

Screen Printer (Micro-tec)



Category – Semiclean PV

Standard Operating Procedure (SOP)



NCPRE -SILICON METALIZATION LAB

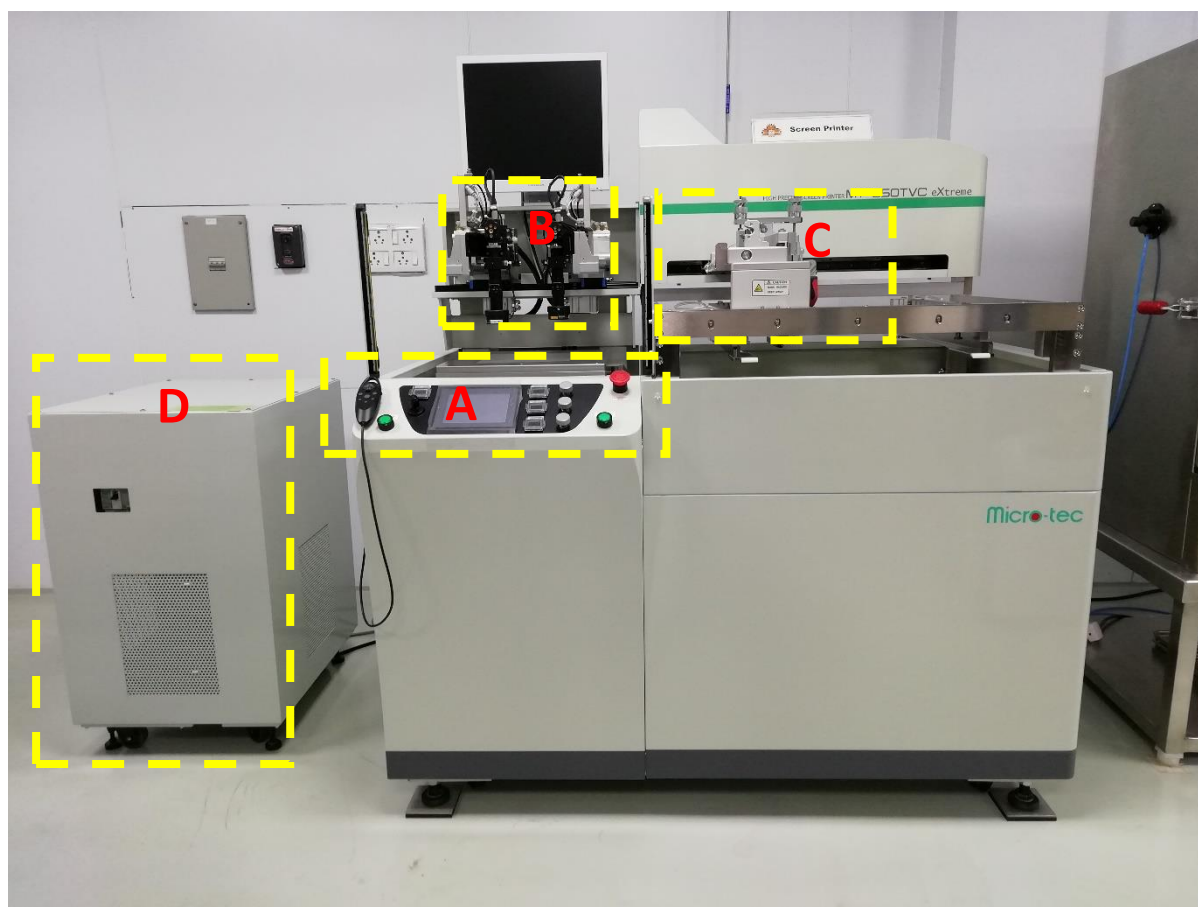
System Owner

Name: - Durga Prasad Khatri
Email id: - 174070007@iitb.ac.in
Mob No: - 7063279501

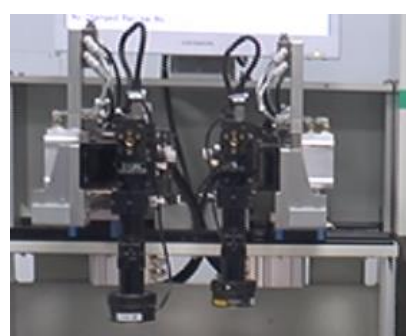
System Co-Owner

Almouzzam Khan
almoazzamkhan@gmail.com
9892491271

1) Introduction to System Parts



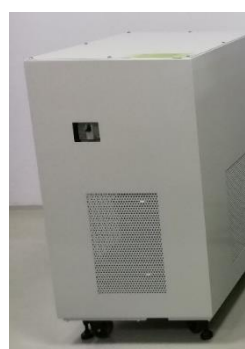
Part A: Touch screen and pressure control nob



Part B: Camera Unit



Part C: Printing head unit



Part D: Transformer



CDA

Table of Contents

| | |
|---|----|
| 1) Introduction to System Parts..... | 1 |
| 2) Safety & Precaution | 3 |
| 3) Point to check | 3 |
| 4) Process flow chart | 4 |
| 5) STANDARD OPERATING PROCEDURE..... | 4 |
| 5.1) Switching ON..... | 5 |
| 5.2) Squeegee head unit setting | 7 |
| 5.3) Squeegee parallel & height adjustment..... | 11 |
| 5.4) Screen placement in Tool | 13 |
| 5.5) Flood blade parallel & height adjustment..... | 15 |
| 6) Printing Mode | 16 |
| 6.1) Auto print Mode | 17 |
| 6.1.1) Dummy print process (In Auto mode)..... | 18 |
| 6.2) Manual Printing Mode. | 20 |
| 7) Print Table Alignment..... | 21 |
| 8) Double Layer Alignment | 22 |
| 8.1) Work Pattern registration | 23 |
| 8.2) Screen pattern (2 nd layer) Alignment | 29 |
| 9) Screen Clean | 31 |
| 10) Switching Off sequence | 32 |
| Vendor detail | 33 |

