

You're Automation Partner



Lamina Reticle Products



F O R T R E N D

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Fortrend - About Us

Founded in 1979 in Silicon Valley, USA, Fortrend is a leader in batch wafer transfer technologies, Standard Mechanical Interface (SMIF) technologies, ultra-clean automation solutions, and wafer surface curing processes for the semiconductor and PV industries. Fortrend SMIF products have become the crucial automation connections between process equipment and the factory delivery system and between different processing equipment. Fortrend's standard 200mm and 300mm front end automation modules are readily integrated into processing tools reliably and cost effectively. Fortrend's 3DIC thermal curing tools set the industrial standards for wafer surface curing processes. Fortrend offers not only standard automation and thermal curing modules, but also custom solutions allowing us to meet custom challenges and difficult configuration requirements quickly with a minimum of expenses. Contact Fortrend and experience our engineering excellence firsthand.

What Set Us Apart

- Original inventor of 200mm SMIF pod loader and micro-environment technology
- Serving 200mm SMIF automation market since 1985 and the dominant solution provider for 200mm SMIF retrofit market today (Over 1,000 load ports delivered since 2008, to 10+ FABs worldwide)
- Pioneer in new generation solar cell (0.15mm thin) batch handling robot
- Complete reticle handling automation solutions
- Leading EUV mask handling and load ports solutions
- 300mm wafer handling product lines (sorters, EFEM, component modules, and integrated oven systems) introduced in 2008
- Over 30 USA and International patents

What Does Fortrend's EUV and Reticle handling solutions Offer?

Fortrend offers several unique solutions to Mask shops and FAB's to improve the performance and yield for Photomask and EUV reticle process, metrology and storage Tools.

Fortrend has developed and improved a number of SMIF load ports, shipping box openers, robotic handling solutions with improved cleanliness and ease of operation to meet the high demands of the industry with the emerging EUV and smaller bandwidth requirements of the next generation Masks and Reticles.

The Benefits

Lowest capital investment and manufacturing cost at highest manufacturing efficiency and production profitability. Fortrend is your one-stop solution provider for all reticle handling and storage requirements.

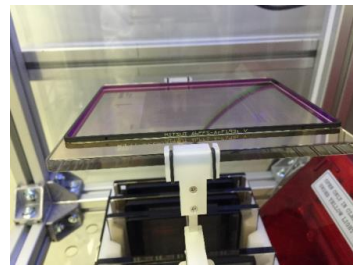
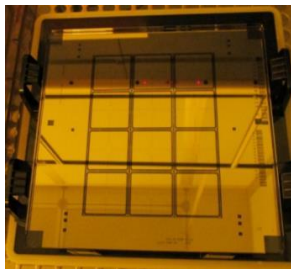
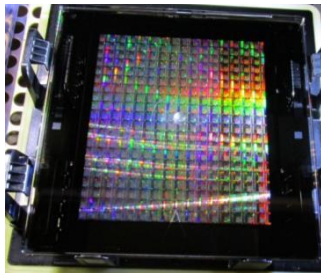
Value Propositions

1. Shortest development time allowing OEM customers to meet window opportunities and fastest time-to-market
2. Best management solutions to handle complicated reticle handling and storage requirements at lowest cost possible
3. Improved production yields for safe and clean reticle handling and storage
4. Meets and exceeds the most rigorous contamination requirements of reticle from particles, ESD, haze, and human handling
5. Easy and cost-effective upgrades of open stage tooling into SMIF compliant tooling.

6. Total solution packages for safe and automated handling of reticles from shipping carriers to custom process pods; to SMIF pods; and to process tools

Mask/Reticles

- Masks or Reticles are used in the Semiconductor Lithographical tools to project the patterns on the wafers during their manufacturing.
- The most common masks used today are the 6" (152.4mm) x 1/4" (6.35mm) thick masks.
- Fortrend manufactures handling equipment for these masks.
- There are two types of 6" mask – the 193 and the EUV mask.
- 193 masks have a pellicle attached to one side to protect the mask from particles.
- EUV masks with and without Pellicles

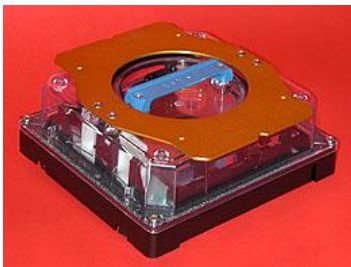


SMIF Pods & Reticle Boxes

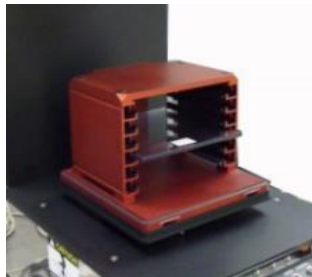
There are 3 types of Reticle/Mask SMIF pods used by SEMI conductor FABS and Mask Manufacturers.

- For the Manufacturing of the masks the SEMI E100 RSP 200 SMIF pod is used.
- Inside the Wafer FABS the lithographical tools use SEMI E111 single RSP or SEMI E112 Multiple RSP's.
- The next generation EUV tools use SEMI E152 SMIF pods.

Other Lithographical tools from Nikon and Canon use their own Mask boxes.



SEMI E111 150 RSP



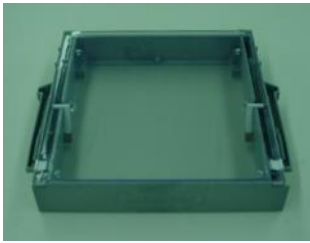
**SEMI E112 150
RSP**



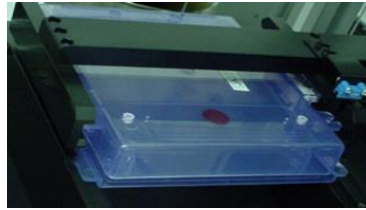
SEMI E100 RSP



**SEMI E152 EUV
Pod**



Nikon Mask Box



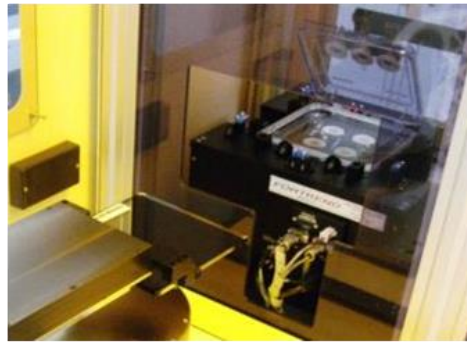
Canon Mask Box

Shipping Boxes & Storage Boxes

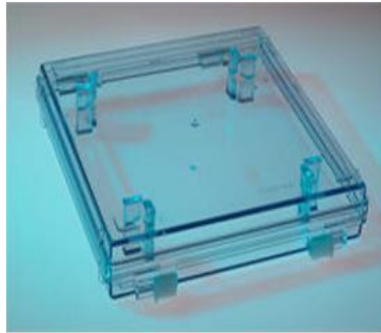
- Both Mask shops and FABS store and transport their masks in several types shipping and storage boxes.
- Fortrend has design and built several types automatic box openers to allow access to the masks inside.
- The Blank Box Opener (BBO) is used to open 5 mask blank boxes from the mask makers – Hoya or ShinEtsu.
- Clam Shell Box Openers (CSO) these open shipping boxes from Toppan, DMS, Pozzetta, IBM and others.
- Other storage box openers are available upon request and engineering study.



