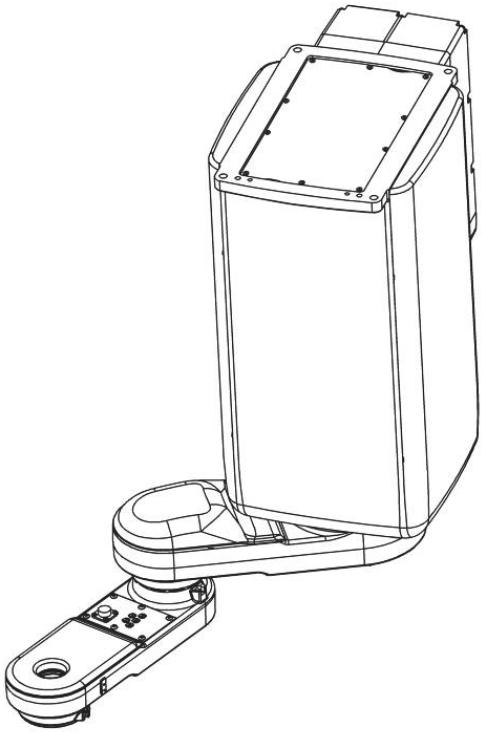
NACHI

Standard specifications

EZ03V4-02/EZ03F4-02

[for CFDL1/L2/L4 controller]

3rd edition



NACHI-FUJIKOSHI CORP.

1605, SEZEN-093-003, 001

NACHI

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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.

"EZ03 series" is a small, simple structure, high speed and high accuracy SCARA type robot which are optimal for assembling, material handling and other application. Because of the hollow structured arm wrist, simplified wiring from the robot body to the tool is possible. This can reduce the wiring burden of customer.

EZ series has 2 kinds of specification, one is Suspended ceiling specification and other is Floor specificcation. And each type has 2 different kinds of upper and lower stroke as shown below.

		Z axis stroke 250mm	Z axis stroke 150mm
4 axis	Suspended ceiling specification (Reach 450mm)	EZ03V4-02-4525	EZ03V4-02-4515
	Floor specification (Reach 550mm)	EZ03F4-02-5525	EZ03F4-02-5515

2. Basic specifications

2.1 Basic specification of Robot body（4 axes）

Item		Specifications			
Robot model		EZ03V4-02 -4525	EZ03V4-02 -4515	EZ03F4-02 -5525	EZ03F4-02 -5515
Construction		SCARA			
Number of axis		4			
Drive system		AC servo motor			
Max. motion range	Axis 1	250mm	150mm	250mm	150mm
	Axis 2	±170 °			
	Axis 3	±180 °		±145 °	
	Axis	±360 °			
	Axis 5	---			
	Axis 6	---			
Max. speed *5	Axis 1	1400mm/s	1200 mm/s	1400mm/s	1200mm/s
	Axis 2	450 °/s			
	Axis 3	720 °/s			
	Axis 4	2400 °/s			
	Axis 5	---			
	Axis 6	---			
Max. pay load		2 kg (3 kg)			
Max. allowable moment of inertia of wrist *1	Axis 4	0.05 kg·m^2 (Rated 0.005 kg·m^2)			
	Axis 5	---			
	Axis 6	---			
Position repeatability *2		±0.014mm			
Max. reach		450mm		550mm	
Air piping		φ6×2			
Application signal wires		10 wires			
Installation		Ceiling setting		Floor setting	
Ambient conditions		Temperature: 0 to 45 ºC *3 Humidity: 20 to 85%RH (No dew condensation allowed) Vibration to the installation surface: Not more than 0.5G (4.9 m/s2)			
Dust-proof / Drip-proof performance *4		IP20			
Noise level *6		70 dB			
Robot mass		42kg		43kg	

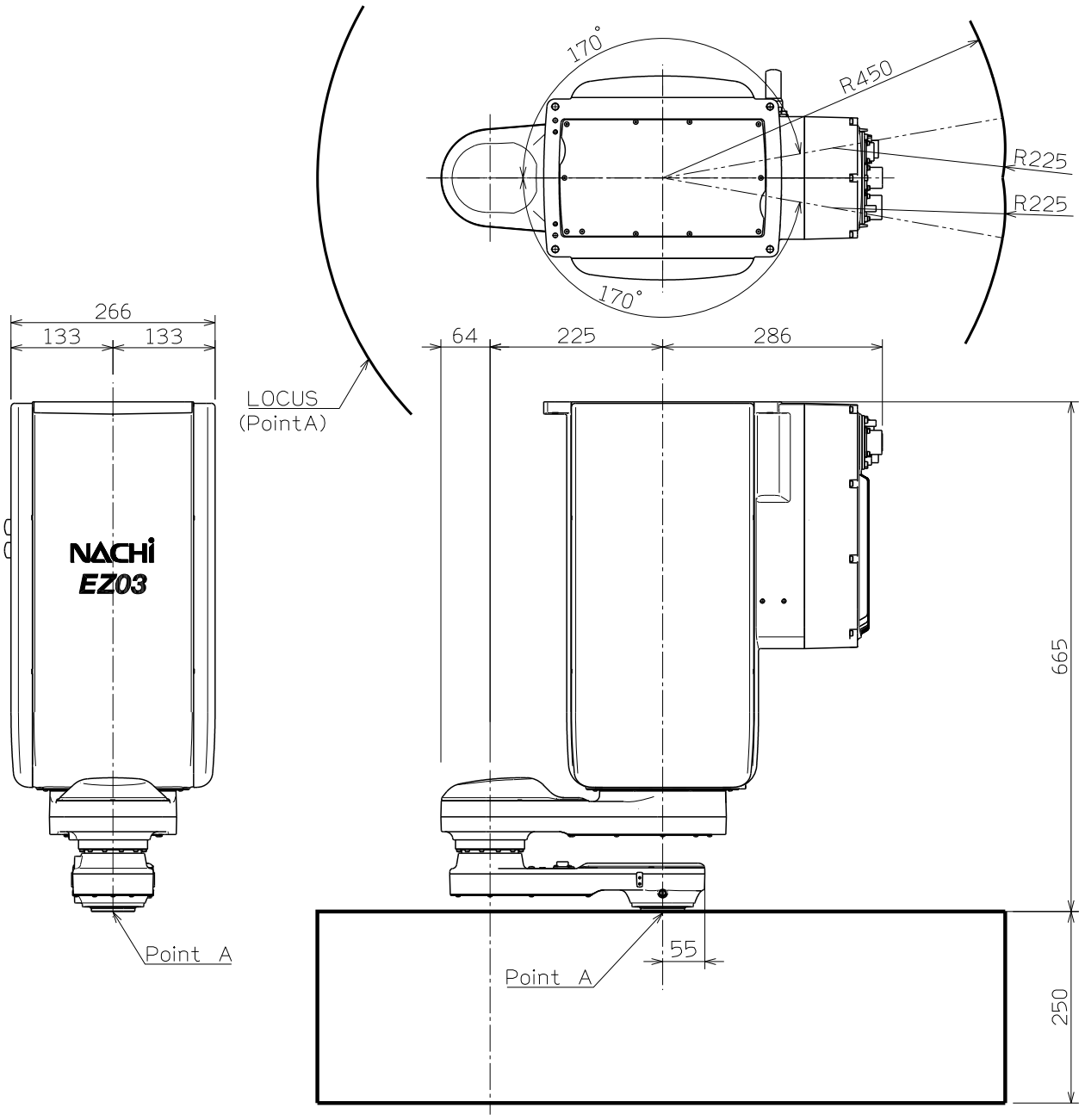
1[rad] = 180/π[°], 1[N·m] = 1/9.8[kgf·m]
- On controller display, axis 1 to 6 is displayed as J1 to J6 for each.
- The specification and externals described in this specification might change without a previous notice for the improvement
- Explosion resistance is not available.

