

Multi-axis high speed response CNC for Industrial Machine

# FANUC

## Power Motion *i*

### -MODEL A Plus



# Multi-axis high speed response motion controller

## FANUC Power Motion *i*-MODEL A Plus

Max. number of paths : 10 paths (\*)

Max. total number of controlled axes : 32 axes

Max. number of simultaneous controlled axes : 4 axes

(\*) Updates from **Power Motion *i*-MODEL A**

### Multi-axis high response motion control

- Further improved high response motion control with High-speed CPU
- Shortened cycle time by quick axis start/stop
- Improved accuracy for machines that require high speed operation by quick response to an external signal
- Shortened cycle time by high speed ladder execution cycle

### Improving custom macros (\*)

- Easier to use, such as adding array variables and SWITCH-CASE syntax
- High-speed CPU greatly improves the performance of custom macros

### Functions for industrial machines

- Supports up to 32 axes by PMC axis control function that can be executed independently for each axis
- Shortened cycle time by acceleration/deceleration specification feed
- Position control, torque control, speed control, and pressure control can be performed to support various machines.

Examples:

- Press machines · Die cushions · Loaders · Body assembly line
- Wire saws · Winding machines · Filling machines · Winding machine
- Packing/wrapping machines · Stamping machines
- Press fitting machine · Inserter · Printing machine
- Various dedicated machines
- Replace hydraulic/Air cylinders with servo motor, etc.

### Functions for press machines

- Easily control the link type servo press
- Improved forming quality by high accuracy pressure control
- Coordinated motion of transfer system with press machine can be performed easily by electric CAM function
- Easily replace hydraulic drive to servo drive with press related functions

### Servo motors and servo amplifiers

- Servo motors, DD motors, and linear motors line-up from small to large models can support to various industrial machines
- Servo amplifiers achieve significant energy savings with power source regeneration and the latest low-loss power devices

### Extensive I/O unit lineup (\*)

- Wide range of I/O units including **FANUC Slice I/O** can support various industrial machines



FANUC Power Motion



Servo Amplifier  
Energy Savings



Servo motors

# for industrial machines

Easier to use, beautiful and powerful  
Contributes to improving productivity and energy saving of industrial machines



i-MODEL A Plus



Achieving



wide range line-up

## Variety of customized functions (\*)

- With standardized easy to used **FANUC PICTURE**, original sophisticated screens can be created very easily.
- A highly reliable capacitive touch panel (**FANUC TOUGH TOUCH**) that supports multi-touch enables consolidation and miniaturization of the operation panel.
- Individualize industrial machines with C language executors
- Built-in high-speed, large-capacity multi-path PMC, and assets can be reused with the function block function.

## Various types of field networks (\*)

- Advancing the IoT adaptability with Multi-function Ethernet and various types of field networks
- Communication with PC and robot can be performed easily via embedded Ethernet
- Various information of machines can be collected and managed by using **FANUC MT-LINKi**

## Easy connection and control of robots (\*)

- Easy connection with Industrial machine and robot
- Robot can be controlled by G code command from CNC
- Robot path can be automatically generated by PC tool

## Advancing Energy saving (\*)

- Advancing significant energy savings through servo motorization of hydraulic/pneumatic mechanisms
- Constant monitoring Power Consumption of industrial machine by Power Consumption Monitor function

## Superior safety functions

- Integrated safety functions facilitate safety of machine by Dual Check Safety (DCS)
- Integration of motion control and safety
- Conformity with International Safety Standard "Functional Safety" ISO13849-1

## High reliability and easy maintainability (\*)

- Hardware built for high reliability allows robust operation in harsh industrial environments
- Enhanced diagnostics improve maintainability so the cause of trouble can be identified quickly reducing MTTR
- USB port can be used to transfer files or upload/download data in the controller using easily obtainable USB flash drives

# System Configuration

## CNC Control Unit (LCD mounted type/stand-alone type)

The display lineup supports a wide range of machines, from compact to large, including the FANUC *i*PC and PANEL *i*H/*i*H Pro with *i*HMI support, a 10.4" LCD unit, and more.