IBM Blue Shipping Box



Clam Shell Box Opener



DMS/Pozzetta Shipping Box



Hoya & ShinEtsu Blank Boxes



Blank Box Opener

OEM Products

PLM 150Rx – RSP 150 SMIF Pod Opener

- Small footprint saves valuable FAB floor space
- ISO Class 1 cleanliness with active self-clean air flow design.
- Supports Multiple and Single SMIF 150 pods
- Lifts the Pod shell leaving the Reticles in a sealed mini-environment
- All electrical system with field programmable application software
- Four programmable Interlock signals
- Pod Present Sensors
- Mask Mapping Sensor
- Protrusion sensor
- OHT Compatible
- Meets SEMI E19.3, E111, E112, E117, S2 and S8 standards and CE certified
- Mounts directly into a process Tool or to a manual load port adaptor to convert open station to a SMIF compatible station.
- Optional version with integral RFID reader/writer



PLM 150Rx

Specifications:	
Reticle size	152mm W x 152mm D x 6.35mm H
Dimension	467W x 460D x 770H mm
Elevator Stroke	210 mm
Load capacity	5.4kg
Pod Types	SEMI E111 Single RSP SEMI E112 Multiple RSP
Pod interface	SEMI E19.3
Power requirement	100V/240VAC @ 1Amp 50/60Hz Or 24 VDC (Option)
Weight	23kg without Pod
Open Pod	< 12 seconds
Close Pod	< 10 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Communication	Parallel and/or Serial
Communication	EIA-RS232C(SECS I/II)
ID device (Optional)	RFID module or IR Link



**PLM 150Rx Mounted
on Host Tool**

PLM 200Rx – RSP 200 & EUV SMIFPod

Opener

- Small footprint saves valuable FAB floor space
- ISO Class 1 cleanliness with active self-clean air flow design.
- Opens Standard **E100 RSP** and **EUV E152** Outer Pods Door
- Lifts the Pod shell leaving the Reticles in a sealed mini environment
- Applies 80N Force to E152 Pod doors during opening and Closing.
- Info Pad Sensor to detect Pod Type
- All electrical system with field programmable application software
- OHT Compatible
- Reticle Present Sensor (E100 SMIF Pods)
- Inner Pod Present Sensor (E152 EUV SMIF Pods)
- Pellicle Present and Orientation sensor (for E100 SMIF Pods)
- Meets SEMI E19.4, E100, E152, E117, S2 and S8 standards and CE certified
- Mounts directly into a process Tool or to a manual load port adaptor to convert open station to a SMIF compatible station.
- Optional RFID reader/writer



PLM 200Rx

Specifications:

Reticle size	152mm W x 152mm D x 6.35mm H
Dimension	467W x 460D x 770H mm
Elevator Stroke	210 mm
Load capacity	5.4kg
Pod Types	SEMI E100 Single RSP SEMI E152 EUV SMIF Pod
Pod interface	SEMI E19.4
Power requirement	100V/240VAC @ 1Amp 50/60Hz Or 24 VDC (Option)
Weight	23kg without Pod
Open Pod	< 12 seconds
Close Pod	< 10 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Communication	Parallel and/or Serial
Communication	EIA-RS232C(SECS I/II)



**PLM 200Rx on SEMI E63
Bolts-M Interface Load
Port Adaptor in Reticle
Sorter**

PLM EUV Dual – EUV SMIF pod opener

- ISO Class 1 cleanliness with active self-clean air flow design.
- Automatic unlocks and locks SMIF outer pod door
- Lifts both inner and outer pod doors.
- Applies 80N force to Outer Pod door, per SEMI E152, during Unlocking and Locking of the Outer Pod door.
- All electrical system with field programmable application software
- Four programmable Interlock signals
- Inner pod Present Sensor
- Inner pod alignment sensors
- Info Pad sensors detect Pod Type - RSP 200 or EUV Pod
- Communication: Serial or Parallel, SECS optional.
- Meets SEMI E19.4, E84, E100, E117, E152, S2 and S8 standards and CE certified
- OHT Compatible
- Optional RFID reader/writer
- Optional Purge Available
- Unlock/Locks Standard 200mm SEMI E100 Reticle SMIF Pods (RSP)



PLM EUV Dual

Specifications:

Reticle size	152mm W x 152mm D x 6.35mm H
Dimension	363W x 420D x 700H mm
Elevator Stroke	240 mm
Load capacity	5.4kg
Pod Types	SEMI E152 RSP or E100 RSP
Pod interface	SEMI E19.4
Power requirement	100V/240VAC @ 1Amp 50/60Hz Or 24 VDC (Option)
Weight	23kg without Pod
Open Pod	< 5 seconds
Close Pod	< 5 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Pod PIP sensor	1 set
Communication	Parallel and/or Serial
Communication	EIA-RS232C(SECS I/II)



**PLM EUV Dual
mounted to EFEM**

PLUS 150 G4

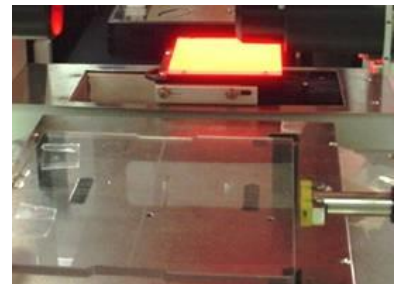
Integrated RSP 150 Pod Opener and Reticle Transfer Robot

- Integrated RSP 150 SMIF opener with reticle handling robot – smallest automation footprint
- Support SEMI E111 RSP-150
- Opener & Robot Arm meet **ISO Class 1** cleanliness work environment.
- Rotate Reticle 0 to 360°; Flip Reticle 0 to 300°
- Various reticle handling arms and gripper designs for flexible OEM reticle manipulation requirements (flip, rotation, extended reach, OCR/BCR, etc.)
- Support serial and parallel I/O communication protocols
- Turnkey system on wheels (easy transportation to service areas)
- Optional 1D, 2D (SEMI T11) and EUV (SEMI T16) bar code readers
- Optional OCR reader



- Optional RFID reader

**PLUS 150 G4
With OHT Light Strip**



**Integrated Bar
Code Reader**



	PLUS 150 G4
SMIF Pod Size	150 mm (SEMI E111)
Height	1812-1847mm
Width	381mm
Depth	562mm
Reticle Rotation	0 to 360°
Reticle Tilt	0 to 300°
SMIF arm payload	3.2 kg
Pod Interface	SEMI E19.3
Power	110V@3A/ 240V@1.4A, 60/50 Hz
Weight	93Kg (pod not included)
Load height	925 mm ± 25 mm
Mounting Repeatability	±0.5 mm
Cycle time	50 to 65 Seconds
Control	Front Panel, Pendant, Host
Communication	RS232C, SECS I/II, Parallel I/O,
Lot ID reader Options	RFID
Cleanliness	ISO Class 1

