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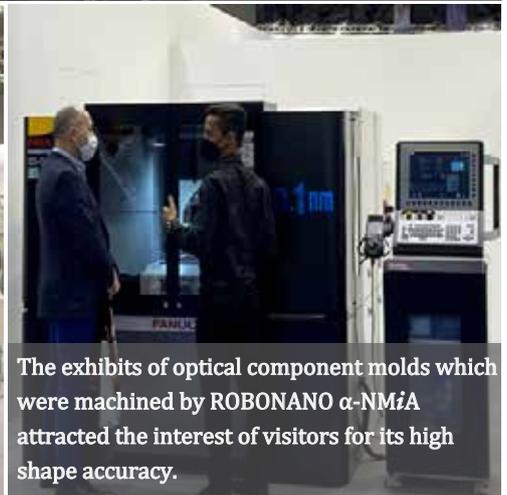
FANUC exhibited a total of 16 latest robots, with the first introduction to the world of the M-1000iA, a large handling robot with a payload of 1,000 kg, and the LR-10iA/10, a full-cover handling robot with a payload of 10 kg. As for collaborative robots, 5 units were exhibited consisting mainly of the CRX series, with visitors being able to actually experience their ease of use.



As for IoT products, a total of 21 solutions including applications from 11 FIELD system partner companies were exhibited. Case studies using actual devices were presented which enabled visitors to understand improvements first hand.



The ROBOMACHINE exhibit highlighted new models consisting of the ROBODRILL α-DiB Plus, ROBOSHOT α-S50iB, and ROBOCUT α-C400iC. Live demonstrations of high-speed and high-precision machining as well as molding were performed along with proposing a complete production automation package by integrating robots.



The exhibits of optical component molds which were machined by ROBONANO α-NMiA attracted the interest of visitors for its high shape accuracy.

