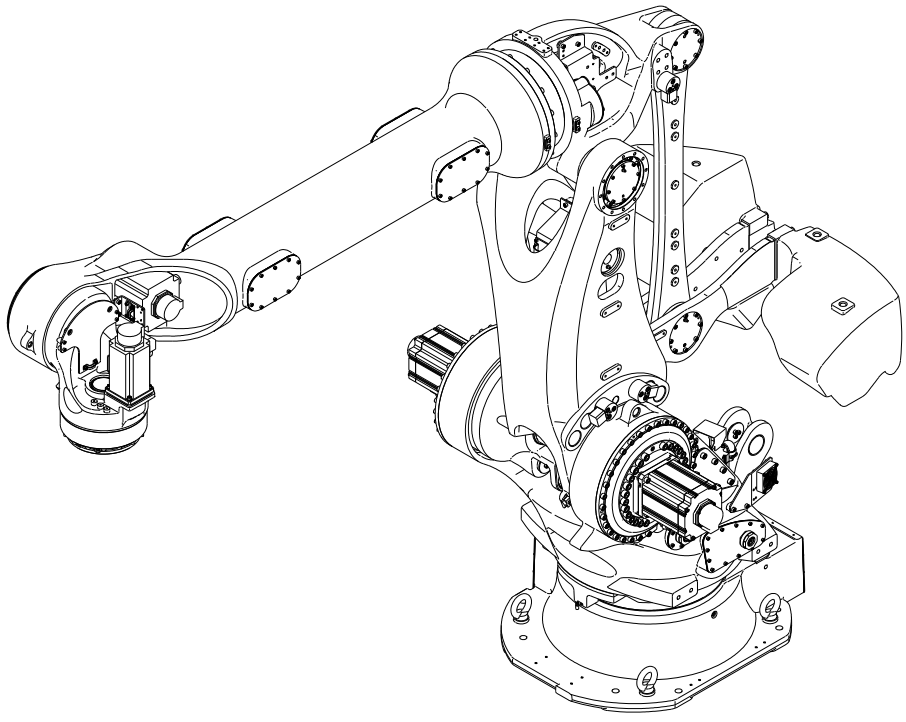
NACHI

# Standard specifications

# MC500P-01 [FD11]

4th edition



NACHI-FUJIKOSHI CORP.

2402, SMCEN-092-004,001

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.
“MC500P” is a robot of simple highly rigid structure which is optimal for material handling application.

| Maximum payload / Mounting condition | 500kg |
|---|---|
| Floor | MC500P-01 |

**■ Characteristics**

1. Due to high wrist torque and high moment of inertia, this robot is suitable for handling of heavy payload.
2. Wide motion range makes easier applicability than before.
3. By installing the balance unit inside arm, swivel base becomes slim and interference radius gets substantially shorter than before.
4. Due to making higher maximum speed, cycle time is shortened. Also it is possible to get faster air-cut motion that is changing wrist attitude widely.
5. By hollow forearm and wrist, cables to end effecter are installed inside arm. So it is possible to install robot in narrow space where used to be difficult to install it.

## 2. Basic specifications

| Item | | Specifications |
|---|---|---|
| Robot type | | MC500P-01 |
| Structure | | Articulated |
| Degree of Freedom | | 5 |
| Drive system | | AC servo motor |
| Maximum motion range | Axis 1 | ±3.14 rad（±180°） |
| | Axis 2 | -1.83～ +1.05rad （-105 ～ +60°） |
| | Axis 3 | -2.27～ +0.52rad （-130 ～ +30°） |
| | Axis 5 | ±2.09 rad （±120°） *6 |
| | Axis 6 | MAX：±6.28 rad （±360°）<br>INITIAL SETTING：±3.67 rad （±210°） *4 |
| Maximum Velocity | Axis 1 | 1.57 rad/s （90°/s） |
| | Axis 2 | 1.57 rad/s （90°/s） |
| | Axis 3 | 1.57 rad/s （90°/s） |
| | Axis 5 | 1.92 rad/s （110°/s） |
| | Axis 6 | 3.14 rad/s （180°/s） |
| Maximum pay load | Wrist | 500 kg |
| | Forearm *1 | 25 kg at maximum |
| Maximum static load torque | Axis 5 | 3450 N·m |
| | Axis 6 | 1725 N·m |
| Maximum moment of inertia *2 | Axis 5 | 600 kg·m$^2$ |
| | Axis 6 | 400 kg·m$^2$ |
| Position repeatability *3 | | ±0.09 mm |
| Mounting Condition | | Floor |
| Ambient conditions | | Temperature: 0 to 45 ºC *5<br>Humidity: 20 to 85%RH (No dew, nor frost allowed)<br>Vibration to the installation face: Not more than 0.5G (4.9 m/s$^2$) |
| Robot weight | | 3,350 kg |

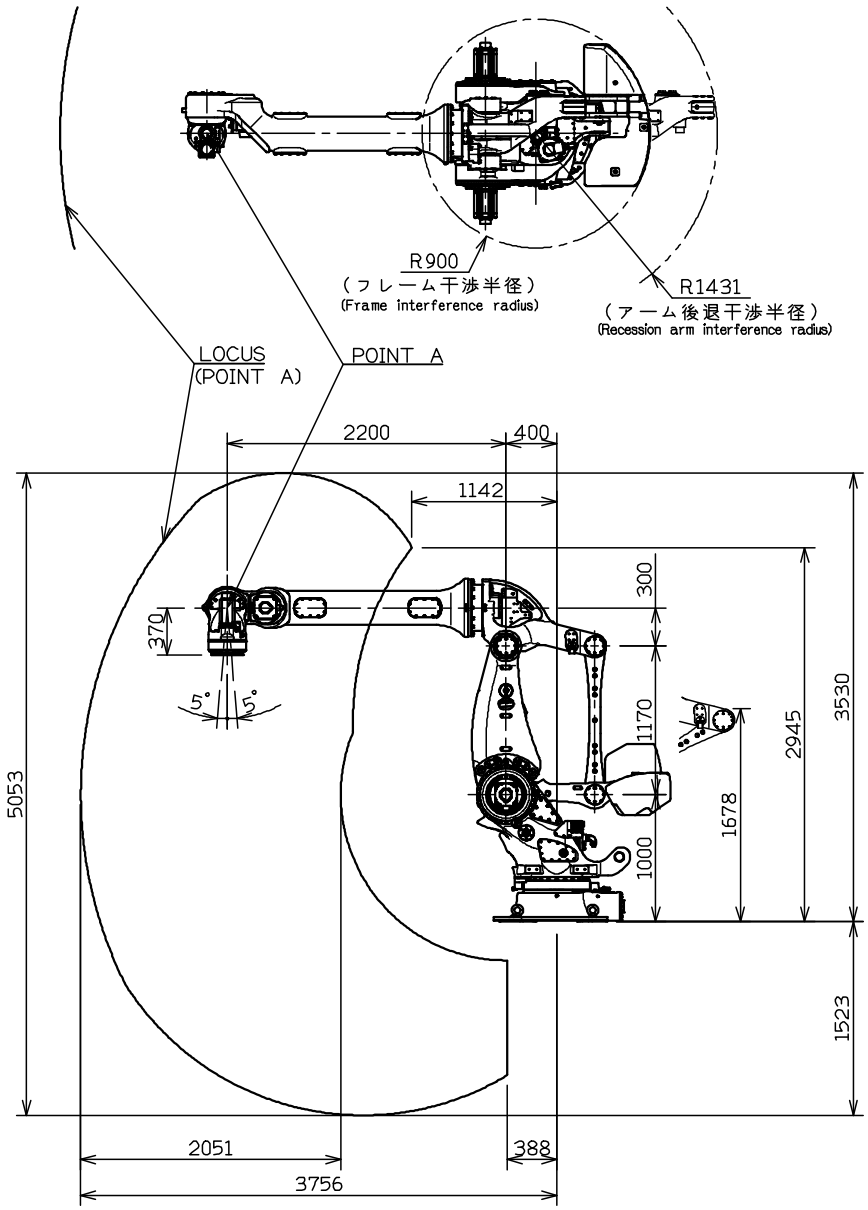
1[rad] = 180/π[°], 1[N·m] = 1/9.8[kgf·m]
- Axis 1 - Axis 6 are displayed as J1-J6 each on the controller screen.
- Specifications are subject to change without prior notice for technical changes.
- The explosion-proof version is not available.

