

# FANUC Robot Vision and Force Control



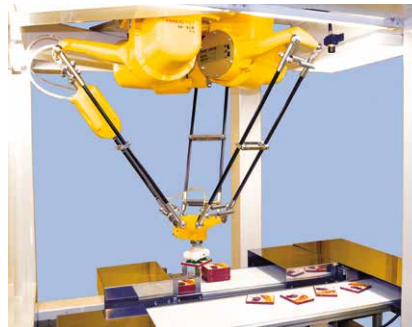
## FEATURES

- Vision sensor and force sensor with the FANUC robots realize highly automated manufacturing systems in assembling and machining areas.
- Vision sensor can be applied to bin-picking automation.
- The robot with vision or force sensor eliminates peripheral equipment conventionally required for part-positioning and rearrangement, and reduces total cost of your system.
- Force control function with the force sensor automates high precision insertion of parts with sensitive control of force applied to a robot end effector.
- The robot with force sensor promotes robotization of deburring and polishing by contouring motion with specified pushing force.
- Robot accuracy enhancement product suites improve robot's positioning accuracy and enhance productive utilization of offline programming system for an actual robot.

## Application Examples



Bin picking



Visual tracking



Visual inspection after assembling



Precise assembling of small parts



Dimension check of holes (Gage insertion by force control)

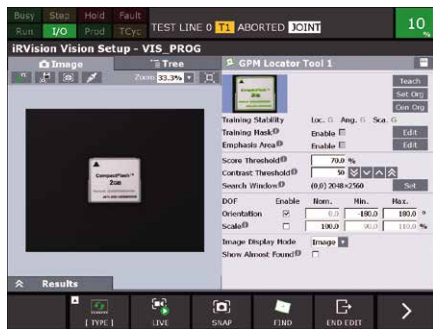


Force controlled deburring

# Integrated Robot Vision *iR*Vision®

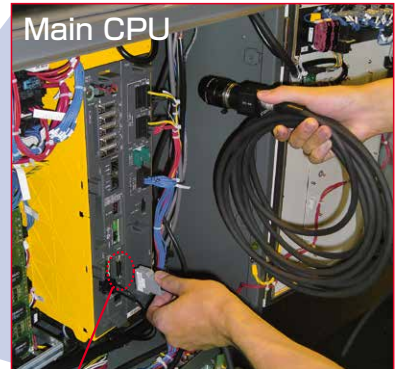
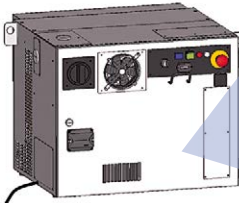
## System Configuration and Setup of *iR*Vision

*iR*Vision function and a dedicated camera port are integrated in the robot controller. The function can easily be set up with graphical user interface on *iPendant*. *iPendant* can also serve as a runtime monitoring screen.



*iPendant*

R-30*i*B Plus Controller



Camera I/F

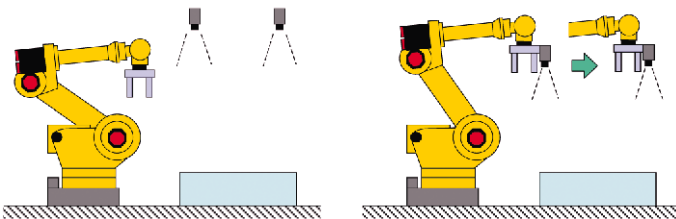
## Key Functions

### 2D single-/multi-view vision process function

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

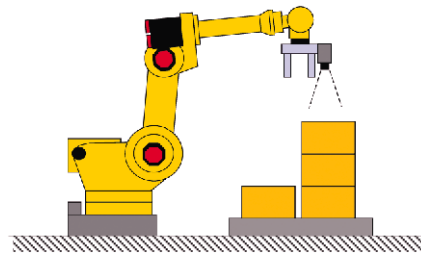
Fixed Cameras

Robot-mounted Camera



### 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.

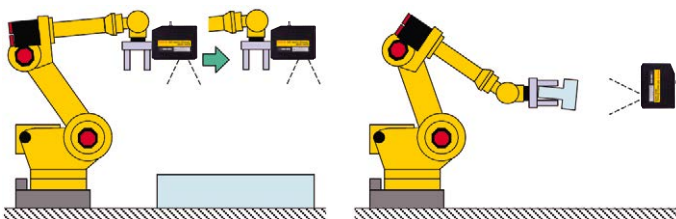


### 3D single-/multi-view vision process function

Allows the robot to detect 3D position and posture of a target object to recognize a large part by multi-view measurement and to conduct tool offset for gripping errors.

