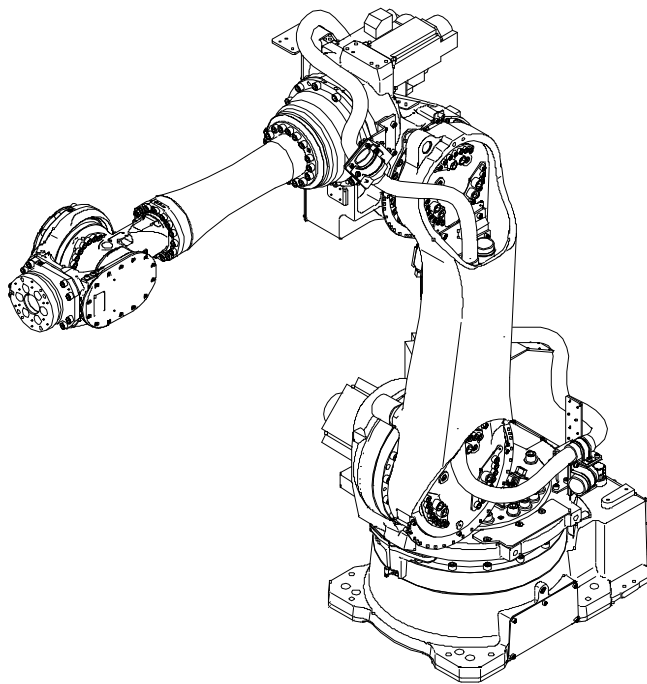


NACHI

Standard specifications
SRA100B-01-FD11/FD18

9th edition



NACHI-FUJIKOSHI CORP.

2102, SSRAEN-050-009,001

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1. Outline

“NACHI ROBOT” has used mechatronic techniques, cultivated throughout the last few decades, to supply robots suited for industries utilizing welding and the material handling techniques.

“SRA100B” is a robot of simple highly rigid structure which is optimal for spot welding, material handling and other, applications.

Standard type	
Mounting condition	Maximum payload 100 kg
Floor	SRA100B-01

1. Due to the compact body, high- density installation is possible.
2. Because the height of the robot is small, a multi-layer installation with other robots is possible.
3. This robot features a powerful wrist that can support a large tool.
4. Due to a wide operation area, it is possible to use for various production process.
5. This robot features the largest wrist bend angle in its class due to the slim compact wrist. The reduction of restriction due to wrist operation opens the robot to more diverse applications.
6. The required installation area has been reduced by routing water, air and cables through the swivel base for spot application.
7. Spot welding cables and tubes are installed inside the swiveling base to save space.

2. Basic specifications

Item	Specifications	
Robot type	SRA100B-01	
Structure	Articulated	
Degree of Freedom	6	
Drive system	AC servo motor	
Maximum Motion range	Axis 1	± 3.14 rad ($\pm 180^\circ$)
	Axis 2	-2.09 ~ +1.05 rad (-120 ~ +60°)
	Axis 3	-2.62 ~ +3.14 rad (-150 ~ +180°)
	Axis 4	± 6.28 rad ($\pm 360^\circ$)
	Axis 5	± 2.36 rad ($\pm 135^\circ$)
	Axis 6	± 6.28 rad ($\pm 360^\circ$)
Maximum Velocity	Axis 1	2.37 rad /s (136°/s)
	Axis 2	1.92 rad /s (110°/s)
	Axis 3	2.27 rad /s (130°/s)
	Axis 4	4.19 rad /s (240°/s)
	Axis 5	4.07 rad /s (233°/s)
	Axis 6	6.13 rad /s (351°/s)
Maximum payload	Wrist	100 kg
	Forearm *1	25 kg (45 kg at maximum)
Maximum static load torque	Axis 4	580 N·m
	Axis 5	580 N·m
	Axis 6	290 N·m
Maximum moment of inertia *2	Axis 4	45 kg·m ²
	Axis 5	45 kg·m ²
	Axis 6	22.7 kg·m ²
Position repeatability *3	± 0.06 mm	
Mounting Condition	Floor	
Ambient conditions	Temperature: 0 to 45 °C *4 Humidity: 20 to 85%RH (No dew, nor frost allowed) Vibration to the installation face: Not more than 0.5G (4.9 m/s ²)	
Protection class	Wrist ; IP67 equivalent, Body ; IP54 equivalent	
Robot weight	690 kg	

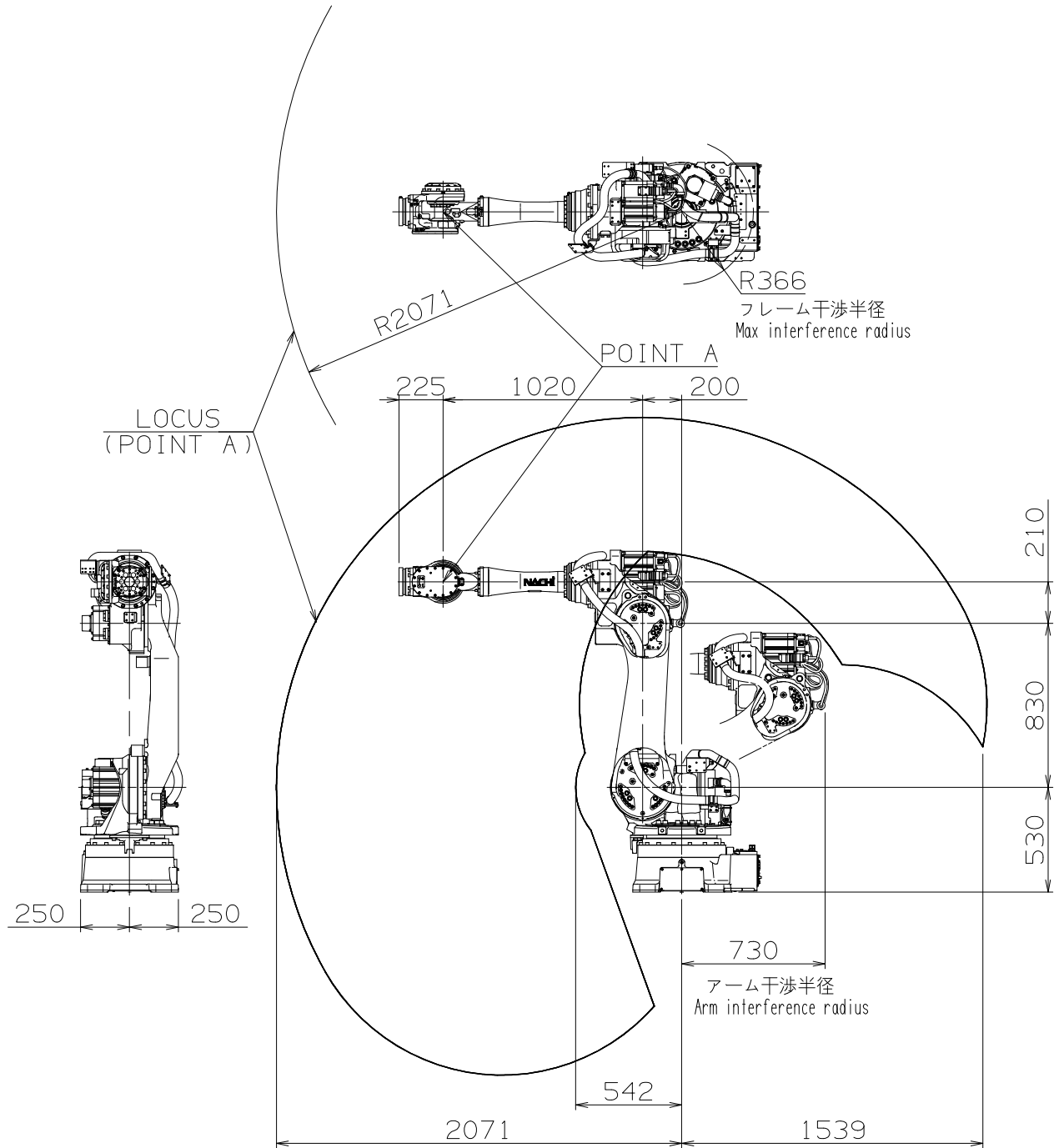
1[rad] = 180/π[°], 1[N·m] = 1/9.8[kgf·m]

- Axis 1 - Axis 6 are displayed as J1-J6 each on the controller screen.
- Specifications are subject to change without prior notice for technical changes.
- Explosion-proof version is not available.

