Fortrend has over 45 years of technical accumulation and experience inheritance in the global semiconductor industry.

SORTER/EFEM SELECTION MANUAL

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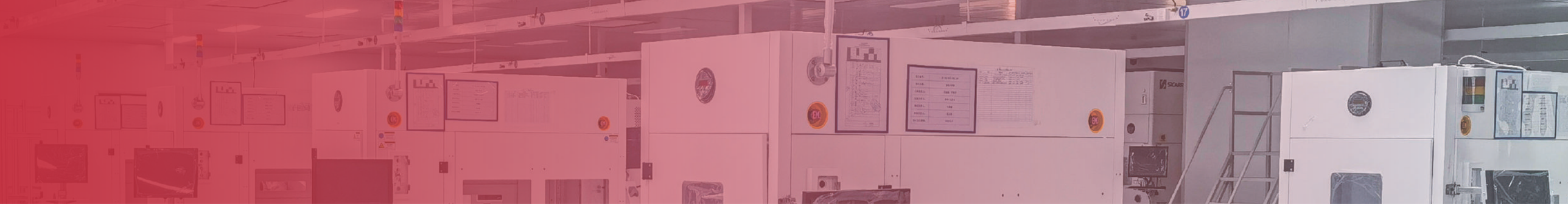
Fortrend Engineering Corporation



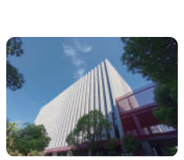
CONTENTS

ABOUT FORTREND

Founded in 1979 in Silicon Valley, USA, Fortrend has always been the top leader in batchwafer transfer technologies, Standard Mechanical Interface (SMIF) technologies, ultra-cleanautomation 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 first hand.

Fortrend Engineering Corporation



Shanghai Fortrend Technology Co.,Ltd

Zhejiang Fortrend Technology Co.,Ltd
Zhejiang Rich Creator Intelligent Equipment Co., Ltd.

Wuxi Fortrend
Intelligent Technology Co.,Ltd

Wuxi Fortrend
Precision Equipment Co.,Ltd

Regarding the SORTER/EFEM Equipment

Wafer sorting equipment (Sorter) and Equipment Front End Module (EFEM) are crucial components in the manufacturing and testing of integrated circuits, widely used in semiconductor manufacturing and inspection processes. They are one of the core modules that enable automated production and process workflows. Currently, the domestic market penetration rate is less than 50%. The company has now achieved full in-house development and mass production of first-tier Sorter/EFEM modules, overcoming several core technological challenges, and holds proprietary intellectual property rights. Moreover, it is capable of meeting customers' high-end customized requirements.

Fortrend has established nearly 18 local customer service centers in the East China, North China, South China, and Southwest regions. Professional technical support engineers provide after-sales service with the fastest response time of 2-4 hours to arrive on site.

During the installation period, free on-site training is provided for the customer's engineers.

A 1-year labor protection and parts warranty is offered, along with free software upgrade services (1-year free software upgrades) for the existing software installed at the customer's factory.

Partner Clients

IBM, NEC, Wolfspeed, San'an, NAURA 北方华创, PIOTECH·HN 拓荆键科
DELL, ASM Pacific Technology, tsmc, YASC, UNT 芯联集成, GMC
IOR, LEUVEN INSTRUMENTS, AIMEY, GTA 超芯半导体, 上海精测半导体 Precision Measurement, FSM
OSRAM, ST, KLA Tencor, 御微 YUWEITEK, 长江存储 YMTC, 中科飞测 SKYVERSE
ACM RESEARCH, GEG, SMIC, 中科信, Cmsemicon, Nordson

Development History

2024

The establishment of Zhejiang Fortrend Intelligent Equipment Co., Ltd.

Automated Material Handling System

2023

Wuxi Fortrend Intelligent Technology Co.,Ltd

Wuxi Fortrend Precision Equipment Co.,Ltd

(VTM) Semiconductor vacuum transfer system

2021

Zhejiang Fortrend Technology Co., LTD

Wet Wafer Transfer & Storage System

2018

P-Rack Stocker System

2022

Furnace Transfer System

2016

ISO-1 Reticle Load Ports

2019

Automatic Mobile Robot

2006

FORTREND China

0% Humidity Barereticle

Storage Chamber

2017

Shanghai Fortrend Technology Co., Ltd.

