

FANUC Intelligent Robot

FEATURES

- Vision sensor and force sensor realize highly automated manufacturing systems in assembling and processing areas.
- Vision sensor can be applied to bin-picking automation.
- Intelligent robot eliminates peripheral equipment required for part-sorting and rearrangement, and cuts total cost of your system.
- Force control automates precise and dexterous insertion of parts with sensitive control of force applied to a robot end effector.
- Intelligent robot promotes robotization of jobs which require special human skills.
- Robot accuracy product suites improve robot's positioning accuracy and promote productive utilization of offline programming.



Application Examples



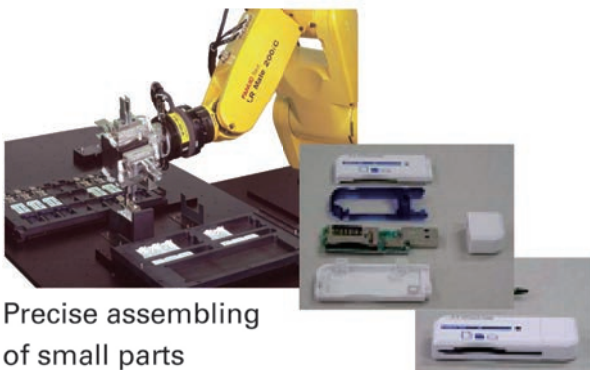
Bin-picking / Loading to machines



Visual line tracking



Visual inspection after assembling



Precise assembling of small parts



Dimension check of holes
(Gage insertion by force control)



Force controlled grinding

Camera Package

- All-in-one sensor head with camera, lens, enclosure and LED light
- Easy lens adjustment
 - Possible to adjust focus and iris of the lens by opening the side cover without using tools.
 - Possible to access the lens without removing the LED light.
- Sufficient environmental resistance
 - IP67 level protection including LED light against dust and water.
 - Tough protective cover of aluminum cast.



3D Laser Vision Sensor

- 3 dimensional measurement with structured light method
- Hybrid measurement of 2D image processing and 3D laser detection
- IP67 level protection against dust and water
- 3D recognition of parts essential to practical bin-picking



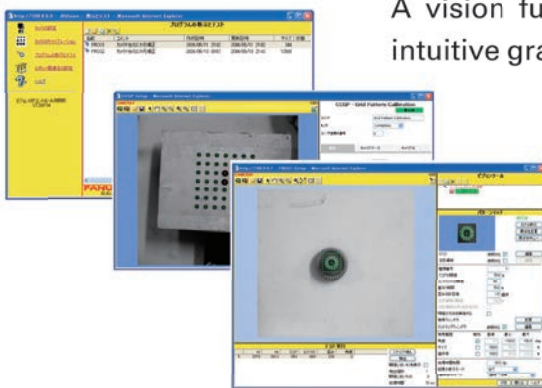
Bin-picking Parts Examples



Configuration for Setup / Runtime

Configuration for setting up vision function

A vision function can easily be set up with the intuitive graphical user interface.



PC for setup



Ethernet

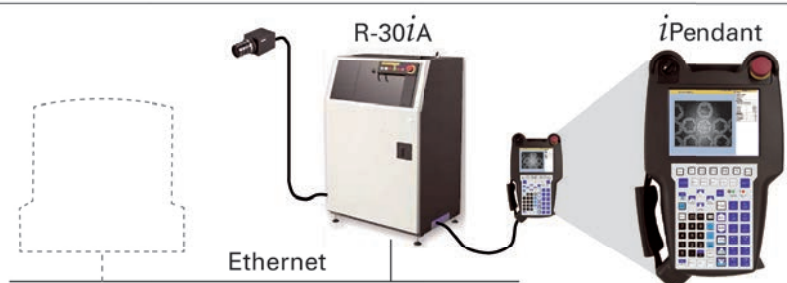
Main CPU board

Camera I/F



Configuration for vision function at runtime

The PC for setup can be disconnected, and *i*Pendant can serve as a runtime monitor of the vision function.