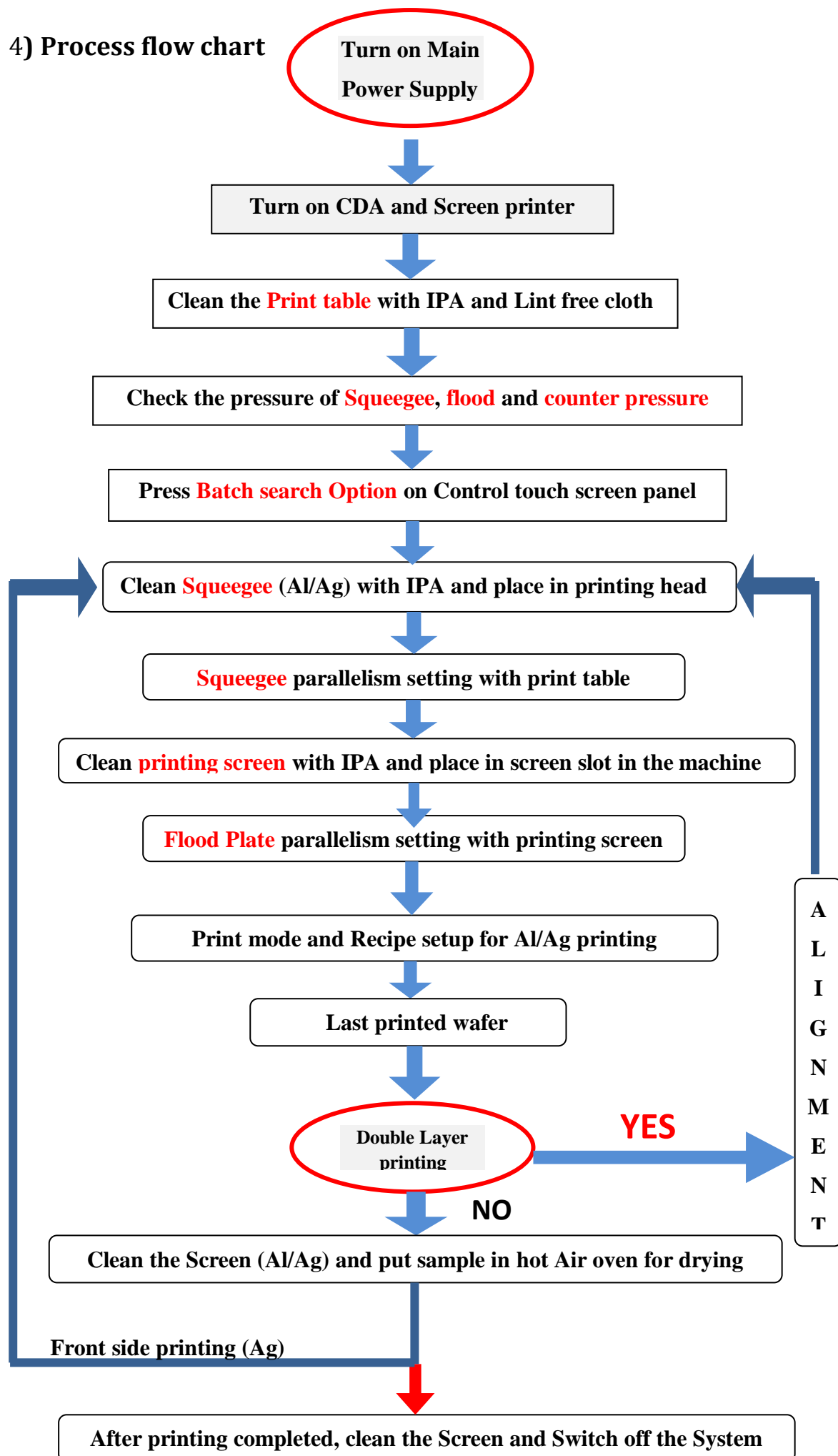
2) Safety & Precaution

- a) Always wear gloves, hair net and face mask before turning on tool.
- b) After turning on the system check the flood, squeegee and counter pressure.
- c) Close all safety door during printing process.
- d) Clean print table and printing head before squeegee parallelism setting.
- e) Mix Al/Ag paste carefully and properly before printing.
- f) Always store paste below 25 °C temperature and do not put in refrigerator.
- g) Always clean screen before and after printing properly.
- i) Never put your hand in **front sensor** area during printing.
- j) If you get an error during process write down and ask SO/CO-SO.
- k) Before last wafer printing in **Auto mode** activate **Screen cleaning** to bring printing head to flood origin position after completing printing process.
- l) For cleaning of Screen and Machine use IPA only and turn on exhaust prior to start the process.

3) Point to check

- 1) Check gas cylinder status (inside pressure (400 psi) and out let pressure (4 bar)).
- 2) Check the number of gloves, lint free cloth, hair net, face mask and IPA (At least 1 liter for 2 screen) available.
- 3) Status of Screen before starting of printing process (Clogging of screen).
- 4) Amount of paste (at least 200 gm), material of paste and shelf life of paste.
- 5) Always check the recipe for printing process.
- 6) Before 1st layer printing check in **Print mode** → **Auto Alignment** tab should be deactivated.

4) Process flow chart



5) STANDARD OPERATING PROCEDURE

5.1) Switching ON

1. Turn ON the MCB (Main Circuit Board) (Fig.1)



Fig.1:-Turning ON the MCB switch

2. Turn ON the CDA (Compressed Dry Air) (Fig.2)

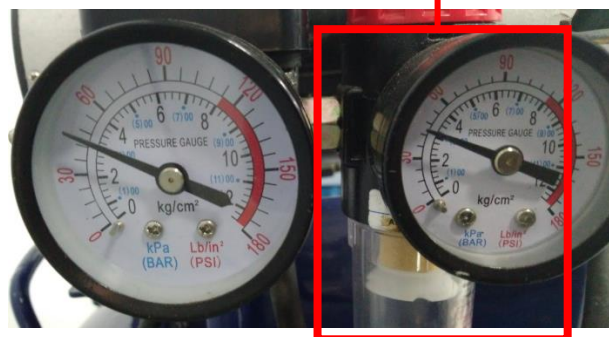
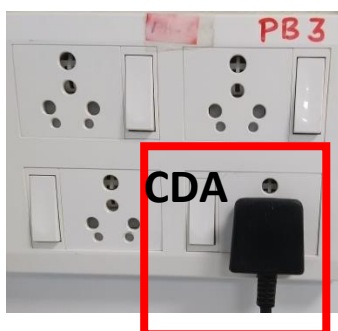


Fig.2:-Turning ON the CDA and checking reading of pressure gauge (6bar)

Note: - After TURN ON CDA wait for OUT let pressure to be 0.5MPa then OPEN Valve to Machine.

3. Switch ON the transformer (Fig.3)

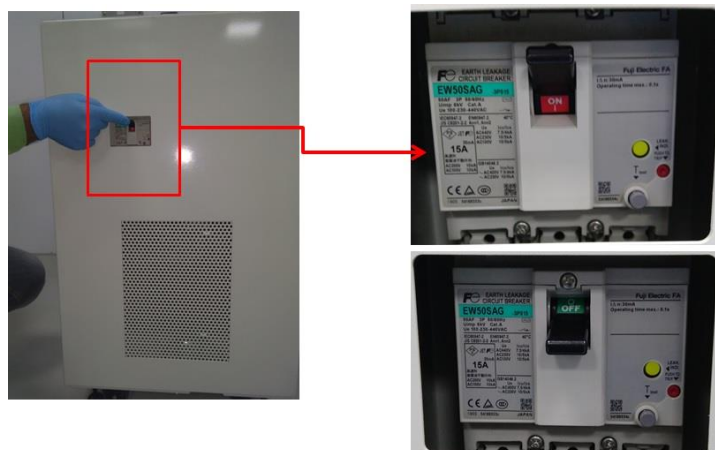


Fig.3: Turing ON Transformer

4. Switch ON the Screen Printer Tool. Lamp will turn on as an indication. (Fig.4)



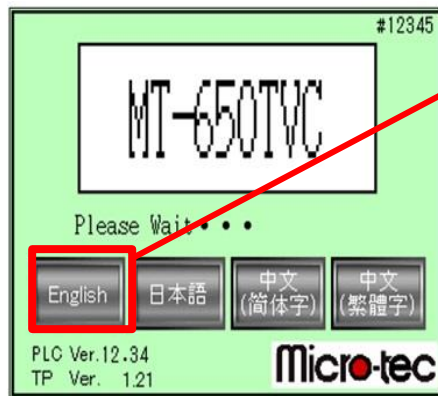
(a) Side view of switch

(b) OFF condition

(c) ON Condition

Fig.4: Turning On the Screen printer tool

5. After Turning on the Language selection page will appear as shown in Fig.5 below



- (1)English : Touch this key to change language to English.
- (2)日本語 : Touch this key to change language to Japanese.
- (3)中文(简体字) : Touch this key to change language to Simplified Chinese.
- (4)中文(繁体字) : Touch this key to change language to Traditional Chinese

Fig.5: Language Selection Window

6. After Selecting the language it will to **Servo Motor Origin Search** window as shown in figure below (Fig.6)

**Fig.6 -Servo Motor Origin Search Screen**

(1)**Batch ORG Search:** - Press this tab to run all servo motor origin search

7. Press **Batch ORG Search**, wait till completing search operation.
8. After completing batch search, Table and squeegee search tab will show message for completing search. The position of table and Squeegee head will as shown in Fig.7,8 below and then it will go to **Main** page automatically.

