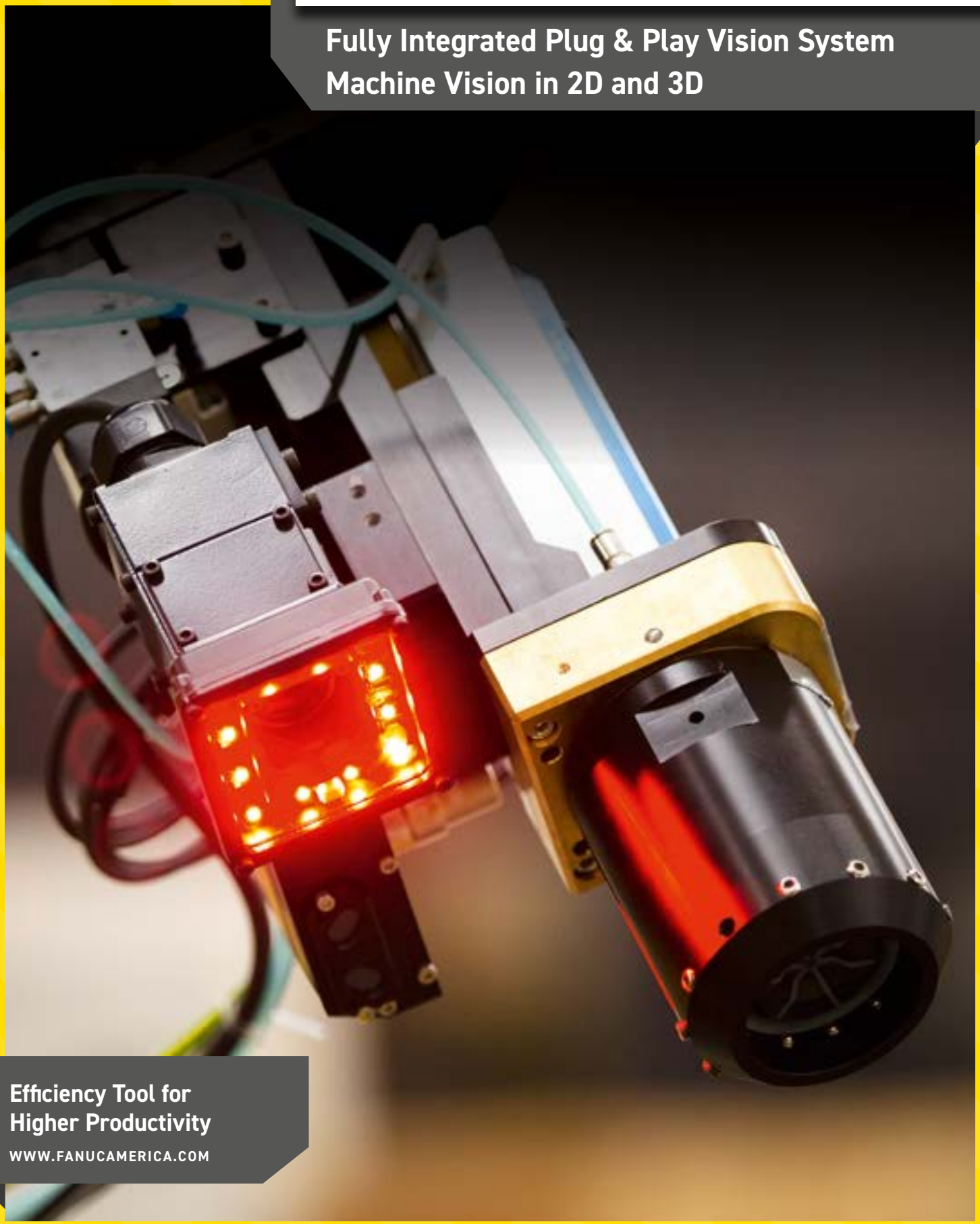
FANUC

ROBOTS | CNC | AUTOMATION

*i*RVision

Fully Integrated Plug & Play Vision System
Machine Vision in 2D and 3D



Efficiency Tool for Higher Productivity

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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 programing or expert knowledge. The need to place the work piece in an exact position for the robot to grip is no longer required, as *i*RVision recognizes the work piece independently. This results in a high operational efficiency of the overall process. The solution is applicable to various industries (Automotive, Food, Metal, Plastic, Aerospace, 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 color) in different resolutions connectable
- Supported vision technologies: 2D, 3D by laser projection and 3D map by structured light
- Can be combined with 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

Ultimate Flexibility for Your Production Processes.

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

- Perform visual processing
- Perform picking and placing of randomly positioned and oriented parts
- Sort by color, shape or many other features
- Read 1D and 2D barcodes
- Control completeness and dimensions

Over 30 Years of Machine Vision Experience

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. The entire range of robots can be equipped with this technology, from the smallest to the strongest robot, across all controller types. Based on this vast variety, the *i*RVision solution is suitable to various applications and industries.

