

ELS-7500EX Registration Instruction Manual

**ELS-7500EX TFE
Electron Beam Lithography Equipment
Optional Function**

ELIONIX Inc.

ELIONIX

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1. INTRODUCTION

The ELS-7500EX registration is **an optional function for the ELS-7500EX (TFE Electron Beam Lithography Equipment)** that is designed for position registration relative to alignment marks on the specimen. This document describes the registration (optional feature) for ELS-7500EX.

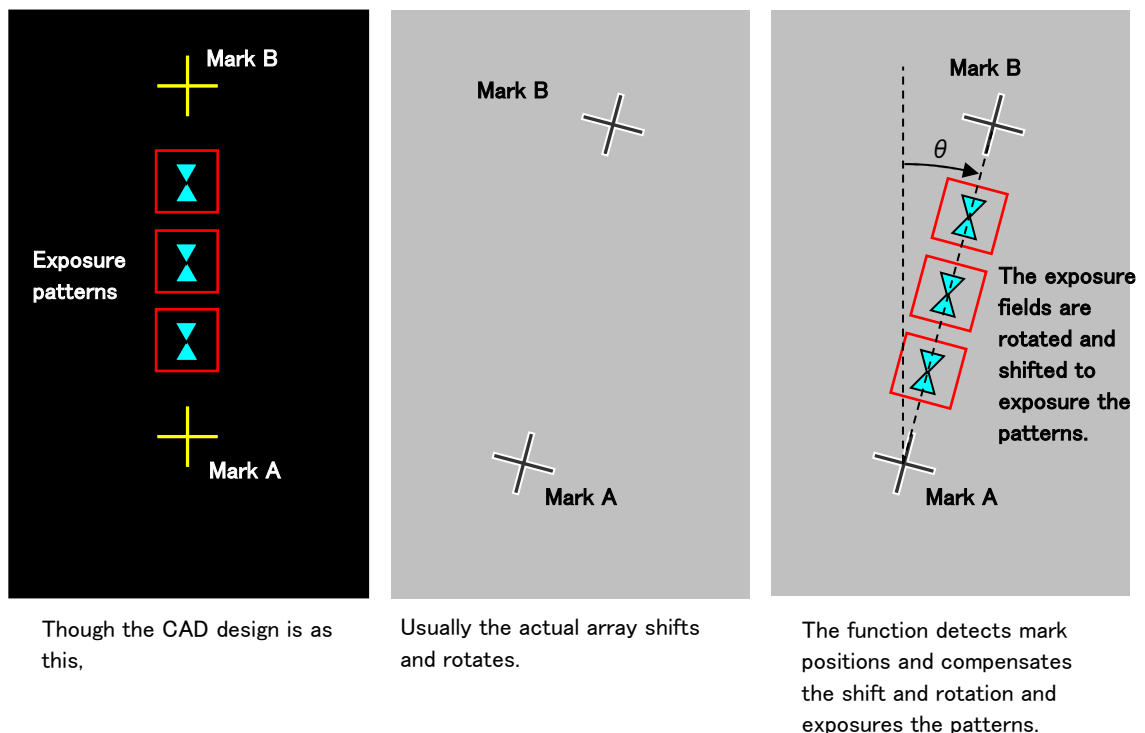
1-1. Principle

Mounting a specimen always involves rotational and positional misalignment. This function corrects the rotational misalignment, determines the amount of positional misalignment, and applies offsets to the stage position for exposure processes.

It is necessary for registration function to fabricate marks for position alignment on the specimen in advance.

Registration is also known as overlay exposure. The specimen is taken out after the first pattern exposure, subjected to some processes, and put back for exposure of another pattern. This function maintains the correct specimen position for the first and second exposures.

The following schematic shows an example of how the 2 marks' registration function works.



1-2. Kinds of Registration

There are 3 kinds of registration as follows. Choose desirable one according to your purpose.

1. Reg-2

A registration using 2 marks. It is a relatively simple registration though it does not include scale correction function. It has tendency that the more an exposure position get away from a mark A, the more the shift error increase.

The already shown schematic is an example of Reg-2 registration.

2. Reg-2 + Reg-4

A registration using one or plural Reg-4 marks with Reg-2 registration simultaneously. It corrects writing position with high precision around each Reg-4 mark neighbors.

You can place many Reg-4 marks around positions requiring high precision alignments.

Reg-4 registration must be used with Reg-2 registration. A Reg-4 mark without Reg-2 registration does not work.

3. Scale Correction (or "S Correction")

"S Correction" uses 4 alignment marks, A, B, C, D mark. The overlay alignment precision is higher than Reg-2. Because "S Correction" corrects the exposure position by the 4 marks position and scale too while Reg-2 corrects only A mark position and the angle of A-B connected line and does not correct the scale.

"S Correction" has tendency that the more an exposure position gets away from each mark, the more the shift error increases.

1-3. Registration types

Two modes of registration operations are provided: auto and manual. They should be selected according to the intended search mode.

1. Auto registration

Searches for marks automatically. Successful mark search depends on the mark lift-off condition. The Au lift-off marks should be in good condition.

2. Manual registration

Searches for marks manually. The operator manually operates the SEM GUI to make a registration by aligning a SEM image with a cross mark. Because the operator searches for marks, worse mark lift-off conditions are tolerable. The lift-off marks may be made of any material if they are identified on the SEM image.

3. SEMI-Auto registration

A combination of Auto and Manual Registration. You can use this in case where Reg-2 or "S Correction" is specified.

At first round the mark search is manual mode and the operator must align the mark by SEM image observation. At the second and following rounds the mode automatically switches to auto mode and the rest alignments will be done automatically.

1-4. Notes

Note 1

In registering two patterns, the first and second exposures must be done under the same conditions (beam current and accelerating voltage). A difference in beam conditions leads to a slight difference in scan amplitude (exposure size). This deserves your attention

because the ECA exposure control unit does not have a correction mechanism for such variance.

2. REG-2

2-1. Method

The Reg-2 function uses a pair of marks (A and B, hereafter referred to as REG marks) to perform the following operations.

1. Specimen rotational misalignment correction (REG-2)

Searches for marks A and B placed on the specimen, calculates the rotational misalignment from the detected actual position, and operates the stage rotation to correct the rotational misalignment. This makes the positional relationship between marks A and B on the specimen identical to that on the CAD data.

2. Positional misalignment calculation (REG-2)

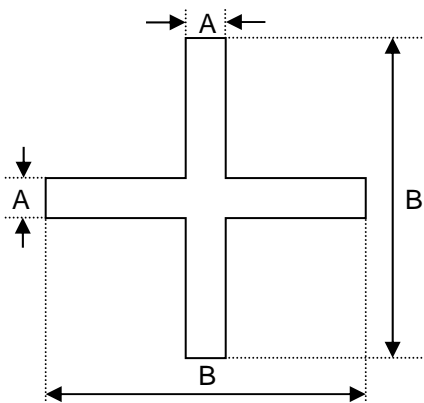
Calculates the difference between the detected actual mark A position and the position specified on the CAD data as an offset value. This value is added to the CAD design values of the stage position when the exposure field is positioned.

2-2. Requirements for Reg-2 Mark Shape

This section describes the dimensional requirements for registration marks. Since marks are identified visually in manual registration, read the following as a reference.


In the case of auto registration, you can select either cross mark type or disk mark type. In many cases, the disk mark type allows higher precision of overlay exposure, though it depends on the finish of the mark.


(1) Reg-2 marks (auto registration , cross mark type)



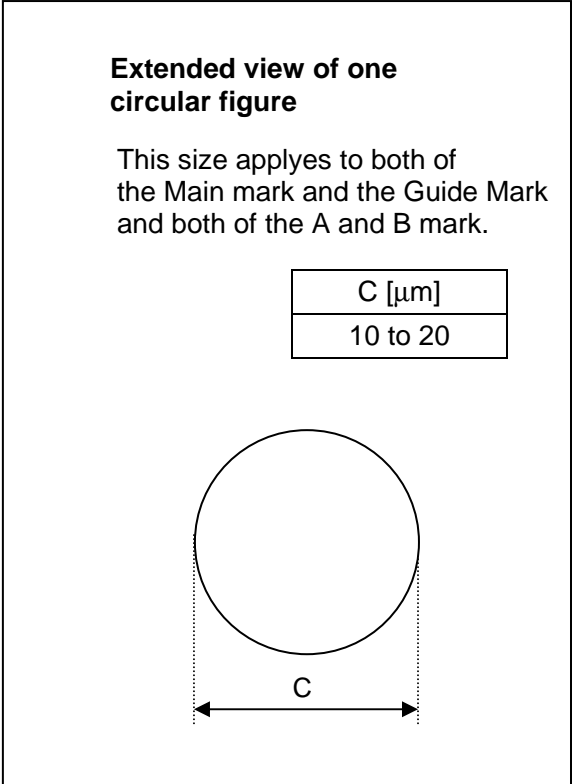
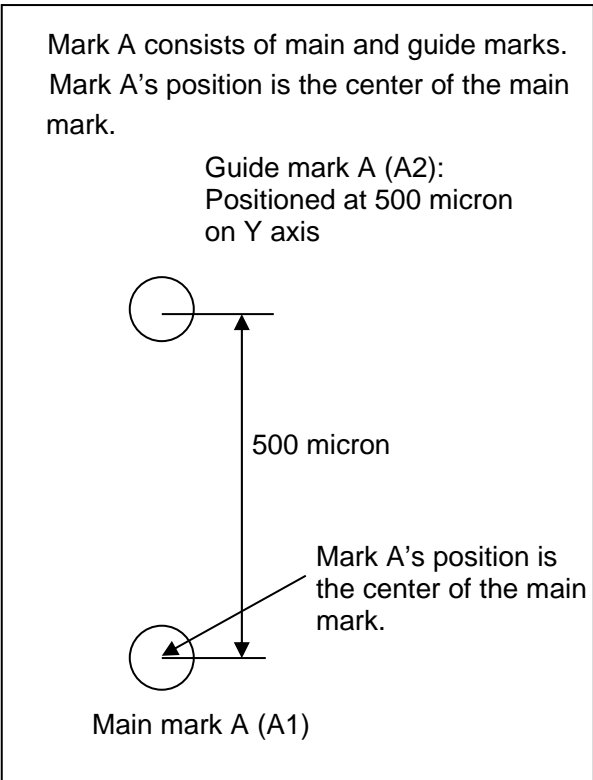
A [μm]	B [μm]
10 to 30	60 to 600

