Service Department
EV620 Bond Aligner
Bond Option

Operation Manual
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Note to the user

General:

1. Installation, adjustment, programming and maintenance (except periodical maintenance described in the manual) may only be done by qualified EV service engineers.

2. For further deliveries please check immediately after unpacking that the consignment confirms to the information given on the packing list.

3. Please read the operating instructions before you operate the unit and follow them in all respects.

4. The equipment may only be operated by personal trained from EV service engineers.

5. No liability will be accepted for personal injury nor material damages in the event that damage or breakdowns occur as a result of failure to comply with these operating instructions; neither will any guarantees relating to repairs to or replacements of our products apply.

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Safety instructions:

1. The equipment represents state-of-the-art technology and optimum operationally reliable. The user may however be exposed to hazards if it is used improperly or for other than its intended purpose!

2. If the equipment is used for any other than its intended purpose, all liability and warranty claims will lapse!

3. All unauthorized modifications and alterations affecting the safety are prohibited!

4. The use of self made tools is not allowed in any case.

5. Any use by unauthorized personnel or careless handling may increase the potential danger.

6. If the media support specified from EV are not fulfilled, the operational function of the equipment is not guaranteed.
1 PREPARING EQUIPMENT FOR INSTALLATION

1.1 Installation

The mask aligner is protected against mechanical damage during transport. Unpacking and removing the transport security locks shall only be done by an authorized service engineer.

The mask aligner has to be stored at a constant temperature of 20°C prior to installation.

1.2 Safety instructions

Do not move in the tray before tray and cover are in highest position. Finish the process regularly after fixing the locking pins of the anodic bond tool, otherwise the bond glass can break. Regulator for "Chuck-Weight" may not be higher than position 500!!

Minimum nitrogen pressure 5.5 bar (70 psi), maximum 6 bar (90 psi). Minimum air pressure 5.5 bar (70 psi), maximum 6 bar (90 psi).
2 DESCRIPTION OF COMPONENTS

2.1 Control panel

2.1.1 Switch for putting into operation

**POWER ON:**
Power switch for control unit.
Turn on the power switch on the lamp power supply and ignite the lamp, before you turn on this switch.

**MAIN SWITCH:**
Emergency stop.
Turn off, then the electronic, the PC and the lamp power supply will turn off too.
2.1.2 Regulations and displays on the control desk

**ILLUMINATION SPLIT FIELD:**
Regulators for the adjustment of the illumination intensity of the split field microscopes.

**WEC:**
To adjust the contact force during the Wedge Error Compensation (planarization). The adjustment is achieved through pneumatic relief of the mask holder (increased pressure relieves the weight of the cover and top chuck = reduced contact force).

The minimal contact force is theoretically 0 (suspended mask holder), reproducible values can be achieved starting from 1 N (about 100 g).
Please note, that the exactness of the planarization decreases with a small contact force (high pressure), so we suggest to limit the contact force to 1 bar.
We recommend a WEC-pressure of 0.5 bar.

**EXP**
This is always activated during the align phase and is necessary for an exact movement of the separation gap (Z-Motor). Default value is 1 bar.
**CHUCK PRESSURE**
Shows the actual pressure during wedge error compensation to lift up the adjustment unit. Default value about 290 mbar.

The regulators for the WEC pressure, EXP-pressure and Chuck-pressure are behind the Front-Panel of the machine.
To make sure that the wedge error compensation works properly you need the right
WEC-pressure (about 0.5bar) and Chuck-pressure (about 290mbar)
To make sure that the Z-Motor move to the right separation distance you have to set the right EXP pressure (about 1bar)

**HARD-CONT./SDB PISTON**
- To adjust the Hard Contact pressure.
- To adjust the pressure of the SDB Piston (for Silicon direct bonding)
- To reduce the vacuum when you use Vac+Hard Contact

### 2.1.3 Keyboard description

**SEP/CONT**
If the red LED is on, the chuck (wafer) isn’t in contact.
Make sure that the EXP-pressure is adjusted to about 1 bar. This is necessary to ensure that the selected separation distance is equal to the movement of the Z-motor.
If the contact force is less the separation distance is less too.