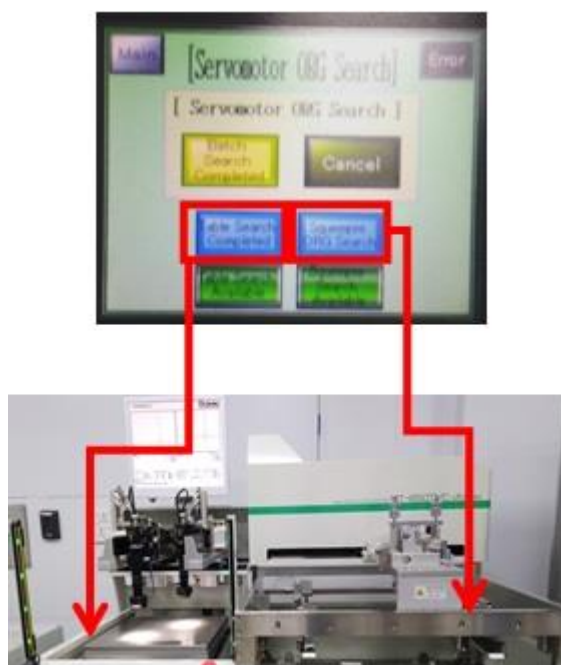


Fig.7: Batch search completed



Fig.8: [Main] Window

5.2) Squeegee head unit setting

Squeegee setting

9. For squeegee settings, Select **Manual Print** in **Main** to go to **Print** page



Fig.9: Manual Print Window

10. Bring the squeegee head to the centre of the print area by pressing **Squeegee Stroke**



Fig.10:- Squeegee in centre

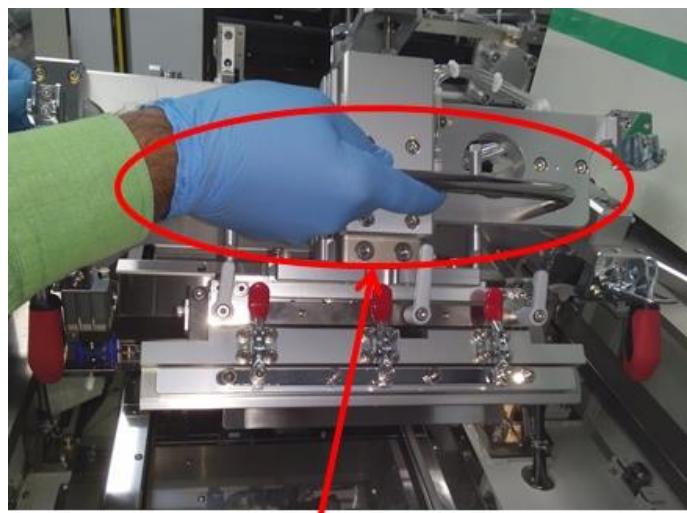
11. Loosen **Head fixing hook** (2parts) of Squeegee head as shown in **Fig.11**



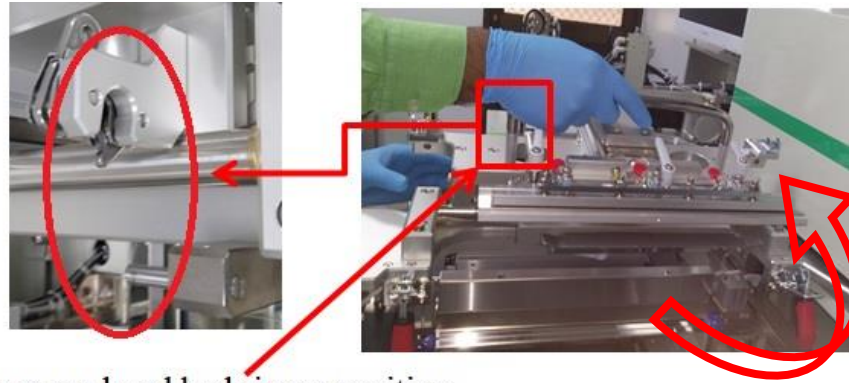
Squeegee head Unlocking key

Fig.11: Unlocking the Squeegee head

12. Open squeegee head by holding Open/close handle until **head fixing snatch lock**.



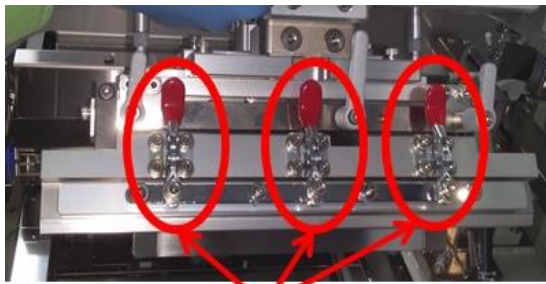
Squeegee head handle



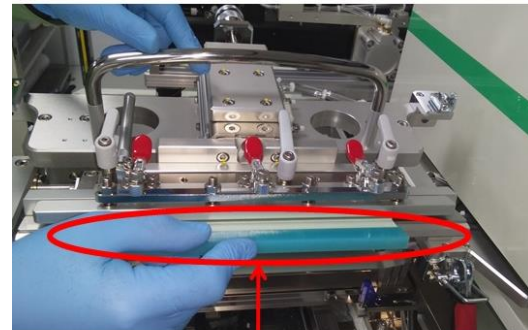
Squeegee head lock in up position

Fig.12: Moving Up Squeegee head

13. Adjust Squeegee to centre, Push Right unit toggle clamp (red colour 3 parts) up to fix.



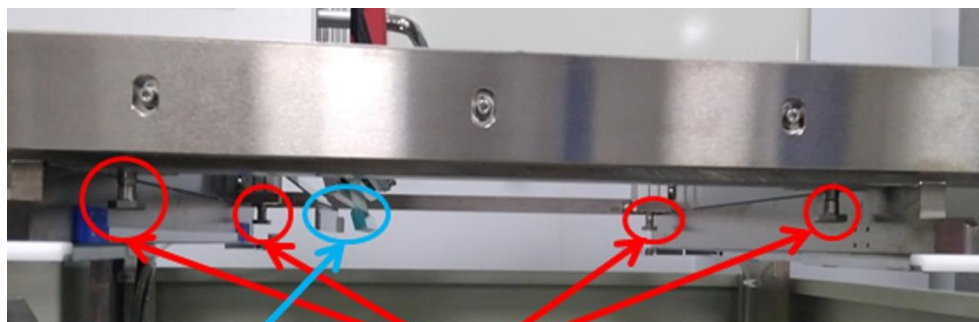
Squeegee Unlock Level



Squeegee

Fig.13: Fixing and Adjusting Squeegee

14. Confirm if Squeegee is fixed tightly.
15. Fasten Right unit pushing amount adjustment handle in order to not let squeegee down by own weight.
16. Close squeegee head by holding Open/close handle. Now Squeegee can be seen as shown in Fig.14 below



Screen clamp

Squeegee and flood plate

Fig.14: Squeegee and flood plate position

17. In **Manual Print Window** press **Table rightward** + **start button** simultaneously & continuously to move table to rightward (print area) as shown in Fig.15 then the position of Table will change and final position is shown in Fig.16 below



Fig.15: Table moving to Right direction



Fig.16: Print Table position (Right side)

18. Press **Table Up△** [It is effective only when printing table is at right side (print Area)].
Note:-Table will move in vertical direction



Fig.17: Moving Print table UP

5.3) Squeegee parallel & height adjustment

1. Fasten left unit pushing amount adjustment handle in order to not let flood down by own weight as shown in Fig.18 below



Fig.18: Flood plate height fixing

2. Release the counter pressure (operation panel) to 0 MPa to move down Squeegee.



Fig.19: Counter pressure Display

3. Place two pieces of thin paper under Squeegee and let them touch both end of the Squeegee as shown in Fig.20.



Fig.20: Placing paper on print Table

4. Adjust the right unit pushing amount adjustment handle to adjust the height of the squeegee. Pull both papers simultaneously until the feeling of pulling force on both papers becomes equal.
5. If there is tilt then loosen Right unit parallel adjustment clamp lever. Control Right unit parallel adjustment **Micrometre head** (Shown in Fig.21) to adjust squeegee parallel until feeling of pulling force on both papers becomes equal.

