ELS-7500EX
ECA Training Manual

1. Pattern Designing by CAD

Elionix Inc.

Starting the Program

User accounts are set by default as shown below.

1. Limited User
   Login account “ELS-7500”
   Password “ELS75”

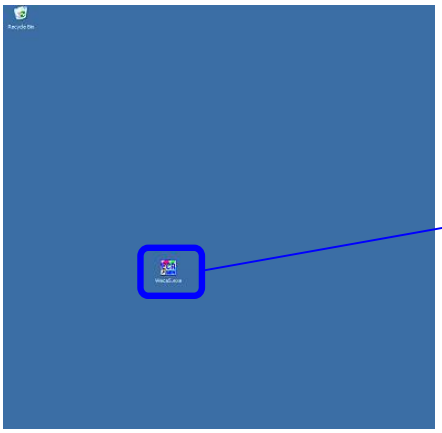
2. Administrator
   Login account “Administrator”
   Password “ELS75”

Normally, the “ELS-7500” limited user account should be entered.

0 Starting the WecaS CAD Software

Procedure:

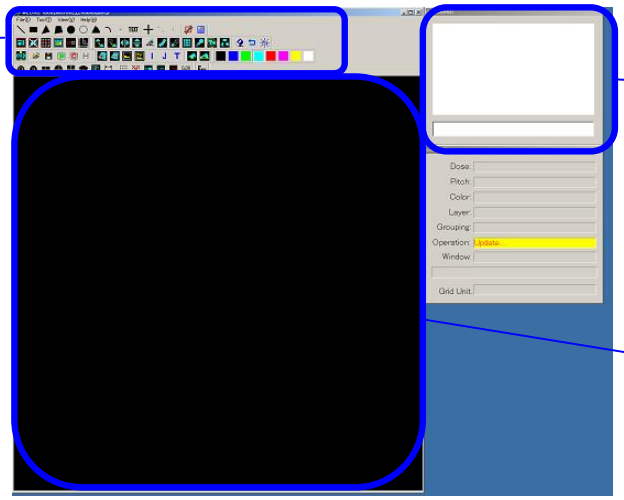
1. Double-click the shortcut  on the desktop.



Double-click this icon.

[Note] If WecaS does not start:
If the SEM PC side system has not been started up, WecaS does not start up. Always check before attempting to start WecaS.

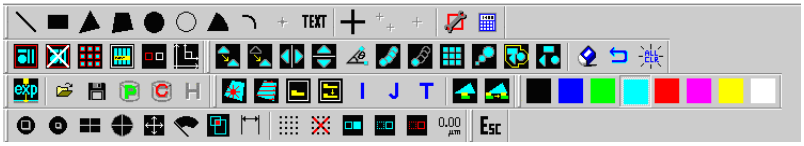
2. The WecaS pattern drawing program starts up.



[Command Window]
Commands can be entered here to draw figures and save data.

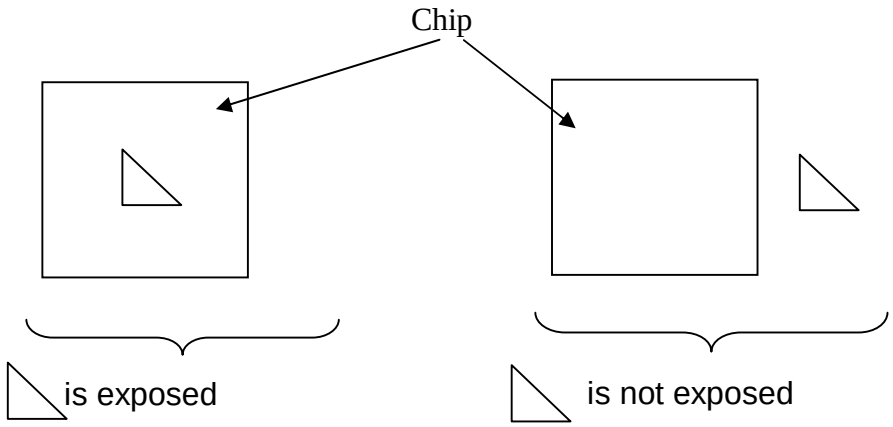
When text is entered via the keyboard, it is automatically input into the command window.

[WecaS Window]
This can be used to draw patterns.



[Icons]
These icons can be used to draw figures, change settings, etc.

●What are chips?
Chips are the areas which an electron beam is able to scan. The ELS-7500EX can expose patterns which fit within the chip. Thus, the chip must always be set.



●Chip size
You can select the chip size. The following 6 sizes are available.

- 75um x 75um
- 150um x 150um
- 300um x 300um
- 600um x 600um
- 1,200um x 1,200um
- 2,400um x 2,400um (Note that 2,400um x 2,400um chip can only be selected when the acceleration voltage is set to 25kV.)

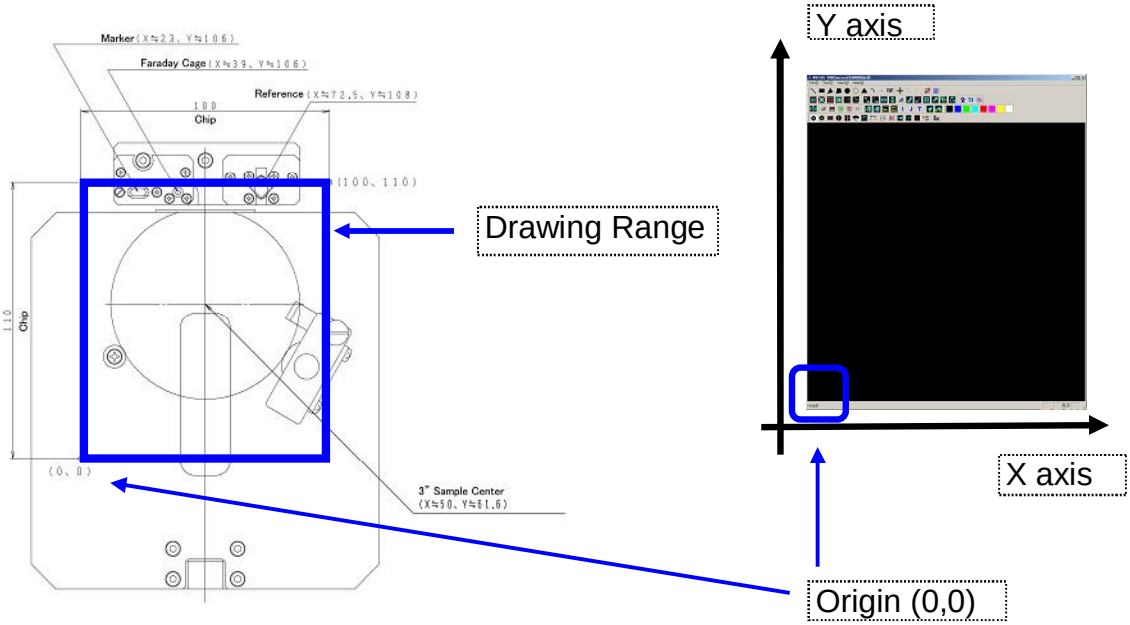
●Number of divisions per chip(We call dot, or pixel.)
When performing electron beam lithography, the chip is digitally scanned. In other words, the set chip size is divided into sections of specified size. The following three types of division are available.

