	Stops routine	NO	Stops routine
6.2.48	STOP OR CONTINUE	YES	DILUTER terminated	NO	Programme can continue
6.2.49	RUN OR PROG OR AID	-	MICROLAB 1000 ready to function in any mode.	-	-

6.3 Program as double diluter

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power	-	Comment	BRIEFLY DISPLAYED
6.3.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	RUN channel selected
6.3.2	RUN OR [PROG] OR AID	YES	Select PROG channel	NO	Reject PROG channel
6.3.3	Method #	enter unoccupied location number	Number displayed		
6.3.4	METHOD (n)	YES	Location referenced for for method entering	NO	No effect
6.3.5	[DIL] DDL DISP DIST	NO	Reject DIL function	YES	Select DIL function
6.3.6	DIL [DDL] DISP DIST	YES	Select DDL function	NO	Reject DDL function
6.3.7	AIR GAP 10 µL	YES	1st air gap volume (v_A) memorized	NO	Select alternative air gap volume (v_A = 0 - 30 µL)
6.3.8	autom. pick up? Y/N	YES	Automatic pick up of diluent	NO	manual pick up of diluent by pushing the handactuator button
6.3.9	REAGENT µL	enter volume			
6.3.10	REAGENT (v_R) µL	YES	Reagent volume memorized	NO	No effect
6.3.11	AIR GAP (v_{A2}) µL	enter volume 0-30			

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.3.12	AIR GAP (v_{A2}) µL	YES	2nd air gap vol.(v_{A2}) memorized	NO	No effect
6.3.13	SAMPLE µL	enter volume			
6.3.14	SAMPLE (v_S) µL	YES	Sample vol. memorized	NO	No effect
6.3.15	DILUENT µL	enter volume			
6.3.16	DILUENT (v_D) µL	YES	Diluent vol. memorized	NO	No effect
6.3.17	VERIFY?	YES	Opportunity to verify or amend parameters	NO	Accept all parameters and select RUN channel
6.3.18	[FUNCT] VOL SYR SPEED	YES	Show function selected	NO	Rejects verification of function
6.3.19	DOUBLE DILUTER	YES	Accepts function	NO	Rejects function as incorrect. Program continues at 6.3.5
6.3.20	FUNCT [VOL] SYR SPEED	YES	Displays air gap volume	NO	Selects SYR
6.3.21	AIR GAP (v_{A1}) µL	YES	Memorizes air gap volume	NO	Change air gap volume
6.3.22	autom. pick up→YES	YES	Memorizes autom.pick up of diluent	NO	Option to select manual or automatic pick up.
6.3.23	Reagent (v_R) µL	YES	Microprocessor memorizes reagent vol. (v_R)	NO	Change reagent vol. (v_R)
6.3.24	Air gap (v_{A2}) µL	YES	Microprocessor memorizes 2nd air gap vol.	NO	Change 2nd air gap vol.(v_{A2})
6.3.25	Sample (v_S) µL	YES	Microprocessor memorizes sample vol. (v_S)	NO	Change sample vol.(v_S)
6.3.26	Diluent (v_D) µL	YES	Microprocessor memorizes diluent vol. (v_D).	NO	Change diluent vol. (v_D)

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.3.27	FUNCT VOL [SYR] SPEED	YES	Shows microprocessor selected syringes.	NO	Rejects SYR channel
6.3.28	A-SYRINGE AD (v_1) µL, mL	YES	Microprocessor memorizes A-syringe	NO	Selects next larger suitable syringe size.
6.3.29	B-SYRINGE DAD (v_2) µL, mL	YES	Microprocessor memorizes B-syringe.	NO	idem.
6.3.30	MICRO(MACRO)-VALVE	YES	Display shows suitable valve block	NO	Selects alternative valve
6.3.31	FUNCT VOL SYR [SPEED]	YES	Displays computerized speeds	NO	Selects VERIFY?
6.3.32	asp SAMPLE (s_1) sec. (s_1 = computed speed)	YES	Accepts calculated time to aspirate sample	NO	Change calculated time
6.3.33	disp SAMPLE (s_2) sec (s_2 = computed speed)	YES	Accepts calculated time to dispense sample	NO	idem.
6.3.34	asp DILUENT (s_3) sec (s_3 = computed speed)	YES	Accepts calculated time to aspirate diluent	NO	idem.
6.3.35	disp DILUENT (s_4) sec (s_4 = computed speed)	YES	Accepts calculated time to dispense diluent.	NO	idem.
6.3.36	VERIFY ?	NO	Selects [RUN] channel	YES	Repeats from 6.3.18.
6.3.37	RUN OR PROG OR AID	YES	Selects channel to run program.	NO	Rejects last method.
6.3.38	LAST METHOD # (n)	YES	Displays method just programmed.	NO	Rejects last method.
6.3.39	(n) DDL (v_R)+(v_S) + (v_D)	YES	Displays method with volumes	NO	RUN OR PROG OR AID.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.3.40	START TO CHANGE SYR	Press start button	Lower drives to allow fitting of syringes	Comment	If syringes fitted are ok the program will continue at 6.3.44 or 6.3.45
6.3.41	INST MICRO(MACRO)-VALVE	Install valve indicate by YES	Computer memorizes which valve is fitted	Comment/NO	Only ever change valve when instructed by the computer/NO -continue at 6.3.30.
6.3.42	INST ASYR AD (v_1) µL	Install A-syringe indicate by YES	Computer memorizes A-syringe (v_1) µL fitted	Comment/NO	Only ever change syringes when instructed by the computer/NO -continue at 6.3.28.
6.3.43	INST BSYR DAD (v_2) µL	Install B-syringe indicate by YES	Computer memorizes B-syringe (v_2) µL fitted	Comment/NO	idem.
6.3.44	START →zero set	Press start button	MICROLAB 1000 finds zero position of syringes	Comment	If zero already set, continue 6.3.45.
6.3.45	START →prime/N →cont	Press start button	A-Syringe cycles continuously until start button is pressed.	Comment	Prime liquid system until no air bubbles are visible.
6.3.46	endprime - PRESS START	Press start button	Prime cycle stops.		
6.3.47	asp AIR GAP (v_{A1}) µL	automatically	B-Syringe aspirates (v_{A1}) µL air gap		
6.3.48	asp (v_D) + (v_R) µL	Press start button place probe tip in reagent	B-Syringe aspirates reagent and A-syringe aspirates diluent.	NO	STOP OR CONTINUE

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.3.49	asp AIR GAP (v_{A2}) µL	Press start button remove probe tip from reagent	B-Syringe aspirates 2nd air gap	NO	idem.
6.3.50	asp (v_S) µL	Press start button place probe tip in sample	B-Syringe aspirates sample	NO	idem.
6.3.51	disp (v_D) + (v_R + v_S) µL	Put delivery tip into receptacle + press start button	Diluted sample delivered	NO	idem.
6.3.52	As 6.3.49 above		Cycle repeats until NO/YES is touched.	NO	idem.
6.3.53	As 6.3.50 above	NO/YES	Enters stop routine		
6.3.54	STOP OR CONTINUE	YES	Terminates diluter	NO	Program continues
6.3.55	RUN OR PROG OR AID	-	MICROLAB 1000 ready to function in any mode	-	-

6.4 Program as single or multiple dispenser

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power	-	-	BRIEFLY DISPLAYED
6.4.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	Select RUN channel
6.4.2	RUN OR [PROG] OR AID	YES	Select PROG channel	NO	Reject PROG channel
6.4.3	METHOD #	enter unoccupied location number	Number displayed		
6.4.4	METHOD # (n)	YES	Location referenced for new program.	NO	No effect
6.4.5	[DIL] DDL DISP DIST	NO	Reject DIL function	YES	Select DIL function
6.4.6	DIL [DDL] DISP DIST	NO	Reject DDL function	YES	Select DDL function
6.4.7	DIL DDL [DISP] DIST	YES	Select DISP function	NO	Reject DISP function
6.4.8	[REP.DISP] SERIAL DISP	YES	Select REP DISP function	NO	Reject REP DISP function
6.4.9	asp.autom.Σ vol? Y/N	YES	Select automatic aspiration	NO	Reject automatic aspiration, but manual operation by pressing start button
6.4.10	disp. automatic? Y/N	NO	Activate dispensing by pressing start button	YES	Automatic dispensing of each aliquot, with selectable time delay of 0.1 to 9.9 sec.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.4.11	REAGENT µL	enter volume	Volume is displayed in µL		
6.4.12	REAGENT (v_R) µL	YES	Volume stored in memory	NO	No effect
6.4.13	#OF ALIQUOTS	enter no. of aliquots	Shows number of aliquots	NO	No effect
6.4.14	#OF ALIQUOTS (y)	YES	Computer calculates volume of total number of aliquots	NO	No effect
6.4.15	VERIFY?	YES	Opportunity to verify or ammend program	NO	Accept all parameters
6.4.16	[FUNCT] VOL SYR SPEED	YES	Displays selected method of operation	NO	Selects VOL
6.4.17	REPEATING DISPENSER	YES	Memorizes selected mode of operation	NO	Selects SERIAL DISPENSER
6.4.18	asp. automatic Σ VOL	YES	Memorizes automatic aspiration of total reagent volume	NO	Manual operation
6.4.18.1	manual START dispense	YES		NO	automatic dispense
6.4.18.2	FUNCT [VOL] SYR SPEED	YES	Displays volumes	NO	Reject VOL channel
6.4.19	REAGENT (v_R) µL	YES	Displays reagent volume	NO	Change reagent volume
6.4.20	#OF ALIQUOTS (y)	YES	Memorizes (y) # of aliquots	NO	Change # of aliquots
6.4.21	FUNCT VOL [SYR] SPEED	YES	Displays computed syringe sizes	NO	Rejects SYR channel
6.4.22	A-SYRINGE AD (v_1) µL, mL	YES	Memorizes calculated syringe size	NO	Displays next suitable syringe size

