SAGA
Microplate Washer
Service Manual

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CONTENT

Chapter 1 Features Description

1．Fully automated, easy operating system and friendly software with large-screen display.

2．Compatible for flat-bottom, U and V bottom type microplates or microstrips, including 8×12, 12×8, 8×6 or 12×4 cells' Elisa microplates.

3．Large-capacity in storage. Enable to define and storage up to 50 programs.

4．Automatic monitoring the vacuum pressure to avoid flowing block or jam.

5．Accurate position, which facilitates the rinse of different plates. Manual adjustment to reset the position to ensure accurate positioning.

6．Easy defining. The times of rinse, volume of dispensing detergent and soaking time can be set as need. Washing by plate or by line, by optional strips is available.

7．Rinse pressure and the volume of liquor is adjustable, so as to reduce the air bubbles and ensure thorough rinse. Single or double aspiration is able to decrease the residual volume less than 3ul.

8．The dispensers with 8-pins or 12-pins are optional.

9．Enable to modify the operating software for the specified requests.

Chapter 2 Instrument Specification

Dispense volume:	50 - 2.000 µL, programmable in steps of 50 µL
Precision:	CV< 2 % at 350 µL
Accuracy:	+/- 2.0 % at 350 µL
Minimum volume of residual:	Single aspiration ≤ 5µL / well
Maximum amount of dispensation:	2000µL×12 or 3000µL×8
Cycle time for whole plate:	75 sec. (single cycle) Resp. 120 sec. (three cycles)
User's defined programs:	50
Manifold:	12 pins (8 pins optional)
Soaking time	0~24 Hr
Display:	LCD (90 x 53 mm)
Fluid reservoir:	2 x 2 ltr. for wash solution and waste
Height x Width x Depth:	390mm(L)×330mm(W)×177mm(H)
Weight	8.5 kg
Power supply:	a.c.220V±22V; a.c.110V±11V
Maximum Power:	80VA
Service temperature:	10□~30□
Storage temperature	-10□~40□

Chapter 3 Introduction of Installation

Notice:
The Elisa Washer must be installed in the laboratory by specialized personnel. At the time of installation, the Washer should be checked to ensure proper operation. Proper installation will ensure optimum performance.

3.1 Unpacking

Shipping and packing materials have been used for protection during transportation under normal handling conditions. Open the carton from the top and remove the instrument from its carton and plastic bags with care. Save the cartons and packing material for your future need.

NOTICE:
The instrument's serial number is identified as the specified Washer as indicated on the back sticker of the instrument.

3.2 Environmental Requirements

The Washer should be mounted on a flat table or workbench in an area free from vibration, dust, strong magnetic filed or direct sunlight.

Operating Temperature Limits:

Ambient temperature 0□-40□ ; Relative humidity: 20%-85% ;

3.3 Power Requirements

A standard 220V/50 Hz or 110V/60 Hz- 150W power is required, as indicated on the back sticker of the instrument. A 3-wire outlet is used to assure proper electrical grounding. If the laboratory power supply varies by more than 10%. It is recommended to install an external stabilizer.

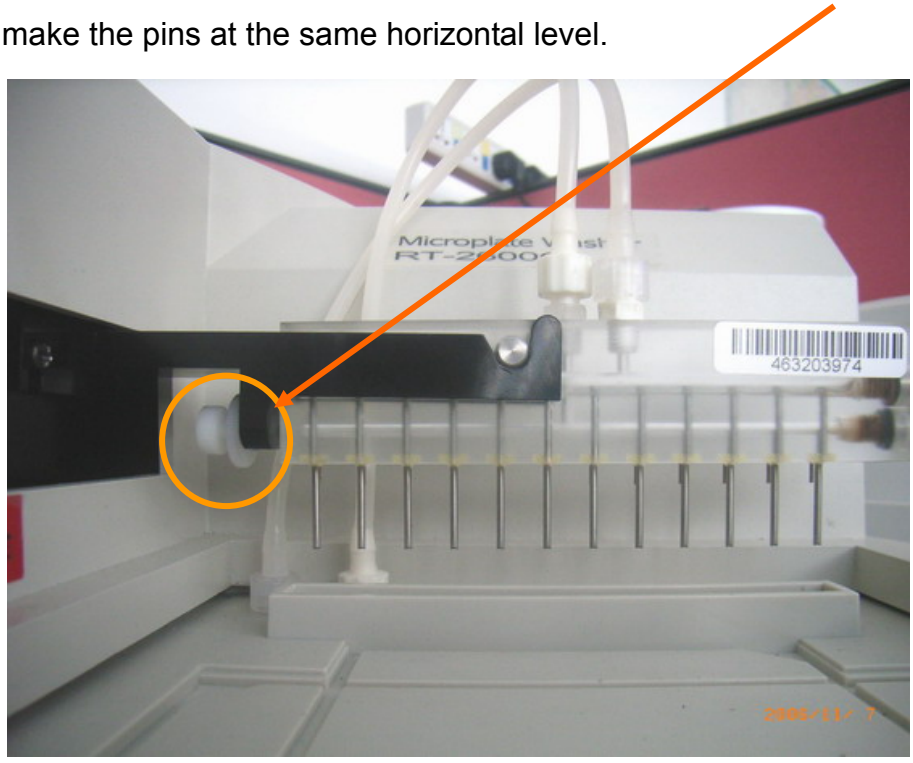
3.4 Components and assembly installation

3.4.1 Bottles and tubing installation:

- Take out and place the two bottles beside the washer;
- Connect the tube with white connector between the “wash inlet” and the Bilge pump through the Wash Bottle lid.
- Connect the tubes with green connectors on the lid of the Waste bottle to the two green vents (“WASTE”) at the back panel of the instrument.
- Close up the lid with sensor plug of the Waste bottle and connect the sensor cable plug to the inlet of the instrument back over.
- Connect the cable of Bilge pump to the plug located at the back of the instrument.

3.4.2 Dispenser installation

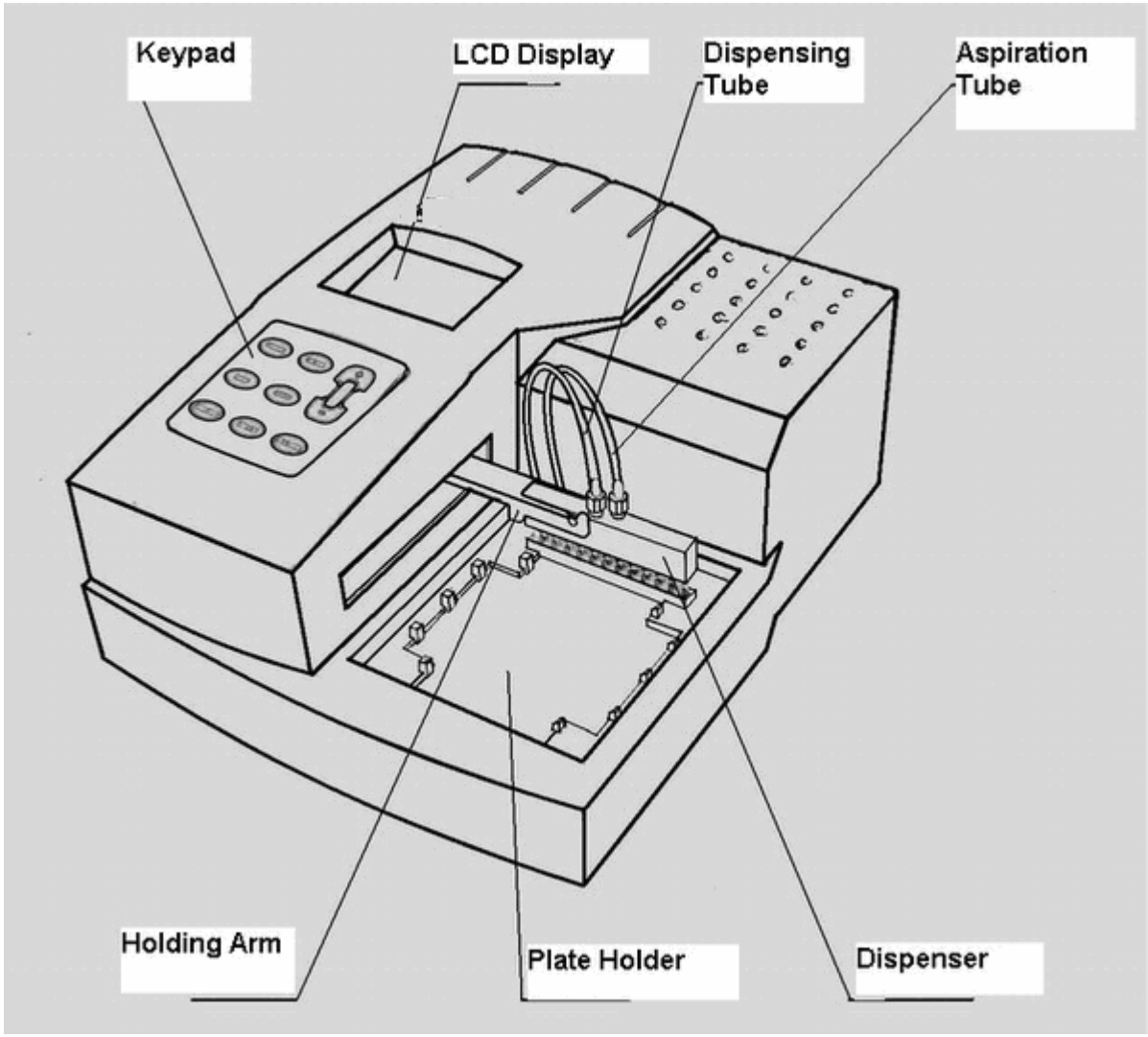
- Connect and fasten the 2 tubs(tubes for dispensing and aspiration) between the dispenser and the plates platform. To mind that the color of the tubing joints should be corresponding.
- Place the Dispenser on the holding arm and adjust the **white screw** on left hand side to make the pins at the same horizontal level.



