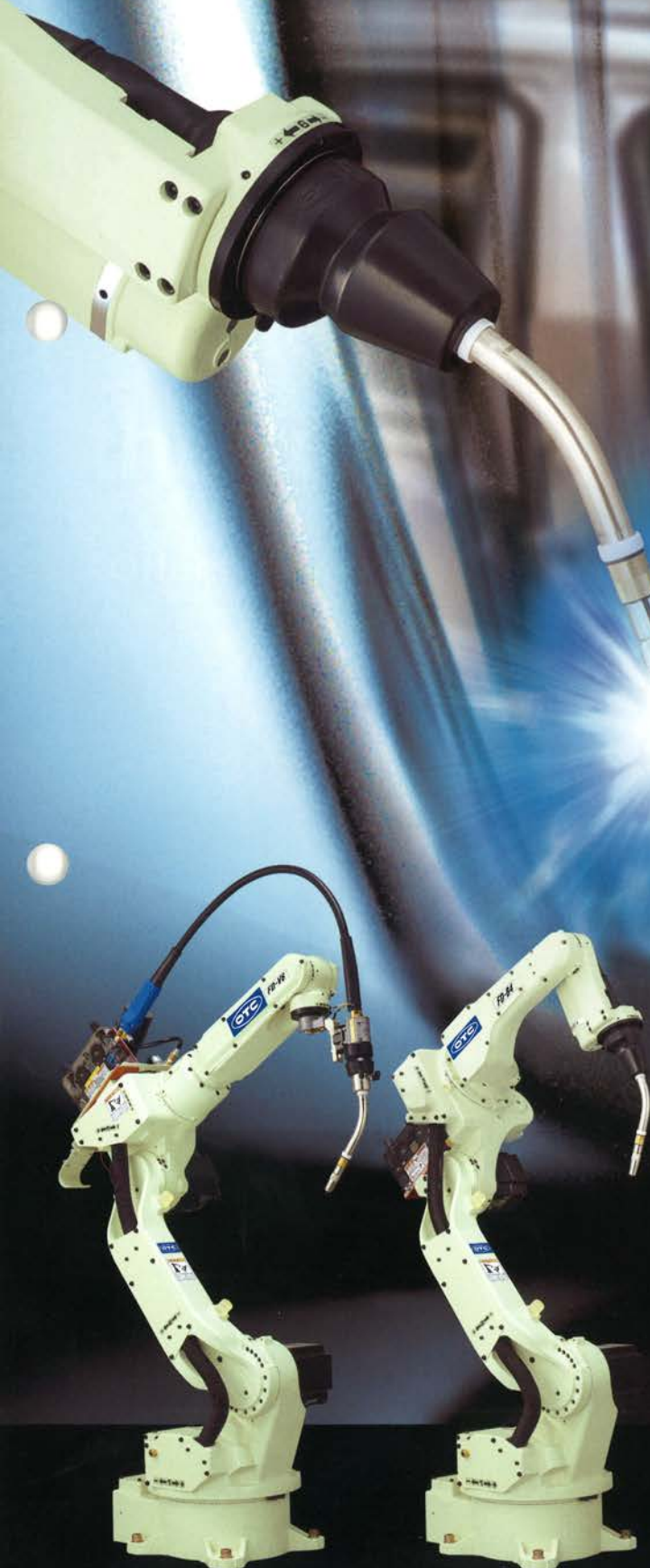


Welding & Handling Robot

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!



Intuitive Operation

Touch panel and jog dial ensure easier operation.



Extensive Quality Control Functions

Easier quantitative management of welding procedures



Compact & Eco-friendly

A streamlined, space-saving design that contributes to energy efficiency by reducing standby power consumption

Smooth operation TEACH PENDANT



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

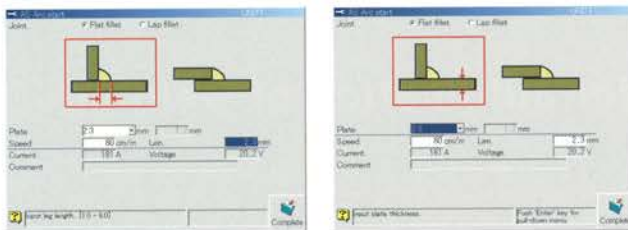
- Inclusion of a USB memory slot simply makes data saving and reading possible



Smart welding

Welding condition guide function

Anyone can easily teach welding conditions.



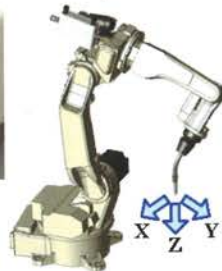
Smooth operation

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 inching and retract movement with jog dial. Jog dial can provide intuitive operation for multiple items.



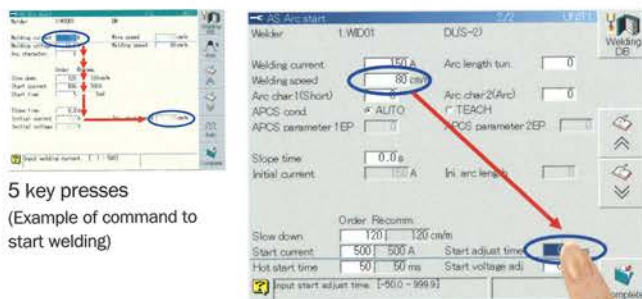
Turn jog dial



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.



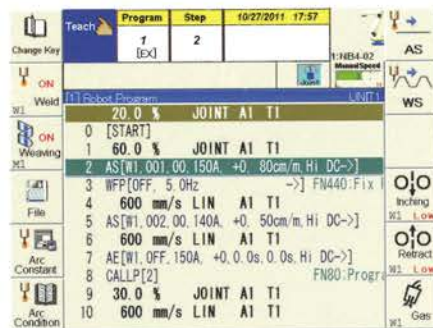
5 key presses
(Example of command to start welding)

1 key press

Smooth operation

Improved display

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



Smooth operation

Iconified operation button

Quick operation is possible by guidance function and iconified operation button.



Smart CONTROLLER FD11

Electric power conservation

- Use of power conservation modes **reduces electric power consumption by 50%**
(Energy conservation timer function)
(External servo off signal function)
* Comparison of apparent power

Minimal maintenance

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

Space conservation

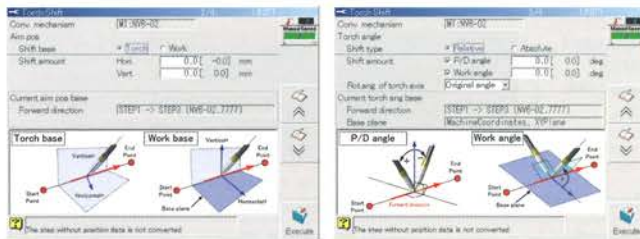
- Volume reduced by **20%**
(compared to a conventional model)
- **Increased space freed above**



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.

