FANUC NEWS

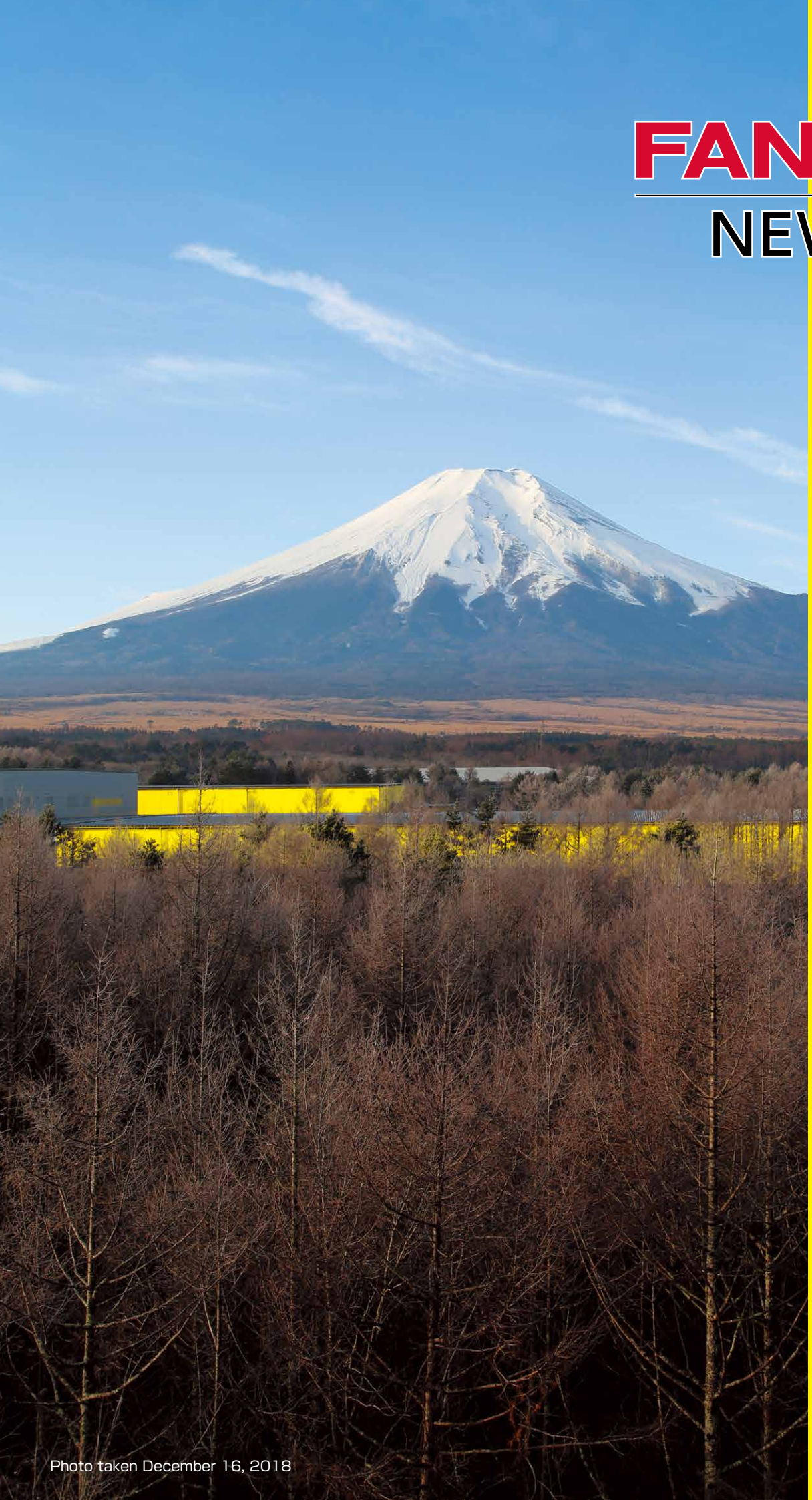


Photo taken December 16, 2018

2018-Ⅲ

JIMTOF 2018

JIMTOF 2018 (The 29th Japan International Machine Tool Fair) was held at Tokyo Big Sight from Thursday, November 1 through Tuesday, November 6, 2018.
This year, the number of participating companies was 1,085, significantly increasing from the last fair. The number of visitors for the 6 days was 153,103, hitting a record high.
Many customers visited the FANUC booth where we exhibited many new products and functions that provide innovation and reliability to manufacturing sites toward a nonstop factory.
In the FIELD system area, many visitors were highly interested in many apps that set a precedent for smart factories. Not only does FANUC endeavor to create new values for things by connecting them and through visualization, but also by efficiently using data. Many customers agreed with and expressed expectations for our efforts related to IoT.

In the FA area, the Series 0*i*-MODEL F Plus gathered attention. This new product is equipped with the ability to customize it among other functions as standard and has an *i*HMI model in the lineup. FA AI functions that can quickly bring benefits to the field (AI thermal displacement compensation, AI servo tuning, and AI spindle monitor) and the servo motor with battery-less pulse coder also draw much attention. Many customers asked us about their practical use.