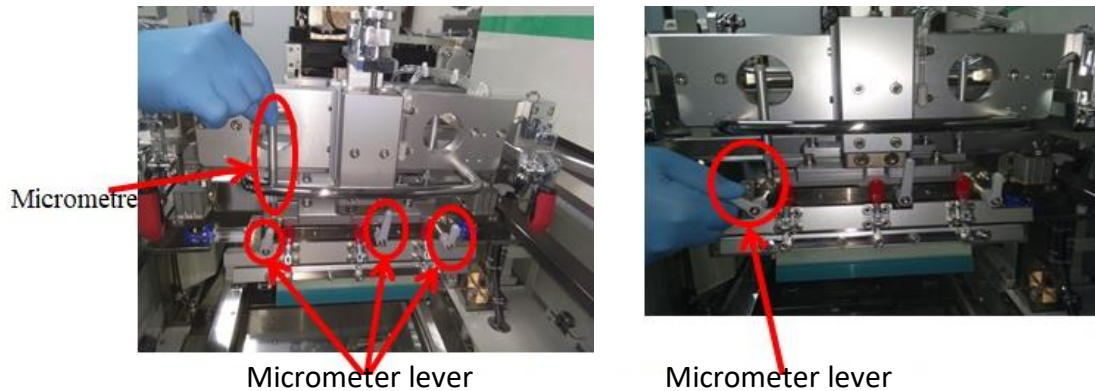


Fig.21: Squeegee Tilt adjustment by Micrometre

6. Fasten **Right unit parallel adjustment clamp lever** after completing the adjustment.

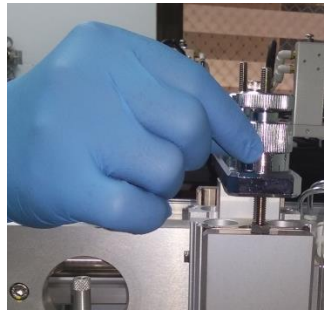


Fig.22: Parallel adjustment clamp lever

7. Use Right unit lock nut to lock the pushing amount.

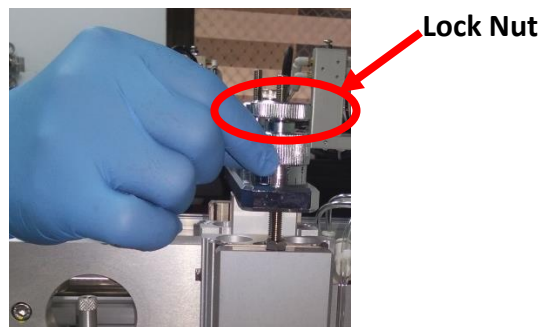


Fig.23: Pushing Lock nut


8. Increase the counter pressure to 0.121 MPa (**starting pressure when system turn on**) to bring the squeegee up.
9. Bring table down (press **table down** ) as shown in Fig.24) & bring table to the left side by pressing **Table leftward + start** simultaneously & continuously.



Fig.24: Table Down and Moving table to left side

10. Bring the squeegee head to the original position by pressing the **Squeegee stroke** continuously in touch panel.

Note:

1. Movement of table and squeeze head can be done only in Manual print window.
2. Ensure to release each Parallel adjustment clamp lever to adjust parallel of Squeegee • It may cause machine defect without release it.
3. Micrometer adjustment: Rotation direction clockwise Bottom side of squeegee (right unit) will go down. Counter clockwise Bottom side of squeegee (right unit) will go up.

5.4) Screen placement in Tool

1. Open squeegee head by holding Open/close handle until Head fixing snatch lock.
2. Go to **[Main]** → **[Setting]** press **unclamp** and also press **Table - LED ON** as shown in Fig.25 below

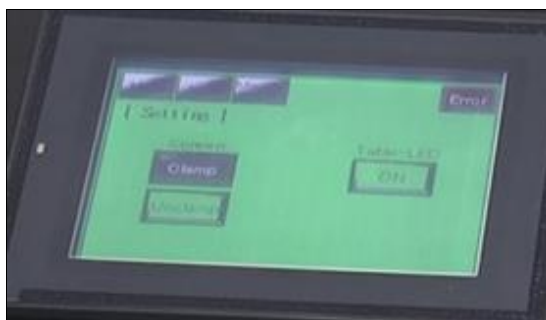


Fig.25: Unclamping screen and turning table LED ON

3. Insert screen on the screen support plate (2 parts) until screen contact on Y-axis stopper left-inner side (**Blue box**).
4. **In Manual Print** press **Table rightward** + **start button** simultaneously & continuously to move table to rightward (print area).
5. Press the **table up**



Fig.26: Position for screen placing

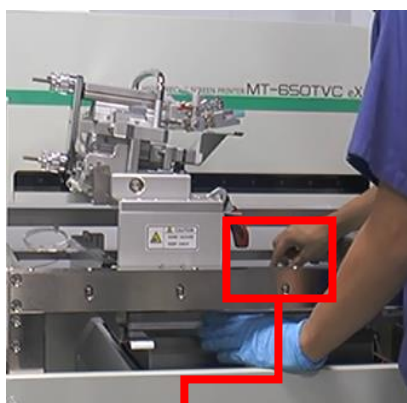


Fig.27: Screen alignment with Table LED light

6. Align the mark on the screen with the LED light of print table.
7. Clamp Screen by touching **Clamp** in **[Setting]** page. Confirm that Screen is fixed.
 - a. Press **[LED off]**.
 - b. Press **[Clamp]**.

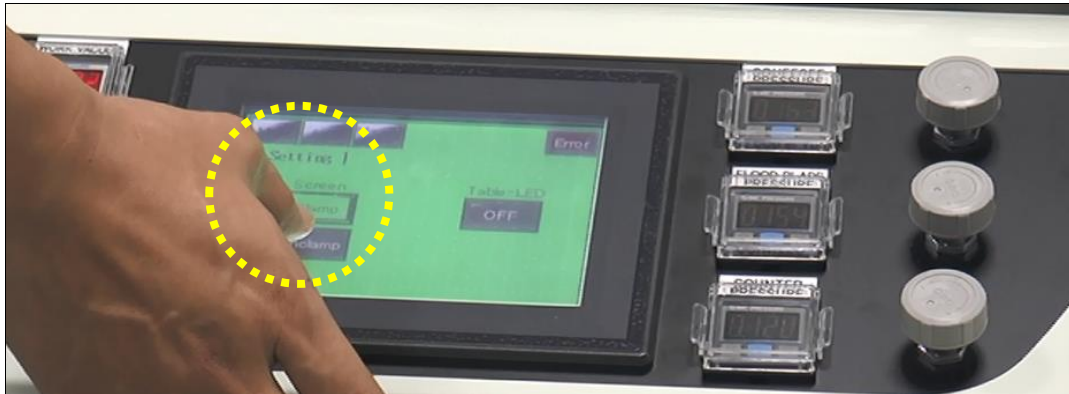


Fig.28: Clamping the screen and LED Off (Main → Setting)

5.5) Flood blade parallel & height adjustment

- a. Close squeegee head by holding Open/close handle.
- b. Fasten the Right unit lock nut (squeegee) so that the squeegee does not fall by its own weight.



Fig.29:-Tightening the squeegee height adjustment

- c. Bring the squeegee head unit to the right position by pressing flood stroke continuously.
 1. Adjust Left unit pushing amount adjustment handle for flood blade to be down stop.
 2. Release the counter pressure (Operation Panel) to “0” MPa to move down Flood blade.

3. Place two pieces of thin paper on the screen, and let them touch both end of the Flood blade at corner.
4. Adjust the left unit pushing amount adjustment handle to adjust the height of the flood blade. Pull both papers simultaneously until the feeling of pulling force on both papers becomes equal.
5. If there is tilt then loosen left unit parallel adjustment clamp lever. Control left unit parallel adjustment micrometer head to adjust flood blade parallel until feeling of pulling force on both papers becomes equal.
6. Ensure that there is some gap between flood blade and screen mask (flood blade gap should be more than the squeegee gap)
7. Fasten **left unit parallel adjustment clamp lever** after completing the adjustment.
8. Use left unit lock nut to lock the pushing amount.
9. Increase the counter pressure to 0.121 MPa to bring the squeegee up.

Recipe set up

- a) Go to **Main** → **File** → select one file recipe → check the snap off distance, speed and position of print head.
- b) After setting recipe save it.

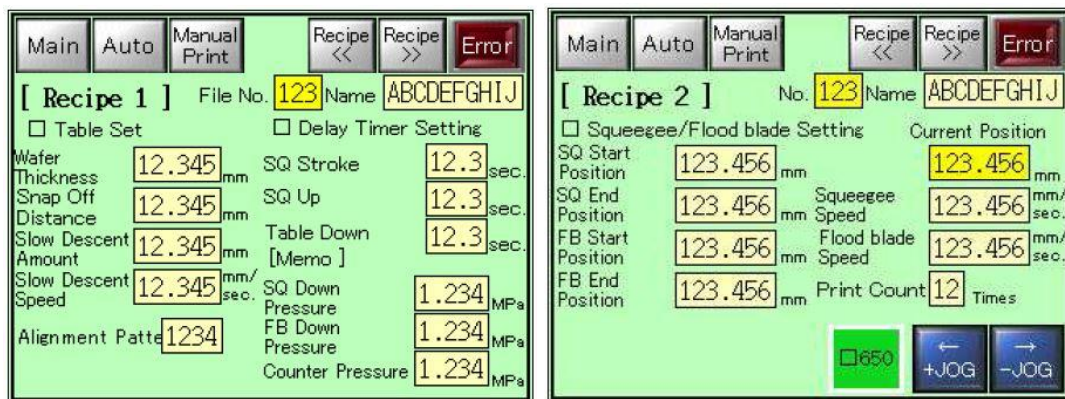


Fig.30: Recipe setting for printing

6) Printing Mode

There are two printing Mode

1. Auto mode
2. Manual Print

6.1) Auto print Mode

1. In **Main** go to **Print mode** activate **print start** , **lift-up pin** and **mechanical org alignment** and deactivate **auto alignment** option as shown in Fig.31 below

