

**Kawasaki Robot
RS03N (A/B00*)
RA03N (A/B00*)**

**Installation and
Connection Manual**

Robot

Kawasaki Heavy Industries, Ltd.

Preface

This manual describes the installation and connection instructions for the Kawasaki Robot RS03N (A/B00*)/RA03N (A/B00*).

Read and understand the contents of this manual and the safety manual thoroughly, and strictly observe all rules for safety before proceeding with any operation.

This manual only describes the installation and connection of the robot arm. Refer to the “Installation and Connection Manual – Controller” for information on the controller.

Never proceed with any operation until you understand the contents of this manual completely.

Kawasaki is not responsible for any accidents and/or damages resulting from operations/maintenance based on only a limited reading or limited understanding of some parts of this manual.

—This manual describes the following robot model. —


RS03N (A00*) ... Standard specifications (Floor/ceiling mount)
RS03N (B00*) ... Standard specifications (Wall mount)
RA03N (A00*) ... Arc weld specifications (Floor/ceiling mount)
RA03N (B00*) ... Arc weld specifications (Ceiling mount)

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1. This manual does not constitute a guarantee of the systems in which the robot is utilized. Accordingly, Kawasaki is not responsible for any accidents, damages, and/or problems relating to industrial property rights as a result of using the system.
 2. It is recommended that all personnel assigned for activation of operation, teaching, maintenance or inspection of the robot attend the necessary education/training course(s) prepared by Kawasaki, before assuming their responsibilities.
 3. Kawasaki reserves the right to change, revise, or update this manual without prior notice.
 4. This manual may not, in whole or in part, be reprinted or copied without the prior written consent of Kawasaki.
 5. Store this manual with care and keep it available for use at any time. If the robot is reinstalled or moved to a different site or sold off to a different user, attach this manual to the robot without fail. In the event the manual is lost or damaged severely, contact Kawasaki.


Symbols

The items that require special attention in this manual are designated with the following symbols.


Ensure proper and safe operation of the robot and prevent physical injury or property damages by complying with the safety matters given in the boxes with these symbols.

 **DANGER**

Failure to comply with indicated matters can result in imminent injury or death.

 **WARNING**


Failure to comply with indicated matters may possibly lead to injury or death.

 **CAUTION**

Failure to comply with indicated matters may lead to physical injury and/or mechanical damage.

[NOTE]

Denotes precautions regarding robot specification, handling, teaching, operation, and maintenance.

 **WARNING**

- 1. The accuracy and effectiveness of the diagrams, procedures, and detail explanations given in this manual cannot be confirmed with absolute certainty. Accordingly, it is necessary to give one's fullest attention when using this manual to perform any work.**
- 2. Safety related contents described in this manual apply to each individual work and not to all robot work. In order to perform every work in safety, read and fully understand the safety manual, all pertinent laws, regulations and related materials as well as all the safety explanations described in each chapter, and prepare safety measures suitable for actual work.**

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1 Precautions

1.1 Cautions to be Taken during Transportation

When transporting the Kawasaki Robot to its installation site, strictly observe the following cautions.



WARNING

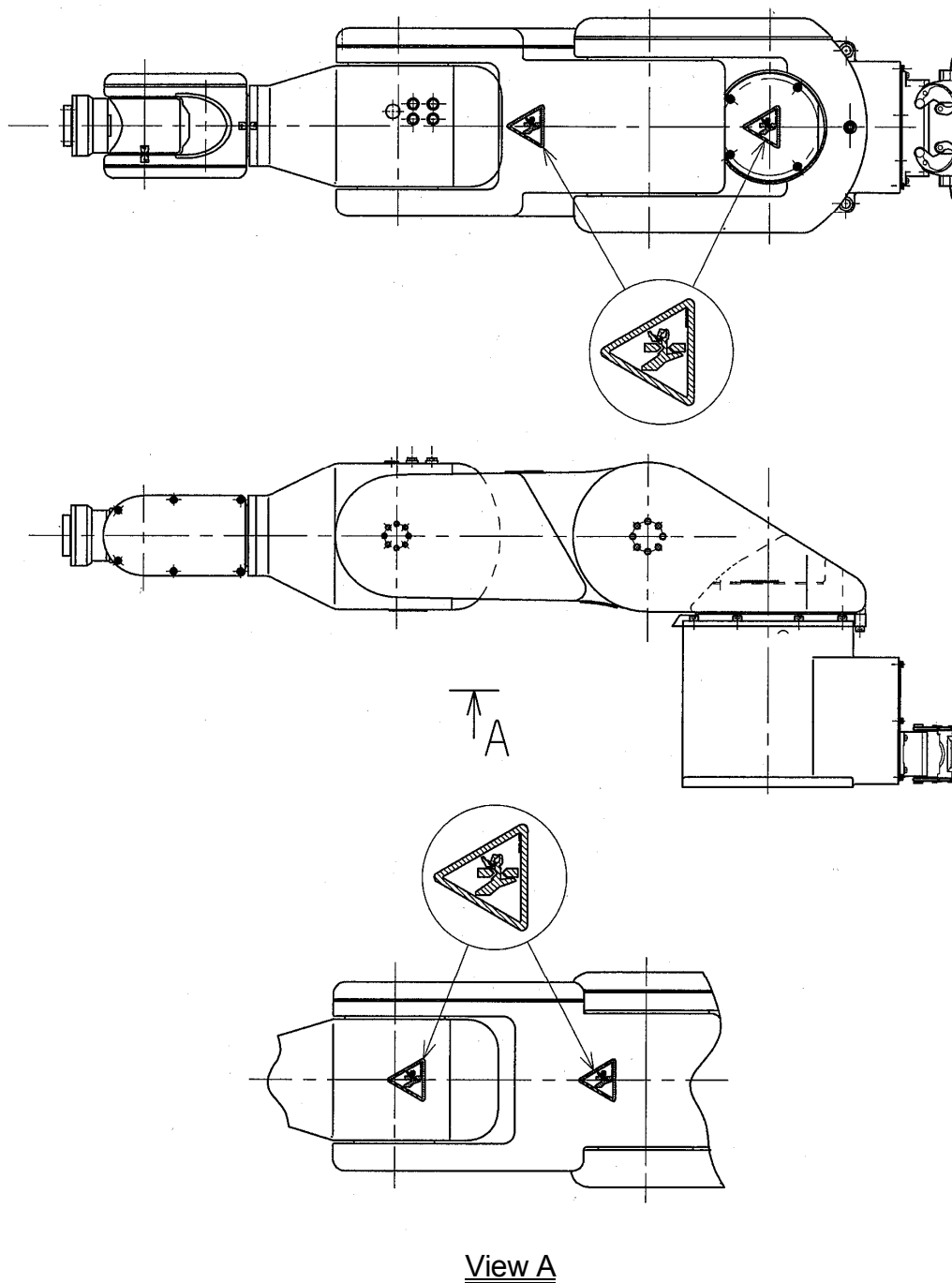
1. When the robot arm is to be transported by using a crane or forklift, never support the robot arm manually.
2. During transportation, never climb on the robot arm or stay under the hoisted robot arm.
3. Prior to installation, turn OFF controller power up to the main power source. Display signs indicating clearly “Inspection and Maintenance in Progress”, and lockout/tagout the main power switch to prevent personnel from accidentally turning ON the power.
4. Prior to driving robot, ensure safety by first confirming no abnormality is observed in installing condition, etc., and then turn ON motor power to set robot to the desired posture. Be careful to not be caught by/between any moving parts due to careless approach to robot and peripheral equipment. After setting robot arm to the specified pose, turn OFF controller power up to the main power source again as mentioned above. Display signs indicating clearly “Inspection and Maintenance in Progress”, and lockout/tagout the main power switch before starting inspection and maintenance.
5. Warning labels are affixed to the arm to identify areas with possibility of electric shock, high temperature or pinching/crushing, so check these areas beforehand. See the following page for the warning labels and their positions.



