

PEER Tool Orchestrator Tool Automation Software

PEER Tool Orchestrator (PTO™) is an industry leading, field-proven, tool automation software product for semiconductor equipment manufacturers. PTO provides equipment manufacturers with material handling, job execution, host communications, and recovery capabilities, built on a wealth of experience from a large install base that keeps growing. With a rock-solid architecture—proven to be adaptable for any type of tool—and new capabilities being built into the product on a regular basis, PTO provides a competitive advantage by reducing the cost of developing a fully automated tool, regardless of its complexity.

From start-ups to large, multi-national companies, PTO gives OEMs the ability to automate a new tool platform or retrofit an existing tool platform in as little as six weeks, accelerate fab acceptance, and ensure equipment reliability in production. By leveraging PTO to provide the factory automation for your tool, your software engineers can focus on adding competitive process features rather than grappling with tedious automation standards or obscure hardware drivers. This lets you maximize your engineering budgets with greatly reduced resources.

By using the most widely accepted tool automation product in the industry, you can be confident you will get a solution that meets your equipment's unique automation needs, on time and on budget. PTO is your safe, proven choice.

Product Family

PTO has evolved into a family of product offerings to meet the automation needs of different tool types and processing scenarios. Choose the one that suits your current needs, and as production requirements for your equipment grow, you can take advantage of additional capabilities by migrating to a different version of PTO.

- ▶ **PTO Benchtop** For tools with no factory automation requirements and no EFEM hardware integration. Relies on PTO's robust infrastructure to provide basic manual control capabilities, co-ordinate wafer processing and provide full user interface management.
- ▶ **PTO 200/PV** For tools where communication to the factory host is based on the E30 GEM standard (200mm, photovoltaic, assembly, and so on). This scaled-back version of PTO Standard is the best solution for tools deployed in fabs with simple factory automation needs. It provides a competitive price point and can be upgraded seamlessly to PTO Standard or PTO TC.
- ▶ **PTO Standard** For tools that need to communicate with a factory host and manage automated material hand-off, job execution, and equipment states based on the 300mm SEMI standards. An E30 adaptor can be included for tools that also run in older fabs.
- ▶ **PTO TC** For tools requiring more sophisticated hardware control, such as vacuum environments (vacuum robots, pumps, valves, gauges), cluster tools with multiple processing chambers, and batch tools with multi-substrate processing requirements.
- ▶ **PTO IMM** For integrated metrology modules. Supports SEMI E127 or the TEL spec for IMM integration; and multiple data clients, with both E30 and E127-style data collection.

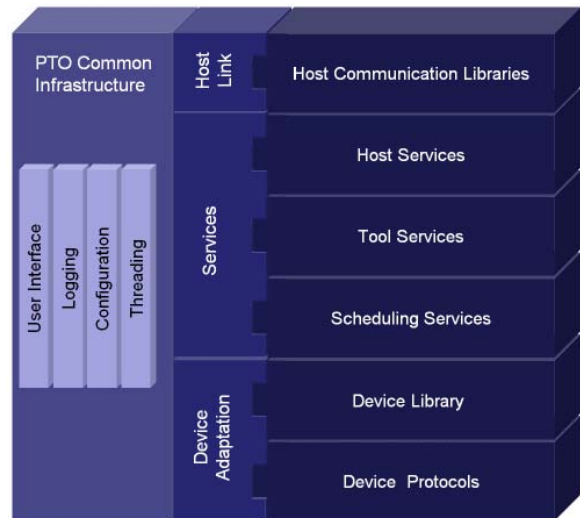
Product Highlights

FEATURES	BENEFITS
<i>Full SECS/GEM and 300mm compliance</i>	<p>Reduces engineering time since all of the SEMI standards and fab automation requirements are built into the product. Robust support is available for these industry standards, ensuring your tool is SEMI compliant for fab acceptance: E4, E37, E5, E30, E39, E40, E84, E87, E90, E94, E116. Additional support is available for many of the newer, innovative standards.</p> <ul style="list-style-type: none">▶ Interface A capabilities for rapid data transfer: E120, E125, E132, E134.▶ Enhanced recipe management for RaP/E139 support, including an infrastructure for OEMs to migrate their existing E30-based recipe models.▶ E127 support for Integrated Metrology Module (IMM) communications within a cluster tool.
<i>Dynamic, flexible wafer scheduling</i>	<p>Accommodates a wide range of processing scenarios and equipment topologies (varying number of wafer stations; parallel or serial wafer flow; collaborative, adjustable routing; deadlock detection; and backwards wafer flows) to maximize throughput, giving you a competitive advantage. The original Wafer Engine provides many configurable, out-of-the-box options, requiring minimal customization. Alternatively, an innovative, task-based Planner supports pluggable, custom scheduling algorithms for more complex tools, targeted to your specific tool topology.</p>
<i>Simplified tool configuration</i>	<p>Allows you to use one software platform across all your shipped tools, reducing field support costs. Configuration screens let you manage hardware variations easily within or across tool platforms, such as the number or type of load ports, process modules, robot end effectors, and so on. You can also adjust light tower, load port, and tag reader behavior to suit any fab you install in without software changes.</p>
<i>Drivers for all major commercial hardware components</i>	<p>Reduces the time and cost of hardware integration, since PTO includes field-proven drivers for all major commercial hardware components (integrated EFEM platforms, load ports, robots, tag readers, WID readers, light curtains, vacuum systems, and so on). Support for new hardware components can be developed quickly in PTO's extensible Device Adaptation layer.</p>
<i>Advanced E84 functionality</i>	<p>Support for standard E84 and Samsung-specific hand-off and recovery scenarios ensures successful integration with material handling systems in the fab.</p>
<i>PFAT integration</i>	<p>Pre-shipment validation with PEER Group's next generation testing product, PEER Factory Acceptance Tester (PFAT™), means increased software quality, faster fab acceptance, and reduced support costs. A unique PTO validation module provides tight PFAT integration, allowing you to perform white box testing of complex, time-dependent scenarios (e.g., ensuring correct wafer flow paths and slot-to-slot wafer integrity).</p>
<i>Extensible UI framework</i>	<p>E95-compliant framework provides an integrated user interface that is able to host standard and customized PTO screens, and any screens you have developed. Or, you can embed PTO screens and UI controls in your own user interface.</p>
<i>Advanced diagnostics</i>	<p>A synchronized view of all real-time or historical log files from multiple sources allows engineers to quickly pinpoint data of interest and export relevant log files when troubleshooting abnormal scenarios.</p>