**CONTINUE**
Execute the next process step

**ENTER**
Confirms data input

**TRACK BALL**
The track ball is used for the PC-control
**KEYBOARD SOCKET**
To plug in an extern Keyboard

**JOYSTICK**
With the Joystick you are able to adjust the split field microscopes.

With the **button** on the joystick you can choose between scan-stage and scan-optic

Microscope movement:
Y-direction:
Move joystick in front or back direction.
If top side is selected, the whole optic moves for- and backward.
If bottom is selected, the corresponding objective moves in Y-direction.

X-direction:
Move joystick in left or right direction.
With top as well as bottom microscope selection, the corresponding objective moves in X-direction.

Z-direction:
Turn the joystick clockwise or anticlockwise to move the optic in Z-direction (focusing)
or the stage in theta direction

**2.2 Chuck stage**

Includes the mechanical system for planarization and alignment. Sheets of metal under the stage allow adjusting the height to different substrate-thickness.

The chuck stage enables the adjustment of substrates in X, Y and theta-direction.
For changing the chuck hight (wafer thickness) see appendix C
“Adjusting the Wafer thickness”
2.3 Lamp Ignition

- Turn on *MAIN SWITCH* of the maskaligner and *POWER SWITCH* of the lamp power supply. (The key-switch of the electronic must be OFF; otherwise you can’t ignite the lamp)
- Start lamp: press *START* key on the external lamp power supply. The display of the power supply have to show “cold” now. The lamp is ignited.
- You have to wait about 5 minutes until the lamp has reached the working temperature and the whole power before you make an exposure.

2.4 PC-control surface

2.4.1 Start software

- Turn on the power switch of the PC after the lamp is ignited
  - Doubleclick the icon “EV620”
  - Turn on the key-switch for the electronic
  - Klick “login” and enter your loginnname and password

When you log in the aligner makes an initialization.
- Doubleklick the icon “recipe1.rcp” or create a new recipe (File → New)

- The programm is complete started now and you can set the process data
Process control menu

Recipe:
To set process data during the process (This is just possible at the steps “Adjust Substrate” and “Adjust mask”)
Controls:
- Change overlay intensity
- Change crosshair color
- Change crosshair thickness
- Change crosshair length
- Move corresponding crosshair in x and y direction (pixel-steps)
- Set black and white intensity of the microscope image

Position:
Choose “Scan Optic” or “Scan Stage” to move with the optic or with the stage

Scan Optic: To switch to optic movement (you can also switch to scan optic by pressing the button on the joystick); In addition you see the position and actual value of the left and the right microscope in X, Y and Z-direction

Store Pos.: You can store the actual optic position.

Load Pos.: You can load a stored optic position.

Safe Image: When you want to save the present image, press “safe image” and it will be saved at “C:\EV620\*.bmp”.

Scan Stage: To switch to stage movement (you can also switch to scan stage by pressing the button on the joystick)

Center Stage: The stage move to the center position in x, y and theta direction
**Continue:**
Execute the next process step

**Undo:**
To go a process step back

**L/R:**
To change between the left and right microscope

**Sep/Cont:**
To change between separation and contact
Red light on→separation

**Exit:**
To leave the process.
At some steps of the process it’s not allowed to leave the process; then you get a message that the machine will be in an undefined condition.

**Change C. Mode:**
With this button you can change the contact mode at the step “adjust substrate”

**Test Contact:**
With this button you can test the contact mode at the step “adjust substrate”
3 ANODIC BONDING

3.1 Alignment without crosshair (silicon/glass bonding)

3.1.1 Set process data

**Process:**
- Anodic Bond

**Process Mode:**
- Transparent
- Overlay
- Crosshair

**Exposure Mode:**
- No Exposure

**Contact mode:**
- Normal

3.1.2 Start process

1. Turn on main switch and key switch
2. Start software
3. Set process data in the recipe and choose the anodic bond process (with „NORMAL“ process mode)
4. Afterwards press the „RUN“ button on the recipe to start the process

3.1.2.1 Initialization

The initialization process is starting and you must wait a moment.
→ <START>
Follow all steps which are displayed

→ <INSERT BONDTOOL>

Insert the appropriate Bondtool and bottom-chuck for this process and Press “CONTINUE”
3.1.2.2  Loading the top wafer

Load the bondglas and the top (1.) wafer on the bottom-chuck.

