High-Reliability and High-Performance Compact Machining Center

FANUC

ROBODRILL α-DIA series
High-Reliability and High-Performance Compact Machining Center

**FANUC ROBODRILL α-DiA series**

**High Performance of Machining**
- High speed, High precision, High power
- Stable machining
- Wide range of application

**High Sustainability**
- High reliability
- Preventive maintenance function
- High maintainability

**Ease of Use**
- Excellent user-Interface
- High expandability
- Simple Integration with FANUC Robot

Applying the latest FANUC CNC & Servo motor technology

Good combination with FANUC Robot
High Performance of Machining

Achieving high productivity by high speed, high precision and high power
Achieving high yield of work piece by stable machining
Utilization in various areas by wide range of application

High Sustainability

Achieving long operation life by high reliability
Prevention of trouble by preventive maintenance function
Minimizing down time by high maintainability

Ease of Use

Easy utilization of high function by excellent user-Interface
Easy operation of peripheral equipments by high expandability
Realizing simple integration with FANUC Robot by supporting automation

※1 Photo when DDR mounted
High Performance of Machining

Wide variety of high speed and high power spindle

- High speed and high power spindle
  - High rigidity mechanism and outstanding rigidity of main spindle enabling excellent ability in milling in addition to drilling and tapping
- Optimum spindle selectable according to application
  - Standard spindle: Applicable to wide range machining use
  - High torque spindle: Applicable to heavy machining of iron parts
  - High acceleration spindle: Applicable to high speed, high efficiency machining of aluminum parts
  - High speed spindle: Applicable to smooth surface machining

<table>
<thead>
<tr>
<th>Spindle spec.</th>
<th>Spindle max. speed</th>
<th>BT tooling</th>
<th>DIN tooling</th>
<th>NC5 tooling</th>
<th>BIG-PLUS tooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard spindle</td>
<td>10000 min⁻¹</td>
<td>Possible</td>
<td>Possible (BT30)</td>
<td>Possible (NC5-48)</td>
<td>Possible (BBT30)</td>
</tr>
<tr>
<td>High torque spindle</td>
<td>10000 min⁻¹</td>
<td>Possible</td>
<td>Possible (BT30)</td>
<td>Possible (NC5-48)</td>
<td>Possible (BBT30)</td>
</tr>
<tr>
<td>High acceleration spindle</td>
<td>24000 min⁻¹</td>
<td>Possible</td>
<td>Possible (BT30)</td>
<td>Impossible</td>
<td>Possible (BBT30)</td>
</tr>
<tr>
<td>High speed spindle</td>
<td>24000 min⁻¹</td>
<td>Possible</td>
<td>Possible (BT30)</td>
<td>Impossible</td>
<td>Possible (BBT30)</td>
</tr>
</tbody>
</table>

*Center through coolant option available (7 MPa withstand pressure)*

DDR with direct drive motor

- Direct drive rotary table providing high-speed indexing DDR
  - Additional 1-axis rotary table with Synchronous built-in servo motor and aiCZ SENSOR
  - Direct drive and non-backlash structure enabling high speed and high precision machining
- Possible to make cradle type jig easily DDR-T

<table>
<thead>
<tr>
<th>DDR specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Items</strong></td>
</tr>
<tr>
<td>Drive system</td>
</tr>
<tr>
<td>Maximum torque</td>
</tr>
<tr>
<td>Maximum speed</td>
</tr>
<tr>
<td>Feed rate</td>
</tr>
<tr>
<td>Least input increment</td>
</tr>
<tr>
<td>Index accuracy</td>
</tr>
<tr>
<td>Clamp system</td>
</tr>
<tr>
<td>Clamp torque</td>
</tr>
<tr>
<td>Max. loading capacity</td>
</tr>
<tr>
<td>Allowable moment load</td>
</tr>
<tr>
<td>Center height</td>
</tr>
<tr>
<td>Machine weight</td>
</tr>
</tbody>
</table>
High speed machining

- FSSB high speed rigid tapping
  - Achieving high speed rigid tapping by FSSB communication between servo and spindle amplifiers
  - Achieving both high speed & high precision by using maximum acceleration power of spindle motor

![Previous rigid tapping](image1.png)  
![FSSB high-speed rigid tapping](image2.png)

