

Electronic Micro Systems



Photo Resist Spinner Model 4000

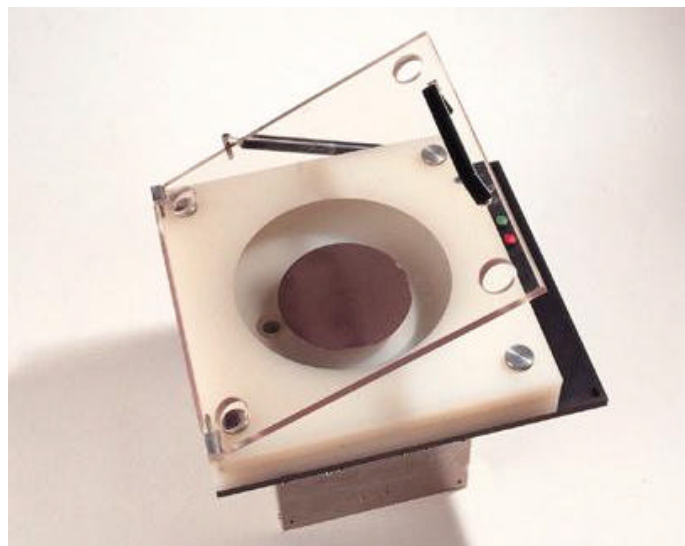


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Instructions

The Photo Resist Spinner Model 4000 from Electronic Micro Systems provides a simple and economical means of applying highly accurate resist coatings to silicon wafers and ceramic substances. Spinning the wafers between 150 and 9,500 rpm using computer control ensures precise repeatability for production of batch wafers.

The Model 4000 consists of two parts: a bench top spinner unit and a separate control unit. The control unit is connected by a flexible cable and can be located outside the immediate working area.

Bench Top Spinner

Wafers of up to 6" inches in diameter are held by vacuum on a chuck and spun inside a polypropylene bowl. The bowl has an aperture to allow an external pump to extract fumes and is easily removed for cleaning.

An interlock switch ensures that the chuck will not spin unless the vacuum is sufficient to hold the wafer securely. A vacuum receiver in series with the vacuum line prevents resist from entering the vacuum system.

A lid with lid interlock can be fitted if required.

Control Unit


Using a simple key pad and menu structure, the following parameters can be set:

- number of spin periods - between 1 and 8
- start & stop delay periods - between 1 and 100 seconds
- spin speed - between 150 and 9,500 rpm
- spin periods - between 0 and 999 seconds
- acceleration control - between 1 and 256 units.

When a sequence starts, the chuck vacuum is switched on and after a programmed number of seconds the program (of up to eight spin periods) runs. At the end of the program, a programmed deceleration occurs, followed by a programmed pause and the chuck vacuum is switched off. (See Fig. 2).

Starting Up

1. Make sure that the Spinner is correctly connected to the Control Unit.
2. Turn on the power switch, located front panel of the Control Unit. The display will show the 'self test' message.



EMS 4000
SELF TEST


After the self test is complete, the software will endeavour to load the program that was being used when the unit was last switched off.