*1: The Allowable moment of inertia of a wrist changes with 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.
* *4: Liquid such as organic compound, acidity, alkalinity, chlorine or gasoline cutting fluid which deteriorates the seal material are not available to use.
*5: Max. speed on the table shown is maximum value, so it changes depending on the work program and condition of wrist load.
*6: A load equivalent noise level, measured according to the JIS Z 8737-1 (ISO 11201).（Operation at rated load and Max. speed）

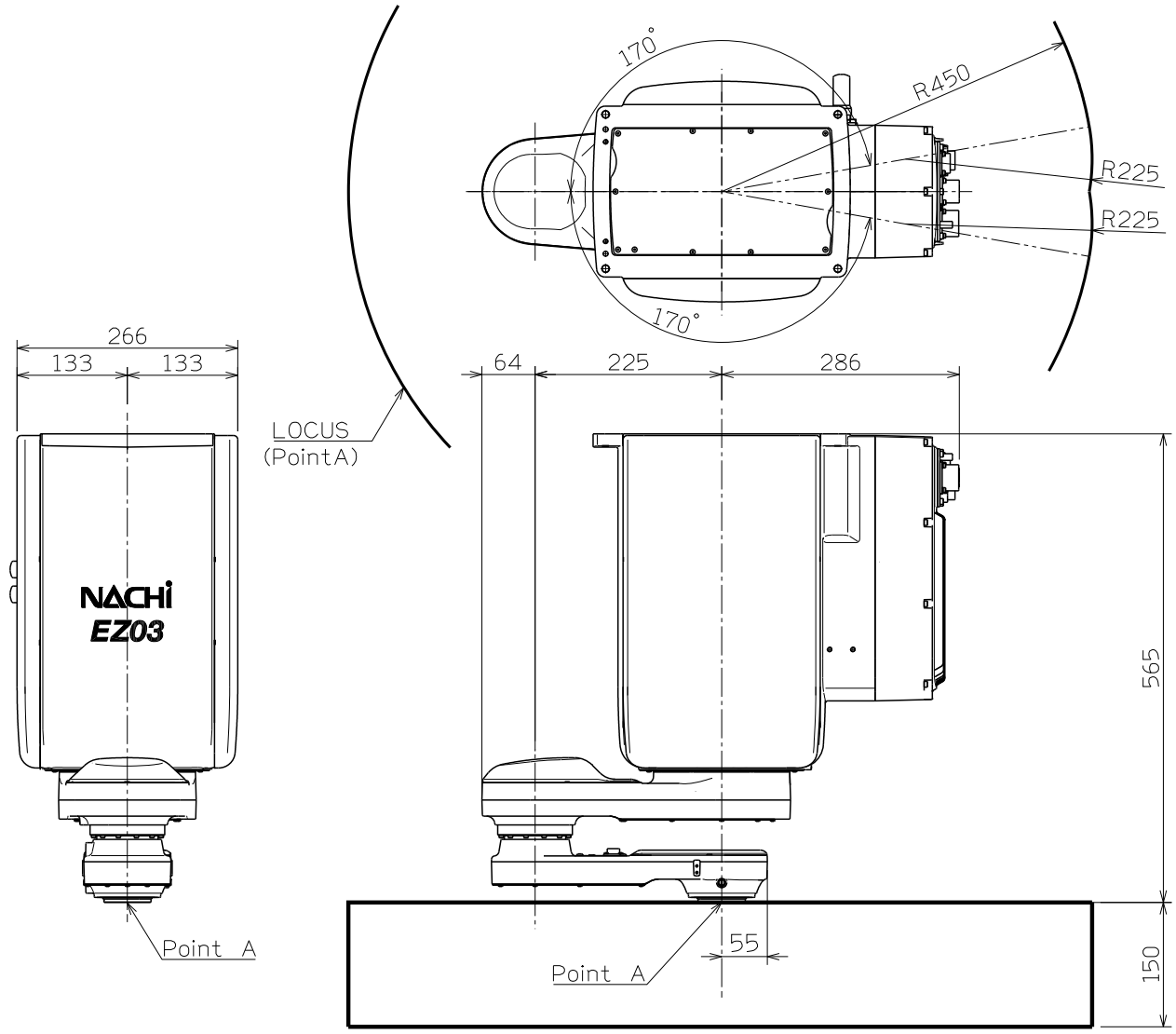
3. Dimensions

3.1 Robot dimensions and Motion range

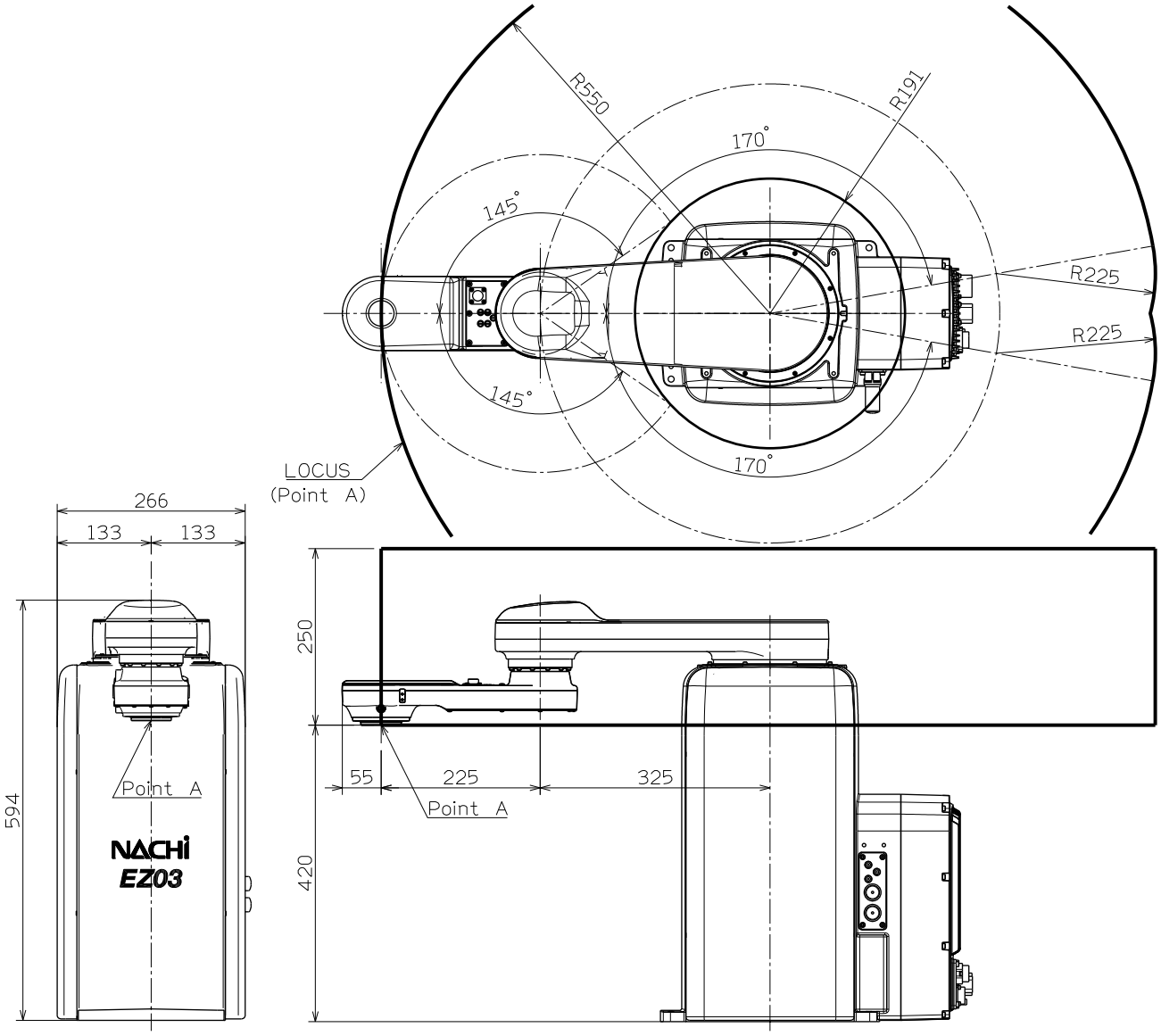
【EZ03V4-02-4525】Ceiling setting



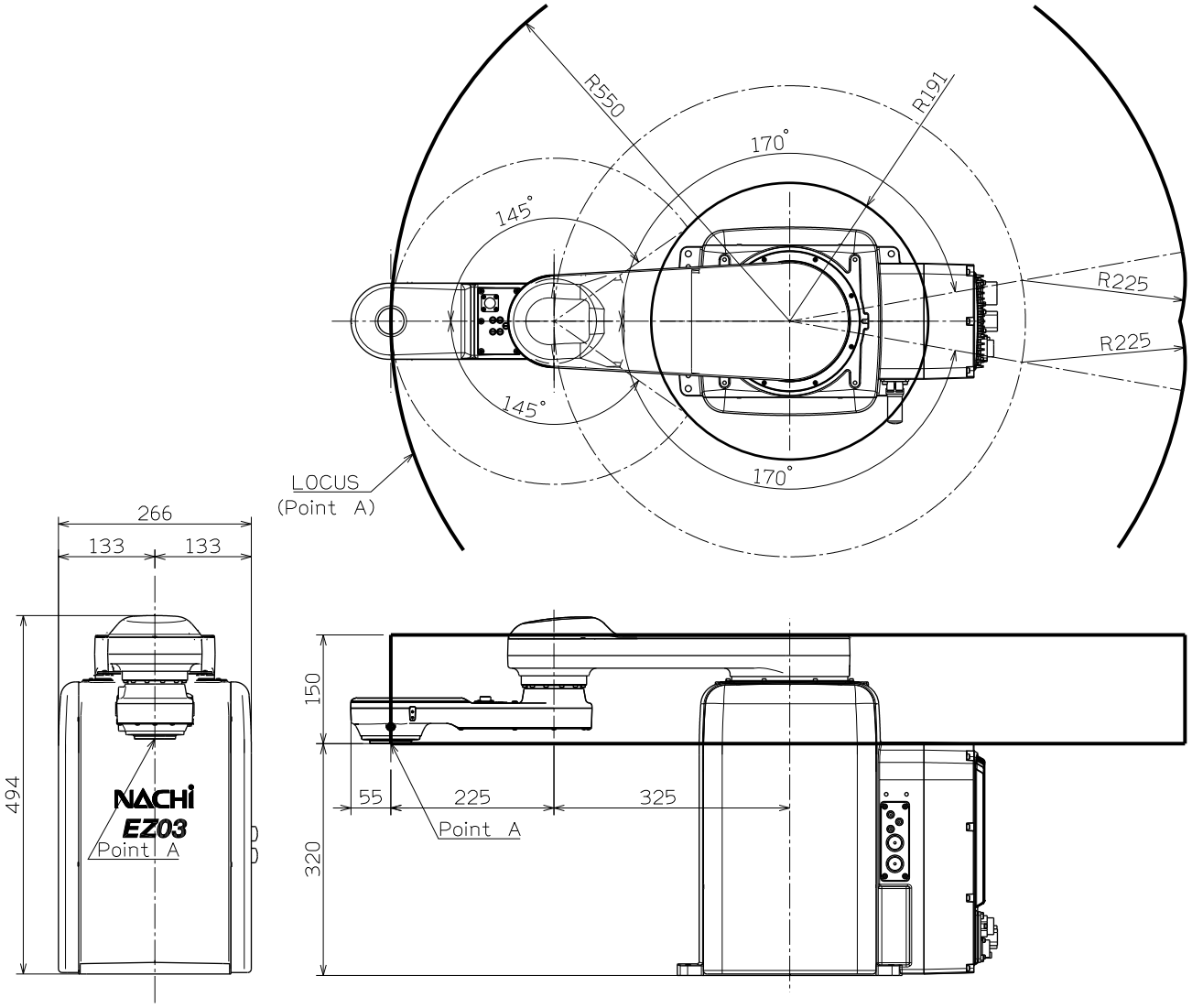
【EZ03V4-02-4515】 Ceiling setting



【EZ03F4-02-5525】 Floor setting

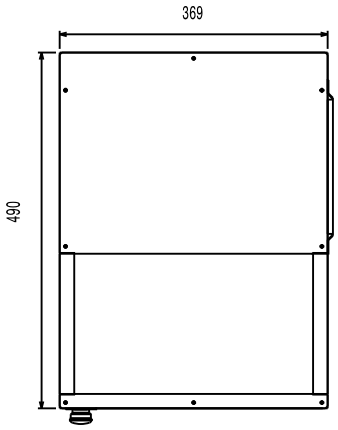


【EZ03F4-02-5515】 Floor setting

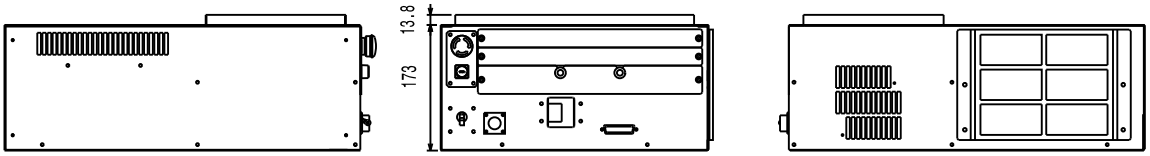


3.2 CFDL1 Controller dimensions and Teach pendant appearance

■Controller cabinet (CFDL1)



