MITSUBISHI ELECTRIC
MITSUBISHI CNC
M700V Series

M700V series

The Best Partner for Your Success
Mitsubishi CNC M700V Series
The best machines for top level manufacturing

The one and only. Only top level manufacturing can survive.
Mitsubishi CNC M700V Series is a state-of-the-art model that provides high-speed and high-accuracy machining and advanced control technologies. These Functions are for customers who keep challenging for more production output, with a worldwide recognized machine for today’s globalized industry.

M700VS Series is an integrated control unit and display type.
M700VW Series also comes with Windows® XP.

These two types of Mitsubishi CNC M700V Series support top level manufacturing.

M700VS and M700VW Series, advanced Mitsubishi CNCs for next-generation machining
From drive units to servo/spindle motors
Advanced CNC components for higher performance
Mitsubishi Electric Factory Automation technologies are condensed into a 64 bit RISC processor and an exclusively developed high speed LSI.

The basic CNC functions, built-in PLC and graphic performance are all improved.

The M700VS has been downsized with power consumption reduced by 66% compared to our conventional Windows-based control models while maintaining the same performance.

Windows®XPe-based M700VW was designed with expandability and stability to enable a higher level of custom functions.

### Machining Program Processing Speed

<table>
<thead>
<tr>
<th>Model</th>
<th>Machining Program Processing Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>153.4 BPM (Note 1)</td>
</tr>
<tr>
<td>M700VS Series</td>
<td>168.8 BPM (Note 1)</td>
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</table>

(Note 1) BPM is the number of machining program blocks processed per minute.

### User Macro Processing Performance

<table>
<thead>
<tr>
<th>Model</th>
<th>User Macro Processing Performance</th>
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</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>1</td>
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<tr>
<td>M700VS Series</td>
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### Built-in PLC Basic Instruction Processing Performance

<table>
<thead>
<tr>
<th>Model</th>
<th>Built-in PLC Basic Instruction Processing Performance</th>
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</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>10 steps/µs</td>
</tr>
<tr>
<td>M700VS Series</td>
<td>100 steps/µs</td>
</tr>
</tbody>
</table>

### Complete Nano Control

All operations from program values to servo commands are done in nanometer units. Interpolation is at the nano-unit level even when program commands are in micrometer units.

### Speed command fluctuation reduced

In complete nano control, the position command calculation fraction of the interpolation calculation is small, so fluctuations in speed command due to the fractions is reduced. This reduces acceleration fluctuations, resulting in finer lines at the time of repeated acceleration/deceleration.

### Interpolation calculation accuracy improved

Even with one-micron-unit commands in the machining program, interpolation is in nanometer units. As the calculation accuracy of a block intersection is improved, lines on the surface is finer.

### Index Modification Function of PLC Instructions

- The index modification function is available, which is one of MELSEC’s wide variety of instructions.
- Repetitive programs can be written easily.
Supporting Machine Tool Accuracy Improvement

OMR-DD Control (High-speed synchronous tapping)
Optimum Machine Response Direct Drive

A high-speed error-compensation function is used for controlling the spindle and servo, enabling accurate tapping.

Adaptive Notch Filter

This function is used to estimate the resonance frequency of the machine and automatically adjust notch filter parameters. This enables the system to monitor the machine fluctuations and prevent repeated fluctuations caused by aged deterioration.

Lost Motion Compensation Control Type 3

This control can compensate for not only the machine friction but also the spring and viscosity elements. Thus, quadrant protrusions, which are generated in circular cutting, can be compensated for within a wide range from low-speed to high-speed cutting.

Machine-end Compensation Control

Corresponds to machine resonance fluctuations
By compensating for the deflection between the motor-end and machine-end, the part shape at a high speed and acceleration rate can be compensated for. The optimal shape can be obtained at a low feed rate and also compensate for the outward expansion of the shape at high feed rates.

Position Loop of Spindle Control

High traceability to command (High-gain control), which has been developed in servo axis control, is now available on spindles, contributes to shorter machining time and higher accuracy.

Position-dependent Gradually Increasing-type Backlash Compensation

Protrusion is reduced by gradually changing the backlash compensation amount according to the reversal of axis travel direction, which enables higher-accuracy machining.

Two-way Pitch Error Compensation

The pitch error compensation function has been improved. By setting the compensation amount separately for the positive and negative directions, different compensation can be applied to each direction.

Lowering Heat Generation of Spindle Motors

Reduced harmonic current mitigates heat generation in the spindle motor.

Automatic Temperature Compensation of Spindle Motor

A built-in thermostat detects the spindle motor’s temperature to compensate for the acceleration/deceleration time when the motor is at a low temperature. It is also possible to monitor the spindle motor’s temperature on the NC screen.

