

# **MICROPLATE WASHER**



## **Service Manual**



**Model : LMW-9620**

**Please read this manual carefully before using the instrument**

**Labnics Equipment**

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# Table of Content

| Sr.No.   | Contents   | Pg. No.  |
|----------|--|----------|
| <b>1</b> | <b>INSTRUMENT DESCRIPTION</b>                    | <b>1</b> |
| 1.1      | Functions Description                            | 1        |
| 1.2      | Structure Introduction                           | 1        |
| 1.2.1    | Power Supply                                     | 1        |
| 1.2.2    | Single Chip System                               | 1        |
| 1.2.3    | Power Supply Board                               | 1        |
| 1.2.4    | Main Board                                       | 1        |
| 1.2.5    | Step Motors                                      | 1        |
| 1.2.6    | Liquid-route System                              | 2        |
| 1.2.7    | Keyboard   | 2        |
| 1.2.8    | Attached Figures                                 | 2        |
| <b>2</b> | <b>TROUBLE SHOOTING</b>                          | <b>3</b> |
| 2.1      | Startup Interface Introduction                   | 3        |
| 2.2      | Startup Abnormalities                            | 3        |
| 2.3      | Liquid can not be infused                        | 3        |
| 2.4      | Abnormal Infusing                                | 4        |
| 2.5      | Declining Scouring sprayer                       | 4        |
| 2.6      | Microplate Holder Abnormal Movement              | 4        |
| 2.7      | Sprayer Holder Abnormal Movement                 | 6        |
| 2.8      | Instruments going out of control while running   | 6        |
| <b>3</b> | <b>REPLACEMENT OF MAIN PARTS</b>                 | <b>6</b> |
| 3.1      | Instrument Cover Replacement                     | 6        |
| 3.2      | Infusing or Ejecting Pump Replacement            | 6        |
| 3.3      | Electromagnetic Valve Replacement                | 7        |
| 3.4      | Holder Motor Replacement                         | 7        |
| 3.5      | Sprayer Motor Replacement                        | 7        |
| 3.6      | PCB Main Board Replacement                       | 7        |
| 3.7      | Power Supply Board Replacement                   | 7        |
| 3.8      | LCD Replacement                                  | 8        |
| <b>4</b> | <b>DETECT &amp; ADJUST</b>                       | <b>8</b> |
| 4.1      | Examine after Turning on the Instrument          | 8        |
| 4.2      | LCD Contrast Adjustment                          | 8        |
| Fig 1.   | Liquid System of The Instrument                  | 8        |
| Fig 2.   | Rear View of the Instrument                      | 9        |
| Fig 3.   | Inner View of the Instrument                     | 9        |
| Fig 4.   | Components Arrangement on the Main Board         | 10       |
| Fig 5.   | Components Arrangement on the Power Supply Board | 10       |

## CHAPTER 1. INSTRUMENT DESCRIPTION:-

### 1.1 Functions Description:

LMW-9620 Microplate Washer is an accessory for ELISA and other scientific tests. It is used in detection processes using ELISA method, such as: removing immune reactant which is not combined; avoiding combination between under-detected antibody and enzymatic conjugate; eliminating dissociated enzymatic conjugate from the reaction liquid; cleaning unwanted material adsorbed on the wells of microplate in the process of reaction. By above functions, the instrument can ensure the accuracy of results tested by ELISA method.

The instrument uses a liquid-route system without positive or negative voltage. When instrument works, the wash liquid will be taken out from the wash liquid bottle and through infusing system; it will be injected into the wells of microplate. The waste liquid will be ejected out from the instrument by the ejecting system. It absolutely conquers cross-pollution between washing liquid and waste liquid in liquid-route system.

### 1.2 Structure Introduction:

#### 1.2.1 Power Supply:

The linear steady power supply provides all voltages required by the instrument. Its input voltage is  $220V \pm 10\%$ , and its output voltages are +5V, +12V and -12V. Among these voltages, +5V is provided for digital circuit, +12V is provided for electromagnetic valve and step motor and -5V is provided for LCD.