H_2O/O_2 Environmental Controlled EFEM

1996

200mm Wafer SMIF

200mm Robot

2011

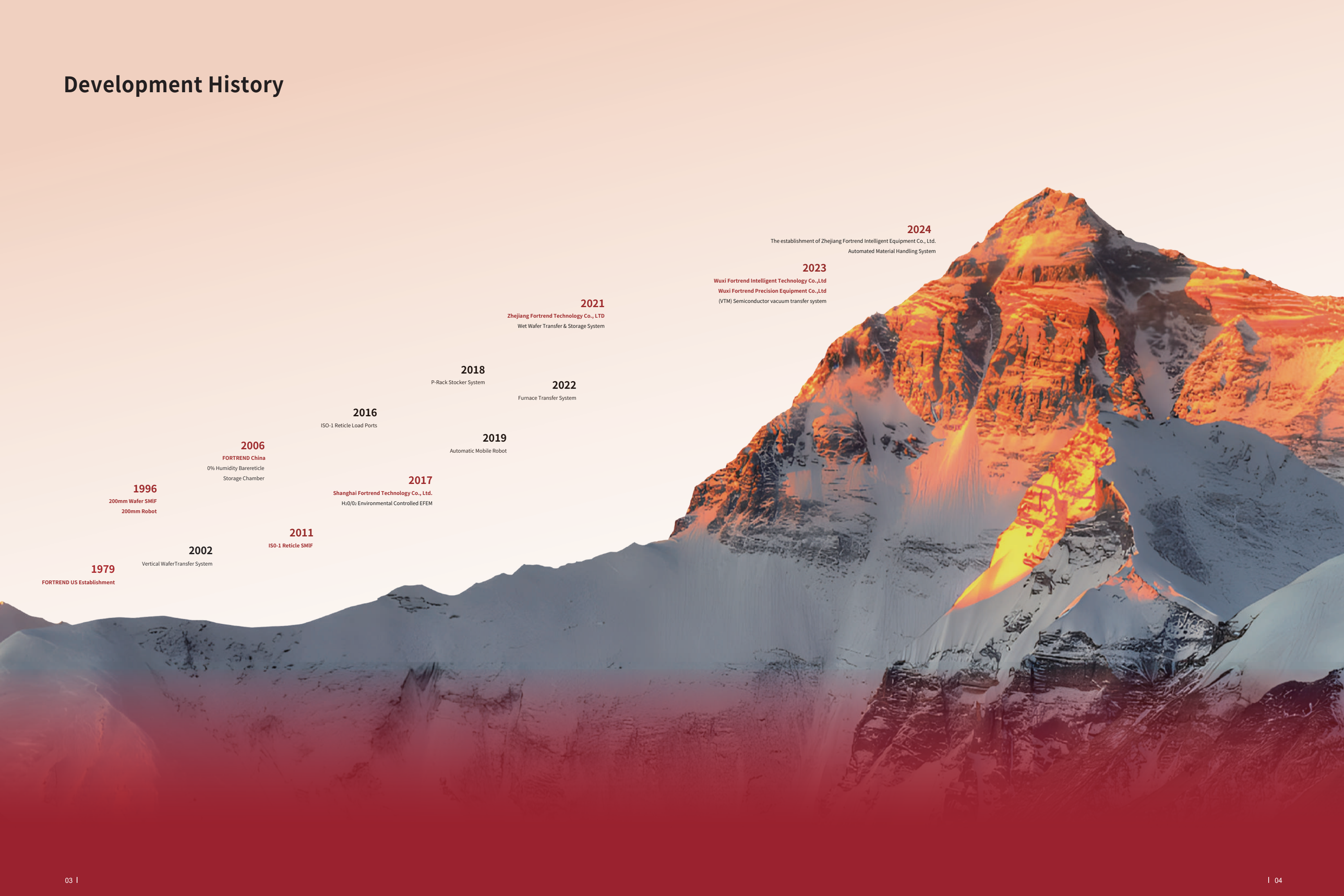
IS0-1 Reticle SMIF

2002

Vertical WaferTransfer System

1979

FORTREND US Establishment



WAFER SORTER

High Cleanliness

High Compatibility

High Capacity

- Wafer thickness support: 100 - 1500μm
- Workstations 2 to 8 are optional
- Supports the transportation of wafers of various sizes
- Various feeding methods are available
- Compact design
- SECS/GEM
- Safety curtain
- OCR (top or bottom)
- N2 purge LP

Specification parameter

- Fortrend wafer sorters are mainly used for wafer transfer, sorting, and merging operations, and can compatible with wafers ranging from 3" to 12".
- Adopting a modular design, the internal cleanliness can achieve ISO Class 1, and it can accommodate wafers of various sizes and types. It features independent integrity, high cleanliness, high compatibility, and other characteristics.
- It is compatible with all SEMI-standard FOUP (Front Opening Unified Pods), FOSB (Full Open Shuttle Bays), SMIF POD (Standard Mechanical InterFace Pods), and Cassette .
- Highly advantageous COO and COC help customers reduce costs and increase efficiency.

Specification parameter	
Rated voltage	Phase AC 220V 50/60 Hz
Rated power	3.52kW(Decide by config)
Comm interface	RJ45
Comm protocol	ASCI/HEX/HSMS&SECS 1I
Software	Fortrend independently developed software
Cleanliness	ISO 14644-1 class 1 / ISO class 3
