

NACHI

Standard specifications

MZ03EL-02

1st edition

NACHI-FUJIKOSHI CORP.

1410, SMZEN-076-001,001

Table of contents

1. Basic specifications.....	1
2. Dimensions	2
3. Details of load mounting face	3
4. Installation procedure	4
5. Allowable wrist load	6
6. Application wiring and tube diagram.....	8
7. Options.....	9
8. Delivery style.....	10
9. Paint color	10
10. Warranty.....	10
11. Special notes	10

1. Basic specifications

Item	Specifications	
Robot model	MZ03EL-02	
Construction	Articulated	
Number of axis	6	
Drive system	AC servo motor	
Max. working envelope	Axis 1	±170 °
	Axis 2	-135 ~ 80 °
	Axis 3	-155 ~ 270 °
	Axis 4	±190 °
	Axis 5	±120 °
	Axis 6	±360 °
Max. speed *6	Axis 1	300 °/s
	Axis 2	230 °/s
	Axis 3	360 °/s
	Axis 4	550 °/s
	Axis 5	550 °/s
	Axis 6	1000 °/s
Max. pay load	Wrist	3.5 kg
Allowable static load torque	Axis 4	6.0 N·m
	Axis 5	6.0 N·m
	Axis 6	2.9 N·m
Allowable moment of inertia *1	Axis 4	0.12 kg·m ²
	Axis 5	0.12 kg·m ²
	Axis 6	0.03 kg·m ²
Position repeatability *2		±0.03mm
Max. reach		1102mm
Air tubes		φ 6×2
Application signal wires		10 wires
Installation *3	Floor / Wall / Tilted / Inverted mount	
Ambient conditions	Temperature: 0 to 45 °C *4 Humidity: 20 to 85%RH (No dew condensation allowed) Vibration to the installation face: Not more than 0.5G (4.9 m/s ²)	
Dust-proof / Drip-proof performance *5	IP67 equivalent (dust and drain proof-type)	
Cleanliness *7	ISO 14644-1 Class 4 equivalent	
Noise *8	70.2 dB	
Robot mass	39kg	

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

- On controller display, axis 1 to 6 is displayed as J1 to J6 for each.

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

- Explosion-proof is not available.

*1: Allowable moment of inertia of wrist changes due to the load conditions of wrist. *2: This value conforms to "JIS B 8432".

*3: Working envelop is limited when wall mount and tilted mount. (Example; axis 1 working envelop is ±30° in case of wall mount)

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

*5: Liquid such as organic compound, acidity, alkalinity, chlorine or gasoline cutting fluid which deteriorates the seal material are not available to use.