#### 1.2.2 Singlechip system:

The 78E58b singlechip acts as the main control chip. The storage units of the singlechip are "32KB APROM" used to store the application programs and the "4KB LDROM" used to store the programs controlling the ISP operation. The two storage units are all MTP-ROM. The 78E58b singlechip manages LCD, keyboard, microplate holder-horizontal moving motor, sprayer vertical-moving motor, turning on and off of all the kinds of pumps and electromagnetic valves.

#### 1.2.3 Power Supply Board:

On the power supply board, the AC voltage is converted into DC voltage through commutating bridge, filter network and steady circuit. The driving circuit controls turning on and off of all the kinds of pumps and electromagnetic valves according to instructions provided by CPU main board.

#### 1.2.4 Mainboard:

Main functions of the main board are as follows:

- (1) Setting system parameters by "transfer programs set".
- (2) Controlling step motors, liquid pumps and electromagnetic valves by driving circuit.
- (3) Controlling LCD.

#### 1.2.5 Step Motors:

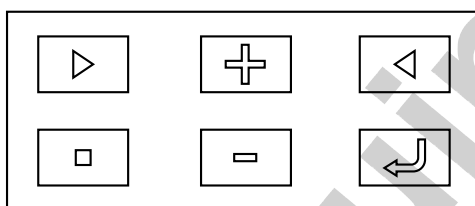
The instrument has two step motors: one controls the microplate holder horizontal movement, other controls the sprayer vertical movement. The two step motors control signals are generated by P1 port

on the control unit U1 (w78e58b) of the main board and T1 signal. Ports from P10 to P13 output pulses and T1 signal controls driving horizontal moving motor or vertical moving motor. The two motors work together to complete washing process of all under-washing wells by rows.

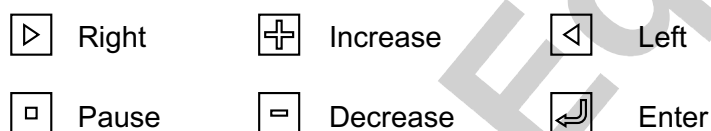
### 1.2.6 Liquid-route System:

Liquid-route system of the instrument is composed of: valve for entering liquid (washing liquid/distilled water), infusing pump, infusing valve, washing sprayer (8 or 12 needles) and waste liquid valve. The entering valve can respectively controls entering of washing liquid or washing liquid into the instrument. Infusing pump and infusing valve are used for controlling infusing liquid into wells of the microplate. The washing sprayer is used for infusing liquid to the wells by 8 or 12 infusing needles or sucking liquid by sucking needles. The waste liquid can be discharged by waste liquid pump.

### 1.2.7 Keyboard:



Operating panel of the instrument is composed of the 6 following functional keys.



Function of “**Pause key**” is the temporary pausing of instrument operation. If you press “**Right key**” after you press Pause key, the instrument will continue working; if you press “**Left key**” after you press Pause key, it will completely stop working and returns to the original state. The “**Enter key**” is used for confirming your operation.

### 1.2.8 Attached Figures:

1. Liquid system of the instrument. (see attached figure 1)
2. Rear view of the instrument. (see attached figure 2)
3. Inner view of the instrument. (see attached figure 3)
4. Main board components arrangement. (see attached figure 4)
5. Power supply board components arrangement. (see attached figure5)

## CHAPTER 2. TROUBLE-SHOOTING:-

### 2.1 Startup Interface Introduction:

First the instrument starts then liquid crystal screen will display the main menu.

**Main Menu**  
Wash Scour Adj

At this time the cursor will glint on "**Wash**", so press Enter key to enter into washing menu. If you press the "**Right key**", Scour will be selected. Then you can scour the pipeline and if you select "**Adj**" and press Enter key to confirm, the screen will display the adjusting menu.

**Adj B 220 S 15**  
**L153 D 500**

The figures in above interface are just for illustration, and may not be the right numbers. The following introduction is about the adjusting menu.

On this menu, "**S**" means SPACE FOR ADJUSTMENT. "**B**" means START POSITION; "**L**" means LOWER POSITION.

The figure "15" following S is set at the time, when the instrument leaves factory. You can adjust the space of suction needle tubes between two sucking operations by increasing or decreasing the value. The figure "220" following B is set at the time, when the instrument leaves factory. You can adjust the space between holes of enzymatic plate at the first row and suction needle tubes by increasing or decreasing the value. You can increase or decrease the figure following "L" to adjust the lower position of suction needle tubes.