FANUC *i*PC  
24"



FANUC *i*PC  
21.5"



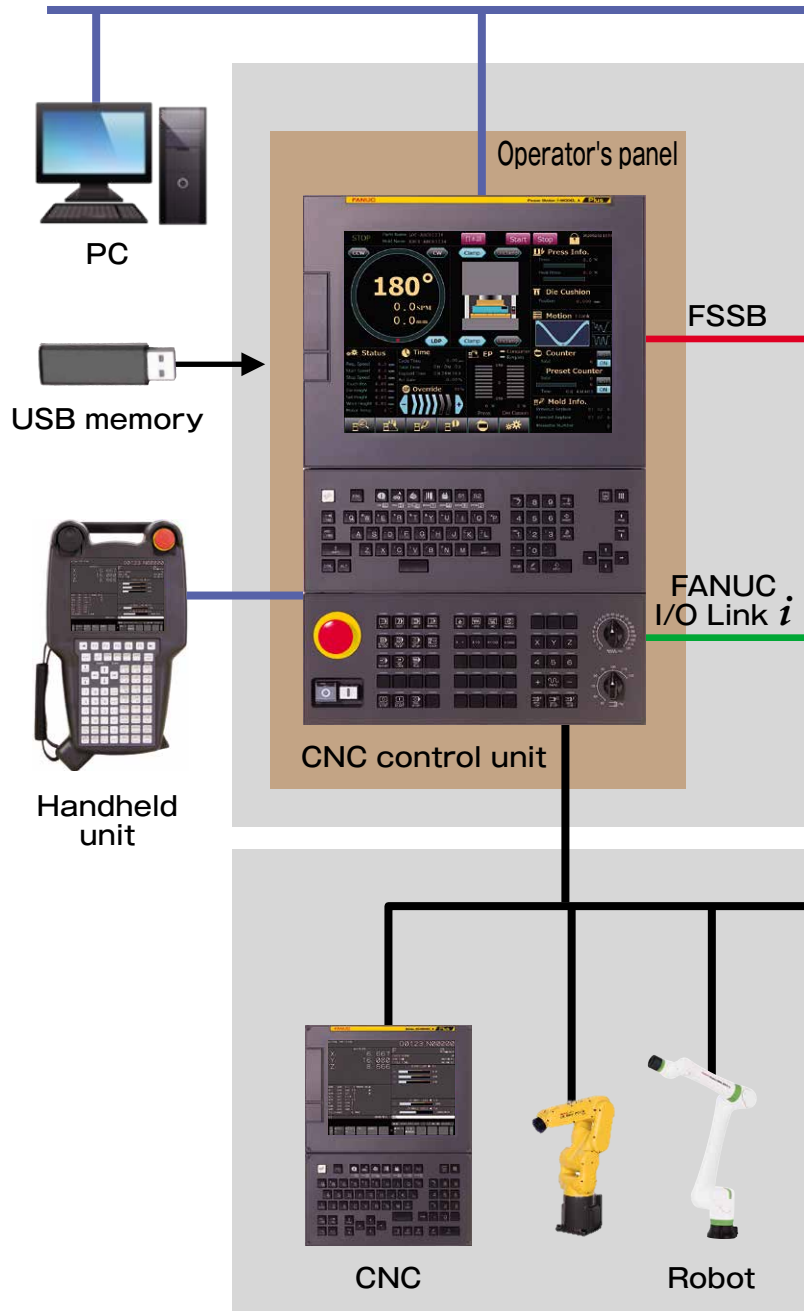
FANUC *i*PC  
15"



PANEL *i*H/*i*H Pro  
19" / 15" / 10.4" LCD



Standard display  
10.4" LCD



## Handheld Unit

Equipped with an emergency stop button and a manual pulse generator, this handy unit line-up achieves safe manual operation of machine tools.



*i*Pendant



Handy Machine  
Operator's Panel



Portable manual  
pulse generator

## I/O Unit

Wide range of I/O units compatible with various installation locations and I/O devices.

### Optimized for operator's panels with its thin and space-saving design

Standard operator's panel with key input duplication



Safety Machine  
operator's panel

Handles the output/input of safety signals



I/O module for operator's panel  
supporting safety function

Compatible with original operator's panels



I/O module for  
operator's panel

### Optimized for control the multi-point output

Small size I/O unit with improved expandability, workability and maintainability



FANUC Slice I/O

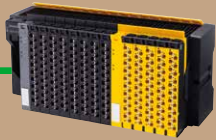
## Ethernet

### Industrial machines

#### Control cabinet



Servo Amplifier



I/O unit



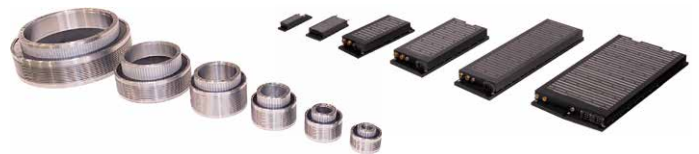
Servo Motor

## Servo Motor

Line-up to meet the various needs of industrial machines and contribute to the energy saving and performance improvement of feed axes



AC SERVO MOTOR  
 $\alpha$ i-B/ $\beta$ i-B series



DD MOTOR  
DiS-B series

LINEAR MOTOR  
LiS-B series

## Servo Amplifier

Line-up to be flexibly available for a variety of industrial machines and contribute to the downsizing of cabinets and energy saving



