Further Advancing the World Standard CNC from FANUC

FANUC
Series Oi-MODEL F
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FANUC Series Oi-MODEL F

New Oi series CNC Provides Added Value to Machine Tools
- New LCD/MDI unit with new design
- Achieves both high accuracy and smoothness with easily adjusting steps
- Loader control commanded by G code meets the request of automation
- The FANUC platform adds the convenience of a PC

High-Speed and High Quality Machining
Excellent Control Functions
- Nano CNC system combined with precise nanocalculation and leading-edge servo technology
- AI Contouring Control effective for high-speed and high precision machining
- Smooth Tolerance Control achieves high-quality machining
- Smart Overlap enables a shorter cycle time for machining parts
- SERVO HRV Control achieves high speed and precision
- SPINDLE HRV Control achieves fast response and high efficiency
- FANUC SERVO GUIDE for quick and smart tuning

Pursuing Ease of Use
Abundant CNC Functions and Operability
- Increasing the number of controllable axes makes it ideal for a wider range of machines
- 10.4 inch LCD/MDI display units with a new design available in addition to the 8.4/10.4/18 inch display units
- Loader is cost effective and easily configured with the new Loader Control function
- FANUC Platform enables the convenience of a PC in the CNC
- Support of various industrial networks and field networks
- Direct editing and operation of the CNC program on memory card

Integrated Operation & Programming Guidance with extremely simplified operations
- FANUC MANUAL GUIDE i
- Programming Guidance with various machining cycles
- High-speed and large capacity PMC with Function Block function as standard and multi-path PMC
- Safety achieved by the Dual Check Safety embedded into CNC
- Customize functions for each unique machine
- Tuning functions help easily set-up machine tool

Ease of Use

Machining Performance

Minimizing Downtime

High Performance and Value
- Packaged with CNC functions in each type
- Ultra compact CNC with less wiring and high reliability with leading-edge technology
- Providing the best solution with the combination of 

CNC Lineup

FANUC Series Oi-MF
CNC for Machining Center
- 1 path system total controllable axes: up to 9 *1
- 2 path system total controllable axes: up to 11 *1
- Simultaneous controlled axes: up to 4 axes

FANUC Series Oi-TF
CNC for Lathe
- 1 path system total controllable axes: up to 9 *1
- 2 path system total controllable axes: up to 12 *1
- Simultaneous controlled axes: up to 4 axes

FANUC Series Oi-PF
CNC for Punch Press
- 1 path system total controllable axes: up to 7 *1
- Simultaneous controlled axes: up to 4 axes
(*1: Total controllable axes is the sum of feed and spindle axes. Please refer to the specifications as for the specifications of each type, including the maximum values of feed axes and spindle axes.)

Focusing on Minimizing Downtime
High Reliability and Easy Maintenance
- Highly reliable hardware allows stable operation in a harsh factory environment
- Failure prediction functions such as the leakage detection function achieve preventive maintenance, preventing long machine downtime
- Enhanced diagnosis and maintenance functions make it easy to identify failure locations and reduces time for recovery
- Improved maintainability achieved by the structure that allows for quick replacement of fans or batteries
State-of-the-Art Hardware

Ultra-Compact, Reduced Wiring, High Reliability

- **Thin and Compact CNC**
  Small sized CNC integrated with the LCD enables a compact operation unit. The depth of CNC is only 60mm (*1). Each display unit size (8.4, 10.4, or 15 inch) accommodates machines of various sizes, from small to large. (*1: 8.4/10.4 Inch display with no optional slot)

- **Enhanced Basic Performance**
  Faster FSSB
  CNC and the amplifiers are connected with FSSB (FANUC Serial Servo Bus) using optical fiber cable. High performance and reduced wiring are realized by optimizing communication protocol and ECC technology with the high-speed and high level noise tolerance by the optical fiber cable. In addition, spindle amplifiers can be now connected to FSSB.

- **FANUC I/O Link i**
  FANUC I/O Link i is a serial I/O interface between the PMC and various I/O units. In addition to general-purpose I/O units, the machine operator’s panel or handy machine operator’s panel can also be connected. FANUC I/O Link i helps with quick recovery from trouble by making it easy to pinpoint the faulty part using various error detection capabilities such as bitwise I/O ground fault detection and I/O power supply failure detection, etc. FANUC I/O Link i realizes Dual Check Safety with a single cable, although conventional systems require two cables.