*1: This value changes due to the placement and load conditions of a wrist. *2: Maximum moment of inertia of a wrist changes due to the load. *3: JIS B 8432 conformance. *4: Using at 1000m or lower sea level. Ambient temperature has limitations when allowable altitude is exceeded.

3. Robot dimensions and Motion range


【SRA100B-01】



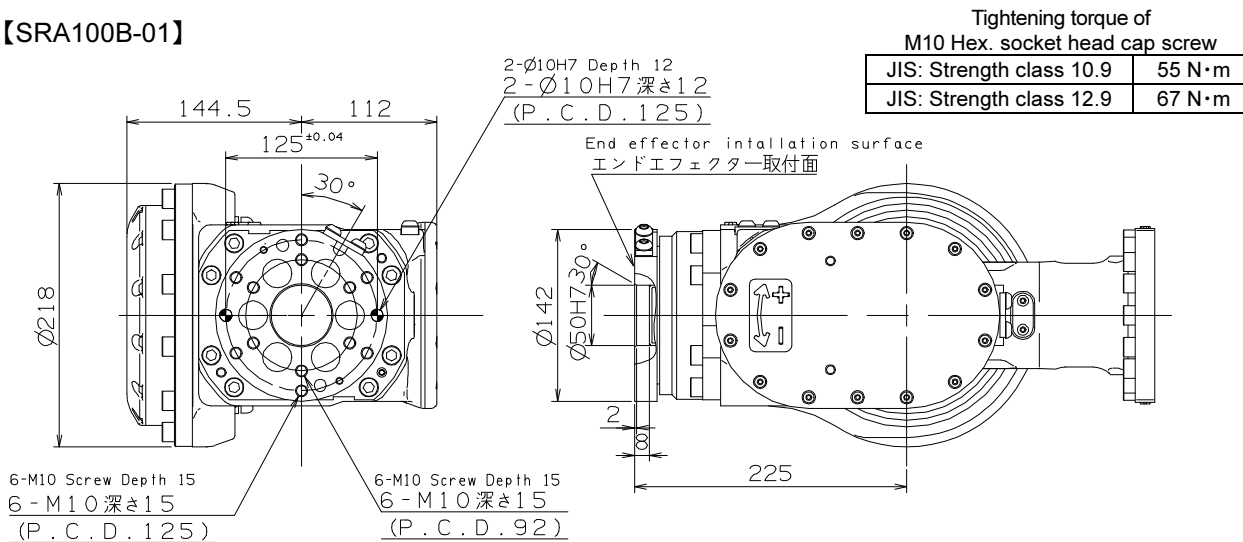
4. Detail of load mounting face

■ Wrist

For the end effector fixing bolts, use the mounting P.C.D. shown in the following figures.
Another P.C.D. is prepared as option. Consult with each NACHI-FUJIKOSHI office for the details.


 CAUTION	Be sure to screw the M10 tool fixing bolts in the wrist not deeper than the screw depth in the mounting face. Screwing the bolts deeper than the screw depth may damage the wrist.
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【SRA100B-01】

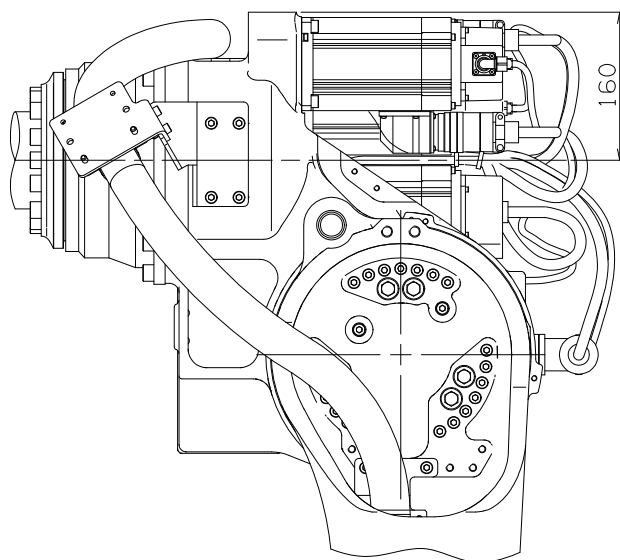
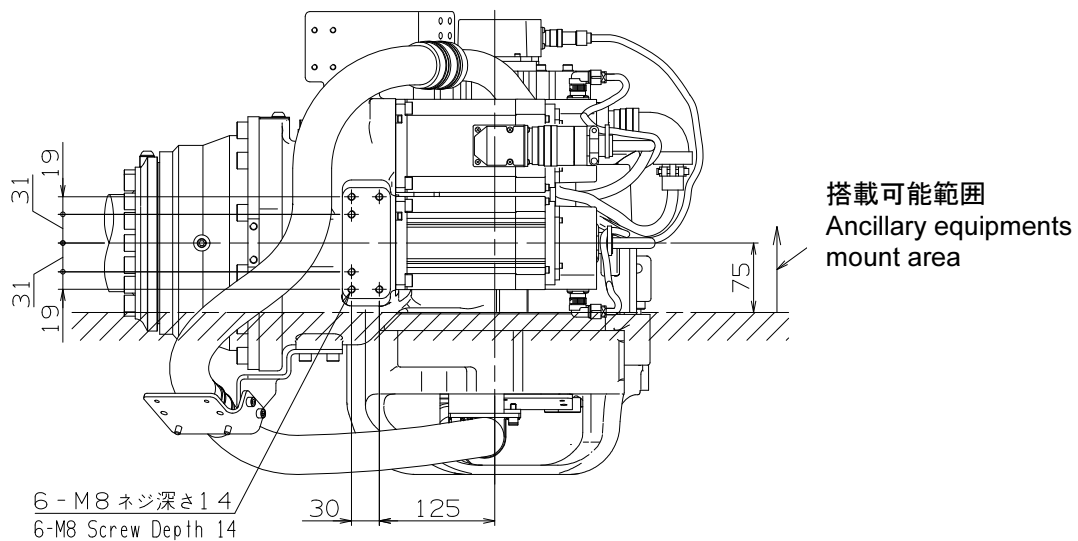


■ Upper part of forearm

Ancillary equipments can be mounted to the upper part of robot forearm.

