FANUC
THE FACTORY AUTOMATION COMPANY
Fine Surface Technology
High quality machining is becoming more and more important in all factory processes, especially for:

- Die molds
- Parts of mobile phone and tablet PC

To achieve High Quality Machining, all the conditions involved in the process are dramatically important:

- Machine Tool
- Tooling
- Machining condition as well as CNC and Servo Control.
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Machining Process

- High precision machining program
- Smooth path generation
- Higher gains of servo control

CAD/CAM → CNC → SERVO → MACHINE TOOL

CNC and SERVO technology of FANUC achieving high quality machining

- High Precision Program Command
- Fast Package Option
- Smooth Tolerance+ Control
- Machin Condition Easy Setting
- SERVO HRV+ Control
- Smart Machine Control
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High Precision Program Command

- Axis Command which value has one digit smaller than incremental system is already considered
- High precision machining program becomes executable
- No need to change increment system (No G-code activation is required, included in IS-C option J805)

- Reduce speed variation owing to improved rounding error
- 0.1 nanometer command available for ultra-precision machine
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**Smooth Tolerance Control**

- Achieve high-quality machining in die & mold application specified with continuous small segments

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**Basic Command**

- **G05.1 Q3 Xp0 Yp0 Zp0 α0 β0**
  - Tolerance control mode ON
- **G10.8 L4 I_ J_ Q_ R_**
  - Changeable tolerance command

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Better surface quality achieved with high precision machining program
Machining condition easy setting

• Easy parameters setting (PATTERN) related to high-speed and high-precision machining.

• 3 kinds of parameter settings are available for machining process (Roughing, Semi-Finish, Finishing)

• Selectable level according to the machining conditions during automatic operation:
  ▪ G-code (G05.1 Q1 R_"level")
  ▪ PMC Signal (MSSP1, MSSP2< Gn589.5, 6 >)
  ▪ Fanuc Setting Screen

• Setting value of Smooth tolerance+ control are also integrated
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SERVO HRV\(^+\) Control

- Improve disturbance suppression by optimization of velocity loop gain
- Reduce path error and make machining surface quality higher

Examples

R-Square, F4000, HRV3\(^+\) Control

Shape:

- OFF: 5mm/div
- Error: 2.5μm/div

Path error

Shape:

- ON: 5mm/div
- Error: 2.5μm/div

Path error

Enlarge
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Smart Machine Control

Smart Overlap
Reducing cycle time

Smart Backlash Compensation
Improvement of machining shape accuracy

Smart Machining Point Control
Suppressing machining point vibration

Smart Adaptive Control
Reducing cycle time in rough cutting

Smart Spindle Acc/Dec
Selection of optimal common Power Supply

Smart Load Meter
Using spindle power most efficiently

Smart Rigid Tapping
Reducing cycle time in tapping

Smart Thermal Control
Avoidance of over-heat in heavy duty cutting
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**AICC II+ - Look-Ahead enhanced specification**

**Improved Block processing capability**

- Programs with small-block output from CAD/CAM can be executed at high speed
- Effective for mold machining
- Example of mold machining

- Part program storage size using memory card: 2GB \(\rightarrow\) **16GB**
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**AICC II⁺ - Look-Ahead enhanced specification**

Processing capability on simultaneous 3 axes machining (blocks/sec):
Realization in software, No need to change hardware

<table>
<thead>
<tr>
<th>Series</th>
<th>AI Contour Control II (Current)</th>
<th>AI Contour Control II⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td>30i-B</td>
<td>2500</td>
<td>4600 *With high-speed processing</td>
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<tr>
<td>0i-F Type 1</td>
<td>1000</td>
<td>2300</td>
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</table>

**Improvement processing capability with High-speed CPU**

<table>
<thead>
<tr>
<th>Series</th>
<th>AI Contour Control II (Current)</th>
<th>High-speed CPU (CPU card D)</th>
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<tr>
<td>30i-B</td>
<td>2500</td>
<td>5500 *With high-speed processing</td>
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</table>
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Milling Standard Packages

Up to 3 Option Packages for each kind of machining center:

<table>
<thead>
<tr>
<th></th>
<th>3-axes Machining</th>
<th>Indexing Machining</th>
<th>Simultaneous 5-axis Machining</th>
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<tbody>
<tr>
<td>With Fine Surface Technology</td>
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<tr>
<td>Function</td>
<td>R370</td>
<td>R371</td>
<td>R372</td>
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</table>
Enhanced AC Servo Motor

- Feed smoothness enhanced by high resolution PULSECODER and the latest control technology
- Water-proof performance enhanced by special sealing structure
- Easy connecting and disconnecting by bayonet connector conformed to MIL Standard

<table>
<thead>
<tr>
<th></th>
<th>Current series</th>
<th>New series</th>
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</thead>
<tbody>
<tr>
<td>$\alpha i$</td>
<td>1,000,000/rev</td>
<td>4,000,000/rev</td>
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<td></td>
<td>16,000,000/rev</td>
<td>32,000,000/rev</td>
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<tr>
<td>$\beta i$</td>
<td>128,000/rev</td>
<td>1,000,000/rev</td>
</tr>
</tbody>
</table>

Resolution of PULSECODER

Current

Improved

Feed smoothness

Extra Shield

High Resolution PULSECODER