Smart welding

Improved movement performance

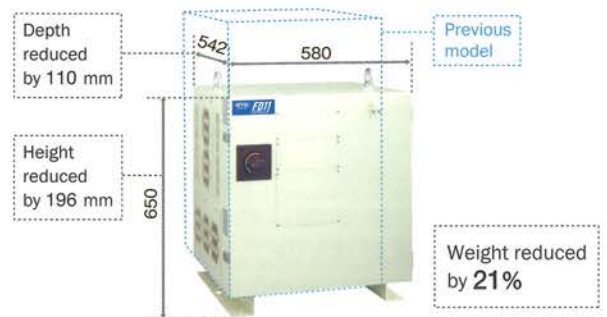
- By increasing the robot response speed to welding start signals, arc start failures are reduced and high-quality bead appearance is achieved.
- By greatly reducing residual vibrations, high-speed approaches are made possible.



Down-sized

Improved space utilization

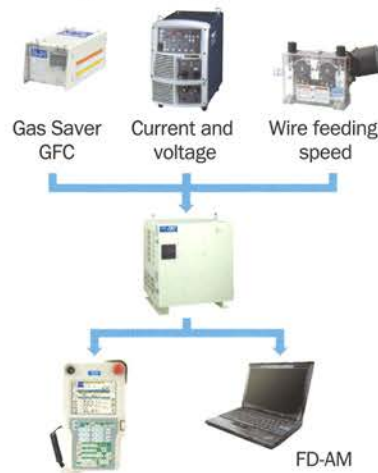
Without increasing the installation footprint, the height has been reduced.



Smart welding

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.

Optional equipment

Torches for Robots & Welding Peripherals

Torch for robot

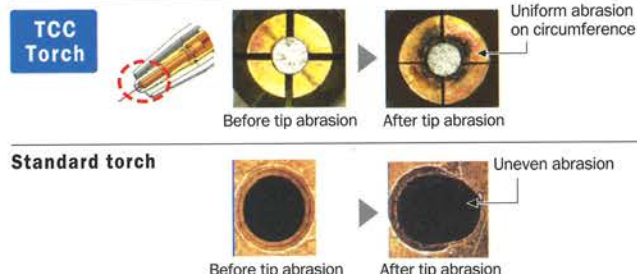
Achieving stable welding operation which enables prevention of welding interruption and reduction in costs of consumables
Forced pressurized power feeding torch (TCC torch)



Model	Maximum welding current (MAG welding)	Rated duty cycle (MAG welding)
RZ3501S/L/H	350 A (350 A)	80% (60%)

Deviation of wire position prevented

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



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 (MTXC-3541PS).

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

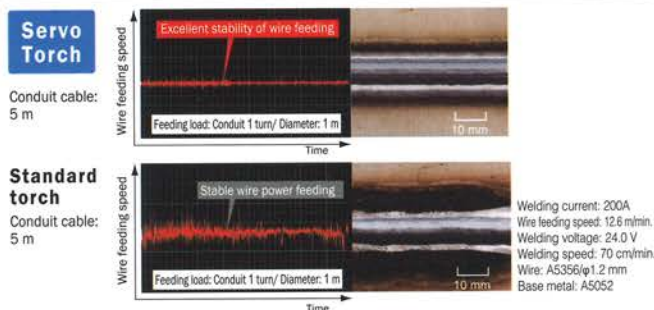
CO₂/MAG Welding Torch

Model	Maximum welding current (MAG welding)	Rated duty cycle (MAG welding)
MTXC-3541PS	350 A (250 A)	50% (50%)
MTXCW-5041PS	500 A (300 A)	70% (50%)

MIG Welding Torch

Model	Maximum welding current	Rated duty cycle
MTXCA-3041PS	300 A	50%
MTCAW-4041PS	400 A	70%

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

RS control realizes secure arc start 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

Torch



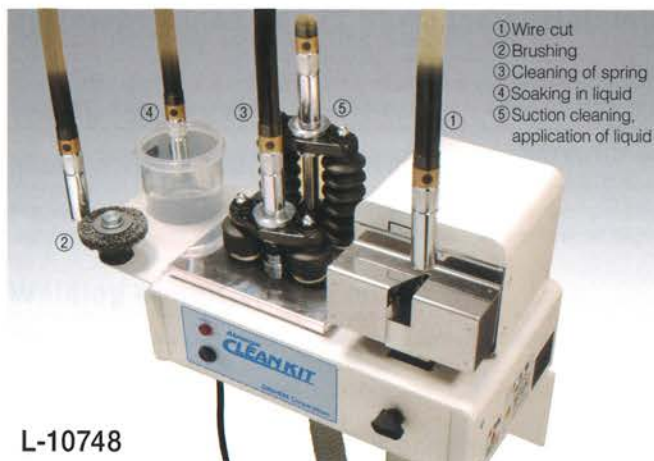
Model RT3500H is shown mounted with optional SSV Shock Sensor Unit.

Model	Maximum welding current (MAG welding)	Rated duty cycle (MAG welding)
RT3500	350 A (350 A)	80% (60%)
RT5000	500 A (350 A)	50% (70%)
RTW5000	500 A (400 A)	70% (60%)

Welding peripherals

For automatic cleaning of the torch and wire cutting

Clean kit



L-10748

Model	L-10748	K-2725	K-2726
Internal diameter of nozzle	Choice from among $\phi 13$, $\phi 16$, and $\phi 19$.	—	—
Power source	AC100V 50/60Hz		
Power consumption (W)	57	—	50
Air source (MPa)	0.49	Unnecessary	Unnecessary
Dimension (Total length×Total width×Total height) (mm)	438 × 195 × 233	498 × 188 × 227	132 × 190 × 143
Weight (kg)	11	9.7	4.5
Applicable wire diameter (mm)	$\phi 1.6$ or less		
Accessories	Guide metal fitting, Special-purpose metal fixture set, Discharge duct set	Guide metal fitting, Special-purpose metal fixture set	Special-purpose metal fixture set
Others	The spatter anti-deposition agent is optional.		
Functions	Dual nozzle cleaning	—	—
	Wire cut	—	—
	Brushing	—	—

* The clean kits L-10748 and K-2725 are not compatible with the forced pressurized power feeding torch (TCC torch).

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)



K-2725



K-2726

Dual cleaning function (only for L10748)

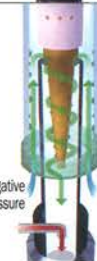
Unburdened by manual cleaning! Improved safety of operation!