(2) Reg-2 marks (auto registration, disk mark type)

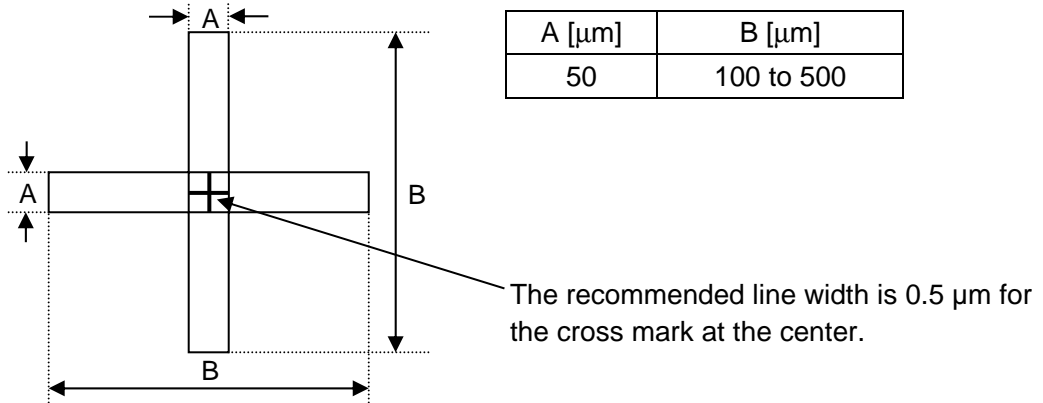
 Mark B consists of one circular figure. The mark's position is the center of the figure.

 Mark A consists of two circular figures.

Extended view of mark A



(3) Reg-2 marks (manual registration)



Note) There are no requirements for the shape of manual registration marks.
The figure above is an example for your reference.

2-3. Requirements for Reg-2 Mark Placement

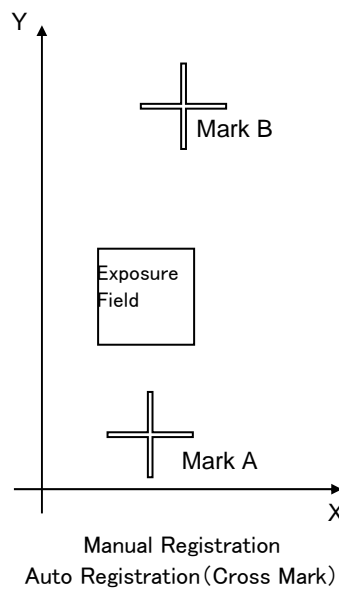
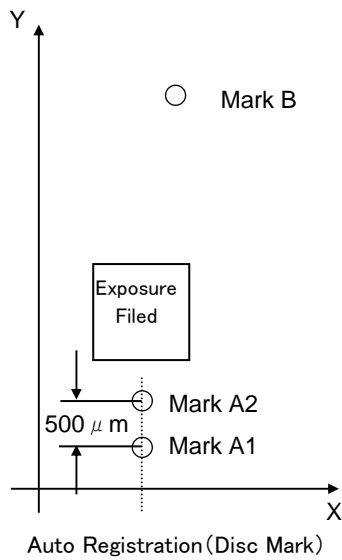
This section describes the requirements for mark placement.

Disc Mark Auto Registration use 3 marks of A1, A2 and B while Cross Mark Auto Registration and Manual Registration need not A2 mark.

Y coordinate of A \leq Y coordinate of B

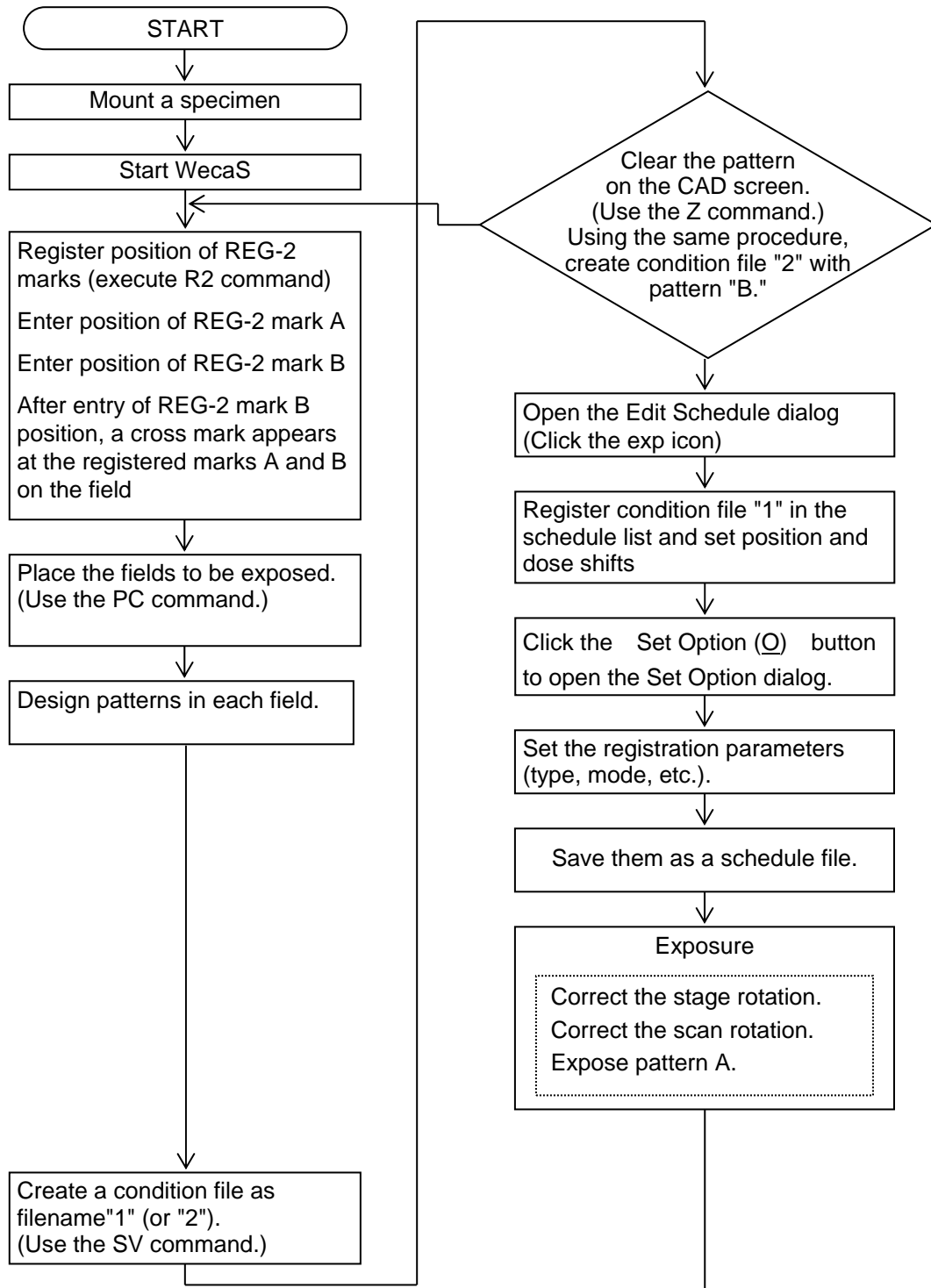
X coordinate of A1 = X coordinate of A2

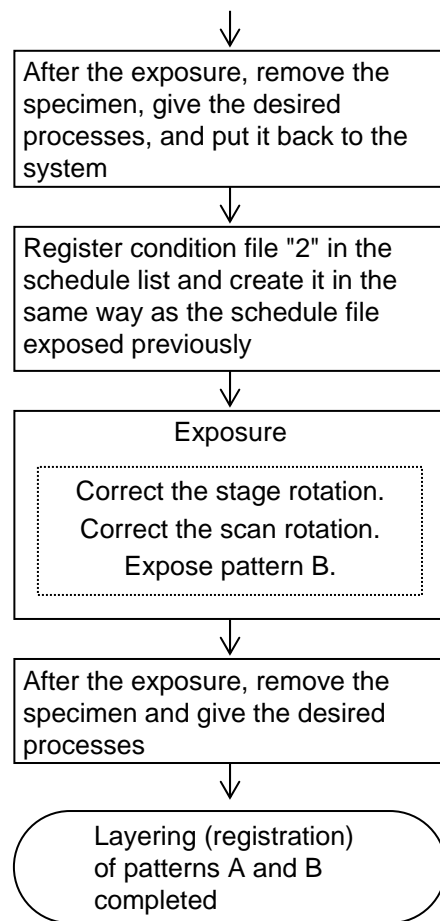
Y coordinate of A2 = Y coordinate of A1 + 500 micron



2-4. PROGRAM OPERATION

Section 1-1 gave an outline of registration operation. This section provides an exposure process flow using general registration. Assume that the operator has already prepared registration marks on the specimen and knows their positions. Patterns A and B are those to be layered in the following exposure process.