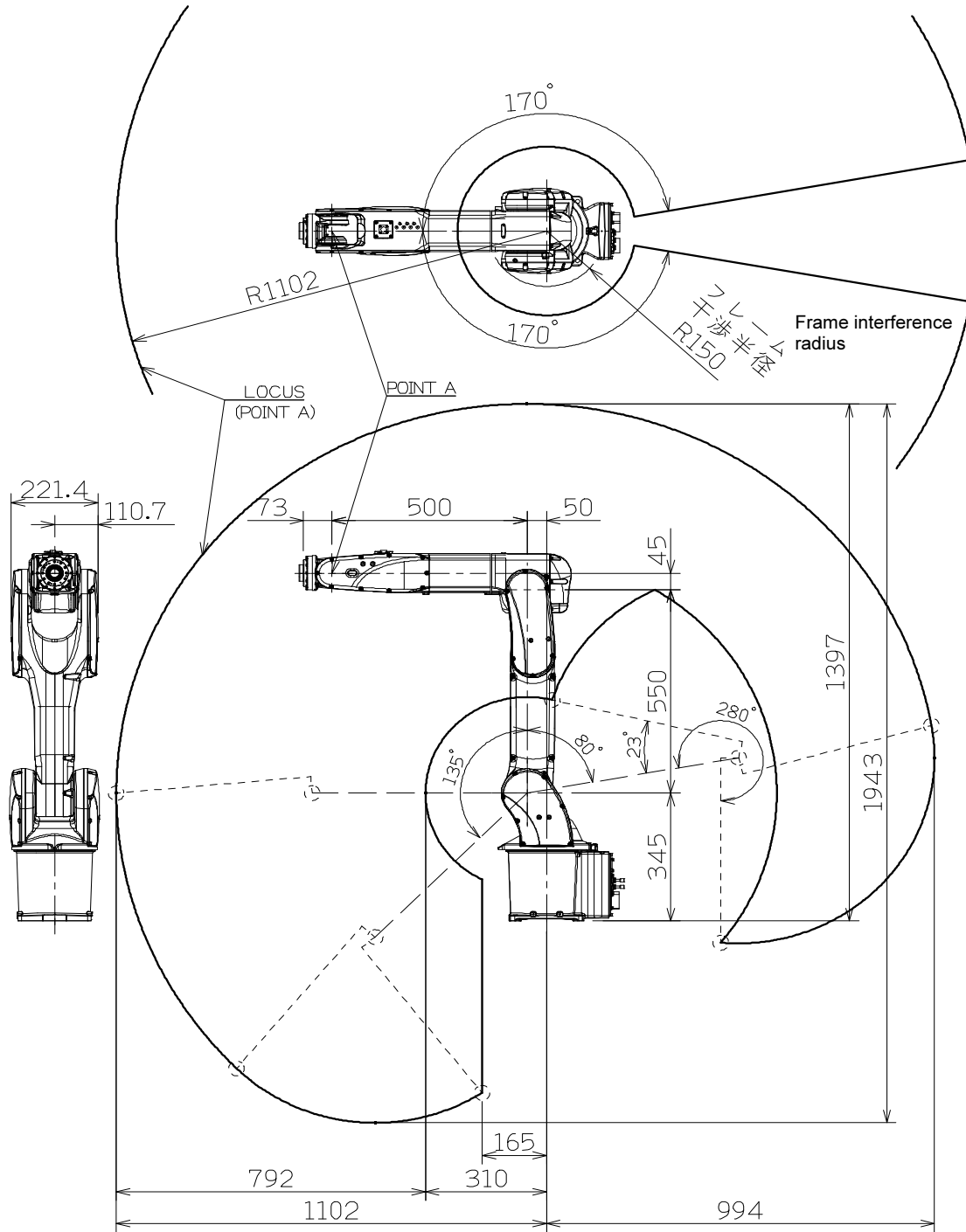
*6: The "Max. speed" in this table is the available maximum value and will change depending on the work-program and the wrist load condition.

*7: If this cleanliness needs to be kept, use robot in a clean room where down flow air exists. Robot is not dust-tight packaged. If robot is used in clean room, abrasive or fine particles shall be removed before carrying it in clean room.

*8: Robot noise is A-weighted equivalent sound level measured under "JIS Z 8737-1" (ISO 11201) with max. payload and max. speed.