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.

Welding peripherals

Reduces the sudden flow of gas and constantly controls the flow of shielding gas.

Gas Saver GFC

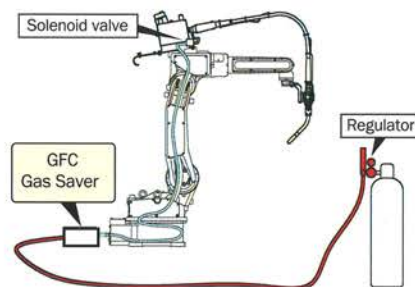


Features and mechanism of Gas Saver

- 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.

CURRENT	V. ADJ.	SPEED	W. CHAR.
150 A	0	80 cm	0
		15.0 L	
CUR	CURRENT	VOLTAGE	Gas
	150	18.0 V	15.0 L
Min/Max	150/150	18.0/18.0	15.0/15.0
FEED LOAD			
			20%
			20/20

- 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 $\pm 2\%$).
- 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

PC software

Offers offline 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

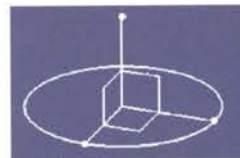
Intuitive operation of 3D model is possible.



Planar movement



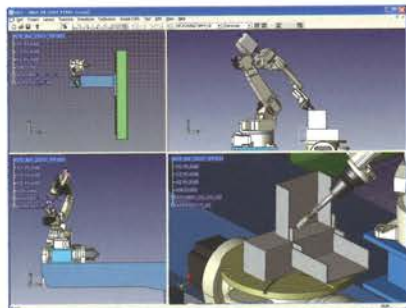
Parallel movement



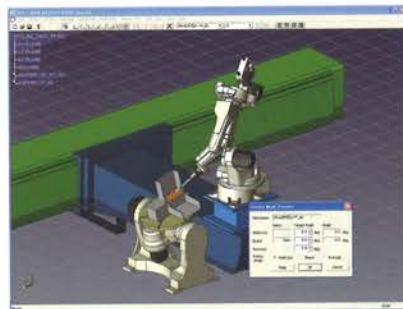
Rotating movement

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.



Multiviewer



Automatic generation of work position (optional)

Tact time can be predicted with accuracy.

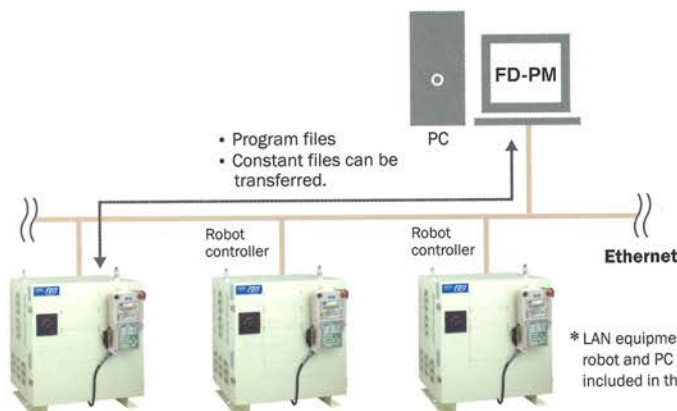
Robot control software ensures high tact simulation accuracy.

PC software

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.

PC software

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.

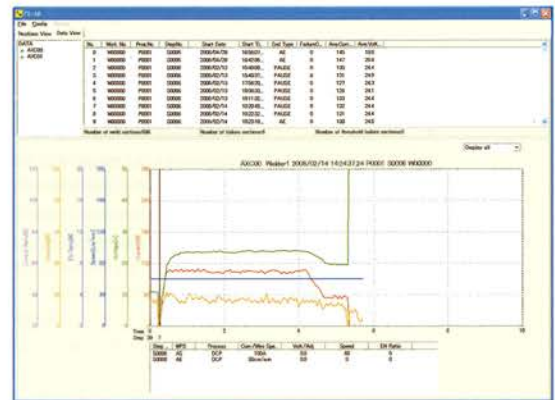
Welding condition can be saved.

The number of times of welding, number of occurrence of failures, task program number, welding time, and average current can be saved.

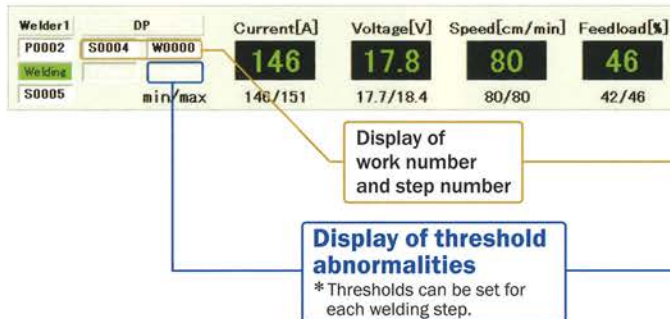
* The storable capacity depends on the capacity of hard disk of your PC.

Quality control for every workpiece

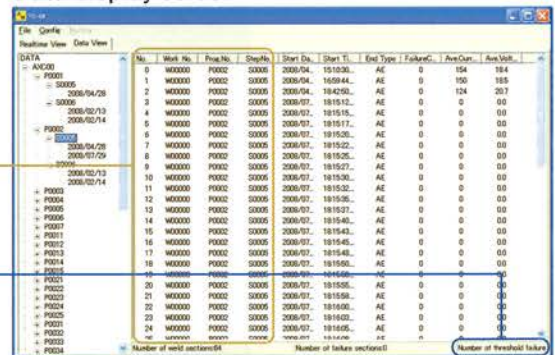
An alarm output or abnormal threshold can be identified for each workpiece by inputting the workpiece number in the robot controller. This monitor supports detection of failure of workpieces.



Real-time monitor screen



Data display screen



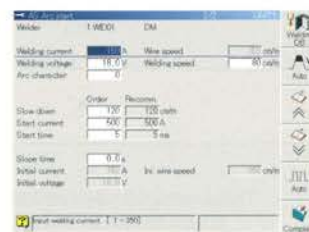
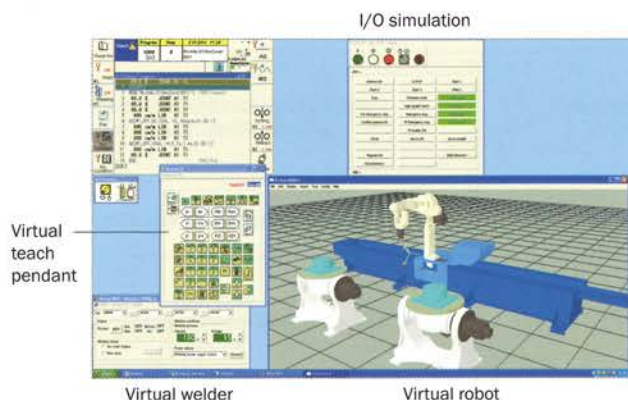
* LAN equipment connecting robot and PC is not included in this product.