- 240,000 x 240,000 dots
- 60,000 x 60,000 dots
- 20,000 x 20,000 dots

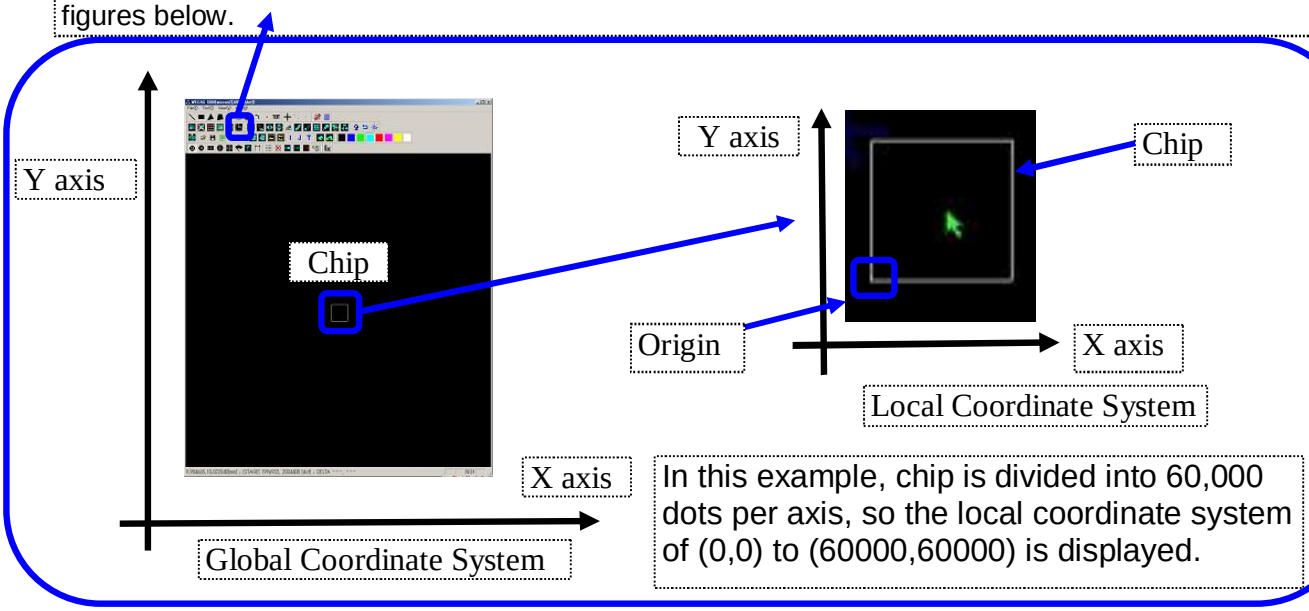
●Chip size determination guidelines
[based on minimum pattern line width]
- For line widths of 20nm or less, 75um chip
- For line widths of 20nm or more, 150um chip
- For line widths of 50nm or more, 300um chip
- For line widths of 150nm or more, 600um chip

Let us examine the coordinate system for an actual 3inch wafer cassette.(4inch ELS-7500EX models can be used with wafers of up to 4inch diameter.)
As the figure below shows, the bottom left corner of the cassette is the origin (0mm,0mm). This origin is the same as the WecaS origin (0mm,0mm). This coordinate is known as the global coordinate system.
[Note] Cassette coordinate systems may vary depending on their specifications. Please check coordinate systems for individual cassette types.

Global Coordinate System



Next, let us look at the coordinate system within the chip.
In addition to the global coordinate system, the ELS-7500EX has a separate coordinate system called the local coordinate system. The local coordinate system is the coordinate system used within the chip. You can switch between the global coordinate system (units: mm) and the local coordinate system (units: dot or mm) by clicking an icon  . Please see the explanatory coordinate system figures below.

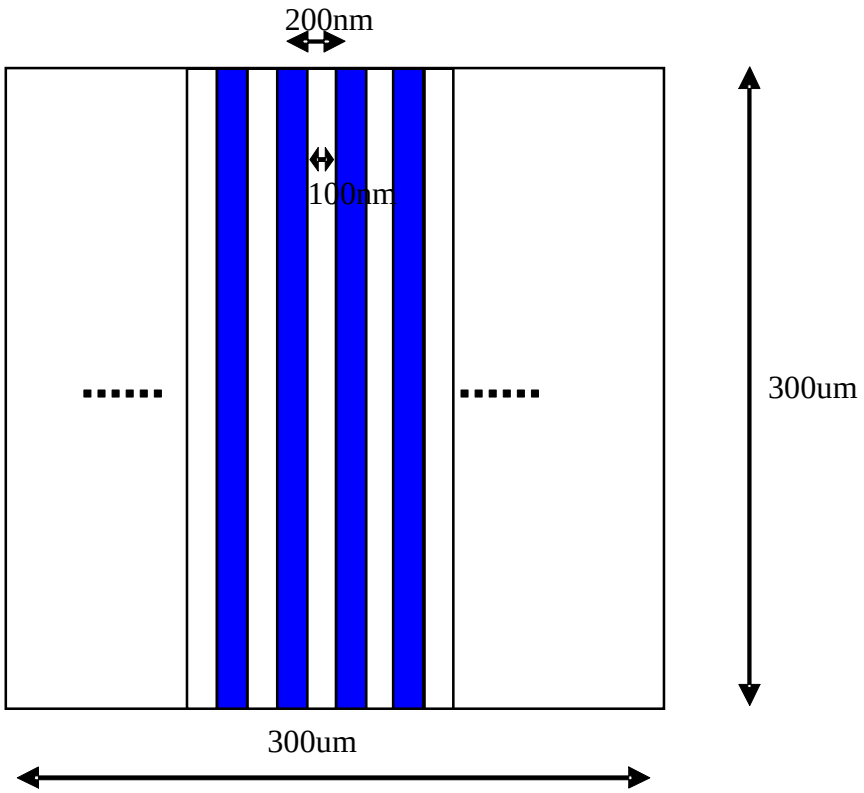


In this example, chip is divided into 60,000 dots per axis, so the local coordinate system of (0,0) to (60000,60000) is displayed.

Training Objective: Create a line and space pattern across an entire 300um x 300um chip.

Objective | Training Objective

You will create a pattern like the one shown below.
In a 300um square, you create a 200nm pitch 1:1 pattern of lines and spaces.
This type of pattern is often used in optical devices.



The pattern designing procedure is as shown below.

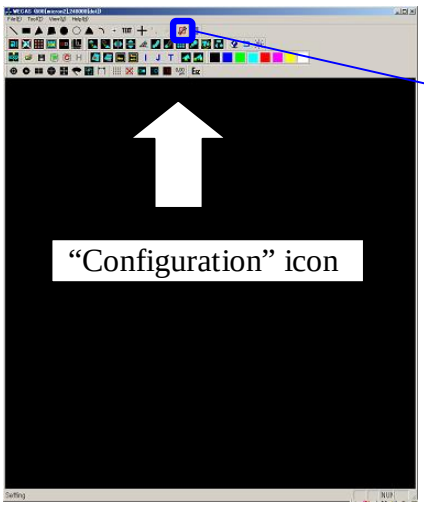
1. Set the chip size and dots
2. Select the location in which the chip is
3. Switch the coordinate system
4. Create a pattern (create a square pattern)
5. Create a pattern (copy the pattern)
6. Save the data

Each of these steps will be explained, in order.

1 Setting the Chip (300um, 60,000dots)

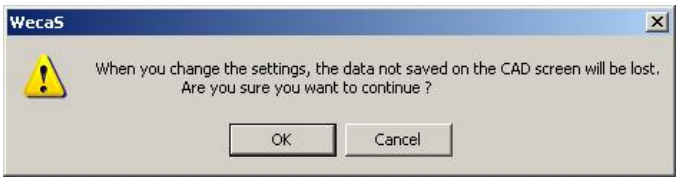
Procedure:

1. Set the chip. Click the  (“Configuration” icon).



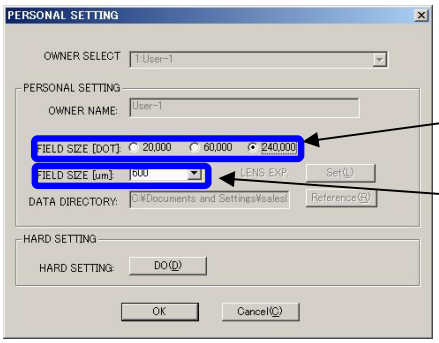
Click the “Configuration” icon.
Configure the chip settings.

