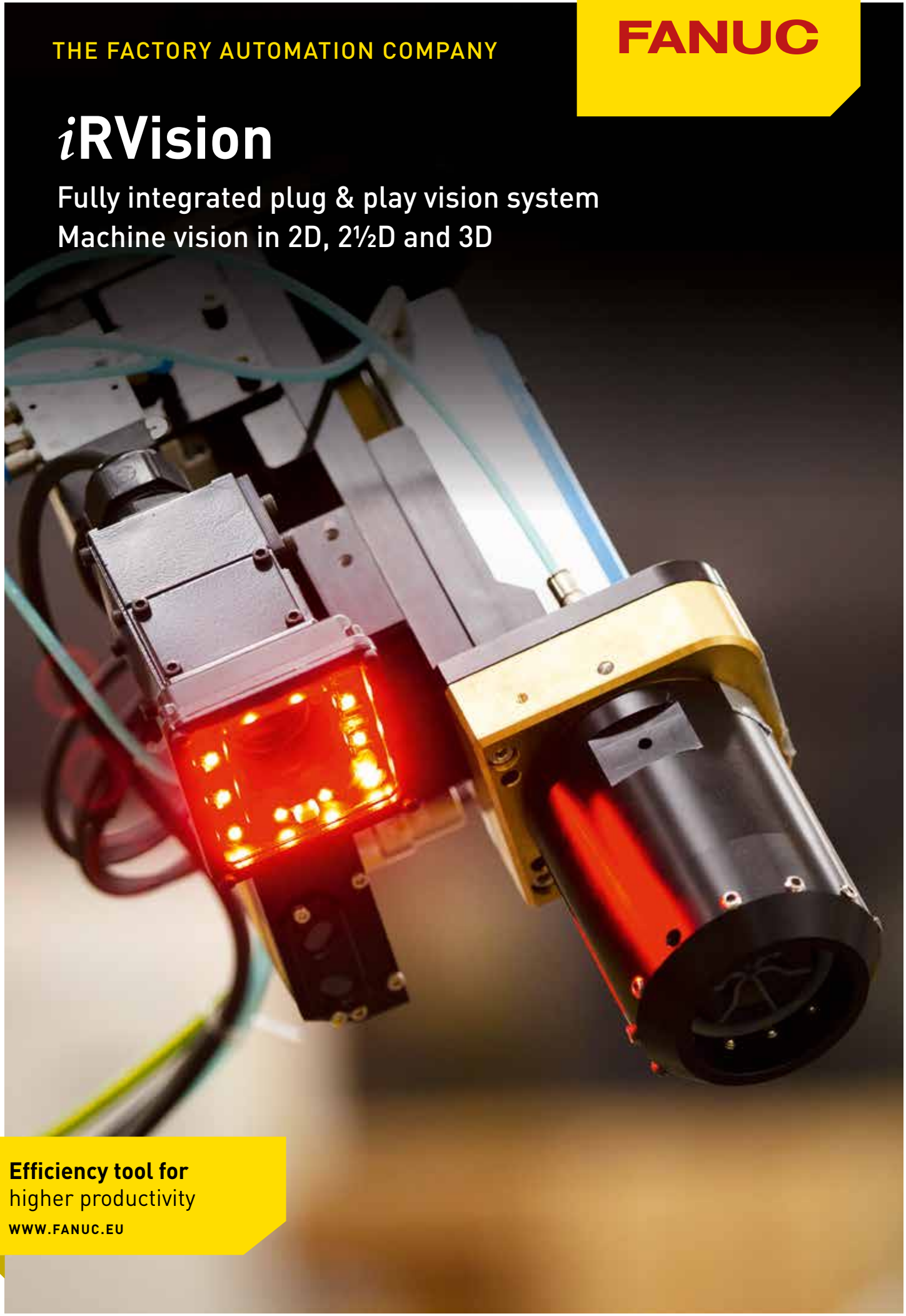
THE FACTORY AUTOMATION COMPANY

FANUC

*i*RVision

Fully integrated plug & play vision system
Machine vision in 2D, 2½D and 3D



Efficiency tool for
higher productivity

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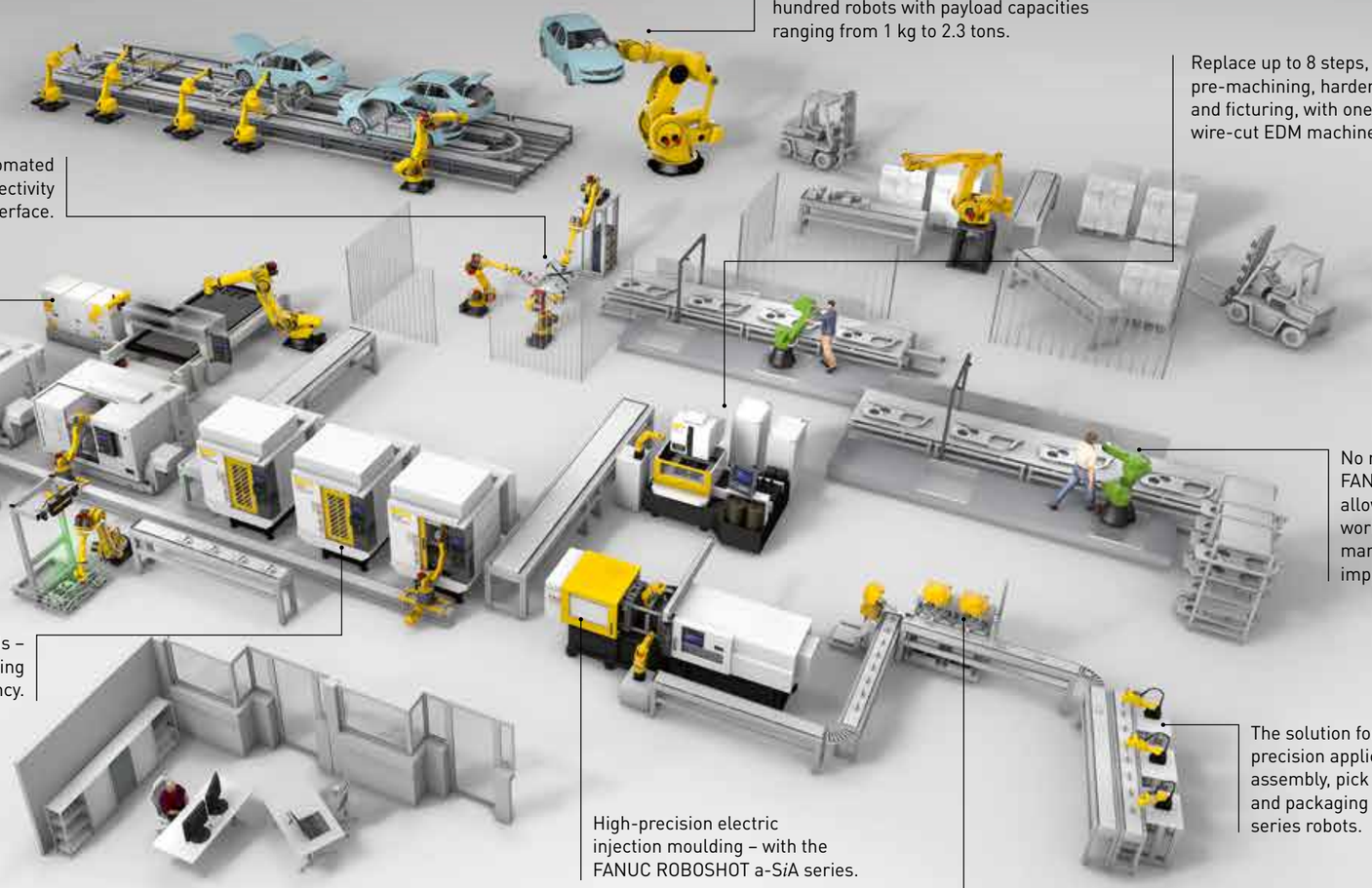
*i*ntelligent automation – 100% FANUC



Lift up to 2.3 tons – choose from over one hundred robots with payload capacities ranging from 1 kg to 2.3 tons.

Replace up to 8 steps, including pre-machining, hardening, finishing and ficturing, with one ROBOCUT wire-cut EDM machine.

Multi-robot welding cells – easy automated welding thanks to seamless connectivity and a single user-friendly CNC interface.

Seamless fiber and CO_2 laser packages for efficient automated laser cutting.

Visual bin picking – gives robots the ability to identify and pick loose parts and even bags from a bin.

No need for safety fences – FANUC collaborative robots allow easy integration into human workspaces for even more manufacturing efficiency and improved health and safety.

Retool in just 0.7 seconds – FANUC ROBODRILL, our vertical machining centre, is designed for maximum efficiency.

High-precision electric injection moulding – with the FANUC ROBOSHOT a-*Si*A series.

The solution for high-speed precision applications, such as assembly, pick and place, inspection and packaging – FANUC SCARA series robots.

Ultra-fast picking, assembling and sorting – FANUC's range of delta robots are ideally suited to high-speed handling processes requiring a great deal of versatility.

Optimised energy usage – intelligent energy management

With three core product groups, FANUC is the only company in its sector to develop and manufacture all its major components in-house. Every detail, both hardware and software, undergoes stringent quality control checks as part of an optimised chain. Fewer parts and lean technology make FANUC solutions reliable, predictable and easy to repair. They are made to run and provide you with the highest uptime on the market.

All FANUC products – industrial robots, CNC systems and CNC machines – share a common servo and control platform, providing seamless connectivity and making full-automation scenarios really simple. Since all products share common parts, spare parts management with FANUC is fairly efficient. Plus, global standards make it very easy to go international with FANUC.

We empower robots to see

*i*RVision is FANUC's unique, fully robot integrated visual detection system enabling the robots to see in order to manage production settings in a faster, smarter and more reliable way.
This increases the overall production flexibility and efficiency in the workplace.
The *i*RVision application solution can be implemented without complicated programming or expert knowledge. The need to place the workpiece in an exact position for the robot to grip is no longer required, as *i*RVision recognizes the workpiece independently. This results in a high operational efficiency of the overall process. The solution is applicable to various industries (Automotive, Food, Metal, Plastic, Aeromotive, Pharma, etc.) and can be customized according to your various needs.