2-5. Operation on the CAD Screen

On the WecaS CAD screen, mark positions (REG-2 marks) are registered in an exposure file (condition file) for registration. Commands used in registration are described below. For information on other commands, refer to the ELS-7500EX Instruction Manual.

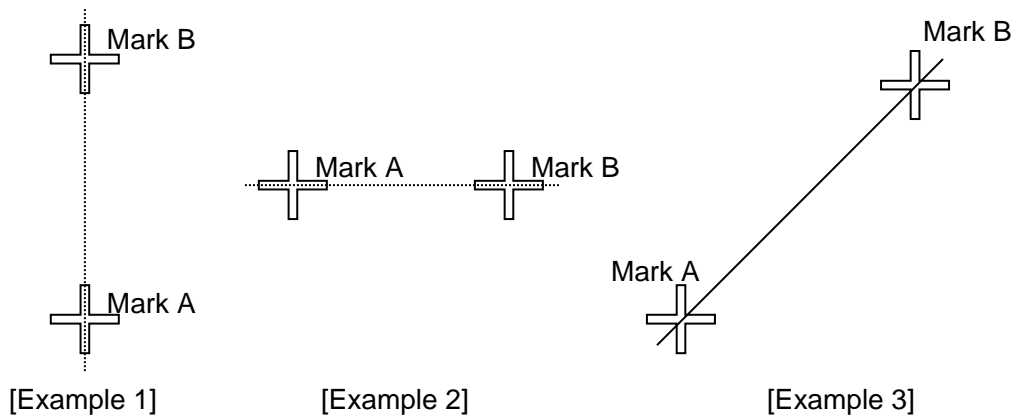
2-5-1. R2 command

Function

Registers the positions of a pair of alignment marks (REG-2 marks) used for (auto/manual) registration. Alignment mark A must be registered earlier than mark B, and their coordinates must satisfy the following condition.

$$Y \text{ coordinate of mark A} \leq Y \text{ coordinate of mark B}$$

(See the figure below.) When you input the positions of marks A and B, white cross marks as large as the field appear. Be careful not to mistake them for an exposure figure displayed in white.



Operation

- a) Type R2 or click the Reg-2 icon (see the following figure).



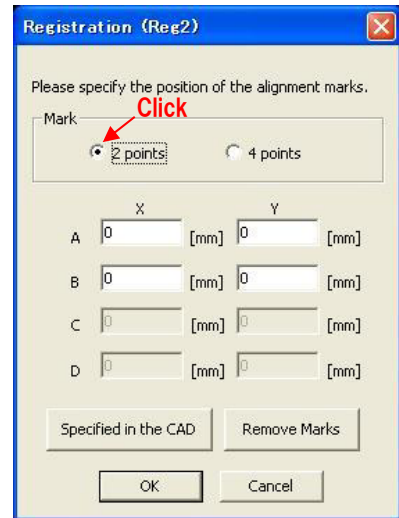
- b) The “Registration (Reg-2)” dialogue window appears.

It is shown as the right image.

The only A and B coordinates are available to input if you click “2 points.”

Input mark positions with mm unit.

- c) Press “OK” and a pair of Reg-2 Mark will appear.
- d) The marks will disappear if you press “Remove Marks” button in the “Registration (Reg-2)” dialogue window.
- e) Press “Specified in the CAD” in the “Registration (Reg-2)” dialogue window if you want to use the “COMMAND” dialogue to specify the mark positions.



2-6. Operation on the Edit Schedule Dialog

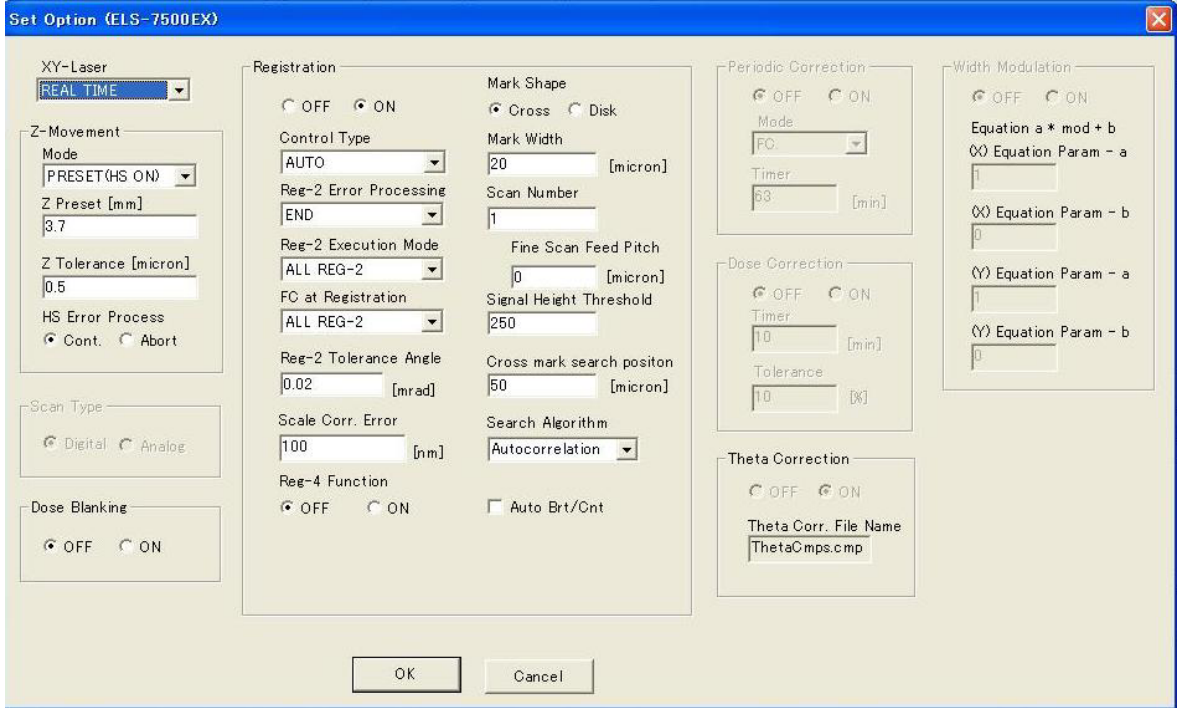
On the WecaS CAD screen, you will create a condition file containing registered marks and execute registration exposure on the Edit Schedule and subsequent dialogs.

2-6-1. Creating a schedule file

Create a schedule file as in ordinary exposure. Registration exposure requires that Reg-2 mark positions are registered in the condition file. For procedure for registering registration marks, see the previous section.

2-6-2. Setting exposure conditions

On the Edit Schedule dialog, click the **Set Option(O)** button to open the Set Option dialog. A window as shown below appears.



In this dialog, you will set the following items.

OFF / ON

Select a registration mode. Select N or Y

ON :Registration is not performed. Even if marks are registered in the condition file, they are not preformed.

OFF :Performs Reg-2 operation for all the condition files with registered marks on the schedule list.

Registration Control Type

Select auto or manual registration. Select AUTO, MANUAL and SEMI-AUTO.

AUTO : Searches for marks automatically.

MANUAL : Searches for marks manually.

SEMI-AUTO : The 1st Round is Manual Searches and the 2nd and following rounds are Auto Search about Reg-2 and "S Correction".

Caution:

1. Only 1st pair of the mark can perform SEMI-AUTO registration. The 2nd and following pairs of marks perform always AUTO registration.
2. Reg-4 is performed always as Auto even though this is selected.

Registration Error Processing

When an error occurs at the registration alignment,

CONFIRM – require the operator what to do

SKIP – skip the alignment and the following exposure and go to the next alignment if it exists.

END – terminate the exposure.

Reg-2 Execution Mode

Registration turns a fie

1ST REG-2 ONLY : Registration alignment is performed at the only 1ST pair of mark even though the schedule file includes plural registration pairs.

All exposures positions are corrected using the 1ST mark alignment result.

ALL REG-2 : Registration alignment is performed at the only 1ST pair of mark even though the schedule file includes plural registration pairs.