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 robot controller itself or via a web browser. The entire range of robots - from small to large, as well as all controller types are compatible with the *i*RVision solution because the robot controller hardware is ready-for-vision.

Efficient Ease of Use

Setup *i*RVision quickly and easily. *i*RVision guides you through each step along the way. A powerful vision toolbox, that is integrated in the standard *i*RVision package, supports any custom application. Thanks to a common HMI (GUI), all vision types share the same look and feel, independant of the used software or hardware platform. The vision executions 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 FANUC's 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.

2D Vision

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

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

- Detection of objects by 3D map (structured light projection) (X, Y, Z, W, P, R)
- Can be used for high-end vision based bin picking, depalletizing, and other material handling applications and functions despite the parts conditions, e.g. being dirty, rusty or oily

3D Vision Sensor

- Detection of objects by 3D map (structured light projection) (X, Y, Z, W, P, R)
- Can be used for high-end vision based bin picking, depalletizing, and other material handling applications and functions despite the parts conditions, e.g. being dirty, rusty or oily
- Detect objects in 3D on a moving conveyor

*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, 3D and Barcode reading
- *i*RPickTool supports 2D and 3D *i*RVision
- 2 different 3D technologies (3D-map and 3D-laser projection)
- Image processing and data storage on robot controller
- Max. 27 cameras connectable to one robot controller
- Different resolutions up to 1920x1200 pixels
- 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 iRVision solution
- Robot integrated camera cable for harsh environment
- 100% FANUC Product, worldwide support
- FANUC simulation-software ROBOGUIDE supports all *i*RVision types

Pre-Sales Support

Prior to the purchase of our *i*RVision solution, we offer to test the vision process 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, palletizing and depalletizing applications,
as well as for vision inspections.

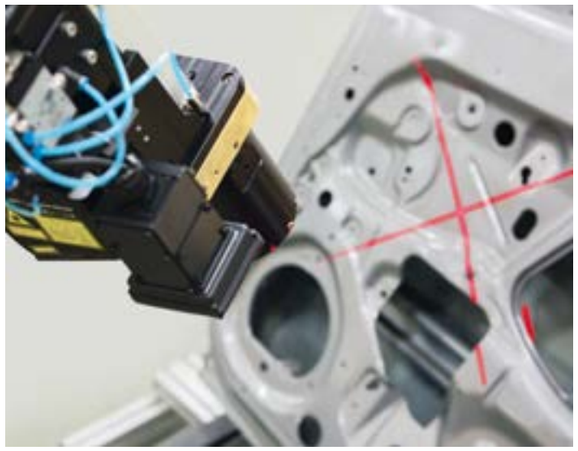
Different 2D Process Types Available

- **2D Single-View Vision Process**
  X, Y, R robot coordinates for non-moving parts
- **2D Multi-View Vision Process**
  X, Y, R robot coordinates for non-moving parts.
  Increased accuracy for huge parts based on more than 1 camera snap
- **2D Single-View Visual Tracking Process**
  X, Y, R robot coordinates for moving parts. Supports *i*RPickTool to pick parts from a moving conveyor
- **Gaze Line Offset Vision Process**
  X, Y, Z, R robot coordinates and orientation according to Camera View Line for non-moving parts
- **Single View Inspection Process**
  Delivers binary inspection result (PASS/FAIL). No robot coordinates
- **2D Calibration Free Vision Process**
  X, Y, R robot coordinates for non-moving parts without camera calibration
- **3D Multi-View Vision Process**
  X, Y, Z, W, P, R robot coordinates for non-moving parts. Four 2D sensors deliver position compensation, mostly used for several robots (typically paint, sealing applications)
- **Barcode Reader Vision Process**
  Delivers the string of 1D or 2D Barcode. Five types of 1D barcode (EAN-13/JAN-13/UPC-A; Code 39; Interleave 2-of-5; Codabar/NW7) and two types of 2D barcode (data matrix ECC200; Model 2 and Micro QR-Code). No position information will be delivered
- **Image to Points Vision Process**
  Finds chains of connected edge points in an image captured by a 2D camera. The detected points on the outline of a work piece could be extracted into a TP program for applications such as deburring
- **Floating Frame Vision Process**
  X, Y, R robot coordinates for non-moving parts. Allows measuring of objects from various robot postures when keeping same relationship between object plane and camera

*i*RVision Functions

*i*RVision 3D with 3DL Sensor

*i*RVision 3DL uses a hybrid sensor head (FANUC development) for the 3D vision function. 3DL head uses structured laser light projections for reliable detections. The projection of structured light makes the system robust against various surface conditions (e.g. flat metal, rust, wet, discolorations, etc.). Through this hybrid technology, FANUC's 3DL Sensor can detect 3 dimensional position and posture of a part.



