

YASKAWA

MotoMINI INSTRUCTIONS

TYPE:

YR-1-06VX05-A00(STANDARD SPECIFICATION)

YR-1-06VX05-A01(WHITE SPECIFICATION)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MotoMINI INSTRUCTIONS

MotoMINI INSTRUCTIONS

YRC1000micro INSTRUCTIONS

YRC1000micro OPERATOR'S MANUAL

YRC1000micro MAINTENANCE MANUAL

YRC1000micro ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The YRC1000micro alarm codes above consists of "MAJOR ALARMS" and "MINOR ALARMS".

MANUAL NO.

HW1484782 ◊



DANGER

- This instruction manual is intended to explain mainly on the mechanical part of the MotoMINI for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator. Any matter not described in this manual must be regarded as "prohibited" or "improper".
- General information related to safety are described in "Chapter 1. Safety" of the YRC1000micro INSTRUCTIONS. To ensure correct and safe operation, carefully read "Chapter 1. Safety" of the YRC1000micro INSTRUCTIONS.



CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product. The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MotoMINI.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.



WARNING

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.



CAUTION

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.



NOTICE

NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING”, and “CAUTION”.



WARNING

- For disassembly or repair not stated in *table 9-1 “Inspection Items”*, contact your YASKAWA representative listed in the table or on the back cover of this instruction manual.



DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
 - Press the emergency stop button on the programming pendant or on the external control device, etc.
 - Disconnect the safety plug of the safety fence.
(when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button



- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop



- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
 - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
 - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
 - Turning ON the YRC1000micro power
 - Moving the manipulator by using the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop button is located on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.



WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
 - Check for a problem in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to a safety place after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual

The MotoMINI is the YASKAWA industrial robot product.

The MotoMINI usually consists of the manipulator, the YRC1000micro controller, the YRC1000micro programming pendant (optional), the YRC1000micro programming pendant dummy connector (optional) and manipulator cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000micro controller	YRC1000micro
YRC1000micro programming pendant	Programming pendant (optional)
YRC1000micro programming pendant dummy connector	Programming pendant dummy connector (optional)
Cable between the manipulator and the controller	Manipulator cable

Registered Trademark

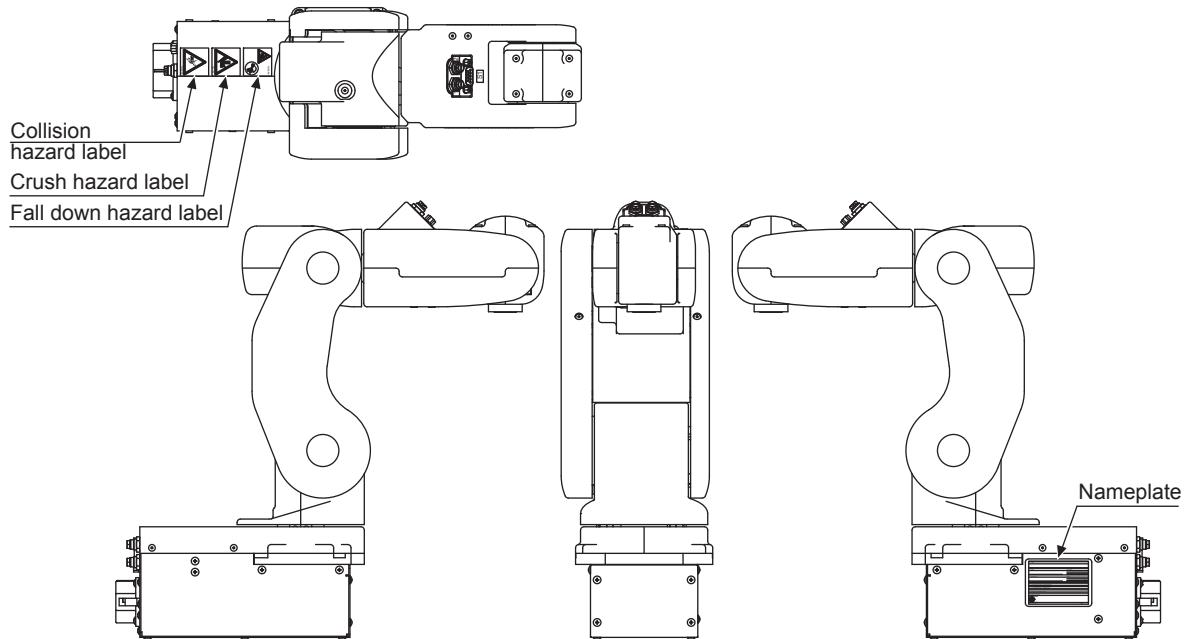
In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

Explanation of Warning Labels

The following warning labels are attached to the manipulator. Always follow the warnings on the labels.

Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Fig. : Warning Label Locations



Name Plate

TYPE	PAYLOAD
DATE	kg
SERIAL NO.	MASS kg
<hr/>	
YASKAWA ELECTRIC CORPORATION 2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan MADE IN JAPAN	
(10)	
NJ4030	

Fall down hazard label

NJ4040

Description

Make sure to secure the manipulator base by using the bolts of the specified sizes and by tightening the bolts with the specified tightening torques. If the power is turned ON and the manipulator is operated without securing the manipulator properly, the manipulator may fall down, which may result in personal injury and/or equipment damage.

Collision hazard label

NJ4032

Description

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:

- Turning ON the YRC1000micro power
- Moving the manipulator by using the programming pendant
- Running the system in the check mode
- Performing automatic operations

Crush hazard label**Description**

Keep clear of moving parts when performing a teaching operation within the manipulator's operating range. Failure to observe this instruction may result in personal injury.

1	Product Confirmation	1-1
1.1	Contents Confirmation	1-1
1.2	Order Number Confirmation	1-2
2	Transport.....	2-1
2.1	Transporting Method.....	2-1
2.1.1	Transporting Posture	2-1
2.1.2	Notes on Transportation	2-2
3	Installation.....	3-1
3.1	Installation of Safeguarding	3-2
3.2	Mounting Procedures for Manipulator Base	3-2
3.2.1	Mounting the Manipulator on the Baseplate	3-3
3.3	Mounting method	3-5
3.3.1	S-Axis Operating Range.....	3-5
3.3.2	Precautions to Prevent the Manipulator from Falling.....	3-6
3.4	Location	3-7
4	Wiring.....	4-1
4.1	Grounding	4-2
4.2	Cable Connection	4-3
5	Basic Specifications	5-1
5.1	Basic Specifications.....	5-1
5.2	Part Names and Working Axes.....	5-2
5.3	Dimensions and P-Point Maximum Envelope.....	5-3
5.4	Stopping Distance and Time for S-, L-, and U-Axes.....	5-5
5.4.1	General Information.....	5-5
5.4.2	Definition of Use	5-5
5.4.3	Stopping Distance and Time for Stop Category 0: S-, L-, and U-Axes.....	5-5
5.4.4	Stopping Distance and Time for Stop Category 1: S-, L-, and U-Axes.....	5-6
5.4.4.1	Extension	5-6
5.4.4.2	Stopping Distance and Time for Stop Category 1: S-Axis.....	5-8
5.4.4.3	Stopping Distance and Time for Stop Category 1: L-Axis	5-9
5.4.4.4	Stopping Distance and Time for Stop Category 1: U-Axis	5-10
5.5	Alterable Operating Range	5-11
5.5.1	Components for Altering Operating Range	5-11

5.5.2 S-Axis Stopper Installation Procedures	5-13
5.5.3 Adjustment to the Pulse Limitation of S-Axis	5-13
6 Allowable Load for Wrist Axis and Wrist Flange	6-1
6.1 Allowable Wrist Load	6-1
6.2 Wrist Flange.....	6-3
7 System Application.....	7-1
7.1 Internal User I/O Wiring Harness and Air Lines	7-1
7.2 S-, R-, B-, and T-Axes without Brake.....	7-3
8 Electrical Equipment Specification	8-1
8.1 Internal Connections	8-1
9 Maintenance and Inspection	9-1
9.1 Inspection Schedule.....	9-1
9.2 Replacement of the Battery Pack	9-4
9.3 Home Position Calibration	9-6
10 Recommended Spare Parts.....	10-1

1 Product Confirmation



CAUTION

- Confirm that the manipulator and the YRC1000micro have the same order number. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.

