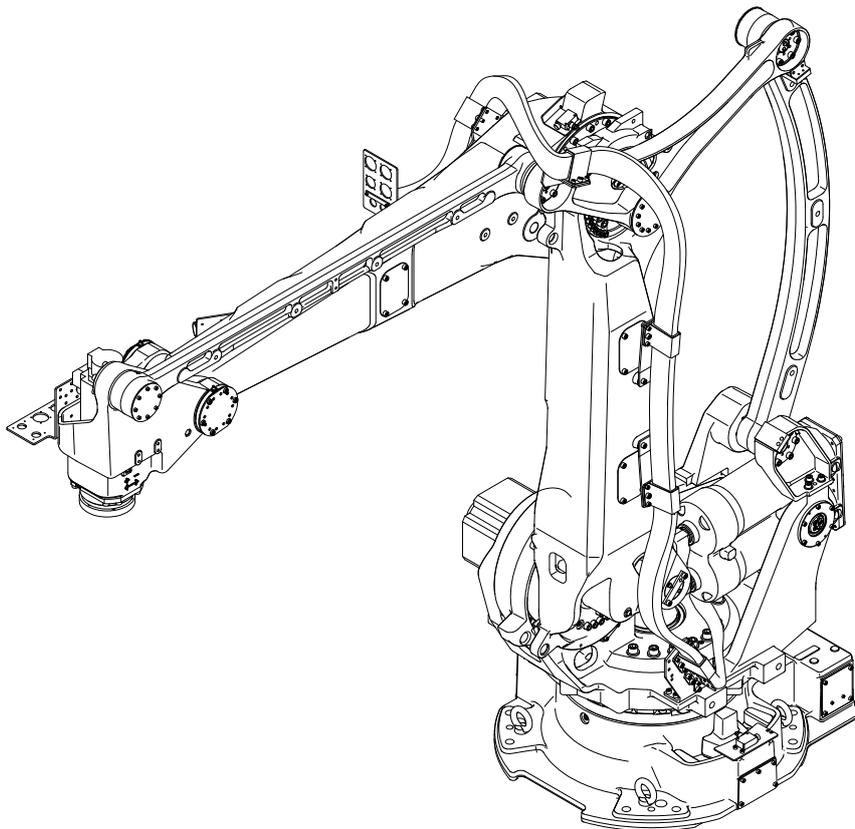


NACHI

Standard specifications

LP-01-AX20/FD11

7th edition



NACHI-FUJIKOSHI CORP.

1307, SLPEN-030-007, 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, spray painting and the material handling techniques.

"LP series" are robots specialized for palletizing application with high speed and high rigidity and 4 axes structure. "LP130-01" is the basic model, and 3 types of robots are featured in the "LP" series.

Robot types

Mounting condition \ Payload	130kg	180 kg	210 kg
	Floor mounting	LP130-01	LP180-01

< Characteristics >

1. 3 types of 130kg, 180kg and 210kg are available so that various hand devices can be applied.
2. The motion range is common to the respective robot. Therefore, examining applicability becomes easier than before.
3. The improvement of the maximum speed and the high acceleration via lightweight body realized the processing performance of 1500 packs/hour(130kg payload) in case of LP130.
4. The appropriate arm length and the large rotation range of each axis realize an enough motion envelope and the height of 2700mm (□1100mm) for layered packs was achieved.
5. The specification of the allowable moment of inertia of wrist axes was improved for tools and work-pieces with high performance and large size.
6. Application wirings and high-capacity piping are added for tools and work-pieces with high performance and large size.

2. Basic specifications

Item		Specifications			
Robot model		LP130-01	LP180-01	LP210-01	
Construction		Articulated construction			
Degrees of freedom		4			
Drive system		AC servo system			
Max. operating range	Arm	Axis 1	±3.14 rad		
		Axis 2	+0.71 to -1.65 rad		
		Axis 3	+0.30 to -2.04 rad		
	Wrist	Axis 4	±6.28 rad		
Max. speed	Arm	Axis 1	2.27 rad/s	2.01 rad/s	1.83 rad/s
		Axis 2	2.01 rad/s	1.75 rad/s	1.75 rad/s
		Axis 3	2.01 rad/s	1.83 rad/s	1.75 rad/s
	Wrist	Axis 4	6.98 rad/s	6.28 rad/s	5.24 rad/s
Max. payload	Wrist	130 kg	180 kg	210 kg	
	Upper part of Forearm *1	25 kg at maximum			
Allowable static load torque of wrist	Axis 4	50 kgm ²	69 kgm ²	100kgm ²	
Position repeatability *2		±0.3 mm	±0.4 mm		
Air pressure		-101.3 to 690 kPa			
Air		2-φ12×8 (to the wrist unit)			
Application signals		20 wires (to the wrist unit) 6 wires (to the fore arm)			
Installation		Floor mounting			
Ambient conditions		Temperature : 0 to 45 °C *3 Humidity : 20 to 85 %RH (No dew condensation is allowed) Vibration to the installation face : Not more than 0.5G (4.9 m/s ²)			
Robot mass		1150 kg			

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

*1: This value changes by placement and load conditions of a wrist.

