

MAZATROL

Conversational and G-code CNC Programming



MAZATROL

Overcoming Barriers to Success

Challenges abound in manufacturing. Complex parts. Difficult materials. Changing workflows. Ever-increasing competitive pressures. Shortages of skilled labor. That's why Mazak developed and continues to advance its line of user-friendly Smooth CNCs with the company's world-renowned MAZATROL programming system for infinite part production capabilities.

The MAZATROL Advantage

- Easy and intuitive programming based on decades of Mazak experience
- Maximized Multi-Tasking and 5-axis machine performance
- Conversational and G-code programming languages are both included
- Shorter learning curves for less-experienced operators
- Fast, optimized toolpath routines without costly CAM systems

MAZATROL Smooth Family of Controls



MAZATROL SmoothX
Built for speed and complex applications, this control makes easy work of even your most-demanding machining operations, from simultaneous full 5-axis to free-form die-mold machining.



MAZATROL SmoothG
Tackle your toughest processing operations with a control that excels in off-centerline machining as well as angled drilling, milling, tapping and other complex part operations.



MAZATROL SmoothEz
This simple yet highly capable control gets you up and running parts fast, with AI-enhanced features that speed productivity.



MAZATROL SmoothAi
Harness the power of artificial intelligence (AI), machine learning and advanced data management with a control developed specifically for Multi-Tasking and full 5-axis machining.

Shown with optional MAZATROL SmoothAi dual monitor



MAZATROL and MPower: An Unbeatable Combination
Mazak's MPower gives you single-source access to end-to-end service and support for the lifetime of your Mazak machine. This includes self-paced CNC training courses through our MPower On-Demand Learning (MODL) system. Schedule a virtual online class or in-person training at one of our Technology and Technical Centers.

MAZATROL: The Conversational Programming System That Thinks Like a Machinist

In June 1981, Mazak introduced the world's first conversational CNC system for lathes, the MAZATROL T-1, perhaps the most significant productivity breakthrough in machine tool history. Before MAZATROL, programming meant loading punched data tapes into a reader on the machine tool, and even minor dimensional changes meant creating a new tape, an expert skill that required extensive training.

MAZATROL enabled operators to create and modify programs themselves with a few keystrokes on the CNC, answering the questions an experienced machinist would ask about a job, and the CNC took care of the rest. Best of all, a week's training gave even novice operators a basic understanding of how to program parts.

As technology continued to advance, MAZATROL CNCs upgraded from 8-bit to 16-bit and later to 32-bit hardware. In 1985, Mazak offered the combination of G-code and conversational programming as optional with its T-2 and M-2 controls, By 1994, fourth-generation MAZATROL CNCs came standard with both G-code and conversational programming in a single control. Four years later, the 64-bit CPU in the MAZATROL FUSION 640-T marked the further integration of program and production information into a PC.

Today's MAZATROL Smooth CNCs enable shops to handle more work in less time and with greater precision. They speed production, cut downtime, and verify part shapes and tool paths visually, all directly on the CNC. MAZATROL Smooth CNCs can engrave, create digital twins of machine tools, handle orbital machining, cut gears and much more. Ongoing MAZATROL development continues to add power, flexibility, speed and convenience, further blurring the line between programmer and operator with greater capabilities built directly into the machine tool.



1981
MAZATROL
T-1, M-1



1985
MAZATROL
T-2, M-2



1989
MAZATROL
T-32, M-32



1995
MAZATROL
T PLUS, M PLUS



1998
MAZATROL
FUSION 640



2005
MAZATROL
MATRIX

MAZATROL *SMOOTH Ai*

Designed specifically for 5-axis and Multi-Tasking machines, the MAZATROL SmoothAi control delivers powerful digital enhancements. This newest generation of MAZATROL Smooth CNC technology adds efficiency and value throughout the machining process with the power of artificial intelligence (AI), machine learning and advanced data management.

