EOS Bravo and EOS Bravo Plus

LICG895 – LICG892 – LICG890

PRELIMINARY **Service Manual**

HOSPITEX DIAGNOSTICS
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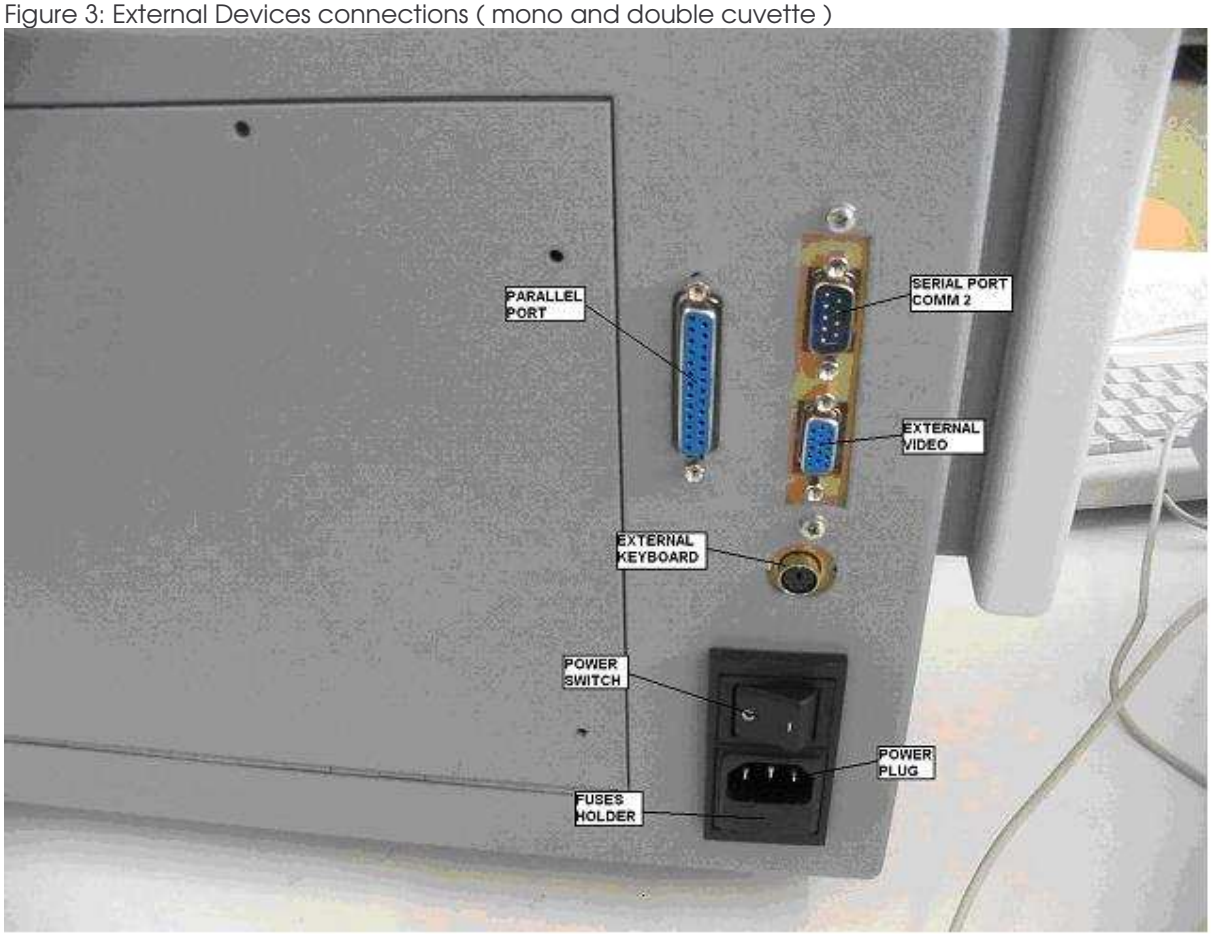
1 - GENERAL VIEW

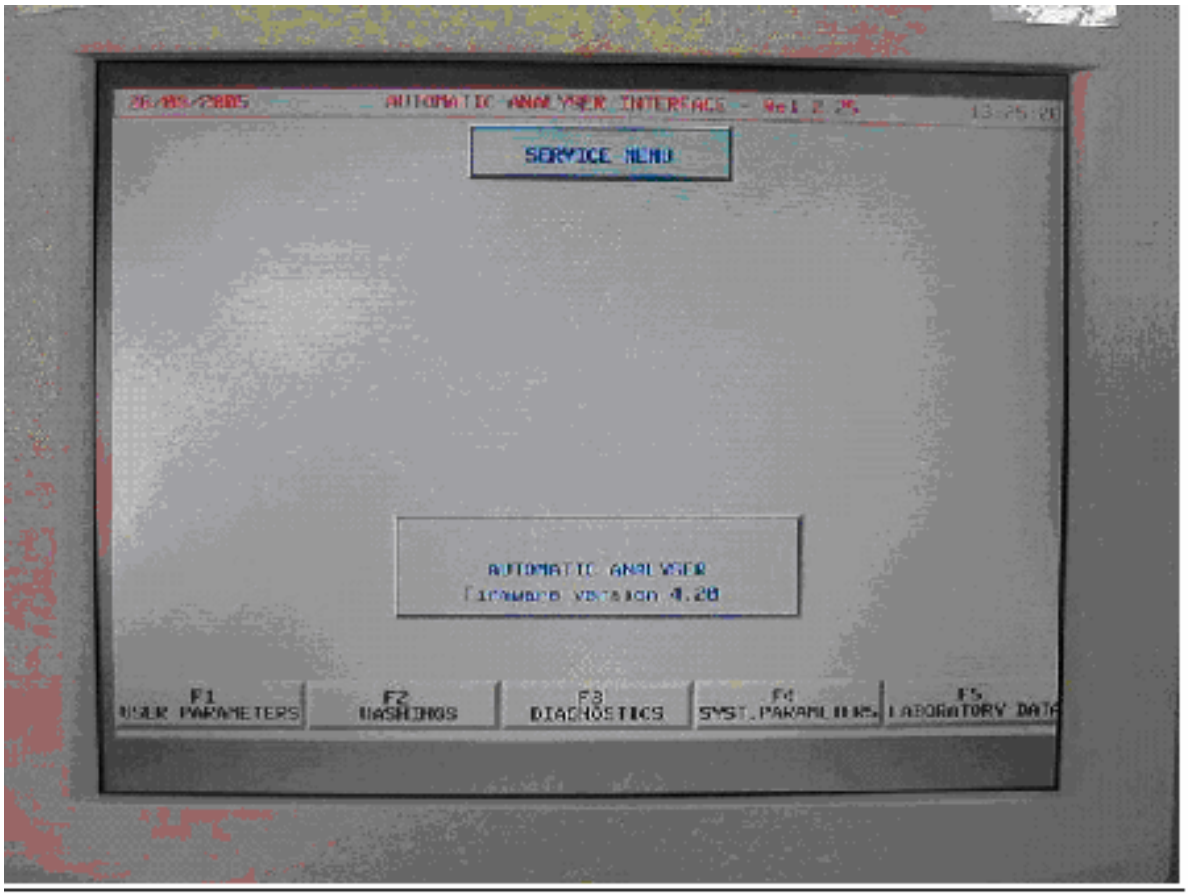
Figure 1: Mono Cuvette

Figure 2: Double Cuvette

Figure 3: External Devices connections (mono and double cuvette)



2 - SERVICE MENU



MAIN MENU' > F5 SERVICE

F1 : WORKING PARAMETERS

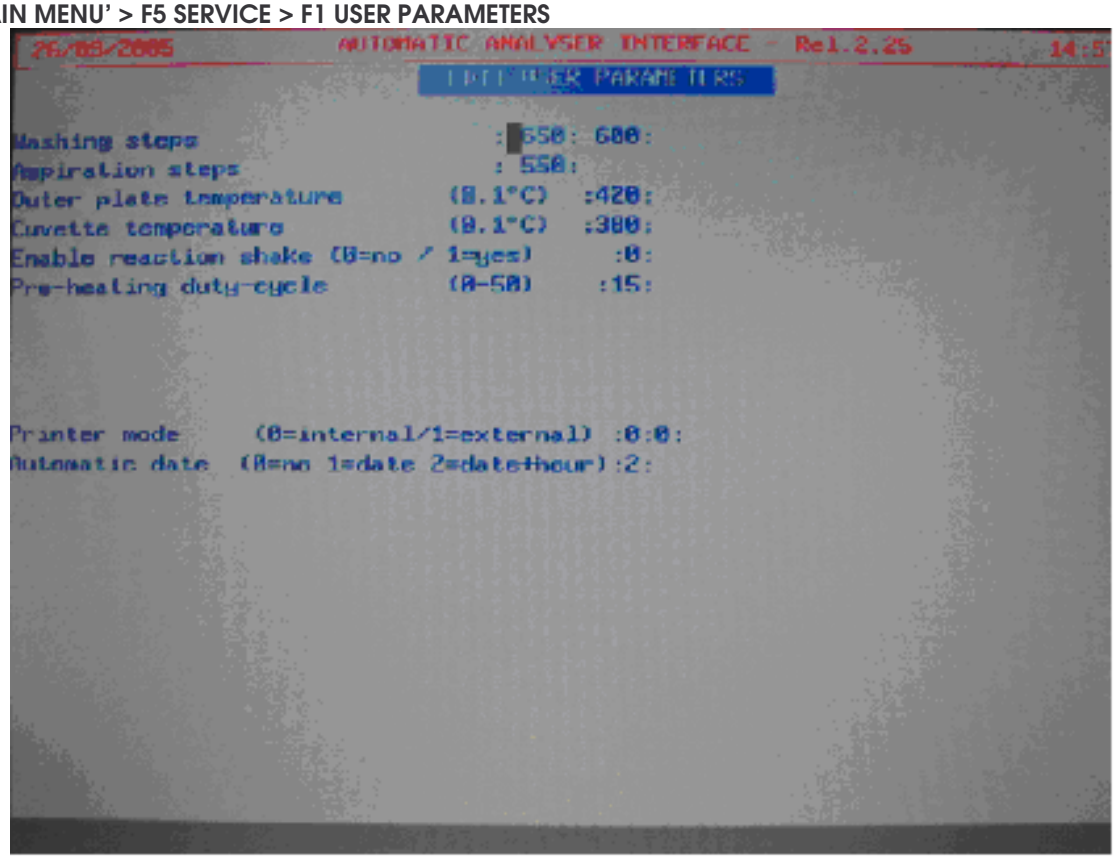
F2 : MANUAL AND AUTOMATIC WASHINGS, AUTOZERO

F3 : MECHANICAL AND FUNCTIONAL TESTS

F4 : SYSTEM PARAMETERS (ONLY FOR SERVICE)

F5 : LABORATORY HEADING AND OPERATOR'S NAME

MAIN MENU' > F5 SERVICE > F1 USER PARAMETERS



WASHING STEPS : Peristaltic pump's steps relative to the first and the second phase of aspiration, used to wash the cuvette with liquid and air

ASPIRATION STEPS : Peristaltic pump's steps used to aspirate the remain of the liquid from the cuvette

OUTER PLATE TEMP. : Parameter to modify the temperature of the plate which holds the reaction segments

CUVETTE TEMP. : Parameter to modify the temperature of the cuvette

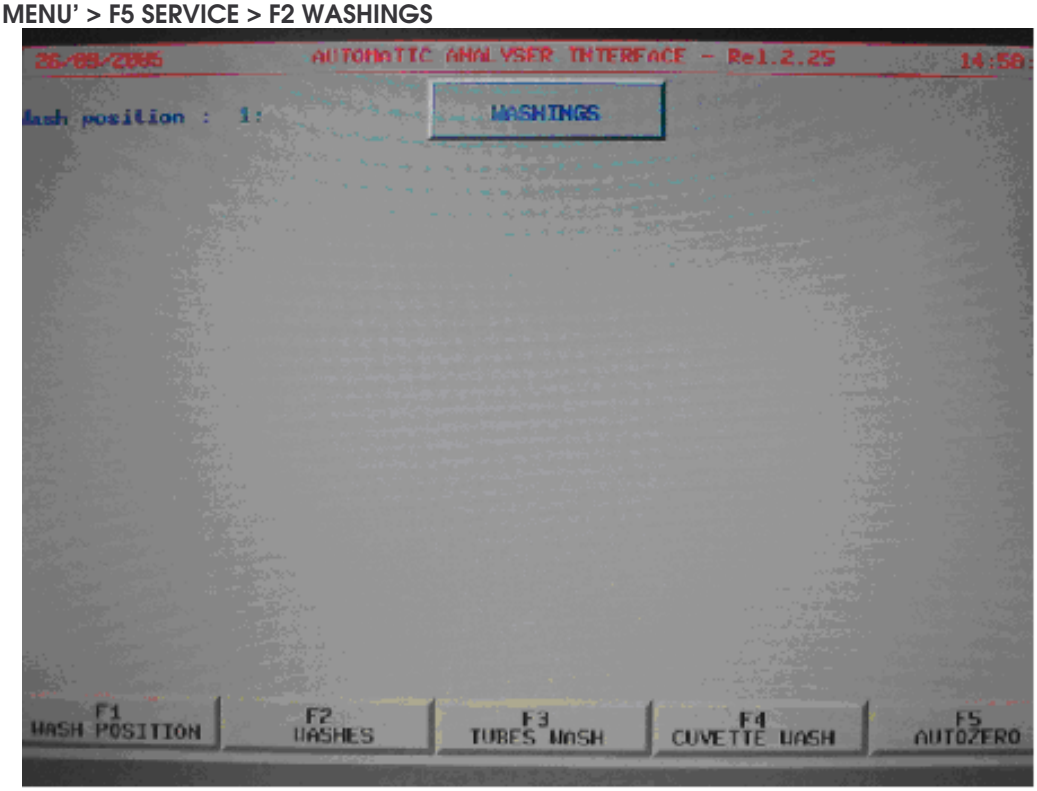
ENABLE REACTION SHAKE : Parameter to enable the function of shake of the plate which holds the reaction segments
(0 = NO, 1 = YES)

PRE-HEATING DUTY-CYCLE : Parameter relative to the power impulse relative to the resistance that is situated around the heating reel

PRINTER MODE : Parameter relative to the printing
0 : 0 = ALL THE PRINTING ARE MADE ON THE INTERNAL PRINTER
1 : 0 = THE PRINTINGS OF THE SESSION ARE MADE ON THE INTERNAL PRINTER AND THE PRINTINGS OF THE REFERTS ARE MADE ON THE EXTERNAL PRINTER
1 : 1 = ALL THE PRINTING ARE MADE ON THE EXTERNAL PRINTER

AUTOMATIC DATE : Parameter relative to the date and time from the internal PC
0 = NO
1 = ONLY DATE
2 = DATE + HOUR

MAIN MENU' > F5 SERVICE > F2 WASHINGS



F1 WASH POSITION : Used to select the number of the hole used for the washings

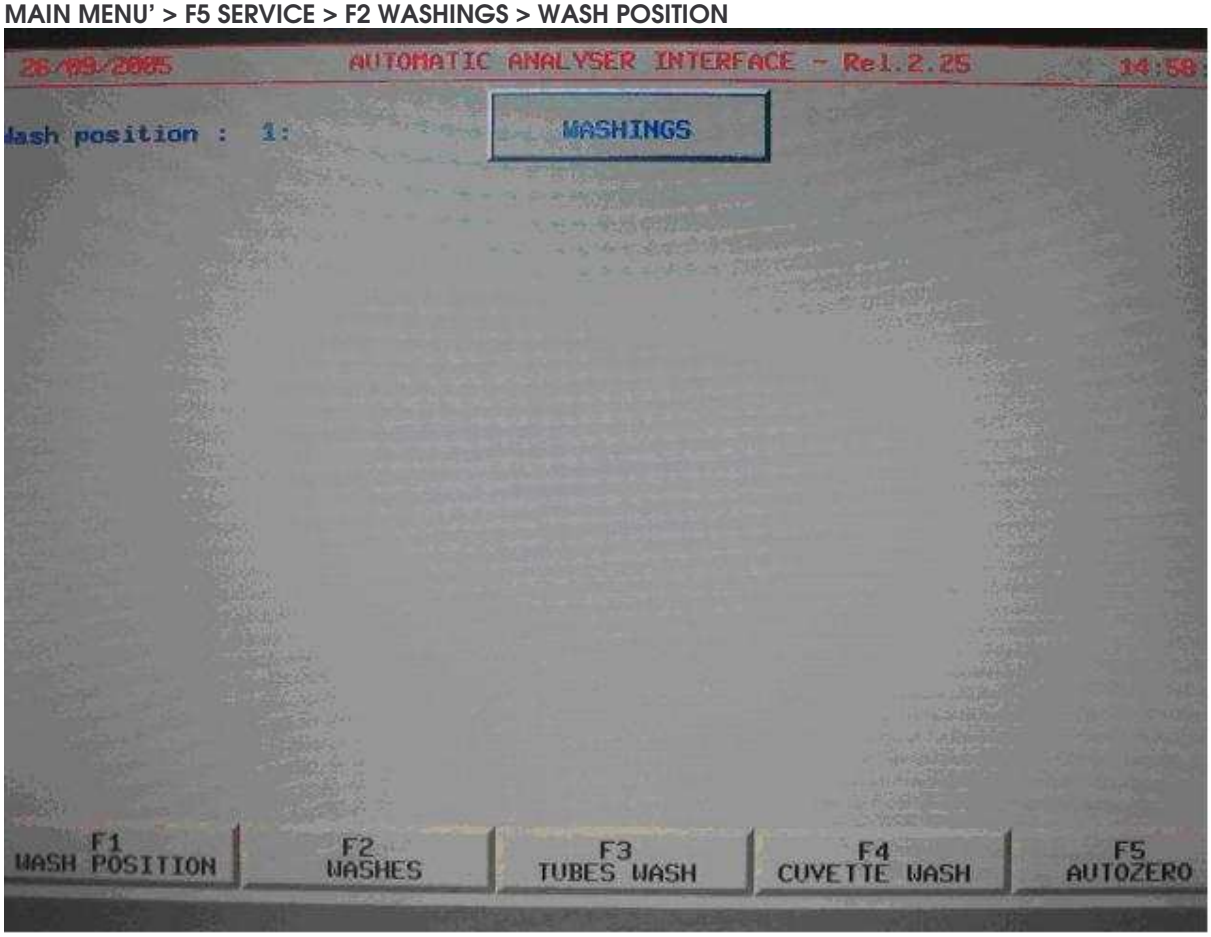
F2 WASHES : The instrument executes a number of XX washings in automatic

F3 TUBES WASH : The instrument executes a washing cycle of the sampling circuit

F4 CUVETTE WASH : The instrument executes a washing cycle of the aspiration circuit

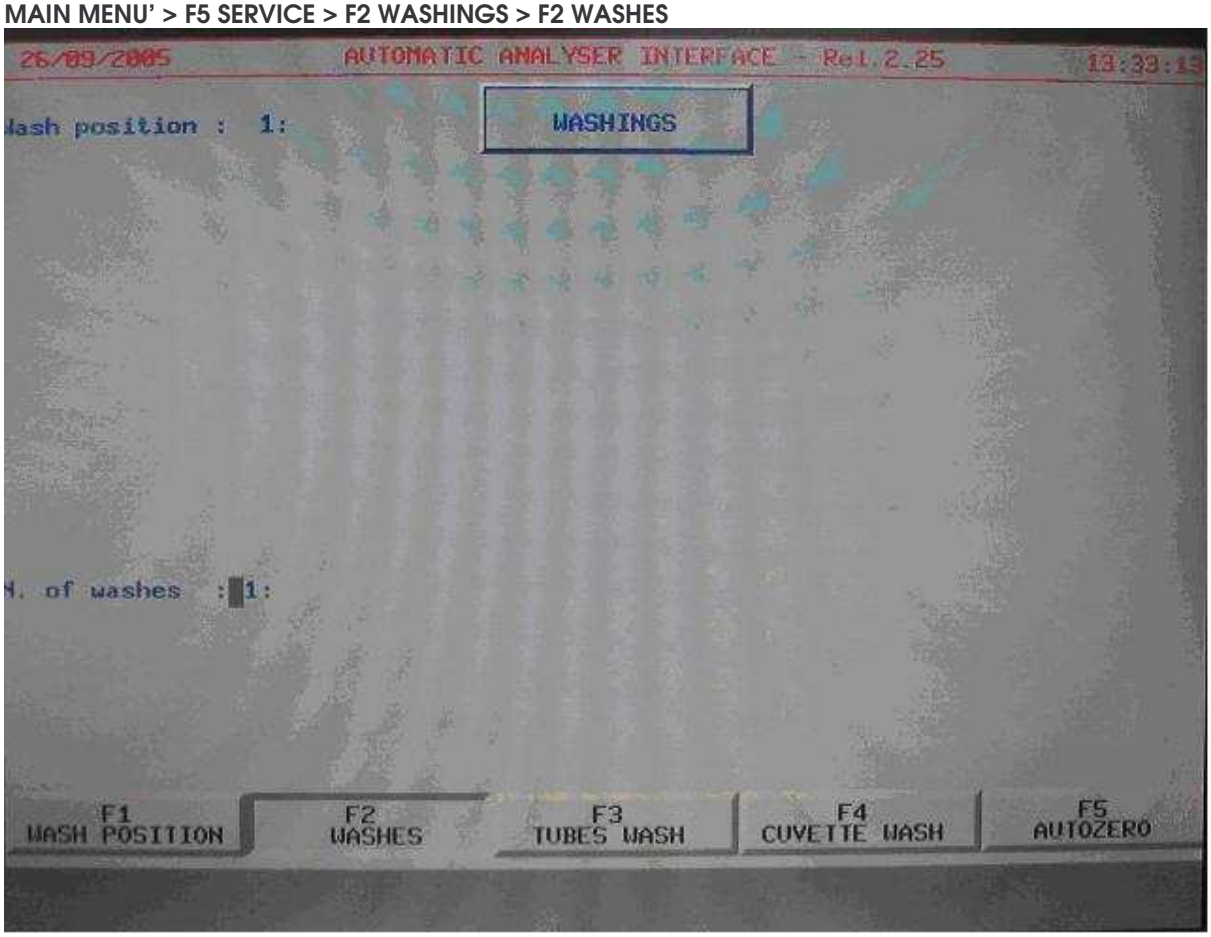
F5 AUTOZERO : The instrument executes the autozero of all filters on board to the filter wheel

MAIN MENU' > F5 SERVICE > F2 WASHINGS > WASH POSITION



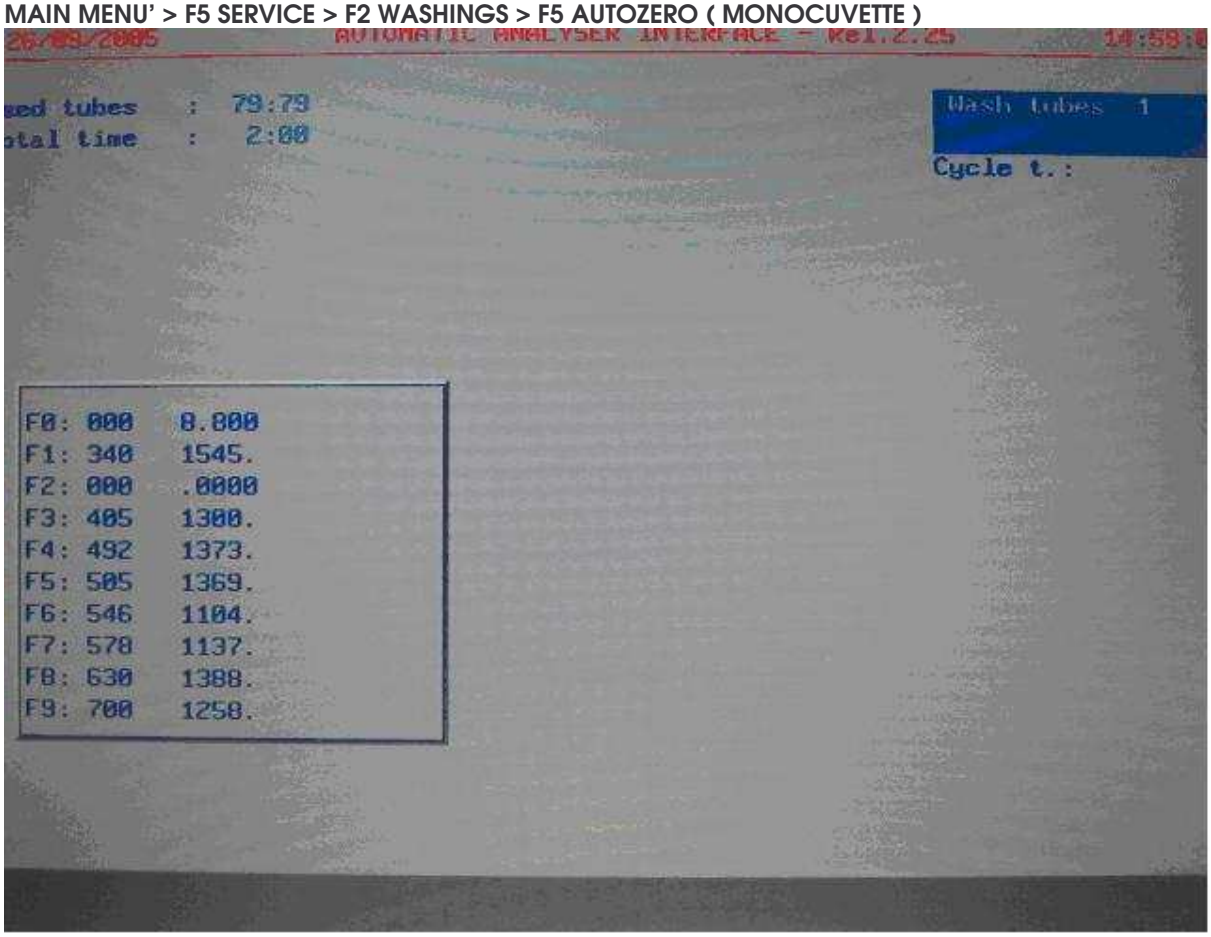
F1 WASH POSITION **:** Used to select the number of hole used for the wash (on the example, the First hole on the first reaction segment)