PLUS 500 G4

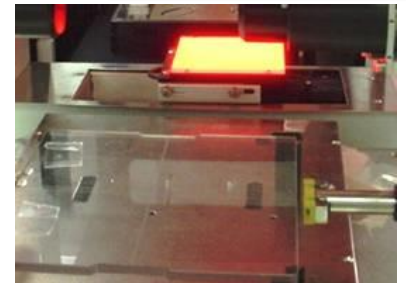
Integrated RSP200 Pod Opener and Reticle Transfer Robot

- Integrated RSP 200 SMIF opener with reticle handling robot – smallest automation footprint
- Support SEMI E100 RSP-200
- Opener & Robot Arm meet **ISO Class 1** cleanliness work environment.
- Rotate Reticle 0 to 360°; Flip Reticle 0 to 300°
- Various reticle handling arms and gripper designs for flexible OEM reticle manipulation requirements (flip, rotation, extended reach, OCR/BCR, etc.)
- Support serial and parallel I/O communication protocols
- Turnkey system on wheels (easy transportation to service areas)
- Optional 1D, 2D (SEMI T11) and EUV (SEMI T16) bar code readers
- Optional OCR reader
- Optional RFID reader

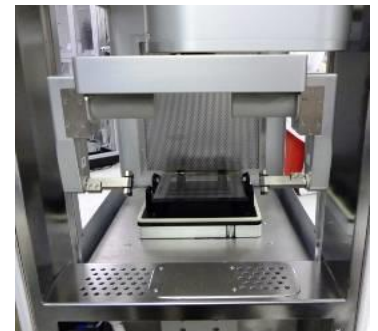


PLUS 500 G4

	PLUS 500 G4
SMIF Pod Size	200 mm (SEMI E100)
Height	1812-1847mm
Width	381mm
Depth	562mm
Reticle Rotation	0 to 360°
Reticle Tilt	0 to 300°
SMIF arm payload	3.2 kg
Pod Interface	SEMI E19.4
Power	110V@3A/ 240V@1.4A, 60/50 Hz
Weight	93Kg (pod not included)
Load height	925 mm ± 25 mm
Mounting Repeatability	±0.5 mm
Cycle time	50 to 65 Seconds
Control	Front Panel, Pendant, Host
Communication	RS232C, SECS I/II, Parallel I/O
Lot ID reader Options	RFID
Cleanliness	ISO Class 1



Integrated Bar Code Reader



Side Grip Reticle Gripper

PLM Open Cassette

Multi-Reticle Cassette Module

Features

- Small footprint saves valuable FAB floor space
- ISO Class 1 cleanliness with active self-clean air flow design.
- Cassette stage at 15° angle for loading and unloading
- Optional FFU system available
- Controller door locks to allow system flushing before opening unit to host tool – prevents FAB contamination into the Host tool.
- All electrical system with field programmable application software
- Four programmable Interlock signals
- Reticle mapper Sensor
- Reticle Protrusion sensors
- 2 Cassette present sensors
- Mounts directly into a process Tool or to a manual load port adaptor.

Specifications:	
Reticle size	150mm W x 150mm D x 6.35mm H
Dimension	363W x 420D x 700H mm
Elevator Stroke	240 mm
Load capacity	5.4kg
Open Cassette Types	Per Customer requirements 
Power requirement	110V/220V 3A/1.4A 50/60Hz or 24 VDC
Weight	23kg without Pod
Open Pod	< 12 seconds
Close Pod	< 10 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Cassette Present sensor	2 sets
Mapper sensor	1 set
Protrusion sensor	1 set
Communication	Parallel and/or Serial



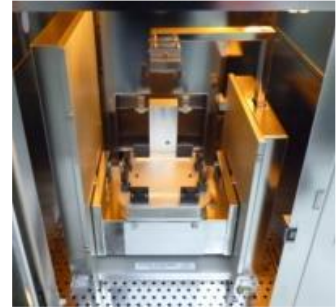
**PLM Open Cassette
Module**



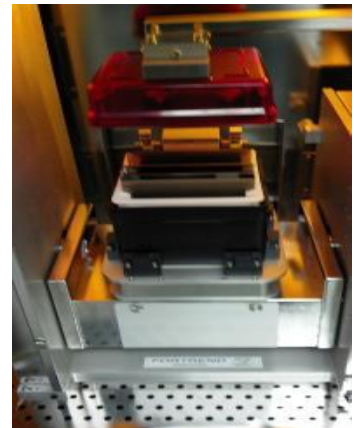
Blank Box Opener

– Hoya & ShinEtsu Shipping Box Opener

- Modular unit for integration into Reticle EFEM's or Sorters
- ISO Class 1 cleanliness with active self-clean air flow design.
- Supports Hoya, ShinEtsu and AGC Type Shipping Boxes.
- Setting gauges for each box type.
- Lifts the shipping box lid.
- Tilts masks to 90 degrees for robotic handling.
- Rotates Masks 0 or 180 degrees for reverse mask removal
- Field programmable application software
- Box Present Sensor
- Box Orientation Sensor
- Reticle Protrusion sensor
- Four programmable Interlock signals
- Mounts directly into a process Tool.
- Optional version with Automated Box lid opener.



Blank Box opener



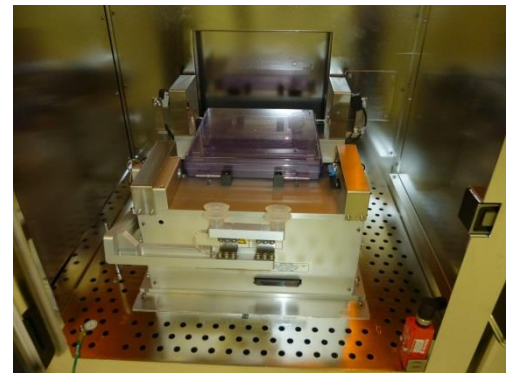
Specifications:

Reticle size	150mm W x 150mm D x 6.35mm H
Dimension	363W x 420D x 700H mm
Box Types	Hoya, ShinEtsu, AGC
Power requirement	110V/220V 3A/1.4A 50/60Hz
Vacuum Requirement	508mm Hg (20" Hg)
Clean Dry Air	5.62 kgf/cm ² (80 to 90 psi)
Weight	29kg without Shipping Box
Open Box	< 12 seconds
Close Box	< 10 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Communication	Serial (RS232)
Operation	Local operation or Host comm
ID device (Optional)	RF ID module
Optional	Automated Lid unclamping

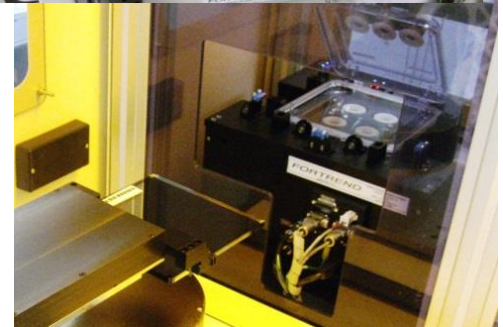
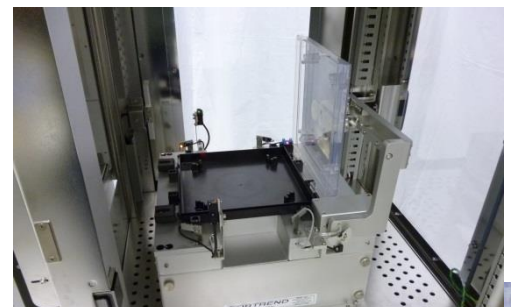
Clam Shell Box Opener