CAUTION

1. Since the robot body unit is composed of precision parts, be careful not to apply excessive shocks during transportation.
2. Prior to installation, remove all obstacles so the installation is carried out smoothly and safely. Clear a passage to the installation area for transportation of the robot arm using a crane or forklift.
3. During transportation and storage,
 - (1) Keep the ambient temperature within the range of $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$,
 - (2) Keep the relative humidity within the range of $35\% \sim 85\% \text{ RH}$ without dew condensation,
 - (3) Keep free from excessively strong vibration or shocks.

Warning labels

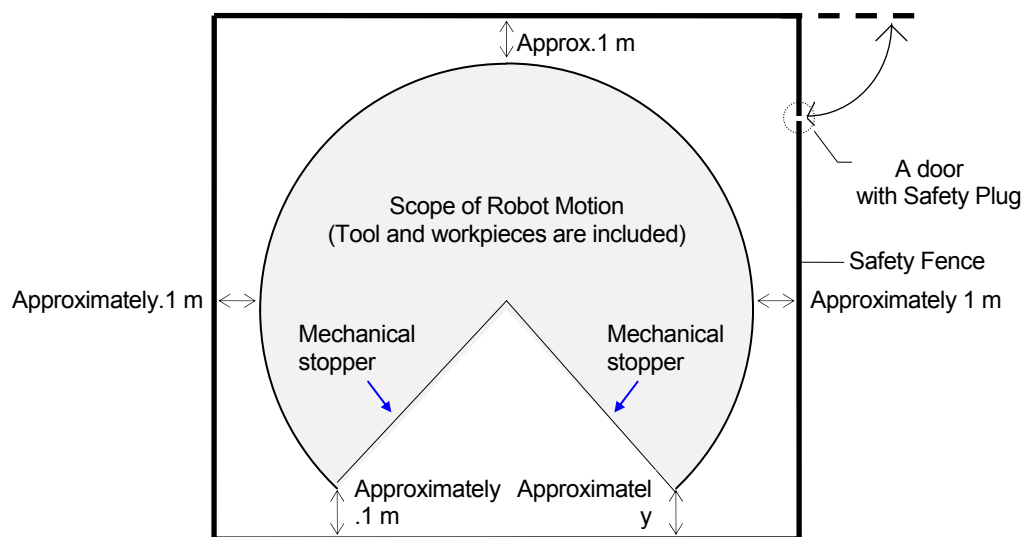


 : Warning label for pinching point

1.2 Installation Environment of Robot Arm

The robot arm must be installed in a place that satisfies all the following environmental conditions:

1. When robot is installed on the floor, the levelness must be within $\pm 5^\circ$.
2. Be sure that the installation floor/pedestal has sufficient rigidity.
3. Secure a flatness to prevent undue force applied to the installation section. (If sufficient flatness is unobtainable, insert liners and adjust the flatness.)
4. Keep the ambient temperature during operation within the range of 0 to 45°C. (Deviation or overload error may occur due to high viscosity of grease/oil when starting operation at low temperatures. In this case, move the robot at low speed before regular operation.)
5. Keep the relative humidity during operation within the range of 35 to 85%RH without dew condensation.
6. The robot installing place should be free from dust, dirt, oil, smoke, water, and other foreign matters.
7. The robot installing place should be free from flammable or corrosive liquid or gas.
8. The robot installing place should be free from excessively strong vibration. (0.5 G or less)
9. The robot installing place should be free from electric noise interference.
10. The robot installing place should be sufficiently larger than the motion range of robot arm.
 - (1) Install safety fence so the maximum movement of fully equipped robot arm (with tools and workpieces) does not cause interference.
 - (2) Minimize the number of entrance gates (only one is best) and equip the entrance gate with a safety plug.
 - (3) Observe the requirements of ISO 10218, etc. established in each region for details of the safety fence.



