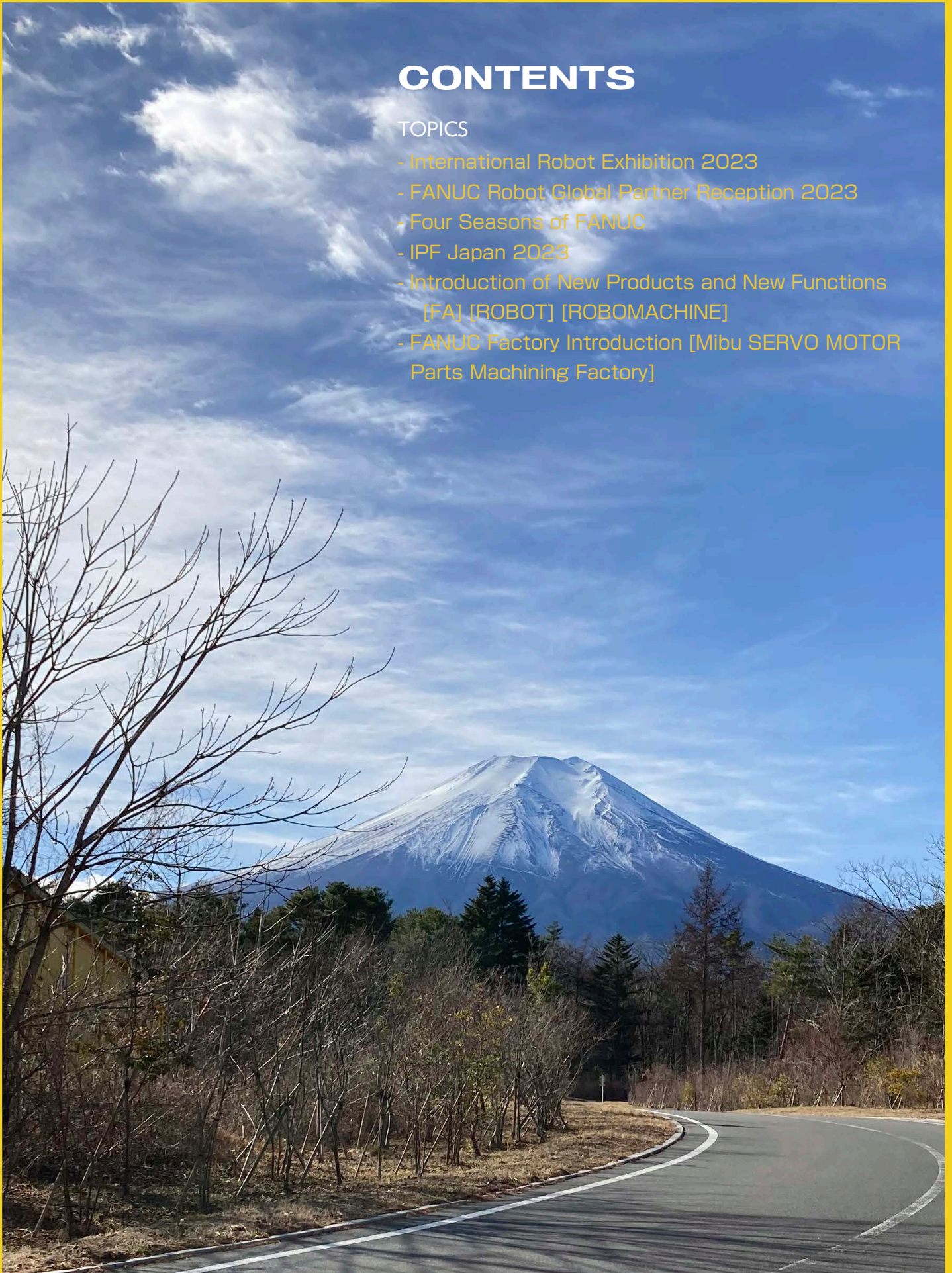


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International Robot Exhibition 2023



The International Robot Exhibition was held at Tokyo Big Sight for four days from November 29 (Wed) to December 2 (Sat).

Partly because it was the first robot exhibition to be held after the downgrading of COVID-19 to Class 5, the event attracted a huge number of visitors, surpassing the attendance in 2019 which was before the pandemic.