EMO 2021
Milano, 4 – 9
October

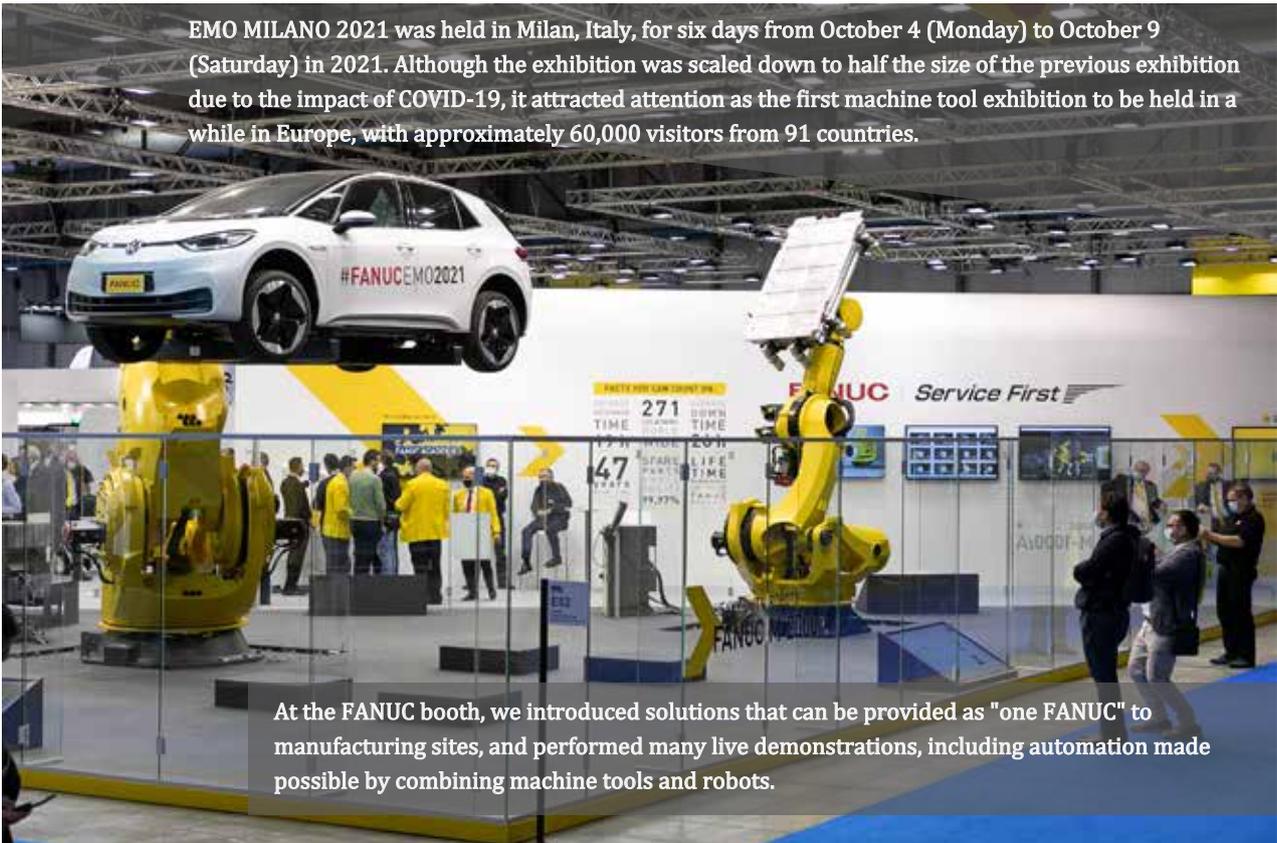
FANUC VIRTUAL BOOTH

In the Service area, FANUC's advantages were highlighted on a screen, such as having 271 service locations around the world and a high stock-to-sales ratio of spare parts in Europe, as well as the excellent feedback of our services in many countries.



For those who were unable to visit physically, we set up a virtual booth on the Internet and showed demonstrations which were conducted at the venue and broadcast messages to the world using videos and other material.

EMO MILANO 2021 was held in Milan, Italy, for six days from October 4 (Monday) to October 9 (Saturday) in 2021. Although the exhibition was scaled down to half the size of the previous exhibition due to the impact of COVID-19, it attracted attention as the first machine tool exhibition to be held in a while in Europe, with approximately 60,000 visitors from 91 countries.



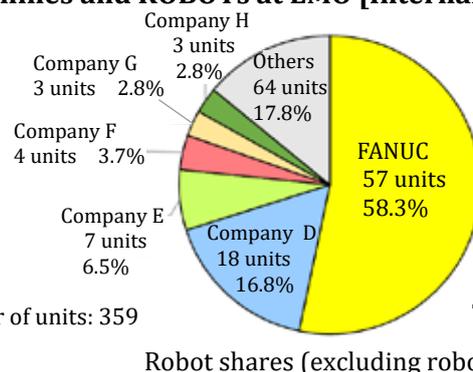
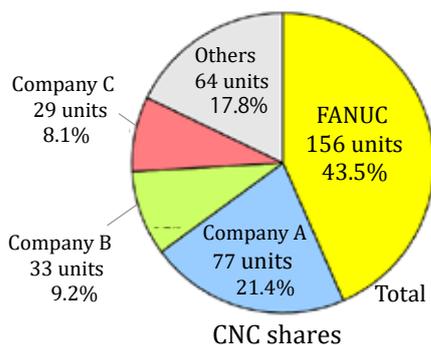
At the FANUC booth, we introduced solutions that can be provided as "one FANUC" to manufacturing sites, and performed many live demonstrations, including automation made possible by combining machine tools and robots.

In the FA (factory automation) zone, the FANUC Digital Twin Concept was exhibited inside a huge tunnel. A visual presentation of this concept, which included videos of work done on site, was displayed on the left and right surfaces of the tunnel for machine manufactures and users to see, and was highly appraised.



FANUC's QSSR G-CODE allows the user to give commands to a robot using the same G-code used for machine tools. This also attracted a great deal of interest.

Shares of CNCs on exhibited machines and ROBOTS at EMO [Internal count]