2 Motion Range and Specification

2.1 Setting the Dimensions of the Safety Fence Based on Max. Motion Range

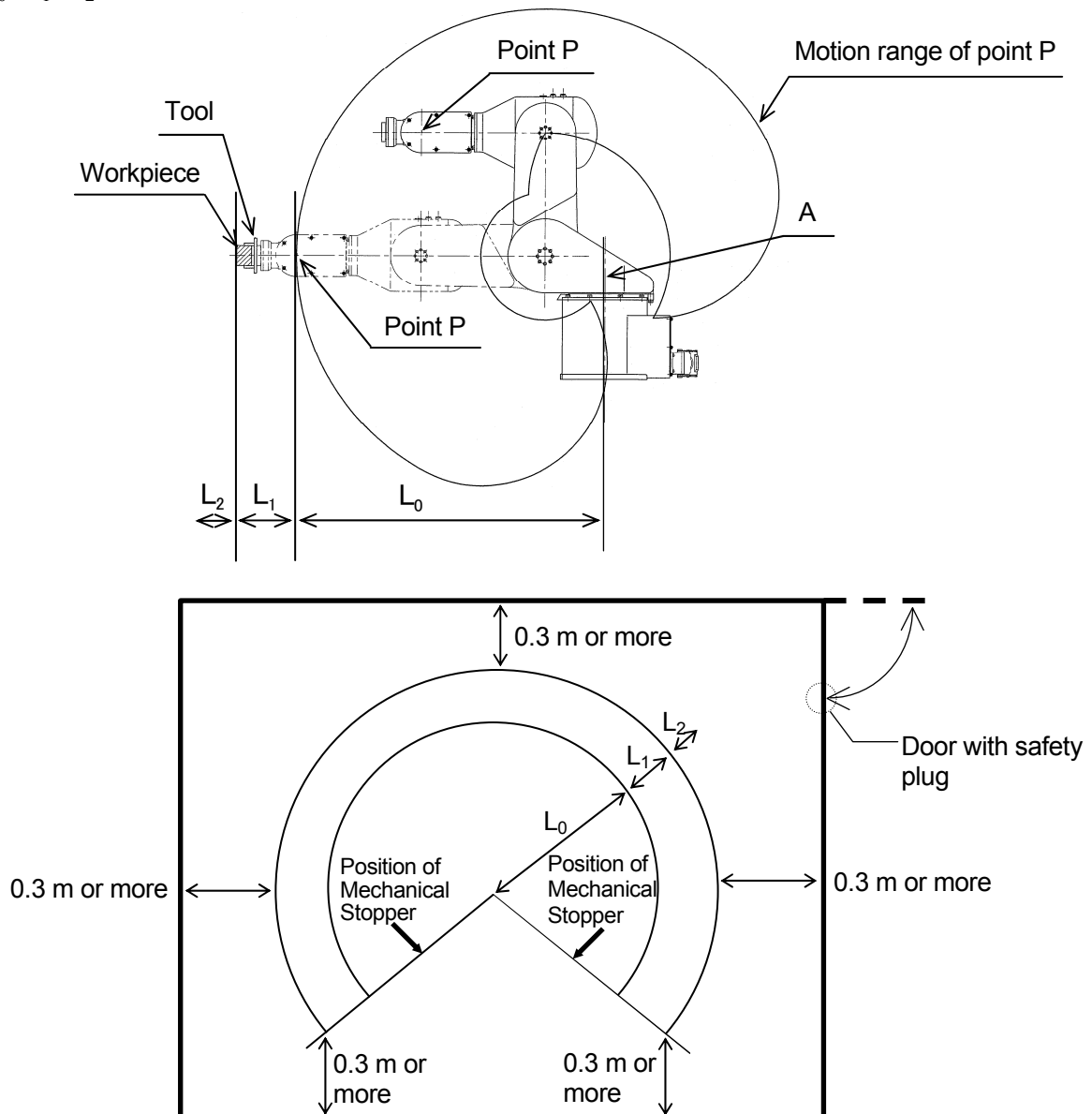
The motion range of the robot is the area reachable by point P.

L_0 : Robot motion range (Distance from A to point P.) (Refer to “2.2 Robot Motion and Specification”)

L_1 : Sum length of wrist flange, tool and workpiece

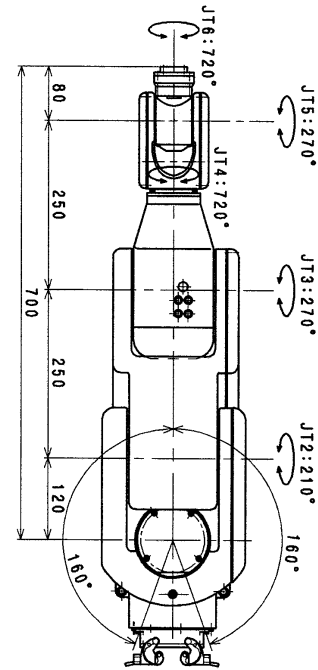
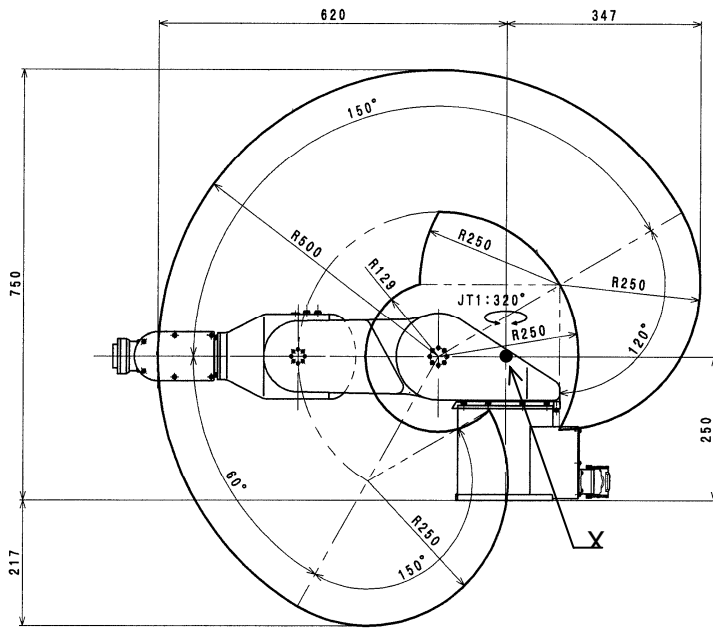
L_2 : Clearance for safety

Refer to the figure below and ensure safety fence dimensions are larger than the sum of $L_0+L_1+L_2$.



