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## Custom Postprocessor Pricing & Feature Support

### 1. General Definition

"Custom Postprocessors" supplied by CAMCAD Technologies, Inc (CAMCAD) are labor charges for configuring one of three types of "Postprocessor Runtime" systems. CAMCAD will decide which solution to use based upon the CAM system to be supported, prior industry experience, user preference if possible, and the type of machine being supported. The solutions we support are "MPost", "SPost", and "OmegaPost". CAMCAD will, at a user's request, consult with a machine tool builder or distributor to obtain accurate specifications & programming manuals for the machine(s) to be supported.

#### 1.1. MPost

MPost - based Custom Postprocessors are configured by implementing a simple ASCII template containing register definitions, variables, commands, and sequences necessary to format machine ready NC Code. There are limited mathematical functions within MPost, i.e. it is a code formatter that directly reads SURFCAM toolpaths and generates NC Code. Deliverables include an ASCII template, annotated test program, and a PDF of the template.

#### 1.2. SPost

SPost - based Custom Postprocessors are APT CLfile based and are configured using a graphical utility for fixed parameter settings plus FIL macro code supporting special effects. Deliverables include encrypted FIL language, PDF of any unique FIL source, annotated test program, fixed parameter files, and a setup file containing user runtime options. FIL source is available upon request and is priced separately.

#### 1.3. OmegaPost

OmegaPost - based Custom Postprocessors include a copy of CAMCAD's OmegaPost RunTime system for directly reading supported CAM system toolpaths. This system is ideal for handling hybrid machines or advanced CNC controller cycles, conversational mode support, extensive toolpath subroutine logic, and so on. Deliverables include an encrypted template, annotated test program, and a PDF of the template. Template source is available upon request and is priced separately.

#### 1.4. CAM Programming Software

All postprocessors are designed to read toolpath data produced by the latest supported version of the SURFCAM programming system software under Windows 7-10 operating systems.

#### 1.5. Warranty & Support

CAMCAD warrants all postprocessors to generate edit-free NC code per original specifications for a period of ninety (90) days from date of initial acceptance. Warranty support requests will be honored if a suspected malfunction can be reproduced using the latest released version of the CAM system. All suspected problems will be addressed, but must be accompanied by a detailed written description, marked-up NC code, and a test case from the CAM system.

Extended service contracts are quoted separately.



Custom Postprocessor Pricing & Feature Support

## 2. Budgetary Pricing

Budgetary pricing below includes standard feature support, and at CAMCAD's discretion, may require separately-priced on-site prove-out. If on-site prove-out & setup is required, CAMCAD assumes ready access to the machine(s), a fully trained operator is available, and that the machine(s) are properly installed and fully functional during normal (8AM~5PM GMT-5) working hours.

### 2.1. Mill/Drill or Machining Center **\$1,500.**

Orthogonal rotary table indexing; Rapid motion analysis for XY[A-B-C]/Z; Spindle oriented G80-series hole-making cycles; Single active work offset relative to world coordinates or local output per work offset.

### 2.2. Single or Twin Turret Lathe **\$1,500.**

Front or rear turret configuration; Horizontal or vertical spindle programmed in XY or ZX view; Twin turrets on common slide; Twin turrets on separate slides (XZ/UW); Canned cycle threading; Single point threading (G33 XZ multi-block) support; Spindle centerline drill cycles; Spindle SFM with auto lock/unlock support; Auto dwell for spindle range change or turret index.

### 2.3. 4-Axis Tilt Wire EDM **\$1,750.**

Upper/lower wire guide projection from table surface; XY/UV support; UV as increments from XY, last UV, or absolute from datum; Wire compensation.

### 2.4. 4-Axis Mill or Machining Center **\$1,500.**

All mill/drill & machining center features; 4<sup>th</sup> axis contouring about orthogonal axis; Inverse Time feed control.

### 2.5. 4-Axis Horizontal Boring Mill **\$3,000.**

All mill/drill & machining center features; 4<sup>th</sup> axis contouring about orthogonal axis; Inverse Time feed control; Hole-making cycles on spindle (Z) or table (W) per command; Quill/table clamp/unclamp support.

### 2.6. 5-Axis Gantry XYZ/AC-BC Mill **\$3,500.**

Mill/drill & machining center features; Safe retract for tool change sequence per specs; Automatic head repositioning when travel limits are encountered; Inverse Time feed control; Canned or emulated hole making cycles; Multi-block linearization of any non-orthogonal arc or helical moves; Multi-block linearization of tooltip during orientation change; Tool length comp to common gage dimension; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

### 2.7. 5-Axis Gantry XYZ/AC-BC Laser or WaterJet **\$3,500.**

Applicable mill/drill & machining center features; Safe retract for tool change sequence per specs; Automatic head repositioning when travel limits are exceeded; Inverse Time feed control; Hole making cycles via subroutine call; Laser or WaterJet power, pulsation, or abrasive assist settings via subroutine call; Multi-block linearization of any non-orthogonal arc moves; Multi-block linearization of tooltip during orientation change; User-defined stand-off along tool axis; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.



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**2.8. 5-Axis HMC with Rotary Table and Tilting Head \$3,500.**

Mill/drill & machining center features; Safe retract for tool change sequence per specs; Head/table repositioning when travel limits are exceeded; Inverse Time feed control; Canned or emulated hole making cycles; Multi-block linearization of arc or helical moves when head is tilted; Multi-block linearization of tooltip during orientation change; Tool length & diameter comp; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.9. 5-Axis VMC or HMC with Dual Rotary Tables - Index Only \$2,500.**

Mill/drill & machining center features; Safe retract for tool change sequence per specs; Automatic table repositioning when travel limits are exceeded; Canned or emulated hole making cycles; Interpolated arc or helical moves when tables are tilted; Full 5ax Indexing support based on CView definitions; Tool length & diameter comp; Machine Datum support; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.10. 5-Axis VMC or HMC with Dual Rotary Tables - Index & Contour \$3,500.**