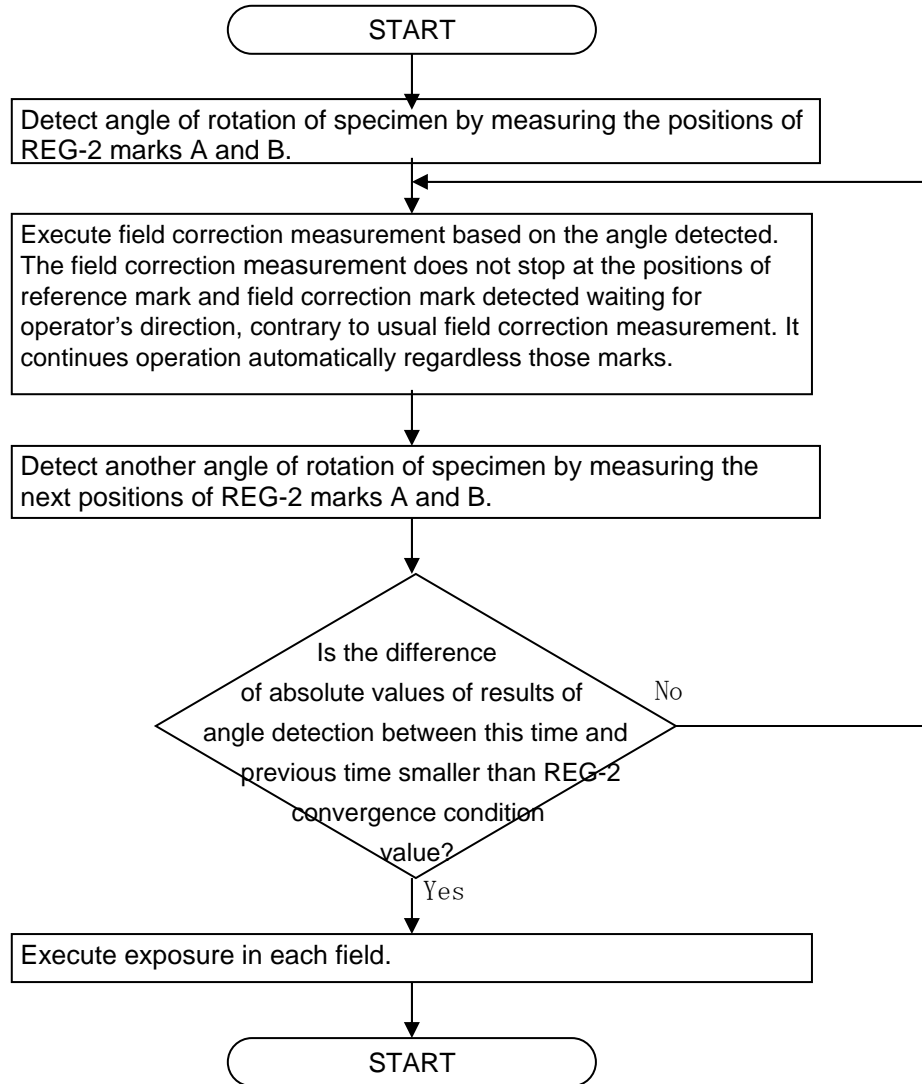
All exposures positions are corrected using the latest mark alignment result.

FC at Registration

Registration turns a field based on the angle of rotation of the specimen detected in the measurement of marks A and B. You can select here to set the detected angle in SRT (Scan Rotation Unit) of the equipment directly or to do field correction based on the angle of rotation.

NO: No field correction is done. The angle detected in the measurement of marks A and B is set directly in SRT (Scan Rotation Unit). The verification of angle of rotation, which is done in the filed correction measurement, is not done here. So, some error may be caused in the angle of rotation of the field.

ALL REG-2: The field correction measurement is done every time an angle is detected at each REG-2 mark. This flow is shown below:



1ST REG-2 ONLY: Executes the field correction measurement only when the angle of rotation is detected at the first REG-2 marks.

JUDGEMENT: The same as “ALL REG-2” currently.

Reg-2 Tolerance Angle [mrad]

Relevant only if execution of field correction measurement is directed by the setting of **FC at Registration**. The angle of rotation of specimen is detected by the REG-2 marks A and B, and the result of detection is compared with that of the previous detection. If the difference of the absolute values of detection results between two measurements is smaller than the value set in “**Reg-2 Tolerance Angle [mrad]**”, then registration measurement completes and exposure begins. The smaller is the value set, the higher precision can be expected for the overlay exposure. The smaller value, though, may lead to longer time for registration measurement or unfinished measurement. So, specify a proper value. The unit for setting, [mrad], stands for “milli-radian”. Specify 0.02 milli-radian usually.

Scale Corr. Error

Only valid in case of Scale Correction (“S Correction”). Consult the “Scale Correction (“S Correction”) explanation.

Reg-4 Function

Set ON in case of using Reg-4 function with Reg-2 registration. Reg-4 marks must be included in the condition file. A Reg-2 registration exposure will be performed without Reg-4 function if this selection is set OFF even if the condition file includes Reg-4 marks.

Mark Shape

Selection of the shape of the mark used for auto registration. For auto registration, you can select either of two types of mark, cross mark type or disk mark type. Specify one of them here. For manual registration this selection is meaningless.

Cross – Using cross marks

Disk – Using disk marks

Mark Width

Specifies the dimensions of registration marks.

The width of an arm in case of cross marks.

The diameter in case of disc marks.

A mark cannot be recognized and an error occurs if the difference between the specified value and the actual size is too much.

Scan Number

Scan Number ≥ 1

The number of mark scan of auto registration. The alignment precision may get better by increasing this number in case of the SED signal includes much noise.

Fine Scan Feed Pitch

1 to 60,000 [dot]

The pitch between 2 scan in case of 2 or more scans is specified in the “Scan Number.”

Signal Height Threshold

Valid only in case of selecting “Threshold” or “Differential” in the latter mentioned “Search Algorithm.”

Cross Mark Position

Valid only in case of cross mark auto registration. The mark search scan distance from the center of a mark.

Search Algorithm

Valid only in case of auto registration.

Threshold : A mark is recognized by binarizing the SED signal with the “Signal Height Threshold” value.

Autocorrelation : A mark is recognized at the center position of symmetrical SED signal distribution.

Differential : A mark is recognized with differential waveform. The maximum and the minimum position are assumed as 2 edge positions of a mark.

ACB Brt / Cnt

Using ACB function or not setting. "ACB" means "Auto Contrast Brightness" function.

Checked – Uses ACB function. Actually only contrast is be adjusted. Brightness is never changed. You set brightness 200 before performing an exposing with "Auto" registration.

No Checked – Does not use ACB function.

2-6-3. Saving a schedule file

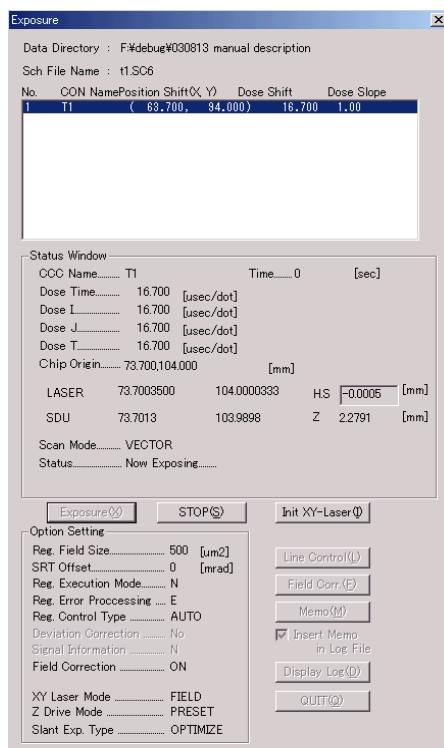
When you create a schedule list and set exposure conditions, save a schedule file.

On the Edit Schedule dialog, click the **Save Sch(S)** button to open the Save As dialog. Enter a file name and save the file.

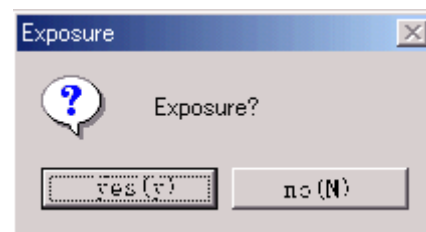
2-6-4. Executing exposure

When the SEM GUI is ready for operation, select EXP PC again. To start registration exposure, use the same procedure as for ordinary exposure. To do so, click the Exposure button in the Exposure dialog, then select Yes in the Confirmation window.

Exposure dialog



Confirmation window



2-6-5. Selecting SEM GUI

After activating Exposure with EXP PC, change to SEM GUI.

2-6-6. Registration flow

This section describes the procedure and operation for registration exposure using a flowchart. The following flow assumes that Exposure has been activated with EXP PC, then SEM GUI selected again.

Unless otherwise noted, the following description assumes that all operator actions take place in the Exposure dialog of the SEM GUI. In addition, messages are output to the Exposure dialog.

