Further progress to the new MITSUBISHI standard CNC

Higher cost-performance for realizing higher-grade machines

[High-speed]
Cycle time reduced with higher machining-control performance

[Multi-axis control]
Multi-axis control and two-part systems for compatibility with various machines

[Nano interpolation]
Smoother cutting surface is achieved with one-nanometer position interpolation

[High-accuracy]
High-accuracy tapping with high-speed compensation control of spindle and servo

[Easy operation]
Simple programming system for machining center and lathe

[Customize]
Development tools for providing a CNC with customized solutions

High Speed Performance

M70v TypeA
- Max. number of part systems ................................................... 2
- Max. number of axes ................................................................ 11
- Max. number of NC axes (in total for all the part systems) 
  Machining center system ..................................................... 8
  Lathe system ................................................................... 9
- Number of simultaneous contouring control axes .................... 4
- Least command increment .................................. 0.1 micrometer
- Least control increment .......................................... 1 nanometer
- Max. PLC program capacity ........................................... 32,000 steps

M70v TypeB
- Max. number of part systems ................................................... 1
- Max. number of axes ................................................................ 9
- Max. number of NC axes (in total for all the part systems) 
  Machining center system ..................................................... 5
  Lathe system.................................................................... 4
- Number of simultaneous contouring control axes .................... 4
- Least command increment .................................. 0.1 micrometer
- Least control increment .......................................... 1 nanometer
- Max. PLC program capacity ........................................... 20,000 steps

Max. number of part systems ................................................... 1
Max. number of axes ................................................................ 9
Max. number of NC axes (in total for all the part systems) 
  Machining center system ..................................................... 5
  Lathe system.................................................................... 4
Number of simultaneous contouring control axes .................... 4
Least command increment .................................. 0.1 micrometer
Least control increment .......................................... 1 nanometer
Max. PLC program capacity ........................................... 20,000 steps

The Best Partner for Your Success
MITSUBISHI CNC

M70v TypeA

M70v TypeB
Versatile lines boasting compact size and less wiring

- Operation panel I/O unit (Max.: 96 inputs/96 outputs)
- Ethernet
- Manual pulse generator
- RIO 1 (Max.: 256 inputs/256 outputs)
- RIO 2 (Max.: 96 inputs/96 outputs)
- Personal computer
- Operation panel I/O unit
- Display front side
- USB memory interface
- CF card interface

Drive units:
- Multi-hybrid drive unit (MDS-DM Series)
- High performance drive unit (MDS-D/DH Series)
- Ultra-compact drive unit with built-in power supply (MDS-D-0V, LS/SPUB Series)

Servo motors:
- Medium-inertia motor (HF Series)
- Low-inertia motor (HF-KP Series)
- Direct drive motor (TM-RB Series)
- Linear servo motor (LM-F Series)

Spindle motors:
- High-performance spindle motor (SJ-J Series)
- Low-inertia and high-speed spindle motor (SJ-JL Series)
- Tool spindle motor (HF-KP Series)
- Built-in spindle motor (HF-SP Series)
**Nano Control**

The least control increment is one nanometer, the command increment is ±99999.9999, and the rapid traverse rate is 1000m/min. All processing from the analysis of machining programs to servo commands is performed in nanometers.

**Speed command fluctuation reduced**

In nano control, the position command calculation fraction of the interpolation calculation is small, so fluctuations in speed command due to the fraction 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 are finer.

**High-speed Machining Mode**

By reading ahead some blocks in a program that contains successive fine travel distances, the program can be rapidly executed at up to 33.7k blocks/minute (8.4k blocks/minute for Type B).

**High-speed Control Function**

- At a corner that consists of straight lines, sharp interpolation control is performed, allowing the commanded path to be followed by correcting curvature.
- Inward deviation error in arc motion is reduced for even higher-accuracy following the command value.

**OMR-DD Control (High-speed synchronous tapping)**

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

**Position Loop of Spindle Control**

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

**Orientation time is reduced**

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

**Rapid Traverse Constant Inclination**

Rapid traverse acceleration/deceleration is performed according to the motor’s torque characteristics.

- The motor’s characteristics can be utilized optimally, positioning time is reduced, and cycle time is improved.
Full of useful functions for combined machining

**Multi-part System Program Management (TypeA)**
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.

**Inclined Axis Control**

- 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.