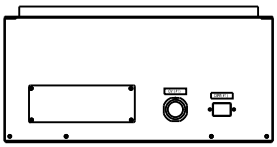
Top view



Left side view

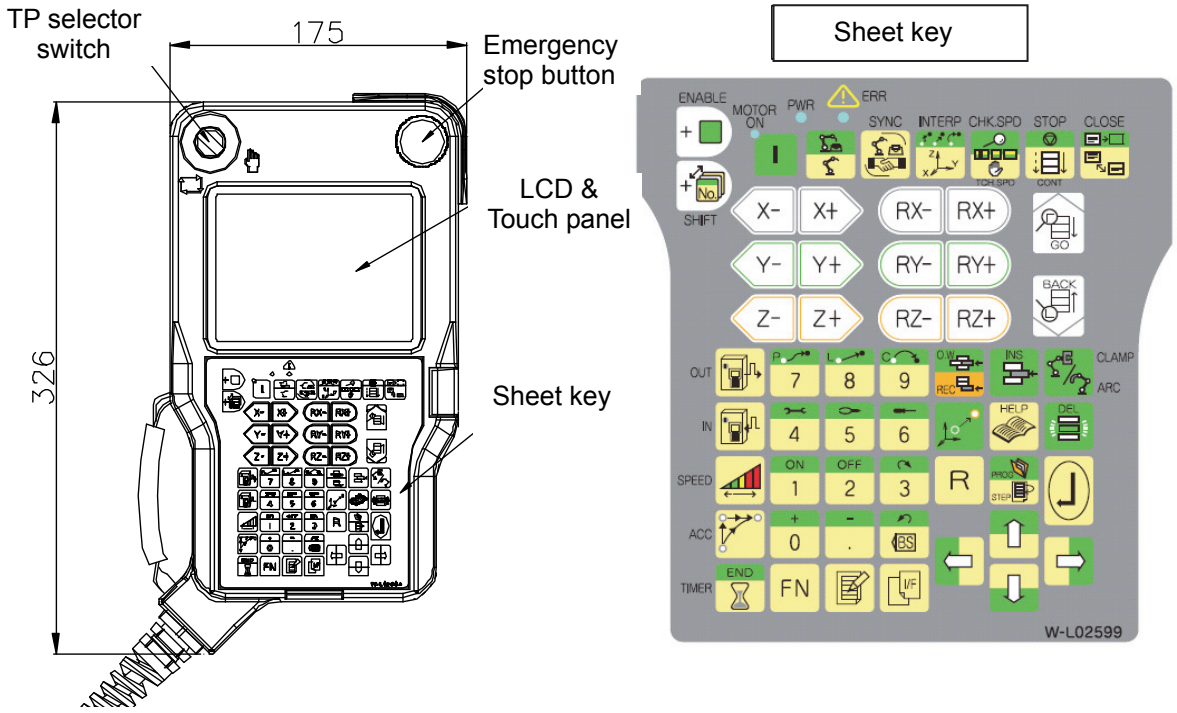
Front view

Right side view



Rear view

■ High Performance Teach Pendant

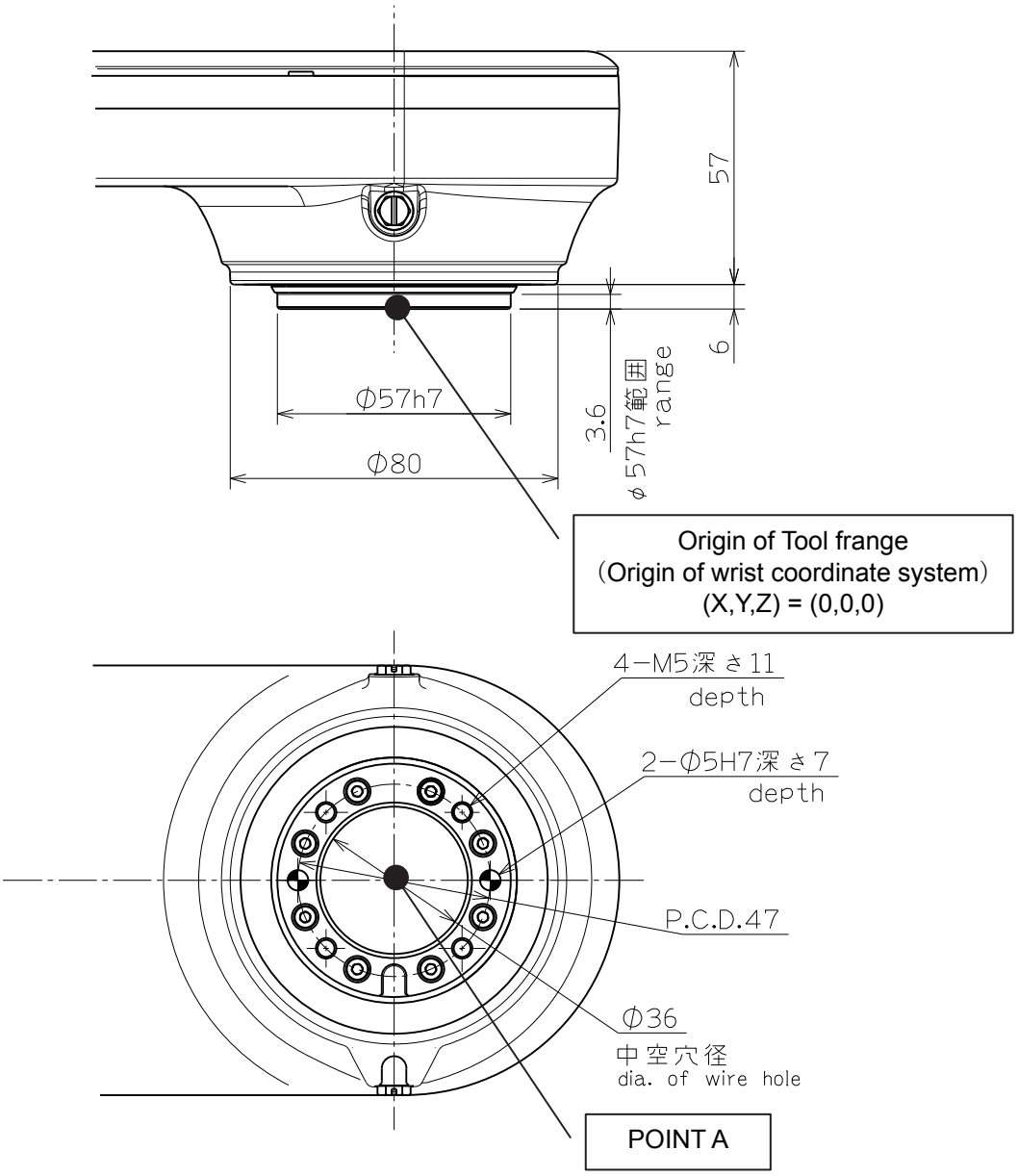


4. Details of load mounting surface

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

CAUTION	Be sure to screw the M5 tool fixing bolts in the wrist not deeper than the screw depth in the mounting surface. Screwing the bolts deeper than the screw depth may damage the wrist.

【EZ03V4-02-4525】【EZ03V4-02-4515】【EZ03F4-02-5525】【EZ03F4-02-5515】



5. Installation procedure

5.1 Installation of Robot body

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 grounding for the robot. If equipment such as a welder that causes substantial noises is needed to use, establish the specified grounding 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-proof 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 "Chapter 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.

Thickness of floor concrete	Not less than150mm
Installation parts *1	4 bolts of M8 X 25 (JIS: Strength class 12.9) 4 plain washers of not less than 2.3mm in thickness
Tightening torque	33.3 N･m
Allowable repeated tensile *2	Approximately 800 N

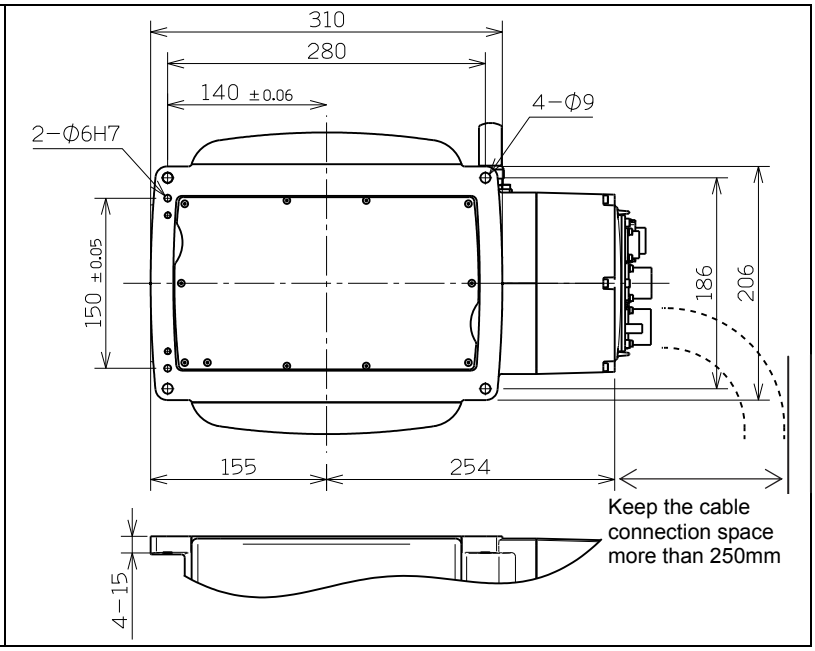
*1 : Installation parts are not accessory of robot.
*3 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

■ **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 motion range (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 motion range can be regulated for safety. Optional part is necessary to enable this function.

【EZ03V4-02-4525】
【EZ03V4-02-4515】
【EZ03F4-02-5525】
【EZ03F4-02-5515】

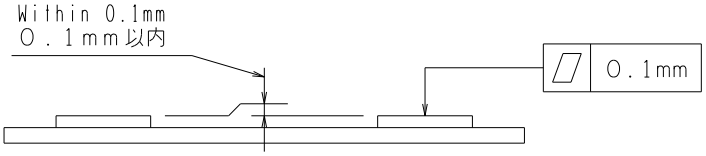


■ **Accuracy of installation surface**

When installing robot, strictly observe precautions listed below to cause no distortion on the base.

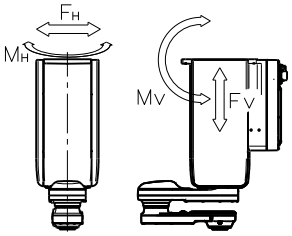
(1) Make the deviation from the flatness of the 4 plates on the robot installation surface fall within 0.2 mm.

(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).