Front view of Dispenser

3.4.3 Power connection

- Fill up the wash bottle with washing detergent.
- Connect the power cord to the power outlet with the compatible power supply, for the details about the power requirement, please refer to the rear sticker label.
- Turn on the switch on to check the instruments' working.

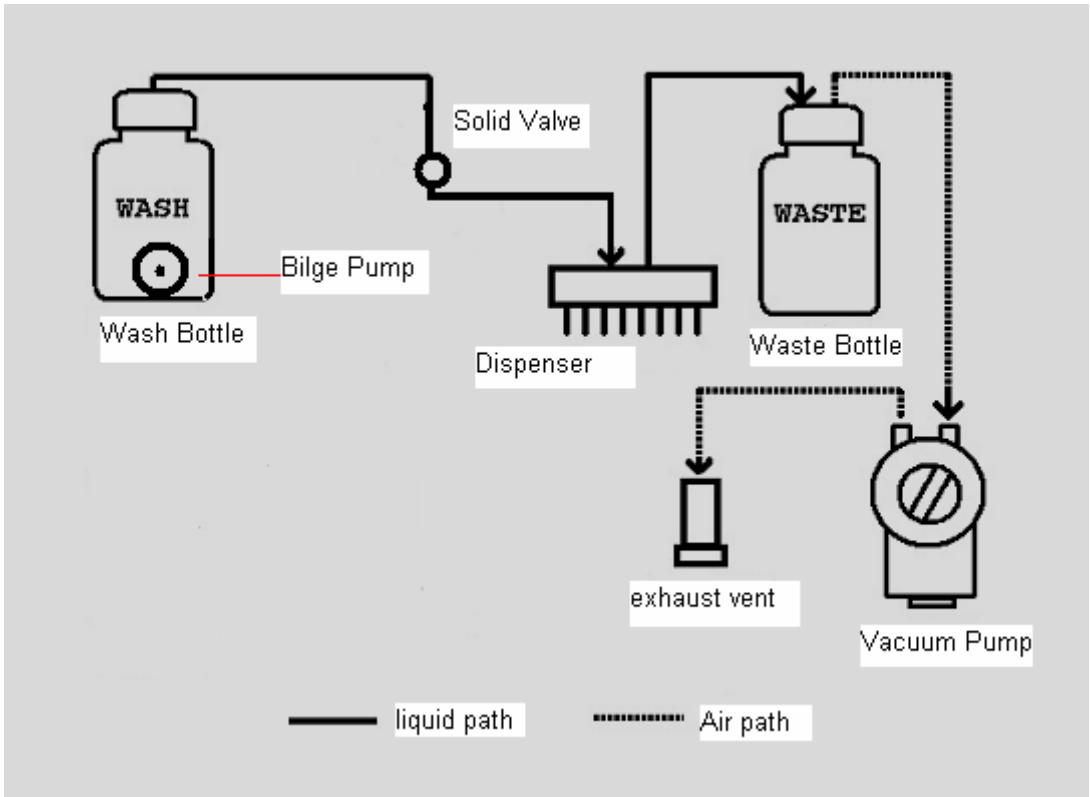


The schematic figure of whole Washer system

Chapter 4 Function Description

Schematic diagram of the washing system

The Elisa Washer system is consist of the components (i.e. Bilge Pump, Solid Valve, Dispenser, Vacuum Pump, Wash Bottle, Waste Bottle etc.)



Schematic diagram of the washing system

4.1 Keypad

The detail description about the keys:

Function of each button	
PRIME	Perform the order of filling
RINSE	Perform the order of rinse
DISP	Perform the dispensing
ASPR	Perform the aspiration
SELECT	Switch the options
START	Execute the order
CANCEL	Stop or cancel the order of the operation; Double-click to enter the system setting menu.
+	Change the parameters
-	Change the parameters

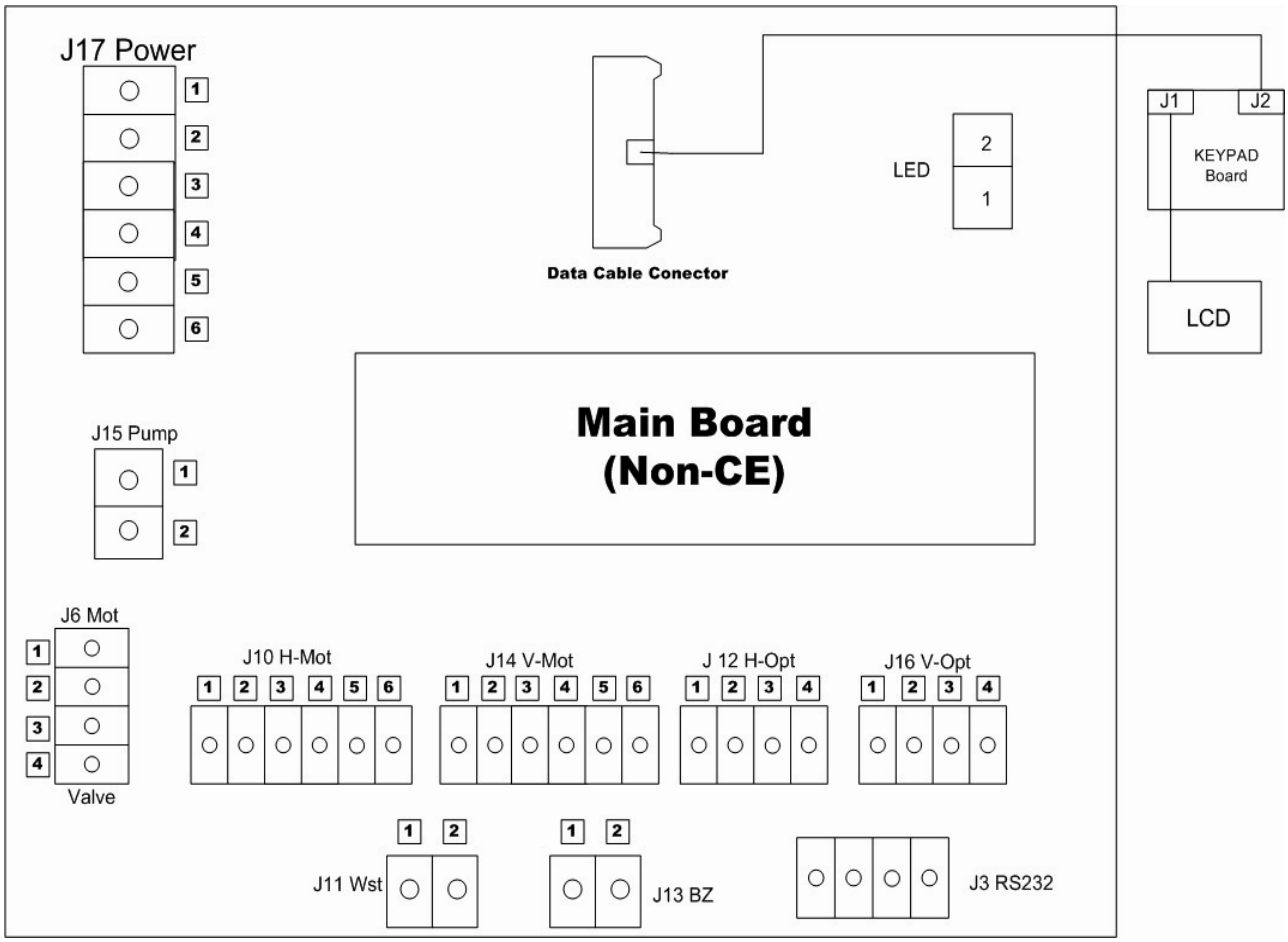
4.2 Description of the circuit mode (PCB)

Notice:
The SAGA Elisa Washer varies CE and Non-CE mode, the different mode is with different components.

