Evolving Servo System with High Speed,
High Precision and Energy Efficiency

FANUC

αi-D series SERVO

Evolving Servo System with High Speed, High Precision and Energy Efficiency

FANUC αi-D series SERVO

- Servo motor : Increased smoothness
- Spindle motor : More power and torque
- Control : Higher precision and quality

Machining performance

CNC

FANUC Series 500*i*-A

0*i*-F Plus, 30*i*-B Plus, Power Motion *i*-A Plus

FSSB (FANUC Serial Servo Bus)

FANUC SERVO AMPLIFIER αi-D series

FANUC SERVO MOTOR αi-D series

FANUC SPINDLE MOTOR αi-D series

LINEAR MOTOR

DD MOTOR

BUILT-IN SPINDLE MOTOR

Energy conservation

- Highly efficient motors
- Highly efficient current control
- Power regeneration as standard
- Amplifiers with low-loss power devices
- Low-loss AC reactor

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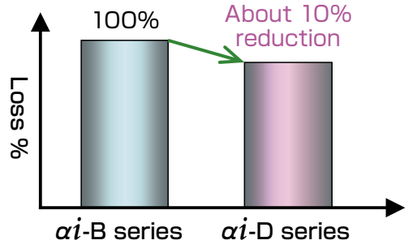


Compared to αi-B series
(Under continuous rated output)

- Improved durability against cutting fluid
- Trouble prediction
- Quick maintenance

Maximizing uptime

- Downsized and reduced wiring
- Easy setting and tuning
- Convenient sizing

Ease of use

Servo motor

Applicable to feed axes of various machines

・A wide line-up range for feed axes of various machines

αiS-D series ・・・ Achieve high-speed and high-acceleration

αiF-D series ・・・ Achieve exceptional smoothness

・Newly added 200 sq. flange size model increases the servo motor choices available for large machines.

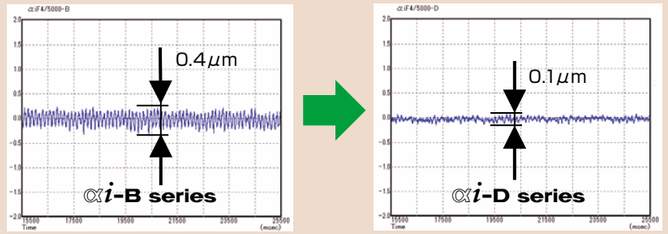
・Productivity is improved by raising maximum speed of live tool motors (40, 60, 90 sq.) to 8000min^{-1}.

Achievement of high-speed, high-accuracy, and high-quality machining

High-accuracy, high-quality machining

・αi-D servo motors have been improved to achieve higher accuracy, lower cogging torque, and faster communication speed with the Pulsecoder. Higher response and machining quality are achieved with the combination of αi-D servo amplifiers and servo HRV control.

Ex.) αiF4 (130 sq.) feed accuracy



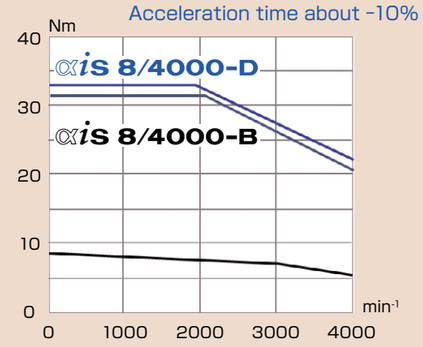
[Conditions] Feed rate 6min^{-1}, Lead 10mm/rev conversion

High-speed machining (Reduction of cycle time)

・Enhanced maximum torque characteristics contribute to quicker acceleration and shorter cycle time.

・Increased maximum speed contributes to positioning operations at high feed rates and shortens cycle time.

Ex.) αiS8 (130 sq.) torque characteristic



Battery replacement unnecessary

Battery-less Pulsecoder

・Battery-less Pulsecoder can be selected for all servo motors.

・Battery change in all axes including peripheral axes is not required.

Battery-less Pulsecoder

Spindle motor

Applicable to various machining

・A wide variety and range of line-up meets various machining needs of machine tools.