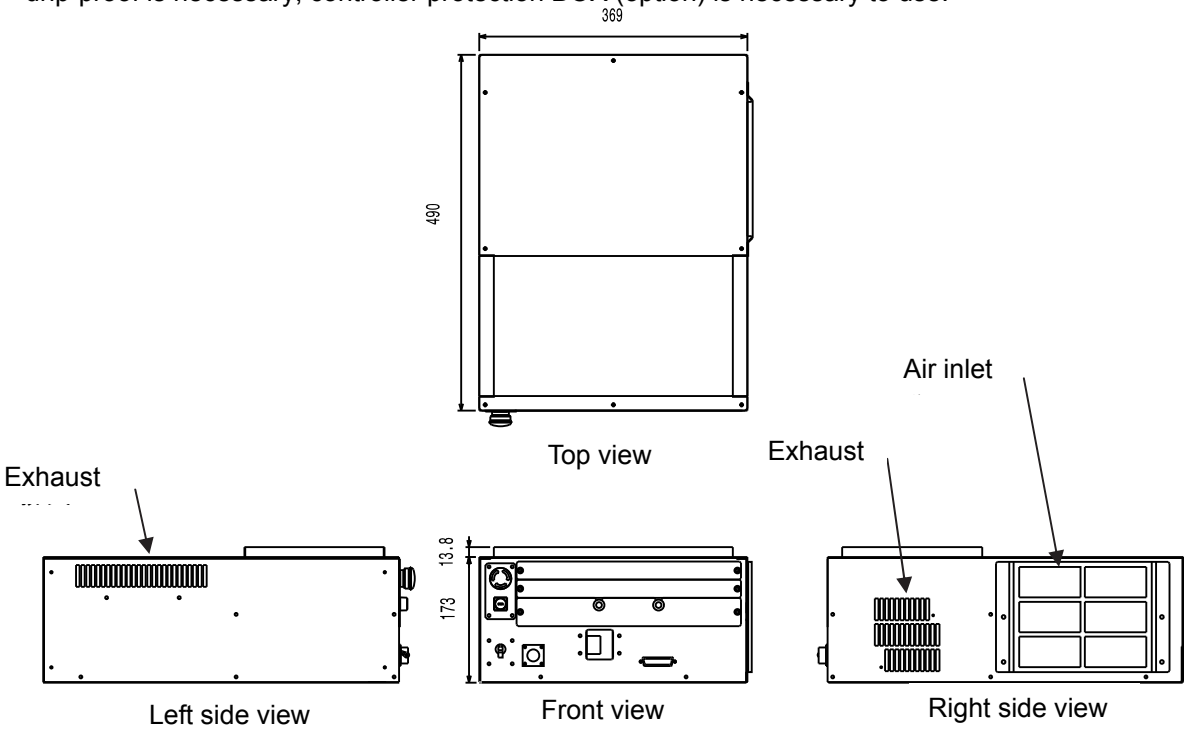
■ **Maximum robot generative force**

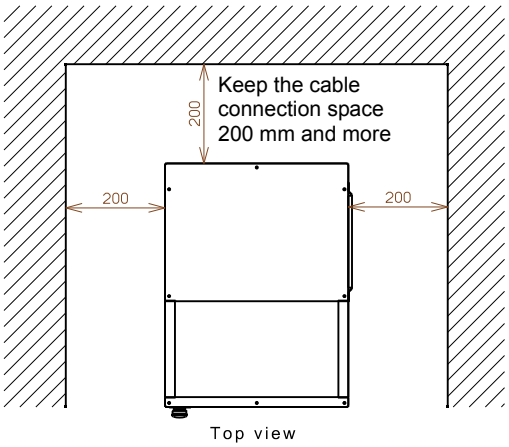
Robot model	Maximum Vertical generative force F_V	Maximum horizontal generative force F_H	Maximum Vertical generative moment MV	Maximum horizontal generative moment M_H
【EZ03V4-02-4525】 【EZ03V4-02-4515】 【EZ03F4-02-5525】 【EZ03F4-02-5515】	700N	500N	200Nm	200Nm

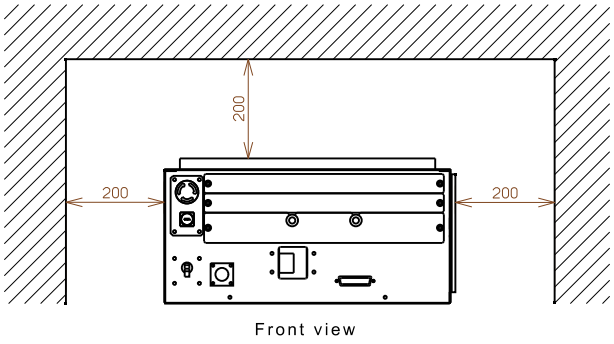


5.2 Installation of Controller (CFDL1)

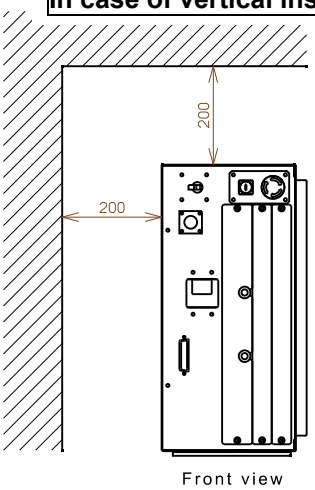
Keep a clearance of at least 200 mm between the CFDL1 controller and the wall behind it in order to ensure proper ventilation. CFD controller is not dust-proof drip-proof. If dust-proof and drip-proof is necessary, controller protection BOX (option) is necessary to use.







In case of vertical installation

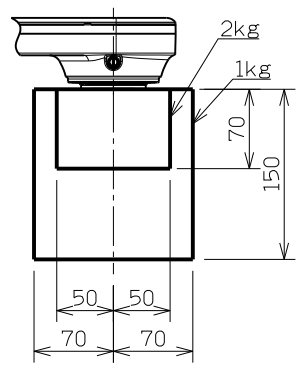
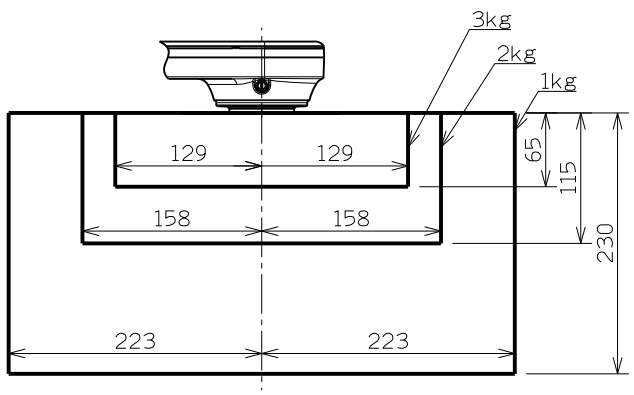


6. Allowable wrist load

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 "2. Basic specifications" and following figures for the detail of each specification.

■ **Torque map for wrist load**

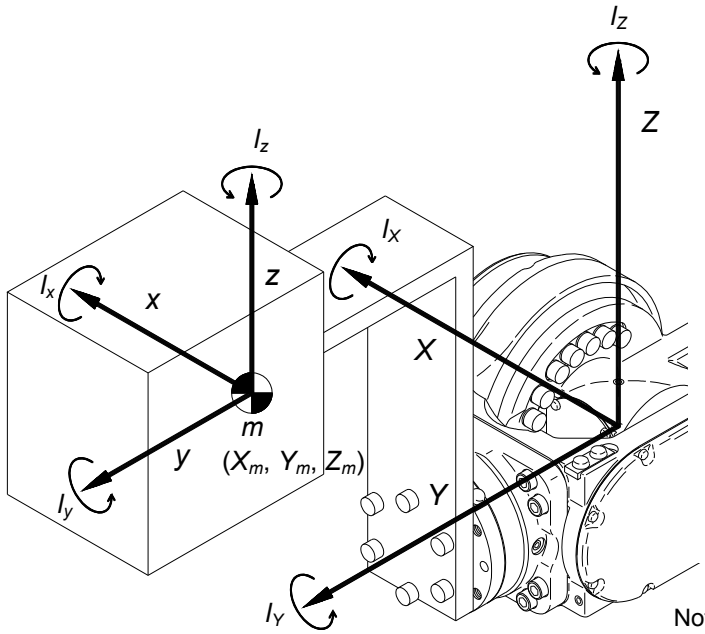
Use the robot under condition that COG of wrist load falls in the range shown in the torque map.

	Rated condition	Max.condition *1
【EZ03V4-02-4525】 【EZ03V4-02-4515】 【EZ03F4-02-5525】 【EZ03F4-02-5515】		

*1: Speed and/or acceleration are automatically limited.

6.1 ■ 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

Note: This figure differs from EZ03 wrist.

・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.)