- **iPendant**
  iPendant is a portable operating unit. It is possible to watch the CNC screen and operate the machines at a distant point from the main operator’s panel. Moreover, touch panel and the manual pulse generator can be selected as an option.

- **Network Support Functions**
  The various Industrial Ethernet and field networks are supported in order to suit a variety of network environments in the factory. Ethernet is supported as a basic function, and the CNC can be connected to a personal computer to transfer a variety of NC data.

- **Easy Maintenance**
  Unexpected system downtime for a long period of time can be prevented by the function to detect and display signs of trouble that can lead to system down if ignored. Fans for cooling and battery are stored in a cartridge and can be replaced easily, and maintainability is enhanced.

**Power magnetic Cabinet**

- **High performance AC SERVO MOTOR**
  FANUC AC SERVO MOTOR for feed axis of machine tools
  - Smooth rotation and compact size
  - Quick acceleration
  - Small and high resolution PULSECODER
  - Excellent waterproofness
  - Bayonet type power connector
  - Reduced Backlash Brake
  - Line-up with both 200V and 400V input

- **FANUC AC SPINDLE MOTOR**
  FANUC AC SPINDLE MOTOR for spindles of machine tools
  - High power and high torque with compact size
  - Fast response and high efficiency achieved by SPINDLE HVR Control
  - Improved machining performance achieved by the enhanced short-time rated output
  - Capable of performing balance correction in the rear part of the motor even after being connected to the spindle hollow shaft models which enable center-through-coolant available
  - Line-up with both 200V and 400V input

**FANUC SERVO AMPLIFIER**

- **Compact and energy-saving SERVO AMPLIFIER**
  compactifies downsizing of the electrical cabinet
  - Achieves high speed, high precision and high quality machining through the high power and high precision current control
  - Preventive maintenance possible by detecting insulation deterioration of motors under cutting fluid environment
  - Quick replaceable fan motor from the front side of the amplifier
  - The trouble-shooting function can only quickly find the causes of alarms
  - A wide line-up of multi-axis amplifiers and all-in-one amplifiers integrating servo and spindle
  - Machine protection at power failure is enabled by adding modules according to the purpose
  - Energy saving by utilizing the latest low loss power device
  - Line-up with both 200V and 400V input

**High Reliability Realized by ECC**

- By applying the ECC (error correcting code), it can automatically correct the error from electrical noise inside of the CNC. As a result, a highly reliable CNC is realized.
High performance

High-Speed, High-Quality Machining

Fine Surface Technology

Fine Surface Technology is a collective term for CNC and servo control technologies that achieve high-quality machining. Fine Surface Technology allows for the interpolation of high-precision machining program output from CAD or CAM. High-speed execution of small segment programs, the generation of a smooth tool path, and accurate command tracing.

- High precision machining program
- High-speed tool path
- Higher servo control gain

High Precision Program Command
- AI Contour Control I⁺
- Smooth Tolerance⁺ Control
- Nano Interpolation

High precision program command

Supports high precision machining program output from CAD or CAM. High-precision programs can be interpolated without changing the incremental system of the CNC. This eliminates errors caused by rounding in the program command unit.

AI Contour Control I⁺ / AI Contour Control II⁺

Optimum the feedrate and acceleration control by reading blocks in advance. During complex machining of aircraft or automobile parts, molds, or other items that are specified as continuous small blocks, it is possible to determine the specified shape by reading program commands in advance, realizing control with a feedrate and acceleration optimal to the performance of the machine. By analyzing the machining program at a high speed, even small segment programs, which are required for high-quality machining, can be executed at a high speed.

Smooth Tolerance⁺ Control

Smoothing continuous small blocks to realize high-quality machining. The machining path specified in continuous small blocks, like the one for mold machining, is smoothed out within the specified allowance error tolerance. The smooth machining path reduces mechanical shock and improves the quality of the machined surface.

Advanced Digital Servo Technology

Smart Machine Control

Smart Machine Control is a function group which achieves high-speed, high-precision, and high-quality machining by optimizing its control in real time to changes in machine conditions such as load, temperature, and position.