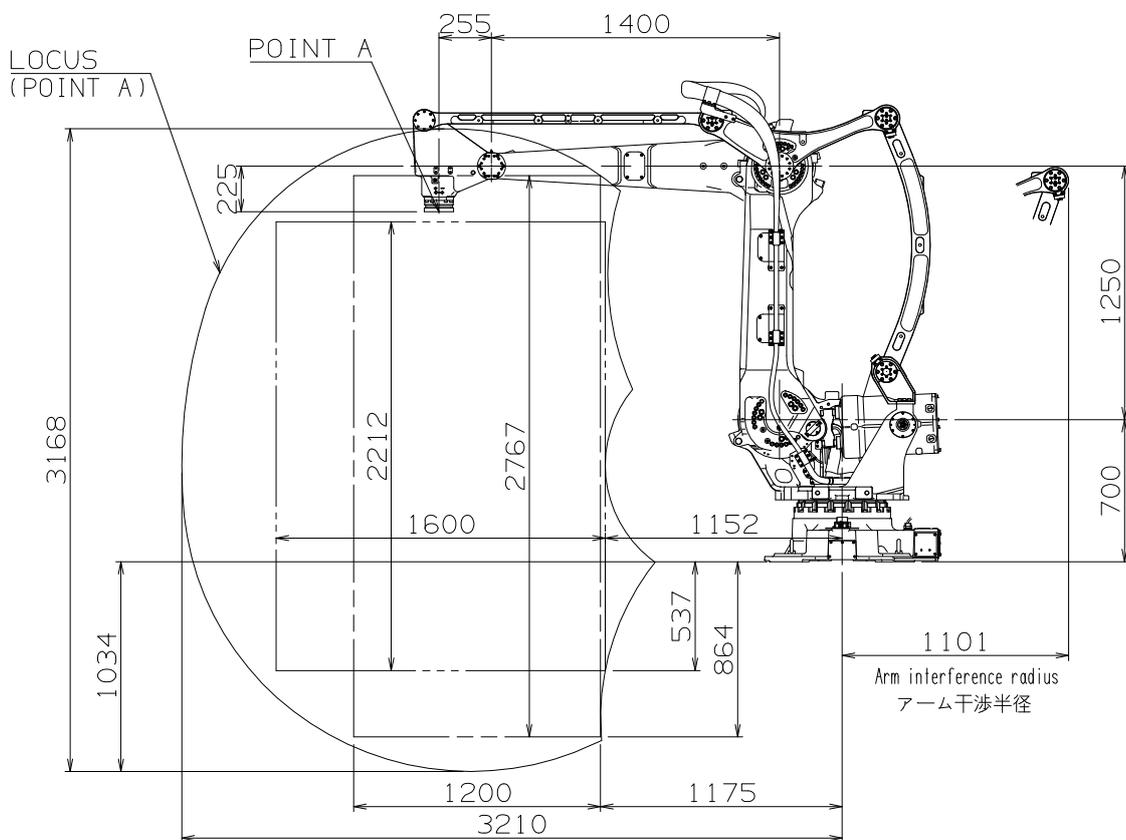
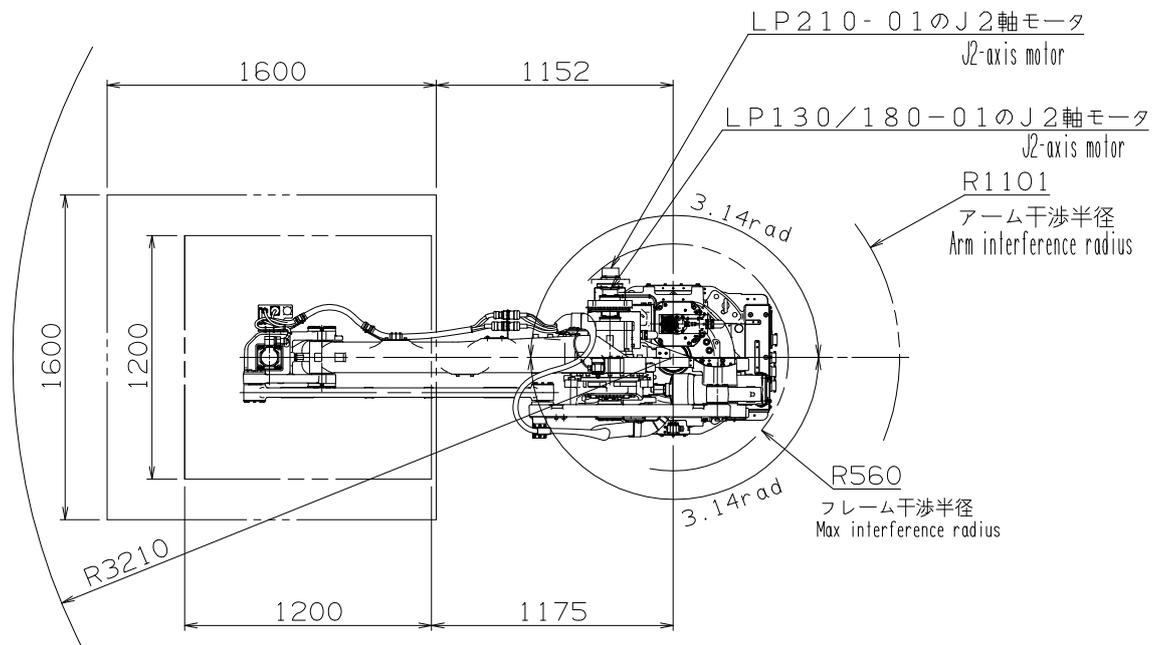
*2: This value conforms to "JIS B 8432".

*3: Permitted height is not higher than 1,000m above sea level. If used in higher place, permitted temperature is affected by height.

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

3. Robot dimensions and working envelope

[LP130-01] [LP180-01] [LP210-01]

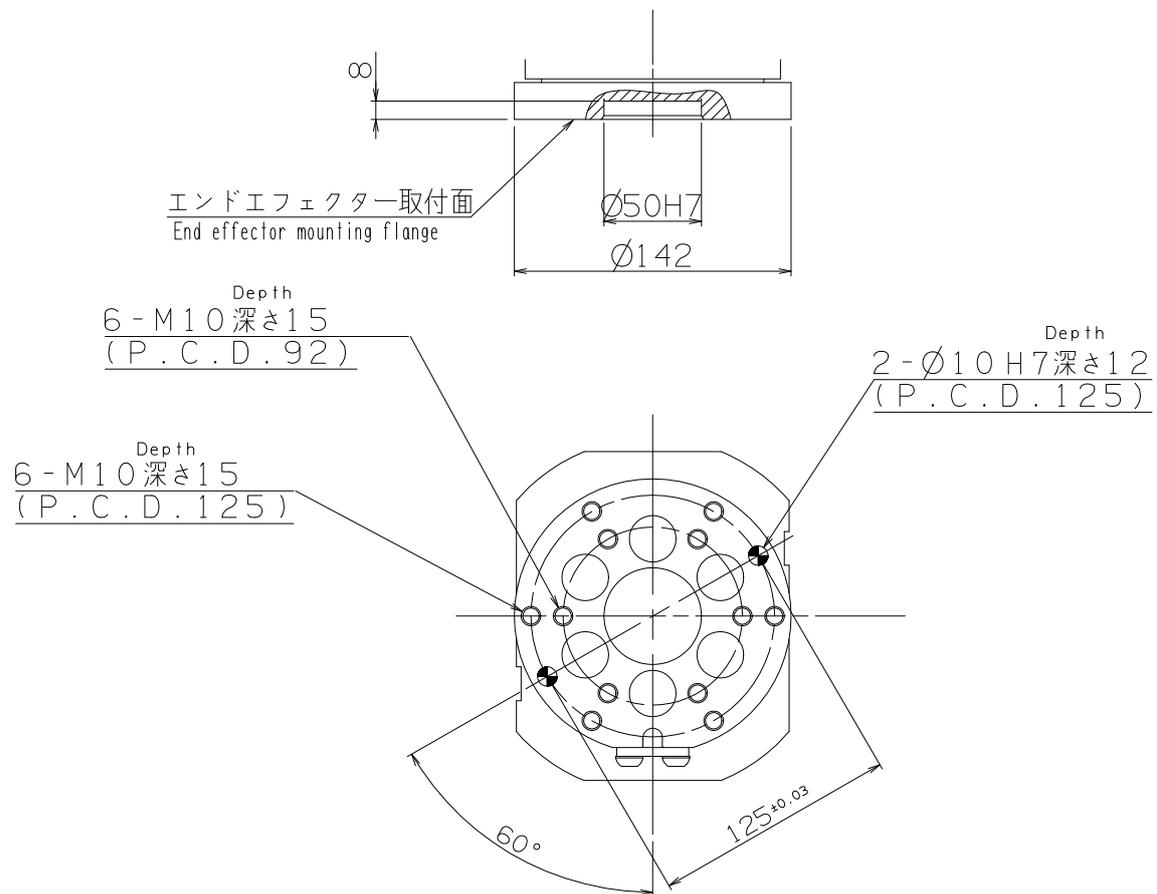


4. Detail of tool mounting plate

For the end effector fixing bolts, use the mounting P.C.D. shown in the following figures.

Besides the mounting P.C.D., different P.C.D. (option) is available. For details, contact our service division.