PC software

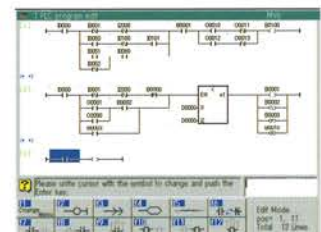
Best suited as a support tool after installation of robot

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.



Modification of welding condition



Editing of PLC program



Check of interface panel

* 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 360 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.



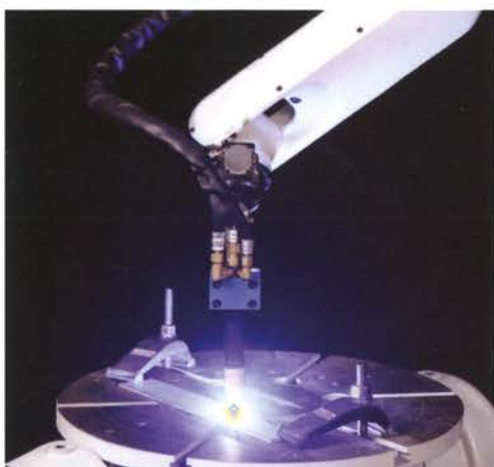
Workpiece position detection	○ (The maximum two-way displacement detection rate per site is about 5 seconds.)	×
Seam tracking	×	○
Recognition of groove shape	×	×
Combination with other sensors	This sensor can be used together with an arc sensor or TIG arc sensor.	Combination use of the touch sensor and laser sensor is possible.
Applicable workpieces	Plate thickness: 3.2 mm or more	Plate thickness: 3.2 mm or more
Accuracy	±1.0 mm (provided that the bend of wire does not change)	±1.0 mm (provided that arc and pool are stable)
Workpiece material	All the materials and surfaces to be energized	Iron system, stainless steel system

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.

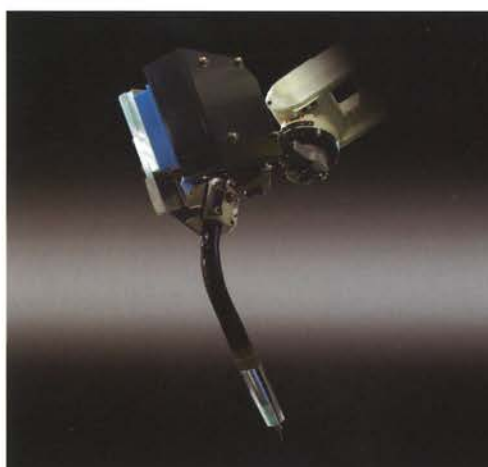


Laser start point detection sensor

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.



×	○ (The maximum two-way displacement detection rate per site is about 1.5 seconds)
○ (only vertical tracking)	×
×	○
Combination use of the touch sensor and laser sensor is possible.	This sensor can be used together with an arc sensor or TIG arc sensor.
(Plate thickness: 1.0 mm or more)	(Plate thickness: 1.0 mm or more)
±0.5 mm (when the electrode is not worn)	±0.5 mm (Search speed 100 cm/ or less. For stand-alone robot)
All the materials which can be welded	The surface shall not be glossy (nonmetal is permitted).

Positioner

Peripheral Equipment Jig Positioner

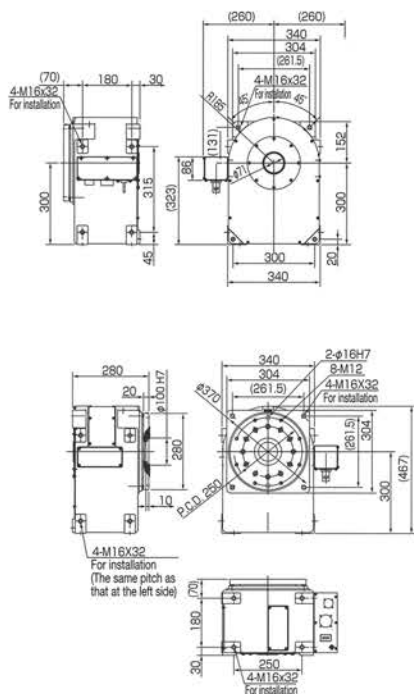
- 6 models of positioners available from 250 kg to 1,000 kg payload capacity.
- Operation of the positioner is totally controlled by the robot teaching pendant. Positioners can be operated independently or synchronized with the robot.
- High accuracy operation is made possible by the same AC servo motor and non-backlash reduction gear that is used for the robot.
- Synchronized motion when using with the OTC robot.

Positioner

Positioner Headstock 1PB Series

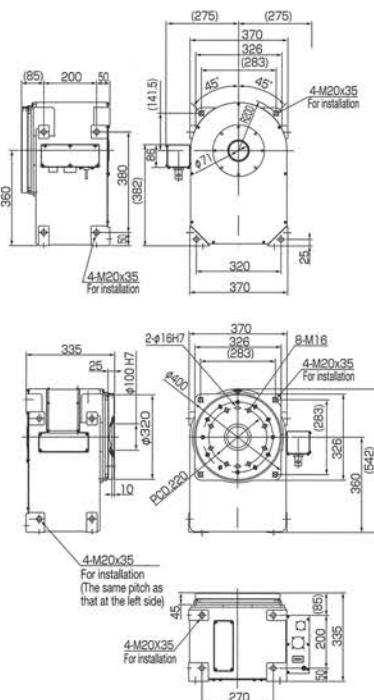
- Can be used to build varied jig systems with a large degree of positioning flexibility.
- A hole through the center of the rotary table, enabling cables and hoses to be routed through easily.

1PB250



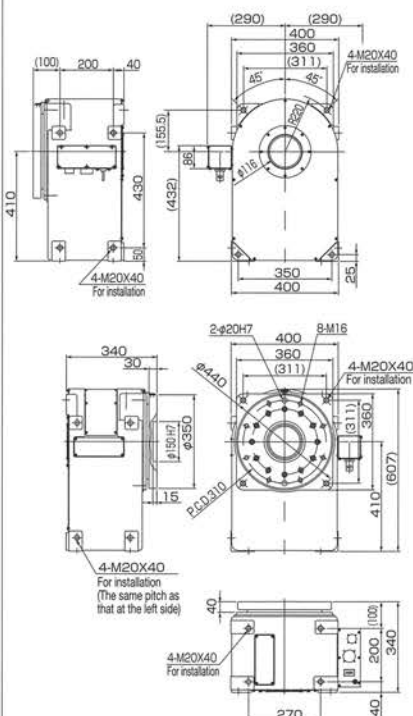
Mountable on both right and left sides of the connector box (factory mounted).