This control offers complete ease of use and ensures high-speed, high-accuracy machining performance with a wide variety of advanced programming functions and software capabilities.



Shown with optional MAZATROL SmoothAi dual monitor

FUNCTIONS INCLUDE:

- **Solid MAZATROL** uses 3D CAD data and AI-enhanced machining process selection to create optimized MAZATROL programs.*
- **SMOOTH Ai Spindle** leverages AI technology to optimize cutting conditions and surface finishes through automatic spindle vibration detection.
- **Ai Thermal Shield** ensures stable machining accuracy through heat displacement compensation enhanced with machine learning.
- **MAZATROL TWINS** simulates entire machines so programmers can access virtual machines on their office PCs.
- **SMOOTH CAM Ai** gives operators the ability to simulate and analyze data for multiple machines and optimize machining parameters in real time.
- **SMOOTH Robot Cell Controller** simplifies robot programming and use with dedicated management software for high-mix/low-volume production.
- **SMOOTH Project Manager** synchronizes the data associated with machining programs across an entire manufacturing facility, including the virtual machines created with MAZATROL TWINS.
- **SMOOTH Machining Configuration (SMC)** enables operators to optimize processes in real time with slider switches that control a wide range of cutting parameters.
- **SMC Plus** serves as an optional software module that helps operators use 3D part models to correct tool contact points in G-code programs for improved accuracy and part quality.

Ergonomics also play an important role in the functionality of this control. A 19" intuitive multi-touch screen enables fast and smooth programming operations, and presents all critical machine data on a single page, with a tilt control panel that positions to accommodate operator height. For additional functionality, display data from the SMOOTH Ai Spindle, SMOOTH PMC and SMOOTH RCC on an optional second screen. The CNC can store up to 32GB of data using its SD card slot.

* This feature is only available on INTEGREX machines.

MAZATROL *SMOOTH Ez*

The MAZATROL SmoothEz CNC packs productivity and enhanced features into a bright 15" capacitive touch-screen display with customizable screens and layouts plus a full onscreen keyboard. The advanced user interface displays 60 programming lines at once to speed both MAZATROL and G-code programming. The redesigned LAUNCHER screen uses the entire panel to ease screen selection and appears in icon form on every screen, with transition buttons to reach the home screen or a previous screen at a single touch. The control is responsive, efficient and easy to learn, even for new operators.

FUNCTIONS INCLUDE:

- **Solid MAZATROL** uses 3D CAD data and AI-enhanced machining process selection to create optimized MAZATROL programs.*
- **Intelligent Thermal Shield** ensures stable machining accuracy through heat displacement compensation enhanced with machine learning.
- **QUICK MAZATROL** provides onscreen display of a 3D part model to simplify program creation and confirmation through the touch screen.
- **MAZATROL TWINS** links up with SMOOTH CAM Ai to simulate and analyze data for multiple machines and optimize machining parameters in real time.
- **SMOOTH Project Manager** synchronizes data associated with machining programs across an entire manufacturing facility, including virtual machines created with MAZATROL TWINS.
- **SMOOTH Corner Control** makes cutter path adjustments to help shorten cycle times.
- **SMOOTH Machining Configuration (SMC)** enables operators to optimize processes in real time with slider switches that control a wide range of cutting parameters.

For optimal ergonomics, use a mounting arm to add a tablet and network it with auxiliary computers for operation of CAD/CAM functions or SMOOTH Project Manager. The CNC can store up to 32GB of data using its SD card slot.

* Solid MAZATROL is available on the turning control and requires the SMOOTH CAM Ai option.



MAZATROL SMOOTHX

One of the fastest and most advanced CNCs on the market, the MAZATROL SmoothX brings extreme productivity advantages to the most demanding machining operations. It ensures the shortest possible machining cycle times, especially in fine-increment programs for simultaneous 5-axis operations and free-form die-mold machining.