2.2 Robot Motion and Specification

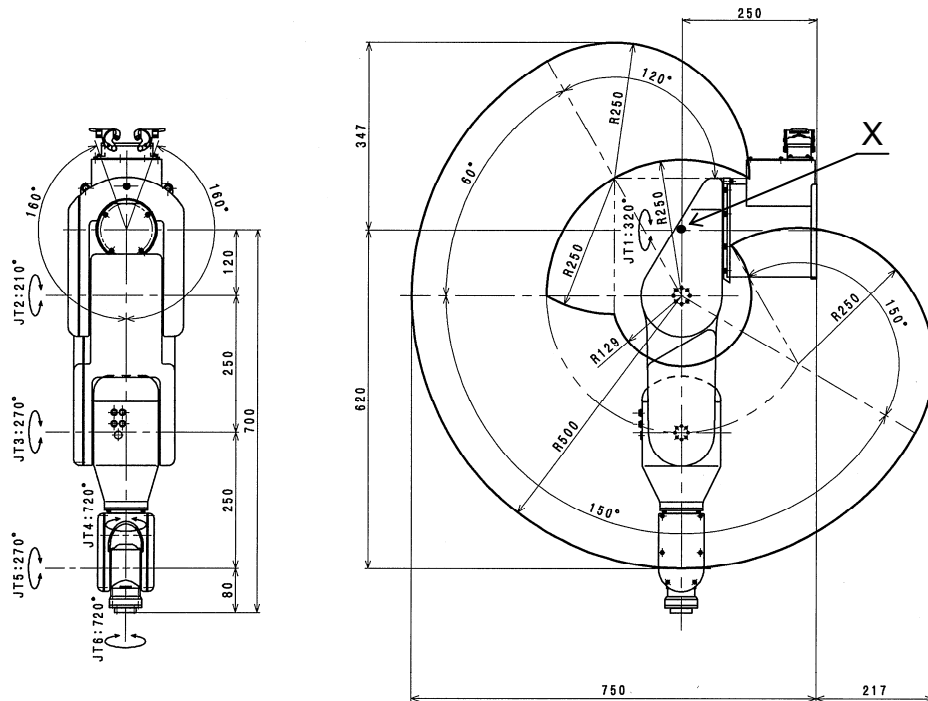
RS03N (A00*)/ RA03N (A00*)



Type	Articulated robot		
Degree of Freedom	6		
Motion Range and Maximum Speed	JT	Motion range	Max. speed
	JT1	-160° ~ +160°	360 °/s
	JT2	-60° ~ +150°	250 °/s
	JT3	-150° ~ +120°	225 °/s
	JT4	-360° ~ +360°	540 °/s
	JT5	-135° ~ +135°	225 °/s
	JT6	-360° ~ +360°	540 °/s
Max. Payload	3 kg		
Wrist Load Capacity	JT	Load torque	Load moment of inertia
	4	5.8 N·m	0.12 kg·m ²
	5	5.8 N·m	0.12 kg·m ²
	6	2.9 N·m	0.03 kg·m ²
Repeatability	± 0.02 mm		
Driving Motor	Synchronous brushless AC servo motor		
Mass	Approx. 20 kg		
Settable Mechanical Stopper	JT1 only (45° pitch)		
Base Origin	Point X in figure above		
Acoustic Noise	< 70 dB (A)*		

NOTE* Measurement conditions
 · robot installed on plate rigidly fixed to floor
 · measuring point:
 1300 mm away from JT1 center
 (The noise level depends on the conditions.)

RS03N (B00*)/ RA03N (B00*)

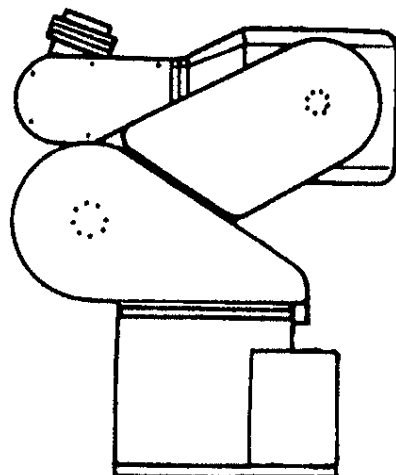


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	JT1	-160° ~ +160°	150 °/s
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	JT4	-360° ~ +360°	540 °/s
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Repeatability	± 0.02 mm		
Driving Motor	Synchronous brushless AC servo motor		
Mass	Approx. 20 kg		
Settable Mechanical Stopper	JT1 only (45° pitch)		
Base Origin	Point X in figure above		
Acoustic Noise	< 70 dB (A)*		

NOTE* Measurement conditions
 · robot installed on plate rigidly fixed to floor
 · measuring point:
 1300 mm away from JT1 center
 (The noise level depends on the conditions.)

3 Transport Method

Robot arm is packed as shown below at time of factory shipment.