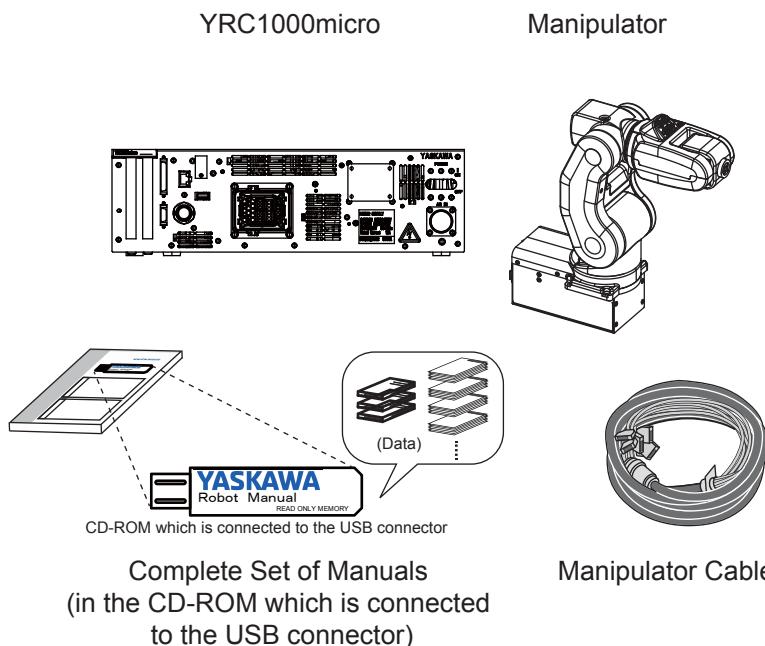
1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives.

Standard delivery includes the following four items
(Information for the content of optional goods is given separately):

- Manipulator (accessories included)
- The YRC1000micro
- Manipulator cables
(between the YRC1000micro and the manipulator)
- Manuals (complete set of manuals)

Fig. 1-1: Four Items for Standard Delivery



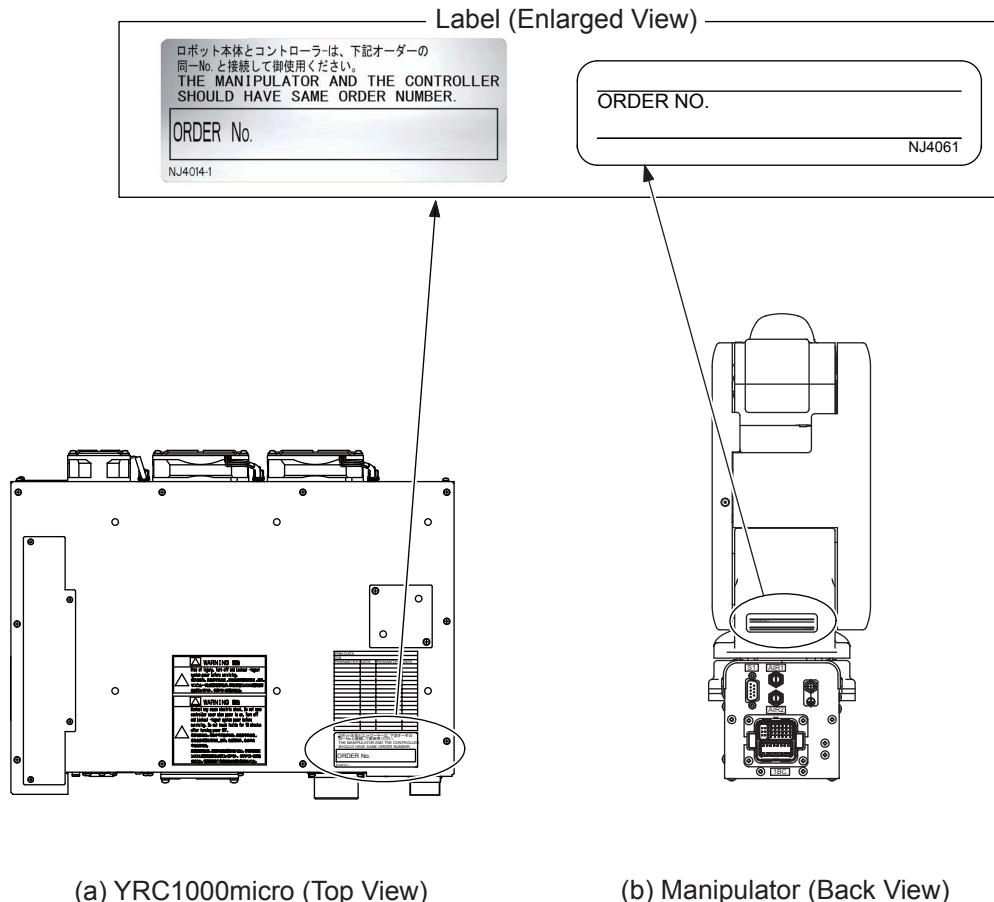
Accessories of Manipulator	Pcs	Remarks
Hexagon socket head cap screw M5 (length: 25 mm)	4	For mountings the manipulator
Conical spring washer M5	4	

-
- 1 Product Confirmation
 - 1.2 Order Number Confirmation
-

1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the YRC1000micro. The order number is located on a label as shown below.

Fig. 1-2: Location of Order Number Labels



(a) YRC1000micro (Top View)

(b) Manipulator (Back View)

2 Transport

NOTICE

- Avoid excessive vibration or shock during transport.

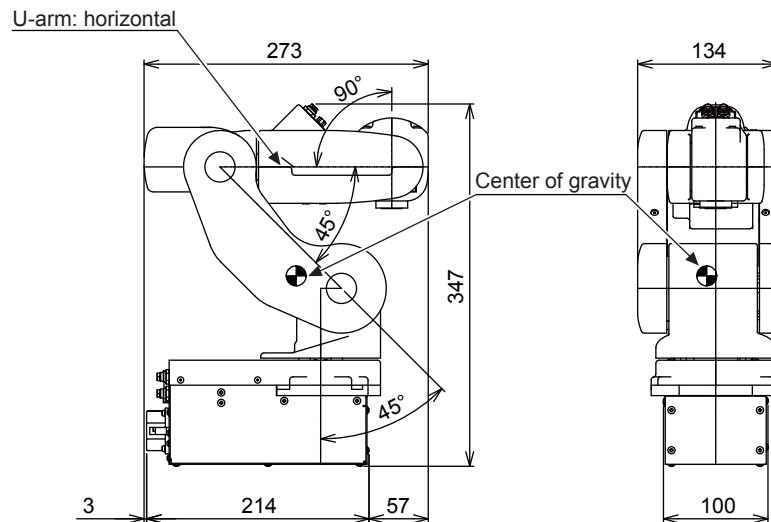
The system consists of precision components. Failure to observe this caution may adversely affect performance.

2.1 Transporting Method

2.1.1 Transporting Posture

As a rule, when transporting the manipulator, take the following posture.