WPH	⩾700（Without Aligner and OCR） ⩾300（With Aligner and OCR）
Uptime	⩾99%
MTBF	⩾4000 hours
MTTR	⩽2 hours
MTBA	>100 hours
MTTA	<10 hours
Wafer Breakage Rate	⩽1/1,000,000
OCR Accuracy Rate for Bare Wafers	⩾99.8%
Repeatability of Positioning Accuracy	±0.1mm

Wafer Sorter Standardized product series

SORTER-2 Loadport

1605mm (L) ×1237mm(W)×1886mm (H)

SORTER-3 Loadport

2155mm (L) ×1237mm(W)×1886mm (H)

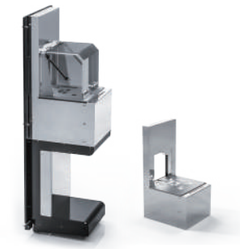
SORTER-4 Loadport

2600mm (L) ×1237mm(W)×1886mm (H)

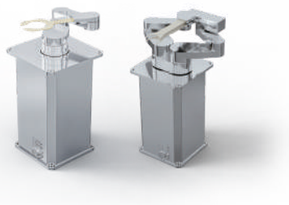
Independently Developed Core Module

Wafer/Frame Loadport

150/200mm Loadport

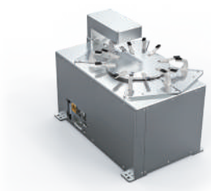


Open Cassette Stage

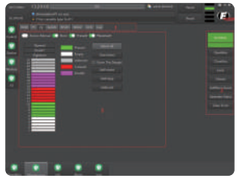


Wafer transfer Robot

Vacuum Pre-Aligner

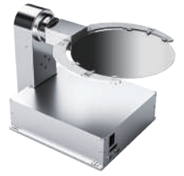


Edge-grip type Aligner



Independently Developed Software

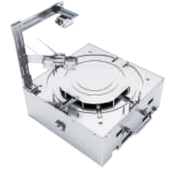
Optical Character Recognition (OCR)



Reversing Mechanism

Reversing Mechanism

Marble Platform



Centralized Stage

Sorter Standardized(Dual-sided Multi-station)

Integrated layout

Agile design

High throughput

- The dual-sided multi-station wafer sorting equipment is designed with wafer carriers on both sides of the frame. This design not only meets various loading and docking requirements but also provides a compact layout, reducing the equipment footprint and improving the utilization rate of the facility space.