*1: This value changes by placement and load conditions of a wrist. *2: Maximum moment of inertia of a wrist changes depending on the load conditions of a wrist. *3: JIS B 8432 conformance. *4: The initial setting of the software limit is ±210°. When installing the cables in the hollow hole part of axis 6, please use the robot in the range of ±210°. If the cables do not go through the hollow hole of axis 6, it is possible to widen the motion range of axis 6 up to ±360° considering the condition. For details of how to change the software limit range, refer to the instruction manual ***"SETUP MANUAL"*** (Chapter 4). *5: Using at 1000m or lower sea level. Ambient temperature has limitations when allowable altitude is exceeded. *6：Axis 5 is controlled in the range of vertically downward +/- 5° by the software. Only at the state of opening the encoder correction screen or operation range setting screen, axis 5 becomes possible to operate +/- 120°.

| | |
|---|---|
| CAUTION | **Position repeatability is defined in accordance with JIS B 8432 (ISO 9283) (Pose repeatability). Repeatability under the following conditions is not guaranteed.**<br><br>・During repeated operation, the case in which approaching movement involves different directions and different orientations toward the measuring point.<br>・During repeated operation, the case in which payload condition changes. (for example, existence / no-existence of work-piece)<br>・During repeated operation, the case in which environment temperature changes. (Robot arm may cause the position repeatability to deteriorate.)<br>・The case in which position repeatability before and after warm-up is required.<br>・The case in which position repeatability of numeric position written in robot coordinate system and position in real space is required. (this is "Absolute position accuracy")<br>・The case in which position repeatability of position generated by shift command or palletize command and position in real space is required. |

# 3. Robot dimensions and motion range

**[MC500P-01]**




| | |
|---|---|
| IMPORTANT | ・Axis 5 is controlled in the range of vertically downward +/- 5° by the software.<br>・Only at the state of opening the encoder correction screen or operation range setting screen, it becomes possible for axis 5 to operate +/- 120°. |

# 4. Detail of load installation plate

■ **Wrist**

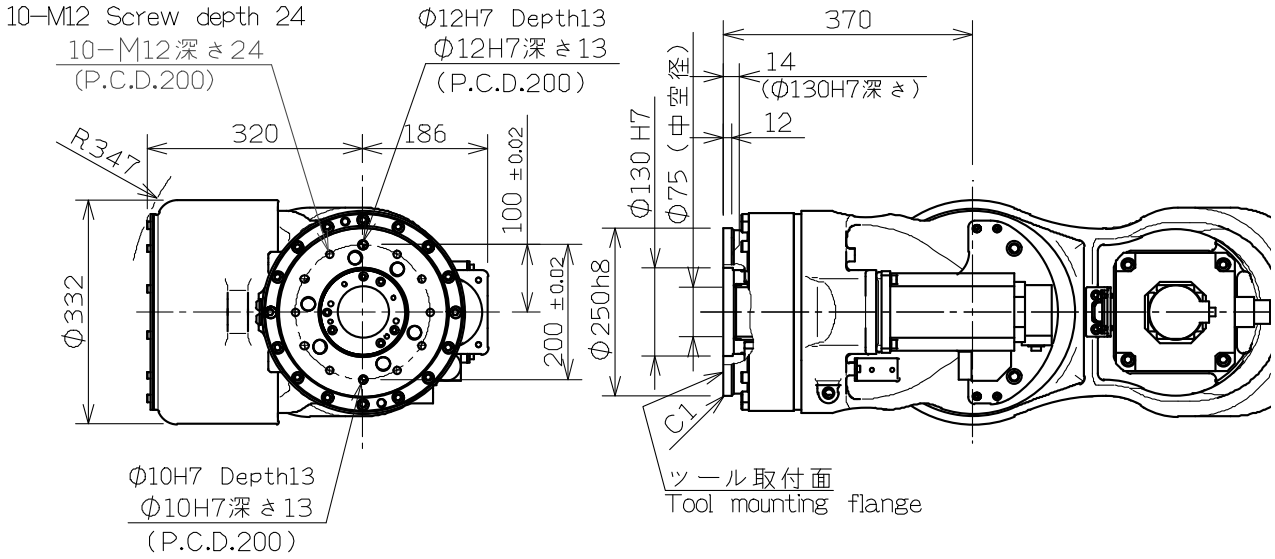
For the end effecter fixing bolts, use the installation P.C.D. shown in the following figures.

| | |
|---|---|
| CAUTION | Be sure to screw the M12 tool fixing bolts in the wrist not deeper than the screw depth in the installation surface. Screwing the bolts deeper than the screw depth may damage the wrist. |

**[MC500P-01]**

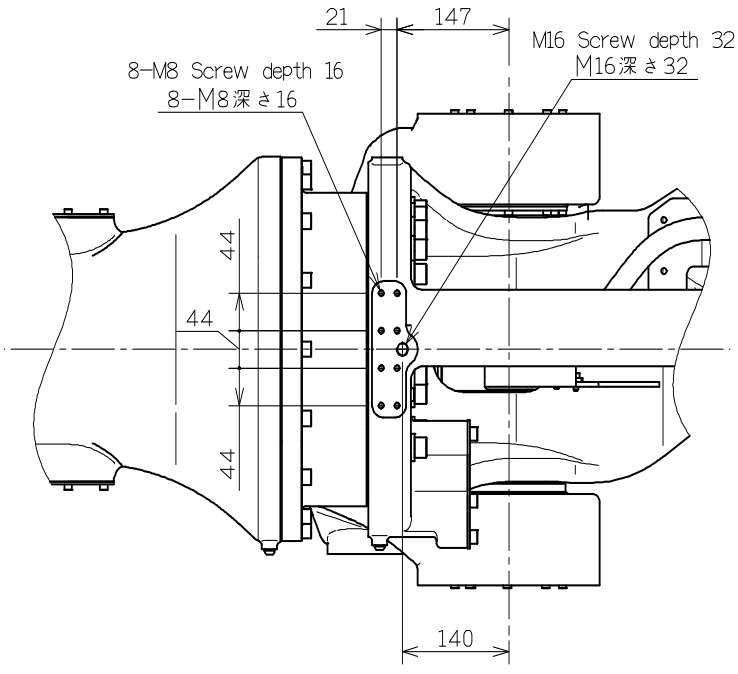
Tightening torque of M12 Hex. socket head cap screw

| | |
|---|---|
| JIS: Strength class 10.9 | 96 N·m |
| JIS: Strength class 12.9 | 116 N·m |



