

TOYODA



TIPROS // FMS

Flexible Manufacturing System



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TOYODA

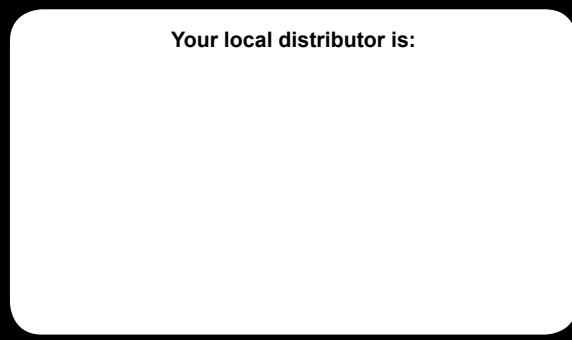
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2013A2000-CP

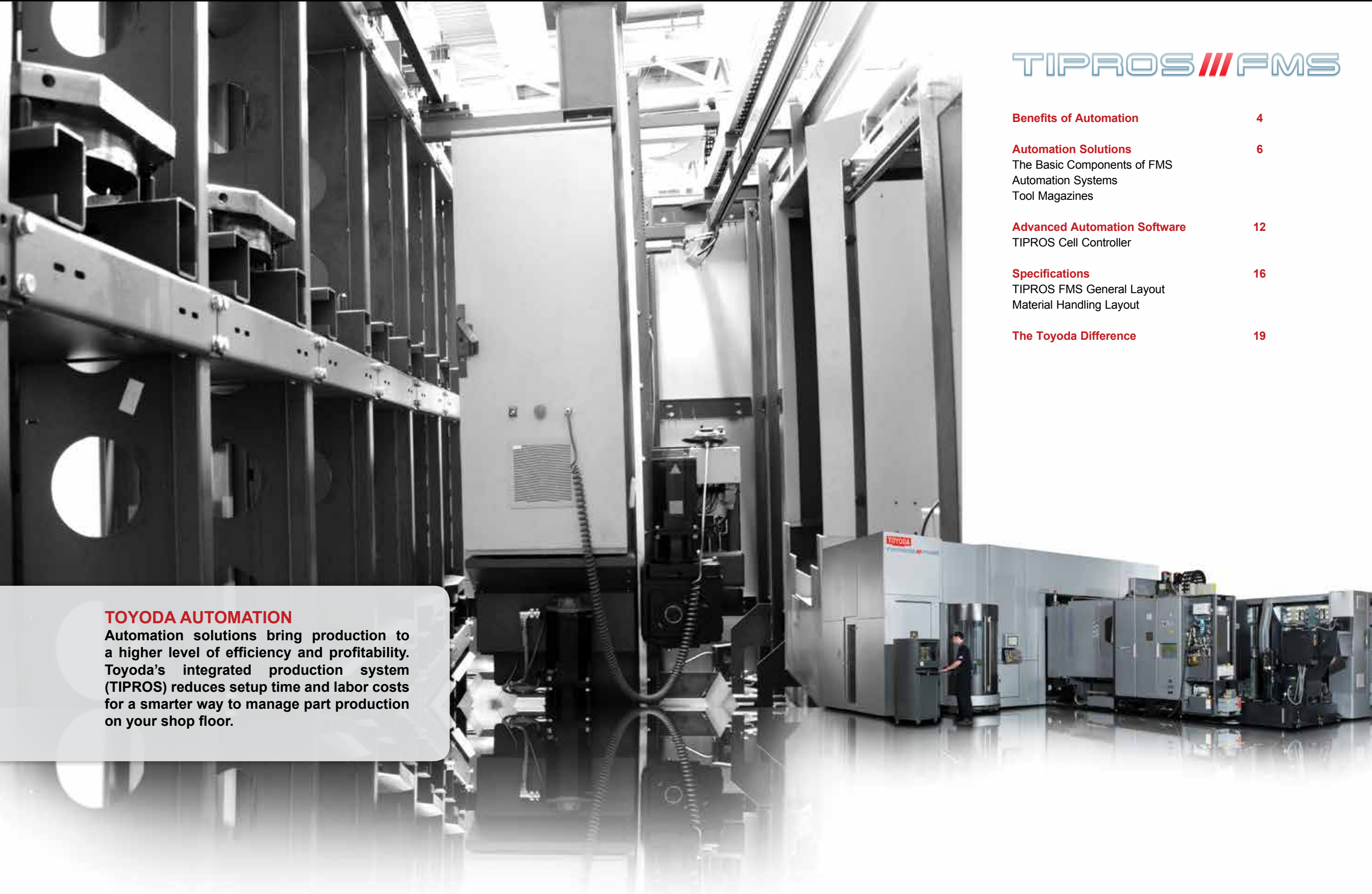


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TIPROS /// FMS

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TOYODA AUTOMATION

Automation solutions bring production to a higher level of efficiency and profitability. Toyoda's integrated production system (TIPROS) reduces setup time and labor costs for a smarter way to manage part production on your shop floor.



Why Use Automation?

Automation is a proven solution to increase a shop's production and efficiency. Rail-guided vehicles (RGVs), robots, and matrix magazines are used to maximize a shop's throughput by reducing setup times, decreasing labor costs, and increasing spindle utilization. Be the competitive advantage with Toyoda's automation solutions.