2. Click the “OK” button.



A window appeared ask you to confirm if you want to make changes. Click the “OK” button

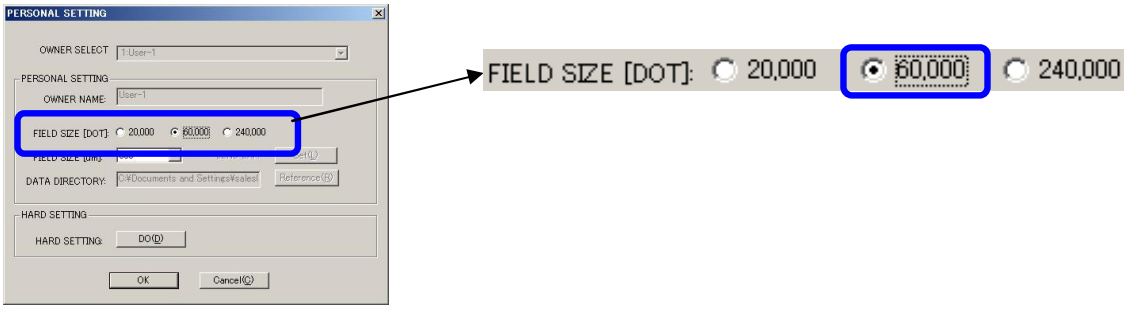
3. The configuration modification window appears. (It is set to the last used settings, so please check the settings.)



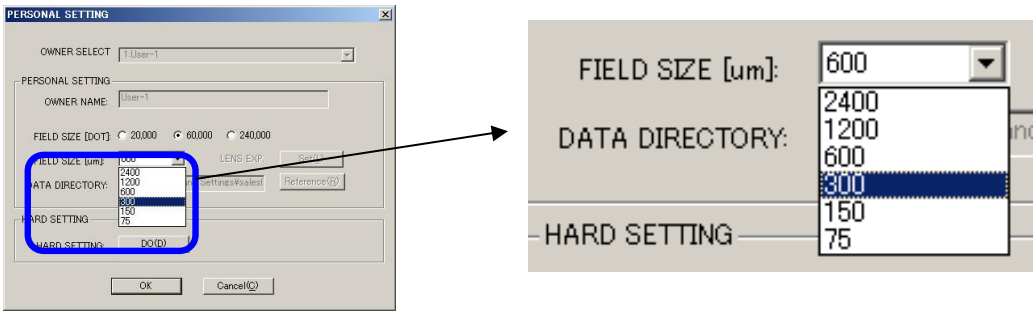
Number of dots

Chip size selection

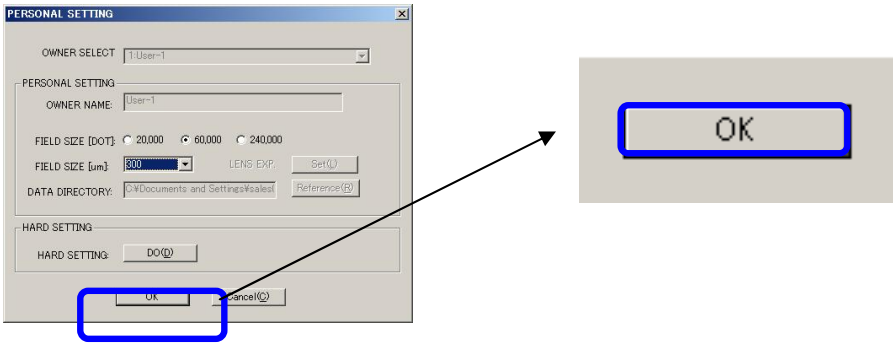
4. Select the chip division of “60,000” into FIELD SIZE[DOT].



5. Click the drop-down list of FIELD SIZE[um], and select “300um”.



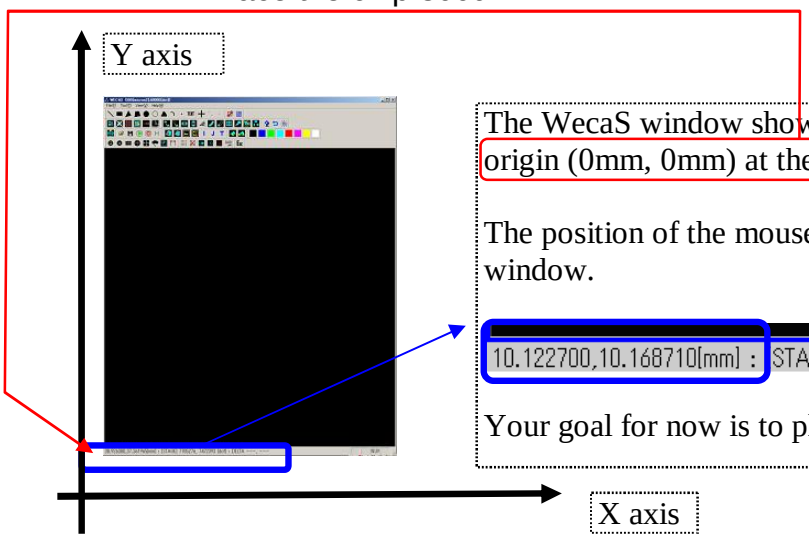
6. Lastly, click the “OK” button.



The chip is set to be 300um and 60,000dots.

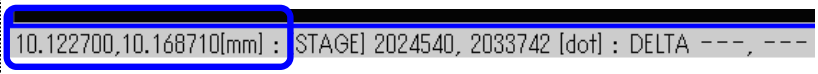
2 Positioning the Chip (300um Chip Positioning)

1. Place the chip 300um.



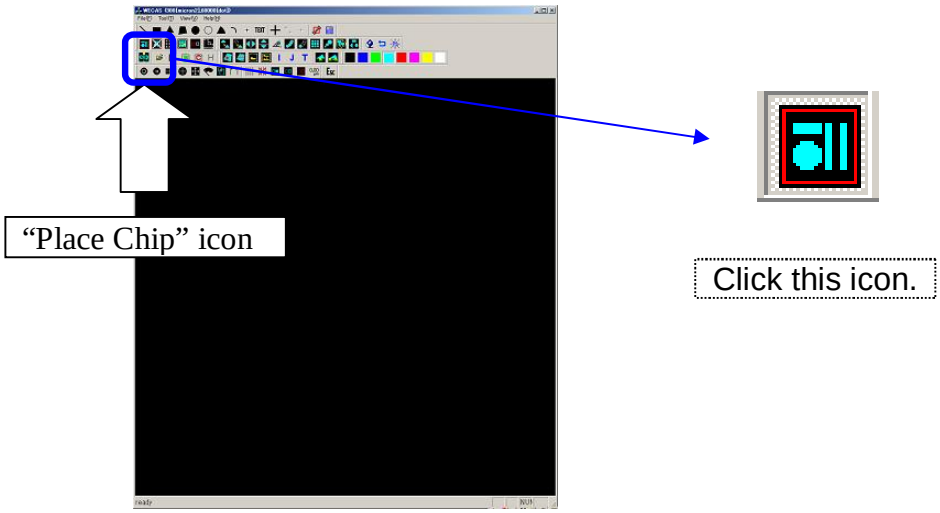
The WecaS window shows an X-Y coordinate system, with the origin (0mm, 0mm) at the bottom left of the window.

The position of the mouse pointer is shown at the bottom of the window.

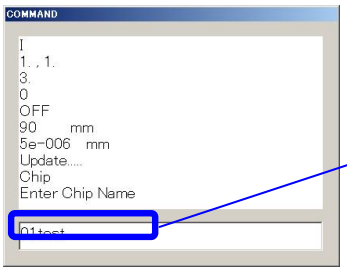


Your goal for now is to place 300um chip at (10.0mm,10.0mm).

2. Click the  "Place Chip" icon.



3. Type chip name in the command entry window.



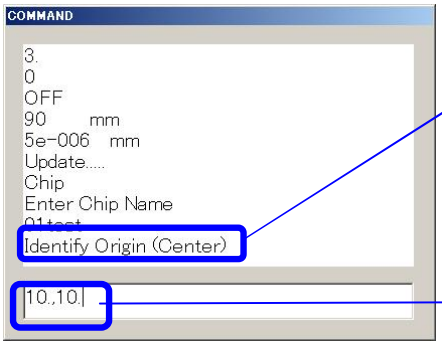
When the "Place Chip" icon is clicked, you are asked to enter the chip name

Enter Chip Name

Set the chip name to "01test" for this example.

Type "01test" in the command window.

4. Type “10.,10.”.



After entering the file name, you are asked to position the field.