FANUC had 39 exhibits under the theme of "Solve the labor shortage problem with FANUC ROBOTS!" To showcase FANUC's collaborative robots, FANUC exhibited the CRX series along with the CR-35iB, and gathered much attention. The CRX series can easily and quickly be used in production lines across various fields, including the food industry, which is experiencing a serious manpower shortage. The CR-35iB caught interest in having a maximum payload of 50kg.

For logistics, where urgent robotization is similarly needed,

the new M-710 model was introduced. With a curved arm, it can work with cage trolleys having depth.

The dynamic demonstration of the new M-950 robot with a payload of 500kg, showed how it can transport large automotive body parts even in crowded automotive manufacturing lines, by taking advantage of the above and back areas of the robot, thus saving space.

Furthermore, unlike dedicated machines, a high rigidity robot performed 3D machining of a large variety of workpieces which were also complex in shape.

Besides these robot systems, other new products and offerings were on display, such as the new robot controller which was renewed for the first time in 11 years to be compliant with international cybersecurity standards, the next-generation ROBOGUIDE (system design support tool) which provides a brand new UI and uses a VR goggle to check systems more realistically, an IoT product for robots (Zero Down Time), FANUC's services, and approaches to energy saving and carbon neutrality. Visitors were captivated with FANUC's versatile capabilities.



Experience easy teaching using the wrist button



Lineup that now includes food grade collaborative robots



Loading and unloading to and from moving hangers



Introduction of Plugin peripheral devices for easy set-up



Cake decoration by robots using manual guided teach



Transport of castings using a 50kg payload collaborative robot

Collaborative Robots



Working with a deep cage trolley



Transporting an automotive seat

New M-710 robot



3D machining



Friction stir welding

High rigidity robot



High-speed transportation by food-adaptive robots

SCARA Robot and Delta Robot



500kg payload robot transporting an automotive body panel

New M-950 robot



Presentation of FANUC's approach

IoT products and FANUC's services



Compliant with cybersecurity standards

New robot controller



VR goggle for checking as if in real scene

Next generation ROBOGUIDE



Presentation of FANUC's approach

Energy saving and achieving carbon neutrality

FANUC ROBOT GLOBAL PARTNER RECEPTION 2023

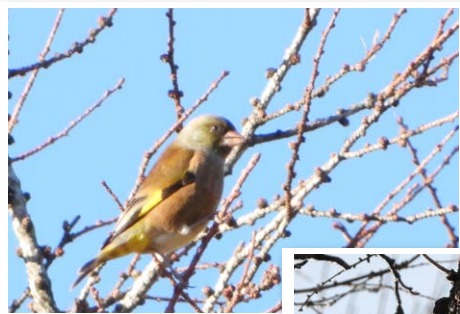


FANUC held the FANUC ROBOT GLOBAL PARTNER RECEPTION 2023 on November 30 (Thu) to coincide with the International Robot Exhibition. It was attended by 139 global partners who sell FANUC robots domestically and abroad. 44 trophies were awarded to partners in gratitude for their daily sales activities. Wuxi Lead Intelligent Equipment in China was the winner of the grand prize. Edgewater Automation in the US, VMI HOLLAND in the Netherlands, and SANY Robotics Technology in China received special prizes. The reception was an opportunity to strengthen relationships with global partners and feel their strong motivation toward future sales. It was a great success.



Four Seasons of FANUC

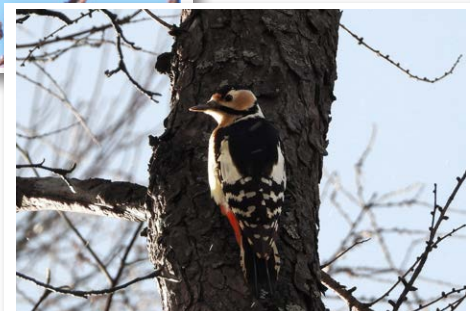
Birds which flock to the forests in and around FANUC.



Greenfinch



Long-tailed tit



Pygmy woodpecker



Brambling

IPF Japan 2023

For five days from November 28 to December 2, IPF (International Plastic Fair) Japan 2023 was held at Makuhari Messe in Chiba Prefecture. This was the first face-to-face exhibition in six years since 2017, as IPF Japan 2020 was held online due to the pandemic.