Maximized Spindle Use

- Increase the RGV's **true spindle utilization up to 95%**
- Eliminate time-consuming repeat setups
- Schedule jobs based on tool availability for alarm-free unmanned machining

Reduced Operating Costs

- Equipment is utilized to its potential
- Manpower requirements per spindle is reduced
- Floor space is used more effectively

More Cash Flow

- Increase throughput while decreasing work in process
- Minimize overruns and excess inventory by only running work in the quantities needed



Monitor Production Remotely

Remote access software allows direct control of the cell from any networked computer. This allows managers to quickly and easily adjust production schedules and oversee the status of a project without visiting the shop floor.

Increased Spindle Utilization

Metalcutting cells significantly increase a shop's production capabilities by automating redundant operator tasks and by storing pallets with ready-to-machine workpieces. This allows our horizontal machining centers to run at **95% spindle utilization**.

Machining with Intuition

TIPROS software utilizes Windows-based computers and maximizes production efficiency through the logical scheduling of jobs.

Unlike a broken tool in traditional lights-out production where the cell would simply shut down and leave hours of work unfinished, TIPROS software has an intuitive system that identifies the broken tool and searches for a replacement in the magazine.

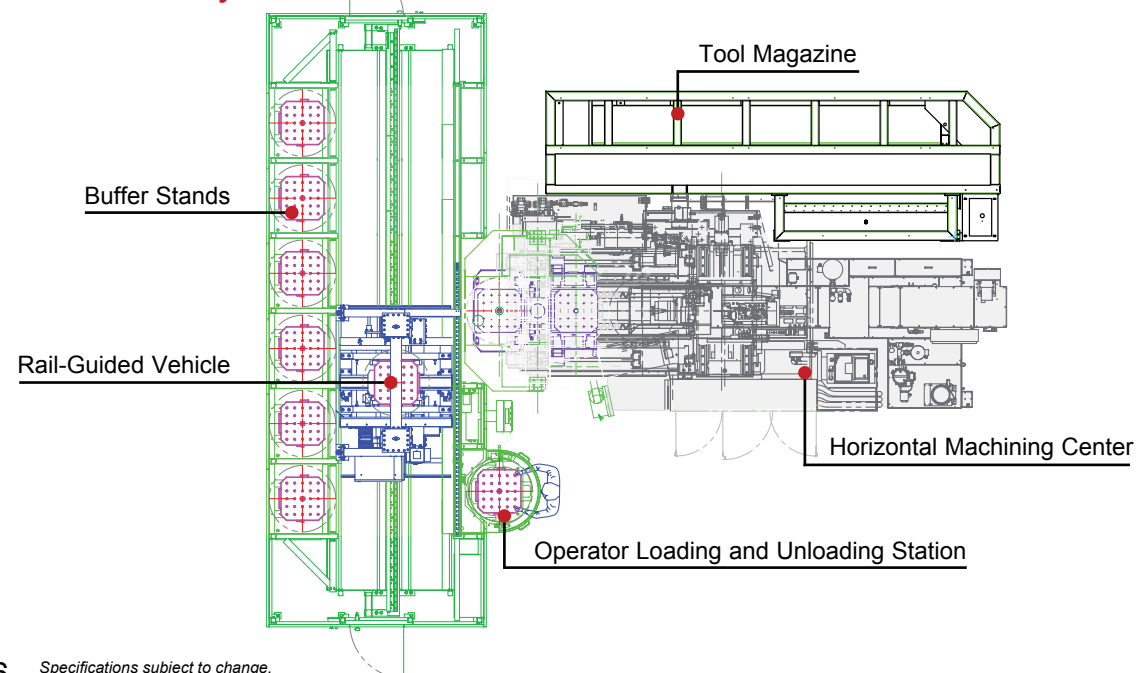
TIPROS analyzes job priority, lead time, machining time, availability of tools, fixture and machine, and the cell's manned and unmanned status to determine the ideal production sequence to finish the job and eliminate downtime.

What is FMS?

A flexible manufacturing system, or FMS, is typically comprised of rail-guided vehicles (RGVs), gantry-style robots, or floor-mounted robotic loading, and is used in combination with a large capacity tool magazine. These automation solutions can be installed independently or as a cell to meet production demands.



General FMS Layout



The Basic Components of FMS

Horizontal Machining Centers

Toyota horizontal machining centers are the foundation of our metalcutting cells. Their construction is extremely robust to maximize accuracy and increase uptime. In thousands of installations, they have been proven to run under incredible loads day after day, year in and year out. Such dependable performance makes these machines ideal for unmanned production environments.

Combinations of four- and five-axis HMCs can be integrated into various systems or cells to automate production. From automated tool changers and manufacturing cells to rail-guided vehicles, pallet pools, and robot-type loading, all are manufactured to the same rigid standards as Toyota machines themselves.



Tool Magazines

Automated setups typically require diverse tooling for multiple workpieces or duplicated tooling for repeated operations. Toyota's matrix magazines maximize tool storage to keep your cell running smoothly during unmanned machining.

Rail-Guided Vehicles

Automation systems generally use an RGV to transfer pallets swiftly to and from buffer stations to machines and loading stations. The FMS's design is modular, allowing for more pallets, machines, and buffer stations to meet production needs. Each automation cell utilizes one RGV, with pallet storage available in one, two, or three levels.



Loading & Unloading Stations

Operators run the entire automation cell from a monitor at the loading and unloading station. The FMS accommodates up to 10 loading stations.