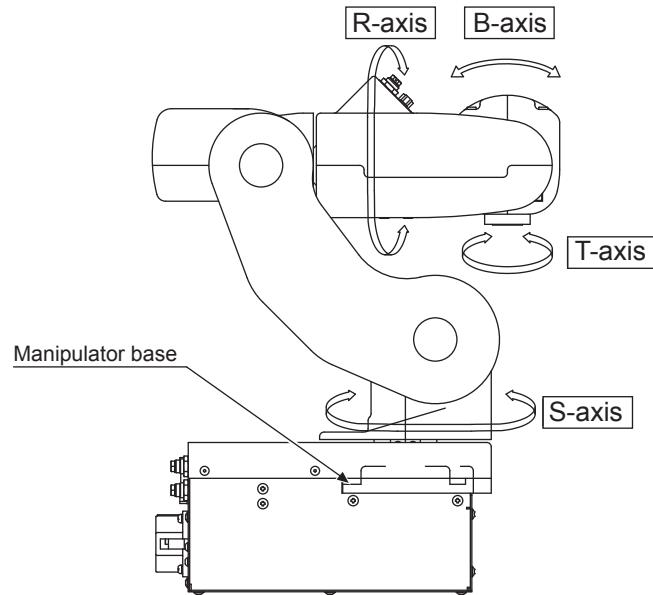
Fig. 2-1: Transporting Position (factory setting)



 2 Transport
 2.1 Transporting Method

2.1.2 Notes on Transportation

Fig. 2-2: Arm Axis Rotations When Transporting the MotoMINI



Basically, MotoMINI must be transported by hand. When transporting the manipulator, wear non-slippery gloves, adjust the posture of the manipulator as shown in *chapter 2.1.1 “Transporting Posture”*, and carry it by holding the base section of the manipulator.

Please keep the followings when MotoMINI is transported since no brakes are equipped on S-, R-, B- and T-axes.

- Be careful of the arm rotations and edges of the manipulator. Arm rotation may cause the centroid deviation and the balance of the manipulator may lost while it is being transported. Take sufficient precautions to avoid the manipulator from falling when transporting.



- The mass of the manipulator is approximately 7 kg.
- Make sure to avoid external force on the arm or motor unit when transporting the manipulator.

3 Installation



DANGER

- Install safety fences.

Failure to observe this warning may result in injury or damage.



WARNING

- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, the safety fence, or the YRC1000micro, etc.

Failure to observe this warning may result in injury or damage.

- Make sure to firmly anchor the manipulator before turning ON the power and operating the manipulator.

Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.

- The base for the manipulator should have adequate strength and rigidity.

Failure to observe this warning may result in injury or damage.

- Do not install or operate a damaged manipulator or a manipulator any of whose components is missing.

Failure to observe this instruction may cause improper movement, etc. of the manipulator, which may result in personal injury and/or equipment damage.

 3 Installation
 3.1 Installation of Safeguarding

3.1 Installation of Safeguarding

To insure safety, be sure to install the safeguarding.

They prevent unforeseen accidents with personnel and damage to equipment.

The following is quoted for your information and guidance.

Responsibility for Safeguarding (ISO 10218)

The user of a manipulator or robot system shall ensure that safeguarding is provided and used in accordance with Sections 6, 7, and 8 of this standard.

The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application.

Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.

3.2 Mounting Procedures for Manipulator Base

The manipulator should be firmly mounted on a baseplate or foundation strong enough to support the manipulator and withstand repulsion forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion force of the manipulator. (Refer to *table 3-1 “Manipulator Reaction Force and Torque”*.)

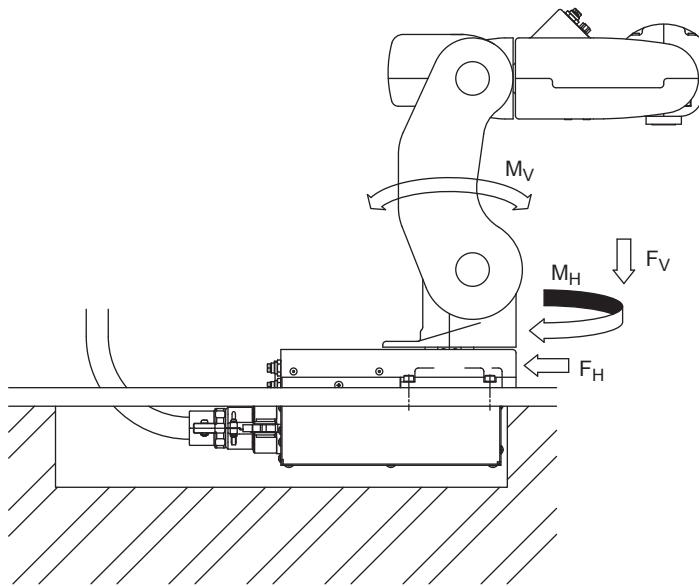
A baseplate flatness must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities.

For installation, refer to *chapter 3.2.1 “Mounting the Manipulator on the Baseplate”*.

Table 3-1: Manipulator Reaction Force and Torque

	Horizontal rotation		Vertical rotation	
	Reaction force F_H	Torque M_H	Reaction force F_H	Torque M_H
Emergency stop	316 N·m (32.3 kgf·m)	96 N·m (9.8 kgf·m)	354 N·m (36.3 kgf·m)	96 N·m (9.8 kgf·m)
Acceleration/ deceleration	149 N·m (15.1 kgf·m)	46 N·m (4.6 kgf·m)	175 N·m (17.8 kgf·m)	46 N·m (4.6 kgf·m)

Fig. 3-1: Manipulator Reaction Force and Torque



3.2.1 Mounting the Manipulator on the Baseplate

The box, connectors, and cables are located below the base of MotoMINI. Secure the following space when installing the manipulator.



- Length: 390 mm or more.
Width: 102 mm (must be exact)
Depth: 70 mm or more.

For the base plate, provide four mounting through holes.

- Length: 390 mm or more.
Width: 102 mm (must be exact)

Fix the baseplate on the floor first. The baseplate should be sufficiently strong and rigid.

The thickness of the baseplate is 16 mm or more and anchor bolts of M6 or larger is recommended.