- Reticle Shipping box Opener

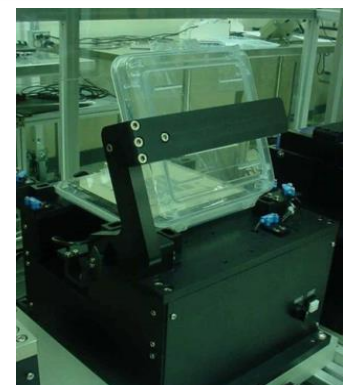
- Modular unit for integration into Reticle EFEM's or Sorters
- ISO Class 1 cleanliness with active self-clean air flow design.
- Models available to **open Pozzetta, Entegris, Toppan, IBM Blue and DMS** type Clam shell type Shipping Boxes.
- Lifts the shipping box lid.
- Automatic unlocks latches - Optional
- Field programmable application software
- Box Present Sensor
- Box Orientation Sensor
- Reticle Present Sensor
- Four programmable Interlock signals
- Mounts directly into a process Tool.



Clam Shell Box Opener



Pozzetta and DMS Clam shell box opener



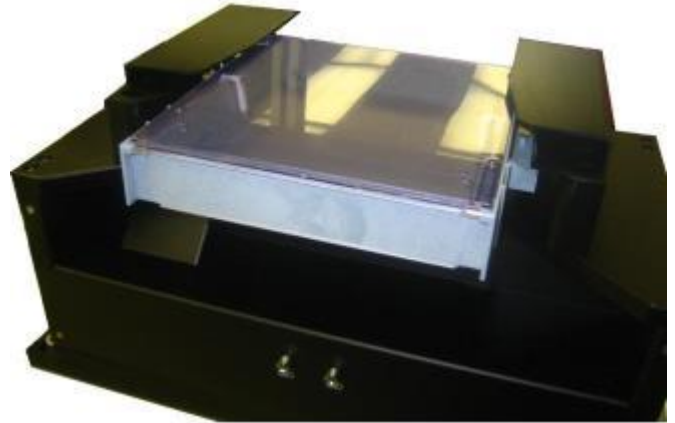
Specifications:

Reticle size	150mm W x 150mm D x 6.35mm H
Dimension	363W x 420D x 700H mm
Box Types	Hoya, ShinEtsu, AGC
Power requirement	110V/220V 3A/1.4A 50/60Hz 24 VDC - Optional
Vacuum Requirement	508mm Hg (20" Hg)
Clean Dry Air	5.62 Kgf/cm ² (80 to 90 psi)
Weight	18kg without Shipping Box
Open Box	< 10 seconds
Close Box	< 10 seconds
MCBF	50,000 cycles
MTTR	< 1 hour
Communication	Serial (RS232)
Operation	Local operation or Host comm
ID device (Optional)	RF ID module
Optional	Automated Lid unclamping

Nikon Box Opener

Designer to open Nikon Lithographical Reticle cartridges

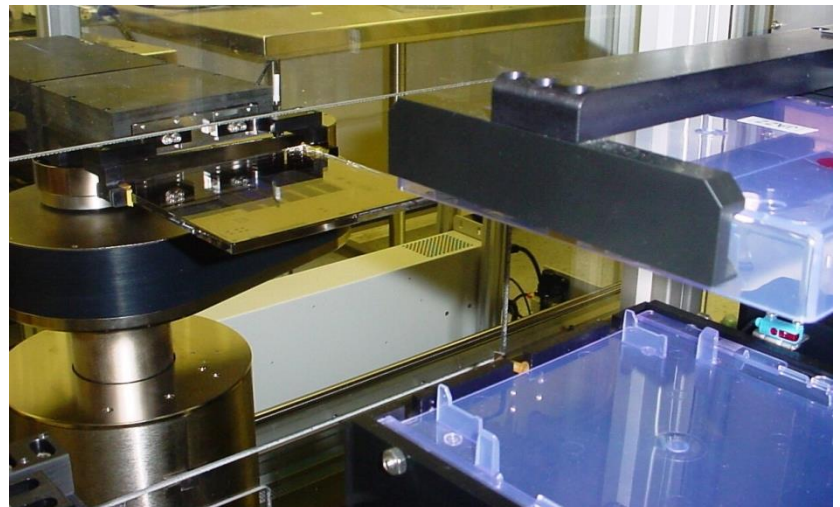
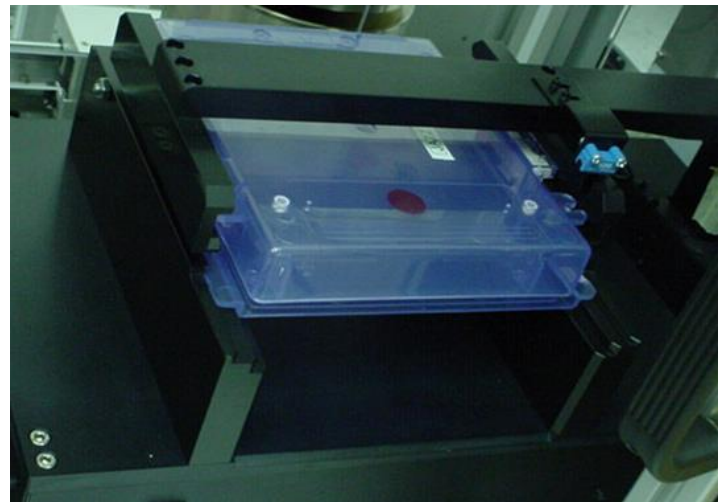
- Ergonomic box placement/removal operations
- Automated Front cover opener
- Box present, cover open, and mask present sensors
- RS-232 serial communication for remote controls
- PIO interlocks for robot safety
- Modular design for easy integration and service
- ISO Class-1 cleanliness



Canon Box Opener

Designer to open Canon Lithographical Reticle cartridges

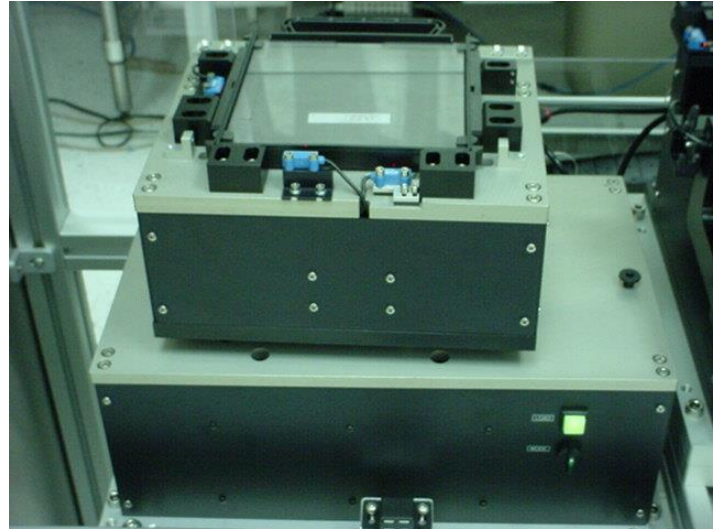
- Ergonomic box placement/removal operations
- Automated Lid lifter opener
- Box present, cover open, and mask present sensors
- RS-232 serial communication for remote controls
- PIO interlocks for robot safety
- Modular design for easy integration and service
- ISO Class-1 cleanliness



DMS Bare Mask Cartridge Opener

The module is designed unlock the DMS Bare Mask Storage cartridge to allow automated loading and unloading.