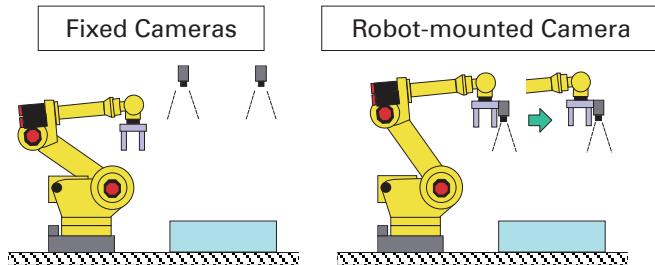


Ethernet

Key Functions

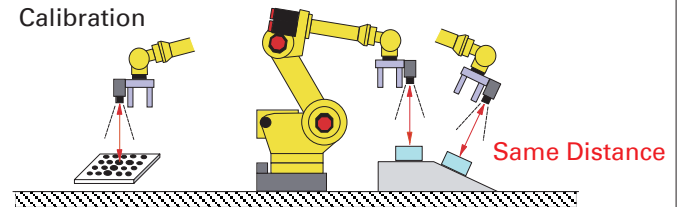
2D multi-view vision process function

Allows the robot to locate a large rigid object precisely by combining the results from multiple snapped images.



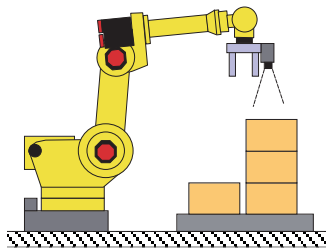
Floating frame vision process function

Allows a single camera calibration data to be applied to generate 2D offset data at different camera poses.



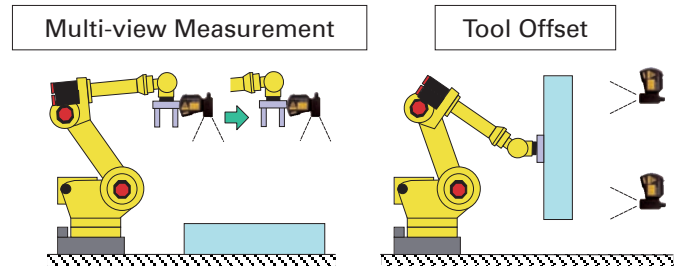
Depalletizing vision process function

Allows a single camera to estimate Z height of each palletized part using the scale information on an image, and outputs X, Y, Z and rotation detected.



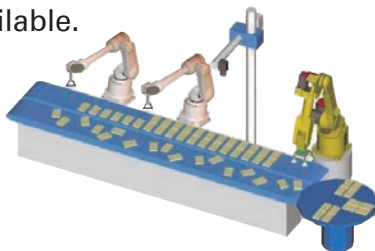
3D Laser Vision Sensor function

Allows the robot to detect 3D position and posture of a target object with application variations as shown below.



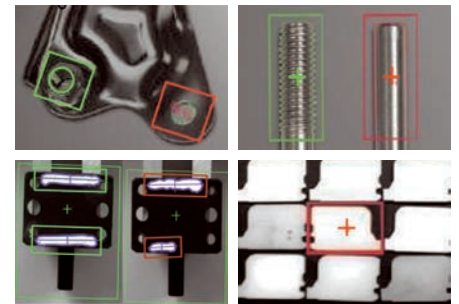
Visual tracking function

Allows the robot to track objects on moving conveyors. Dynamic load balancing among multiple robots is also available.



Anti-Defect vision process function

Allows robotized automation to carry out mistake-proofing.



Specifications

Items		Standard configuration	High performance configuration
Sensor head	2D measurement	Camera Package(standard speed camera)	Camera Package(standard/double speed camera)
	3D measurement	3D Laser Vision Sensor(standard speed camera)	3D Laser Vision Sensor(standard/double speed camera)
	LED light		○
	Power supply for Sensor and LED		R-30iA,R-30iA Mate integrated
	Exposure control		○
	Number to be connected	Max. 8 (Max.4 for 3DL Sensor and LED)	Max. 32 (Max.4 for 3DL Sensor and LED)
Sensor control	Image processing	R-30iA,R-30iA Mate main board	Vision board (*)
	Processing performance	○	◎
	Image resolution	512 × 480	640 × 480
	User interface		PC (disconnected except during setup)
	Image display		iPendant (or the PC connected via Ethernet)
	Password protection		○

