Welding & Handling Robot
Friendly series
FD-B4/B4L/V6/V6L/V20/H5/V166/V210
Friendly series changes the future of manufacturing

Offers the most suitable solution for automation of welding

High quality arc welding packages for everyone!

- **EASY**
  - Intuitive Operation
  - Touch panel and jog dial ensure easier operation.

- **QUALITY**
  - Extensive Quality Control Functions
  - Easier quantitative management of welding procedures

- **ECOLOGY**
  - Compact & Eco-friendly
  - A streamlined, space-saving design that contributes to energy efficiency by reducing standby power consumption
### Smooth operation

#### TEACH PENDANT

**Smart welding**

**Welding condition guide function**

Anyone can easily teach welding conditions.

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**Compact and lightweight**

- 27% lighter (960 g) compared to previous model, making teaching for a long time possible
- 40% smaller in size compared to previous model, making simple handling even in tight spaces possible

**Smooth teaching**

- Simple operation with the touch panel
- Simple adjustment with the jog dial

**Smooth backups**

- Inclusion of a USB memory slot simply makes data saving and reading possible

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**Smooth operation**

#### Jog dial

It is possible to do high and low scroll of teaching program, to make an adjustment of wire aiming position and to do wire feeding and retract movement with jog dial. Jog dial can provide intuitive operation for multiple items.

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**Improved display**

By improving the display of characters, the display has become easy to see.

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**Smooth operation**

#### One-touch access

The Touch Panel offers one-touch access to the input section, minimizing the number of times keys must be pressed.

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**Iconified operation button**

Quick operation is possible by guidance function and iconified operation button.
Electric power conservation
- Use of power conservation modes reduces electric power consumption by 50%
- Energy conservation timer function
- Comparison of apparent power

Minimal maintenance
- Addition of axes is simply made possible
- Reduced number of parts by 30%

Space conservation
- Volume reduced by 20%
  (compared to a conventional model)
- Increased space freed above

Smart welding

Improved operability
Correcting teaching to improve welding quality is made possible in a short time.

Adjustment of the torch angle is simply possible
The torch position and torch angles (push angle, drag angle, work angle) of the welding section can be changed all at once.

Improved movement performance
- By increasing the robot response speed to welding start signals, arc start failures are reduced and high-quality bead appearance is achieved.
- By greatly reducing residual vibrations, high-speed approaches are made possible.

Down-sized

Improved space utilization
Without increasing the installation footprint, the height has been reduced.

Depth reduced by 110 mm
Height reduced by 196 mm
Weight reduced by 21%

Increased reliability
When a welding error occurs troubleshooting can be done easily, leading to reducing downtime.

Welding recorder (optional)
When a welding error occurs, data is backed up automatically. This helps finding the cause of the trouble, leading to reducing downtime.

Traceability is easily added (optional)
Simply by connecting an FD-AM computer, traceability can be included.

Smart welding

Gas Saver
GPC
Current and voltage
Wire feeding speed
FD-AM
Optional equipment
Torches for Robots & Welding Peripherals

**Torch for robot**
Achieving stable welding operation which enables prevention of welding interruption and reduction in costs of consumables
**Forced pressurized power feeding torch (TCC torch)**

This photo indicates the TCC torch RZ3501H equipped with a shock sensor SSB (optionally available).

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip capacity (A)</th>
<th>Heat duty cycle (%)</th>
<th>Heat duty cycle (L/H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RZ3501S/L/H</td>
<td>550 A (350 A)</td>
<td>60% (60%)</td>
<td></td>
</tr>
</tbody>
</table>

**Deviation of wire position prevented**
This torch improves the deviation of wire position by about 50% or more compared with the standard torch.

**TCC Torch**
Uniform abrasion on circumference

Before tip abrasion
After tip abrasion

Standard torch
Uneven abrasion

Before tip abrasion
After tip abrasion

**Improved durability of the tip**
Durability of the tip holder improved about 3 times or more compared with the standard robot tip.

**Reliable power supply**
Compared to a conventional standard torch, this offers improved welding quality thanks to the stable wired power supply.