 CAUTION	<p>When ancillary equipments are mounted on the upper part of forearm, please mount them on the “ancillary equipments mount area” indicated in the following figure. If they are mounted on the place outside of this area, they interfere with lower arm (joint 2 arm) when joint 3 moves to the rear working envelope. Consequently, ancillary equipments may be broken.</p>
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【SRA100B-01】





5. Installation procedure

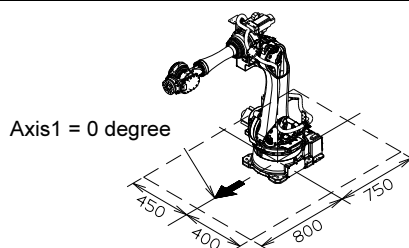
The installation location and the installation procedure of the robot are critical factors to maintain robot functions. The ambient conditions of installation location not only have influence on the life of mechanical sections of the robot, but also get involved in safety issues. Consequently, strictly observe the environmental conditions shown below. Furthermore, utmost care should be exerted for the installation procedure and the foundation for the robot in order to maintain the robot performance. Strictly observe the installation procedure for the robot provided below.

■ Safety measures against entry in the robot operating area







 WARNING	While the robot is in operation, workers are in danger of coming in contact with the robot. To avoid that, install a guard fence so as to keep the worker away from the robot. Not doing so will cause the workers or other persons to accidentally enter the operating area, thus resulting in accidents.
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■ Safety measures for the robot and peripheral equipment locations

 WARNING	Do not install the operation and the adjustment part within the robot operating area. Install the robot control panel, interlock panel, and all the other operation panels where it's safe, so that they can be operated outside of the guard fence . In case those operation panels are installed near the robot, workers can get caught in the robot, when the robot operation fails.
 IMPORTANT	When installing this robot, open space written in figure is necessary for maintenance work such as motor replacement, balancer replacement and other work.





■ Safety measures for installation work

 WARNING	To install the robot, it is important to install the robot so that no workers will get pinched or hurt by the robot or a device around them. The robot must not operate in the maximum operating range with a tool equipped on, and make sure not to touch any peripheral equipment.
 WARNING	Be sure to install the robot according to the specified procedure. Otherwise possibilities occur that robot's base may move or robot may fall over while in operation.
 WARNING	You must fully understand the connection procedure to make proper wire connections between the robot and the controller or the robot and the peripheral equipment. Not following the proper procedure will cause the malfunction of the robot.
 WARNING	Be sure to establish a proper grounding for the robot. If the equipment makes substantial noises such as a welder, conduct the specified grounding construction for the equipment.
 WARNING	Please pay extra attention not to damage wirings during transportation or installation of the robot. Furthermore, after installing the robot, apply protective guards to wirings so that it won't be damaged by workers or other persons, or forklift trucks or any other.
 WARNING	Installation structures (robot raiser, etc.) may cause problems such as vibration and servo tracking error. If such problem occurs, please promptly improve the installation structure. If installation structures are kept using as they are, reliability and lifetime of not only the robot but also the installation structures may be damaged, due to the vibration and sudden braking of robot.

■ Installation location and ambient conditions

Conditions (temperature, humidity, height and vibration) are written in “2. Basic Specifications”. Further ambient conditions listed below must be observed.

- (1) Location with the drainage structure so that swivel base is not flooded, when the liquid such as water or cutting fluid is splashed on the robot body
- (2) Location with no flammable or corrosive fluid or gas.
- (3) Type D grounding (the grounding resistance is 100Ω or less) is necessary.

 IMPORTANT	Our company's robot, controller and related option equipment are designed for general industrial use. Unless otherwise specified in the specifications or manuals, operations in special conditions and environments such as outdoor, X-ray environment, radiation environment, nuclear power control, aerospace equipment, public transportation, medical equipment, etc. are not assumed. Our company and its subsidiaries are not liable for any accidents, failures, etc., that may occur if the robot is used in such an environment without asking our company to do so.
 IMPORTANT	Using mounting condition that does not comply with specifications may cause the robot system to malfunction or fail prematurely. In that case, robot will be out of warranty. Please understand it in advance.

■ Installation procedure

While robot moves, large reaction force is applied to the swiveling base from all directions. Consequently, the robot should be installed in such a manner that the foundation endures not only the static loads but also the reaction force caused by robot movement.

Repair uneven spots, cracks, and others on the floor, and then install the robot by following to the table below. If thickness of floor concrete is less than needed level, an independent foundation should be constructed. Inspect the foundation prior to the robot installation, and then construct the foundation, if necessary.

Robot Model	SRA100B-01
Thickness of floor concrete	Not less than 150 mm
Installation parts *1	4 bolts of M20 (JIS: Strength class 12.9) not less than 65mm 4 plain washers of not less than 4.5 mm in thickness and HRC35 in hardness
Tightening torque *2	560 ± 30 N·m
Allowable repeated tensile *3	Appx. 30,000 N




*1 : Installation parts are not accessory of robot.

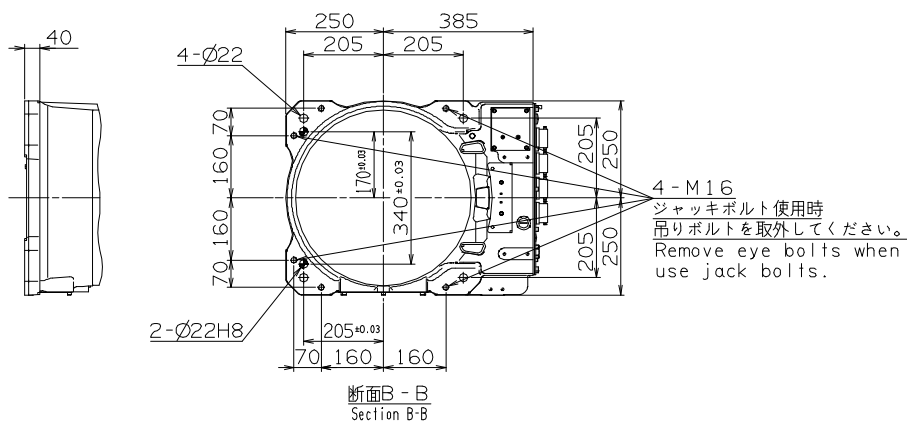
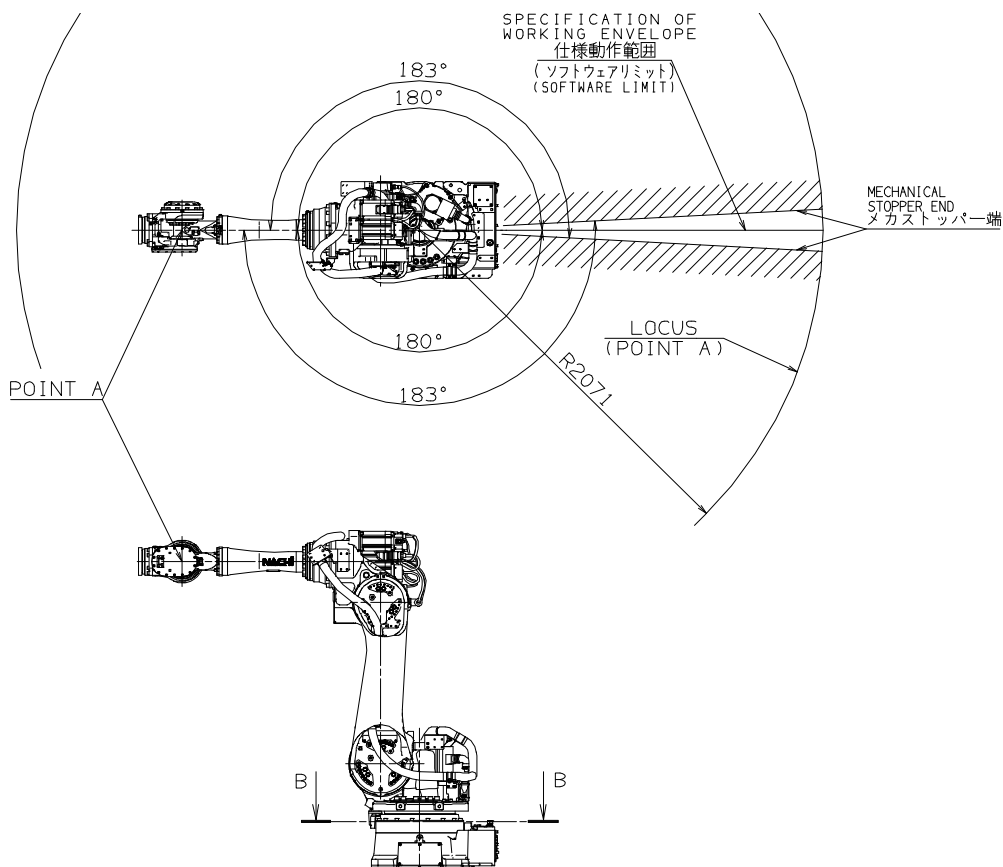
*2 : Apply a coating of lubricating oil to the threaded parts of bolts, and then tighten bolts by using torque wrench to the specified tightening torque.