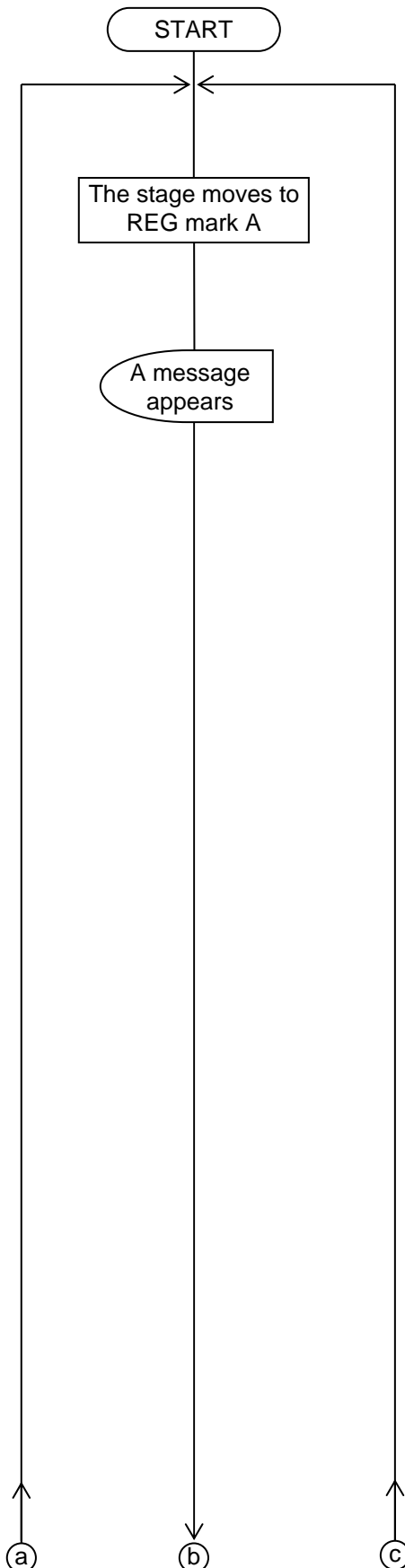
Notation

[P] Program action

[O].... Operator action

[D].... Message output to Exposure dialog.

A. Auto registration



In the flowchart shown at the left, START is the point of time at which the operation to select SEM GUI (described in 2-6-5) has completed.

[P] Move the stage to the registered REG-2 mark A.

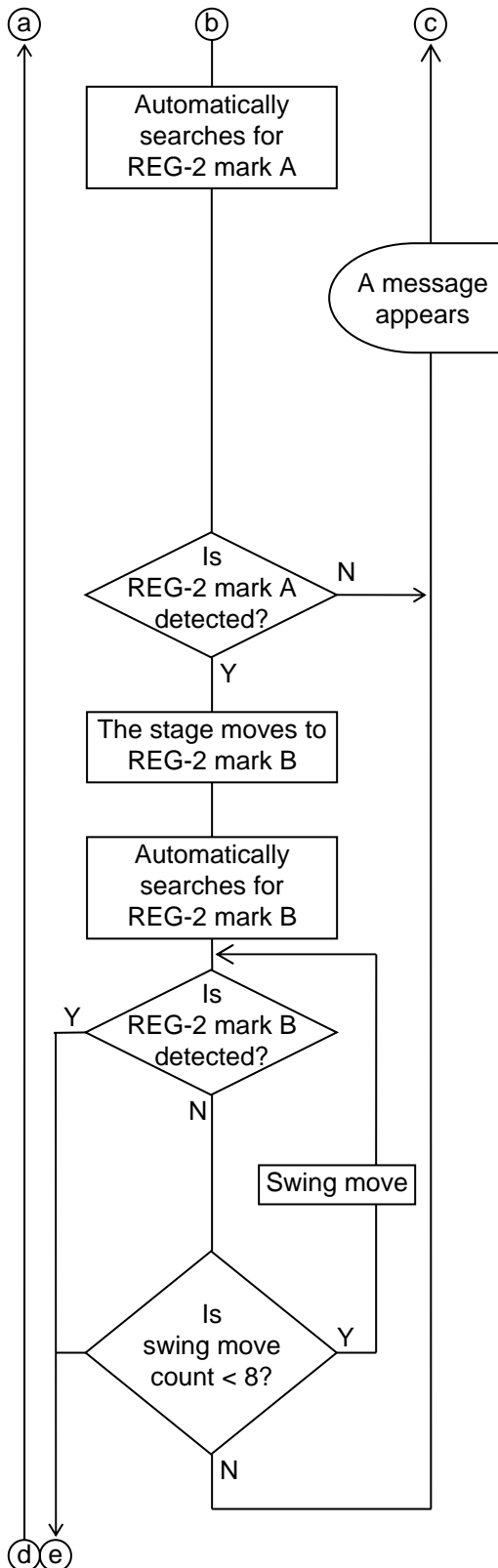
[D] Message

"Release BEAM BLANKING and move the MARK to the CENTER of SEM CRT with SDU. And Adjust contrast and brightness. Then click OK button."

[O] When the above message appears, align the mark position of SEM image with the cross mark by manually operating the stage. For auto registration, this operation is required to inform the program of the approximate position about the first mark position.

The detailed steps are as follows.

1. Initialize the cross mark before displaying them. Click the Initialize button in the Scan dialog, then select Cross Mark. The cross mark appears.
2. Reset Blanking. The SEM image of the mark appears.
3. Adjust Contrast and Brightness until you can clearly see the mark and base pattern.
4. Align the center of mark with the cross mark. Move the stage until the center of mark is aligned with the cross mark. When they are properly aligned, increase SEM magnification. If there is a conspicuous drift in the mark, move the stage again until the positional drift between the mark and cross mark is about within 1 μm . Both of the stage and control system go off-line status. Then manually move the stage until the mark is aligned with the center of SEM image while viewing the SEM image.
5. When the mark comes to the center of the cross mark, click OK in the Exposure dialog.



[P] Mark search on REG-2 mark A starts. The program automatically executes the subsequent blanking operations.

[D] Message

(The message is output to EXP PC.)

If the REG-2 mark detection fails, a "Mark search Error" message appears, followed by a "Retry or End?" message dialog.

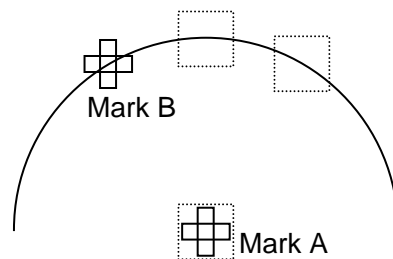
[O] (This operation must be done with EXP PC).


To do automatic search for mark A again, click **Retry** . To terminate the operation, click **End** .

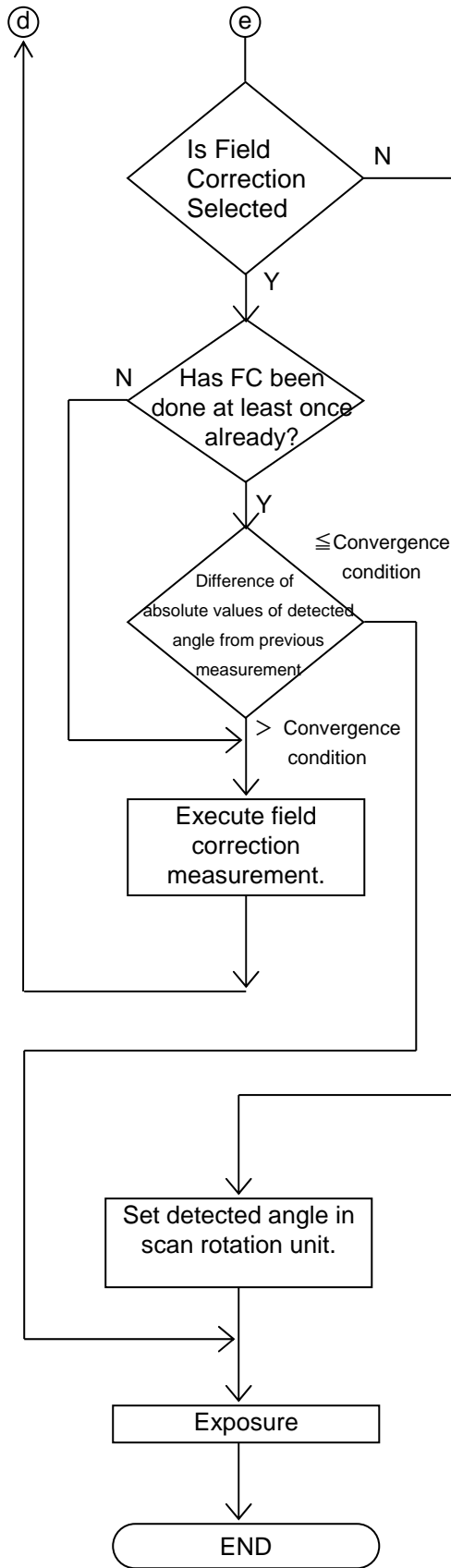
[P] Search for REG-2 mark B is retried until the mark is found or as many times as the predetermined number.

Swing move:

Searches for the mark by moving the stage position along by the arc defined by mark A being the center and the distance to mark B being the radius.