**Welding peripherals**
For automatic removal of spatters in the nozzle
**Air blow kit**

Only addition of the air blow kit to CO2/MAG standard torch enables quick-change into the air blow style tip body!

**Advantages of air blow specification**
- Automatic removal of spatters in the nozzle with air, prevention of welding interruption.
- Enhancement of the life of nozzle by cooling the nozzle with air, reduction in the running cost.

Note: Compatible with RT3500*, RT5000* and RZ35**.

**Torch for robot**
For improving welding quality
**Compact servo torch**

The photo indicates the full feeding unit equipped with a compact servo torch for CO2/MAG (MTX9-341FSP).

- Be sure to use the compact servo torch together with an assist feeder.
- We provide compact servo torches for CO2/MAG and for aluminum MAG.

**CO2/MAG Welding Torch**

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum welding current (CO2/MAG)</th>
<th>Minimum working current (MAG)</th>
<th>Welding efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTX9-341FSP</td>
<td>350 A (250 A)</td>
<td>50% (60%)</td>
<td></td>
</tr>
<tr>
<td>MTX9-341FSP</td>
<td>500 A (250 A)</td>
<td>50% (60%)</td>
<td></td>
</tr>
</tbody>
</table>

**MIG Welding Torch**

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum welding current (MIG)</th>
<th>Welding efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTX9-341FSP</td>
<td>350 A (250 A)</td>
<td>50% (60%)</td>
</tr>
<tr>
<td>MTX9-341FSP</td>
<td>500 A (250 A)</td>
<td>50% (60%)</td>
</tr>
<tr>
<td>MTX9-341FSP</td>
<td>400 A (200 A)</td>
<td>70% (60%)</td>
</tr>
</tbody>
</table>

**Excellent stability of wire feeding**

**Decrease in deviated wire position**
The compact servo torch has realized reduction in deviated wire position to one third or lower compared with the standard torch (about 0.2 mm or less), and also reduction in welding defects such as bead deviation and burn through.

**Optional software dedicated to servo torch**
RS Control realizes secure and stary by instantaneously raising the wire which makes contact with the base metal, and allows reduction of spatters at the start of welding.

- The RS control is limited in applicable robot model, welding power source, and welding mode.
- This model requires optional software.

**Torch for robot**
Our bestselling CO2/MAG torch compatible with a shock sensor

Model RT3500H is shown mounted with optional SSB Shock Sensor Unit.

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum welding current (CO2/MAG)</th>
<th>Welding efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT 3500</td>
<td>350 A (350 A)</td>
<td>80% (60%)</td>
</tr>
<tr>
<td>RT 5000</td>
<td>500 A (350 A)</td>
<td>50% (70%)</td>
</tr>
<tr>
<td>RTW5000</td>
<td>500 A (400 A)</td>
<td>70% (60%)</td>
</tr>
</tbody>
</table>
Clean kit

The clean kit has realized improvement in the operation rate of welding robot and the welding quality.

- Automatically removes spatters in the torch nozzle. (L-10748, K-2725)
- Enables simultaneous operation of cleaning and application of adhesive spatter inhibitors. (L-10748, K-2725)
- Brushing function is added to wire cutting function (K-2726), (L-10748, K-2725)

**Eccentric spring type drill**

**Features**
- The clean kit cleans the inside of the nozzle and the outer surface of the tip simultaneously by eccentric rotation.

**Effects**
- The eccentric spring type drill scrapes spatters away effectively in the right and left directions and downwards by rotation of the eccentric spring type drill.
- The spring type drill can move to the depth of the nozzle and scrape spatters out.

**Powerful suction device**

**Features**
- The powerful suction device allows removal of all spatters in the depth of the nozzle by suctioning, and uniform application of a proper amount of anti-deposition agent to the depth of the torch by forming mist of a small amount of the agent applied on the top of the torch by powerful suction simultaneously.

**Effects**
- The device can remove spatter hanging down stubbornly by suctioning with high finishing and cleaning accuracy.
- It has the nozzle cooling effect (capable of cooling the nozzle to 40 to 50°C during cleaning) (Ratio compared with the former: 1/5) and can prevent dripping.