Different 3DL Process Types Available

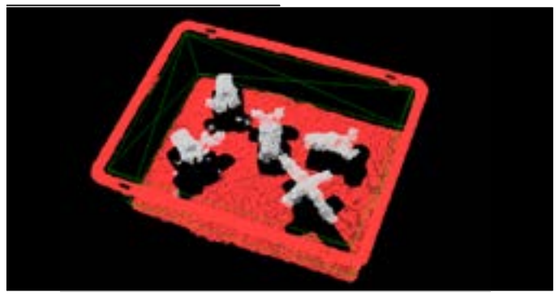
- **3DL Single-View Vision Process**
  X, Y, Z, W, P, R robot coordinates for non-moving parts
- **3DL Multi-View Vision Process**
  X, Y, Z, W, P, R robot coordinates for non-moving parts. Provides increased accuracy for huge parts based on at least two camera snaps
- **3DL Cross Section Vision Process**
  X, Y, Z robot coordinates (linked to UTtool or UFrame) for non-moving parts. Laser slit beam projection generates a black and white image of the contour of the part
- **3DL Curved Surface Vision Process**
  X, Y, Z, W, P, R robot coordinates for non-moving parts, combines CSM.
  Locator Tool and laser beam projection to locate parts with a cylindrical surface
- **Bin Picking Support (optional)**
  Bin picking system enables the vision system to recognize the position and posture of all parts, which are randomly placed inside a container.
  This option contains all mandatory functions required for a successful bin picking application. Bin picking supports all types of *i*RVision Sensors, and provides two important functions:

  - **Part List Manager** organizes all detected parts in accordance to their position and posture, reachability and other part-relevant information

  - **Interference Avoidance** takes all mechanical interference contours in account and plans all mandatory positions for the robot approach, the pick and retract movements. Complete robot movement is planned by the system itself

*i*RVision 3D with 3DV Sensor

The *i*RVision 3D Area Sensor uses a projector unit for 3D measurements. 3D data is measured in a wide area by projecting structured light very quickly for reliable detection. A 3DV Sensor may be used for depalletizing, kitting, tote picking, presence absence check, 3D visual line tracking and many more applications. The 3DV Sensor is also ideal for 2D applications with low contrast or hard to find targets.



3D Vision Sensor

- 3DV/400 for smaller field of view (400 x 300 x 300 mm)
- 3DV/600 for medium field of view (700 x 525 x 500 mm)

Different 3D Tools and Functions Available

- **3D Peak Locator Tool**
  X, Y, Z robot coordinates for non-moving parts.
  Locally, it finds the highest position in the 3D map
- **3D Blob Locator Tool**
  X, Y, Z, W, P, R robot coordinates for non-moving parts. It delivers normal vector of plane positions of the gravity centre of blobs
- **3D Gripper Finger Locator Tool**
  Finds the grip position of a work piece using real grippers. In case a part needs to be picked up with a gripper (no vacuum or magnet), additional space around the part is mandatory. GF locator tool uses a gripper model to find the best pick position
- **3D Box Locator Tool**
  Finds boxes which are palletized orderly. It uses the size of boxes to find their upper surface by referring to a 3D map and a camera image
- **3D Cylinder Locator Tool**
  Finds some cylinder parts from a 3D map
- **3D One-Sight-Model Locator Tool**
  Finds a 3D model which has been taught in advance for one face of a workpiece from 3D data and outputs the 3D position and posture
- **3D COG Measurement Tool**
  X, Y, Z robot coordinates for non-moving parts.
  It finds positions of the gravity center relatively to parent GPM or CSM
- **3D Plane Measurement Tool**
  X, Y, Z, W, P, R robot coordinates for non-moving parts. This tool is combined with 2D pattern matching and finds the position and orientation of a part
- **3D Obstruction Measurement Tool**
  Could be added to GPM or CSM locator tool, to detect higher 3D point and avoid potential collisions before pick operation
- **Bin Picking Support**
  Enables the vision system to recognize the position and orientation of all parts, which are randomly placed inside a container. This option contains all mandatory functions required for a successful bin picking application. Bin picking supports all types of iRVision Sensor, and provides two important functions:

  - **Part List Manager** organizes all detected parts in accordance to their position and orientation, reachability and other part-relevant information

  - **Interference Avoidance** takes all mechanical interference contours in account and plans all mandatory positions for the robot approach, the pick and retract movements. Complete robot movement is planned by the system itself

*i*RVision Functions

*i*RVision 3D with 3DA Sensor

*i*RVision 3D Area Sensor uses a projector unit for 3D measurements. 3D data is measured in a wide area by projecting structured light very quickly for reliable detection. 3DA Sensor can be mainly used for depalletizing and bin picking.