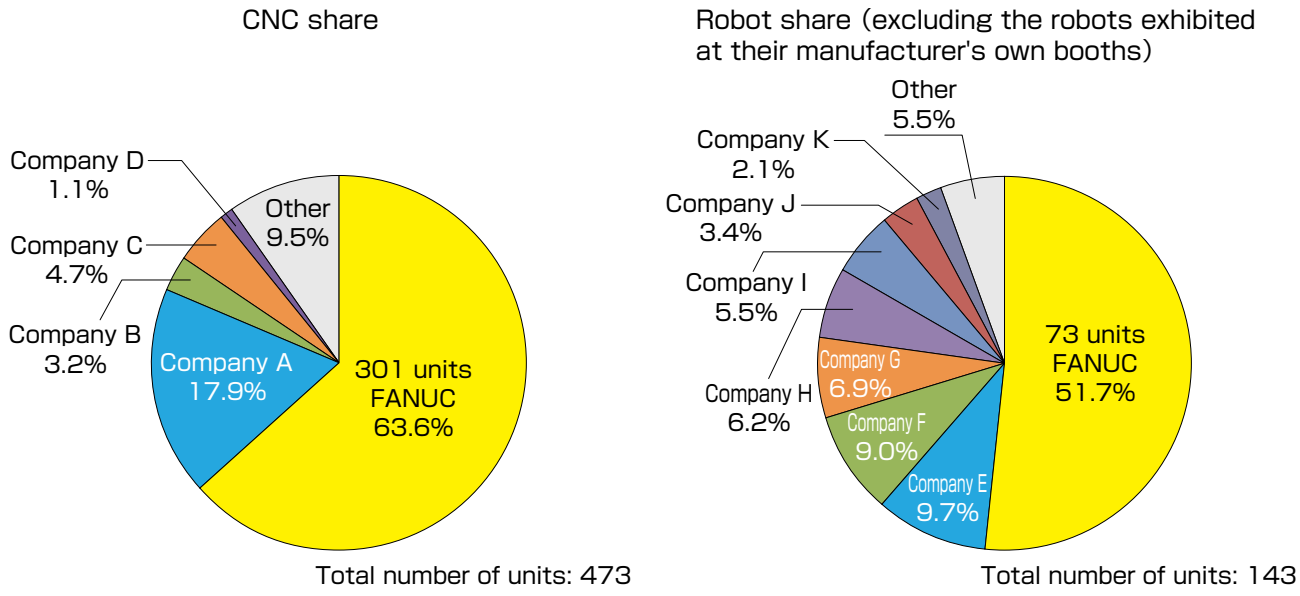
In the robot area, a collaborative robot mounted on an AGV and another collaborative robot that performs setup using a 3D vision sensor performed assembly work with a worker to demonstrate a specific example of production facilities where collaborative robots are introduced. The deep learning bin-picking system, which facilitates setup work, was also popular.

In the ROBODRILL area, the ROBODRILL demonstrated dynamic cutting of steel and aluminum blocks to show visitors the high-level machining performance. The custom screen, which improved the usability, also attracted the visitors. The demonstration of the PCD tool cutting through simple connection with a collaborative robot (QSSR) in the ROBOCUT area and the demonstration of mirror finishing without polishing of an automobile headlight mold in the ROBONANO area also consistently attracted many visitors.

In the service area, we presented our efforts toward lifetime maintenance, preventive maintenance and BCP, and new service activities of our service website and FIELD system services. Our presentations were highly appreciated by those in charge of field maintenance. We also introduced the new FANUC Academy with a video presentation to give our guests the whole picture of this facility equipped with plenty of practice devices and state-of-the-art educational equipment.

The Japan Machine Tool Builders' Association, which cohosted this event, displayed the operating states of over 300 machines from 72 companies on a large monitor, comparing the venue to a factory. The operating states of 167 machines from 47 companies were stably displayed during the event via the FIELD system.

FANUC CNC, which has further evolved with the AI and IoT functions that quickly bring benefits to the field, and the FANUC robots, which support the automation of manufacturing sites more effectively with collaborative and SCARA robots in the lineup, were supported by many participating companies again at this JIMTOF, each acquiring a large share.



Share of FANUC CNC and FANUC robots at JIMTOF 2018 [survey by FANUC]

On the first evening of JIMTOF 2018, FANUC held a party, inviting many related parties domestically and from overseas. The party started with complementary speeches by guests. Participants freely networked with one another over dinner and enjoyed the lively evening.

Ms. Yuko Tamai
Director, Industrial Machinery Division,
Manufacturing Industry Bureau
Ministry of Economy, Trade and Industry

Mr. Akihiro Teramachi
President and CEO
THK Co., Ltd.

Dr. Yoshiharu Inaba
Chairman and CEO
FANUC CORPORATION

Kenji Yamaguchi
President and COO
FANUC CORPORATION

IMTS 2018

IMTS 2018 was held at the McCormick Place in Chicago, U.S. for 6 days from September 10 (Mon) to September 15 (Sat), 2018. This event was prosperous with 130,000 visitors from all over the world.

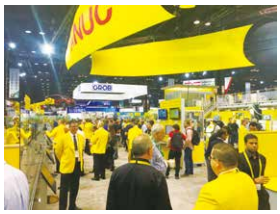
In our booth, FANUC hung a huge yellow airship from the ceiling and introduced the latest FA, ROBOT and ROBOMACHINE products, efforts related to IoT, and our services that cover the whole world under the theme of one FANUC and Service First.