The control incorporates a wide variety of advanced programming functions that allow it to offer complete ease of use and ensure high-speed, high-accuracy machining performance.

FUNCTIONS INCLUDE:

- **Super High-Speed Mode** helps provide maximum interpolation capabilities.
- **High Gain Feed Forward Control** boosts machining speed and accuracy.
- **Fast Rotary Axis Speeds** optimize gear skiving and rotary axis threading.
- **Variable Acceleration Control** calculates optimal acceleration for a combination of axes.
- **Intelligent Pocket Milling** engages a high-efficiency toolpath when milling part cavities.
- **Smooth Corner Control** makes cutter path adjustments to help shorten cycle times.
- **Orbit Machining** enables milling spindle servo orientation to turn complex features.
- **Position-Controlled Hobbing** provides fast, convenient hobbing and skiving operations.
- **Real-Time Tuning** ensures optimal machining balance as workpiece weight changes.

Ergonomics also play an important role in the functionality of this control. A 19" intuitive multi-touch screen enables fast and smooth programming operations, and presents all critical machine data on a single page, with a tilt control panel that positions to accommodate operator height. The CNC can store up to 32GB of data using its SD card slot.

MAZATROL SMOOTHG

The MAZATROL SmoothG makes it easy to generate programs for processing complex parts through off-centerline machining as well as angled drilling, milling and tapping.

The control incorporates a wide variety of advanced programming functions that allow it to offer complete ease of use and ensure high-speed, high-accuracy machining performance.

FUNCTIONS INCLUDE:

- **High Gain Feed Forward Control** boosts machining speed and accuracy.
- **Fast Rotary Axis Speeds** optimize gear skiving and rotary axis threading.
- **Variable Acceleration Control** calculates optimal acceleration for a combination of axes.
- **Intelligent Pocket Milling** engages a high-efficiency toolpath when milling part cavities.
- **Smooth Corner Control** makes cutter path adjustments to help shorten cycle times.
- **Orbit Machining** enables a machining center with a C-axis to turn complex features.
- **Position-Controlled Hobbing** provides fast, convenient hobbing and skiving operations.
- **Real-Time Tuning** ensures optimal machining balance as workpiece weight changes.

Ergonomics also play an important role in the functionality of this control. A 19" intuitive multi-touch screen enables fast and smooth programming operations, and presents all critical machine data on a single page, with a tilt control panel that positions to accommodate operator height. The CNC can store up to 32GB of data using its SD card slot.





Tool Data Integration

To ensure the use of correct H or D codes, simply call up a G43 or G41/G42 command and the MAZATROL Smooth CNC applies the correct values based on known tools. In response to simple pocket numbers or Tool Group Numbers, the machine automatically loads all the information for the specific tool in the spindle.



Quick MAZATROL

Import 3D CAD data and retrieve machining dimensions directly from the drawing for fast, easy programming. The CNC displays dynamic real-time updates directly on a 3D model during data entry. Check shapes and processes onscreen to reduce program errors and minimize programming time.



Adjustable Ultra Precision

Easily optimize roughing cycles for faster cuts with MAZATROL functions including SMOOTH Machining Configuration (SMC), Geometry Compensation, and SMOOTH Corner Control. Make smooth, accurate finish cuts with a simple M or G-code call.



Full-Machine Simulation

Both in conversational and in G-code programming, view a simulation that includes table and cover movements as well as all machine components. Describe a workpiece or upload a parasolid model, then watch complete material removal – even in full 5-axis machining mode.



Quick G-code

Open a dynamic 3D graphical representation of a program tool path onscreen, touch a line and immediately move to the corresponding section of an G-code program to edit the path. Quick G-code can analyze a program and suggest blocks that may leave cutter marks on the part surface.



Microsoft® Windows® Integration

For intuitive operation, control efficiency and data security, MAZATROL CNCs incorporate Windows file handling, networking and multiple process capabilities.