MAIN MENU' > F5 SERVICE > F2 WASHINGS > F2 WASHES



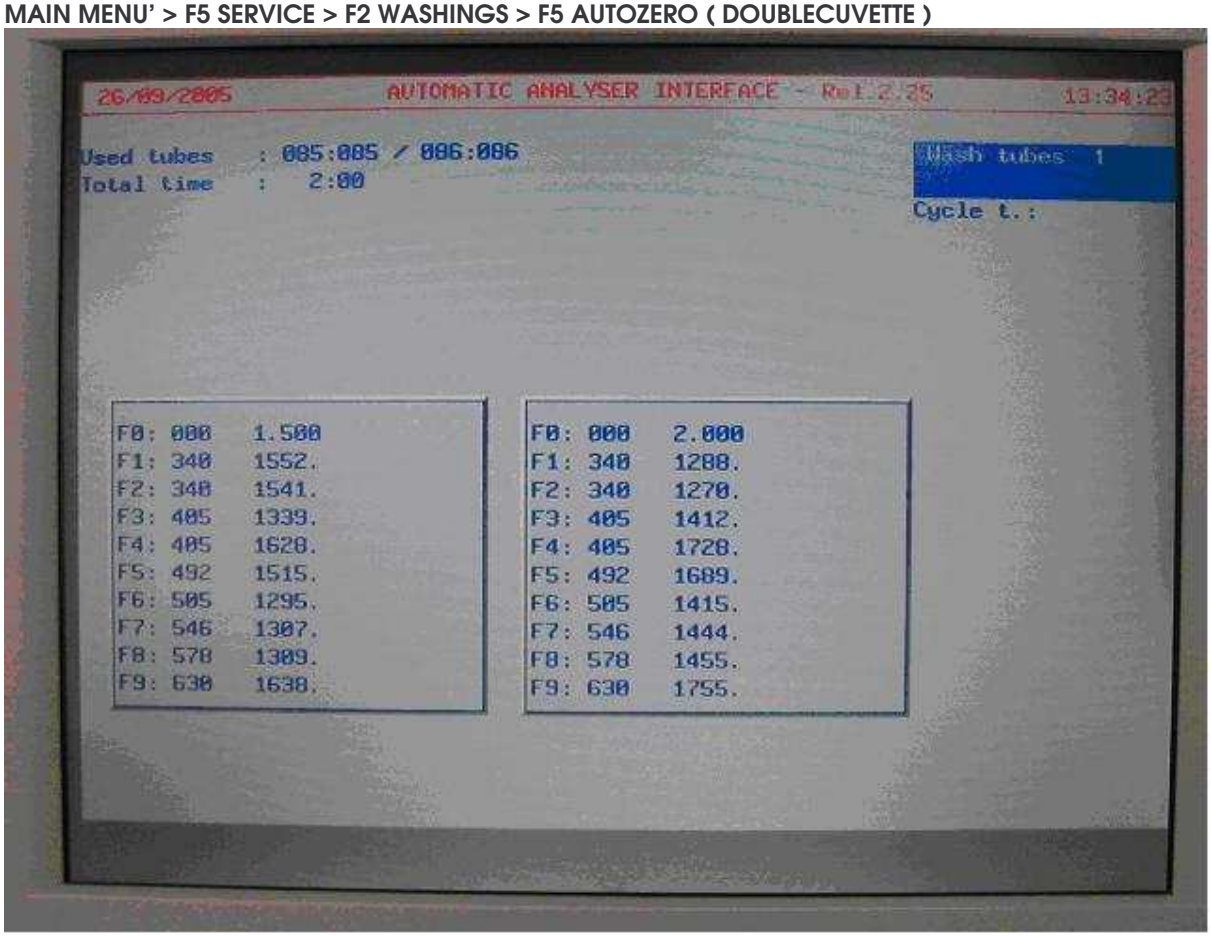
F2 WASHES **:** Used to determinate the number of XX complete washes of the hydraulic circuit SAMPLING/ASPIRATION (min 1, max 99).
This is useful when we want to wash the hydraulic circuit very accurately but We don't want remain in front of the instrument.

MAIN MENU' > F5 SERVICE > F2 WASHINGS > F5 AUTOZERO (MONOCUVETTE)



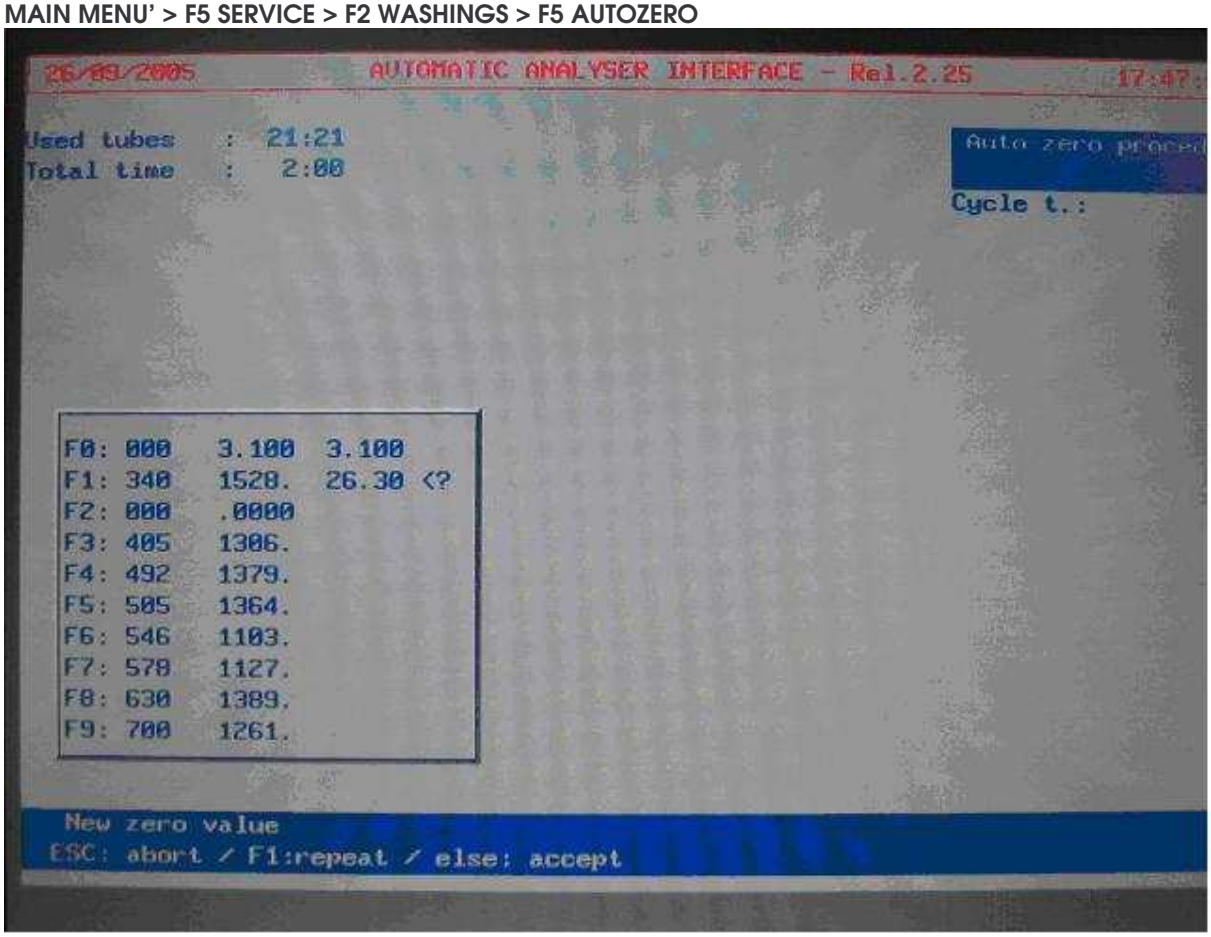
F5 AUTOZERO **:** Used to execute an autozero of the complete filter wheel.
In case that during the autozero there are no variations respect the previous Values the cycle will be terminated without any signal.

MAIN MENU' > F5 SERVICE > F2 WASHINGS > F5 AUTOZERO (DOUBLECUVETTE)



F5 AUTOZERO : Used to execute an autozero of the complete filter wheel.
In case that during the autozero there are no variations respect the previous Values the cycle will be terminated without any signal.

MAIN MENU' > F5 SERVICE > F2 WASHINGS > F5 AUTOZERO

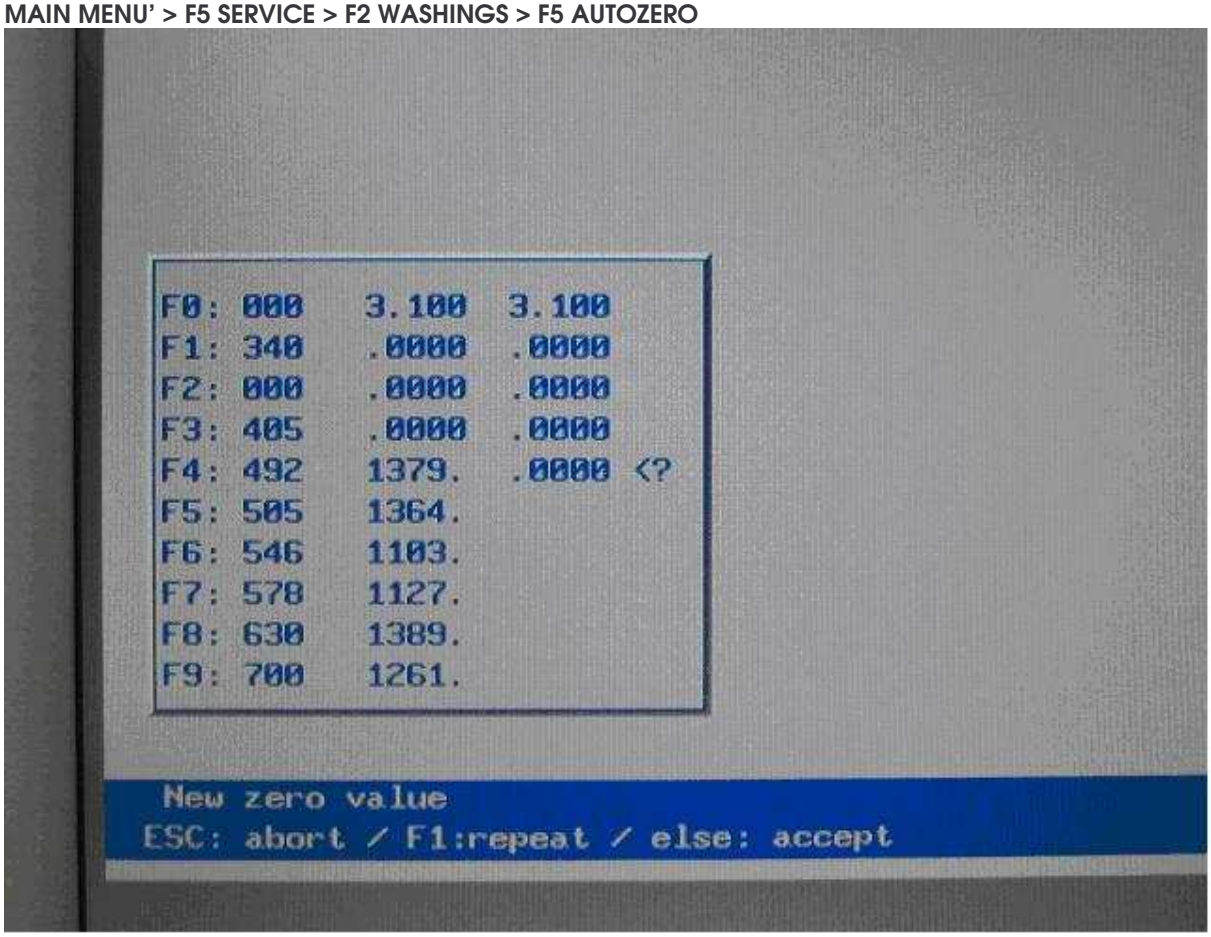


F5 AUTOZERO **:** Example of autozero with a variation in the reading.
A variation of +/- 5% is shoved with the visualization of the following voices:

ESC : ABORT – Cancels the session
F1 : REPEAT - Repeat the session of autozero
ELSE : ACCEPT – Pressing any key except the key " ESC "
or " F1" we accept the new value visualized

EVERY TIME THE AUTOZERO GETS BLOCKED, PRESS F1 TO RESTART THE PROCEDURE

MAIN MENU' > F5 SERVICE > F2 WASHINGS > F5 AUTOZERO



F5 AUTOZERO **:** Example of autozero with a problem.
In this particular case we have the lamp which is not functioning.

This can be noted since the values of all filters are very similar if not equal to the **FILTER 0 = OFFSET**

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS

F1 READING TEST : Used to execute the reading tests in mV or to execute the regulation of the offset and the gain

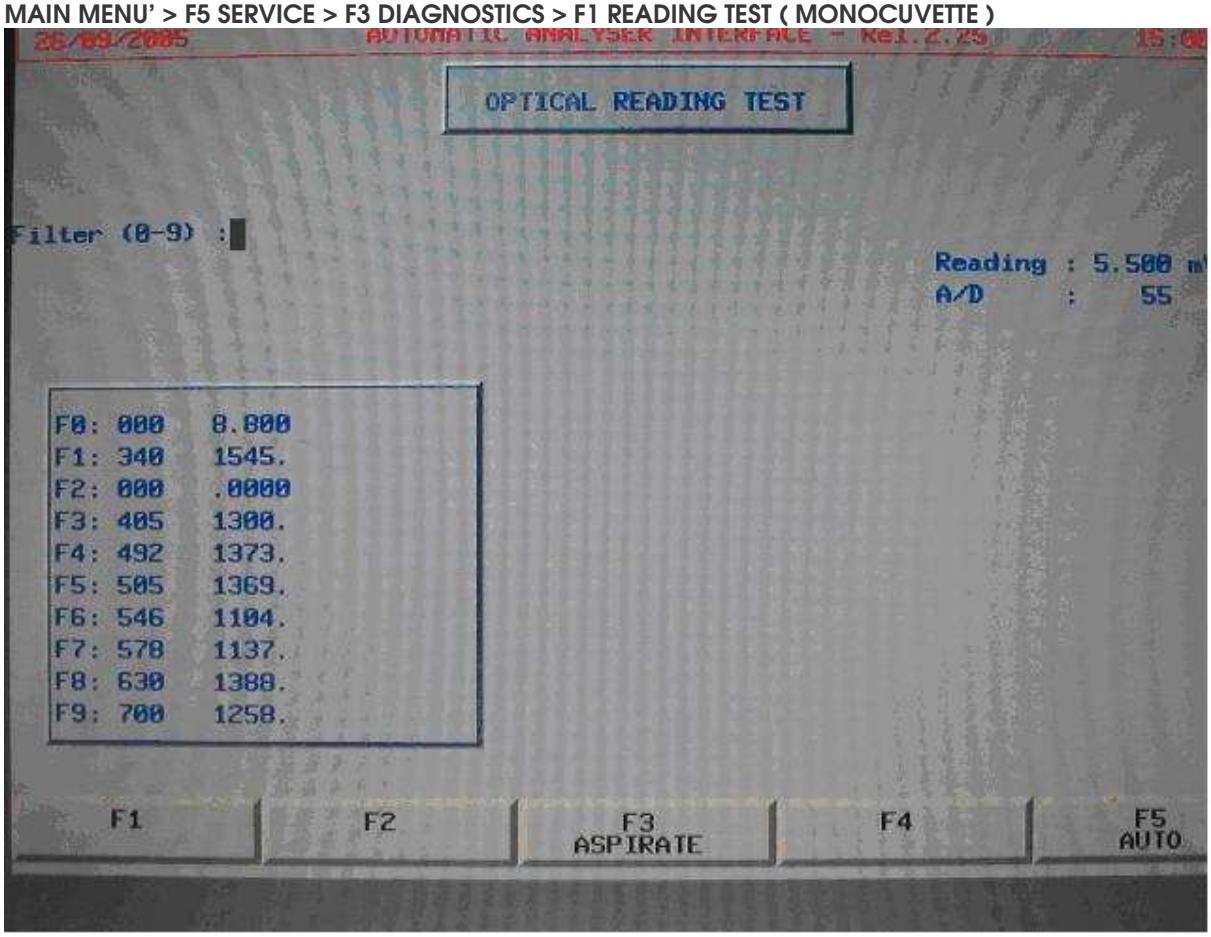
F2 O.D. TEST : Used to execute readings in absorbance

F3 HARDWARE TEST : Used to execute tests of MECHANICAL/ELECTRONICAL functionality

F4 PROCEDURE TEST : Execute a complete test divided in single operation

F5 : Reserved key

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F1 READING TEST (MONOCUVETTE)



F1 READING TEST **:** Remove the aspiration needle and put it in a holder with distillated water.
Press F3 ASPIRATE to aspirate.

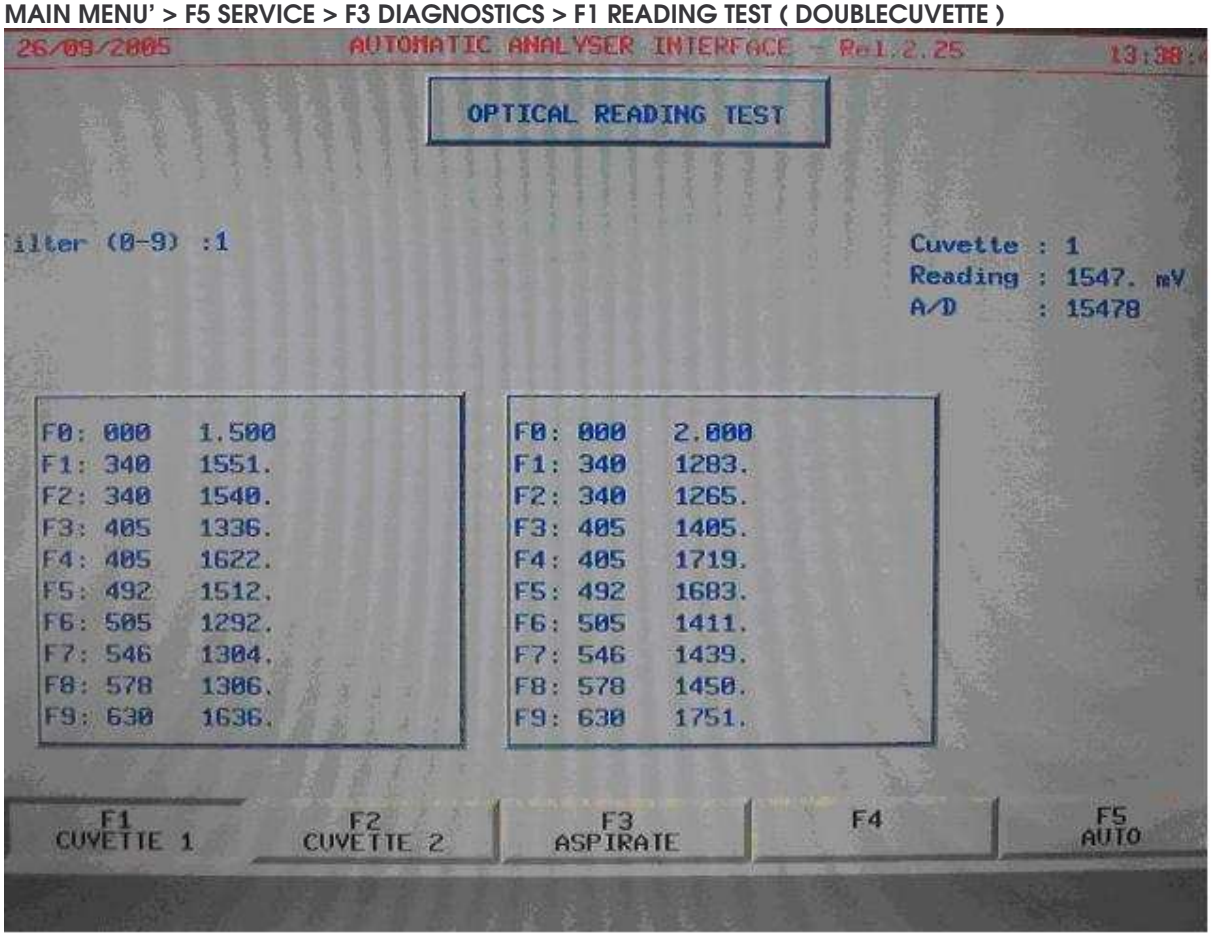
After you have aspirate water, select the filter 1 = 340 nm.
You get visualized the reading of the filter in mV and in digit.
Using the trimmer of the gain we can increase or decrease the value of the reading.
Act on the gain trimmer to have a reading ≥ 1300 mV.
You should keep in mind, that once you act on the trimmer of the gain to modify the reading of all the filters on board to the filters wheel.

To execute the regulation of the offset select the Filter 0 = NULL and act on the relative trimmer to have a reading > 1 mV.

Once the regulation of the gain and the offset is done, it's necessary To execute an autozero to be able to memorize the new values.

THE OPERATIVE RANGE FOR EVERY SINGLE FILTER IS 500 mV ÷ 1800 mV

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F1 READING TEST (DOUBLECUVETTE)



F1 READING TEST **:** Remove the aspiration needle and put it in a holder with distillated water.
Press F3 ASPIRATE to aspirate.

After you have aspirate water select the channel that you want adjust (example F1 CUVETTE1) and select the filter 1 = 340 nm.
You get visualized the reading of the filter in mV and in digit.
Using the trimmer of the gain we can increase or decrease the value of the reading.
Act on the gain trimmer to have a reading ≥ 1300 mV.
You should keep in mind, that once you act on the trimmer of the gain to modify the reading of all the filters on board to the filters wheel.

To execute the regulation of the offset select the Filter 0 = NULL and act on the relative trimmer to have a reading > 1 mV.