- Double measurement two-station equipment dimensions: 1650mm (Length) × 1662mm (Width) × 1886mm (Height).

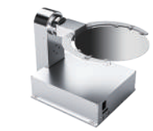
Case Presentation

Sorter Customized(Taiko Wafer)

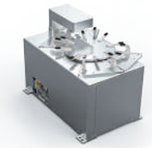
Customized Solutions

Special Wafer Processing

Support Lifting/
Bernoulli Fingers



Reversing Mechanism



Edge-grip type Aligner

Clamp type/Contact Bernoulli

- The Taiko Wafer Sorter minimally supports 6-inch, 8-inch, and 12-inch wafers with a minimum dimension of 50μm. It supports lifting/Bernoulli pick-and-place methods and provides a high-precision alignment and flipping mechanism.

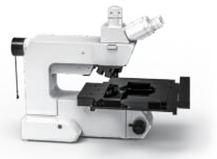
Case Presentation

Sorter Customized(OM loader)

Dexterous Design

Paired with a fully automatedmicroscope

Equipped with macro/ microscopic inspection capabilities



显微镜

宏观检机构

- The OM Loader Sorter is designed for multi - size wafer handling (6", 8", 12"). It supports mapping before wafer loading into the chamber and is compatible with various wafer transfer, sorting, and merging. It performs wafer scanning, alignment, sorting, batching, and reading wafer IDs in a micro - environment. Additionally, it enables semi - automatic and manual wafer surface inspection on both the micro - and macro - inspection platforms.

Case Presentation

Sorter Customized(Packaging Machine)

Integrated design

Applied to automated packaging

Capable of supporting cake box shipping packaging

Bernoulli Robot

Packaging Mechanism

- The packaging machine can automatically complete the wafer packaging process, supporting various wafer box formats (Foup/Smif Pod/cassette to Coin Stack Box), and is suitable for 6-inch, 8-inch, and 12-inch wafers and Taiko Wafer.

Case Presentation

WAFER EFEM

High Cleanliness

High Compatibility

High Capacity

- Wafer thickness support: 100 - 1500μm
- Workstations 2 to 8 are optional
- Supports the transportation of wafers of various sizes
- Various feeding methods are available
- Interface with multiple process equipment
- SECS/GEM
- Light curtain
- OCR (top or bottom)
- N2 purge LP

Specification parameter

- Fortrend equipment front - end modules are mainly designed to meet customized process requirements and are compatible with wafers ranging from 3" to 12".
- The internal cleanliness of the equipment can reach ISO Class 1, and it can adapt to wafers of different sizes and types, featuring high cleanliness, high compatibility, and other characteristics;
- It is compatible with all SEMI-standard FOUP, FOSB, SMIF POD, and Cassette.

Specification parameter	
Rated voltage	Phase AC 220V 50/60 Hz
Rated power	3.52kW(Decide by config)
Comm interface	RJ45
Comm protocol	ASCI/HEX/HSMS&SECS 1I
Software	Fortrend independently developed software
Cleanliness	ISO 14644-1 class 1 / ISO class 3
Uptime	⩾99%
MTBF	⩾4000 hours
MTTR	⩽2 hours
MTBA	>100 hours
MTTA	<10 hours
MCBF	100,000Wafers
Wafer Breakage Rate	⩽1/1,000,000
OCR Accuracy Rate for Bare Wafers	⩾99.8%
Repeatability of Positioning Accuracy	±0.1mm

EFEM Standardized(Product Series)

EFEM-2 Loadport

1605mm (L) ×1237mm(W)×1886mm (H)

EFEM-3 Loadport

2155mm (L) ×1237mm(W)×1886mm (H)

EFEM-4 Loadport

2600mm (L) ×1237mm(W)×1886mm (H)