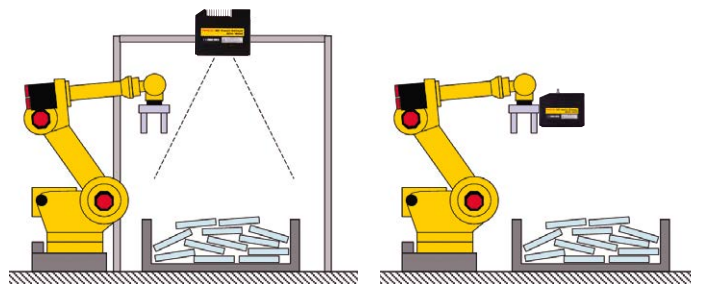
Multi-view Measurement

Tool Offset



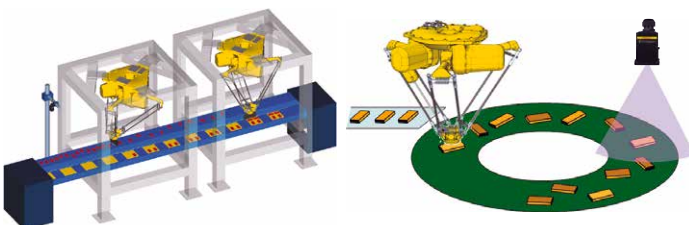
### Bin picking function

Allows the robot to pick randomly piled objects by the sensor measurement along with avoiding interference.



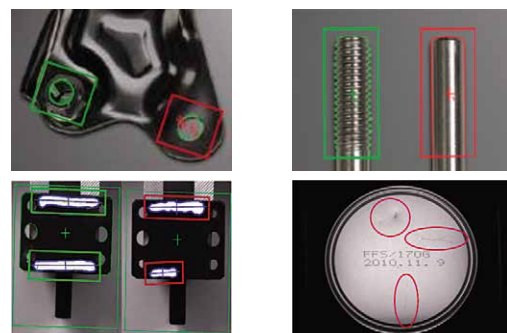
### Visual tracking function (*iR*PickTool)

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







### Anti-Defect vision process function

Allows robotized automation to carry out error-proofing and flaw detection.

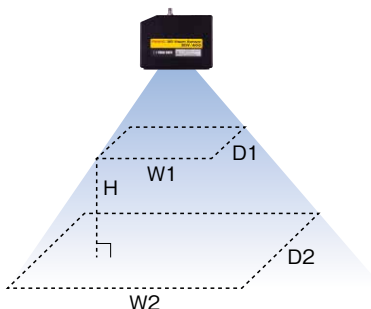


# Integrated Robot Vision *iR*Vision®

## Specifications

<b>2D Camera</b> 	Image Type	Grayscale/Color
	LED Light for 2D Detection	Red/White/None
	Image Resolution	Grayscale : 1280×1024/Color : 640×512
	Focal Length [mm]	8/12/16/25
	Outer Dimension [mm]	80×131.8×74
	Mass [kg]	0.6
<b>3D Laser Vision Sensor</b> 	Measurement Method	3D measurement with structured laser slit beams
	Measurement Range [mm]* W1×D1×H, W2×D2	220×164×100, 276×208
	LED Light for 2D Detection	Red/None
	Outer Dimension [mm]	187.6×145.8×88.7
	Mass [kg]	1.1
<b>3D Vision Sensor</b> 3DV/70 , 3DV/200 3DV/400, 3DV/600 	Measurement Method	3D measurement with a single pattern light
	Maximum 3D Points	3DV/70 : 870×950 3DV/200 : 1060×950 3DV/400 : 1104×950 3DV/600 : 1104×950
	Measurement Range [mm]* W1×D1×H, W2×D2	3DV/70 : 55×70×56, 83×92 3DV/200 : 123×123×190, 219×198 3DV/400 : 268×262×500, 527×460 3DV/600 : 575×499×500, 805×698
	LED Light for 2D Detection	Blue
	Outer Dimension [mm]	154×133×51
	Mass [kg]	1.1
<b>3D Vision Sensor</b> 3DV/1600 	Measurement Method	3D measurement with a single pattern light
	Maximum 3D Points	1104×960
	Measurement Range [mm]* W1×D1×H, W2×D2	1245×1178×2000, 3203×2797
	LED Light for 2D Detection	Blue
	Outer Dimension [mm]	234×198.2×70
	Mass [kg]	3.2
<b>Common Specifications</b>	LED Power Supply	R-30iB Plus Integrated
	Operating Temperature [°C]	0 to 45
	Protection Class	IP67
	Robot Mountable	Yes
	Connectable Number	Up to 27