Heavy cutting performance improved

Heavy cutting performance has been improved with the addition of position loop control on the spindle. By lowering the impact load fluctuation, the speed fluctuation rate has been reduced to less than 1/2 of our conventional system.

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Technologies

Human Machine Interface provides for better visibility and operator ease of use

Easy-to-use interface with useful functions

HMI for Easier and More Visible Use

- Screen structure linking to the operation processes
  Operation processes are divided into three steps, “Monitor”, “Setup” and “Edit”, and necessary information is aggregated into three screens. These screens can be displayed by touching a single button on the keyboard.

- Pop-up screens
  Tabs allow the user to select necessary operations from the operation menu, and pop-up screens allow the user to access desired information while the original screen remains displayed. For displays with a touch panel, a keyboard can be displayed on the screen.

- 2-part system display
  The Monitor screen of the 2nd part system can be displayed together with the 1st part system. Switching screens is not necessary.

- Menu customization function
  Menu keys on the bottom of the screen can be freely arranged. Frequently used menu keys can be put together on the first page.

Operation Support

- Manual/Automatic backup function
  - Batch backup of the NC data into the memory card/USB memory inserted in the front interface of the display is possible. For the built-in hard disk type M700VW Series, backup in the hard disk is also possible.
  - Data is automatically backed up at a certain interval set by the parameter.

- Operability of operation search improved
  Using the program edit screen, it is possible to execute a program from the line specified by the cursor. The operation search immediately detects the edited part to check the content of operation.

- Guidance function
  By pressing the help button, guidance (operation procedure/parameter descriptions/alarm descriptions/G code format) regarding the currently displayed screen will be shown.

- Menu list
  Menu list buttons are newly introduced. With these buttons, the screen desired for display can be called up directly. The selected screen's function outline is also displayed.

- Program Operation
  - Program input error warning function
    - The added 3D solid model check function allows more realistic cutting check.
  - Program restart function improved
    - Even if a machining program is stopped for reasons such as tool breakage, the program can be restarted when it has been stopped using only the INPUT operation.

- Program input error warning function
  - The added 3D solid model check function allows more realistic cutting check.
  - This function helps an operator to input and check programs. Errors are indicated when a decimal point is omitted.

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Technologies

For High Quality machining with smoother finish and faster performance

Five-Axis Machining functions such as Tool Center Point and SSS control have been enhanced.

With the enhancement of these functions, five-axis control will provide high-end performance.

The advanced five-axis control provides great potentials.

SSS Control (Machining Center System) *1st part system only
Super Smooth Surface

- By judging part program paths, unnecessary deceleration is reduced, even when fine steps in the program exist. This provides a smooth finish without deviation for die-mold machining.
- Machining time can be shorter by 5 to 30% relative to our conventional system, especially more effective at a higher feed rate.
- SSS control ensures high machining stability and quality with virtually no effects resulting from cutting shape or speed.
- Optimum speed control is always performed even with a program with an error, resulting smooth surface in short time.

SSS Control is now available for the most basic function of five-axis simultaneous interpolation control, tool center point control. It compensates uneven paths output from CAM to smoothly joint the tool center point’s path.

By realizing speed control not susceptible to tool center point path error and fluctuation of rotary axis travel amount, high-grade cutting in five-axis simultaneous machining using tool center point machining is achieved.

This function suppresses the vibrations of the tool by moving the rotary axis smoothly. Even when this function is active, the Tool Center Point path moves according to the command program path.

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Tool Center Point Control
(Machining Center System)

Control is performed at the speed of the table coordinate system so that the tool center point traces a straight line. This function contributes to high-accuracy machining on the machining surfaces.

Example of detecting a tool interference while a tilt type tool is rotating

When a possibility of interference is detected on a machine model, the motor decelerates to a stop before interfering. The part to interfere is displayed in a different color.

Tool Handle Feed & Interruption
(Machining Center System)

The Tool Handle Feed & Interruption function enables you to perform handle feed by making the tool diameter direction as an X or Y axis of complicated workplace under five-axis machining.

The tool position can be changed without moving the tool tip, even when the machining part is rotating.

Example of detecting a tool interference while a tilt type tool is rotating

When a possibility of interference is detected on a machine model, the motor decelerates to a stop before interfering. The part to interfere is displayed in a different color.

3D Machine Interference Check

This function prevents interference on a machine model (in both manual and automatic operations) before it actually happens in the machine.

The part to interfere can be checked by moving, rotating or enlarging the models.

Interference can be prevented for a tilt type tool axis and rotating enlarging the models.

The part to interfere can be checked by moving, rotating or

Inclined Surface Machining
(Machining Center System)

You can rotate or move the origin of the original coordinate system parallel to define a feature coordinate system. To start machining, issue normal program commands to the arbitrary plane (inclined surface) in space. The feature coordinate system is set again according to the tool axis’s direction. The machining program can be created without paying attention to the direction of the coordinate system or tool axis rotational direction.
Various Functions for Compound Machining

Supports various compound machining applications, from multi-part system program paths for multi-axis machining centers to multi-axis milling and hobbing.