1PB500



Mountable on both right and left sides of the connector box (factory mounted).

1PB1000



Mountable on both right and left sides of the connector box (factory mounted).

Model Name	A2PB252-E	A2PB502-E	A2PB1002-E
Max. Payload Capacity	250 kg	500 kg	1000 kg
Rotating Speed	2.6 rad/s {150°/s}	2.1 rad/s {120°/s}	1.3 rad/s {72°/s}
Allowable Rotating Torque	206 N·m	490 N·m	1078 N·m
Position Repeatability	±0.1 mm (Position at R300 mm)	±0.1 mm (Position at R300 mm)	±0.1 mm (Position at R300 mm)
Stop Position	Random	Random	Random
Mass (Weight)	110 kg	170 kg	220 kg

Positioner

2-Axes Double Support Positioner 2PF Series

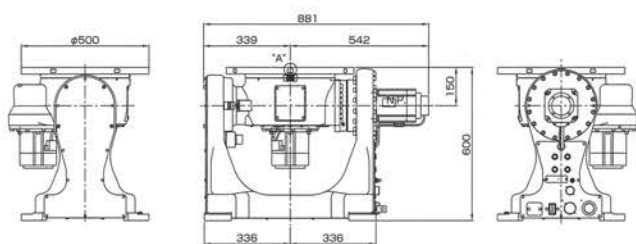
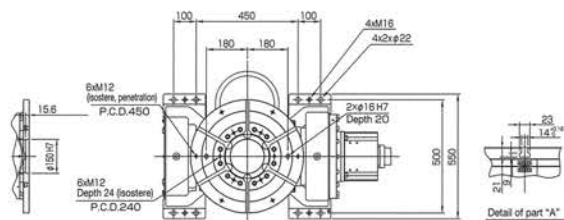
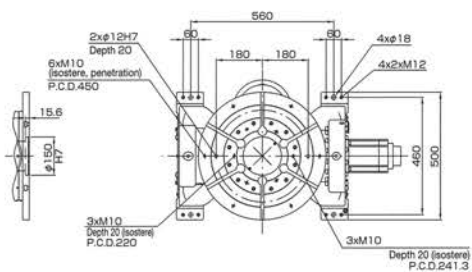
- High-speed motion increases production efficiency!

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.

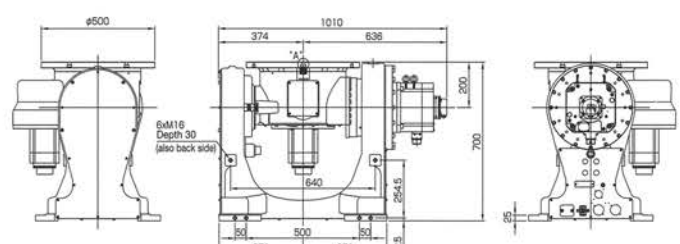
2PF300/500/1000



2PF1000



2PF300/500



2PF1000

Model Name	A2PF301-ENN	A2PF501-ENN	A2PF1001-ENN
Max. Payload Capacity	300 kg	500 kg	1000 kg
Rotating Speed	3.1 rad/s {180°/s}	2.8 rad/s {162°/s}	2.9 rad/s {166°/s}
Tilting Speed	2.2 rad/s {125°/s}	1.5 rad/s {84°/s}	1.4 rad/s {82°/s}
Rotating Torque	294 N·m	392 N·m	882 N·m
Tilting Torque	882 N·m	1347 N·m	3704 N·m
Position Repeatability	±0.08 mm (Position at R250 mm)	±0.08 mm (Position at R250 mm)	±0.08 mm (Position at R250 mm)
Stop Position	Random	Random	Random
Mass (Weight)	260 kg	260 kg	470 kg

Slider

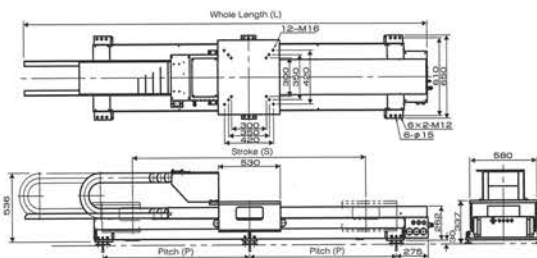
Peripheral Equipment Jig Slider

- 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.

Slider

Linear Sliders (Light Duty) Model 1SB

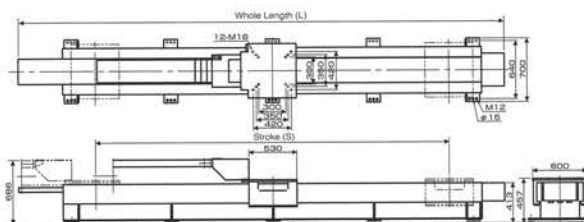
- A maximum of 330 kg can be loaded.
- Dust-proof structure prevents spatter, oil and dust from entering.



Slider

Linear Sliders (Standard Duty) Model 1SR

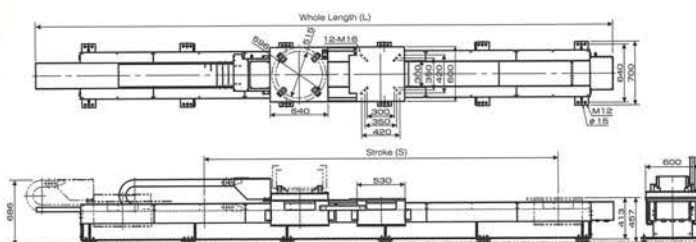
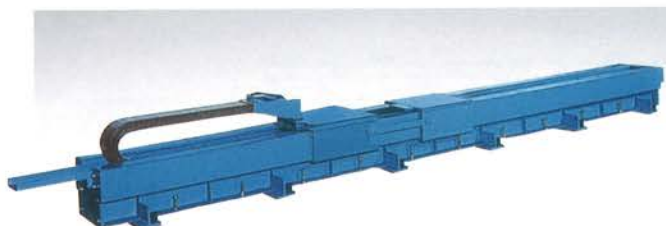
- Standard Duty with a maximum loading weight of 330 kg
- Dust-proof structure prevents spatter, oil and dust from entering.



Slider

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.