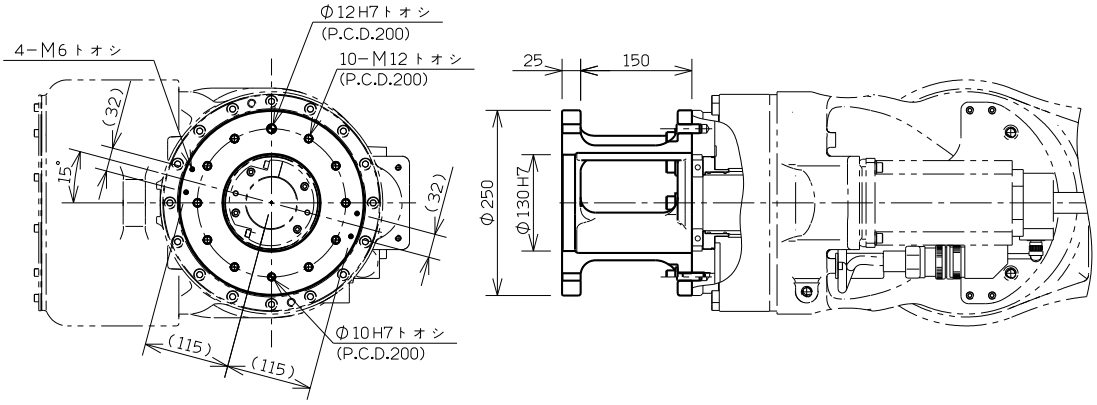

■ **Upper part of forearm**

**[MC500P-01]**



## ■ Load mounting face of Extension flange

This flange is used for cables side routing (P.C.D.200).




Load mounting face of Extension flange OP-W3-015

# 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. |

## ■ 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. |

## ■ 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 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 | MC500P-01 |
|---|---|
| Thickness of floor concrete | More than 160mm |
| Installation parts *1 | 8 bolts of M20 (JIS: Strength class 12.9) more than 70mm<br>8 plain washers of more than 4.5 mm in thickness and HRC35 in hardness |
| Tightening torque *2 | 560±30 N·m |
| Allowable repeated tensile *3 | Approximately 56,000 N |

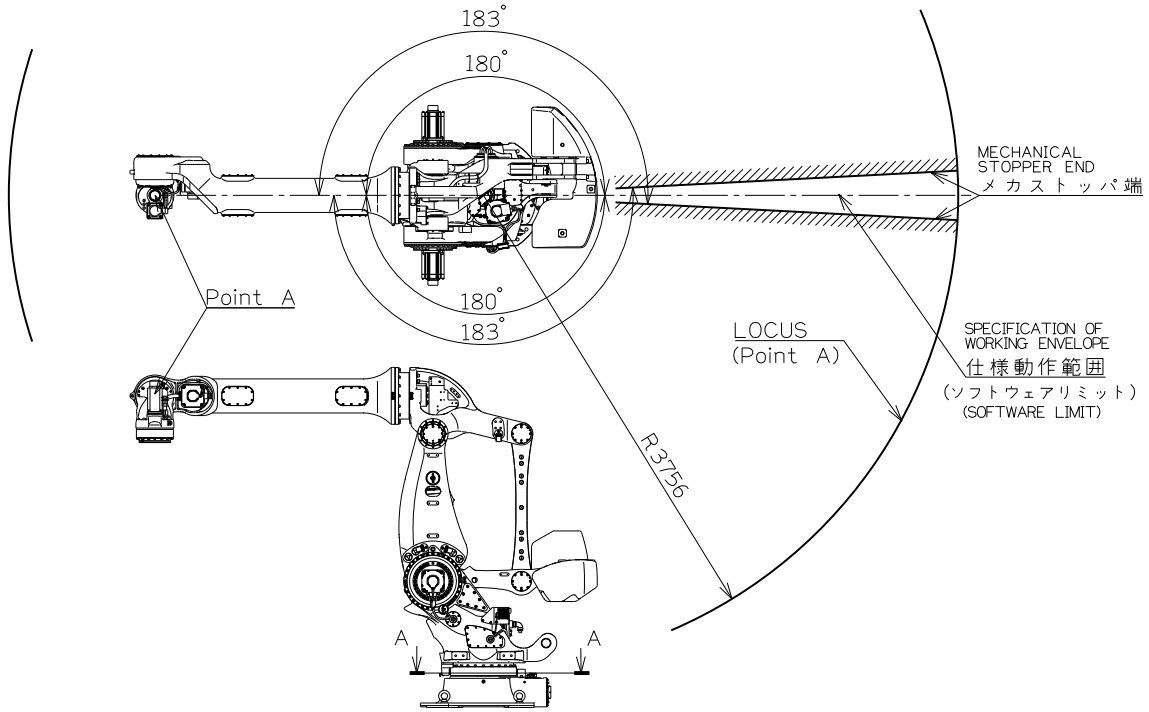
*1 : Installation parts are not accessory of robot.
*2 : Apply a coating of lubricating oil to the threaded parts of bolts, and then tighten bolts by using torque wrench to the specified tightening torque.
*3 : This tensile is per installation bolt when robot is installed with all bolts written in table above.

## ■ Installation space

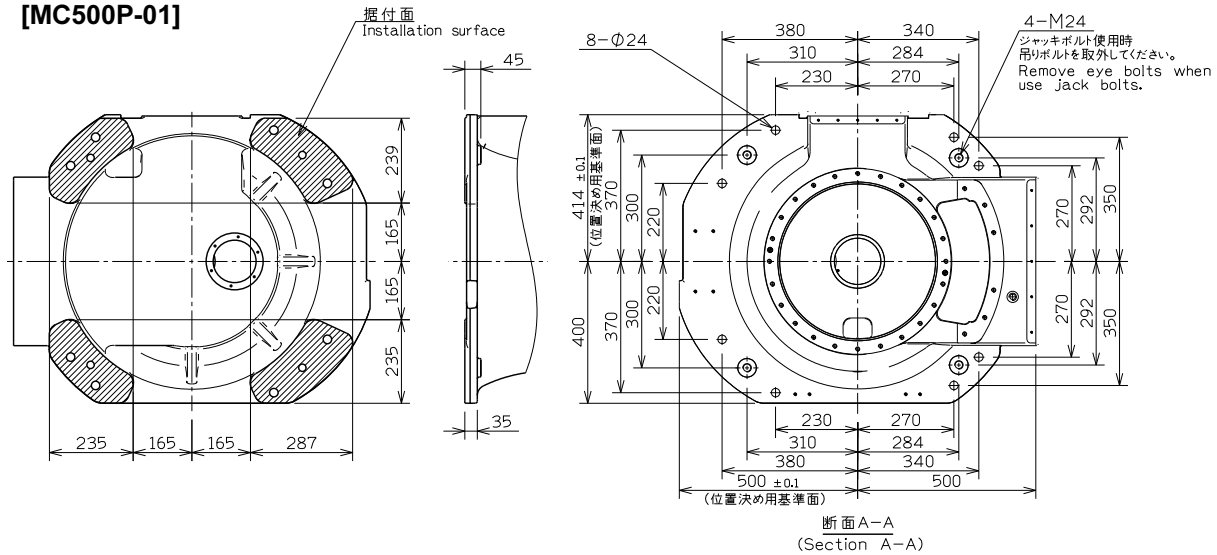
To install the robot, lock the swiveling base of the robot.