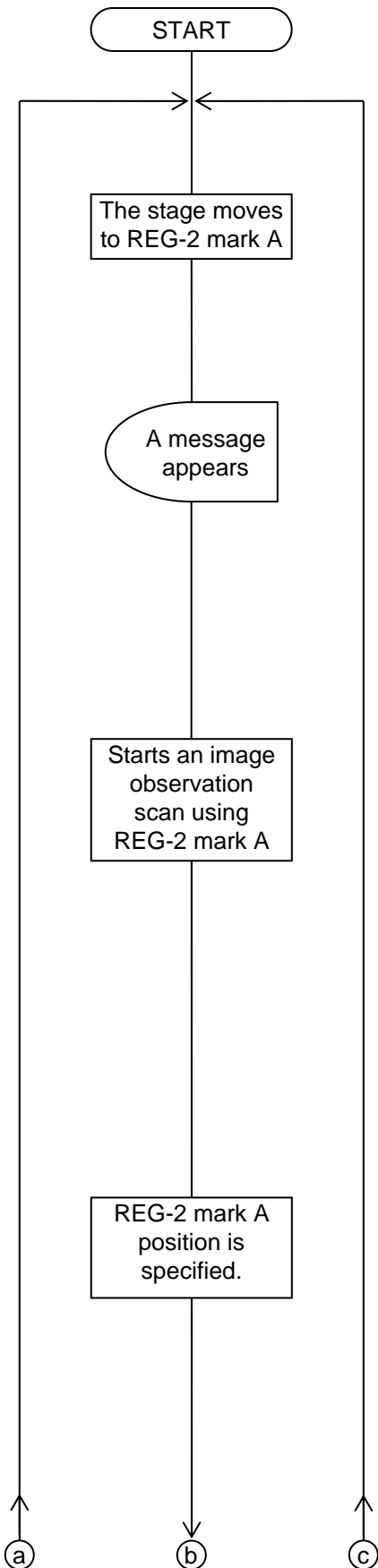


 indicates a search area.



[P] If execution of field correction measurement is selected (i.e. if “**FC at Registration**” is set to “ALL REG-2”, or if the measurement of first REG-2 marks is specified in the “1ST REG-2 ONLY” setting), the value set in “Reg-2 Tolerance Angle [mrad]” is the condition for deciding convergence. If the difference of absolute values of the results of the current measurement from the previous one is smaller than the value specified for the convergence condition, it is assumed to have converged, and exposure begins. If no execution of field correction measurement is selected, exposure begins once an angle is detected at the REG-2 marks A and B.

B. Manual registration



In the flowchart shown at the left, START is the point of time at which the operation to select SEM GUI (described in 2-6-5) has completed.

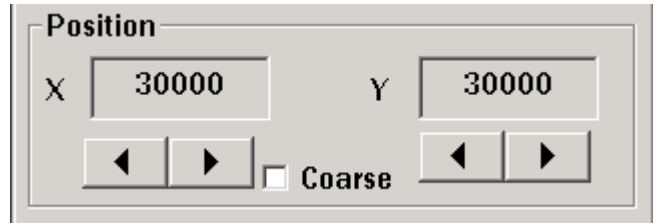
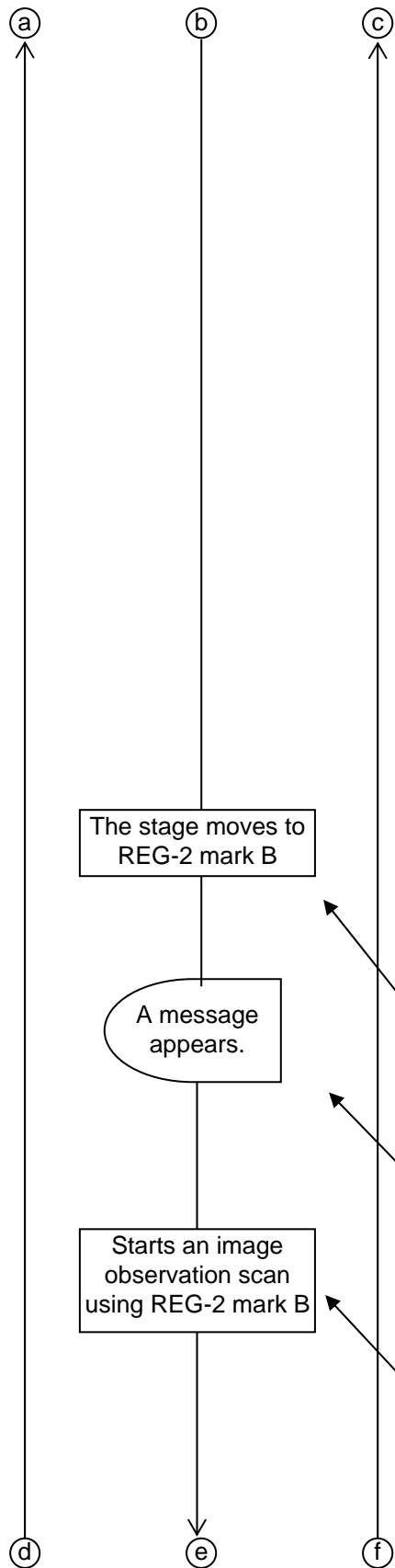
[P] The program automatically moves to REG-2 mark A position.

[D] Message
 "[Reg-2 A-MARK]
 Release BEAM BLANKING and move the MARK to the CENTER of SEM CRT with SDU."

[O] The operator manually operates the SEMI GUI to make a registration by aligning a SEM image with a cross mark. For auto registration, this operation is required to inform the program of the approximate position about the first mark position.

The detailed steps are as follows.

1. Initialize the cross marks before displaying them. Click the Initialize button in the Scan dialog, then select Cross Mark. The cross mark appears.
2. Reset Blanking. The SEM image of the mark appears.
3. Adjust Contrast and Brightness until you can clearly see the contrast difference between the mark and the background.
4. Align the center of mark with the cross mark. Move the stage until the center of mark is aligned with the cross mark. The unit is not ready for magnification change yet.
5. if the deviation between the center of the crossmark and the mark gets smaller than about 0.5 micron, you can abandon further adjustment by the stage driving and use the image shift function instead. Change the scan mode to "Slow." Click the Position buttons captioned with triangle shape marks to move the SEM image. These buttons are located on the Exposure dialog and entitled with "Position" as the following image.



If "Coarse" is checked, the image shift moves quicker.

If the mark gets closer to the crossmark, magnify the SEM image more and adjust the deviation again by the Position buttons.

Repeat these steps until the deviation becomes the smallest one. The deviation directly affect the accuracy.

If you feel difficulty because the scan rate is "Slow," you can select "Medium", initially.

But finally you should confirm the adjustment status with "Slow" scan. Otherwise the accuracy may lose. Because the quicker the selected scan-rate is, the more the difference between the actual mark position and the SEM image will be.

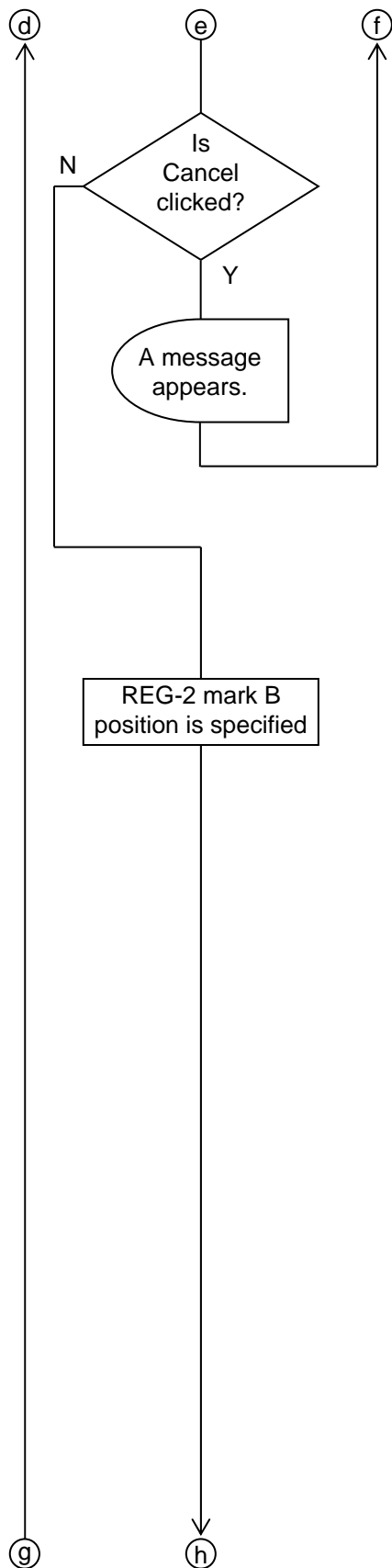
Be careful not to expose the mark and around it too much to avoid damage and contamination.

6. When the deviation between the mark and the crossmark falls within as small as you can, click OK in the Exposure dialog.
7. Now, REG-2 mark A position has been specified.

[P] Automatically the beam blanking sets and the stage moves to REG-2 mark B.

[D] Message
 "[Reg-2 B-MARK]
 Release BEAM BLANKING and move the MARK to the CENTER of SEM CRT with SDU."
 appears.

[O] You will see the same message as you saw in the steps for REG-2 mark A. Take the same steps.