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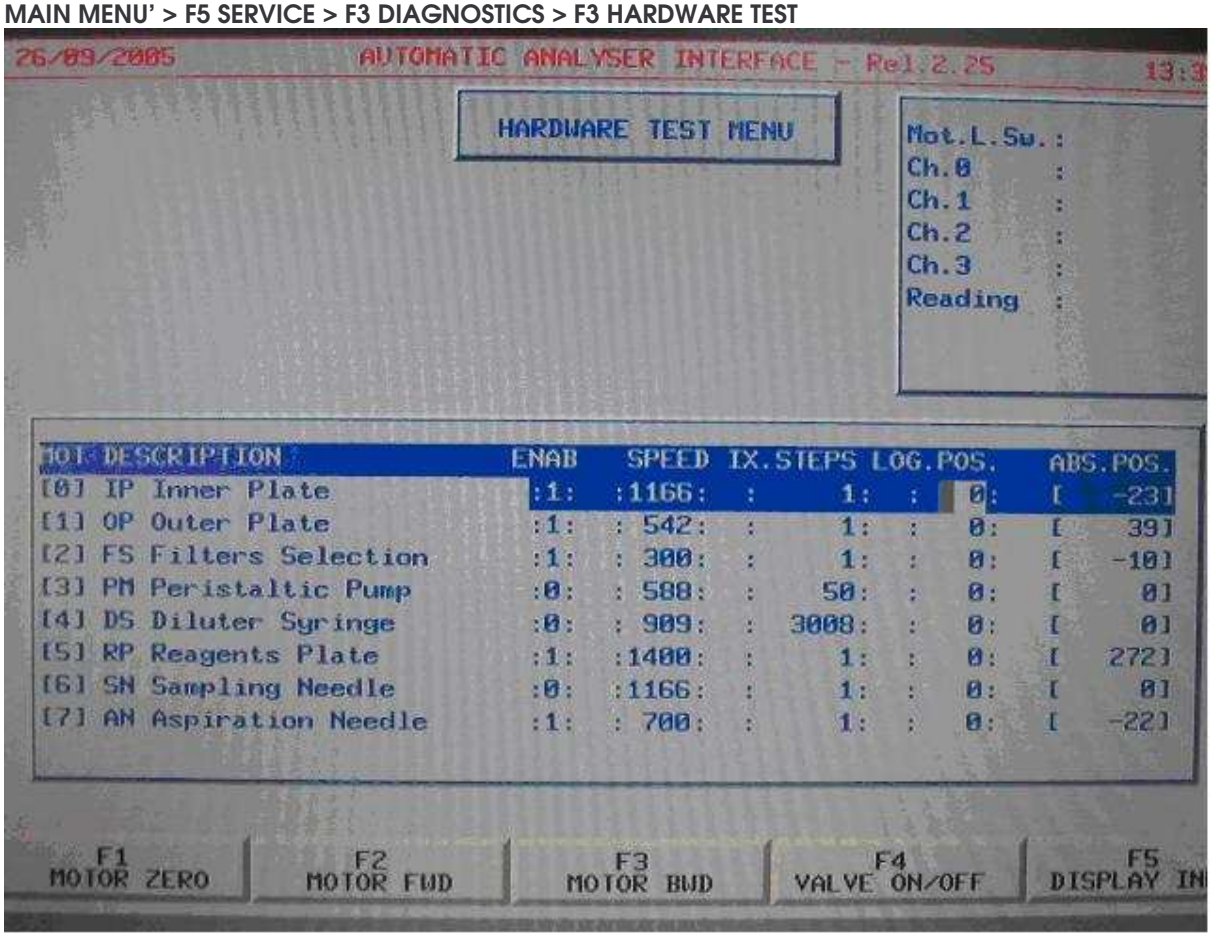
THE OPERATIVE RANGE FOR EVERY SINGLE FILTER IS 500 mV ÷ 1800 mV

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F3 HARDWARE TEST



F1 MOTOR ZERO : Used to execute the home position of the motor under examination

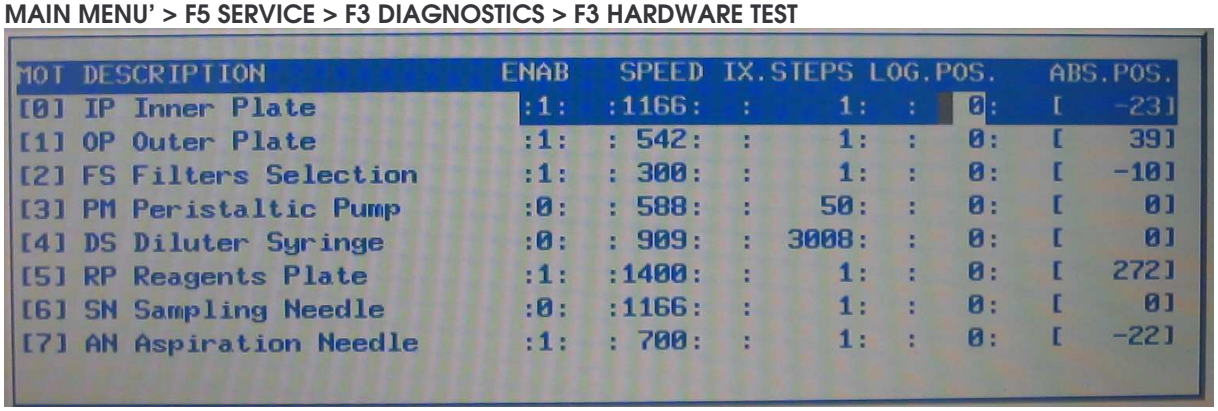
F2 MOTOR FWD : Used to move in the clock sense the motor under examination

F3 MOTOR BWD : Used to move in the anticlock sense the motor under examination

F4 VALVE ON/OFF : Used to verify the functionality of the electrovalve situated on the diluter
Used to verify the functionality of the two pumps in the double cuvette

F5 DISPLAY INP. : The command F5 active the continues visualisation of the inputs

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F3 HARDWARE TEST



MOT	DESCRIPTION	ENAB	SPEED	IX.STEPS	LOG.POS.	ABS.POS.
[0]	IP Inner Plate	:1:	:1166:	1:	0:	[-23]
[1]	OP Outer Plate	:1:	: 542:	1:	0:	[39]
[2]	FS Filters Selection	:1:	: 300:	1:	0:	[-10]
[3]	PM Peristaltic Pump	:0:	: 588:	50:	0:	[0]
[4]	DS Diluter Syringe	:0:	: 909:	3008:	0:	[0]
[5]	RP Reagents Plate	:1:	:1400:	1:	0:	[272]
[6]	SN Sampling Needle	:0:	:1166:	1:	0:	[0]
[7]	AN Aspiration Needle	:1:	: 700:	1:	0:	[-22]

LEGENDA

MOT : Number relative to the motor in object

DESCRIPTION : Description of the motor in object

ENAB : Command to block the motor in object
(0 = FREE / 1 = BLOCKED)

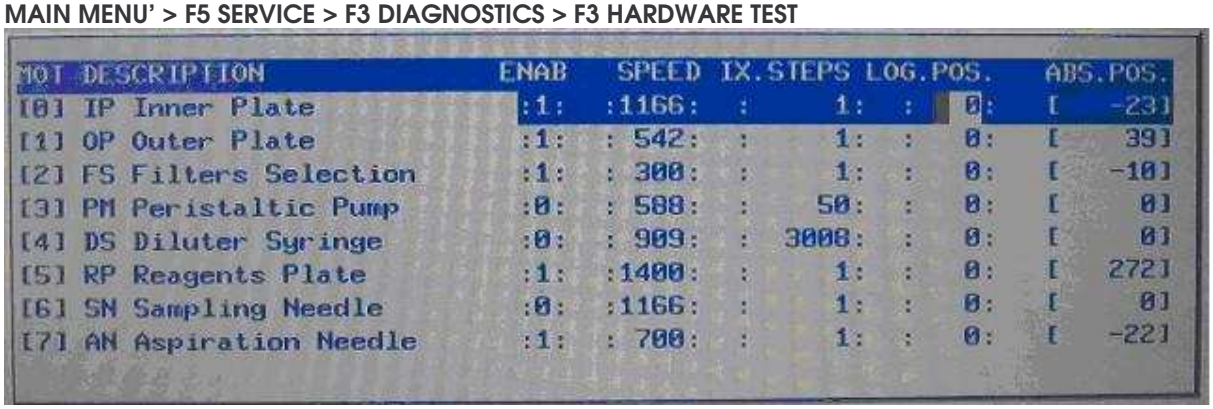
SPEED : Speed of the motor in object

IX. STEPS : X Steps to execute with the motor in object

LOG. POS. : Position were we want put the motor in object

ABS. POS : Real position , in steps, that the motor has taken

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F3 HARDWARE TEST



MOT DESCRIPTION	ENAB	SPEED	IX.STEPS	LOG.POS.	ABS.POS.
[0] IP Inner Plate	:1:	:1166:	1:	0:	[-23]
[1] OP Outer Plate	:1:	: 542:	1:	0:	[33]
[2] FS Filters Selection	:1:	: 300:	1:	0:	[-10]
[3] PM Peristaltic Pump	:0:	: 588:	50:	0:	[0]
[4] DS Diluter Syringe	:0:	: 909:	3008:	0:	[0]
[5] RP Reagents Plate	:1:	:1400:	1:	0:	[272]
[6] SN Sampling Needle	:0:	:1166:	1:	0:	[0]
[7] AN Aspiration Needle	:1:	: 700:	1:	0:	[-22]

LOGICAL POSITION

INNER PLATE **:** The logical position from 0 to 31 carries the relative cups under the relative point of sampling.
The logical position from 32 to 63 carries the relative cups under the relative point of sampling.

OUTER PLATE **:** The logical position from 1 to 96 carries the relative holes of the reaction segments under the aspiration needle.
The logical position from 101 to 196 carries the relative holes of the reaction Segments under the point positioning of sampling arm.

The logical position from 1 to 189 carries the relative holes of the reaction segments under the aspiration needle *
The logical position from 201 to 389 carries the external ring of the reaction segments under the point positioning of sampling arm *
The logical position from 202 to 390 carries the internal ring of the reaction segments under the point positioning of sampling arm *

FILTER SELECT **:** The logical position corresponds to the number of the relative filter

PERISTALTIC PUMP **:** NOT IN USE

DILUTER SYRINGE **:** The logical position indicates 1 uL to dispense

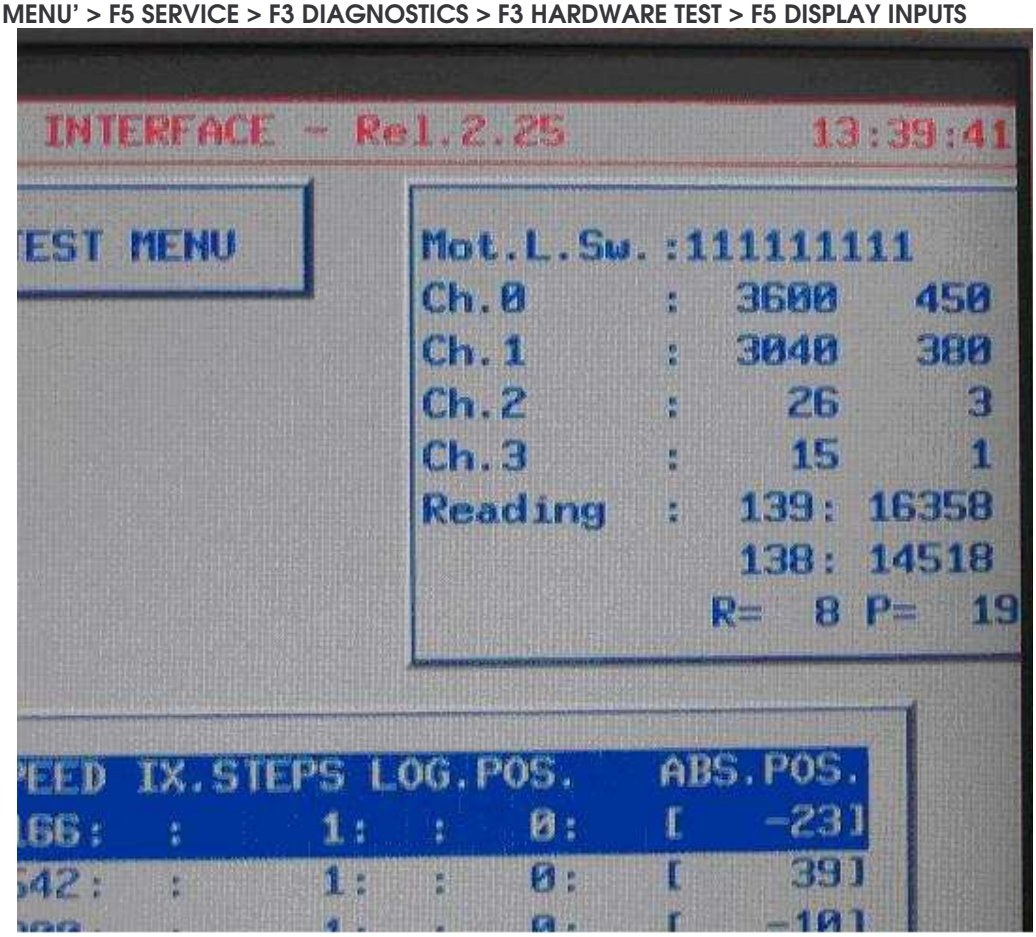
REAGENT PLATE **:** The logical position from 1 to 18 or from 1 to 27 carries the sampling arm up to the relative bottles.
The logical position 41 sampling arm up to the inner plate internal ring.
The logical position 42 sampling arm up to the inner plate external ring.
The logical position 43 sampling arm up to the outer plate.
The logical position 43 sampling arm up to the outer plate internal ring.*
The logical position 44 sampling arm up to the outer plate external ring.*
The logical position 44 sampling arm up to the repose condition

SAMPLING NEEDLE **:** the logical position 3 sampling needle down in the bottom of sample cups.
The logical position 4 sampling needle down in the hole of the reaction segments.
The logical position 8 sampling needle down in the bottom of the reagents bottle.

ASPIRATION NEEDLE **:** the logical position 4 aspiration needle down in the bottom of the holes of the reaction segments.
the logical position 4 aspiration needle 1 down in the bottom of the holes of the reaction segments external ring.*****

*** ONLY FOR THE DOUBLE CUVETTE**

MAIN MENU' > F5 SERVICE > F3 DIAGNOSTICS > F3 HARDWARE TEST > F5 DISPLAY INPUTS



MOT.L.SW. : Indicates the logical status of the home position sensor and the logical status of the level sensor.

CH0 : Channel of the A/D CONVERTER for the outer plate temperature. Visualizes the value of temperature in teen degrees.

CH1 : Channel of the A/D CONVERTER for the cuvette temperature. Visualizes the value of temperature in teen degrees.

CH2 : Not in use

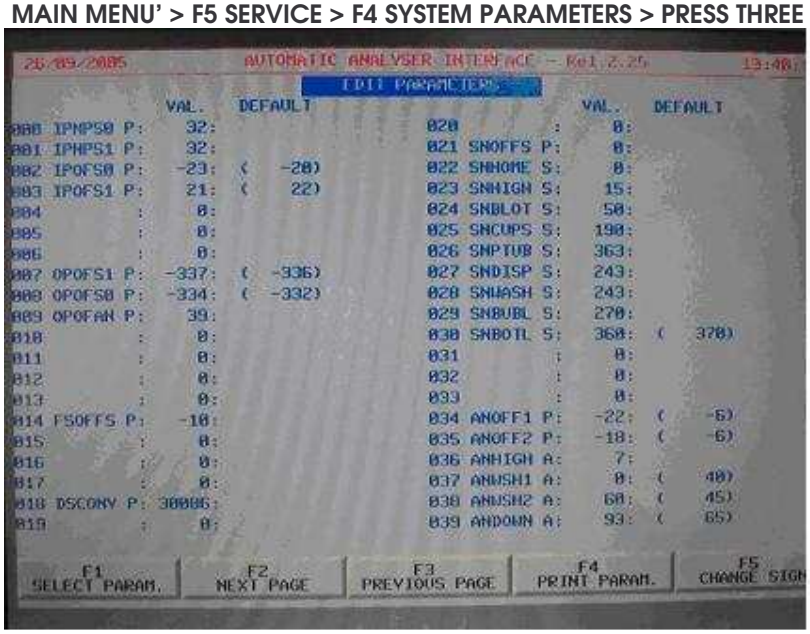
CH3 : Not in use

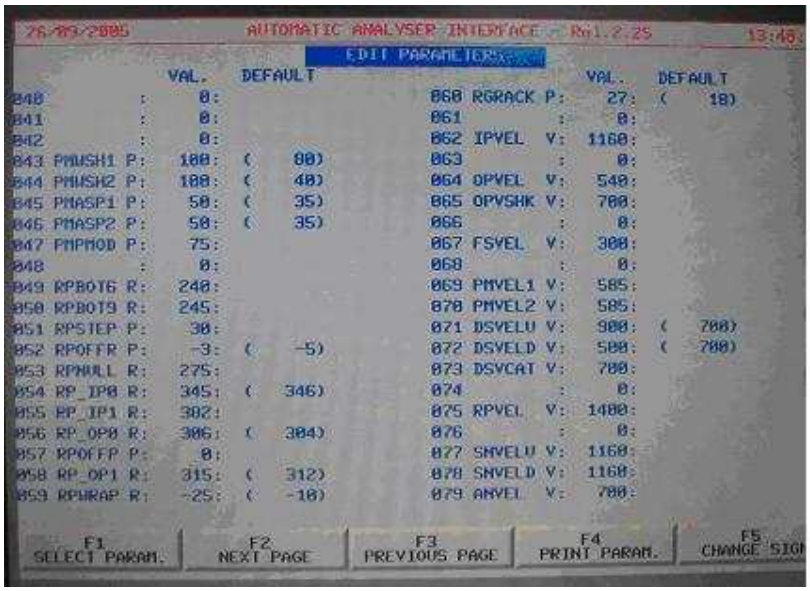
READING : Not in use

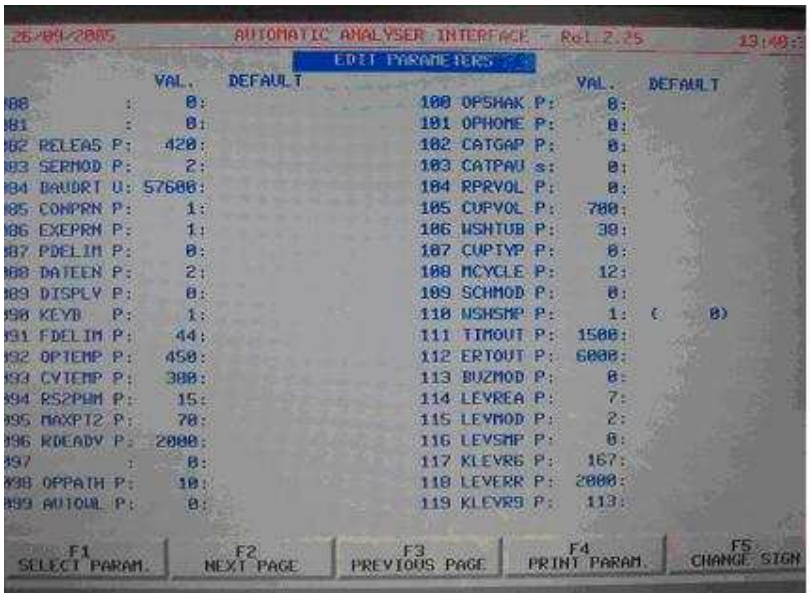
R : Indicates the state of the functioning of the heating circuit of the outer plate.

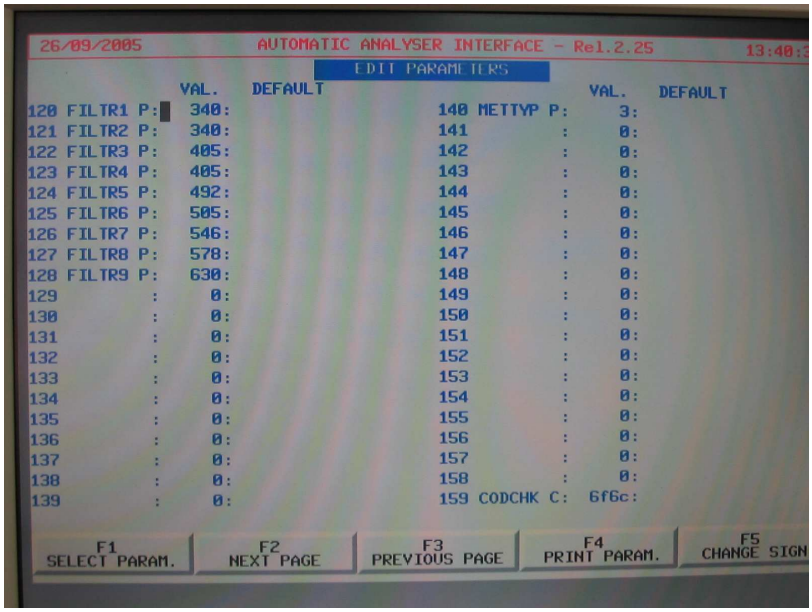
P : Indicates the state of the functioning of the heating circuit of the optical group.

MAIN MENU' > F5 SERVICE > F4 SYSTEM PARAMETERS > PRESS THREE TIMES DOT (.)









F1 SELECT PARAM. : Select the parameter

F2 NEXT PAGE : Calls the next page

F3 PREVIOUS PAGE : Calls the previous page

F4 PRINT PARAM. : Prints the parameters to the selected page

F5 CHANGE SIGN : Changes the sign of the selected parameter

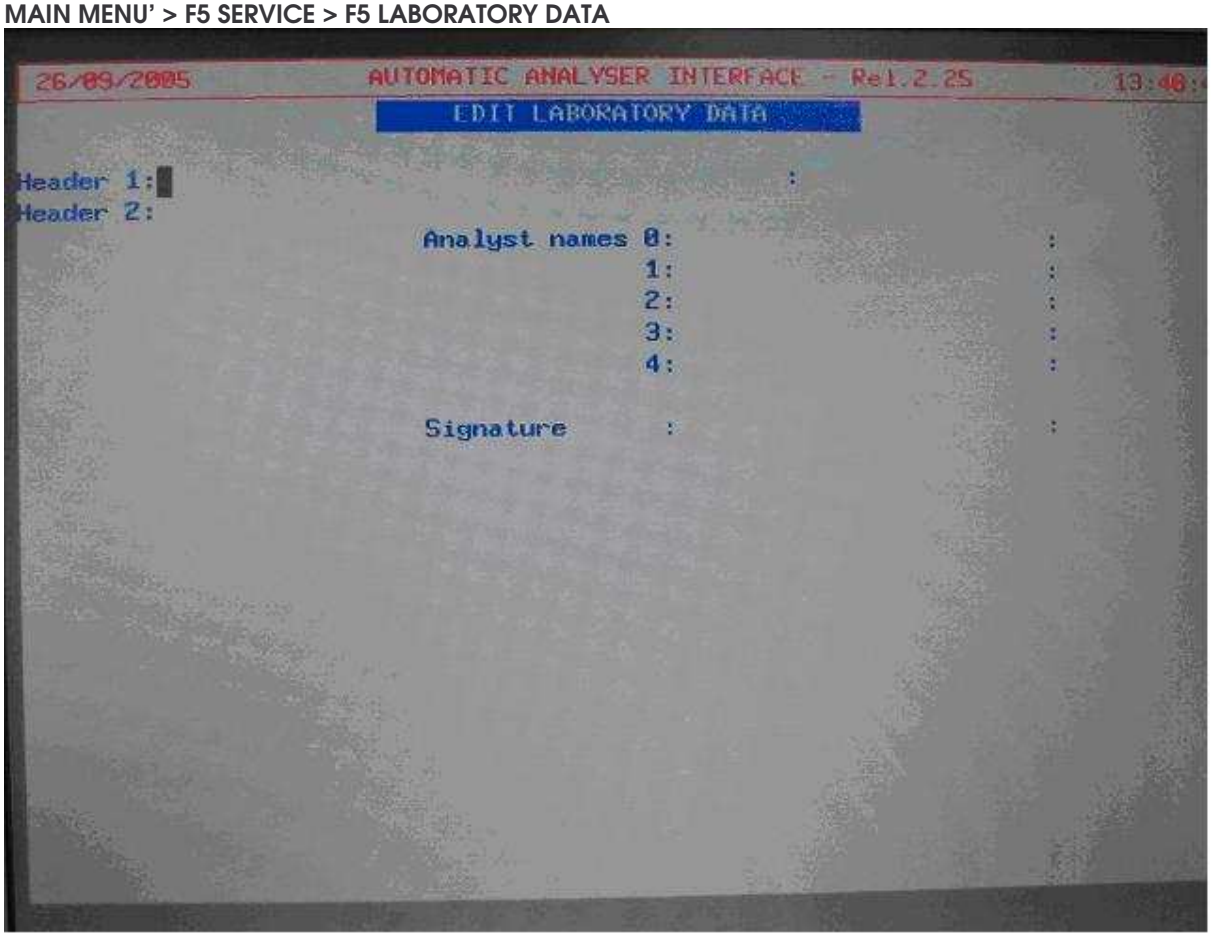
NOTE
THE ACCES TO THE PAGES OF THE SYSTEM PARAMETERS IS SUGGESTED ONLY FOR THE Hospitex Diagnostics PERSONNEL OR OTHER AUTHORISED PERSONNEL.

N°	MNEMONIC	DESCRIPTION	SAMPLE PLATE 32+32	NOTE
		IP MOTOR	DEFAULT VALUE	
000	IPNPS0	Inner plate n° position of external ring	32	
001	IPNPS1	Inner plate n° position of internal ring	32	
002	IPOFS0	Inner plate offset for external ring	-20	
003	IPOFS1	Inner plate offset for internal ring	22	
		OP MOTOR		
007	OPOFS1	Outer plate2 ring offset sample needle side	-333	Only for double cuvette
008	OPOFS0	Outer plate ring offset sample needle side	-332	
009	OPOFAN	Outer plate offset aspiration needle side	23	
		FS MOTOR		
014	FSOFFS	Filter selection offset	0	
		DS MOTOR		
018	DSCONV	Diluter syringe conversion factor	30086	(step*10ml)
		SN MOTOR		
021	SNOFFS	Sample needle offset	0	
022	SNHOME	Sample needle home position	0	
023	SNHIGH	Sample needle height before home, for rotation over reagent bottles	15	
024	SNBOTL	Sample needle out of blot paper filter (not for rotation)	50	
025	SNCUPS	Sample needle for sampling on internal plate: sample/STD cups	190	
026	SNTUB	Sample needle for sampling on internal plate: sample/STD tube	363	
027	SNDISP	Sample needle for dispensation on outer plate	243	
028	SNWASH	Sample needle for wash tubes on outer plate	243	
029	SNBUBL	Sample needle for R2/R3 and bubbles dispense on outer plate	270	
030	SNBOTL	Sample needle on reagent bottles	370	
		AN MOTOR		
034	ANOFFS1	Aspiration probe n°1 offset	0	
035	ANOFFS2	Aspiration probe n°2 offset	0	Only for double cuvette
036	ANHIGH	Aspiration probe high position in home pos.	25	
037	ANWSH1	Aspiration probe wash step 1	160	
038	ANWSH2	Aspiration probe wash step 2	170	
039	ANDOWN	Aspiration probe sampling step for reading	225	
		PUMP MOTOR		
043	PMWSH1	Peristaltic pump wash step 1	650	
044	PMWSH2	Peristaltic pump wash step 2	250	
045	PMASP1	Peristaltic pump aspiration step 3 cuvette 1	550	
046	PMASP2	Peristaltic pump aspiration step 3 cuvette 2	550	
047	PMPMOD	Peristaltic pump mode	0	0 = Steps 75 = msec (only for double cuv.)
		RP MOTOR		
049	RPBOT6	Rp motor position of bottle n°1 with rack 6	240	
050	RPBOT9	Rp motor position of bottle n°1 with rack 9	245	