3D Area Sensor

- 3DA/1300 for standard pallet format (1340 x 1000 x 1000 mm)

Different 3D Tools and Functions Available

- **3D Peak Locator Tool**
  X, Y, Z robot coordinates for non-moving parts.
  Locally, it finds the highest position in the 3D map
- **3D Blob Locator Tool**
  X, Y, Z, W, P, R robot coordinates for non-moving parts.
  It delivers normal vector of plane positions of the gravity centre of blobs
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  It finds positions of the gravity center relatively to parent GPM or CSM
- **3D Plane Measurement Tool**
  X, Y, Z, W, P, R robot coordinates for non-moving parts.
  This tool is combined with 2D pattern matching and finds the position and orientation of a part
- **3D Obstruction Measurement Tool**
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  - **Part list manager** organizes all detected parts in accordance to their position and orientation, reachability and other part-relevant information

  - **Interference avoidance** takes all mechanical interference contours in account and plans all mandatory positions for the robot approach, the pick and retract movements. Complete robot movement is planned by the system itself

*i*RPickTool

*i*RVision 2D 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.

*i*RPickTool's highly functional software package includes:

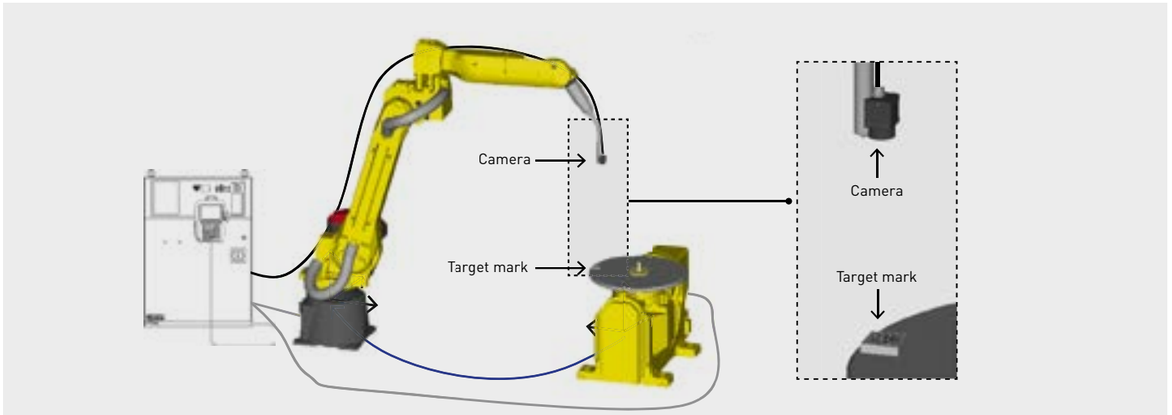
- Various system layouts by default supported
- Linear and Circular conveyor systems by default supported
- Multiple robots by default supported, connected by TCP/IP
- Queue Management by default integrated in the standard *i*RPickTool software package
- Load balancing by default integrated. Amount of 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 (bvox 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

Different 2D Process Types Available:

- 2D Single-View Visual Tracking, X, Y, R robot coordinates for moving parts
- 2D Multi-View Visual Tracking, X, Y, R robot coordinates for moving parts. Increased accuracy for huge parts based on more than 1 camera snap

*i*RCalibration

*i*RCalibration functions are based on *i*RVision, but it is a stand-alone service tool to simplify the initial setup and to speed up the entire integration, which results in an improvement of the application accuracy. 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 *i*RCalibration Functions Available

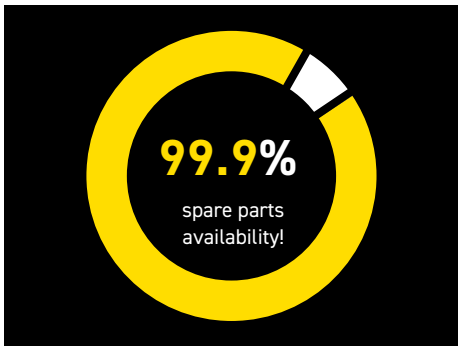
- **iRCalibration Vision Mastering /Mastering Recovery Function**
  Supports quicker and simpler mastering/remastering of FANUC robots, independent of the operator's skills
- **iRCalibration Vision Tool Center Point (TCP) Setting**
  Supports simpler and more accurate setting of the robot TCP, independent of the operator skill's
- **iRCalibration 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
- **iRCalibration 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
- **iRVision 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
- **iRTorchMate 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

- **iRTorchMate**
  Prevents alignment issues from occurring by keeping the tool centre point exactly on the tool path, 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.



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 minimize 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 maximize 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.