*3 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ Installation space

To install the robot, lock the swiveling base of the robot.

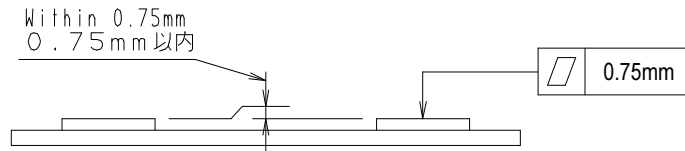
 CAUTION	<p>The mechanical stopper end is located in a position exceeding the specified working envelope (software limit) of axis 1 by 3°. To install the safety fence, with consideration given to the wrist configuration and the shape of end effector.</p>
 WARNING	<p>On axes 1, 2 and 3, the robot working envelope can be regulated for safety (optional function). Since optional parts should be installed to enable this function, do not independently move the standard parts (e.g. mechanical stopper).</p>
 WARNING	<p>If mechanical stopper collides and robot stops, it's possible that some parts are already damaged, for example, mechanical stopper is transformed or fixing bolts are broken. In this case, sufficient intensity and function can not be kept. Mechanical stopper and reduction gear of collided joint are needed to be replaced to the new one.</p>



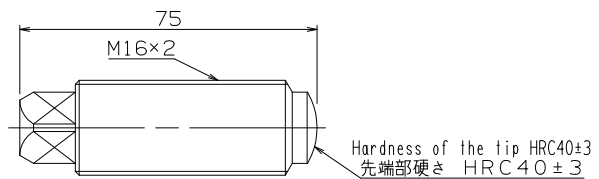
■ Accuracy of installation surface

When installing robot, strictly observe precautions listed below to cause no deformation in the swivel base.

- (1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 0.75 mm.
- (2) Make the deviation in height between the 4 places of each base plate installation surface and the robot installation surface fall in the range of 0.75 mm (± 0.375 mm).



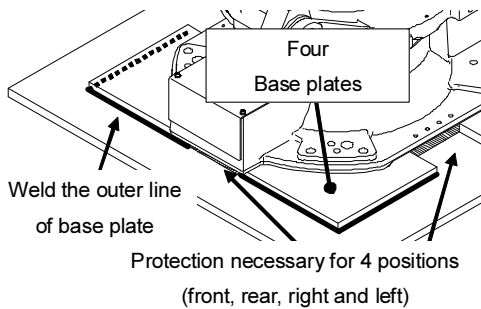
- (3) If the two precautions above cannot be observed, use jack bolts to bring the four places into even contact with the installation surface.



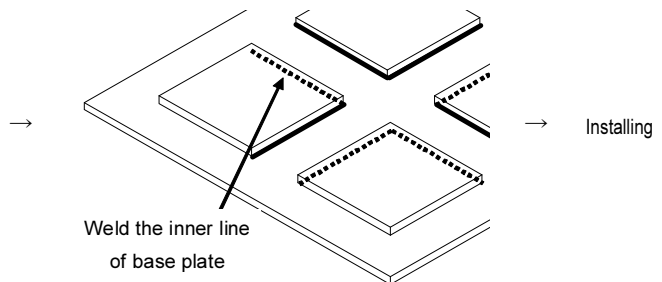
■ Welding of base plate

Protect the space (4 places of the front, back, left and right) on robot bottom and installed side by the cover etc. as follows when you weld with the base plate installed in the robot body by the welding spatter and the spark, etc. so that wiring in the robot should not receive damage. After welding the outer line, once remove the robot and weld the inner line.

Temporary install the robot, and weld the outer line of base plate.

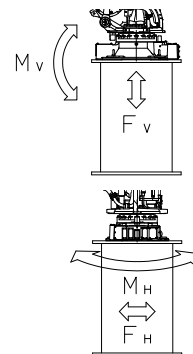


Once remove the robot and weld the inner line.





■ Maximum robot generative force

Robot model	Max. vertical generative force F_V	Max. horizontal generative force F_H	Max. vertical generative moment M_V	Max. horizontal generative moment M_H
SRA100B-01	29,200 N	21,600 N	46,500 N·m	40,200 N·m



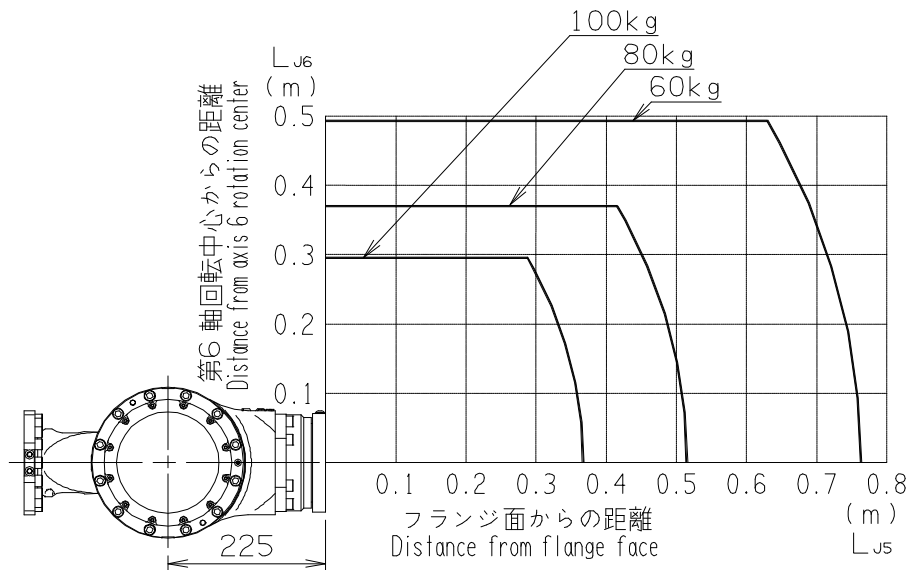
6. Allowable wrist load

 CAUTION	<p>The wrist load is regulated by “Maximum payload”, “Maximum static load torque”, and “Maximum moment of inertia”. If wrist load exceeds beyond these allowable values, WE CANNOT GUARANTEE THE FUNCTION OF THE ROBOT.</p> <p>Please refer to “2. Basic specifications” and following figures for the detail.</p>
 CAUTION	<p>Before using the robot, please register the "weight", "COG (center of gravity) position" and "inertia Moment" of wrist payload as the load condition. Robot is controlled to minimize the operating time according to the registered value.</p> <p>Therefore, even if the load condition was within the specifications, if that is incorrect, excessive acceleration will be generated, and reliability and life may be damaged.</p> <p>Even if the correct value is registered, vibration or servo tracking error may occur due to the insufficient rigidity of the payload. If such problem occurs, please adjust the “speed”, “acceleration” and “smoothness”. Those factors can be adjusted in every step. See the instruction manual for details.</p> <p>FD controller instruction manual BASIC OPERATIONS (TCFEN-002) 4.3 Teaching</p>

■ Torque map

C.O.G. of wrist load should exist inside the range shown below.