051	RPSTEP	Rp motor steps between 2 bottles rack 6	30	
052	RPOFFR	Rp motor offset on reagent bottles	-5	
053	RPNULL	Rp motor idle position	275	
054	RP_IP0	Rp motor inner plate external ring	346	
055	RP_IP1	Rp motor inner plate internal ring	382	
056	RP_OP0	Rp motor outer plate dispensing position	310	
057	RPOFFP	Rp motor offset on inner/outer plates	0	
058	RP_OP1	Rp motor outer plate dispensing position	309	
059	RPWRAP	Else steps before reagent plate arm mechanical stop	-10	
060	RGRACK	Reagent rack selection	18	18 reagents or 27 reagents
		MOTOR SPEED		
062	IPVEL	Inner plate rotation speed	1160	
064	OPVEL	Outer plate rotation speed	540	
065	OPVSHK	Outer plate shake speed	700	
067	FSVEL	Filters wheel rotation speed	640	
069	PMVEL1	Peristaltic pump 1 rotation speed	585	
070	PMVEL2	Peristaltic pump 2 rotation speed	585	Only for double cuvette
071	DSVELU	Diluter motor up speed	700	
072	DSVELD	Diluter motor down speed	700	
073	DSVCAT	Not used	700	
075	RPVEL	Reagent plate arm rotation speed	1400	
077	SNVELU	Sampling needle up speed	1160	
078	SNVELD	Sampling needle down speed	1160	
079	ANVEL	Aspiration needle up/down speed	1160	
		VARIOUS		
082	RELEAS	Current software release	420	
083	SERMOD	Serial port mode	2	0=Host, 1=Remote, 2=Graph consolle
084	BAUDRT	Host communication baud rate	57600	
085	CONPRN	Consolle printer	0	0=Int., 1=Loc. ext
086	EXEPRN	Execution printer	0	0=Int., 1=Loc. ext
087	PDELIM	Execution printer results field delimiter	0	
088	DATEEN	Automatic data & time from PC	2	0=No, 1=Enable date from PC, 2=Enable Date&Time
089	DISPLV	Not used	0	
090	KEYB	Keyboard automatic setting	1	0=Ita, 1=US, 2=Fra
091	FDELIM	Not used	44	
092	OPTEMP	Outer plate setting temperature	420	°Cx10
093	CVTEMP	Cuvette setting temperature	380	°Cx10
094	RS2PWM	Sample needle pre-heating duty cycle	15	
095	MAXPT2	Peltier element maximum power	70	
096	RDEADV	Reaction bottle dead volume in microliters	2000	
098	OPPATH	Optical path selection	7	Helma cuvette = 10 I.S.E. cuvette = 7
099	AUTOWL	Not used	0	
100	OPSHAK	Outer plate shake enable	0	0 = NO, 1 = YES
101	OPHOME	Outer Plate Home position check during the execution run	0	0 = NO, 1 = YES
102	CATGAP	Not used	0	
103	CATPAU	Not used	0	

104	RPRVOL	Reagent prime setup	0	
105	CUPVOL	Sample cup volume in uL	700	
106	WSHTUB	Number of execution tube washes	10	
107	CUPTYP	Not used	0	
108	MCYCLE	Machine cycle in sec.	12	
109	SCHMOD	Schedule mode	0	
110	WSHSMP	Sampling probe wash after every sampling	0	0 = NO, 1 = YES
111	TIMOUT	Time out for data communication msec	1500	
112	ERTOUT	Wait time on error during execution msec	6000	
113	BUZMOD	Enable buzzer during editing	0	
114	LEVREA	Else steps before needle stop in the reagent bottle	7	
115	LEVMOD	Reagent level check	2	0 = Disable, 1 = Normal, 2 = Normal + Extrapolation
116	LEVSMP	Not used	0	
117	KLEVR6	Conv. Factor: uL of reagent for sample needle steps (rack 6)	167	
118	LEVERR	Reagent level error in uL	2000	
119	KLEVR9	Conv. Factor: uL of reagent for sample needle steps (rack 9)	113	
120	FILTR1	Filter wheel position n°1	340	
121	FILTR2	Filter wheel position n°2	0	Double cuvette = 340 nm
122	FILTR3	Filter wheel position n°3	405	
123	FILTR4	Filter wheel position n°4	492	Double cuvette = 405 nm
124	FILTR5	Filter wheel position n°5	505	Double cuvette = 492 nm
125	FILTR6	Filter wheel position n°6	546	Double cuvette = 505 nm
126	FILTR7	Filter wheel position n°7	578	Double cuvette = 546 nm
127	FILTR8	Filter wheel position n°8	630	Double cuvette = 578 nm
128	FILTR9	Filter wheel position n°9	700	Double cuvette = 630 nm
140	METTYP	Methods structure type	3	
159	CODCHK	Parameters checksum	XXXX	

MAIN MENU' > F5 SERVICE > F5 LABORATORY DATA

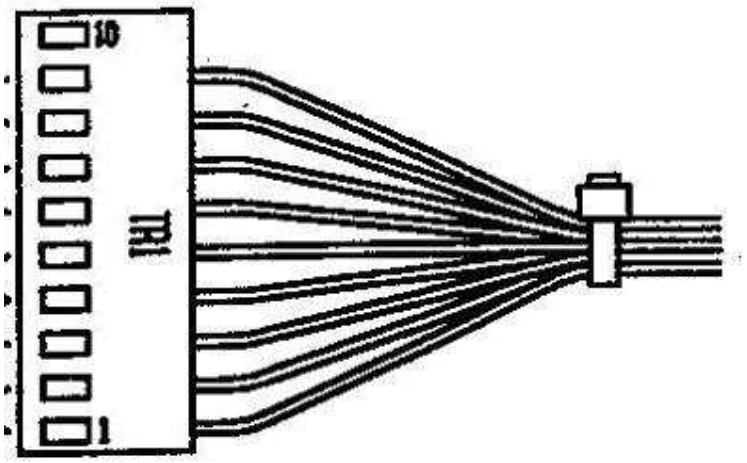


F5 LAB. DATA : It allows to insert the data of the laboratory .
Furthermore, it is possible to insert the name of the OPERATOR 0 (Master) and the names of the other 4 OPERATORS with limited access to the system.

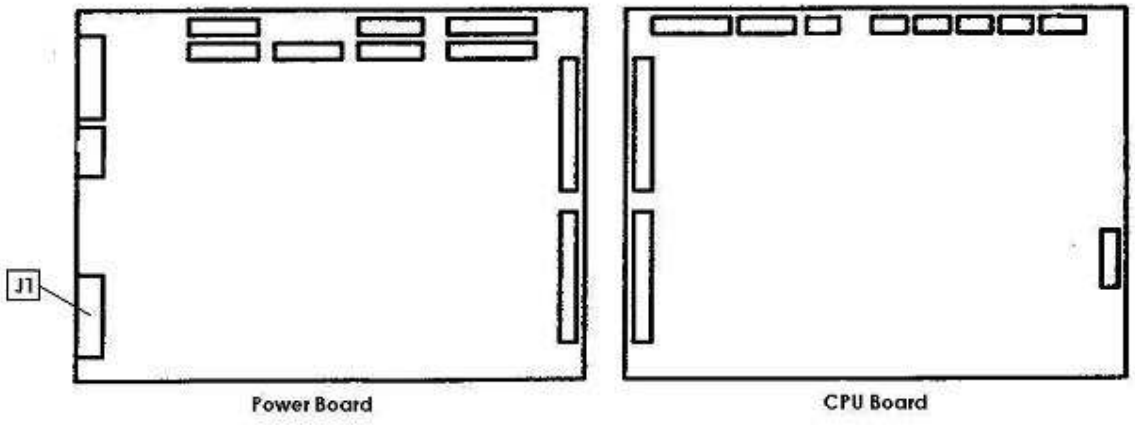
3 - ASSEMBLY AND ADJUSTEMENT

1) position the instrument with the door with the boards towards you.
2) assembly the CPU board fixing it with the four screws on the angles, do not insert any connectors.
3) assembly the Power board fixing it with the four screws on the angles, plus the central screw which is positioned between the connectors J1 and J2. Do not insert any connector or fuses.
4) Fix the fuses 5x20 mm of 3,15 A (6,3 for the alimentation at 110 Volt) into the fuses holder of the net entrance module.
5) Connect the alimentation, turn on the instrument and measure the exit tension of the transformer on the TR1 connector (MX396 10 poles) of the cablings according to the following scheme:

- pin 1 <> 2 = 20 Vac (acc. of 20 to 22 V)
- pin 3 <> 4 = 8 Vac (acc. of 8 to 9 V)
- pin 4 <> 5 = 8 Vac (acc. of 8 to 9 V)
- pin 3 <> 5 = 16 Vac (acc. of 16 to 18 V)
- pin 6 <> 7 = 11 Vac (acc. of 11 to 12 V)
- pin 8 <> 9 = 5,5 Vac (acc. of 5,5 to 6,5 V)



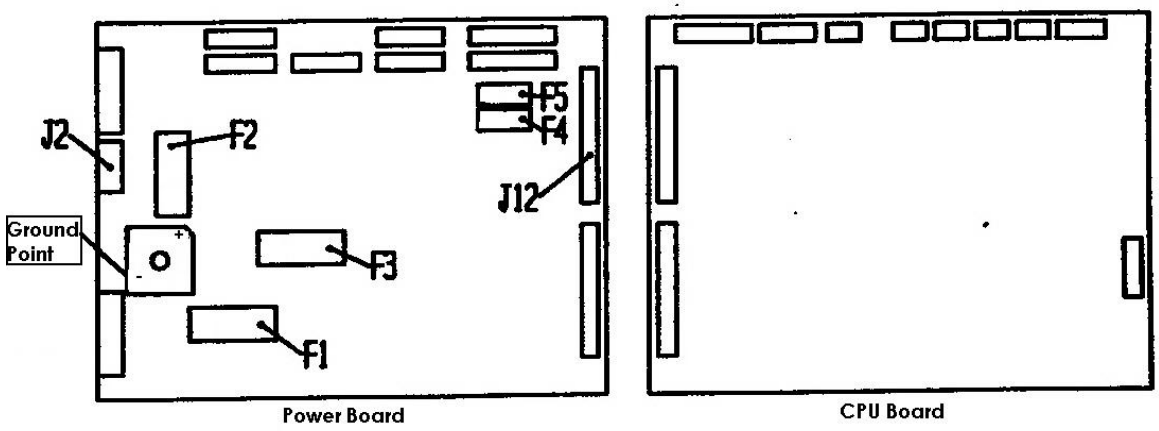
6) turn off the instrument and connect the connector of the cabling with the note TR1 (MX396 10 poles) on the connector J1 of the Power board.



WARNING: form this moment avoid to position your face on the boards (in particular the power board) when the instrument is turned on.

7) turn on the instrument and measure the stabilizing tensions connecting the negative end of the tester of the ground and the positive end on the exit point of the fuses holder on the power board following the below scheme:

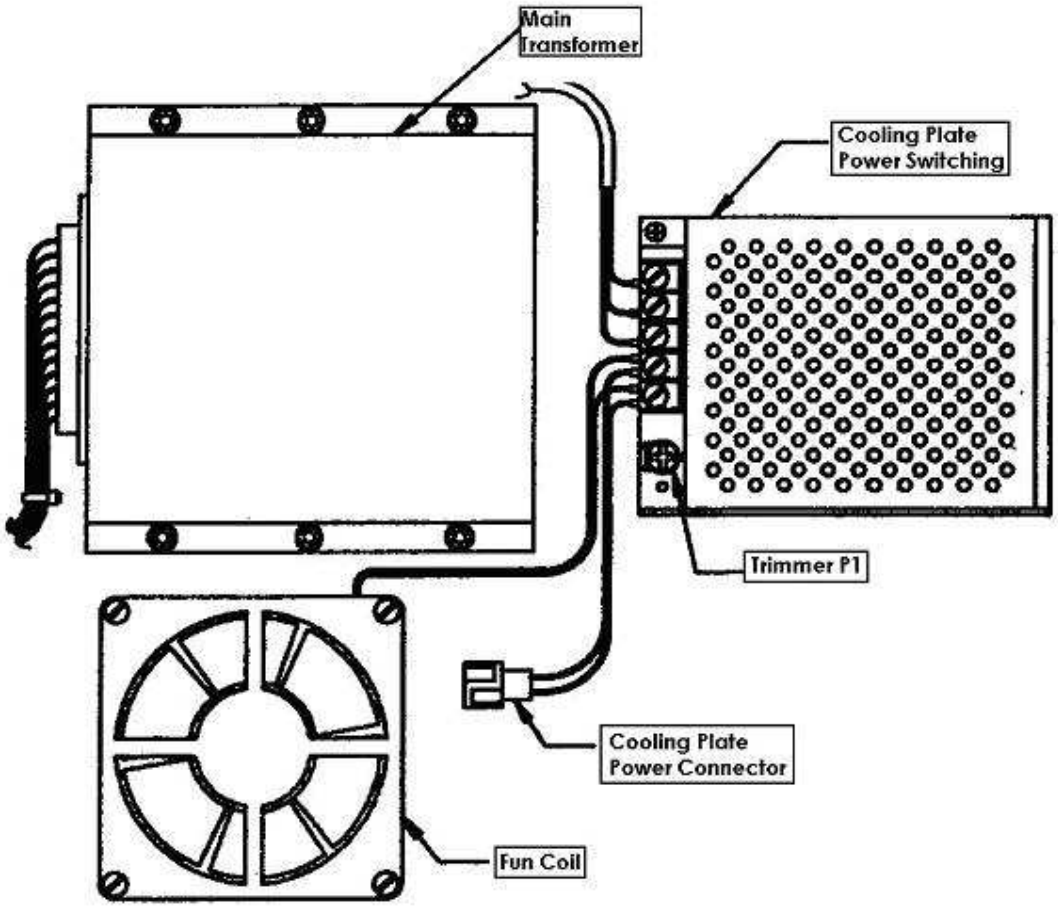
- F1 = +28 Vcc (acc. of 28 to 30 Vcc)
- F2 = + 7 Vcc (acc. of 7 to 8 Vcc)
- F3 = +15 Vcc (acc. of 15 to 16 Vcc)
- F4 = +11 Vcc (acc. of 11 to 12 Vcc)
- F5 = -11 Vcc (acc. of 11 to 12 Vcc)



8) measure the stabilizing tensions on the connectors J2 and J12 on the power board following the below scheme:

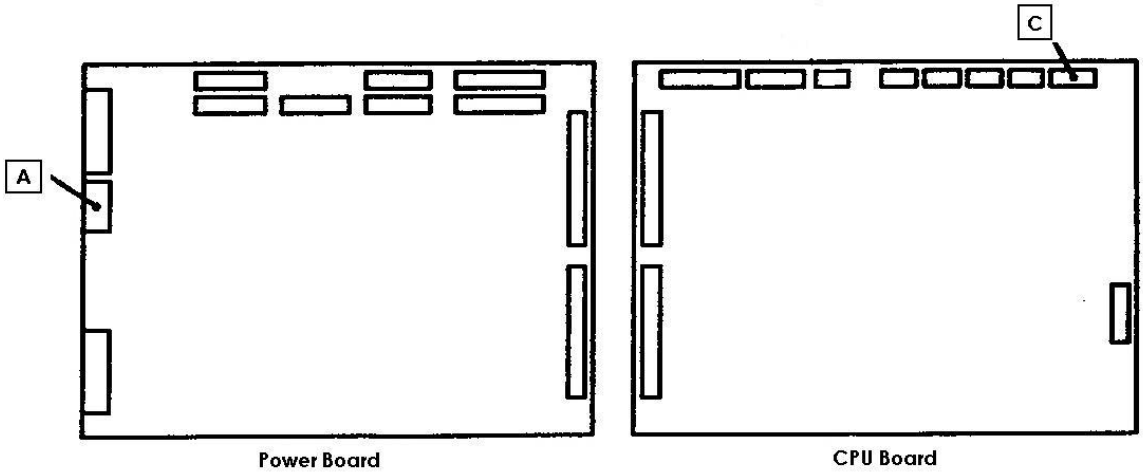
- J12 pin 35, 36, 37, 38, 39, 40 = ground
- J12 pin 33, 34 = - 5 Vcc (acc. of 4,9 to 5,1)
- J12 pin 31, 32 = + 5 Vcc (acc. of 4,9 to 5,1)
- J12 pin 25, 26, 27, 28, 29, 30 = + 5,1 Vcc (acc. of 5,0 to 5,2)
- J2 pin 4, 5, 6, 8 = ground
- J2 pin 7 = + 6Vcc (variable of 5,2 to 6,5)
- J2 pin 1, 2, 3 = + 12, 5 Vcc (acc. of 12,4 to 12,6)

9) for the reagent cooling plate verify that the supplementary fan, situated beside the transformer, is moving regularly without noise and that the air is directed towards outside of the instruments. Connect the positive end of the tester on the pin 1 and the negative end on the pin 2 of the alimentation connector of the reagent cooling plate and regulate the trimmer P1 of the supplementary alimentator to obtain a tension between +14,01 and +14,02 Vcc.



10) leave the instrument on for some minutes, and then re-control again the tensions as per point 7 and 8 and verify that there are no problems due to the non correct assembly of the boards.

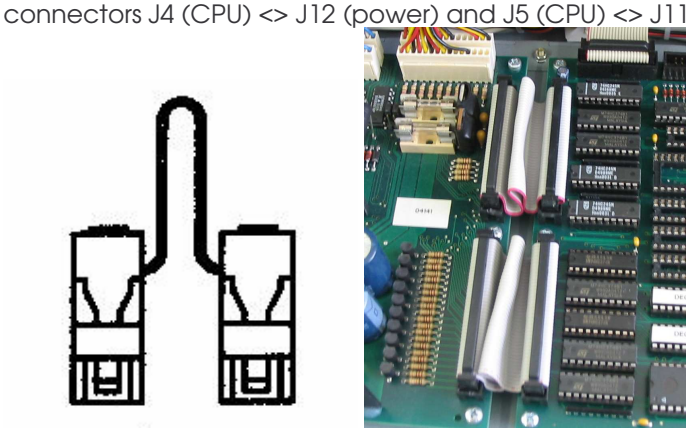
11) turn off the instrument and insert the connectors of the cablings on the Power and CPU board as follows:



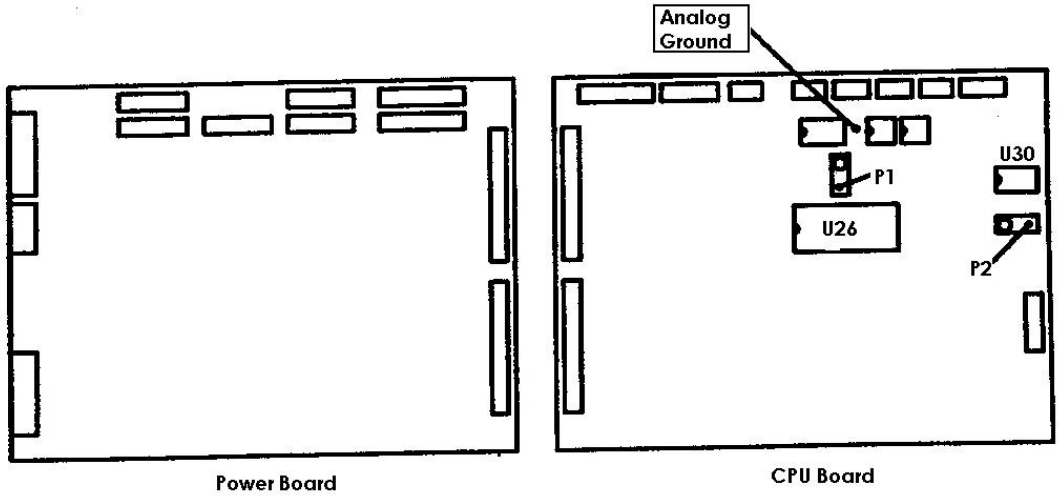
A = MX396 8 poles with the notes VID, V1, V2, L1 on the connector J2 of the power board

C = MX254 8 poles with the notes ST1, ST2 on the connector J10 of the CPU board

12) take the two board interconnection cables and insert them as a bridge between the connectors J4 (CPU) <> J12 (power) and J5 (CPU) <> J11 (power).

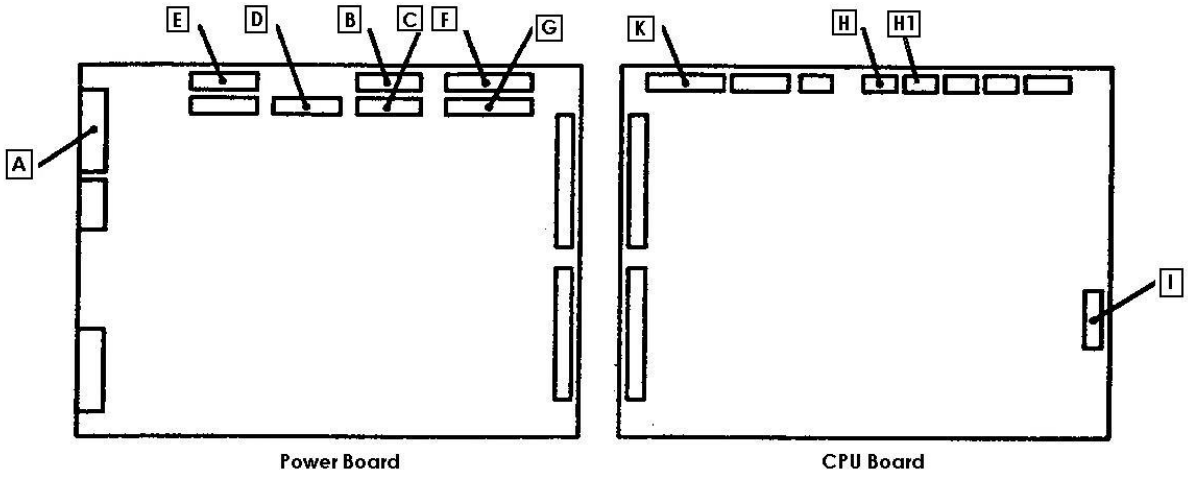


13) turn on the instrument
14) Check the two reference tensions VREF1 e VREF2 on the CPU board as follows:
- VREF1: connect the negative end of the tester on the analogical ground and the positive end on the pin 2 of the U26 and then regulate the trimmer P1 to obtain a value of tension equal to +1,000 Vcc ± 0,005V.
- VREF2: connect the negative end of the tester on the analogical ground and the positive end on the pin 6 of the U30 and then regulate the trimmer P2 to obtain a value of tension equal to +2,731 Vcc ± 0,005V.



15) turn off the instrument and insert the connectors of the cabling on the boards as follows:

A = MX396 10 poles with the notes PT1, R1, R2, EV1 on the connector J3 of the power board
B = MX254 12 poles with the notes MIP, MOP, on the connector J4 of the power board
C = MX254 12 poles with the notes MFS, MPM on the connector J5 of the power board
D = MX254 12 poles with the notes MDS, MRP on the connector J6 on the power board
E = MX254 12 poles with the notes MSN, MAN on the connector J7 of the power board
F =MX254 15 poles with the notes SIP, SOP, SFS, SDS on the connector J9 on the power board
G = MX254 15 poles with the notes SRP, SSN, SAN on the connector J10 on the power board
H = MX254 6 poles with the note FD1 on the connector J6 of the CPU board
H1 = MX254 6 poles with the note FD2 on the connector J7 of the CPU board
I = Flat 16 poles on the serial port of the connector J1 of the CPU board
J = Not used
K =Flat 20 poles of the internal PC on the connector J3 of the CPU board

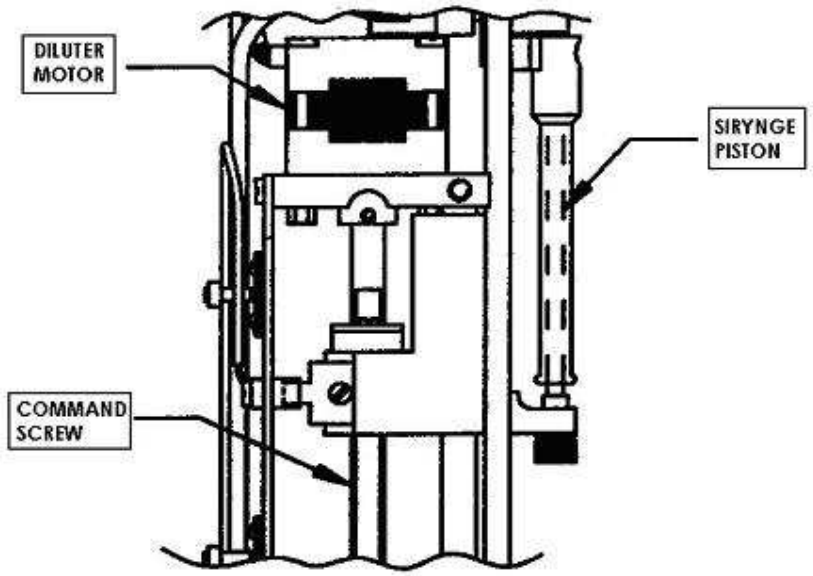


16) connect all the connectors of the cabling on the dispositives present on the instrument according to the following scheme:

- MX254 6 poles with the note MDS on the motor of the diluter using a motor protection diode module
- MX254 3 poles with the note SDS on the optical limit switch of the diluter
- MX254 2 poles with the note EV1 on the electrovalve of the diluter
- MX254 6 poles with the note MS on the motor of the sampling needle (through the rotating connection) using a motor protection diode module
- MX254 3 poles with the note SSN on the optical limit switch of the sampling needle (through the rotating connection)
- MS396 2 poles with the note R2 on the heating reel (through the rotating connection)
- MX254 6 poles with the note MRP on the motor of the reagent plate using a motor protection diode module
- MX254 3 poles with the note SRP of the optical limit switch of the reagent plate
- MX254 6 poles with the note MIP on the motor of the sample plate using a motor protection diode module
- MX254 3 poles with the note SIP of the optical limit switch of the sample plate
- MX396 2 poles with the note R1 on the heating reel of the reaction plate

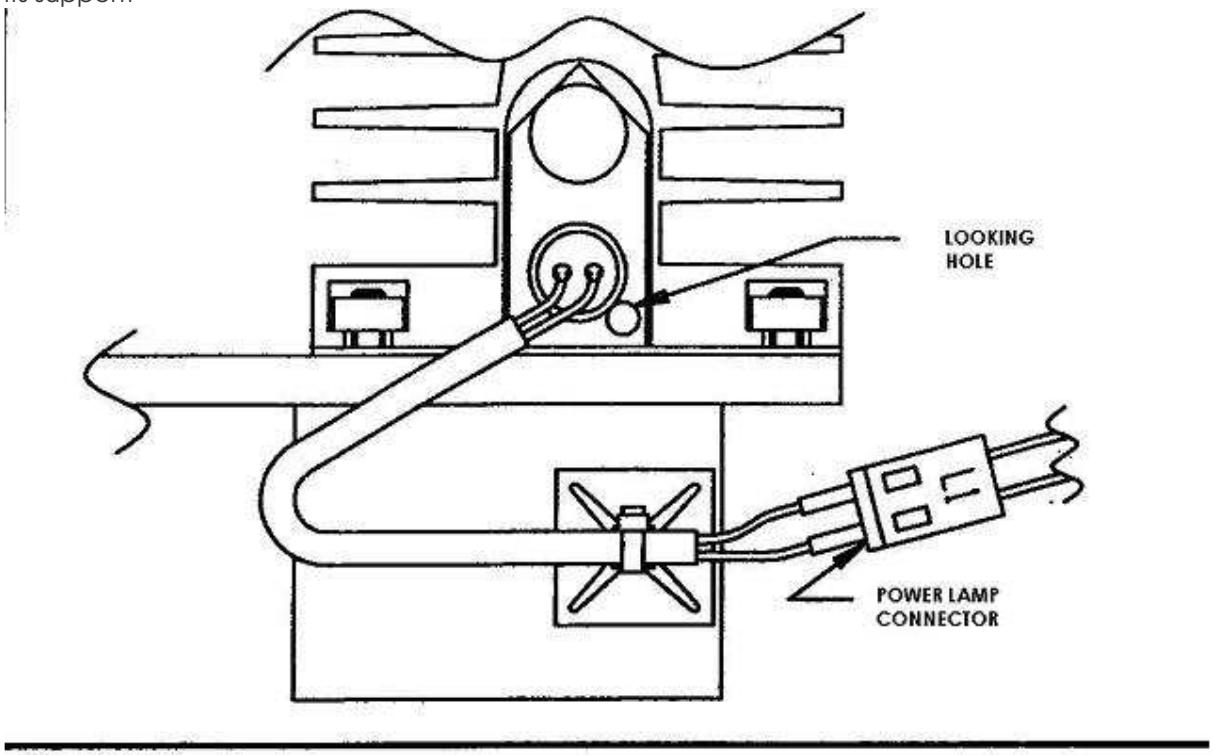
- MX254 2 poles with the note ST2 on the temperature sensor of the reaction plate
- Faston couple, coming out from the cabling together with the cables R1 and ST2, on the security thermostate of the reaction plate
- MX254 6 poles with the note MOP on the motor of the reaction plate using a motor protection diode module
- MX254 3 poles with the note SOP on the optical limit switch of the reaction plate
- MX254 6 poles with the note MAN on the motor of the reading needle using a motor protection diode module
- MX254 3 poles with the note SAN on the optical limit switch of the aspiration needle
- MX254 6 poles with the note MPM on the motor of the peristaltic pump using a motor protection diode module
- MX254 6 poles with the note MFS on the filter wheel motor using a motor protection diode module
- MX254 3 poles with the note SFS on the optical limit switch of the filter wheel
- MX254 6 poles with the note FD1 on the cable coming form the preamplifier board
- MX254 2 poles with the note ST1 on the temperature sensor of the flow cell
- MX396 2 poles with the note PT1 on the Peltier cell of the flow cell thermostation
- MX396 2 poles with the note L1 on the optical lamp
- Faston couple coming out from the cabling together with the cables L1 and PT1 on the security thermostate of the flow cell
- Flat 16 poles of the serial port on the cpu board to the serial port of the PC104 board

17) Take everything in high towards the electro valve, the diluter piston rotating manually the command screw connected to the motor tree.