Part Offset Support

Control virtually all variations of offsetting, including G54, G54.1Px, G92, G54.2Px, G54.4Px and more. To eliminate errors in workpiece setup and fixturing, adjust offsets on the fly with G10 or a direct macro variable setting.

Tool Offset Support

Accommodate a wide variety of tool offsets on the CNC, including tool radius G43, G41/G42, G41.2, G41.4, G41.5 and so on, along with 5-axis side offsetting, tool length G43, G44, G43.1, G43.4, G43.5 and more.

Spare Tool Setup

Apply the same group number to two or more tools, and indicate how long each should run and/or how many parts each should cut.

Safety Shield

This function performs an interference check on an axis during manual and automatic operation. Using the specified 3D model, it considers the amount of movement of the axis and whether there is a possibility of interference. If there is, it immediately displays a warning and stops the moving axis.

Compatible G-code Support

Quickly adapt code posted for another type of control – typically unedited – with built-in support for virtually every standard G-code found on any FANUC-compatible machine. Changes involve only a few M and T-codes.

Easy-G10 Data Change

Unlike other controls, MAZATROL Smooth CNCs accommodate various cutting strategies or mixed machines within a cell, and can change many machine parameters on the fly without using G10 to alter offset and macro data.

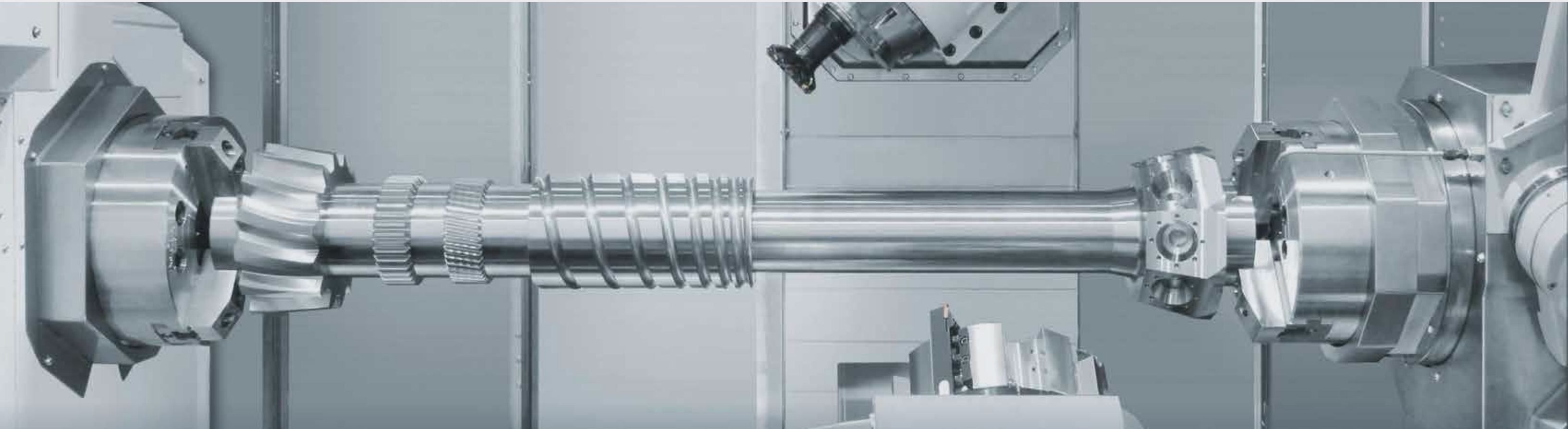
Flexible Macro Variables

Define many parameters as A-system variables within the MAZATROL Smooth control and manipulate them easily to optimize processes for a specific machining environment.

Internal SSD Drive

Reduce the risk of data loss with SSD internal drives for storage featured on SmoothAi and SmoothG controls.