 CAUTION	Be sure to screw the M10 end effector 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.
 CAUTION	Use the mounting P.C.D.125 when you install the load of 100 kg or more, or the moment of inertia of 25kgm ² or more. (Only when the customer doesn't consider strength of the bolt at the end-effector side.)
 CAUTION	When attaching an end-effector like gripper device etc., insert a locating pin using the hole (φ10H7) for positioning and preventing the end-effector from rotating.

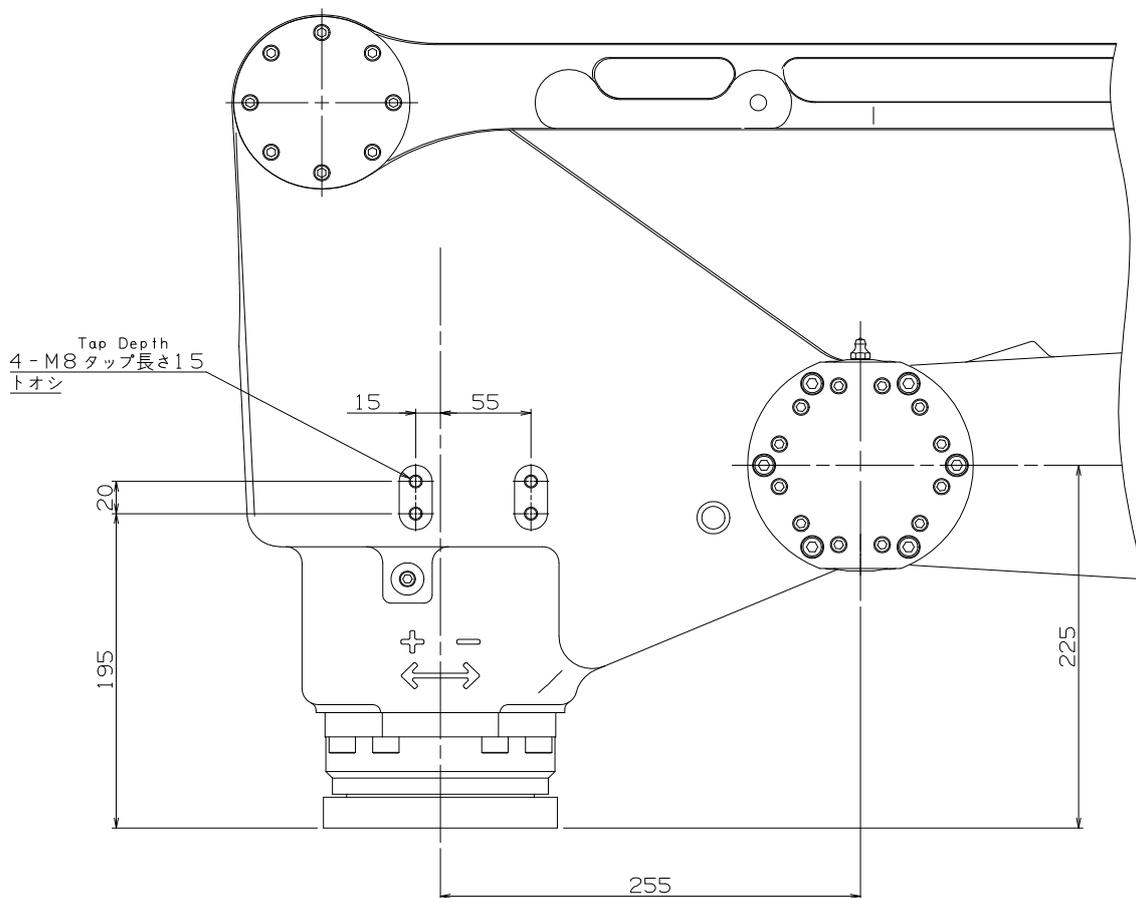


5. The side of the wrist unit

Peripheral devices can be installed on the side of the wrist unit.

 CAUTION	Please be sure that the total mass of ((A) hand device + (B) workpiece + (C) additional peripheral device on the wrist unit) should keep the rated payload condition.
 CAUTION	The main material of the wrist unit is aluminium. Because the thread tap is through, the length of engagement should be from 14mm to 15mm.

[LP130-01] [LP180-01] [LP210-01]



6. 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.

Installation

To install the robot, give it first priority to thoroughly consider safety of workers and take safety measures. The following describes precautions for this purpose.

Safety measures against entry in the robot operating area

 CAUTION	<p>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.</p>
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■ 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.

■ 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 reaction force caused by accelerating or decelerating the speed to lock the robot, not to mention that it endures static loads.

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	LP130-01	LP180-01	LP210-01
Thickness of floor concrete	Not less than 160 mm		
Installation parts *1	8 bolts of M20 (JIS: Strength class 12.9) not less than 65mm 8 plain washers of not less than 4.5 mm in thickness and HRC35 in hardness		
Tightening torque	560 ± 30 N·m		
Allowable repeated tensile *2	Approximately 35,000 N	Approximately 42,000 N	Approximately 46,000 N

*1 : Installation parts are not accessory of robot.

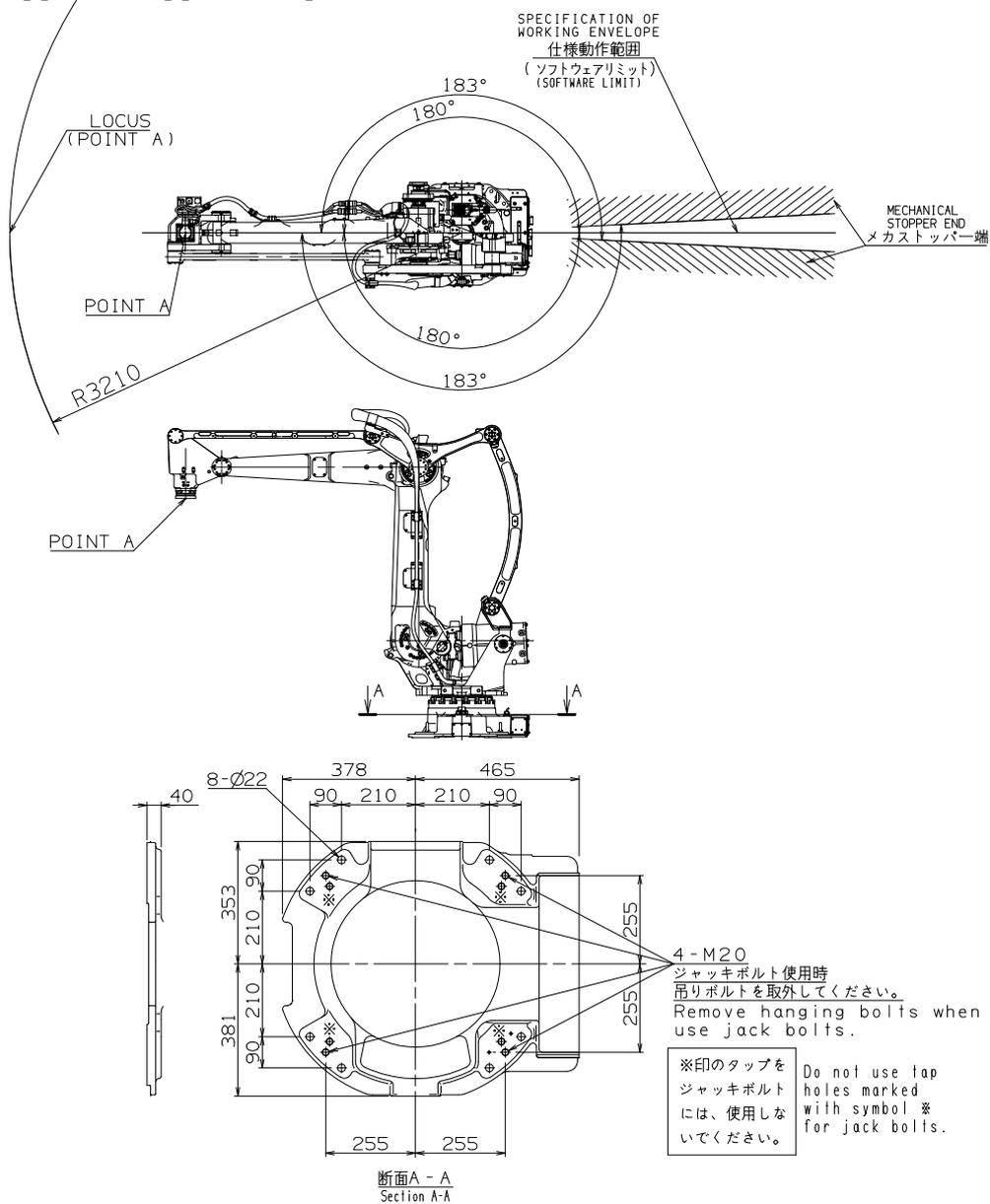
*2 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ Installation space