Force Sensor

Force Sensor Variation

FS-15iA
for mini robots



FS-40iA
for small robots



FS-100iA
for medium robots

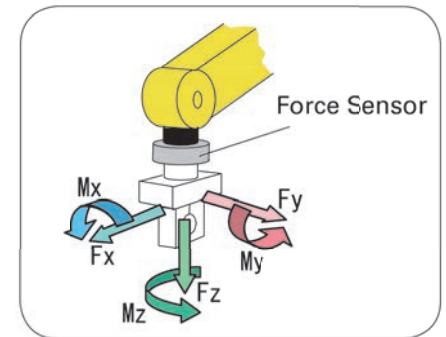


FS-250iA
for large robots

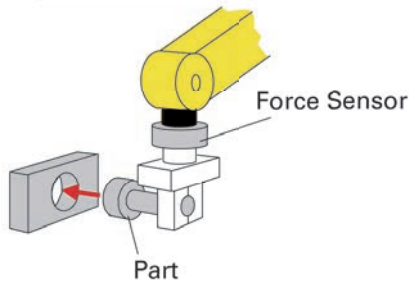


Key Functions

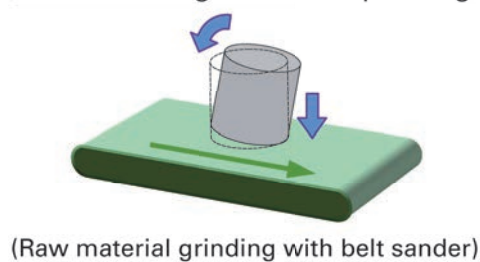
- Detects both force and torque applied to a robot end effector in F_x , F_y , F_z , M_x , M_y and M_z simultaneously.
- Realizes H7/h7 class insertion.
- Robotizes various application requiring an intentional contact of two objects, such as face matching and contouring.



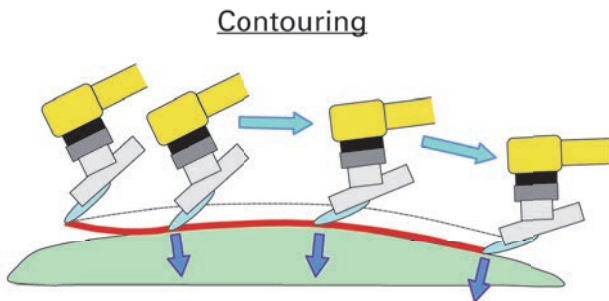
Precise Insertion



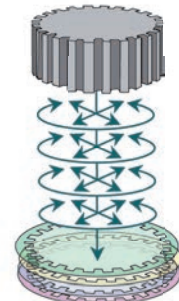
Face matching / Constant pushing



Insertion with position searching and phase matching



Phase matching insertion



*Force control performance of a robot depends on the robot type, gripper design/weight, parts shape/weight to be handled as well as parts fixing method. The feasibility and applicability of a force sensor should be determined through testing with the actual production conditions.

Specifications

Items	Specifications			
	FS-15iA	FS-40iA	FS-100iA	FS-250iA
Dimensions	φ 94 × 43 mm	φ 105 × 47 mm	φ 155 × 59 mm	φ 198 × 85 mm
Mass	0.57 kg	0.87 kg	3.2 kg	6.9 kg
Rated load	F_x, F_y, F_z	147 N	392 N	980 N
	M_x, M_y, M_z	11.8 Nm	39.2 Nm	156 Nm
Static overload	F_x, F_y, F_z	1570 N	3920 N	9800 N
	M_x, M_y, M_z	125 Nm	392 Nm	1560 Nm
Resolution	F_x, F_y, F_z	0.39 N	1.0 N	2.0 N
	M_x, M_y, M_z	0.016 Nm	0.029 Nm	0.08 Nm
Accuracy	2% or less of the rated load			
Applicable robot	LR Mate 200iC, M-10iA	M-20iA	M-710iC	R-2000iB