Intelligent Pocket Milling

Engage high-efficiency toolpaths to ensure constant cutting loads and angles of tool engagement for optimal milling of part cavities. Achieve up to 35% faster machining of difficult-to-cut materials with greater efficiency and full use of machine-tool power.



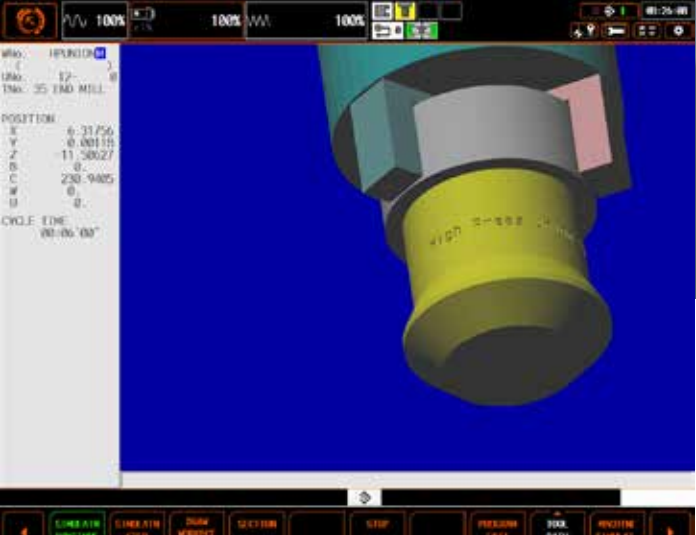
Oval Turning

Cut highly accurate oval and cam shapes at greater speeds on a turning center using a special oscillating integrated linear motor synchronized with the machine's spindle.



SMOOTH Orbiturn

With the X and Y axes synchronized in a circular motion and the turning tool tip vertical to the cutting face, cut features on large, complex parts such as valves and manifolds in a single setup. This function can cut diameters down to 2" and serves as a finishing operation for I.D., O.D. and face work, achieving the desired surface finish with standard tooling after the completion of milling.



SMOOTH Engraving

Quickly and easily program alphanumeric engraving operations on flat or cylindrical surfaces. Adjust character height, width and spacing to fit, and apply variable data such as product codes or dates. Tool diameter determines the weight of the type. Input strings up to 40 characters long (100 characters in G-code).



SMOOTH Tool Management

Track tool life, eliminate input errors and reduce non-cut time with centralized management, data registration and setup of an entire factory's tools. Ensure proper preventive maintenance for improved use of valuable resources.



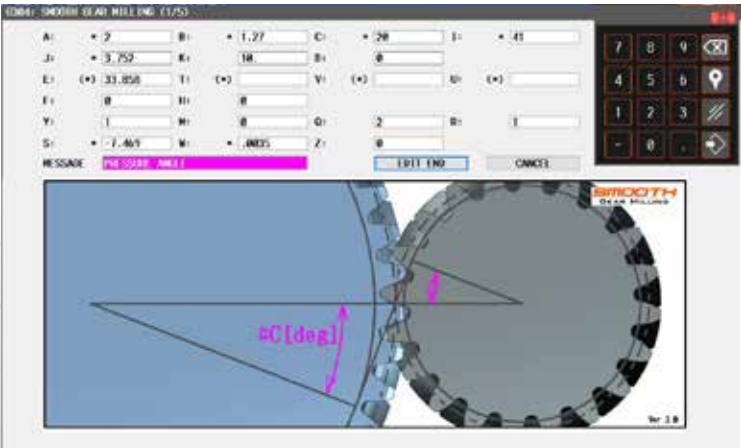
SMOOTH Set & Inspect

Accelerate on-machine work measurement and inspection with simplified programming of tool setting and part probing macros. Developed in conjunction with Renishaw, this function handles metrology and compensation through intuitive touch-panel operation.