Buffer Stands

Available in one, two, or three levels, buffer stands are storage locations for pallets within the system. Two-level systems can be upgraded to three-level systems at any time.



Automation Systems



TIPROS FMS

Toyota's TIPROS FMS leads the industry with unique features to greatly increase productivity. Integrating this intuitive system keeps jobs organized, leads to significantly reduced downtime, and allows for lights-out production. With the capacity to hold up to 300 pallets on up to three levels, the automation cell is customizable to effectively meet the needs of any shop.

Single-Level System

The expandable, single-level FMS allows for the integration of machines, pallets, and stations on either side of a central track. Parts are delivered to the machine by a high-speed RGV. The cell controller tracks pallet locations within the system, while the pallet identification is verified by an RFID located on each pallet. A RFID sensor is mounted on the RGV to guarantee the correct pallet is loaded every time.

Multi-Level System

This modular design has the same features as the single-level system, with either two or three levels of pallet storage to maximize floor space. The welded construction, linear guideways, and high-speed RGV support high rates of acceleration.



Built for Flexible Automation

Modular, Expandable, Upgradeable

Using pre-engineered, modular components, an initial cell installation can be modest so production is profitable from the start. The system can grow with production needs by adding more machines and pallets for greater handling capacity.

Reduced Setup & Tear Down

TIPROS FMS eliminates the need to repeatedly set up and tear down fixtures, as a single cell holds up to 120 pallet buffer stations. An additional 300 pallets can be stored offline and put back into production quickly when needed. Part changeover is reduced to minutes by selecting the part number, lot size, and job priority on a central shop floor computer.

Pallet Pool

Pallet pools are an economical option for expanding storage and automating production on a single machining center. Like the FMS, pallet pools utilize a single RGV to transport pallets to and from the machine. The single-level pallet pool has seven buffer stations and one loading station. The two-level pallet pool accommodates 14 buffer stations, and can be upgraded to a three-level cell with 21 buffer stations.



Robot Loading

Rail-Guided, Pedestal, or Gantry Pallet Management

Robot loading systems are custom designed for high-volume production environments. They allow machines of various sizes to be fully automated in a single cell. Parts are delivered to the machine and then loaded into a dedicated fixture by the robot. Finished parts are automatically unloaded to the outboard pallet changer position.