SERVO AMPLIFIER  
 $\alpha$ i-B series



SERVO AMPLIFIER  
 $\beta$ iSV-B series

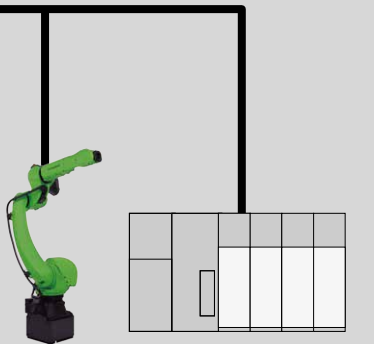


### Field networks

### Peripheral equipment

Compatible with various field networks

- FL-net
- EtherNet/IP
- PROFINET
- Modbus/TCP
- CC-Link IE Field
- DeviceNet
- PROFIBUS-DP
- CC-Link
- EtherCAT



Peripheral device

cabinets with high scalability and extensive modules such as /input type and the analog/digital output/input module

Excellent cost performance with multi-point output/input



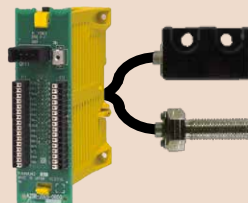
I/O unit for power magnetics cabinet

Compact and with reduced wiring



I/O unit for connector panel

Effective for thermal displacement compensation with multi-point temperature sensor input



Temperature sensor input unit

Optimized for reduced wiring by enabling distributed setup

Can be positioned near sensors scattered inside and outside the machine cabinet

IP67 type



I/O Unit-MODEL B

# Intelligent Servo System with High-Speed, Precision and Efficiency Machining Performance

Promoting High-Speed, Precision, Compact Size and High Efficiency of Industrial Machines

## FANUC AC SERVO MOTOR $\alpha i$ -B series , $\beta i$ -B series DD MOTOR $\Delta i$ S-B series , LINEAR MOTOR $L i$ S-B series

AC SERVO MOTOR, DD Motor and Linear Motor Achieving Servo Drive and High-Speed/High Precision Feed for Industrial Machines

### ● Wide range of sizes

Servo Motor: Motor ranges with continuous torque from 0.16Nm to 18000Nm

DD Motor: Motor range with continuous torque from 15Nm to 4500Nm

Linear Motor : Motor range with peak force from 300N to 21000N

Large servo motors with high torque and high power are suited to large industrial machines. It contributes to the use of electric servos in hydraulic/pneumatic mechanisms, high-speed, high-precision, and energy-saving.



## FANUC SERVO AMPLIFIER $\alpha i$ -B series , $\beta i$ -B series

Compact and Energy Saving Servo Amplifier

### ● Compact size

Downsizing of amplifier is achieved by optimum cooling design, also contributing to control cabinet downsizing.

### ● Energy saving

Power consumption is largely reduced by full line regeneration back to power source.  
Reduction in power loss is achieved by using the latest high efficiency power devices.

### ● Technology for larger output

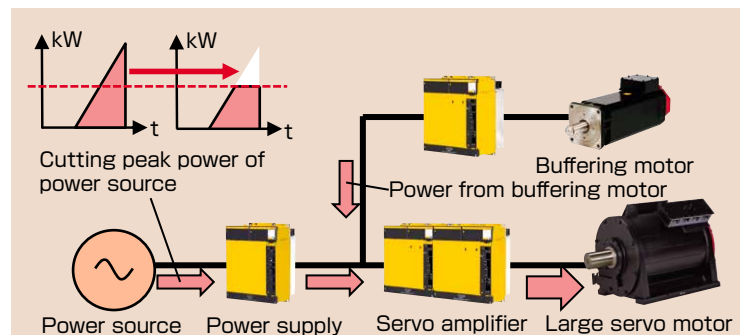
Large servo motors can be driven by multiple standard large servo amplifiers.  
Supporting larger output application by multiple motor drive.



## Reduce capacity of power source by Energy Charge Unit

### ● Cutting peak power of power source

Large servo motor needs high power to accelerate. This function provides power from buffering motor to driving motor, and can cut peak power from power source. By using FANUC AC SERVO MOTOR with high efficiency as buffering motor, the whole system is high efficiency.