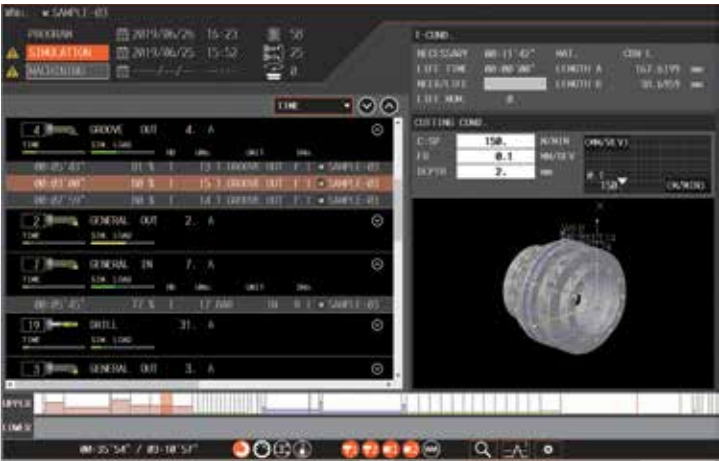
SMOOTH Gear Cutting

Reduce machining time and eliminate the need for 3D models, CAD/CAM software and CNC programming to hob, mill and skive gears on Mazak Multi-Tasking machines, all with convenient data visualization for higher productivity. SMOOTH Gear Hobbing synchronizes the rotation of milling and main spindles to profile specific gears. SMOOTH Gear Milling uses an end mill and ball nose end mill to machine spur gears. SMOOTH Gear Skiving machines small lots of I.D. and O.D. gears through conversational programming.



SMOOTH Cutting Adviser

Simulate, visualize and optimize machining conditions with support for changing parameters from MAZATROL's SMOOTH CAM Ai functions. Select data from simulation or machining results, and track tools, MRR, machining load, elapsed time, spindle servo load, speeds, feeds and depths of cut.



Innovative Functions for Higher Productivity

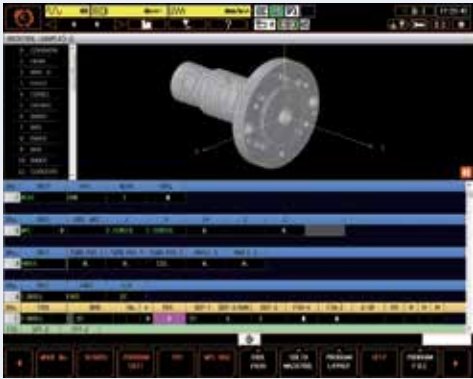
Solid MAZATROL

When you import a 3D CAD work model, artificial intelligence supports optimized programming, quickly making predictive decisions that typically rely on extensive operator experience. AI functionality enables the control to understand past programming experiences and automatically adjust cutting parameters based on previous results.

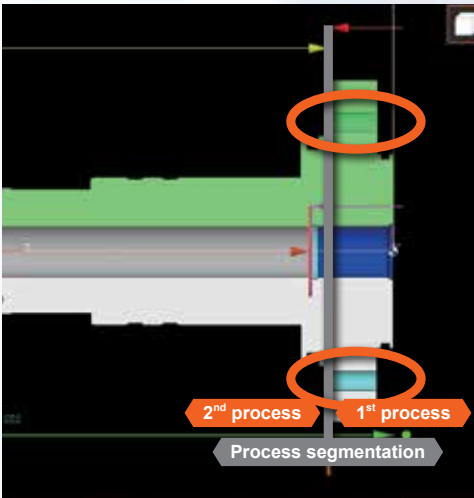


Import 3D CAD model

Required
time for
programming
2.5 min.



MAZATROL programming completed



Without Solid MAZATROL
and AI learning



1st process

Turning, Drilling



2nd process

Turning

Interrupted cutting in the second process affects the finished surface of the part.

With Solid MAZATROL
and AI learning



1st process

Turning



2nd process

Turning, Drilling

Uninterrupted cutting yields a highly accurate finished surface.