2. Dimensions

【MZ03EL-02】

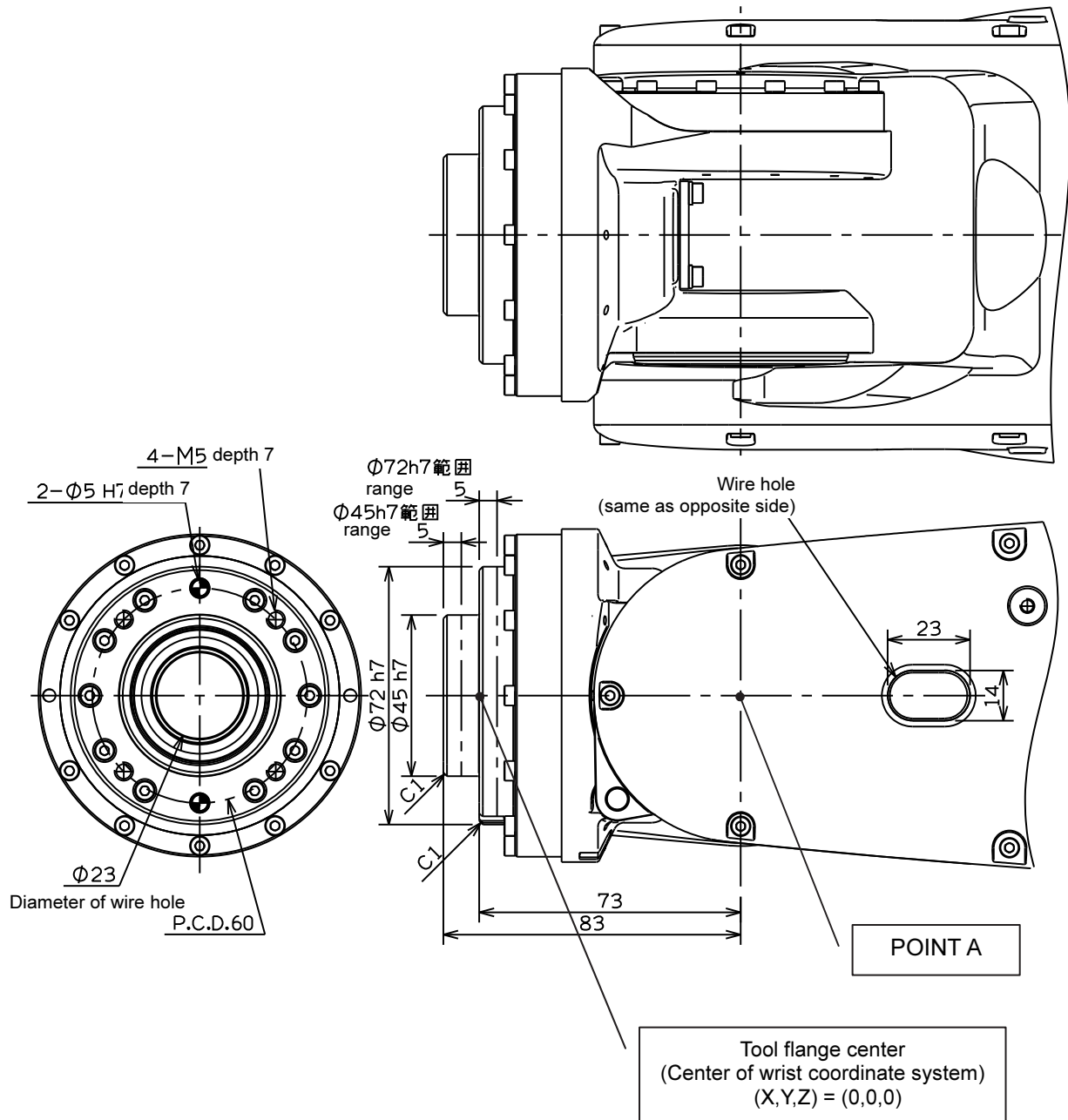


3. Details of load mounting face








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

 CAUTION	<p>Be sure to screw the M5 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.</p>
---	--

【MZ03EL-02】



4. Installation procedure

 WARNING	To install the robot, it is important to position the robot so that no workers will get pinched by the robot inside or around a device to use the robot. The robot must not come into contact with any peripheral equipment when operating in the maximum operating range with a tool mounted on it.
 WARNING	Be sure to install the robot according to the specified procedure. Otherwise it will cause the robot to move or topple over while in operation, thus inducing an imminent hazardous situation.
 WARNING	To make wire connections between the robot and the controller or the peripheral equipment, fully understand the connection procedure for proper wire connections. Making wire connections according to improper procedure will cause the robot to malfunction.
 WARNING	Be sure to establish a proper ground for the robot. If equipment such as a welder that causes substantial noises is needed to use, establish the specified ground for the equipment.
 WARNING	During transport or installation 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.
 IMPORTANT	Robot is not dust-tight packaged. If robot is used in clean room, abrasive or fine particles shall be removed before carrying it in clean room. It is recommended that robot should be cleaned by swabbing with isopropyl alcohol (IPA). Use of other solvents or pure water could contribute rust or peel of coating materials.
 IMPORTANT	It is to be noted that cleanliness of robot is worse if it has operated in poor conditions for a long time or if it has been left as it was.

■ Installation location and ambient conditions

Conditions (temperature, humidity, height and vibration) are written in “1. 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.

	Standard mount
Thickness of floor concrete	Not less than 150 mm
Installation parts *1	4 bolts of M10 X 30 (JIS: Strength class 12.9) 4 plain washers of not less than 3.2 mm in thickness and HRC35 in hardness
Tightening torque *2	67 N·m
Allowable repeated tensile *3	Approximately 700 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.