3. If no valid program can be retrieved, default values will be placed in the memory and the display will read:



MEMORY CORRUPTED
DEFAULTS USED

4. When a valid program is loaded into the memory the unit is ready for use and the display reads:



PROGRAM 1
PRESS D TO SET

Programming The Model 4000

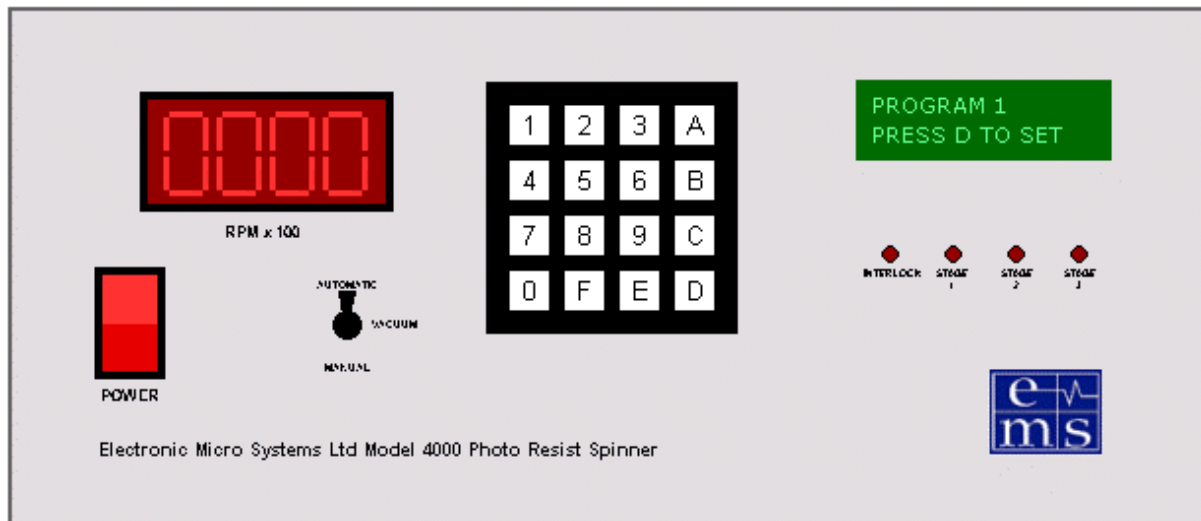


Figure 1 - Model 4000 Front Panel

The model 4000 is programmed using an hierarchical menu structure, similar to many modern mobile telephones.

You navigate around the menu by using the following navigational keys:

Key	Function
Numeric Keys (1..9,0)	Buttons used to enter specific numeric data.
E	This button acts as an ENTER button and is used to tell the software that you have finished entering a number. It is also used to select a menu option when navigating the menu.
D	This button acts as a STEP button and is used to 'step' over the current menu option onto the next option.
C	Used to ESCAPE from the current point in the menu structure and return to the root of the menu.
A	This button can be used to increment a numeric value by 1. It will not work once you have started to enter a number.
B	This button can be used to decrement a numeric value by 1. It will not work once you have started to enter a number.
F	Not used - Reserved for decimal point.

As you press D you will be offered a menu option. To select that option, simply press the E key. If you would like to be offered a different option, press D.

You can press C at any time to escape the current editing operation.

When you press D, you may be asked to enter some data or you may enter a new 'sub-menu' in which case you will be presented with the first option in that sub-menu.

This may sound confusing, so just play with the unit, especially the D and E buttons and you will soon get the idea.

The basic structure of the menu for the Model 4000 is shown in figure 3.

The Model 4000 can store up to 59 programs in its non-volatile memory store. Each program is made of up to 8 program steps and each step has program-mable acceleration (called 'Ramp' in the program), time of spin (called 'Dwell') and speed. Additionally, the start delay, final ramp and stop delay can also be set up. See Figure 2.