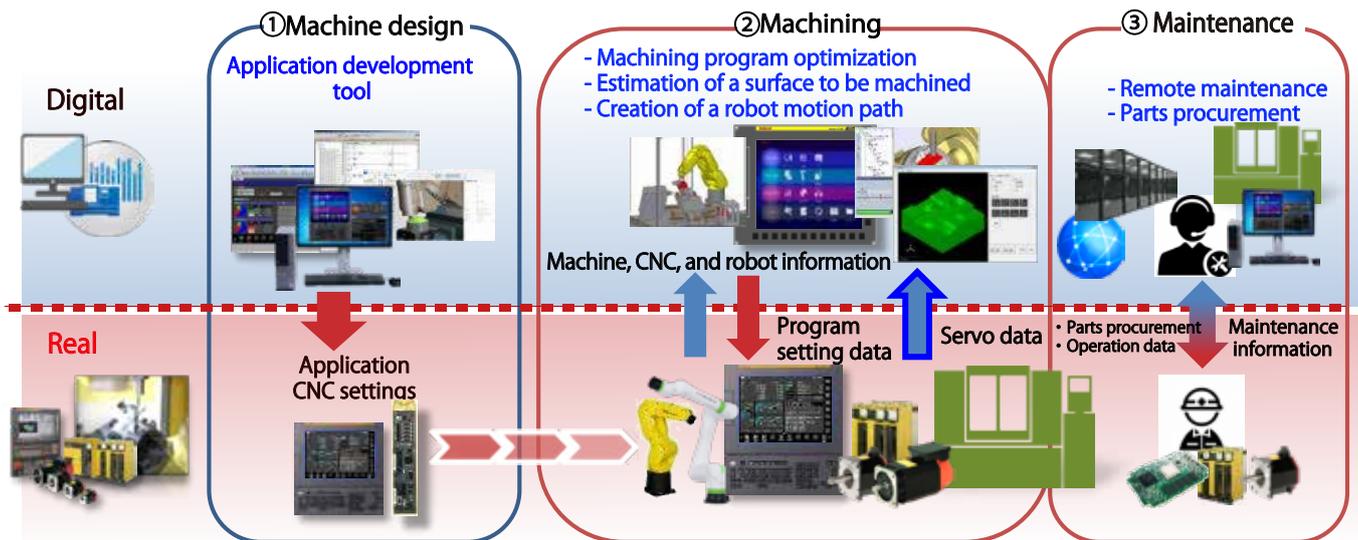


Introduction of New Products and New Functions

FA FANUC CNC Digital Twin Concept

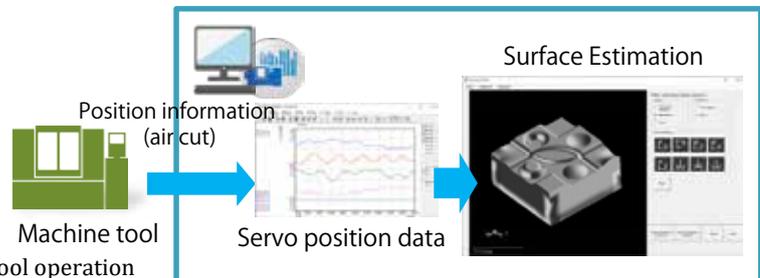
FANUC continues to improve the functionality and performance of FA products, including CNCs, servo motors, and lasers. By adopting the concept of digital technology (DX) in a "Digital Twin CNC," the streamlining and optimization of designing machine tools and work at machining sites are accelerated.

- CNC technology in the real world and digital technology are connected, and the feedback from real machine tools are reflected in digital technologies such as simulations.
- Efficiency and convenience in a series of tasks such as machine design, machining, and maintenance are improved, enhancing machining performance. This enables machine manufacturers and machine users to improve productivity.



New Function - Surface Estimation

Surface Estimation is a useful new function for improving machining efficiency, which follows the CNC digital twin concept. This function estimates the surface to be machined before actual cutting, by running the machining program on the machine without load and using the measured servo position data of each axis. Although the impact of machining conditions such as tools is not considered, a machining result that is close to the actual machining result is estimated by simulating the machine tool operation using digital technology. Using this function eliminates unnecessary trial and error during cutting, resulting in improvements in productivity.



New Product - FANUC iPC

The FANUC iPC is an industrial PC proposed by FANUC under its CNC digital twin concept to help support digitalization in manufacturing. For digitalizing manufacturing, the FANUC iPC can be introduced in a variety of ways, including installment on a network or as an addition to existing equipment. With its compatibility with CNCs and high reliability including noise immunity and cutting fluid resistance developed through our experience in developing CNCs, the FANUC iPC introduces digital technology to machining sites.

A multi-touch compatible capacitive touch panel (FANUC TOUGH TOUCH) is used as a human-machine interface which allows smoother and more intuitive operation. FANUC TOUGH TOUCH can significantly reduce the risk of errors in operations due to noise, which has been an issue with conventional capacitive touch panels, with noise immunity, and mistakes caused by cutting fluid, water, and even when wearing gloves.

FANUC TOUGH TOUCH can also be used as a CNC display with PC functionality as a successor to the former PANEL iH Pro.



- Prevent unintentional operation caused by coolant, water and dust
- Immunity against electrical noise
- Operable with gloved fingers

FANUC TOUGH TOUCH

ROBOT New Product - FANUC Robot M-1000iA

FANUC has developed the M-1000iA, a large heavy payload robot with a wide motion range and 1,000 kg wrist payload.