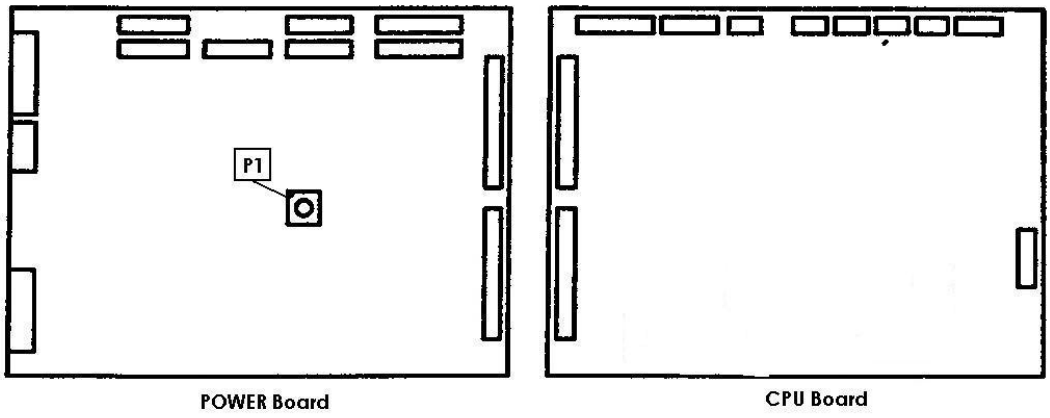


18) turn on the instrument and make sure that within 1-2 seconds the printer executes an empty course of the head.

19) Control that the optical lamp is turned on looking at the hole present on the superior part of its support.



20) regulate the lamp tension connecting the tester on the two pin of the cabling connector L1 present near to the lamp itself, without disconnecting it, and regulate the trimmer P1 on the power board to obtain a value of the tension equal to +5,65 Vcc ± 0,05V.



21) start the initial zero cycle of the instrument press the Enter key. Since at this point some of the motors could be connected in a wrong way you can find a zero errors. Ignore these errors pressing the Enter key each time the cycle is interrupted and the instrument beeps to notify the error.
At the end of the zero procedure you will find some screens which will notify the presence of errors in the methods, ignore them by pressing STOP to arrive to the Main menu screen.

22) adjust the rotation verse of the sample plate going to the hardware test screen, pressing in sequence the keys F5 (service), F3 (Diagnostics), and again F3 (hardware test) starting from the main menu and evidence the line IP (sample plate) form the motor's table using the up and down arrows.
Press the key F1 (zero motor) to execute the research of the zero of the sample plate which should be stopped with the hole marked B in correspondence of the left side of the instrument.
Move the cursor in the column "Pos.Log." by the key Enter and then digit 10, the plate should rotate in anticlockwise for about 1/3 of round bringing the hole marked 10 into the position where the hole marked B was before. If this is not the case, i.e. if the plate rotates in clockwise, disconnect the cabling connector with the note MIP, exchange between them the two cables of blue colour and reconnect the connector and repeat this point from the beginning to verify that the rotation verse has been effectively corrected.

23) adjust the rotation verse of the reaction plate going to the hardware test screen, pressing in sequence the following keys F5 (service), F3 (Diagnostics) and again F3 (hardware test) starting from the main menu, and then evidence on the line OP (test plate) of the motor's table using the keys arrows up and down.
Press the key F1 (zero motor) to execute the zero research of the reaction plate which should stop at the point marked 1 in correspondence of the right side of the instrument.
Move the cursor of the column "pos.log" using the key Enter and then digit 025, the plate should rotate in clockwise of about ¼ round bringing the point marked 2 into the position where the point marked 1 was situated before. If this is not the case, i.e. if the plate is moving in the opposite way, disconnect the connecter of the cabling with the note MOP, exchange between them the two cables of blue colour, reconnect the connector and repeat the procedure of this point from the beginning to verify that the rotation sense is effectively corrected.

24) adjust the rotation verse of the filter wheel going to the screen hardware test, pressing in sequence the keys F5 (service), F3 (Diagnostics) and again F3 (hardware test) starting from the main menu, and then evidence the line FS (filter wheel) from the motor's table using the arrows up and down.
Press the key F1 (zero motor) to execute a research of the filter wheel zero which should stop with the hole marked 0 between the two arms of the transmission chain which is situated behind it.
Move the cursor to the column "pos.log." using the key Enter and then digit 1, the filter wheel should rotate in clockwise for more then one round positioning the hole marked 1 to the position where the hole marked 1 was positioned before. If this is not the case, i.e. the filter wheel is moving in the contrary verse disconnect the connector of the cabling noted with MFS, exchange between them the cables of blue colour, reconnect the connector and repeat this point from the beginning to verify that the rotation sense has been effectively changed.

25) adjust the rotation verse of the peristaltic pump going into the screen hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from the main menu and then evidence the line PM (peristaltic pump) of the motor's table using the arrows up and down.
Press the key F2 (motor ahead) and the reel of the peristaltic pump should rotate in anticlockwise sense for about 1 / 2 round. If this is not the case, i.e. the reel is moving in the contrary sense, disconnect the connector of the cabling with the note MPM, exchange between them the two blue colour cables, reconnect the connector and repeat this point from the beginning to verify that the rotation sense has been effectively changed.

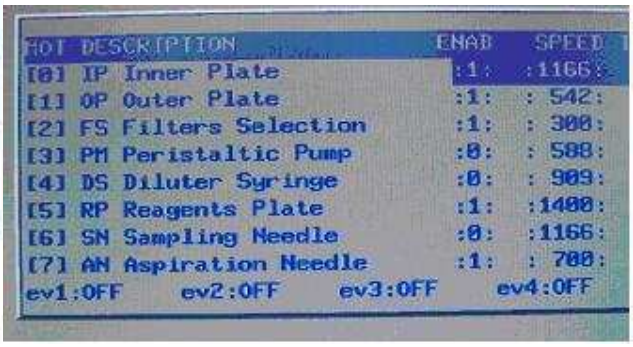
26) adjust the movement sense of the dilutor using the screen hardware test, pressing in sequence the keys F5(service), F3 (diagnostics) and again F5 (hardware test) starting from the main menu and then evidence the line DS (diluter) of the motor's table using the arrows up and down.
Press the key F1 (zero motor) to execute a research of the piston zero of the diluter which should stop all in high, without the instrument signing errors (beep). If this is not the case, i.e. the piston stops all down and / or an error is signed, disconnect the connector with the note MDS, exchange between them the two blue coloured cables, reconnect the connector and repeat this point from the beginning to verify if the movement has been effectively corrected.

27) adjust the rotation sense of the reagent plate using the screen of hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from the main menu and then evidence the line RP (reagent plate) of the motor's table using the arrows up and down.
Press the key F1 (zero motor) to execute a research of the reagent plate zero which should stop with the needle arm in correspondence of the left side of the instrument without the instrument is signing an error (beep). If this is not the case, i.e. the plate is rotating in the contrary sense and / or an error is signed, disconnect the connector of the cabling with the note MRP, exchange between them the two blue coloured cables, reconnect the connector and repeat this point the verify that the rotation sense has been effectively changed.

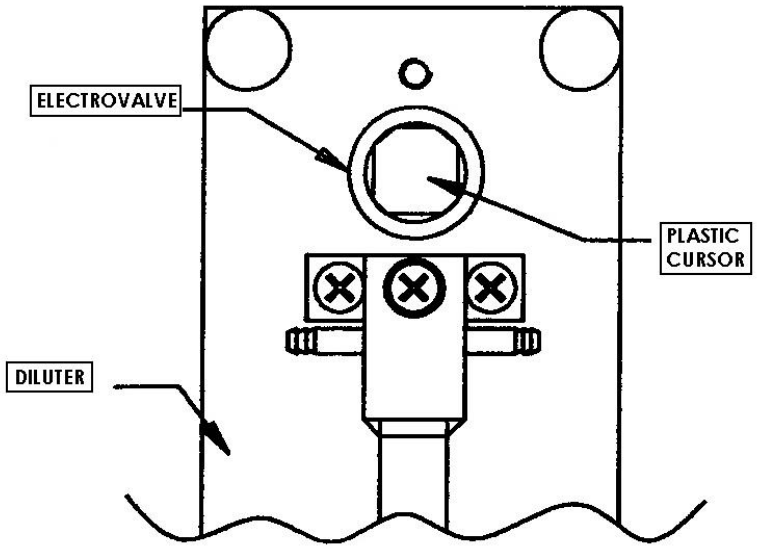
28) adjust the rotation sense of the sampling needle using the screen of hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from the main menu and then evidence the line SN (sampling needle) of the motor's table using the arrows up and down.
Press the key F1 (zero motor) to execute a research of the sampling needle which should stop all in high without the instrument is signing an error (beep). If this is not the case, i.e. the sampling needle is stops all in down and / or an error is signed, disconnect the connector of the cabling with the note MSN, exchange between them the two blue coloured cables, reconnect the connector and repeat this point the verify that the rotation sense has been effectively changed.

29) adjust the rotation sense of the aspiration needle using the screen of hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from the main menu and then evidence the line AN (aspiration needle) of the motor's table using the arrows up and down.
Press the key F1 (zero motor) to execute a research of the aspiration needle which should stop all in high without the instrument is signing an error (beep). If this is not the case, i.e. the aspiration needle is stops all in down and / or an error is signed, disconnect the connector of the cabling with the note MAN, exchange between them the two blue coloured cables, reconnect the connector and repeat this point the verify that the rotation sense has been effectively changed.

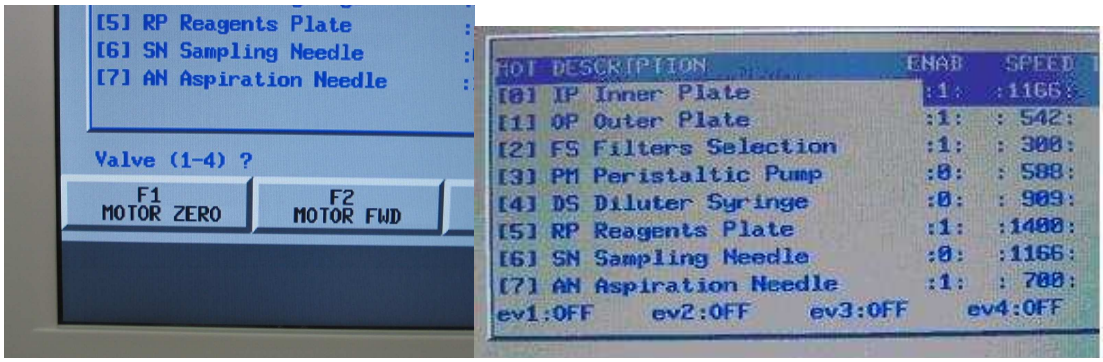
30) verification of the diluter's electrovalve functionality using the screen hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from main menu and then press the key F4 (valve on /off) and on video we have the message VALVE (1 – 4) ?.



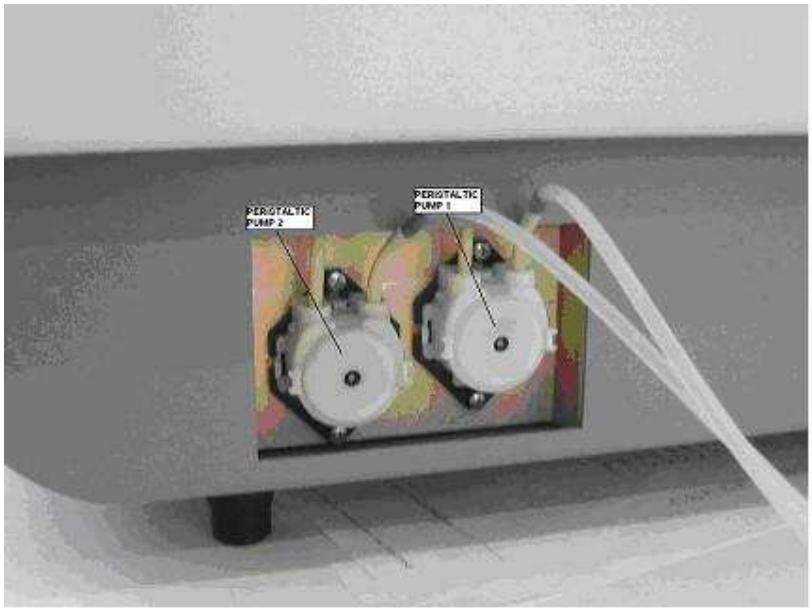
Select 1 and verify that the plastic cursor (black and white) present on the central part of the electrovalve of the diluter is moving correctly. At the end of this operation press another time 1 to leave the cursor in release position.



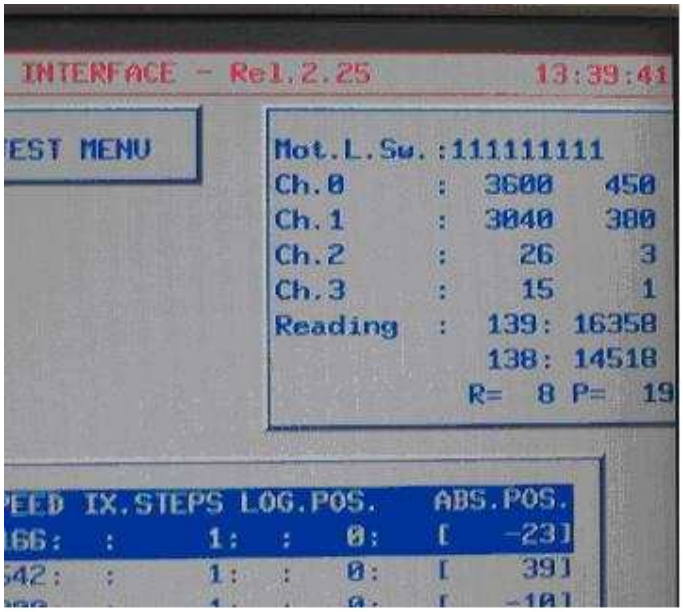
31) verification of the two direct current peristaltic pumps (only for double cuvette) functionality using the screen hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from main menu and press the key F4 (valve on /off) and on video we have the message VALVE (1 – 4) ?.



Select 3 and verify that the pump relative to the flow cell n°1 is moving in the clock wise direction.
At the end of this operation press another time 3 to leave the pump in release position.
Select 4 and verify that the pump relative to the flow cell n°2 is moving in the clock wise direction.
At the end of this operation press another time 4 to leave the pump in release position.



32) verification of the analogical entrance functionality going to the screen hardware test, pressing in sequence the keys F5 (service), F3 (diagnostics) and again F3 (hardware test) starting from the main menu, and then activate the continuous visualisation of the entrance state, pressing the key F5 (entrance vis.) which will be visible on the upper right side of the screen.
Control that the number situated on the extreme right of the line with the digit CH.0 indicates a value tending to 420 and the one at the extreme right line with the digit Ch. 1 indicates a value tending to 380.



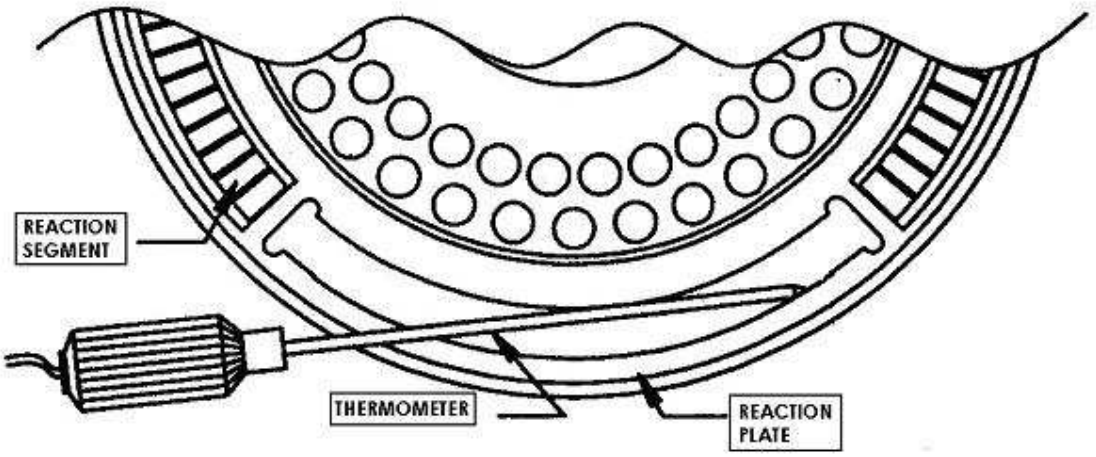
33) control that the tension of the optical lamp is not under the + 5,60 V otherwise regulate it once again to arrive to the value between the + 5,60 Vcc and + 5,65 Vcc.

34) turn off the instrument, put all the missing screws to complete the fixing of the power and CPU boards and fix the fan holder with the four screws TC+M3x10. Connect the two fans to the connector of the cabling with the digit V1 and V2 (MX254 2 poles).

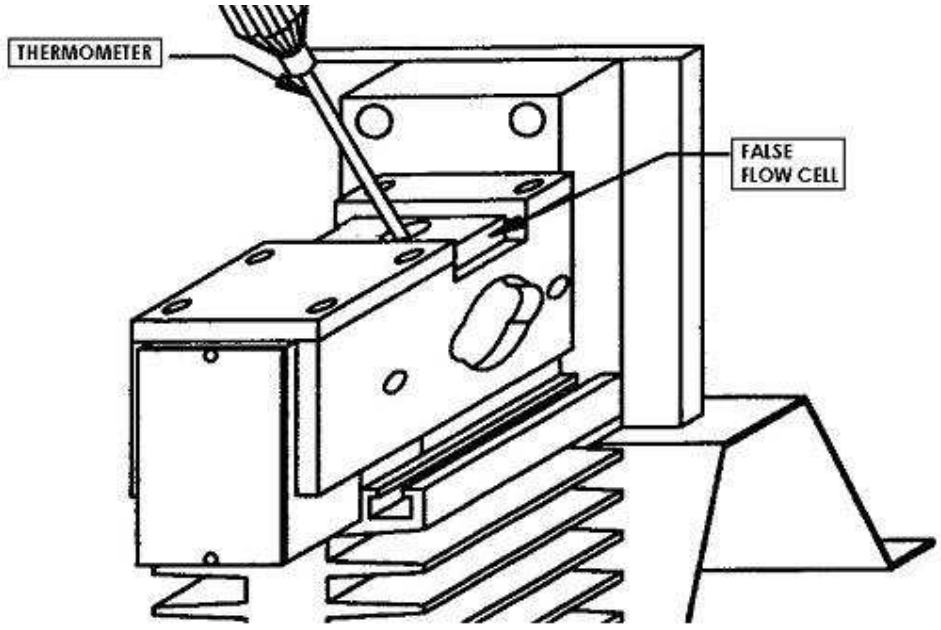
35) turn on the instrument and verify that the two fans are moving regularly without noise and the air is sent towards the power board.

36) start the initial zero cycle of the instrument, pressing the key Enter which should proceed and terminate without errors occur. At the end of the you should find the main menu screen.

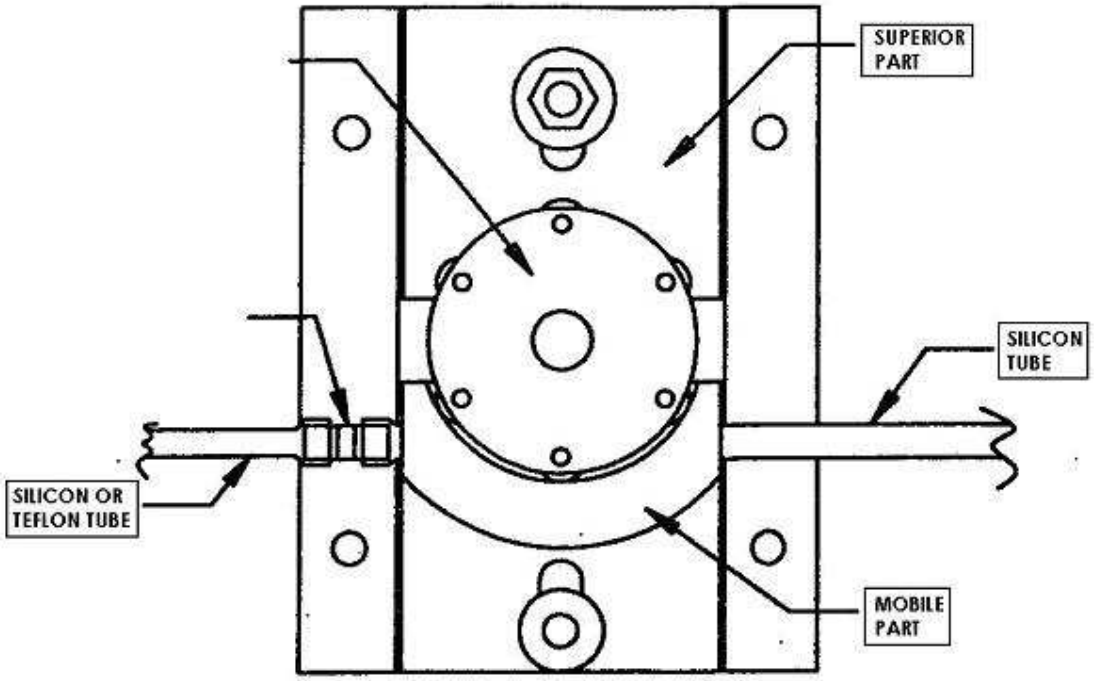
37) position the thermometer on the reaction plate putting the end of it in one of the reaction segments in the way that the edge of it arrived to the bottom near to the temperature sensor and then dry with some paper tissues the holder to avoid the heat dispersion and contemporary block the thermometers position.
Take three reaction segments and insert them in the three holders remained free on the reaction plate.



38) position a thermometer in the optical group inserting the end of it through the central hole of the false flow cell which should be inserted at the place of the true one in the optical group.



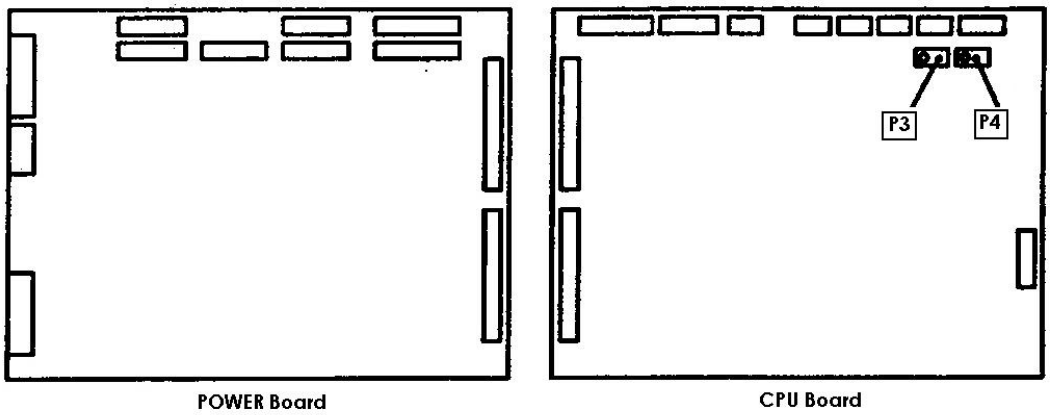
39) insert the peristaltic pump tubing loosening the screw blocking the mobile part of the pump in the way to free the vertical movement and make it go down to the bottom.
Insert the free end of the silicon tube coming from the flow cell into the two holes present on the side of the mobile part.
Tear the tube from the exit hole until the two joining points of the tubes arrived to the mobile part.