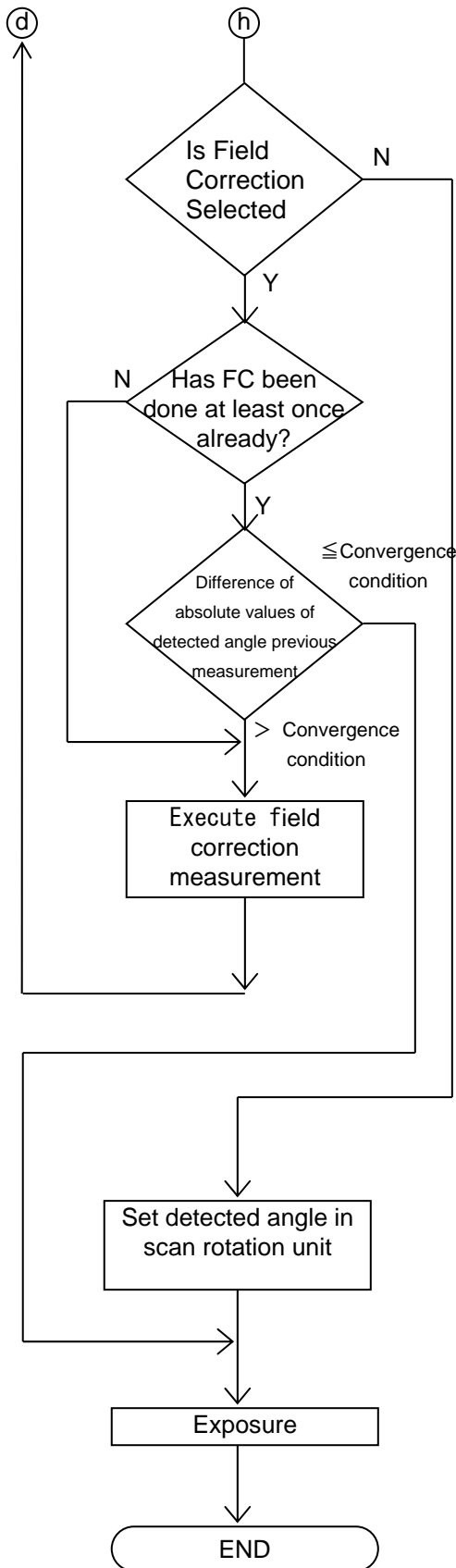
[O] If REG-2 mark B is not found or you want to abort the mark search, click Cancel to stop the search.

[D] Message
When the search is aborted using the above procedure, "B Mark search Error Change to EXP PC" appears.

[O] Now, select EXP PC.
When "Retry or End?" dialog appear on EXP PC, click the Retry button to search again or End button to abort.

[O] When the mark comes to the center of the cross mark at the same magnification as that for REG-2 mark A, click OK

(NOTE)
Since an interlock is activated when OK button is pressed at the mark B position, the operation is enabled only when the SEM magnification is the same as that used to specify mark A. Also, it is not possible to select a SEM magnification higher than that used to specify mark A.
For this, to facilitate the operation, increase the SEM magnification until its display stays unchanged before clicking OK.



[P] If execution of field correction measurement is selected (i.e. “**FC at Registration**” is set to “ALL REG-2”; or if the measurement of the first REG-2 marks is specified in the “1ST REG-2 ONLY” setting), the value set in “Reg-2 Tolerance Angle [mrad]” is the condition for deciding convergence. If the difference of absolute values of the results of the current measurement from the previous one is smaller than the value specified for the convergence condition, it is assumed to have converged, and exposure begins. If no execution of field correction measurement is selected, exposure begins once an angle is detected at the REG-2 marks A and B.

3. REG-4

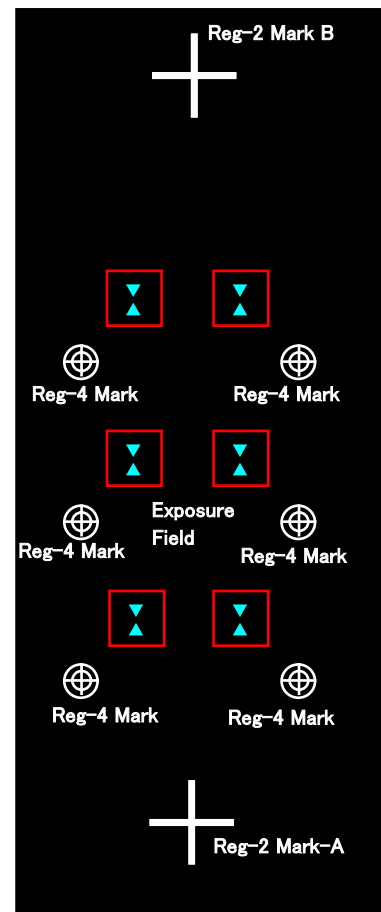
There is tendency that the overlay alignment precision of Reg-2 registration goes worse as an exposure field gets away from the Mark A. Adding Reg-4 marks to Reg-2 registration is useful to improve the alignment precision if the whole exposure area is wide.

After a Reg-2 alignment process completes Reg-4 alignment processes start if the condition file includes Reg-4 marks and Reg-4 registration is set "ON" in the schedule file option setting.

The all of Reg-4 mark are searched and the detected position shift values are stored into separate files, entitled as "Reg-4-date-number.csv." Here "date" and "number" vary for each file. In the writing step the closest Reg-4 mark to the current exposure field is used to correct the writing position.

Adding Reg-4 marks to a condition file is performed by "R4" command of the CAD function of WecaS. "Delete" or "DE" command works for a Reg-4 mark.

After arranging exposing patterns, Reg-2 Marks and Reg-4 Marks complete, save the CAD design as a condition file.



3-1. Requirements for Reg-4 Mark Shape

The requirements for Reg-4 Mark are the same of Reg-2 Mark. Refer the chapter of "2-2. Requirements for Reg-2 Mark Shape."

But A2 and B Mark are not necessary for Reg-4 Mark. Place only one mark anywhere you want high accuracy overlay writing position.

3-2. Operation on the CAD Screen

Refer "2-5. Operation on the CAD Screen." Be sure to place Reg-2 marks before Reg-4 arrangement.

Operation

- a) Type R4 or click the Reg-4 icon (see the following figure).



- b) "Enter P"
- c) Specify a Reg-4 Mark positon.
- d) A Reg-4 Mark will appear at your speciyed postion.

The process returns to the step b) and you can place another Reg-4 Mark repeatedly until you select other command or figure.

- e) You can delete a Reg-4 mark with "DE" or delete command.

- f) Save the CAD figures including Reg-4 marks as a condition file.

3-3. Operation on the Edit Schedule Dialog

Refer "2-6-2 Setting expose options." Set "Registration" "On" to enable Reg-2 function. Set registration items adequately. Set "Reg-4 function" "On."

Reg-4 mark measuring starts after Reg-2 marks alignment process completes.

4. SCALE CORRECTION FUNCTION ("S CORRECTION" FUNCTION)

The WecaS "Scale Correction Function" corrects dimension errors between a stepper or aligner exposure and the WecaS exposure over it.

This function uses 4 marks, A, B, C, D arranged like a rectangle vertexes.

This function measures A, B, C, D mark positions before an exposure and corrects each exposing position based on the measured position data.

"Scale Correction Function" cannot be performed with Reg-2 or Reg-4 simultaneously.

The 4 mark, A, B, C, D positions needs to be registered with the CAD function of WecaS and before a "S Correction" exposure starts.

4-1. Requirements for S Correction Mark Shape

The shape requirements for "S Correction" Mark are the same of Reg-2 Mark. Refer the chapter of "2-2. Requirements for Reg-2 Mark Shape."

But a S Corretion Mark needs 4 marks. An A2 mark is necessary too if you want to use "Auto" S Correciton.

4-2. Operation on the CAD Screen

Refer "2-5. Operation on the CAD Screen."

Operation

- a) Type R2 or click the Reg-2 icon (see the following figure).



Reg-2 icon

b) The “Registration (Reg-2)” dialogue window appears.

It is shown as the right image.

Click the “4 points” radio button and 4 point, A, B, C, D position inputs will turn valid.

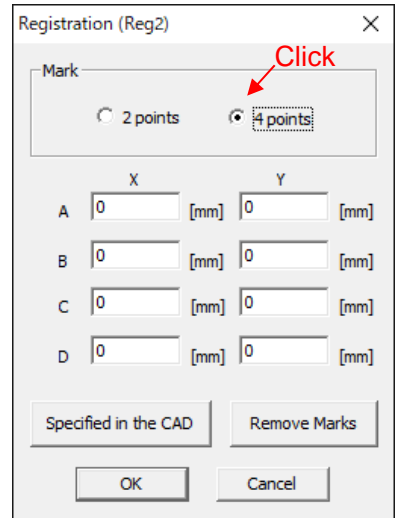
Input them in “mm” unit.

c) Press “OK.”

d) The 4 marks are renamed according to the position relation among them if they are suitable.

e) “Mark Placement Error” will appear if you input incorrect position relation data.

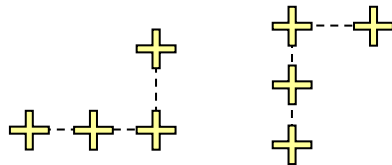
In this case you need to input suitable data.



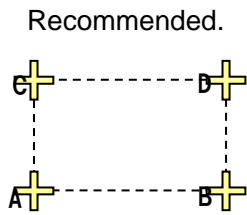
Examples of 4 mark arrangements.

4 marks need to be arranged like rectangle vertices.