αiI-D series ・・・ Achieve excellent machining performance with high-speed and high-power

αiIP-D series ・・・ Realize high-torque with smaller amplifier

αiIT-D series ・・・ Enable center-through coolant by hollow shaft

αiIL-D series ・・・ Attain low temperature rise and high-torque with liquid-cooling

αiS-D series ・・・ Create high-power and high-acceleration by using neodymium magnets

・Models for lathe, suitable for belt drive with higher allowable radial load, are also available.

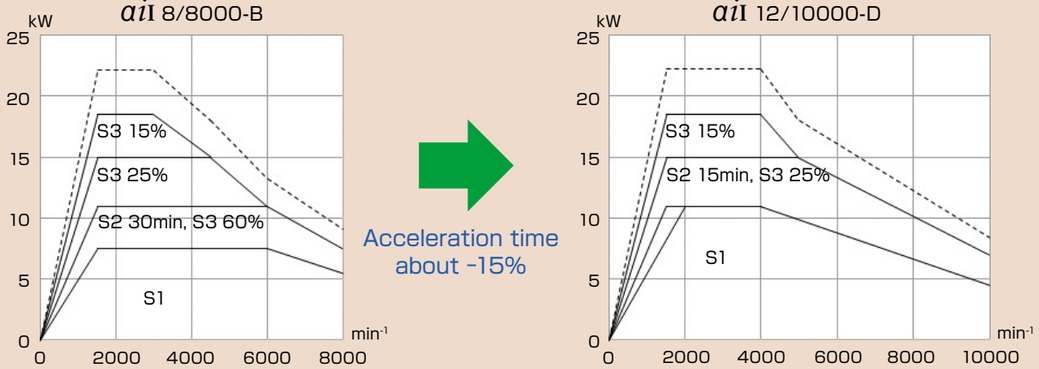
Higher machining performance

・Enhanced maximum output characteristics contribute to quicker acceleration up to high-speed range and shorter cycle time.

・Superior continuous output characteristics contribute to high-efficiency machining.

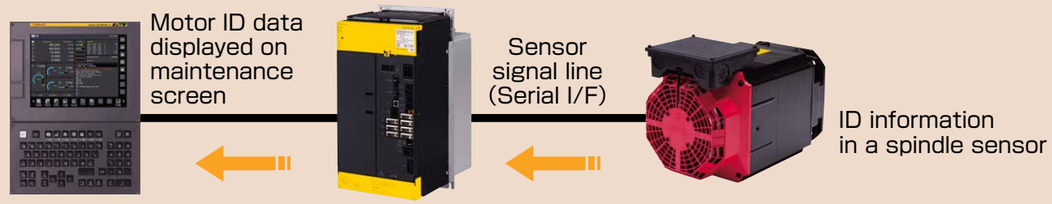
・Increased maximum speed contributes to wider application range of machining.

・Vibration class of V3 as standard contributes to high-accuracy machining.



Visualization of spindle motor information

・Information such as Motor ID is available on CNC screen and contributes to improvement of motor traceability.



Servo Amplifier

Flexible combination for various machine configurations

Separated-type amplifiers

・The best suited arrangement according to various machine layouts is possible with the combination of servo amplifiers, spindle amplifiers and common power supplies.

αi**SV-D series** : “Servo amplifier”, which drives servo motors
αi**SP-D series** : “Spindle amplifier”, which drives spindle motors
αi**SVP-D series** : Multi-axis amplifier which has servo axes and spindle axes
αi**PS-D series** : “Common power supply”, which supplies main power for driving motors

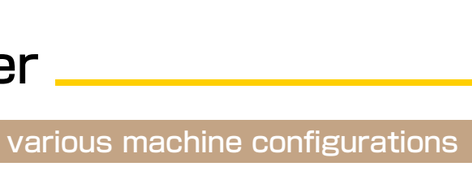
Integrated-type amplifiers

・The integrated-type amplifiers achieve downsizing and simple wiring by integrating servo axes, spindle axis and power supply.
・Additional separated-type amplifiers can be installed with αi**PSVSP-D** easily by connecting directly with DC-link short bars.