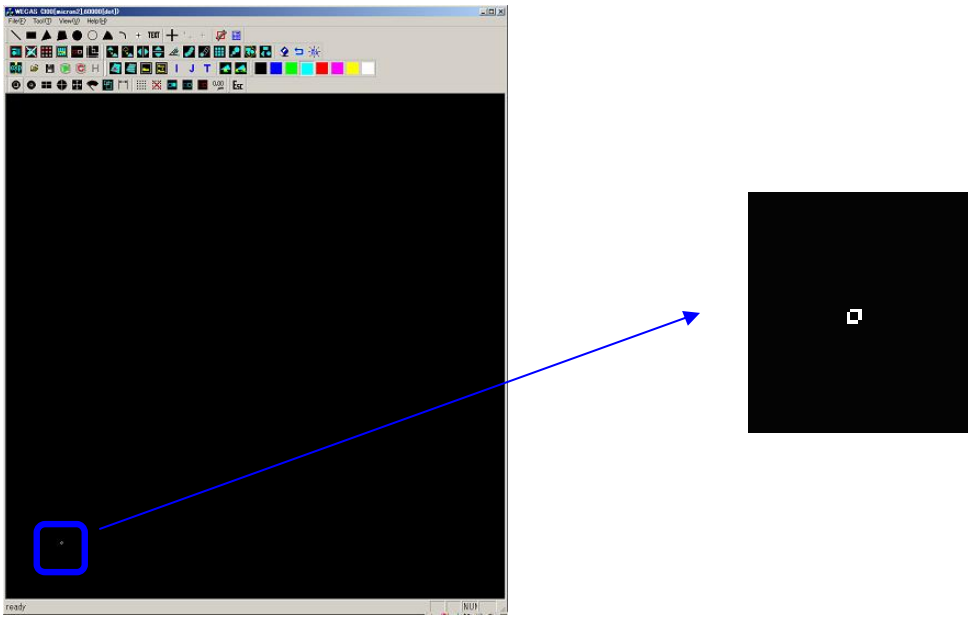
Identify Origin (Center)

You are to place it at (10.0mm,10.0mm), so enter “10.,10.” Placing a decimal point after a number (“.”) indicates “mm”.・

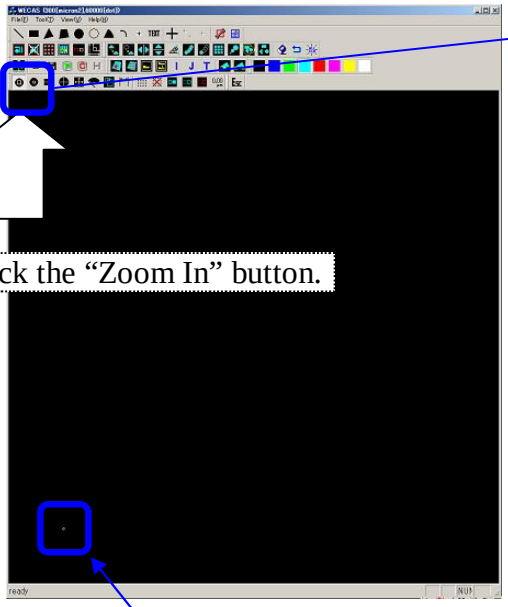
10.,10.

【Note】If no decimal point (“.”) is entered, the system recognizes the entered number as a dot coordinate.

5. The chip at the (10mm,10mm) position appears.



6. Click the  “Zoom In” icon.

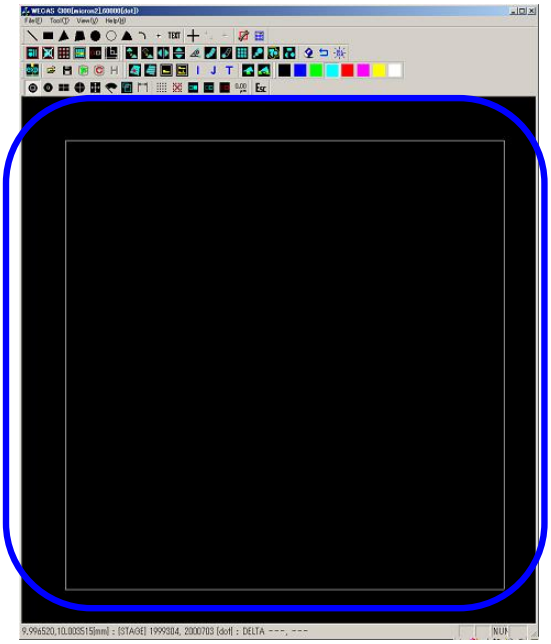


Click the “Zoom In” button.

After clicking “Zoom In” button, click the point where you want to magnify ; thus, click around the chip you placed.

* The “Zoom Out” button  is the right of the “Zoom In” button. Click this to shrink the displayed area.

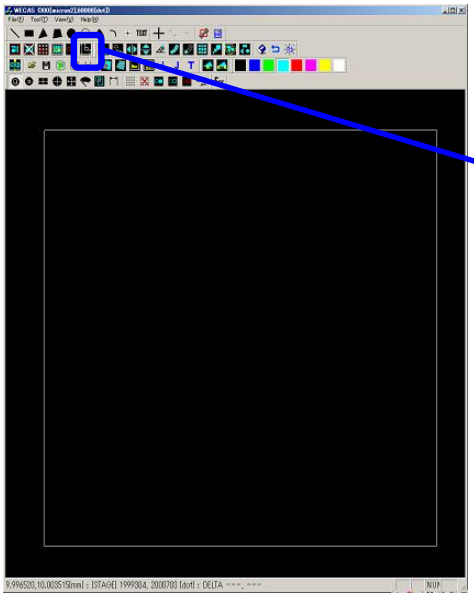
7. Click the chip  in several times to your necessity.



You have to draw object within the square of the chip.

3 Switch the Coordinate System

1. Click the  "Switch Coordinate System" icon.

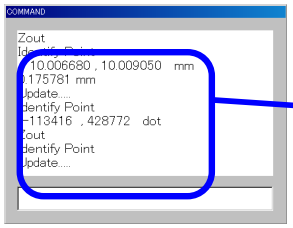


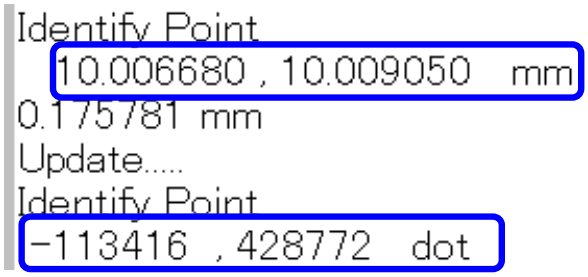
You are to draw objects inside the chip.

Thus, it is convenient for you to switch to the chip coordinate system.

To switch the coordinate system, click the "Switch Coordinate System" icon  .

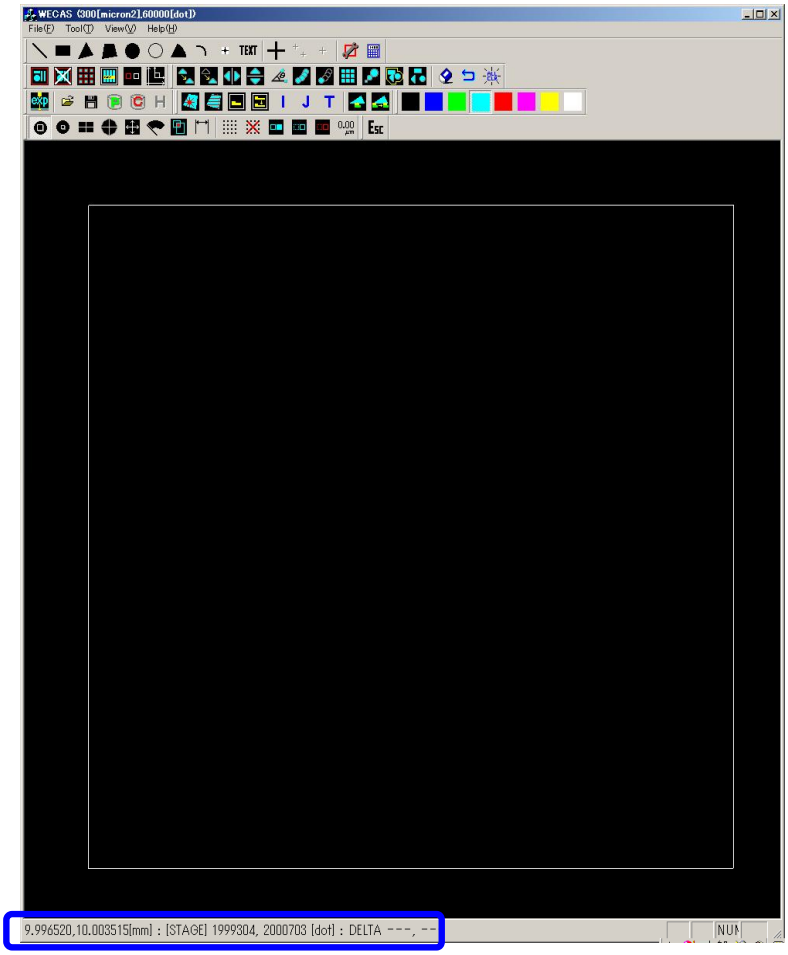
2. The command window shows the updated coordinate system.