**Polar Coordinate Interpolation**

- 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.
- It is useful for tasks such as cutting linear cutouts on the outside diameter of the workpiece and grinding camshafts.

**Hobbing (TypeA)**

- G 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.

**Milling Interpolation (TypeA)**

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.

**Mixed Control (cross axis control) (TypeA)**

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.

**Balance Cut (TypeA)**

- 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.

**Control Axis Synchronization Across Part Systems (TypeA)**

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.

**2-part System Synchronous Thread Cutting (TypeA)**

- Part system synchronous thread cutting allows the 1st part system and the 2nd part system to perform thread cutting simultaneously for the same spindle.
- 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.

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**System Configuration Example**

**Optimum performance for various applications**

### Machining Center System

**Compact Milling Machine**
The compact operation board, in which the control unit is integrated, and the ultra-compact drive units achieve downsizing of the control board and machine.

**Tapping Machine**
The multi-hybrid drive unit optimally controls the spindle motor for tapping to bring out the function of high-speed tapping DMN-DD. An NC five-axis control (simultaneous four-axis) enables control of the tilt table.

**Multi-axis Machining Center (TypeA compatible)**
A system with a maximum of 11 axes and two part systems achieves optimal control even for a compound axis configuration that includes a synchronization axis and a peripheral axis, such as in a large machine or a line dedicated machine.

### Lathe System

**Compact Lathe**
The compact operation board, in which the control unit is integrated, and the ultra-compact drive units achieve downsizing of the control board and machine.

**Milling-enabled Lathe (TypeA compatible)**
Even without a Y axis, the milling function enables contour control machining on the side or face of a workpiece. Furthermore, the tool spindle motor contributes to downsizing of the turret.

**Compound Multi-axis Lathe (TypeA compatible)**
Up to four spindles can be controlled by a system with a maximum of 11 axes and two part systems. Owing to the drive units that drive three servo axes/two spindles, we offer an optimal system construction for machines of various axis configurations.
Enhanced operability with greater ease of use

**HMI for Easier and More Visible Use**

- **Screen structure linked to 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.

- **Auto-scale adjustment of the graphic check function**
  When the automatic graphic check function is enabled, by selecting a file, the scale is automatically adjusted to draw the whole machining path. (In single-plane display mode)

- **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.

- **3D solid program check**
  The added 3D solid model check function allows more realistic cutting check.*

- **Operation Support**
  - **Manual/Automatic backup function**
    *Batch backup of the NC data into the CF card/USB memory inserted in the front interface of the display is possible.
    *Data is automatically backed-up at a certain interval set by the parameter.

  - **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.

  - **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.

  - **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.

*Available with M70V TypeA (M System) only.
Memory Card/USB Memory Interface

**Easy to import external data**

- A compact flash memory card (CF card) /USB memory interface is located on the front of the display. In using CF card, the card slot can be completely covered by a lid so as to prevent foreign materials from entering (IP67).

**Front IC Card Mode**
- It is possible to directly search and run the machining programs from the CF card. Subprogram calls are also available.
- The machining programs in the CF card can be edited directly.

**Easy to Change Languages**
- It is possible to change languages using a CF card.
- Support for 17 languages, securing reliable use worldwide.

**Ethernet Communication**

By connecting a personal computer and an CNC via Ethernet, the machining programs and parameters can be input and output.

**Data Backup Function**

It is possible to backup NC data collectively and periodically to a CF card /USB memory on the front of the display. This backup data is helpful for restoring the system in the case of an accident.

**Program Restart Function**

It is possible to restart a program even when a machining program is interrupted due to tool breakage or power outages by automatically searching the block that was last executed before the interruption.

**Tapping Retract**

Even when tapping is interrupted due to emergency stops or power outages, retraction of the tool out of a workpiece can be automatically carried out upon restarting operation.

**Vertical Axis Drop Prevention Function at Power Failure**

The drive system instantly detects a power failure, and the gravity axis is retracted so as to prevent a crash with a workpiece.

**Ground Fault Detection for Each Motor**

Ground fault detection, which was formerly centrally performed by a power supply unit, has changed so that the fault can be detected per motor. As detecting a faulty axis is possible, the restore time is shorter.

**Drive Unit with Higher Oil-proof**

A cooling fan for the radiator fin outside the panel is molded so as to further prevent the oil from entering. The absence of a fan inside the drive unit contributes to the avoidance of electric circuit failures caused by inhaled dust and oil-mist.