*Another air source is required during use of this function.*

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**Gas Saver GFC**

**Features and mechanism of Gas Saver**

- The gas flow rate from each welding section can be adjusted with the Teach Pendant. You can also set the gas flow rate for particular types of gas or welding methods.
- The actual gas flow rate can be monitored in real time with the Teach Pendant.
- The flow control prevents a sudden increase in flow at the start of welding. Because it controls the flow with high accuracy in real time, the desired gas flow rate can be kept stable (flow accuracy ±2%).
- While the gas is flowing, the flow rate is constantly monitored. If a flow shortage occurs, the robot can be stopped.

**Mechanism of gas wastage when no gas saver is used**

- During welding: The flow control valve maintains a constant flow rate.
- During welding stop: The pressure regulator allows high-pressure gas to accumulate in the gas hose between the gas flow regulator and the solenoid valve.
- At the start of welding: The high-pressure gas in the hose is instantly released, becoming waste gas.
Optional equipment
PC Software

Off-line teaching beyond simulator
Offline teaching system FD-ST

High-accuracy/high-performance teaching & simulation achieved by the same operation as that of robot!

Fully compatible with the controller FD11

This teaching system can be operated by the same operation of the robot controller FD11. If OTC standard robot system is provided, the setup can be completed only by reading the backup data.

New function realizing simplified operation!

Snap function at any point
The snapping operation can be done anywhere on the surface of 3D model.
- Snapping is possible only at the end points.
- Direct designation is impossible at the points other than end points.

Designation is possible at the end points, edge lines, and any points on the plain surface.

Equipped with easily understandable operate handle
Intuitive operation of 3D model is possible.

Planar movement
Parallel movement
Rotating movement

Automatically creates the welding pass on any edge line on the 3D work model.
*In preparing the 3D workpiece model, 3D CAD is required separately.

Tact time can be predicted with accuracy.
Robot control software ensures high tact simulation accuracy.

Backup tool for task program
PC external storage software
FD-PM

Various files such as task program and PLC program can be saved or loaded between PC and robot controller.
Centralized control using only one PC is possible by connecting plural robots to LAN.

*LAN equipment connecting robot and PC is not included in this product.
Welding quality control by PC

PC arc monitor FD-AM

Visual display of welding condition

This monitor displays the welding current, welding voltage, and wire feeding load graphically. It can also display detailed welding start condition and state of robot controller.

Monitoring accuracy improved

The sampling frequency is increased 10 times compared with the conventional method, allowing detection of instantaneous arc outage or arc outage in short tack welding.

Welding condition can be saved.

The number of times of welding, number of occurrence of failures, task program number, welding time, and average current can be saved.
*The storabe capacity depends on the capacity of hard disk of your PC.

Quality control for every workpiece

An alarm output or abnormal threshold can be identified for each workpiece by inputting the workpiece number in the robot controller. This monitor supports detection of failure of workpieces.

Real-time monitor screen

Data display screen

Display of work number and step number

Display of threshold abnormalities
*Thresholds can be set for each welding step.

Best suited as a support tool after installation of robot

Robot simplified simulation tool FD on desk

Enables editing of the welding condition and PLC program as well as the task program by the same operation procedure of robot.

* In transferring of the data from/to FD11 controller, either optional USB memory or PM is required separately.
Optional equipment
Sensors for Robots

**Workpiece position detection sensor**

**Touch sensor FD-WD**

*Workpiece position detection sensor by touching the welding wire*

- Applicable to all the workpieces with a medium thickness or thicker.
- Most inexpensive among all workpiece position detection sensors.
- Requires no separate sensor unit because this sensor has a built-in controller.
- Allows high-speed search at up to 380 cm/min.
- A separate sensor unit (optional) is ready for hardly energized surfaces such as rust and black scale.

**Tracking sensor for CO₂/MAG welding**

**Arc sensor FD-AR**

*Automatic seam tracking by weaving*

- This sensor allows correction of curved workpiece or thermal distortion which can't be corrected only by detecting workpiece position.
- Applicable to workpieces with medium thickness or thicker.
- Most inexpensive among all the tracking sensors.
- Easy to use from the viewpoints of interference of workpieces and maintenance because this sensor requires no additional parts around the torch.
- Can't be used for tracking on aluminum.