MAZATROL TWINS

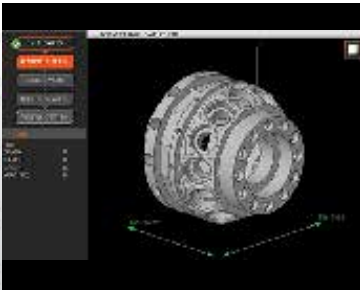
Some monitoring programs simply track and report machine status, but MAZATROL TWINS vastly exceeds that functionality. Rather than try to integrate a full CAM system into the SmoothAi CNC, Mazak takes advantage of the existing power of a shop's desktop PC system to reduce cycle times, improve surface finishes and enhance ease of operation.

MAZATROL TWINS looks remotely at a machine and models all parameters of its performance, including tool use, cutting volume and load, machining time, axis coordination, and 3D models of the workpiece, tooling and fixturing. Through an open interactive interface between the machine and CAM software, data flows in both directions to create an accurate offline visualization of the machine tool.

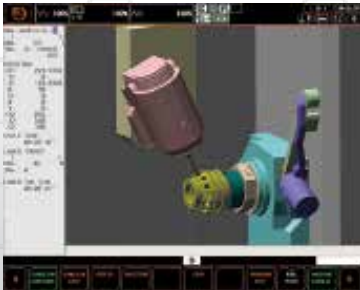


SMOOTH CAM Ai

Create and edit programs, simulate and analyze data for multiple machines and optimize machining parameters in real time, all from an office PC. Then transmit the data to machines on the factory floor for fast, accurate setups. SMOOTH CAM Ai easily changes machining conditions such as speeds, feeds and depths of cut on the fly. Its SMOOTH Cutting Adviser function optimizes machining parameters to control data about tools, material removal, machining load and time, and changes in cutting speed, depth of cut and other machining data.



AI programming



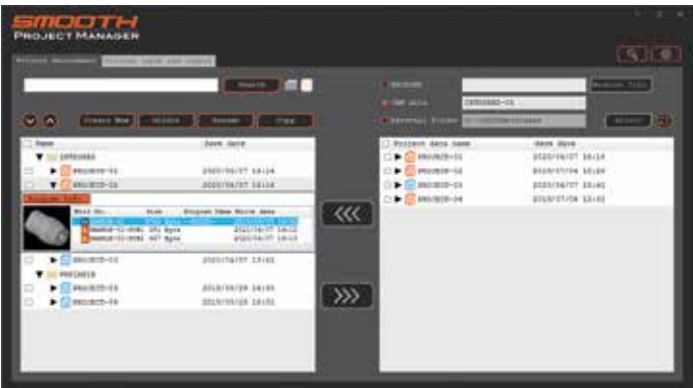
Fast simulation



Analysis/Optimization

SMOOTH Project Manager

SMOOTH Project Manager synchronizes machining data across an entire manufacturing facility and manages all data required to execute machining programs, including tool data, fixtures, coordinate system, parameters and workpiece 3D models. In addition, its project data synchronization features can work with SMOOTH CAM Ai and many CAD/CAM software packages to keep data synced between virtual machines created with MAZATROL TWINS and MAZATROL SmoothAi CNCs on the factory floor. The ability to save and reuse machining information as project data enables shops to reduce setup time.



SMOOTH Machining Configuration

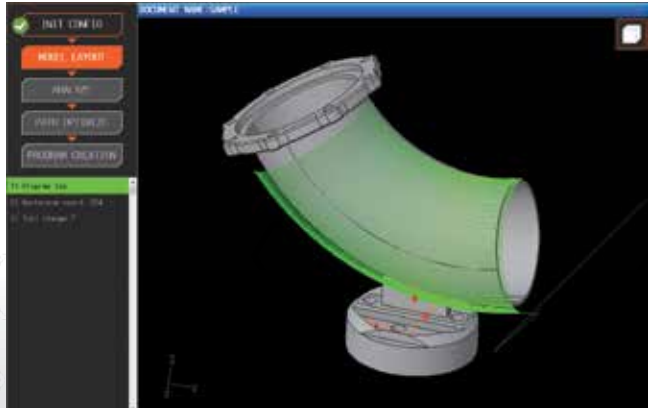
Slider switches on the MAZATROL CNC tune machining features to match material requirements and machining methods, with especially effective results on complex workpiece contours defined in small program increments. Adjust rotary axis acceleration, speeds, accuracy priorities, cycle time, finished surface and machining shape, and store these settings in memory for future reuse.