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.4.23	MICRO(MACRO)-VALVE	YES	Micro-valve accepted	NO	Shows alternative valve
6.4.24	FUNCT VOL SYR SPEED	YES	Shows microprocessor selected speeds	NO	VERIFY?
6.4.25	asp REAGENT (s3) sec (s3 = computed time)	YES	Accept calculated time to aspirate reagent	NO	Change calculated time
6.4.26	disp REAGENT (s4) sec (s4 = computed time)	YES	Accept calculated time to dispense reagent	NO	idem
6.4.27	VERIFY?	NO	Selects RUN channel	YES	Verification required,repetition from step 6.4.16
6.4.28	RUN OR PROG OR AID	YES	RUN channel selected	NO	Reject RUN channel
6.4.29	METHOD # (n)	YES	Displays methods (n)		
6.4.30	(n) RDISP man (y) x (v_R) µL	YES	Accepts method (n) just programmed and displays description of method	NO	Select other method number
6.4.31	START TO CHANGE SYR	Press start button		Comment	If correct syringes are already installed, program continues at 6.4.35 START zero set
6.4.32	INST MICRO(MACRO)-VALVE	Install valve and indicate by YES	Microprocessor memorizes which valve fitted	Comment NO	Only ever change valve when indicated to do so/NO - continue at 6.4.23
6.4.33	INST ASYR AD	Install A-syringe indicate by YES	Microprocessor memorizes which A-syringe fitted	Comment NO	Only ever change syringe when indicated to do so/NO - continue at 6.4.22

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.4.34	INST ANY B-SYRINGE	YES	Size of syringe has no impact on results	NO	Continue to START zero set
6.4.35	START →zero set	Press start button	MICROLAB 1000 finds zero position of syringes	NO	Press start button
6.4.36	START →prime/N →cont	Press start button	A-Syringe cycles continuously until start button is pressed again	NO	Program continues without priming
6.4.37	endprime→PRESS START	Press start button	Prime cycle stops.		
6.4.38	asp (v_R) µL	Press start button	Aspiration of total volume from stock solution		
6.4.39	disp #1 (v_R) µL	Press start button	First aliquot (v) is dispensed	NO	STOP OR CONTINUE
6.4.40	disp # 2 ... (y) x (v_R) µL	Press start button	2nd and subsequent aliquots are dispensed	NO	idem
6.4.41		Press start button NO/YES	Program is interrupted		
6.4.42	STOP OR CONTINUE	YES	Program terminated	NO	Program continues at position where interrupted
6.4.43	RUN OR PROG OR AID	-	MICROLAB 1000 ready to function in any mode		

6.5 Program as a serum distributor

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power	-	Comment	BRIEFLY DISPLAYED
6.5.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	Select RUN channel
6.5.2	RUN OR [PROG] OR AID	YES	Program channel selected	NO	Reject PROG channel
6.5.3	Method #	Enter unoccupied location number	Number displayed		
6.5.4	METHOD # (n)	YES	Location referenced for new program	NO	No effect
6.5.5	[DIL] DDL DISP DISTR	NO	Reject DIL function	YES	Select DIL function
6.5.6	DIL [DDL] DISP DIST	NO	Reject DDL function	YES	Select DDL function
6.5.7	DIL DDL [DISP] DIST	NO	Reject DISP function	YES	Select DISP function
6.5.8	DIL DDL DISP [DIST]	YES	Select DIST function	NO	Reject DIST function
6.5.9	[SERUM DIST] MULTI ASP	YES	Select SERUM DIST function	NO	Selects MULTI ASP
6.5.10	AIR GAP 30 µL	YES	Air gap volume confirmed	NO	Automatic pick up? Y/N
6.5.11	automatic pick up? Y/N	YES	Automatic pick up of wash volume	NO	Manual pick up of wash volume by pressing start button

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.5.12	SAMPLE #(v_{S1}) µL	enter volume	Volume displayed	NO	Terminates sample volume entry
6.5.13	SAMPLE #(v_{S1}) µL	YES	Volume memorized	NO	No effect
6.5.14	SAMPLE #(v_{S2}) µL	enter volume	Volume displayed	NO	Terminates sample volume entry. Selects wash volume
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6.5.15	SAMPLE #(v_{S10}) µL	enter volume	Volume displayed	NO	Terminates sample volume entry. Selects wash volume
6.5.16	Sample #(v_{S10}) µL	YES	Volume memorized	NO	idem
6.5.17	WASH VOLUME µL	enter volume (recommend volume: 10xtotal serum vol.)	Volume displayed	NO	No effect
6.5.18	VERIFY?	YES	Opportunity to verify or amend program	NO	Selects RUN channel
6.5.19	[FUNCT] VOL SYR SPEED	YES	Shows mode of operation	NO	Selects VOL channel
6.5.20	SERUM DISTRIBUTOR	YES	Memorizes function programmed	NO	Selects DIL DDL DISP DIST
6.5.21	FUNCT [VOL] SYR SPEED	YES	Displays programmed volumes	NO	Selects SYR channel
6.5.22	AIR GAP 30 µL	YES	Displays mode of pick up of wash solution		
6.5.23	autom.pick up→YES	YES	Memorizes mode of pick up of wash solution	NO	Automatic pick ? Y/N

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.5.24	SAMPLE # 1 (v_{S1}) µL	YES	Memorizes 1st sample volume	NO	Change 1st sample volume
6.5.25	SAMPLE # 2 (v_{S2}) µL	YES	Memorizes 2nd sample volume	NO	Change 2nd sample volume
6.5.26	SAMPLE # 3 (v_{S3}) µL	YES	Memorizes 3rd sample volume	NO	Change 3rd sample volume
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6.5.27	SAMPLE # 10 (v_{S10}) µL	YES	Memorizes 10th sample volume	NO	Change 10th sample volume
6.5.28	WASH VOLUME (v_w) µL	YES	Memorizes wash volume	NO	Change wash volume
6.5.29	FUNCT VOL SYR SPEED	YES	Shows microprocessor selected syringe sizes	NO	Rejects syringe verification
6.5.30	A-SYRINGE AD (v_1) mL	YES	A-Syringe value accepted	NO	Shows next suitable syringe size
6.5.31	B-SYRINGE DAD (v_2) µL, mL	YES	B-Syringe value accepted	NO	Shows next suitable syringe size
6.5.32	MICRO(MACRO)-VALVE	YES	Valve type accepted	NO	Shows alternative valve type.
6.5.33	FUNCT VOL SYR SPEED	YES	Shows computed speeds	NO	VERIFY ?
6.5.34	asp SAMPLE (s_3) sec (s_3 = computed time)	YES	Accept computed time to aspirate sample	NO	Change computed time.
6.5.35	disp SAMPLE (s_4) sec (s_4 = computed time)	YES	Accept computed time dispense sample	NO	idem

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.5.36	asp WASH (s_1) sec (s_1 = computed time)	YES	Accept computed time to aspirate wash solution	NO	idem
6.5.37	disp WASH (s_2) sec (s_2 = computed time)	YES	Accept computed time to dispense wash solution	NO	idem
6.5.38	VERIFY?	NO	All parameters accepted	NO	Verification required
6.5.39	[RUN] OR PROG OR AID	YES	Select RUN channel to execute method programmed	NO	Selects PROG channel
6.5.40	METHOD # (n)	YES	Accepts method (n) just programmed	NO	Select another method
6.5.41	(n) DIST Σ (v waste + v_{S1} to v_{S10}) + v_W		Displays method and volumes	NO	RUN OR PROG OR AID
6.5.42	START TO CHANGE SYR	Press start button		Comment	If correct syringes are already installed, program continues at 6.5.45 or 6.5.46
6.5.43	INST MICRO(MACRO)-VALVE	Install valve indicate by YES	Computer memorizes which valve is fitted	Comment/NO	Only ever change valve when indicated to do so/NO - continue at 6.5.31
6.5.44	INST ASYR AD	Install A-syringe indicate by YES	Computer memorizes which A-syringe fitted	Comment/NO	Only ever change syringes when indicated to do so/NO - continue at 6.5.29
6.5.45	INST BSYR DAD	Install B-syringe indicate by YES	Computer memorizes which B-syringe fitted	Comment/NO	Only ever change syringes when indicated to do so/NO - continue at 6.5.30
6.5.46	[START] → zero set	Press start button	MICROLAB 1000 finds zero position of syringes	NO	Press start button