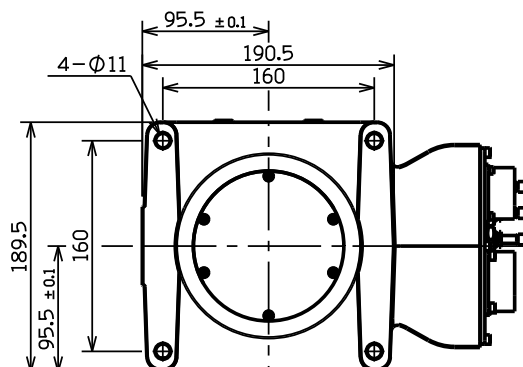
■ Installation space

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

 WARNING	The mechanical stopper end is located in a position exceeding the specified working envelope (software limit) of axis 1. To install the safety fence, with consideration given to the wrist configuration and the shape of tool.
 WARNING	On axis 1, 2 and 3, the robot working envelope can be regulated for safety. Optional part is necessary to enable this function.

Standard mount

【MZ03EL-02】



■ Accuracy of installation surface

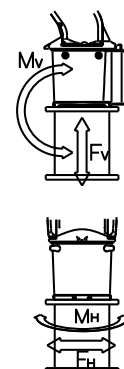
When installing robot, strictly observe precautions listed below to cause no deformation in the base.

- (1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 0.2 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 0.2 mm (±0.1 mm).



■ Maximum robot generative force

Robot model	Maximum Vertical generative force F_V	Maximum horizontal generative force F_H	Maximum Vertical generative moment M_V	Maximum horizontal generative moment M_H
MZ03EL-02	1,900N	1,400N	1,400Nm	1,200Nm



5. Allowable wrist load



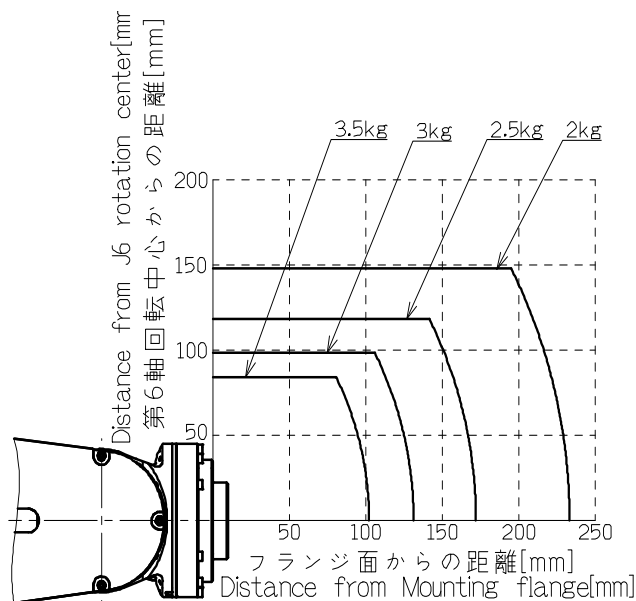
CAUTION

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 “1. Basic specifications” and following figures for the detail of each specification.

■ Torque map for wrist load

Use the robot under condition that COG of wrist load falls in the range shown below.