1. ***The instrument could be distinguished by the SN(Serial No.):***
2. ***CE: SN is with letter "B" included: 460xxxxxxBE***
3. ***Non-CE: SN is without letter "B" included: 460xxxxxxE***

The detail description of each conjoint socket on the PCB

Non-CE mode:

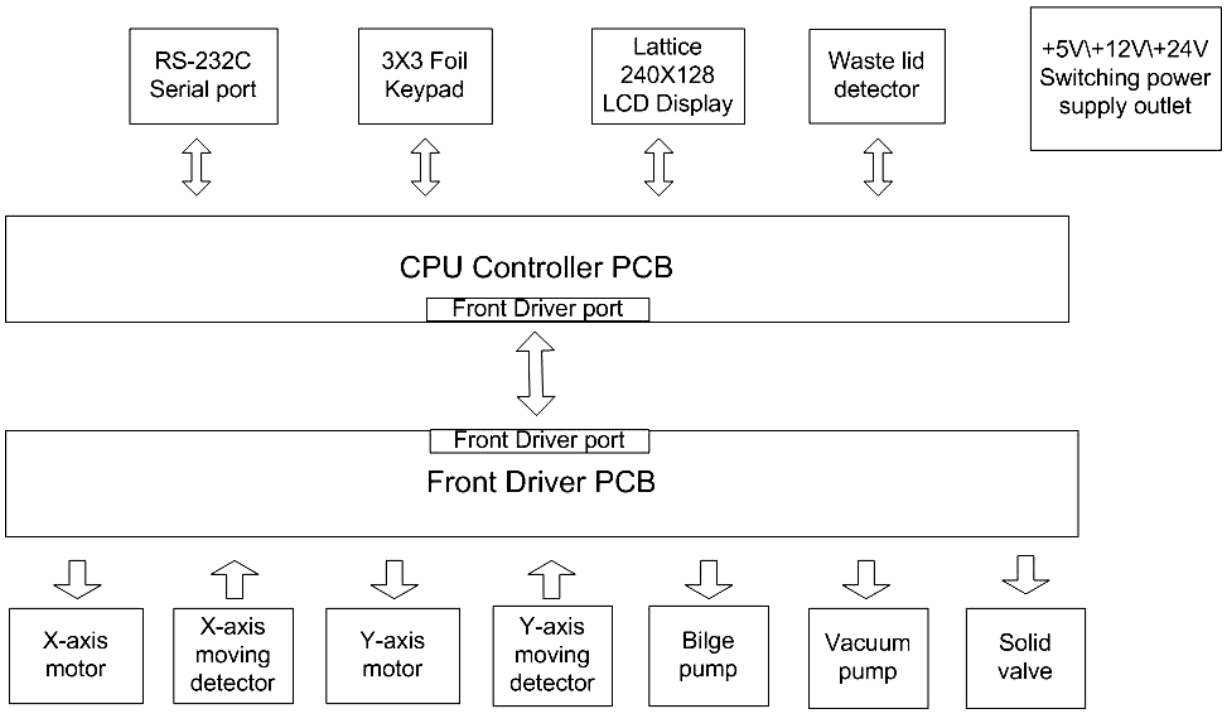


Schematic diagram of Main board functions (Non-CE)

Details of the connectors &jumper **(Main Board <Non-CE mode>)**				
J17	Power inlet	J17-1(red): 5V DC	J17-3(yellow): 12V DC	J17-5(Green):24V DC
		J17-2(black): Grd. 0V	J17-4(black): Grd. 0V	J17-6(black): Grd. 0V
J15	To Vacuum Pump		J15-1: 12V DC	J15-2: 0V Grd.
J16	To Bilge Pump		J16-1(blue): 12V DC	J16-2: Grand 0V
	To Solid Valve		J16-3: Grand 0V	J16-4(red): 24V DC
J13	To Speaker(BZ)		J12-1&2: 5V DC	
J12	To Horizontal Detector (H -Opt.)		J12-1(red): 2V DC (Power for the detector)	
			J12-2(blue): signal voltage of detector	0V: light pass(moving)
				5V: light cut (original position)
			J12-3&4(black):	Grand 0V
J10	To Horizontal moving Motor		J10-1(blue); J10-3(red);	Motor moving: 22V

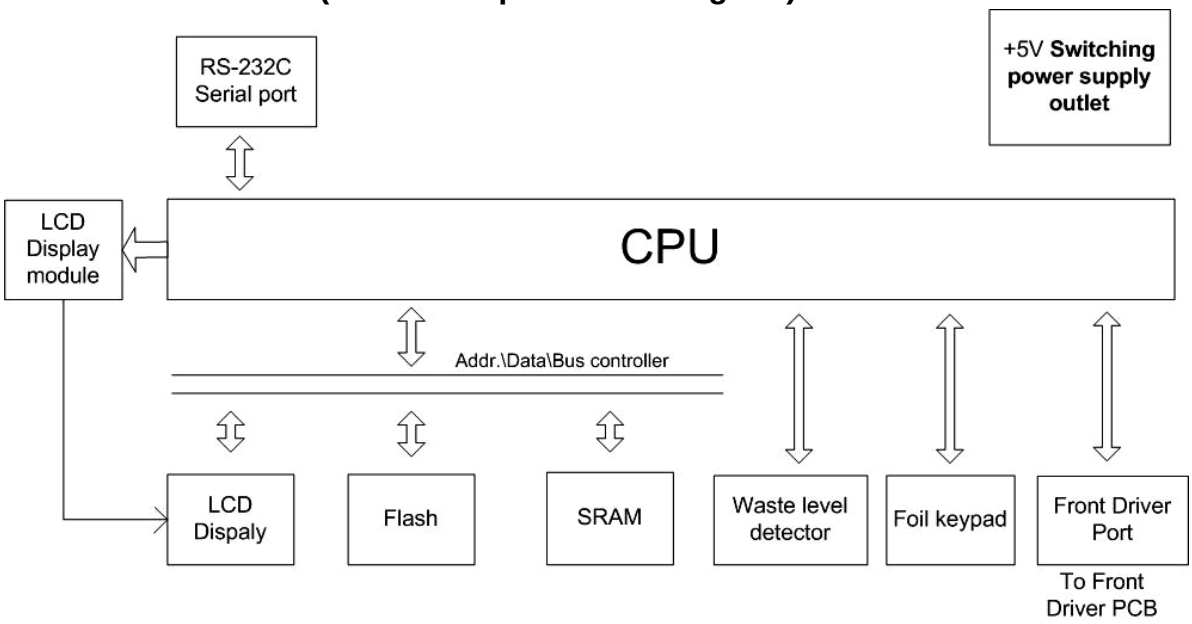
	(H-Mot.)	J10-4(green); J10-6(Grd.)	Motor stand by: 0V
J16	To Vertical Detector (V-Opt.)	J16-1(red): 1.1V DC (Power for the detector)	
		J16-2(blue): signal voltage of detector	0V: light pass(down)
			5V: light coupling cut
		J16-3&4(black):	Grand 0V
J14	To Vertical moving Motor (V-Mot.)	J14-1(blue); J14-3(red); J14-4(green); J14-6(Grd.)	Motor moving: 22V
			Motor stand by: 0V

CE mode:

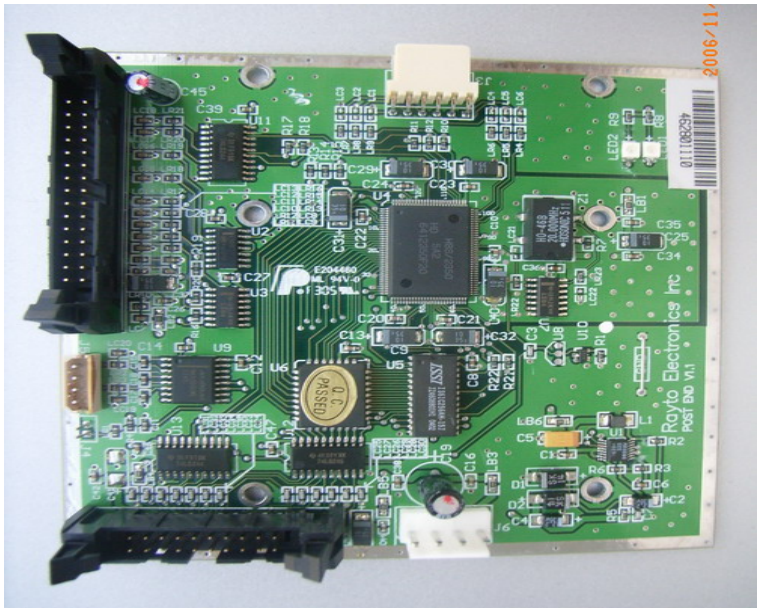


Schematic diagram of the System

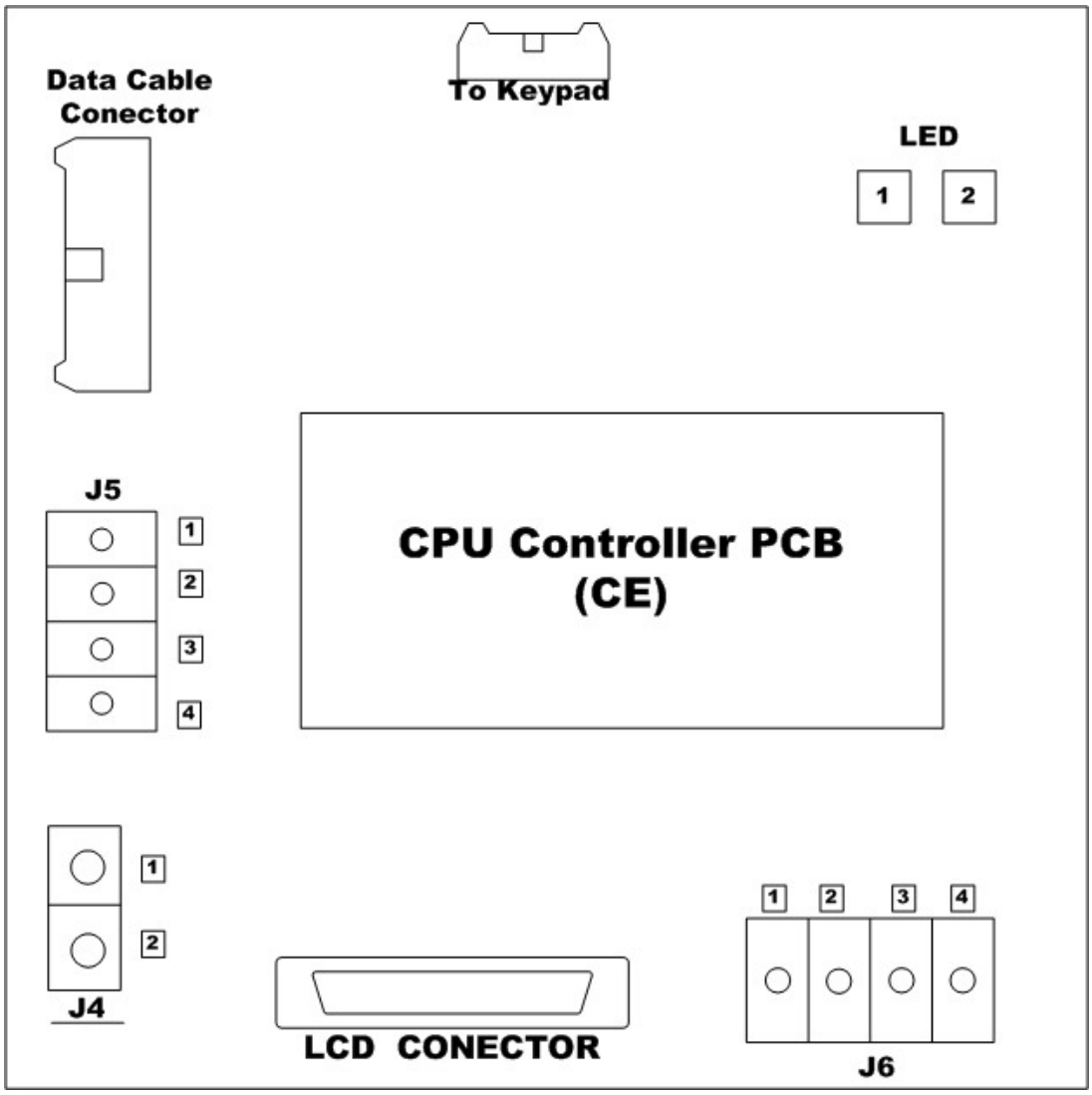
CPU Controller PCB (Schematic photo and diagram)