40) regulate the aspiration of the peristaltic pump from the screen of hardware test, pressing in sequence the keys F5 (service), F3 (diagnosis) and again F3 (hardware test) starting from the main menu and then evidence the line PM (peristaltic pump) of the motor's table using the up and down arrows.
Move the cursor into the column "p.index" and write the number 30000.
Loosen the blocking screw of the superior part in way to leave it free to move in a vertical way.
Press upwards the mobile part, which should squeeze the silicon tube , in the way to make it arrive to a distance of about 1 mm form the pump reel and strengthen the blocking screw.
Insert the aspiration needle, connected to the flow cell, and the silicon tube coming out from the peristaltic pump into a recipient containing distilled water.
Press the key F2 (motor ahead) and the pump will move executing 150 complete rounds during which you should verify that the water is regularly aspirated though the needle and expelled the silicon tube. Extract and immerge the needle into the water several times to see if the tube connected to it is emptied and filled each time.
In case there are some irregularities you should loosen and move, pressing it more and less, the mobile part of the pump until you achieve a regular aspiration and / or verify if there are any leakage or obstruction in the tubes or in the flow cell.

If the pump is still during the regulation press again the key F2 to restart it.
Once you have obtained the requested regulation fix the blocking screw on the superior part to bring it near to the superior board of the mobile part.

41) control the temperature indicated by the thermometer inserted in the reaction plate which should show 42,0 °C ± 0,2 °. Regulate the trimmer P3 of the CPU board rotating it in anticlockwise if the temperature is read is inferior or in clockwise if the temperature is superior.



42) control the temperature indicated by the thermometer positioned into the false flow cell which should be of 38,0 °C ± 0,2 °C. Regulate the trimmer P4 of the CPU board rotating it in anticlockwise if the read temperature is inferior or in clockwise if it is superior.

4 - ELECTRONIC AND MECHANICAL DESCRIPTION

Echo instrument can be divide in two different parts:

- **Electronic part**
- **Mechanical part**

The electronic part included:

- CPU Board
- Power Board
- Preamplifier Board
- Internal PC Board
- Level Sensor Board
- Main Transformer
- Cooling Plate Power Switching
- Motor Driver Power Switching

The Mechanical part included:

- Central Mechanical group
- Optical group
- Diluter group
- Peristaltic Pump group

Electronic:

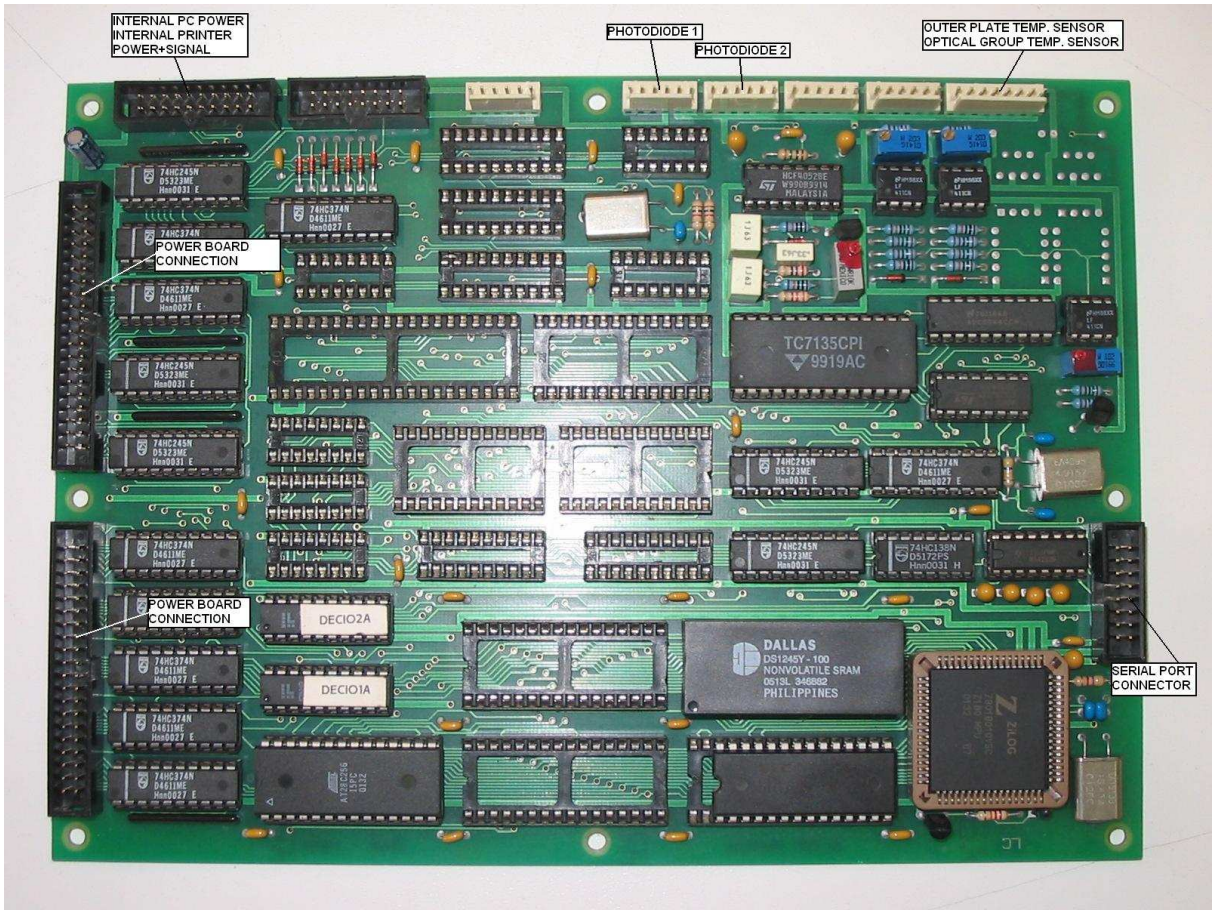


Figure 1: CPU Board

The CPU Board is arranged with a Z80 processor family and its circuit.
A NON-VOLATILE RAM contains the user defined parameters.
Two EPROMS are present and these contains the firmware. During a firmware updates these components could be replaced.

Figure 2: CPU Board layout

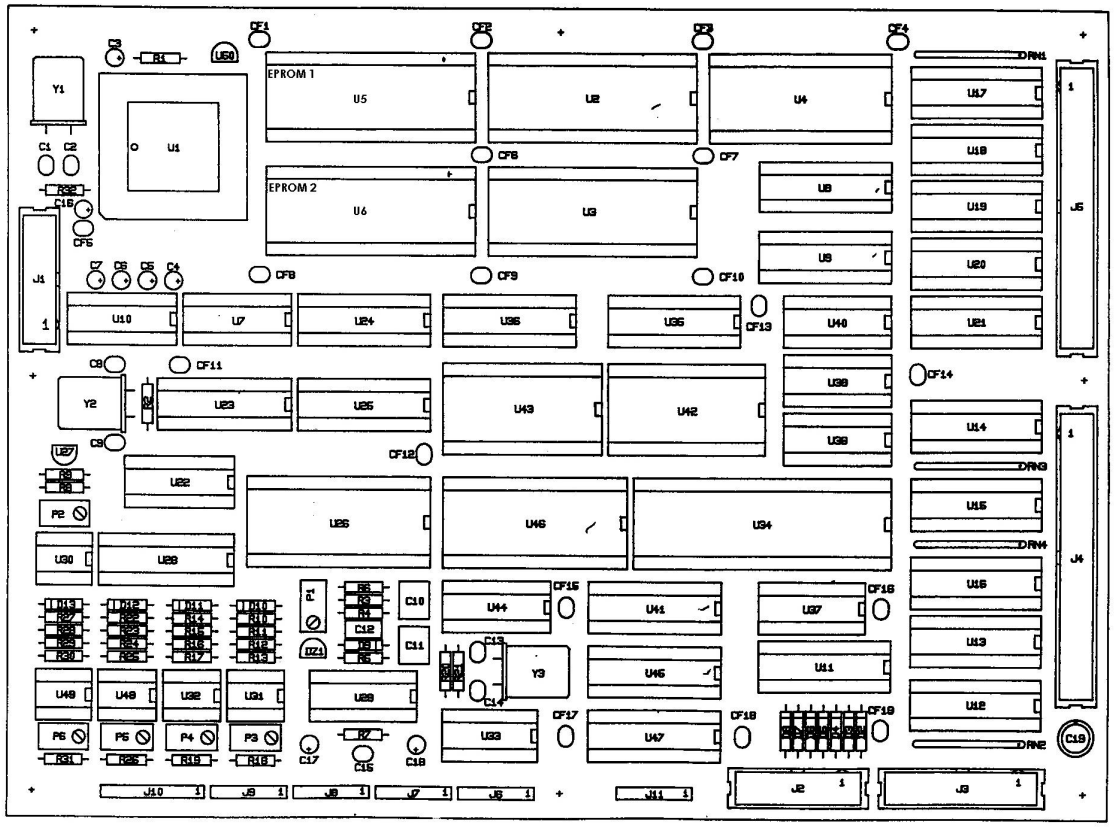


Figure 3 : Memory and Microprocessor

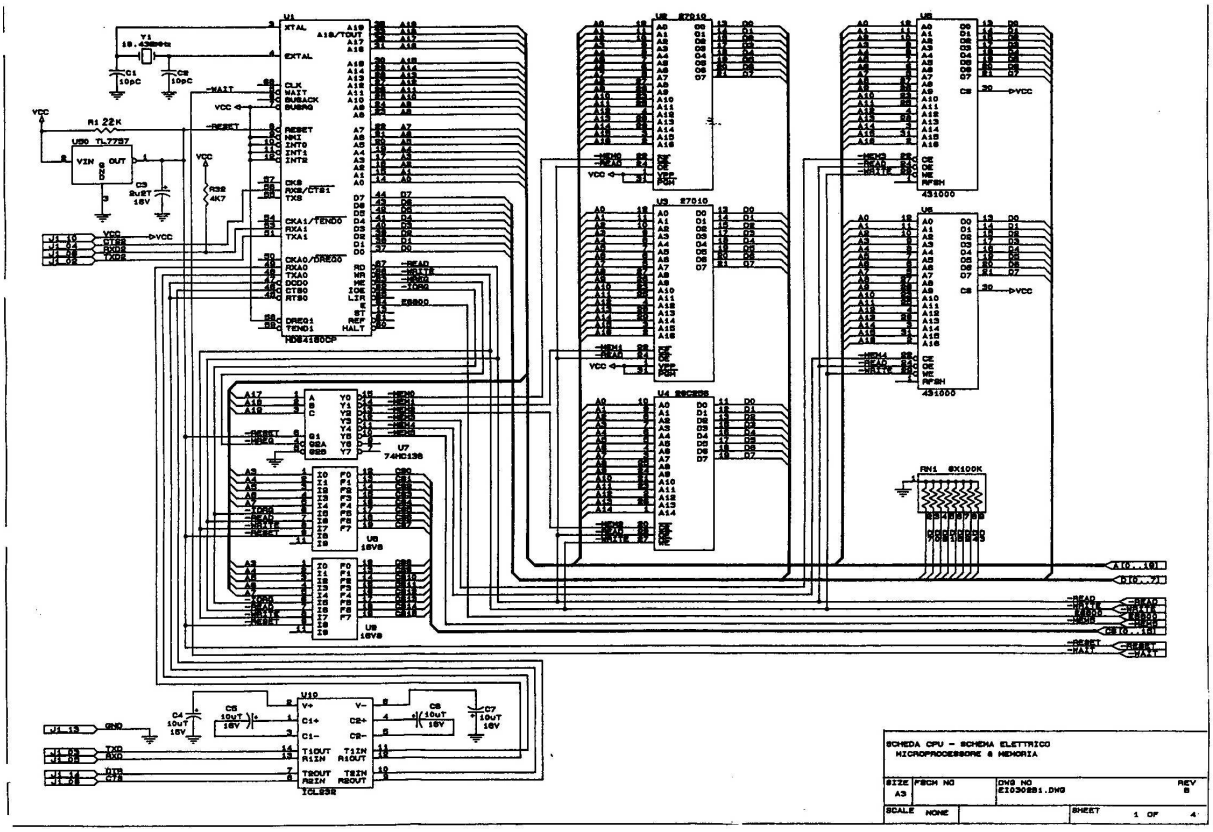


Figure 4: Digital INPUT/OUTPUT

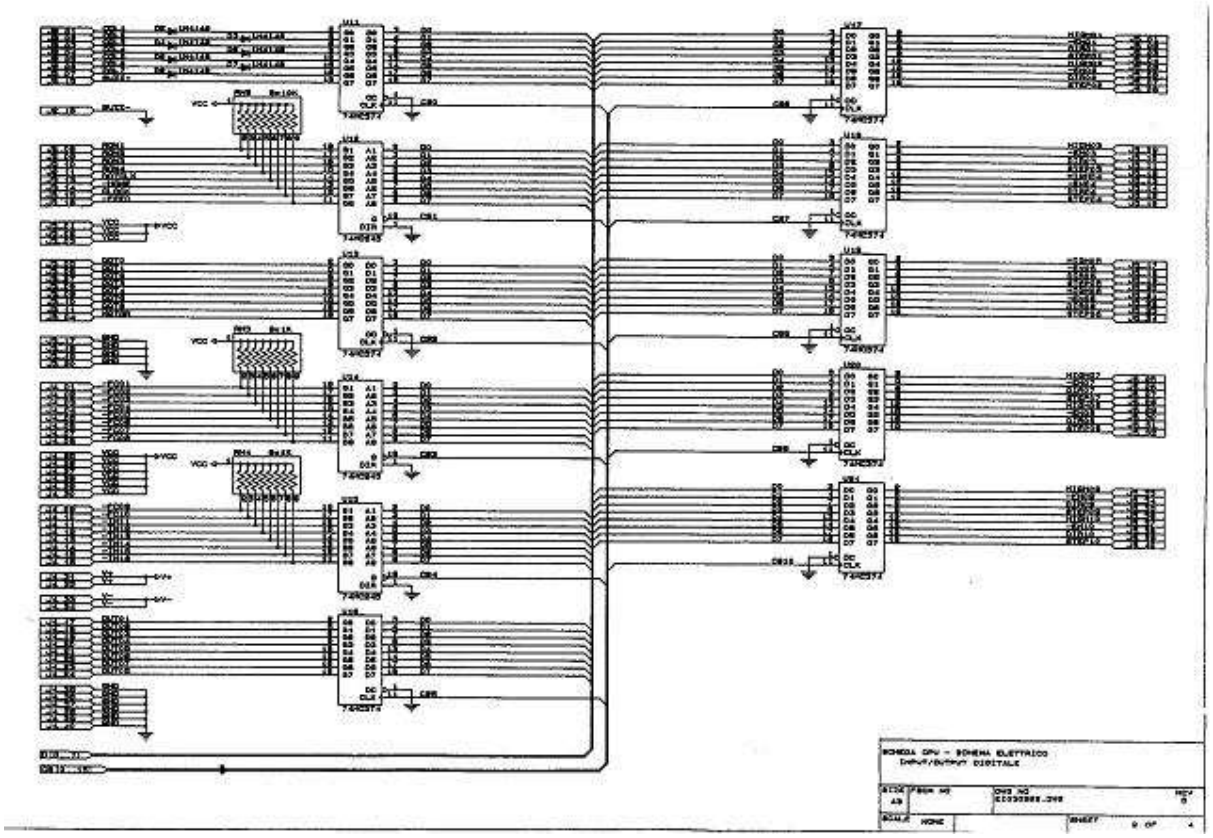


Figure 5: Analog Input

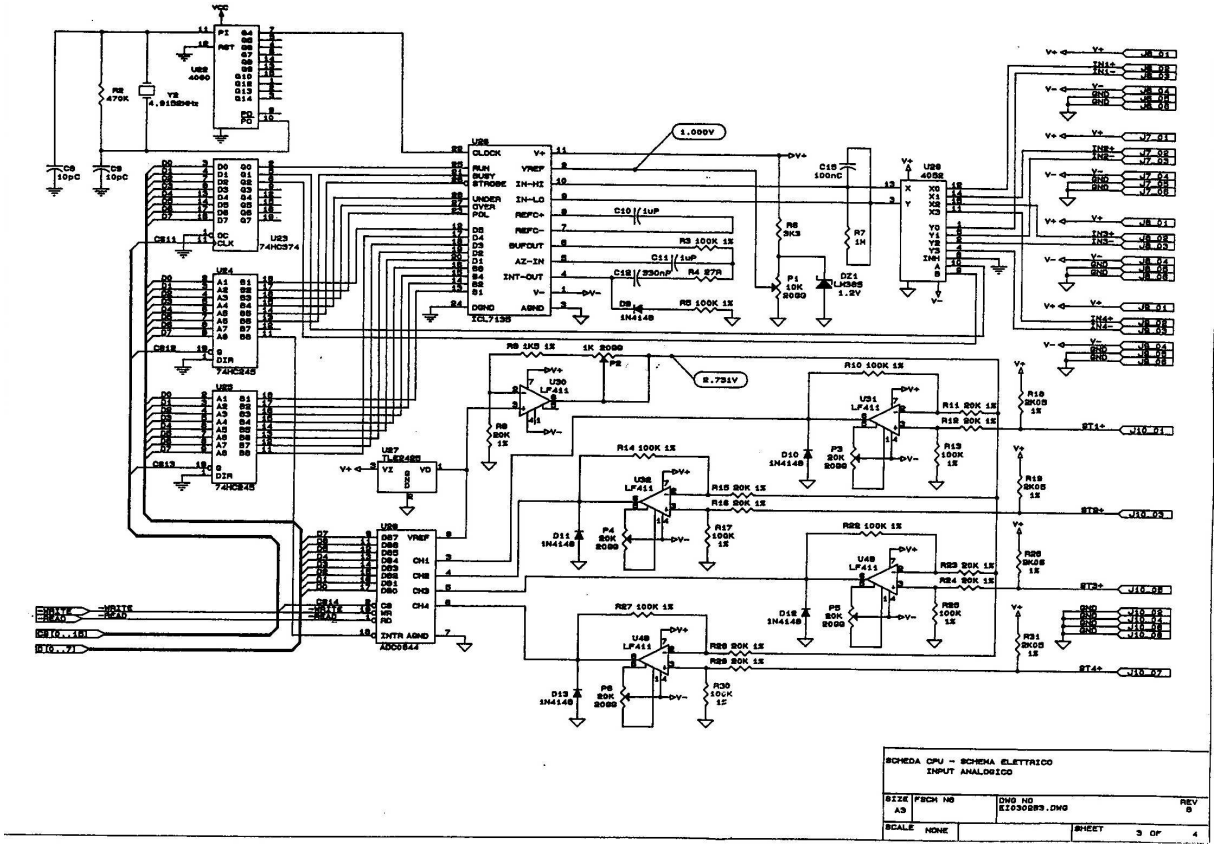
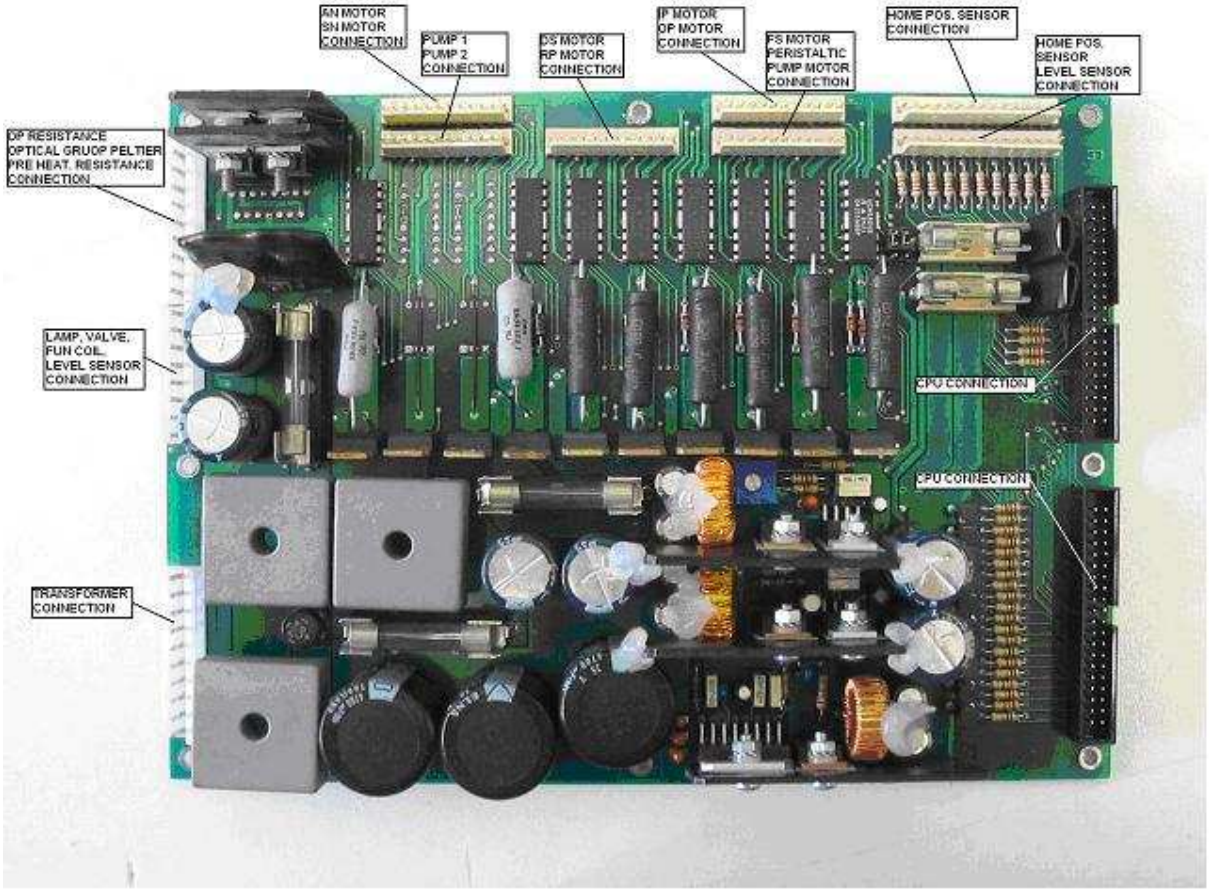


Figure 2: POWER Board



The POWER Board is the power interface between CPU and external devices like Stepper Motors, Home Position sensors, Temperature sensors and so on.

The Power Board receive AC voltage from the Main Transformer and provides DC power supply +/- 12 Vcc and
+/- 5 Vcc to the instrument electronic.

Fuses are present on the Power to protect the parts in case of malfunction.