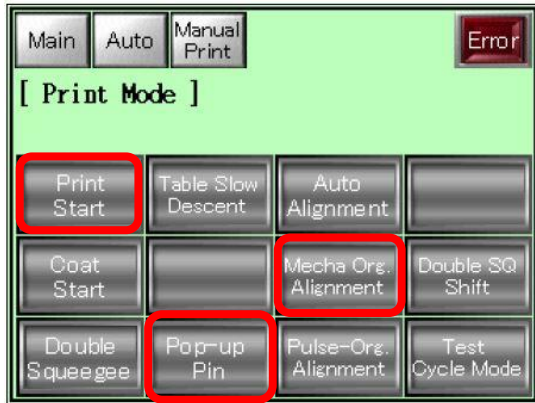


Fig.31- In print mode activation of different function

2. Bring print head to left most position and open it. Now put paste (Al/Ag) on screen as shown below in Fig.32.



Fig.32: Placing Al paste on Screen top side

3. Now close the Squeegee print head. Place wafer on print table within the area shown in Fig .33

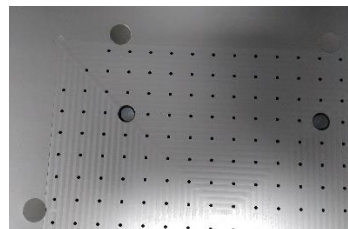
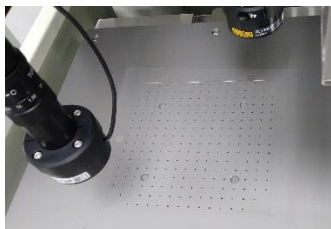


Fig.33:- Placing of Wafer on print table (a) Wafer area (b) wafer placed (c) Alignment mark.

4. Now go to Main then Auto mode.

5. Do 1st print as **Dummy print on thin plastic film** to check the alignment of screen and print result of first layer.

6.1.1) Dummy print process (In Auto mode)

1. Place the wafer in print table and press **Continuous suction** as shown in figure.33.
2. Spread the dummy plastic film over the wafer and spread with squeegee properly.
3. Now press **Dummy Print** tab and press manual tab to go in **Auto mode** operation.
4. Now check that paste on screen and squeegee lock nut should be free, pressure of squeegee, flood plate ($>.150$ Mpa).and counter pressure ($>.121$ Mpa) should be proper.



Fig.34:- Auto mode window

- a. Spread the dummy plastic film over the wafer.
- b. Press **Auto** & then do **Dummy Print**
- c. Press **Continuous Suction** & press **Manual** (This will turn to Auto mode)
- d. Press both **Start** button simultaneously as shown in fig.35. This will bring the table in the print area and start printing the wafer.



Fig.35:-Start button in Auto mode

e. Inspect the patterns & the alignment closely on film and if print is fine then remove plastic film.

Note:-If the print is not fine then please refer Table alignment section.

f. Now deactivate (release) **Dummy print** and **Continues Suction**.

g. Press [**Main**] and got to **Print Mode** →press **Print mode**

h. Press **Pop up pin** to activate.

[Note: **pop up pin should be deactivated while doing the dummy prints].**

i. Place the wafer on print table.

j. Go to **Auto** mode and activate **Auto mode**. Both start button will start to blink.

k. Press both start button simultaneously.

l. After printing process completed Pop-Up pin will lift wafer as shown in figure.35 and wafer should be handled as shown in Fig.36 below



Fig.36:- Wafer lifting and handling after printing

m. Before printing last wafer in Auto mode activate **Screen Cleaning** tab. So after printing **print head** will stay at left most position and a message will appear “**It is time to clean a screen**”.

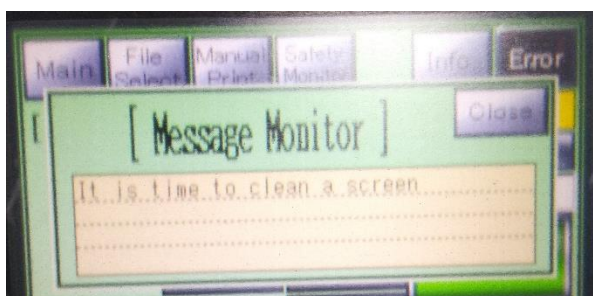


Fig.37:-Screen cleaning message

6.2) Manual Printing Mode.

1. Go to **Main** and press **Manual Print** tab as shown in Fig-38 .

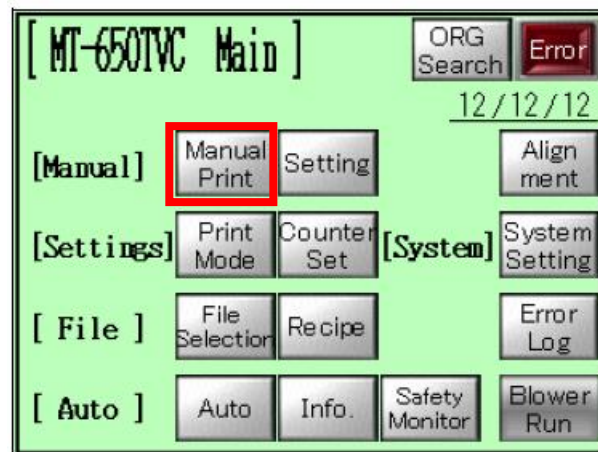


Fig.38:-Main tab

2. Place wafer on print table and align with print area.
3. Bring the Print head to left most position.
4. In Manual print Tab (Fig.39)



Fig.39:- Manual print Tab

5. Place the wafer on print table and align. Now press **Wafer Suction**
6. Press **Flood Blade up** to down flood on screen on left most side.
7. Press **Flood Blade stroke** till flood blade cover entire screen opening on screen .



Fig.40:- Silver paste after flood stroke

8. Press **Flood Blade Up** to up lift the flood blade.
9. Press **Squeegee Up** to move squeegee down.
10. Press **Table Rightward** and **Right start** button together for print table to down to the screen.
11. Press **Table Up** then Press **Squeegee Stroke** and hold till print head return to left most position.
12. Press **Squeegee Up** then press **Table down**.
13. Press **Table Leftward** and **Right Start** together and hold till table come to left most position.
14. Press **Wafer Suction** then **lift -up pin** to lift wafer up from print table.

7) Print Table Alignment

In **Main** or **Manual print** window press Alignment option then Alignment window will open as shown Fig.41 below.

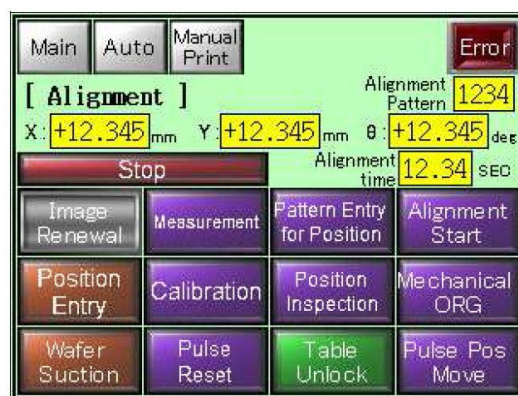


Fig.41:- Print Table Alignment Window

1. Press **Table Unlock** and now move the **joy stick** in the desired direction as shown in Fig.42.

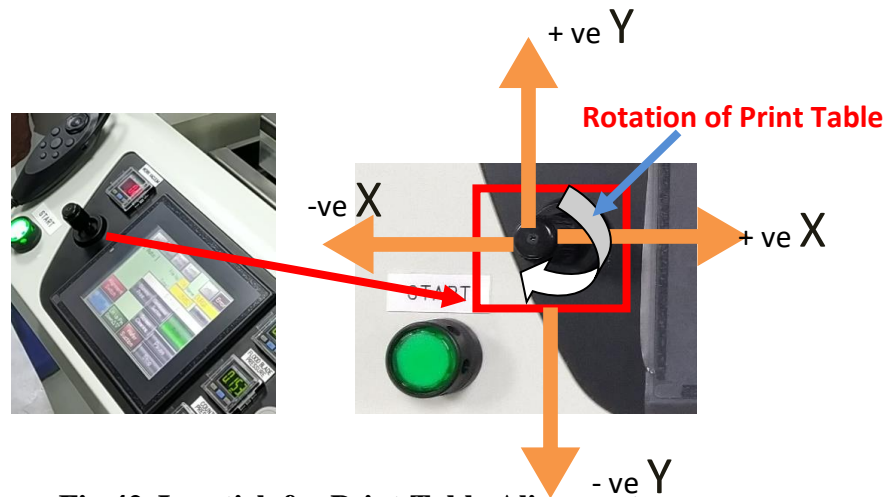


Fig.42-Joy stick for Print Table Alignment.