→ <LOAD TOP WAFER>

Position the bond glass on the chuck (see drawing):

![Diagram of bond glass and wafer positioning]

Load the wafer on the chuck with the clean side (bond side) down (use the ruler to preposition the bond glass and the wafer as shown in the drawing).

![Diagram showing wafer placement]

Move bond glass and wafer exactly to the edge of the ruler

Press “CONTINUE” and the Glas and the wafer are fixed on the bottom chuck with vacuum.

*Don’t forget to remove the ruler!*
Pull the Separation flags out!

\( \rightarrow \) \(<\text{MOVE TRAY IN}>\)

When you have moved the tray in, the aligner starts with the \textit{wedge-error-compensation} (planarization) automatically.

\( \rightarrow \) \(<\text{PLEASE WAIT}>\)
\( \rightarrow \) \(<\text{ADJUST MICROSCOPE}>\)

3.1.2.3 Adjust top-wafer

To adjust the marks of the top-wafer, you use the split field microscope. Press \textit{“Scan Optic”} in the \textit{“Limits-menu”} (or with the button on the joystick) and you can move the microscopes with the joystick in x-, y- and z-direction. (z \( \rightarrow \) focus)

To change between the left and right microscope, press the \textit{“L”} or the \textit{“R”} button.

To make sure that the wafer is straight on the stage the actual y-positions of the microscopes should show the same value (when they show the same value, they are in a straight line) and you see both marks on the screen. Otherwise you have to turn the wafer with the stage.

During the alignment procedure the top-wafer is in separation to the bond-tool

When the marks are adjusted, press \textit{“continue”} and the bond-tool sucks the wafer with vacuum.

\( \rightarrow \) \(<\text{PLEASE WAIT}>\)
\( \rightarrow \) \(<\text{MOVE TRAY OUT}>\)
3.1.2.4 Load bottom wafer

Load the bottom-wafer (glas-wafer) in the same way like the top-wafer on the bondglas but with the clean side to the top.

Press “continue” and the glas and the wafer are fixed on the bottom chuck with vacuum.

→ <MOVE TRAY IN>

3.1.2.5 Adjust bottom wafer

→ <PREADJUST SUBSTRATE>

To adjust the bottom-wafer move the stage.
Don’t move with the microscopes because they are already adjusted to the marks of the top-wafer. When you are ready with the prealignment press “Continue”.

The aligner starts with the wedge-error-compensation (planarization) automatically.

→ <ADJUST STAGE>

Now you can adjust the marks of the bottom-wafer to the marks of the top-wafer by moving the stage.
When you are ready with the alignment press “Continue”

→ <INSERT SEPARATION FLAGS>

press “CONTINUE”

The top-wafer and the bottom-wafer are going in contact.

→ <CLAMP WAFER>

Clamp both wafer and the bondglass by pushing the fixing bolts of the bond-tool down and turn them 90° (see drawing). After let go the fixing-bolts both wafer and the bond glass will be held by the clamp-feet.
→ <REMOVE BOND CHUCK>
press „continue“

→ <MOVE TRAY OUT>
→ <PRESS <CONTINUE> OR <UNDO>>

When you press <continue>, the process will start again.
When you press <undo>, the process will end.