Fuses Values :

F1 = 10 A 6x30
F2 = 5 A 6x30
F3 = 10 A 6x30
F4 = 200 mA 5x20
F5 = 200 mA 5x20

No adjustment are necessary for the DC voltages because integrated stabilizer I.C. are used

Figure : POWER Board Layout

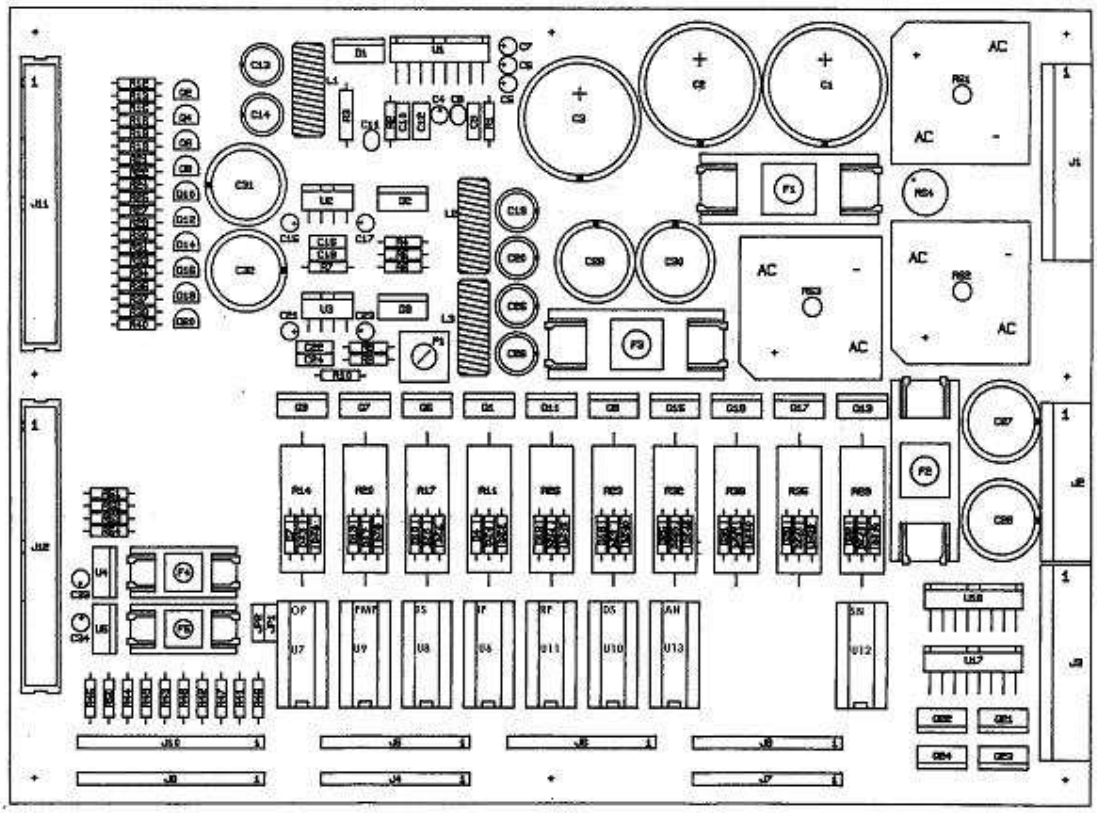


Figure : Power circuit

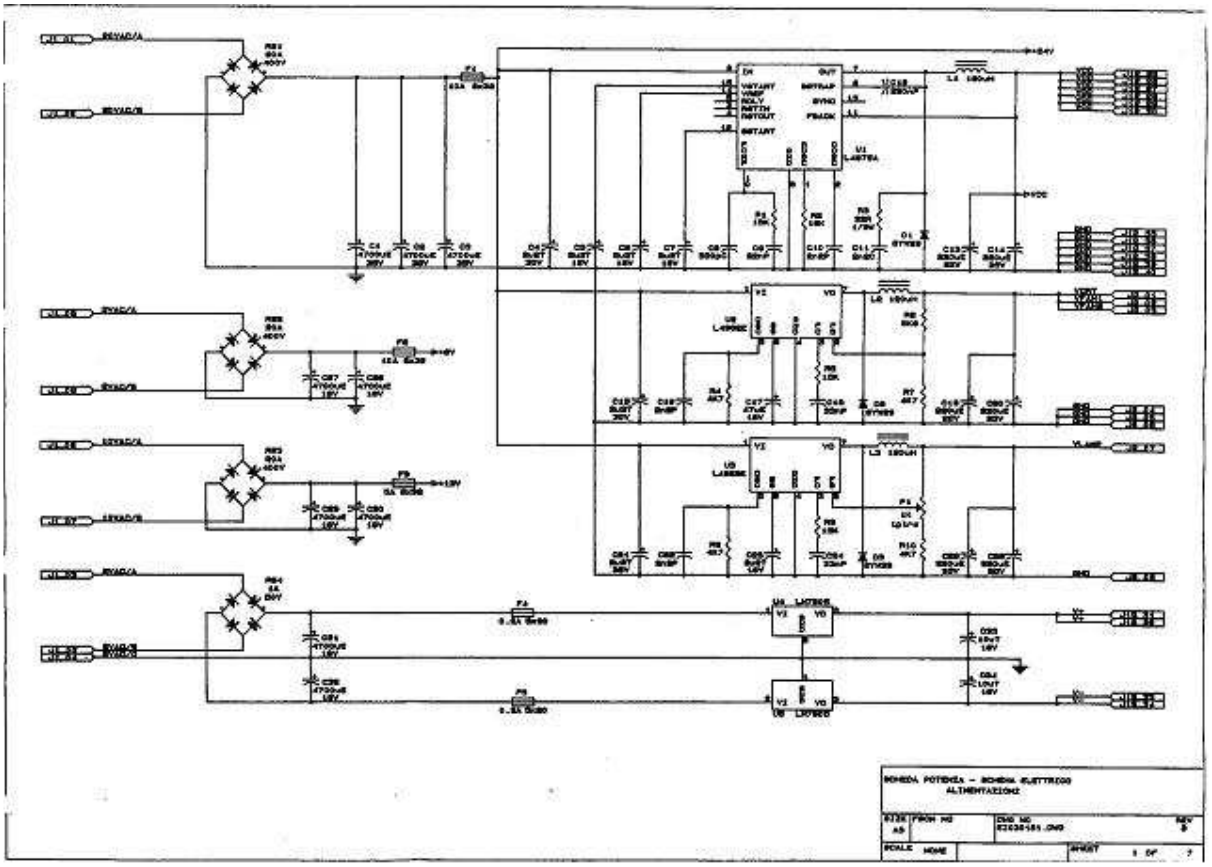


Figure : Motor Drivers circuit

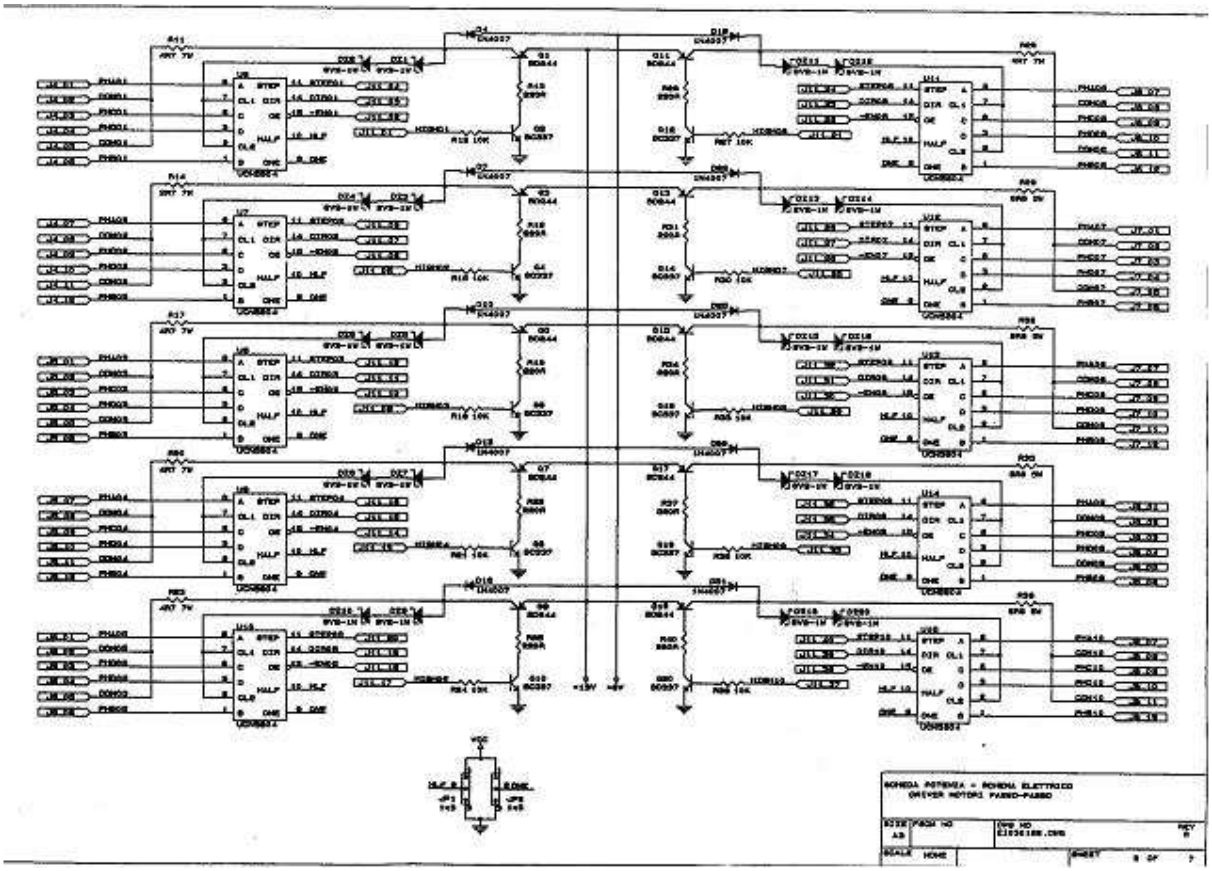


Figure : Input and Output circuit

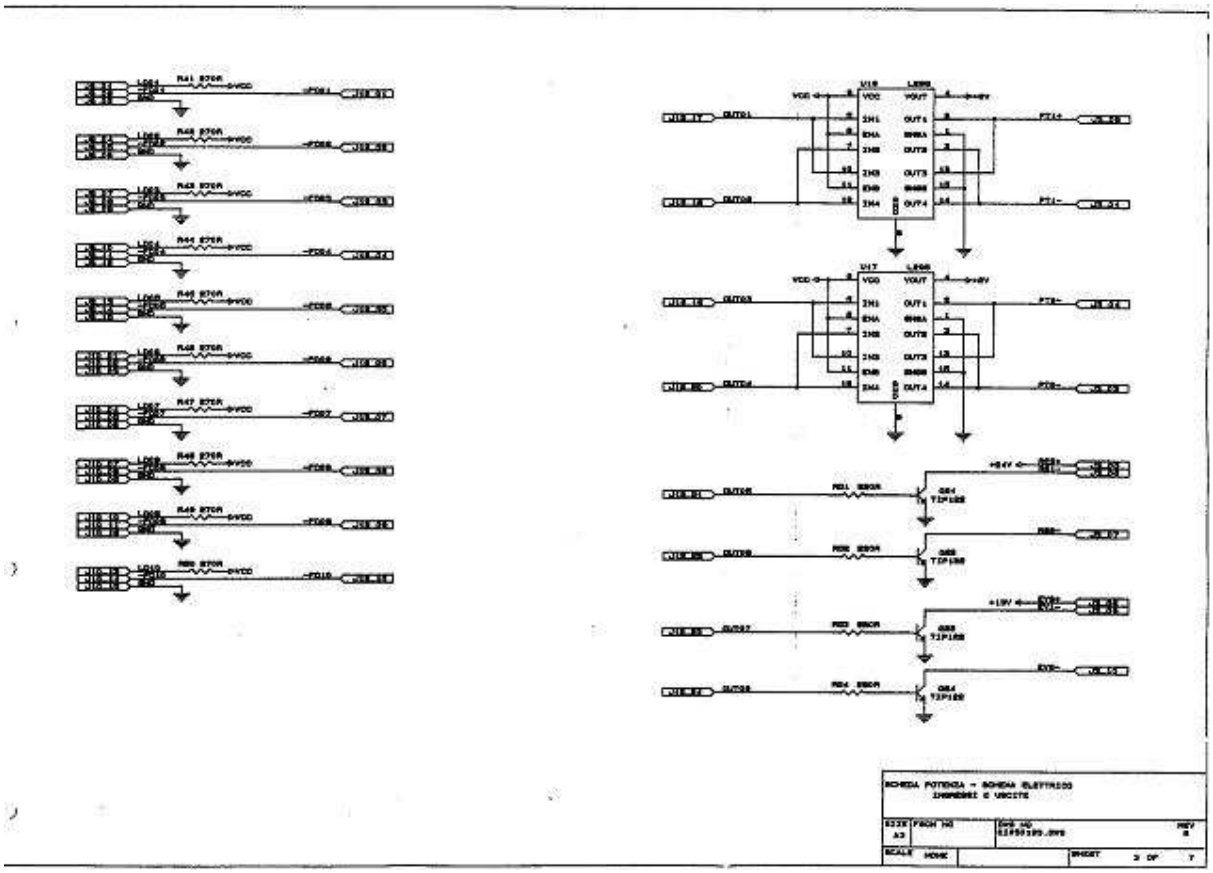


Figure 3: PREAMPLIFIER Board (monocuvette)

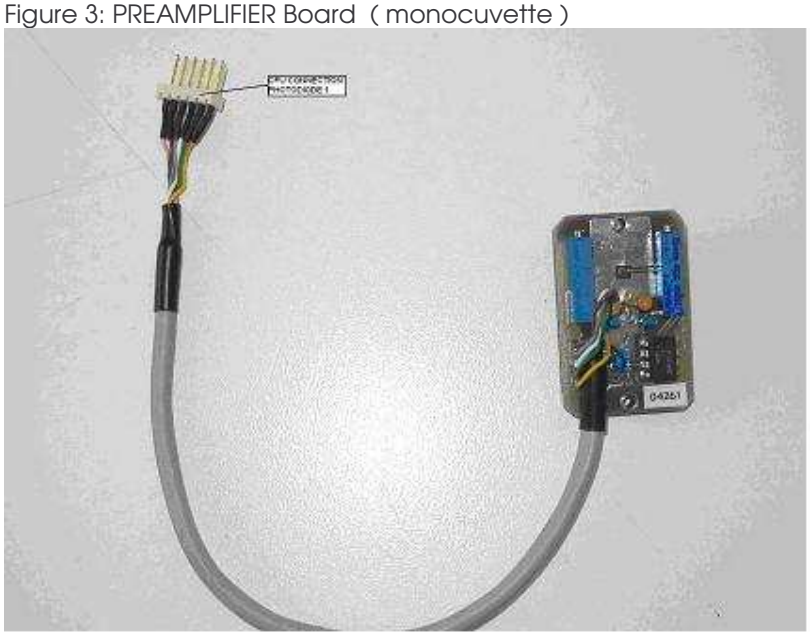


Figure 4: PREAMPLIFIER Board (double cuvette)

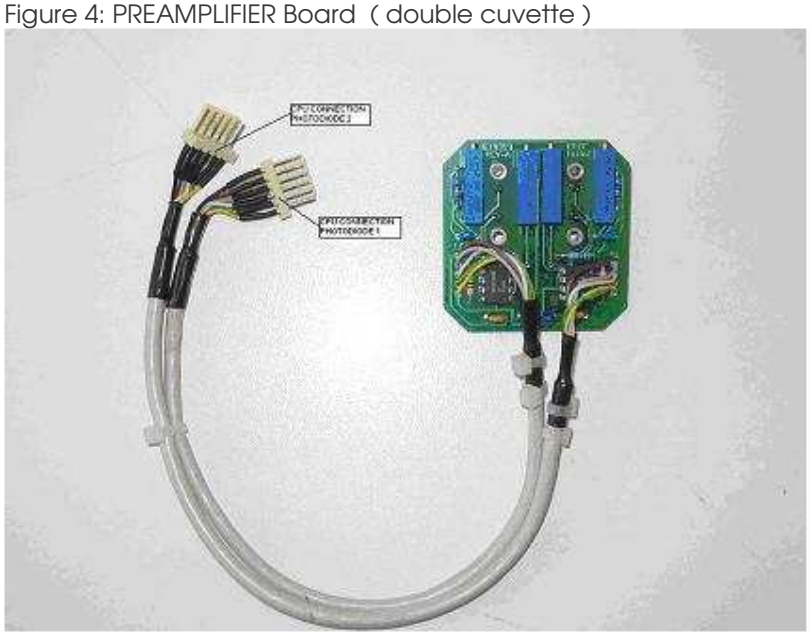


Figure 5: INTERNAL PC Board

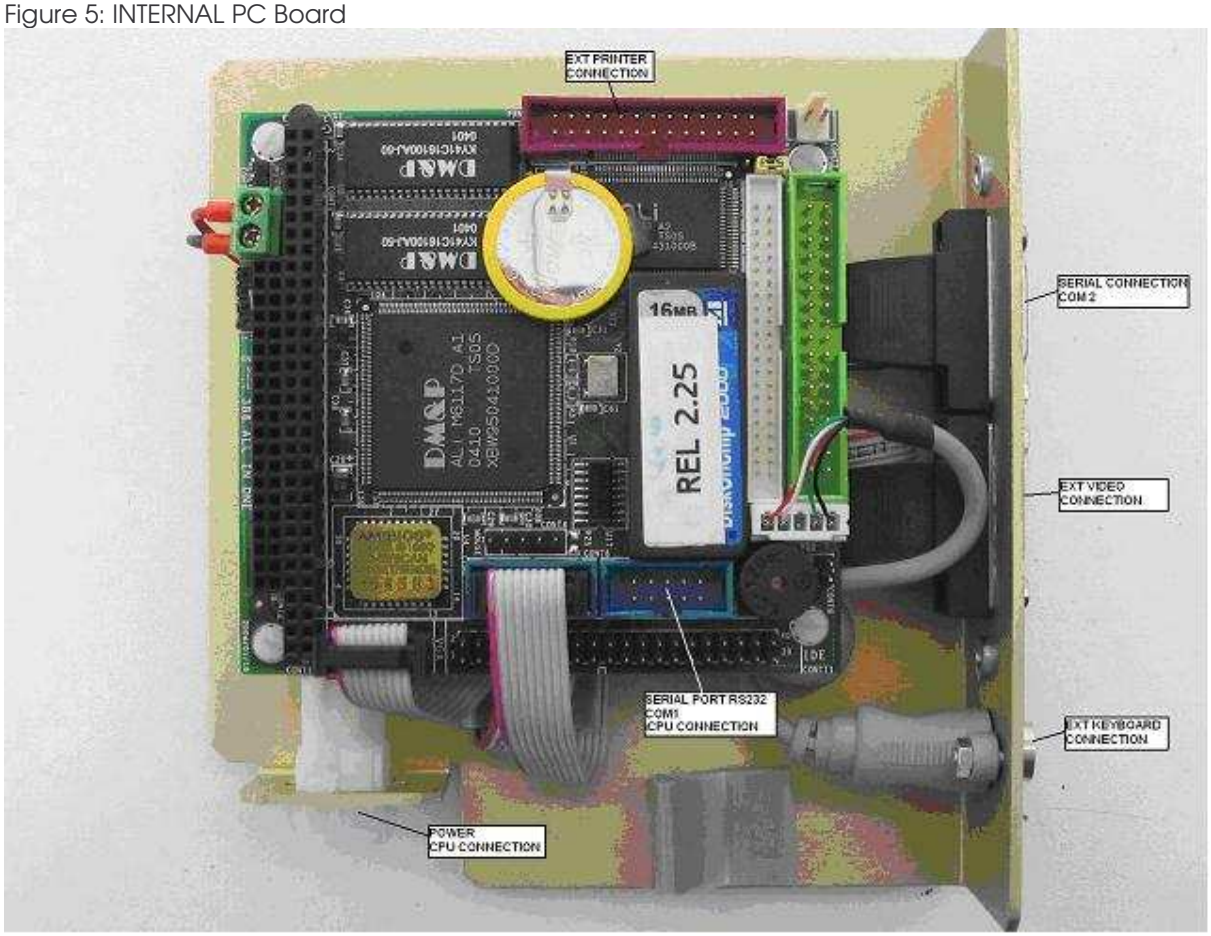
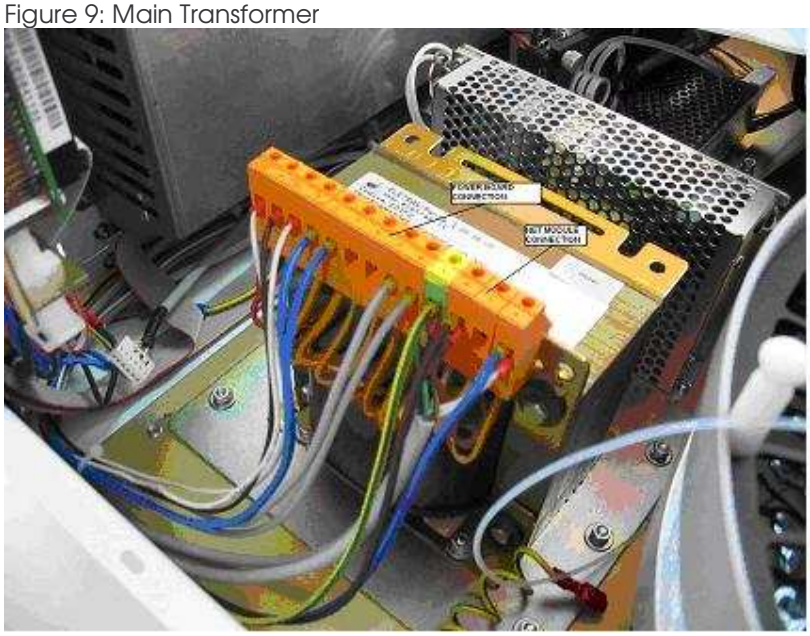


Figure 8: Level Sensor Board

Figure 9: Main Transformer



Select the main voltage on main transformer in order to connect the instrument to 115 VAC or 220 VAC.

115 VAC: Connect the 1st (neutral) and the 2nd (phase) and the 4th (ground) together. AC line has to be connect between 1 and 2 terminal.

220 VAC: Connect the 1st (neutral) and the 3rd (phase) and the 4th (ground) together. AC line has to be connect Between 1 and 3 terminal.

Figure 10: Main Transformer electrical

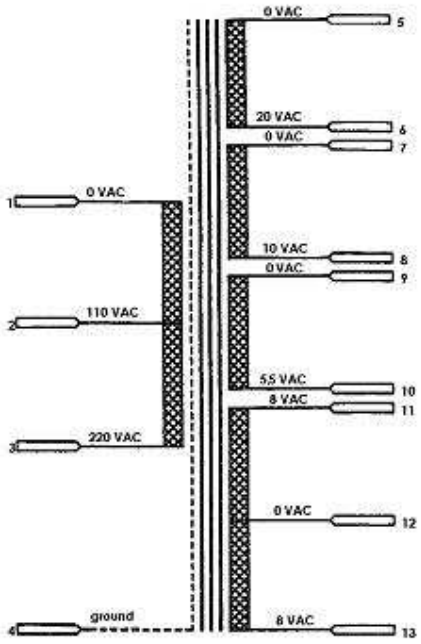


Figure 10: COOLING PLATE Power Switching – MOTOR DRIVER Power Switching

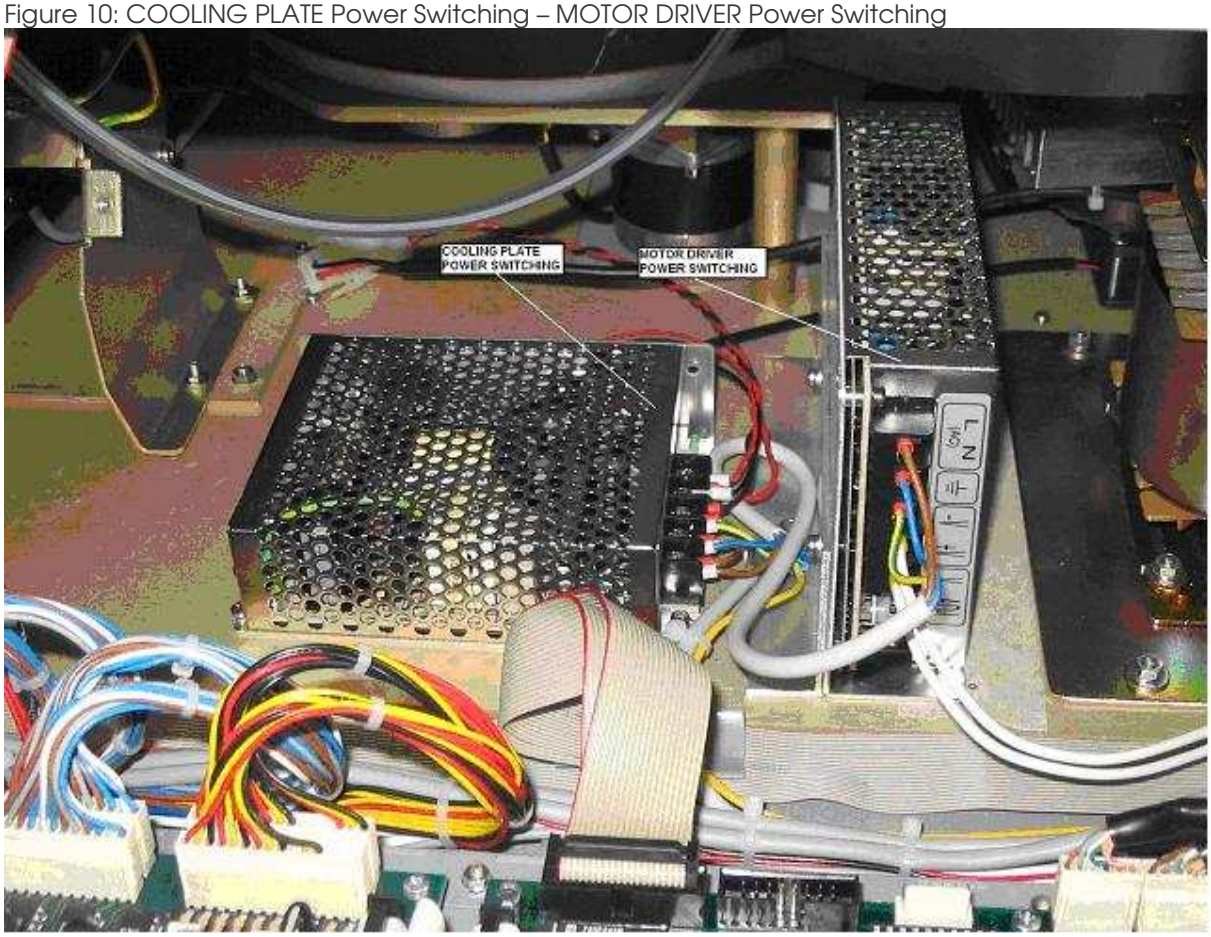


Figure 11: Power Board

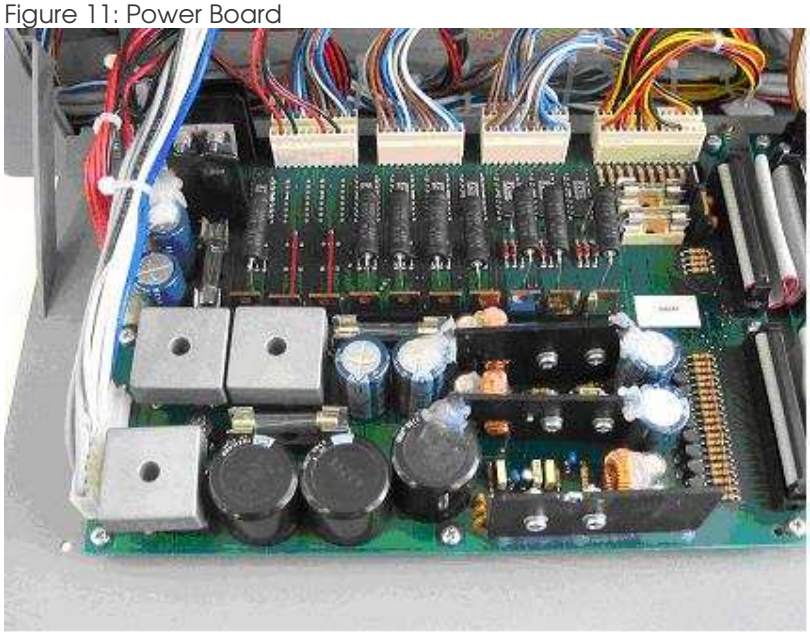


Figure 12: CPU Board

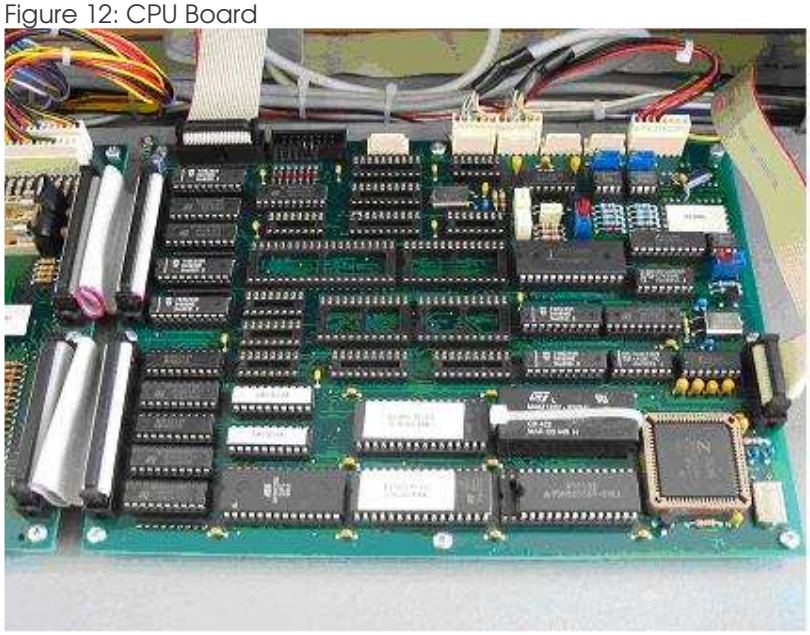


Figure 13: Power Board + CPU Board

Figure 14: Internal PC

Figure 15: Cooling plate Power Switching + Motor driver Power Switching and Main Transformer