<table>
<thead>
<tr>
<th>Workpiece position detection</th>
<th>〇</th>
<th>×</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seam tracking</td>
<td>×</td>
<td>〇</td>
</tr>
<tr>
<td>Recognition of groove shape</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Combination with other sensors</td>
<td>〇</td>
<td>×</td>
</tr>
<tr>
<td>Applicable workpieces</td>
<td>Plate thickness: 3.2 mm or more</td>
<td>Plate thickness: 3.2 mm or more</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1.0 mm (provided that the bend of wire does not change)</td>
<td>±1.0 mm (provided that arc and pool are stable)</td>
</tr>
<tr>
<td>Workpiece material</td>
<td>All the materials and surfaces to be energized</td>
<td>Iron system, stainless steel system</td>
</tr>
</tbody>
</table>
Tracking sensor for TIG welding

**TIG arc sensor FD-TR**

**Automatic seam tracking in TIG welding**

- Allows arc length constant control (vertical tracking) in TIG.
- Allows stable execution of welding by keeping the arc length constant to the thermal distortion of thin plate.
- Allows high-accuracy tracking even in pulse TIG welding.
- Easy to use from the viewpoints of interference of workpieces and maintenance, because it requires no additional parts around the torch.

![Image of TIG arc sensor](image1)

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Laser start point detection sensor

**Laser search FD-QD**

**High-accuracy workpiece position detection sensor using laser**

- Realizes higher speed and higher accuracy than those of the touch sensor.
- Allows high accuracy detection for a wide spectrum of applications from thin plate to medium thickness plate.
- Allows recognition of various welding joints by easy operation.
- Allows visual check of the recognition result using a teach pendant.
- Enables automatic change of the welding condition based on the recognition result.
- Can be used for applications other than welding.

![Image of Laser search FD-QD](image2)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>✗</td>
<td>(The maximum two-way displacement detection rate per site is about 1.5 seconds)</td>
</tr>
<tr>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>✗</td>
<td>(only vertical tracking)</td>
</tr>
<tr>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>✗</td>
<td>Combination use of the touch sensor and laser sensor is possible.</td>
</tr>
<tr>
<td>✗</td>
<td>This sensor can be used together with an arc sensor or TIG arc sensor.</td>
</tr>
<tr>
<td>±0.5 mm (when the electrode is not worn)</td>
<td>±0.5 mm (Search speed 100 cm/ or less. For stand-alone robot)</td>
</tr>
<tr>
<td>All the materials which can be welded</td>
<td>The surface shall not be glossy (nonmetal is permitted).</td>
</tr>
</tbody>
</table>

10
Positioner
Peripheral Equipment Jig Positioner

Positioner

Positioner Headstock
1PB Series

- Can be used to build varied jig systems with a large degree of positioning flexibility.
- A hole through the center of the rotary table, enabling cables and hoses to be routed through easily.

<table>
<thead>
<tr>
<th>Model Name</th>
<th>1PB250</th>
<th>1PB500</th>
<th>1PB1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Payload Capacity</td>
<td>250 kg</td>
<td>500 kg</td>
<td>1000 kg</td>
</tr>
<tr>
<td>Rotating Speed</td>
<td>2.6 rad/s (150°/s)</td>
<td>2.1 rad/s (120°/s)</td>
<td>1.3 rad/s (72°/s)</td>
</tr>
<tr>
<td>Allowable Rotating Torque</td>
<td>206 N·m</td>
<td>490 N·m</td>
<td>1078 N·m</td>
</tr>
<tr>
<td>Position Repeatability</td>
<td>±0.1 mm (Position at R300 mm)</td>
<td>±0.1 mm (Position at R300 mm)</td>
<td>±0.1 mm (Position at R300 mm)</td>
</tr>
<tr>
<td>Stop Position</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
</tr>
<tr>
<td>Mass (Weight)</td>
<td>110 kg</td>
<td>170 kg</td>
<td>220 kg</td>
</tr>
</tbody>
</table>

*Mountable on both right and left sides of the connector box (factory mounted).*
2-Axes Double Support Positioner
2PF Series

- High-speed motion increases production efficiency!
  An increase in the maximum rotation speed of the tilting axis by 2.5 times and in rotation axis by 2 times was achieved in comparison with the conventional machine 300 kg payload type.