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.5.47	START →prime/N →cont	NO	Priming of system not required	YES	priming required
6.5.48	asp AIR GAP 30 µL	Press start button	B-syringe aspirates air gap	NO	STOP OR CONTINUE
6.5.49	asp WASH (v_w) + SAMPLE (v_{S1} to v_{S10})	Press start button Place tip in sample	Aspiration of total wash and sample volume	NO	idem
6.5.50	disp # 1 (v_{S1}) µL	Press start button Place tip in 1st receptacle	1st sample delivered	YES/NO	idem
6.5.51	disp # 2 (v_{S2}) µL	idem Place tip in 2nd receptacle	2nd sample delivered	YES/NO	idem
6.5.52	disp # 3 (v_{S3}) µL	idem Place tip in 3rd receptacle	3rd sample delivered	YES/NO	idem
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6.5.53	disp # 10 (v_{S10}) µL	idem Place tip in 10th receptacle	10th sample delivered	YES/NO	idem
6.5.54	disp WASTE + wash	idem Place tip in receptacle	Extra sample and tip washed with (v) µL sol.	YES/NO	idem
6.5.55	As 6.5.47 above	idem	Cycle repeats	YES/NO	idem

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.5.56	As 6.6.48 above	NO	Enters stop routine	START	Cycle continues
6.5.57	STOP OR CONTINUE	YES	Terminates distributor	NO	Program continues where interrupted
6.5.58	RUN OR PROG OR AID	-	MICROLAB 1000 ready to function in any mode	-	-

6.6. Program as serial diluter

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch power on	Microprocessor checks system	Comment	BRIEFLY DISPLAYED
6.6.1	[RUN] OR PROG OR AID	NO	Rejects RUN channel	YES	RUN channel selected
6.6.2	RUN OR [PROG] OR AID	YES	Selects PROG channel	NO	PROG channel rejected
6.6.3	METHOD #	enter unoccupied location number	Number displayed	NO	No effect
6.6.4	[DIL] DDL DISP DIST	YES	Selects DIL function	NO	Rejects DIL function
6.6.5	[DILUTER]/SERIAL DIL	NO	Rejects DIL function	YES	Selects DIL function
6.6.6	DILUTER/[SERIAL DIL]	YES	Selects SERIAL DIL function	NO	Rejects SERIAL DIL function
6.6.7	AIR GAP 10 µL	YES	Memorizes air gap volume	NO	Change air gap volume
6.6.8	autom pick up? Y/N	YES	Selects automatic pick up	NO	Manual operation, by pressing start button
6.6.9	TOTAL VOLUME (v_T) µL	enter volume of sample + diluent	Volume displayed	NO	No effect
6.6.10	DIL # 1 1÷	enter dilution ratio (lowest)	Lowest dilution ratio	NO	idem VERIFY? : terminates entering dilution ratio
6.6.11	DIL # 1 1÷ (x_1)	YES	1st dilution ratio memorized	NO	idem

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.6.12	DIL # 2 1÷	enter dilution ratio	2nd dilution ratio displayed	NO	idem
6.6.13	DIL # 2 1÷ (x_2)	YES	2nd dilution ratio memorized	NO	idem
6.6.14	DIL # 3 1÷	enter dilution ratio	3rd dilution ratio displayed	NO	idem
6.6.15	DIL # 3 1÷ (x_3)	YES	3rd dilution ratio memorized	NO	idem
6.6.16	DIL # 4 1÷	enter dilution ratio	4th dilution ratio displayed	NO	idem
6.6.17	DIL # 4 1÷ (x_4)	YES	4th dilution ratio memorized	NO	idem
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	.				
6.6.18	DIL # 10 1÷	enter dilution ratio	10th dilution ratio displayed	NO	idem
6.6.19	DIL # 10 1÷ (x_{10})	YES	10th dilution ratio memorized	NO	idem IMPORTANT Depending on total volume of sample + diluent and dilution ratios selected, certain ratios cannot be executed due to the resolution of the syringe drive. Display shows:

	Display	Action	Result	Alternative Action	Alternative Result Comment
					DILUTION IMPOSSIBLE NEXT DIL POSSIBLE and closest ratio will be displayed. Accept with YES and continue, or reject with NO and try different ratio.
6.6.20	VERIFY ?	YES	Verification required	NO	RUN OR PROG OR AID
6.6.21	[FUNCT] VOL SYR SPEED	YES	Displays mode of operation programmed	NO	Selects VOL
6.6.22	SERIAL DILUTER	YES	Memorizes mode of operation	NO	[DIL] DDL DISP DIST
6.6.23	FUNCT [VOL] SYR SPEED	YES	Displays volumes calculated	NO	Selects SYR
6.6.24	AIR GAP (v_A) µL	YES	Accepts entered air gap volume	NO	Change air gap volume
6.6.25	autom. pick up→YES	YES	Accepts automatic pick up of diluent	NO	Selects autom pick up? Y/N
6.6.26	TOTAL VOLUME (v_T) µL, mL	YES	Displays volume of diluent and sample	NO	Change volume of diluent and sample
6.6.27	DIL # 1 1÷ (x_1)	YES	Displays and memorizes 1st dilution ratio	NO	Change dilution ratio
6.6.28	DIL # 2 1÷ (x_2)	YES	Displays and memorizes 2nd dilution ratio	NO	Change dilution ratio
6.6.29	DIL # 3 1÷ (x_3)	YES	Displays and memorizes 3rd dilution ratio	NO	Change dilution ratio

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	Display	Action	Result	Alternative Action	Alternative Result Comment
6.6.30	DIL # 10 1÷ (x_{10})	YES	Displays and memorizes 10th and last dilution ratio	NO	Change dilution ratio
6.6.31	FUNCT VOL [SYR] SPEED	YES	Displays calculated syringe sizes	NO	Selects SPEED
6.6.32	A-SYRINGE AD (v_1) µL, mL	YES	Install requested syringe and confirm by pressing YES	NO	IMPORTANT: no effect, calculated syringe must be installed
6.6.33	B-SYRINGE DAD (v_2) µL, mL	YES	Install requested syringe and confirm by pressing YES	NO	idem
6.6.34	MICRO(MACRO)-VALVE	YES	Install requested valve block and confirm by pressing YES	NO	Alternative valve block may be installed, as long as no syringes larger than 5 mL are installed.
6.6.35	FUNCT VOL SYR [SPEED]	YES	Computed speeds are displayed	NO	VERIFY ?
6.6.36	asp SAMPLE (s_3) sec	YES	Memorizes computed aspiration speed	NO	Change speed
6.6.37	disp SAMPLE (s_4) sec	YES	Memorizes computed dispense speed	NO	Change speed
6.6.38	asp DILUENT (s_1) sec	YES	Memorizes computed diluent aspiration speed	NO	Change speed
6.6.39	disp DILUENT (s_2) sec	YES	Memorizes computed diluent dispense speed	NO	Change speed

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.6.40	VERIFY ?	NO	Selects RUN channel	YES	Verifies again from step 6.6.20
6.6.41	[RUN] OR PROG OR AID	YES	Selects method # just programmed	NO	RUN OR PROG OR AID
6.6.42	METHOD # (n)	YES	Location referenced and method parameters displayed	NO	No effect
6.6.43	(n) SDIL (v_T) µL 1÷ (x)	YES	Execution of method confirmed	NO	RUN OR PROG OR AID
6.6.44	START TO CHANGE SYR	press start button	Lower drives to allow syringe fitting	NO/Comment	PRESS START If correct syringes are already installed, program continues at [START] → zero set
6.6.45	INST MICRO(MACRO)-VALVE	YES	Install requested valve block and confirm by YES	NO	No effect - requested valve mandatory
6.6.46	INST ASYR AD (v_1) µL, mL	YES	Install requested syringe and confirm by YES	NO	No effect - requested syringe must be installed
6.6.47	INST BSYR DAD (v_2) µL	YES	Install requested syringe and confirm by YES	NO	No effect - requested syringe must be installed
6.6.48	[START] zero set	press start button	MICROLAB 1000 finds zero position of syringes	NO	PRESS START
6.6.49	[START] → prime/[N] → cont	press start button	A-Syringe cycles continuously until cycle is terminated by pressing start button	NO	asp # 1 (v_{D1}) + (v_{S1})
6.6.50	endprime → PRESS START	press start button	Prime cycle is stopped and volumes of 1st dilution ratio are displayed	NO	[STOP] OR CONTINUE