Model 1SB

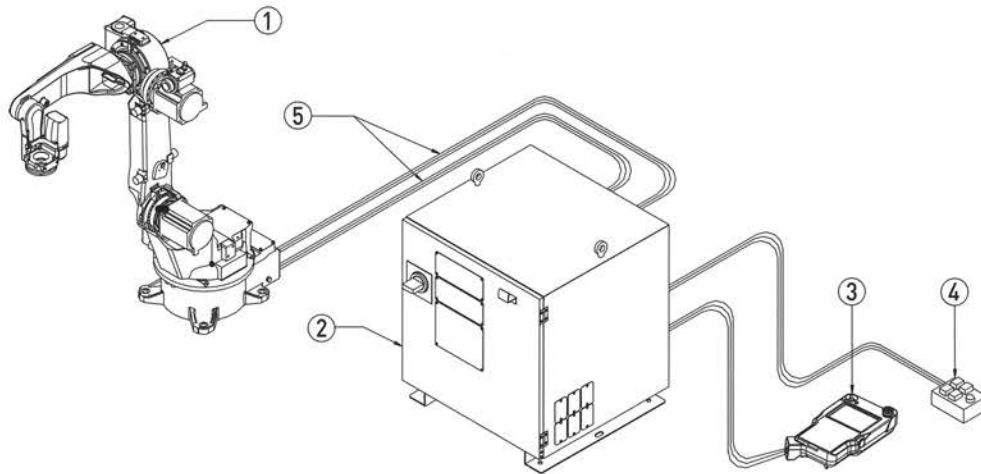
Model 1SR

Model 1SR-P

Model Name	A2SB102-E, A2SB202-E		A2SR292-E, A2SR392-E, A2SR492-E, A2SR592-E, A2SR692-E						A2SR19P2-E, A2SR29P2-E, A2SR39P2-E, A2SR49P2-E, A2SR59P2-E				
Stroke Length	1 m, 2 m		2.9 m, 3.9 m, 4.9 m, 5.9 m, 6.9 m						1.9 m, 2.9 m, 3.9 m, 4.9 m, 5.9 m				
Max. Moving Speed	0.3 m/s		0.295 m/s						0.295 m/s				
Max. Mounting Capacity	330 kg		330 kg						660 kg (330 kg for each table)				
Position Repeatability	±0.1 mm		±0.1 mm						±0.1 mm				
	A2SB102-E	A2SB202-E	A2SR292-E	A2SR392-E	A2SR492-E	A2SR592-E	A2SR692-E	A2SR19P2-E	A2SR29P2-E	A2SR39P2-E	A2SR49P2-E	A2SR59P2-E	
Stroke S (mm)	1000	2000	2900	3900	4900	5900	6900	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	

Configuration example

FD-B4 Configuration Example



Number and Part Name	Model	Specification
① Manipulator	NB4 (Model Type: NB42-N C F N)	N : Standard C : Chinese E : English F : Floor Type C : Ceiling Mounted W : Wall Mounted N : Standard
② Controller	FD11 (Model Type: FD11-J V O***)	J : Standard V : NV6, NB4 (Combination Manipulator Notation) O : No External Axis P : External 1 Axis 2 : External 2 Axes 4 : External 1 Axis × 2 A : Large Capacity External 1 Axis (Standard Case External Axis Spec.) *** Additional Case Spec.
③ Teach Pendant	FDTSDSJN-1L**	** : 08 8 m Spec. (Standard) : 15 15 m Spec.
④ Operation Box	FDOP-00**	O : Standard ** : 05 5 m Spec. (Standard) : 10 10 m Spec. : 15 15 m Spec.
⑤ Control Cable 1, 3 (Wire Harness)	FDRB-10**	** : 05 5 m Spec. (Standard) : 10 10 m Spec. : 15 15 m Spec.

FD11 Controller Specifications

Dimensions	580 mm (W) × 542 mm (D) × 650 mm (H)
Mass	Approx. 62 kg
Ambient Temperature Range	0 to 45°C
Ambient Relative Humidity Range	20 to 80%RH (Non-condensing)
Power Supply	3-phase 200/220 VAC+10%, -15%, 50/60 Hz FD-H5 1.0 kVA FD-B4/V6 1.5 kVA FD-B4L/V6L 2.4 kVA FD-V166/210 7.5 kVA
General Purpose Physical 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

Dimensions	175 mm (W) × 326 mm (D) × 81 mm (H)
Mass	Approx. 0.96 kg
Operation Device	Axis keys, TP selector switch, jog dial, enable switch, operation ready ON key, emergency stop button, USB memory slot (1 slot)
Display	5.7 inches/640 × 480 dots/65536 colors/ touch panel/LED backlight
IEC Protection Class	IP65
Cable Length	Standard: 8 m, optional: 15 m