2. Move the joy stick in in one direction . Now press the **Table Unlock** to fix lock position of table.
3. Now check the print result again after printing on plastic film. Do the step till alignment get completed.

8) Double Layer Alignment

For double layer alignment, different layer are define the as follow

- a). 1st layer –Work pattern
- b). 2nd layer- Screen pattern

Process flow for rear side and front side double layer printing is describe below,

1. Finger (Ag) layer (1st layer)
2. Busbar and finger (Ag) layer (2nd layer)

For work pattern registration

In **Manual print** mode after printing last wafer of 1st layer do not remove the **wafer suction** or in **Auto Mode** activate **Continuous Suction** for printing wafer.

(Note-Deactivate pop up pin in print mode for last wafer only).

Double layer alignment process

8.1) Work Pattern registration

1. On computer screen Make sure that both alignment mark are visible(Fig.43) . Camera should be in diagonal position.

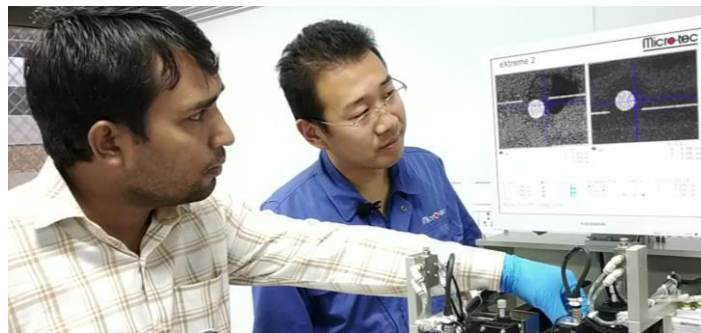


Fig.43:- Alignment of Camera to bring alignment mark in Camera view area

2. Press button no-7 ON Console (back side) and then on the computer screen **Main** a pop window will appear as shown in Fig .45



Fig.44: Front and Back side of Console (Alignment Remote) with Button function



Fig.45:- **Main** Pop up widow after pressing button 7 on console

3. Now go to **Others** as shown in Fig.45 (red box) a pop window will open, select **Account setting** and then select **Administrator**



Fig.46:-Administrator account logging

4. Enter Administrator password and press **Ok**.

5. Come back to **Main** (Pop up window) and go to **Pattern setting** → **Work pattern** as shown in Fig.47 below



Fig.47:Work pattern registration selection Window.

6. Select Work Pattern then camera selection window will appear as shown in Fig.48



Fig.48: Camera Selection window

7. Select Camera 1 by pressing **0** on console

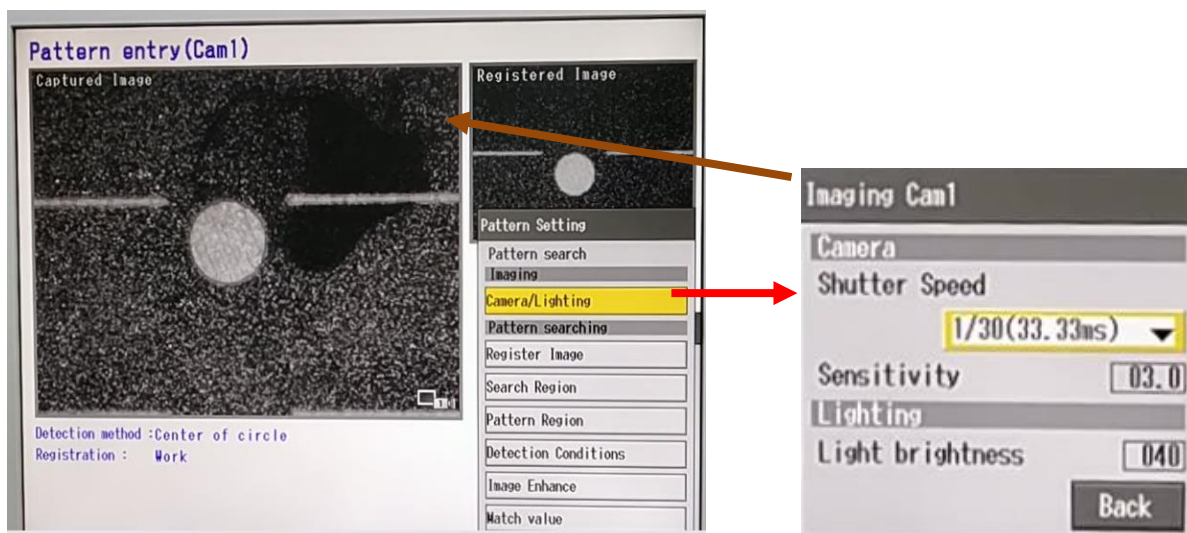


Fig.49:- Adjustment of image by camera lighting option

8. After adjusting camera light go to **Register Image** option and press **save** it will show registering image in % . After 100 % completing press **OK** shown in Fig.50 below.

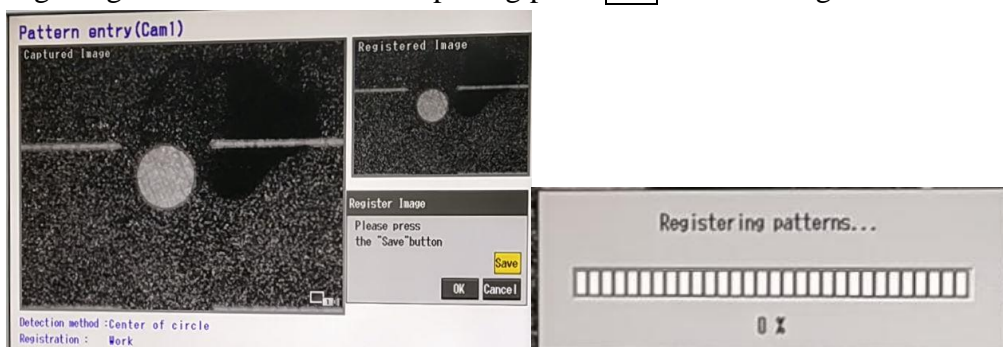
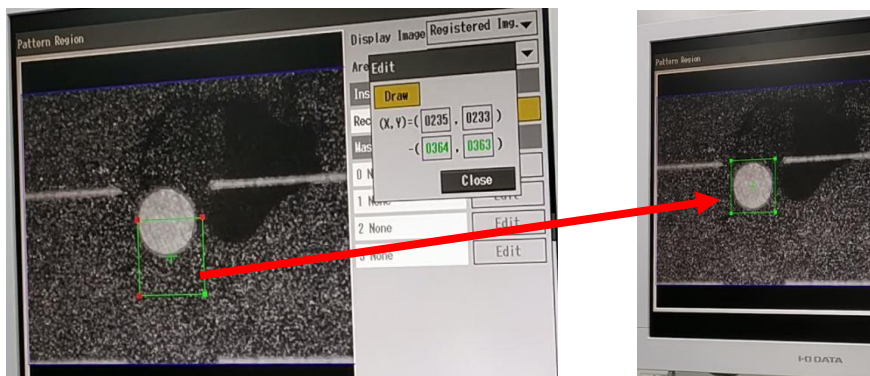


Fig.50: Pattern registration for Cam1.