Higher axis feed accuracy

- Higher axis feed accuracy by the latest CNC and Servo functions
  - SERVO HRV* control: Achieving high responsibility by optimized electrical control
  - Latest AC Servo Motor: Applying latest AC Servo Motor which achieves more smooth feed
  - Input increment 0.1 μm: Addition of the mode in which feed can be commanded with the least 0.1 μm
  - Achieving high quality machining (ex. Higher surface quality and circularity improved) by each function

![Higher surface quality](image3.png)

Stable machining

- High precision compensation of thermal displacement without external sensor
  - Estimating the thermal displacement along each axis based on the operation status of the spindle and feed axes

- Automatic optimization by the touch probe
  - Adjust value optimized automatically with measuring result by the touch probe (option)

![AI Thermal Displacement Compensation Screen](image4.png)
High Sustainability

Excellent chip evacuation

- Excellent chip evacuation (Option)
  - Chip evacuation ability enhanced on the condition of much quantity of chips
  - Maintenance and cleaning cycle can be extended

- X-axis telescopic cover with 3 pieces (Option)
  - Covering against chip and coolant enhanced by improved shape of telescopic cover
  - Reduction of the load to telescopic cover and enhanced cover and cushion gum by 3 pieces structure

- Cleaning unit for tool taper shank (Option)
  - Flushing the tool taper shank by the coolant to prevent catching cut chips during tool change
  - The stable cutting accuracy can be maintained

- Tool run-out detection function (Option)
  - Run-out measurement sensor can detect tool run-out before cutting
  - When the amount of run-out becomes excessive, it is possible to remove the cut-chips by the retry function
  - Measurement time is 0.4 s or less

High maintainability

- SMART TROUBLE SHOOTING FUNCTION
  - The Trouble diagnosis monitor screen displays useful information to make decisions at the occurrence of alarms
  - An alarm cause and how to handle it are identified according to the failure diagnosis flow displayed in the Trouble diagnosis guidance screen
  - The facility availability ratio are improved due to a reduction of down time

- Improvement of maintainability for I/O device
  - The cause and point the failure of I/O devices (disconnection, earth fault etc) are identified
  - The facility availability ratio are improved due to a reduction of down time
High reliability

- Abundant track records at FANUC in-house factory
  - Using ROBODRILLS for both steel and aluminum parts machining at FANUC in-house factory
- Applying maintenance data of FANUC in-house factory
  - Accumulating maintenance data of ROBODRILL gotten at FANUC in-house factory
  - Achieving high reliability by returning the maintenance data to ROBODRILL design

Complete preventive maintenance

- Leakage Detection Function
  - Early detection of insulation resistance drop of each motor and motor power cable
  - Enable preventive maintenance before breakdown
- Fan Monitor Function
  - Monitoring cooling fans of CNC, Servo Amplifiers, Spindle Amplifier and Power Supply
  - Make announcement when the cooling fans rotation is under standard value
  - Easy to detect the abnormal fan
- PERIODICAL MAINTENANCE
  - Make announcement for the necessary items by schedule
  - Possible to make announcement it the maintenance time is approaching
  - Possible to set customized maintenance items (Max. to 8)

- Machine configuration to improve parts replacement
  - Improved new fan unit is adopted for easy parts replacement
  - The facility availability ratio are improved due to a reduction of down time
- RECHARGEABLE BATTERY UNIT (Option)
  - Rechargeable battery and charging circuit integrated
  - Automatically recharged while ROBODRILL power ON
  - Supplying backup power both CNC and PULSE-CODER instead of disposable battery
  - Battery maintenance time and disposal of used batteries reduced
Ease of Use

The latest CNC of FANUC

● 10.4” Color LCD and compact operator’s panel
  - Provides CNC with 10.4” color LCD and compact operator’s panel
  - Allows all operations by the least key push
  - Also allows machine control by vertical softkeys on the right side of LCD
  - USB port newly added on the left side of LCD, in addition to conventional memory card slot

High usability

● Easy operation on ROBODRILL exclusive screen (Quick Screen), including programming, maintenance, etc.
  - Quick editor
    CNC program editor that possible to edit character
    Minimum operation to input G code and M code by program input guidance
  - Coordinate/Tool Compensation
    Possible to set work coordinate and tool compensation on one screen
    Possible to protect or restore the prepare data such as work coordinate, tool compensation and program
  - Machine operation setting
    Possible to set the optimized machining mode and energy save mode according to the program
  - Maintenance/Setting
    Easy to operate ROBODRILL maintenance such as turret restoration, motor reference position return, AI Thermal Displacement Compensation