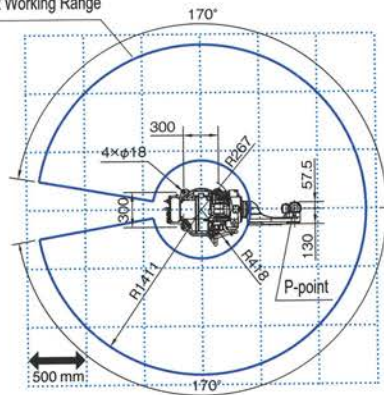
Range of motion

Manipulator Working Range/Specifications

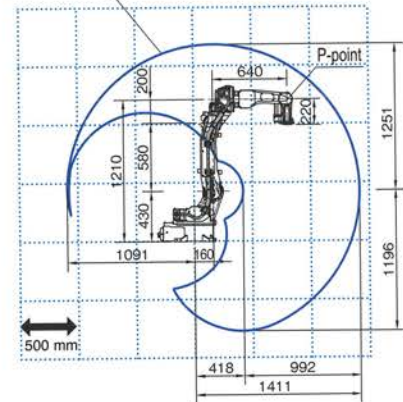
Standard FD-B4



P-point Working Range



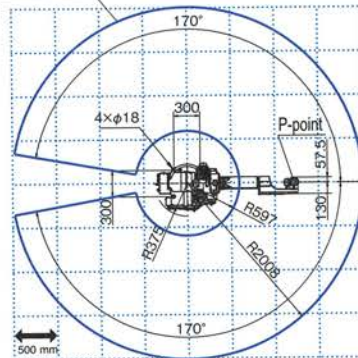
P-point Working Range



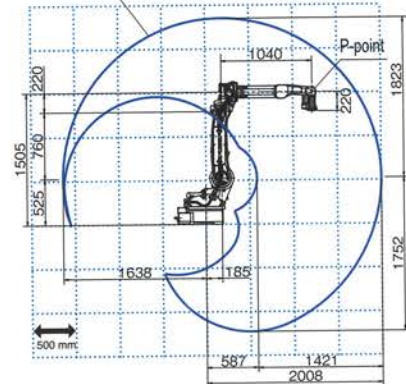
Long Reach FD-B4L



P-point Working Range



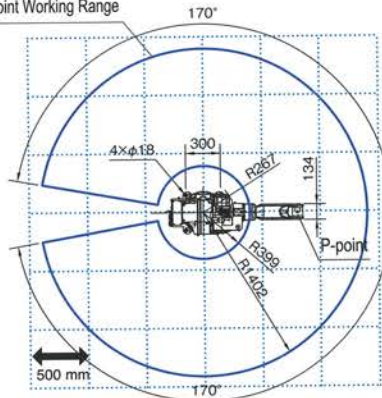
P-point Working Range



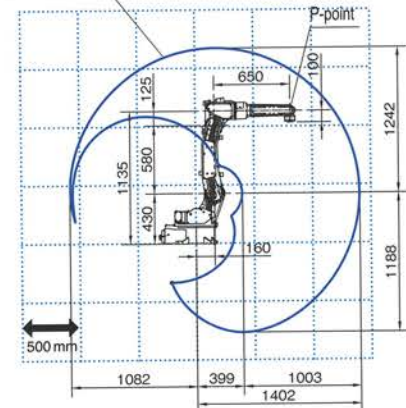
Standard FD-V6



P-point Working Range



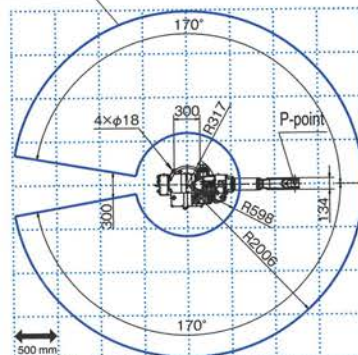
P-point Working Range



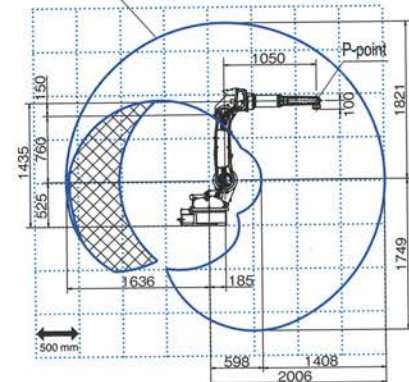
Long Reach FD-V6L



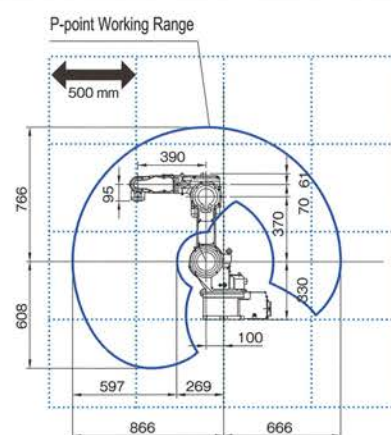
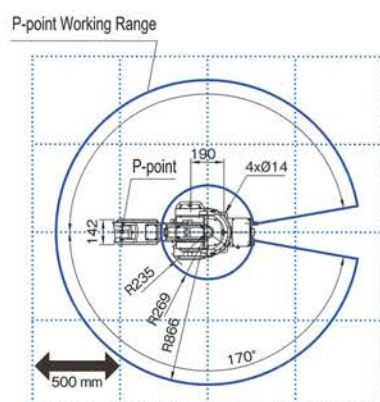
P-point Working Range



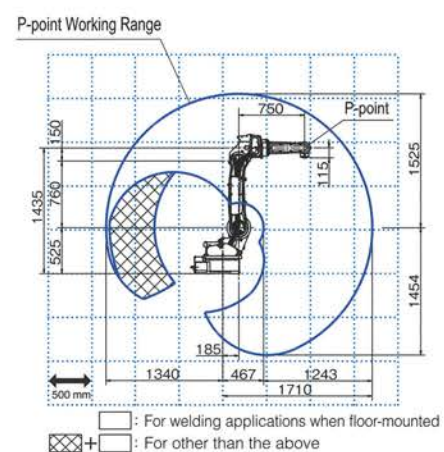
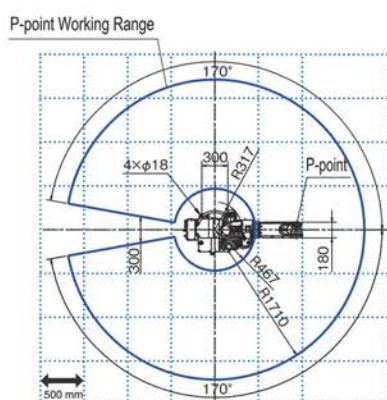
P-point Working Range



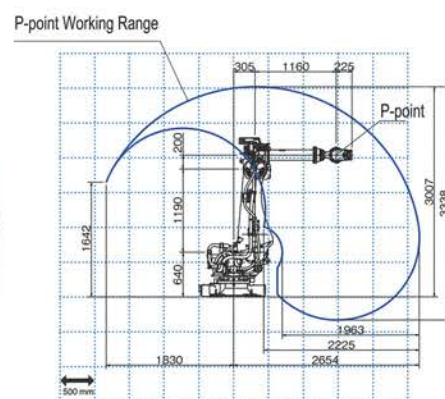
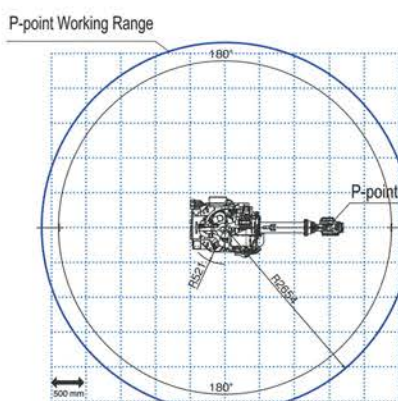
□ : For welding applications when floor-mounted
 ⊞ : For other than the above

