MITSUBISHI ELECTRIC
MITSUBISHI CNC
M700V Series

Changes for the Better

The Best Partner for Your Success
The Best Partner for Your Success
MITSUBISHI CNC

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

Mitsubishi CNC M700V Series
The best machines for top level manufacturing

M700VS and M700VW Series, advanced Mitsubishi CNCs for next-generation machining

Windows® is either a trademark or registered trademark of Microsoft Corporation in the United States and/or other countries.
Lineup

System Configurations & Product Lines

From drive units to servo/spindle motors
Advanced CNC components for higher performance

Drive Unit
- Multi-hybrid drive unit: MDS-DH/DH2 Series
- High-performance drive unit: MDS-DX/DX2 Series
- Ultra-compact drive unit with built-in power supply: MDS-DJ Series

Servo Motor
- Medium-inertia motor: HF Series
- Low-inertia motor: HF-SP Series
- Direct drive servo motor: TM-PH Series
- Rotary detector: MBA Series
- Linear servo motor: LM Series

Spindle Motor
- High-performance spindle motor: SJ-V Series
- Low-inertia and high-speed spindle motor: SJ-VL Series
- Tool spindle motor: HF-KP Series
- Detector for C-axis: MBE Series
- Built-in spindle motor

MELSOFT (Tools)
- Personal computer + Windows®
- NC Designer
- NC Monitor
- NC Explorer
- GX Developer
- NC Maintainer
- etc.

M700 VW Series
- Drive Unit Servo Motor Spindle Motor

M700 VS Series
- Drive Unit Servo Motor Spindle Motor

Mitsubishi CNC
- M700VW Series
- M700VS Series

Machine Operation Panel
- MELSOFT (Tools)
- Personal computer + Windows®
- NC Designer
- NC Monitor
- NC Explorer
- GX Developer
- NC Maintainer
- etc.

High-performance drive unit with built-in power supply
MDS-DJ Series
Technologies

Basic Performance and Functions

For higher speed and higher accuracy

Bringing the complete nano world closer to you

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 M700V Series 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>Series</th>
<th>BPM (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>13,500 BPM</td>
</tr>
<tr>
<td>M700V Series</td>
<td>16,900 BPM</td>
</tr>
</tbody>
</table>

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

### User Macro Processing Performance

<table>
<thead>
<tr>
<th>Series</th>
<th>Blocks/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>1</td>
</tr>
<tr>
<td>M700V Series</td>
<td>2</td>
</tr>
</tbody>
</table>

### Built-in PLC Basic Instruction Processing Performance

<table>
<thead>
<tr>
<th>Series</th>
<th>Stairs/μs</th>
</tr>
</thead>
<tbody>
<tr>
<td>M700 Series</td>
<td>10</td>
</tr>
<tr>
<td>M700V Series</td>
<td>100</td>
</tr>
</tbody>
</table>

---

Maching Program Processing Speed

M700 Series

M700V Series

User Macro Processing Performance

Built-in PLC Basic Instruction Processing Performance

---

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
- Interpolation calculation accuracy improved

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.

---

PLC Axis

- **Indexing function**
  - By setting the number of stations required for the application, the drive automatically sets up equal intervals between each station. Positioning of the axis is only possible by commanding the station number.

- **PLC axis mixed control**
  - Even if a pallet is changed, the axis can always be controlled as an NC axis in the machining area, and as a PLC axis in the setup area, which enables setup of a rotary axis without stopping machining.

---

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.

---

* Windows® is either a trademark or registered trademark of Microsoft Corporation in the United States and/or other countries.

* MELSEC is a trademark or registered trademark of Mitsubishi Electric Corporation in Japan and/or other countries.
Technologies

Supporting Machine Tool Accuracy Improvement

Calculated control (OMR control) of the drive system based on the machine model realizes optimum machine operation.

OMR-DD Control (High-speed synchronous tapping)

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 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 protrusion, which is 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-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.

Position Loop of Spindle Control

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

1. Mechanical spring element can influence for pull
2. Difference between static and dynamic friction is large and deep
3. Conventional solution is not enough
4. Our conventional series
5. <MDS-D2/DH2 Series>

Position Loop of Spindle Control

Orientation time is reduced

Deceleration is performed with the maximum torque to minimize the spindle orientation time.

Spindle acceleration/deceleration time shortened

The change of accel/decel characteristics due to motor temperature changes can be suppressed, which allows the system to be controlled at a constant accel/decel rate.

Spindle motor temperature rise characteristics

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 thermistor 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.
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.

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.

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. Displays with a touch panel, a keyboard can be displayed on the screen.

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.

Simple programming function
Programs are automatically created for each process when an operator selects machining process and inputs data on screen. A tool path can be graphically drawn for the program check.

This function also supports in-clined surface machining.

Program Operation

Machining programs in the memory card or in the hard disk (for M700VW Series) can be directly searched and run. Direct edit is also available.

The program format is unlimited.

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 M700V Series, backup in the hard disk is also possible.

Data is automatically backed-up at a certain interval set by the parameter.

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.

Operability of 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.

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 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

Machining programs in the memory card or in the hard disk (for M700VW Series) can be directly searched and run. Direct edit is also available.

Sub-program call is available from machining programs stored in the memory card or hard disk.

The program format is unlimited.
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 potentialities.

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

- 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 point 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.

OMR-FF Control

Optimum Feed Forward

Unlike conventional control, which simply matches the motor path to the commands, OMR control calculates the machine’s status based on a model and applies correction to motor control in order to match not the motor position, but the machine tool position to the commands.