- Smart Spindle Acc/Dec
  - Selection of optimal common Power Supply
  - Max power of PS
  - Total power
  - Power of spindle
  - Time of spindle

- Smart Rigid Tapping
  - Reducing cycle time for tapping
  - Temperature of tapping

- Smart Thermal Control
  - Avoid overheat caused by frequent Acc/Dec
  - Overheat level

- Smart Load Meter
  - Best use of spindle performance

- Smart Adaptive Control
  - Reducing cycle time for heavy cutting
  - Feed speed
  - Load level
  - Temperature

SERVO HR⁺ Control

High-speed and high-precision servo control. By combining hardware technology and software technology such as the latest servo control HR⁺, high-speed and high precision control with nano-meter level is ensured. Mechanical resonance can be suppressed by the automatic following HR⁺ filter even though its frequency changes.

SPINDLE HR⁺ Control

High response and high efficiency spindle control
- Achieving high gain control and low heat generation at high-speed rotation by faster sampling time of the current control loop
- Optimum orientation for reducing cycle time by the optimum deceleration according to the inertia of workpieces or tools
- Supports Nano Interpolation in position control enabling Nano CNC system for spindle as well as feed axis

Application example of SERVO HR⁺
Pursuing Ease of Use

Abundant CNC functions

Increase of CNC Functions

Increasing the number of controllable axes and paths makes it ideal for a wider range of machines:
- Expanded axis number (from 8 axes to 16 axes) on 1 path system
- Increased number of axes (from 11 axes to 12 axes) and spindles (from 6 spindles to 10 spindles) on the 2-path system of Oi-TP
- 2-path system is available on Oi-MF
- No count is axis for number of feed axes, the number of controllable feed axes is increased

In addition to 24/10.4 display unit, larger 15 inch display unit is available.

By using the large display, the operability is further improved.

Enabling the commonly used and other various functions (program folder management of part program etc.) of 30i-B series, the usability of CNC system is further improved.

- Axis name expansion
- Program folder management
- Quick program reset
- 26 languages are supported
- Flexible path axis assignment
- Multi-path PMC function
- Ladder Dividing Management function
- Main menu screen etc.

Function for Loader Control

Loader control can be easily achieved at low cost. This function can contribute to the automation of machine tools.
Loader can be controlled by the same G codes as those of machining programs. There is no need to control an axis by the PMC ladder, etc. Loader programs can be executed independently of machining programs.

Machining program
G00 X100, G02 Y0 M200 ;

Control of Turret

Control of Loader

Loader program
G00 Z0 M200 X0 ;

Excellent Operability

FANUC Platform Provides Convenience of PC on CNC

Convenient platform with useful functions (e.g., high-speed graphics, large memory, etc.) can be added on CNC.
- Remote desktop function improves convenience of CNC by enabling operation of the PC connected via Ethernet from CNC (e.g., operating the CAD/CAM, referencing the manual, etc.)
- Large program can be edited and operated with built-in large memory
- Web browser can be used

Remote desktop function
Operating the PC connected via Ethernet from CNC

Memory operation with large memory

Web browser

Integrated Operation & Programming Guidance with extremely simplified operations

FANUC MANUAL GUIDE i

MANUAL GUIDE i is an integrated operation guidance, which provides easy operation guidance from programming through machine operation on one single screen. It can be used for lathes, milling machines and machining centers.

- Integrated operating screen
- ISO code part programming
- Powerful program editing functions
- Various machining cycles
- Realistic machining simulation
- Setup guidance
- Multi-path lathe function

Free figure input screen

Machining simulation screen (Scaling and rotation of animation)

Programming Guidance with various machining cycles

FANUC MANUAL GUIDE 0i

MANUAL GUIDE 0i is an easy to use part programming operation guidance function that simplifies the creation of a machining program. It is concentrated to the functionality of creating a part program and can be used for lathes, milling machines and machining centers.

- ISO code part programming
- G-code and M-code assistance
- Various machining cycles
- Contour programming
Network Support Functions

With plenty of network functions, you can construct an optimum system for machine tools.

Ethernet

Embedded Ethernet of 100Mbps is supported on the CNC main board. CNC can be connected to a personal computer to transfer NC programs and monitor CNC status. The Fast Ethernet board can be mounted as an option. Data can be transferred simultaneously among multiple computers at high speed. These features are ideal to construct a production system which exchanges information among machining lines and factory host computer.