[SRA100B-01]

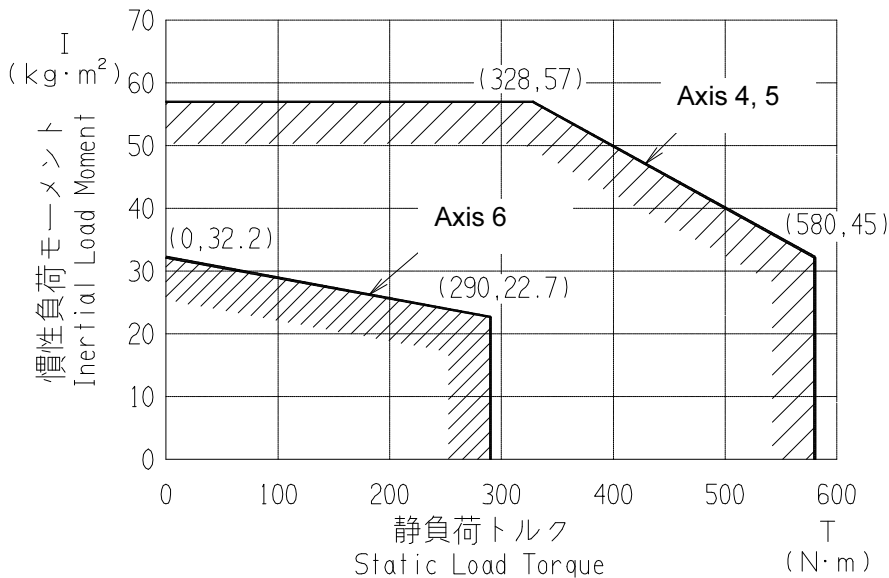


■ Moment of inertia map

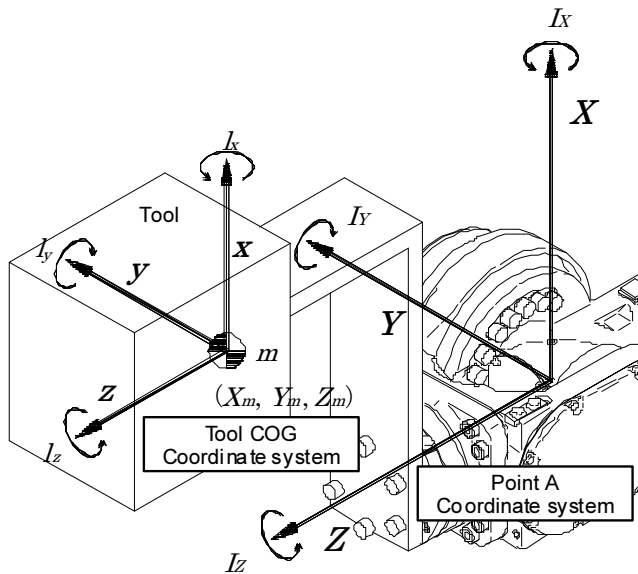
Static load torque and moment of inertia of wrist load should exist inside the range shown below.

IMPORTANT If the real inertia is over the limit written in "2. Basic specifications", maximum speed will be restrained by software.

[SRA100B-01]



■ How to find the inertia moment



Point A coordinate system
Origin is Point A (intersection point of axis 6, 4 rotation center and axis 5 rotation center) and its X, Y and Z direction are defined as

- X: Perpendicular coordinate with Y, Z
- Y: Axis 5 rotation center when wrist is in reference position
- Z: Axis 6 and 4 rotation center when wrist is in reference position

Tool COG coordinate system

- Origin is COG of tool, and parallel to point A coordinate system
- x: Parallel to X
- y: Parallel to Y
- z: Parallel to Z

Inertia moment

- I_x: Around X on point A coordinate system
- I_y: Around Y on point A coordinate system
- I_z: Around Z on point A coordinate system
- I_x: Around x on tool COG coordinate system
- I_y: Around y on tool COG coordinate system
- I_z: Around z on tool COG coordinate system

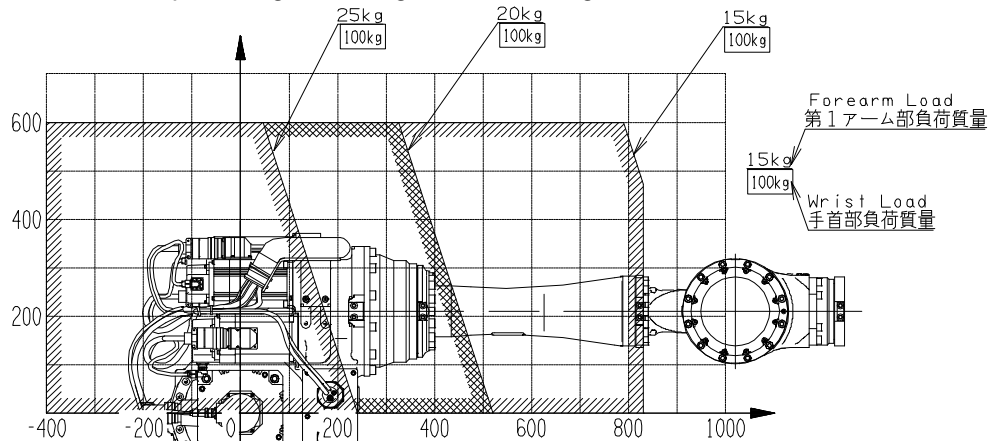
m: Tool mass
(X_m, Y_m, Z_m): COG of tool on point A coordinate system

<p>1 Calculate inertia moment defined on tool COG coordinate system (xyz). If tool is regarded as prism, it is calculated as right formula.</p>	<p>Inertia moment example on tool COG coordinate system</p> <p>If tool is regarded as prism</p> $I_x = \frac{1}{12} m \cdot (A^2 + B^2)$ $I_y = \frac{1}{12} m \cdot (A^2 + C^2)$ $I_z = \frac{1}{12} m \cdot (B^2 + C^2)$ <p>These values (I_x, I_y, I_z) are registered to controller.</p> <p>Inertia moment on tool COG coordinate system</p> <p>This is different from "allowable moment of inertia" written in robot specification sheet.</p>
<p>2 Calculate inertia moment defined on point A coordinate system (XYZ), then calculate inertia moment around robot wrist joint (axis 4, 5 and 6). This result must not be larger than "Allowable moment of inertia" written in robot specification sheet.</p>	<p>Inertia moment on point A coordinate system (XYZ) is</p> $I_X = m \cdot (Y_m^2 + Z_m^2) + I_x$ $I_Y = m \cdot (X_m^2 + Z_m^2) + I_y$ $I_Z = m \cdot (X_m^2 + Y_m^2) + I_z$ <p>Axis 4 and 5 inertia moment is larger value of I_x and I_y, because this depends on axis 6 position. Axis 6 inertia moment is I_z itself.</p> $I_{J4} = I_{J5} = \max(I_X, I_Y)$ $I_{J6} = I_Z$

