High Speed and High Precision AI Wire-cut Electric Discharge Machine

FANUC ROBOCUT α-0iD/α-1iD (CE-Model)
State-of-the-art wire EDM, exhibiting the comprehensive strength of FANUC

FANUC ROBOCUT α-iD series (CE-Model)

- High-performance CNC coupled with digital servo technology
- High-rigidity casting and a thermal insulation structure
- Reliability first design concept resulting in a high operating rate with less failures
- Advanced AWF enabling safe unmanned operation

High precision
- New high-rigidity casting with thermal insulation structure
- Twin servo wire tension control
- Inverter-controlled water temperature management
- Servo water level control
- Upgraded AI pulse control

Long machining stroke

<table>
<thead>
<tr>
<th></th>
<th>X × Y × Z axis</th>
<th>α-iD</th>
<th>iD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>370 × 270 × 255 mm</td>
<td>600 × 400 × 310 mm</td>
<td></td>
</tr>
</tbody>
</table>

High reliability
- Air jet AWF
- Pre-seal mechanism
- Partitioned seal plate structure

Economic efficiency
- Longer consumable life
- Low running cost
- Installation space saving

Excellent operability
- Latest CNC FANUC Series 310i-s-WA
- 15-inch large LCD
- Touch panel
- USB I/O
High-Speed and High-Precision Machining with AI Pulse Control

AI Pulse Control

- Issuing velocity commands in accordance with the accurately counts the number of discharge pulses.
- By achieving uniformity in energy density and discharge gap, enables high-speed and high-precision machining.
- Has improved the discharge state monitoring cycle (4 times from that of conventional machines).
- Enables higher-speed and higher-precision machining by controlling the servo at high speed directly, not via the CNC.

Multi-Level Figures

- Even in multi-level figure machining and in machining in an open state, AI pulse control enables optimum control based on the accurately detected number of discharge pulses, thereby achieving stable high-speed machining.

Nano Interpolation

- Servo command from the CNC = 0.001 μm (1 nm)
- Eliminates the accumulation of axis moving errors.
- With its very accurate and smooth axis moving, achieves machining at improved precision.

Difference in command unit
0.001mm VS 0.000001mm (0.001 μm = 1nm)

Without Nano interpolation

NC Program
X1.0000 Y0.0001

0.0001

With Nano interpolation

NC Program
X1.0000 Y0.0001

0.000001

Effective discharge pulse

Effective discharge pulse

Video cutting path

Ideal cutting path

Actual cutting path

Video cutting path

Ideal cutting path

Actual cutting path
**Al Corner Control**

- Accurately detects changes in the amount of machining at corners to optumly control the speed and machining energy, thereby achieving high-precision corner machining.

**Excellent Circularity**

- The Sample of the high-speed and high-precision machining achieved with AI pulse control, accurate and smooth axis control achieved with nano interpolation.

<table>
<thead>
<tr>
<th>Wire</th>
<th>Discharge pulse</th>
<th>AI pulse control</th>
<th>Prevention of overcutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 degrees</td>
<td>45 degrees</td>
<td>90 degrees</td>
<td></td>
</tr>
</tbody>
</table>

Examples of sharp corner cutting with AI pulse control

**Cutting Samples**

- 20mm/60mm fitting
- Multi-level fitting
- Tapering with upper and lower irregular figures
- Involute gear

**High-Grade PCD Machining (option)**

- Optimum power supply for PCD machining.
- Enables high-speed machining while minimizing damage to edges.
- Maintains quality even during long-time machining.

**Further fine roughness of 0.7 µmRz (option)**

- The micro finish power supply (MF power supply, optional) provides fine discharge pulse to generate a fine surface roughness of 1.5 µmRz or less.
- Use of the insulation jig achieves a further fine roughness of 0.7 µmRz or less.