αi**PSVSP-D series** : Common power supply, Servo amplifier and Spindle amplifier integrated amplifier
αi**PSV-D series** : Common power supply and Servo amplifier integrated amplifier

AC Reactor

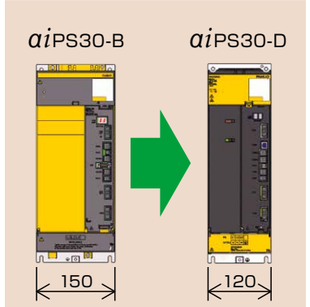
・The design has been renewed by adopting a unique new hexagonal structure, which reduces losses and contributes to energy conservation.
・The thermostat provides overheat protection for the AC reactor.

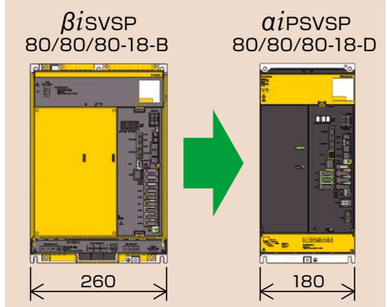


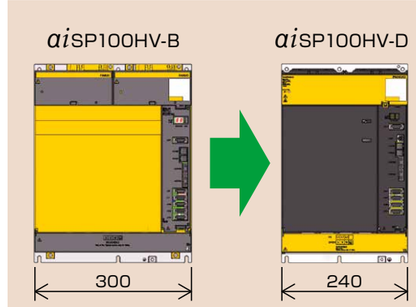
Downsizing of a control cabinet

Smaller amplifiers

・The width of amplifiers are reduced by up to 30% compared with previous models.

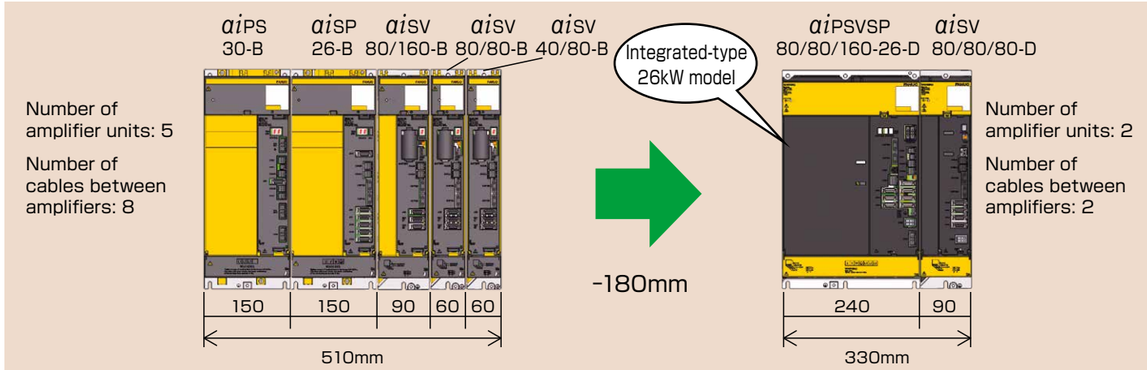






Expanded line-up of multiple-axis amplifiers

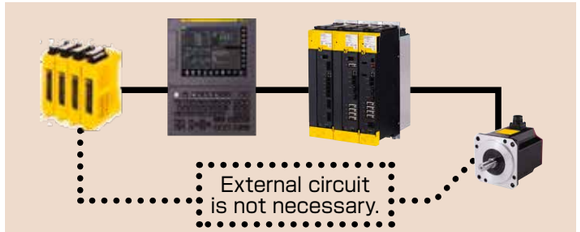
・The use of suitable multiple-axis amplifiers realizes downsizing of a control cabinet, and simplified wiring with a reduced number of amplifier units.



Reduction of devices in a control cabinet

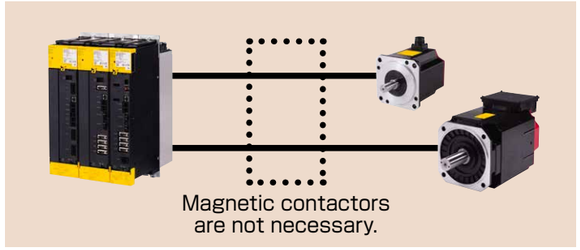
Brake control circuit in amplifiers

・The circuit to control holding brakes of servo motors is built into servo amplifiers.
・It is not necessary to prepare brake control circuits separately and also wiring for control signals via I/O units.
・This feature contributes to downsizing, simple wiring and cost-saving of a control cabinet.