In the FA area, the successor of the 0*i*-F, the CNC 0*i*-F Plus, the new Panel *i*H Pro, the Fast Cycle-time Technology to reduce cycle times, demonstrations of cutting and marking using a fiber laser that was synchronized to the axis control at high speed and with high precision gathered attention.

In the robot area, we exhibited the green collaborative robots, SCARA robots, AI bin-picking. In addition, a large robot carried an electric vehicle and a robot with 3D vision mounted on the AGV charged the vehicle and inspected the parts on the backside of the car body. This area was always crowded by many visitors.

In the ROBOMACHINE area, customers were impressed with the new developments made for ROBODRILL, ROBOSHOT, and ROBOCUT as well as demonstrations of AI, QSSR, and LINK*i*. The demonstration of mold cutting by ROBONANO gathered attention from many visitors.

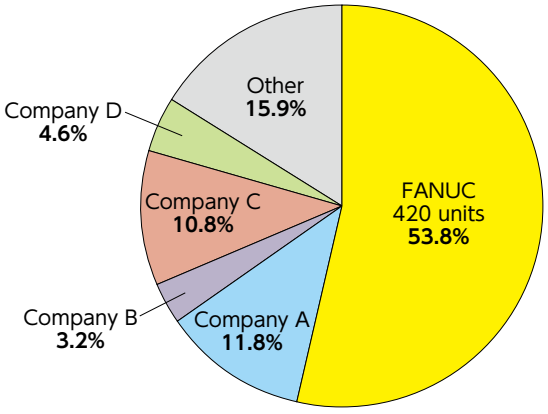
In the IoT area, we exhibited the FIELD system, LINK*i* and ZDT. In particular, we exhibited the operating state monitor connected to 328 machine tools at 144 companies' booths in the exhibit venue using the FIELD system. This monitor was popular among those in charge of factory maintenance.



In the service area, we introduced new functions, alarm searches, manual searches, and visual guidance on our service website. We also presented our lifetime maintenance policy, which allows customers to safely use our products all over the world.

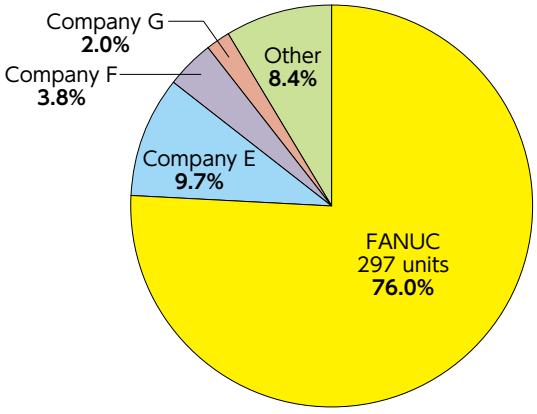
Our shares in the machines exhibited at the IMTS are as shown below. We would like to express our sincere gratitude to the customers who presented our products. Thank you very much.

CNC share



Total number of units: 781

Robot share (excluding the robots exhibited at their manufacturer's own booths)



Total number of units: 391

Introduction of New Products and New Functions (FA)

■ FANUC Series 0*i*-MODEL F Plus

FANUC has developed the FANUC Series 0*i*-MODEL F Plus as the successor to the FANUC Series 0*i*-MODEL F. The FANUC Series 0*i*-MODEL F Plus is easy to use with significantly enhanced basic functions.
The FANUC Series 0*i*-MODEL F Plus is the latest model of the CNC 0*i* Series, which is highly appreciated all over the world. Over 1,300,000 CNC 0*i* Series have been shipped in total.

● Totally new design

We gave the new dark screen a black, flat appearance that is easy to read and easy on the eyes. We created the new machine tool appearance by improving details including the new 10.4" unit, which replaces the conventional 8.4" screen, the MDI unit with a new design, new color combination and hierarchical icon display.

● *i*HMI

Customers can select the *i*HMI, our new user interface, which supports the machining field in an integrated way. The *i*HMI provides the best usability ever, making full use of the graphical screen. The *i*HMI goes beyond the operations of a conventional CNC, working with standard FANUC applications and applications specific to each machine manufacturer. As a result, users can efficiently carry out a series of tasks such as programming, simulation, actual machining, measurement, and proposals for improvements with simple operations.

● Latest FANUC CNC and servo technologies

The FANUC Series 0*i*-MODEL F Plus employs the latest FANUC control technologies including the Fine Surface Technology to enable high-definition machining and the Fast Cycle-time Technology to reduce cycle times. Because cumbersome settings are not required, you can immediately make use of the latest technologies, and therefore, effectively realize the machine's performance.

● Customization functions provided as standard

The FANUC Series 0*i*-MODEL F Plus is equipped with the FANUC customization functions, that is, FANUC PICTURE executor, C language executor, and macro executor as standard. With the significantly enhanced expressiveness of the screen and a new script for strong control available in the latest version of FANUC PICTURE, you can more flexibly create screens suited to your machine tool.