Schematic diagram of the CPU Controller PCB



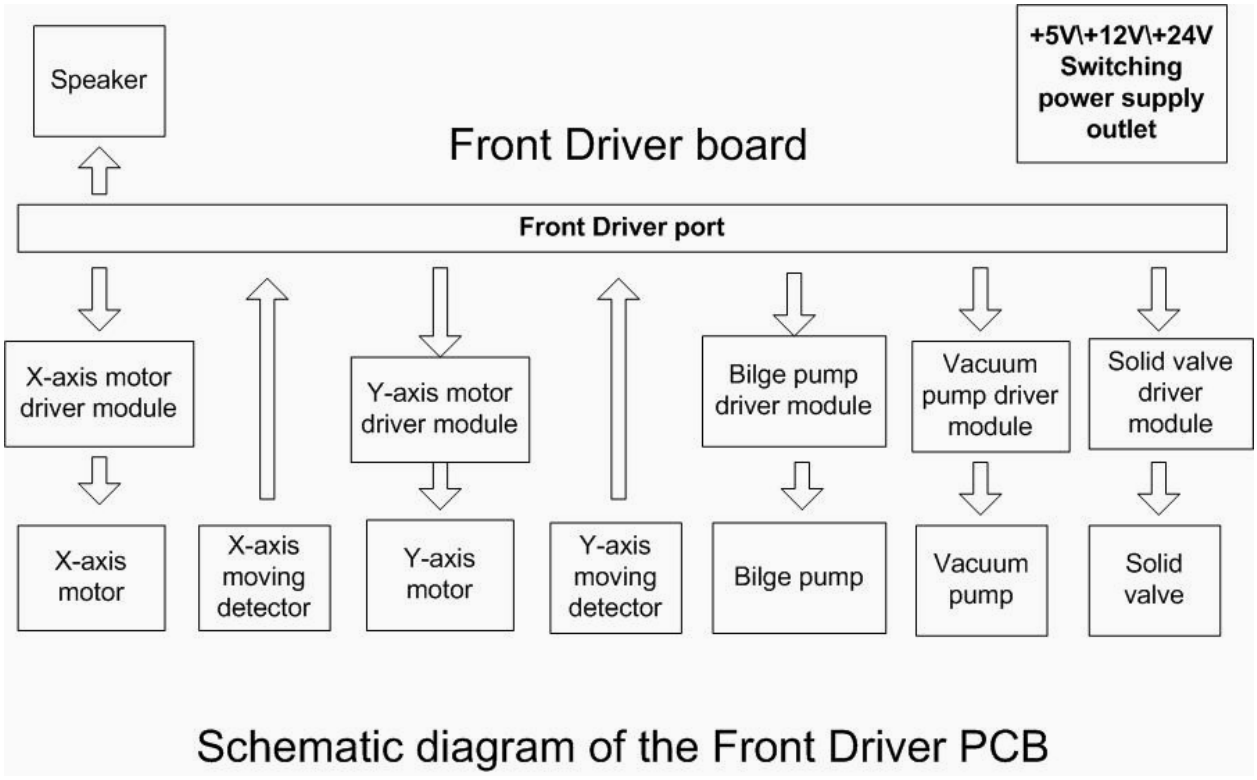
CPU Controller PCB



Schematic Diagram of CPU Controller PCB (CE mode)

Details of the connectors jumper (**CPU Controller PCB<CE mode>**)			
J4	To Waste solution level detector	Waste bottle lid	
J5	To RS-232 port	Operating software burn in	
J6	Power inlet	J6-1: X J6-2: Grand 0V	J6-3: Grand 0V J6-4: 5V
LED	Status instruction	LED2: Flashing	Normal

Front Driver PCB (Schematic photo and diagram)