- The M-1000iA is FANUC's largest robot to feature a serial link mechanism. The J3 arm can stand upright and rotate backwards. This wide range of motion allows the robot to operate in various layouts.
- With a wrist payload of 1,000 kg and strong wrist performance, this robot can transport heavy and large workpieces, such as battery units for electric cars, which are recently in high demand, and long construction materials. Its arm is designed for high rigidity, allowing the robot to support machining applications such as drilling holes.
- The wrist of the robot has dustproof and waterproof features equivalent to IP67. As such, the M-1000iA can be used safely even in an environment where dust, chips, and droplets are scattered.
- In addition to the conventional iPendant, a tablet-type teach pendant which enables intuitive operation can be used. It is an easy-to-use robot even for first-time FANUC robot customers.



FANUC Robot M-1000iA



Leveraging its wide motion range, high payload capacity, and ease of use, the M-1000iA contributes to improving productivity for customers.

Moving a battery unit for electric vehicles

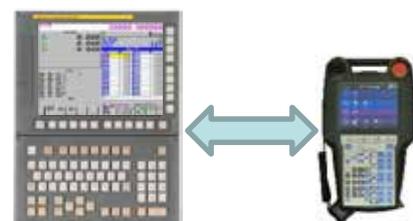
ROBOT New Function - CNC Custom Macro Variable Access Function

As a new function for FANUC robots, the CNC custom macro variable access function has been released. This function allows a FANUC robot to be easily connected to a FANUC CNC fitted to an existing machine.

- With this function, the custom macro variables of the CNC can be read and written from the robot program.
- The robot can be notified by the CNC when machining is finished. Also, the robot program or CNC subprogram to be executed according to the macro variable value is selectable.
- The robot's servo hand position data can also be written to the CNC's macro variable to inform the CNC of the size of the cast workpiece gripped by the robot.
- With this function, robots can be connected to FANUC CNCs which were built in 2000 or later that support embedded Ethernet. Since additional software options or changes in the ladder programs on the CNC are not required, it is convenient when adding a robot to an existing machine tool.



Connecting the CNC and the robot with only one Ethernet cable



Reading and writing the CNC's macro variables from and to the robot's program

FANUC will continue to promote the integration between CNCs and robots, to further contribute to factory automation.

ROBOMACHINE New Product - ROBODRILL α -DiB Plus series



The ROBODRILL is a high-performance, highly-reliable compact machining center that employs FANUC's latest CNC and servo technologies. With its highly rigid mechanical structure and wide variety of spindles, the ROBODRILL can

be used in a broad range of applications, from mass production of aluminum and steel parts to machining of difficult-to-cut materials such as stainless steel and titanium, along with simultaneous 5-axis machining using an additional rotary table.

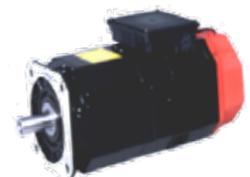
High machining performance

While maintaining high machining performance and reliability as before, productivity has been further improved by thoroughly reducing inactive time.

- The non-cutting time has been reduced by using the fast cycle time technology of the latest CNC Series 31i-MODEL B Plus.
- The programming know-how for achieving the fastest operation of the ROBODRILL has been converted into G-code as a dedicated canned cycle.
- The tapping spindle, which reduces spindle acceleration/deceleration time and heat generation, has been added to the lineup of spindles. It is optimal for light cutting of aluminum parts.



Series 31i-MODEL B Plus

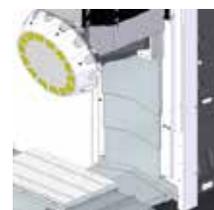


Synchronous spindle motor for tapping spindles

Minimizing downtime

Aiming for "Reliable. Predictable. Easy to Repair." FANUC has developed new functions to minimize downtime.

- The slide covers of each axis have been improved to enhance chip removal and cover durability.
- The preventive maintenance and restoration functions have been enhanced to reduce downtime due to sudden malfunctions.
- The PC software, ROBODRILL-LINKi, is useful for collecting data on the operating status of machines and devices throughout the factory, enabling improvements in the operating rate.



Z-axis telescopic cover



ROBODRILL-LINKi

Ease of use

In addition to the new screens to improve usability, the range of customization has been expanded to suit the ways of use.

- Frequently used screens can now be displayed easily from the menu of favorite screens.
- The custom screen function allows users and peripheral equipment manufacturers to register up to 15 screens.
- The enhanced network function setting screens contribute to the introduction of IoT in users' factories.