The theme of FANUC's booth was "Smart Machine, Smart Factory." A molding system consisting of seven units combining the latest ROBOSHOT α-SiB series, articulated robots and network technologies was exhibited. The practical exhibit leveraging the latest molding technologies and automation technologies was highly appraised.



In the exhibition area for energy saving and environmental friendliness, the latest energy saving technologies of the ROBOSHOT, such as the plasticizing energy monitor and insulated jacket, along with being capable of using biodegradable resin and recycled resin with their low environmental impact, attracted a high level of interest.

In particular, many voiced high expectations for using the plasticizing energy monitor to set molding conditions for low energy consumption.



The exhibit showed various molding fields that are supported, such as insert molding of automotive components using thermosetting resin and MIM (Metal Injection Molding). Visitors spoke highly of the exhibit as being a valuable reference for future developments in molding.

At the mold machining factory exhibit, FANUC's compact machining center - the ROBODRILL α-DiB Plus series, and the wire electrical discharge machine - the ROBOCUT α-CiC series, were on display. The ROBODRILL α-DiB Plus is FANUC's latest series that supports high-precision mold machining. With this exhibit, visitors could witness FANUC's comprehensive capabilities in injection molding.



FANUC's booth was a huge success, attracting not only an abundance of domestic customers, but also many overseas customers as well. Our gratitude is extended again to those who visited our booth.

Introduction of New Products and New Functions

FA New Product FANUC CNC Reflection Studio

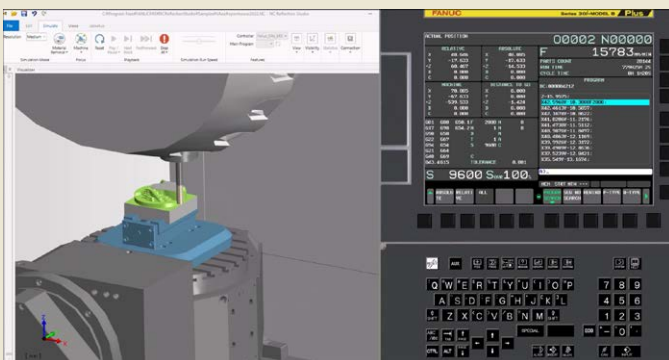
FANUC proposes the use of digital technologies for optimizing machining processes. By using such technologies, machining programs and machine motions can be checked on a PC, reducing work time and saving energy.

FANUC CNC Reflection Studio is a machine simulation software that allows the machine movement check on a PC. Mechanical interference caused by errors in a machining program or tool settings can be detected before actual operation. Also, by connecting to CNC GUIDE 2, which is capable of an exact replication of the interpolation function of a CNC and simulation of a machine's responsiveness including servo control, CNC Reflection Studio is able to provide extremely accurate and highly reliable simulation through precise G code analysis. What is noteworthy is that visual checks of complicated machine movements, such as using the tilted working plane indexing command and rotary axes for simultaneous 5-axis machining, are made possible. This reduces the time to confirm with the actual machine, and improves the machine's uptime.

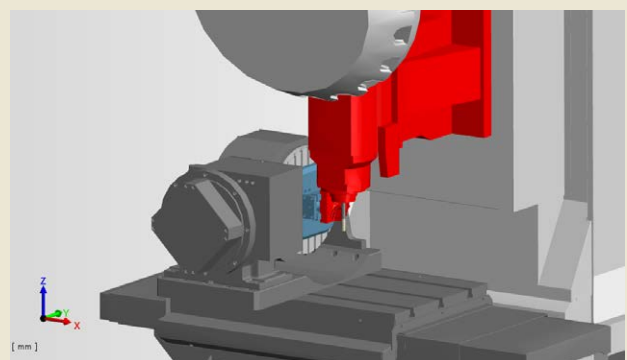
When CAD models (STL file format) for machine components such as tables and columns are available, machine models for machine simulations can easily be created just by correlating the model and CNC axes with the tool provided with this product.

Other usages are shown below.