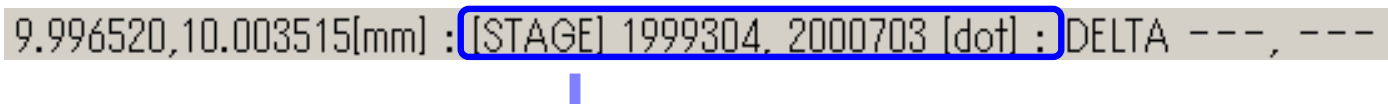




The coordinate information shown in the command window is switched from "mm" to "dot".

3. You can confirm on the WecaS window that the coordinate system has been switched.





The coordinate system display area is switched from [STAGE] (global coordinate system) to [CHIP] (local coordinate system).

4 Create a Pattern (Create a Square Pattern)

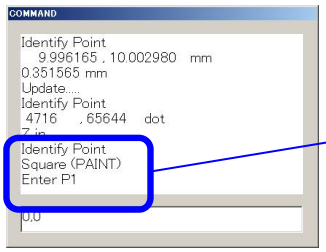
1. Click the  “Square(DS)” icon.

Click this icon.

You have to specify two points to create a rectangular pattern.

In this section, you create Line & Space pattern all over the field by drawing the rectangular repeatedelly.

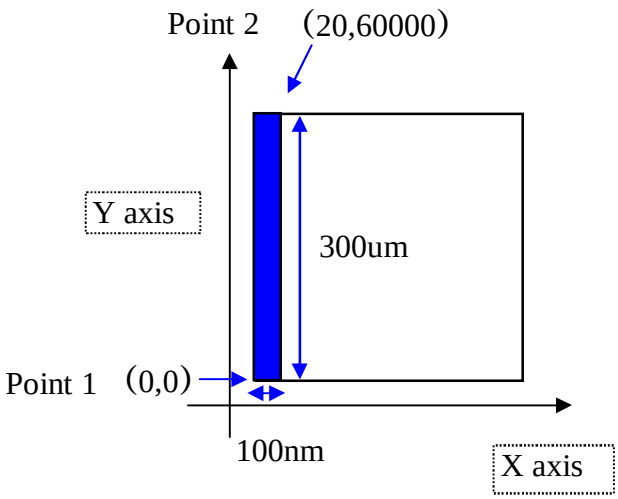
2. Specify point 1



Click the Square icon, and you are asked for the coordinates of the first point in the command window.

Identify Point
Square (PAINT)
Enter P1

Type “0,0”.



300um Chip Coordinate System

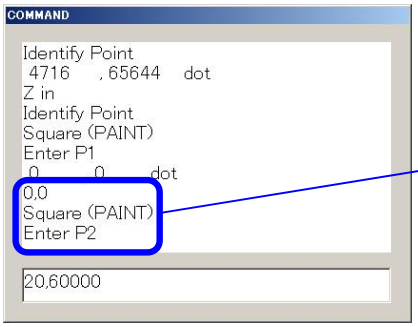
You create the rectangular pattern by specifying the position, on the local coordinate system, of the opposite corner of the rectangle.
Here, you create a 100nm wide, 300um long rectangle, and repeatedly copy it to other positions along the X axis (L&S pitch direction) to create a line and space pattern.

Coordinates are specified in terms of dots, so you must first calculate how many dots are equivalent to the 100nm in length.

300(um) / 60,000(dot)=0.005um (5nm)

Thus, 100nm=20dot.
You can create a 100nm x 300um rectangle by creating a rectangle 20dots wide and 60,000dots long.

3. Specify point 2

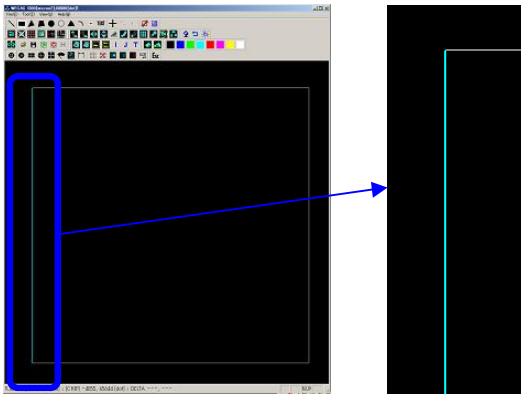


After you enter the coordinates of point 1 of the rectangle, the system asks you for the coordinates of point 2.

Square (PAINT)
Enter P2

Type “20,60000”.

4. A rectangular pattern is displayed in the WecaS window.

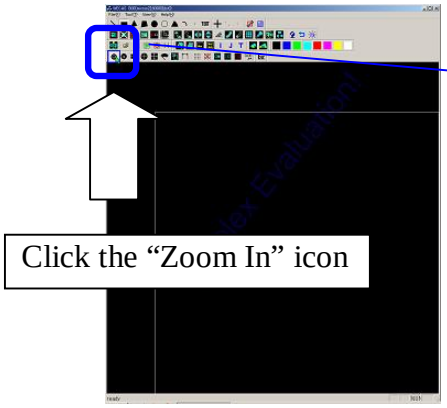


The rectangular pattern in Cyan is very small.

[Reference 1] The  icon
This is the “Undo” icon. This button is used to undo that immediately preceding figure operation, returning to the state before the operation was performed. For example, if the  icon were used to make a rectangle of a different size, the  icon could be used to undo the rectangle creation. This icon can not be used to undo chip operation commands.

[Reference 2]Cancelling icons
In order to discontinue the current command, type “!” .

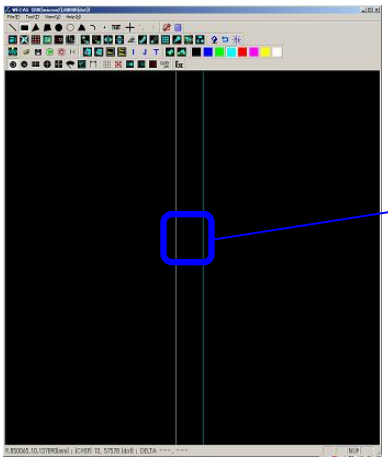
5. Click the  “Zoom In” icon.

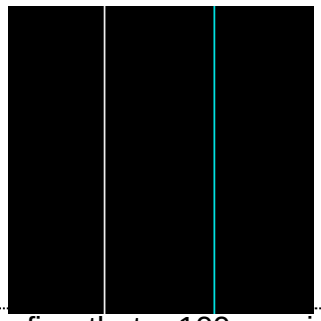


Click the “Zoom In” icon

Click the “Zoom In” icon again to confirm the rectangle pattern you have drawn.

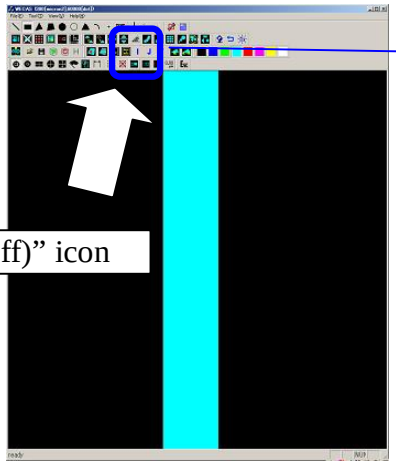
6. Repeat this process until the rectangle object becomes sufficiently large.