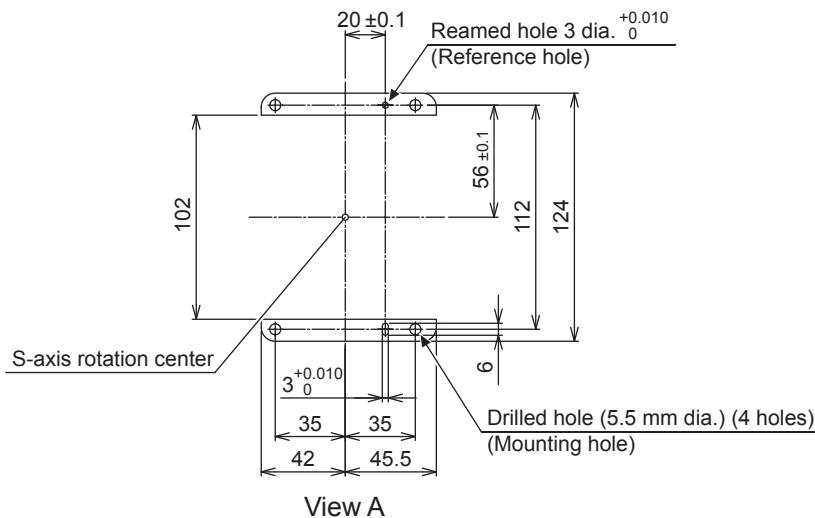
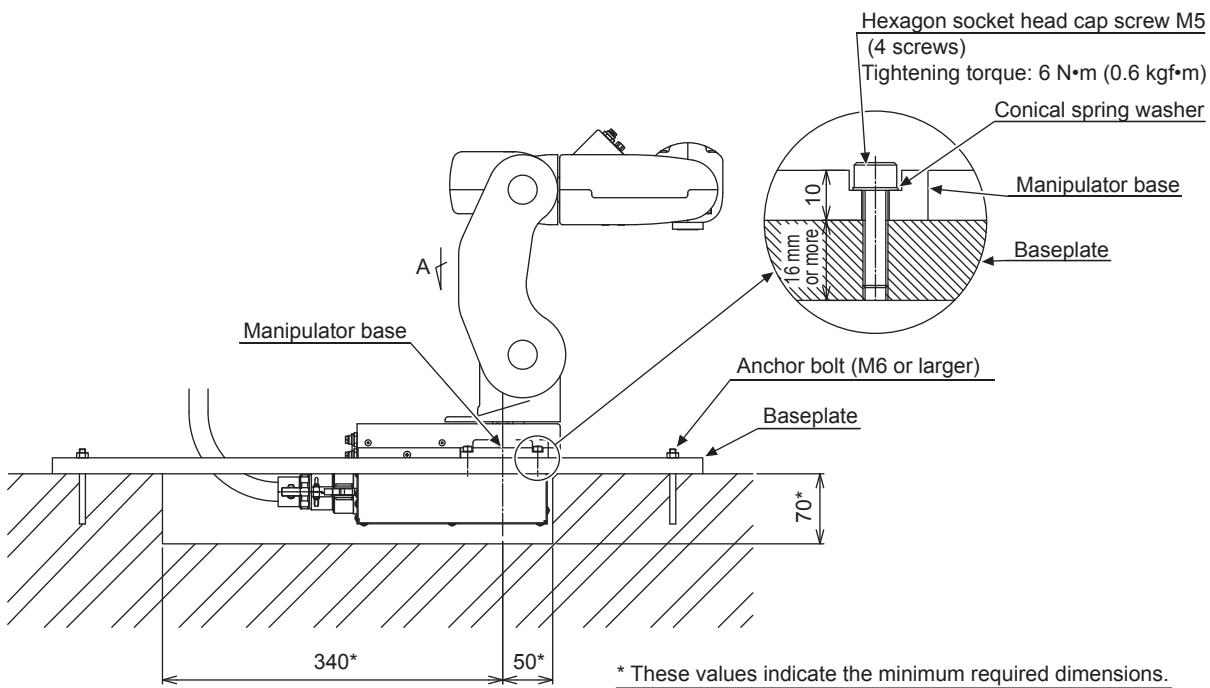
Then, fix the manipulator base to the baseplate. Four mounting holes are provided on the manipulator base.

Fix the manipulator base to the baseplate using four hexagon socket head cap screw M5 (tensile strength: 1200 N/mm² or more) (length of 25 mm or more is recommended) with a tightening torque of 6 N·m using four mounting holes on the manipulator base.

Tighten the screws and anchor bolts securely so that they will not work loose during operation. For details, refer to fig. 3-2 "Mounting the Manipulator on the Baseplate"

3 Installation
3.2 Mounting Procedures for Manipulator Base

Fig. 3-2: Mounting the Manipulator on the Baseplate



3.3 Mounting method

The MotoMINI can be mounted in four ways: floor-mounted way, wall-mounted way, tilt-mounted way and ceiling-mounted way. For wall-mounted, tilt-mounted and ceiling-mounted ways, the following points are different from the floor-mounted way.

- S-axis operating range
- Precautions to prevent the manipulator from falling

3.3.1 S-Axis Operating Range

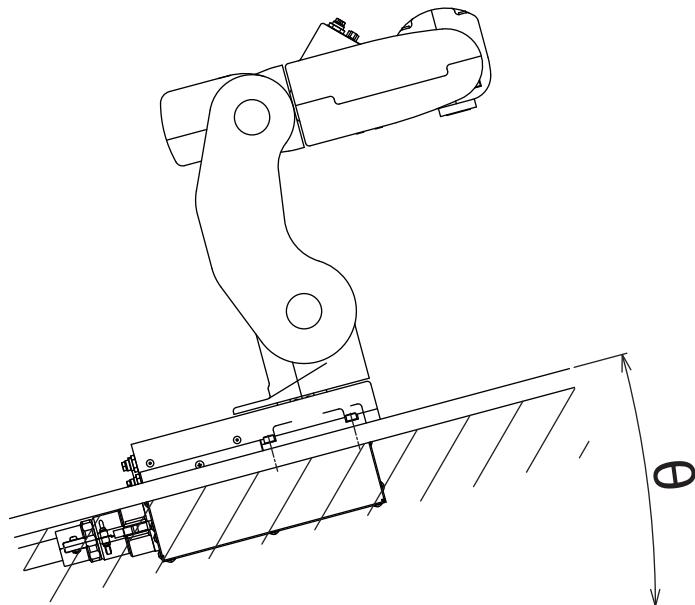
For wall-mounted way, the S-axis operating range is $\pm 30^\circ$.

For the tilt-mounted way, the operating range of the S-axis varies as shown in the following table.

Table 3-2: Installation Angle for Tilt-Mounted Way and Operating range of S-axis

Installation Angle (θ)	Operating range of S-axis
$0^\circ \leq \theta \leq 30^\circ$	within $\pm 170^\circ$ (no limit)
$30^\circ < \theta \leq 40^\circ$	within $\pm 50^\circ$
$40^\circ < \theta \leq 50^\circ$	within $\pm 40^\circ$
$50^\circ < \theta$	within $\pm 30^\circ$

Fig. 3-3: Installation Angle for Tilt-Mounted Way



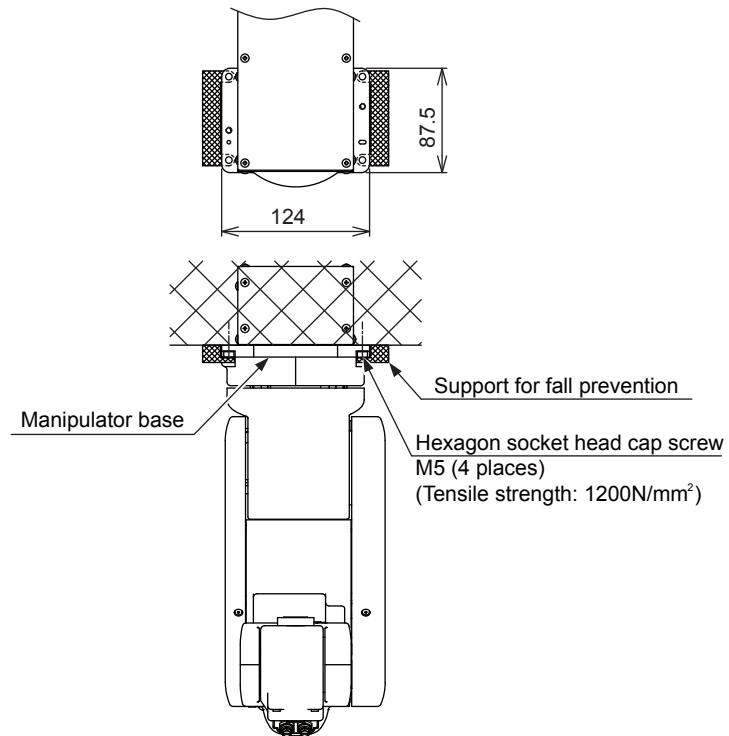
For the wall-, tilt-, and ceiling-mounted way, the installation angle relative to the ground must be input by using the programming pendant.