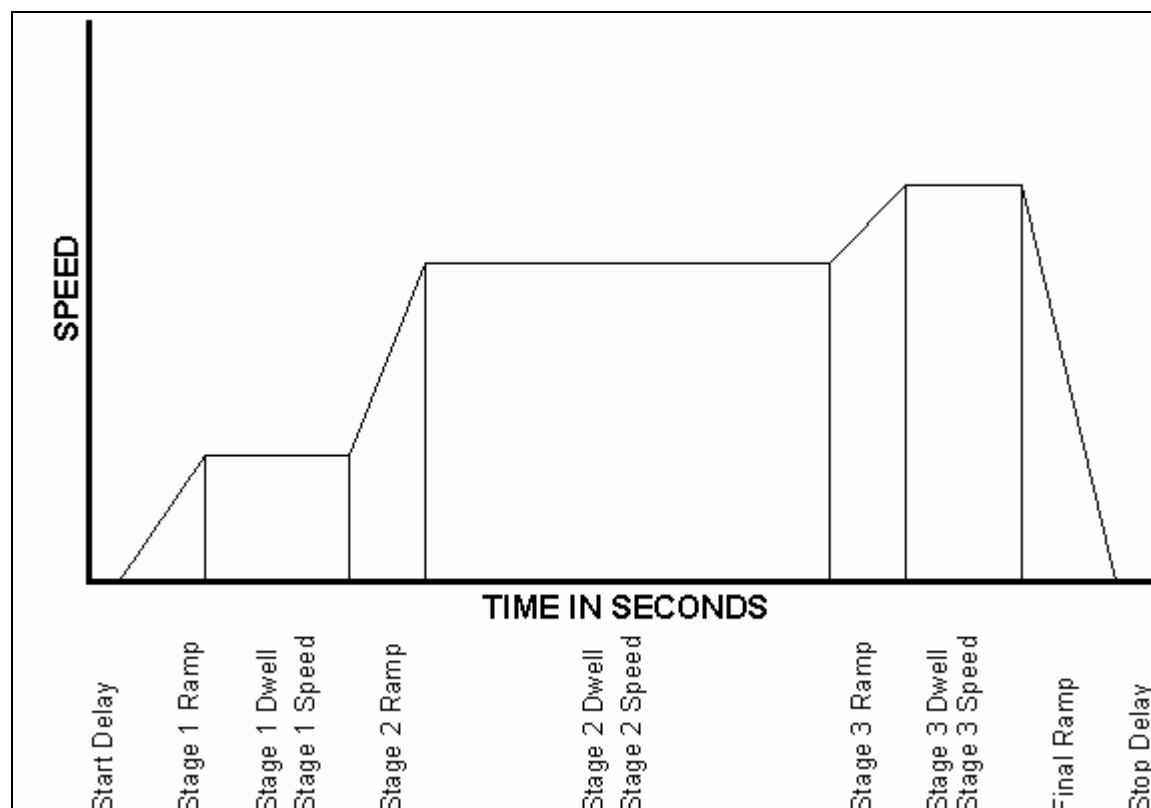


Figure 2 - An Example Three Stage Program

The following pages demonstrate how to perform programming tasks although it does not show all stages because they all follow similar sequences and once you have learnt how to program one stage you will have learned how to program them all.