Compact **FD-H5**

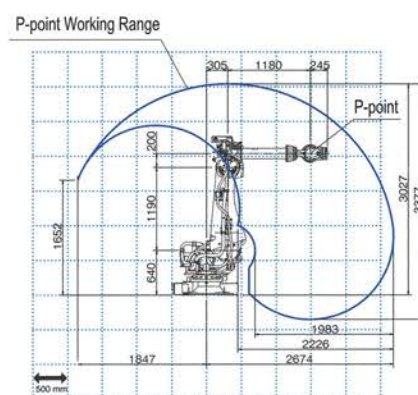
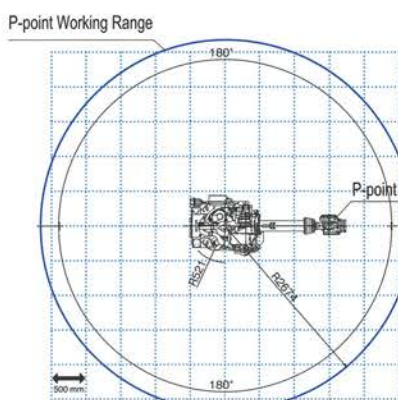
Standard **FD-V20**



Standard **FD-V166**



Standard **FD-V210**



Specifications

Manipulator Specifications

	FD-B4	FD-B4L	FD-V6	FD-V6L
Model	NB4	NB4L	NV6	NV6L
Number of Axes	6	◀	◀	◀
Maximum Capacity	4 kg	4 kg	6 kg	6 kg
Positional Repeatability	±0.08 mm (Note 1)	±0.08 mm (Note 1)	±0.08 mm (Note 1)	±0.08 mm (Note 1)
Driving Capacity	2550 W	4650 W	2600 W	5000 W
Working Range	J1 (Rotation)	±170° (±50°) (Note 2)	±170° (±50°) (Note 2)	±170° (±50°) (Note 2)
	J2 (Lower arm)	□155° to +90°	□155° to +100° (Note 3)	□155° to +100° (Note 3)
	J3 (Upper arm)	□170° to +180°	□170° to +190°	□170° to +260° (Note 4)
	J4 (Swing)	±155°	±155°	±180°
	J5 (Bending)	□45° to +225° (Note 5)	□45° to +225° (Note 5)	□50° to +230°
	J6 (Twist)	±205° (Note 5)	±205° (Note 5)	±360°
Maximum Speed	J1 (Rotation)	3.66 rad/s {210°/s} (3.32 rad/s {190°/s}) (Note 2)	3.40 rad/s {195°/s} (3.05 rad/s {175°/s}) (Note 2)	3.40 rad/s {195°/s} (3.05 rad/s {175°/s}) (Note 2)
	J2 (Lower arm)	3.66 rad/s {210°/s}	3.49 rad/s {200°/s}	3.49 rad/s {200°/s}
	J3 (Upper arm)	3.66 rad/s {210°/s}	3.49 rad/s {200°/s}	3.49 rad/s {200°/s}
	J4 (Swing)	7.33 rad/s {420°/s}	7.33 rad/s {420°/s}	7.33 rad/s {420°/s}
	J5 (Bending)	7.33 rad/s {420°/s}	7.33 rad/s {420°/s}	7.33 rad/s {420°/s}
	J6 (Twist)	10.5 rad/s {600°/s}	10.5 rad/s {600°/s}	10.82 rad/s {620°/s}
Wrist Allowable Load	J4 (Swing)	10.1 N·m	10.1 N·m	11.8 N·m
	J5 (Bending)	10.1 N·m	10.1 N·m	9.8 N·m
	J6 (Twist)	2.94 N·m	2.94 N·m	5.9 N·m
	J4 (Swing)	0.38 kg·m ²	0.38 kg·m ²	0.30 kg·m ²
	J5 (Bending)	0.38 kg·m ²	0.38 kg·m ²	0.25 kg·m ²
	J6 (Twist)	0.03 kg·m ²	0.03 kg·m ²	0.06 kg·m ²
Arm Cross-sectional Area	2.94 m ² × 340°	6.37 m ² × 340°	3.14 m ² × 340°	7.48 m ² × 340°
Environmental Conditions	0 to 45°C, 20 to 80%RH (No Condensation)	◀	◀	◀
Mass (weight)	154 kg	277 kg	144 kg	273 kg
Maximum Load of Upper Arm	10 kg (Note 6)	20 kg (Note 6)	10 kg (Note 6)	20 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.

FD-H5	FD-V20	FD-V166	FD-V210
NH5	NV20	FD-V166	FD-V210
◀	◀	◀	◀
5 kg	20 kg	166 kg	210 kg
±0.05 mm (Note 1)	±0.07 mm (Note 1)	±0.1 mm (Note 1)	±0.15 mm (Note 1)
1440 W	5600 W	18 kW	◀
±170°	±170° (±50°) (Note 2)	±180°	◀
□125° to +90°	□155° to +100° (Note 3)	□80° to +60°	◀
□140° to +245°	□170° to +260° (Note 4)	□146.5° to +150°	◀
±190°	±180°	±360°	◀
□30° to +210°	□50° to +230°	±135°	±130°
±360°	±360°	±360°	◀
3.49 rad/s {200°/s} (2.79 rad/s {160°/s}) (Note 2)	3.40 rad/s {195°/s} (3.05 rad/s {175°/s}) (Note 2)	2.18 rad/s {125°/s}	2.01 rad/s {115°/s}
3.49 rad/s {200°/s}	3.32 rad/s {190°/s}	2.01 rad/s {115°/s}	1.83 rad/s {105°/s}
4.54 rad/s {260°/s}	3.14 rad/s {180°/s}	2.11 rad/s {121°/s}	1.97 rad/s {113°/s}
6.63 rad/s {380°/s}	6.98 rad/s {400°/s}	3.14 rad/s {180°/s}	2.44 rad/s {140°/s}
6.63 rad/s {380°/s}	6.98 rad/s {400°/s}	3.02 rad/s {173°/s}	2.32 rad/s {133°/s}
8.95 rad/s {510°/s}	10.5 rad/s {600°/s}	4.54 rad/s {260°/s}	3.49 rad/s {200°/s}
11.9 N·m	43.7 N·m	951 N·m	1,337 N·m
11.9 N·m	43.7 N·m	951 N·m	1,337 N·m
5.21 N·m	19.6 N·m	490 N·m	720 N·m
0.303 kg·m ²	1.09 kg·m ²	88.9 kg·m ²	141.1 kg·m ²
0.303 kg·m ²	1.09 kg·m ²	88.9 kg·m ²	141.1 kg·m ²
0.061 kg·m ²	0.24 kg·m ²	45.0 kg·m ²	79.0 kg·m ²
1.22 m ² × 340°	5.27 m ² × 340°	6.58 m ² × 360°	6.67 m ² × 360°
◀	◀	◀	◀
58 kg	278 kg	1010 kg	1040 kg
1 kg	20 kg (Note 6)	45 kg (90 kg max.) (Note 7)	◀
Floor-/Ceiling-/Wall-mounted	◀	Floor-mounted	◀
White (Munsell notation 10GY 9/1)	◀	◀	◀

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