### 2.2 Startup abnormalities:

**Case 1.** The instrument doesn't start when turned on.

**Reasons:** – Either the power supply plug is not connected properly (please connect again) or the fuse is burned out (change the fuse).

**Case 2.** After switching on the power supply, if lamp works properly but there is no display on the LCD.

**Reasons:** – Either connectors are not connected properly (so connect the connectors) or LCD is burned out (so change the LCD).

### 2.3 Liquid can not be infused:

All needles do not infuse liquid.

**Reasons:** It may be due to the improper working of infusing pump.  
Electromagnetic valve does not turn on.

### **Check steps and measures:**

(1) **Infusing pump is not working properly:-**

Detect the controlling signal at the connected position of the infusing pump power supply wire, when the instrument is running. If the controlling voltage is 220V and winding of the pump is obstructed, you should change the infusing pump.

(2) **The electromagnetic valve does not turn on:-**

Detect the controlling signal at the connected position of the electromagnetic valve power supply wire, when the instrument is running. If the controlling voltage is 12V and winding of the valve is obstructed, you should change the electromagnetic valve.

### **2.4 Abnormal Infusing:**

- (1) Asymmetric Infusing: Some needles infuse little liquid, it may be due to blocking of crystal. So you should use medical injecting pinhead to dredge the infusing tubes and sucking tubes and then scour the pipeline by distilled water.
- (2) If needle leaks: Either something is wrong with the electromagnetic valve or the liquid-route system has not being shut. Then you should change the valve.
- (3) There are some air bubbles in silicon tube: (it may cause inexact infusing volume): infusing electromagnetic valve or joints of pipeline has been leaked. Then you should find out the cause and solve it.

### **2.5 Declining Scouring sprayer:**

It may be caused either by bending of connected board or by loose fixing screws. You should adjust the connected board to make it toward the scouring sprayer and check whether the screws are loose or not. After the problem get solved, please enter the adjusting menu to adjust the position of scouring sprayer again.

### **2.6 Microplate Holder Abnormal Movement:**

Checking flow: Loose synchronous belt → the synchronous belt and the motor shaft are not fixed → holder is blocked → optical-coupling for limiting position shifts → motor does not rotate → abnormal power voltage → connectors are disconnected → abnormal electric level of control pins for corresponding IC → bad step motor.

#### **Checking steps and measures:**

- (a) If synchronous belt is loose: – It may be due to loose driven synchronous shaft, so you should fix it again and then install synchronous belt properly.
- (b) If the motor is moving: – it means that the synchronous shaft and the motor shaft are not fixed, so please tightly screw the fixed bolt.
- (c) If the holder is locked by something, please remove it.

#### **If motor doesn't start normally and is unsteady:**

- (d) Check the reliability of the connector.

-Check JP4, JP5 on the main board (see attached figure 5) to find out whether the pin is properly connected to the socket or not.

-Check connections of all kinds of pins and sockets.

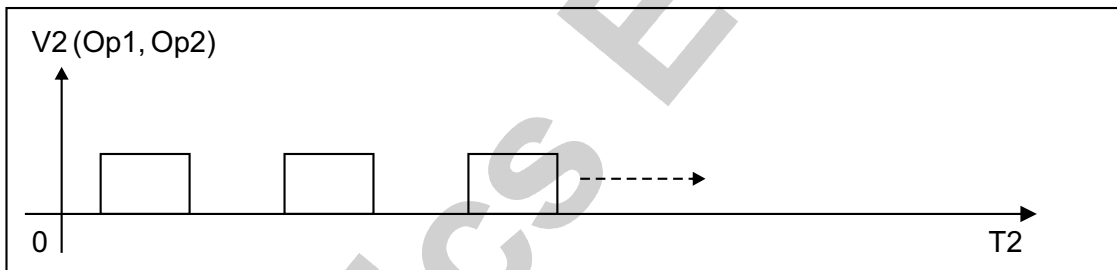
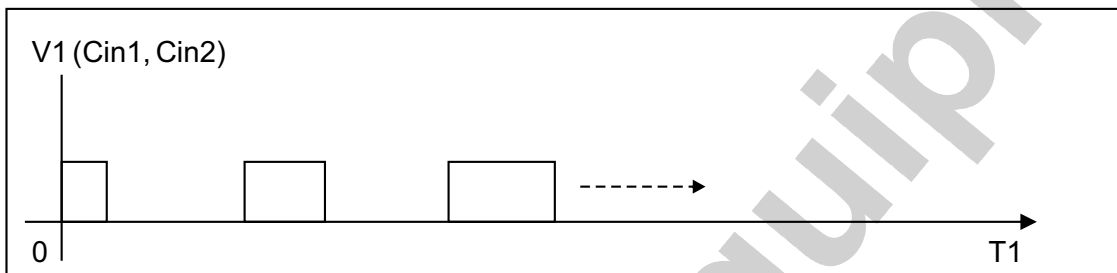
(b) Check the working voltage of motor.