You can confirm that a 100nm wide pattern has been created. To make the object seen easily, fill in the patttern.

7. Click  “Paint On/Off” icon.

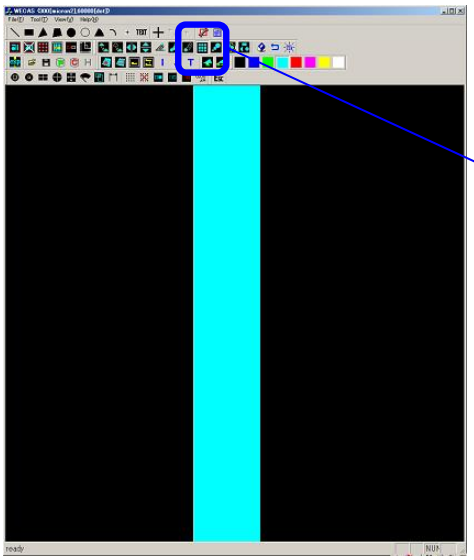


“Paint (On/Off)” icon

Click the “Paint (On/Off)” icon.
The pattern is filled with the Cyan color, making it easier to see. You can confirm the colored-in pattern.

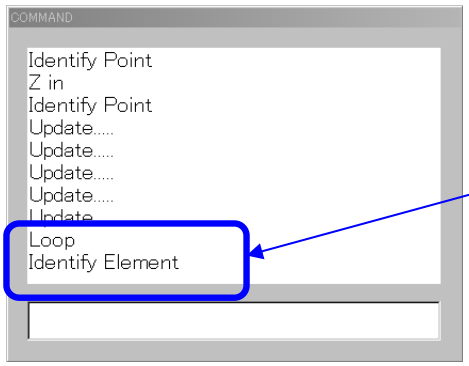
5 Create a Pattern (Copy the Pattern)

1. Click  “Copy Matrix” icon.



The 100nm wide, 300um long line created is to be copied as one-dimentional matrix across the entire 300um x 300um chip. The icon used to copy the figure as a matrix is the  icon.

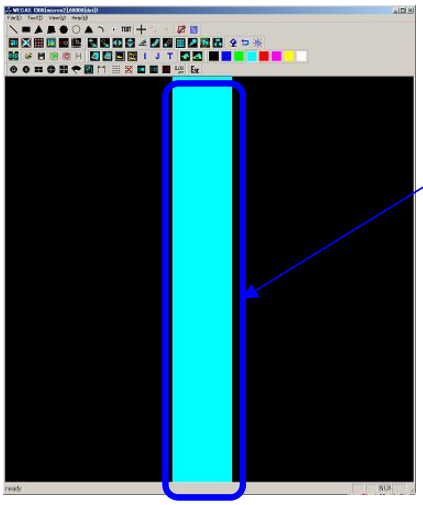
2. Enter conditions required for matrix copy command



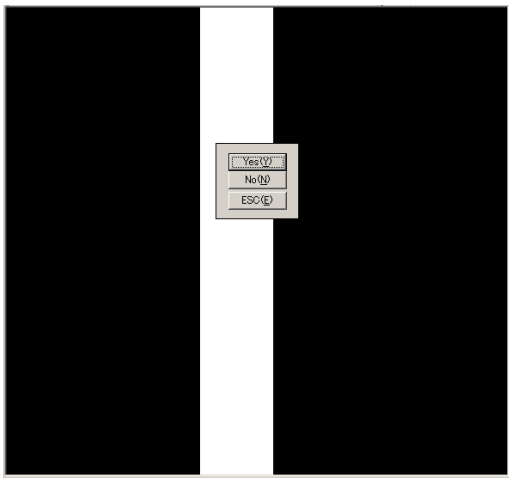
Loop
Identify Element

Identify and click the 100nm wide, 300um long line you have created.

3. Click the rectangle pattern you have created.



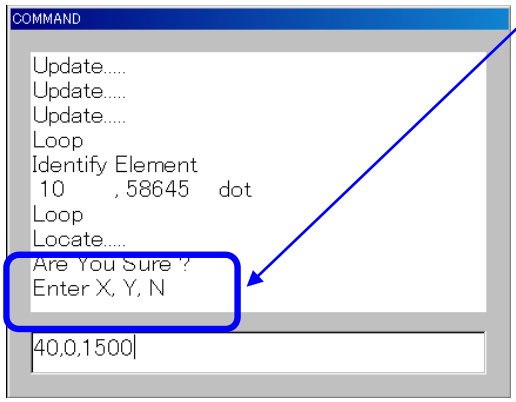
4. Click the poped up Yes(Y) “Yes(Y)” button.



After you click the object in Cyan, it turns white, and you are asked to confirm that this is the object you want to copy.

Click the Yes(Y) “Yes” button.

5. Type “40,0,1500”.



You are asked to enter parameters ;

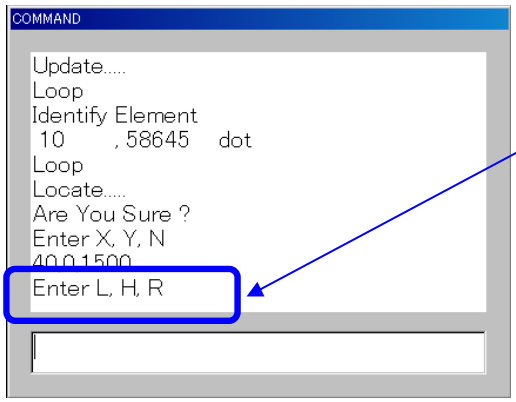
Enter X, Y, N

The parameters are ;
- X: Pitch in X direction (specify in dots or mm)
- Y: Pitch in Y direction (specify in dots or mm)
- N: Number of copies (including the copy source)
  N>=1

In this example:
- The X direction pitch is 200nm (40dots or 0.00002mm)
- The Y direction pitch is 0
- The number of copies is: 60000(dot)/40(dot)=1500

So you should type “40,0,1500” or “0.00002,0,1500”.

6. Press the “Enter” key.



Next, you are asked the size of the object if you want to change the size of the copied objects.

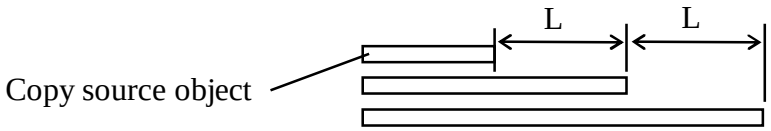
Enter L, H, R

You do not need to change the size of the objects for this patterning example, so press “Enter” without typeing any other values.

For reference, the parameters are as below.
- L: Scanning length adjustment
- H: Scanning width adjustment
- R: Radius adjustment

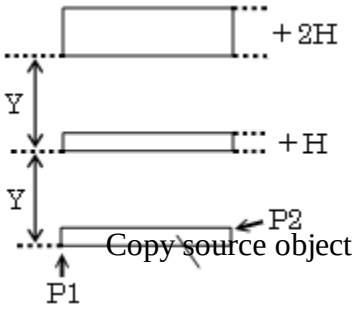
■ L: Scanning Length Adjustment

The entered value (L) is accumulated to the length of copied objects. (See the figure below.)
Either positive or negative value can be entered. For straight lines, the value is added to the scan direction length each time a copy is made. For rectangles, the value is added to the X direction length each time a copy is made. This can only be used for straight lines or rectangular figures.

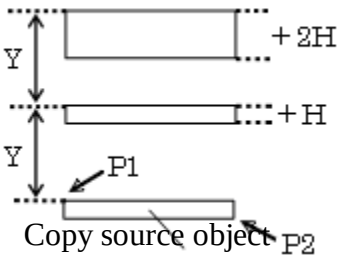


■ H: Scanning Width Adjustment

As with L, the entered value (H) is accumulated to copied objects. (See the figure below.)
The entered value (H) is added to the Y direction.
Negative value may also be used, but H can only be used for rectangle figures. There are two possible adjustment patterns, shown below. The pattern used depends on how the second point's coordinates (P1,P2) were specified when making the rectangle being copied.