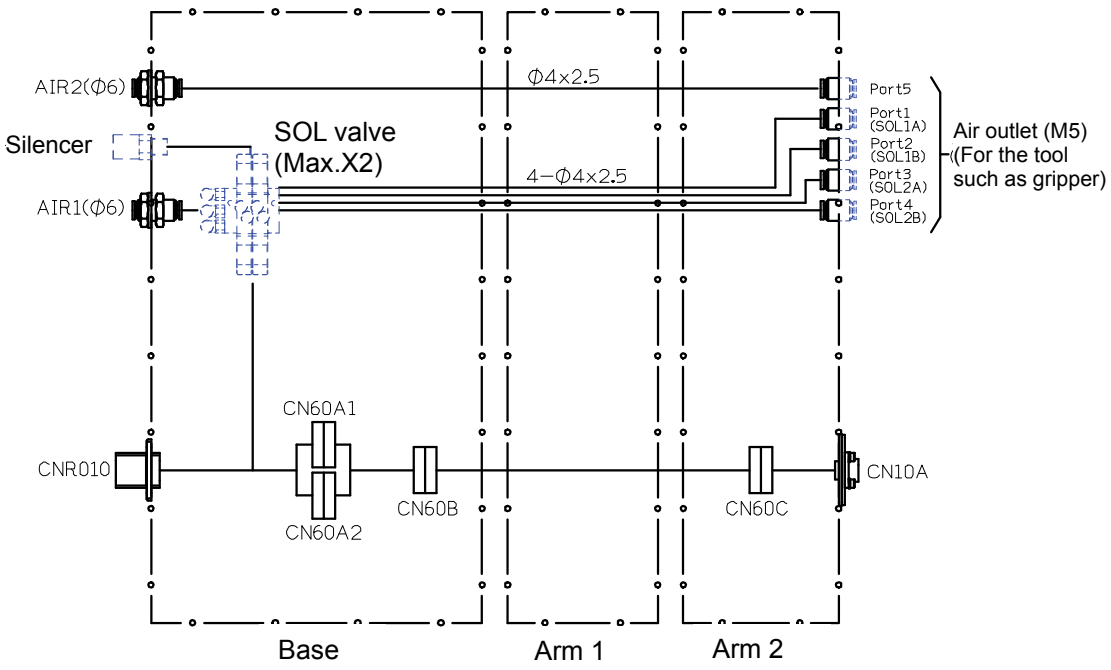
$$I_{J4J5} = \max (I_X , I_Z)$$

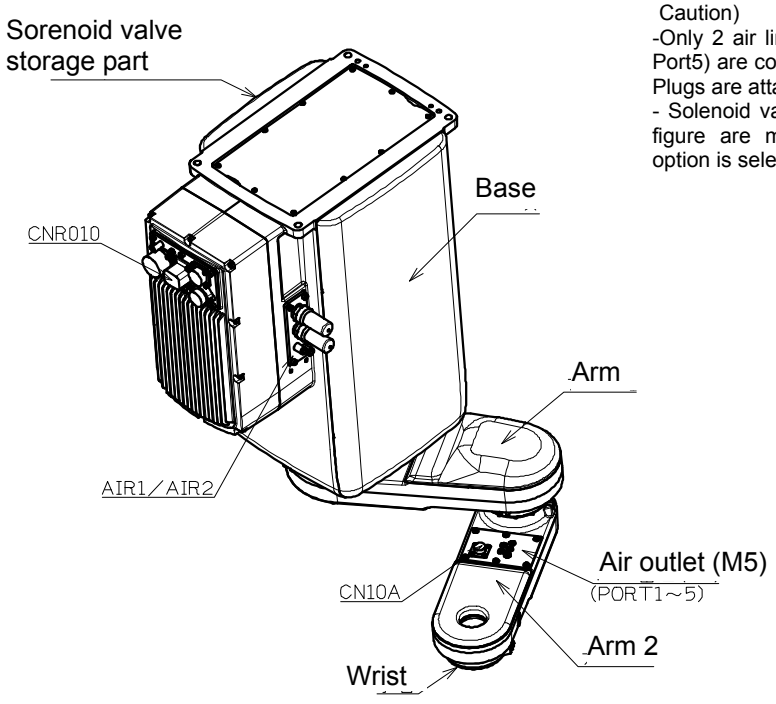
$$\because I_X = m \cdot (Y_m{}^2 + Z_m{}^2) + I_x$$

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

7. Application wiring and tube diagram

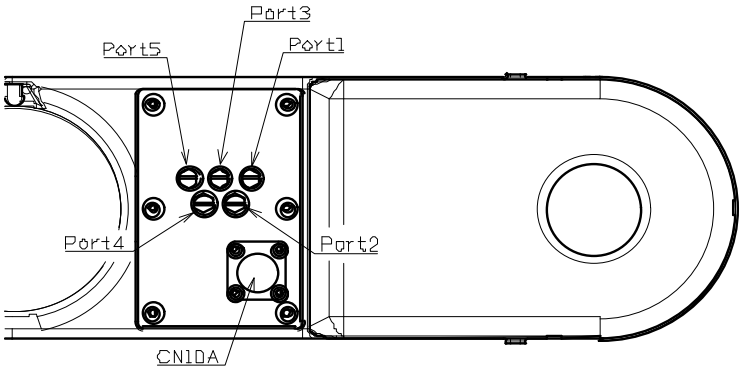
■ **When installing Solenoid valve (option) (4 axis)**





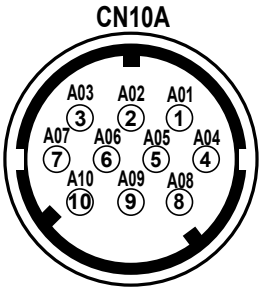
Caution)
-Only 2 air lines (AIR1 to Port1 and AIR2 to Port5) are connected directly inside gear box. Plugs are attached on air outlet.
- Solenoid valves and silencer written in this figure are mounted when “solenoid valve” option is selected.

■ **Detailed diagram of the application connectors（4 axis）**



	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 type 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

8. Control specification

○; Supported, —; Setting disable (Execution enable), ×; Not supported

Functions	Functional description	Smart TP	Compact TP
Robot language	SLIM language is supported for complicate application.	○	—
Interpolation	Linear interpolation; XYZ parallel movement on robot coordinate system (based on the world wide standard JIS B8437) Fixing TCP; Changing robot posture while fixing TCP point Tool coordinate; XYZ parallel movement on tool coordinate system Circular interpolation; Movement on circle by determined with 3 points. Start point and end point can be designated individually.	○	○
Low speed playback	TCP speed is limited 250mm/sec under following condition. 1. Low speed signal input 2. Check GO/BACK operation 3. First step playback after STEP number is designated	○	○
Speed definition	TCP linear speed 1 - 5000mm/sec（0.1mm/sec unit） Time 0.01 - 100sec（0.01sec unit） Power ratio 1.0 - 100.0 %（0.1% unit） Tool angle speed 1 - 500deg/s (1deg/s unit)	○	○
Speed override	Playback speed can be varied 1 - 150% without changing recorded speed.	○	○
Check GO/BACK	In teach mode, recorded position can be confirmed step by step or continuously, and forward / backward. (Functions also can be played back.)	○	○
Accuracy	8 degrees (0 - 1000mm) of in position accuracy can be designated on every step. And in-position or path-through can be designated also.	○	○
Tool designation	32 different tools can be designated on every step.	○	—
Automatic tool constant calculator	Tool length (TCP position), tool weight and COG and tool moment of inertia can be calculated automatically by designated program.	○	×
Self checking	Self check the error of robot and controller. (700 kind of errors)	○	○
Error detection	Check the condition of robot and controller all the time. Robot stops immediately when error happens.	○	○
Logical I/O	Maximum 2,048 logical inputs and 2,048 logical outputs are available as standard.	○	○
Signal assignment	Port assignment and positive/negative logic of all I/O is available.	○	—