## Small size I/O unit contributing to downsizing of control cabinet Ease of Use

### FANUC Slice I/O

Small size I/O unit with superior expandability, workability and maintainability

- Optimizing configuration of I/O units due to extensive module lineup
- Flexibly expanding I/O points by adding I/O modules side by side
- Pre-assembled wires due to removable Front connector contributes to shorter assembling time
- Quick and easy wiring due to push-in type terminal block



# Multi-axis high response motion control

Machining Performance

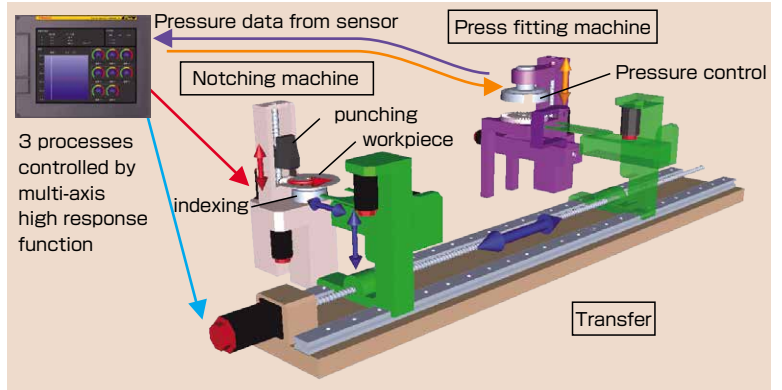
## Multi-axis high response function for quick axis start/stop

### Simultaneous execution of multiple programs.

- Independent motion for each axis can be achieved by ISO G-code program as max. 24 programs can be executed at the same time.

### Quick response is achieved for an external signal.

- Examples of machines where the accuracy can be improved are: notching machines, stamping machines, cutting machines, packaging/wrapping machines.
- High response and reduction of cycle time can be achieved by high-speed ladder execution cycle.
- The pressure control can be achieved with high accuracy by the pressure and position control.



## Enhanced functionality of custom macros and improved performance

- Ease of use has been pursued by adding array variables and SWITCH-CASE branch syntax etc.
- A high-speed model can be selected for machines that frequently use custom macros. The custom macro calculation performance has been greatly improved (more than double the **Power Motion i-A**\*1).

\*1): Results may vary depending on conditions.

# Applicable functions for industrial machines

## Flexible support for various machine configurations by multi-axis and multi-path functions

### One control can support up to 10 paths and 32 axes - this includes multi-axis machines.

- Up to 10 ISO G-code programs can be simultaneously executed. Independent operation such as press operation and loader operation, etc. can be easily achieved. Synchronization between two or more executing programs can be easily achieved by the waiting M-codes function.
- Simple motion profiles can be achieved by using the ISO G-code programs and/or PMC axis control functions.

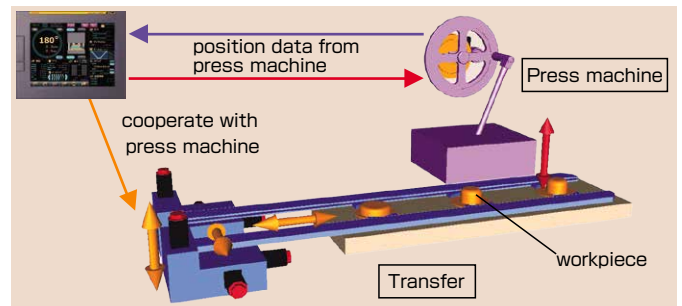
## Integrated functions for press machine

### Control function for link type press

- Link type servo press where deceleration ratio in slider part changes according to the main gear position angle can be controlled easily.

### Electric CAM function

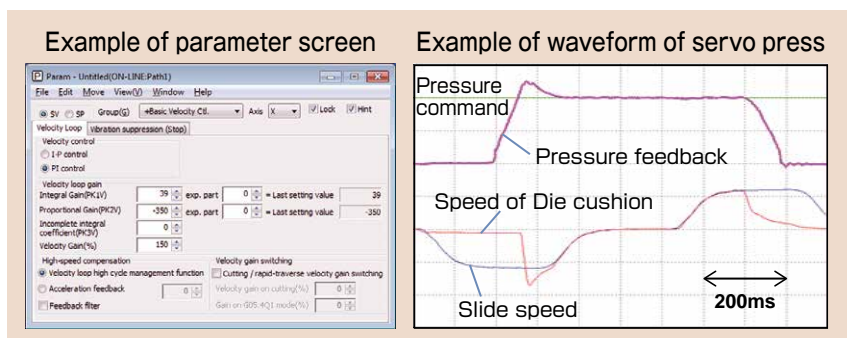
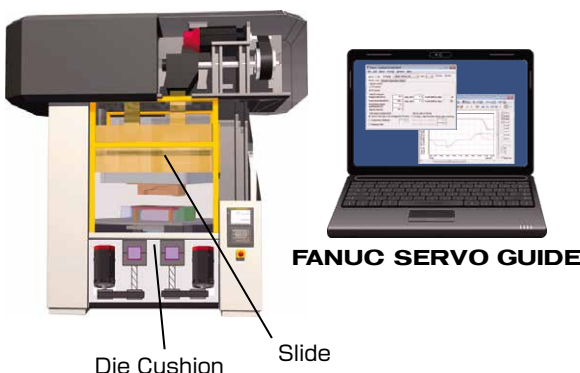
- Synchronized motion between transfer machine and press machine can be performed by electric CAM function.