For the input procedures, refer to chapter 8.4 "ARM Control" in "YRC1000micro INSTRUCTIONS (RE-CTO-A222)". Also, the operating range of the S-axis must be altered by referring to chapter 5.5 "Alterable Operating Range".

3.3.2 Precautions to Prevent the Manipulator from Falling

For the wall- or ceiling-mounted ways, take measures to the base part of the manipulator to avoid it from falling in case of emergency. Refer to fig. 3-4 "Precaution Against Falling" for details.

Fig. 3-4: Precaution Against Falling



In case of using the wall/ceiling-mounted way, inform YASKAWA of the matter when placing an order. Be sure to contact your YASKAWA representative (listed on the back cover of this instruction manual) to perform a wall/ceiling installation on site.

3.4 Location

When installing the manipulator, satisfy the following environmental conditions.

- Ambient temperature: 0°C to 40°C
- Humidity: 20% to 80%RH at constant temperature
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid
- Free from excessive vibration
(Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Free from the strong magnetic field
- Altitude: 1000 m or less
- Flatness for installation is 0.5 mm or less



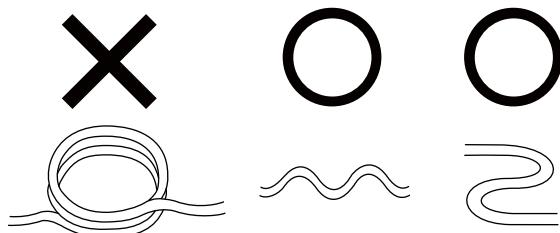
When the operation is started after the manipulator has been out of operation and left in the low temperature (almost 0°C) for a long period, the alarm may occur since the friction torque of the drive unit is large.
If the alarm occurs, perform the break-in for few minutes.

4 Wiring

WARNING



- Ground resistance must be 100 Ω or less.
Failure to observe this warning may result in fire and/or electric shock.
- Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)
Failure to observe this warning may result in electric shock and/or personal injury.
- Wiring must be performed by authorized or certified personnel.
Failure to observe this caution may result in fire and/or electric shock.
- When laying the cables from the manipulator to the YRC1000micro, DO NOT cover the cable with heat insulating material and avoid multiple cabling.
Failure to observe this caution may result in burn caused by cable heat emission failure.



4.1 Grounding

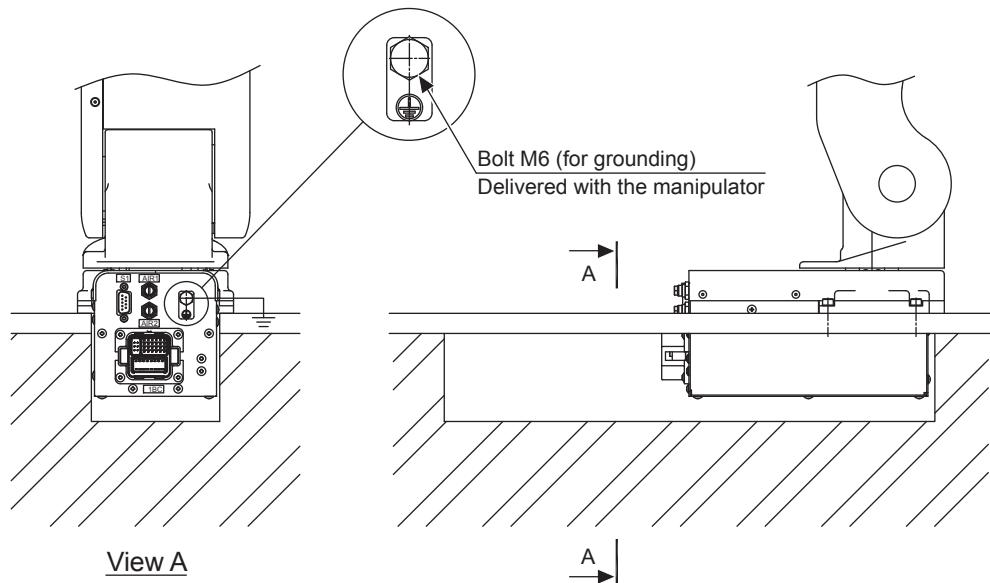
Follow electrical installation standards and wiring regulations for grounding. Ground resistance must be 100Ω or less. A ground wire of 5.5 mm^2 or more is recommended.

Refer to *fig. 4-1 “Grounding Method”* to connect the ground line directly to the manipulator.

NOTE

- Never use this wire sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.

Fig. 4-1: Grounding Method



4.2 Cable Connection

Connect both edge of the manipulator cable to the connectors of the manipulator base and of the YRC1000micro. Before connecting the cable, verify the numbers on the connector as shown in *fig. 4-3 "Manipulator Cables"*.

For the connecting position, refer to *fig. 4-4 "Manipulator Cable Connection (Manipulator Side)"* and *fig. 4-5 "Manipulator Cable Connection (YRC1000micro Side)"*.

Refer to *table 4-1 "Specifications of Manipulator Cable"* and *fig. 4-6 "Overhead View of Manipulator Cable Connection (Manipulator Side)"* for the outside diameter and the minimum bending radius (for fixed part and moving part) of the manipulator cable and protruding amount of the manipulator cable on the manipulator side.

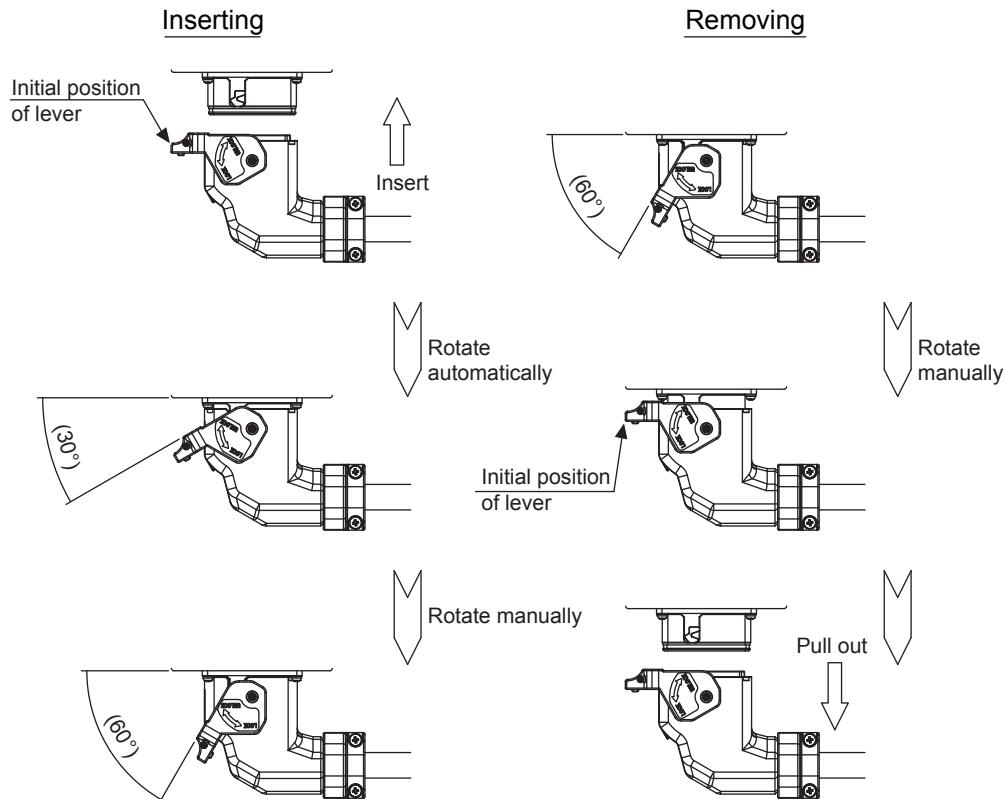
■ Procedures for inserting the connector

1. Confirm the connector lever of the manipulator cable is at the initial position. Insert the cable straight into the connectors of the manipulator and the YRC1000micro. When the manipulator cable is inserted to a certain depth, the lever automatically rotates about 30 degree forward.
2. Push the lever manually and turn it (about 30 degree) until it clicks to lock.