- As a sales tool to introduce the features of machines to users
- As a support tool to remotely check machine operation
- As a training tool to learn how to operate a machine



Machine simulation using
FANUC CNC Reflection Studio

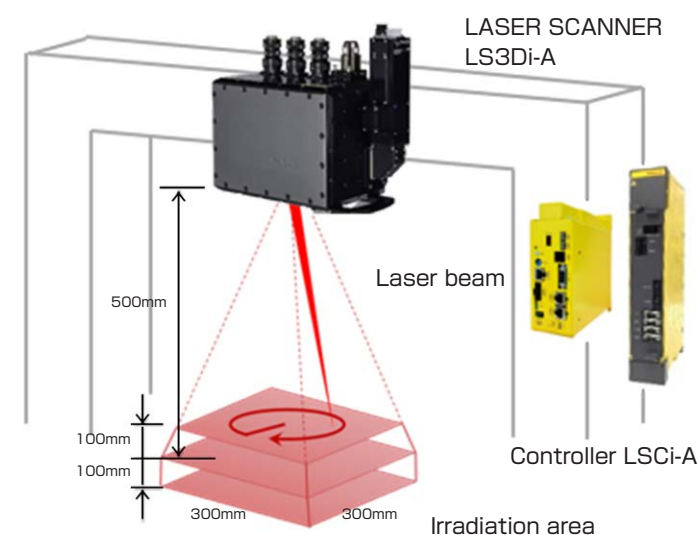


Mechanical interference check

FA New Product LASER SCANNER LS3Di-A

FANUC released new product of LASER SCANNER LS3Di-A as a single unit. LASER SCANNER LS3Di-A is designed as 3D galvano-type, and is developed based on FANUC servo motor control technology.

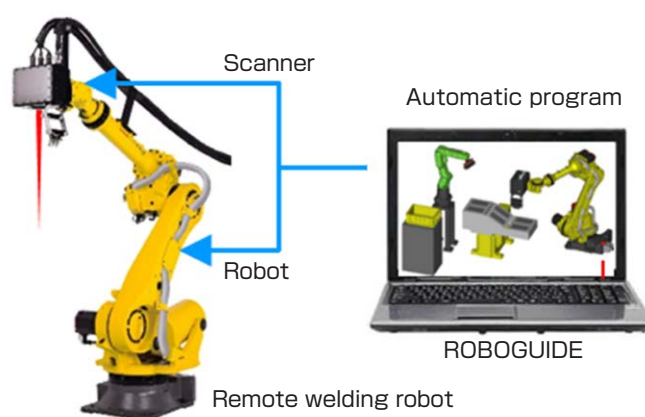
- The LASER SCANNER LS3Di-A can focus laser beams in a wide irradiation range from a long distance, and can scan various shapes. This scanner finely oscillates X and Y axis mirrors that reflect laser beams with a two-axis motor by feeding back at high speed, and accurately irradiates laser beams in a range of 300mm × 300mm. In addition, the positioning of the focusing lens is controlled with a motor which vertically adjusts the laser focal point with a span of ±100mm. Not only 2D but also 3D laser processing is possible. This scanner can be used applied in a wide range of applications including laser welding of metal, cutting of metal foil or non-metal thin plates, and heating or removing of coatings.
- With the high-speed control of the laser scanner controller LSCi-A, scanning of laser focal points can be commanded with G code commands to specify the X, Y, Z coordinates and many CNC functions can be used simultaneously. For example, the processing commands for consecutive circular motion simplifies wobbling and weaving processing. The LSCi-A is equipped with two-channel laser output control, and supports the ring mode laser that changes the laser beam mode at the focal point. It also has a port for connecting measurement monitoring equipment such as OCT sensor that can detect welding depth in real-time.
- By installing LS3Di-A on the remote welding robot, optimal processing systems can be built up for the welding application of large workpieces which exceed the irradiation range, and the continuous precision welding application of precise workpieces also. The offline simulator ROBOGUIDE can be used to generate programs for both robots and scanners simultaneously, so that the robot and scanner can coordinate their motions for laser machining.



Wobbling welding



Weaving welding



The LASER SCANNER LS3Di-A can be applied for various applications, and contributed for reducing cycle time and streamlining production line processes.

FANUC has launched the M-710iD series, the successor of the medium-size handling robot M-710iC series, as well as the M-950iA/500, a new heavy payload robot.