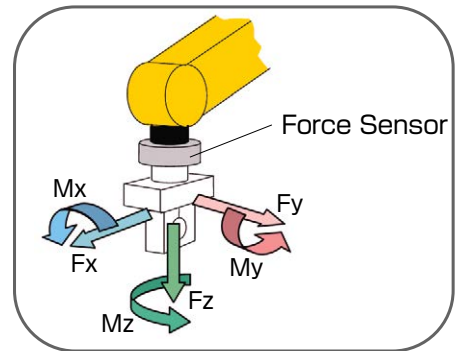
\* Measurement Range



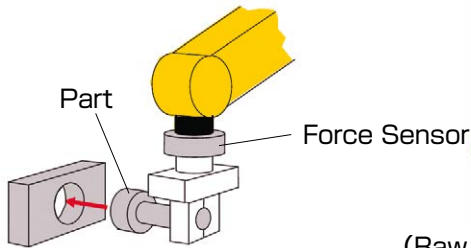
# Force Sensor

## Key Functions

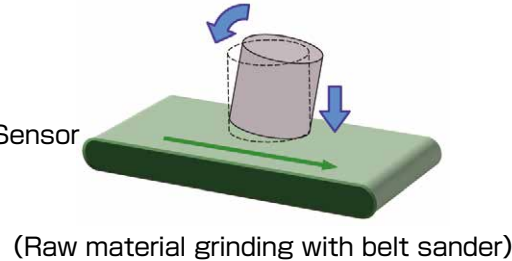
- Detects both force and torque applied to a robot end effector in  $F_x$ ,  $F_y$ ,  $F_z$ ,  $M_x$ ,  $M_y$  and  $M_z$  simultaneously.
- Realizes H7/h7 JIS tolerance insertion.
- Robotizes various application requiring an intentional contact of two objects, such as face matching and contouring.



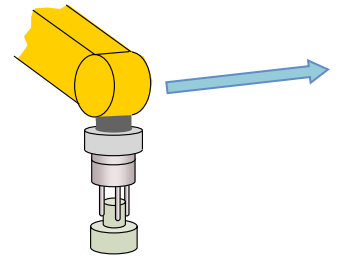
### Precise Insertion



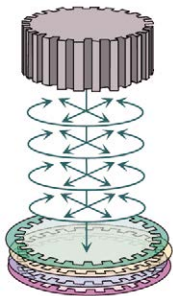
### Face matching / Constant pushing



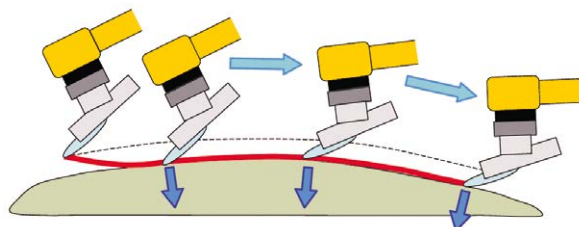
### Mass measurement in motion



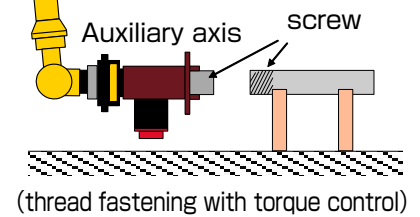
### Insertion with position searching and phase matching