● Integrated operation, programming guidance (MANUAL GUIDE ć)
  - Easy to program and operate machining on one screen
  - Easy to program with G code through graphic guide
  - No need to calculate drill position or pocket machining, simple command
  - Simple machining simulation of solid model

Operator’s panel (standard)  Operator’s panel with alphabet keys (option)

Quick editor  Coordinate/Tool compensation

Machine operation setting  Maintenance/Setting

Cycle program input  Machining simulation
Automation application

- ROBOT interface 2
  - Easy and inexpensive construction of Machining Cell with safety issue
  - Enable to connect four ROBODRILLS and one ROBOT
  - No system controller (Control software included in ROBODRILL PMC)
  - Support for side Servo door control by ROBOT controller

High expandability

- Custom PMC
  - Easy to create LADDER program in order to control peripheral devices
  - Possible to set LADDER program I/O only for peripheral devices
  - Customize I/O signals (Standard: Input 16/Output 16 Max: Input 1024/Output 1024)

- Custom control panel
  - Possible to monitoring peripheral devices status
  - Control machining program ON/OFF by switch
  - Possible to create switch of lamp, ON/OFF switch, pulse switch
  - Easy and inexpensive construction of peripheral devices with perfect maintainability

Technology for power saving

- Proven power regeneration function
  - The power regeneration function that use regenerating energy occurred on deceleration of motors has been adopted since 1994.

Conformity of safety standards (Option)

- Conformity of each country’s safety standard
Machining Capability

Machining sample (1)

<table>
<thead>
<tr>
<th>Material</th>
<th>Spindle spec.</th>
<th>Standard spindle</th>
<th>High torque spindle</th>
<th>High acceleration spindle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Machining</td>
<td>Drilling</td>
<td>Tapping</td>
<td>Drilling</td>
</tr>
<tr>
<td></td>
<td>Tool dia. (mm) x Tap size x Tap pitch (mm)</td>
<td>Tool dia. (mm) x Feed (mm/rev)</td>
<td>Tap size x Tap pitch (mm)</td>
<td>Tool dia. (mm) x Feed (mm/rev)</td>
</tr>
<tr>
<td>Cabon Steel C45</td>
<td>Dia.30 x 0.10</td>
<td>M20 x 2.5</td>
<td>Dia.30 x 0.15</td>
<td>Dia.20 x 0.10</td>
</tr>
<tr>
<td>Grey Cast Iron</td>
<td>Dia.30 x 0.25</td>
<td>M27 x 3.0</td>
<td>Dia.30 x 0.30</td>
<td>M16 x 2.0</td>
</tr>
<tr>
<td>Aluminum Alloy Die Casting</td>
<td>Dia.32 x 0.35</td>
<td>M30 x 3.5</td>
<td>Dia.32 x 0.40</td>
<td>M24 x 3.0</td>
</tr>
</tbody>
</table>

(1) Sample data may vary on machining conditions

Available Options

- Top cover
- Coolant unit (tank)
- Tool length switch for automatic measurement
- Touch probe
- LED Illumination
- Coolant unit with chip flush (spot gun provided)
- Automatic Grease Lubricating System (LHL Liquid Grease)
- Automatic Oil Lubricating System
- Automatic fire extinguisher

(Note)

- If machining “combustible materials” such as resin and magnesium or using a water-immiscible cutting fluid, select an automatic fire extinguishing system because of fire hazards. For information on the objects that can be extinguished by an automatic fire extinguishing system, contact your ROBODRILL sales representative.
- The machine life may be shortened depending on the workpiece, tool, coolant, or lubricant to be used.

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 ROBODRILL which focus on practical operations and programming with machining know how and maintenance.

World Wide Support Over 230 Offices

Inquiries : Yamanekako-mura, Yamanashi, Japan 401-0501
Phone : 81-555-84-6030 Fax : 81-555-84-5540
Outer Dimensions and Floor Plan