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.6.51	asp # 1 $(v_{D1}) + (v_{S1})$	place probe tip into first sample and press start button	Diluent and sample are aspirated	NO	idem
6.6.52	disp # 1 $(v_{D1}) + (v_{S1})$	press start button to dispense in receptacle	Diluent and sample are dispensed	NO	idem
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6.6.53			Dilution series continued until NO is touched		
6.6.54	STOP OR CONTINUE	YES	Enters stop routine	NO	Dilution series continue after YES has been touched
6.6.55	RUN OR PROG OR AID	-	MICROLAB 1000 ready to function in any mode		

6.7 Program as Serial Dispenser

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power	-	Comment	BRIEFLY DISPLAYED
6.7.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	RUN channel selected
6.7.2	RUN OR [PROG] OR AID	YES	Select PROG channel	NO	PROG channel rejected
6.7.3	Method #	enter unoccupied location number	Number displayed	-	-
6.7.4	Method (n)	YES	Location referenced for method being entered	NO	No effect
6.7.5	[DIL] DDL DISP DIST	NO	Reject DIL function	YES	Select DIL function
6.7.6	DIL [DDL] DISP DIST	NO	Reject DDL function	YES	Select DDL function
6.7.7	DIL DDL [DISP] DIST	YES	Select DISP function	YES	Reject DISP function
6.7.8	[REP.DISP] SERIAL DISP	NO	Reject REP.DISP function	YES	Select REP.DISP function
6.7.9	REP.DISP [SERIAL DISP]	YES	Select SERIAL DISP function	NO	Reject SERIAL DISP function
6.7.10	asp. autom. ΣVOL ? Y/N	YES	Automatic pick up of reagent	NO	Manual pick up of reagent
6.7.11	disp automatic ? Y/N	YES	Automatic dispense of reagent	NO	Manual dispense of reagent
6.7.12	TIME DELAY 1 s	YES	Memorizes time delay of 1 sec.	NO	Select any time between 0.1 and 9.9 sec.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.7.13	REAGENT # 1 µL	enter volume	Volume displayed	NO	Terminates reagent volume entry
6.7.14	REAGENT # 1 (V_{R1}) µL	YES	Volume memorized	NO	No effect
6.7.15	REAGENT # 2 µL	enter volume	Volume displayed	NO	Terminates reagent volume entry
6.7.16	REAGENT # 2 (V_{R2}) µL	YES	Volume memorized	NO	VERIFY ?
	•				
	•				
	•				
6.7.17	REAGENT # 10 µL	enter volume	Volume displayed	NO	Terminates reagent volume entry
6.7.18	REAGENT # 10 (V_{R10}) µL	YES	Volume memorized	NO	No effect
6.7.19	VERIFY ?	YES	Opportunity to verify or ammend program	NO	Selects RUN channel
6.7.20	FUNCT VOL SYR SPEED	YES	Shows mode of operation	NO	Selects VOL channel
6.7.21	SERIAL DISPENSER	YES	Memorizes mode of operation	NO	Selects DIL DDL DISP DIST
6.7.22	asp.automatic ΣVOL	YES	Memorizes automatic pick up	NO	Selects manual operation
6.7.23	dispense automatic	YES	Memorizes automatic dispense	NO	Selects manual operation

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.7.24	TIME DELAY 1 s	YES	Memorizes time delay of 1 s	NO	Select any time between 0.1 and 9.9 sec.
6.7.25	FUNCT [VOL] SYR SPEED	YES	Displays programmed volumes	NO	Selects [SYR] channel
6.7.26	REAGENT # 1 (V_{R1}) µL	YES	Memorizes (V_{R1}) volume	NO	Change # 1 reagent volume
6.7.27	REAGENT # 2 (V_{R2}) µL	YES	Memorizes (V_{R2}) volume	NO	Change # 2 reagent volume
	.				
	.				
	.				
6.7.28	REAGENT # 10 (V_{R10}) µL	YES	Memorizes (V_{R10}) volume	NO	Change # 10 reagent volume
6.7.29	FUNCT VOL [SYR] SPEED	YES	Shows microprocessor selected syringe sizes	NO	Rejects syringe verification
6.7.30	A-SYRINGE AD (V_1) µL	YES	A-Syringe value accepted	NO	Shows next suitable syringe
6.7.31	MICRO(MACRO)-VALVE	YES	Valve type accepted	NO	Shows alternative valve type
6.7.32	FUNCT VOL SYR [SPEED]	YES	Shows computed speeds	NO	VERIFY ?
6.7.33	asp REAGENT s_3 sec	YES	Accept computed speed to aspirate reagent	NO	Change speed
6.7.34	disp REAGENT s_4 sec	YES	Accept computed speed to dispense reagent	NO	idem
6.7.35	VERIFY ?	NO	All parameters accepted	NO	Verification required

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.7.36	[RUN] OR PROG OR AID	YES	Select RUN channel to execute method programmed	NO	Selects PROG channel
6.7.37	Method # (n)	YES	Execute method (n) just programmed	NO	Select any other method
6.7.38	(n) SDISP aut # 1 (V_{R1}) µL	YES	Displays method and volumes	NO	[RUN] OR PROG OR AID
6.7.39	START TO CHANGE SYR	Press start button	Lower drives to allow syringe fitting	Comment	If syringes already installed are o.k, program continues at 6.7.43
6.7.40	INST MICRO(MACRO)-VALVE	Install valve and indicate by YES	Microprocessor memorizes which valve fitted	Comment/NO	Only ever change valve when indicated to do so/NO - continue at 6.7.31
6.7.41	INST ASYR AD (v_1) µL	Install A-Syringe indicate by YES	Microprocessor memorizes which A-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so/NO - continue at 6.7.30
6.7.42	INST ANY B-SYRINGE	Install any B-Syr. indicate by YES	Microprocessor memorizes which B-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so
6.7.43	[START] → zero set	Press start button	MICROLAB 1000 finds zero position of syringes		
6.7.44	[START] → prime/[N] → cont	Press start button	A-syringe cycles continuously until start button is pressed	NO	No prime cycle required

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.7.45	endprime→PRESS START	Press start button	Prime cycle stops		
6.7.46	asp (V_{RT}) µL	automatically	A-Syringe aspirates (V_{RT}) volume	YES/NO	Enters stop routine
6.7.47	disp # 1 (V_{R1}) µL	automatically	A-Syringe dispenses (V_{R1}) volume	YES/NO	idem.
6.7.48	disp # 2 (V_{R2}) µL	automatically	A-Syringe dispenses (V_{R2}) volume	YES/NO	idem
	.				
	.				
	.				
6.7.49	disp # 10 (V_{R10}) µL	automatically	A-Syringe dispenses (V_{R10}) volume	YES/NO	idem.
6.7.50	As 6.7.46	Continues operation		Comment	Operation repeats until YES/NO is touched
6.7.51		YES/NO	Stops routine		
6.7.52	STOP OR CONTINUE	YES	SERIAL DISP terminated	NO	Stops routine
6.7.53	RUN OR PROG OR AID		MICROLAB 1000 ready to function in any mode		