→ <END OF PROCESS>
3.2 Alignment with crosshair/overlay (silicon/silicon bonding)

3.2.1 Process control menu

3.2.2 Set process data

**Process:**
- Anodic Bond

**Process Mode:**
- Transparent
- Overlay
- Crosshair

**Exposure Mode:**
- No Exposure

**Contact mode:**
- Normal

![Recipe Screen](image)

3.2.3 Start process

1. Turn on main switch and key switch
2. Start software
3. Set process data in the recipe and choose the anodic bond process (with overlay or crosshair process mode)
4. Afterwards press the „RUN“ button on the recipe to start the process

3.2.3.1 Initialization

The initialization process is starting and you must wait a moment.

→ **<START>**
Follow all steps wích are displayed

→ **<INSERT BOND TOOL>**
Insert the appropriate Bondtool and bottom-chuck for this process and Press „CONTINUE“

3.2.3.2 Loading the top wafer

Load the bondglas and the top (1.) wafer on the bottom-chuck.

Refer to 3.1.2.2.

→ **<MOVE TRAY IN>**
When you have moved the tray in, the aligner starts with the **wedge-error-compensation** (planarization) automatically.

→ **<PLEASE WAIT>**
→ **<ADJUST MICROSCOPE>**

### 3.2.3.3 Adjust Top Wafer

To adjust the marks of the top-wafer, you use the split field microscope. Press **“Scan Optic”** in the **"Limits-menu"** (or with the button on the joystick) and you can move the microscopes with the joystick in x- y and z-direction. (z → focus)

To change between the left and right microscope, press the **“L”** or the **“R”** button. To make sure that the wafer is straight on the stage the actual y-positions of the microscopes should show the same value (when they show the same value, they are in a straight line) and you see both marks on the screen. Otherwise you have to turn the wafer with the Stage.

During the alignment procedure the top-wafer is in separation to the bond-tool.

When the marks are adjusted, press "continue" and the bond-tool suck’s the wafer with vacuum.

### 3.2.3.4 Adjust crosshair / adjust overlay

Now you can make the crosshair/overlay-adjustment

→ **<ADJUST CROSSHAIR / ADJUST OVERLAY>**

**A) Crosshair-Adjustment**

Move the crosshair with help of the **Trackball.**

In the control menu you can choose between the left and the right crosshair.

Press the left button of the trackball and you can move with the crosshair.

For the fine adjustment press the up/down left/right buttons in the control menu.

In the controls menu you can also adjust the length, width and the color of the crosshairs.
A fine adjustment of the crosshairs is possible with the left, right, up, down, buttons in the control menu. (pixel-steps)

Lay the crosshairs exactly over the marks of the top-wafer.

B) Overlay-Adjustment

With the overlay-adjustment mode (choose it in the recipe before you start process) you can store the image of the adjusted marks of the top wafer. (adjust the marks and press “continue”) Later when you want to adjust the bottom wafer you see the stored image of the top-wafer on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer to the image of the top wafer.

Press “Continue”

→ <PLEASE WAIT>
→ <MOVE TRAY OUT>

3.2.3.5 Load bottom wafer

Load the bottom-wafer in the same way like the top-wafer on the bondglass but with the clean side to the top.

Press “continue” and the bondglass and the wafer are fixed on the bottom chuck with vacuum.

→ <MOVE TRAY IN>
3.2.3.6 Adjust bottom wafer

→ <PREADJUST SUBSTRATE>

Move the bottom wafer with the stage. Don’t move with the microscopes because they are already adjusted to the marks of the top wafer. Move with the stage in x,y, and theta-direction until you see both marks of the bottom-wafer on the screen.

Press “continue”

→ <INSERT SEPARATION FLAGS>

press “CONTINUE”

The aligner starts with the wedge-error-compensation (planarization) automatically.

→ <ADJUST STAGE>

A) Crosshair

Adjust the marks of the bottom wafer exactly to the crosshair by moving the stage.

During the adjustment the bottom wafer and the top wafer are in separation. To change between separation and contact press “Sep/Cont” When you are ready with the alignment press “Continue”
B) Overlay
You see the stored image of the mask marks on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer (stage) to the image of the top wafer.

Press "Continue" when you are ready with adjustment.