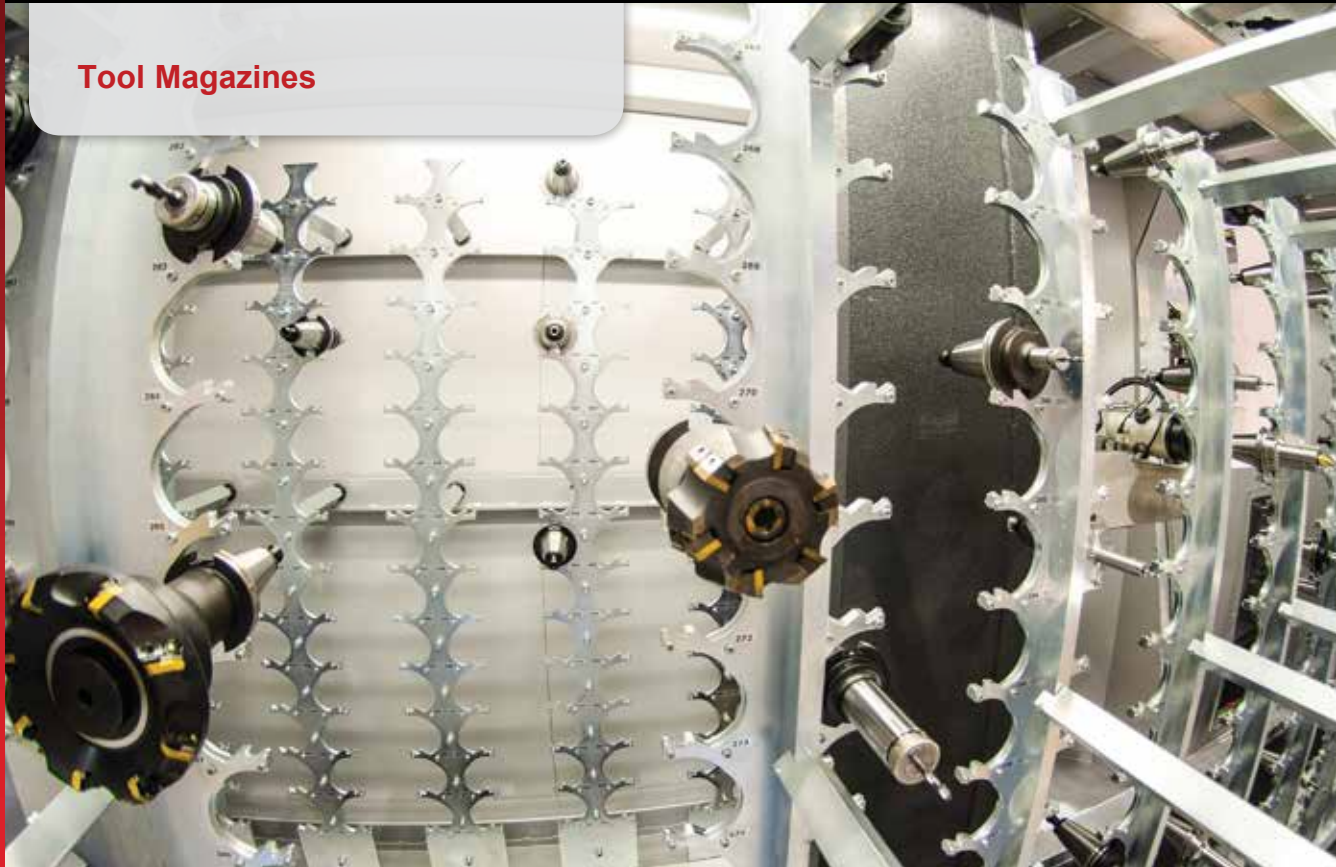


Multigenerational Compatibility

Toyota designs its automation cells with innovation in mind, allowing older and newer machine models to be seamlessly integrated into a single system. This compatibility holds true because of Toyota's consistent machine design over many decades. Two specific features in our machines that have remained constant are the pallet locator system and the pallet's height from the floor. Regardless of age, horizontal machining centers can easily co-exist in a Toyota automation cell.



Tool Magazines



Compact Matrix Magazine

The compact tool magazine is an auxiliary tool storage unit ideal for housing unique tools or multiple backup tools used during unmanned machining. Toyoda's compact matrix magazine is capable of holding up to 180 tools (50 taper) and up to 304 tools (40 taper). Custom configurations are available.



Matrix Magazine

Toyoda's matrix tool magazine is a large capacity, auxiliary tool storage rack that accommodates up to 504 tools. Ideal for workpieces requiring many unique tools or redundant tools, the matrix magazine eliminates unnecessary trips to the tool room.



Live Tool Monitoring

All matrix magazines offer Toyoda's live tool monitoring software. This optional software works dynamically to automatically detect broken and worn tools and bring them to the unloading station to be replaced. In a touchscreen interface, this system monitors the specifications and life of every tool in operation, making it easy for the operator to manage the inventory of tools in the cell.



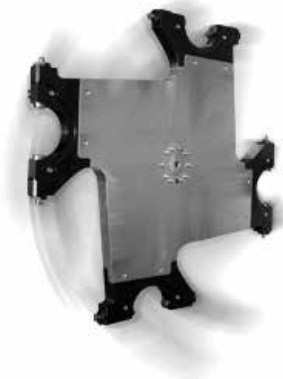
Simplified Tool Loading Station

Load and unload tools in a five-position rack without interrupting magazine operations. The magazine's controller reads the part program to preselect and display the needed tools. Track every tool with the continuous monitoring of the magazine, loading station, and revolver. Touchless tool identification and tool length monitoring are available.



Four-Position Tool Turret

Toyoda's matrix magazine features a four-position tool turret that allows for multiple tools to be preloaded near the machine, reducing the automation system's tool change time to that of the machine itself. This technology allows for the staging of tools, eliminating wait time typically seen with large magazines when a series of short cycle time tools are processed sequentially.





Powerful Cell Management

The basic function of a cell controller is to select and execute the part program, then return the pallet and finished workpiece to the operator's loading station or storage rack.

Toyoda's TIPROS cell controller goes beyond these basics to make the system user-friendly and extremely powerful. TIPROS has DNC capabilities, tool management, production monitoring, production scheduling, performance diagnostics, and maintenance support capabilities.



TIPROS FMS Software		Light	Level 1	Level 2	Level 3
Personal Computer	Transfer Control (CL30)		●	●	●
	DNC and Reporting Functions (MG30)			●	●
	Tool Management (TL30)				●
NC	Transfer Control (OP40iPP)	●			

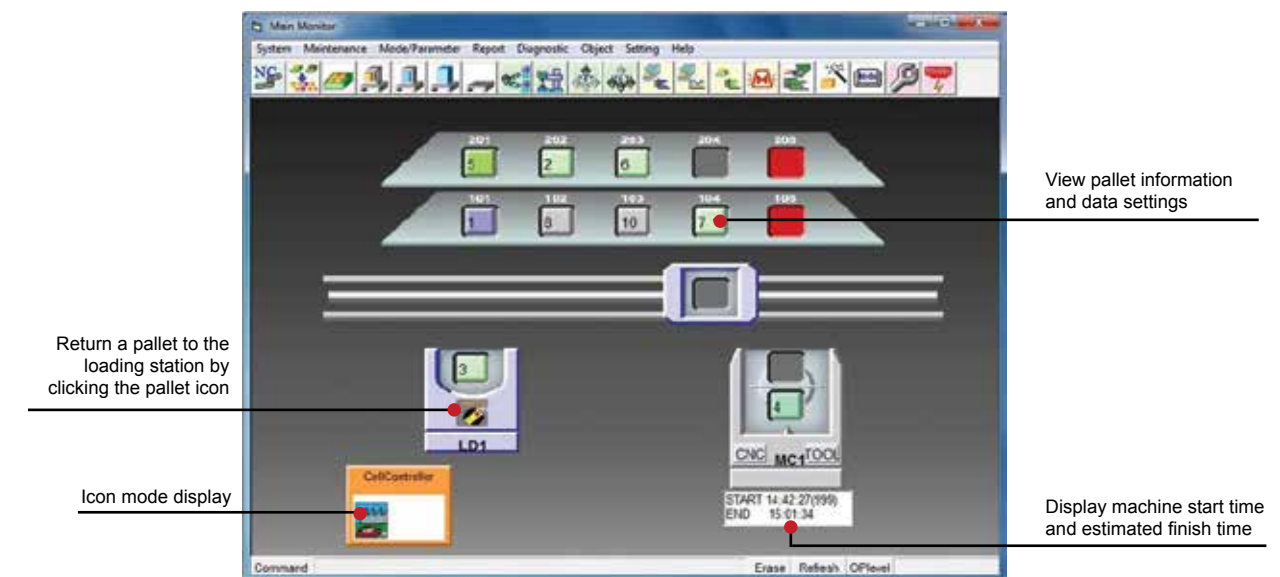
● Vertical Pallet Pool System ● Stacker Crane and RGV System