100% FANUC
Based on over 30 years of experience, we are specialists on the field of specifically tailored vision systems for robots. FANUC robots stand for high reliability, and our globally uniform service & support network guarantees competent troubleshooting and a timely delivery of spare parts.

FANUC *i*RVision supports:

- Up to 27 cameras (B/W and colour) in different resolutions connectable
- Supported vision technologies: 2D, 2½D, 3D by laser projection or structured light
- Can be combined with *i*RVision Bin Picking and *i*RPickTool
- Complete robot range, from small to large
- Detection of non-moving and moving parts independent of their size, shape or position
- Usage of *i*RVision for advanced service functions (*i*RCalibration Suite)
- Tools which automate calibration procedures and make manual teaching unnecessary

Over **30** years of *i*RVision experience

2800 units sold per year

Easy plug and play technology

*i*RVision is fully robot integrated, not requiring an interface to external devices or any additional hardware (such as PCs, monitors or side cabinets) for the set up and operation. The vision process configuration can be done directly on the iPendant of the robot controller or on an external PC by using a web browser. The entire range of robots - from small to large ones, as well as all controller types are compatible with the *i*RVision solution because the controller hardware is ready-for-vision.

Efficient ease of use

The solution is setup within a fast matter of time, as it guides you through each step along the way. A powerful vision toolbox, that is integrated in the standard *i*RVision package, supports any tailor-made application. Thanks to a common HMI (GUI), all vision types share the same look and feel, independant of the used software/hardware platform. Vision command instructions are integrated in the basic robot TPP (Teach Pendant Programming) with direct and complete access to vision process data through *i*Pendant.

Easy simulation

All vision types of *i*RVision are supported in the simulation software ROBOGUIDE.
This software enables a simulation of the process, allowing you to select and modify parts and dimensions as required and evaluate the feasibility and efficiency of the entire process before making a purchase decision.

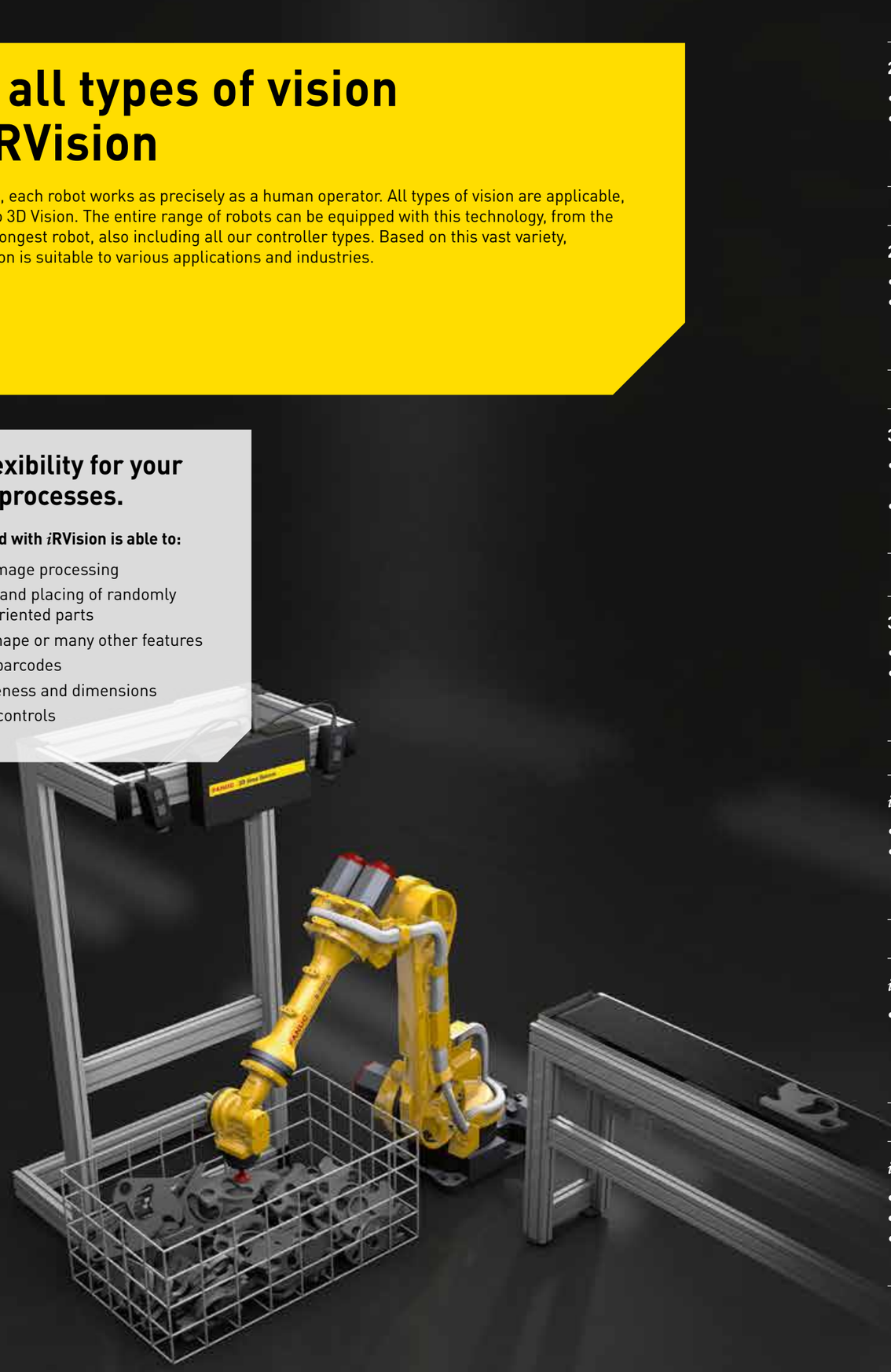
Cover all types of vision with *i*RVision