6.8 Program as Multiple pick up

	Display	Action	Result	Alternative Action	Alternative Result Comment
	SELF TEST COMPLETED	Switch on power		Comment	BRIEFLY DISPLAYED
6.8.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	RUN channel selected
6.8.2	RUN OR [PROG] OR AID	YES	PROG channel selected	NO	Reject PROG channel
6.8.3	METHOD #	enter unoccupied location number	Number displayed		
6.8.4	METHOD (n)	YES	Location referenced for method being entered	NO	No effect
6.8.5	[DIL] DDL DISP DIST	NO	Reject DIL function	YES	Select DIL function
6.8.6	DIL [DDL] DISP DIST	NO	Reject DDL function	YES	Select DDL function
6.8.7	DIL DDL [DISP] DIST	NO	Reject DISP function	YES	Select DISP function
6.8.8	DIL DDL DISP [DIST]	YES	Select DIST function	NO	As 6.8.5 above
6.8.9	[SERUM DIST] MULTI ASP	NO	Reject SERUM DIST function	YES	Select SERUM DIST function
6.8.10	SERUM DIST [MULTI ASP]	YES	Select MULTI ASP function	NO	As 6.8.9 above
6.8.11	ASP # 1 µL	enter first sample volume to be aspirated	Display first sample volume	NO	Terminates sample volume entry. Selects wash volume.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.8.12	ASP # 1 (V_{S1}) µL	YES	Memorizes first sample volume	NO	No effect
6.8.13	ASP # 2 µL	enter 2nd sample volume to be aspirated.	Display 2nd sample volume	NO	Terminates sample volume entry. Selects wash volume.
6.8.14	ASP # 2 (V_{S2}) µL	YES	Memorizes 2nd sample volume	NO	No effect.
	.				
	.				
	.				
6.8.15	ASP # 10 µL	enter 10th sample volume to be aspirated	Display 10th sample volume	NO	Terminates sample volume entry. Selects wash volume.
6.8.16	ASP # 10 (V_{S10}) µL	YES	Memorizes 10th sample volume	NO	No effect.
6.8.17	WASH VOLUME µL	enter wash volume	Display wash volume	NO	No effect.
6.8.18	WASH VOLUME (V_W) µL	YES	Memorizes wash volume	NO	No effect.
6.8.19	VERIFY ?	YES	Opportunity to verify or ammend program	NO	Selects RUN channel
6.8.20	[FUNCT] VOL SYR SPEED	YES	Shows mode of operation	NO	Selects VOL channel
6.8.21	MULTIPLE ASPIRATION	YES	Memorizes function programmed	NO	As 6.8.5 above.
6.8.22	FUNCT [VOL] SYR SPEED	YES	Shows mode of operation	NO	Selects SYR channel
6.8.23	ASP # 1 (V_{S1}) µL	YES	Memorizes 1st sample volume	NO	Alter 1st sample volume.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.8.23	ASP # 2 (V_{S2}) µL	YES	Memorizes 2nd sample volume	NO	Alter 2nd sample volume.
	•				
	•				
	•				
6.8.24	ASP # 10 (V_{S10}) µL	YES	Memorizes 10th sample volume	NO	Alter 10th sample volume.
6.8.25	WASH VOLUME (V_W) µL	YES	Memorizes wash volume	NO	Alter wash volume.
6.8.26	FUNCT VOL [SYR] SPEED	YES	Shows microprocessor selected syringe sizes	NO	Rejects syringe verification.
6.8.27	A-SYRINGE AD (V_1) mL	YES	A-Syringe value accepted	NO	Shows next suitable syringe size.
6.8.28	B-SYRINGE DAD (V_2) µL	YES	B-Syringe value accepted	NO	Shows next suitable syringe size.
6.8.29	MICRO(MACRO)-VALVE	YES	Valve type accepted	NO	Shows alternative valve.
6.8.30	FUNCT VOL SYR [SPEED]	YES	Shows computed speeds	NO	VERIFY ?
6.8.31	asp SAMPLE (s_1) sec	YES	Accept computed time to aspirate sample.	NO	Change computed speed
6.8.32	disp SAMPLE (s_2) sec	YES	Accept computed time to dispense sample.	NO	idem.
6.8.33	asp WASH (s_3) sec	YES	Accept computed time to aspirate wash	NO	idem.

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.8.34	disp WASH (s_4) sec	YES	Accept computed time to dispense wash	NO	idem.
6.8.35	VERIFY ?	NO	All parameters accepted	YES	As 6.8.19 above.
6.8.36	[RUN] OR PROG OR AID	YES	RUN channel selected	NO	As 6.8.1 above
6.8.37	METHOD # (n)	YES	Accepts method (n) just programmed	NO	Select any other method.
6.8.38	(n) MULTIASP # 1 (V_{S1}) µL	YES	Displays method and volumes	NO	As 6.8.1 above
6.8.39	START TO CHANGE SYR	Press start button		Comment	If correct syringes are already installed, program continues at 6.8.43.
6.8.40	INST MICRO(MACRO)-VALVE	Install valve indicate by YES	Computer memorizes which valve fitted	Comment/NO	Only ever change valve when indicated to do so/NO - continue at 6.8.29
6.8.41	INST ASYR AD	Install A-syringe indicate by YES	Computer memorizes which A-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so/NO - continue at 6.8.27
6.8.42	INST BSYR DAD	Install B-syringe indicate by YES	Computer memorizes which B-syringe fitted	Comment/NO	Only ever change syringe when indicated to do so/NO - continue at 6.8.28
6.8.43	[START] → zero set	Press start button	MICROLAB 1000 finds zero position of syringes	NO	Press start button.
6.8.44	[START] → prime/[N] → cont	NO	Priming of system not required	YES	Priming of system required.
6.8.45	asp (V_W) µL	Press start button	B-Syringe aspirates wash	YES/NO	STOP OR CONTINUE

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.8.46	asp # 1 (V_{S1}) µL	Press start button	A-Syringe aspirates 1st sample	YES/NO	idem.
6.8.47	asp # 2 (V_{S2}) µL	Press start button	A-Syringe aspirates 2nd sample	YES/NO	idem.
	.				
	.				
	.				
6.8.48	asp # 10 (V_{S10}) µL	Press start button	A-Syringe aspirates 10th sample	YES/NO	idem.
6.8.49	disp (V_T) µL	Press start button	A-Syringe dispenses total sample volume	YES/NO	idem.
6.8.50	disp WASH	Press start button	B-Syringe dispenses wash volume	YES/NO	idem.
6.8.51	As 6.8.45 above	Press start button	Cycle repeats	YES/NO	idem.
6.8.52		YES/NO	Enters stop routine		
6.8.53	STOP OR CONTINUE	YES	Terminates MULTI ASP function	NO	Program continues.
6.8.54	RUN OR PROG OR AID		MICROLAB 1000 ready to function in any mode		

6.9 To find a stored method or an unoccupied location

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.9.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	Select RUN channel
6.9.2	RUN OR [PROG] OR AID	NO	Reject PROG channel	YES	Select PROG channel
6.9.3	RUN OR PROG OR [AID]	YES	Select AID channel	NO	Reject AID channel
6.9.4	[REVIEW] OR DELETE	YES	Select REVIEW feature	NO	Reject REVIEW feature
6.9.5	(overview of laction 1)	YES	Advances location number	NO	Returns programme to 6.9.1
6.9.6	(overview of location 2)	YES	Advances location number	NO	idem
	.				
	.				
	.				
6.9.7	(overview of location 50)	YES	Advances location number	NO	idem
6.9.8	As 6.9.1	YES	Selects RUN channel	NO	Rejects RUN channel

6.10 To delete one or all programmes

	Display	Action	Result	Alternative Action	Alternative Result Comment
6.10.1	[RUN] OR PROG OR AID	NO	Reject RUN channel	YES	Select RUN channel
6.10.2	RUN OR [PROG] OR AID	NO	Reject PROG channel	YES	Select PROG channel
6.10.3	RUN OR PROG OR [AID]	YES	Select AID channel	NO	Reject AID channel
6.10.4	[REVIEW] OR DELETE	NO	Reject REVIEW feature	YES	Select REVIEW feature
6.10.5	REVIEW OR [DELETE]	YES	Select DELETE feature	NO	Reject DELETE feature
6.10.6	DEL ALL METHOD ? Y/N	NO			
6.10.7	METHOD #	Enter number of method to be deleted	Number displayed	YES	FOR DEL PRESS "." (deletes all programmes)
6.10.8	METHOD (n)	YES	Computer eliminates entire method from location selected		
6.10.9	[RUN] OR PROG OR AID	YES	Select RUN channel	NO	Reject RUN channel

SECTION 7

Fitting the valve block

7.1.1 Two types of valve block can be used with the MICROLAB 1000, designated MICRO and MACRO. They should only be fitted or exchanged when indicated by the micropressor.

7.1.2 Lift display cover to give access to the valve block and syringe connections. Insert the two white guides into the two valve drive holes situated beneath the display with the two syringe coupling threaded holes downward. It is not necessary to align the drives with the valves, this will automatically take place during operation. Secure by inserting the central locking screw.

To remove the valve block see section 7.3.1.

Fitting the syringes

7.2.1 Great care must be taken when fitting the syringes not to subject them to any side stress.

Syringes should only be fitted or exchanged when indicated by the microprocessor. No attempt should be made to move the syringe drives by hand, they are programmed to be at their lowest position whenever it is necessary to change or fit different syringes.

7.2.2 The MICROLAB 1000 is designed to be used with AccuDil® syringes, a reagent syringe is fitted to the "A" drive (left hand side) and a "D" type, sample syringe to the "B" (right hand side). Sizes to be fitted will be indicated by the microprocessor during dialogue routine. A mechanical stop is fitted to the plunger of the sample syringe to ensure accurate alignment with its side connector outlet in the zero position.

7.2.3 Lift display cover to give access to valve block and syringe connections. Loosen the left hand plunger locking ring. Take a reagent/diluent syringe of the volume indicated on the display and pull out the plunger about 2 cm. Holding the syringe vertical with one hand, insert the plunger button into the plunger locking ring assembly and lightly tighten with the other. Extend the syringe and carefully fit barrel into the valve block by twisting with a clockwise motion until tight. Finally tighten the plunger locking ring firmly by hand.