To install the robot, lock the swiveling base of the robot. For the installation space, refer to Fig.7-1

 CAUTION	The mechanical stopper end is located in a position exceeding the specified working envelope (software limit) of axis 1 by 3°. To install the guard fence, with consideration given to the wrist configuration and the shape of end effector.
 DANGER	On axis 1, 2 and 3, the robot working envelope can be regulated for safety (for this regulation, optional parts must be purchased). Since optional parts should be installed to enable this function, do not independently move the standard parts (e.g. mechanical stopper).

[LP130-01] [LP180-01] [LP210-01]



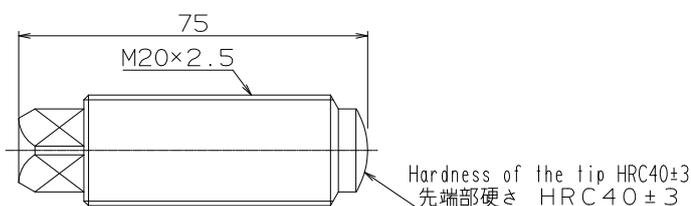
■ Accuracy of installation surface

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 1.0 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 1.0 mm (± 0.5 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.

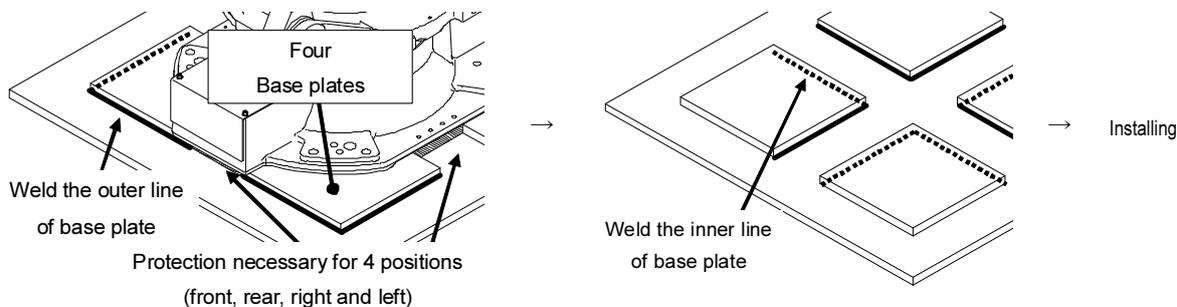


■ Welding of base plate

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.

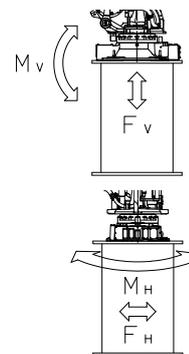
Temporary install the robot, and weld the outer line of base plate.

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
LP130-01	40,800 N	28,700 N	80,400 N·m	69,900 N·m
LP180-01	45,700 N	33,100 N	96,600 N·m	84,400 N·m
LP210-01	48,600 N	35,700 N	106,300 N	93,200 N·m