-Connect the black meter pen of multimeter with the ground JP3 (V-) and connect the red meter pen with the pin JP3 (V+), multimeter should indicate 12V.

(c) Check the pulse on the corresponding IC control pin.

Observe the control pulse on U1 pin 1, 2, 3, 4 by the oscillograph. The following are the correct pulse graph.

### Driving Waves



**Case 1:** If the wave is correct, but the motor doesn't work properly.

**Solution:** Check pin 15 of U1 to find out whether the wave is correct.

**Case 2:** If vertical motor doesn't work properly.

**Solution:** Check pin 10, 12, 14, 16 of U8 to find out whether the waves are correct.

**Case 3:** If horizontal motor doesn't work properly.

**Solution:** Check pin 10, 12, 14, 16 of U8 to find out whether the waves are correct.

The motor is burned. You should change it.

## 2.7 Sprayer Holder Abnormal Movement:

Checking flow: loose synchronous belt → synchronous belt and motor shaft are not fixed → holder is blocked → optical-coupling for limiting position shifts → motor does not rotate → abnormal power voltage → connectors are disconnected → abnormal electric level of control pins for corresponding IC → bad step motor.

## 2.8 Instruments going out of control while running:

It may be caused by strong electromagnetic field. Then you should turn off the instrument and take measures to remove the disturbing element or (change the place of instrument).

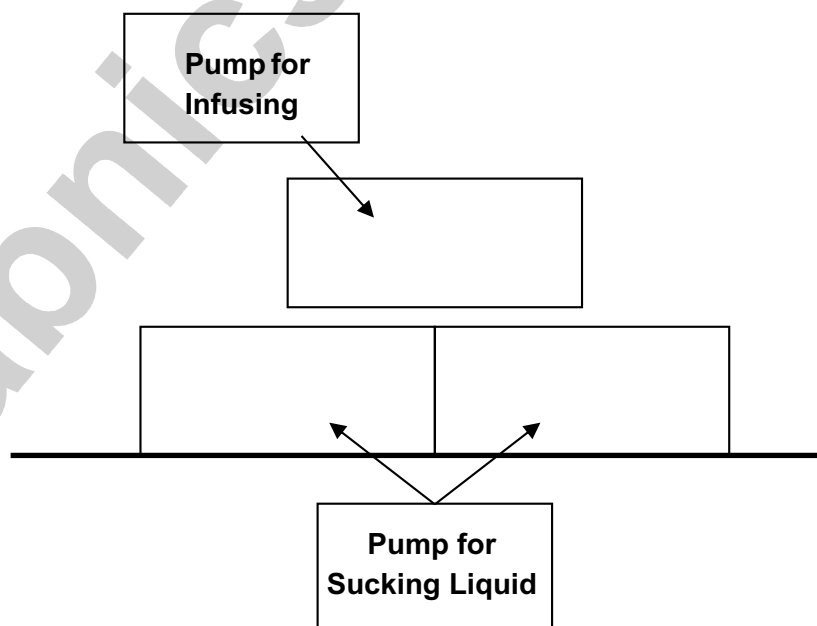
## CHAPTER 3. REPLACEMENT OF MAIN PARTS:-

### 3.1 Instrument Cover Replacement:-

- (1) Unplug AC cord from the instrument.
- (2) Unscrew the screws on both sides of the instrument.
- (3) Gently open the cover of instrument (be careful about the connected lines in the instrument).

### 3.2 Infusing or Ejecting Pump Replacement:-

- (1) Turn off the instrument and open the cover. Then you can see 3 liquid pumps in the instrument. The two paralleled pumps are sucking pumps and above them is infusing pump as the following figure shows.