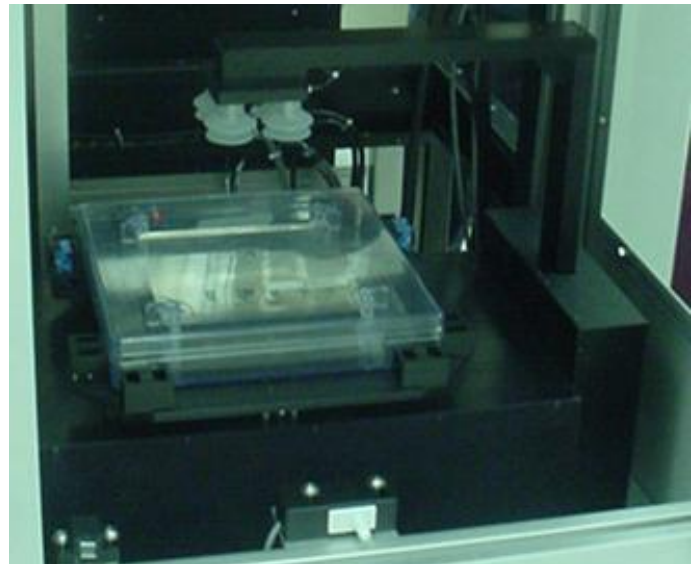
- Ergonomic box placement/removal operations
- Automated un clamping of cartridge locks
- Turntable for orientation
- Cartridge present, open, and mask present sensors
- RS-232 serial communication for remote controls
- PIO interlocks for robot safety
- Modular design for easy integration and service
- Optional Mask Bar code reader (1D and 2D codes)
- ISO Class-1 cleanliness



Lift Lid Box Openers - PD Box

The module is designed lift the lid off shipping and Storage boxes to allow automated loading and unloading.

- Ergonomic box placement/removal operations
- Automated lid lifting
- Box present, open
- Mask present sensors
- RS-232 serial communication for remote controls
- PIO interlocks for robot safety
- Modular design for easy integration and service
- ISO Class-1 cleanliness

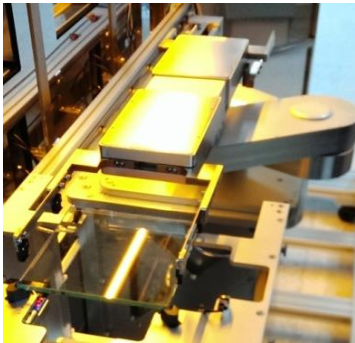


Reticle Transfer Robots - Single arm

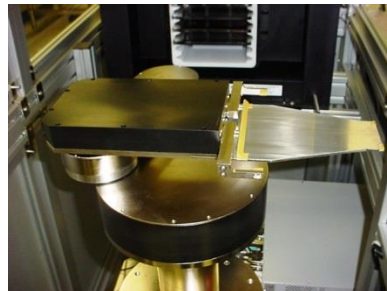
- ISO Class 1 Scara Robot
- End Effector's to suit shipping boxes, SMIF pods and custom tool stages Requirements
 - Side grip End
 - Forked End Effector
 - Paddle End Effecters
 - EUV Masks
- Single and Dual End Effector Designs
- Mask Mapper - Optional
- Linear Track to move Scara robot between box station (Optional)
- Fast & Precise Motion Robot
- 0.1 micron meter CLASS 1 Cleanliness



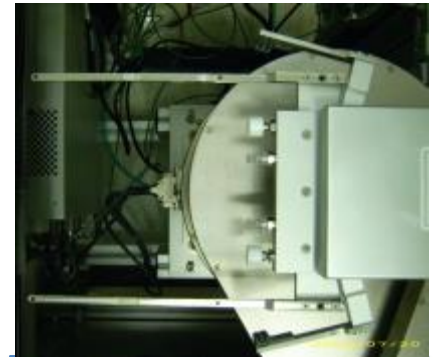
Single Arm



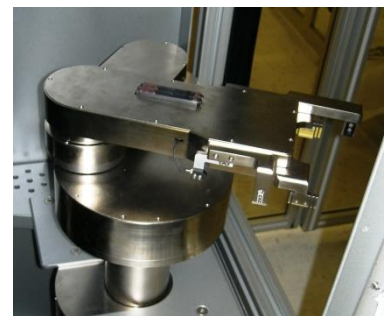
**Dual End effector on
Scara Robot**



Paddle End Effecters



**Fork End Effector for
Nikon Box**



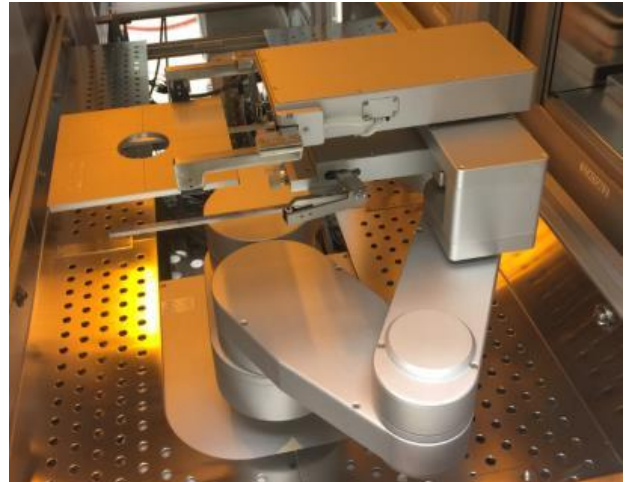
**Edge Gripper End
Effector**



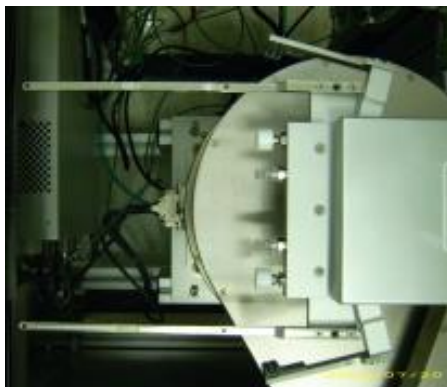
Linear Track

Reticle Transfer Robots - Dual arm

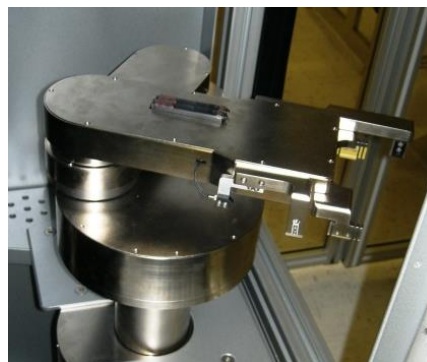
- ISO Class 1 Scara Robot
- End Effector's to suit shipping boxes, SMIF pods and custom tool stages
- Requirements
 - Side grip End
 - Forked End Effector
 - Paddle End Effecters
 - EUV Masks
- Single and Dual End Effector Designs
- Mask Mapper - Optional
- Linear Track to move Scara robot between box station (Optional)
- Fast & Precise Motion Robot
- 0.1micron meter CLASS 1 Cleanliness