Schematic diagram of the Front Driver PCB

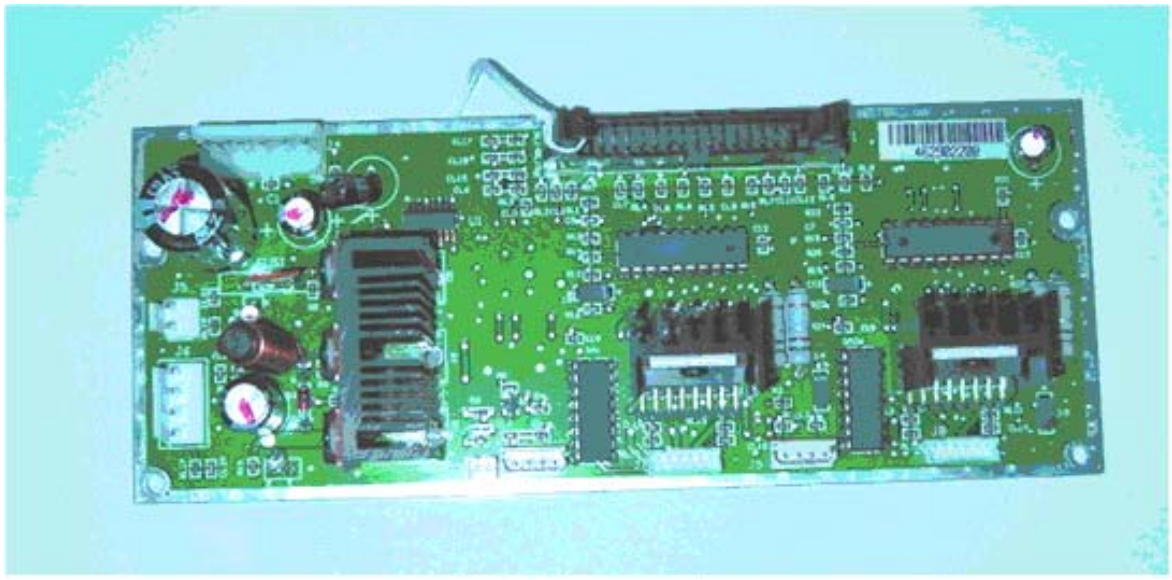
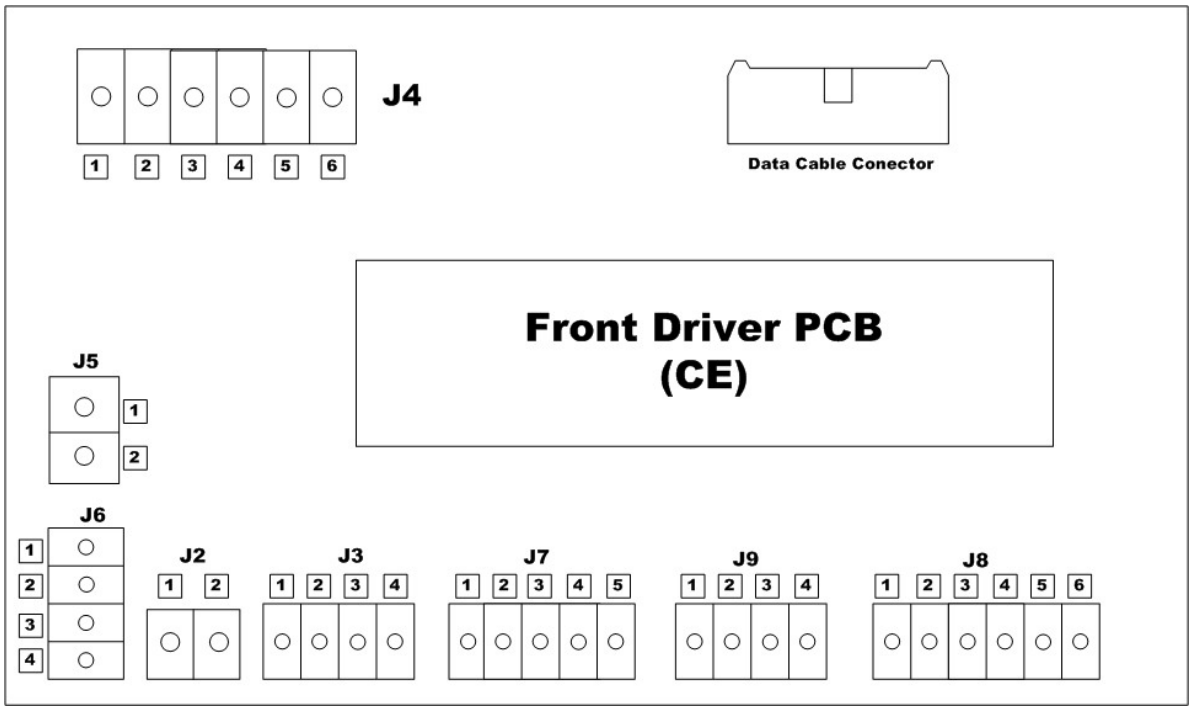
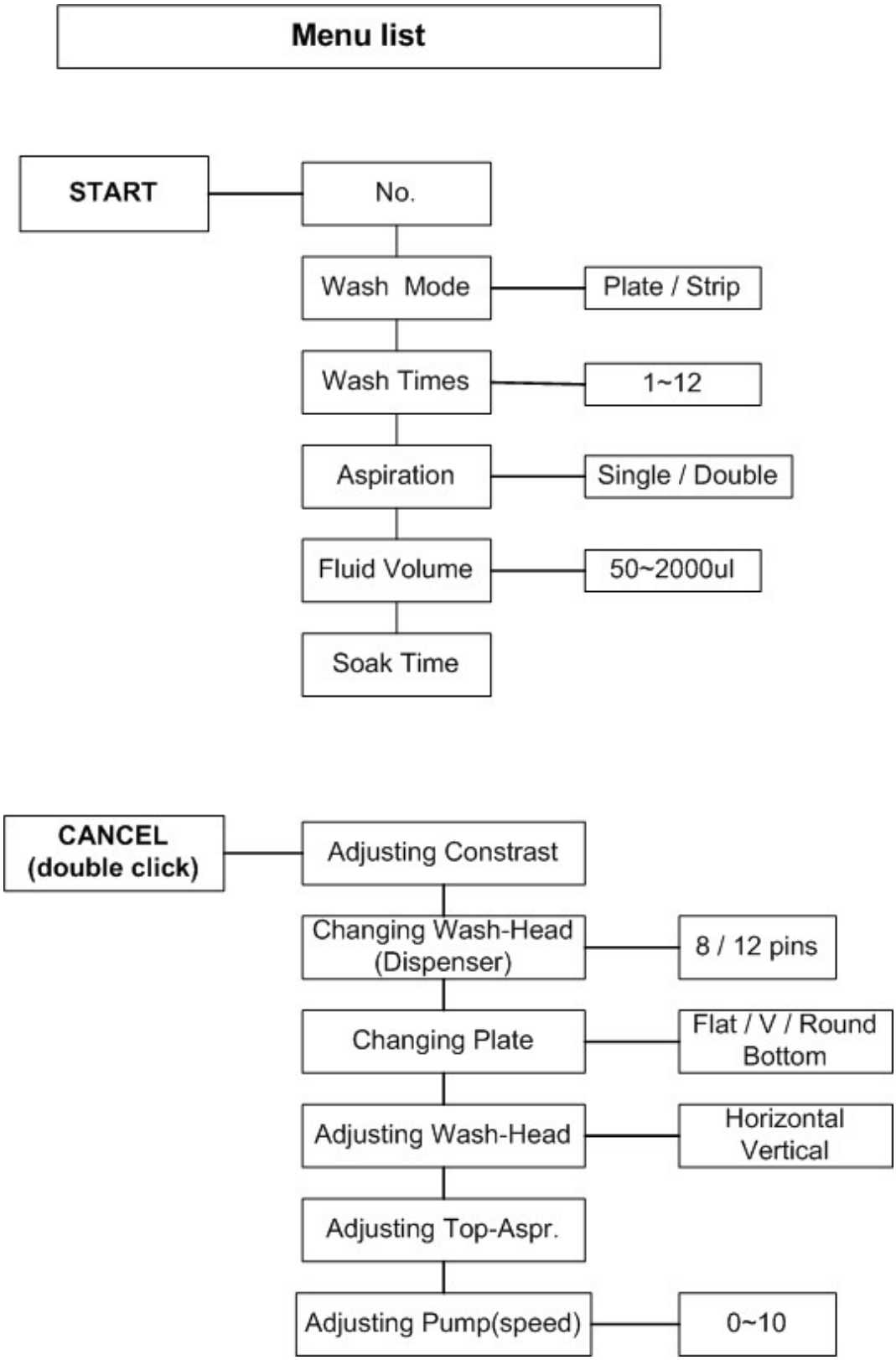


Photo of Front Driver Board (CE mode)



Details of the connectors **(Front Driver PCB<CE mode>)**				
J4	Power inlet	J4-1(black): Grand 0V	J4-3(black): Grand 0V	J4-5(black): Grand 0V
		J4-2(green): 24V DC	J4-4(yellow): 12V DC	J4-6(red): 5V DC
J5	To Vacuum Pump		J5-1: Grand 0V	J5-2: 12V DC
J6	To Bilge Pump		J6-1(blue): 12V DC	J6-2: Grand 0V
	To Solid Valve		J6-3: Grand 0V	J6-4(red): 24V DC
J2	To Speaker		J2-1&2: 5V DC	
J3	To Horizontal Detector		J3-1(red): 1.1V DC (Power for the detector)	
			J3-2(blue): signal voltage of detector	0.1V: light pass
				5V: light cut (original position)
			J3-3&4(black):	Grand 0V
J7	To Horizontal moving Motor		J7-1(blue); J7-3(red); J7-4(green); J7-6(Grd.)	Motor moving: 22V
				Motor stand by: 0V
J9	To Vertical Detector		J9-1(red): 1.1V DC (Power for the detector)	
			J9-2(blue): signal voltage of detector	0.1V: light pass
				5V: light coupling cut
			J9-3&4(black):	Grand 0V
J8	To Vertical moving Motor		J8-1(blue); J8-3(red); J8-4(green); J8-6(Grd.)	Motor moving: 22V
				Motor stand by: 0V

Chapter 5 System setting



5.1 Adjust the position of the dispenser

Since the different type of the dispenser for the optional choice, the SAGA+ enable the users to adjust the position of the dispenser to adapt to the microplates with different mode. The users can adjust the position of the dispenser by step of ±1mm in the vertical and horizontal direction each.

The procedure is as follows:

- Place the microplate on the platform.
- Double click CANCEL and enter the system setup menu.
- Click SELECT to choose “adjust the position of the dispensing head”. Press START and the dispenser will automatically move to the first strip and drop the pins into the bottom of the well. The display is as follows:

Adjust the position of the dispenser	
Horizontal	**+0.0mm**
Vertical	**+0.0mm**

- Press SELECT to switch between horizontal and vertical setting.
- Press “ **+** “ and “ **-** “ to adjust the position of the dispenser. In the horizontal setting, the probes (the thick, long pins) should be move at the center of the micro-well; in the vertical setting, the probes should touch the bottom of the micro-well, and dispenser should stands off the arm-holder by of **0.5 ~ 1mm**.
- After finishing the adjustment, press START to store the setting into FlashROM and the dispenser will return to the original position.

5.2 To adjust the rotate speed of the Bilge pump

To adjust the rotate speed of the Bilge pump by [+] and [-] to change the parameter, ranging from 0 to 10. The proper rotate speed can easily change the pressure of the liquor injection. “0” is default setting.

The indication of the Bilge pump
0000

5.3 To adjust the “Top aspiration”

In the case of dispensing volume is more than the capacity of the micro-wells, the system will automatically start to aspiration to avoid the detergent over-flow. If the top aspiration does not work properly, the position of top aspiration should be to reset.

Double-click [CANCEL] in the main menu to enter into the system setup menu. Select “**the position of top aspiration**” and use the sign “**+**” and “ **-** ” to adjust the position of pins (the thick needle). Usually it should be adjusted to match the level of the top of the micro-wells.

Chapter 6 How to replace the spare parts

6.1 How to replace the dispenser

If the dispenser is seriously jammed and cannot be cleaned up, it doesn't work properly, it must be replaced.

Remove the dispenser, loosen the two joints on the dispenser, and disconnect the dispenser from the tubing. Replace the defectived dispenser with a new one, screw and fasten the screws, place it back into its arm-holder and adjust the white screw on left hand side to make the pins at the same horizontal level.

6.2 How to replace Power supply

If the power supply board is damaged, it needs to be replaced with a new one.
Disconnect the power connector between the Power supply and the switch, remove the screws fasten the mounted Power supply, remove the whole body and replace it with a new one.