Independently Developed Core Module

Wafer/Frame Loadport

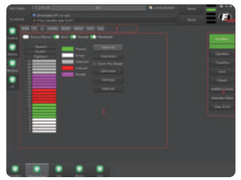
150/200mm Loadport

Open Cassette Stage

Wafer transfer Robot

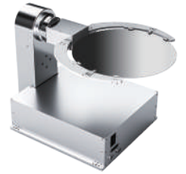
Vacuum Pre-Aligner

Edge-grip type Aligner



Independently Developed Software

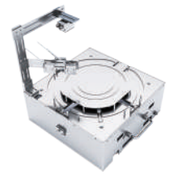
Optical Character Recognition (OCR)



Reversing Mechanism

Reversing Mechanism

Marble Platform



Centralized Stage

EFEM Customized(Interface with Measurement Process)

High Precision　High Cleanness　High Stability

Wafer Aligner

Humid Robot

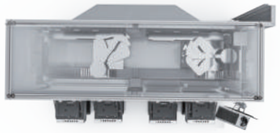
Drying Unit

- EFEM for interfacing with metrology process equipment typically come equipped with high-precision edge finders and code readers. They are widely used in devices such as metrology, AOI , and CD-SEM . In the context of interfacing with immersion metrology processes, they can be configured with air knives, humid robot, and drying modules to perform functions such as wafer air drying and cooling, as well as surface cleaning.

Case Presentation

EFEM Customized(Interface with Ion Implantation Process)

High Cleanliness　Modular design　High stability



Dual Robot Layout Diagram

FOUP Handling Robot

FOUP Buffer Station

- The ion implantation process equipment EFEM can be equipped with wafer box storage functions, and can be interfaced with overhead cranes or manual loading. It is configured with FOUP storage positions and FOUP Robots. Typically, it features dual Robots for wafer transfer to increase production capacity. It can also be configured with a 1+5 Robot setup, supporting the simultaneous pick-up and placement of five wafers.

Case Presentation

EFEM Customized(Epitaxial)

High integration

Modular performance

High stability

Merge and Split Module

Grinding Stone Cassette

Cleaning Module

- The front-end automation module for epitaxy processes includes a graphite plate/ring merging and splitting module, a grinding plate Cassette, a cleaning module, a wafer flying detection module, and a grinding plate edge-finding module, interfacing with the vacuum transfer chamber (VTM).

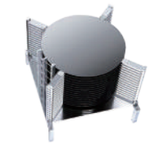
Case Presentation

EFEM Customized(Interface with PVD / CVD / ETCH)

High Cleanliness

Modular design

High efficiency



Wafer Buffer Module。

Single-Arm Dual-Fork Robot

EFEM+VTM

- The front-end automation module for PVD/CVD/ETCH processes is typically equipped with a high-speed single-arm dual-fork robot to enhance productivity. It also includes a wafer buffer mechanism and can be integrated with a vacuum transfer module (VTM).

Case Presentation

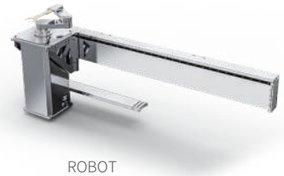
EFEM Customized(Interface with Lithography Process)

compatible with the low material input port of the lithography machine

Dual Robots

Capable of independently interfacing with a photolithography machine

Photolithography Machine Docking Interface



ROBOT

Lithography Machine Docking Robot

- Independent front-end automated transfer module for direct docking with photolithography machines: It enables direct connection with the photolithography machine for automatic loading and unloading. The robotic arm is adaptable for transferring wafers from the wafer cassette to the photolithography machine's docking window. Equipped with dual robots: a standard robot and a small Z-axis robot, it offers transfer solutions for wafers of various sizes (6"/8"/12"). The small Z-axis robot meets the transfer requirements for docking platforms with heights ranging from 620mm to 800mm.

Case Presentation

EFEM Customized(Interface with CMP / Bonding Process)

High Cleanliness

Long-term stability

High compatibility

Large Z-axis Robot

Dual-Flip Robot with Large Z-axis and Large X-axis

- Interface with CMP and Bonding processes: Solutions that integrate EFEM with process robots can be provided. Process robots can be configured with large Z-axis robots and large Z-axis, large X-axis dual-rotation robots. For the CMP process, they can also be matched with Wet Robot and drying modules.