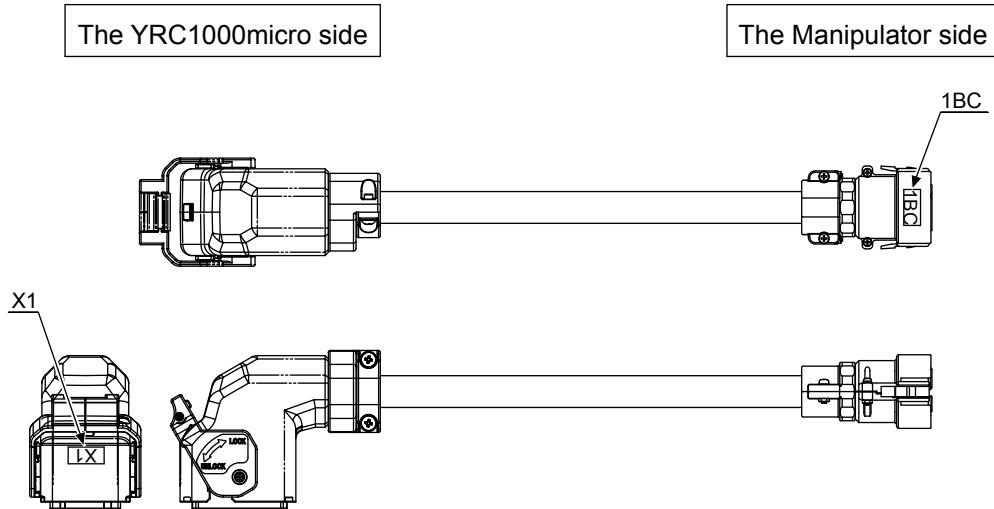
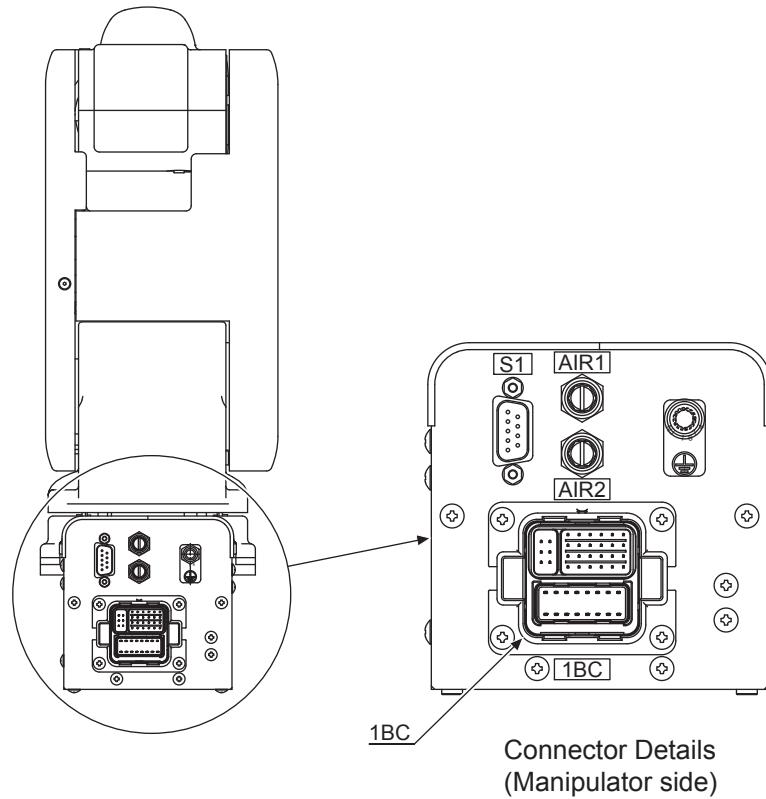
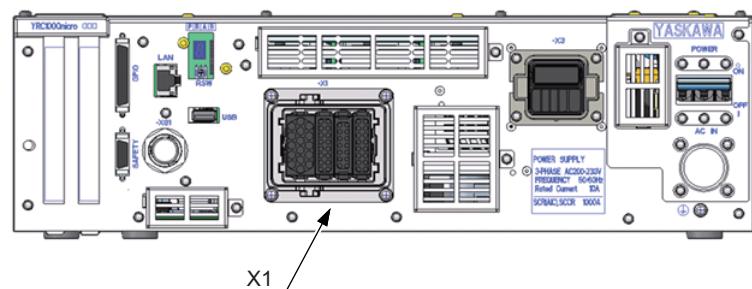
■ Procedures for removing the connector

1. Release the lock by pushing the releasing part of the lever to unlock. Turn the lever about 60 degree to the initial position.
2. Pull out the connector straight.

Fig. 4-2: Connection of Manipulator Cable



4 Wiring
 4.2 Cable Connection

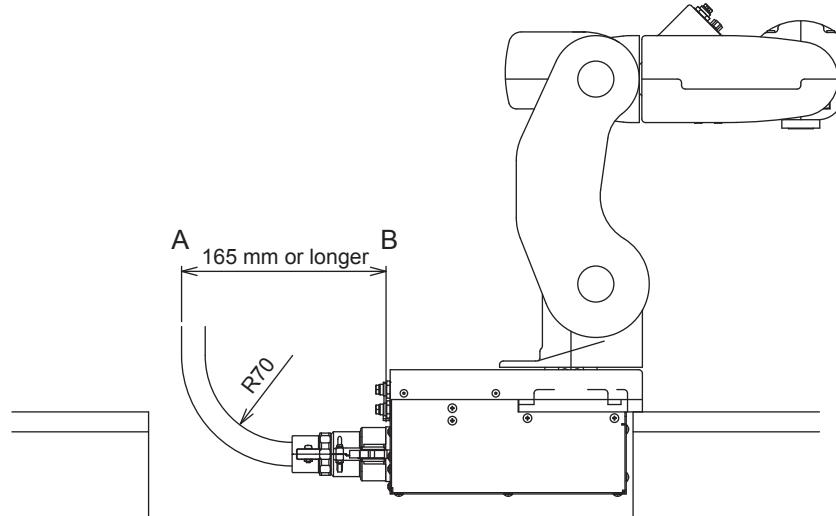
Fig. 4-3: Manipulator Cables*Fig. 4-4: Manipulator Cable Connection (Manipulator Side)**Fig. 4-5: Manipulator Cable Connection (YRC1000micro Side)*

4 Wiring
4.2 Cable Connection

Table 4-1: Specifications of Manipulator Cable

Outside diameter (mm)	Minimum bending radius (mm)		Distance between A and B (mm)
	Fixed part	Moving part	
19	70	190	165

Fig. 4-6: Overhead View of Manipulator Cable Connection (Manipulator Side)