### Contouring



### Thread fastening



\* 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

for a mini robot  
(3-axis)



FS-15iAe

for a mini robot



FS-15iA

for a small robot



FS-40iA

for a medium robot



FS-100iA

for a large robot



FS-250iA

## Specifications

Items		Specification				
		FS-15iAe	FS-15iA	FS-40iA	FS-100iA	FS-250iA
Dimensions		φ90 × 36 mm	φ94 × 43 mm	φ105 × 47 mm	φ155 × 59 mm	φ198 × 85 mm
Mass		0.31 kg	0.57 kg	0.87 kg	3.2 kg	6.9 kg
Rated load	$F_x$ , $F_y$ , $F_z$	147 N ( $F_z$ )	147 N	392 N	980 N	2500 N
	$M_x$ , $M_y$ , $M_z$	11.8 Nm ( $M_x, M_y$ )	11.8 Nm	39.2 Nm	156 Nm	500 Nm
Static overload	$F_x$ , $F_y$ , $F_z$	1570 N ( $F_z$ )	1570 N	3920 N	9800 N	25000 N
	$M_x$ , $M_y$ , $M_z$	125 Nm ( $M_x, M_y$ )	125 Nm	392 Nm	1560 Nm	5000 Nm
Resolution	$F_x$ , $F_y$ , $F_z$	0.39 N ( $F_z$ )	0.39 N	1.0 N	2.0 N	4.9 N
	$M_x$ , $M_y$ , $M_z$	0.016 Nm ( $M_x, M_y$ )	0.016 Nm	0.029 Nm	0.08 Nm	0.25 Nm
Accuracy		3% or less		2% or less of the rated load		
Applicable robot		M-1iA, M-3iA, LR Mate 200iD, M-10iA		M-20iA, M-20iB	M-710iC	R-2000iC
Operating Temperature		0 to 45°C				
Protection Class		IP67				

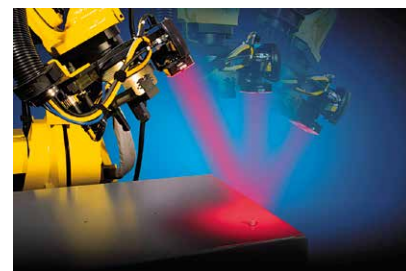
\* A part of the above list includes design specifications.

# Robot Accuracy Product Suites *iRCalibration*<sup>®</sup>

## Outline

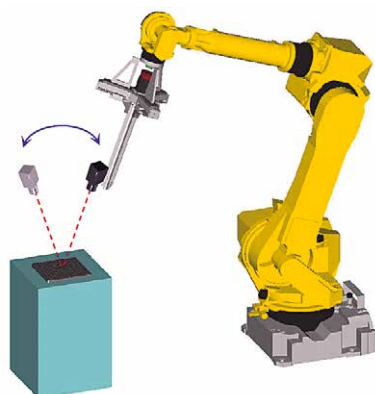
Functions to improve robot accuracy using the integrated vision

<i>iRCalibration</i>	Outline
Vision Mastering	Robot positioning accuracy improvement
Vision Axis Master	Automatic one-axis mastering with vision
Vision TCP Set	Automatic setting of a tool center point
Vision Frame Set	Automatic setting of a user frame
Vision Multi-Cal	Automatic calibration of a multi-arm system
Vision Shift	Man-hours reduction for robot teaching
Mastering Recovery	Mastering condition recovery after maintenance operation as mechanical part replacement



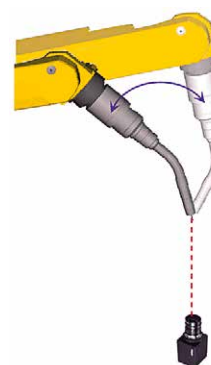
## Key Functions

### Vision Mastering



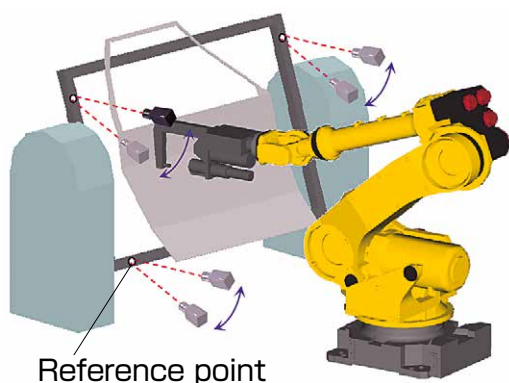
The function calibrates the robot mechanics. It improves the positioning accuracy of a robot, contributing to an accuracy improvement of TCP setting, vision application and easy utilization of offline programs.