<table>
<thead>
<tr>
<th>Wire</th>
<th>0.25 dia. brass wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece material</td>
<td>SKD11</td>
</tr>
<tr>
<td>Workpiece thickness</td>
<td>40mm</td>
</tr>
<tr>
<td>Cutting times</td>
<td>5</td>
</tr>
<tr>
<td>Machining profile</td>
<td>30mm dia. hole cutting</td>
</tr>
<tr>
<td>Surface roughness</td>
<td>2.0 µmRz (Ra: 0.22 µm)</td>
</tr>
</tbody>
</table>

**Roundness**

- Top 1.0 µm
- Middle 1.1 µm
- Bottom 1.2 µm

**Surface Roughness**

- Ra = 0.0763 µm
- Rz = 0.5417 µm
- Rt = 0.6652 µm

**Measurement Conditions**

- Measured condition horizontal direction
- Length = 2.5mm
- Cut off = 7x0.25mm
- Filter = Gaussian

**MF power supply cutting**

*All cutting results contained herein are those obtained under FANUC-designated conditions and FANUC measurement conditions.*
New Mechanical Unit in Pursuit of Higher Precision

The ROBOCUT mechanical unit has been designed through accurate analysis, with consideration given to rigidity and thermal balance. It adopts a table movement system suitable for high-precision machining, thereby achieving stable machining precision.

**New, High-Rigidity Casting**
- The symmetrical casting structure, with the load and thermal balance, ensures stability, and the pyramid structure with a large bed eliminates load overhang during table movement to maintain a high rigidity even for a heavier workpiece.

**Lower Guide Unit Improvement**
- The rigidity has been increased.
- The heat sauce is eliminated from the lower arm.

**Servo Water Level Control**
- The water level is automatically followed the Z-axis position by servo motor valve control.
- Optimum for different thickness machining.

**Pre-Seal Mechanism** (Japanese patent No. 3483599)
- The adhesion of machining debris (sludge) on the seal portion is reduced.
- Preventing a reduction in machining precision due to an increase in friction resistance.

**Linear Encoder (XY-Axis option)**
- The stable and high precision machining can be kept up for a long period of time.
- The reference point return is unnecessary.
- The automatic power failure recovery is possible.

**Inverter-Controlled cooler**
- A high-precision inverter-controlled dielectric fluid cooling system with controlled temperature of ±0.1°C is provided as standard.
Advanced AWF and Twin Servo Wire Tension Control

The time-proven, high-reliability AWF has been further improved to achieve high-speed AWF of 10 seconds. FANUC’s digital servo technology is applied to the wire traveling system, achieving high-precision tension control.

**Air Jet AWF**

- An air jet transport system is adopted in upper pipe for improving AWF accuracy, reliability and speed.
- A thermal fusion system unique to ROBOCUT is adopted.
- The annealing effect and thermal fusion create straight and very sharp wire.

**Simple upper guide**

**Wire straightness (without water jet)**

- **Without annealing**
- **With annealing**

**Sharp wire tip**

- The sharp wire tip can easily be routed through a very small clearance die guide.
- The wire can reliably enter the machining groove in AI-AWR.

**Twin Servo Wire Tension Control**

- Reducing tension variations to 1/4 of conventional machines and improving stability of machining.

**AI Wire break repair function (option)**

- The function re-connect the wire near the breakage point without returning to the start hole position.
- It is effective when the cutting groove shuts by the distortion or the rust of workpiece.
- The return time from start hole position to the breakage point can be omitted.

(Thickness : Max. 40mm/wire diameter  \( \Phi 0.2 \), \( \Phi 0.25 \))
Simple Operation with High-Performance CNC

The latest, high-performance CNC, FANUC Series 310/s-WA, is incorporated to considerably improve operability.

15-Inch Large-Size Touch Panel

- The 15-inch LCD touch panel has considerably improved the amount of display information and operability.
- The desired screen can be selected with a single push of either of the two dedicated vertical and horizontal keys.
- Operability will be further improved by connecting a USB mouse.