- (2) Change the infusing pump: unplug the power supply of infusing pump from the power supply board and unplug tubes. Unscrew the three screws and replace the old pump. Replace it with a new pump in the opposite order.
- (3) Steps of changing the sucking pump are the same as above. But you should first remove the infusing pump and then dismantle the sucking pump.

### **3.3 Electromagnetic Valve Replacement:-**

- (1) Turn off the power supply and open the instrument cover.
- (2) Unplug the power supply of electromagnetic valve from the power supply board and unplug the tubes. Unscrew the four screws for fixing the electromagnetic valve.
- (3) Take down the old electromagnetic valve.
- 12(4) Install a new pump in the opposite order.

### **3.4 Holder Motor Replacement:-**

- (1) Unplug the holder motor from the main board.
- (2) Unscrew the four screws for fixing the motor.
- (3) Replace the old motor.
- (4) Install a new motor in the opposite order.

### **3.5 Sprayer Motor Replacement:-**

- (1) Unplug the sprayer motor from the main board.
- (2) Unscrew the four screws for fixing the motor.
- (3) Replace the old motor.
- (4) Install a new motor in the opposite order.

### **3.6 PCB Main Board Replacement:-**

- (1) Open the cover of instrument according to 3.1.
- (2) Unplug the leads connected with the main board and then unscrew the fixing screws to replace the board.
- (3) Install and fix the new main board and connect the leads with the main board. Then switch on the power supply to check whether voltage on the main board is correct or not.

### **3.7 Power Supply Board Replacement:-**

- (1) Open the cover of instrument.
- (2) Unplug the leads connected with the power supply board and then unscrew the fixing screws to replace the board.
- (3) Install and fix the new power supply board and connect the leads with the board. Then switch on the power supply to check whether voltage on the board is correct or not.

### 3.8 LCD Replacement:-

- (1) Unplug the leads connected with LCD and then unscrew the four fixing screws to replace the old LCD.
- (2) Plug the leads connected with the new LCD and then turn on the instrument to check the normal functioning of display.
- (3) Screw the four screws to fix the new LCD.

## CHAPTER 4. DETECT & ADJUST:-

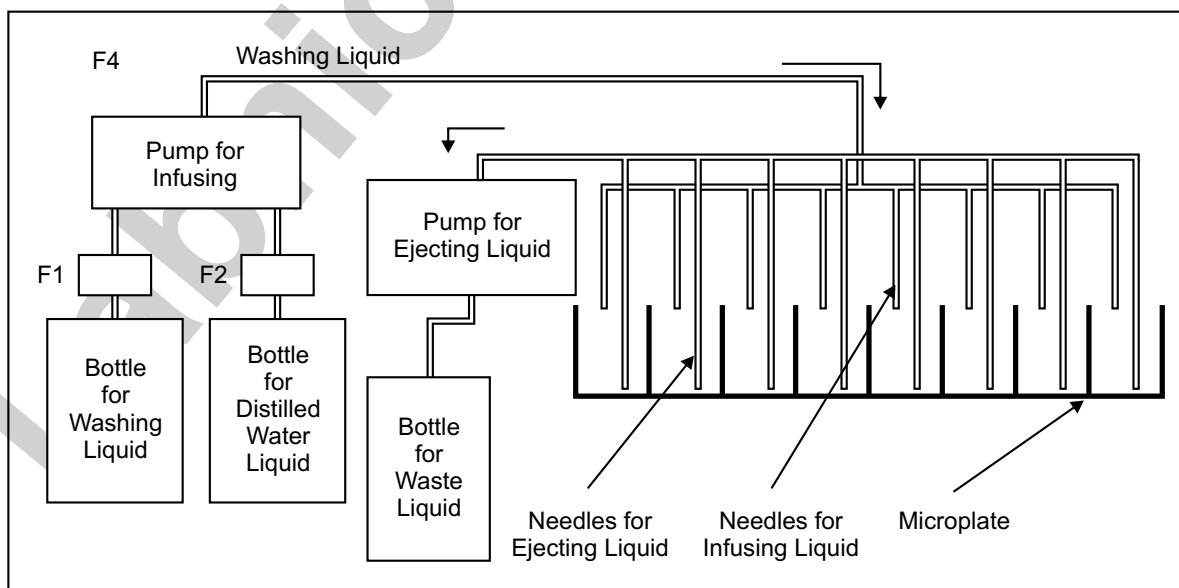
### 4.1 Examine after Turning on the Instrument:-

After the instrument is maintained, the following tests should be performed (do not install the cover and connect the washing bottle and the distilled water).