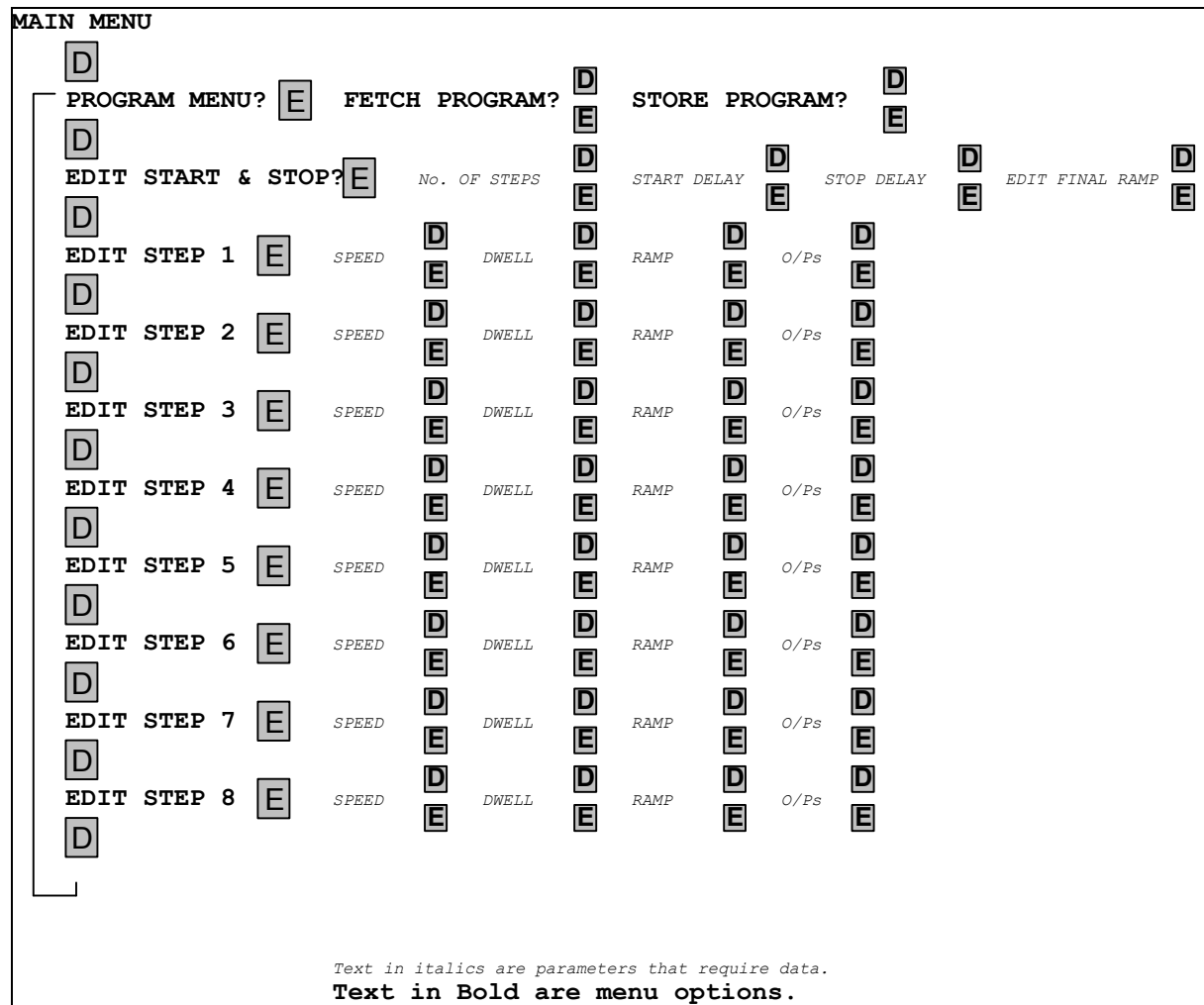



Figure 3 - Model 4000 Menu Structure

Starting A New Program

Lets assume that we are setting up a program for a three stage programmed sequence. You will notice that a number will be offered when you press D in order to enter a value. This will be the number that is in the current program. Sometimes the number will be the value you require and at other times you will need to enter the number using the buttons on the front panel.

1. Make sure that you start from the point where the display reads:




PROGRAM 1
PRESS D TO SET

2. Press D.



PROGRAM MENU?

3. Press D again.



EDIT START &
STOP?

4. Press E.



No. OF STEPS:
3

Explanation: The software offers the current number of steps that the program will execute. Either press the numeric key for the number of steps that you require (between 1 & 8) then press E or, as in this case, you can press D to move onto the next parameter.

5. Press D.

START DELAY:
2

Explanation: The software offers the current Start Delay. This is the time required for the vacuum to build up on the chuck. Either press the numeric key(s) for the number of seconds (between 0 & 100) then press E or you can press D to move onto the next parameter.

6. Press D.

STOP DELAY:
2

Explanation: The software offers the current Stop Delay. This is an extra delay to ensure that the chuck is completely still before the vacuum is removed from the chuck. Either press the numeric key(s) for the number of seconds (between 0 & 100) then press E or you can press D to move onto the next parameter.

7. Press D.

EDIT FINAL
RAMP: 20

Explanation: The software offers the current Final Ramp. This is the final deceleration rate in system units. The higher the number, the more rapidly the motor will decelerate. Either press the numeric key(s) for the number of units (between 0 & 100) then press E or you can press D to move onto the next parameter.

8. Press D.

EDIT STEP 1

Explanation: You have reached the end of the 'Edit Start & Stop' sub-menu and the software is offering the next option on the Main Menu. Either press E to edit the parameters for Step 1 or you can press D to move onto the 'Edit Step 2' option on the Main Menu.

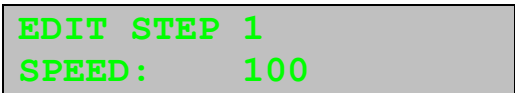
Setting Up A Program Step

By now you should be more familiar with the D button to navigate around the menu. To set up a program step use the D button until the display shows the step number you want to modify e.g.



```
EDIT STEP 1
```

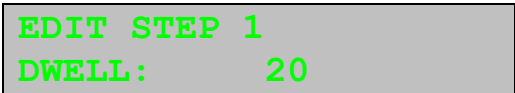
1. Press E.



```
EDIT STEP 1  
SPEED: 100
```

Explanation: You have entered the 'Edit Step 1' option and the software is showing the current speed. Either press the numeric key(s) for the speed you require (between 1 & 10,000RPM) then press E or you can press D to move onto the next parameter.