### 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.

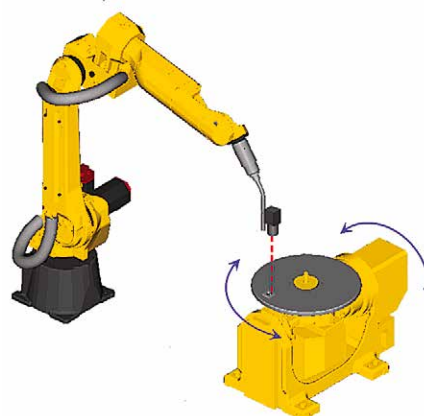
### Vision Shift / Vision Frame Set



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.

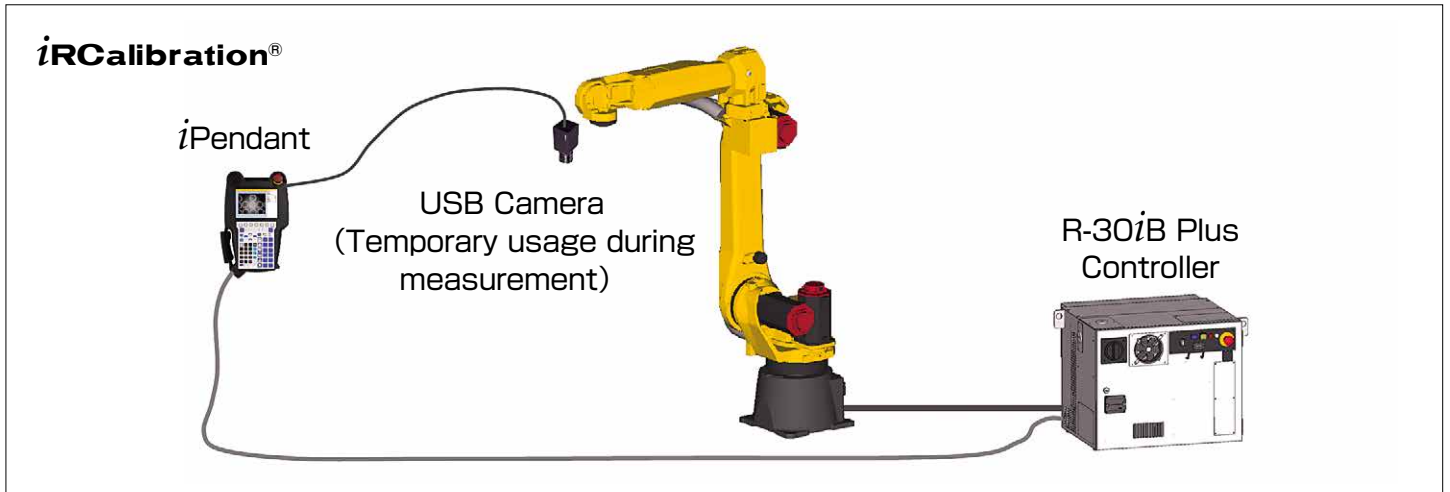
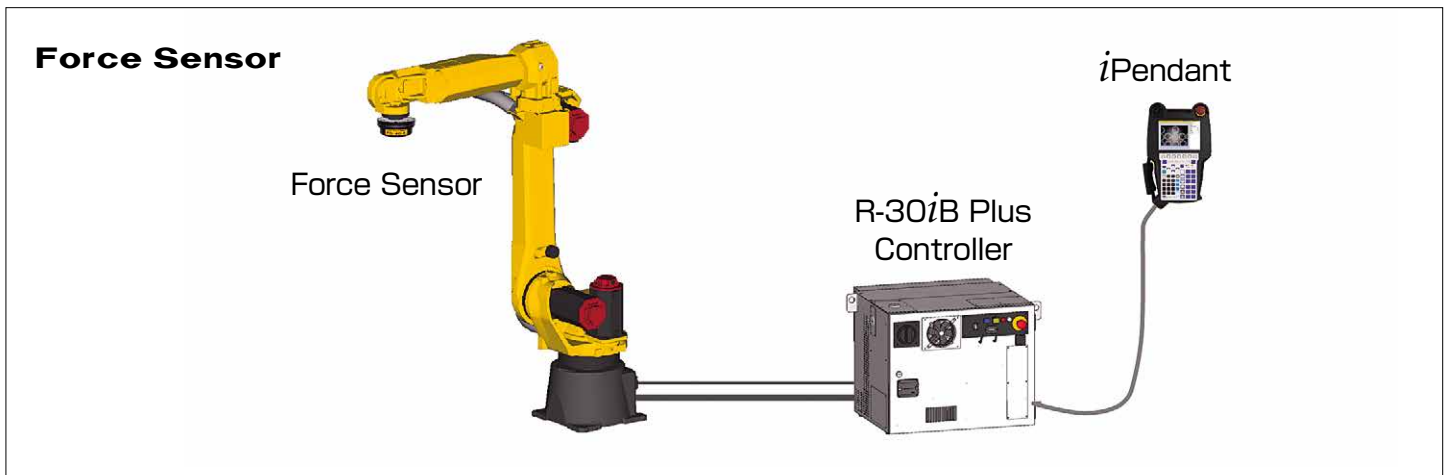