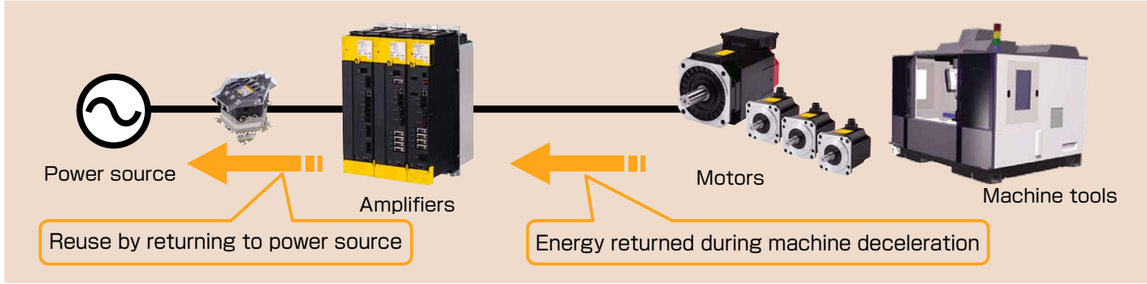
Safe Torque Off (STO) function

・Motor power can be cut off safely by the duplicated cut-off circuit in amplifiers, conforming IEC 61800-5-2.
・It is not necessary to prepare magnetic contactors to cut off motor power.
・This feature contributes to downsizing, simple wiring and cost-saving of a control cabinet



Saving energy with power regeneration method

・Amplifiers (excepting for αi**PSV-D**) save energy by returning regenerative energy during deceleration to power source without heat dissipation loss, which is also applied in conventional models.

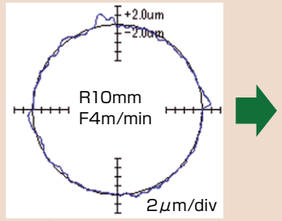


Servo Control

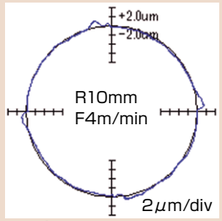
Servo control to achieve high-speed and high-accuracy

SERVO HRV+ Control (High Response Vector)

- In αi-D series SERVO, rotational smoothness of SERVO MOTOR, current resolution of SERVO AMPLIFIER, and communication speed of PULSECODER are improved. High-speed and high-accuracy machining at nanometer level can be achieved thanks to higher servo gain by both the latest SERVO HRV+ control and hardware enhancement. The automatic-following HRV filter can suppress mechanical resonance even when its frequency changes.
- Higher cycle of position and velocity control can be used in FS500i-A. It will improve the smoothness of axis movement.



αi-B series servo

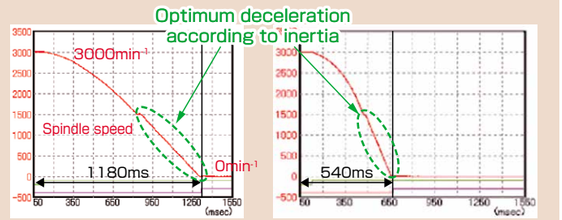


αi-D series servo

Spindle control to achieve high-response and high-efficiency

SPINDLE HRV Control (High Response Vector)

- High-speed current control achieves the high-gain control and the low heat generation of motors at high-speed rotation which leads to energy conservation.
- Optimum Orientation function enables the optimum deceleration according to the inertia of workpieces or tools, and cycle time can be reduced.
- Nano Interpolation in position control enables Nano CNC system for spindle axis as well as feed axis.