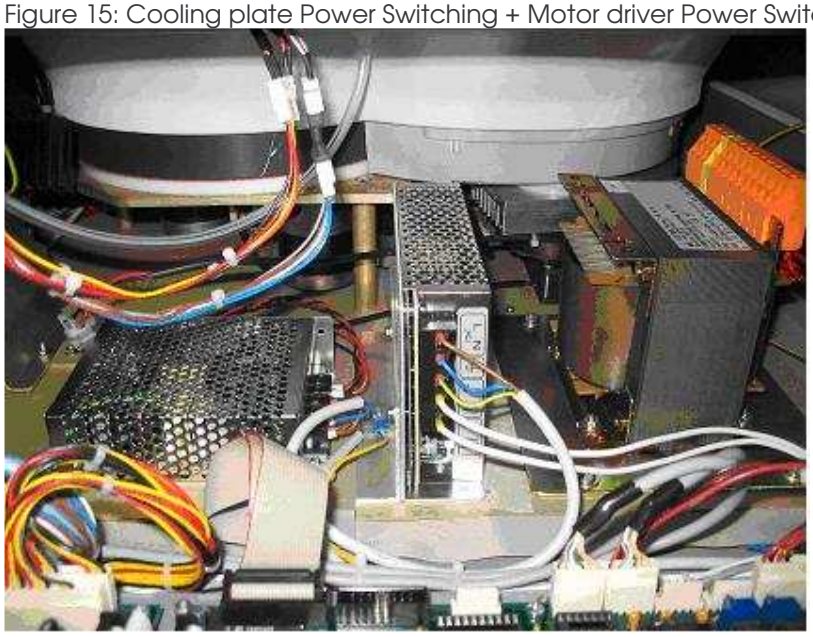
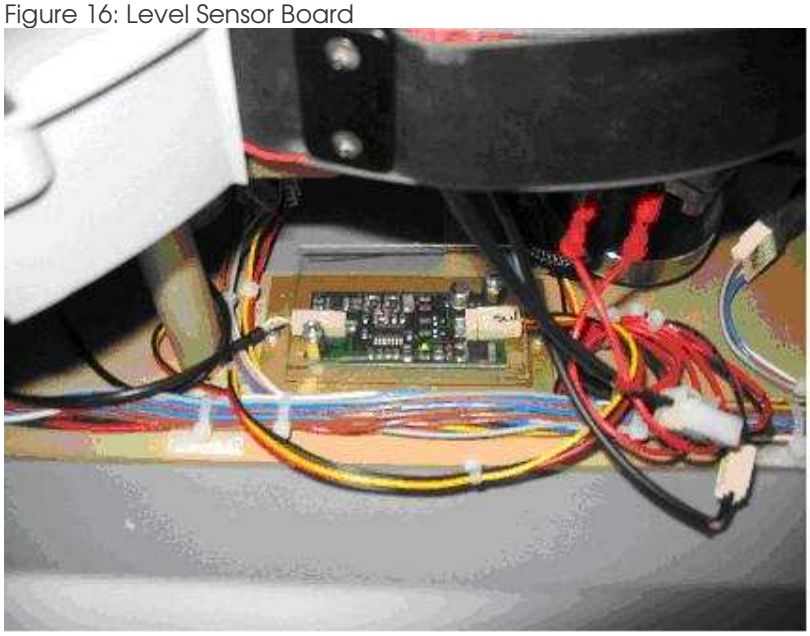
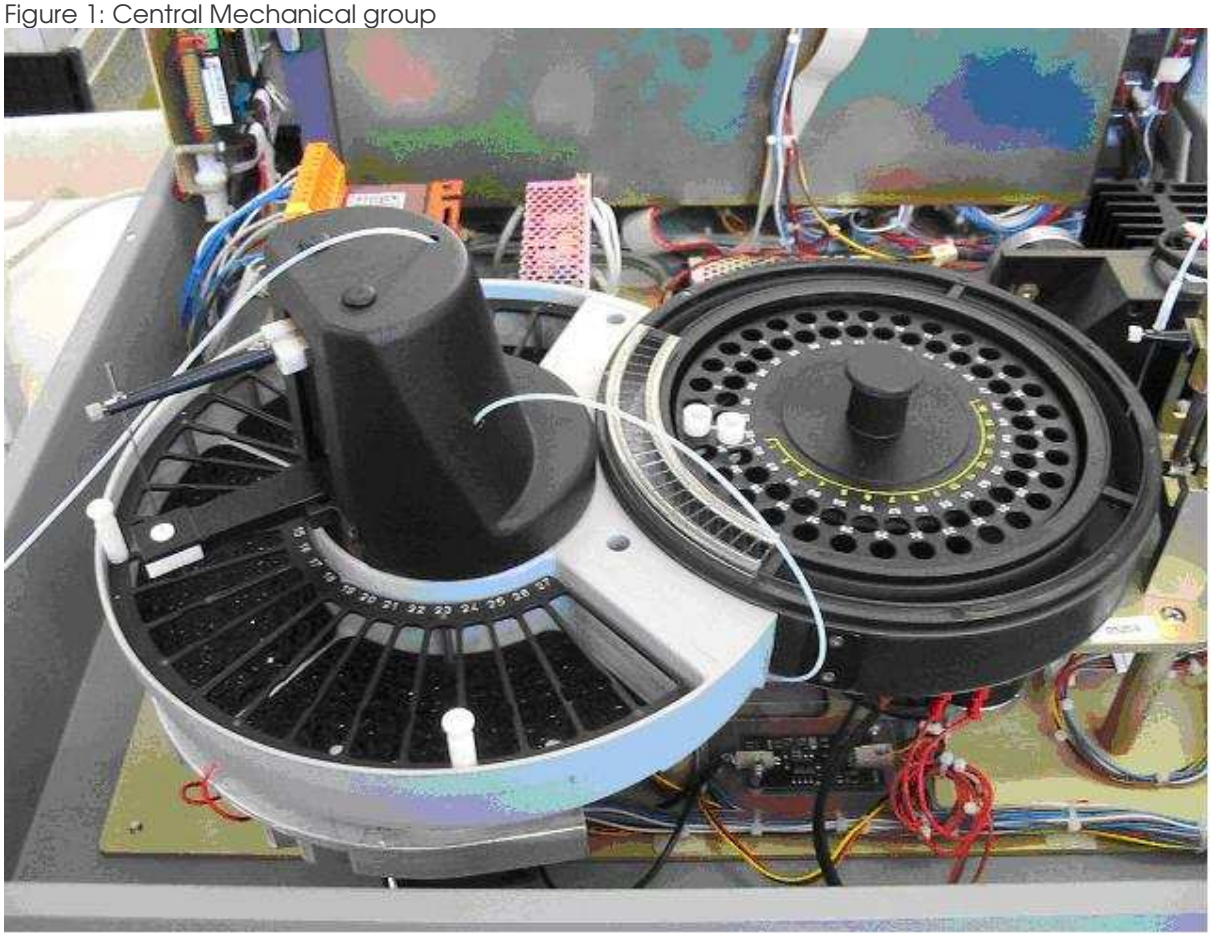


Figure 16: Level Sensor Board



MECHANICALS:

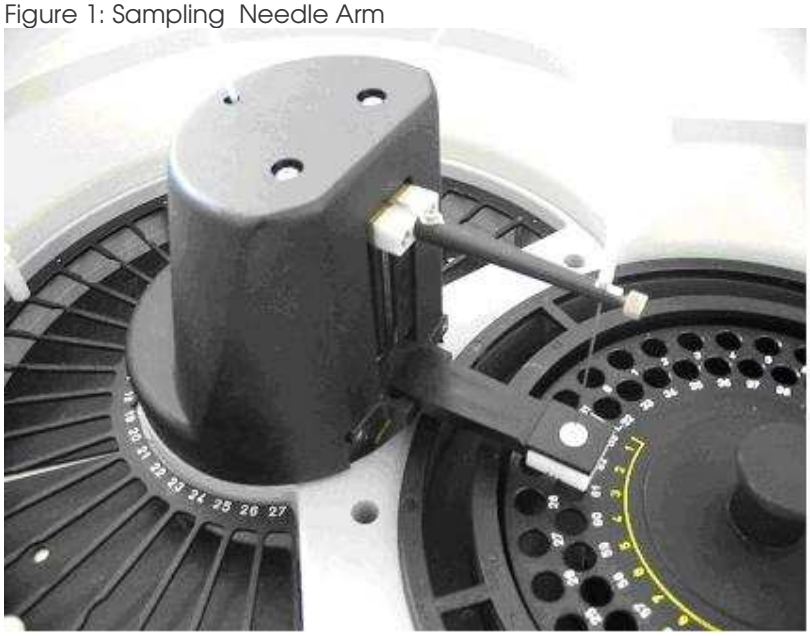
Figure 1: Central Mechanical group



The Central Mechanical group included:

- Sampling Arm
- Reagent Plate
- Outer Plate
- Inner Plate
- Aspiration Needle

Figure 1: Sampling Needle Arm



The sampling needle arm movement and position is controlled by a stepper motor driver (U12) located onboard to the Power board that drives the stepper motor model 103-546-5342 and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the arm is transferred by a mechanism driven from a belt and two pulleys.

Figure 2: Reagent Plate Arm

The Reagent plate movement and position is controlled by a stepper motor driver (U11) located onboard to the Power board that drives the stepper motor model 23L-C304-76W and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the arm is transferred by a mechanism driven from a belt and two pulleys.

Figure 3: Outer plate

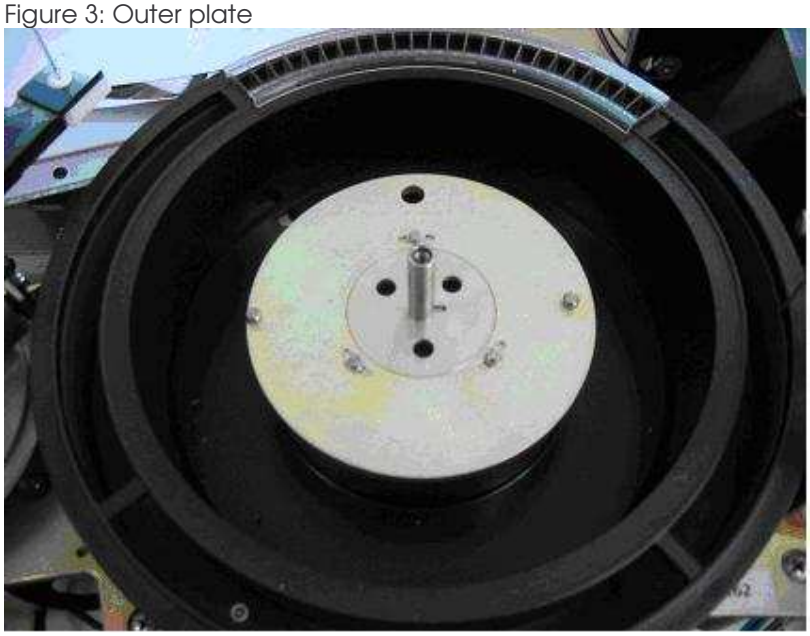
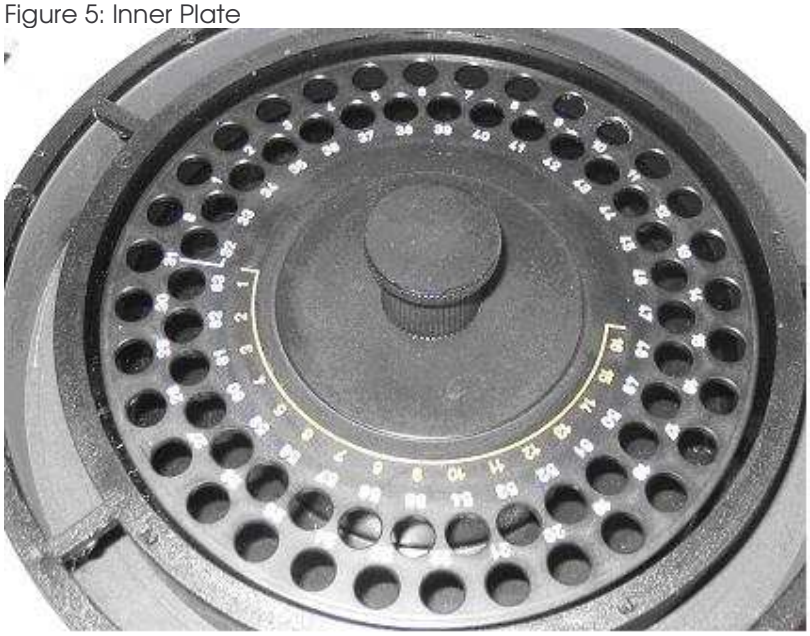


Figure 4: Outer plate (double cuvette)

The OUTER plate movement and position is controlled by a stepper motor driver (U7) located onboard to the Power board that drives the stepper motor model 23L-C304-76W and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the arm is transferred by a mechanism driven from a belt and two pulleys.

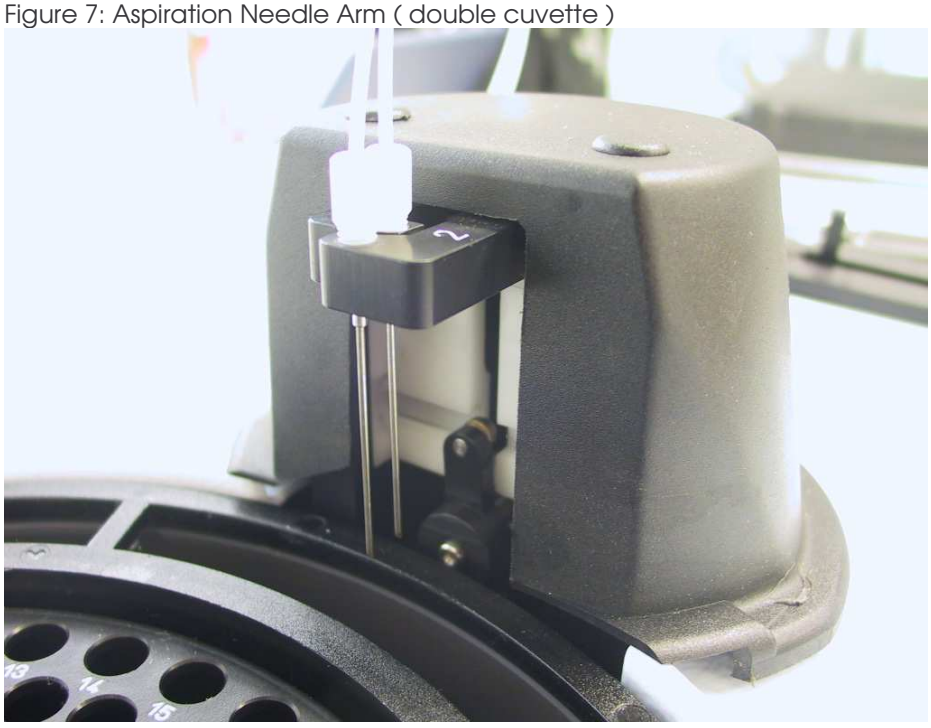
Figure 5: Inner Plate



The INNER plate movement and position is controlled by a stepper motor driver (U6) located onboard to the Power board that drives the stepper motor model 23L-C304-76W and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the arm is transferred by a mechanism driven from a belt and two pulleys.

Figure 6: Aspiration Needle Arm (mono cuvette)

Figure 7: Aspiration Needle Arm (double cuvette)



The ASPIRATION NEEDLE ARM movement and position is controlled by a stepper motor driver (U13) located onboard to the Power board that drives an stepper motor model 103-546-5342 (for mono cuvette) or an stepper motor model 103-547-52500 (for double cuvette) and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the arm is transferred (for the mono cuvette) by a mechanism driven from a belt and two pulleys.
The movement from the motor to the two arms is transferred (for the double cuvette) by a mechanism driven

Figure 7: Optical group (mono cuvette)

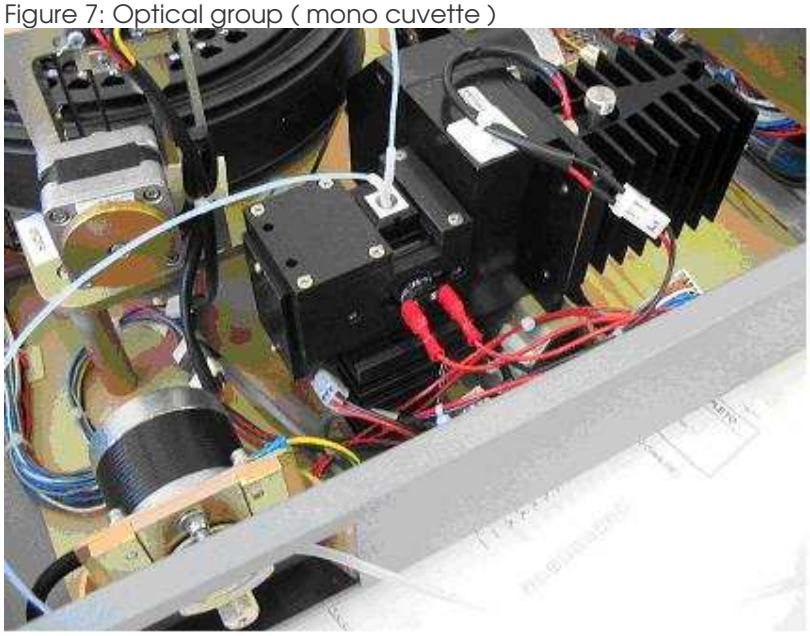
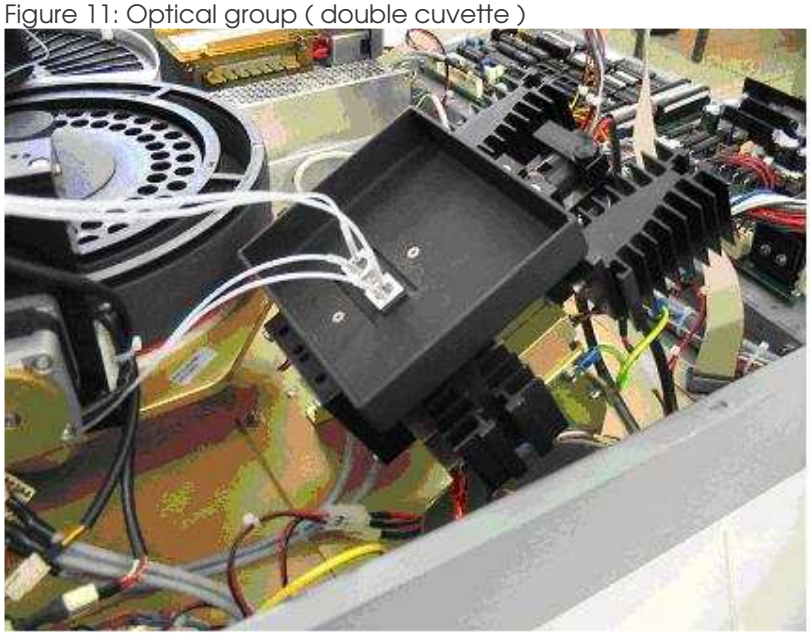


Figure 11: Optical group (double cuvette)

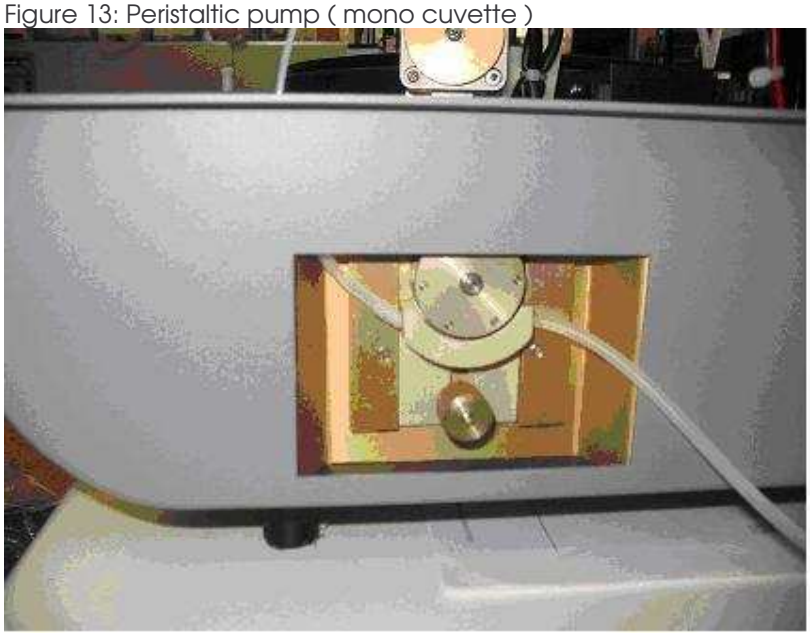


The FILTER WHEEL movement and position is controlled by a stepper motor driver (U8) located onboard to the Power board that drives an stepper motor model 23LM-C304-76W (for mono cuvette) or an stepper motor model 103-547-52500 (for double cuvette) and an optical sensor barrel that informs when the arm is at home position.
The movement from the motor to the wheel is transferred (for the mono cuvette) by a mechanism driven from a belt and two pulleys.
The movement from the motor to the wheel is transferred (for the double cuvette) directly.

Figure 10: Diluter

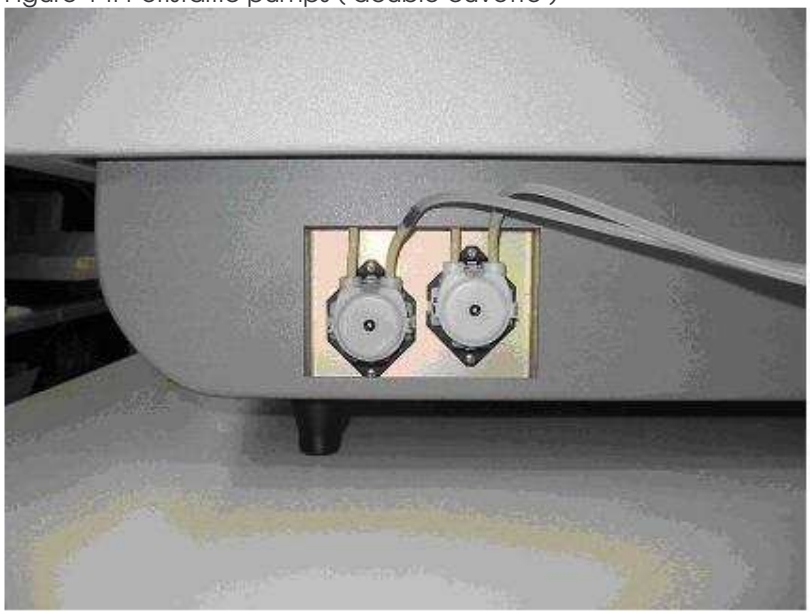
The SYRINGE movement and position is controlled by a stepper motor driver (U10) located onboard to the Power board that drives an stepper motor model HY200 1713 0100 and an optical sensor barrel that informs when the syringe is at home position.
The movement from the motor to the syringe is made by a mechanism driven from a no-ending screw.

Figure 13: Peristaltic pump (mono cuvette)



The PERISTALTIC PUMP movement is controlled by a stepper motor driver (U9) located onboard to the Power board that drives an stepper motor model 23LM-C304-76W.
The movement from the motor to the rotor is direct.

Figure 14: Peristaltic pumps (double cuvette)



The PERISTALTIC PUMPS movement is powered directly from the Power board that drives two direct current motor 12 VCC (ASF Thomas)