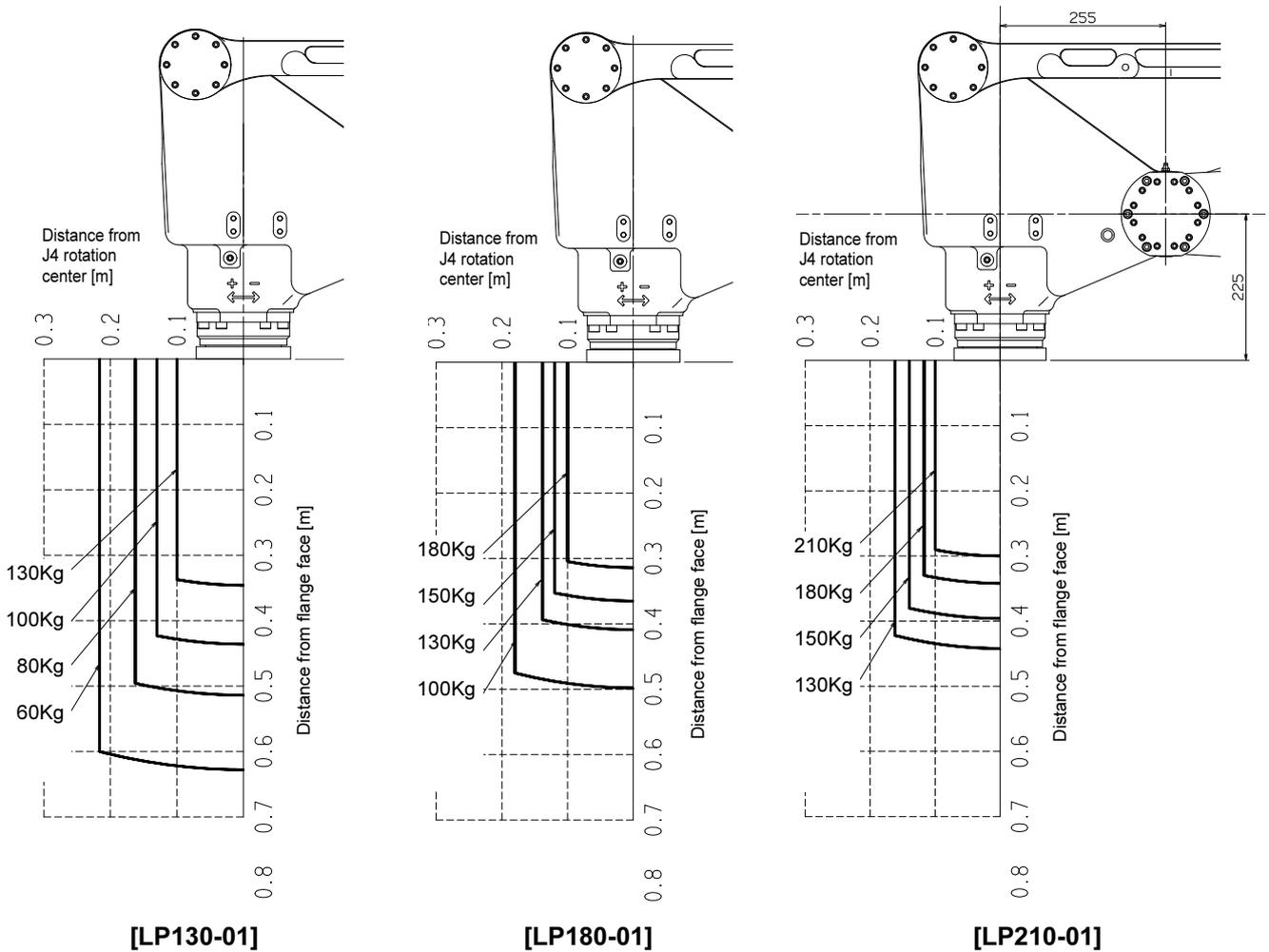


7. Allowable wrist load

 CAUTION	<p>Load fixed on the tip of wrist is regulated by “allowable payload mass”, “allowable static load torque”, and “allowable moment of inertia”. Strictly keep the wrist load within each allowable value. If wrist load exceeds the allowable value, this robot is out of guarantee. Refer to the table of “2. Basic specifications” and following figures for the detail of each specification.</p>
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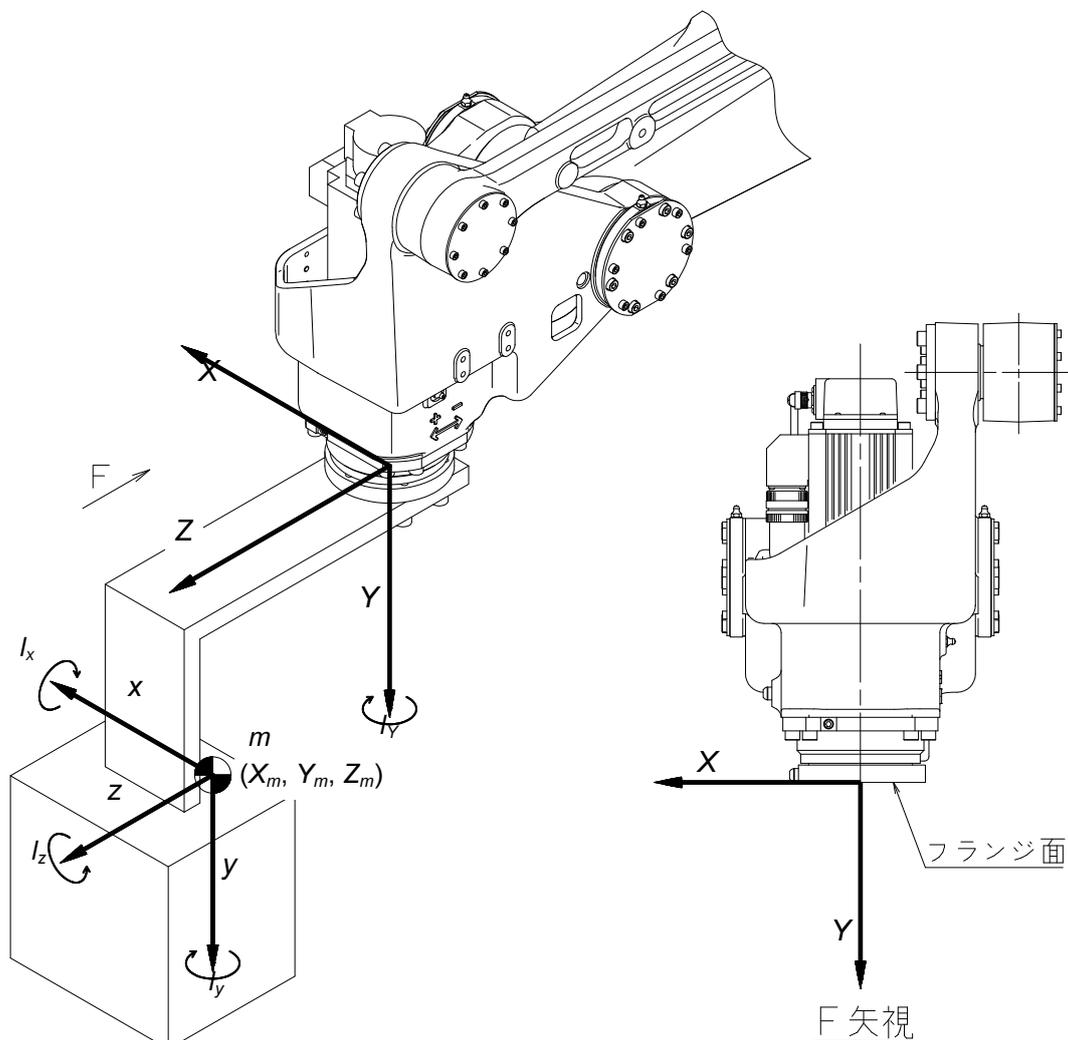
■ Wrist load installation map

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



■ How to find the moment of inertia of wrist axis

The following section shows general methods of calculating the moment of inertia around each axis.



X: X axis in the basic wrist configuration

Y: Axis 4 rotation axis in the basic wrist configuration

Z: An axis that is vertical to the X axis and the Y axis in the basic wrist configuration

x: Axis parallel to the X axis in the load gravity center

y: Axis parallel to the Y axis in the load gravity center

z: Axis parallel to the Z axis in the load gravity center

I_x : Moment of inertia around the X axis passing through the load gravity center

I_y : Moment of inertia around the Y axis passing through the load gravity center

I_z : Moment of inertia around the Z axis passing through the load gravity center

m : Load mass

(X_m, Y_m, Z_m) : Gravity center coordinates of load

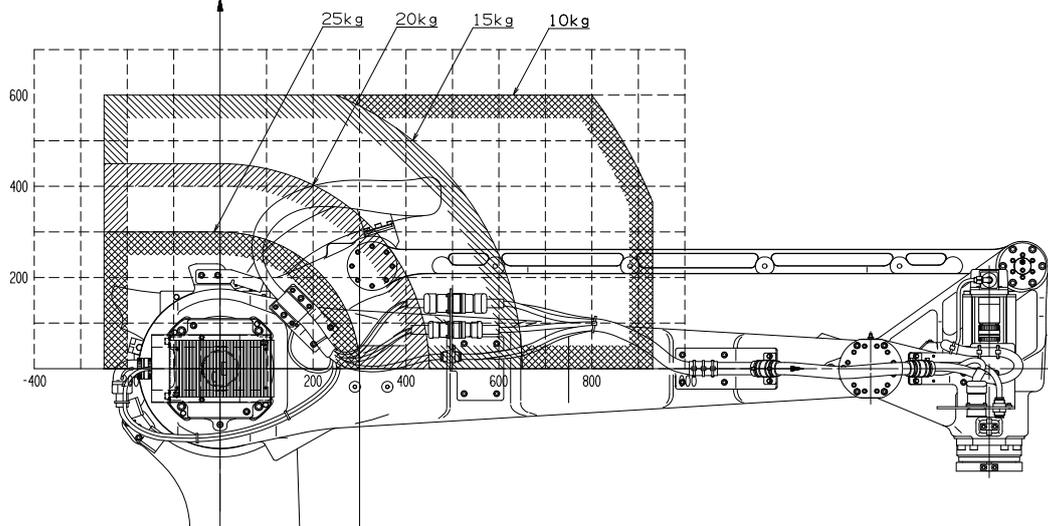
The moment of inertia around axis 4 is found by the expression shown below.