Mill/drill & machining center features; Safe retract for tool change sequence per specs; Automatic table repositioning when travel limits are exceeded; Inverse Time feed control; Canned or emulated hole making cycles; Interpolated arc or helical moves when tables are tilted; Full 5ax Indexing and Contouring support including multi-block linearization of tooltip during orientation change; Tool length & diameter comp; Machine Datum support; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.11. 5-Axis VMC or Gantry with Non-Orthogonal Nutator Head \$4,500.**

Mill/drill & machining center features; Safe retract for tool change sequence per specs; Automatic head repositioning when travel limits are exceeded; Inverse Time feed control; Canned or emulated hole making cycles; Multi-block linearization of any non-orthogonal arc or helical moves; Multi-block linearization of tooltip during orientation change; Tool length comp to common gage dimension; Single active work offset.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.12. 4-Axis Lathe with Live Tooling - Main Spindle Only \$4,500.**

Single or twin turret lathe features; Applicable mill/drill & machining center features for face or radial cutting via virtual milling axis in CNC. 4-Axis radial contouring support.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.13. 5-Axis Lathe with Live Tooling - Main Spindle Only \$6,500.**

Single or twin turret lathe features; Applicable mill/drill & machining center features via virtual milling axis in CNC; 4- and 5-Axis contouring support.

Note: On-Site final setup may be required and is not included in the price for the postprocessor.

**2.14. Annual Service Contract \$1,000.**

After the initial 90-day warranty, users can purchase a 12-month warranty extension. To clearly define responsibilities and to set proper expectation, all software change requests are categorized as one of the following three categories and will be responded to as shown below:

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### Custom Postprocessor Pricing & Feature Support

<b>Bugs</b>	Deficiencies that prevent use of the Custom Postprocessor per original specifications. Examples are system crashes, incorrect output, or missing functionality. These items will be repaired at no added cost.
<b>Modifications</b>	Changes to the way the Custom Postprocessor works that arise after final acceptance. If CAMCAD determines a modification request is minor, CAMCAD may choose to implement a Modification at no cost as part of an annual service contract, however, CAMCAD reserves the right to quote an additional implementation cost.
<b>Enhancements</b>	New features not defined in the original specifications that arise after final acceptance. CAMCAD reserves the right to quote an additional implementation cost for any Enhancement.

Note: On-Site final service may be required and is not included in the price for the maintenance.

### 2.15. Source Code

CAMCAD has developed extensive library routines used to simplify the configuration process and to improve the quality and level of machine tool support at reasonable prices. CAMCAD library routines are copyrighted, provided in encrypted form only, and are not for sale or redistribution without CAMCAD's express written consent.

The unique logic required to support a particular machine is provided in encrypted form and password-protected man-readable PDF to aid the programmer in understanding the logic. This information is also considered to be copyrighted material, is not to be duplicated, and is to be used for internal purposes only for supporting the target CNC machine.

The price for source code varies, and will be quoted individually. Please note that when machine-specific source code is provided CAMCAD is no longer responsible for any warranty requests and will charge a consulting fee to recover and/or correct any user-implemented changes.

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Custom Postprocessor Pricing & Feature Support

### 3. Standard Features - All Machine Types

Support for standard features is included at no extra cost above the basic cost for the machine type when implemented according to CNC industry standards. CAMCAD reserves the right to define standard vs. optional features based upon prior experience, or at its discretion, examination of programmer reference manuals and/or sample NC code files. Any manuals received will be returned upon request when the postprocessor has been completed.

#### 3.1. Verification Listing (SPost & OmegaPost)

Input records followed by NC Blocks; Cycle time per block, per page, per tool; Error diagnostics with suggested remedy; Travel summary including postprocessor limits and min/max actuals; Tooling summary including chart of tools used, lengths, time/tool, record number. A "@debug" option is available that will produce extended diagnostics in the LST file.

#### 3.2. NC Code -- Word Address Format

ASCII NC code format; 72-128 characters per line with error checking; Special rewind stop & end of transmission characters; Special end of block characters; Operator messaging support with special prefix & suffix; Upper/lower case message conversion & filtering to remove illegal characters; Spaces preceding letter address per specs.

#### 3.3. Rapid Positioning with XY/Z Motion Breakup

XYABC/Z vs. Z/XYABC for plunge/retract movements; Standard G-code or custom rapid code; Non-modal vs. modal rapid support.

#### 3.4. Alternate Solution Calculations

Each multi-axis path is pre-scanned to determine minimum number or repositioning sequences when travel limits are exceeded; User-defined retract distance, rate, repos control, and plunge rate;

#### 3.5. Linear Moves

XYZ feed moves; Special non-modal G/M-code Support; Special feed register or conversion; Minimum machine resolution monitoring; Segmentation of moves that exceed machine interpolation limits.

#### 3.6. Rotary Axis Clamping

Automatic clamp/unclamp for indexing; Forced unclamping at strategic events for rotary axis contouring.

#### 3.7. Tool Change or Turret Index Sequence

Special first tool change sequence per specs; 2nd -nth tool change sequence per specs; Calculated tool length offset applied to NC control point as applicable.

#### 3.8. Tool List

Consolidated list of unique tools can be generated that precede or follow user setup notes in the NC file.

#### 3.9. Tool Path Annotation

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### Custom Postprocessor Pricing & Feature Support

Tool path numbering and path identifiers such as Nnnn (PATH: nn - 2ax Contour) along with tool description, CView description, and tool parameters per specs; SPost or OmegaPost only.

#### 3.10. Tool Pre-Select

Automatic search for next tool change or end of file; T-code merged with adjacent blocks per specs; 1st tool memorized and re-issued at end of program.

#### 3.11. Arc & Helical Moves - All Supported Interpolation Planes

G02/3 XY IJ vs. R support; Quadrant breakup vs. 90-180-360 degree interpolation; Helical interpolation or helical motion linearized as a series of line segments according to a chordal deviation tolerance.