Thanks to *i*RVision, each robot works as precisely as a human operator. All types of vision are applicable, ranging from 2D to 3D Vision. The entire range of robots can be equipped with this technology, from the smallest to the strongest robot, also including all our controller types. Based on this vast variety, the *i*RVision solution is suitable to various applications and industries.

Ultimate flexibility for your production processes.

The robot equipped with *i*RVision is able to:

- perform visual image processing
- perform picking and placing of randomly positioned and oriented parts
- sort by colour, shape or many other features
- read 1D and 2D barcodes
- control completeness and dimensions
- perform quality controls



2D vision

- Detection of objects positioned in one layer (X,Y,R)
- Picking up non-moving parts

2½D vision

- Detection of objects positioned in two or more layers (X,Y,Z,R)
- Picking up non-moving parts with different heights

3D laser vision

- Detection of object position and orientation by laser projection (X,Y,Z,W,P,R)
- Picking up non-moving parts in all 6 degrees of freedom

3D Area Sensor and 3D Vision Sensor

- Detection of objects by structured light projection (X,Y,Z,W,P,R)
- Can be used for high-end vision based bin picking, depalletising, and other material handling applications and functions despite the parts conditions, e.g. being dirty, rusty or oily

***i*RPickTool**

- Detection of objects on-the-fly in conveyor tracking (X,Y,R)
- For all processes involving the need to identify, pick and place objects on a moving conveyor

***i*RCalibration**

- *i*RCalibration functions are service tools based on *i*RVision. They simplify the initial setup, speeding up the entire integration, which results in an improvement of the application accuracy.

***i*RVision Weld Tip Inspection / *i*RTorchMate**

- *i*RVision Weld Tip Inspection for spot welding
- *i*RTorchMate for arc welding
- Supports the optical wear and condition control of a WeldTip or ArcTorch during automatic production.

*i*RVision efficiency highlights

*i*RVision overview

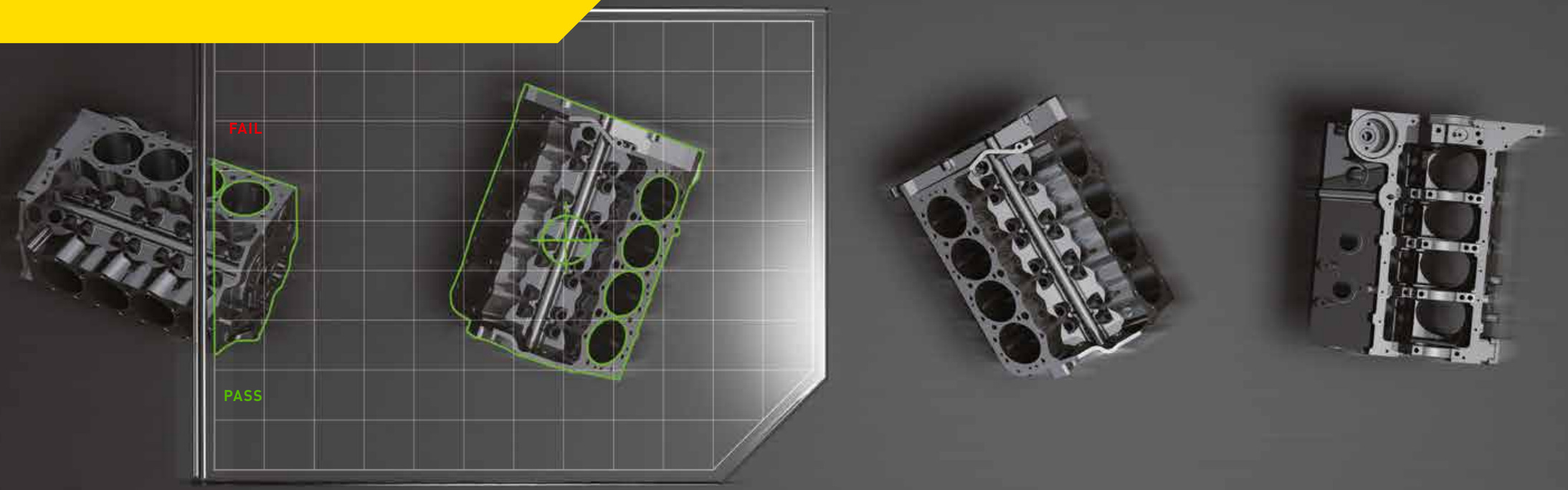
- vision software is completely embedded in the robot's hard- and software
- 2D, 2½D, 3D and Barcode reading
- *i*RPickTool supports 2D *i*RVision
- 2 different 3D technologies (laser projection, structured light projection)
- image processing and data storage on robot controller
- max. 27 cameras connectable to one robot controller
- different resolutions up to 1984x1264 pixels
- colour camera support
- many vision algorithms supported such as Geometric Pattern Matching and Blob detection
- cable length up to 50m supported
- huge vision tool box embedded in *i*RVision standard software package
  - over 20 different vision process types supported
  - additionally over 50 different vision command tools could be used/combined to create a special, tailor-made *i*RVision solution
- robot integrated camera cable for harsh environment
- 100% FANUC product, worldwide support
- FANUC simulation-software ROBOGUIDE supports all types of *i*RVision devices

