

Combined G-Code and Conversational Programming Strategies



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INTRODUCTION

Manufacturers' part programming needs vary from one shop and industry segment to the next. So their machine tool CNC needs are different as well. Truly effective controls allow for the programming of complex to simple part geometries programed either in the front office or on the shop floor at the machine tool. G-code (EIA/ISO) and conversational types of part programming make this possible.

For its MAZATROL CNC technology, Mazak combined the best of both worlds in terms of the two programming types. This technology white paper presents explanations of both as part of Mazak's MAZATROL SMOOTH CNC controls along with individual benefits of having both capabilities within one control for particular applications and individual manufacturing needs.

G-CODE PROGRAMMING (EIA/ISO)

MAZATROL G-codes are the same as those used in conventional EIA/ISO CNC machines. This similarity lets machine users run programs made for other different brand machines with little or no editing then confirming axis strokes along with cutting conditions.

Controls with G-code programming capability allow for several advanced functions that speed and simplify programming as well as ensure error-free and optimized cutting paths for shorter machining cycle times. Other beneficial functions include full simulation along with support features for tool and part offsets in addition to that for standard code

MAZATROL Smooth CNC functions include:

Tool data integration

To ensure the use of correct H or D codes, users simply call up a G43 or G41 command, and the MAZATROL Smooth CNC knows what tool it has and applies the correct values. This works the same whether shops use simple pocket numbers or Tool Group Numbers – either way, the machine automatically has all the information for the particular tool loaded in the spindle. Each tool has a complete page of stored information associated with it that the control, in turn, monitors and uses automatically.

Adjustable Ultra Precision

SMC, Geometry Comp, Ultra High-Speed, SCC and more easily optimize roughing cycles for faster cuts. Then with a simple M or G-code call, they make finish cuts smooth and accurate as well.

Quick EIA

This feature allows users to open a graphic of the program toolpath and simply touch the line that needs editing. The control then quickly jumps to that part of the program.

Quick MAZATROL

Import 3D CAD data with this function for fast and easy programming. The control then updates, in real time, the displayed 3D model as program data is input.

Full Machine Simulation

Both conversational and G-code supported, this full machine simulation includes that of table and cover movements as well as all the components of the specific machine at hand. Users can describe their workpiece or upload a parasolid model, then watch full material removal – even in full 5 axis machining.

Microsoft® Windows® Integration

Windows file handling, networking and multiple process capabilities ensure control efficiency, intuitiveness and security.

Part Offset Support

Control of virtually all variations of offsetting – G54, G54.1Px, G92, G54.2Px, G54.4Px and more. Users can adjust offsets on the fly with G10 or direct macro variable setting to eliminate workpiece setup error and fixture error.

TOOL Offset Support

Allows control to accommodate a wide variety of tool offsets, including Tool Radius- G43, G41, G41.2, G41.4, G41.5 and so on, along with five axis side offsetting and tool length G43, G44, G43.1, G43.4, G43.5 and more.

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Spare Tool Setup

Lets users give two or more tools the same group number and indicate how long each should run and/or how many parts they should cut.

“Standard” Code Support

MAZATROL supports virtually every “Standard” G-code found on any Fanuc-compatible machine to eliminate any need for edits to adapt code posted for another different control. If changes are needed, the task involves only a few M and T codes.

Easy G10 Data Change

While many machines use G10 to alter offset and macro data, MAZATROL Smooth controls can change many of the parameters in the machine on the fly. This allows shops to accommodate different machines in a cell or cutting situations.

Flexible Macro Variables

As needed, users can easily manipulate many parameters – defined as A-system variables within the MAZATROL Smooth control – to their shop’s individual machining environment.

CONVERSATIONAL/MAZATROL

The development of MAZATROL advanced conversational programming has dispelled the industry’s long held belief that programming at a machine tool’s controller was inefficient and tedious. MAZATROL conversational programming makes it possible for inexperienced operators to quickly and easily develop machining programs while out on the shop floor.

Conversational programming is a wizard-like programming mode that either hides G-code or completely bypasses the use of it, as is the case with Mazak’s MAZATROL.

Operators begin the process answering conversationally displayed questions concerning the intended workpiece. These queries include type of material, OD/ID dimensions, part lengths and several others. Then according to the input data, the MAZATROL control automatically calculates intersection coordinates and tool index positioning in addition to optimized cutting conditions and machining processes.

As these questions are answered, the control constructs the program, then allows the machinist/programmer to graphically check the tool path and verify the program. In the event of program flaws or missing information, the control will display an alert, and the programmer must remedy the problem.

SMOOTH TECHNOLOGY CNC PLATFORM

Mazak's MAZATROL Smooth CNCs are part of the company's SMOOTH TECHNOLOGY platform that spans the entire part production landscape from programming and metal removal to automation and data collection. This all-encompassing platform seamlessly brings unmatched speed, accuracy, functionality and ergonomics to virtually every type of metalworking application.

As one of the four facets of SMOOTH TECHNOLOGY – Machine Design, Engineering Support, CNC Technology and Solutions – Mazak MAZATROL Smooth controls greatly improve machine tool management and operator efficiency.

This next generation of intuitive human-machine interfaces from Mazak offers the world's fastest processing speeds and user-friendly programming capabilities. Every feature of Mazak's MAZATROL Smooth CNCs is a direct response to real-world issues and customer input. The controls and their advanced, versatile MAZATROL programming language allow manufacturers to machine in ways never thought possible. Within the MAZATROL Smooth family of controls are the SmoothC, SmoothG and SmoothX.

Mazak's MAZATROL SmoothC technology is simple but innovative and sports several features that enhance cutting capabilities. The control makes it easy for operators to generate programs for basic turning, milling, drilling and tapping operations.

The MAZATROL SmoothG CNC optimizes programming and 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.

For highly advanced programming, the MAZATROL SmoothX CNC is the most progressive control available and significantly reduces part cycle times, especially in fine increment programs for full simultaneous 5-axis machining on applicable Mazak machines. The control has a processing speed four times faster than that of its predecessor.

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SUMMARY

Machine controls have come a long way in just the past few decades. And technologies, one of which being Mazak's MAZATROL Smooth controls, continue to develop at greater speeds. However, the truly innovative developments are not new for the sake of being new. These developments offer the solutions and functionality, such as both G-code and conversational programming, that manufacturers need to deal with real-world machining challenges.

THE SMOOTH CHALLENGE

For what it refers to as the SMOOTH CHALLENGE, Mazak pit one machine tool CNC against another. It did so to discover just how much faster Mazak's latest generation MAZATROL SmoothX CNC is over its predecessor the MAZATROL Matrix 2 CNC and thus to what extent users could shorten part cycle times.

Mazak ran the exact same 5-axis aluminum impeller part, simultaneously, on two Mazak full 5-axis Vertical Machining Centers – a VC-400A/5X with Matrix 2 control and VC-500A/5X with the SmoothX. Other than the difference in controls, the machines ran the same part program and cut at the same parameters. Spindle speeds were 12,000 rpm, and the machines fed at 260 imp.

At the conclusion of the SMOOTH CHALLENGE, the machine with the SmoothX control cut its part over one minute faster.

[Click here to watch the Mazak SMOOTH CHALLENGE](#)