#### 3.12. Drill Cycles

G80 series spindle cycles that align with the CAM system, including Centerdrill, Drill, Peck Drill, Tap, LHtap, Rigid, LHrigid, Chip Break, Bore, Ream & Back Bore as applicable for the machine; Dwell, orient, 2nd retract register, uPM-uPR cycle feed; Automatic spindle reverse for left-hand tapping functions; G98-99 initial vs. rapid plane retract support; Intelligent motion analysis & cycle cancellation/reinstatement between holes at varying heights; Emulated cycles as G00-G01 moves per specs;

#### 3.13. Dwell Control

Single-shot dwell at specific events per user specs; Dwell time added to accumulated cycle time; Special register format support.

#### 3.14. Coolant Control

Flood, Mist, Tap, Thru-Spindle, On-Off codes; Multiple coolant codes merged with adjacent NC blocks per specs.

#### 3.15. Feedrate Control

uPM, uPR G/F codes with F-register width support based on feed mode; Inverse time feed codes when applicable; G/F codes merged with motion blocks per specs.

#### 3.16. Spindle Speed, Direction, and Range Control

G/M/S-codes per specs; Automatic gearbox range change sequence; Merged with adjacent NC blocks per specs.

#### 3.17. Cutter Diameter & Length Compensation

G-code based diameter comp per specs; H-T-code based length comp per specs; Codes merged with adjacent blocks per specs.

#### 3.18. Work Offset

Default or prompted register number if not in 1st toolpath; Min-max register checking; Memorized work offset reinstatement per specs; Standard vs. extended work offset syntax per specs.

#### 3.19. User Startup Sequence

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### Custom Postprocessor Pricing & Feature Support

Machine wake-up states banner per specs; Startup blocks with post revision date, file ID, execution date & time; Prompted or default program number & post ID banner.

#### 3.20. User Shutdown Sequence

Safe return to home position per specs; Rotary table unwind sequence if applicable; Travel & time summary as commentary in NC code; Special end of transmission character.

#### 3.21. User Gohome Sequence

Safe return to home position per specs based on previous machining mode; Rotary table unwind sequence if applicable.

#### 3.22. Machine Constraint Checking

Min/max linear/rotary axis limit checking; Spindle min-maxRPM checking; Feed min/max uPM uPR 1/Time checking; Max tool number or number of tool changes with warnings per specs.

#### 3.23. Multiple NC Code Files

Max NC file size based upon character count or cycle time; Special restart sequence; Block number reset; SPost only.

#### 3.24. Travel Summary

Travel and error summary in operator listing or NC file including: Travel min-max for program, total feed time, total rapid time, number of tool changes, number of paths, and file size; SPost or OmegaPost only.

#### 3.25. Machine Datum

Ability to globally transform (translate, rotate, mirror) input based on a SURFCAM Machine Datum view definition without the need to regenerate toolpaths.

#### 3.26. Broken Tool Check

CHECK/TOOL,*n,n,n,n,n* defines a random list of tools that will call a user subroutine to check for tool accuracy and/or breakage before reloading tool after use back into the tool magazine.

#### 3.27. Warning Message Summary

Accumulated list of warning messages in .LST file at end of job.

#### 3.28. HSM, DWO, TCP Support

Activation & deactivation of High Speed Machining (HSM), Dynamic Work Offset (DWO), and Tool Centerpoint Management (TCP) features in the correct order per specs.



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## Custom Postprocessor Pricing & Feature Support

### 4. Extra Cost Features - All Types - Quoted Individually

Extra cost features will be quoted after agreement on detailed specifications. CAMCAD may request NC code samples, user manuals, marked up listings, and/or a pre-paid on-site survey before issuing a formal quotation for support of these items.

Extra cost features fall into (but are not limited to) the categories shown below.