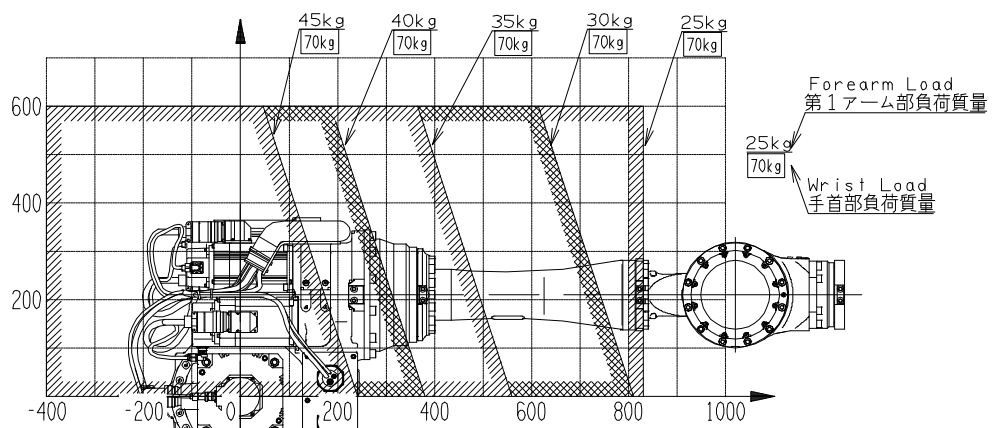
■ Allowable forearm load

Use the robot under condition that COG of the ancillary equipment on the forearm falls in the range shown below. When tool weight is lower than the rated value, weight of the ancillary equipment can be allowed up to 45Kg according to the tool weight.

[SRA100B-01]
When wrist load is 100kg



[SRA100B-01]
When wrist load is 70Kg



7. Option specifications

No.	Item	Specifications	Parts No.	
1	Installation parts *1	Chemical anchor specification	with pin hole OP-F1-029	
		Base plate welded (anchors not included)	without pin hole OP-F1-033	
		Hammer drive anchor specification	with pin hole OP-F2-020	
		Base plate welded (anchors not included)	without pin hole OP-F2-021	
		Pins set (Installation pins & polyethylene plug)		OP-F1-030
		Leveling plate (□180mm×t=32mm, 4 plates)		OP-F1-031
		Installation bolts & washers		OP-F1-032
		Chemical anchor		OP-F1-038
		Hammer drive anchor	OPJ-F2-0005	
2	Motion range LS		Refer to the "Motion range limit option" table below	
3	Adjustable LS dog			
4	Adjustable stopper			
5	Big capacity application box *2	Big capacity BJ3 wiring junction box		OP-E5-004
6	Transfer jig	Fork bracket for floor mounting type	OP-S2-031	
7	Zeroing pin & Zeroing block *1	For 100kg payload	OP-T2-053	
8	ISO Flange adaptor	Converts into the tool installation size with ISO	OP-W2-001	
9	Flange adaptor	For 100kg payload (P.C.D.92)	OP-W3-001	
10	Wrist axis positioning marking *3	For 100kg payload	OP-N3-016	
11	Encoder connector Protector	For axis 3	OP-P6-005	
12	Bypass cable *1		BCUNIT20-30	
13	Scale seal *3	For wrist three axes	OP-N2-020	

*1 : These parts are packed separately from the robot. (Not attached on the robot)

*2 : When "big capacity application box" option is mounted, robot width is enlarged.

*3 : "Wrist axis positioning marking" and "Scale seal" can not be used at the same time. Please select either one.

■ Motion range limit option

Option	Specification
Motion range LS	Motion range limit switch (dual circuit) and dog can be installed for axis 1, 2 and 3. This option includes limit switches of axis 1, 2 and 3. This option is already mounted before shipment.
Adjustable LS dog	Motion range can be limited by installing Limit switch dog at various angles. This can be selected for axis 1, 2 and 3 individually. This option is only changing the dog position. Limit Switch itself is not included. Please order "Motion range LS" option at the same time. This option is shipped separately. (Not mounted on robot before shipment).
Adjustable stopper	Motion range can be limited by installing a mechanical stopper at various angles. This can be selected for axis 1 and 2 individually. This is a separate option from "Motion range LS". In case that "Motion range LS" option is used together, "Adjustable LS dog" option must be ordered at the same time, because LS dog position needs to be adjusted. This option is shipped separately. (Not mounted on robot before shipment). Axis 1 is adjustable from: $\pm 3.14 \text{ rad} \sim \pm 0 \text{ rad}$, every 0.17 rad Axis 2 is adjustable from: +0.26 and +0.52 rad, from the rear operation edge

	Parts No.		
	Axis 1	Axis 2	Axis 3
Motion range LS	OP-D7-011 (3 pcs. set)		
Adjustable LS dog	OP-S5-021	Included in OP-D7-011	
Adjustable stopper		OP-A5-029	Not available

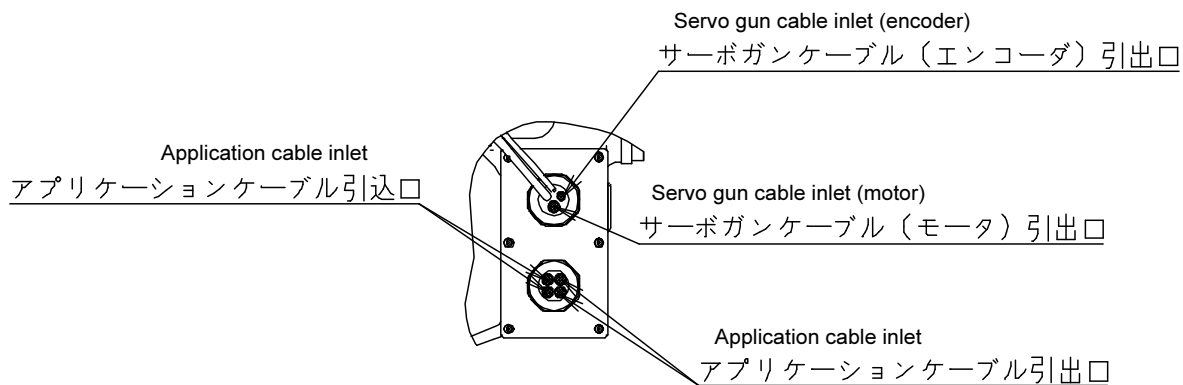
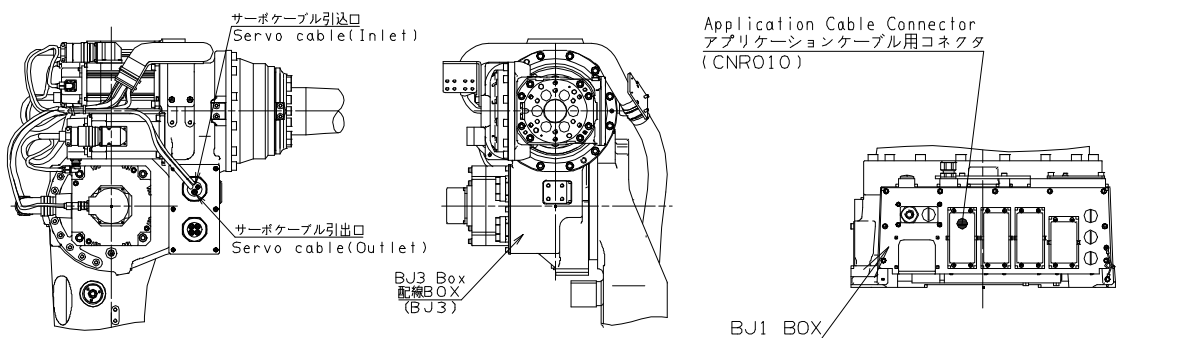
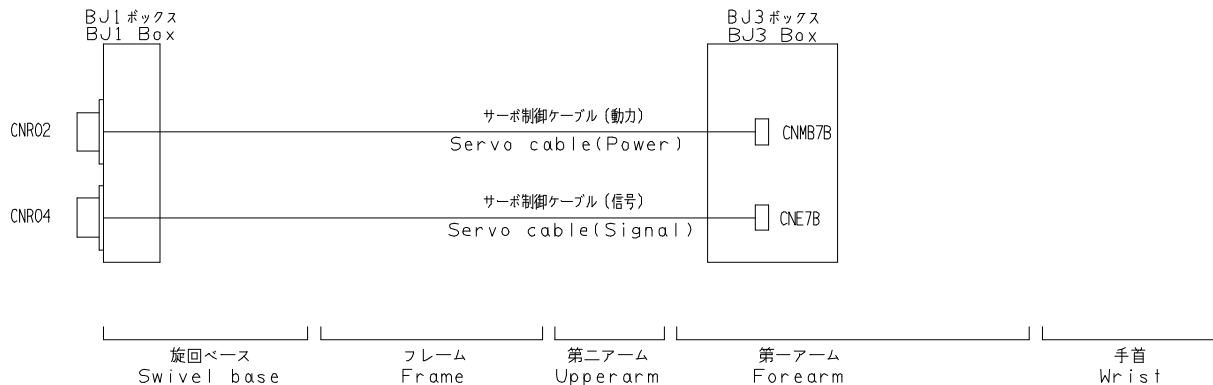
<Notes> ·Only for axis 1, "Adjustable stopper" includes "Adjustable LS dog". Please note that even if only the stopper is used, that the LS dog is already included as a package.