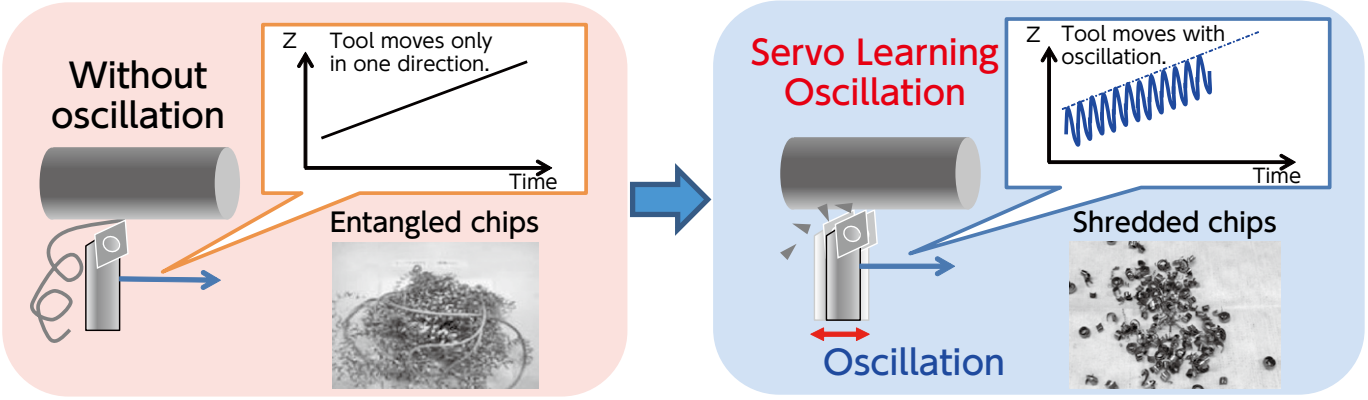
● Expanded memory capacity

The FANUC Series 0*i*-MODEL F Plus has a larger machining program capacity. On top of that, you can expand the program capacity by up to 2 GB by using a memory card. In addition, FANUC has expanded the memory capacity used by ladder programs and customization functions. Therefore, each machine manufacturer can create and add more powerful applications of their own.

■ Servo Learning Oscillation for shredding chips in turning

Servo Learning Oscillation is the function to realize oscillation cutting for shredding chips in turning.
For oscillation cutting, the oscillation command is superimposed on the machining path in CNC, and the tool and workpiece relatively oscillate during turning. This avoids troubles due to chips and allows for continuous machine operation. In addition, the effect to reduce facility costs is expected because an external chip shredder is no longer needed. Also the effect of volume reduction and easy disposal of chips is expect. Thanks to our unique technology “Servo Learning Control” applied to this function, the cutting tool accurately follows the oscillation command, thus it is easy to set the cutting conditions on the shop floor.

Effect of application of Servo Learning Oscillation



Introduction of New Products and New Functions (Robot)

■ FANUC Robot CR-15*i*A

FANUC has launched the CR-15*i*A as a new variation that follows the 35-kg heavy payload CR-35*i*A and the small collaborative robots, CR-4*i*A, CR-7*i*A, and CR-7*i*A/L in the CR Series of "green robots," which can collaboratively work with human workers without a safety fence.
The CR-15*i*A is a mid-sized collaborative robot with a 15-kg payload that can work with human workers without a safety fence. No need for a safety fence also means compactness. Therefore, you can easily introduce the CR-15*i*A into manufacturing processes mainly performed human workers to gradually automate those processes. In addition, the CR-15*i*A can be hung from the ceiling or attached to a wall. This allows you to have a wider working space without obstructing the human working area. Therefore, you can use this robot for a variety of manufacturing processes including part transportation and assembly.

- Like the conventional CR Series, the FANUC proprietary safety function safely stops the robot if it contacts a human being.
- FANUC has acquired a safety certification according to the international ISO10218-1 standards for this robot from a third-party safety certification organization.
- The collaborative robot is green so that you can immediately distinguish it from our standard yellow robots as a safe robot.
- Like the conventional CR Series, the original robot is a yellow one and highly reliable. You can also continue to use advanced intelligence functions including *i*RVision (integrated vision) and force sensors.

This enhancement of the lineup of green robots, which allow man-machine collaboration, contributes to new automation in the manufacturing industry.

New model added to the "green robot" lineup
CR-15*i*A

■ FANUC 3D Vision Sensor 3DV/400

FANUC has developed and launched a small lightweight 3D vision sensor known as the 3DV/400 that can be mounted on a robot arm.

You can measure the three-dimensional shape of workpieces with this 3D vision sensor, identify their positions and orientation based on that three-dimensional shape, and use the data to remove three-dimensionally misaligned workpieces.

- The 3D Vision Sensor 3DV/400 consists of two cameras and one projector. The two cameras take images of a specially designed pattern made by the projector to measure the three-dimensional shape of a workpiece.
- The measurement time is shorter than conventional sensors, which need multiple projected patterns. This is because the 3D Vision Sensor 3DV/400 can measure the three-dimensional shape with a single projected pattern.
- Because the measurement time is short, you can take images without stopping the robot and measure the shape even if the sensor or workpiece moves (e.g., visual tracking to recognize workpieces moving along the conveyor).
- One camera cable can supply power for data transmission and the sensor, which contributes to reduction in wiring and maintenance costs.
- The 3D Vision Sensor 3DV/400 has vibration resistance for mounting on the robot and IP67 dust-proof and drip-proof performance.