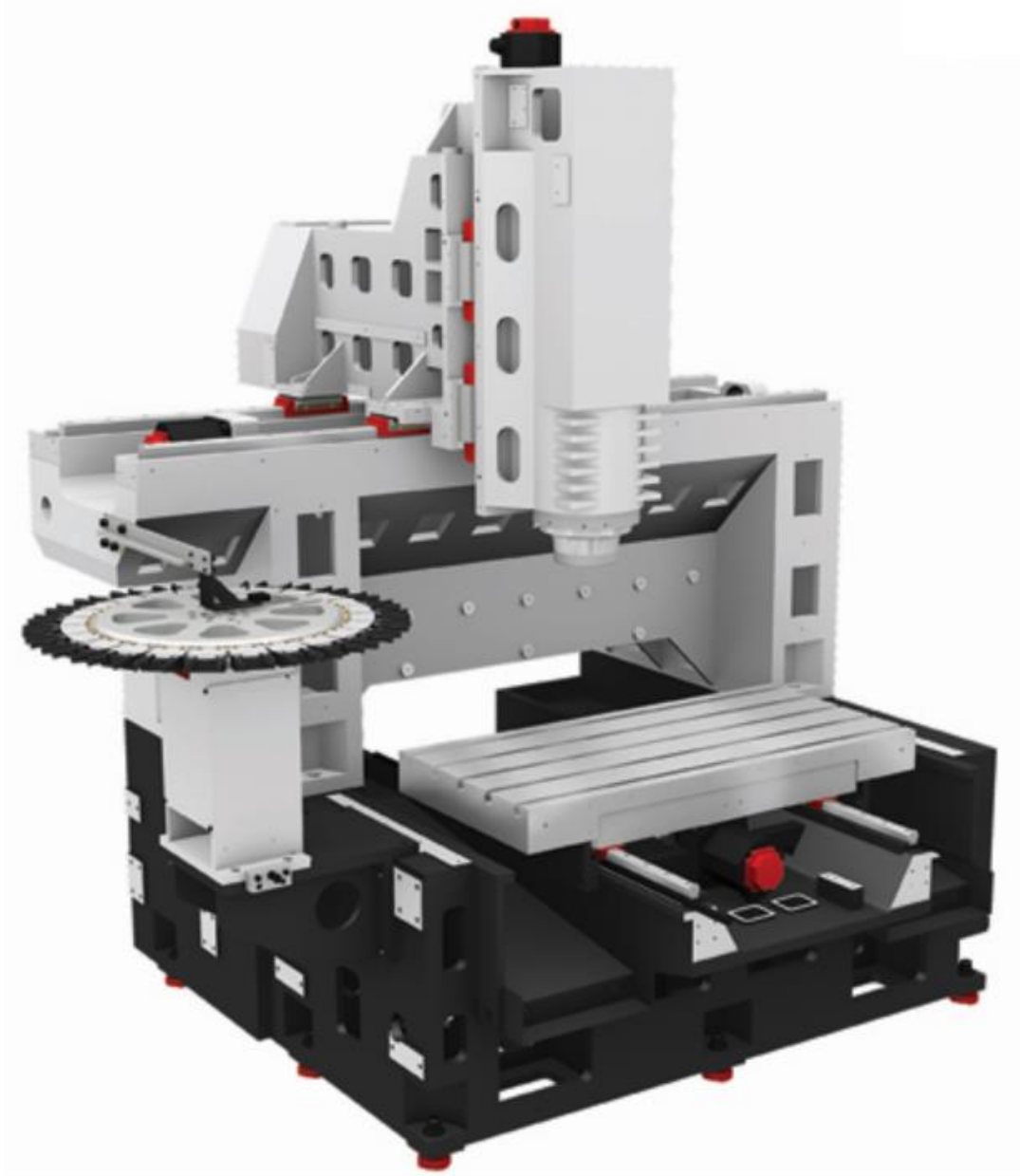
- Automated Tool Breakage Subroutine Calls for Selected Tools
- Automatic or unusual E-Pack Calculations for Wire EDM
- Auxiliary Linear or Rotary Axis Support
- Cell Controller Interface
- Controller-Resident 3D WorkPlane Support
- Conversational, unusual, or Non G-Code Based Syntax
- Custom Pallet Changing Support
- Custom Thread Milling Support
- External Tool Library or Speed/Feed Library Interface
- Facing Head Attachment
- Laser Tool Calibration Routine
- MillTurn Secondary Turret Support
- MillTurn Sub-Spindle Support
- Multiple Input or Output Files
- Multiple Spindles or NC Control Points
- Multiple Turret Synchronization, a.k.a. Pinch Turning
- Non-Orthogonal Axis Support
- Non-Standard Formula-Based Feed Control
- Polar Coordinate Axis Support
- Probe Cycle Support
- Prompted Input or Decision-Making at Runtime
- Right Angle Head Attachments
- Toolpath Subroutine Creation within Main Body Program
- Toolpath Subroutine Creation in External File(s).
- Switchable Head Attachments
- Right-Angle Head Attachments
- Tabbed Columnar Data or Binary File Support
- Vector-based Cutter Diameter Compensation
- Single-point Emulated Threading Support
- Any feature not defined in the "Standard Features" section



## 5. Machine Axis Diagrams

This section contains diagrams of each machine type. The reference numbers (5.xx) correlate to the pricelist numbers in section 2 of this document.