TIPROS /// Level 1 Cell Controller

User-Friendly Interface

Toyoda's easy-to-use TIPROS software uses a Windows-based operating system. Full color graphics and familiar Windows icons enable any computer user to quickly become a proficient cell operator. Operator support for setup, maintenance, and troubleshooting are built into the controller, while the Work Wizards function helps new users benefit from the full power of the system on day one.

From the cell's central controller, operators can easily check the status of a machine or pallet by clicking on the machine icon, saving operators the time and hassle of checking Fanuc controls on individual machines. The cell's entire production schedule can be managed using a drag-and-drop method, allowing new workpieces to be added to the cell from anywhere on the company's integrated network.



TIPROS Material Handling Functions

- Specify the order in which work is performed, or add and delete work from the schedule
- Predict the completion of work in queue
- Route pallets to multiple machines, or engage multiple CNC programs for a single pallet
- Route high-priority jobs to the next available machine
- Abort a part program, unload a pallet from machine, clear the tool from spindle, and reset the control
- Flag a pallet that generates a broken tool error
- Flag pallets as "first piece" to automatically generate an operator call for program prove-out
- Control power to all machines and the RGV from a single location

Level 1 Standard Features

- Cell control
- Loading station in-process return
- Multi-face machining function (four-side, four-button on touch panel)
- Preventative maintenance on the cell control screen

TIPROS /// Level 2 Cell Controller

TIPROS level 2 has all the functions of level 1, as well as expanded production reports, machine utilization reports, operator logs, and alarm logs.

Automatic, Detailed Reports

TIPROS aids in the optimization of your cell by offering reporting options from daily production reports to long-term capacity utilization.

Detailed production data, operation logs, and alarm logs are stored in a Microsoft Access database, making it easy for the user to generate custom reports or to upload information to a corporate database.



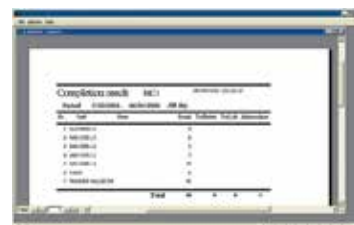
Production Report



Alarm Report



Operation Report



Machining Report

Production Report

Production reports show tables and charts for part and process comparisons, batch tracking, and scheduling. Review production history for any time period, and organize it by categories such as customer, part, cycle time per pallet, and quantity.

Alarm Report

This report flags errors, diagnoses problems, and records those events for maintenance analysis and corrective action, giving shops the ability to track the number of incidents and downtime per alarm.

Alarm recovery is fully automatic, with motors relying on absolute encoders. Addressing an RGV's automatic alarm takes a simple mouse click. Online instructions help the operator identify the alarm, while absolute encoders on all axes of the vehicle enhance recovery.

Operation Report

Operation reports provide machine status and utilization histograms for each machine in the cell. Track how long it took to start the machine, to produce a workpiece, and to wait for parts to see true machine utilization without unnecessary paperwork.

Machining Report

The report shows machining status by part number and by machine. In charts and tables, the machining report provides real-time monitoring of work in process and the production status.

Level 2 Standard Features

- Cell control
- Loading station in-process return
- Preventative maintenance on the cell control screen
- Multi-face machining function (four-side, four-button on touch panel)
- FANUC screen (machine) display on the cell control
- Reporting function
- NC program control
- Manual DNC function (program transmit by manual mode)
- Continuous DNC function (program transmit by automatic mode)
- Tool check

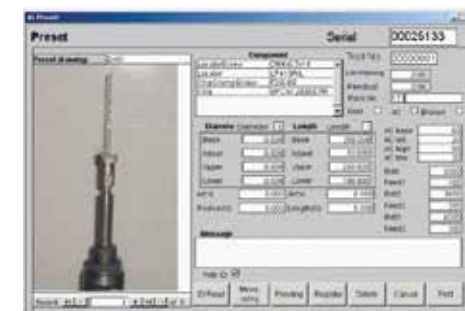
TIPROS /// Level 3 Cell Controller

Tool Management

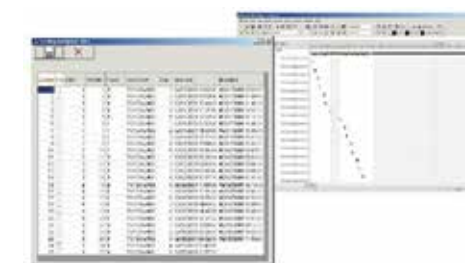
Toyota's advanced suite of tool management functions provides invaluable data for long runs of complex parts. Tool pocket number translation permits a CNC program to be written without knowing the location of each tool. Additional functions include tool presetter integration, RFID tags, automatic loading of tool offsets, and tool life uploading and downloading.

Dynamic Scheduling

This feature determines the most efficient production schedule based on your shop's machining needs. It analyses job priority, lead time, machining time, the availability of tools, fixture and machine, and the cell's manned and unmanned status to determine the ideal production sequence.