| | |
|---|---|
| WARNING | The mechanical stopper end is located in a position exceeding the specified motion range (software limit) of axis 1 by 3°. To install the safety fence, with consideration given to the wrist configuration and the shape of end effecter. |
| WARNING | On axes 1, 2 and 3, the robot motion range 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). |
| WARNING | 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 been kept. Mechanical stopper and reduction gear of collided joint are needed to be replaced to the new one. |

**[MC500P-01]**




**[MC500P-01]**



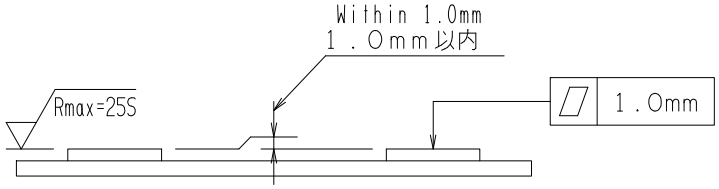
## ■ Accuracy of installation surface

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

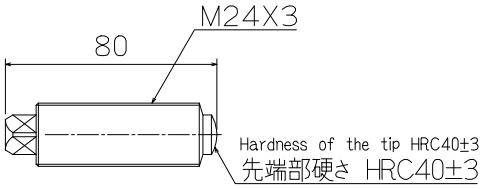
(1) Level of the flatness of 4 plates on the installation surface must be within 1.0 mm.

(2) Keep the gap between the installation surface of 4 each base plates and the installation surface within 1.0 mm(±0.5 mm) range in height.

(3) Surface roughness of the base plate must be less than 25S with Rmax.




(3) In case, if it's difficult to follow the precautions described above, please use jack bolts to make 4 plates even towards the installation surface.

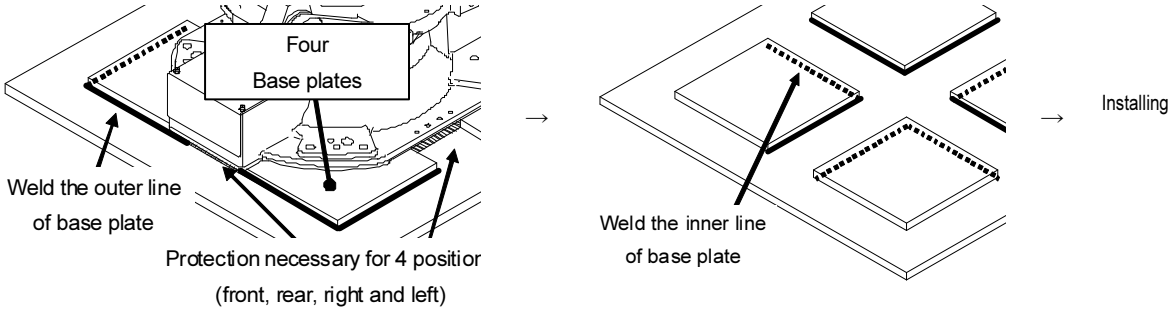



## ■ Welding of base plate

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.

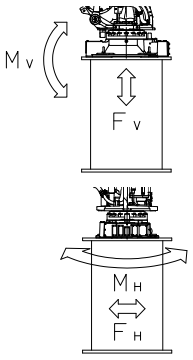
Temporary install the robot, and weld the outer line of base plate.

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 $M_H$ |
|---|---|---|---|---|
| MC500P-01 | 95,300 N | 69,500 N | 260,400 N·m | 225,800 N·m |



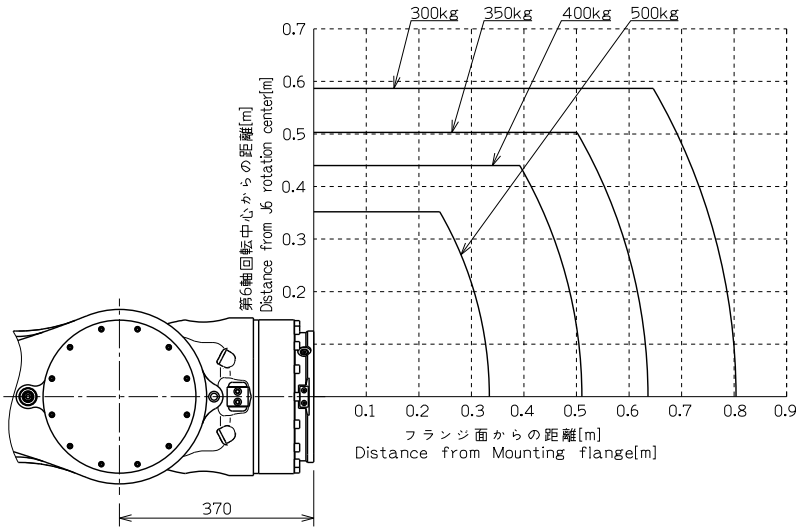
# 6. Allowable wrist load

| | |
|---|---|
| CAUTION | **The wrist load is regulated by the allowable pay load mass, allowable static load torque, and allowable moment of inertia. If the wrist load exceeds beyond these allowable values, WE CANNOT GUARANTEE THE FUNCTION OF THE ROBOT.** Please refer to “2. Basic specifications” and following figures for details of each specification. |
| CAUTION | 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. 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. 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. FD controller instruction manual BASIC OPERATIONS (TCFEN-002) 4.3 Teaching |

**■ Torque map for the wrist load**

Use the robot within the condition that COG of the wrist load stays in the range shown in the torque map.