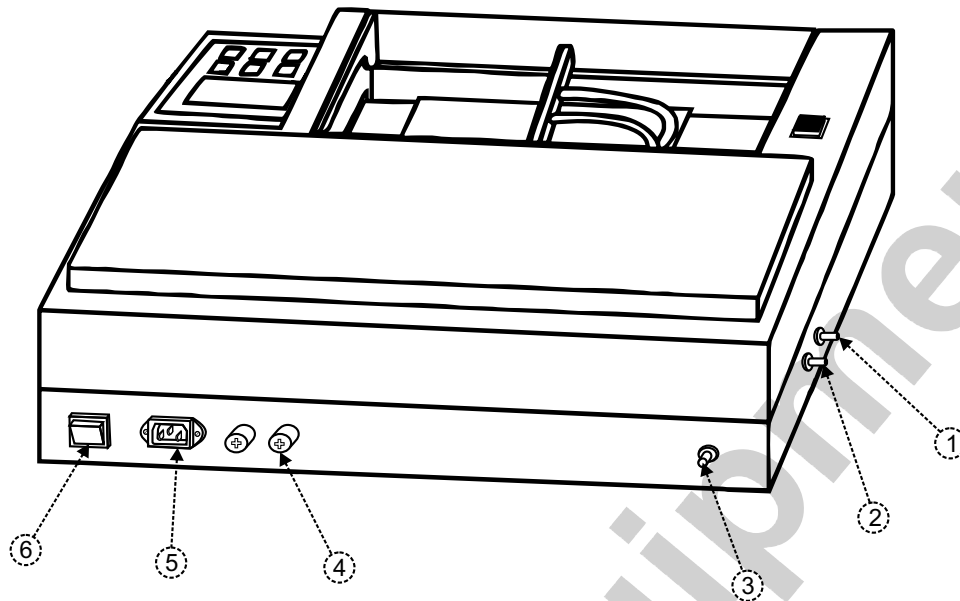
- (1) Turn on the instrument and check whether the start-up menu of the instrument is ok.
- (2) Respectively check whether “Wash” and “Adjust” functions are working properly.
- (3) Put the plate properly and enter “Wash” program (do not connect the washing liquid). Then start the washing program and check whether the positions of the plate holder and the sprayer are correct or not. Otherwise you should again adjust them.
- (4) Connect the bottles of washing liquid and distilled water and then start the cleaning or washing program and check carefully whether there is leakage of liquid or not. If yes, you should find out the cause and remove it.
- (5) If above tests have been passed out, please turn off the power supply and install the cover. Then do repeat the “start test” again.

### 4.2 LCD Contrast Adjustment:-

In case, readability of LCD panel needs to be improved, it is possible to adjust it by a potentiometer placed on the PCB main board inside the instrument. The potentiometer lies in between the connected plug of LCD mainboard and the connected plug of the power supply.



**Figure 2: Rear View of the Instrument**



- |   |                             |   |                              |
|---|-----------------------------|---|------------------------------|
| ① | Entrance for Washing Liquid | ② | Entrance for Distilled Water |
| ③ | Entrance for Waste Liquid   | ④ | Fuse                         |
| ⑤ | Socket for Power Supply     | ⑥ | Power Supply Switch          |

**Figure 3: Inner View of the Instrument**

- ① Pump for Infusing Liquid  
(below it is the pump for ejecting Liquid)
- ② Electromagnetic Valve
- ③ Sprayer Moving Module
- ④ Sprayer
- ⑤ Bracket for Sprayer
- ⑥ Microplate
- ⑦ Holder for Microplate
- ⑧ Step Motor
- ⑨ Power Supply Board
- ⑩ Main Board
- ⑪ LCD