ROBOT New Product FANUC Robot M-710iD Series

- Since its release in 2006, the M-710iC series has become popular with customers around the world, leading to its long-term use spanning a long 17 years. FANUC has now developed the M-710iD/50M with a payload of 50kg as the successor to the M-710iC/45M, and the M-710iD/70 with a payload of 70kg as the successor to the M-710iC/50 and M-710iC /70.
- In addition to enhanced motion performance, the M-710iD series is fully covered to minimize exposure of the joints to enhance dust and splash resistance as well as rigidity. By curving its arm, the robot can reach deeper locations in front without the arm's motion interfering with peripheral equipment.
- With such features, the M-710iD series can be used in a wide range of applications and industries, for example, for supplying components to machine tools, transporting/assembling large workpieces, as well as in logistics.



M-710iD/50M

M-710iD/70



Approaching deep area utilizing the curved arm

ROBOT New Product FANUC Robot M-950iA/500

- The M-950iA/500 is a serial-link single-arm type robot. Compared to the parallel link type with two arms, the motion range is significantly wider, and interference can be limited when rotating, so that there is flexibility in installment. It can be set up even in narrow spaces.
- With one of the largest allowable wrist moments and allowable wrist inertia for a robot in the 500kg payload class, this robot is suited to transporting long and large workpieces as well as heavy components such as batteries.
- The M-950iA/500 offers high-quality automation by utilizing its six degrees of freedom even for applications that require high rigidity, such as friction stir welding (FSW), or machining using robots, for which demand is recently increasing.



M-950iA/500

ROBOT New Product New Robot Controller R-50iA

FANUC has launched the robot controller, R-50iA, which acquired the third-party international security standard certifications of IEC 62443 4-1 and 4-2 for the first time in the world*.

- Higher performance
The control performance of the robot has been enhanced, and the accuracy has doubled for signal output and tracking on the motion path. The resolution of the built-in vision has also been increased to five million pixels, covering a wide field of view.
- Cybersecurity
Security functions such as secure web communication and built-in firewalls have significantly improved, enabling R-50iA to be third-party certified. These functions satisfy the security requirements which are increasingly demanded in production lines.
- New function to easily build automation systems
On the R-50iA controller Python scripts can be executed to facilitate the customization of systems. The controller also supports a new software PLC function compliant with international standards.
- Enhancement of energy saving functions
A new amplifier equipped with low-loss power elements, a low power-consumption fan, and a new eco mode function reduce the robot's power consumption.
- Remote maintenance
Remote maintenance from a FANUC site can be performed by connecting a smartphone to the R-50iA controller. FANUC's experts on site check the state of the robot and provide advice.

With the new R-50iA robot controller, FANUC promotes smart factories.

(*Based on FANUC's research. "Python" is a registered trademark of the Python Software Foundation.)



R-50iA Mate Controller



R-50iA Controller
A Cabinet



R-50iA Controller
B Cabinet

ROBOMACHINE New Product ROBOSHOT α -S15iB

The ROBOSHOT α -SiB series, which is FANUC's latest electric injection molding machine series, has a new addition: the α -S15iB with a clamping force of 15 tons.

- The α -S15iB is equipped with an injection unit with a speed of 800mm/s. Screw diameters from Φ 14 to Φ 18 are supported, and minute precision moldings, such as precision connectors, can be stably molded.
- The large built-in 21.5-inch display unit, PANEL iH Pro, significantly enhances ease-of-use.
- The latest ejector protection function automatically sets the monitoring range of the ejector load. The function is highly sensitive to detecting abnormal loads on the ejector, thus preventing ejector pins from being damaged due to overfilling, which is a major issue in precision connector molding.
- The α -S15iB conforms to the international safety standard ISO 20430:2020 (JIS B 6711:2021) for horizontal injection molding machines.

With the addition of the α -S15iB, the lineup of the ROBOSHOT α -SiB series is now complete, having machines with clamping forces from 15 to 450 tons.



Maximum clamp tonnage [kN]	150		
Mold height (min/max) [mm]	260 / 130		
Tie bar spacing (w × h) [mm]	260 × 235		

Screw diameter [mm]	Φ 14	Φ 16	Φ 18
Maximum injection volume [cm ³]	9	11	19
Maximum injection pressure [MPa]	250	250	230
Maximum injection speed [mm/s]	800		

ROBOMACHINE New Product ROBOCUT α -C800iC

The ROBOCUT α -CiC series, which is FANUC's latest wire electrical discharge machine, has a new addition: the large model α -C800iC.