Pre-sales support

Prior to the purchase of our *i*RVision solution, we offer to test the vision process with you within your environment. Through the usage of our simulation software tool – ROBOGUIDE, we are capable of evaluating the time, effort and feasibility of the entire process to implement the vision system application requirements.

Integration and Maintenance support

Once you have selected the *i*RVision solution, we further support you in getting started with the set-up to tailor the solution to your individual application needs. We provide you with a direct access to your entire vision process, enabling you to identify further vision needs. Furthermore, our 24/7 real-application support hotline is available worldwide, where technicians provide their help in troubleshooting the entire setup.



*i*RVision 2D

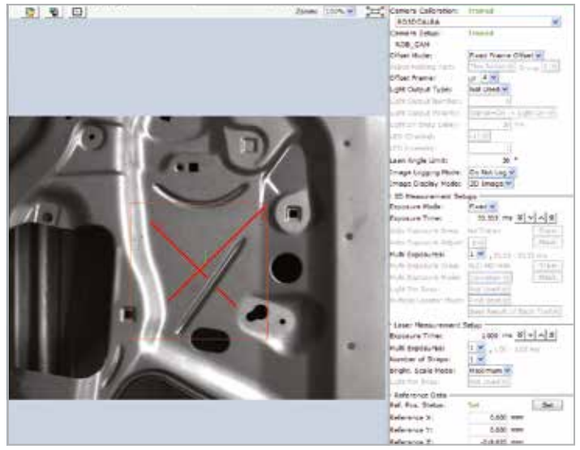
*i*RVision finds parts and their precise positioning and part orientation (X,Y, Z and R). As a result, the production flexibility increases due to the eliminated need for expensive positioning fixtures. 2D vision is suited for any material handling applications, palletising and depalletising applications, as well as for vision inspections.

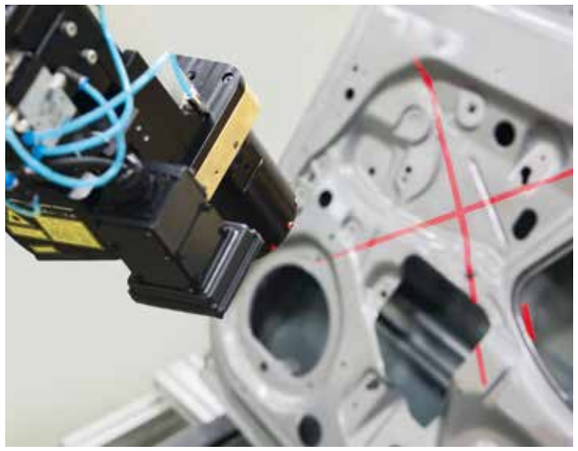
DIFFERENT FUNCTIONS AVAILABLE

- **2D Single-View Vision Process**
  X,Y,R robot coordinates of non-moving parts.
- **2D Multi-View Vision Process**
  X,Y,R robot coordinates of non-moving parts. Provides higher accuracy for very large parts based on more than one camera view.
- **Depalletising Vision Process**
  X,Y,(Z),R robot coordinates of non-moving parts.
- **2D Calibration-free Vision Process**
  X,Y,R robot coordinates of non-moving parts. Processes images without camera calibration.
- **3D Tri-View Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts. Three or more 2D cameras are used to find 3D offset of a large part. Mostly used to offset several robots in paint and sealing applications.
- **Floating Frame Vision Process**
  X,Y,R robot coordinates of non-moving parts. Allows locating of parts from various robot postures when keeping same relationship between part's plane and camera.
- **Single-View Visual Tracking Process**
  outputs binary inspection result (PASS/FAIL). Supports the new AI Error Proofing Tool.
- **Reader Vision Process**
  outputs the character string of 1D or 2D Barcode. Supports five types of 1D barcode (EAN-13/JAN-13/ UPC-A; Code 39; Interleave 2-of5; Codabar/NW7) and two types of 2D barcode (datamatrix ECC200; Model 2 and Micro QR-Code).
- **Image to Points Vision Process**
  outputs chains of connected edge points in an image captured by a 2D camera. The detected points on the outline of a part can be extracted into a TP program for applications such as deburring.