·"Adjustable stopper" is not available on axis 3 by its constructive reason. Select "Adjustable LS dog" to limit its motion range.

8. Application wiring and piping diagram

■ Standard specification

【SRA100B-01】

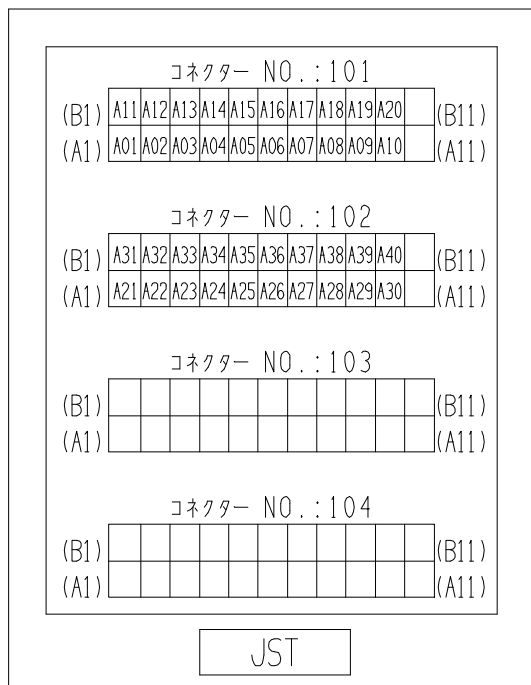


Detail of BJ3 BOX

■ Detailed diagram of the application connectors (option)

【SRA100B -01】

(1) BJ1 side (connector)



User-side Connectors

Wire-side shell: JFM-WSA-4-A (JST)

or JFM-WSA-4-C (JST)

Guide plate A kit: JFM-GPAK-4 (JST)

Receptacle housing: JFM2FDN-22V-K (JST)

Receptacle contact:

a: SJ2F-01GF-P1.0 (JST) (0.20 ~ 0.50sq)

b: SJ2F-21GF-P1.0 (JST) (0.30 ~ 0.75sq)

Manual crimp tool:

a: YRS-8861

b: YRF-1120

Cable diameter suitable for wire-side shell:

JFM-WSA-4-A $\phi 26.2 \sim \phi 28.0$

JFM-WSA-4-C $\phi 15.5 \sim \phi 16.5$

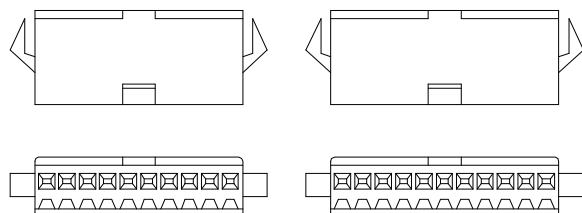
(Pin location shows the connector mounted on robot body and is the view from connecting side.)

Application wiring specification

Rated voltage Max. AC/DC 115 V

Rated current rating Max. 1 A

(2) BJ3 side (connector)



CN61

1	2	3	4	5	6	7	8	9	10
A01	A02	A03	A04	A05	A06	A07	A08	A09	A10

CN62

1	2	3	4	5	6	7	8	9	10	11
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	ECE

CN63

1	2	3	4	5	6	7	8	9	10
A21	A22	A23	A24	A25	A26	A27	A28	A29	A30

CN64

1	2	3	4	5	6	7	8	9	10	11
A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	ECE

Connector form (CN61, CN63)

Housing SMP-10V-BC (JST)

User-side Connectors

Housing SMR-10V-B (JST)

Contact SYM-001T-P0.6 (Wire of Application : AWG#22~28)

Pressure tool YRS-121

Connector form (CN62, CN64)

Housing SMP-11V-BC (JST)

User-side Connectors

Housing SMR-11V-B (JST)




Contact SYM-001T-P0.6 (Wire of Application : AWG#22~28)