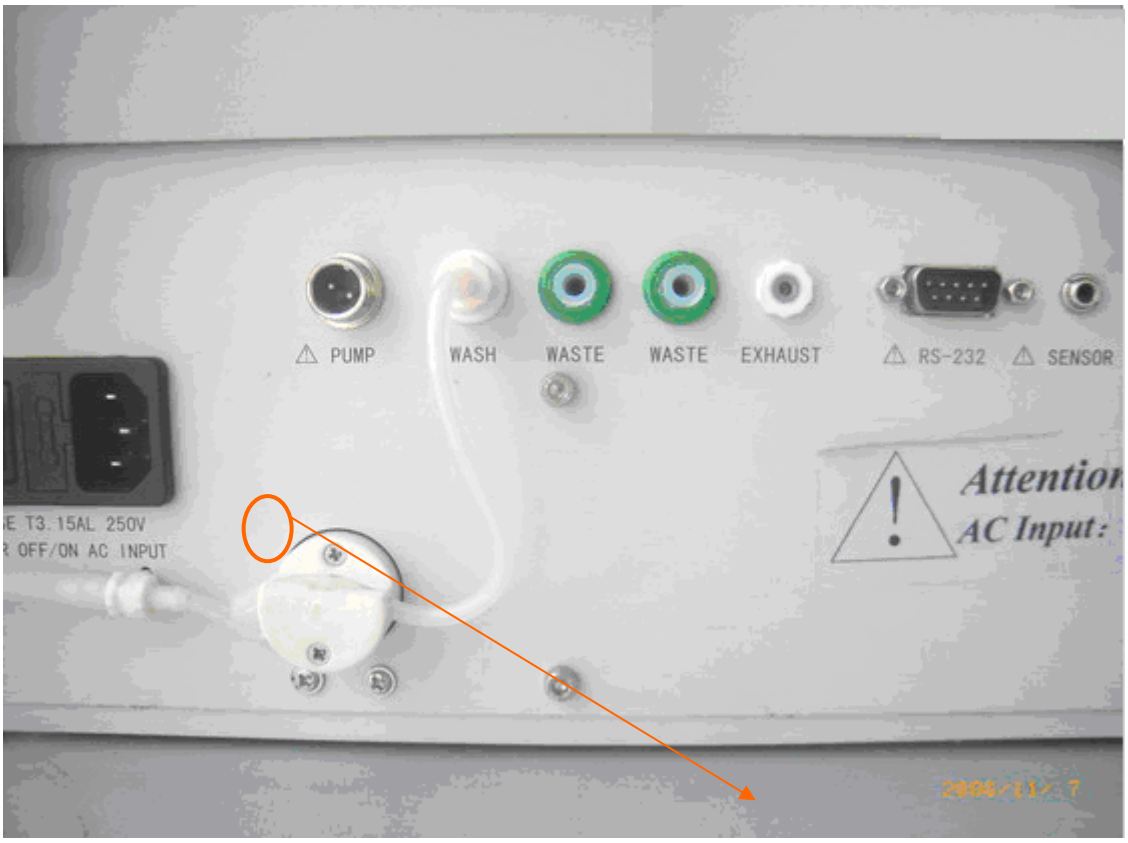
Power supply location

6.3 How to replace the Bilge Pump

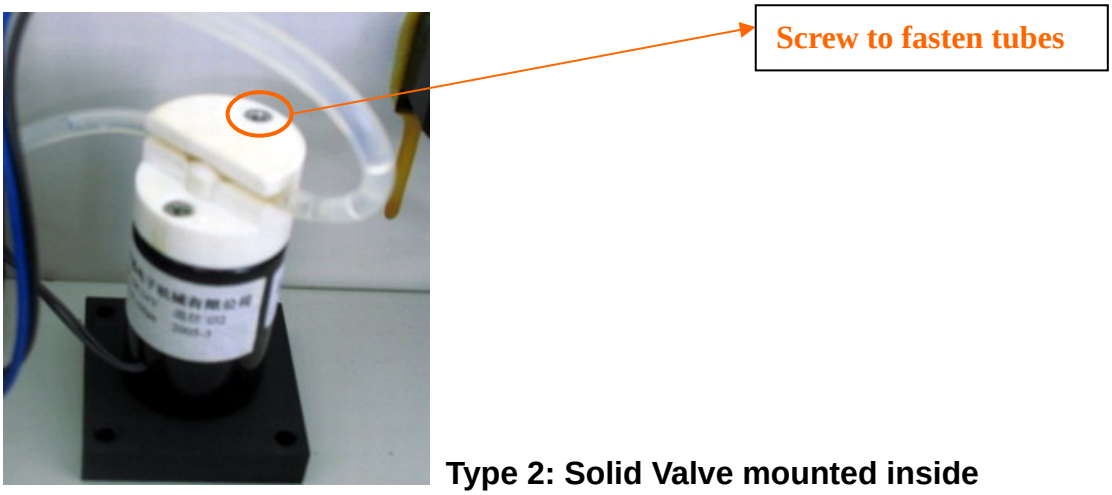
If the Bilge pump is damaged or it doesn't work properly, it needs to be replaced with a new one.
Take the Bilge pump out of the Wash bottle, pull out the tubing joint, replace the pump with a new one, re-connect the tubing and the power cable.

6.4 How to replace the Solid Valve

Since the Washer is being updated by manufacturer the location and the structure may be different, so it should make clear which type of the defective valve for replacement.



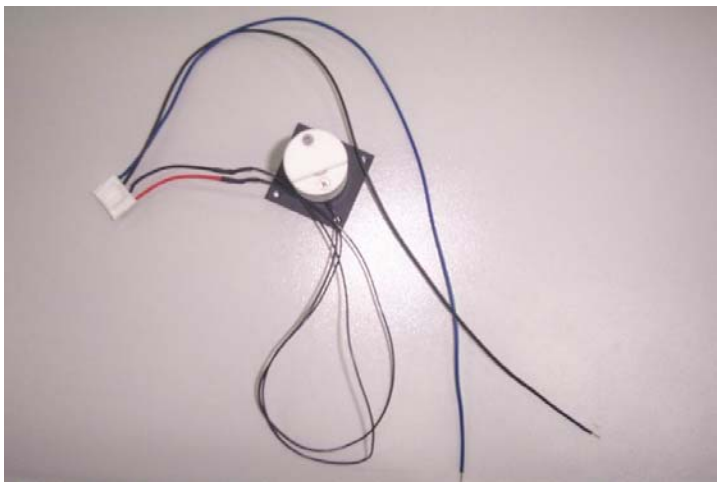
Type 1: Solid Valve mounted backside



Type 2: Solid Valve mounted inside

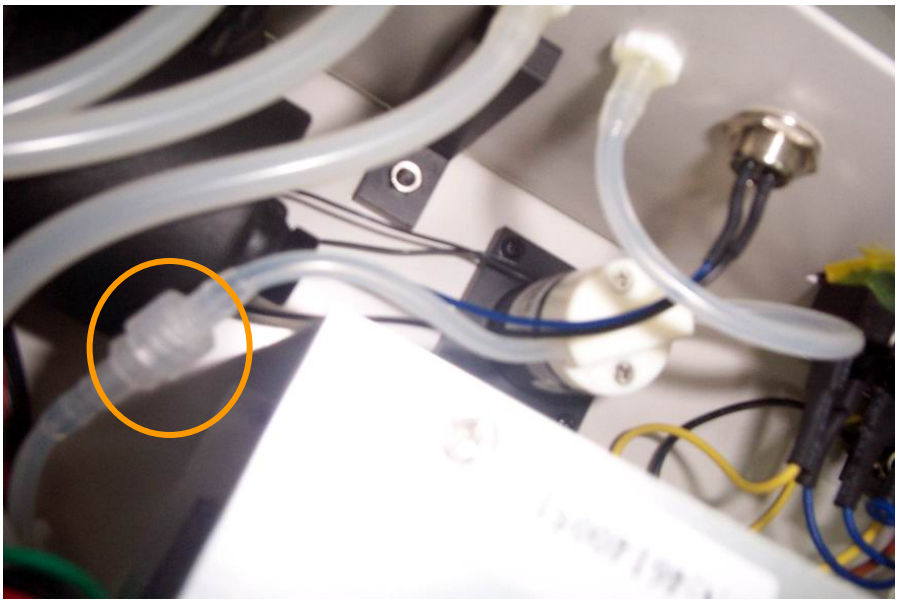
If the Washer does not dispense or can not stop dispense detergent, the Solid valve properly be out of work. Check the “Screw” as the photo first, try to re-screw it with the driver, if the problem remains, try to check the power voltage of the solid, the normal voltage is 24V DC. If the problem with the solid valve is confirmed, it could be concluded the valve should be replace.

The standard Solid valve is as the photo as below:



Solid Valve

Try to disconnect the solder of the power cable with the electric heater, and remove the damaged the valve from its holder, disconnect the **tubes’ connecting**, as below photo. Just replace it with a corresponding type.