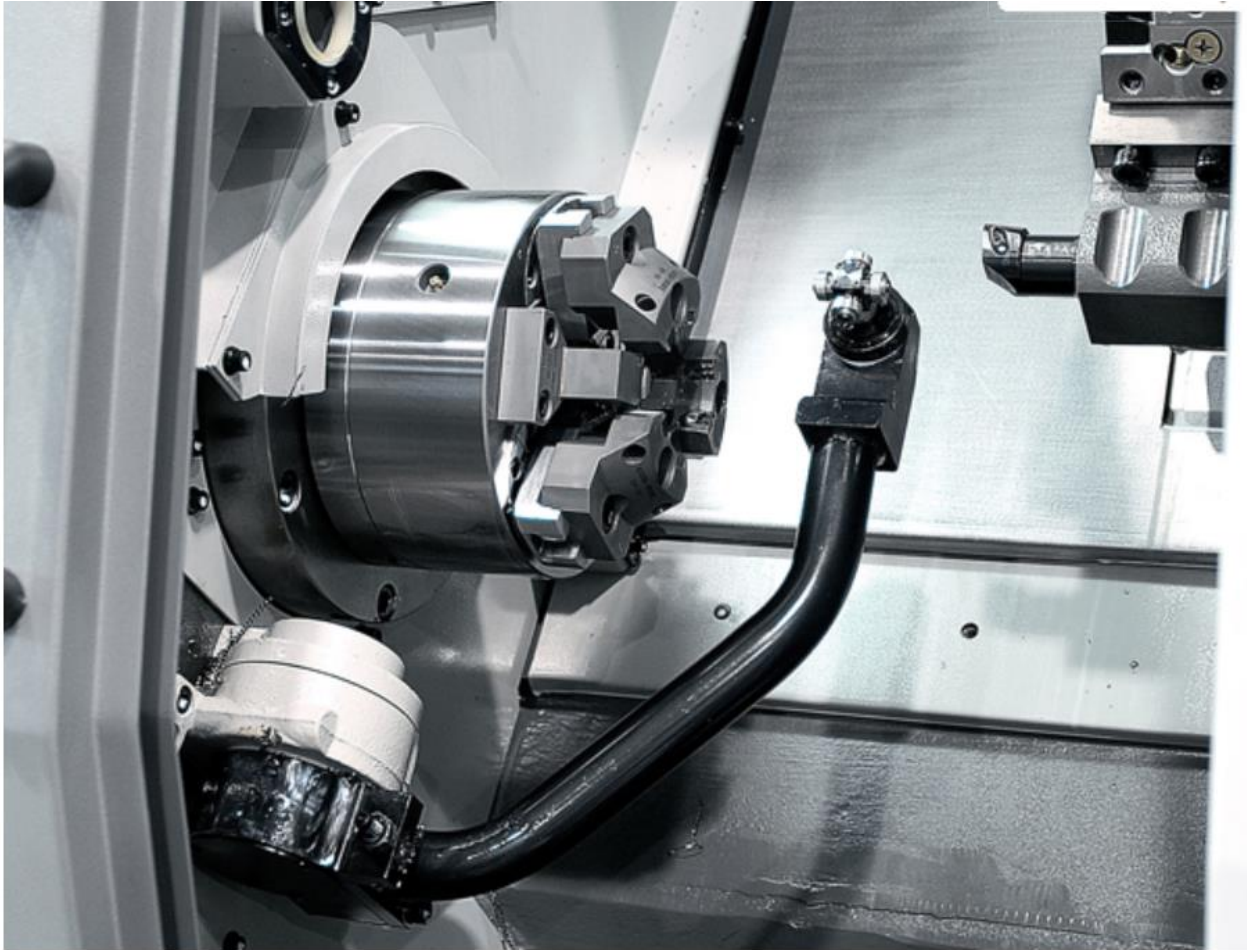
### 5.1. Mill/Drill or Machining Center



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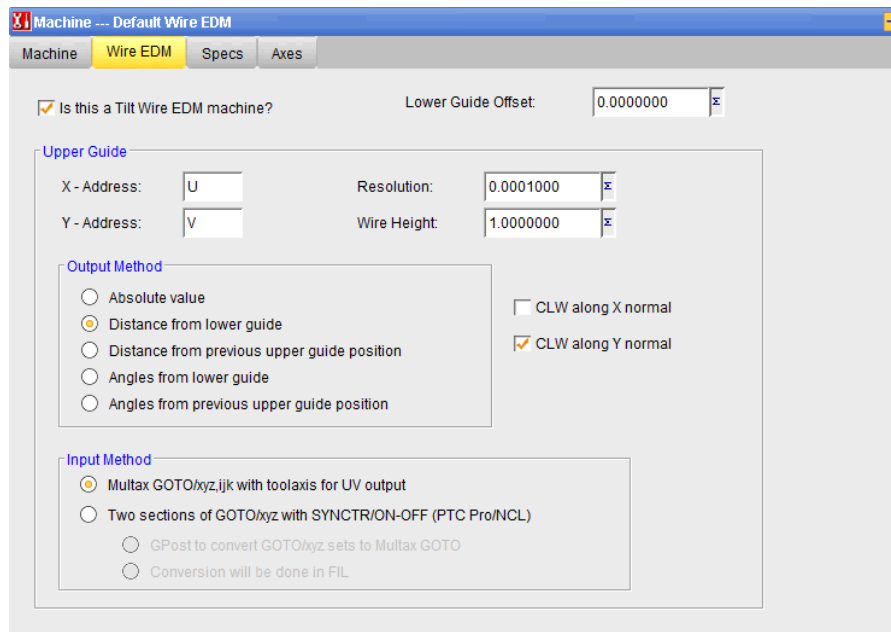
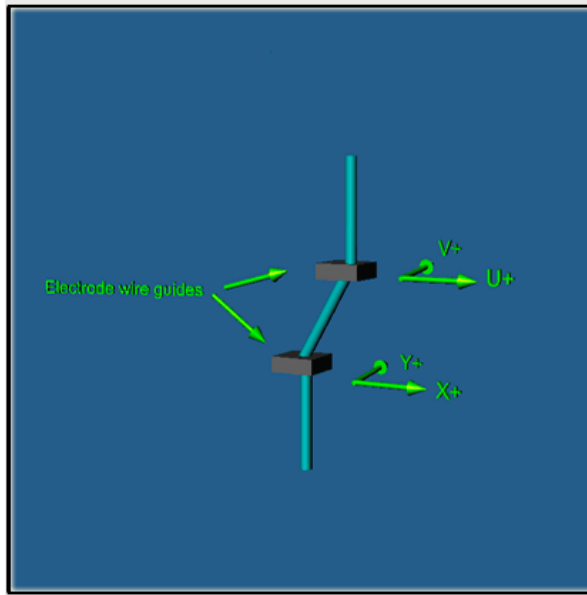
Custom Postprocessor Pricing & Feature Support