FANUC MT-LINK (Operation Management software) / FANUC OPC Server

This is a PC software that can manage the operational state of machine tools by connecting with them in the factory. It is suitable for the centralized control of the machine tools in the factory because the function to forward the processing program is provided. The collected data like the operation results can be accessed by the upper host system such as MES (Manufacturing Execution System). Moreover, the PC software for the OPC server is prepared. This software can read and write the variable data between machine tools and the MES system with the OPC client function. The machine tools can be connected with the upper host system such as MES by using these software.

Industrial Ethernet / Field Network

The I/O signals of various peripheral devices such as waterproof equipment can be controlled and monitored by the ladder program.

Supports various networks:
- Fi-net
- Ethernet/IP
- PROFIBUS
- DeviceNet (Master/Slave)
- DD/Link (Slave)

Safety Function

Dual Check Safety + Servo STO

Dual Check Safety is a safety function that conforms to the international safety standard (ISO 13849-1 PL d). This function offers a high level of safety by redundant monitoring, and by providing duplicate paths of breaking power for the servo/spindle amplifier. Safety functions built into the CNC make it easier to conform to the safety standards for machine tools.

- Cost can be reduced by significantly simplifying additional circuits for adherence to the safety standard.
- Two PMC functions have been incorporated into the CNC to duplicate sequence control for safety-related Input/output signals.
- Safety-related Input/output that is defined by a MTB allows redundant monitoring for controlling peripheral devices.
- By using FANUC I/O Link, 1 channel I/O Link cable can configure safety function.
- The safety machine operator’s panel which can make the key signals a safety-related signal is prepared.
- The Safe Torque Off (STO) function is incorporated in the servo amplifier. It is no longer necessary to install a magnetic contactor in the power line between the servo amplifier and the motor in order to shut the motor off.
Many Customizable Functions

Customizable functions are available, which allow machine tool builders to customize their own machine tools.

- Customizing operation screens
- MCN operator’s panel is realized by softkey
- Implementing original sequence control based on PMC

**C Language Executor/FANUC PICTURE**

Machine tool builders can create their own operation screens, which enables unique CNC display and operation.

- C language is used for programming.
- Multi-window display enables creation of pop-up menus.
- Operation screens using the touch panel can be created.
- In addition to standard AN5C functions, many functions are available for CNCs and PMCs.
- High-level tasks to which high execution priority is assigned can monitor signal and position information.

**FANUC PICTURE**

FANUC PICTURE enables a machine operation screen to be created only by pasting screen components such as buttons and lamps on the personal computer.

- Easy-to-use interface unique to FANUC.
- A screen usable on a display unit with or without a touch panel can be created.
- A screen usable on a 15 inch display unit and with vertical soft keys can be created.
- A created screen is executed by the C language executor, and can coexist with a C language executor application created by a machine tool builder.

**Machine Operation Menu Function**

The softkey displayed on CNC screen can be used as a button to operate the machine. Machine operation such as turning on or off the coolant, that is usually done with the machine operation board, can be done with a softkey on the CNC screen instead.

- The vertical softkey or horizontal softkey is used as a machine operation menu key.
- The hierarchy of the machine operation menu and the displayed character string can be set easily with a special tool on PMC.

**FANUC LADDER-III**

For machine customization, a machine tool builder’s own sequence control can be incorporated into the built-in PMC. A PMC sequence program can be created on a personal computer by using FANUC LADDER-III, a very easy-to-use programming tool with many useful functions.

- A program can be created with ladder and function block.
- A program can be coded using signal names instead of signal addresses.
- Online monitoring and editing can be performed by connecting a personal computer with the CNC via Ethernet.
- Including PMC Function Library which enables you to integrate functions such as PMC axis control easily.

Easy Setup

Powerfully supports setup and tuning of the CNC system

**Easy CNC Startup**

Automatic tuning of servo axes gain and filter

The recommended parameters for the CNC and servo axes for achieving high-speed and high-precision feed can be set by the CNC Startup Tool. Sufficient precision can usually be achieved by this setting. When even higher precision is required, the filter to eliminate machine resonance and optimum velocity gain suitable to the machine characteristics can also be set automatically by only pressing the soft-key for parameter tuning.