SMC PLUS

OPTIONAL

To ensure correct toolpaths and highly accurate finished surfaces, compare tool contact points in G-code programs with a 3D model and make adjustments.



Customer Support and Training

Mazak Technology and Technical Centers

Mazak’s comprehensive customer support relies on its strategically located network of Technology and Technical Centers across North America to give customers convenient access to component machining demonstrations, experienced applications engineers and technical training. At the same time, these centers easily channel customer insights to Mazak manufacturing to provide input into machine tool development.

Technology and Technical Centers offer advanced application support, education and training, new technology and manufacturing systems, along with on-site training and seminars.

Advanced application support

- **Expert application engineers** help customers optimize part-production processes and create effective manufacturing solutions.
- **Mazak-certified cutting-tool, workholding and automation partners** collaborate with customers to develop optimized turnkey manufacturing solutions.
- **Test cuts** of customer parts run on Mazak’s latest, most-advanced machine tools.
- **Secure applications development and complete design privacy** protect each customer’s individual manufacturing system.

Education and training

- **On-site training and technology seminars**, some in cooperation with Mazak technology partners.
- **Free access** to the most advanced machine tools.
- **Industry-focused education** for fields including general aerospace, energy, jet engine and construction.
- **New technology and manufacturing systems.**
- **The latest, most-advanced manufacturing systems** that can optimize the processing of industry-specific components.
- **Productivity experts** to help customers select the best new machine tool technologies for their particular businesses.
- **Hands-on application and operator development courses.**
- Regularly scheduled **market-focused events** that provide valuable industry insight.

MAZATROL: Easy Successes and Indispensable Results

No shop wants to struggle with programming or rely on hit-and-miss results. MAZATROL makes it easy to take on new types of parts and materials, and get more work done with the personnel already on the shop floor. From high-mix, low-volume output to just-in-time production and the ever-growing push for better, faster results, MAZATROL enables shops to grow and thrive under competitive pressures. This comprehensive Mazak innovation makes programming options available to shops of all sizes, with an easy route to making better parts.

SMOOTH programming courses (in person and online/on demand)

Through MPower Complete Customer Care, the MPower On-Demand Learning (MODL) system presents a unique, phased approach to education and training. Customers can capitalize on their investments in advanced technology through hands-on courses, web-based instruction and real-world examples.

Every customer who purchases a new Mazak machine tool receives three years of free training, and the program provides an appropriate entry point for individuals at every level of skill and expertise. Tiers of offerings range from self-paced coursework to highly advanced classes.

In addition to online classes, students may attend in-person courses at a variety of locations, including the Mazak Learning Center and the Center for Multi-Tasking and Manufacturing Excellence in the company’s Florence, Kentucky-based headquarters, where more than 3,000 customers receive training annually. All Mazak Technology and Technical Centers also offer a host of training alternatives, and can present onsite programs held at customer facilities.

The core advantage of MAZATROL – its conversational approach to part programming – quickly enables students to become fully capable operators. Students reach competence after a single five-day class, and further coursework helps competent operators become master craftspeople.



Mazak Edmonton Technical Centre



Mazak Southwest Technology Center



Mazak National Technology Center



Mazak Southeast Technology Center



MAZAK CORPORATION
NORTH AMERICAN MANUFACTURING HEADQUARTERS

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MazakUSA.com

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