**5.2. Single or Twin Turret Lathe**



Custom Postprocessor Pricing & Feature Support

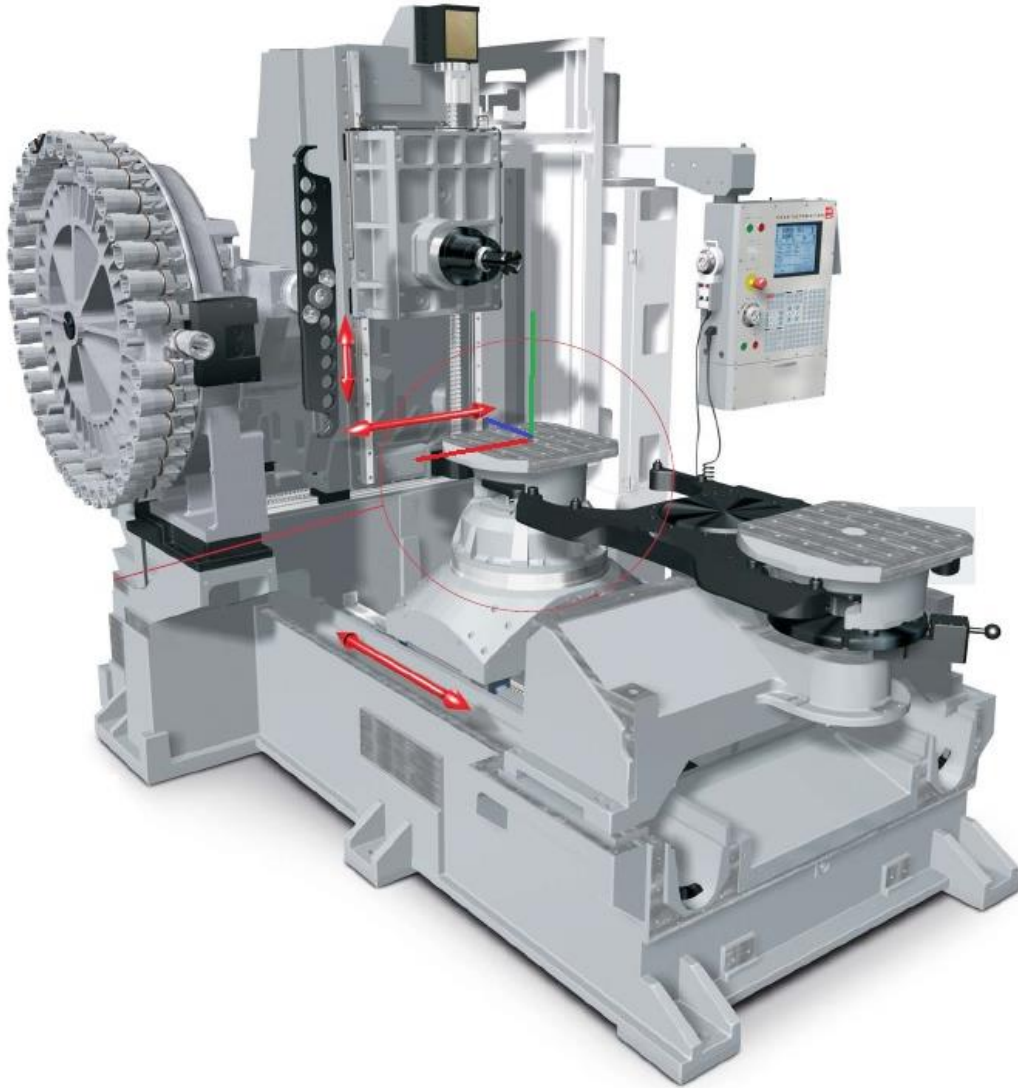
**5.3. 4-Axis Tilt Wire EDM**



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Custom Postprocessor Pricing & Feature Support

**5.4. 4-Axis Mill or Machining Center**



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Custom Postprocessor Pricing & Feature Support

**5.5. 4-Axis Horizontal Boring Mill**



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Custom Postprocessor Pricing & Feature Support

**5.6. 5-Axis Gantry XYZ/AC-BC Mill**



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Custom Postprocessor Pricing & Feature Support

**5.7. 5-Axis Gantry XYZ/AC-BC Laser or WaterJet**



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Custom Postprocessor Pricing & Feature Support

**5.8. 5-Axis HMC with Rotary Table & Tilting Head**





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Custom Postprocessor Pricing & Feature Support

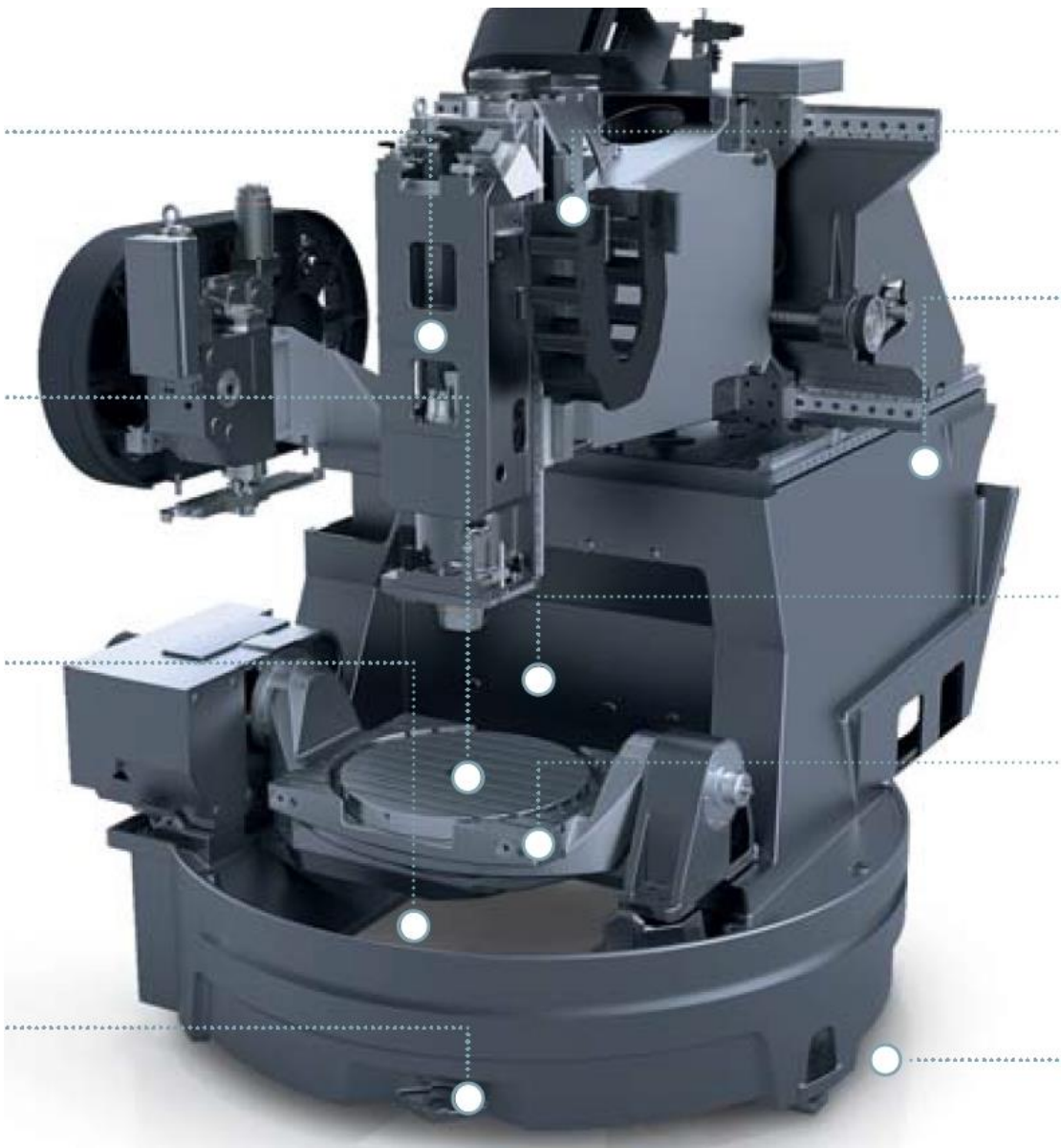
**5.9. 5-Axis HMC with Dual Rotary Tables**