The sample syringe is fitted in a similar manner, but in this case the threaded portion is free to rotate on the barrel, this ensures that the side connector can always be set to face toward the right side of the instrument.

To remove syringes follow the fitting instructions in the reverse order, they may only be dismounted when indicated by the microprocessor.

To exchange the valve block

7.3.1 Dismount syringes, see section 7.2.3. Remove the locking screw from the centre of the valve block and pull the block horizontally away from the main instrument.

To mount another valve block follow 7.1.2.

To exchange syringes

7.4.1 The syringes may only be exchanged when indicated by the microprocessor. Dismount syringes fitted and mount the alternatives in accordance with section 7.2.3.

To replace defective syringes

7.5.1 If the instrument is running, switch off the mains power and allow 5 seconds to elapse before continuing.

Switch on the power and after the SELF CHECK the MICROLAB 1000 will show the RUN OR PROG OR AID display. Select RUN by touching YES and also the METHOD #(n) used by YES again. Now the display shows START zero set. Press any key but not the start button and MICROLAB 1000 will enter the START TO CHANGE SYR routine. Proceed by following the display dialogue in the normal way, see section 7.2.3. If the syringe size as indicated on the display is not available, touch NO. The instrument will enter the programme mode and will allow a change of syringe size, however, some performance will be lost.

Follow the dialogue in the usual way to program the specific method required.

It may be of help to read the appropriate function under section 6.

FUNCTION	SECTION
Diluter	6.2.36
Double Diluter	6.3.40
Dispenser	6.4.31
Serum Distributor	6.5.41
Serial Diluter	6.6.44
Serial Dispenser	6.7.39
Multiple pick up	6.8.39

Aspiration tube

7.6.1 The aspiration tubing is fitted directly to the left side of the valve block, using the flared M6 screw connector and tightening firmly by hand. A 2 mm x 1 mm x 500 mm is supplied but this may be shortened if expensive or small volume of reagent is to be used. See also section 7.7.1.

Sample/delivery tube

7.6.2 The sample tubing is connected to the side outlet of the sample syringe, using the flared M6 screw connector. The tapered delivery tip should be threaded through handactuator and held in place by lightly tightening the end section. The tube and the cable may be held together using the small clips provided. See also section 7.7.1.

Selection of tubing

7.7.1 If volumes greater than 5 mL are contemplated the aspiration and delivery tubes should be replaced with accessory number 240000/240360 tubing. This has a larger internal diameter than the standard tubing supplied and will produce less resistance to the flow. An alternative would be to reduce the speed of aspiration and delivery by programming. However when it is required to use sample volumes in excess of 700 µL the larger delivery tube, number 240360 should be used to avoid the sample entering the syringe, as this may caus contamination producing unacceptable carry-over.

Cleaning of the FEP tubing

7.7.2 After using the MICROLAB 1000 for a longer period, the innerwall contamination of the dispensing tubing installed in the handactuator 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, using the PRIME cycle. After cleaning flush system at least 5 times with distilled water before using again with reagents.

Important:
This procedure should be done at least once a week.

SECTION 8

Technical Specifications

Methods of operation	Dispenser, Multiple Dispenser, Diluter, Double Diluter, Serial Diluter, Serum Distributor, Multiple Pick up.
Syringe Drives	Each syringe is driven by a high resolution stepper motor and a precision lead screw. An auxiliary synchronmotor drives the valve.
Syringe sizes	Sample syringe: 50, 100, 250, 500 µL, 1.0, 2.5 and 5 mL Diluent syringe: 250, 500 µL, 1.0, 2.5, 5.0, 10.0 and 25.0 mL Optimal syringe sizes are calculated by the microprocessor, but the operator may alter this selection.
Valves	MICRO or MACRO valve Selected by the microprocessor, but may be altered by the user.
Tubing	Standard aspiration tubing: 2 x 1 x 500 mm, (dead volume approx. 390 µL) Standard probe tubing: 2 x 1 x 900 mm, (dead volume approx. 700 µL) Macro aspiration tubing: 3 x 2 x 500 mm, (dead volume approx. 1.5 mL) Macro probe tubing: 3 x 2 x 900 mm, (dead volume approx. 2.5 mL)
Method storage	Maximum 50 methods. These are not lost when power is switched off and may be recalled for use at any time. Memories are protected over 8 years.
Aspirating and dispensing speeds	Range from 1 to 20 seconds for full stroke of syringe plunger. Following speeds are selectable: 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 18 and 20 secs. The requested speeds can be programmed individually for the aspiration of reagent and sample, as well as for the dispensing. Optimum speed is computed by microprocessor, but operator may alter this selection by directly keying in modified values.
Display	20 Alpha-numeric characters. Used in dialogue with the operator, i.e. display messages, instructions and positions in program.
Accuracy	Method of operation: Diluter/Dispenser, applicable to syringes > 250 µL 30 % of syringe capacity < 1 % 10 % of syringe capacity < 1 % 5 % of syringe capacity < 1.2 % 2 % of syringe capacity < 2 % 1 % of syringe capacity < 3 %

Precision	Method of operation: Diluter/Dispenser, applicable to syringes > 250 µL
	30 % of syringe capacity <0.2 %
	10 % of syringe capacity < 0.4 %
	5 % of syringe capacity < 0.5 %
	2 % of syringe capacity < 0.8 %
	1 % of syringe capacity <1.5 %
	These specifications are statistically based on the test results of more than 500 instruments manufactured and are exceeding the requirements of DIN 12650.
Interface	RS 232 C (Baud rate 2400)
Mains supply	100/120/220/240 Volts - 50/60 Hz Voltages are selectable.
Power consumption	40 VA
Fuse ratings	at 100/120 Volts - 2 Amps at 220/240 Volts - 1 Amp
Dimensions	170 x 230 x 300 mm
Weight	8.5 kg
	We reserve the right to alter these specifications without notice.