(Note) CompactFlash is a trademark of SanDisk Corporation in the United States and other countries.
Simple Programming Functions

Simple programming tools, "NAVI MILL" and "NAVI LATHE"

Interface Design with Overall View
Intuitively view system configuration and machining programs.

LIST VIEW
LIST VIEW displays objects such as programs, processes, file data and parameters.

OPERATION VIEW
OPERATION VIEW displays the items corresponding to the object selected in LIST VIEW. Data can be input easily referencing the guidance drawing for input items.

Automatic Setting of Cutting Conditions
Simply input the tool number. The cutting conditions for each process are automatically set based on previously registered tool files and cutting-condition files.

Checker and Guidance Functions
Detects input errors for troubleshooting.

Message guidance
Troubleshooting options for input errors are displayed.

Parameter guidance
Displays parameter details and setting range.

Tool guidance
Displays primary data of the tool data previously registered in the tool file.

Customize Machining Programs
Machining programs using macro programs enable commands to be added between processes via the editing screen. Machine tool builders can customize the macro program of each process according to machine specifications and machining know-how.

Menu
NAVI MILL

Turning
Face cutting
Drilling
Boring

Milling
Deep drilling
Hole drilling

Assist
Transfer

NAVI LATHE

Turning
Face cutting
Drilling
Boring

Milling
Deep drilling
Hole drilling

Assist
Transfer

Create machining programs on a personal computer

Magicpro-NAVI MILL on PC / Magicpro-NAVI LATHE on PC (Simple programming tool for use with personal computer)

With Magicpro-NAVI MILL/LATHE on PC*, the same machining programs created with NAVI MILL/LATHE on a CNC can be created on a personal computer.

Items such as machining programs, tool files and cutting-condition files can be shared between the NAVI programs on the CNC and a personal computer.

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.

NC Trainer (MITSUBISHI CNC Training Tool)
NC Trainer is an application for operating the screens of MITSUBISHI CNC M70V 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.
Development Tools

More comfortable development environment

<Custom screen development>
Make your CNC more user-friendly by developing original screens

**NC Designer (Screen Design Tool)**
- By laying out ready-made standard parts, you can easily create original screens without programming.
- When using a 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)

<PLC development> Editable on both personal computers and HMI screens

**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.

**Onboard Ladder Editor**
Operability of ladder editing/monitoring on the NC display is widely improved. Various functions are enhanced, such as divided screens, the search function and the monitoring screen.

<Easy setup>
Offering a wide range of support tools, from machine design to setup

**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.

<Setup Installer>
Register the desired display language.

**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 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.

**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*
- Break diagram display, speed loop gain adjustment, position loop gain adjustment, notch filter setting, acceleration/deceleration time constant adjustment, circularity adjustment and servo waveform measurement.
A wide range of support features according to various machine configurations

### CC-Link

The NC unit can be connected to a network to serve as the master/local station of the MELSEC CC-Link.

The optical cable can be extended to a maximum of 90m by connecting up to two optical servo communication repeater units between the CNC unit and a servo drive unit.

### Displays & Keyboards

<table>
<thead>
<tr>
<th>Keyboard</th>
<th>Display</th>
<th>M70V</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCU7-KB926</td>
<td>10.4-type touch panel</td>
<td>10.4-type</td>
</tr>
<tr>
<td>FCU7-KB026</td>
<td>8.4-type sheet keys</td>
<td>8.4-type</td>
</tr>
<tr>
<td>FCU7-KB044</td>
<td>10.4-type sheet keys</td>
<td>10.4-type</td>
</tr>
<tr>
<td>FCU7-KB046</td>
<td>10.4-type clear keys</td>
<td>10.4-type</td>
</tr>
<tr>
<td>FCU7-KB048</td>
<td>10.4-type clear keys</td>
<td>10.4-type</td>
</tr>
<tr>
<td>FCU7-KB029</td>
<td>8.4-type sheet keys</td>
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<tr>
<td>FCU7-KB047</td>
<td>10.4-type touch panel</td>
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<tr>
<td>FCU7-KB921</td>
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<tr>
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<td>10.4-type</td>
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</tr>
</tbody>
</table>

The internal components of the keyboard are protected against water and oil (IP65F). The interface for the CF card is mounted on the front panel of the display.