**Dual Arm
Scara Robot**



**Fork End Effector for
Nikon Box**



**Edge Gripper End
Effector**

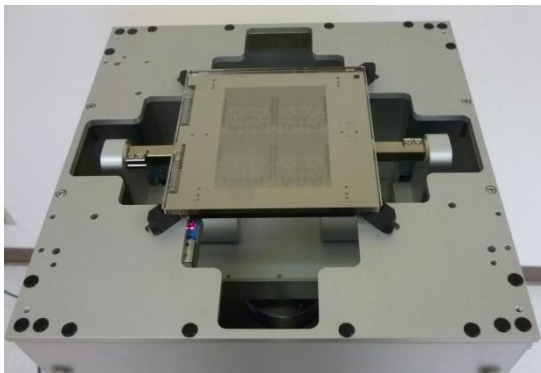
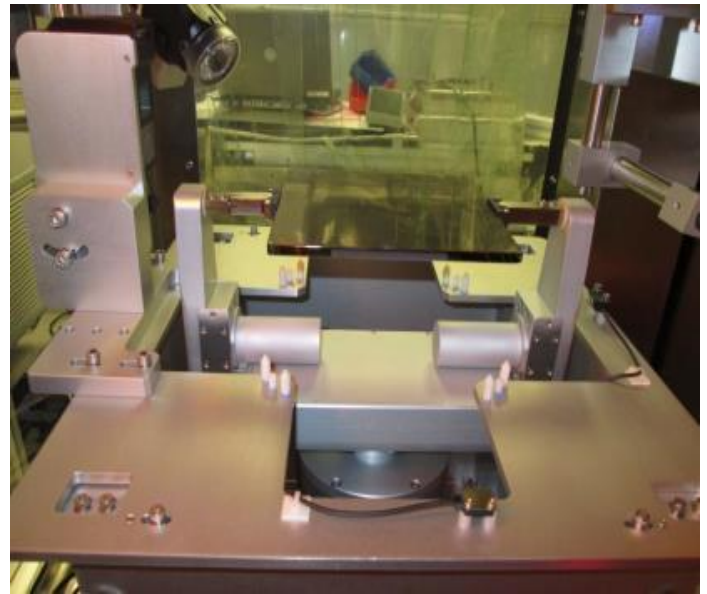
Reticle Robots General Specifications

Item		Specification
Model		ASR-2000R
Reticle Size		152 x 152 mm
Motion Range	R-axis stroke	300mm to 600 mm (not including EEF length)
	T-axis	370 °
	Z-axis	200 mm (Single Z-Stage)
Speed	R-axis	800 mm/s
	T-axis	240 degs/s
	Z-axis	500 mm/s
Repeatability	R-axis	± 0.1mm
	T-axis	± 0.020
	Z-axis	± 0.1mm
Mini Rotation Diameter		Depending on the Arm and EEF length
Payload		2kg
Motor		AC Servo motor
Cleanliness		ISO Class1
Weight		About 55 Kg
Mapping sensor		Option
Port application		Option
Teaching Pendant		UNIVERSAL With EMO, Dead Man Switch
MTBF		≥ 8,000 hrs.
MTTR		≤ 2 hrs.
Robot Controller		19" Rack Mount
Robot Driver Box		19" Rack Mount

Turn/Flip Robot

Integrated Turn/Flip Module designed to orientate and flip the Mask/Reticles

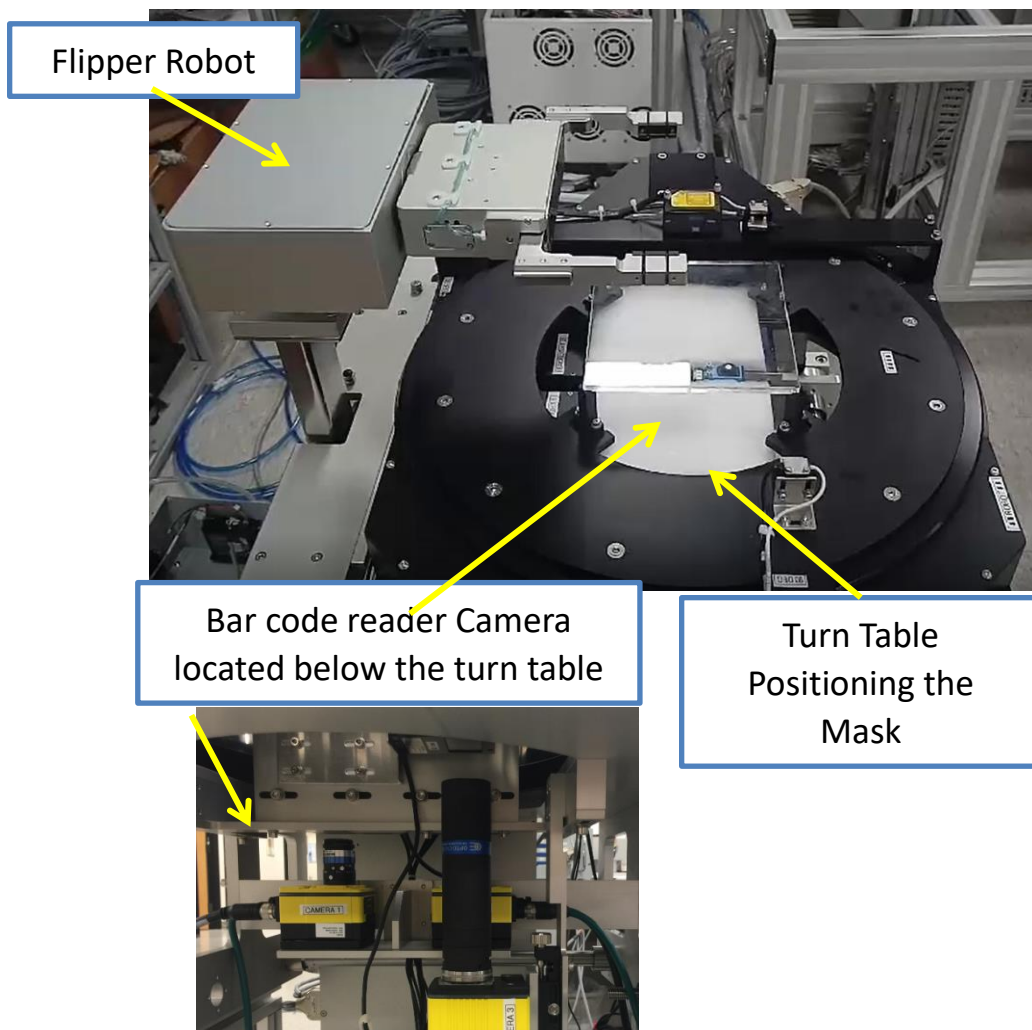
- Turn at 90°, 180°, 270°, 360°
- Flip 180°
- Mask present Sensor
- Pellicle Detection & Orientation Sensors
- Side grip End Effector
- All Mechanism below mask
- Meets ISO Class 1 environmental
- Optional Joystick control for manually manipulating Masks for visual inspection