Solid Valve and tube

Chapter 7 Recommended Maintenance

7.1 Daily maintenance

1. Empty and clear the Waste Bottle
2. Fill Wash Bottle with wash solution
3. Clean and wipe off the remnant solution on the worktable

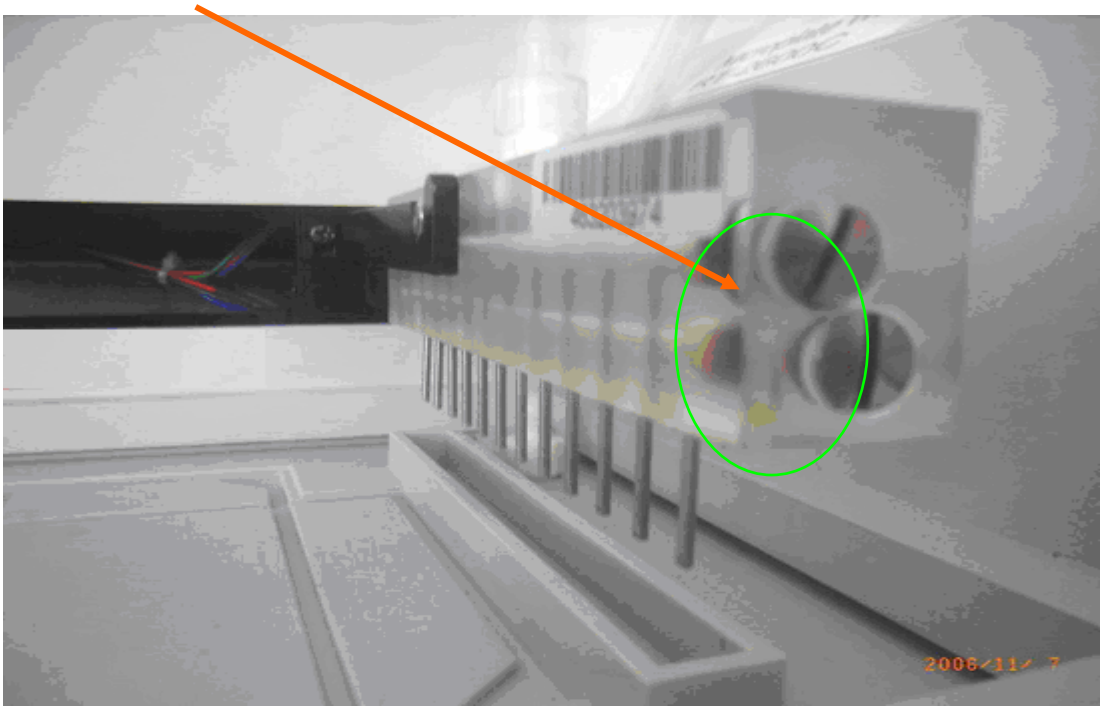
Never use any organic solvent, grease or corrosive solution to clean the worktable or the surface of the instrument.

7.2 Maintenance on the dispenser

The dispenser is one of the main components of SAGA, which affect the the accuracy of the dispensing volume as well as the volume of residual liquid, therefore, the maintenance on the dispenser is of much meaning.

The procedure of maintenance is as following:

1、 Switch off the power. Screw off the two plastic tubing connector and the **metal screws** on the right side of the dispenser by anticlockwise.



2、 Use the smaller-size poking needle to clear out each dispensing probes

(the short, thin one) and use the larger-size poking needle to clear out the aspirating probes (the long, thick one). If the poking needles are lost, the dispenser can be cleared out with something like that.

3、 Take off the dispenser with the screws-removed end downward. Flap it against paper towel or gauze so as to remove the blockage from the tubing and also can rinse it inside with an injector.

4、 After clear the deposit inside the dispenser, please put the black gasket round the root of the metal screws and tighten up the two metal screws (Note: ensure no air-leakage on the gasket and screws)

5、 Immerse the dispenser completely in a large container filled with water. Plug a large-size injector into the plastic hole on the dispenser, push and pull the plunger to rinse the dispenser inside couples of times. Both of the two plastic holes should be done as such.

6、 Mount the dispenser back to the arm-holder and screw up the plastic tubing connectors.

7.3 Maintenance on Wash bottle

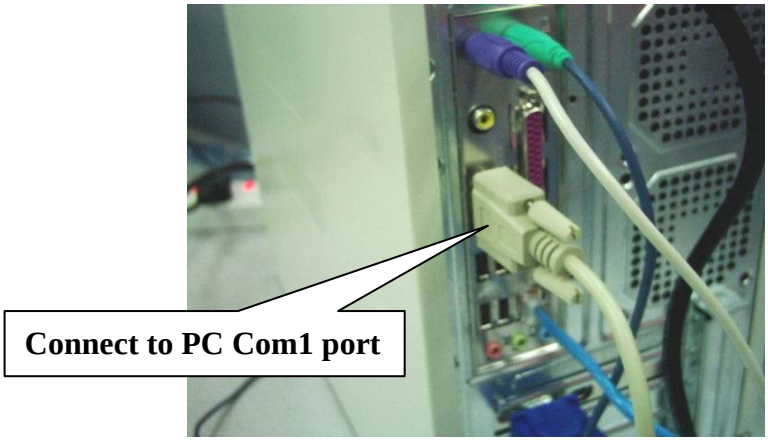
Fill up the Wash bottle with distilled water or wash solution to wash and rinse the blank plate and tubing once a weak and clean up the whole probes and the Bilge pump.

Note: the level of wash solution in the Wash bottle should be higher than that of the Bilge pump.

Chapter 8 Instruction for system software refresh

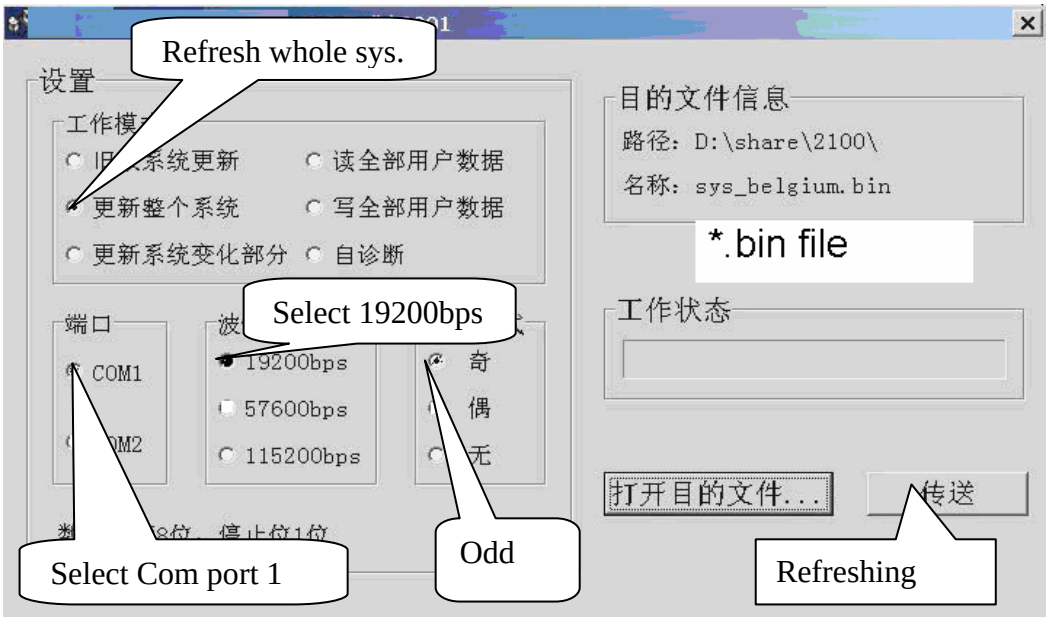
Kindly perform the refreshing as per the following instruction step by step.

1. Make sure your Washer is power off.
Prepare an RS232 serial cable, connect your instrument (RS-232 port) with PC COM1 port. Please ensure the power supply and RS232 cable well connected. Please turn off PC's screen saver and don't operate programs on PC during the refreshing.



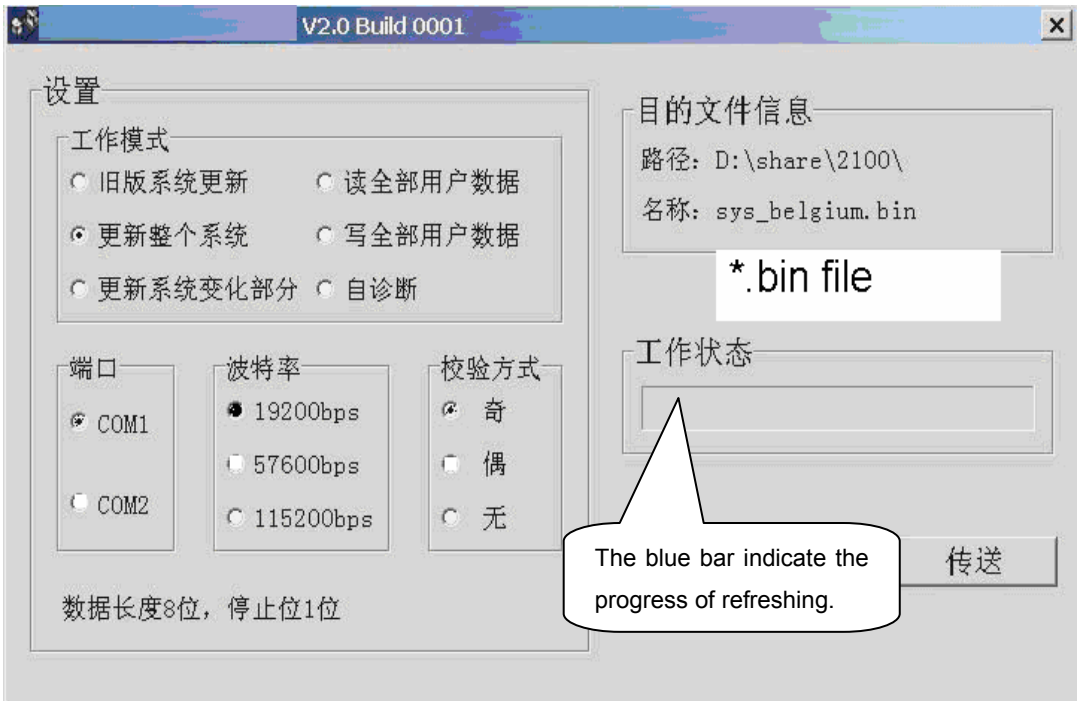
2. Run "**Newup chinese.exe**" on your PC.
Set the parameters exactly according to the following Figure and click "open file" button.

4. Select the specified file, for example "**Washer V2.2e**" and click "OK" button.



4. Click “**Refreshing**” button first, you will see the state showing “transmitting”,

5. Turn on the instrument. Wait for a moment, the software upgrade will start. The blue bar indicates the progress of upgrading. The whole process will take a few minutes. Don’t do other operations on PC during the upgrading (remember!).