**[MC500P-01]**

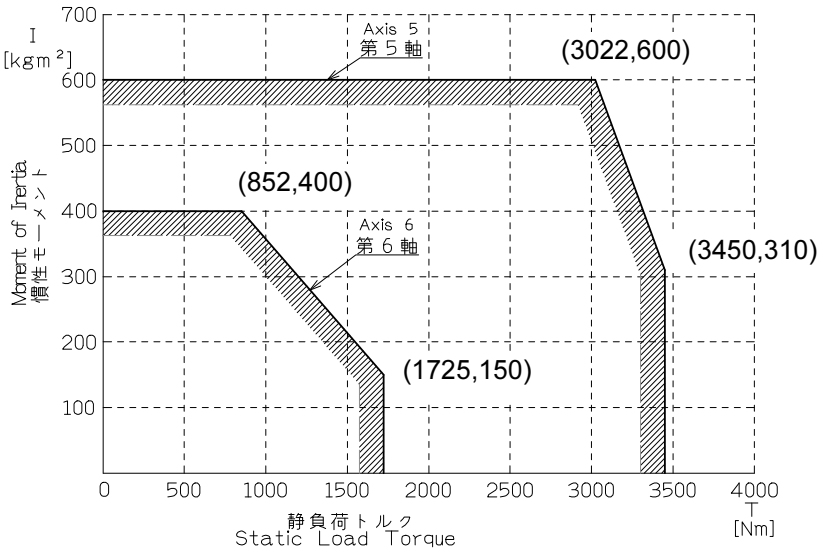


## ■ Map of Moment of inertia for the wrist load

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

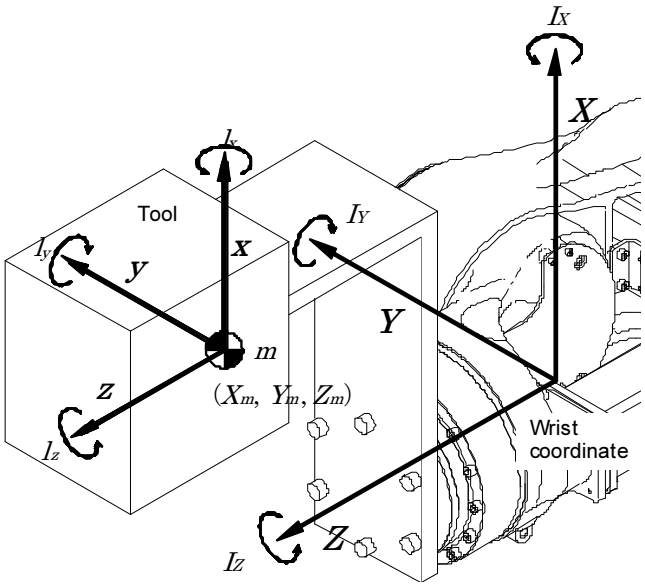
| | |
|---|---|
| IMPORTANT | If the load exceeds more than the Max. allowable moment then, maximum speed is automatically limited by the software to protect the robot. |

**[MC500P-01]**




According to the degree of the inertia moment, the wrist operates with the appropriate speed.

## ■ Calculation of the wrist inertia moment

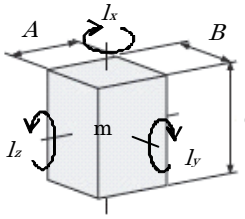
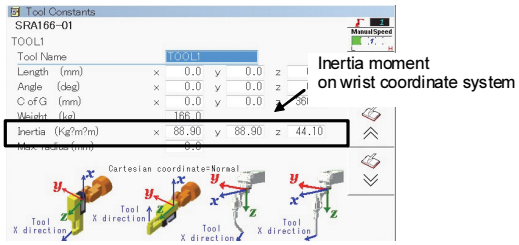



Wrist coordinate system
X: Perpendicular coordinate with Y, Z
Y: Axis 5 rotation center when wrist is in reference position
Z: Axis 6 and 4 rotation center when wrist is in reference position

Tool COG coordinate system
(Origin is COG of tool, and parallel to wrist coordinate system)
x: Parallel to X
y: Parallel to Y
z: Parallel to Z

Inertia moment
$I_X$: Around X on wrist coordinate system
$I_Y$: Around Y on wrist coordinate system
$I_Z$: Around Z on wrist 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

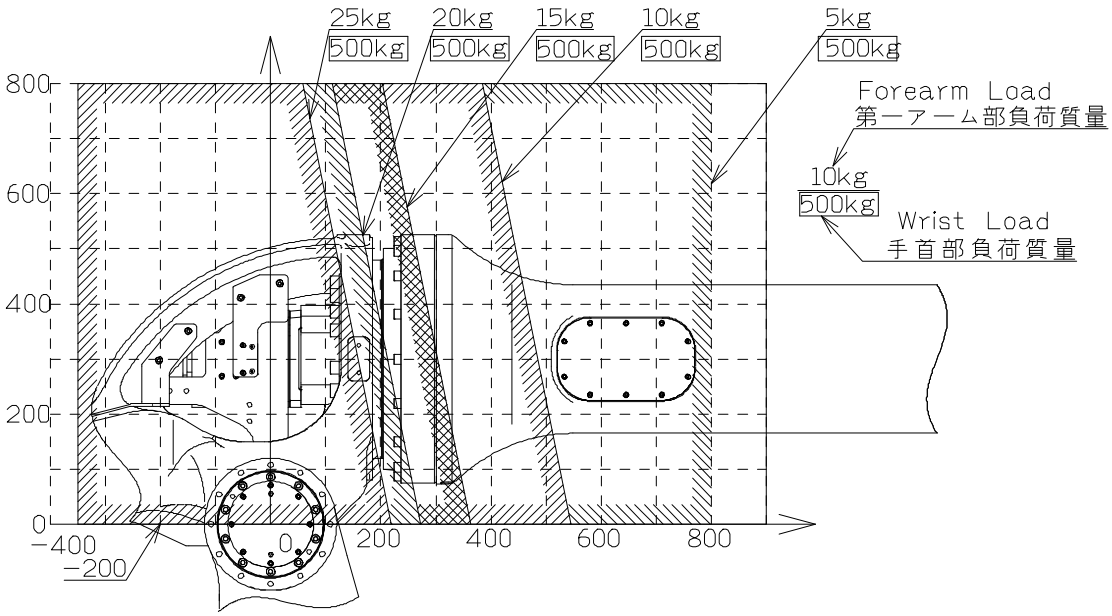
m: Tool mass
(Xm, Ym, Zm) : COG (center of gravity) of tool

| | | |
|---|---|---|
| 1 | Calculate inertia moment on tool COG coordinate system (***xyz***).<br>If tool is regarded as prism, it is calculated as right formula. | Inertia moment example on tool COG coordinate system<br>  <br>If tool is regarded as prism<br>$I_x = \frac{1}{12} m \cdot (A^2 + B^2)$<br>$I_y = \frac{1}{12} m \cdot (A^2 + C^2)$<br>$I_z = \frac{1}{12} m \cdot (B^2 + C^2)$ |
| 2 | Calculate inertia moment on wrist coordinate system (***XYZ***).<br>If tool is regarded as aggregate of more than one solid, all inertia moment must be combined. | $I_X = m \cdot (Y_m^{\ 2} + Z_m^{\ 2}) + I_x$<br>$I_Y = m \cdot (X_m^{\ 2} + Z_m^{\ 2}) + I_y$<br>$I_Z = m \cdot (X_m^{\ 2} + Y_m^{\ 2}) + I_z$<br>"Inertia moment on wrist coordinate system" is registered to controller.<br>  |
| 3 | Calculate inertia moment around robot wrist joint (axis 4, 5 and 6).<br>This result must not be larger than "Allowable moment of inertia" written in robot specification sheet. | Axis 4 and 5 inertia moment is adopted larger value of around wrist coordinate system X and Y. (Because this depends on the axis 6 position.)<br>Axis 6 inertia moment is around wrist coordinate system Z itself.<br>$I_{J4} = I_{J5} = \max ( I_X , I_Y )$<br>$I_{J6} = I_Z$ |

## ■ Load on the forearm

Use the robot within the condition that COG of the ancillary equipment on the forearm (: Arm of axis 3) stays in the range shown below.