Tool Management

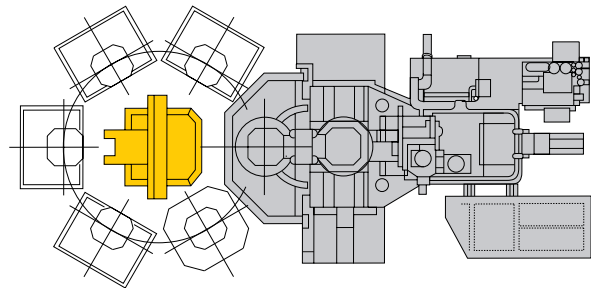


Dynamic Scheduling

Level 3 Standard Features

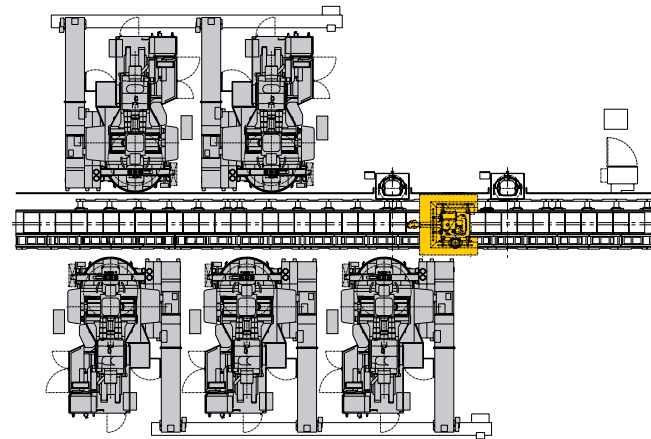
- Cell control
- Loading station in-process return
- Preventative maintenance on the cell control screen
- Multi-face machining function (four-side, four-button on touch panel)
- FANUC screen (machine) display on the cell control
- Reporting function
- NC program control
- Manual DNC function (program transmit by manual mode)
- Continuous DNC function (program transmit by automatic mode)
- Tool check
- Tool data control for magazine
- Life over tool change instruction
- Setting of each tool data and data back up
- Manual socket layout
- Stored tool detection
- Work instruction by preset drawing
- Independent preset
- Tool data download and upload
- Total prediction
- Undersized or oversized tool change instruction
- Auto socket layout
- Continuous preset
- Selection of stored tool
- Using time setting





Single- or Multi-Level Pallet Pool

Pallet Pool	Vertical Pallet	Horizontal Pallet
Machines	1	Maximum 2
Misc. Equipment	—	—
Loading Stations	1	Maximum 2
Buffer Stands	Maximum 15	Maximum 10
Pallets	Maximum 300	
Tools	40 to 504 per machine	
Part Programs	Unlimited	
Transfer Device	Transfer table	
CNC Unit	Fanuc 16i, 18i, 30i, 31i	
Software	Windows XP	
DNC Connection	Ethernet, RS422	
Database	Microsoft SQL Server	
Reports		
Machining	4	
Operations	4	
Production	3	
System Alarm	3	
Pallet Configurations	8	
Pallet Offsets	400	



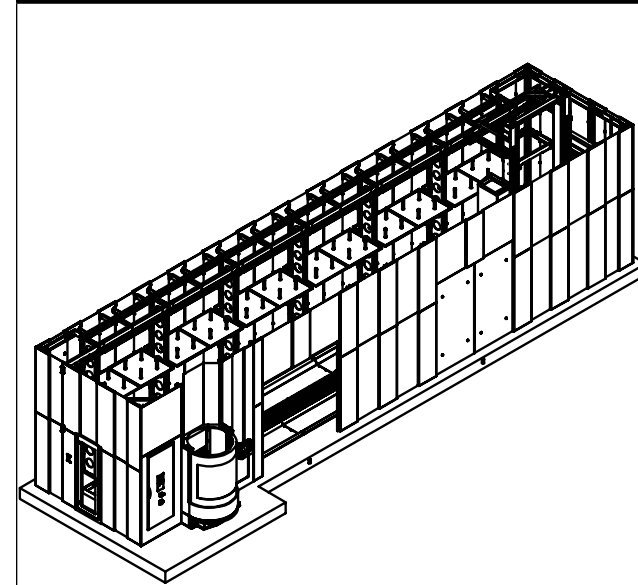
Expandable Single- or Multi-Level FMS

Single-Level and Multi-Level FMS	
Machines	Maximum 20
Misc. Equipment	Maximum 3
Loading Stations	Maximum 10
Buffer Stands	8 to 120
Pallets	Maximum 300
Tools	40 to 504 per machine
Part Programs	Unlimited
Transfer Device	Rail-guided vehicle
CNC Unit	Fanuc 16i, 18i, 30i, 31i
Software	Windows XP
DNC Connection	Ethernet, RS422
Database	Microsoft SQL Server
Reports	
Machining	4
Operations	4
Production	3
System Alarm	3
Pallet Configurations	8
Pallet Offsets	400

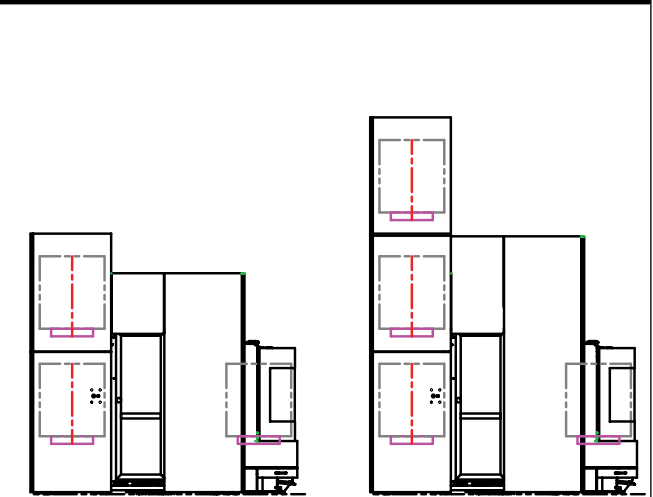
Some specifications may require level 2 or level 3 software.