## Useful servo tuning tool

### FANUC SERVO GUIDE

- FANUC SERVO GUIDE is tuning tool of the servo axis in an integrated manner, including setting parameters and measuring data.
- Observing the motions of each servo axis as waveform data contribute to servo tuning and trouble shooting of industrial machine.



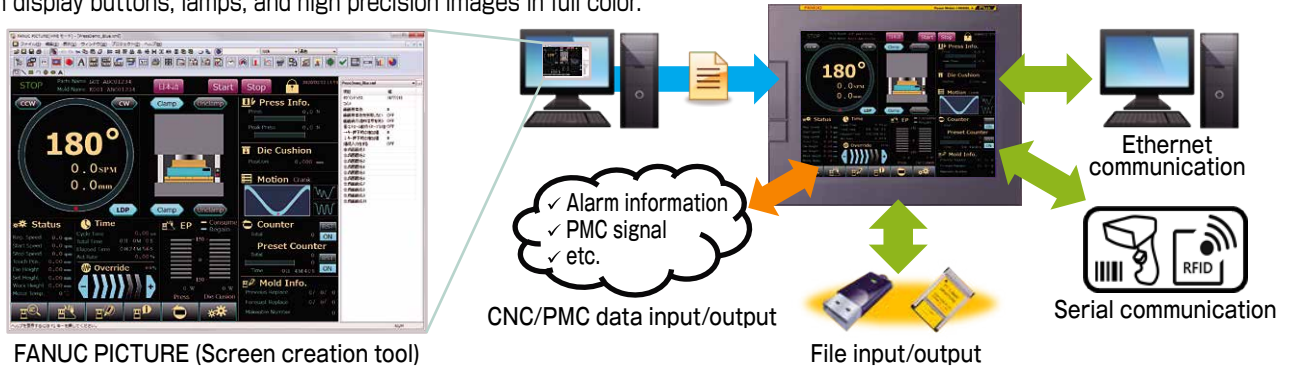
# Many Customizable Functions

Ease of Use

## FANUC PICTURE

This tool enables you to create a machine operation screen simply by pasting screen components such as buttons and lamps on the PC.

- The screen creation tool is FANUC's proprietary easy-to-use user interface that is optimized for creating screens for CNCs.
- A screen usable on a display unit with or without a touch. Complicated controls such as network communication and file control can be easily implemented by using general-purpose scripts. In addition, in the PANEL *i*H series display device, it is possible to create screens that leverage the performance of display devices.
- You can display the font for each language of any desired size.
- You can display buttons, lamps, and high precision images in full color.



## C Language Executor

- In addition to standard ANSI functions, many functions are available for controls and PMCs.
- High-level tasks to which high execution priority is assigned can monitor signal and position information.

# Powerful PMC

Ease of Use

## High-Speed, Large Capacity, and Multi-path PMC

### High-Speed and Large Capacity

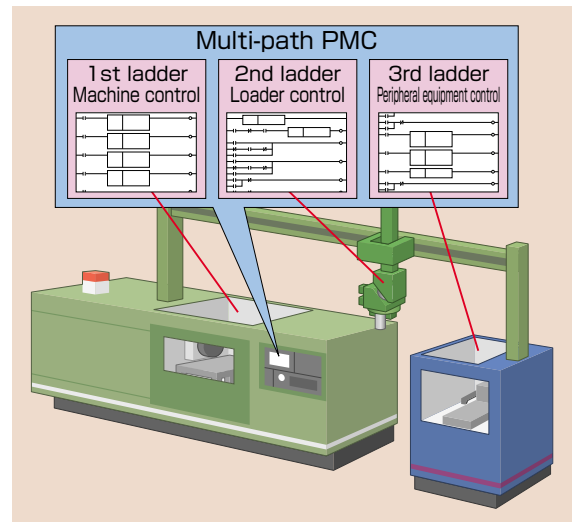
The internal PMC functions can also process large-scale sequence control at a high speed through the use of a powerful dedicated processor and the latest custom LSI.

- Program capacity Max. 300,000 steps (Total of all PMC paths)
- Internal relay (R) Max. 60,000 bytes
- Data table (D) Max. 60,000 bytes
- PMC paths Max. 5 paths (Max. 40 ladder programs)

### Multi-path PMC

One PMC can execute up to five independent ladder programs, including loader control and peripheral equipment control.

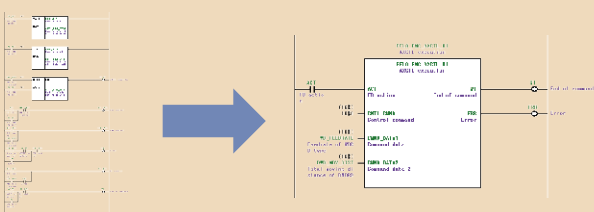
- Ladder programs can easily be developed according to each user's machine configuration.
- Cost reductions are achieved by eliminating external PLCs or other devices for peripheral equipment control.