Architecture

Written entirely in C#, PTO is an object-oriented framework of modular components and services organized into layers. Each layer provides an incremental level of functionality, from the minutiae of protocol-specific commands for individual hardware pieces, to the high-level requirements for job execution and host communications.

Because of this modular approach, your solution can use a combination of out-of-the-box components, components customized for your tool's specific needs, or components written by your own engineering team. With such a flexible architecture, PTO can be adapted and extended to fit the unique needs of any tool while still taking advantage of a common framework and proven, standardized components.



Common Infrastructure Layer

The common infrastructure is utilized by all members of the PTO product family, providing fundamental functionality for all modules and services. Its wide-reaching configuration capabilities give PTO the flexibility needed to address virtually any tool topology or processing requirement. The User Interface framework can be extended easily to include tool-specific screens.

Host Link Layer

Utilizing the industry-proven connectivity product, NexEDA™, this layer manages host-to-tool communications and control via the 300mm SEMI standards, including Interface A data publication. A backwards compatibility mechanism also allows PTO to work with older factory hosts that support E30 GEM capabilities only.

Services Layer

This layer contains the principal building blocks or “services” for automated tool functionality, including:

- ▶ Services that implement GEM and 300mm functionality for job management, carrier management, automated material hand-off, internal material movement, performance tracking, data collection, alarm management, and so on.
- ▶ The Wafer Engine service, which is responsible for wafer scheduling, software interlocks for wafer handling security, and automated wafer recovery. For more complex tools, a customizable set of services for task-based scheduling of wafers, maximizing throughput and ensuring optimal wafer handling for your specific tool topology.
- ▶ For vacuum-based tools, the Vacuum Control service provides complete control of pump-down and venting sequences by co-ordinating all pumps, valves, and gauges.
- ▶ The Recipe Management service, which manages recipe upload/download from the host and co-ordination with your process chamber(s). Supports both cluster and chamber-specific recipes.

Device Adaptation Layer

Translates high-level processing commands from the scheduling-based services into hardware-specific commands and provides hardware concurrency control. Contains drivers for all major commercial components (robots, load ports, tag readers, WID readers, and vacuum systems), as well as interchangeable low-level hardware communications protocols, allowing for easy exchange of hardware on a tool.

Features At-A-Glance

Feature	PTO Benchtop	PTO 200/PV	PTO Standard	PTO TC	PTO IMM
E30/GEM host link		●	●	●	
300mm host link			●	●	
IMM tool and host link					●
Recipe management	●	●	●	●	●
Alarm management	●	●	●	●	●
Automated wafer recovery		●	●	●	●
Carrier management (open cassette, SMIF, FOUP, FOSB)		●	●	●	
AMHS management			●	●	
E95-compliant GUI infrastructure	●	●	●	●	
Job management screens		●	●	●	
Tool status screen	●	●	●	●	
Advanced status screens (vacuum, facilities)				●	
“Off the shelf” Wafer Engine	●	●	●	●	
Advanced, pluggable Planner				●	
Hardware concurrency control	●	●	●	●	
Manual control (robots, pumps, valves)				●	
Vacuum scheduling control				●	
EFEM drivers (load ports, ATM robot, aligner, tag reader, WID reader, FFU)		●	●	●	
Vacuum drivers (load locks, pumps, gauges, valves, vacuum robots)				●	
Security infrastructure	●	●	●	●	●
Log management	●	●	●	●	●
Threading framework	●	●	●	●	●
Configuration management			●	●	

About PEER Group

PEER Group provides leading-edge factory automation software solutions, integration and consulting services to advanced manufacturers and OEMs in the semiconductor, electronics, life sciences, automotive and solar industries. Many of the world’s best manufacturing companies turn to PEER Group to solve their most challenging equipment automation, data management and custom application development problems. PEER Group partners with leading software and automation companies to ensure the most efficient delivery of highly functional, reliable and scalable solutions. Learn more about PEER Group at www.peergroup.com.

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