Standard posture

JT1 : 0°

JT2 : -60°

JT3 : -150°

JT4 : 0°

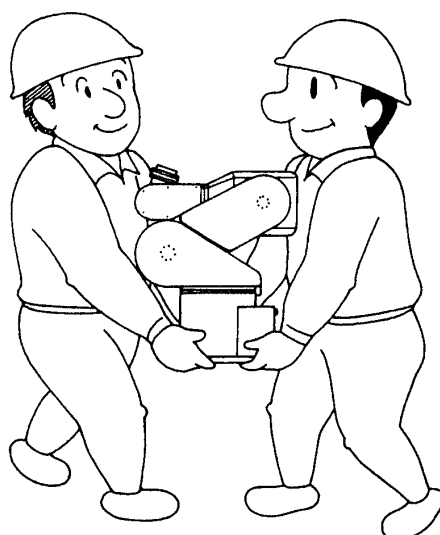
JT5 : +135°

JT6 : 0°



CAUTION

The mass of robot arm is approx. 20 kg for models RS03N(A/B00*)/
RA03N(A/B00*). For your safety, transport robot arm by two or more
persons.



4 Installation Method

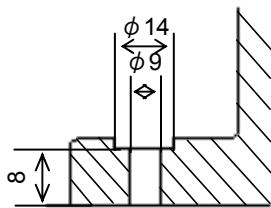
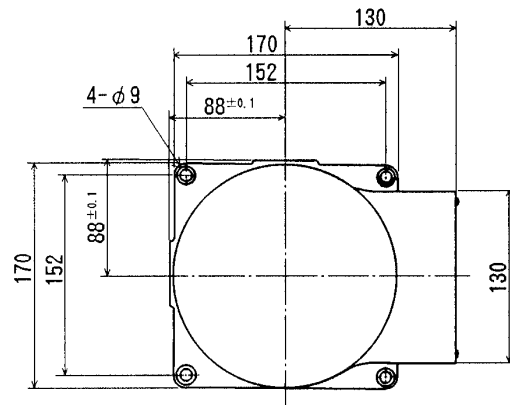
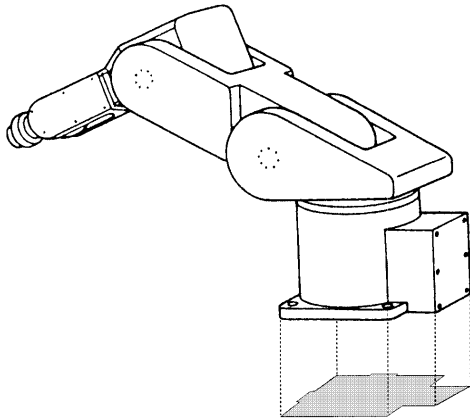
WARNING

When installing the robot on the wall or ceiling, the robot may fall or be damaged during the installation operation. Be sure to contact nearest Kawasaki when using this installation method.

4.1 Installing Robot Arm

RS03N(A00*)/RA03N(A00*)

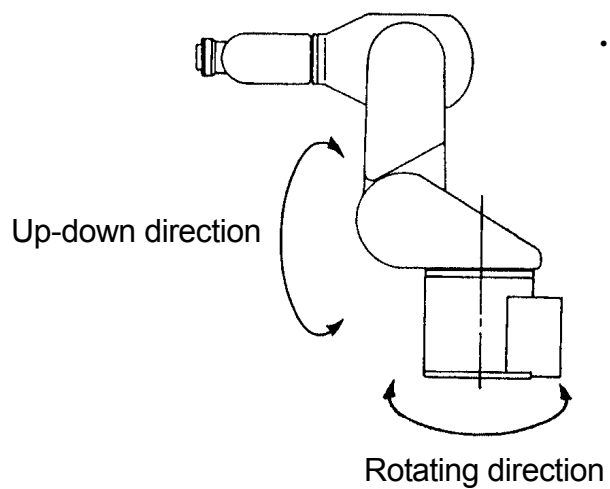
1. Install robot arm using the $\phi 9$ bolt holes (4 parts) in the base section as shown below.



Installation cross-section

High-tension bolt: 4-M8
Material: SCM435
Strength level: 10.9 or more
Tightening torque: 29.40 N·m

2. During operation, the robot arm applies the following moments M on its installation surface.
At robot installation, confirm this surface can adequately withstand these forces.



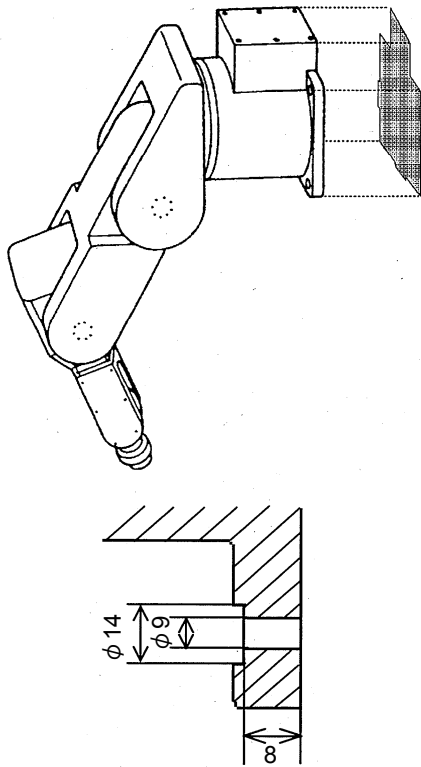
• RS03N(A00*)/RA03N(A00*)

Up-down direction: $M \text{ max.} = 357 \text{ N}\cdot\text{m}$

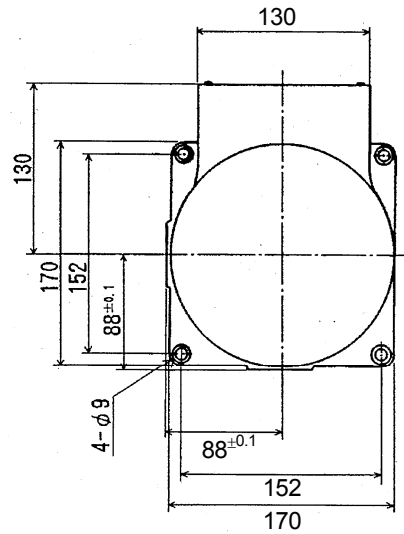
Rotating direction: $M \text{ max.} = 293 \text{ N}\cdot\text{m}$