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Custom Postprocessor Pricing & Feature Support

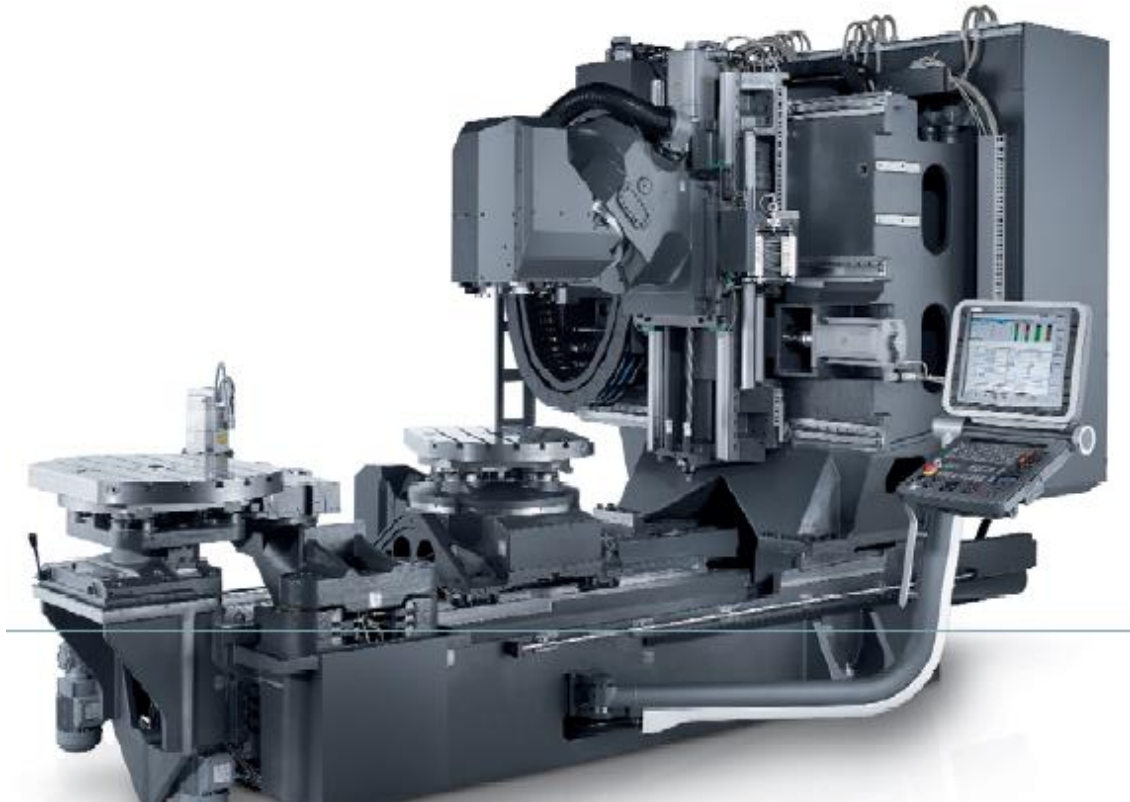
**5.10. 5-Axis VMC with Dual Rotary Tables**



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Custom Postprocessor Pricing & Feature Support

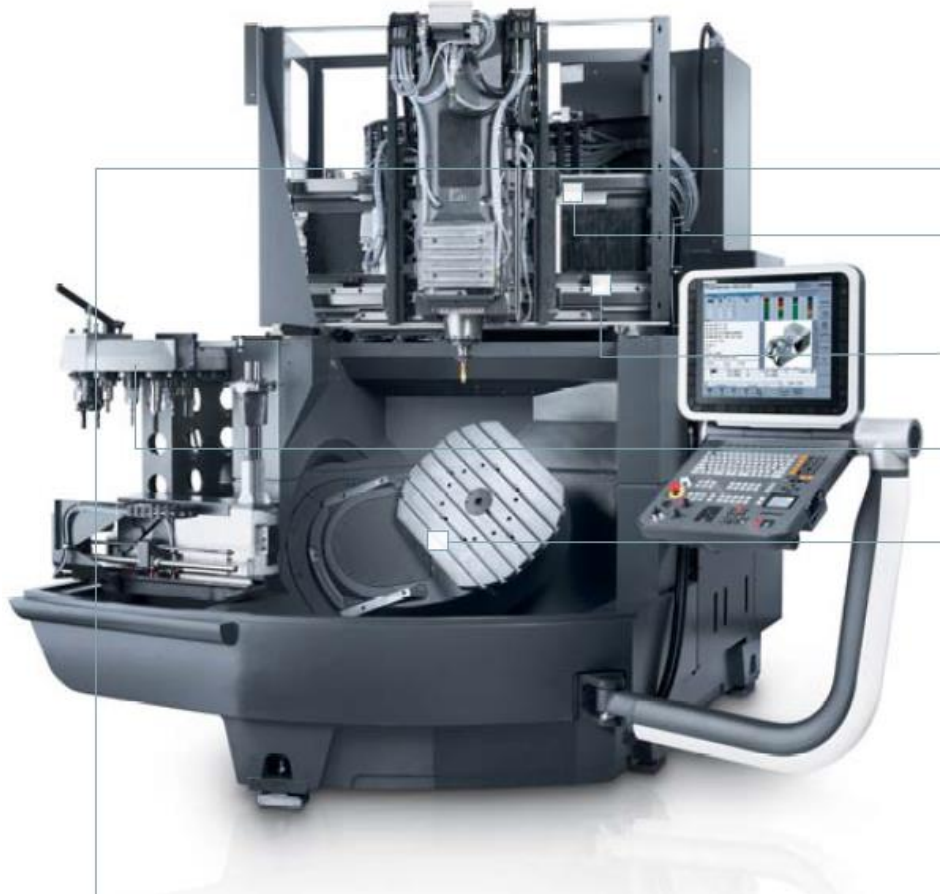
**5.11. 5-Axis VMC with Non-Orthogonal Nutator Head**