The new 3D vision sensor further promotes automation of three-dimensional parts.

3DV/400

■ LINK*i* for ROBOMACHINE

LINK*i* for ROBOMACHINE (ROBODRILL-LINK*i*, ROBOSHOT-LINK*i*, and ROBOCUT-LINK*i*) is a ROBOMACHINE network system that promotes the adoption of IoT in manufacturing sites. LINK*i* collects and analyzes ROBOMACHINE operation information and provides a wide range of functions useful in manufacturing sites such as the operation monitoring function and quality monitoring function. As the demand for the adoption of IoT is increasingly rising in the market, FANUC is further enhancing LINK*i* for ROBOMACHINE.

● ROBODRILL-LINK*i* (ROBODRILL)

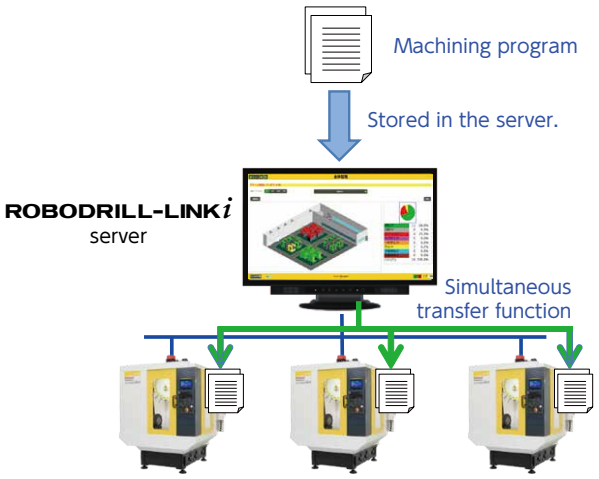
ROBODRILL-LINK*i* is a machine monitoring system which collects and analyze ROBODRILL operation information to support its operation rate.
Recently, FANUC has developed the following functions to further enhance ROBODRILL-LINK*i*.

● Symultaneous file tranfer function

You can send machining programs to multiple ROBODRILLS at once. This process is effective to write machining programs to many ROBODRILLS that perform the same machining.

● Maintenance information monitoring function

You can collect and monitor maintenance information such as replacement time period of consumable parts and tool life information, so that factory management can plan the maintenance schedule effectively.

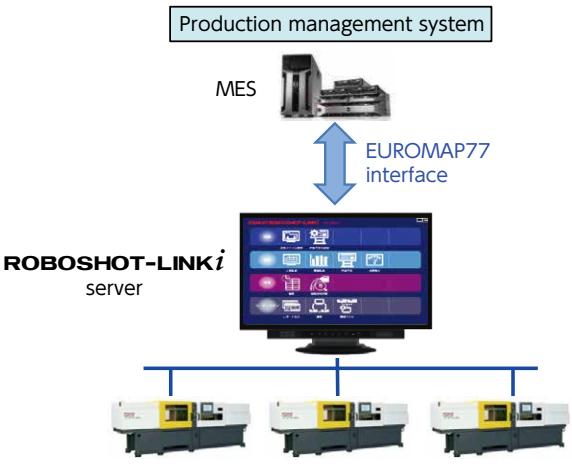


● ROBOSHOT-LINK*i* (ROBOSHOT)

ROBOSHOT-LINK*i* is a production and quality information managing system for collecting and analyzing ROBOSHOT operation information and molding data to promote the use of IoT in molding factories.
To increase the usage of ROBOSHOT-LINK*i*, it now supports the new communication interface, EUROMAP 77.

●Communication intarface EUROMAP77

EUROMAP77 is a new communication interface for injection molding machine and MES (Manufacturing Execution System) which is established in Europe in May 2018. ROBOSHOT-LINK*i* supports these standards ahead of competing products. EUROMAP77 interface enables sending data which ROBOSHOT operation information and molding data collected by ROBOSHOT-LINK*i* to MES.



● ROBOCUT-LINK*i* (ROBOCUT)

ROBOCUT-LINK*i* is a production and quality information monitoring system for collecting and analyzing ROBOCUT operation information and cutting data to contribute to improve the productivity of electrical discharge machining.
ROBOCUT-LINK*i* has supported the preventive maintenance function to increase its usage.

● Preventive maintenance function

ROBOCUT-LINK*i* has a preventive maintenance function to notify the user before machine failure to prevent ROBOCUTs go down.
ROBOCUT-LINK*i* can be used to check whether a ROBOCUT is being inspected periodically and the life of consumables.
ROBOCUT-LINK*i* can also send emails to inform users the inspection period and the life of consumables to remind them to conduct maintenance and inspection.