Item		Specification
Model		Turn/Flip Robot
Reticle Size		152 x 152 mm
Motion Range	T-axis	360 °
	Z-axis	300 mm
Repeatability	T-axis	± 0.02
	Z-axis	± 0.1mm
Payload		2kg
Motor		AC Servo motor
Cleanliness		ISO Class1
Weight		About 55 Kg
Teaching Pendant		UNIVERSAL With EMO, Dead Man Switch
MTBF		≥ 8,000 hrs.
MTTR		≤ 2 hrs.
Robot Controller		19" Rack Mount

Turn Table with Mask Flipper

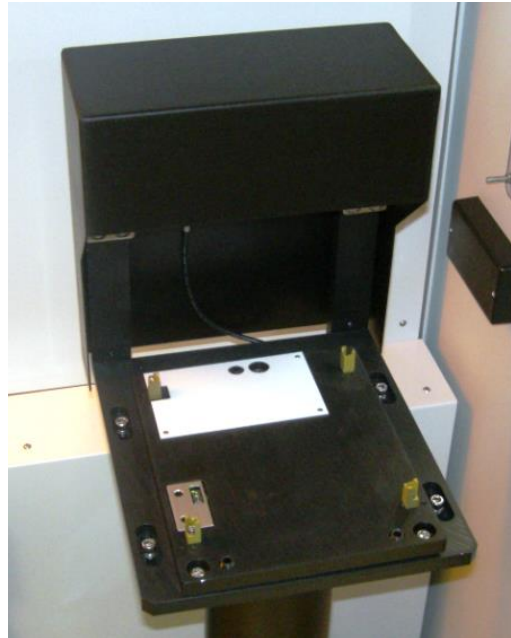
- Turn Table and integrated Mask Flipper
- Turn Table to orient Mask 90°, 180° or 270°
- Mask and Pellicle detection
- Mask Chamfer camera – Detects the Chamfer to confirm if a blank mask is chrome up or down
- Mask Flipper integrated into the module to flip
- Bar Code reader and lighting to read 1D and 2D Bar codes found on SEMI P1 Reticles
- Reader able to read the following types of 2D Bar codes:
 - SEMI T11 Data Matrix Codes.
 - QR codes



Turn Tables & Hand-Off Stations

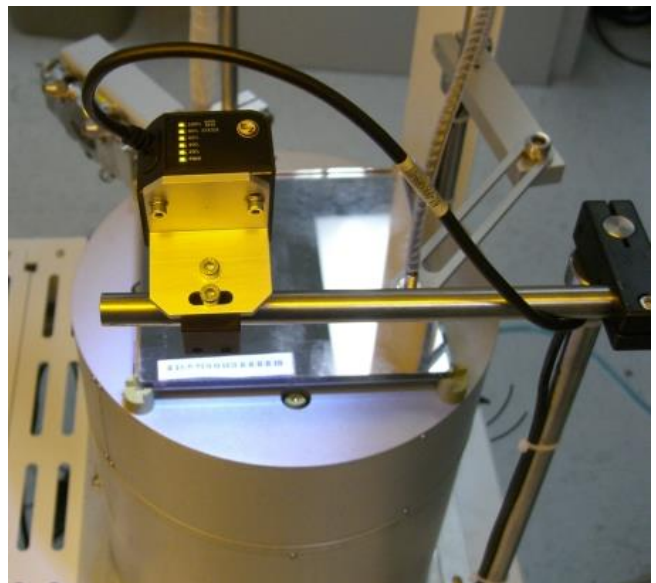
Fixed Hand-Off Station

- Stage used for Re-gripping Mask between stations
- Mask presence sensors
- Optional Bar code Reader can be installed.
- Pellicle Present sensors optional
- ISO Class- 1 cleanliness



Turn-Table Hand-Off Station

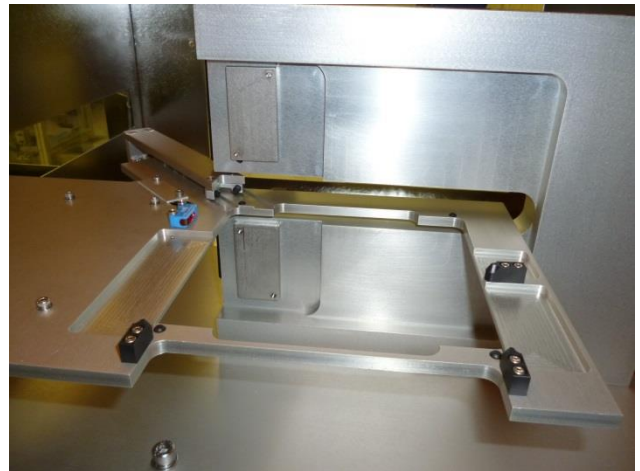
- Used to Swap Reticle grip
- Rotate Mask 90°, 180°, 270° as Required
- Mask presence sensor
- Pellicle sensor optional
- Pneumatic or Electrical versions
- Bar Code Reader optional
- ISO Class- 1 cleanliness



Mask Thickness Measurement Module

Integrated Module for measuring the Thickness of Blank Mask

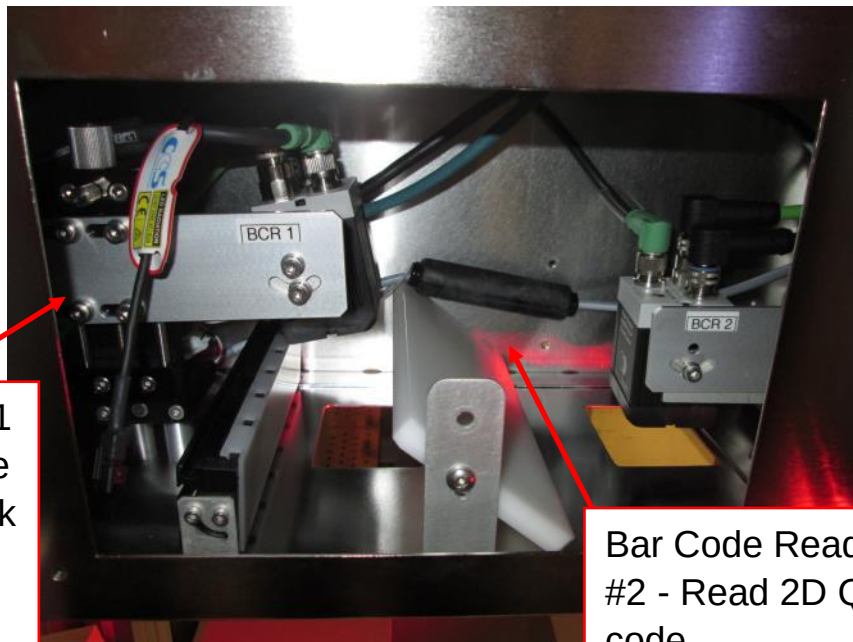
- Precision measurement sensors to verify the thickness of the Photomask.
- Programmable to measure up to 16 different locations over mask surface.
- Thickness logged at each position.
- Average thickness of Mask calculated.
- Static measurement repeatability $\leq 0.05\mu\text{m}$
- Load unload measurement repeatability $\leq 0.2\mu\text{m}$
- Sensor Resolution: $0.02\ \mu\text{m}$