Compact Matrix Magazine	No. of Tools	Max. Length of Tool	Max. Weight of Tool
40 Taper	304	21.7 in (551 mm)	59.4 lb (26.94 kg)
50 Taper	180	21.7 in (551 mm)	59.4 lb (26.94 kg)
Matrix Magazine	No. of Tools	Max. Length of Tool	Max. Weight of Tool
40 Taper	342	21.7 in (551 mm)	59.4 lb (26.94 kg)
Expanded 40 Taper	494	21.7 in (551 mm)	59.4 lb (26.94 kg)
50 Taper	308	21.7 in (551 mm)	59.4 lb (26.94 kg)
Expanded 50 Taper	504	21.7 in (551 mm)	59.4 lb (26.94 kg)

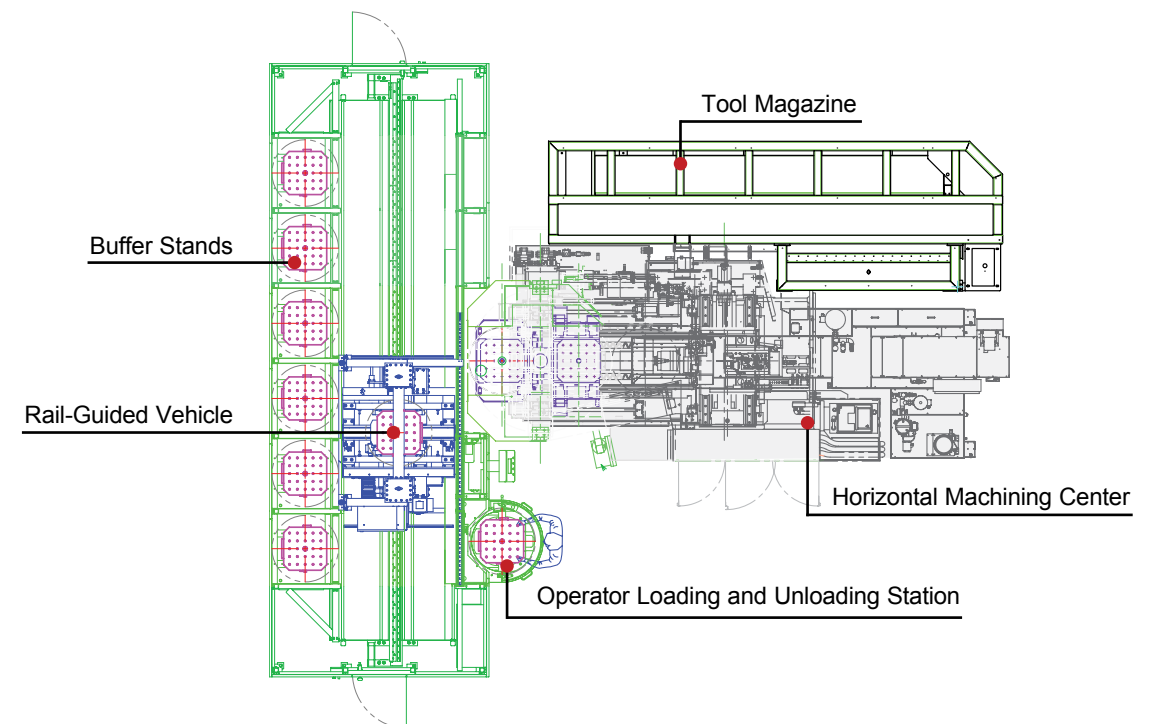
TIPROS FMS Isometric View



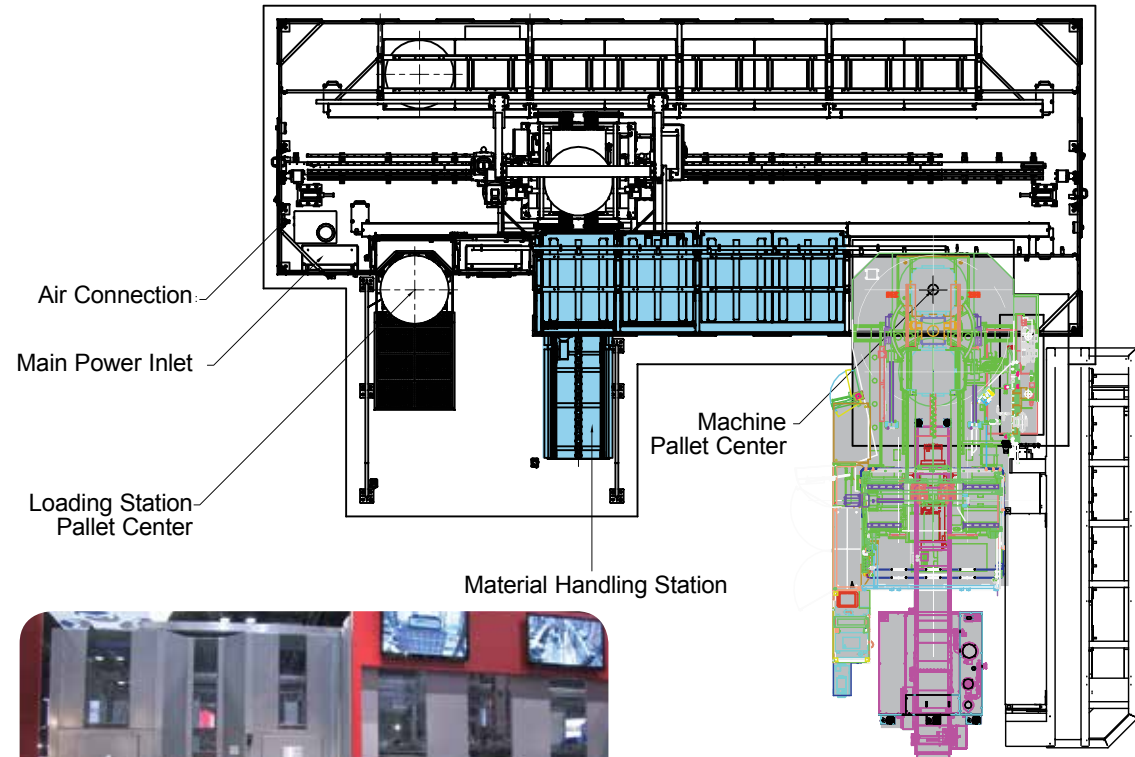
Two-Level / Three-Level Elevation View



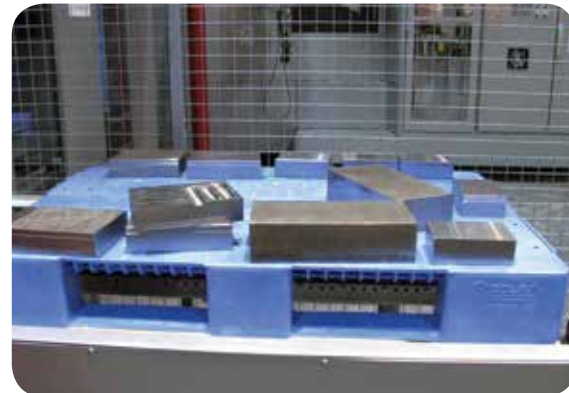
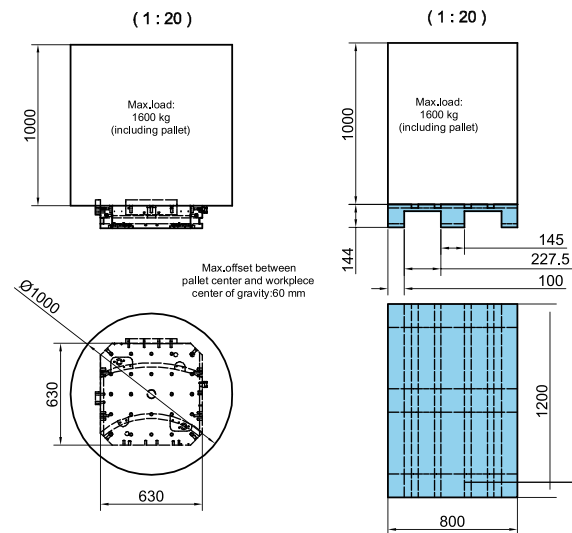
TIPROS FMS General Layout



TIPROS FMS Layout with Material Handling



Machine Pallet and Material Handling Pallet Layout (Sample Reference for 630-sized HMC)



Material Handling Station

THE TOYODA DIFFERENCE

Production Experience

Toyoda is one of the world's largest machine tool builders, but we also have a successful production side to our business. Every year, Toyoda manufactures and sells more than \$1.5 billion in steering and driveline systems to automotive OEMs around the world. This gives our company unique insight into the shop floor challenges our customers face every day.

Proven Technology

Our experience with high-volume production helps us design and build machine tools that perform under pressure. We continually refine processes, build reliable machines, and test them in our own factories. When you decide to buy a Toyoda machining center or grinder for your business, you can be confident that you are investing in proven technology.

Customer Support

Toyoda works closely with its nationwide dealer network to keep local service engineers on call should you need them. In addition, our own factory-trained service engineers are stationed across the U.S., Canada and Mexico. Our extensive spare parts inventory (\$20 million) ensures that virtually any replacement part will be shipped to you in 24 hours.

Toyoda Machinery USA

Toyoda Machinery USA is headquartered just northwest of Chicago in Arlington Heights, Illinois. Our office in Monterrey, Mexico proudly serves Toyoda's Central and South American customers, while our Minnesota- and Massachusetts-based Tech Centers cater to their respective regions. Toyoda's Remanufactured Products Division, located just outside Detroit, Michigan, provides rebuild, remanufacturing, and service support for the machine tool industry.



The information provided herein should not be construed as a contract. Product designs are subject to change without prior notice. Available machines or machines shown may vary depending on optional equipment or design variations.

Some product features may be photographed with guarding removed for purposes of illustration only. Machinery should never be operated without all proper safety devices in place and functioning.