Multi-part Systems Multi-axis
A maximum of two part systems and 16 axes can be controlled for the machining center. A maximum of four part systems and 16 axes can be controlled for the lathe. (A maximum of two part systems and 12 axes for M720V5, M720VW Series)

Multi-part System Program Management
Separate programs, used in each part system, can be managed under a common name in the multi-part system. This function facilitates management of the process programs that are simultaneously executed in the multi-part systems.

Control Axis Superimposition (Lathe System)
This function enables machining using a certain part system simultaneously with that of another part system by superimposing their movements.

This is effective when machining in multiple part systems is executed simultaneously. It allows for an axis to shift its coordinate system relative to the system using the axis.

Inclined Axis Control (Lathe System)
Even when the control axes configuring a machine are mounted at an angle other than 90 degrees, this function enables it to be programmed and controlled in the same way as with an orthogonal axis.

The inclination angle is set using a parameter, and axes are controlled using the movement amounts of the axes which are obtained through conversion and compensation using this angle.

Mixed Control (cross axis control) (Lathe System)
The control axes of each part system can be exchanged using a program command. This enables the axis defined as the axis of the 1st part system to be operated as the axis of the 2nd part system.

Milling Interpolation (Lathe System)
This function converts the commands programmed for the orthogonal coordinate axes into linear axis movements (tool movements) and rotary axis movements (workpiece rotation) to control the contours. This enables milling operations using a lathe without a Y axis.

Balance Cut (Lathe System)
Deflection can be minimized by holding tools simultaneously from both sides of the workplace and using them in synchronization to machine the workplace (balance cutting).

The machining time can be reduced by machining with two tools.

Hobbing (Lathe System)
G code format is available for hobbing. A spur gear can be machined by synchronously rotating the hob axis and the workplace axis in constant ratio. A helical gear can be machined by compensating the workplace axis according to the gear torsion angle for the Z axis movement.

M700V series

2-part System Synchronous Thread Cutting (Lathe System)
2-part system synchronous thread cutting allows the 1st part system and the 2nd part system to perform thread cutting simultaneously for the same spirals.

2-part system synchronous thread cutting has two commands: command (G76.1) for cutting threads in two places simultaneously, which is known as "2-part system synchronous thread cutting cycle I"; and command (G76.2) for cutting a thread using the two part systems simultaneously, which is known as "2-part system synchronous thread cutting cycle II".

Machining Center

Control Axis Synchronization Across Part Systems (Lathe System)
Synchronization control enables an arbitrary control axis in the other part system to move in synchronization with the movement command assigned to an arbitrary control axis. (NC axes: X1, Y1, Z1, C1, S1; PLC axes: G1, I1, J1)

Compound Lathe

Inclined Axis Control (Lathe System)

Hobbing (Lathe System)
Solution

Customization/Support Tool

NC Designer and other Software Applications tools are available to support the customization of the machine. Some software applications support a C Language Library to support a higher level of customization.

NC Designer (Screen Design Tool)
- By laying out ready-made standard parts, you can easily create original screens without programming.
- When using touch panel display, a machine operation panel can be built on the NC display.
- Events of the standard parts can be described using macros.
- Using the C language source generation function of NC Designer, customized functions can be added by programming in C language. (Dedicated development environment necessary.)

Develop screen configuration

Simply by locating parts of various functions on the screen, it is possible to create custom screens easily.
- It is possible to check the performance of custom screens on a personal computer.

GX Developer (PLC Programming Tool)
The MELSEC programming tool, offering a wide array of functions and easy use, allows for convenient program design and debugging. Linking with a simulator or other utility allows for the efficient creation of desired programs.

NC Trainer (MITSUBISHI CNC Training Tool)
- NC Trainer is an application for operating the screens of MITSUBISHI CNC M700V Series and machining programs. This application can be used for learning operating CNC and checking the operations of the machining programs.
- NC Trainer plus can also be used for checking the sequence program and custom screens.

NC Configurator2 (Parameter Setup Support Tool)
The NC data file necessary for NC control and machine operation (such as parameters, tool data and common variables) can be edited on a personal computer. This tool can be downloaded from MELFANSweb free of charge. (Some functions are subject to fees.)

NC Explorer (Data Transfer Tool)
By connecting the NC and host personal computer via Ethernet, data such as machining programs can easily be shared. This tool can be downloaded from MELFANSweb free of charge.

Servo Selection Tool
By selecting the machine configuration model and inputting the machine specifications, the optimal servo motor meeting specifications can be selected. Other selection functions which fully support drive system selection are also available. This tool can be downloaded from MELFANSweb free of charge.
- <Main functions>
  - Servo motor capacity selection, regenerative resistor capacity selection, spindle acceleration/deceleration time calculation, power supply capacity selection, power supply facility capacity calculation, etc.