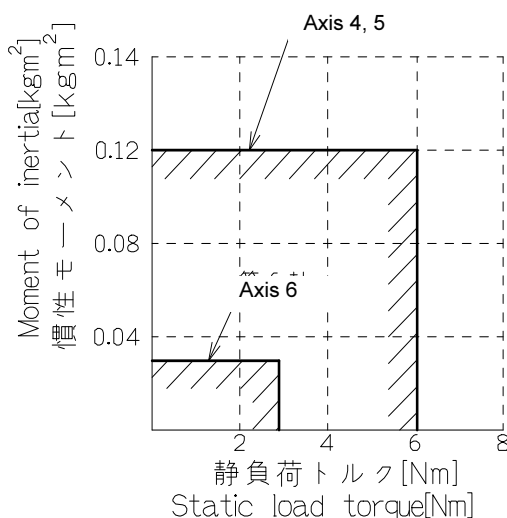
【MZ03EL-02】



■ Moment of inertia map for wrist load

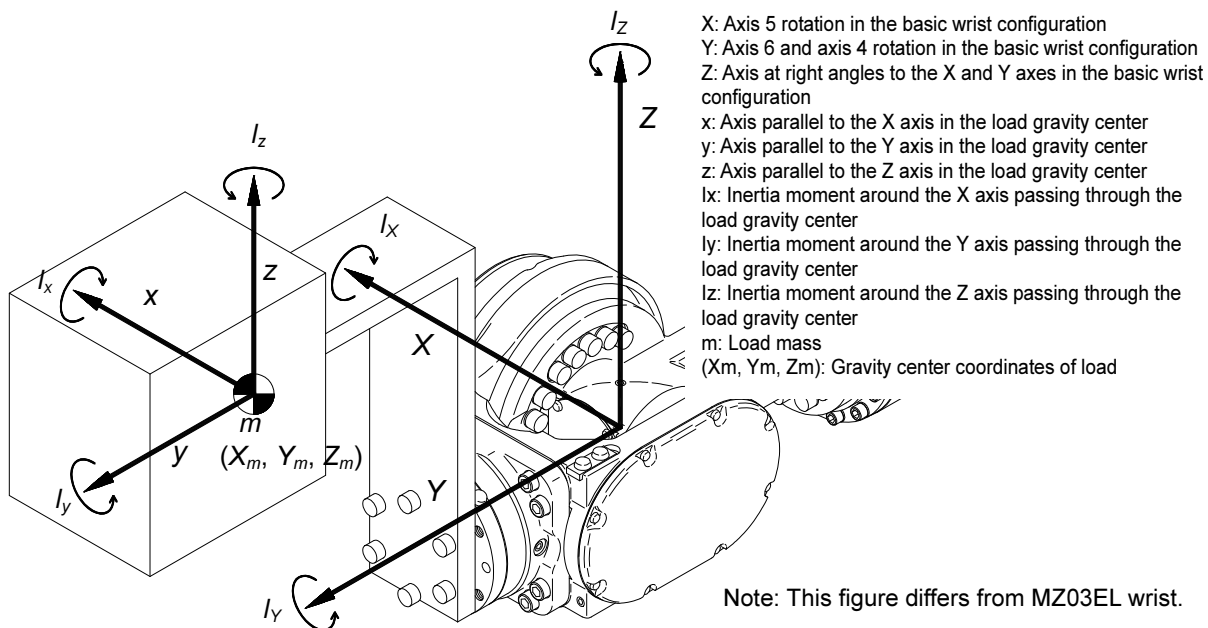
Use the robot under condition that static load torque and moment of inertia fall in the range shown below.

【MZ03EL-02】



■ How to find the inertia moment of each axis

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



X: Axis 5 rotation in the basic wrist configuration
 Y: Axis 6 and axis 4 rotation in the basic wrist configuration
 Z: Axis at right angles to the X and Y axes 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
 Ix: Inertia moment around the X axis passing through the load gravity center
 Iy: Inertia moment around the Y axis passing through the load gravity center
 Iz: Inertia moment around the Z axis passing through the load gravity center
 m: Load mass
 (Xm, Ym, Zm): Gravity center coordinates of load