**α-D21SiA/D14SiA**

**α-D21MiA/D14MiA**

**α-D21LiA/D14LiA**

*1 These dimensions may vary on some options. (For further details, please contact FANUC.)
## Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>X-D21SIA</th>
<th>X-D14SIA</th>
<th>X-D21MIA</th>
<th>X-D14MIA</th>
<th>X-D21LIA</th>
<th>X-D14LIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Machine(Standard)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-axis travel (Longitudinal movement of table)</td>
<td>300 mm</td>
<td>500 mm</td>
<td>700 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y-axis travel (Cross movement of saddle)</td>
<td>300 mm + 100 mm</td>
<td>400 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-axis travel (Vertical movement of spindle head)</td>
<td>330 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from table surface to spindle gage plane</td>
<td>150 to 480 mm</td>
<td>(When no high column is specified)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Table</strong></td>
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</tr>
<tr>
<td>Working space (X-axis × Y-axis)</td>
<td>630 mm × 330 mm</td>
<td>650 mm × 400 mm</td>
<td>850 mm × 410 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity of workpiece mass</td>
<td>200 kg (uniform load)</td>
<td>300 kg (uniform load)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working surface configuration</td>
<td>3T-slots size 14 mm pitch 125 mm</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Spindle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed range</td>
<td>100 min⁻¹ to 10000 min⁻¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spindle gage (Call number)</td>
<td>7/24 taper No.30</td>
<td>(with air blow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Feedrate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid traverse rate</td>
<td>48 m/min (X.Y.Z)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedrate</td>
<td>1 mm/min to 30000 mm/min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tool change system</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of tooling</td>
<td>Turret type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool storage capacity</td>
<td>21 tools : α-D21SIA/D21MIA/D21LIA</td>
<td>14 tools : α-D14SIA/D14MIA/D14LIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum tool diameter</td>
<td>80 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum tool length</td>
<td>200 mm : α-D14SIA</td>
<td>190 mm (Changed by specifications)</td>
<td>250 mm (Changed by specifications)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of tool selection</td>
<td>Random shortest path</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum tool mass</td>
<td>2 kg/tool (total mass 23 kg/3 kg/tool) : α-D21SIA/D21MIA/D21LIA</td>
<td>2 kg/tool (total mass 15 kg/3 kg/tool) : α-D14SIA/D14MIA/D14LIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool changing time (Cut to Cut)</td>
<td>1.4 s : α-D14SIA/D14MIA/D14LIA (When 2 kg/tool is specified)</td>
<td>1.6 s : α-D21SIA/D21MIA/D21LIA (When 2 kg/tool is specified)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Motors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spindle drive motor</td>
<td>11.0 kW (1 minute rating)/3.7 kW (continuous rating)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidirectional accuracy of positioning of an axis (ISO230-2:1988)</td>
<td>0.006 mm to 0.020 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidirectional repeatability of positioning of an axis (ISO230-2:1997, 2006)</td>
<td>Less than 0.004 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sound pressure level</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Less than 70 dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control unit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>FANUC Series 31i-B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simultaneously controlled axes</td>
<td>Max4 axes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Installations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note/Please make sure to comply with installation conditions specified by FANUC when installing ROBODRILL.</td>
<td></td>
<td></td>
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<tr>
<td><strong>Power source</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>200 Vac. to 220 Vac., -15 % to +10 %, 3-phase, 50 Hz ± 1 Hz or 60 Hz ± 1 Hz 10 kVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressed air supply</td>
<td>0.35 MPa to 0.55 MPa (0.5 MPa is recommended) (gage pressure) 0.15 m³/min (at atmospheric pressure)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Machine size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine height</td>
<td>2236 mm ± 10 mm (When no high column is specified)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor space</td>
<td>995 mm × 2210 mm</td>
<td>1565 mm × 2040 mm</td>
<td>2115 mm × 2040 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass of machine</td>
<td>Approx. 1950 kg</td>
<td>Approx. 2000 kg</td>
<td>Approx. 2100 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Positioning accuracy is the adjusted and measured value in compliance with applicable standard at FANUC's factory. Depending on an influence of JIG & workpiece mass on table, the use conditions and installation environment, there may be a case where the accuracy shown in this catalog can not be achieved.

*2 Sound pressure level is measured in compliance with FANUC’s own regulation. Depending on the use conditions and installation environment, there may be a case where the sound pressure level shown in this catalog can not be achieved.

*3 Fastening the machine to the floor (mounting anchors) may be required depending on the use conditions and installation environment, or to prevent the machine from toppling over due to an earthquake.

*4 In case of center through coolant and cleaning unit for tool taper shank, additional +1 kVA is required respectively. In case of additional 1 axis, additional maximum +1.5 kVA is required. A cable with 8 mm² or more should be used at primary power connection.

*5 In case of center through coolant, additional +0.05 m³/min is required. In case of air blow for chips, additional +0.2 m³/min is required. In case of side automatic door, 0.4 MPa compressed air supply or more is required.

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