$$I_{J4} = I_Y = m \cdot (X_m^2 + Z_m^2) + I_y$$

8. Allowable forearm load

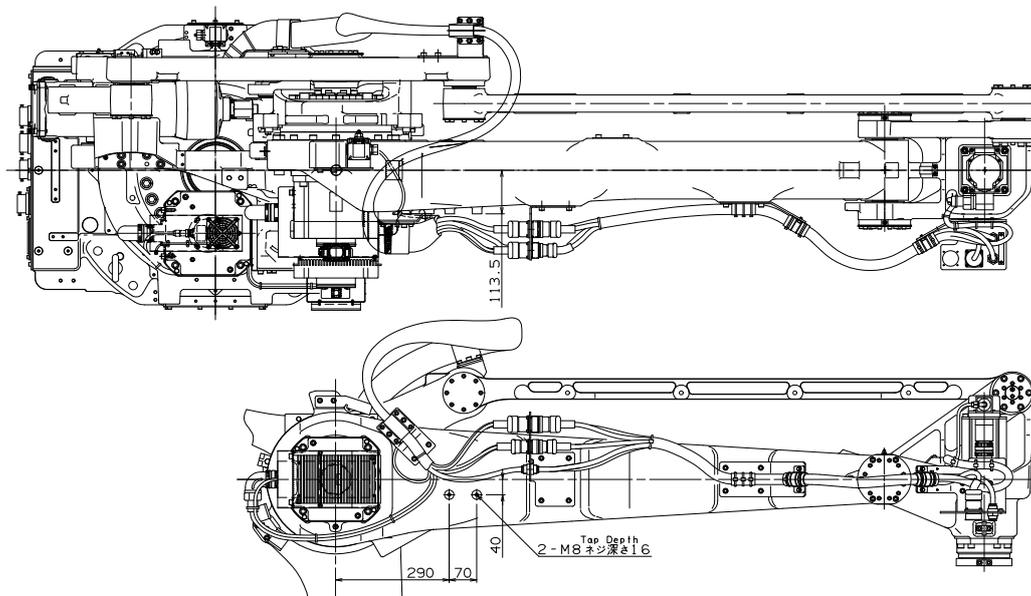
Ancillary equipment can be mounted to the upper part of robot forearm. The ancillary equipment of 25 kg at maximum can be mounted according to the mass and gravity center position. For details, request the technical information to our technical department.

[LP130-01] [LP180-01] [LP210-01]



Using the taps shown below, it is possible to install additional loads on the Fore arm.

 CAUTION	<p>The main material of the tap is aluminium. The length of engagement should be from 14mm to 15mm. (The depth of the thread tap is 16mm,)</p>
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9. Option specifications

○: Possible to correspond / —: Impossible to correspond

№	Item	Specifications	Parts No.	Robot model		
				LP130-01	LP180-01	LP210-01
1	Installation parts *1	Chemical anchor specification (Base plate welded, anchors not included)	OPJ-F1-0045	○		
		Ore anchor specification (Base plate welded, anchors not included)	OPJ-F2-0017	○		
		Installation bolts & washers (for robot installation)	OPJ-F1-0042	○		
2	Axis 1 adjustable stopper *1	Restriction of axis 1 operation range (±0 rad from ±2.61 rad every 0.17 rad)	OP-S5-012	○		
3	Axis 2 adjustable stopper *1	Restriction of axis 2 operation range (-0.26 and -0.52 rad from the operation edge)	OP-A5-024	○		
4	Adjustable limit switch *1	For axis 2 and axis 3 limit switch dog set	OP-S4-006	○		
5	Transfer jig	Fork bracket	OP-S2-033	○		
6	Zeroing pin & Zeroing block *1	For 130kg, 180kg and 210kg payload	OP-T2-059	○		
7	ISO Flange adaptor	Converts into the tool installation size with ISO	OP-W2-006	○		
8	Wrist axis positioning marking	For 130kg, 180kg and 210kg payload	OP-N3-008	○		
9	Application cable	Cable for additional application signals (6×0.2sq) (From forearm to wrist unit)		○		
10	Bypass cable unit *1	Temporary recovery cable for cable troubles		○		
11	Arm fixing jig *1	For axis 2 motor replacement (recommended q' ty; one for plural robots)	KP-ZD-004	○		
12	Scale sticker	Stickers to check axis 4 reference position	OP-N2-020	○		
13	Brake release switch *2	Motor brake release switches for all axes (installed inside of controller)	FD11-OP90-D OP90-PARTS-01	○		