→ <MOVE CONTACT>
press „CONTINUE“

The top-wafer and the bottom-wafer are going in contact.

→ <CLAMP WAFER>

Clamp both wafer and the bondglass by pushing the fixing bolts of the bond-tool down and turn them 90° (see drawing). After let go the fixing-bolts both wafer and the bond glass will be held by the clamp-feet.

→ <REMOVE BOND CHUCK>
press „CONTINUE“

→ <MOVE TRAY OUT>
→ <PRESS <CONTINUE> OR <UNDO>>

When you press <CONTINUE>, the process will start again.
When you press <UNDO>, the process will end.

→ <END OF PROCESS>
3.3 Triple Stack Alignment

3.3.1 Process control menu

3.3.2 Set process data

**Process:**
- Triple Stack Bond

**Process Mode:**
- Transp.-Transp.
- Cross.-Transp.
- Overl.-Transp.
- Transp.-Cross.
- Cross.-Cross.
- Transp.-Overl.
- Overl.-Overl.

**Exposure Mode:**
- No Exposure

**Contact mode:**
- Normal

3.3.3 Start process

5. Turn on main switch and key switch
6. Start software
7. Set process data in the recipe and choose the anodic bond process (with overlay or crosshair process mode)
8. Afterwards press the „RUN“ button on the recipe to start the process

3.3.3.1 Initialization

The initialization process is starting and you must wait a moment.
→ **<START>**
Follow all steps which are displayed

→ **<INSERT BONDTOOL>**
Insert the appropriate Bondtool and bottom-chuck for this process and Press “CONTINUE”
3.3.3.2 Loading the top wafer

Load the bondglas and the top (1.) wafer on the bottom-chuck.

Refer to 3.1.2.2.

→ <REMOVE RULER AND MOVE TRAY IN>

When you have moved the tray in, the aligner starts with the wedge-error-compensation (planarization) automatically.

→ <CHECK FLAGS MUST BE OUT>
→ <PLEASE WAIT>
→ <ADJUST MICROSCOPE>

3.3.3.3 Adjust Top Wafer

To adjust the marks of the top-wafer, you use the split field microscope.
Press "Scan Optic" in the "Limits-menu" (or with the button on the joystick) and you can move the microscopes with the joystick in x- y and z-direction. (z → focus)
To change between the left and right microscope, press the “L” or the “R” button.
To make sure that the wafer is straight on the stage the actual y-positions of the microscopes should show the same value (when they show the same value, they are in a straight line) and you see both marks on the screen. Otherwise you have to turn the wafer with the Stage.

During the alignment procedur the top-wafer is in separation to the bond-tool

When the marks are adjusted, press “continue” and the bond-tool suck´s the wafer with vacuum.

3.3.3.4 Adjust crosshair / adjust overlay

Now you can make the crosshair/overlay-adjustment

→ <ADJUST CROSSHAIR / ADJUST OVERLAY >
A) Crosshair-Adjustment

Move the crosshair with help of the *Trackball*. In the control menu you can choose between the left and the right crosshair. Press the left button of the trackball and you can move with the crosshair. For the fine adjustment press the up/down left/right buttons in the control menu. In the controls menu you can also adjust the length, width and the color of the crosshairs.

A fine adjustment of the crosshairs is possible with the *left, right, up, down*, buttons in the control menu. (pixel-steps)

Lay the crosshairs exactly over the marks of the top-wafer.

B) Overlay-Adjustment

With the overlay-adjustment mode (choose it in the recipe before you start process) you can store the image of the adjusted marks of the top wafer. (adjust the marks and press “continue”) Later when you want to adjust the bottom wafer you see the stored image of the top-wafer on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer to the image of the top wafer.

Press “*Continue*”
3.3.3.5 Load center wafer

→ <LOAD CENTER WAFER WITH GLAS AND RULER>

Load the center-wafer in the same way like the top-wafer on the bondglass.