Case Presentation

EFEM Customized(Frame wafer)

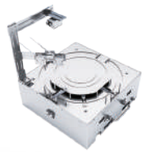
High Cleanliness

High Compatibility

Independently Developed
Alignment Module

Load Port

Frame FORK OCS



Indigenization

Clamping Type Frame Fork

- The Frame EFEM supports both Frame Wafer Loadport and Open Cassette Stage wafer loading systems. It is compatible with 4" - 12" frame wafers and can be equipped with our self - developed high - precision alignment mechanisms. The mechanical arms can be either clamping type or vacuum - suction type. Additionally, it can also meet the compatibility requirements between frame wafers and regular wafers.

Case Presentation

Core Module150mm/200MM LOADPORT

High Versatility
High Compatibility

Customization

High Compatibility

Standard Load Port Universal equipment , fully compliant with SEMl standards, with high versatility, high compatibility.

Loading type: SMIF POD is compatible with 6" and 8" wafers.

Built-in original factory mapping system enables the detection of overlapping, skewed, and protruding wafers, effectively preventing wafer collisions during integrated wafer transportation.

Optional multiple types of code reading are available: RFID/Smart Tag.

Optional customization components are available: Info Pad Sensor; E84 interface; Adapter to implement the open cassette loading method, flexibly meeting various working condition requirements.

- PLM is a mature wafer opener that is equipped with sensors compatible with both 6-inch and 8-inch wafer unpacking and inspection, capable of accurately detecting the status of wafers in POD boxes. PLM can interface with a variety of equipment, and its rich selection of optional features provides more solutions for customer production line upgrades.

Case Presentation

Outer dimensions	L: 432mm W: 422mm H: 772mm	Cleanliness	Class l @ 0.1um
Communication interface	Serial EIA-RS232C,Paralle l/O	Rated voltage	DC 24 V
Main material	Aluminum alloy, Stainless steel (SUS 304)	Rated voltage	60 W
Optional features	ID reading and writing device with optional RFID module or IR Link	Comm protocol	HEX、SECS

Core Module (300mm LoadPort)

Self-Developed

Compliant with SEMI Standards

High Versatility High Compatibility

300mm LoadPort

Full-scale production autonomy and proprietary patents for core components.

The key structures and designs of the 300mm LoadPort are all independently patented by Fortrend, and both the design and production are carried out within Fortrend's own production base. Integration of hardware and software ensures the standardization and consistency of the equipment.

Hardware and software design compliant with SEMI standards and universal specifications.

The complete machine is designed and manufactured in accordance with SEMI standards, using the RS-232 HEX communication protocol for communication with interfacing equipment. It is also expandable with various communication and interfacing methods.

Diversified functional configuration options, suitable for a variety of working conditions.

The original Wafer Mapping system utilizes proprietary advanced control algorithms to enable detection of wafer presence, absence, stacking, and tilting. Optional functions such as the E84 communication protocol and N2 purge can meet various on-site requirements.

Specification parameter

Outer dimensions	L: 586mm W: 472mm H: 1349mm	Equipment weight	It varies depending on the configuration
Rated power	144W	Rated voltage	DC 24 V
Communication mode	Serial RS-232C, parallel I/0	Rated voltage	6 A
Optional features	AMHS Communication Port (E84)	Comm protocol	HEX、SECS

Core Module Introduction Frame LoadPort

Self-Developed

Compliant with SEMI Standards

High Versatility High Compatibility

Frame Load Port

Full-scale production autonomy and proprietary patents for core components.

The key structures and designs of the 300mm LoadPort are all independently patented by Fortrend, and both the design and production are carried out within Fortrend's own production base. Integration of hardware and software ensures the standardization and consistency of the equipment.

Designed specifically for back-end packaging and testing processes.

The complete machine is designed and manufactured in accordance with SEMI standards, using the RS-232 HEX communication protocol for communication with interfacing equipment. It is also expandable with various communication and interfacing methods.

Diversified functional configuration options, suitable for a variety of working conditions.