• Inertia moment around axis 6

$$I_{J6} = I_y = m \cdot (X_m^2 + Z_m^2) + I_y$$

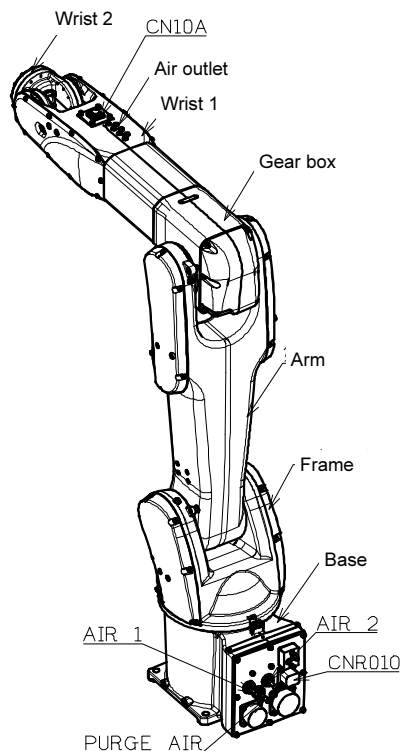
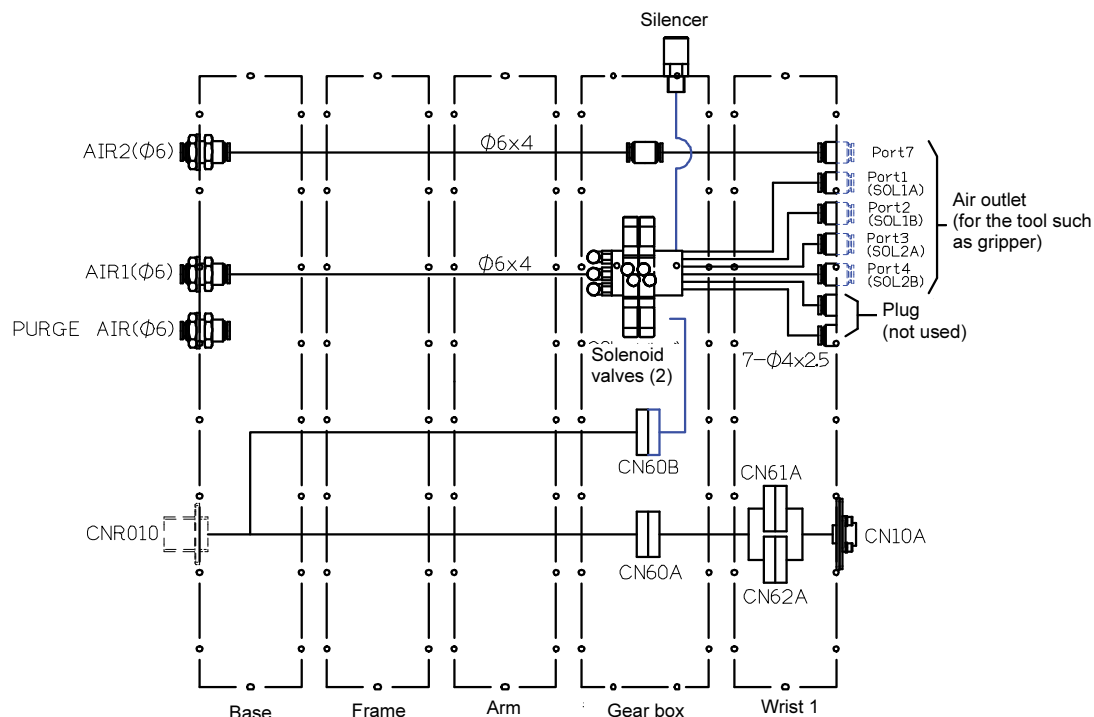
• Inertia moment around axis 4 and axis 5 (The inertia moment around axis 4 and axis 5 varies with axis 6 configuration. Consequently, in order to simplify the calculation, take a maximum value around the X and Z axes in above figure, as the inertia moment.)