Press “CONTINUE” and the bondglass and the wafer are fixed on the bottom chuck with vacuum.
→ <REMOVE RULER AND MOVE TRAY IN>

3.3.3.6 Adjust center wafer

→ <ADJUST STAGE – PRESS <CONTINUE> OR SEP/CONT TO MOVE IN CONTACT>

Move the center-wafer with the stage.
Don’t move with the microscopes because they are already adjusted to the marks of the top wafer. Move with the stage in x,y, and theta-direction until you see both marks of the center-wafer on the screen.

Press “CONTINUE”

The aligner starts with the wedge-error-compensation (planarization) automatically.
A) Crosshair
Adjust the marks of the center-wafer exactly to the crosshair by moving the stage.

During the adjustment the center-wafer and the top wafer are in separation.
To change between separation and contact press “Sep/Cont”
When you are ready with the alignment press “Continue”

B) Overlay
You see the stored image of the mask marks on the screen (you can change the intensity with the overlay regulator) and you can adjust the center-wafer (stage) to the image of the top wafer.

Press “Continue” when you are ready with adjustment.

The top-wafer and the center-wafer are going in contact.

⇒ <INSERT CLAMPING FLAGS>

Clamp both wafer with the clamping flags of the bond-tool.

⇒ <PLEASE WAIT>
⇒ <MOVE TRAY OUT>
3.3.3.7 Load bottom wafer

→ <LOAD BOTTOM WAFER WITH GLASS AND RULER>

Load the bottom-wafer in the same way like the top-wafer on the bondglass but with the clean side to the top.

Press “CONTINUE” and the bondglass and the wafer are fixed on the bottom chuck with vacuum.

→ <REMOVE RULER AND MOVE TRAY IN>
→ <PLEASE WAIT>

3.3.3.8 Adjust bottom wafer

→ <ADJUST STAGE – PRESS <CONTINUE> OR SEP/CONT TO MOVE IN CONTACT>

Move the bottom wafer with the stage.
Don’t move with the microscopes because they are already adjusted to the marks of the top wafer. Move with the stage in x,y, and theta-direction until you see both marks of the bottom-wafer on the screen.

Press “CONTINUE”
The aligner starts with the wedge-error-compensation (planarization) automatically.
A) Crosshair
Adjust the marks of the bottom wafer exactly to the crosshair by moving the stage.

During the adjustment the bottom wafer and the CENTER-wafer are in separation.
To change between separation and contact press "Sep/Cont"
When you are ready with the alignment press "Continue"

B) Overlay
You see the stored image of the mask marks on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer (stage) to the image of the top wafer.

Press "Continue" when you are ready with adjustment.

→ <MOVE CONTACT>

press „CONTINUE“
→ **<CLAMP WAFER>**

Clamp the three wafer and the bondglass by pushing the fixing bolts of the bond-tool down and turn them 90° (see drawing). After let go the fixing-bolts the three wafer and the bond glass will be held by the clamp-feet.

→ **<REMOVE BOND CHUCK>**

press „CONTINUE“

→ **<MOVE TRAY OUT>**

→ **<PRESS <CONTINUE> OR <UNDO>>**

When you press <CONTINUE>, the process will start again. When you press <UNDO>, the process will end.

→ **<END OF PROCESS>**
4  SILICON DIRECT BONDING

4.1  Process control menu

4.2  Set process data

Process:
•  SDB

Process mode:
•  Crosshair
•  Overlay
•  Transparent

Exposure mode:
•  No Exposure

Contact mode:
•  SDB-Piston
•  Vacuum Contact
•  V. Contact + SDB Piston

4.2.1  Start process

Before you start with process you have to install the appropriate chucks for this process!

1.  Turn on main switch and key switch
2.  Start software (refer to Lithography-part)
3.  Set process data in the recipe and choose SDB
4.  Afterwards press the „RUN“ button on the recipe to start the process

4.2.1.1  Initialization

The initialization process is starting and you must wait a moment.