## Function Block function

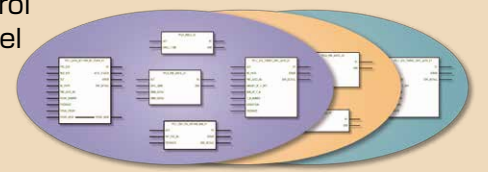
- This function enables repeated ladder circuit patterns to be arranged in function blocks and easily reused.
- The PMC function libraries attached to FANUC LADDER-III include functions ready for immediate embedding such as PMC axis and peripheral equipment control, and can be freely customized.

### Reuse ladder circuits as function blocks



### A full range of libraries are included in FANUC LADDER-III

- PMC axis control
- Operator's panel
- I/O devices
- CNC functions
- Others





# Network Support Functions

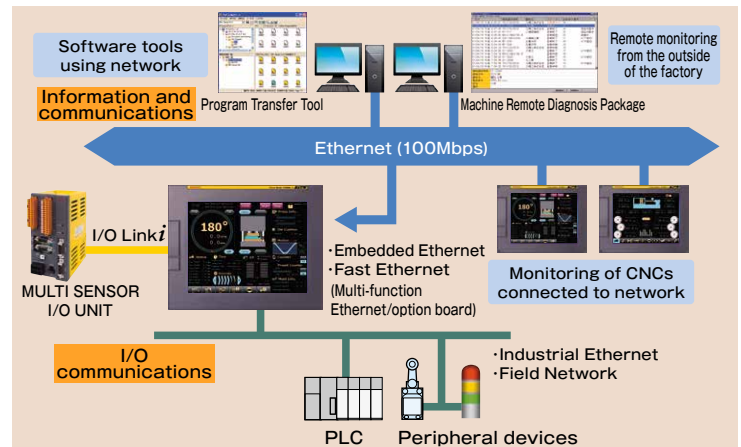
Ease of Use

Advancing the IoT adaptability of industrial machines with extensive network functions

## Ethernet / Industrial Ethernet / Field Network

Multi-function Ethernet is included as standard in addition to embedded Ethernet. Moreover, information communication functions such as NC program transfer and remote diagnosis are supported as standard, as is control I/O communication. Multi-function Ethernet enables high-speed communication using a dedicated processor, and can be used for various types of industrial Ethernet communication.

Various types of field networks are also supported as options. Industrial Ethernet and field networks enable connection with various peripheral devices, that includes the control of peripheral devices such as waterproof I/O devices and the collection of sensor information. It is also possible to read information from collision sensors, temperature sensors, etc., through an I/O Link *i*-connected multi-sensor I/O unit.



## Supported Industrial Ethernet/Field Networks

- FL-net
- EtherNet/IP (master/slave)
- PROFINET (master/slave)
- Modbus/TCP (slave)
- CC-Link IE Field (slave)
- DeviceNet (master/slave)
- PROFIBUS-DP (master/slave)
- CC-Link (slave)
- EtherCAT (master)

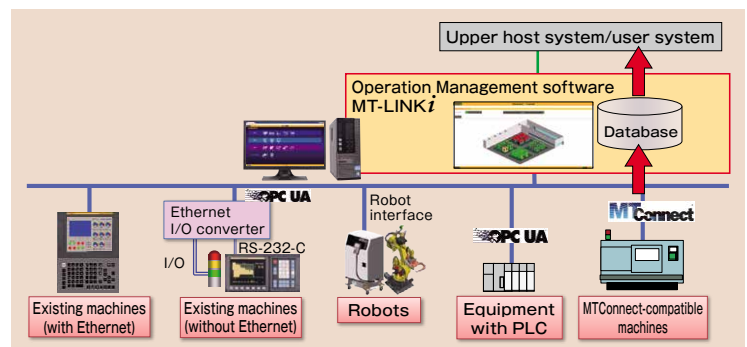
## FANUC MT-LINK*i* (Operation Management Software)

### MT-LINK*i*

MT-LINK*i* is a software product that can collect, manage, and help visualize various information of machines connected via Ethernet.

It helps visualize the machines in factories, and contributes to minimizing downtime.

- It can collect device information not only from industrial machines equipped with FANUC CNCs, but also from FANUC robot controllers, OPC-compatible PLCs, and MTCConnect-compatible machine tools.
- Information of existing devices that do not have Ethernet I/F can also be collected by using an Ethernet I/O converter.
- Many standard screens that display various pieces of information such as the operational states and operational results of machines are available.