### 2PF300/500/1000

<table>
<thead>
<tr>
<th>Model Name</th>
<th>A2PF301-ENN</th>
<th>A2PF501-ENN</th>
<th>A2PF1001-ENN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Payload Capacity</td>
<td>300 kg</td>
<td>500 kg</td>
<td>1000 kg</td>
</tr>
<tr>
<td>Rotating Speed</td>
<td>3.1 rad/s (180°/s)</td>
<td>2.8 rad/s (162°/s)</td>
<td>2.9 rad/s (166°/s)</td>
</tr>
<tr>
<td>Tilting Speed</td>
<td>2.2 rad/s (125°/s)</td>
<td>1.5 rad/s (84°/s)</td>
<td>1.4 rad/s (82°/s)</td>
</tr>
<tr>
<td>Rotating Torque</td>
<td>294 N·m</td>
<td>392 N·m</td>
<td>882 N·m</td>
</tr>
<tr>
<td>Tilting Torque</td>
<td>882 N·m</td>
<td>1347 N·m</td>
<td>3704 N·m</td>
</tr>
<tr>
<td>Position Repeatability</td>
<td>±0.08 mm (Position at R250 mm)</td>
<td>±0.08 mm (Position at R250 mm)</td>
<td>±0.08 mm (Position at R250 mm)</td>
</tr>
<tr>
<td>Step Position</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
</tr>
<tr>
<td>Mass (Weight)</td>
<td>260 kg</td>
<td>260 kg</td>
<td>470 kg</td>
</tr>
</tbody>
</table>
Slider
Peripheral Equipment Jig Slider

- Sliders are available in 12 models with strokes between 1 m and 6.9 m.
- Employment of an AC servo motor and non-backlash reduction gear provides the same high accuracy operation as that of robots.
- Combination with the OTC robot allows synchronized operation.
- The cable bearer is provided in the center of the slider, which allows space-saving installation.

Linear Sliders (Light Duty)
Model 1SB

- A maximum of 330 kg can be loaded.
- Dust-proof structure prevents spatter, oil and dust from entering.

Linear Sliders (Standard Duty)
Model 1SR

- Standard Duty with a maximum loading weight of 330 kg
- Dust-proof structure prevents spatter, oil and dust from entering.

Linear Sliders (with Carriage Duty)
Model 1SR-P

- The wire pack can be mounted on the truck connected to the robot-mounting part.
- Dust-proof structure prevents spatter, oil and dust from entering.

<table>
<thead>
<tr>
<th>Model 1SB</th>
<th>Model 1SR</th>
<th>Model 1SR-P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stroke Length</strong></td>
<td>1 m, 2 m</td>
<td>2.9 m, 3.9 m, 4.9 m, 5.9 m, 6.9 m</td>
</tr>
<tr>
<td><strong>Max. Moving Speed</strong></td>
<td>0.3 m/s</td>
<td>0.295 m/s</td>
</tr>
<tr>
<td><strong>Max. Mounting Capacity</strong></td>
<td>330 kg</td>
<td>330 kg</td>
</tr>
<tr>
<td><strong>Position Repeatability</strong></td>
<td>±0.1 mm</td>
<td>±0.1 mm</td>
</tr>
</tbody>
</table>


| **Stroke S (mm)** | 1000 | 2000 | 2900 | 3900 | 4900 | 5900 | 1900 | 2900 | 3900 | 4900 | 5900 |
| **Whole Length L (mm)** | 2510 | 3510 | 4500 | 5500 | 6500 | 7500 | 8500 | 4500 | 5500 | 6500 | 7500 | 8500 |
| **Mass (kg)** | 450 | 550 | 650 | 750 | 850 | 950 | 1050 | 800 | 900 | 1000 | 1100 | 1200 |

* Ensure that the total mass of the manipulator and other peripherals does not exceed the payload capacity.
### Configuration example
**FD-B4 Configuration Example**