Figure 9.1.1

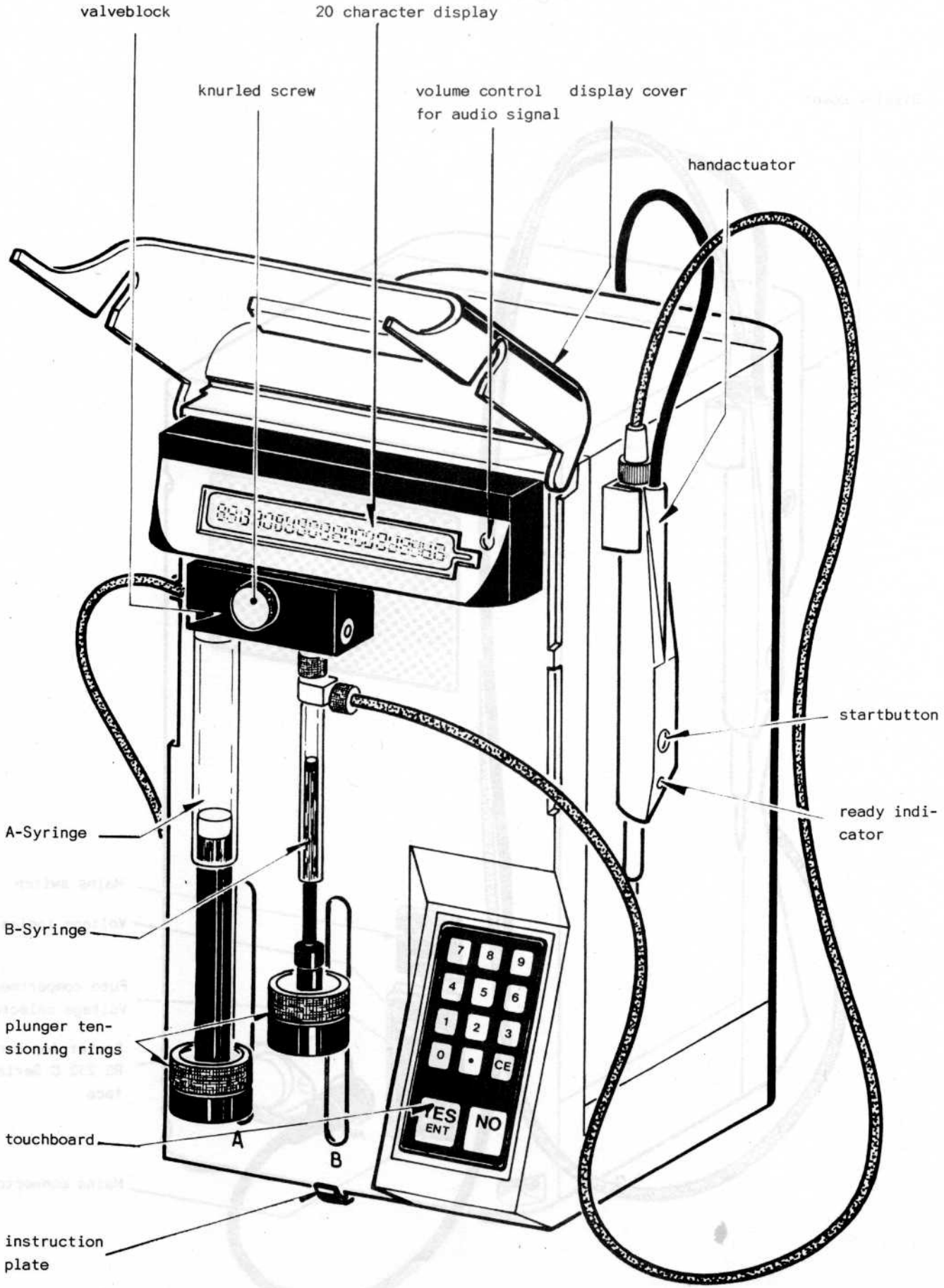
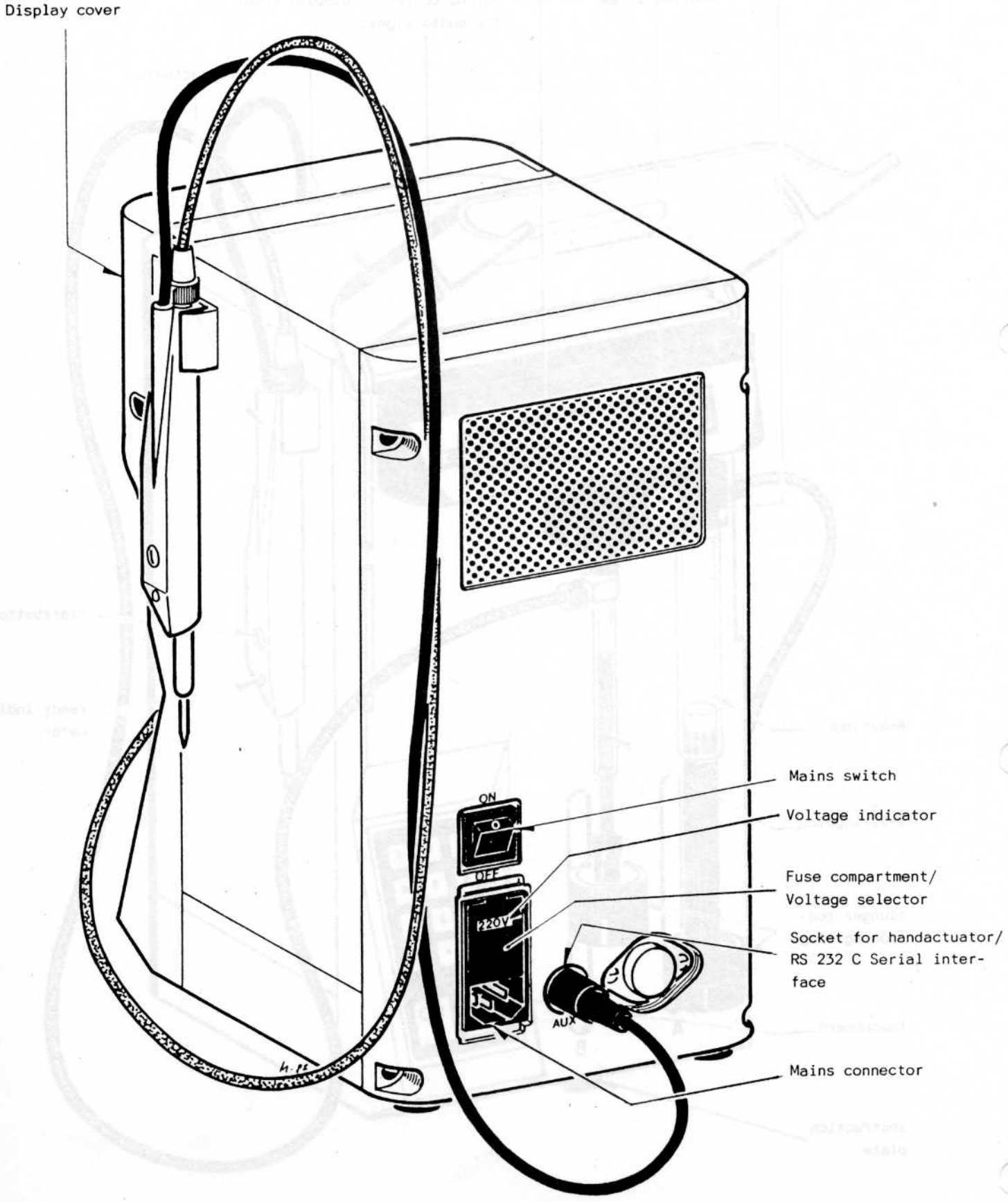

valveblock
20 character display
knurled screw
volume control for audio signal
display cover
handactuator
startbutton
ready indicator
A-Syringe
B-Syringe
plunger tensioning rings
touchboard
instruction plate
A
B
7
8
9
4
5
6
1
2
3
0
CE
YES ENT
NO

Figure 9.1.2


Display cover
ON
OFF
220V
AUX
Mains switch
Voltage indicator
Fuse compartment/
Voltage selector
Socket for handactuator/
RS 232 C Serial inter-
face
Mains connector

SECTION 10

Description of RS 232 C interface

10.1 Introduction

The MICROLAB 1000 is equipped with a RS 232 C interface which includes transmitted data (T_x), received data (R_x) and ground (GND).

After switching on the MICROLAB 1000 the display shows RUN OR PROG OR AID. To activate the interface, any ASCII-character has to be sent to the interface before any key on the MICROLAB 1000 keyboard has been touched. The display will then show EXTERNAL. In this mode only single movements can be programmed at a time.

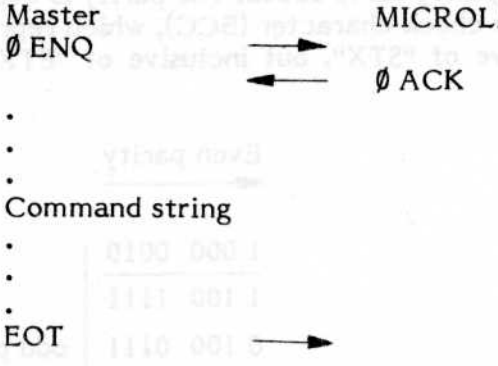
The MICROLAB 1000 may be cascaded with one or more MICROLAB M's. The MICROLAB 1000 has to be the last unit in such a cascade. A MICROLAB unit acts always as a slave.

10.2 Protocol

10.2.1 Line establishment

Transmission is composed by "EOT Ø ENQ" (enquiry) and terminated with "EOT" (end of transmission). Transmission is composed after the MICROLAB 1000 has acknowledged with "Ø ACK" (acknowledge). Within the "ENQ" ... "EOT" frame no other unit in a cascade can be addressed.

Example:
MICROLAB 1000 should be activated



10.2.2 Communications

Data will be transferred in blocks using 7-bit-ASCII-codes (DIN 66003). The first character of a block is "STX" (start of text). The signal "ETX" (end of text) followed by a BCC (block check character) terminates the block.

Each data block transfer is acknowledged by the receiver:

"ACK" (acknowledge):	after a successful transfer
"NAK" (negative acknowledge):	faulty transfer, requests a transfer repetition,

No answer — in case "ETX" or "BCC" was faulty.

The master must possess a termination criteria, i.e. "Time Out" and a repetition-counter. The MICROLAB 1000 does not possess a termination criteria.

Examples:
successful transfer

Master		MICROLAB 1000
STX O G ETX BCC	→	
	←	ACK

faulty transfer (transmission error)

Master		MICROLAB 1000
STX O G ETX BCC	→	
	←	NAK
STX O G ETX BCC	→	(repetition)
	←	ACK

garbled transfer (e.g. ETX faulty)

Master		MICROLAB 1000
STX O G ETX BCC	→	
		no answer
time out		
STX O G ETX BCC	→	(repetition)
	←	ACK

10.2.3 Data communications-check

To each 7-bit character a parity bit is added. The parity is even. "ETX" (end of text) is followed by a block check character (BCC), which represents the check sum of the block (exclusive of "STX", but inclusive of "ETX"). The parity is odd.

Example:

		Even parity ←	
STX	(02H)	1 000 0010	
O	(4FH)	1 100 1111	
G	(47H)	0 100 0111	odd parity
ETX	(03H)	0 000 0011	
BCC		0 100 0100	↓

STX has priority and deletes a previous, not terminated string.