FANUC Received the double awards, from Minister of Economy, Trade and Industry Award and Minister of Internal Affair and Communications, at the Robot Award

FANUC's ZDT (Zero Down Time) received the Minister of Economy, Trade and Industry Award and the Minister of Internal Affair and Communications Award at the 8th Robot Award hosted by the Ministry of Economy, Trade and Industry. This is the first time that one product received two awards.
The ZDT received two of the six Minister Awards (Minister of Economy, Trade and Industry Award, Minister of Internal Affair and Communications Award, Minister of Education, Culture, Sports, Science and Technology Award, Minister of Health, Labour and Welfare Award, Minister of Agriculture, Forestry and Fisheries Award, and Minister of Land, Infrastructure and Transport Award) at the Robot Award.

FANUC ZDT was highly recognized as the first commercialized IoT system in the world, creating new customer value through the adoption of IoT in the product and the business results, namely, the fact that the ZDT has already been connected to 20,000 robots.
FANUC Chairman and CEO, Dr. Y. Inaba and Dr. K. Inaba, General Manager, Robot Business Division, received the award certificate and memorial trophy at the awards ceremony on Wednesday, October 17, 2018.

Awards ceremony

Practical IoT product that eliminates down time at manufacturing sites, ZDT (Zero Down Time)

Introduction of the awarded product

ZDT is an IoT technology that realizes preventive maintenance and failure prognosis and eliminates downtime by connecting industrial robots that operate at a factory via a network and collectively managing information from the robots in a server. This technology contributes to the improvement of factory operating rates by monitoring the mechanical units of robots and the system and notifying customers when a failure is expected in order to prevent downtime.

FANUC Chairman and CEO, Dr. Inaba Received the Order of the Rising Sun, Gold and Silver Star.

In Autumn 2018, FANUC Chairman and CEO, Dr. Inaba had the honor of receiving the Order of the Rising Sun, Gold and Silver Star.
His dedication to company business and development of industry as well as assistance to the government by accepting public positions were recognized.
His dedication to company development has contributed first and foremost to the development of FANUC.
He has also contributed to the development of industry, for example by serving as the vice chairman of the Japan Machine Tool Builders' Association for 13 years and the chairman of the Japan Robot Association for three terms.
In terms of assistance to the government, he participated in committees organized by the government, the Ministry of Economy, Trade and Industry, the Ministry of Education, Culture, Sports, Science and Technology, and the Ministry of Health, Labour and Welfare and other activities.
The main reason for which he received this honor is his dedication to company business.


The ninth man from left in the front row is FANUC Chairman and CEO, Dr. Inaba.

AC Party

The 61st AC Party was held on Tuesday, August 21. The AC Party started as an internal get-together organized by the Automatic Control Section set up in 1958. The group has grown larger every year and now has 1,244 members. This year's AC Party, which was held in the new cafeteria at the new laboratory completed last February, was attended by 1,207 members, including 166 new members.
At the start of the party, FANUC Chairman and CEO, Dr. Inaba gave an opening greeting in which he encouraged employees to push development forward placing the most importance on product reliability by making the most of new facilities such as the reliability evaluation facility.
Following President Yamaguchi's toast in the cafeteria full of people holding drinks and plates of food in their hands, AC participants deepened their bonds with a renewed determination to strive toward further development.

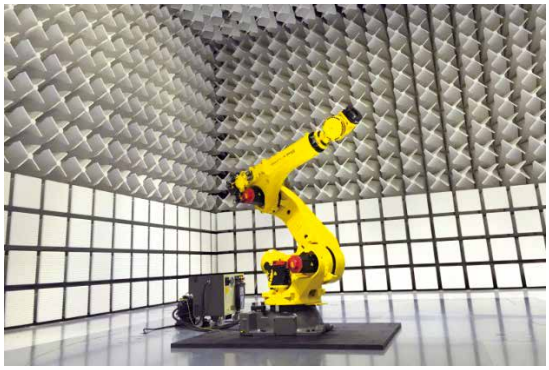
14th Japan Student's Indoor Flying Robot Contest

The 14th Japan Student's Indoor Flying Robot Contest was held on September 29 (Sat) and September 30 (Sun) at the Ota-City General Gymnasium. This contest was intended to encourage students to make things, but more importantly to develop human resources in aircraft design, manufacturing and other areas. A total of 48 teams from universities, technical colleges, high schools, and vocational schools across Japan participated in the contest.
Participants conducted missions such as material transportation and figure-eight flight and competed in flight performance, control technology, and flying techniques. FANUC was a special sponsor of this contest and granted the FANUC Award to Yamaguchi University for their airframe design that realizes stable flight control.

14th Japan Student's Indoor Flying Robot Contest	Host: The Japan Society for Aeronautical and Space Sciences Co-hosts: Tokyo Ota Ward Government, JAXA (Japan Aerospace Exploration Agency), and Ohta Business Sozo Kyougikai Special adviser: Professor Shinji Suzuki, Department of Aeronautics and Astronautics, University of Tokyo Chairman: Professor Takeshi Tsuchiya, Department of Aeronautics and Astronautics, University of Tokyo

FANUC EMC Center has been certified as Appointed EMC Laboratory by TÜV Reinland Japan

On October 11, 2018, 10m Anechoic Chamber in our reliability evaluation building was certified as appointed EMC laboratory by TÜV Rheinland Japan.
Acquiring the certification of the appointed EMC laboratory is a proof that we conduct in-house EMC testing conforming to the international standard ISO/IEC 17025.
From now, the EMC testing for CE marking acquisition, which had been done at external EMC testing laboratories, are able to be done in-house. The acquisition of the appointed EMC laboratory means that more efficient and reliable R&D has become possible.
※ EMC: ElectroMagnetic Compatibility



Anechoic Chamber in the Reliability Evaluation Building


Certificate

of

Appointment

Certificate of Appointed EMC laboratory

Visiting Users

TAKANO Co. Ltd. manufactures standard and custom-order parts for press molding parts and provides high quality products by leveraging machining expertise accumulated over the long history since its foundation.