RS03N(B00*)/RA03N(B00*)

1. Install robot arm using the $\phi 9$ bolt holes (4 parts) in the base section as shown below.

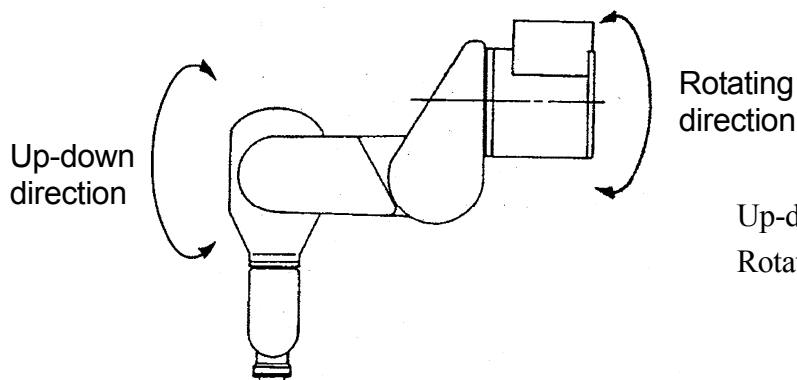


Installation cross-section



High-tension bolt: 4-M8
 Material: SCM435
 Strength level: 10.9 or more
 Tightening torque: 29.40 N·m

2. During operation, the robot arm applies the following moments M on its installation surface.
 At robot installation, confirm this surface can adequately withstand these forces.



Up-down direction: $M \text{ max.} = 465 \text{ N}\cdot\text{m}$
 Rotating direction: $M \text{ max.} = 220 \text{ N}\cdot\text{m}$

5 Installation of Tools

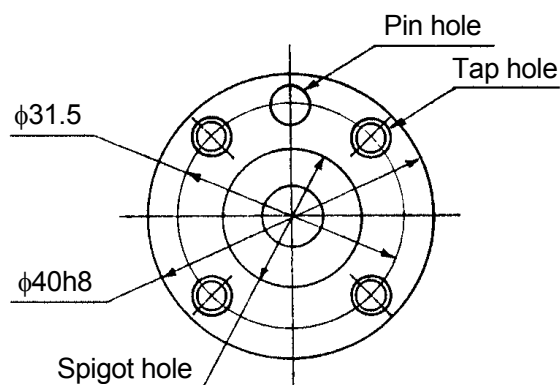


WARNING

Prior to installing tools on the robot, turn OFF controller power up to the main power source. Display signs indicating clearly “Inspection and Maintenance in Progress”, and lockout/tagout the main power switch to prevent personnel from accidentally turning ON the power.

5.1 Dimensions of Wrist End (Flange Face)

A flange is provided for installation of tool at end of robot arm. Tighten fixing bolts using the four tap holes (M5 bolts) on flange shown below. Also, use the pin holes and spigot hole for positioning tool.



Tap holes: 4-M5, Depth 8 (90° separation)
Pin hole: $\phi 5H7$, Depth 6
Spigot hole: $\phi 20H7$, Depth 4
Depth of engagement: 6 ~ 8 mm
High-tension bolt: SCM435,
Strength level 10.9 or more
Tightening torque: 6.86 N·m
(Conforms to ISO9409-1)



CAUTION

If the depth of engagement (length of fixing bolt within flange) exceeds the specified depth, the fixing bolt may interfere with wrist assembly and the flange cannot rotate.

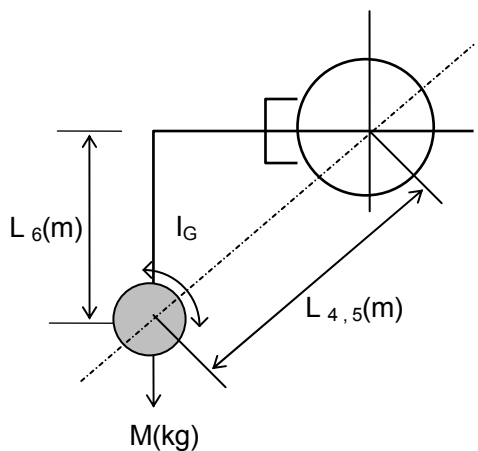
5.2 Setting the Load Mass

1. The maximum load mass of the robot including the mass of tool, workpiece, etc. is specified per robot model. Also, additional specifications also apply to the max. load torque capacity of the wrist section.
2. Strictly observe the limiting conditions for load torque and load moment of inertia around each wrist axis JT4, JT5, JT6 as shown below.

⚠ WARNING

1. **Exceeding the specified load mass may cause deterioration in motion performance and shorten the life of robot.**
2. **The specified load capacity for mass includes the mass of all attachments such as hand, tool changer, shock absorber, etc. When the total load mass exceeds the load capacity specification, be sure to consult Kawasaki before proceeding with operations.**

The load torque and load moment of inertia are evaluated by the following formulae.