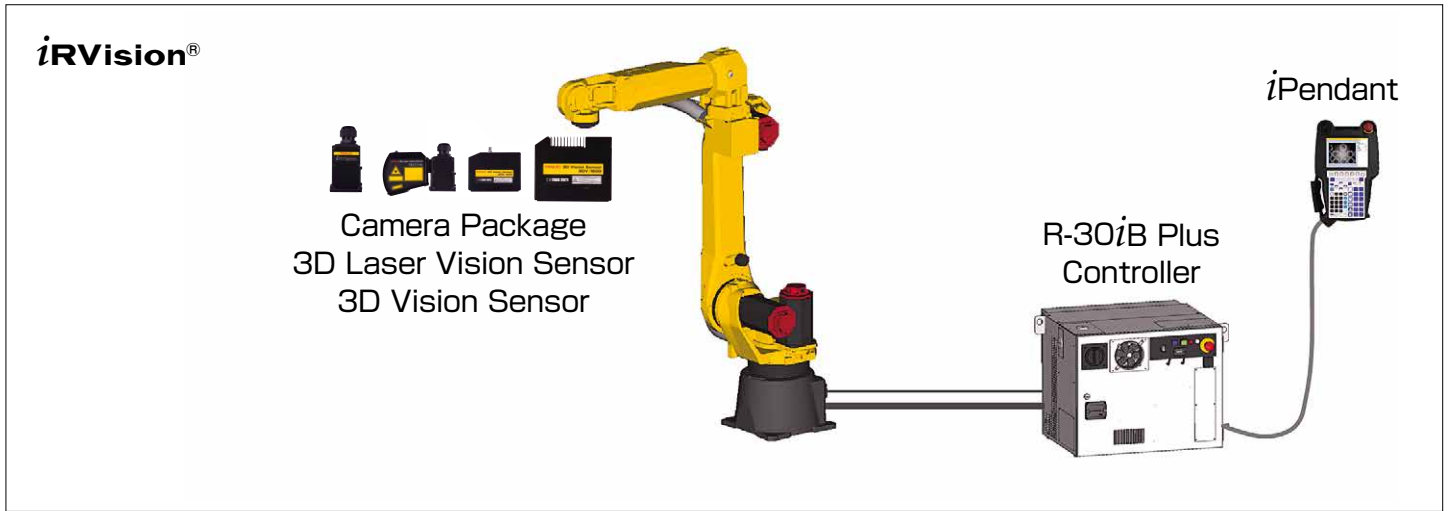
It can also be used to set a user frame automatically by the measured reference points data.

### 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 CORPORATION

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