Setup / Maintenance Navigation

- By following screen display, it is possible to efficiently perform setup work needed to start machining.
- Maintenance navigation supports in daily maintenance and in taking action in response to alarms.

AI Setting

- This function enables the machine to provide optimum cutting conditions merely by entering a wire diameter, a workpiece material and thickness, a nozzle distance and a target surface roughness.

Easy and Sophisticated Drawing

- The drawing speed has been increased considerably.
- The wire position cursor automatically follows up the machining path.

Easy-to-Use External Input/Output

- Programs can be input and output using a USB memory stick or a memory card and also through Ethernet network communication.

High-Performance CAM System PC FAPT CUT (Option)

- Easy-to-use, dedicated CAM system on a Windows® PC to take advantage of ROBOCUT.
- Creates optimum NC programs for ROBOCUT.
- Incorporates cutting conditions for ROBOCUT.
- High affinity with ROBOCUT

Network System CUT MONITOR

- Can be used in a place away from the ROBOCUT to check the machining status, send and receive NC programs, and change cutting conditions.
- A self-learning function is available.
- Simply practicing using this system as directed by guidance messages displayed by the function.
- A self-learning function is available.
- Simply practicing using this system as directed by guidance messages displayed by the function.

Hardware Configuration

- *Operating system Microsoft® Windows® 2000 SP4/XP SP2/Vista
- Ethernet
- Machine status monitor
- High speed I/O of NC program
- 1 Operating system
- Microsoft® Windows® NT 4.0 (SP5 or more)/2000/XP

* 1 Subject to Internet provider
* 2 Subject to Internet provider
Simple Operation with High-Performance CNC

The latest, high-performance CNC, FANUC Series 310i-A, is incorporated to considerably improve operability.

15-Inch Large-Size Touch Panel
- The 15-inch LCD touch panel has considerably improved the amount of display information and operability.
- The desired screen can be selected with a single push of either of the two dedicated vertical and horizontal keys. Operability will be further improved by connecting a USB mouse.

Easy and Sophisticated Drawing
- The drawing speed has been increased considerably.
- Programs can be input and output using a USB memory stick or a memory card and also through Ethernet network communication.

Setup / Maintenance Navigation
- By following screen display, it is possible to efficiently perform setup work needed to start machining.
- Maintenance navigation supports in daily maintenance and in taking action in response to alarms.

AI Setting
- This function enables the machine to provide optimum cutting conditions merely by entering a wire diameter, a workpiece material and thickness, a nozzle distance and a target surface roughness.

High-Performance CAM System PC FAPT CUT i (Option)
- Easy-to-use, dedicated CAM system on a Windows® PC to take advantage of ROBOCUT.
- High affinity with ROBOCUT
  - Creates optimum NC programs for ROBOCUT.
  - Incorporates cutting conditions for ROBOCUT.
- User friendly design
  - A self-learning function is available.
  - Simply practicing using this system as directed by guidance messages displayed by the function.
- Easy creation of taper figures
  - Enables easy creation of NC programs of tapers with upper and lower irregular figures or tapers with angle commands.

Network System CUT MONITOR i
- Can be used in a place away from the ROBOCUT to check the machining status, send and receive NC programs, and change cutting conditions.

High affinity with ROBOCUT
- Creates optimum NC programs for ROBOCUT.
- Incorporates cutting conditions for ROBOCUT.
User friendly design
- A self-learning function is available.
  - Simply practicing using this system as directed by guidance messages displayed by the function.
Easy creation of taper figures
- Enables easy creation of NC programs of tapers with upper and lower irregular figures or tapers with angle commands.