**[MC500P-01]**



# 7. Option specifications

○: Combatible / －: Incompatible

| No | Item | Specifications | Parts No. | Robot model |
|---|---|---|---|---|
| | | | | MC500P-01 |
| 1 | Installation parts *1 | Chemical anchor specification<br>Base plate welded (anchors not included) | OP-F1-037 | ○ |
| | | Hammar drive anchor specification<br>Base plate welded (anchors not included) | OP-F2-022 | ○ |
| | | Installation bolts & washers | OP-F1-036 | ○ |
| 2 | Extension flange | Side routing flange fro cables (P.C.D.200) | OP-W3-015 | ○ |
| 3 | Axis 1 adjustable stopper *1<br>(Including the dog for adjustable LS) | Restriction of axis 1 operation edge<br>(±2.61 rad to every ±0, 0.13 rad) | OP-S5-027 | ○ |
| 4 | Axis 2 adjustable stopper | Restriction of axis 2 operation edge<br>(by changing the position of the standard parts)<br>(-0.26 rad , -0.52 rad from the upper limit, -0.26 rad, -0.52 rad from the lower limit) | Standard | ○ |
| 5 | Axis 3 adjustable stopper *1 | Restriction of axis 3 operation edge<br>(-0.26 rad , -0.52 rad from the upper limit, -0.26 rad, -0.52 rad from the lower limit) | OP-A6-030 | ○ |
| 6 | Axis 2 adjustable LS dog | Axis 2 axis adjustable limit switch dog set | OP-S8-009 | ○ |
| 7 | Axis 3 adjustable LS dog | Axis 3 axis adjustable limit switch dog set | OP-S4-015 | ○ |
| 8 | Transfer jig *3 | Fork bracket (Front and back 2 directions) | OP-S2-046 | ○ |
| 9 | Transfer jig *3 | Fork bracket (Front, back, right and left 4 directions) | OP-S6-015 | ○ |
| 10 | Zeroing pin & Zeroing block *1 | | OP-T2-097 | ○ |
| 11 | Dual circuit limit switch | For axes 1, 2 and 3 (3pcs. of dual circuit LS) | Standard | ○ |
| 12 | Encoder connector Protector | For axis 2 and 3 | OP-P6-010 | ○ |
| 13 | Scale seal | For 5,6 axis | OP-N2-020 | ○ |
| 14 | Gas balancer unit pressure gauge *1 | Analog pressure gauge | KP-ZJ-013 | ○ |
| | | Digital pressure gauge | KP-ZJ-014 | ○ |
| 15 | Gas balancer unit charging equipment *1 *2 | Charging unit (W22,picth14,Female) | KP-ZJ-015 | ○ |
| | | Charging unit (W23,picth14,Male) | KP-ZJ-016 | ○ |
| | | Joint of Female->Male (W22) | KP-ZJ-019 | ○ |
| 16 | Gas balancer support axis grease lubrication tool *1 | Long nozzle for the Axis 2 support axis lubrication | KP-ZJ-069 | ○ |

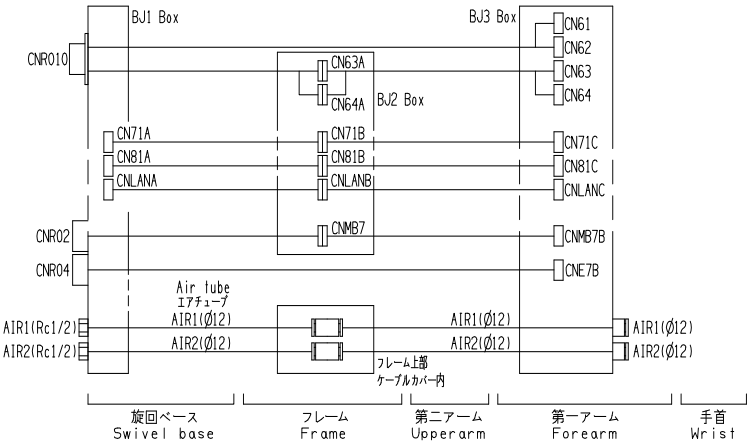
*1 : These parts are packed separately from the robot. (Not attached on the robot)

*2 : If diameter of charging equipment (gas cylinder) is “W22, pitch14, Female, Right screw, Metal contacts”, please prepare the charging equipment “KP-ZJ-015” and the joint “KP-ZJ-019”.

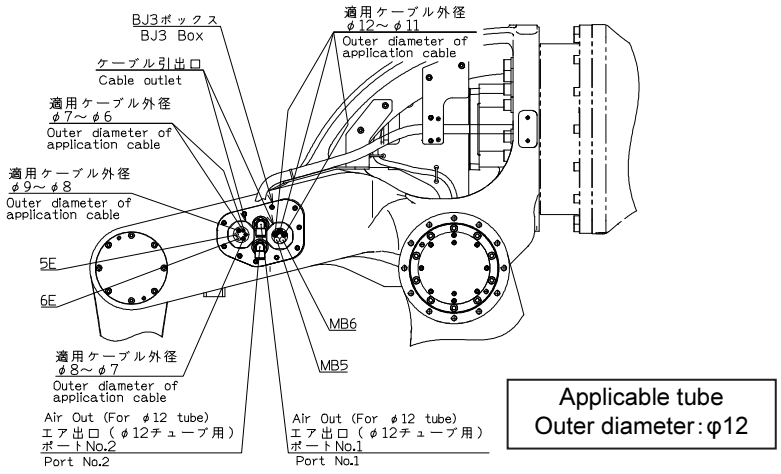
*3 : Fork bracket (Front and back 2 directions) and Fork bracket (Front, back, right and left 4 directions) can not be used at the same time. Please select one of the two.

# 8. Application wiring and piping diagram

## ■ Standard specification
**[MC500P-01]**

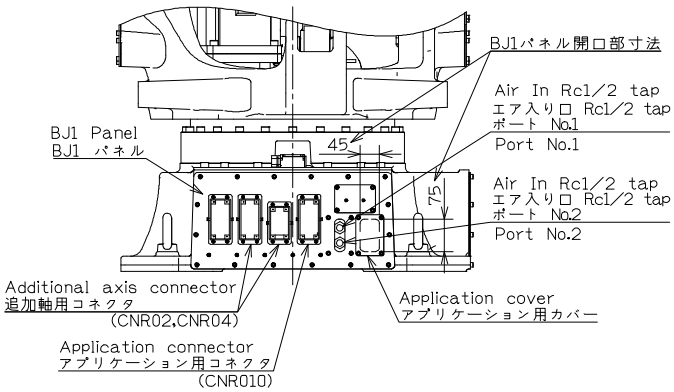



## ■ Upper part of forearm - Wiring and piping for application
**[MC500P-01]**




(NOTE) In wiring box BJ3, there are application connectors shown in the next page
When connecting cables inside BJ3, select the adequate hole that corresponds to the cable size.