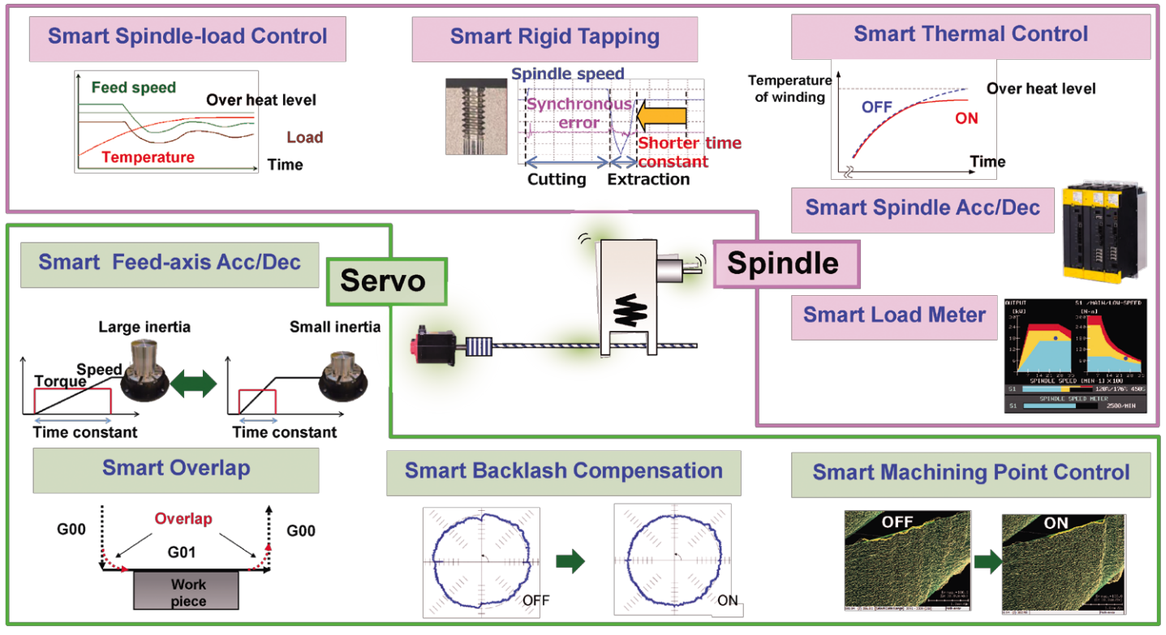
Large inertia　　Small inertia

Optimum Orientation (example)

Smart Servo Control

Optimizing control in real time

Smart Servo Control is a group of functions to optimize control in real time according to the change of machine conditions such as load, temperature and position. High-speed, high-accuracy and high-quality machining can be achieved by using these functions.

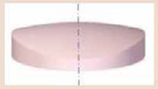


Servo Learning Control / Servo Learning Oscillation

- Servo Learning Control enables high-speed, high-accuracy machining of workpieces that require repeatable cutting commands, such as aspherical workpieces, gears, and so on.
- Servo Learning Oscillation accurately follows high frequency oscillation commands, thereby ensuring reliable chip shredding during turning and drilling.

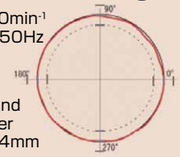
Example of the application of Servo Learning Control

Aspheric lens



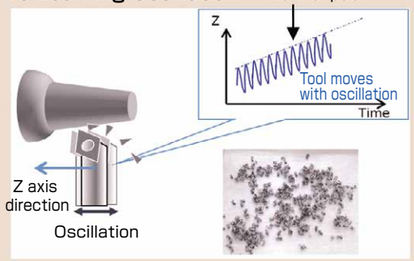
Piston (Non-cylindrical)

Example of piston machining



Combinations with a DD or liner motor are particularly effective for achieving high-accuracy machining.