9. Go to **Pattern Region** option and select the region of pattern by use of console button.



(a) Pattern region



(b) Moving pattern region to actual pattern

Fig.51: pattern region fixing

1. After fixing pattern region ,

Go to **Detect Point** → **Detect Conditions**

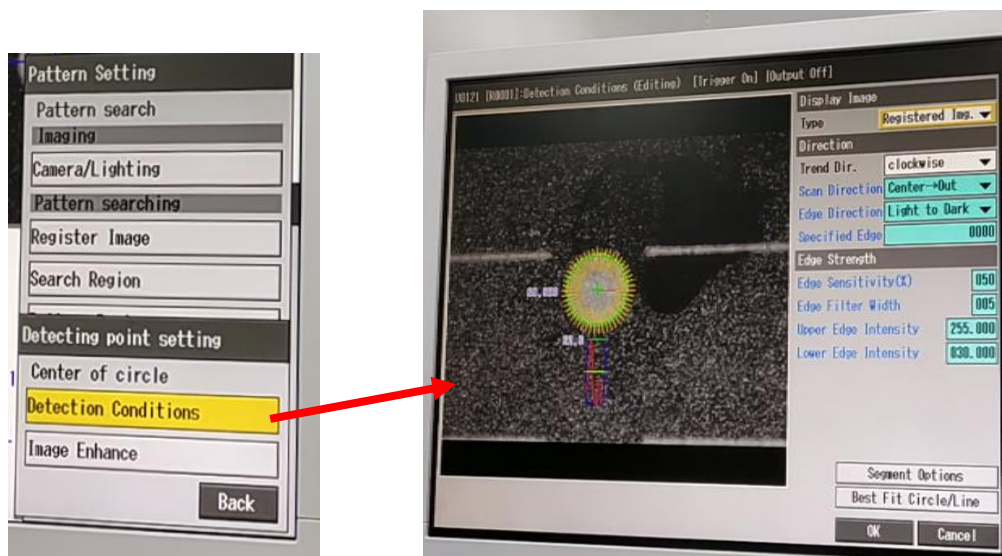


Fig.52: Changing scan and edge direction

Now fix the Scan direction and edge direction over the pattern region and press **Ok**.

2. Return to Pattern setting and then go to Copy Camera 1 → 2 tab and copy parameter of camera 1 to 2.
 3. Go to Camera 2 option and registered image and fix position of pattern region as Camera 1 completed.
13. Now come back to **Pattern Setting** and press **Save** as shown below in Fig.53,

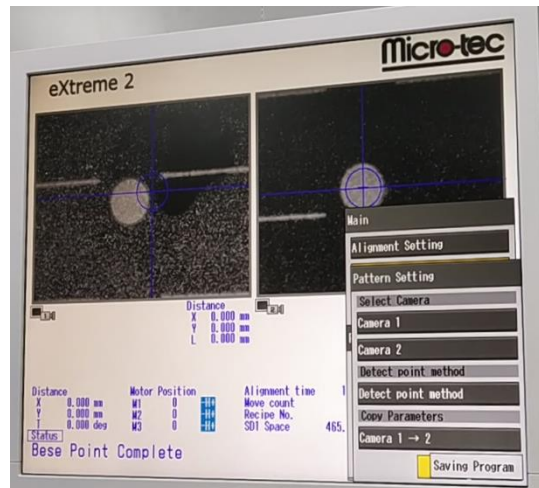
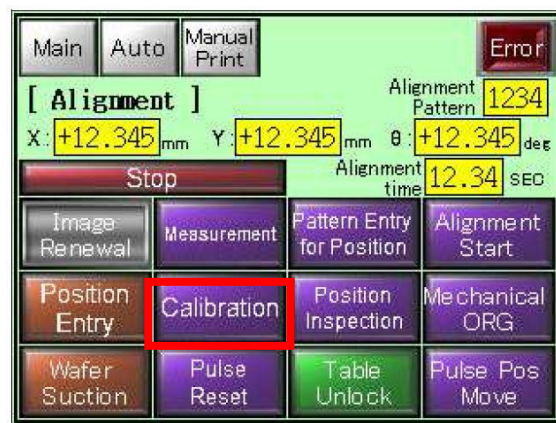
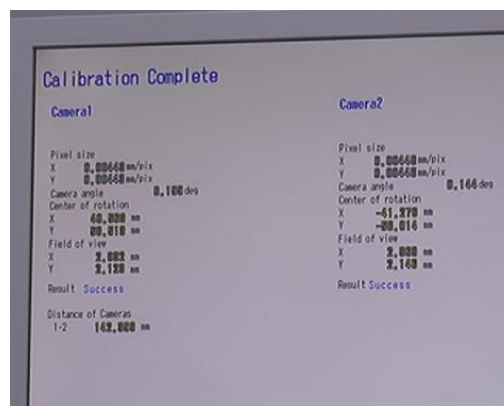
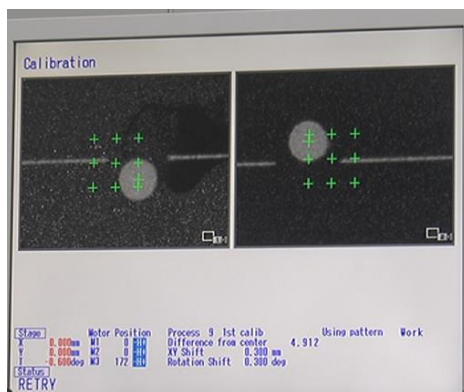


Fig.53:- Saving programs of Workpattern registration.

14. Now exit from Main. Go to **Alignment tab** on Control Screen and press **Calibration**.



(a) Calibration on control screen (Alignment Tab)



(b) Result on Monitor

Fig.54: Calibration of camera

1. Now remove the wafer from print table. Clean the First layer screen. After completing setting of 2nd layer screen (squeegee, flood plate and recipe set up and paste on screen).
2. Print a dummy print of thin film to check the position of alignment mark on camera view area.

8.2) Screen pattern (2nd layer) Alignment

3. After checking the Alignment mark in camera view ,print a dummy on wafer (Without 1st layer on it).
4. Press button no-7 on console , go to **Pattern Setting** and select **Screen Pattern** and **Register image** as previous steps and save the program. After saving program exit from **Main**.



Fig.55:Screen Pattern Selection in pattern setting

5. After Screen Pattern registration, Go to **Alignment Tab** on contral screen and press **Position entry** (only for 2nd Layer) to enter the position of screen pattern.

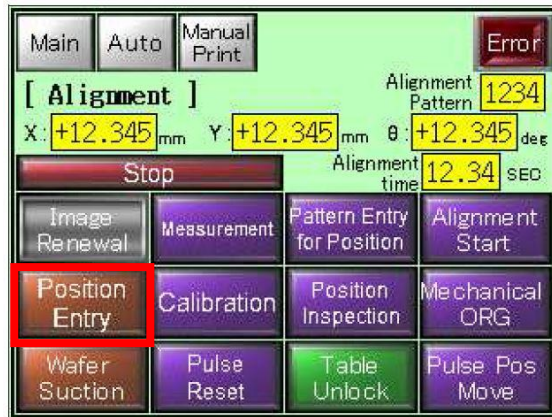


Fig.56: Position Entry for Screen Pattern

6. Go to **Print Mode** and activate tab in red color with **Auto Alignment**.

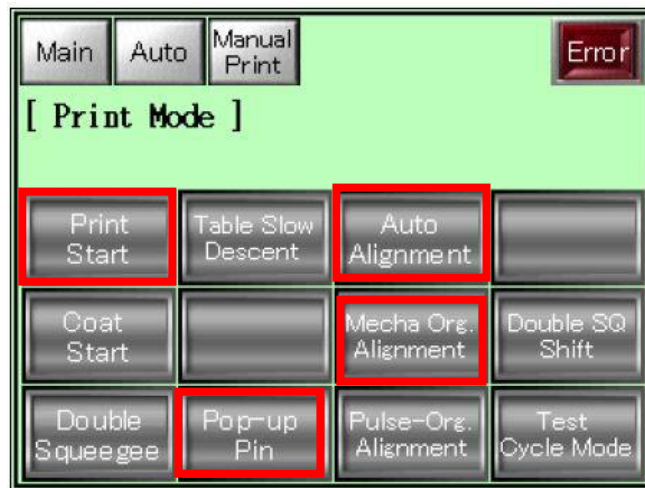


Fig.53.: Activating Auto Alignment in print mode

7. Now place wafer with 1st layer printed (after wafer drying) on it. Go to **Auto** and activate **Auto mode**.
8. Press both start button together, on Computer screen 2 circle will align on the same position.