ID Reader Stations

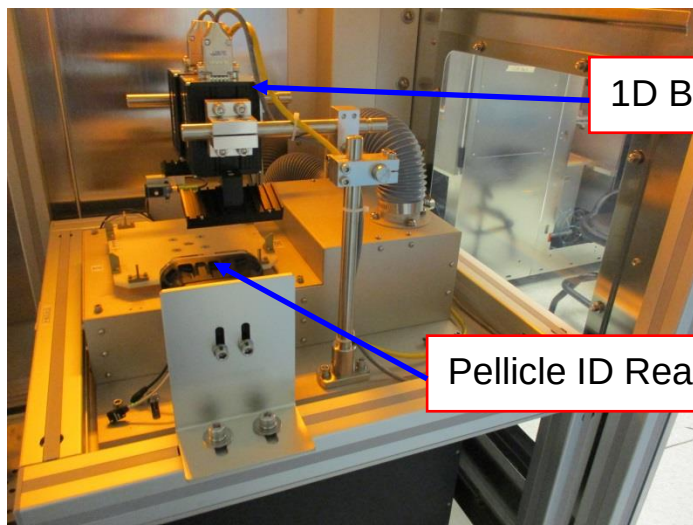
Fortrend ID readers are set up to identify the following types of Bar Code on Masks and Pellicles:

- 1D codes (Nikon, ASML, Canon)
- SEMI T11 Data Matrix
- SEMI T16 Data matrix on EUV Mask
- QR Codes
- OCR Codes



Bar code Reader #1
- Read 1D and Date
present on the mask
present on the
corner of mask

Bar Code Reader
#2 - Read 2D QR
code

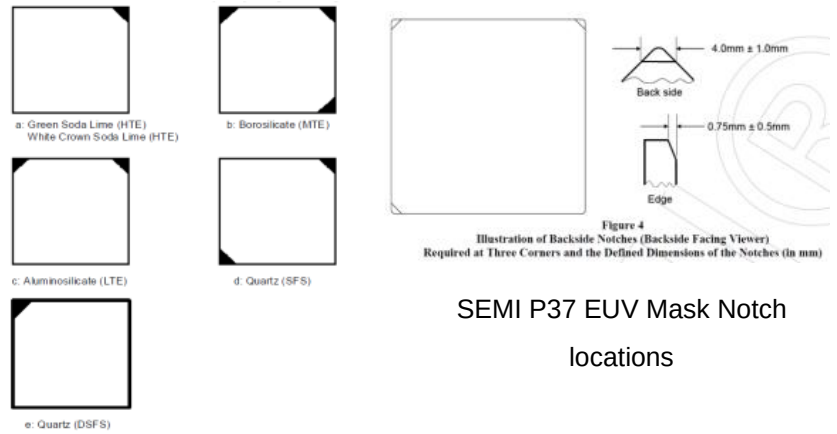
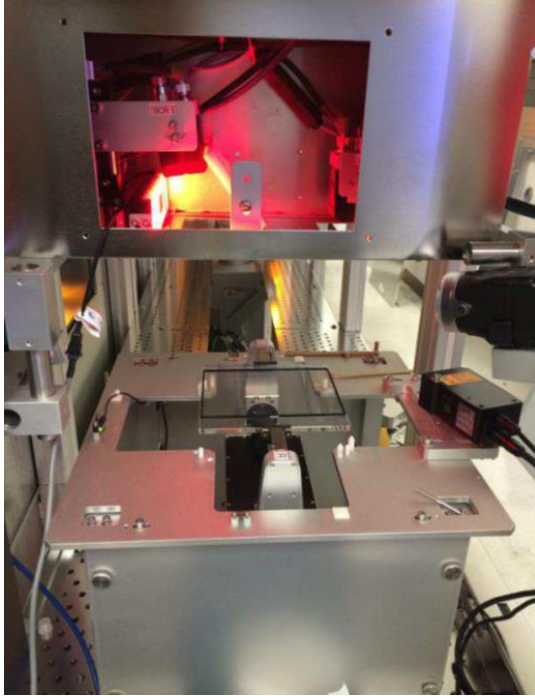


1D Bar Code Reader

Pellicle ID Reader

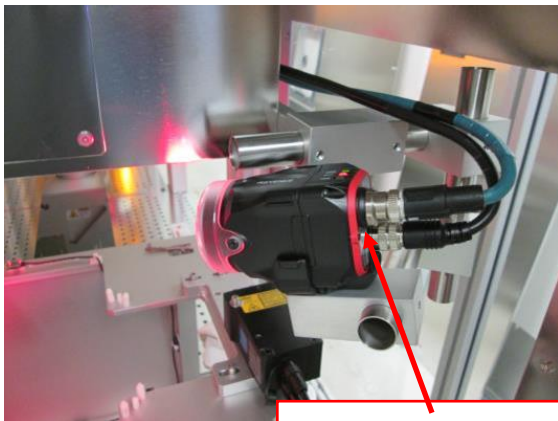
Notch Identification Station

The Notch Identification system uses a recognition camera set up to identify which Reticles per SEMI P1 and P37, have the Identification chamfer ground into the corner. Using the system logic the blank mask can be orientated correctly for future operations.



SEMI P37 EUV Mask Notch locations

SEMI P1 Photomask Notch locations



Chamfer Detector



Chamfer present on the corner of mask

Fortrend Worldwide Offices

USA

Fortrend Engineering Corporation

2220 O'Toole Avenue,

San Jose, CA 95131

Tel: (1) 408-734-9311

Fax: (1) 408-734-4299

E-Mail: Sales@Fortrend.com

Service: service@Fortrend.com

China

Shanghai

Shanghai Fortrend Technology Co., Ltd

上海大族富创得科技有限公司

No.555 Wanfang Rd, Minhang District,

Shanghai, China, 201112

上海市闵行区万芳路 555 号

201112

T: +86-021-3478-6180

M: +86-158-21578510

Email : Sales@fortrend.com.cn

Service: Service@fortrend.com.cn

Shenzhen

Fortrend Sales and Service Center

Tel: (86) 138-8921-5407

Taiwan

Sun Corporation

No.3, Ln. 61, Sec.6, Jhonghua Rd,

Hsinchu city 300, Taiwan

Tel: (886) 3-518-1250

Fax: (886) 3-518-1350

網址: www.Suncorp.com.tw

Email: sales@Suncorp.com.tw

Service: service@suncorp.com.tw

Malaysia

FORTREND MALAYSIA

Kulim

Malaysia

Service: service@fortrend.com.tw

Distributor

Europe – Sistem Technology

Sistem Technology Limited

Suite 3

Innovation Centre, Silverstone

Technology Park

Silverstone, Northamptonshire

NN12 8GX UK

T: +44 1327 317621

F: +44 1327 858133

Email: Sales@sistemtechnology.com

<http://www.sistemtechnology.com>

Web Site: [Http://www.Fortrend.com](http://www.Fortrend.com)

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