10.2.4 Command list

ASCII	Hex	
'O'	4F	turn valve to Output
'I'	49	turn valve to Input
'P'	5Ø	left syringe - Pick up
'D'	44	left syringe - Dispense
'p'	70	right syringe - pick up
'd'	64	right syringe - dispense
'Z'	5A	initialize
'S'	53	Status request
'G'	47	Go (Start)
'K'	4B	activate Keyboard / initial status RUN OR PROG OR AID

Parameters

ASCII	HEX
Ø	3Ø
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
:	3A
;	3B
<	3C
=	3D
>	3E
?	3F

A syringe command is followed by a parameter block.

Format:

Sssssv

S syringe command (P,D,p,d)

s number of steps of stepper motor

$$ssss = \frac{\text{volume } (\mu L)}{\text{syringe capacity } (\mu L)} \times 1000$$

full stroke = 1000 steps

v speed

range 3Ø ... 3F

Ø = 1 sec	8 = 7 sec
1 = 1.5 sec	9 = 8 sec
2 = 2 sec	: = 10 sec
3 = 2.5 sec	; = 12 sec
4 = 3 sec	< = 14 sec
5 = 4 sec	= = 16 sec
6 = 5 sec	> = 18 sec
7 = 6 sec	? = 20 sec

indicated time is per full stroke of syringe

10.2.5 Status reply

Upon a status request 'S' the MICROLAB 1000 will immediately return a 2 byte status information.

Note:

No status reply is transmitted in case 'S' was acknowledged by 'NAK'.

Format:

STX B_1 B_2 ETX BCC

Byte 1:

Bit		
7	parity	
6	1	1 = command running Ø = command executed
5	'O'	
4	'I'	
3	'P'	
2	'D'	
1	'p'	
Ø	'd'	

Byte 2:

Bit		
7	parity	
6	1	
5	Ø	not used
4	Ø	not used
3	=1	command 'Z' busy
2	=1	syntax error
1	=1	left syringe overloaded
Ø	=1	right syringe overloaded

Example:
Turn valve to 'INPUT' position

Master		MICROLAB 1000	
STX I G ETX BCC	→		
	←	ACK	
STX S ETX BCC	→		
	←	ACK	
	←	STX P@ ETX BCC	command busy
ACK	→		
.			
.			
.			
STX S ETX BCC	→		
	←	ACK	
	←	STX@@ ETX BCC	command executed
ACK	→		

whereby		B1	B2
P @	≙	1Ø1ØØØØ	1ØØØØØØØ

10.2.6 Important notes

- 'Z' has highest priority, it can interrupt any running operation.
- Of the commands O,I,Z,S,K only one can be transmitted at a time.
- P or D can be combined with p or d. Also while one syringe is in process, the second may be released. Except this case, no motion command (O,I,P,D,p,d) is accepted during the busy state of the instrument. A syntax error would be set.
- The execution of the commands O,I,P,D,p,d,Z can be started in 3 different ways:

1. transmitting G together with the command in the same string
   immediate execution
2. transmitting G in a separate string after the command string
   execution upon receipt of G
3. no G is transmitted
   execution is released by an external switch (e.g. handactuator)

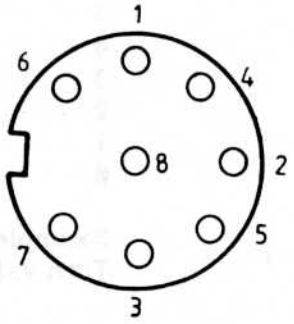
- After power on and after a syringe overload has occured no other command than Z will be accepted.
- The command K returns the control to the keyboard of the MICRO-LAB 1000. This is effective only after termination by EOT.
  Note:
  K acts like a hardware reset and does not pay attention to running commands.

10.3 Hardware specifications

The RS 232 C is accessible at the 8 pin DIN socket at the back panel of the MICROLAB 1000.

Pin configuration:

Pin		
1	LED K	Handactuator
2	START SWITCH IN	Handactuator
3	START SWITCH OUT	Handactuator
4	LED A	Handactuator
5	GND	Handactuator
6	Tx	RS 232 C
7	Rx	RS 232 C
8	GND	RS 232 C

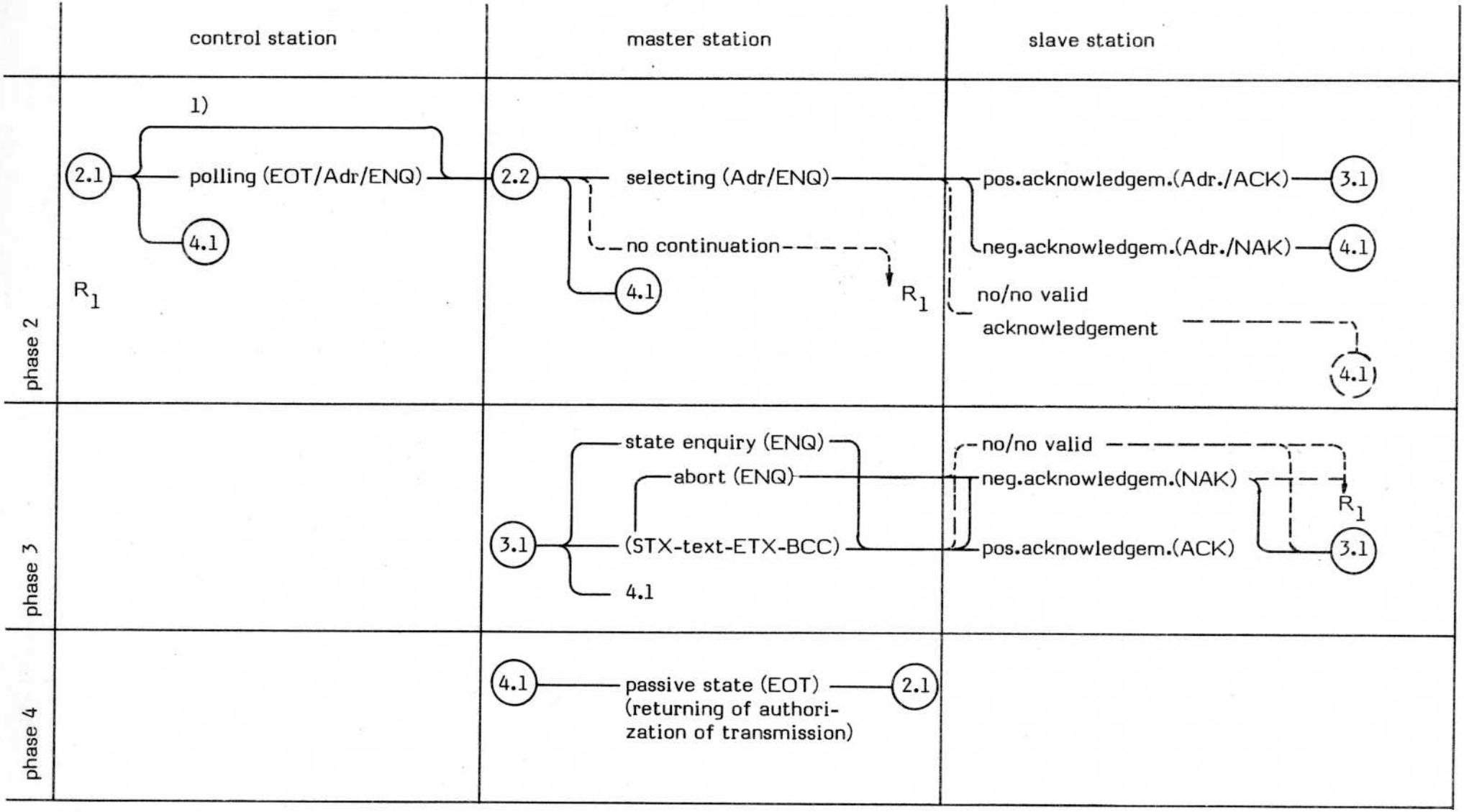


An optional Y piece adapter allows the use of the handactuator and the interface at the same time.

Interface specifications:

Baud rate :	2400
Parity :	even
Start bit :	1
Data bits :	7
Parity bit :	1
Stop bits :	2

Branching diagram



1) The control station is master station in case no polling has taken place

R_1: Recovery after time control is over by means of the control station

SECTION 11

Test Certificate

MICROLAB 1000, Serial Number..2988.. Date.....20.1.88

Results obtained are the average of 15 separate weighings of water at 10 % part volume (22° C)

2500 µL A-Syringe, DISP mode: accuracy:.....-0.11..... %

precision:.....0.01..... %

500 µL B-Syringe, DIL mode: accuracy:.....0.06..... %

precision:.....0.26..... %

Quality controller:.....D. Cela.....

2500µl A Syringe
250µl B-Syringe .