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Custom Postprocessor Pricing & Feature Support

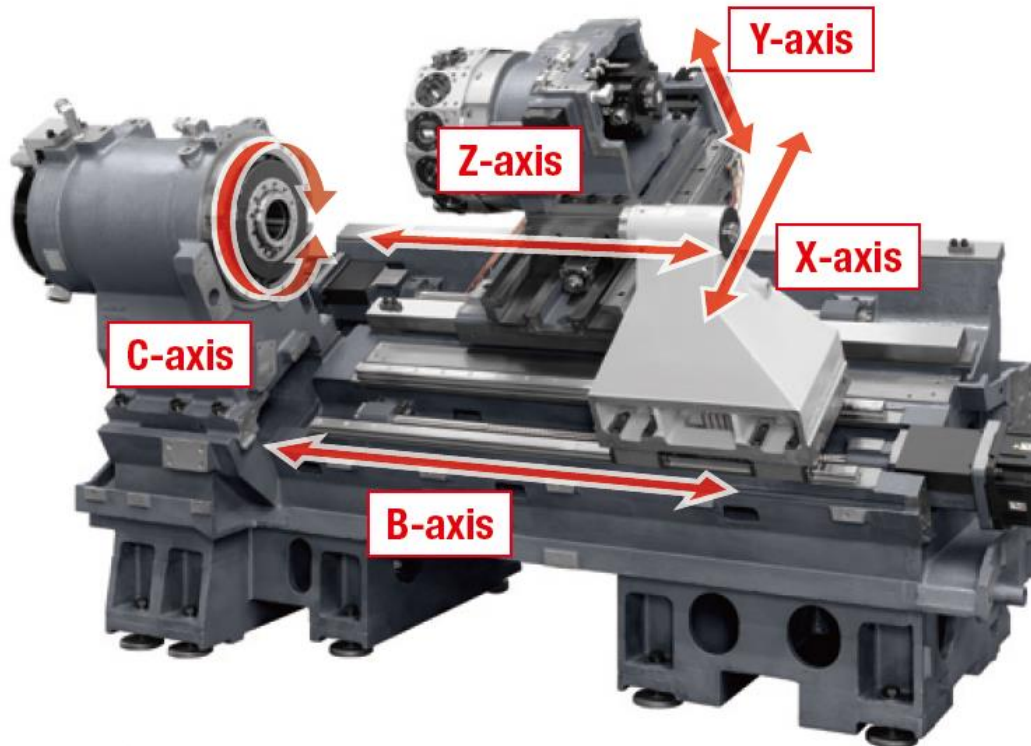
**5.12. 5-Axis VMC with Non-Orthogonal Nutator Table**



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Custom Postprocessor Pricing & Feature Support

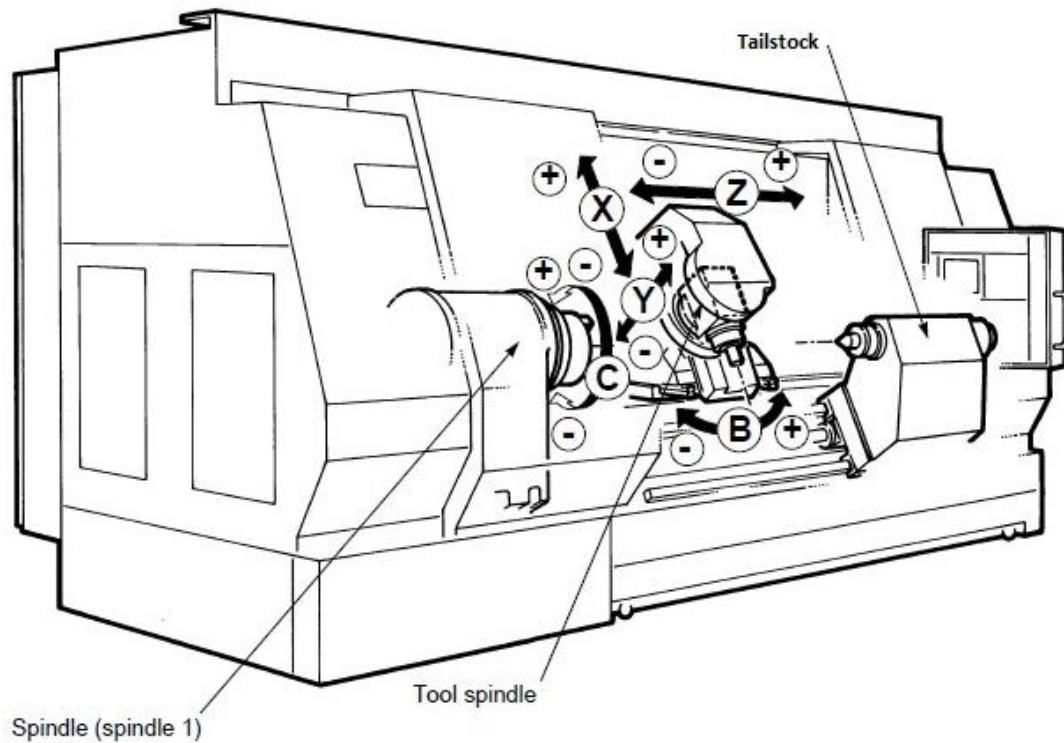
**5.13. 4-Axis Lathe with Live Tooling - Main Spindle Only**



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Custom Postprocessor Pricing & Feature Support

**5.14. 5-Axis Lathe with Live Tooling - Main Spindle Only**



Custom Postprocessor Pricing & Feature Support

**5.15. 5-Axis Lathe with Live Tooling - Main & Sub Spindle**