2. Press D.



```
EDIT STEP 1  
DWELL: 20
```

Explanation: The software is showing the current Spin Time. Either press the numeric key(s) for the time you require (between 1 & 999 Seconds) then press E or you can press D to move onto the next parameter.

3. Press D.



```
EDIT STEP 1  
RAMP: 100
```

Explanation: The software is showing the current acceleration / deceleration rate in system units. The higher the number the more rapidly the motor will accelerate / decelerate. Either press the numeric key(s) for the ramp you require (between 1 & 1000 units) then press E or you can press D to move onto the next parameter.

4. Press D.

```
EDIT STEP 1
O/Ps:
```

Explanation: The software is offering the option of specifying the state of the outputs during Step 1. If you don't want to change the outputs then press D to move onto the next parameter.

Either press D.

```
EDIT STEP 2
```

OR press E.

```
EDIT STEP 1
O/Ps: 11001001
```

Explanation: The software is showing the current settings for the outputs for this state. To modify the output states enter a 1 for ON and a 0 for OFF. It is important to enter all eight outputs before pressing E. For an explanation of assigning the outputs see Appendix B.

Output 8 is the left most digit and Output 1 is the right most digit.

5. Press E.

```
EDIT STEP 2
```

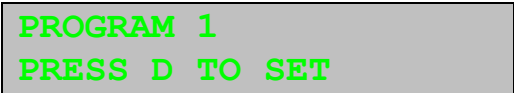
Explanation: You are now ready to set up the next step, following the same procedure as above.

Saving and Retrieving Programs

The Program that is currently in memory can be saved to avoid accidentally overwriting some of its values. The program is then stored and can be recalled when the process requires repeating. Programs are identified by a number between 1 and 59.

Saving Programs

1. Make sure that you start from the point where the display reads:



PROGRAM 1
PRESS D TO SET

2. Press D.



PROGRAM MENU?

3. Press E.



FETCH PROGRAM?

Explanation: The software is offering the option of retrieving a previously stored program.

4. Press D.



STORE PROGRAM?

Explanation: The software is offering the option of storing the current program.

5. Press E.



SAVE WHICH
PROGRAM?

Explanation: Enter the number you wish to use to identify the program followed by the E button.

If the program store already holds a valid program you will be asked to confirm the location.

```
OVERWRITE
1=YES  0=NO
```

If you confirm the program number, or if the chosen location does not already hold a valid program, the program will be saved and the display will read:

```
STORING
PROGRAM 2
```

When the program has been written the display will return to the Main Menu starting point.

```
PROGRAM 2
PRESS D TO SET
```

Retrieving Programs

1. Make sure that you start from the point where the display reads:

```
PROGRAM 1
PRESS D TO SET
```

2. Press D.


```
PROGRAM MENU?
```

3. Press E.

```
FETCH PROGRAM?
```

Explanation: The software is offering the option of retrieving a previously stored program.

4. Press E.



FETCH WHICH
PROGRAM?

Explanation: Enter the number of the program you wish to retrieve followed by the E button.

If the program store does not hold a valid program the display will read:



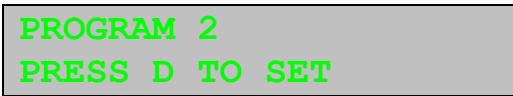
INVALID PROGRAM

If the chosen location does hold a valid program, the program will be retrieved and the display will read:



PROGRAM 2
RETRIEVED

After a small delay the display will return to the Main Menu starting point.



PROGRAM 2
PRESS D TO SET

Spinner Unit Operation

1. Position the appropriate size chuck on the spindle of the spinner unit. The top surface of the chuck should be smaller than the wafer/substrate to prevent resist from contaminating the top surface of the chuck.
2. Switch on the power to the remote control unit and enter the speed and time values for your required process settings or retrieve a previous program (see pages 9 & 13).
3. Place the wafer/substrate centrally on the chuck.
4. Press the Green start button on the spinner unit.