### Control Unit

The control unit is integrated into the back side of the display.

### Mitsubishi Factory Automation Solutions

- Our cultivated Factory Automation technologies and experience contribute to offer the best suited systems for users.
- Our FA solutions support high and low hierarchy components, a network and even applications that control the components and network required for a manufacturing floor.
Servo Motors

**Direct Drive Servo Motor  TM-RB Series**
- High-performance Spindle Motor  SJ-V Series
- **Linear Servo Motor  LM-F Series**
  - Axes in clean environments are possible since no ball screws are used and therefore contamination from grease is not an issue.
  - Elimination of transmission mechanisms which include backlash, enables smooth and quiet operation even at high speeds.
  - **Dimensions**:
    - Length: 230 to 1,010 [mm]
    - Width: 120 to 240 [mm]
  - **Maximum speed**: 4,000 or 5,000 [r/min]
  - **Range**: 0.5 to 9 [kW]
  - **Medium-inertia, high-accuracy and high-speed drive system**
  - **Product line**:
    - Small capacity: HF-KP Series
    - Includes low-inertia motors
    - Suitable for use in environments requiring quick acceleration.
    - 2.5 to 9 [kW]
    - Maximum speed: 6,000 [r/min]
    - Small-capacity motor with detection provided at a resolution of 200,000 [pp/min].
  - **Direct Drive Servo Motor  TM-RB Series**
    - High-torque direct-drive combined motor with a high-gap control system provides quick acceleration and positioning, which makes rotation smoother.
    - Suitable for a rotary axis that drives a table or spindle head.
    - Compared with a conventional rotary axis with a deceleration gear this motor has higher accuracy and is maintenance-free, having no wear or backlash.
    - **Range**: Maximum torque: 36 to 1,280 [N·m]

Spindle Motors

**High-performance New Type Spindle Motor  SJ-D Series**
- **Low-inertia, High-speed Spindle Motor  SJ-VL Series**
  - The spindle dedicated to tapping machines requiring faster drilling and tapping.
  - The low-inertia structure and high-speed motorization, resulting in higher productivity. In addition, when driven by a multi-hybrid drive (MDS-DM Series), the motor contributes to downsizing of the cabinet, and energy savings.
  - **Product line**:
    - Low-inertia normal: SJ-VL Series 3 to 11 [kW]
    - Low-inertia hollow shaft: SJ-VL2 Series 3.7 to 11 [kW]
  - **Specifications**
    - Maximum speed of spindles is available, including standard, high-speed and wide-range output units, all to support diversified machine tool needs.
    - Product line: Normal: SJ-VL Series 0.75 to 55 [kW]
      - Wide-range constant output Speed: 5,000 [r/min]
      - High-speed SJ-VL2 Series 2.0 to 18 [kW]
      - High-speed SJ-VL Series 2.0 to 18 [kW]
  - **Tool Spindle Motor  (HF-KP/HF-SP Series)**
    - Taking advantage of the characteristics of a servo motor such as smoothness and high-output, this motor serves as a compact and high-output spindle motor which is capable of high-speed rotation (6,000/min).
    - The motor contributes to downsizing of spindles, such as the rotary tool spindle.
    - Product line: Small capacity: HF-KP Series 0.4 to 9 [kW]
      - Medium capacity: HF-SP Series 2.0 to 4.9 [kW]
  - **Built-in Spindle Motor**
    - Electricity loss is minimized by providing better efficiency during high-speed rotation.
    - Motor coil and axis has been reduced, resulting in a shorter overall motor length.
    - As feedback communication is serial, the resolution is significantly increased (5ppm, 4 million ppm)
    - The adjustment P07 has been eliminated to achieve adjustment-free conditions. The maximum gap has been reduced to 0.3mm.

IPM Spindle Motor

- In answer to demands for downsizing and higher efficiency, an IPM motor has been introduced for further energy savings.
- Reduction in acceleration/deceleration time contributes to shorter cycle times.
- **Specifications**
  - Maximum speed: 4,000 or 5,000 [r/min]
  - **Range**: 0.5 to 9 [kW]
  - **Medium-inertia, high-accuracy and high-speed drive system**
  - **Product line**:
    - Small capacity: HF-KP Series
    - Includes low-inertia motors
    - Suitable for use in environments requiring quick acceleration.
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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.