*i*RVision 3D with 3D Laser Sensor

FANUC 3DL sensor projects laser lines for reliable 3D measurement. The projection of laser light makes the system robust against various surface conditions (e.g. flat metal, rust, wet, discolorations, etc.). Using its hybrid technology, the 3DL sensor can detect 3 dimensional position and posture of a part. All 3DL sensors support both robot-mount and fixed installation.



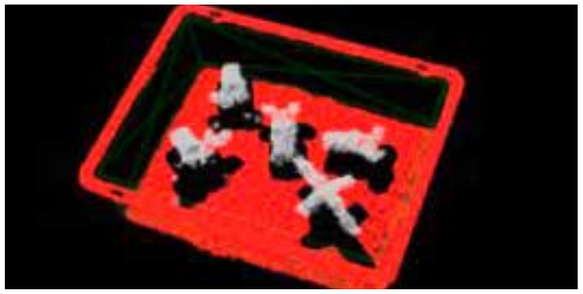


DIFFERENT FUNCTIONS AVAILABLE

- **3DL Single-View Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts.
- **3DL Multi-View Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts. Provides increased accuracy for very large parts based on at least two camera snaps.
- **3DL Cross Section Vision Process**
  X,Y,Z robot coordinates (linked to UTtool or UFrame) of non-moving parts. Generates a black and white cross-sectional image of a part (by laser slit beam projection) and measures cross-sectional features.
- **3DL Curved Surface Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts. Combines the CSM Locator Tool and laser beam projection to locate parts with a cylindrical surface.
- **3DL Displacement Command Tool**
  measures the distance to a part.
- **3DL Plane Command Tool**
  measures the position and posture of a part featuring a planar section.
- **3DL Cylinder Command Tool**
  measures the position and posture of a part featuring a cylindrical section.

*i*RVision 3D with 3D Vision

FANUC 3DV sensor acquires a detailed depth image by a quick projection & snap of a single blue pattern. 3DV sensors can be used for bin picking, tote picking, kitting, depalletizing, presence/absence check, 3D visual line tracking and many other applications. 3DV sensors are also ideal for 2D applications where objects are hard to find due to low contrast or noisy 2D image data. All 3DV sensors support both robot-mount and fixed installation.



3D Vision Sensor Types

- 3DV/400 for small-size field of view: 400 x 300 x 300 mm
- 3DV/600 for mid-size field of view: 600 x 500 x 500 mm
- 3DV/1600 for large field of view: 1600 x 1600 x 1300 mm

DIFFERENT FUNCTIONS AVAILABLE

- **3DV Single-View Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts.
- **3DV Stitching Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts. Stitches multiple depth images into one for a larger effective FOV or depth data interpolation.
- **3D Peak Locator Tool**
  X,Y,Z robot coordinates for non-moving parts, each found as locally highest point in the 3D map.
- **3D Blob Locator Tool**
  X,Y,Z,W,P,R robot coordinates of parts, each found as a 3D blob (continuously connected set of 3D points on a part surface).
- **3D GF Locator Tool**
  X,Y,Z,R robot coordinates of non-moving parts, each found as a position where the fingers of a modeled two-finger parallel gripper (GF) fit to grasp the part without interference.
- **3D Box Locator Tool**
  X,Y,Z,W,P,R robot coordinates of non-moving boxes which are palletized orderly, each found as top surface of a 3D box model with specified dimensions.
- **3D Cylinder Locator Tool**
  X,Y,Z,W,P,R robot coordinates of parts, each found as top surface of a 3D cylinder model with specified diameter and length.

- **3D One-Sight-Model Locator Tool**
  X,Y,Z,W,P,R robot coordinates of parts, each found as 3D model that has been taught (using 3D data or 3D CAD file) for one face of the part.
- **3D COG Measurement Tool**
  measures center of gravity (Z) of a part that was found by a parent 2D tool (GPM or CSM Locator Tool).
- **3D Plane Measurement Tool**
  measures the plane (Z,W,P) of a part thta was found by a parent 2D tool (GPM or CSM Locator Tool).
- **3D Obstruction Measurement Tool**
  measures obstruction (number of higher 3D points) above a part that was found by a parent 2D tool (GPM or CSM Locator Tool). Indicates and helps to avoid potential interference before pick operation.

*i*RVision 3D with 3D Area Sensor

FANUC 3DA sensor uses a dedicated projector unit for 3D measurements. 3D data is measured in a wide area by projecting a quick series of structured light patterns (greenish stripes). The 3DA Sensor supports fixed installation type and can be used for bin picking and depalletizing.