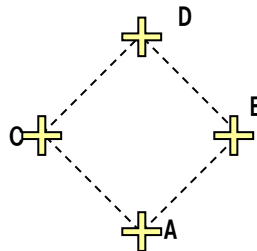
Not acceptable arrangement



Acceptable arrangements



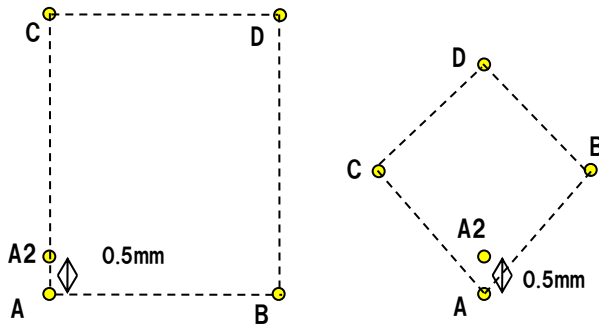
Not recommended.



caution: In case of a rhomboid (shown at the above right), $A_x \neq D_x$ and $C_y \neq B_y$. Even if they are not the same, the closer A_x and D_x , C_y and B_y become, the worse the accuracy of the correction goes. It is desirable to use a rectangle like position relation shown at the above left.

In case of using disc marks in “Auto” registration, an A2 mark is necessary. It is used to estimate the rotation angle of a specimen. is necessary.

An A2 mark is not necessary in case of cross mark “Auto” reigstration.



In case of “Auto” DISC registration an A2 mark must be placed 0.5mm right above an A mark. An A2 mark is not necessary in case of “Auto” CROSS registration.

- f) Press “Specified in the CAD” in the “Registration (Reg-2)” dialogue window if you want to use the “COMMAND” dialogue to specify the mark postions.

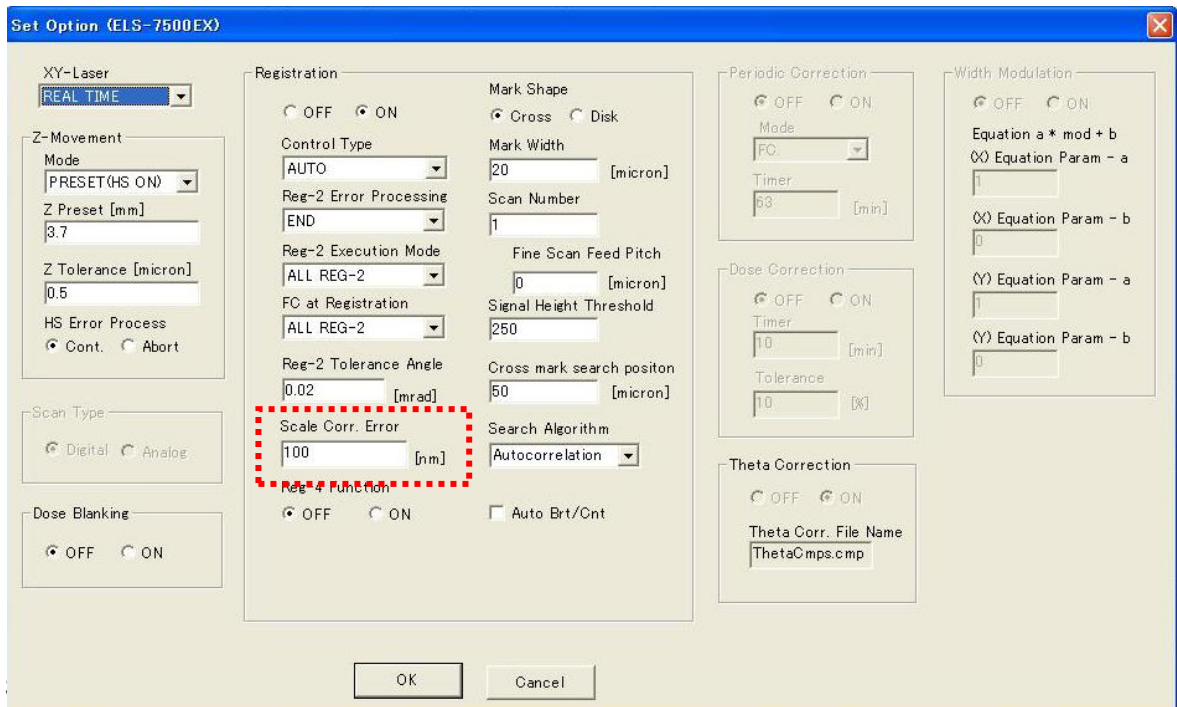
4-3. Operation on the Edit Schedule Dialog

Refer “2-6-2 Setting expose options.”

S Correcion needs an additional setting to be specified compared to Reg-2 registration. It is “Scale Corr. Error” in the “Set Option” dialogue.

On the other hand, “Reg-2 Tolerance Angle” and “Reg-4 Function” are ignored.

Reg-4 cannot be performed with “S Correction” simultaneousl even if the condition file includes some Reg-4 marks.



“S Correction” determines accomplishment of measurement of the A, B, C, D mark postion by the repeatably of their values. “S Correction” repeats the A, B, C, D mark mesurement process until the deference of position value between the current result and the previous one

become less than "Scale Corr. Error" value. It ends the process when the deference becomes as that and starts an exposure process.

"S Correction" doesnot refer "Reg-2 Tolerance Angle"

Set "Auto Brt/Cnt" to check if you want to ACB or Auto Cotrast Brightness.

4-4. "S Correction" Process

In case of "Auto" registration,

Set brightness 200 when you use ACB function while you donot use ACB, adjust the cotrast and brightness manually suitable to mark search.

Press "Exposure" button of the "Exposure" dialogue of WecaS.

At first an exposure process confirms the location of the Field Correction Mark when it stars.

And the stage moves to the A mark.

The process after that runs fully automatically.

But it may terminate when an error such as mark search error occurs.

In case of "Manual" registration,

Press "Exposure" button of the "Exposure" dialogue of WecaS.

At first an exposure process confirms the location of the Field Correction Mark when it stars.

And the stage moves to the A mark and the following message appears the "Exposure" dialogue window.

"Release dialogue of SEM."

"BEAM BLANKING and move"

"the MARK to the CENTER of SEM "

"CRT with SDU. "

"Then press the OK button.

According to the message, adjust the cross mark postion to the actual A mark one by observing the SEM view using magnification as high as possible. The adjustment accuracy leads directly to the msalignment corretion accuracy of exposing patterns.

Press "OK" button after accomplishment of the adjustment to move B mark.

The stage moves to the B mark and the similar message appears.

Repeat this process at A, B, C, D mark until the position deference between the previous result and the latest one.

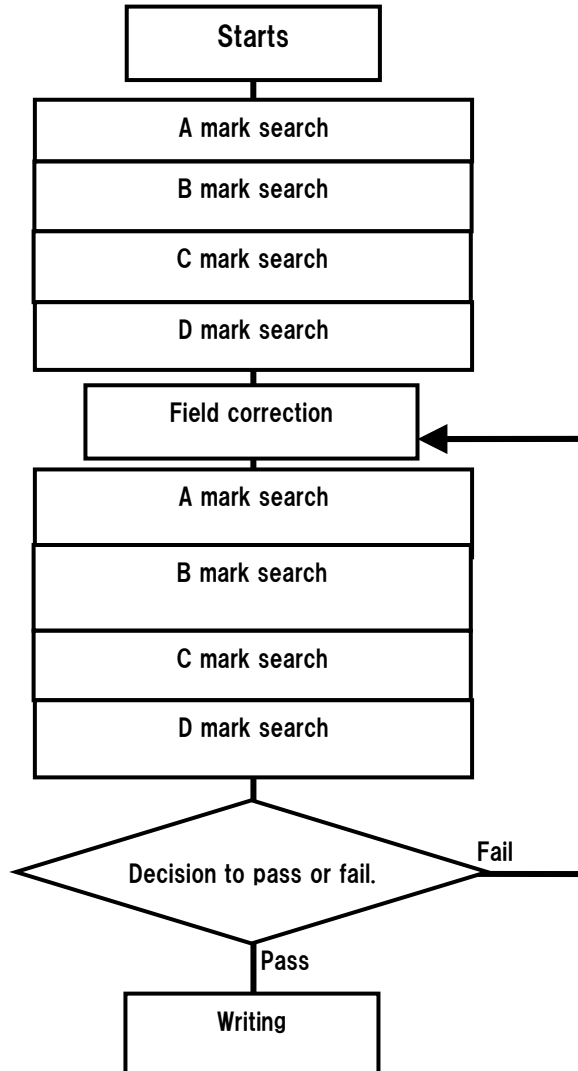
If the deference becomes less than "Scale Corr. Error" value, the process ends the measurement and starts to write the patterns.

In case of "SEMI-AUTO" registration,

at first the process does the same of "Manual" registration.

After one round measurement of A, B, C, D mark accomplishes, the process perfromes as well as "Auto" registration and runs after that fully automatically.

The process flow of an exposure using "S Correction" diagram



One or more filed corrections run between each A, B, C, D mark measurements according to the "FC at Registration" setting.

An exposure with "S Correction" generates a "regS.csv" file in the data folder. To open it with Excel or Notepad you can confirm the measured A, B, C, D mark positions.

Decision:
Is the difference between the previous measured positions of A, B, C, D marks and the latest ones less than "Scale Corr. Error" ?