The original Wafer Mapping system utilizes proprietary advanced control algorithms to enable detection of wafer presence, absence, stacking, and tilting. The optional E84 communication protocol can be applied to AMHS/AGV automated transportation.

Specification parameter

Outer dimensions	L: 594mm W: 485mm H: 1349mm	Equipment weight	It varies depending on the configuration
Rated power	144 W	Rated voltage	DC 24 V
Communication mode	Serial RS-232C, parallel I/0	Rated voltage	6 A
Optional features	AMHS Communication Port (E84)	Comm protocol	HEX、SECS

Core Module (Open Cassette Stage)

Self-Developed

Customization

High Versatility
High Compatibility

Frame OCS
with Cover Shield Support

Wafer OCS with Cover Shield Support

Designed Specifically for Wafer Open Cassette、Frame Open Cassette;

Optional with a variety of customized accessories, flexibly meeting different working condition requirements;

Equipped with the original factory Mapping system, capable of detecting stacked and skewed wafers, eliminating wafer collision issues during transportation;

Wafer OCS Base

Frame OCS Base

Specification parameter

Outer dimensions	L:425mm W:365mm H:772mm	Equipment weight	It varies depending on the configuration
Rated voltage	DC24V	Rated current	6A
Rated power	144W	Communication mode	RS485、RS232
Communication protocol	HEX、ASCII		

Core Module(Wafer Transfer Robot)

Self-Developed

Universal RS232
Protocol Interface

Customization

Full-scale production autonomy and proprietary patents for core components.

Fortrend owns the patents of key Robot modules which are also produced in Fortrend production base. The vertical integration of software and hardware ensures the standardization and consistency of the equipment.

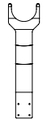
Diversified custom components. Applicable to various working situations.

Multiple optional end effectors and linear moudles are suitable for precision environment of semiconductors and pan semiconductors, and can meet various process urgently requirements on site.

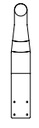
Time tested Smart Move function and easy-to-use teaching design.

The smart move function with optimized arm motion path can complete transmission work efficiently and accurately, while its humanized and intuitive teaching design allows operators to get started with simple training.

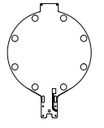
Vacuum FORK -- Y type



Vacuum FORK - Linear type

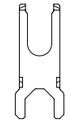


Non-Contact Bernoulli

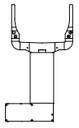


Contact Bernoulli

Clamp type (optional on 6/8/12)



Clamp type FrameFORK



Specification parameter

Outer dimensions	L:340mm W:340mm H:931mm	Equipment weight	It varies depending on the configuration
Arm load	3KG	Body material	Aluminum
Arm qty	Single Arm/ Double Arm	End effectors(EEF) Specif	Ceramics/Aluminum /CFRP
Cleanliness	Classl@0.1um	Applicable carrier types	SMIF Pod、Reticle Box、FOUP/FOSB

Core Module(Wafer Pre-Aligner)

Self-Developed

Customization

High Versatility
High Compatibility

Efficient operation, locating the wafer notch position in less than 7 seconds (excluding the time for wafer handling), quickly completing the correction of the wafer center and angle.

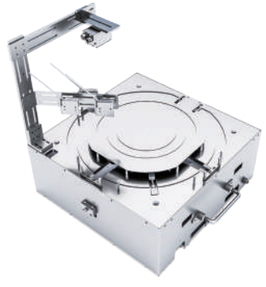
It supports both translucent and opaque wafer applications, suitable for silicon wafers and silicon carbide wafers with diameters ranging from 150 to 300mm.

Integrated design with a built-in controller, eliminating the need for an additional controller and wiring space, achieving an ultra-compact size.

The system is equipped with real-time monitoring capabilities, allowing for the live detection of the status of motor drive control systems, vacuum systems, detection systems, and circulation systems.

- The FPA series wafer edge finder is a four-axis controlled device that uses a miniature single-axis robotic module, characterized by high rigidity and small size. It achieves high-speed, efficient, and high-precision wafer edge detection and center position calibration. (Wafer position ⩽ ±0.1mm; Wafer notch/flat ⩽ ±0.1°)

Centralized Stage



Compatible with 6, 8, and 12-inch Frame rings.