Servo Learning Oscillation

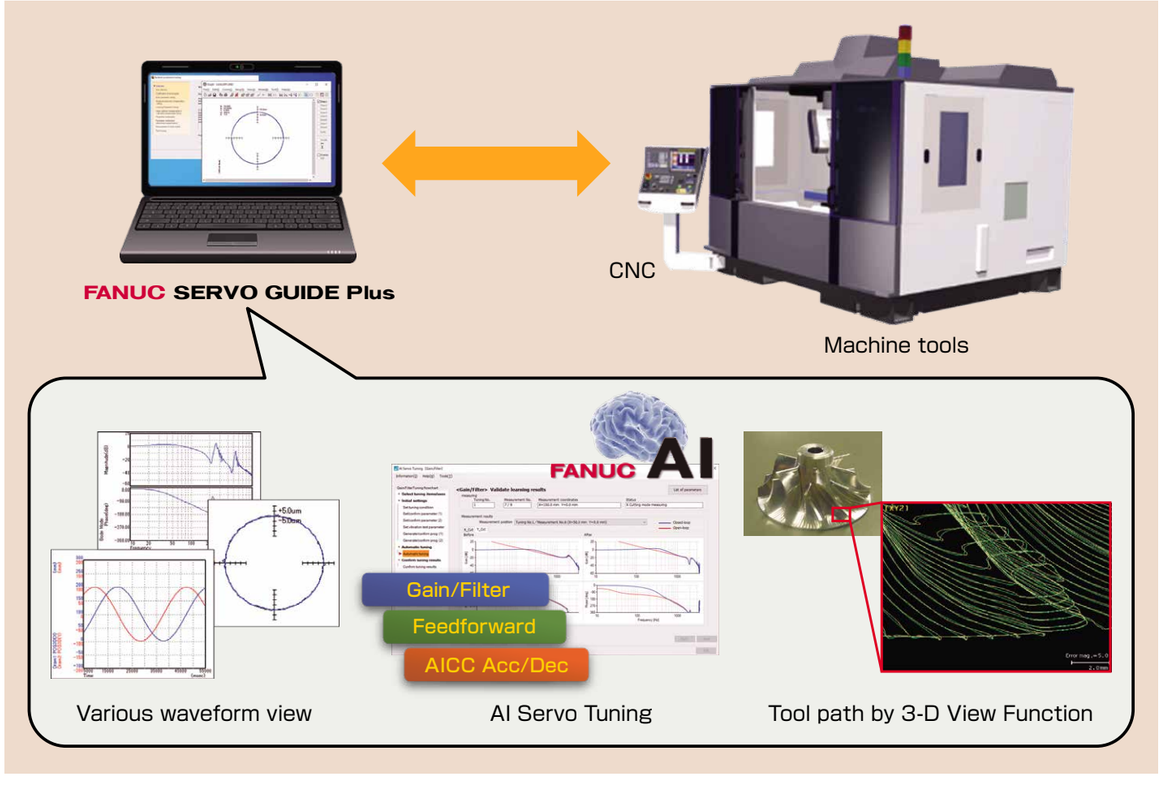


Servo Tuning Tool FANUC SERVO GUIDE Plus

Integrated tuning tool for Servo and Spindle

SERVO GUIDE Plus helps to improve machining performance through the various waveform analysis and the optimization of servo/spindle parameters according to machine characteristics.

- All in one package for servo tuning including data measurement, parameter management and test program preparation
- Various views of waveform helps easy analysis of machine condition
- AI Servo Tuning is an auto-tuning algorism with artificial intelligence. It can optimize parameters easily and in a short time.
- 3-D View Function (option) visualizes the tool path and path error and helps trouble shooting of 5-axis machining



Maximizing Uptime

Reliable　Improving of reliability for cutting fluid

Servo motor IP67 as standard

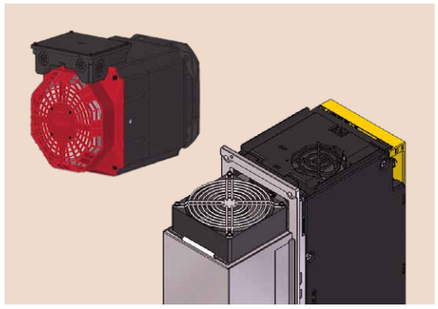
Adopting new IP67 connector, sealing parts and an improved sealing structure has achieved higher cutting fluid resilience than former models.
αi-D series servo motors are IP67 as standard (200 sq. or less).

Spindle motor

The risk of penetration of cutting fluid from shaft-through portion is reduced by improved seal structure of labyrinth for high-speed models.
The environmental durability for high-speed models is enhanced.

Molded Fan Motor

Molded fan motors have been adopted, in which the coils and printed circuit board are molded with resin.
Molded fan motor has high durability against coolant and prevents the failure of fan motor by itself.



Predictable　Trouble Prediction Function

Unexpected machine stop is prevented, and preventive maintenance becomes available, by detecting anomaly signs of the motor, amplifier, and fan motor.

Leakage Detection Function

Leakage detection function measures the insulation resistance of the motor and detects insulation deterioration.
All αi-D servo amplifiers, including Integrated-type amplifiers have this leakage detection function.