<table>
<thead>
<tr>
<th>Number and Part Name</th>
<th>Model</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Manipulator</td>
<td>NB4</td>
<td>N: Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Chinese</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E: English</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F: Floor Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C: Ceiling Mounted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W: Wall Mounted</td>
</tr>
<tr>
<td>② Controller</td>
<td>FD11</td>
<td>J: Standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V: NV6, NB4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manipulator Notation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D: No External Axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P: External 1 Axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2: External 2 Axes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4: External 1 Axis x 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A: Large Capacity External 1 Axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Standard Case External Axis Spec.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*** Additional Case Spec.</td>
</tr>
<tr>
<td>③ Teach Pendant</td>
<td>FDTPDSJN-1L**</td>
<td>** : 08 8 m Spec. (Standard)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>: 15 15 m Spec.</td>
</tr>
<tr>
<td>④ Operation Box</td>
<td>FDOP:0.0**</td>
<td>** : 05 5 m Spec. (Standard)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>: 10 10 m Spec.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>: 15 15 m Spec.</td>
</tr>
<tr>
<td>⑤ Control Cable 1, 3</td>
<td>FDRB-10**</td>
<td>** : 05 5 m Spec. (Standard)</td>
</tr>
<tr>
<td>(Wire Harness)</td>
<td></td>
<td>: 10 10 m Spec.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>: 15 15 m Spec.</td>
</tr>
</tbody>
</table>

### FD11 Controller Specifications
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>580 mm (W) x 542 mm (D) x 650 mm (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Approx. 62 kg</td>
</tr>
<tr>
<td>Ambient Temperature Range</td>
<td>0 to 45°C</td>
</tr>
<tr>
<td>Ambient Relative Humidity Range</td>
<td>20 to 80%RH (Non-condensing)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>3-phase 200/220 VAC+10%, -15%, 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>FD-H6: 1.0 kVA</td>
</tr>
<tr>
<td></td>
<td>FD-B4/6: 1.5 kVA</td>
</tr>
<tr>
<td></td>
<td>FD-B4L/6L: 2.4 kVA</td>
</tr>
<tr>
<td></td>
<td>FD-V166/210: 7.5 kVA</td>
</tr>
</tbody>
</table>

**General Purpose I/O**
- 8 input 8 output (as a standard)

**Memory Capacity**
- 160,000 instructions (by PTP Instruction in a single mechanism)

**Number of Task Programs**
- 9,999

**External Memory**
- USB memory (Robot Control: 1 slot, Teach Pendant: 1 slot) Optional

**Painting Color**
- Munsell notation: 10GY 9/1

### Teaching Pendant Specifications
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>175 mm (W) x 326 mm (D) x 81 mm (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Approx. 0.96 kg</td>
</tr>
<tr>
<td>Operation Device</td>
<td>Axis keys, TP selector switch, jog dial, enable switch, operation ready ON key, emergency stop button, USB memory slot (1 slot)</td>
</tr>
<tr>
<td>Display</td>
<td>5.7 inches/640 x 480 dots/65536 colors/ touch panel/LED backlight</td>
</tr>
<tr>
<td>IEC Protection Class</td>
<td>IP65</td>
</tr>
<tr>
<td>Cable Length</td>
<td>Standard: 8 m, optional: 15 m</td>
</tr>
</tbody>
</table>
The figures below show the working range of P-point with no torch mounted.
## Specifications

### Manipulator Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>FD-B4</th>
<th>FD-B4L</th>
<th>FD-V6</th>
<th>FD-V6L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Axes</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Maximum Capacity</td>
<td>4 kg</td>
<td>4 kg</td>
<td>6 kg</td>
<td>6 kg</td>
</tr>
<tr>
<td>Positional Repeatability</td>
<td>±0.08 mm (Note 1)</td>
<td>±0.08 mm (Note 1)</td>
<td>±0.08 mm (Note 1)</td>
<td>±0.08 mm (Note 1)</td>
</tr>
<tr>
<td>Driving Capacity</td>
<td>2550 W</td>
<td>4650 W</td>
<td>2800 W</td>
<td>5000 W</td>
</tr>
</tbody>
</table>