- With an X-axis travel of 800mm and a Y-axis travel of 600mm, the α -C800iC is optimal for machining large molds and parts. Additionally, a Z-axis travel of 500mm is available as an option for machining thick workpieces.
- Similar to the already released α -C400iC and C600iC, the α -C800iC is capable of high-speed and ensures outstanding precision in machining, with its exceedingly rigid body structure, along with the latest discharge unit and discharge control.
- The discharge control, iPulse3, has been elevated to the next level of machining accuracy by optimizing discharge control and machining conditions, such as uninterrupted machining of small-radius corners and nozzle opening condition.
- The highly reliable automatic wire feeding system, AWF3, allows continuous unmanned operation for a long period of time. In addition, with its simple structure, the automatic wire feeding mechanism has excellent main-tainability. The success rate for threading wire is excep-tional, and high stability is ensured for a long time.
- With the high-performance display unit, PANEL iH Pro, the drawing time is reduced by 75%. Operations are in-tuitive to improve ease-of-use. For example, adjustments in machining speed and corner/approach points has become simpler.

The addition of the α -C800iC to the compact α -C400iC and medium-size α -C600iC in the ROBOCUT α -CiC series, completes the lineup.



XY-axis travel	800 x 600 mm
UV-axis travel	200 x 200 mm
Z-axis travel	Standard : 310 mm Optional : 510 mm
Wire diameter	Φ 0.1 ~ 0.3 mm
Maximum workpiece dimensions	1250 x 975 x 300 mm (X x Y x Z)
Maximum workpiece weight	3000 kg

FANUC Factory Introduction

Mibu SERVO MOTOR Parts Machining Factory

The Mibu SERVO MOTOR Parts Machining Factory is an automated factory where various motor parts manufactured by FANUC are machined. These machining processes include turning of iron or aluminum castings to produce flange parts, turning and cylindrical grinding of round bars to produce shaft parts, milling of aluminum die-cast parts by ROBODRILLS, precision machining of servo motor sensor parts, and finishing of servo motor assembly parts. Transport of all parts is automated by connecting each building and manufacturing process in the Mibu Factory with automatic warehouses and conveyors. In addition, the amount of valuable resources such as chips, a by-product of each machining equipment, can be monitored. Pallets filled with chips are automatically replaced with empty pallets via an automatic warehouse.

- In the “flange machining cell,” the dimensions of all items are measured after machining so that manufacturing codes are linked to measured data. Because measured surfaces must remain clean throughout measurement, they are washed outside the machine to remove residue and then undergo automatic measurement.
- In the “shaft machining cell,” a simple washing pan is installed around the lathe or grinding machine to collect and reuse water-soluble coolant on the workpieces. This has reduced the amount of discarded coolant and dirt on the surrounding floor.

By introducing an AGV mounted with a collaborative robot (RocoMo-V), a system has been devised to collect products machined by each ROBODRILL and to supply materials. The RocoMo-V does not require a safety fence and can work in the same space as human workers. RocoMo-V approaches the specified ROBODRILL, and using the hand camera (iRVision), it detects the presence, position, and any material shortage of products on the conveyor.

This eliminates the need for an alignment mechanism for each ROBODRILL, minimizing the number of sensors in building a system.

- The “shaft machining cell” reduces the size of the machining cell by storing round bars (material) for each specified length in the automatic warehouse and automatically supplying them to each lathe according to the production plan. Now, a new “shaft cutting system” has been added. With this, the cutting and machining of long materials is done in-house, resulting in cutting costs, optimizing warehouse inventory, and shortening lead time.



100% inspection in the “flange machining cell”



Simple pan for washing with water in the “shaft machining cell”



RocoMo-V supplying materials and collecting products



Shaft cutting system



FANUC's History Series 11

DC Spindle Motor

FANUC's first spindle motor developed in 1976, using ferrite permanent magnets. This spindle motor utilized the motor cooling technology of the DC servo motor's heat pipes, instead of the internal ventilation cooling methods adopted by other companies, to create a unique fully enclosed cooling method that was put to practical use. Preventing factory air which contained coolant mist from entering the motor, substantially enhanced reliability. This cooling technology was used for a long time until the era of the AC spindle motor, when the vent hole cooling method was adopted for the stator core.



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