Example of a custom screen



Ethernet setting screen

"Partial automation" of manufacturing processes using robot modules

The Mibu Factory, which manufactures CNCs and servo amplifiers, is working on the automation of manufacturing processes using robot modules, aiming to streamline manual processes and reduce manpower.

A robot module is a modular device developed for FANUC's own factories. The module consists of a robot, a controller and some peripheral equipment (e.g. power supply, air supply and network), which are placed inside a standardized frame. By adding a hand used for work, and other peripheral devices such as a table, the robot module can be used in various processes. The robot module is covered with a transparent shield, and the range of movement of the robot is limited to the area within the shield by the dual check safety (DCS) function, thus ensuring the safety of the operator. (Some collaborative robot modules do not require a transparent shield.) One advantage of the robot module is that it can easily be moved to another location and started up immediately, by merely connecting the power supply, air supply and network.

FANUC's manufacturing processes depend on the production planning of each case. One is "fully automated or semi-automated processes" and another is "manual processes." Recently, "partial automation" is frequently applied, in which some manual processes are automated using robot modules. In manual processes, the workers can share their work with robots

that excel at repetitive work and work that requires stable quality. In such a manner, workload and manpower are reduced, and stability in quality and productivity are improved. Due to being standardized and being versatile, robot modules have reduced the cost of automation. Also, it is easy to change the line layout, and set up can be completed in a short time.

Examples of "partial automation" using robot modules in our factory, can be seen in the seal dispensing process and the screw fastening process in assembling printed circuit boards. By automating the seal dispensing process, quality has stabilized (e.g. quantity and position). Combined with the reduction of the workload of workers, productivity is doubled. In the screw fastening process in assembling printed circuit boards, "partial automation" reduced manpower by one person and improved productivity by 20%.

Since less expensive and simple "partial automation" can be implemented easily, it is useful in improving the quality of ordinary manual work processes, decreasing manpower and improving productivity. In addition, when there is a sudden change in manufacturing plans, or a wide variety of products in small quantities are required, "partial automation" is able to respond flexibly, such as by easily changing the layout, and efficiency can be confirmed immediately. "Partial automation" is well received on site for promoting improvement activities.



Outer view of a robot module (LR Mate type)



Overall work scene (one worker, one robot module)



Robot module applying sealant



Robot module fastening screws on a PCB

The 17th All Japan Student Indoor Flying Robot Contest

The 17th All Japan Student Indoor Flying Robot Contest was held from December 17 (Fri) to December 19 (Sun) at the Ota-City General Gymnasium. This time, the contest was conducted by taking measures to prevent the spread of COVID-19, such as taking peoples' temperatures, disinfecting hands, and registering participants in advance.

This contest was intended to encourage students to engage in the "making of things," but more importantly to develop human resources in aircraft design, control and other areas. A total of 48 teams from universities, technical colleges, high

schools, and vocational schools across Japan, from Okinawa to Hokkaido, participated in the contest.

Participants conducted missions such as transporting goods and flying with an autopilot system, and competed in flight performance, control technology, and flying techniques.

FANUC is a special sponsor of this contest where students, who have the skills to immediately engage in company work, gather together. At this contest, the FANUC Award was granted to the Tokyo Metropolitan College of Industrial Technology who won the first place in the autopilot category.



Students competing in the Indoor Flying Robot Contest



Exhibition of a robot (CRX-10iA)

Four Seasons of FANUC

In late autumn in the FANUC forest, many plants and trees bear fruit, and birds and squirrels scurry about in search of

this blessing. Here are some of the fruits and flowers that adorn the FANUC forest as it prepares for the onset of winter.



Japanese honeysuckle

The glossy dark purple berries are eye pleasing. This plant has white to pale pink flowers in early summer, which gradually turn yellow. By this change in color, it is also called kinginka (literally, "gold-and-silver flower"). It is also known as ninto (literally, "enduring winter") from the way it tolerates the winter cold without shedding leaves.



Rosa multiflora

Despite the allure of the bright red berries, trying to touch them will be a stinging experience as they have small sharp thorns.

Fragrant pure white flowers bloom from spring to summer and many berries appear in autumn, presenting a delightful sight.





FANUC's History Series 3

「FANUC 250」

FANUC's first CNC. In 1964, the FANUC 250 was developed by converting a small-scale computer used in factory process control systems, known as JOB MASTER, into a CNC machine. Simultaneously, the software of the computer was completely rewritten. This CNC was not intended for general machine tools. It was delivered to Toyo Kogyo Co., Ltd. (currently, Mazda Motor Corporation) as a CNC for the internal grinding of rotary engines.



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