**Easy Setting of Machining Conditions**

Because standard setting values are provided for each machining process (roughing, semi-finishing and finishing), parameters that affect high-speed high precision machining can be set and tuned for each machine, with easy-of-operation enabled by the intuitive slide bar. During machining, you can select the process by using the machining program or screen operations to perform the machining under optimal conditions.

Parameter values recommended by FANUC can be set by simple operations.

Select the settings suitable for the machining process and perform machining.

Easy and intuitive tuning is possible. Tuning for each machine is also possible.

Set parameter values for three patterns

Roughing

Semifinishing

Finishing

Easy tuning using the cursor keys
**Easy Maintenance**

**Functions for minimizing downtime**

**Contribution to Preventive Maintenance**

**Leakage Detection Function**
Insulation deterioration sometimes causes a machine to stop due to cutting fluid infiltrating the motor, especially in a severe machining environment. The leakage detection function built into the amplifier automatically measures the insulation resistance of the motor, and detects insulation deterioration in progress before it leads to machine downtime, enabling preventive maintenance.

**Cooling Fan Warning Function**
By monitoring a decrease in the rotational speed of each cooling fan motor of the CNC and the servo amplifier, signs of fan abnormalities can be detected. This function enables preventive maintenance. Fans are stored in a cartridge and can be replaced quite easily, so maintainability is enhanced.

**Failure Part Detection**

**Trouble Diagnostic Function**
Various failure detection functions provided to the I/O Link I and FSSB can detect interruptions in the power supply to the I/O modules or servo amplifier and identify disconnection locations of the communication cable. In addition to this, I/O Link I can detect the ground fault of each DO.

The trouble-shooting function enables you to see diagnosis information helpful in determining the status when an alarm occurs on the CNC screen.

- Trouble-shooting guidance screen
- Trouble-shooting monitor screen
- Trouble-shooting graph screen

**Encoder Communication Check Circuit**
If the detector encounters a communication error, which detector, feedback cable or servo amplifier has failed can be identified by using this check circuit for a quick recovery.

**Protecting Machine at Power Failure**

**Machine Protection at Power Failure**
Damage of workpieces and tools at power failure is prevented where a stable power supply cannot be expected.

- Gravity-axis drop prevention
  - The circuit incorporated in the amplifier detects power interruption and quickly activates the gravity axis brake.
- Stop distance reduction
  - Feed axes are decelerated to stop in order to prevent them from crashing in high-speed machine tools.
- Retract
  - Workpiece is retracted from workpiece keeping synchronization with gear cutting machine.

**Powerful Software Tools**

Supports development of machine tool builders in a variety of fields such as simulation and data management

**FANUC NCGuide**
Software tool “FANUC NCGuide” which simulates CNC operations on a PC to fully utilize the ever advancing CNC functions. The software tool can be used for development and educational purposes.

- **NCGuide Education Package**

**FANUC Program Transfer Tool**
FANUC Program Transfer Tool is a software tool for transferring part programs and data by connecting PC and CNC via Ethernet. Files in the CNC program memory are displayed on the tool in an easy-to-understand way, so input/output operation can be easily performed with a mouse.

**FANUC SERVO GUIDE**
Support of efficient servo tuning for high-speed and high-precision machining. **FANUC SERVO GUIDE** allows you to perform tuning of the servo and spindle, including creating test programs, setting parameters and measuring data in an integrated manner. This PC software directly connects a PC and the CNC and is easy to use. In addition to the motions of each servo axis and spindle axis, you can observe program execution status inside the CNC and PMC signals as waveform data and analyze the machine operation in detail. **FANUC SERVO GUIDE** also supports continuous measurement for long periods. The Tuning Navigator tunes gain, filter and other servo/spindle functions automatically, allowing advanced servo tuning to be quickly completed. The automatic tuning function for pretension compensation significantly reduces the time for high-speed and high-precision tuning.
Excellent Maintenance Services

FANUC service team delivers customer trust and confidence based on direction of service “Maximizing Uptime”, “Global Service” and “Lifetime maintenance”.

Service First

Conforming to the spirit of “Service First”, FANUC provides lifetime maintenance to its products for as long as they are used by customers, through more than 260 service locations supporting more than 100 countries and regions throughout the world.

Maximizing Uptime

Global Service

Lifetime Maintenance

FANUC ACADEMY

FANUC ACADEMY operates versatile training courses to develop skilled engineers effectively in several days.

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