Capacitor Check Function

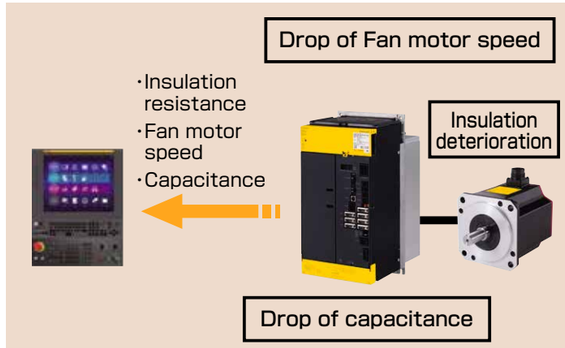
Capacitor check function measures the capacitance for main circuit in servo amplifier and detects drop of capacitance.

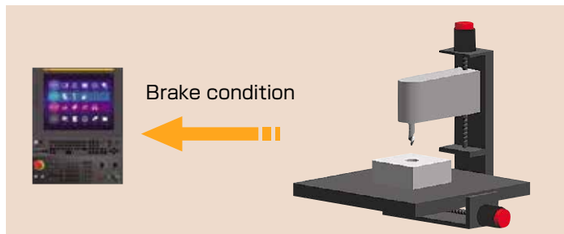
Fan motor speed detection function

Fan motor speed detection function measures the speed of the fan motor in servo amplifier and detects drop of fan motor speed.

Brake check function

The brake check function measures the brake condition and detects a failure of the brake.



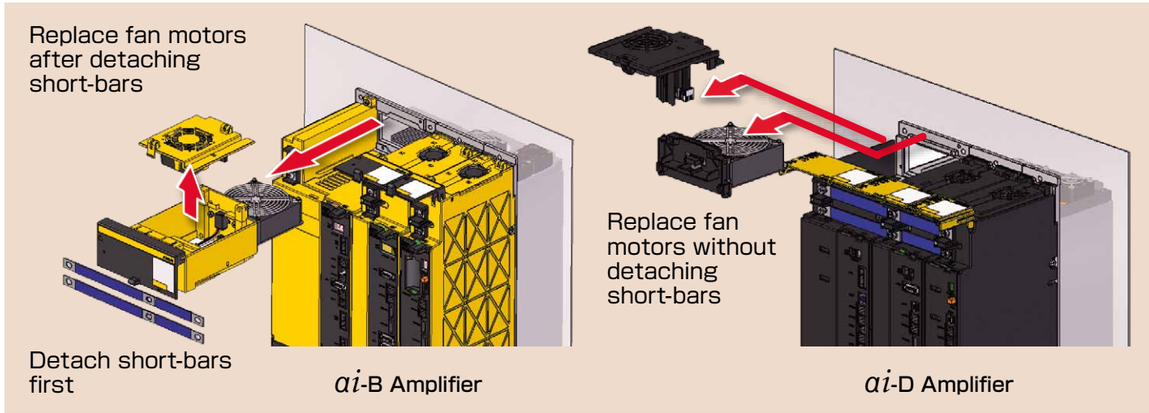


Fan motor stop detection function for Spindle motor

Detection of a stopped spindle motor fan is realized by the addition of thermostat to the fan motor.
Preventive maintenance is possible before overheating of spindle motor since a fan motor "WARNING" will be displayed on the CNC.

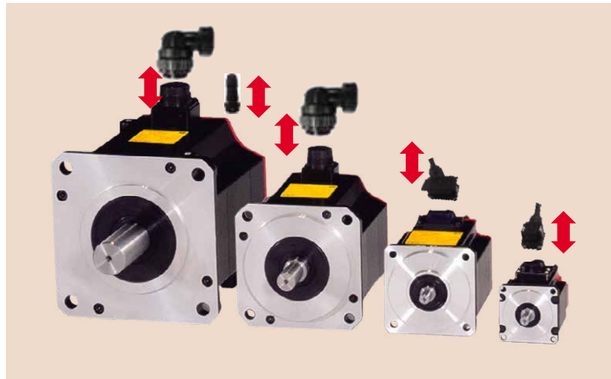
Easy to repair　Quick Replacement of Fan motor

Fan motors can be replaced from the front of amplifiers without detaching amplifiers from a cabinet and disconnecting wiring.
Fan motor replacement time is greatly reduced.



Easy to repair　One-touch connector

One-touch power connector usage is added for small servo motors.
Both of power and signal connector can be attached and detached with a single touch.
One-touch connectors contribute to reducing maintenance time.



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.

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