Pressure tool YRS-121

9. Transport procedure

Safety measures against transport

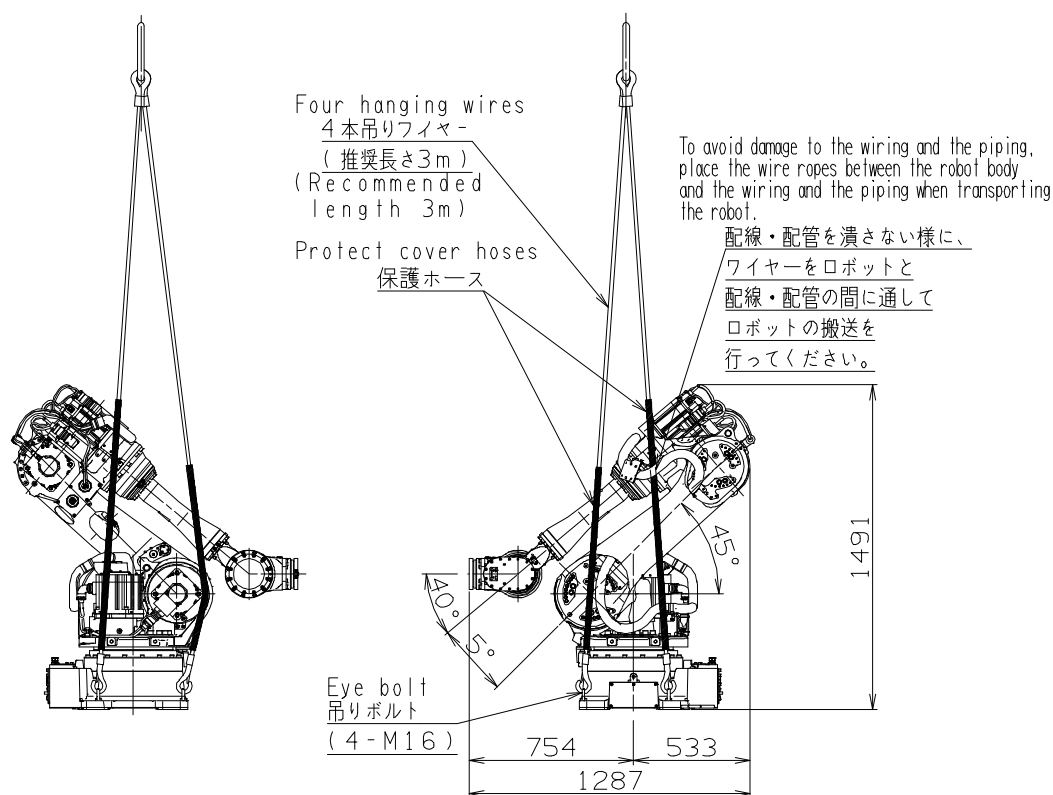
The following describes precautions for transporting the robot. Fully understand the precautions for safe transport work.

 WARNING	The robot must be transported by personnel who have licenses required for slinging work, crane operation, forklift truck operation, and others. The weight of the robot and controller is listed in the Operating Manual and the Maintenance Manual. Check for the weight, and then handle them according to procedures suitable for the weight.
 WARNING	To lift the robot or the controller, follow the procedures specified in the Maintenance Manual. Following any procedures other than those specified will cause the robot to topple over or drop during transport, thus resulting in accidents.
 WARNING	During transport or installation work of the robot, pay utmost care not to cause damage to wirings. Furthermore, after installing the robot, take protective measures such as using protective guards so that the wirings will not be damaged by workers or other persons, or forklift trucks or else.

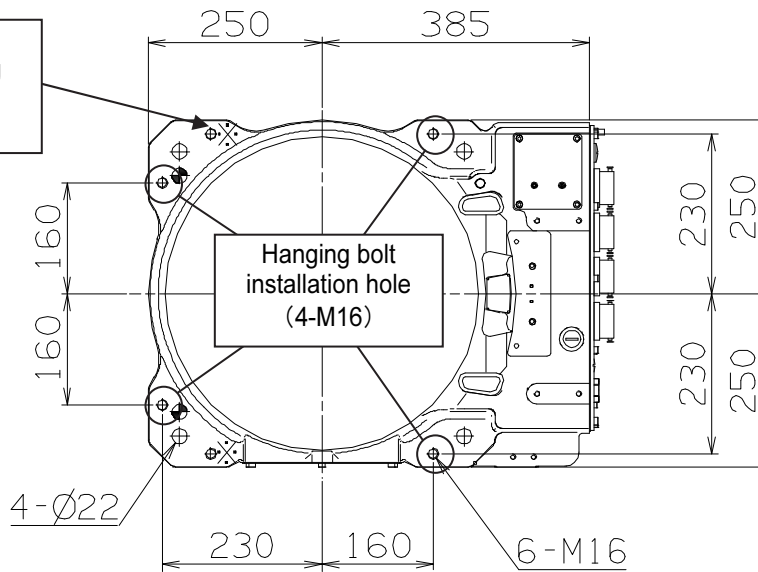
To transport the robot, make it a rule to use a crane.

At first, put the robot into the configuration shown in figure below and mount the four M16 hanger bolts to the swivel base. Then, be sure to lift the robot using four hanging wires. For this purpose, it is recommended to use hanging wires of 3 m in length and protect areas that contact the robot, using rubber hoses to cover the wire ropes. For the areas to be covered with the rubber hoses refer to figure below.

【SRA100B -01】

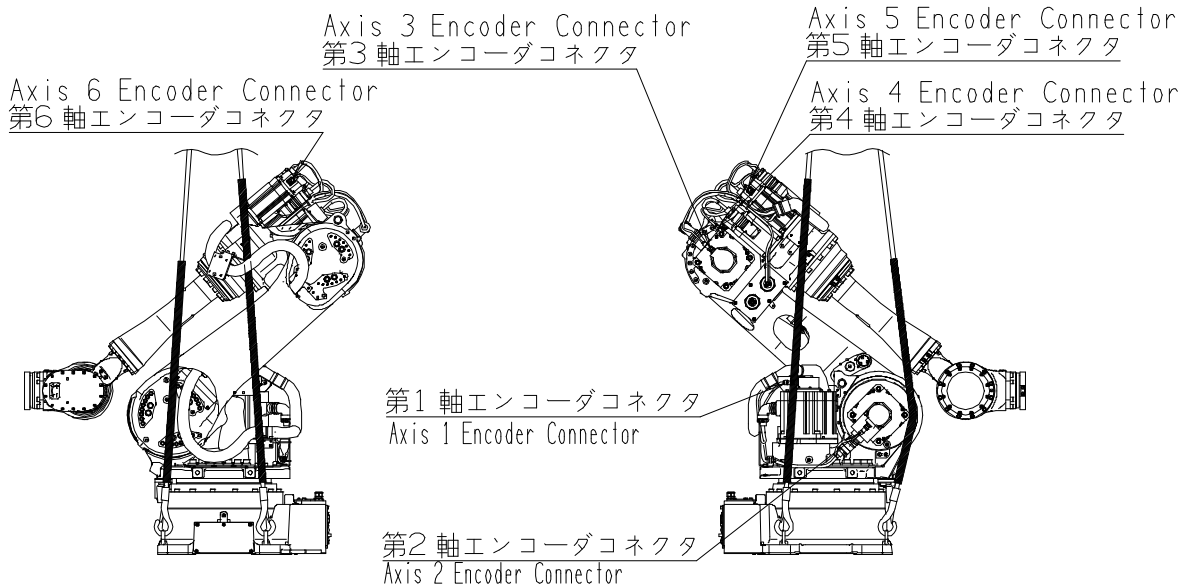


Never use taps marked ※ to hang the robot. (2-M16)



CAUTION

If hanging wires push the encoder connectors or wiring/piping, they may be broken when hanging the robot. When hanging the robot, please pay attention not to make the wires touch the encoder connectors and wiring/piping.



10. Delivery style (specification which contains a robot)

1. There are three styles as shown below.

	Style	Details
1	Delivery on the truck	Robot is delivered on the truck near the entrance of customer's plant. (Installation and test-run is not included)
2	Delivery after installation and test-run	Robot is installed and test-run is done. (Teaching with work piece is not included.)
3	Delivery after installation and teaching with work piece	After style 2, teaching with work piece is done.

Because the expense is different, which form to choose be sufficiently examined.

2. Operation and maintenance education

The special spot operation guide and the special spot preservation guide are the outside of the estimation. Consult with each NACHI-FUJIKOSHI office for the details as for the schooling system.

11. Consuming power (Robot + Controller)

7.0 kVA (may vary according to the application and motion pattern.)

12. Paint color

Standard color Controller cabinet Munsell 10GY9/1
 Robot body Munsell 10GY9/1

13. Warranty

Elapse of 1 year after delivery. (8 hours/day running)

The specification and externals described in this specifications might change without a previous notice for the improvement.

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