### Working Range

- **Arm:**
  - J1 (Rotation): ±170° (±50°) (Note 2)
  - J2 (Lower arm): □155° to +90°
  - J3 (Upper arm): □170° to +180°
  - J4 (Swing): ±155°
  - J5 (Bending): □45° to +225° (Note 5)
  - J6 (Twist): ±200° (Note 5)
- **Wrist:**
  - J1 (Rotation): 3.66 rad/s (210/ s)
  - J2 (Lower arm): 3.66 rad/s (210/ s)
  - J3 (Upper arm): 3.66 rad/s (210/ s)
  - J4 (Swing): 7.33 rad/s (420/ s)
  - J5 (Bending): 7.33 rad/s (420/ s)
  - J6 (Twist): 10.5 rad/s (600/ s)

### Maximum Speed

- **Arm:**
  - J1 (Rotation): 3.6 rad/s (180/ s) (3.05 rad/s (175/ s)) (Note 2)
  - J2 (Lower arm): 3.6 rad/s (200/ s)
  - J3 (Upper arm): 3.6 rad/s (200/ s)
  - J4 (Swing): 7.33 rad/s (420/ s)
  - J5 (Bending): 7.33 rad/s (420/ s)
  - J6 (Twist): 10.5 rad/s (600/ s)
- **Wrist:**
  - J1 (Rotation): 10.1 N·m
  - J2 (Lower arm): 10.1 N·m
  - J3 (Upper arm): 10.1 N·m
  - J4 (Swing): 2.94 N·m
  - J5 (Bending): 2.94 N·m
  - J6 (Twist): 0.03 kg·m²
- **Arm Cross-sectional Area:**
  - J1 (Swing): 2.94 m² × 340°
  - J2 (Lower arm): 6.37 m² × 340°
  - J3 (Upper arm): 3.14 m² × 340°
  - J4 (Swing): 7.48 m² × 340°

### Environmental Conditions

- 0 to 45°C, 20 to 80%RH
- (No Condensation)

### Mass (weight)

- 154 kg
- 144 kg
- 277 kg
- 273 kg

### Maximum Load of Upper Arm

- 10 kg (Note 6)
- 10 kg (Note 6)
- 10 kg (Note 6)
- 10 kg (Note 6)

### Installation Method

- Floor-Ceiling-Wall-mounted

### Paint Color

- White (Munsell notation 10GY 9/1)