→  <START>

Follow all steps which are displayed

→  <INSERT MASKHOLDER>

Insert the appropriate Bondtool and bottom-chuck for this process and
Press “CONTINUE”
4.2.1.2 Loading the top wafer
Load the top-wafer on the bottom-chuck and prealign it with the ruler.

➔ <LOAD TOP WAFER WITH RULER>

press „CONTINUE“

➔ <REMOVE RULER AND MOVE TRAY IN>

When you have moved the tray in, the aligner starts with the wedge-error-compensation (planarization) automatically.

➔ <PLEASE WAIT>

➔ <ADJUST MICROSCOPE>

4.2.1.3 Adjust top wafer

To adjust the marks of the top-wafer, you use the split field microscope.
Press “Scan Optic” in the ”Limits-menu” (or with the button on the joystick) and you can move the microscopes with the joystick in x- y and z-direction. (z → focus)
To change between the left and right microscope, press the “L” or the “R” button.
During the alignment procedur the top-wafer is in separation to the bond-tool
To prealign the top-wafer use the stage.
To make sure that the wafer is straight on the stage the actual y-positions of the microscopes should show the same value (when they show the same value, they are in a straight line) and you see both marks on the screen. Otherwise you have to turn the wafer with the stage.
When the marks are adjusted, press “continue” and the bond-tool suck’s the wafer with vacuum.

→ <PLEASE WAIT>
→ <MOVE TRAY OUT>

4.2.1.4 Adjust crosshair / adjust overlay
Now you can make the crosshair/overlay-adjustment

→ <ADJUST CROSSHAIR / ADJUST OVERLAY>

A) Crosshair-Adjustment

Move the crosshair with help of the Trackball.
In the control menu you can choose between the left and the right crosshair.
Press the left button of the trackball and you can move with the crosshair.
For the fine adjustment press the up/down left/right buttons in the control menu.
In the controls menu you can also adjust the length, width and the color of the crosshairs.

A fine adjustment of the crosshairs is possible with the left, right, up, down buttons in the control menu. (pixel-steps)

Lay the crosshairs exactly over the marks of the top-wafer.
B) Overlay-Adjustment

With the overlay-adjustment mode (choose it in the recipe before you start process) you can store the image of the adjusted marks of the top wafer. (adjust the marks and press “continue”)
Later when you want to adjust the bottom wafer you see the stored image of the top wafer on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer to the image of the top wafer.

Press “Continue”

→ <PLEASE WAIT>
→ <MOVE TRAY OUT>

4.2.1.5 Load bottom wafer
Load the bottom wafer in the same way like the top-wafer

→ <LOAD BOTTOM WAFER WITH RULER>

press „continue“

→ <REMOVE RULER AND MOVE TRAY IN>

The aligner don’t make a wedge error compensation when the tray is in.
4.2.1.6 Adjust bottom wafer

→ <ADJUST SUBSTRATE>

A) Crosshair

Adjust the marks of the bottom wafer exactly to the crosshair by moving the stage. During the adjustment the substrate and the mask are in separation. To change between separation and contact press “Sep/Cont”. When you are ready with the alignment press “Continue”
B) Overlay
You see the stored image of the top wafer on the screen (you can change the intensity with the overlay regulator) and you can adjust the bottom wafer (stage) to the image of the top wafer.
To change between separation and contact press “Sep/Cont”

Press „Continue“

After the alignment the aligner will bond the two wafers with the contact mode and bond-time you choose before you started the process.
- SDB-Piston
- Vacuum Contact
- V.Contact + SDB Piston

The bonding time counts up and when it's finished you can unload the bonded wafer.

→ <MOVE TRAY OUT>
→ <REMOVE BONDED WAFERS>

press „CONTINUE“

→ <END OF PROCESS>
5 Appendix A

5.1 Technical data

Wafer / substrate parameter:
Size: 2” – 6” Wafer, 4”x 4”, (6”x 6” option) and pieces (single chips)
Thickness: Mask aligner: 0.1 – 10mm (max. 2mm for bottom side alignment)
                 Bond aligner: 0.1 – 3mm for each wafer or substrate, max stack height 4.5mm

Mask parameter:
Size: max. 7”
Thickness: < 4mm

Alignment:
Range of alignment: X,Y,Z: +/- 5mm
Rotation: Theta +/- 3.5°
All movements are fully motorized.
Actuated by analog 3 axis joystick.
Resolution. 0.06µm
Optional high precision micrometers for alignment available.