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 table (useful when soft limit is not enough to prevent interference)

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 changes in color.

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.

Tool Handle Feed & Interruption (Machining Center System)

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 potentialities.

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

- 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 point 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.

OMR-FF Control

Optimum Feed Forward

Unlike conventional control, which simply matches the motor path to the commands, OMR control calculates the machine’s status based on a model and applies correction to motor control in order to match not the motor position, but the machine tool position to the commands.

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 table (useful when soft limit is not enough to prevent interference)

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 changes in color.

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 M720V, 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 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.

**Multi-part System Synchronous Thread Cutting**

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

**Milling Interpolation (Lathe System)**

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

**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 spindle.

**Balance Cut (Lathe System)**

- Deflection can be minimized by holding tools simultaneously from both sides of the workpiece and using them in synchronization to machine the workpiece (balance cutting).
- The machining time can be reduced by machining with two tools.

**Guide Bushing Spindle Synchronization Control (Lathe System)**

This function is for a machine with a spindle motor to rotate a guide bushing. This function allows the guide bushing spindle motor to synchronize with a reference spindle motor (Reference spindle).

The position error compensation function reduces the spindle's vibration due to the workpiece's torsion, and the motor's overload.

**Hobbing (Lathe System)**

- 3 code format is available for hobbing.
- A spur gear can be machined by synchronously rotating the hob axis and the workpiece axis in a constant ratio. A helical gear can be machined by compensating the workpiece axis according to the gear torsion angle for the Z axis movement.

**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.
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)**
- 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.

**Develop screen configuration**

**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. Please contact us to purchase a full function version. (A limited function version is also available 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.

**NC Trainer / NC Trainer plus (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 PLC program and custom screens.

**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 is free of charge. Please contact us.

**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.

*Ethernet is a registered trademark of Xerox Corporation in the United States and/or other countries.
*MELSEC, MELSOFT, are registered trademarks of Mitsubishi Electric Corporation in Japan and/or other countries.
*M700VW only
## Drive Units

### High-performance Servo/Spindle Drive Units

- **MDS-D2/DH2 Series**
  - All robust drive units use a maximum of three servo axes and one spindle.
  - As the servo-spindle drive is highly accurate, energy is efficiently saved in deceleration, reducing overall system energy savings.
  - STO (safe torque off) is now available.*

- **MDS-DM2 Series**
  - All compact drive units provide a maximum of three servo axes and one spindle.
  - As the servo-spindle drive is highly accurate, energy is efficiently saved in deceleration, reducing overall system energy savings.
  - STO (safe torque off) is now available.*

### Multi-hybrid Drive Units

- **M750VS/M730VW Series**
  - MDS-D2/DH2 Series
  - **Max. number of axes (NC axes + Spindles + PLC axes)**: 12
    - M750VW: 16
    - M730VW: 16
  - **Max. number of NC axes (in total for all the part systems)**: 16
    - M750VW: 16
    - M730VW: 16
  - With the fastest current control cycle, basic performance is drastically enhanced. A combination of high-speed servo motor and high-accuracy detector helps enhance overall drive performance.

### Servo Motors

- **Medium-inertia Motor HF Series**
  - High-inertia machine accuracy is ensured. Suitable for machines requiring quick acceleration.
  - Range: 0.3 to 10 [kW]
  - **Maximum speed**: 4,000 or 5,000 [r/min]
  - Supports three types of detectors with a resolution of 260,000, 1 million, or 16 million p/rev.

- **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]
  - Supports three types of detectors with a resolution of 260,000, 1 million, or 16 million p/rev.

### 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: 140 [kW]
    - Compact & light: 15-type [kW]
    - Low-inertia: 140 [kW]
    - **Range**: 3000 to 14,000 [rpm]

- **Low-inertia, High-speed Spindle Motor SJ-VL Series**
  - The spindle dedicated to tapping machines requiring higher cutting speed and tapping.
  - **Product line**
    - Low-inertia normal: 32 [kW] (260,000 p/rev)
    - Low-inertia hollow shaft: 32 [kW] (16 million p/rev)

### Tool Spindle Motor

- **HF-KP Series**
  - **Range**: 0.4 to 2.9 [kW]
  - **Maximum speed**: 10,000 [rpm]

- **IPM Motor**
  - **Range**: 0.4 to 2.9 [kW]
  - **Maximum speed**: 10,000 [rpm]

---

*Please consult our website for availability of STO as a whole system.

---

### Displays & Keyboards

<table>
<thead>
<tr>
<th>Model name</th>
<th>M700VS Series control unit</th>
<th>M700VW Series control unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNC unit</td>
<td>compact</td>
<td>separate from the operation board</td>
</tr>
</tbody>
</table>

- **M700VS Series control unit**
  - **Control unit**
    - Display: 10.4-type touch panel
    - Keyboard: 15-type touch panel
  - **Control unit**
    - Display: 8.4-type touch panel
    - Keyboard: 10-type touch panel

- **M700VW Series control unit**
  - **Control unit**
    - Display: 10.4-type touch panel
    - Keyboard: 15-type touch panel
  - **Control unit**
    - Display: 8.4-type touch panel
    - Keyboard: 10-type touch panel

*For the detailed specifications, please refer to the specifications manuals.
**Safety Warning**

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

Eco Changes is the Mitsubishi Electric Group’s environmental statement, and expresses the Group’s stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
http://Global.MitsubishiElectric.com

Revised publication, effective Oct. 2012.
Superseding publication of K-K02-8-C8220-D Sep. 2011.
Specifications are subject to change without notice.