6. When the upgrading is done, you can see the state bar showing completed. Turn off your instrument directly.

7. Disconnect the RS-232 cable, then restart the system. Now you are running under the updated system software.

Chapter 9 Trouble Shooting Guide

Symptoms	Causes and Remedies
1.No display and no moving reaction while the power is on.	Check the power cable connection and the fuse. Check the power supply of the outlet: J17 (Non-CE) and J4 (CE), the proper out put voltage is 5V, 12V and 24V.
2.The problem with the dispensing The volume dispensed is less than the defined	Check if the dispenser and the tubing is blocked Check if the Solid Valve and its power (24V) works properly. Check the Bilge Pump and reset the “Speed of pump rotation”
3.The volume dispensed is more than defined and overflow	Adjust the “Top-Aspiration” setting Check the Solid Valve
4.The problem with aspiration, the residual volume is more than expected.	Check the tubing and the Waste Bottle Lid if any air-leakage caused. Check if the Vacuum Pump work properly. And refer to the Chapter V in this Manual to “Adjust the position of the Dispenser”.
5.The problem with the keypad	Check the Keypad Board(Non-CE). Check and set the Foil Keypad flat, ensure no air bubbles in it Check the cable connection of the Keypad
6.The problem with the arm-holder moving	Check the moving motor. Check the detector of the moving position

NOTE:

LINEAR's products vary CE and Non-CE mode,the instrument should be compatible with the specified parts.

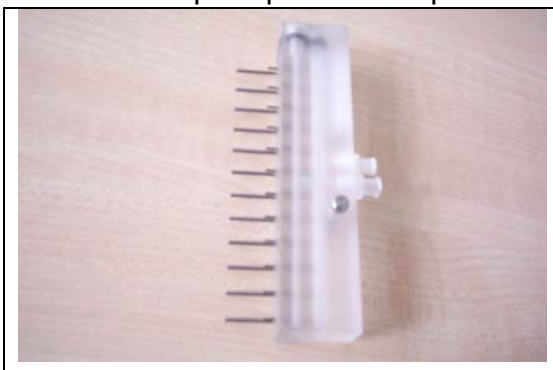
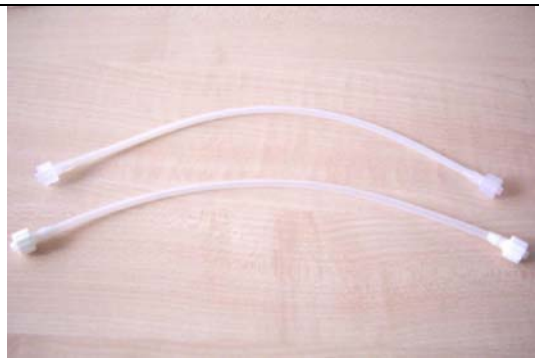
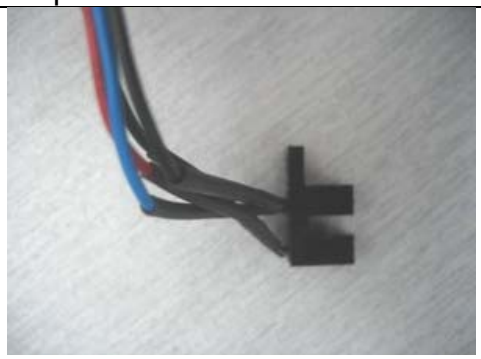
The instrument could be distinguished by the SN(Serial No.):

CE: SN is with letter "B" included: 460xxxxxxBE

Non-CE: SN is without letter "B" included: 460xxxxxxE

ALL PRICES ARE EXW IN US DOLLARS.
LINEAR RESERVES THE RIGHTS TO ADJUST THE PRICES WITHOUT NOTICE IN ADVANCE

Photos for Spare parts description:

<table>
<tr><td> 
Dispenser(12-pins)</td><td> 
Dispenser(8-pins)</td></tr>
<tr><td> 
Wash solution tube</td><td> 
Dispenser tubes</td></tr>
<tr><td>  </td><td> 
Moving detector</td></tr>
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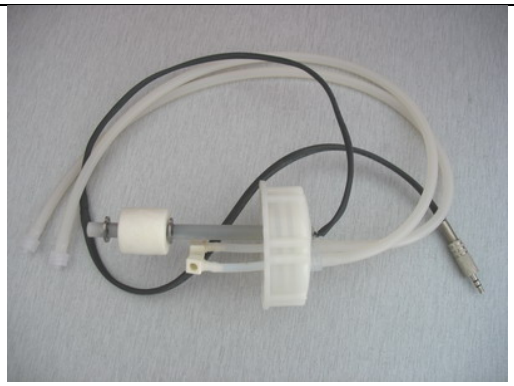
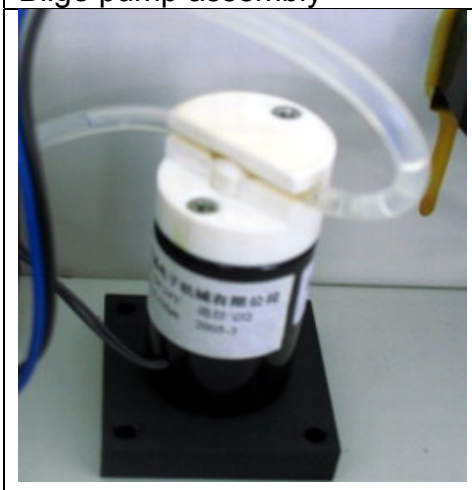
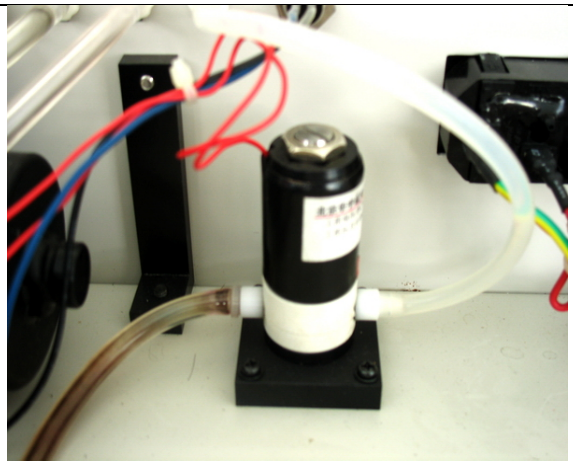
Bilge pump assembly



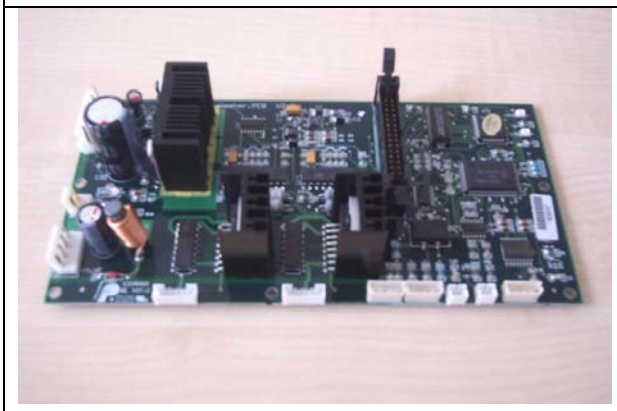
Waste lid assembly



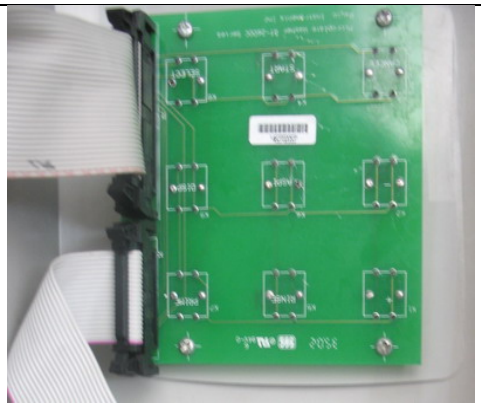
Solid valve



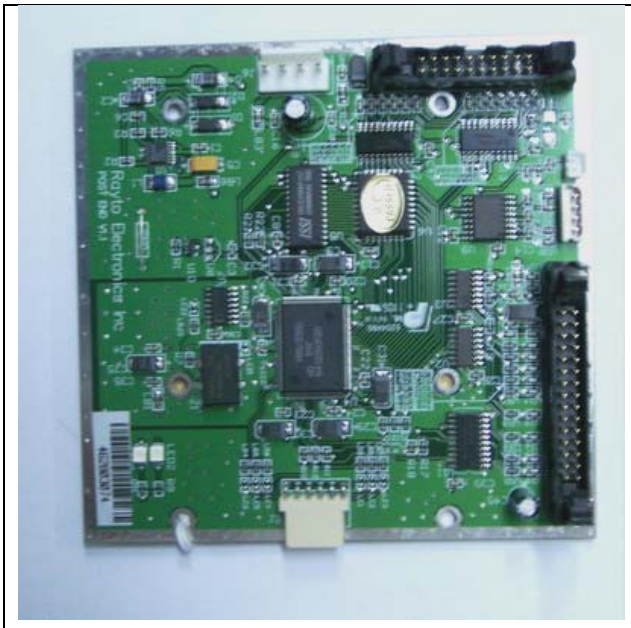
Solenoid valve



Main board (Non-CE mode)



Keypad board (Non-CE mode)



CPU Controller Board
(CE mode)

Front Driver Board
(CE mode)