Alignment accuracy:
Mask aligner: 0.5µm for top side alignment (with 20x obj.)
                 1µm for top to bottom side alignment (with 20x obj.)
Bond aligner: 0.5µm for glass/silicon , 1µm for silicon/silicon

Separation/proximity adjustment:
Separation: max. 300µm adjustable in 1µm steps (resolution of Z-movement 0.33µm) controlled by software/microprozessor

Contact force between mask and substrate for wedge compensation
Mask aligner: Adjustable from 0.5 – 40N
Bond aligner: Adjustable from 1 – 40N

Exposure modes:
Soft contact, Hard contact,
Vacuum contact, Proximity

Printing resolution:
Depending on contact modes and contact pressure
(data sheet available on request)
5.2 Utility requirements

Supply voltage: 220V/50Hz

Power requirement: 0.5 - 1.3 kW
(depends on lamp power)

Compressed air: 6 bar (87 psi)
(alternative N₂)

Vacuum: 150 mbar (absolute) (112 Torr)

Nitrogen N₂: 6 bar (87 psi)

Dimensions EV620 (WxDxH): 900 x 1000 x 1050

Minimum distance to back wall: 200mm

Dimensions power supply: 260 x 460 x 250mm

Weight: Mask aligner: 155kg (337lbs)
Power supply: 20kg (45lbs)
6 Appendix B

Warranty

Electronic Visions warrants the EV 420 for one year against defects in workmanship and materials exclusive of consumable parts such as lamps, bulbs, mirrors, heating elements and rubber or polymer parts such as gaskets, seals, o'ring, etc.

This warranty is limited to replacement of any parts which upon examination by Electronic Visions are determined to be originally defective, not damaged through negligence or abuse. Any parts returned for determination of defect should be returned to Electronic Visions prepaid.

Use of not EV manufactured or certified parts on the mask bond aligner EV 420 and its components will result in a loss of warranty. Several components are sealed to limit the access to EV authorized service engineers. A broken seal will exclude any warranty claims.
7 Appendix C

Maintenance

7.1 Changing the bottom chuck

Requirements:
Tray in loading position (moved out).

Lift up the chuck from the tray and disconnect the vacuum hose from the chuck. Connect the vacuum hose to the new chuck and put it in.

![Diagram showing changing the bottom chuck](image)

**Caution**: Do not damage the glass insertion (exposure mode).

7.2 Changing to different substrate size

Switch off the aligner *(POWER OFF)*;
Remove the maskholder (refer to: Changing the maskholder) and insert the new one.
Change the chuck (refer to: Changing the chuck).
7.3 Adjusting the wafer thickness

The height of the chuck stage is adjusted to standard height when we distribute the machine. Wafer up to a thickness of 3 mm could be unnoticed.

If you want to change to other substrate with larger sizes, remove or add distance slices under the alignment stage.

Before changing the height you have to bring each level (X-, Y-, and theta) into middle position

a. Switch off the aligner. (MAIN SWITCH off)

b. Remove the sheet metal cover in front of the alignment stage.

c. Loosen (do not completely remove the screws !) the 3 screws on the alignment stage. Now the unit lifts up due to integrated springs under the stage and you can add or remove distance slices.

d. After adding or removing distance slices push all slices to the block and fix the unit with the 3 screws again.

e. Take back the sheet metal cover and start the aligner again.
7.4 Microscope

Changing the magnifications at the bottom side (objectives)

Change the objectives if this is necessary

When the aligner is in loading position (the tray is out) remove the top bond chuck. Now change the objectives (turn counter-clockwise to fix them).

Pay attention: Remove the distance rings from the objectives and mount them on the new ones.

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