Formulae

Load mass (incl. tool): $M \leq M_{max}$. (kg)

Load torque: $T = 9.8 \cdot M \cdot L$ (N·m)

Load moment of inertia: $I = M \cdot L^2 + I_G$ (kg·m²)

M_{max} (RS03N): Maximum load mass=3 kg
 M_{max} (RA03N): Maximum load mass=3 kg

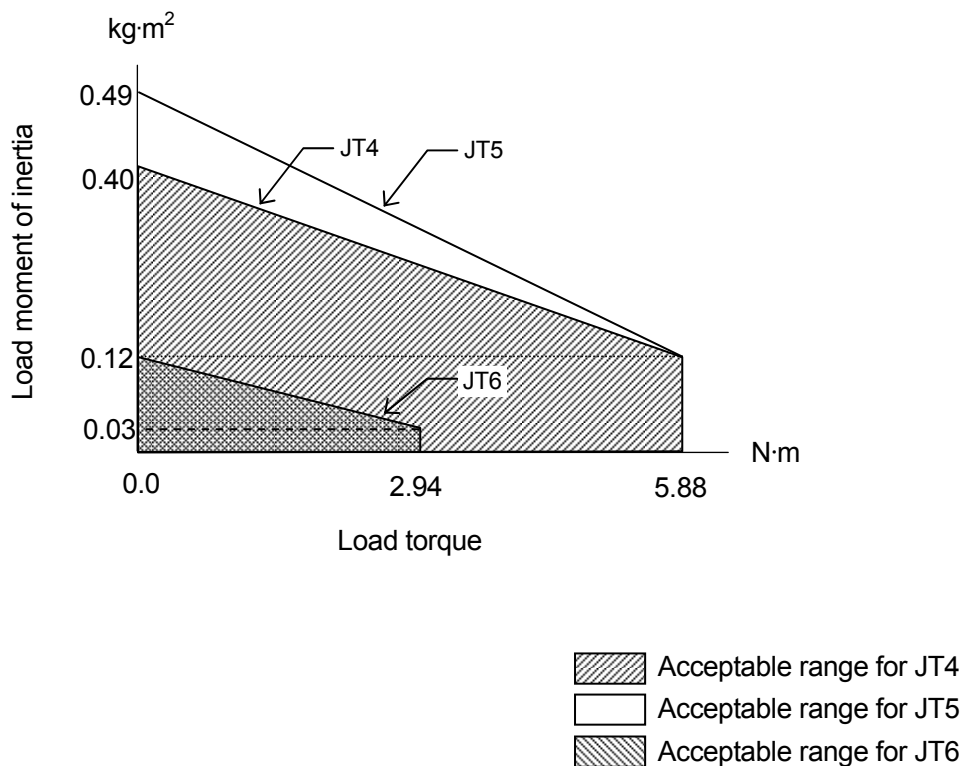
I_G : Moment of inertia around center of gravity. (kg·m²)
 L : Length from center of rotation axis to load center of gravity. (m)
 L_6 : Length from center of JT6 rotation axis to load center of gravity.
 $L_{4,5}$: Length from center of JT4 (JT5) rotation axes to load center of gravity. (See left)

When calculating the load by dividing it into sections (for example, tool section, workpiece section, etc.), evaluate the load torque and load moment of inertia from the sum of all the sections.

Adhere to the following limiting conditions for the load mass, etc. in wrist section.

1. The allowable load mass including the tool mass can be no more than 3 kg.
2. The load torque and the load moment of inertia in each wrist axis (JT4, JT5, JT6) must be within the allowable range shown below.

RS03N (A/B00*)/ RA03N (A/B00*)



[NOTE]

Scales shown in graph are approximate. If load on arm approaches limits, calculate load torque and load moment of inertia exactly.

6 Connection of Air System

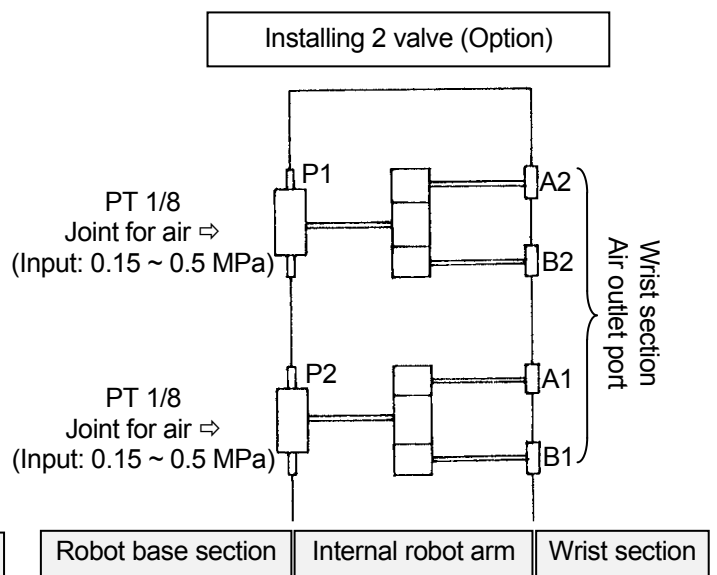
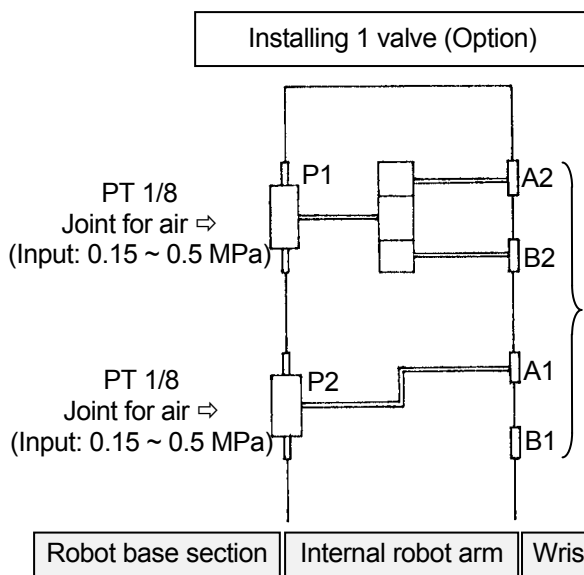
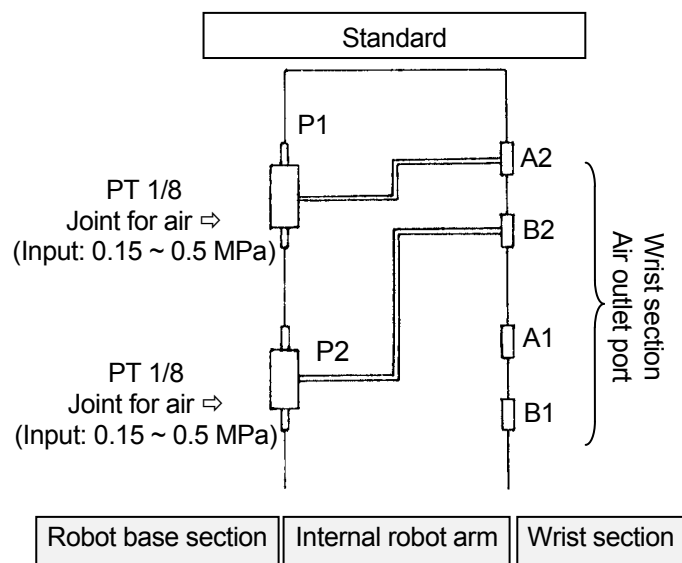
6.1 RS03N (A/B00*)