○; Supported, －; Setting disable (Execution enable), ×; Not supported

Functions	Functional description	Smart TP	Compact TP
Editor	Can perform correction, deletion and confirm of the created program. 1. Screen editor Addition, deletion and copy of every move step and function is available. (Recorded position can be also edited.) 2. Copy utility Recorded program and step can be copied. 3. Program conversion Condition & speed, each axis angle, parallel shift, etc. 4. Program Certification File directory, file verify	○	×
Machine lock	This can check I/O by playback program, keeping robot stationary.	○	○
I/O simulation	This can check program flow by changing logical I/O from teach pendant, keeping physical I/O locked.	○	○
Memory protect	This can protect program to avoid the modification and deletion by careless operation.	○	—
Power saver	This can save energy by motor power off and brake lock after pre-determined time passed with no movement. When more time passed, fan motors inside of cabinet will stop for further power saving.	○	○
Monitor utility	Real time monitor of following data; 1. Robot program	○	○
	2. Error logging	○	○
	3. Fixed I/O	○	—
	4. General usage I/O	○	○
	5. Program queue	○	—
	6. Operating time etc.	○	—
Help message (Built-in manual)	Operations and function explanations are displayed on teach pendant. And graphical troubleshooting manual is also displayed.	○	×
Customization	Software keys are re-locatable for better operation.	○	×
Power failure backup	When main power is down while playback robot, all necessary data is back upped for easy restarting of the robot after power on. (Save the data, which was just before the power outage occurs.)	○	○
Program queue	Up to 10 programs to be played back can be stored.	○	—
Home position	Up to 32 home positions can be defined. Home position signal is outputted.	○	—
Function commands	・ General usage signal output ・ General usage signal input ・ Program flow control (step jump/call, program jump/call) ・ Timer delay ・ Shift instruction etc.	○	○

○; Supported, －; Setting disable (Execution enable), ×; Not supported

Functions	Functional discription	Smart TP	Compact TP
Interface panel	Pushbuttons and lamps can be arranged on teach pendant touch panel screen. Operating switches and indicators are replaced to software, so this utility can contribute to cost down. Available to register up to 31 keys /screen * 15 screens = 465 keys	○	×
Ethernet	File upload and download via Ethernet is available. (1 port)	○	○
Software PLC	This is sequencer, which is built-in controller type. Use I/O part of the optional board for input and output. (Refer to hardware option)	○	—
High Speed Interference Detection	In the case operation mistake or unexpected interference occurs during teaching work, this function can detect the collision between tool and peripheral equipments, and stops the robot immediately.	○	○
Overhaul Prediction	This is to prevent from trouble occurrence by estimating the lifespan of bearings in each robot arm and by detecting torque over. Furthermore, this function can predict the overhaul timing of robot.	○	—
Palletizing	Palletizing and de-palletizing teaching can be programmed by easy pattern definition.	○	—
Adaptive motion control	Enabling to drive each joint with flexiblitity.	○	—
Oscilloscope	Enabling to monitor the servo data such as velocity, current, etc. of each joint by graphical display on teach pendant.	○	—
Fine motion control	Enabling to improve the locus accuracy. Command is recorded in step.	○	—
User Task	Task program can be executed separately from robot program.	○	—
Language	English Japanese Chinese Korean Germany Italian Spanish	○	× (*)

(*) Japanese is KANA characters. Chinese is Pin-In alphabetic characters. Other language is in English.

9. Options

■ **Option List**

No.	Item	specification	Parts No	Remarks
1	Adjustable stopper	For 2 axis	OP-S5-032	
2	Transfer jig	For crane and ceiling-jig transporting	OP-S2-049	
3	Tools	For 4 axis Zeroing pin & block	OP-T2-099	For 1 to 4 axis
4	Solenoid valve	1 valve	OP-H4-009	Pressure range : 0.1 to 0.5MPa Coil voltage : DC24V
		2 valves	OP-H5-011	
5	Wires clamp	Wiring/ piping cramp of 4 axis hollow	OP-W3-018	Air (φ4 : 5 lines), signals
6	USB memory	1GByte	FD11-OP93-A	
7	Mini I/O board	8 points/ 8 points (Relay output)	—	Mounted on sequence board as a standard.
8	Digital I/O Board	I/O 32 points /32 points (NPN 1 board)	CFD-OP125-A	Occupies 1 slot
		I/O 64 points /64 points (NPN 2 boards)	CFD-OP125-B	Occupies 2 slots
		I/O 32 points /32 points (PNP 1 board)	CFD-OP151-A	Occupies 1 slot
		I/O 64 points /64 points (PNP 2 boards)	CFD-OP151-B	Occupies 2 slots
9	EthernetIP	Master 1CH	CFD-OP130-A	Occupies 1 slot
		Slave 1CH	CFD-OP130-B	
		Master 1CH＋Slave 1CH	CFD-OP130-C	
		Slave 2CH	CFD-OP130-D	
		Master 2CH	CFD-OP130-E	
10	DeviceNet board	Master 1CH	CFD-OP131-A	Occupies 1 slot
		Slave 1CH	CFD-OP131-B	
		Master 1CH＋Slave 1CH	CFD-OP131-C	
		Slave 2CH	CFD-OP131-D	
		Master 2CH	CFD-OP131-E	
11	DeviceNet board (Quick connect specification)	Master 1CH	CFD-OP129-A	Occupies 1 slot
		Slave 1CH	CFD-OP129-B	
		Master 1CH＋Slave 1CH	CFD-OP129-C	
		Slave 2CH	CFD-OP129-D	
		Master 2CH	CFD-OP129-E	
12	PROFIBUS board	Master 1CH	CFD-OP132-A	Occupies 1 slot
		Slave 1CH	CFD-OP132-B	
		Master 1CH＋Slave 1CH	CFD-OP132-C	
		Slave 2CH	CFD-OP132-D	
		Master 2CH	CFD-OP132-E	
13	PROFINET board	Slave 1CH	CFD-OP136-B	Occupies 1 slot
		Slave 2CH	CFD-OP136-D	
14	CC-Link	Master + Slave 1CH	CFD-OP98-B	Occupies 1 slot
15	FL-net	1CH	CFD-OP101-B	Occupies 1 slot
16	Analog output	Analog output 4CH	CFD-OP46-B	Occupies 1 slot
17	Conveyor synchronization interface	RS422 differencial input encoder counter	CFD-OP47-A	Occupies 1 slot
18	Controller protection box	Protection level IP54 support (Add Dust / Drew-proof BOX)	CFD-OP133-A	1 - 2 robots specification (CFDL1, CFDL2)
			CFDL-OP133-A	4 robots specification (CFDL4)
20	UL specification	ULstandard support	CFDL-UL-A	
	CE specification	CE marking support	CFDL-CE-A	
	KCs specification	Korea KCs support	CFDL-KCS-A	
21	Smart TP	Cable length 4m	CFDTP-10-04M	This is an option. Please select one out of three.
22	Mini TP	Cable length 4m	MINITP-10-04M	
23	TP shorting plug	Using when disconnecting to TP.	CFD-OP153-A	
24	TP extention cable	5m	CFDTP-RC05M	Extention is up to one cable. Both sides are connector specification.
		10m	CFDTP-RC10M	
25	Motor / Encoder harness	2m	E000E-J1-02-A	Cable to connect robot and the controller. Must select option. Please select one out of five.
		5m	E000E-J1-05-A	
		10m	E000E-J1-10-A	
		15m	E000E-J1-15-A	
		20m	E000E-J1-20-A	

No.	Item	specification	Item No.	Remarks
26	CNR010 I/O harness (Robot side-Connector connection Controller side- separated wires)	2.5m	IOCABLE-10-02M	I/O cable between robot and controller. Controller side is separate cable. Manufacturing needs to be done by customer.
		5.5m	IOCABLE-10-05M	
		10.5m	IOCABLE-10-10M	
		15.5m	IOCABLE-10-15M	
		20.5m	IOCABLE-10-20M	
		25.5m	IOCABLE-10-25M	
27	CNR010 I/O harness Relay output support (Robot / controller side- Both side is connector)	2.5m	IOCABLE-40B-02M	I/O cable, which connecting to sequence I/O board between robot and controller.
		5.5m	IOCABLE-40B-05M	
		10.5m	IOCABLE-40B-10M	
		15.5m	IOCABLE-40B-15M	
		20.5m	IOCABLE-40B-20M	
		25.5m	IOCABLE-40B-25M	
28	I/O cable on robot arm	1.5m	IOCABLE-20-01M	
29	I/O connector on robot arm	Connector only. Soldering type	IOCABLE-20-00	
28	32 points I/O harness (Controller side-connector Application side- separate wires) Additional I/O board specification (One board)	2.5m	IOCABLE-30-1-02M	Customer need to conduct wiring to application side. Avairable by CFD-OP-125-A CFD-OP-151-A
		5.5m	IOCABLE-30-1-05M	
		10.5m	IOCABLE-30-1-10M	
		15.5m	IOCABLE-30-1-15M	
		20.5m	IOCABLE-30-1-20M	
		25.5m	IOCABLE-30-1-25M	
29	64 points I/O harness (Controller side-connector Application side- separate wires) Additional 2 I/O boards specification	2.5m	IOCABLE-30-2-02M	Customer need to conduct wiring to application side. Avairable by CFD-OP-125-B CFD-OP-151-B
		5.5m	IOCABLE-30-2-05M	
		10.5m	IOCABLE-30-2-10M	
		15.5m	IOCABLE-30-2-15M	
		20.5m	IOCABLE-30-2-20M	
		25.5m	IOCABLE-30-2-25M	
30	Power voltage alterration	For AC100V portable transformer	CFD-OP154-A	1-2 robot specification
			CFDL-OP154-A	4 robots specification

・4：Solenoid valve- Model SYJ3220-5GR-M3（SMC）, 2 positions 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
Number of the valves depends on the specification. Refer “1. Outline” also.