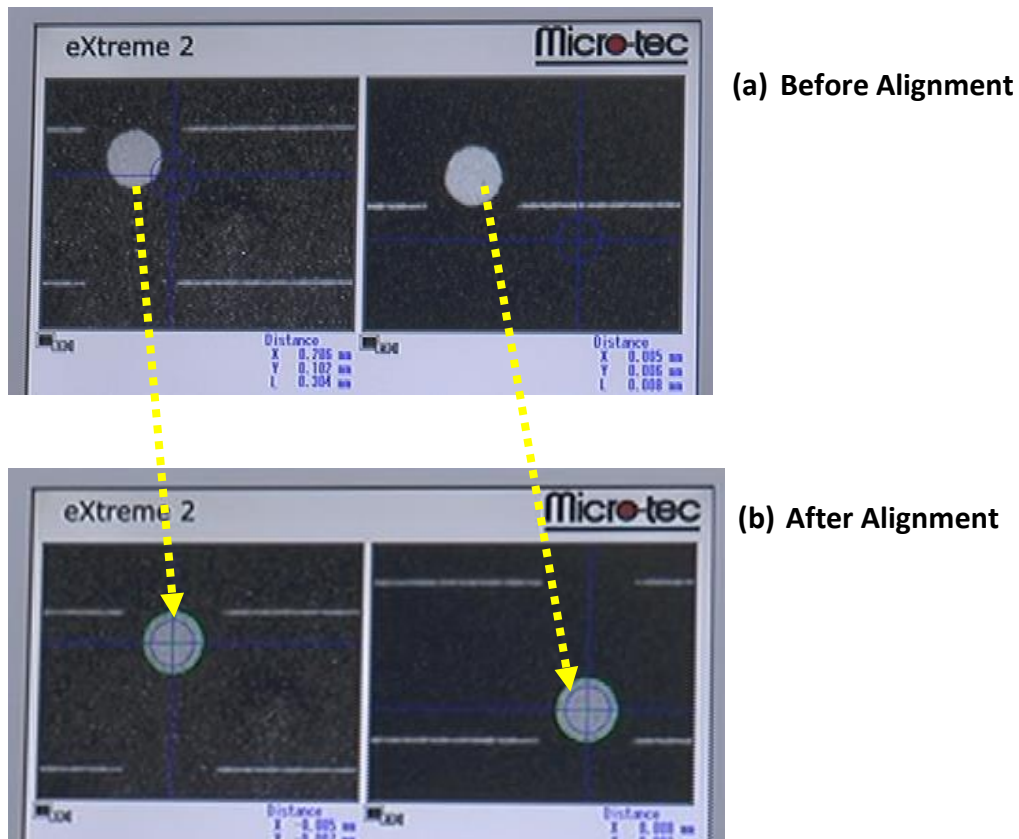


Fig.58:- Auto Alignment of 2 layer in double layer printing.

9) Screen Clean

1. Move print head to left most position. Open the print head.
2. Remove the paste from squeegee and flood plate and remove squeegee from print head.
3. Go to Main → Setting → Unclamp the screen.
4. Remove the screen from machine and place on cleaning tub.
5. Remove the paste from screen as shown in figure below carefully.

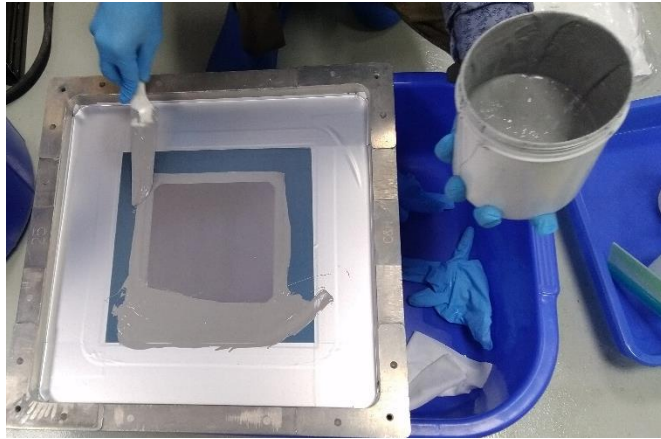


Fig.59:Removing the paste from screen

6. Spray the IPA over the screen and remove the paste by using lint fromfrom corner first.
7. Now spray IPA on screen and remove the paste from printing part of screen.
8. Now flip the the screen and spray IPA and remove paste by lint free cloth.
9. Repaet the process up paste are coming out after spraying thje IPA.
- 10.After complete removing the paste , screen will look as shown in figure below,

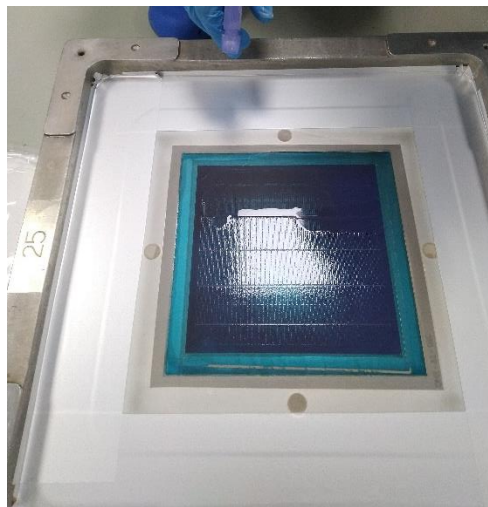


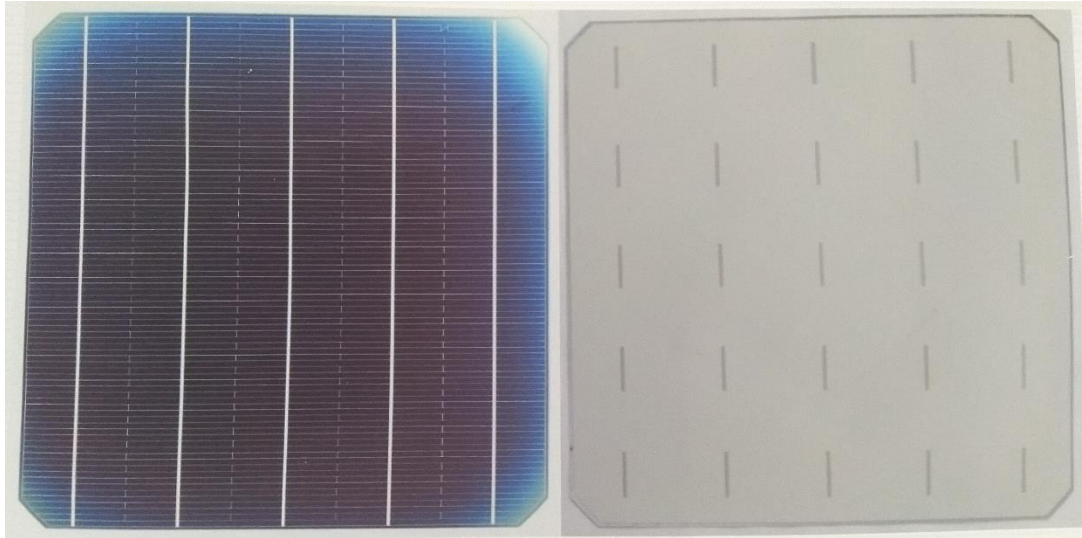
Fig.60: Screen after Cleaning

11. Clean the Printing head by IPA to remove the paste and close the print head.

10) Switching Off sequence

1. Close printing head.
2. Clean the print table and cover the print table with plastic film.
3. Swith off the machine (press Red power button).
4. Switch off the transformer and CDA.

5. Switch off Main power supply (MSB) for Screen Printer and CDA.
6. Release the pressure of CDA.



Printed Result on Front side double layer with AgAl print on rear side.

Vendor detail

1. System Engineer

YU NAKATANI

MANAGER, MICRO-TEC CO, LTD JAPAN

[EMAIL - NAKATANI@E-MICROTEC.CO.JP](mailto:NAKATANI@E-MICROTEC.CO.JP)

MOBILE: +81-9069452105

PHONE: +81-47-350-5131

SKYPE ID- MTC005H

2. Indian Vendor

UDAY CHITRE

HEAD – BUSINESS DEVELOPMENT,

KUNAL ENTERPRISES, INDIA

[EMAIL-UDAY@KUNALENTERPRISE.COM](mailto:UDAY@KUNALENTERPRISE.COM)

MOBILE: 9820640345

PHONE: +91-22-4210-5858

[illegible]