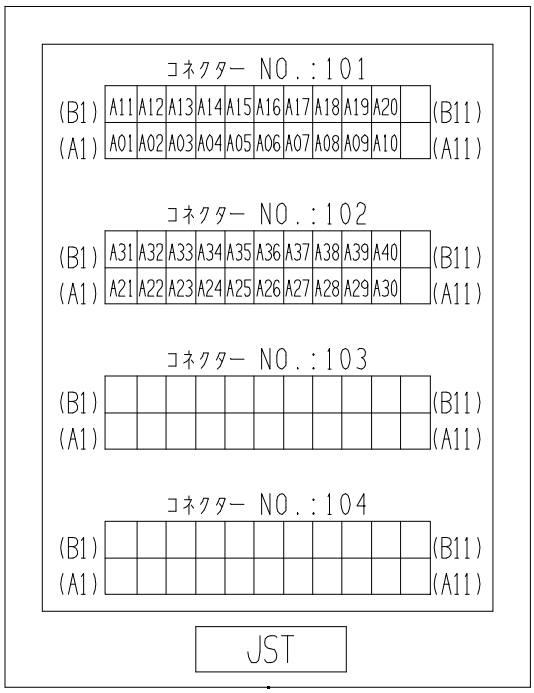
## ■ Base frame block - Wiring and piping for application
**[MC500P-01]**




(NOTE) In wiring BOX (BJ1 BOX), there are connectors shown in the next pages.
And, to use the DeviceNet / Ethernet connectors, it is necessary to process the application cover.

## ■ Details of application connectors (standard) [MC500P-01]

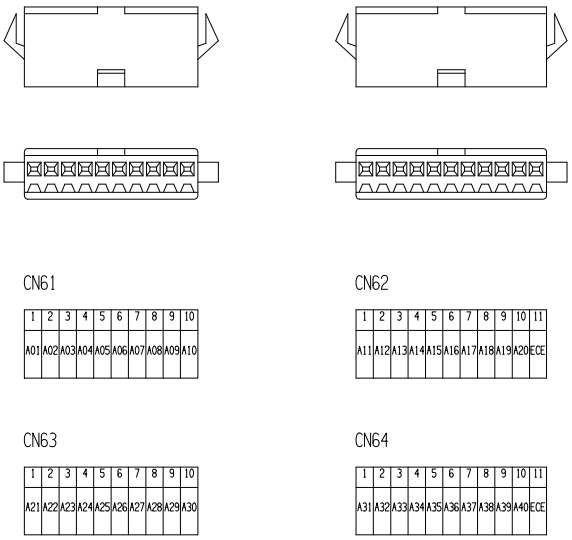
（1） BJ1 side (connector)




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 ~ 0.50 $mm^2$)
b: SJ2F-21GF-P1.0 (JST) (0.30 ~ 0.75 $mm^2$)
Manual crimp tool:
a: YRS-8861
b: YRF-1120
Cable diameter suitable for wire-side shell:
JFM-WSA-4-A φ26.2～φ28.0
JFM-WSA-4-C φ15.5～φ16.5
(Shown pin assignment is a view from an insertion face of robot side connector.)

Application wiring specification
Rated voltage Max. AC/DC 115 V
Rated current rating Max. 1 A

（2） BJ3 side (connector)

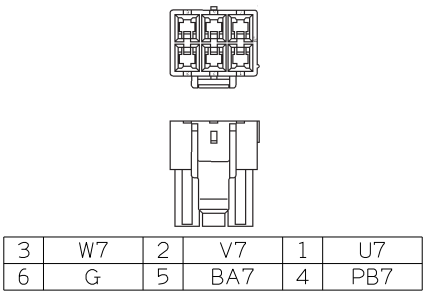



Connector form (CN61, CN63)
Housing SMP-10V-BC (JST)
User-side Connectors
Housing SMR-10V-B (JST)
Contact SYM-001T-P0.6
(Applicable wire：AWG#22～28)
Manual crimp tool: YRS-121

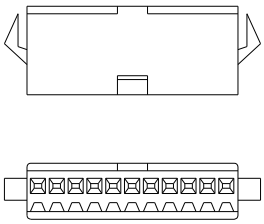
Connector form (CN62, CN64)
Housing SMP-11V-BC (JST)
User-side Connectors
Housing SMR-11V-B (JST)
Contact SYM-001T-P0.6
(Applicable wire：AWG#22～28)
Manual crimp tool: YRS-121

## ■ Details of connectors for additional axis (Standard) [MC500P-01]

BJ3 side (Joint connector)



| | | | | | |
|---|---|---|---|---|---|
| 3 | W7 | 2 | V7 | 1 | U7 |
| 6 | G | 5 | BA7 | 4 | PB7 |



| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | 447 | 457 | P5E7 | M5E7 | M3E7 | P3E7 | G |

Connector type (CNMB7B)
Housing VLP-06V(JST)

User-side connector
Housing VLR-06V(JST)
Retainer VLS-03V(JST)
Contact SVM-61T-P2.0
(Applicable wire: AWG#20～14)
Manual crimp tool: YC-590

Connector type (CNE7B)
Housing SMP-11V-BC(JST)

User-side connector
Housing SMR-11V-B(JST)
Contact SYM-001T-P0.6
(Applicable wire: AWG#22～28)
Manual crimp tool: YRS-121

(Shown pin assignment is a view from an insertion face of robot side connector.)

## ■ Details of connector for DeviceNet（Standard）[MC500P-01]

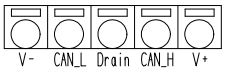
CN71A

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 24V+ | 24V- | 24V+ | 24V- |

CN71C

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 24V+ | 24V- | 24V+ | 24V- |

CN81A




CN81C


Connector
in wiring box BJ1

Connector
in wiring box BJ3

| | | CN71A | CN71C |
|---|---|---|---|
| Connector | Housing | VLR-04V | VLP-04V |
| User-side connector | Housing | VLP-04V | VLR-04V |
| | Contact | SVF-61T-P2.0 (0.5～2.0 $mm^2$)<br>SVF-42T-P2.0 (0.3～1.25 $mm^2$) | SVM-61T-P2.0 (0.5～2.0 $mm^2$)<br>SVM-42T-P2.0 (0.3～1.25 $mm^2$) |
| | Retainer | VLS-02V | |
| | Crimp tool | YC-590（SV*-61T-P2.0）<br>YC-592（SV*-42T-P2.0） | |

| | | CN81A | CN81C |
|---|---|---|---|
| Connector | | 231-635/010-DM | 231-305/037/010-DM |
| User-side connector | Connector | 231-305/037/010-DM | 231-635/010-DM |
| | Crimp tool | 231-131 | |
| | Contact | CAN_L, CAN_H :216-301<br>V-, V+ :216-201<br>Drain :216-201<br>Crimp tool :206-204 | |

(Shown pin assignment is a view from an insertion face of robot side connector.)