We visited their headquarters/factory in Ota City, Gunma Prefecture, to interview Mr. Takano, President.

Mr.Takano, President

Please tell us about your campany's history and business domain.

Mr. Takano, President: We mainly manufacture parts for press molding. We manufacture molding parts for blades, guide parts and other parts at the factory in our headquarters (Ota City, Gunma Prefecture) and deliver them to about 2,500 mold manufacturers and press and mold manufacturers across Japan.
My father (Mr. Hiroshi Takano) started the company by manufacturing molds in the free space in our house more than 40 years ago.
At that time, most mold manufacturers internally manufactured molds and mold parts that are incorporated into molds. We also focused on manufacturing mold parts in addition to molds.
My father was really good at creating new mold parts thanks to his ingenuity and other mold manufacturers wanted to use our mold parts. So, the company started making mold parts for other companies as well. The percentage of mold parts in sales gradually increased and now we produce hundreds of types of mold parts as a mold part manufacturer.

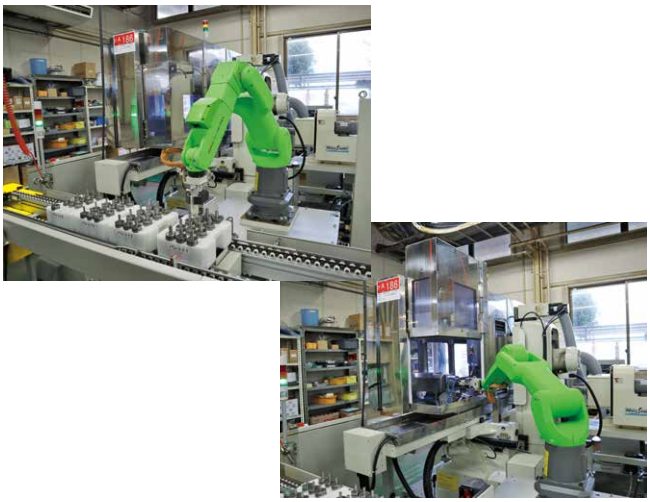
What are the strong points of your company?

Mr. Takano, President: We have expertise on machining of mold parts accumulated over our long history and the latest facilities including an NC cylindrical grinding machine, NC composite lathe, and robots.
By making the most of these facilities, we internally perform the cutting and heat treatment through to the grinding processes in an integrated way to realize high quality products and short lead times. In addition, we control the whole procedure from end to end, starting from order reception through to manufacturing, inspection, and logistics all in one place to build an agile service organization.

Your company has installed the green collaborative robot, CR-7*i*A. We also appreciate your using the first release of FIELD system. Can you tell us how you arrived at this decision?

Mr. Takano, President: We had felt the necessity for production automation and robotization several years ago and gave it much thought. We wanted to maintain the price competitiveness of products and ensure stable quality through automation and robotization.
When looking around the JIMTOF exhibition in 2016, we found the optimal equipment for automating and robotizing the production of a blade part called a punch,

Takano headquarters and factory



Cylindrical grinding automation system using the CR-7*i*A

one of our main products. We also found out the we could take advantage of subsidies by smartly combining robots and IoT technology. That's why we consulted with FANUC, which provides advanced robots and IoT technology, about implementing these technologies.
Now, the collaborative robot loads and unloads punches in the cylindrical grinding machine day and night. In addition, we installed a new app in the FIELD system to collect measurement values from the cylindrical grinding machine and peripheral devices and monitor their states.

Please tell us your thoughts after using them.

Mr. Takano, President: The FANUC collaborative robot does not need a safety fence because it safely stops if it comes in contact with a human worker. Therefore, we were able to install this automation system using the collaborative robot in a very small space. In addition, automation and robotization brought benefits such as an increase in the daily production volume resulting from nighttime operation and reduction in human working hours to about one-tenth.
On top of that, the *i*ZDT app in the FIELD system monitors robot operation and prevent failures and downtime.

Please tell us if you have any requests that you would like to make to FANUC.

Mr. Takano, President: FANUC sincerely supported us in implementing this automation system from startup to troubleshooting. Thank you.
FANUC also meticulously taught us about the teaching procedure of the collaborative robot one by one from the startup. However, we may not be able to solve actual problems by ourselves if one were to happen. So, we look forward to FANUC's continued support.
We also hope that FANUC will further enhance FIELD system apps with functions that improve production efficiency, such as a push notification function for when the operation line stops or a scheduler link function.

(Interviewer : Shingo Numoto, Public Relations Department, FANUC CORPORATION)

"I am happy to see the robot silently working in a completely dark factory when I leave the office late at night." says Mr. Takano, President.