3D Area Sensor Types

- 3DA/1300 for large field of view: 1300 x 1000 x 1000 mm

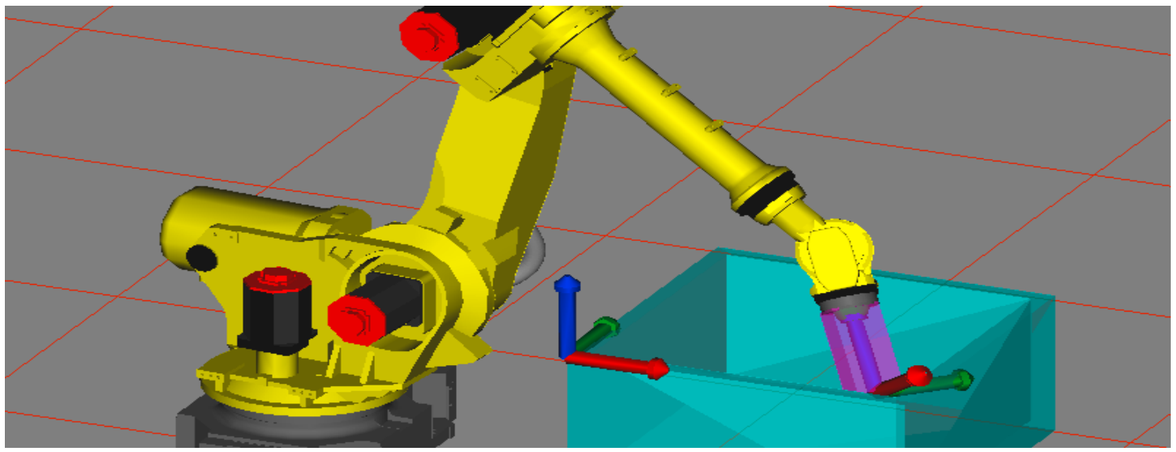
DIFFERENT FUNCTIONS AVAILABLE

- **3D Area Sensor Vision Process**
  X,Y,Z,W,P,R robot coordinates of non-moving parts.
- **3D Peak Locator Tool**
  X,Y,Z robot coordinates of non-moving parts, each found as locally highest point in the 3D map.
- **3D Blob Locator Tool**
  X,Y,Z,W,P,R robot coordinates of non-moving parts, each found as a 3D blob (continuously connected set of 3D points on a part surface).
- **3D GF Locator Tool**
  X,Y,Z,R robot coordinates of non-moving parts, each found as a position where the fingers of a modeled two-finger parallel gripper (GF) fit to grasp the part without interference.
- **3D Box Locator Tool**
  X,Y,Z,W,P,R robot coordinates of non-moving boxes which are pallletized orderly, each found as top surface of a 3D box model with specified dimensions.
- **3D Cylinder Locator Tool**
  X,Y,Z,W,P,R robot coordinates of non-moving parts, each found as top surface of a 3D cylinder model with specified diameter and length.
- **3D One-Sight-Model Locator Tool**
  X,Y,Z,W,P,R robot coordinates of parts, each found as 3D model that has been taught (using 3D data or 3D CAD file) for one face of the part).

- **3D COG Measurement Tool**
  measures center of gravity (Z) of a part that was found by a parent 2D tool (GPM or CSM Locator Tool).
- **3D Plane Measurement Tool**
  measures the plane (Z,W,P) of a part that was found by a parent 2D tool (GPM or CSM Locator Tool).
- **3D Obstruction Measurement Tool**
  measures obstruction (number of higher 3D points) above a part that was found by a 2D tool (GPM or CSM Locator Tool). Indicates and helps to avoid potential interference before pick operation.

*i*RVision Bin Picking

*i*RVision Bin Picking option provides important and useful functions that are necessary in addition to vision functionality for a successful bin picking or tote picking application. All types of *i*RVision sensors are supported.



DIFFERENT FUNCTIONS AVAILABLE

- **Part List Manager function**
  organizes all detected parts in accordance to their pick priority, pick status, position and orientation, and other part-related information.
- **Interference Avoidance function**
  takes all mechanical interference contours into account and plans all mandatory positions for the robot approach, the pick and retract movements. Complete robot movement is planned by the system itself.
- **4D Graphics (optional)**
  greatly facilitates user's insight into the system by providing graphical display of the 3D point cloud, vision results, Interference Avoidance data and last result, part data status in the Parts List.

- **FANUC Bin Picking Gripper**
  features two flexible fingers and adjustable stroke, dedicated for bin picking of irregular lightweight parts up to 2 kg. Available for various M-10 and M-20 series robots.
- **Soft Robotics mGrip Gripper**
  features two or more flexible rubber fingers for very soft handling of irregular or unknown lightweight parts including food.

FANUC Bin Picking Gripper

Soft Robotics mGrip Gripper

*i*RPickTool

*i*RVision functionality can be added to *i*RPickTool to support the detection of randomly placed parts on a moving conveyor. This way, the *i*RPickTool equips single or multiple robots with the ability to identify, pick and place items in linear and/or circular conveyor tracking. This is supported by a wide range of features including advanced queue management, buffering and tray functionality.