5 Basic Specifications

5.1 Basic Specifications

Table 5-1: Basic Specifications¹⁾

Item	Model	MotoMINI
Configuration		Vertically Articulated
Degree of Freedom		6
Payload		0.5 kg
Repeatability ²⁾		±0.02 mm
Range of Motion	S-axis (turning)	-170° - +170°
	L-axis (lower arm)	-85° - +90°
	U-axis (upper arm)	-50° - +90°
	R-axis (wrist roll)	-140° - +140°
	B-axis (wrist pitch/yaw)	-30° - +210°
	T-axis (wrist twist)	-360° - +360°
Maximum Speed	S-axis	5.5 rad/s, 315 °/s
	L-axis	5.5 rad/s, 315 °/s
	U-axis	7.3 rad/s, 420 °/s
	R-axis	10.5 rad/s, 600 °/s
	B-axis	10.5 rad/s, 600 °/s
	T-axis	10.5 rad/s, 600 °/s
Allowable Moment ³⁾	R-axis	0.42 N·m (0.043 kgf·m)
	B-axis	0.42 N·m (0.043 kgf·m)
	T-axis	0.37 N·m (0.038 kgf·m)
Allowable Inertia (GD ^{2/4})	R-axis	0.00378 kg·m ²
	B-axis	0.00378 kg·m ²
	T-axis	0.00299 kg·m ²
Approx. Mass		7 kg
Protective enclosure		All axes: IP30
Mounting method ⁴⁾		Floor-, wall-, tilt-, ceiling-mounted,
Ambient Conditions	Temperature	0°C - 40°C
	Humidity	20% - 80% RH at constant temperature
	Vibration Acceleration	Less than 4.9 m/s ² (0.5 G)
	Altitude	1000 m or less
	Others	<ul style="list-style-type: none"> • Free from corrosive gas or liquid, or explosive gas. • Free from water, oil, or dust. • Free from excessive electrical noise (plasma). • Free from strong magnetic field.
Power Capacity		0.5 kVA
Applicable controller		YRC1000micro
Equivalent continuous sound pressure level ⁵⁾		65 dB or less

1 SI units are used in this table. However, gravitational unit is used in () .

2 Conformed to ISO9283.

3 Refer to chapter 6 “Allowable Load for Wrist Axis and Wrist Flange” for details on the allowable moment of inertia.

4 For the tilt-, and the wall-mounted ways, S-axis has the limited operating range. For details, refer to chapter 3.3.1 “S-Axis Operating Range” .

5 Conformed to equivalent continuous A-weighted sound pressure level measured in accordance with ISO11201(EN31201).

1. Measurement is carried out when the maximum load is mounted to the manipulator and operated in the maximum speed.

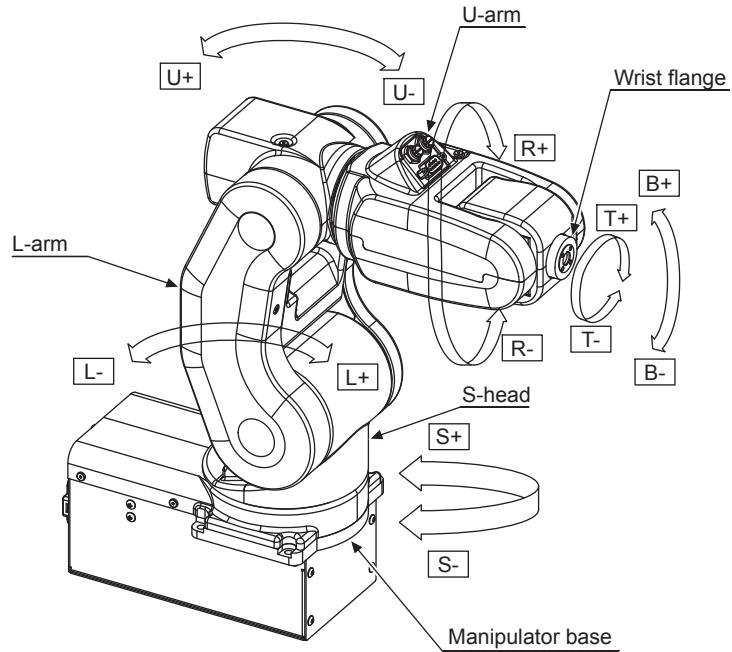
2. Measurement is carried out:

-between 1.2 m and 1.5 m above the ground.

-400 mm away from the P-point maximum envelope

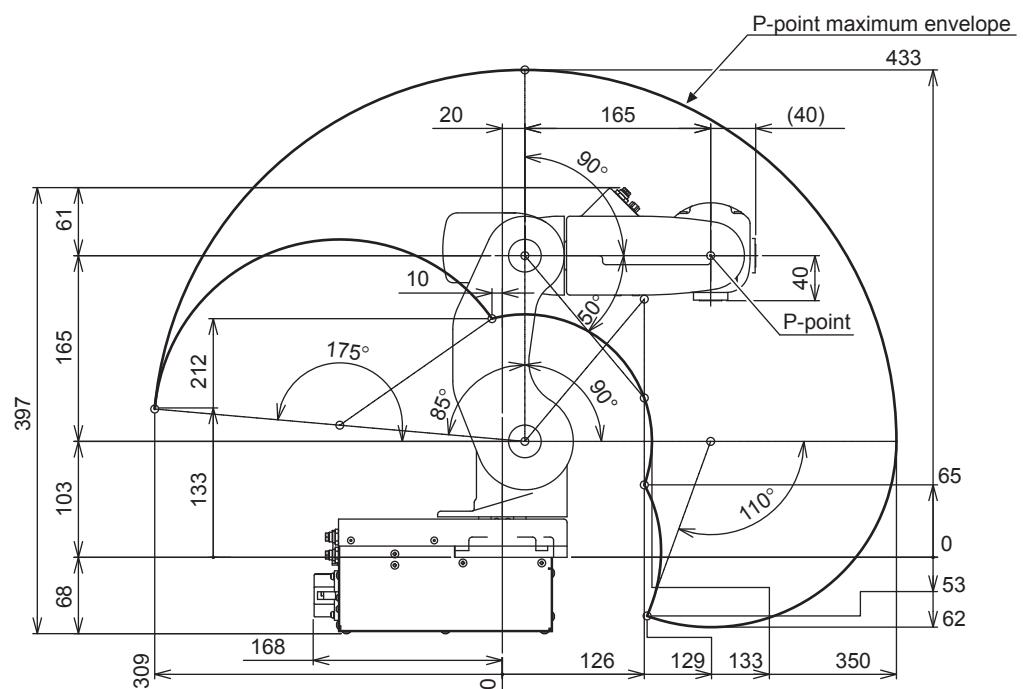
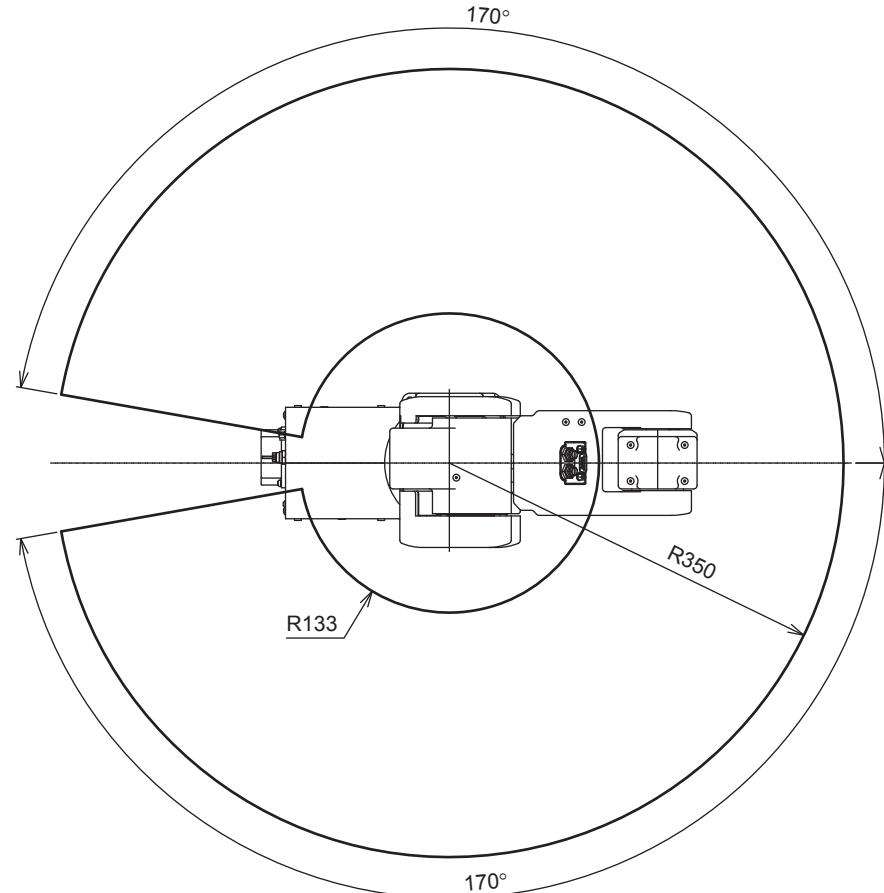
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes