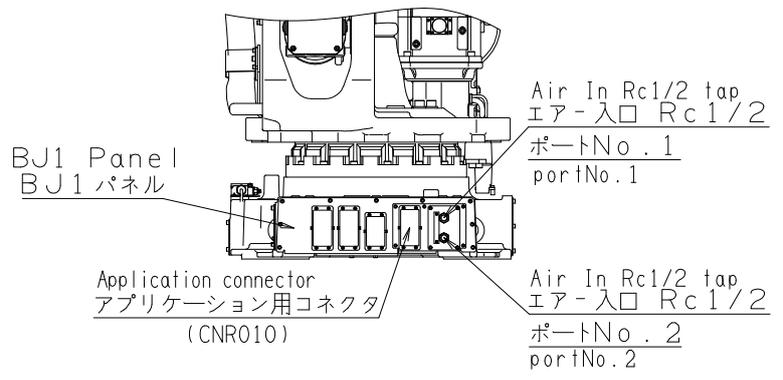
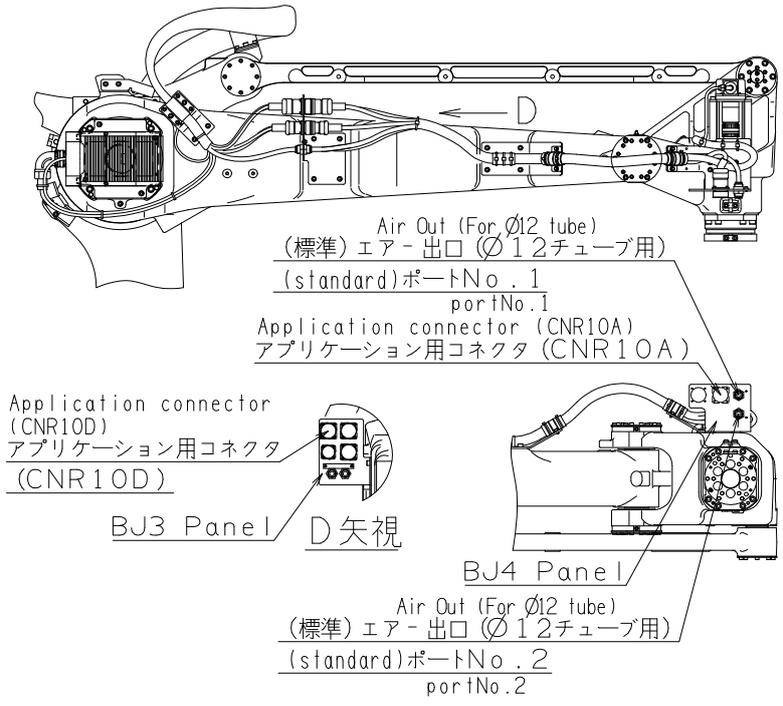
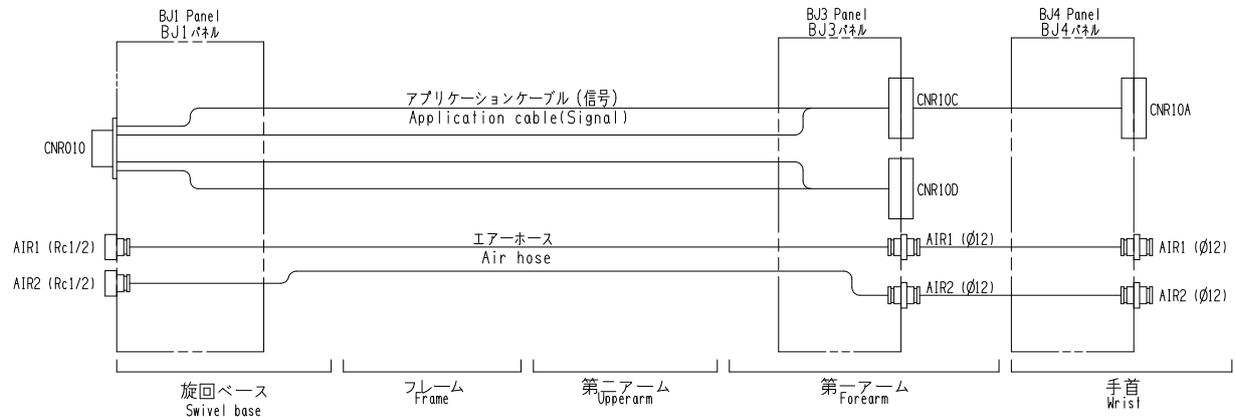
*1 : These parts are packed separately from the robot. (Not attached on the robot)

*2 : When purchasing a brake release switch, two parts must be ordered at the same time.

10. Application wiring and piping diagram

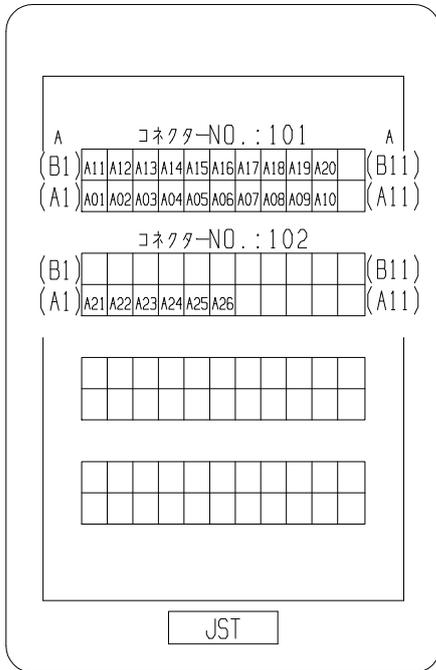
■ Standard specification

[LP130-01] [LP180-01] [LP210-01]



■ Detailed diagram of the application connectors

(1) BJ1side (connector)



(This figure is drawn seeing from the backside of the robot.)

Opposite connector

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-Aφ26.2~φ28.0

JFM-WSA-4-Cφ15.5~φ16.5

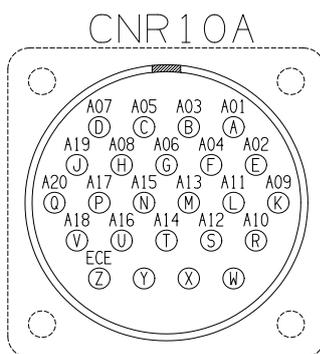
Application wiring specification

Rated voltage Max. AC/DC 115 V

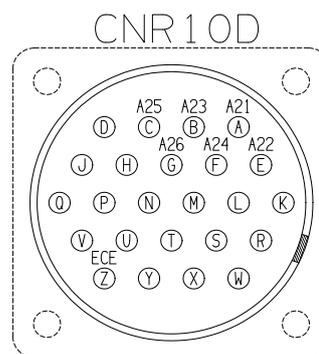
Rated current rating Max. 1 A

(2) BJ3・BJ4 side (connector)

BJ4 side connector
Key position "standard"



BJ3 side connector
Key position "X"



(This figure is drawn seeing from the contact side.)

Connector model (CNR10A)

Partner connector model

Connector model (CNR10D)

Partner connector model

N/MS3102A24-28S(JAE)

N/MS3106B24-28P(JAE)

N/MS3102A24-28SX(JAE)

N/MS3106B24-28PX(JAE)