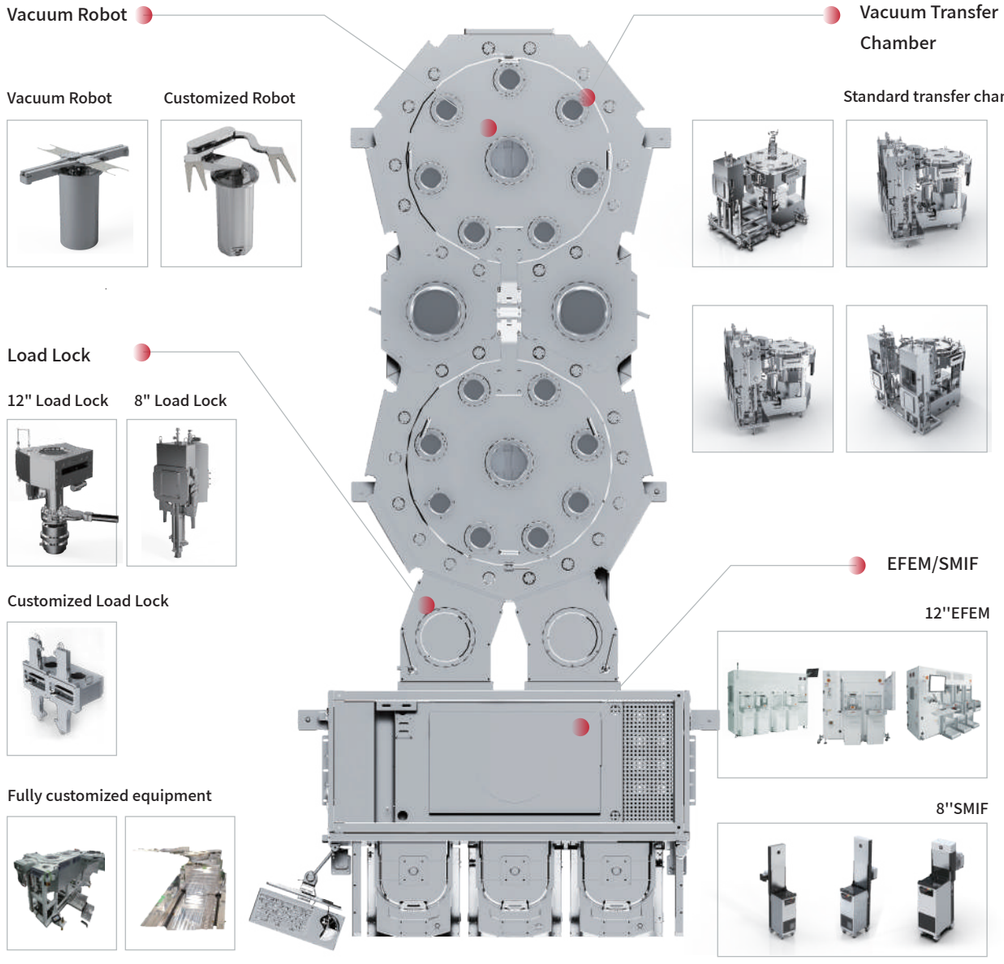
Capable of configuring QR code reading functionality.

Repeat positioning accuracy ⩽±0.1mm, rotation angle ⩽±0.1°.

Adjustment time < 6 seconds.

Maximum initial offset ±7mm.

Three-stage Integration Plan



The equipment front end can optionally be equipped with an EFEM or SMIF , The EFEM is available in both standard and customized types;

The Load Lock is available with different structures and transfer methods;

Customized transfer chambers can be designed to meet the specific requirements of the process chambers;

Vacuum robots can be selected in different models and end effectors based on actual operating conditions;

The transfer chamber and Load Lock can be optionally equipped with built-in modules for orientation, cooling, and preheating.

Optional AWC (Automatic Wafer Centering) function, Buffer function, and wafer storage module.