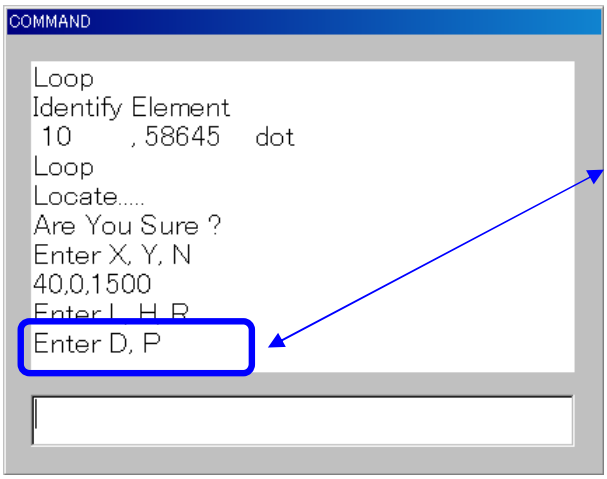


When P1(Y)<P(2)



When P1(Y)>P(2)

7. Press the “Enter” key.



After copying the matrix, if the object being copied is an arc or circle, you are asked if you want to change the size of the object.

Enter D, P .

The object being copied in this example is a rectangle, so press “Enter” without entering any other values.

For reference, the parameters are as below.

- D: Draw start angle adjustment
- P: Scan pitch adjustment

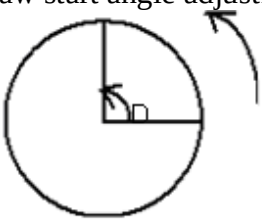
■ R, D, and P

These only apply to arcs and circles when it is using CPG hardware (option). When using the CM command on standard figures, you are not asked to enter values for them.

- R: Radius adjustment

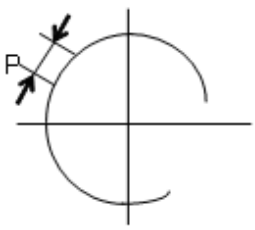
The radius is adjusted by R for each copy.

- D: Draw start angle adjustment

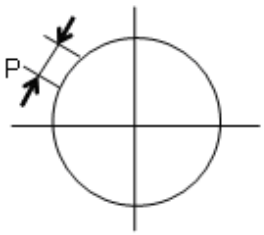


This parameter is only used for arcs.
Values are entered in deg. Resolution values can be entered in increments of 0.1degree The draw start angle is adjusted by D(degree) for each copy.
Negative values cannot be used.

- P: Scan pitch adjustment



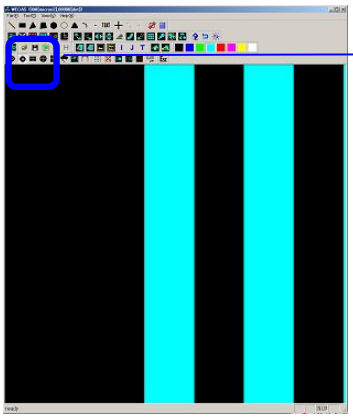
【Arc】



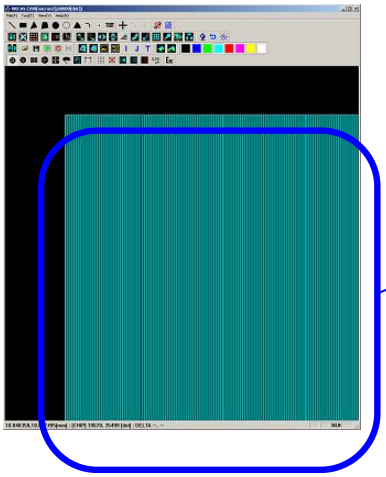
【Circle】

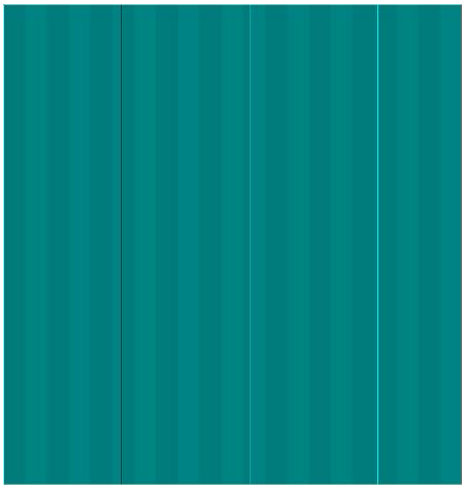
The minimum pitch increment is 1. The scan pitch is adjusted by P for each copy.

8. Line & Space pattern has been created, so zoom out to see the entire object.
Click the “Zoom Out(O)” icon.



In order to view the line and space pattern you have created, click the “Zoom Out” icon and click several times on the pattern.

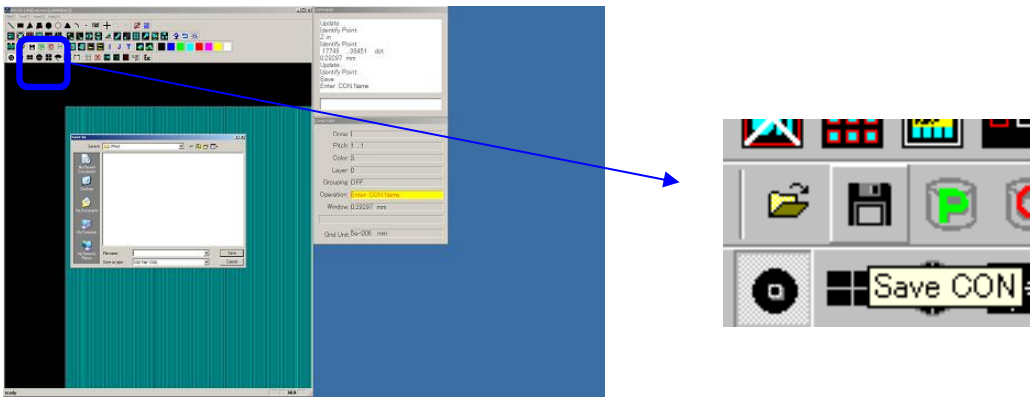




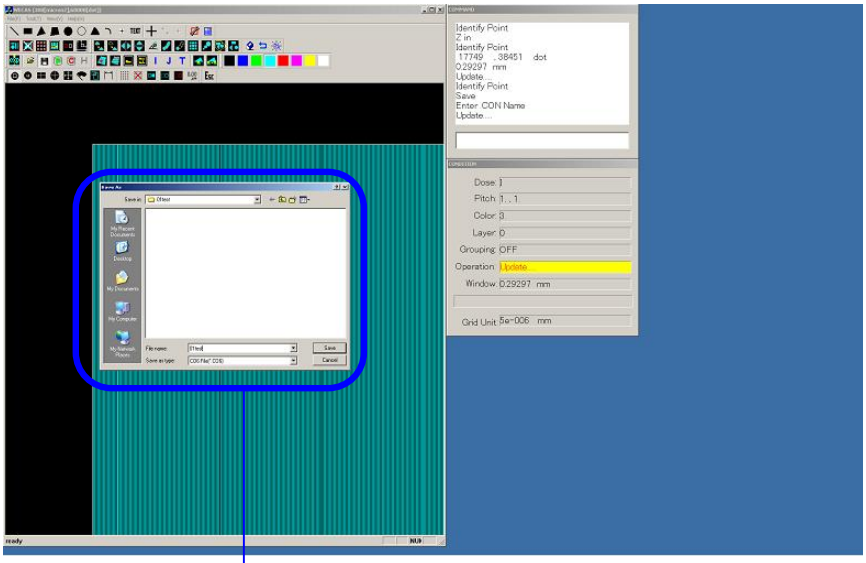
You can confirm that the entire 300um x 300um chip now contains a 200nm pitch, 100nm line width pattern of lines and spaces.