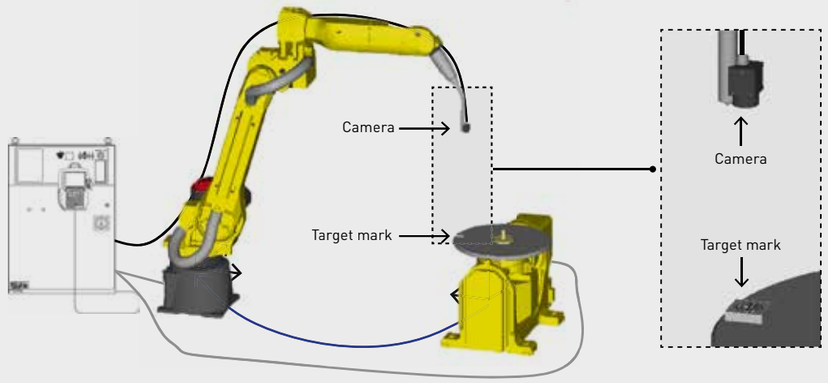
DIFFERENT FUNCTIONS AVAILABLE

- **2D Single-View Visual Tracking**
  X,Y,R robot coordinates of moving parts.
- **2D Multi-View Visual Tracking**
  X,Y,R robot coordinates of moving parts. Provides higher accuracy for very large parts based on more than one camera view.
- **3DV Single-View Visual Tracking**
  X,Y,Z,W,P,R coordinates of moving parts which are not flat or not horizontal.
- **Various system layouts** by default supported.
- **Linear and Circular** conveyor systems by default supported.
- **Multiple robots** by default supported, connected by TCP/IP.
- **Queue Management** by default integrated in the standard *i*RPickTool software package.
- **Load balancing** by default integrated.
  Amount of parts to be handled by each robot can easily be manipulated during runtime.
- **Recipe management** by default supported to quickly switch between different production scenarios.

- **Tray function** (Box or blister) by default integrated.
  Completeness check of outgoing tray and tray management is easy to setup, fully supported by load balance and additional special functions.
- **Conveyor stop/start function** by default integrated.
  Infeed part check and outgoing tray completeness check could be combined with the conveyor stop/start and/or ejector function to eject incomplete trays.
- **Different sorting functions** by default integrated.
- **Wide conveyors** can be equipped with several parallel mounted cameras to increase part detection accuracy.
- **Pre-Grouping** by default integrated.
  Creation of pre-groups on the same conveyor to save time when complete groups can be picked and placed in downstream area.
- **Sensor task customization** can be performed by users to have full control over complex detection methods and queue feed. This is supported by default.
- **Servo conveyor and Indexer function** by default supported in order to control conveyor by FANUC servo motor.

*i*RCalibration and more ...

Most *i*RCalibration functions are based on *i*RVision, but act as a stand-alone tool box for commissioning and service. *i*RCalibration facilitates the initial setup and the entire integration, while ensuring very high accuracy of the robot. Additional solutions based on vision systems are the *i*RVision Weld Tip Inspection, which prevents wear and tear of the weld tip, and the *i*RTorchMate, which inspects the ArcTorch, calculates and corrects a possible misalignment.



DIFFERENT FUNCTIONS AVAILABLE

- ***i*RCalibration vision mastering /mastering recovery**
  Supports quicker and simpler mastering/ remastering of FANUC robots, independent of the operator's skills.
- ***i*RCalibration vision tool center point (TCP) setting**
  Supports simpler and more accurate setting of the robot TCP, independent of the operator skill's.
- ***i*RCalibration vision frame setting**
  Supports simpler and more accurate setting of robot UFRAME. Function is available as a manual, one time setup function or as an automated UFRAME setting, independent of the operator's skills.
- ***i*RCalibration vision multi group calibration**
  Supports simpler and more accurate setting of relationships between two robots, or between a robot and a positioner coordinated by a single controller, independent of the operator's skills.

- ***i*RVision Weld Tip Inspection for spot welding**
  Supports the optical wear and condition control of a WeldTip during automatic production. Based on the result, the tip can be reworked or replaced without a production interrupt.
- ***i*RTorchMate for arc welding**
  Supports the optical control of an e.g. ArcTorch during automatic production. Based on the result ArcTorch offset can be added or other actions can be executed.


*i*RTorchMate

- ***i*RTorchMate**
  Prevents alignment issues by keeping the tool centre point exactly on the tool path, thus ensuring consistent weld quality

Efficient FANUC service worldwide

Wherever you need us, our comprehensive FANUC network provides sales, support and customer service all around the world. That way, you can be sure you have always got a local contact that speaks your language.

99.9%
spare parts availability!

Efficient training: FANUC Academy

The FANUC Academy offers everything you need to upskill your teams and increase productivity – from introductory programs for beginners through to courses tailored to the needs of expert users and specific applications. Fast and effective learning, on-site training or cross machine training, make up the extensive educational offering.

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Efficient long-time productivity: FANUC Maintenance Services

To minimise impact on production and get the most out of your machine, we offer maintenance services designed to lower your machine's TCO. Whatever your production scenario, FANUC solutions keep your machine running via dedicated preventive, predictive and reactive maintenance procedures that maximise uptime and keep downtime to a bare minimum.

24/7
support

Efficient supply: Lifetime OEM spare parts

As long as your machine is in service we will provide you with original spare parts – for a minimum of 25 years. With more than 20 parts centres all over Europe, dedicated service engineers and direct online access to FANUC stores, availability checks and ordering, we keep you running whatever happens.

One common servo and control platform –
Infinite opportunities
THAT's FANUC!

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FA
CNCs,
Servo Motors
and Lasers

ROBOTS
Industrial Robots,
Accessories
and Software

ROBOCUT
CNC Wire-Cut
Electric Discharge
Machines

ROBODRILL
Compact
CNC Machining
Centres

ROBOSHOT
Electric CNC
Injection Moulding
Machines

ROBONANO
Ultra Precision
Machine

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