(NOTE) Adequate contact and manual crimp tool should be used for each cable.
(Preparation of the user-side connectors are required by customer.)

■ **Details of Ethernet connectors (standard [MC500P-01]**

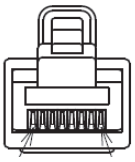
CN71A

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 24V+ | 24V- | 24V+ | 24V- |

CN71C

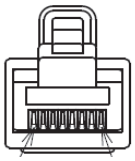
| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 24V+ | 24V- | 24V+ | 24V- |

CNLANA



Connector
in wiring box BJ1

CNLANC



Connector
in wiring box BJ3

| | | **CN71A** | **CN71C** |
|---|---|---|---|
| Connector | Housing | VLR-04V | VLP-04V |
| User-side connector | Housing | VLP-04V | VLR-04V |
| | Contact | SVF-61T-P2.0 (0.5～2.0 $mm^2$)<br>SVF-42T-P2.0 (0.3～1.25 $mm^2$) | SVM-61T-P2.0 (0.5～2.0 $mm^2$)<br>SVM-42T-P2.0 (0.3～1.25 $mm^2$) |
| | Retainer | VLS-02V | |
| | Crimp tool | YC-590(SV*-61T-P2.0)<br>YC-592(SV*-42T-P2.0) | |

| | | **CNLANA** | **CNLANC** |
|---|---|---|---|
| Connector | RJ45 plug connector | 5-569552-3 | 5-569552-3 |
| User-side connector | Hood | RJ45 type connector | RJ45 type connector |
| | | | |

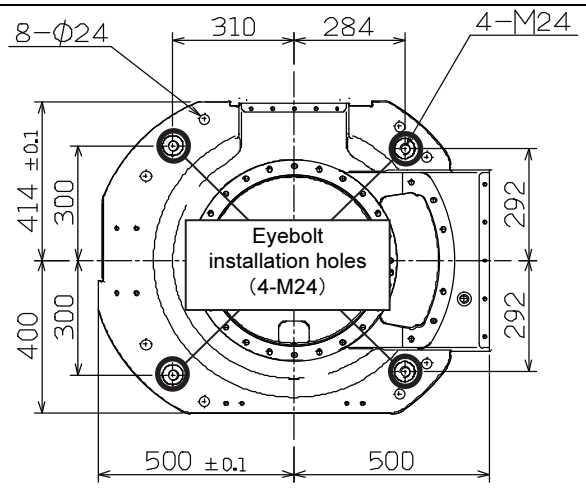
(Shown pin assignment is a view from an insertion face of robot side connector.)

(NOTE) Adequate contact and manual crimp tool should be used for each cable.
(Preparation of the user-side connectors are required by customer.)

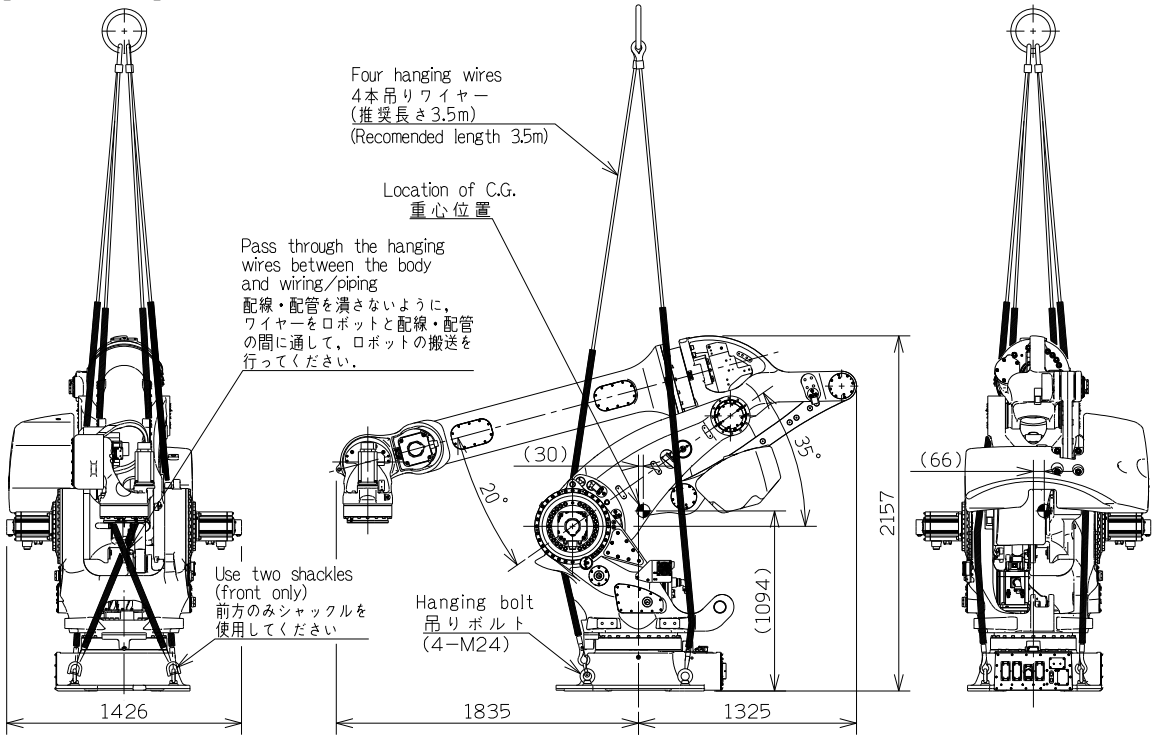
# 9. Transport procedure

| | |
|---|---|
| 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. |
| CAUTION | 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. |
| 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. |

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 install the four M24 hanger bolts to the swivel base. Then, be sure to lift the robot using 4 hanging wires. It is recommended to use hanging wires of 3.5 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.




**[MC500P-01]**



# 10. Terms of Delivery and Installation (Specification that contains robot)

1. There are three terms as shown below.

| | Terms | 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 performed. (*Teaching with work piece is not included.) |
| 3 | Delivery after installation and teaching with work piece | Other than Term2, perform teaching with actual work piece. |

Costs differ significantly according to which term you select, so please discuss well and make a decision according to your needs.

2. Operation and maintenance education

The special spot operation guide and the preservation guide are the not included. Consult with each NACHI-FUJIKOSHI office for the training and etc.

# 11. Consuming power (Robot + Controller)

**[MC500P-01]**
9.7 kVA (Max.)、3.1 kVA(Average)
(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

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

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

| | | |
|---|---|---|
| NACHI<br>NACHI-FUJIKOSHI CORP. | ***www.nachi-fujikoshi.co.jp*** | |
| **NACHI-FUJIKOSHI (CHINA) CO., LTD.** | ***www.nachi.com.cn*** | |
| **NACHI ROBOTIC SYSTEMS, INC. (NRS)** | ***www.nachirobotics.com*** | |
| **NACHI EUROPE GmbH** | ***www.nachi.de*** | |

- Concerning the Contact list, please refer to ***"Contact list (TFDJP-254)"***.
- 
- 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.
- This is an original instruction.