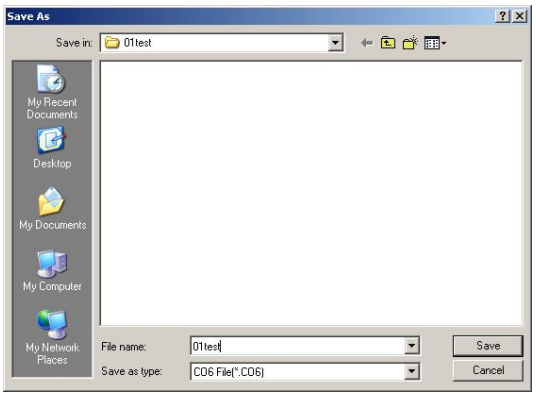
6 Save Data

1. Click the “Save” icon to save the data you have created.



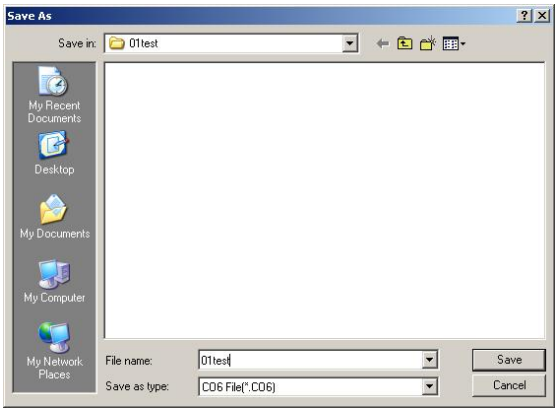
2. The “Save As...” window appears.



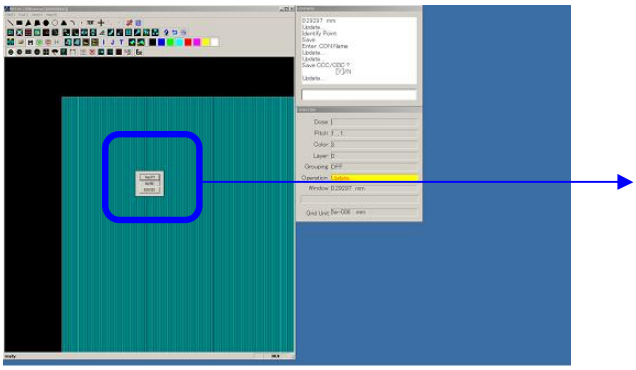


The “Save As...” window appears.

3. Type the file name. For this example, type “01TEST”. And click save button.

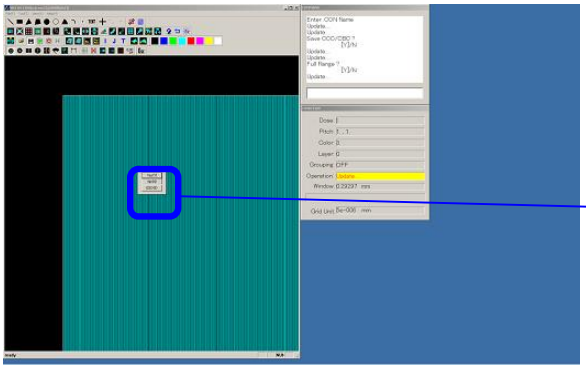


4. Click Yes on the pop-up menu.



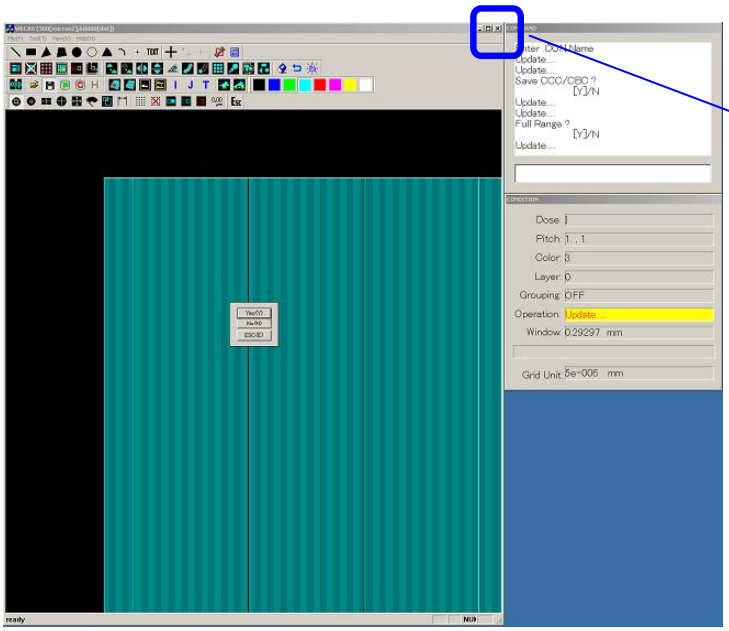
Click the “Yes(Y)” button.

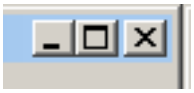
5. Click Yes on the another pop-up menu.



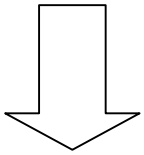
After clicking the “Yes(Y)” button, another confirmation window appears. Click the “Yes(Y)” button again.

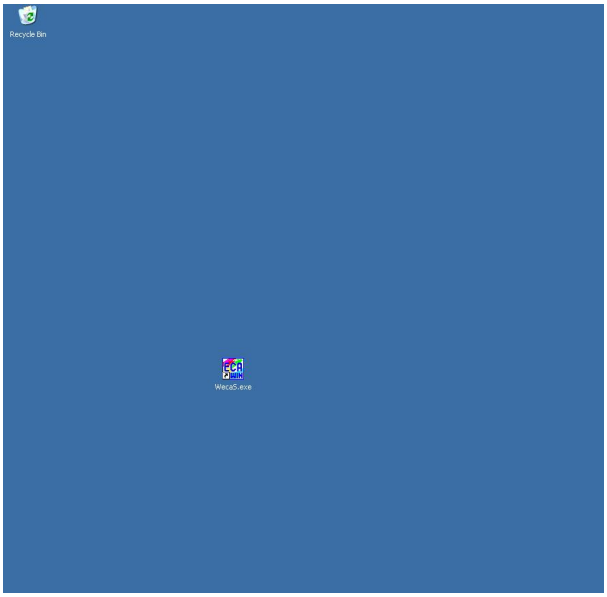
6. Lastly, click “Exit” to shut down the program.





Click the “Exit” button to shut down the program.





1. Transmission Errors

When starting WecaS program on ECA PC, you might come across that sand clock icon keeps showing up and you never see the program window. In that case, it is possible for ECA PC to have transmission errors toward sub ECA PC.
Solution is given as follows. Shut down the program on the ECA PC, and reset the sub ECA PC. Wait about one minute, and then start the WecaS again. If you cannot close the program, etc, use the Task Manager to force the WecaS program to shut down.

■Commands and Procedure
Press the Ctrl, Alt, and Del keys simultaneously.
↓
The “Windows XP Security” window appears.
↓
Click the “Task Manager” button.
↓
Click the “Processes” tab. A list of all current processes is displayed. Look for the “WecaS.exe” process.
↓
If you find it, highlight it with the mouse, and right-click, without moving the mouse. Select “End Process” on the pull-down menu that appears.

The WecaS program is force-quitted.

2. Multiple Process Error

Sometimes, when attempting to start the WecaS program, you may be presented with a message saying, “The program is already running. Multiple instances of the program cannot be run simultaneously.” The WecaS program you are trying to does not start because it indicates that the WecaS program is already running. When this occurs, as with (1) above, use the Task Manager to shut down the instance of WecaS that is already running.

●Number of chip divisions - Guide line
240,000dots division: Used only for special situations.
20,000dots division: This is rarely used now.
This has been included for customers using older models.

●Chip settings and division settings
Customers who have not used this system in the past are recommended to configure the system to use a 300um x 300um chip, with 60,000 x 60,000dots division.
If, during the course of design work, these settings are found to be inconvenient from an optimization standpoint, they can be changed in order to gain a greater understanding of the pattern drawing equipment.

The 300um x 300um chip, 60,000 x 60,000dots division setting is based on the sensitivity of conventional electron beam resists, connection accuracy when connecting figures, and many application examples of this system.