$$I_{J4J5} = \max (I_X , I_Z)$$

$$\because I_X = m \cdot (Y_m^2 + Z_m^2) + I_x$$

$$\because I_Z = m \cdot (X_m^2 + Y_m^2) + I_z$$

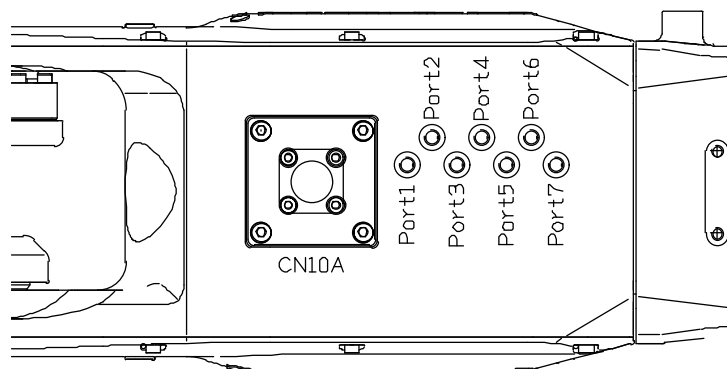
6. Application wiring and tube diagram



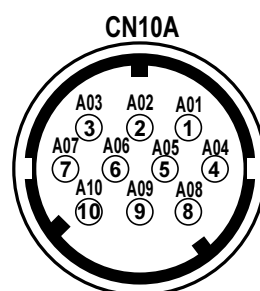
Note

- 2 solenoid valves are installed in gear box as standard
- Solenoid valve; Type SYJ3220-5GR-M3 (SMC), 2 position double solenoid, Coil voltage DC24V, Consuming power 0.35W, With surge voltage protector circuit (no pole), No-lock push type manual operation, Without sub-plate for tube, Without bracket (Pressure range : 0.1 to 0.5MPa, Coil voltage : DC24V)

■ Detailed diagram of application connectors (standard)



	6	5	4	3	2	1
D	G	A20	A19	A18	A17	A16
C		A15	A14	A13	A12	A11
B	A22	A10	A09	A08	A07	A06
A	A21	A05	A04	A03	A02	A01



Connector CNR010 on base
 Tyco AMP 1939839-1, 1939840-1, 1903112-2
 Partner connector type
 Tyco AMP 1939847-1, 1939850-1, 1827570-2

Connector CN10A on wrist 1
 JAE JN1AS10ML1-R
 Partner connector type
 JAE JN1DS10SL2

7. Options

No.	Item	Specifications	Parts No.	Notes
1	Adjustable stopper	Restriction of axis 1 to 3 working envelope	OP-S5-025	
2	Transfer jig	Common for crane transporting, inverted and wall mount	OP-S2-042	
3	Tools	Zeroing pin & Zeroing block	OP-T2-078	
4	Solenoid valve *1 (equipped as standard)	2 valves	OP-H5-008	Pressure range : 0.1 to 0.5MPa Coil voltage : DC24V
5	Wires clamp *2	Clamp for wires and air tubes inside axis 6 hole	OP-W3-012	Air (φ4: 7 lines), signals
6	ISO flange *3	P.C.D.31.5	OP-W2-012	

*1: Solenoid valve; Type SYJ3220-5GR-M3 (SMC), 2 position double solenoid, Coil voltage DC24V, Consuming power 0.35W, With surge voltage protector circuit (no pole), No-lock push type manual operation, Without sub-plate for tube, Without bracket

*2: This option includes flange1, flange2, clamp, and bolts (4-M5x20), and positioning pin MDP-5x25.

*3: This option includes ISO flange and installation bolts (4-M5x15).

8. Delivery style

	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)

9. Paint color

Standard color	Robot cover and wrist 1	Munsell 6.5PB9/1
	Arm	Munsell N5.5
	Base	Munsell N2

.5

10. Warranty

Elapse of 1 year after delivery.

But following case is out of warranty even within warranty term.

- 1) Damage happened because robot was used under condition of exceeding robot specification or reduction gear specification or motor specification.
- 2) Damage happened because of customer's controller trouble or peripheral equipment (for example; primary power).
- 3) Damage happened because robot was used under condition that its lifespan is estimated shorter than 1 year.

11. Special notes

- 1) Mechanical lifespan of robot greatly varies due to its speed and acceleration which is determined by the command of controller. In order to secure mechanical lifespan, please be sure to control robot properly.

- 2) Following features are different due to its shipped date.

Feature	Shipped on 2014 (Proto model)	Shipped on 2015 or after
Encoder temperature sensor	Supported	Supported
Lubrication port for main bearing of main axes reduction gear	Not supported	Supported

- 3) AS for the features not written in this specification sheet, NACHI and customer will need further discuss about them and write them in this sheet if necessary.
- 4) NACHI will submit another document which contains specification of encoder, motor, reduction gear, mass and inertia model, electric wiring and or so.