### Standard screen example)



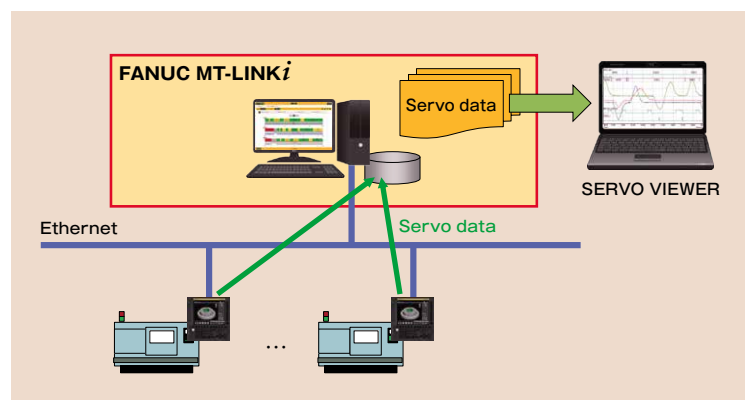
Overview screen

Operational results screen

## Visualization of machine operation

A combination of MT-LINK*i* and SERVO VIEWER makes servo data and various status signals to be collected, achieving the visualization of detailed machine operations.

- High-speed sampling (1 ms) servo data is efficiently collected from multiple machine tools.
- Various schedule and trigger functions enable efficient analysis by collecting only required data at the right timing.



# Easy Robots Connection and Control

Ease of Use

## Easier to connection and control of robots

Equipped with the following functions that allow you to quickly and easily introduce robots to industrial machines.

### Robot Control by G-CODE Command

It is possible to control the robot from CNC.

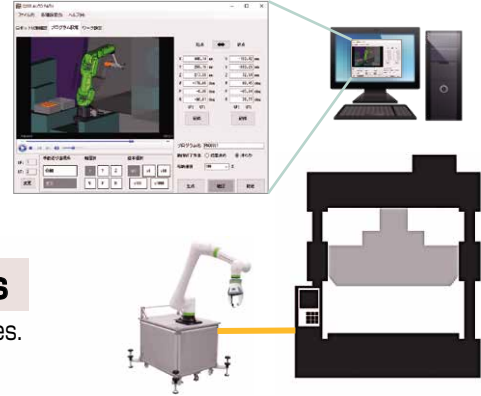
- By using CNC program (G-code commands), robots can be controlled like a loader
- By using familiar industrial machine's handles, robots can be positioned and taught easily from CNC screen



### Automatic Robot Path Generation

This function makes it possible to automatically generate a robot path that does not interfere with PC tools.

- Automatically generate path that does not interfere with the machine tool just by specifying the start point and end point
- The generated path can be confirmed by simulation, reducing man-hours for teaching robot.



### Coordination with robots using macro variables

Robots can be installed on existing machines without changing industrial machines.

- No need to change ladder and software of industrial machines
- Coordinating CNC and robot operations using custom macro variables

# Advancing Energy Saving

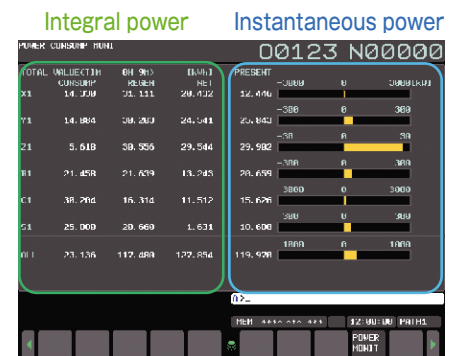
Ease of Use

## Monitoring Power Consumption of Industrial machine

### Power Consumption Monitor Function

It can be checked the power consumption data of the servo and spindle axis and the energy saving effect of power regeneration on the power consumption monitor screen. It can also be read using the PMC window, FOCAS2 function, etc., and it is possible to promote energy saving by monitoring the power consumption of industrial machine.

- Equipped with power consumption monitor screen as standard
- Constant display of power consumption bar graph is possible
- It is possible to create your own application by acquiring power data with the PMC window and FOCAS2 function.



# Safety Functions

Ease of Use

## Integration of Motion Control and Safety Function

### Dual Check Safety Function

This is a safety function integrated into the CNC that conforms to ISO 13849-1 PL d.

Multiple processors perform dual monitoring of the actual positions, speed, and safety-related I/O of servo motors and spindle motors, securing a high level of safety by providing duplicated paths for cutting off power.

### Network safety function

By combining this function with the Dual Check Safety function, safety functionality of the machining line is achieved.

- Safety function by FL-net
- EtherNet/IP Adapter Safety function
- PROFINET IO Device Safety function
- PROFINET I/O Controller Safety function

### Safe Torque Off (STO) function

This is a safety function integrated in servo amplifiers that conforms to IEC 61800-5-2.

Motor power can be safely cut off by the duplicated cut-off path within the amplifier.