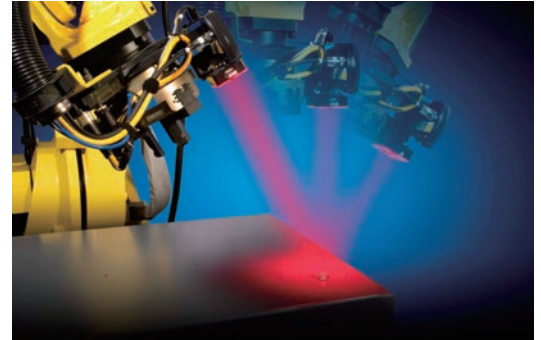
*A part of above list includes design specifications.

Robot Accuracy Product Suites *iRCalibration*

Outline

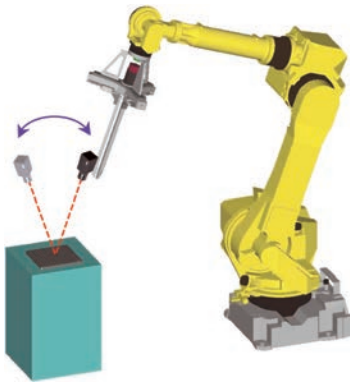
Functions to improve robot accuracy using the integrated vision

- Vision Mastering : Robot positioning accuracy improvement
- Vision TCP Set : Automatic setting of tool center point
- Vision Shift : Man-hours reduction for robot teaching
- Vision Frame Set : Automatic setting of user frame
- Vision Multi-Cal : Automatic calibration of multi-arm system



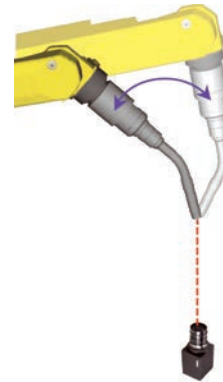
Function Details

Vision Mastering



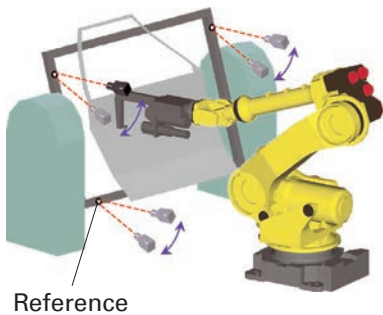
The function calibrates the robot mechanics. It improves the absolute positioning accuracy of a robot, contributing to an accuracy improvement of TCP setting, vision application and easy utilization of offline programs.

Vision TCP Set



The function allows you to set a tool frame automatically which was conventionally done by manual operation of the robot. It helps to set TCP accurately.

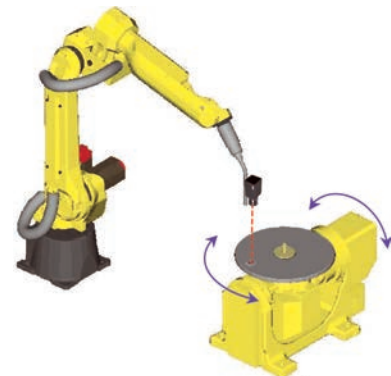
Vision Shift / Vision Frame Set



The function guides the robot to measure reference points on a part or its fixture automatically and adjusts programmed points. It helps to save both time and manpower for robot system relocation and offline program utilization.