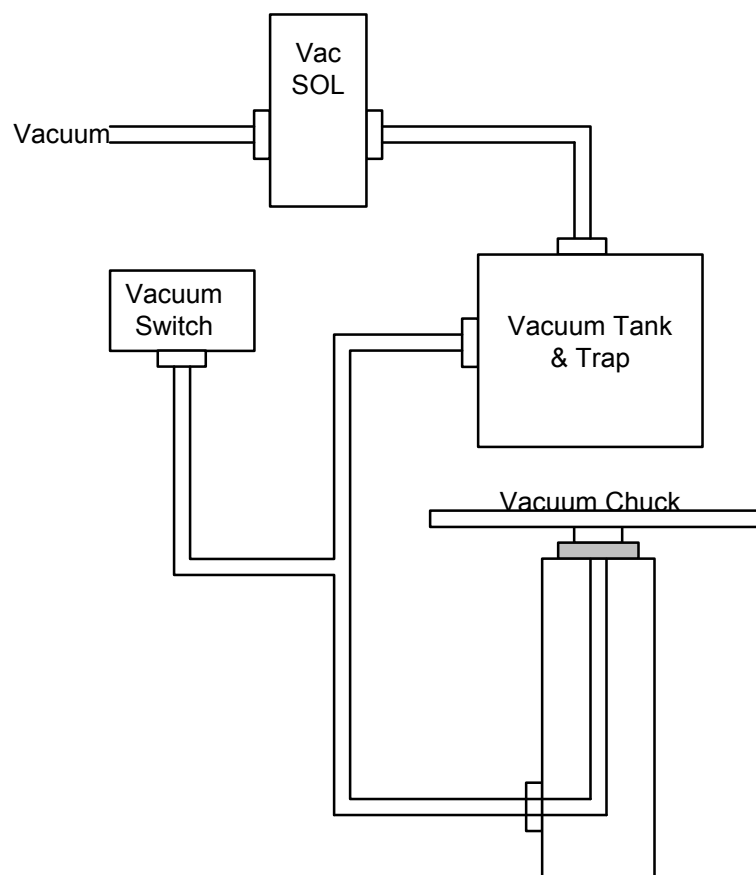
NOTE: If the wafer/substrate is not central on the chuck, press the Red reset button on the spinner unit. This stops the program. Re-position wafer/substrate and press the Green button on the spinner unit to restart the program.

5. Apply the photo resist to the centre of the wafer/substrate.
6. The remote control unit will control the spinner unit until the end of the program.

Setting Up A New Process

Repeat the above procedure, making adjustments to the time and speed values, until the required coating thickness is achieved.

When the correct values have been found, save the program as described on page 11. This program can then be recalled for batch production at a later date.

APPENDIX A**Pneumatic Diagram**

APPENDIX B**Connector Details**

Pin Number	Function
1 & 2	Motor Positive Connection
3 & 4	Motor Negative Connection
5	System 0 Volts
6	Lid Input Signal (connect to System 0 Volts to assert)
7	Start Button Input Signal (connect to System 0 Volts to assert)
8	Stop Button Input Signal (connect to System 0 Volts to assert)
9	Vacuum Input Signal (connect to System 0 Volts to assert)
10	Vacuum Output (Connects to +12 Volts when switched on)
11	Tacho Positive Input
12	Tacho Negative Input
13	Not Used
14	Not Used
15	Chassis Earth

Table 1 - Main Connector Details

The outputs that can be programmed to operate during the spin sequence are identified as follows:

Out 8	Out 7	Out 6	Out 5	Out 4	Out 3	Out 2	Out 1
Not Available	Not Available	LED 3 on Front Panel	LED 2 on Front Panel	LED 1 on Front Panel	Pins 8 & 3 on 9 Way 'D' Type	Pins 7 & 2 on 9 Way 'D' Type	Pins 6 & 1 on 9 Way 'D' Type

Programming a 1 turns the output ON (contacts closed) during the step.
Programming a 0 turns the output OFF (contacts open) during the step.

Pin Number	Function
1 & 6	Contacts for Out 1
2 & 7	Contacts for Out 2
3 & 8	Contacts for Out 3
4 & 5	No Connection
9	Chassis Earth

Table 2 - Auxiliary Outputs