NACHI NACHI-FUJIKOSHI CORP.		http://www.nachi-fujikoshi.co.jp/	
Japan Main Office	Phone: +81-3-5568-5245	Fax: +81-3-5568-5236	Shiodome Sumitomo Bldg. 17F, 1-9-2 Higashi-Shinbashi Minato-ku, TOKYO, 105-0021 JAPAN
Nachi Robotic Systems Inc. (NRS)		http://www.nachirobotics.com/	
North America Headquarters	Phone: 248-305-6545	Fax: 248-305-6542	22285 Roethel Drive, Novi, Michigan 48375-4700 U.S.A.
Training Office	Phone: 248-334-8250	Fax: 248-334-8270	22213 Roethel Drive, Novi, Michigan 48375 U.S.A.
Greenville Service Office	Use 248-305-6545	Use 248-305-6542	South Carolina, U.S.A.
San Antonio Service Office	Use 248-305-6545	Use 248-305-6542	Texas, U.S.A.
Kentucky Branch Office	Phone: 502-695-4816	Fax: 502-695-4818	116 Collision Center Drive, Suite A, Frankfort, KY 40601 U.S.A
Toronto Branch Office	Phone: 905-760-9542	Fax: 905-760-9477	89 Courtland Avenue, Unit 2, Vaughan, Ontario L4K3T4 CANADA
Mexico Branch Office	Phone :+52-555312-6556	Fax:+52-55-5312-7248	Urbina # 54, Parque Industrial Naucalpan, Naucalpan de Juarez, 53370, Estado de México, MEXICO
Saltillo Service Office	Phone :+52-844416-8053	Fax: +52-844416-8053	Canada 544 Privada Luxemburgo C. P. 25230, Saltillo, Coahuila, MEXICO
NACHI EUROPE GmbH		http://www.nachirobotics.eu/	
Central Office Germany	Phone: +49-2151-65046-0	Fax: +49-2151-65046-90	Bischofstrasse 99, 47809, Krefeld, GERMANY
U.K. branch	Phone: +44-0121-423-5000	Fax: +44-0121-421-7520	Unit 3, 92, Kettles Wood Drive, Woodgate Business Park, Birmingham B32 3DB, U.K.
Czech branch	Phone: + 420-255-734-000	Fax: +420-255-734-001	Obchodni 132, 251 01 Cestlice, PRAGUE-EAST CZECH REPUBLIC
NACHI AUSTRALIA PTY. LTD.		http://www.nachi.com.au/	
Robotic Division & Victoria office	Phone: +61-(0)3-9796-4144	Fax: +61-(0)3-9796-3899	38, Melverton Drive, Hallam, Victoria 3803, , AUSTRALIA
Sydney office	Phone: +61-(0)2-9898-1511	Fax: +61-(0)2-9898-1678	Unit 1, 23-29 South Street, Rydalmere, N.S.W, 2116, AUSTRALIA
Brisbane office	Phone: +61-(0)7-3272-4714	Fax: +61-(0)7-3272-5324	7/96 Gardens Dr,Willawong,QLD 4110, , AUSTRALIA
NACHI SHANGHAI CO., LTD.		http://www.nachi-korea.co.kr/	
Shanghai office	Phone: +86-(0)21-6915-2200	Fax: +86-(0)21-6915-2200	11F Royal Wealth Centre, No.7 Lane 98 Danba Road Putuo District, Shanghai 200062, China
NACHI KOREA		http://www.nachi-korea.co.kr/	
Seoul office	Phone: +82-(0)2-469-2254	Fax: +82-(0)2-469-2264	2F Dongsan Bldg. 276-4, Sungsu 2GA-3DONG, Sungdong-ku, Seoul 133-123, KOREA

Copyright NACHI-FUJIKOSHI CORP.

Robot Division

1-1-1, FUJIKOSHIHONMACHI, TOYAMA CITY, JAPAN 930-8511
Phone +81-76-423-5137
Fax +81-76-493-5252

NACHI-FUJIKOSHI CORP. holds all rights of this document. No part of this manual may be photocopied or reproduced in any form without prior written consent from NACHI-FUJIKOSHI CORP. Contents of this document may be modified without notice. Any missing page or erratic pagination in this document will be replaced.

In case that an end user uses this product for military purpose or production of weapon, this product may be liable for the subject of export restriction stipulated in the Foreign Exchange and Foreign Trade Control Law. Please go through careful investigation and necessary formalities for export.

Original manual is written in Japanese.

NACHI-FUJIKOSHI CORP. ©