6.1.1 Air Piping Diagram

For RS03N (A/B00*), air piping and valves for activating the tool can be installed in the robot arm. The valves can be turned ON/OFF by teach pendant without using an interlock.

Specification of built-in valves is as follows. Standard spec. robot does not house the valves.

Option	Double solenoid	1 unit
	Double solenoid	2 units
	Single solenoid	1 unit
	Single solenoid	2 units

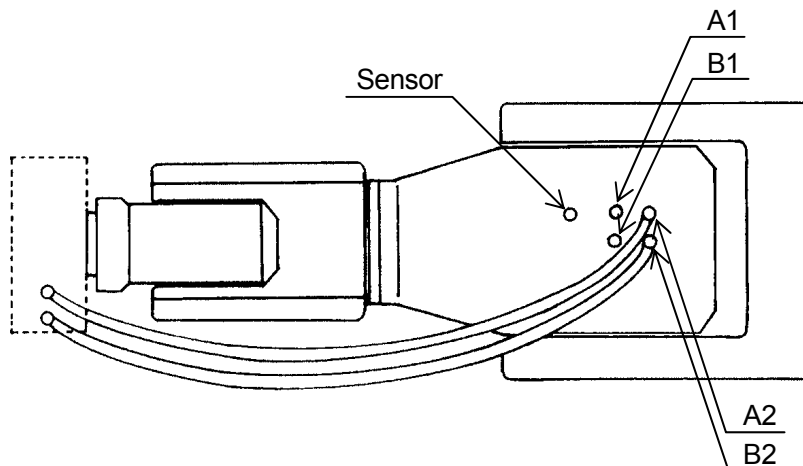


[NOTE]

Valve specification: 0.23 CV value, 2 positions. Valves not meeting above specifications can only be installed in arm after consulting Kawasaki for information on air system specifications.

6.1.2 Connection to the Tool from Air Outlet

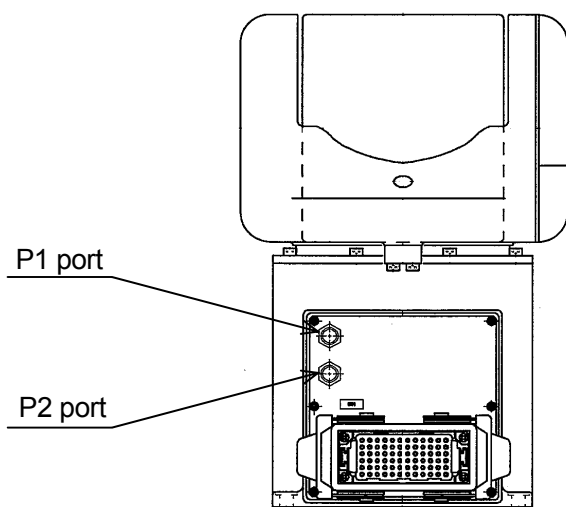
Air outlet ports are provided in the wrist section as shown in figure below.



Joint: Universal elbow (SMC:M-5HL-4)

6.1.3 Air Inlet to the Robot Arm

Air connecting ports are provided in the robot base section as shown in figure below.



Robot base section



CAUTION

Air supplied to P1 and P2 ports (PT1/8 joint) for air must be in pressure range: 0.15 ~ 0.5 MPa

[NOTE]

Refer to 6.1.1 for air piping diagram in the robot arm.

7 Precautions at Repeat Operation (RS03N/RA03N (A/B00*))

For (RS03N (A/B00*)/ RA03N (A/B00*)), when operating the robot at repeat operation, strictly observe the limiting conditions for motor duty around each wrist axis.

1. JT1 - JT3: 75 % or less
2. JT4 - JT6: 65 % or less

⚠ CAUTION

1. **Exceeding the specified load capacity may cause deterioration in motion performance and shorten the life of robot.**
2. **When motor duty exceeds its limit, adjust it to be within the limiting condition by reducing speed or acceleration, teaching a wait time on the motion path, etc.**

[NOTE]

Motor duty for each wrist axis can be checked by teach pendant. For more information, refer to the separate option manual “Failure Prediction Function for Reduction Gear”(90210-1188).

Example of motor duty adjustment (For RS03N (A00*))

Motion pattern	Standard setting (Variable accel/decel ratio: 100 %)	High accel/decel setting (Variable accel/decel ratio: 150 %)
Pick and place continuous motion with load mass of 1 kg. { X-base axis forward/back 10 times (X:300 mm Z:25 mm) Y-base axis forward/back 10 times (Y:300 mm Z:25 mm) Z-base axis forward/back 10 times (Z:300 mm Y:25 mm)	Cycle time: 29 seconds Wait time not required.	Cycle time: 25 seconds Requires 0.9 sec. wait time per 1 sec.-motion.

[NOTE]

Percentage settings for acceleration and deceleration can be changed via Aux.0515 Acceleration and deceleration variable function specification.



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