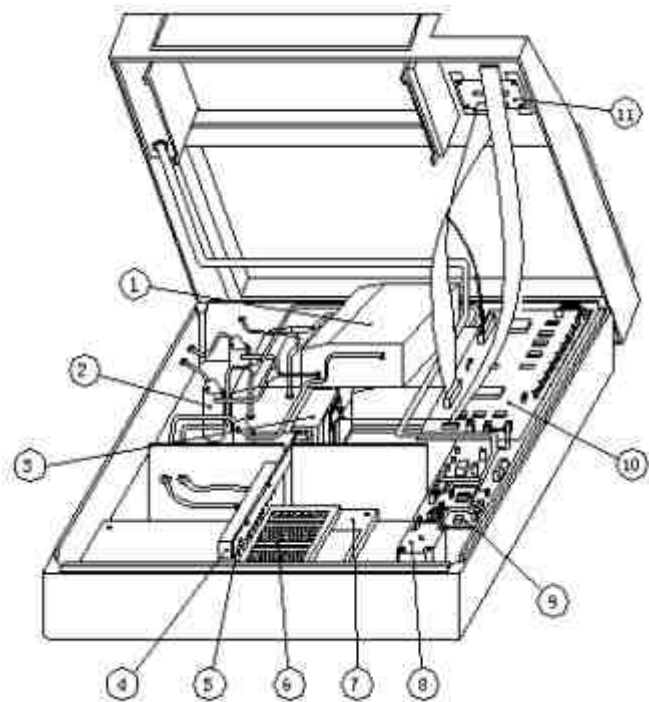


Figure 4: Components Arrangement on the Main Board

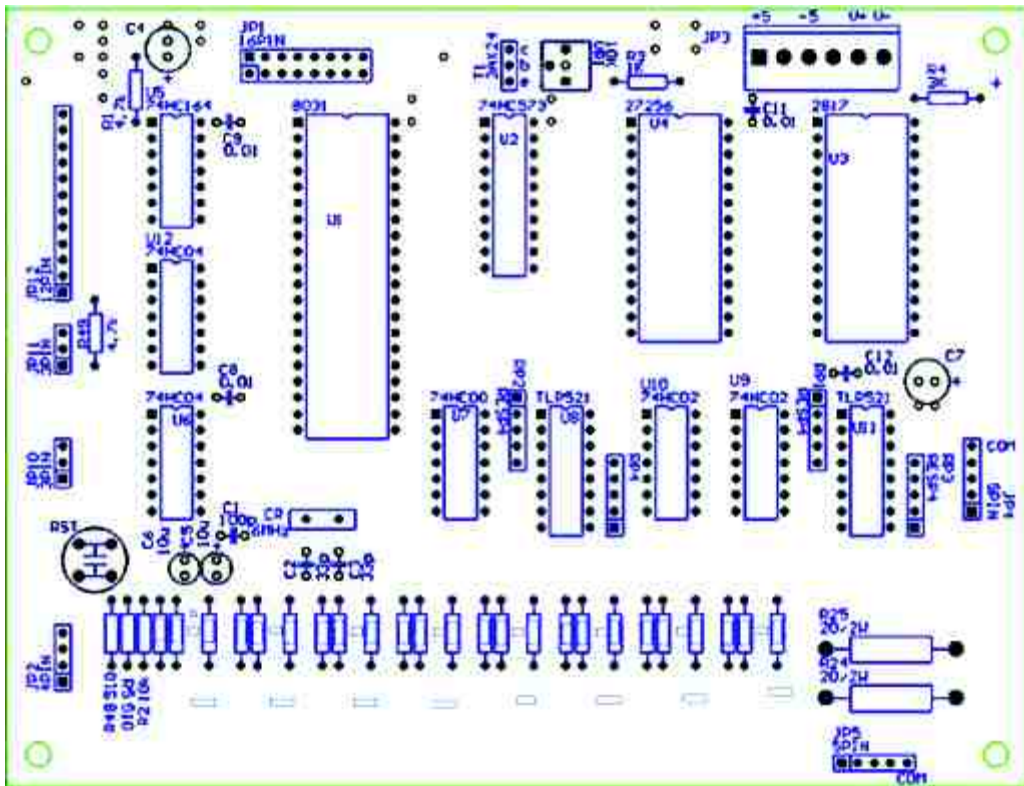


Figure 5: Components Arrangement on the Power Supply Board