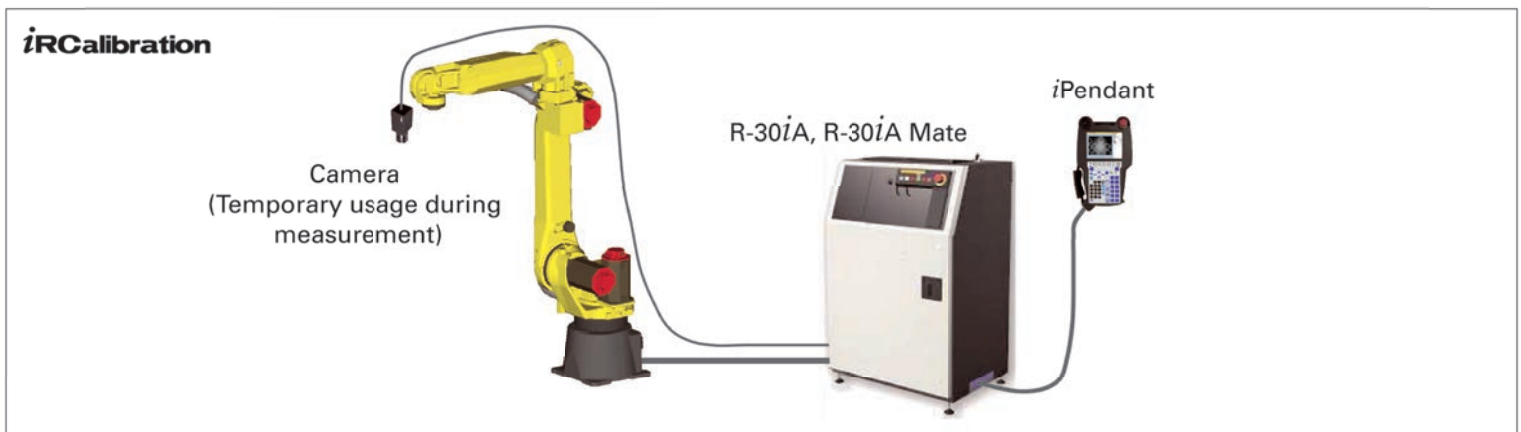
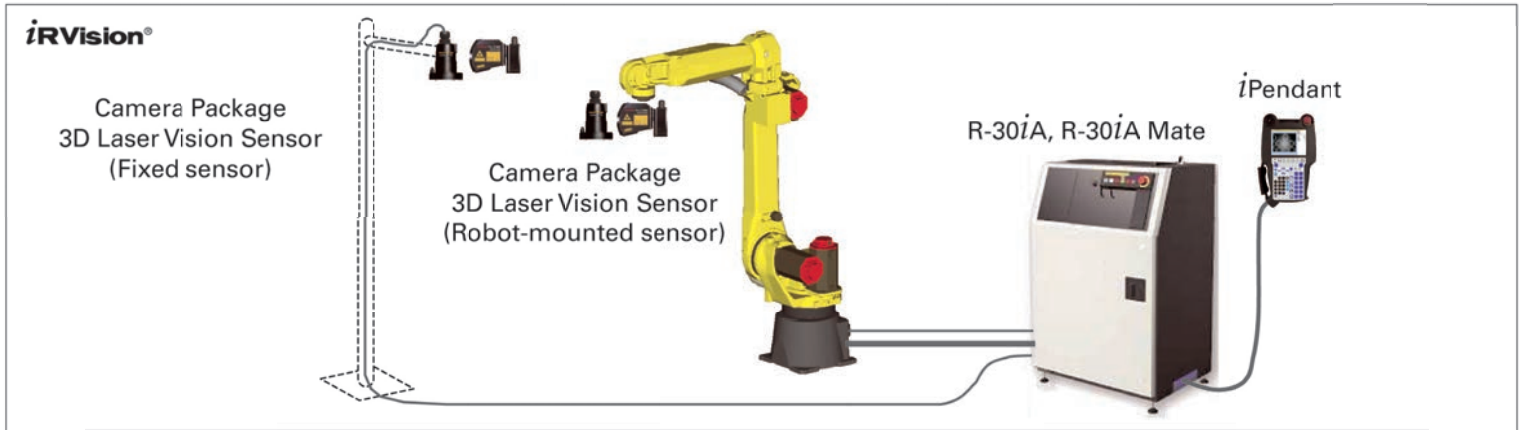
It can also be used to set a user frame automatically by the measured reference points data.

Vision Multi-Cal



The function calibrates relations between multi-group robots which are under coordinated control. Both two-arm configuration and one-arm and one-positioner configuration are supported. It helps to improve the coordinated motion accuracy.

Basic Configurations



* **iRVision®** is a registered trade mark of FANUC LTD.

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