・5：Frange 1,Frange 2, Cramp and and 4 bolts (M5x20), and a positioning pin MDP-5x25. For details, refer to the instruction manual “CFD CONTROLLER TECHNICAL DOCUMENT 1” (TCFEN-155).

・6：USB memory: Used to backup program and constant files. Insertion port is on the front panel as standard.

・8： Additional I/O Board
Photo coupler input; DC24V no pole, Input resistance 3KΩ/8mA
NPN Transistor output; DC24V NPN, output voltage DC36V output current 100mA
PNP Transistor output; DC24V PNP, output voltage DC36V output current 100mA
Relay output; DC24V Relay contact output voltage DC30V output current 500mA

・9,11,12,13,14 and 15：Each Fieldbus board / Available up to 4 channels. Maximum channel quantity may vary according to Fieldbus specification and combination with other options.

・17：Conveyor synchronization I/F- To perform conveyor synchronized motion, speed signal receiver board is added. Differential input (conforming to RS-422), Terminating register 100Ω (set by SW on board), Response frequency 1MHz at maximum.

・18：Controller protection BOX can upgrade the protective level of the CFDL controller from IP20(standard spec.) to IP54.
In case of 4 robots specification (CFDL4), please use CFDL-OP133-A

・22：Compact TP- FD on Desk Light is necessary for setup.

・23：TP shorting plug- When disconnecting the teach pendant from the CFD controller, connect this shorting plug instead of the teach pendant (The emergency stop lines are jumpered). While this plug is connected, manual operation of the robot and teaching operation is impossible. And, to playback (start) the work-program, it is necessary to input the external signals from an external PLC etc.

・24：Teach pendant extension cable- Diameter φ5.8mm, minimum bending radius 35mm

・26：I/O harness- Robot side connector CNR010(assembled) is included. Cable diameter φ10.5mm, minimum bending radius 65mm

・27：I/O harness- Both side connectors are included. Cable diameter φ10.5mm, minimum bending radius 65mm

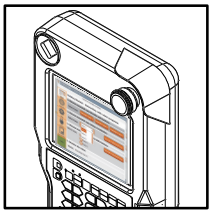
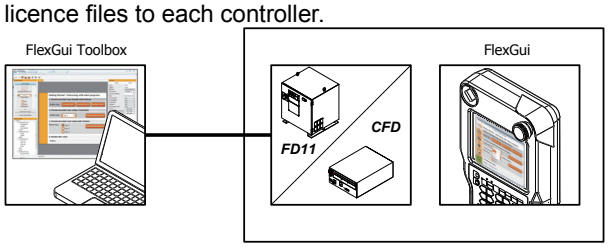
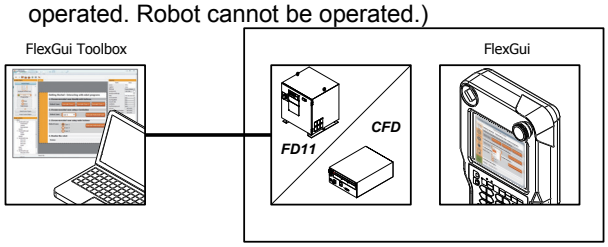
・28,29：I/O cable on robot arm and connector - These option parts are the same with that of MZ series.

・30,31： These are the cables that can be used for CFD-OP125 and CFD-OP151. The controller side connecters are pre-assembled.

・32：Power voltage alteration- This is a transformer unit to change the power source voltage to 100VAC. The cable between the CFDL controller and the transformer unit must be prepared by customer. (The connecter is included in this option) Because there are several robots that can not be used with this option, please contact our technical department in advance.

9.1 ■FlexGui (only for Smart Teach Pendant)

The ***"FlexGui"*** is a function in which "Fidget" like buttons, indicators, digital displays etc, can be placed on the teach pendant screen. And it is also possible to use those fidgets with scripts and robot variables. By using this function, it becomes possible not only to make a simple and easy GUI on the teach pendant screen but also to construct a highly integrated operation panel on the screen without expensive hardware. Please use this function to reduce the cost and to make the operation interface of the robot more simple.

Product name (License name)	Description	Free / Charged	License file
No name (Demonstration version)	This is a trial version of the FlexGui that is pre-installed in the robot controller when shipping. Created GUI screen file cannot be saved. FlexGui 	Not necessary	Not necessary
FlexGui	Created screen is saved when disconnecting to power supply. It is possible to transfer the GUI screen file (that is created using the "FlexGui Toolbox"(NOTE) on the PC) to the robot controllers by connecting Ethernet. In case there are several controllers, it is necessary to get licence files to each controller. 	Necessary	Necessary
FlexGui Remote	The PC, which operates FlexGui Toolbox, corresponds with the controller then, it is possible to operate the controller from PC. In case there are several controllers, it is necessary to get licence files to each controller. (Only key input of the screen can be operated. Robot cannot be operated.) 	Necessary	Necessary (When using FlexGui Remote, FlexGui licence is necessary.)

(NOTE) FlexGui Toolbox can be downloaded from www.flexgui.net

IMPORTANT	- If the license file is necessary, please contact our sales department in advance of ordering the robot controller. - When purchasing a license file after the controller, it is necessary to get the ***"FlexGui ID"*** displayed on the teach pendant screen.

■ **Instruction**

№	Item	Specification
1	Instruction manual	Offers instructios of basic operation and initial setting of the robot with PDF format(DVD).

10. Delivery style and service (specification which includes a robot)

1. There are three styles as shown below.

	Style and service	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	Besides style 2, teaching with work piece is done.

Price may vary largely depends on which style and service to choose, therefore please consider well before making a decision.

2. Operation and maintenance education

Special operation and preservation guide in your local city/ country are not included. Please concult with NACHI-FUJIKOSHI service center close from your location for training and etc.

11. Consuming power (Robot + Controller)

0.6 kVA at maximum (may vary according to the application and motion pattern.)

12. Paint color (Robot and controller)

Standard color Munsell 6.5PB9/1

CFDL1 Controller Munsell N1.5

13. Warranty

1 year after delivery.

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

14. Cautions

CAUTION	**There is a case that the wrist vibration occurs when operating with low speed, even setting the wrist load correctly, depending on the motion and the tool shape of robot. This occurs because of the arm drive system vibration and natural frequency of the arm come close to each other.** It is possible to make the vibration small by shifting resonance point followed by the method below in that case. ・ Change recorded speed of the robot program ・ Change tool weight and inertia moment ・ Change robot posture
CAUTION	**There is a case that vibration, overload and execution error can occur depending on the motion and/ or loading condition when start-up under low temperature.** In that case, conduct break-in about 10 min w/ 30% override, and speed up gradually.
CAUTION	**In case of transporting the arm without fixing, there's a possibility to damage the robot by vibration or impact during transportation.** Please make sure to equip the arm fixing bracket, which was installed at shipping when transporting the robot.
CAUTION	**Overhaul period of robot itself is either 4 years or 20,000 Hr. (Choose shortest one.) This overhaul period is caulcurated by the motion pattern of NACHI standard, therefore durability may decline depends on operating condition of the customer.** It is recommended to operate 50% of cycle time duty as a operation guide to meet the overhaul period above. *Cycle time duty: The ratio of operation time during 1 cycle. Stop time of the robot includes arm halt during hand operation and waiting till next cycle.

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Original manual is written in Japanese.