Network System CUT MONITOR i
- Real-time monitoring and recording of the operating status of the machine
- Input and output of NC programs
- Changes EDM DATA in machining
- E-mail to cellular phones

*1: Operating system  Microsoft® Windows® 2000 SP4/XP SP2/Vista
*2: Subject to Internet provider
Available Options

Wire cutter
20L ion exchanger
Flame light
Touch sensor
Rotary Table
30kg wire loader

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>3-01 D</th>
<th>3-11 D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machining method</td>
<td>Submerge/Flushing</td>
<td>Submerge/Flushing</td>
</tr>
<tr>
<td>Maximum workpiece dimensions</td>
<td>Without Automatic door</td>
<td>Option</td>
</tr>
<tr>
<td>Standard</td>
<td>700 x 600 x 250 mm</td>
<td>1050 x 820 x 300 mm</td>
</tr>
<tr>
<td>Option</td>
<td>700 x 555 x 250 mm</td>
<td>1050 x 775 x 300 mm</td>
</tr>
<tr>
<td>Maximum workpiece mass</td>
<td>500 kg</td>
<td>1,000 kg</td>
</tr>
<tr>
<td>XY axis table travel</td>
<td>Standard</td>
<td>370 x 270 mm</td>
</tr>
<tr>
<td>Option</td>
<td>255 mm</td>
<td>310 mm</td>
</tr>
<tr>
<td>Z axis travel</td>
<td>Standard</td>
<td>775 x 250 mm</td>
</tr>
<tr>
<td>Option</td>
<td>600 x 250 mm</td>
<td>600 x 300 mm</td>
</tr>
<tr>
<td>UV axis travel</td>
<td>Standard</td>
<td>30 x 60 mm</td>
</tr>
<tr>
<td>Option</td>
<td>15 x 60 mm</td>
<td>45 x 70 mm</td>
</tr>
<tr>
<td>Max. taper angle</td>
<td>Standard</td>
<td>15°</td>
</tr>
<tr>
<td>Option</td>
<td>0.1°</td>
<td>0.3°</td>
</tr>
<tr>
<td>Wire diameter</td>
<td>Standard</td>
<td>0.1 mm</td>
</tr>
<tr>
<td>Wire mass</td>
<td>Approx. 1,800 kg</td>
<td>Approx. 3,000 kg</td>
</tr>
<tr>
<td>Machine mass</td>
<td>16 kg</td>
<td></td>
</tr>
<tr>
<td>Part program storage size</td>
<td>4MB</td>
<td></td>
</tr>
</tbody>
</table>

Installation Conditions

Power supply
- 200 VAC ±10% three-phase, 50/60 Hz ±1 Hz
- 220 VAC ±10% three-phase, 60 Hz ±1 Hz
- Connection cable terminal size: 8-5
- Power consumption: 13kVA

Air supply
- Air pressure: 0.5 MPa or greater
- Flow rate: 100 liters/min. or greater
- Connection port: DIN14153 (Regulator-side coupler mounting screw: Rc1/4)

Environment
- Ambient temperature: 15°C to 30°C
- Humidity: 75%RH or less
- 20°C ±1°C in case high precision machining is needed. Install under the oil mist free and dust free environment.

Grounding
- The unit must be grounded to avoid damage resulting from electro-magnetic interference or electrical leakage.
- The grounding itself should be of Type C (grounding resistance of 10Ω max.) as specified in the electrical installation standards and should be carried out independently of the grounding of any other piece of machinery. (One point grounding)

Shield room
- If discharge noise can interfere with surrounding radio, television, and other sets, a shield room needs to be created.

Maintenance and Customer Support

Worldwide customer support and service
FANUC operates customer service and support system anywhere in the world through subsidiaries, affiliates and distributor partners. FANUC provides the highest quality service with the quickest response at the location nearest you.

FANUC Training Center
FANUC training center operates training programs on FANUC ROBOCUT throughout the year, which focus on practical operations and programming with machining know how and maintenance.

ROBOAUTO
- Achieve unmanned operation by automatic loading and unloading of workpieces with FANUC robot.
- Optimum for PCD cutting tool machining.

For machining the rotator figures with a rotary table.

- ROBOAUTO
- For machining the rotator figures with a rotary table.
- Optimum for PCD cutting tool machining.
- ROBOAUTO