MS Configurator (Servo Adjustment Support Tool)
Servo parameters can be automatically adjusted by activating the motor using machining programs for adjustment or vibration signals, and measuring/analyzing the machine characteristics. This tool can be downloaded from MELFANSweb free of charge.
- <Main functions>
  - Bode diagram measurement display, speed loop gain adjustment, position loop gain adjustment, notch filter setting, acceleration/deceleration time constant adjustment, circularity adjustment and servo waveform measurement.

NC Monitor (Remote Monitoring Tool)
An identical NC display screen can be displayed on a personal computer. By connecting a personal computer to the NC unit when necessary, various data can be checked and set using the same HMI as the standard NC screen.

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Magicpro-NAVI MILL on PC
Magicpro-NAVI LATHE on PC*
(Simple programming tool for use with personal computer)
- Simple programming functions “NAVI MILL” and “NAVI LATHE” are available on a personal computer. The programs made by these tools can be forwarded to NC by using NC Explorer and can be executed.

*Magicpro World is a registered trademark of Mitsubishi Electric Mechatronics Software Corporation.
Main Specifications

<table>
<thead>
<tr>
<th>Model name</th>
<th>Machining center system</th>
<th>Lathe system</th>
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<th>Lathe system</th>
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<tr>
<td>15-sheet</td>
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Drive Units

High-performance Servo/Spindle Drives MDS-D/DF Series

- With the latest current control cycle, basic performance is drastically enhanced (high gain control).
- A combination of high-speed servo motor and high-accuracy feedback detector helps enhance overall drive performance.
- The connection between the drive unit and CNC is fast and reliable optical communication.
- A built-in drive unit driving a maximum of two spindles is available, contributing to a reduction in control panel size.

Servo/Spindle Drives MDS-D-SVJ/SUJ/SPU Series

- Ultra-compact drive units with built-in power supplies contribute to reducing control panel size.
- The connection between the drive unit and CNC is fast and reliable optical communication.
- A high efficiency fan and low-loss power module have enabled unit downsizing, which also leads to a reduction in control panel size.

Medium-inertia Motor HF Series

- High-inertia machine accuracy is ensured. Suitable for machines requiring quick acceleration.
- Range: 0.1 to 50 [kW]
- Maximum speed: 4,000 or 5,000 [r/min]
- Variable speed range: A combination of detection with a resolution of 300,000 or 1 million per step/rev.
- Servo/Spindle Drives MDS-D/DH Series

Low-inertia Motor HF-KP Series

- Suitable for an auxiliary axis that requires high-speed positioning.
- Range: 0.2 to 0.75 [kW]
- Maximum speed: 6,000 [r/min]
- Servo/Spindle Drives MDS-D/DH Series

Spindle Motors

High-performance New Type Spindle Motor SJ-D Series

- Motor energy loss has been significantly reduced by optimizing the magnetic circuit.
- Product line:
  - Normal: SJ-D Series (0.7 to 11 [kW])
  - Compact & light: SJ-D Series (0.5 to 5 [kW])
  - High-speed: SJ-D Series (2.0 to 13 [kW])

Low-inertia, High-speed Spindle Motor SJ-VL Series

- The spindle dedicated to tapping machines requiring low-inertia and tool positioning.
- The low-inertia reduces acceleration/deceleration time significantly in high productivity work.
- Product line:
  - Low-inertia normal: SJ-VL Series (0.7 to 11 [kW])
  - Low-inertia hollow shaft: SJ-VLS Series (0.7 to 11 [kW])

Built-in Spindle Motor

- The feedback communication is serial, the resolution is significantly enhanced (Max. 4 million points).
- The adjustment PCB has been eliminated to achieve adjustment-free conditions. The standard gap has been reduced to 0.3mm.

High-performance Spindle Motor SJ-V Series

- Suitable range of spindle motors is available, all ready to support diversified machine tool needs.
- Product line:
  - Normal: SJ-V Series (0.75 to 55 [kW])

Tool Spindle Motor HF-KP/HF-SP Series

- Sealing advantage of characteristics of a servo motor such as smallness and high-output, this motor serves as a compact and high-output spindle motor which is capable of high-speed rotation (6,000rpm).

- This motor contributes to diversifying of spindles, such as the rotary tool spindles.
- Product line:
  - Small capacity: HF-SP Series (0.4 to 0.8 [kW])
  - Medium capacity: HF-SP Series (2.2 to 4 [kW])

IPM Spindle Motor

- In answer to demands for diversification and higher efficiencies, IPM motor has been introduced for further energy saving.
- REDuction in acceleration/deceleration time contributes to shorter cycle times.