11. Transport procedure

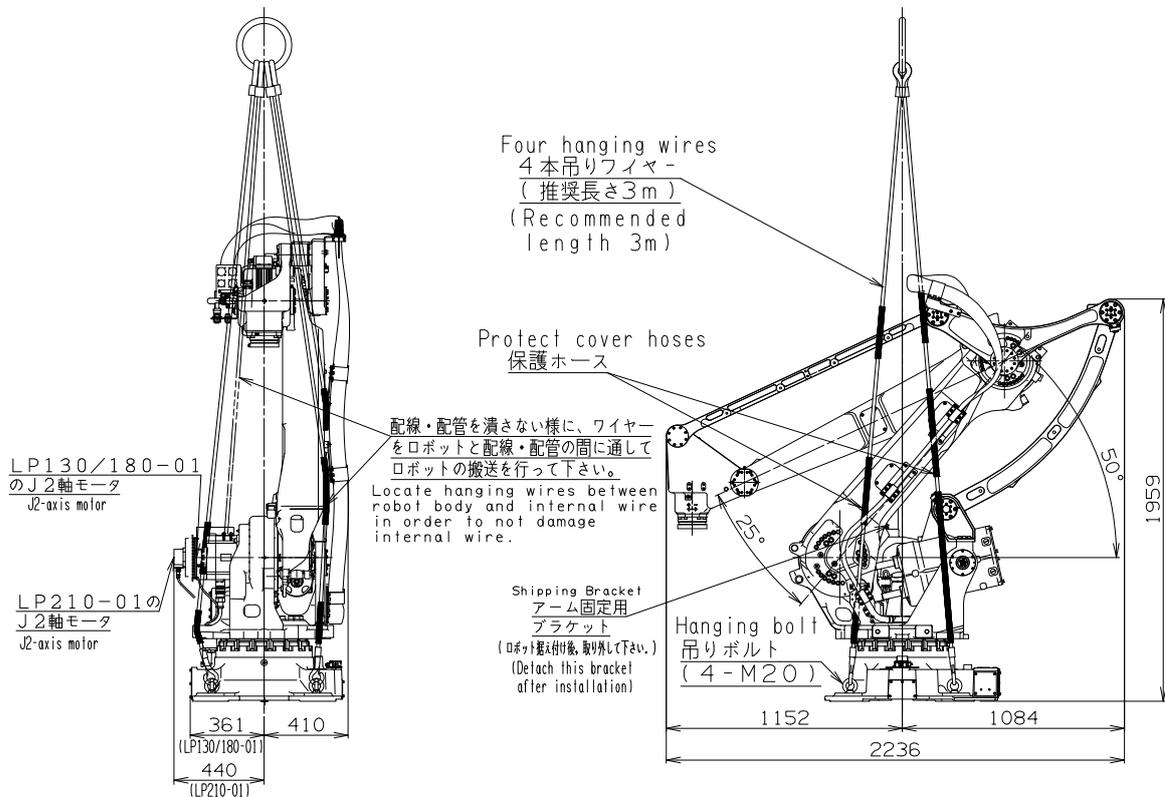
Safety measures against transport

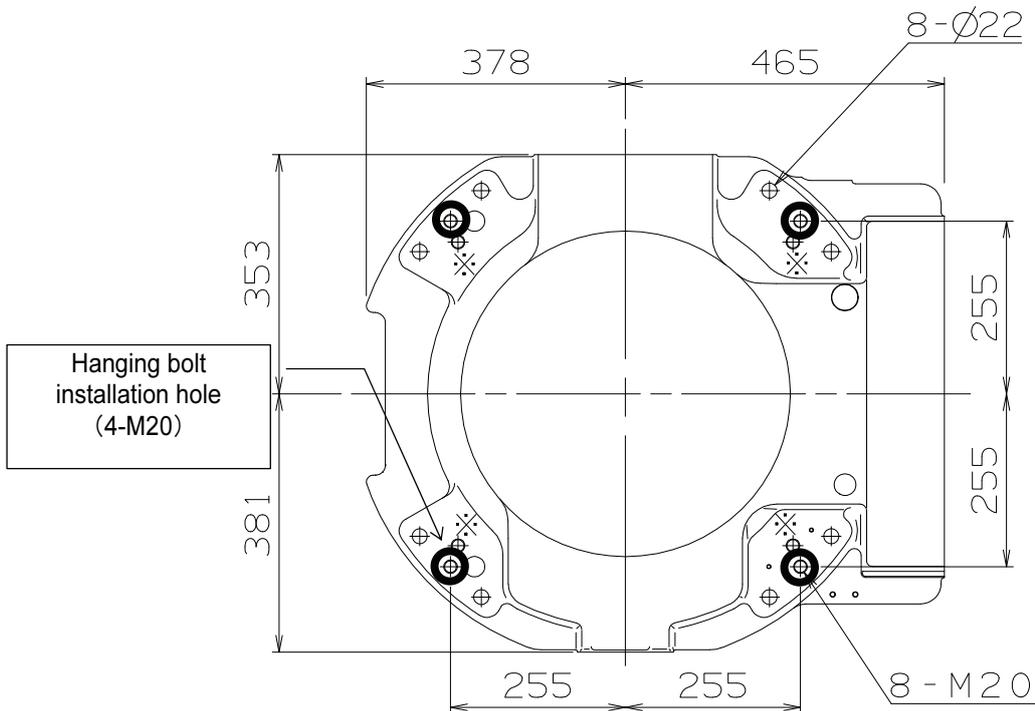
The following describes precautions for transporting the robot. Fully understand the precautions for safe transport work.

 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.

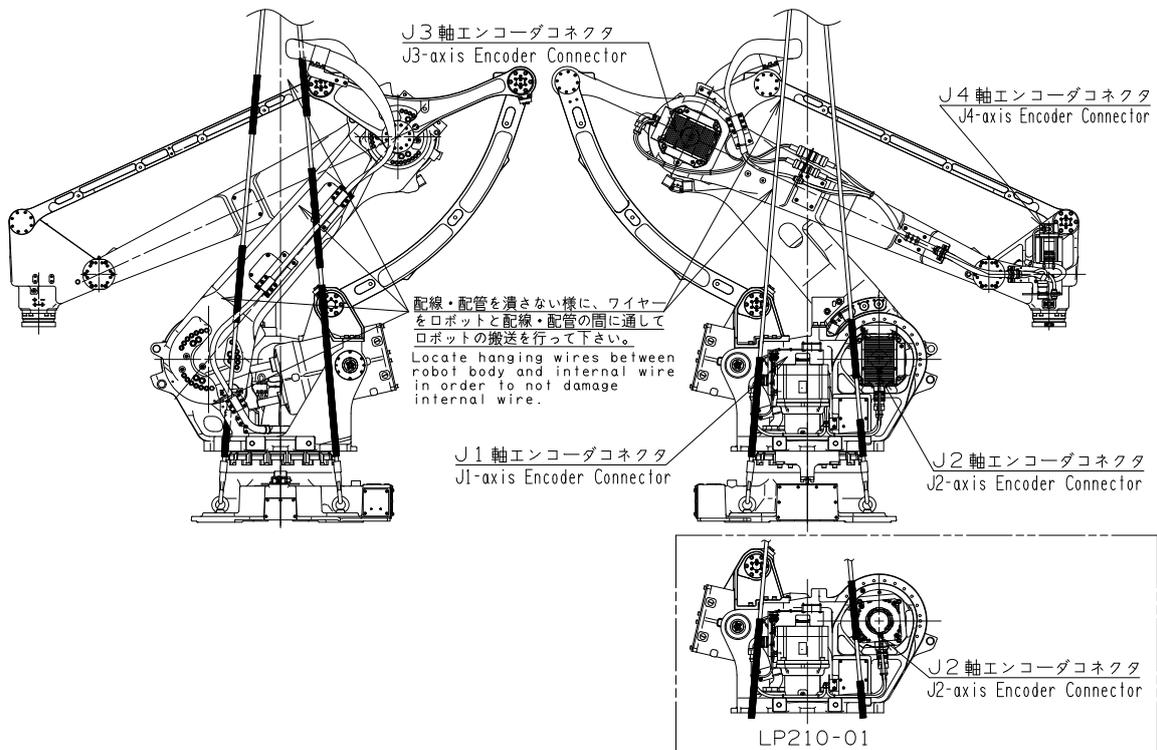
First, put the robot into the configuration shown in figure below and mount the four M20 hanger bolts to the swivel base. Then, be sure to lift the robot using four hanging wires. For this purpose, it is recommended to use hanging wires of 3 m in length and protect areas that contact the robot, using rubber hoses to cover the wire ropes. For the areas to be covered with the rubber hoses refer to figure below.





The screw hole of the ✕ sign is not used for the hanging bolt.

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



12. Installation (specification which contains a robot)

1. Delivery condition

	Condition	Details
1	Delivery on the truck	Robot is delivered on the truck near the entrance of customer's plant.
2	Delivery after installation and test-run	Robot is installed and test-run done.
3	Delivery after installation and test-run 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 operation guide and the special preservation guide are the outside of the estimation. Also, there is schooling system in the Toyama factory, too.
Consult with each NACHI-FUJIKOSHI office for the details.

3. The type D grounding (the grounding resistance is 100Ω or less) is necessary.

13. Consuming power

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

14. Paint color

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

15. Warranty

Elapse of 1 year after delivery.

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

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Original manual is written in Japanese.

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