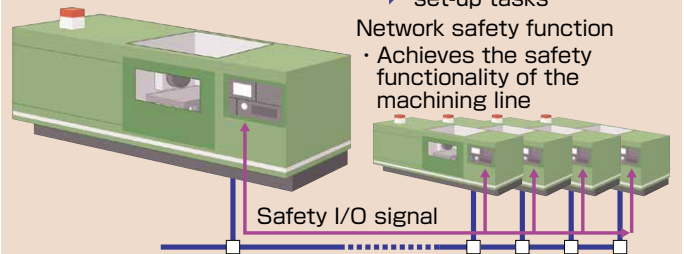
#### Dual Check Safety Function

- The machine can be operated safely while the protective door is open

→ Optimization of set-up tasks

#### Network safety function

- Achieves the safety functionality of the machining line



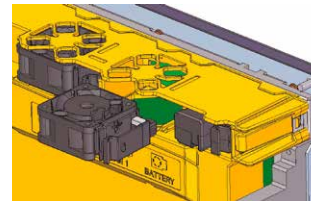
# Easy Maintenance

## Functions for maximizing uptime

### Contribution to 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.



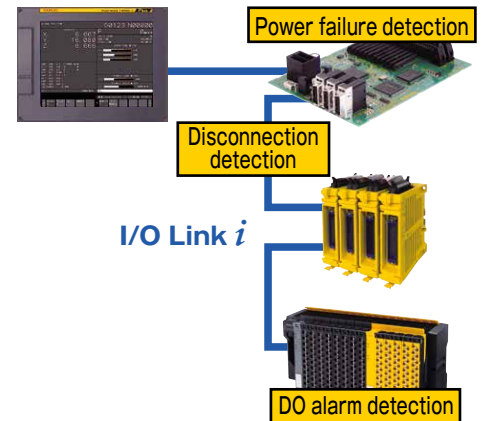
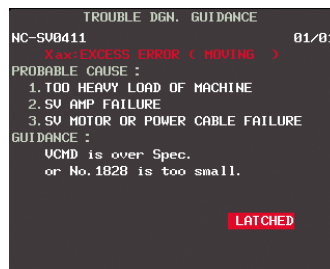
### Failure Part Detection

#### Trouble Diagnosis 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 that, I/O Link *i* can detect the ground fault of each DO.

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

- Trouble diagnosis guidance screen
- Trouble diagnosis monitor screen
- Trouble diagnosis graph screen



#### Encoder Communication Check Circuit

This check circuit enables a quick recovery from encoder communication alarm by identifying which part such as encoder, feedback cable or servo amplifier has failed.



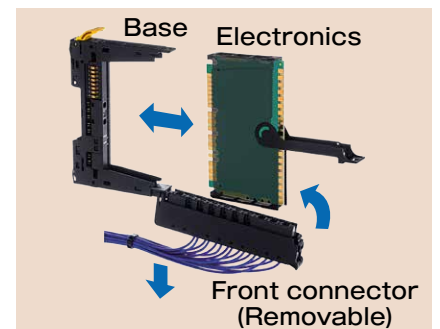
### Reduction of Recovery Time

#### FANUC Slice I/O

Exchangeable of electronics housing without removing wires due to 3-Pieces Structure; "Front connector", "Electronics" and "Base".

In addition to that, following functions can easy detect failure module.

- LED indication for each signal state and unit status
- Enable voltage check of each I/O terminal
- Display nickname of each module on the front of module



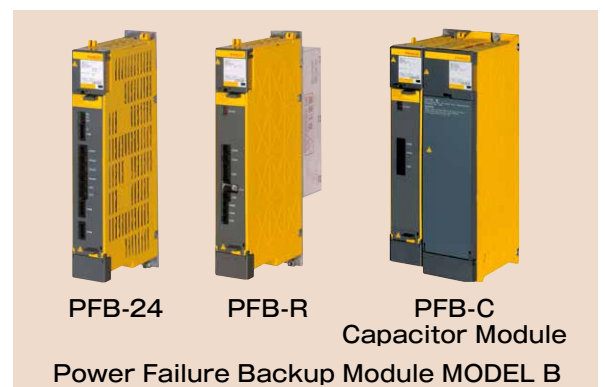
### Prevent Machine Damage at Power Failure

#### Machine Protection at Power Failure

Damage of machines and workpieces at power failure is prevented where a power supply is unstable or in a lightning-prone areas.

- Gravity-axis drop prevention  
The holding brake of gravity axis are quickly activated by detecting power failure in the circuit incorporated into the amplifier.
- Stop distance reduction \*1)  
Feed axes are quickly stopped to avoid a crash in high-speed machine tools.

\*1) "Power Failure Backup Module (Hardware)" or "Power Failure Backup Function (Software)" shall be applied.



# Service & Support

## 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.



## FANUC CORPORATION

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