**Notes:**
1. The value of the positional repeatability is at the tool center point (TCP) compliant to ISO 9283.
2. The value in the parentheses indicates the wall-mounting condition.
3. Working range of J2 axis may be restricted when wall-mounting.
4. The operation range of the J3 axis is restricted to -170° degrees to +250° degrees when floor-based welding is applied.
5. Working range of J6 axis may be restricted by the position of J5 axis.
6. When loading the Max. payload capacity as the end effector.
7. This value changes by placement and load conditions of a wrist.
*These specifications are subject to change without prior notice.
*FD-166/210 is a standard specification.
<table>
<thead>
<tr>
<th><strong>FD-H5</strong></th>
<th><strong>FD-V20</strong></th>
<th><strong>FD-V166</strong></th>
<th><strong>FD-V210</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NH5</td>
<td>NV20</td>
<td>FD-V166</td>
<td>FD-V210</td>
</tr>
<tr>
<td>≤</td>
<td>≤</td>
<td>≤</td>
<td>≤</td>
</tr>
<tr>
<td>5 kg</td>
<td>20 kg</td>
<td>166 kg</td>
<td>210 kg</td>
</tr>
<tr>
<td>±0.05 mm (Note 1)</td>
<td>±0.07 mm (Note 1)</td>
<td>±0.1 mm (Note 1)</td>
<td>±0.15 mm (Note 1)</td>
</tr>
<tr>
<td>1440 W</td>
<td>5800 W</td>
<td>18 kW</td>
<td>≤</td>
</tr>
<tr>
<td>±170°</td>
<td>±170° (±50°) (Note 2)</td>
<td>±180°</td>
<td>≤</td>
</tr>
<tr>
<td>□125° to +90°</td>
<td>□150° to +100° (Note 3)</td>
<td>□80° to +60°</td>
<td>≤</td>
</tr>
<tr>
<td>□140° to +245°</td>
<td>□170° to +260° (Note 4)</td>
<td>□146.5° to +150°</td>
<td>≤</td>
</tr>
<tr>
<td>±190°</td>
<td>±180°</td>
<td>±380°</td>
<td>≤</td>
</tr>
<tr>
<td>□30° to +210°</td>
<td>□50° to +230°</td>
<td>±135°</td>
<td>±130°</td>
</tr>
<tr>
<td>±360°</td>
<td>±360°</td>
<td>±360°</td>
<td>≤</td>
</tr>
<tr>
<td>3.49 rad/s (200°/s) (2.79 rad/s (160°/s)) (Note 2)</td>
<td>3.40 rad/s (195°/s) (3.05 rad/s (175°/s)) (Note 2)</td>
<td>2.18 rad/s (125°/s)</td>
<td>2.01 rad/s (115°/s)</td>
</tr>
<tr>
<td>3.49 rad/s (200°/s)</td>
<td>3.32 rad/s (190°/s)</td>
<td>2.01 rad/s (115°/s)</td>
<td>1.83 rad/s (105°/s)</td>
</tr>
<tr>
<td>4.54 rad/s (260°/s)</td>
<td>3.14 rad/s (180°/s)</td>
<td>2.11 rad/s (121°/s)</td>
<td>1.97 rad/s (113°/s)</td>
</tr>
<tr>
<td>6.63 rad/s (380°/s)</td>
<td>6.98 rad/s (400°/s)</td>
<td>3.14 rad/s (180°/s)</td>
<td>2.44 rad/s (140°/s)</td>
</tr>
<tr>
<td>6.63 rad/s (380°/s)</td>
<td>6.68 rad/s (400°/s)</td>
<td>3.02 rad/s (173°/s)</td>
<td>2.32 rad/s (133°/s)</td>
</tr>
<tr>
<td>8.96 rad/s (510°/s)</td>
<td>10.5 rad/s (600°/s)</td>
<td>4.54 rad/s (260°/s)</td>
<td>3.49 rad/s (200°/s)</td>
</tr>
<tr>
<td>11.9 N·m</td>
<td>43.7 N·m</td>
<td>951 N·m</td>
<td>1,337 N·m</td>
</tr>
<tr>
<td>11.9 N·m</td>
<td>43.7 N·m</td>
<td>951 N·m</td>
<td>1,337 N·m</td>
</tr>
<tr>
<td>5.21 N·m</td>
<td>19.6 N·m</td>
<td>490 N·m</td>
<td>720 N·m</td>
</tr>
<tr>
<td>0.303 kg·m²</td>
<td>1.09 kg·m²</td>
<td>88.9 kg·m²</td>
<td>141.1 kg·m²</td>
</tr>
<tr>
<td>0.303 kg·m²</td>
<td>1.09 kg·m²</td>
<td>88.9 kg·m²</td>
<td>141.1 kg·m²</td>
</tr>
<tr>
<td>0.061 kg·m²</td>
<td>0.24 kg·m²</td>
<td>45.0 kg·m²</td>
<td>79.0 kg·m²</td>
</tr>
<tr>
<td>1.22 m² × 340°</td>
<td>5.27 m² × 340°</td>
<td>6.58 m² × 360°</td>
<td>6.67 m² × 360°</td>
</tr>
<tr>
<td>≤</td>
<td>≤</td>
<td>≤</td>
<td>≤</td>
</tr>
<tr>
<td>58 kg</td>
<td>278 kg</td>
<td>1010 kg</td>
<td>1040 kg</td>
</tr>
<tr>
<td>1 kg</td>
<td>20 kg (Note 6)</td>
<td>45 kg (90 kg max.) (Note 7)</td>
<td>≤</td>
</tr>
<tr>
<td>Floor-Ceiling-Wall-mounted</td>
<td>≤</td>
<td>≤</td>
<td>≤</td>
</tr>
<tr>
<td>White (Munsell notation 10GY 9/1)</td>
<td>≤</td>
<td>≤</td>
<td>≤</td>
</tr>
</tbody>
</table>
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