TAKANO CO. Ltd. (http://www.kk-takano.co.jp/)

▶President and CEO : Eiji Takano ▶Capital stock : 20 million yen ▶Number of employees : 100
▶Address : Higashikanai-cho 1237, Ota-shi, Gunma Phone : 0276-22-6270 Fax : 0276-22-6278

Four Seasons of FANUC

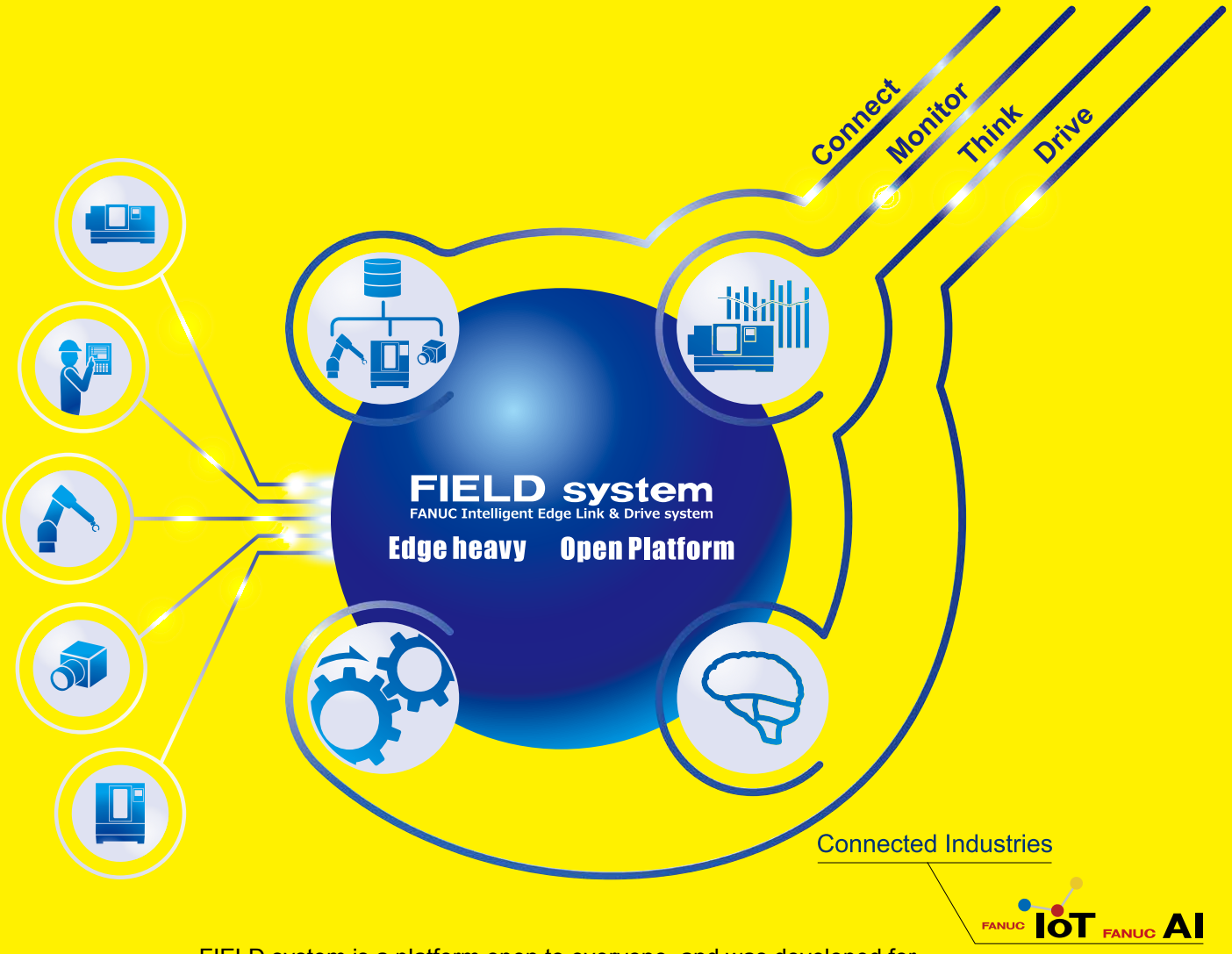
On the premises of FANUC, autumn vividly and swiftly passed and winter is coming with clear air and quiet.

<Autumn leaves and mushrooms that colored the premises of FANUC in Autumn>

Smart Machine Smart Factory

Driving machinery smartly and efficiently for a smarter factory

Discover new *value* with FIELD system: an ecosystem for manufacturing that utilizes production data more effectively.



FIELD system is a platform open to everyone, and was developed for edge-heavy computing by bringing together the latest IoT and cutting-edge AI technologies.

By using this system,

FANUC aims to work with partners around the world to innovate manufacturing.

FANUC News 2018-Ⅲ

FANUC CORPORATION
Oshino-mura, Minamitsuru-gun, Yamanashi 401-0597 Japan
https://www.fanuc.co.jp/
Phone: (81) 0555-84-5555
Fax: (81) 0555-84-5512
Person in charge of publishing:
Yoshihiro Gonda, Representative Director, Senior Executive Vice President and CFO (General Manager, Corporate Administration Division)