FEATURES

- Vision sensor and force sensor with the FANUC robots realize highly automated manufacturing systems in assembling and processing areas.
- Vision sensor can be applied to bin-picking automation.
- Intelligent robot 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.
- Intelligent robot promotes robotization of deburring and polishing by contouring motion with specified pushing force.
- Robot accuracy product suites improve robot’s positioning accuracy and promote productive utilization of offline programming system to an actual robot.

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 deburring
Integrated Robot Vision \textit{iRVision}®

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

**3D Laser Vision Sensor**
- 3D measurement with structured laser slit beams.
- Hybrid measurement of 2D image processing and 3D laser detection.
- Widely applicable to 3D recognition of a target part.
- IP67 level protection against dust and water.

**3D Area Sensor**
- 3D measurement with structured pattern light.
- Provides 3D map information in the wide field of view.
- Recognizes 3D locations of multiple parts at a time and allows the robot to pick them up from a bin in a short cycle time.
- IP65 level protection against dust and water.

Application Examples of 3D Area Sensor

System Configuration and Setup of \textit{iRVision}

\textit{iRVision} function and a dedicated camera port are integrated in the robot controller. The function can easily be set up with graphical user interface on \textit{iPendant}. \textit{iPendant} can also serve as a runtime monitoring screen.
Integrated Robot Vision iRVision®

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 the Z height of each palletized part using the detected scale information, 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 variation as below.

- Multi-view Measurement
- Tool Offset

Bin picking function
Allows the robot to pick randomly piled objects by the sensor measurement while avoiding interference.

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 and flaw detection.

Specifications

<table>
<thead>
<tr>
<th>Sensor head</th>
<th>2D measurement sensor</th>
<th>Camera Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color camera</td>
<td>3D measurement sensor</td>
<td></td>
</tr>
<tr>
<td>LED light</td>
<td>3D Laser Vision Sensor, 3D Area Sensor</td>
<td></td>
</tr>
<tr>
<td>LED power supply</td>
<td>R-30iB integrated</td>
<td></td>
</tr>
<tr>
<td>Exposure control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor control</th>
<th>Image processing</th>
<th>On R-30iB main CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image resolution</td>
<td>Max. 1280 x 1024</td>
<td></td>
</tr>
<tr>
<td>Number of sensor head connected</td>
<td>16 (4 for 3DL Sensor and LED), Extensible</td>
<td></td>
</tr>
<tr>
<td>User interface</td>
<td>iPendant</td>
<td></td>
</tr>
<tr>
<td>Password protection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Force Sensor

Force Sensor Variation

for a mini robot (3-axis)  for a mini robot  for a small robot  for a medium robot  for a large robot

FS-15iAe  FS-15iA  FS-40iA  FS-100iA  FS-250iA

Key Functions

- Detects both force and torque applied to a robot end effector in Fx, Fy, Fz, Mx, My and Mz 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

Contouring

Mass measurement in motion

(Raw material grinding with belt sander)

* 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

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS-15iAe</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Ø90 × 36 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>0.31 kg</td>
</tr>
<tr>
<td>Rated load</td>
<td>Fx, Fy, Fz</td>
</tr>
<tr>
<td></td>
<td>Mx, My, Mz</td>
</tr>
<tr>
<td>Static overload</td>
<td>Fx, Fy, Fz</td>
</tr>
<tr>
<td></td>
<td>Mx, My, Mz</td>
</tr>
<tr>
<td>Resolution</td>
<td>Fx, Fy, Fz</td>
</tr>
<tr>
<td></td>
<td>Mx, My, Mz</td>
</tr>
<tr>
<td>Accuracy</td>
<td>3% or less</td>
</tr>
<tr>
<td>Applicable robot</td>
<td>M-1iA, M-3iA, LR Mate 200iC, M-10iA</td>
</tr>
</tbody>
</table>

* A part of the above list includes design specifications.
Robot Accuracy Product Suites iRCalibration

Functions to improve robot accuracy using the integrated vision

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

Key Functions

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 a TCP accurately.

Vision Shift

Reference point

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.

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**

3D Area Sensor

Camera Package

3D Laser Vision Sensor

R-30iB

**Force Sensor**

**iRCalibration**

USB Camera

(Temporary usage during measurement)

R-30iB

**iPendant**

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