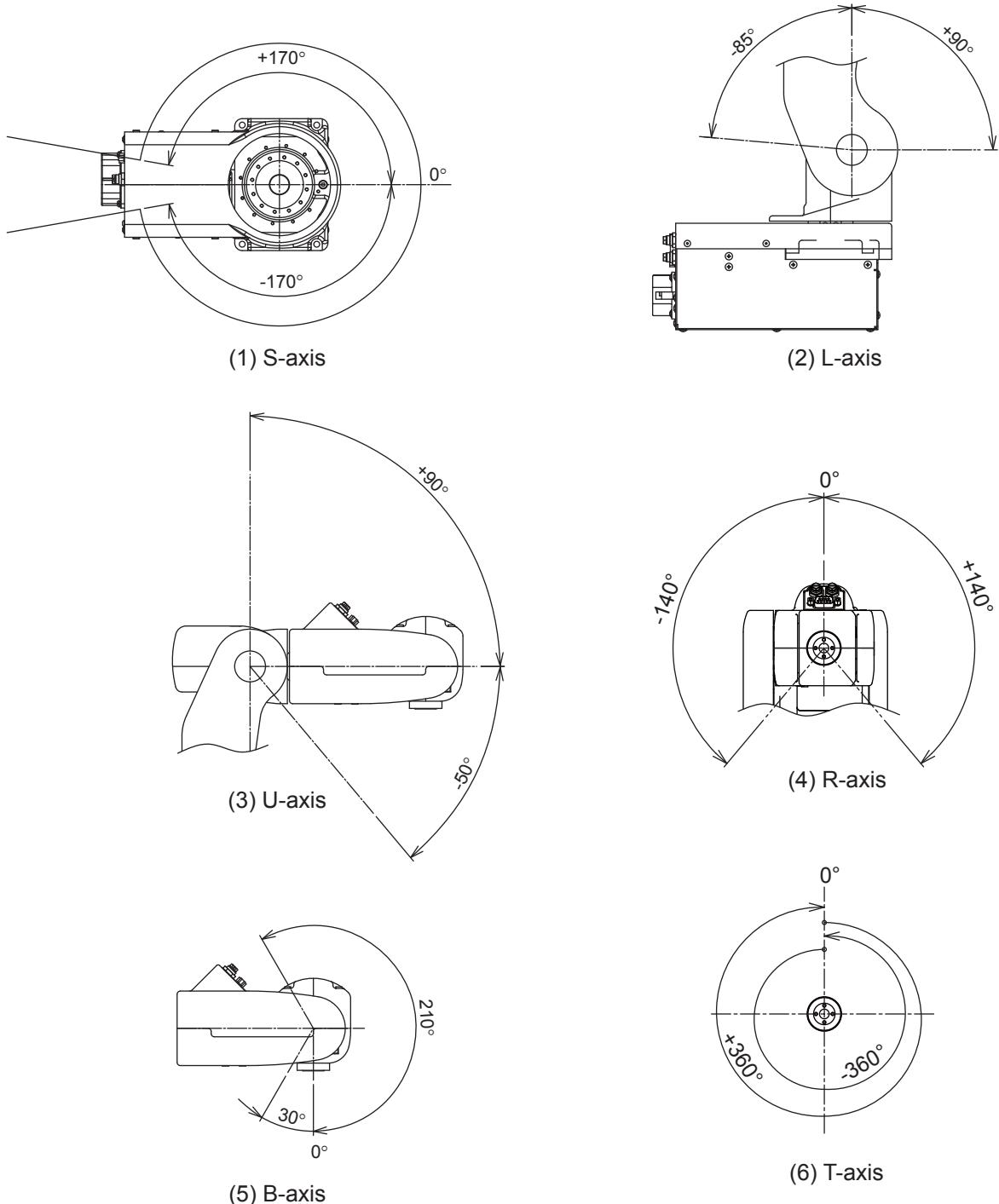
5.3 Dimensions and P-Point Maximum Envelope

Fig. 5-2: Dimensions and P-Point Maximum Envelope



5 Basic Specifications
5.3 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Home Position and Operating Range of Each Axis



5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.1 General Information

- The stopping distance is an angle traveled by the manipulator from the moment when the stop signal is activated until the manipulator comes to a complete standstill.
- The stopping time is a time elapsed from the moment that the stop signal is activated until the manipulator comes to a complete standstill.
- The data that are given for the main axes S, L, and U are the maximum displacement.
- Superposed axes motions may result in longer stopping distance.
- Stopping distance and stopping time are measured in accordance with ISO 10218-1, Annex B.
- Stop categories: According to IEC60204-1
 - Stop category 0
 - Stop category 1
- The values specified for Stop category 0 are the reference values that are determined by tests and simulations. The actual stopping distance and stopping time may differ. Stopping distance and stopping time are measured by the measurement function inside the manipulator.

5.4.2 Definition of Use

- Load: Rated load weight and load on an arm
- Speed: Operating speed of the manipulator
- Extension: Distance between the rotation center and the P-point of each axis

5.4.3 Stopping Distance and Time for Stop Category 0: S-, L-, and U-Axes

Measurement Conditions

- Load: Maximum load
- Speed: Maximum speed
- Posture: Maximum inertia generation posture

Axis	Stopping distance (deg)	Stopping time (sec)
S-axis	20.2	0.121
L-axis	15.1	0.074
U-axis	17.1	0.059

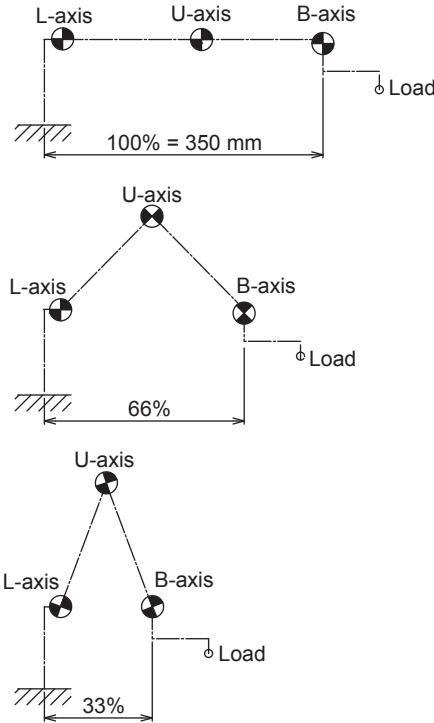
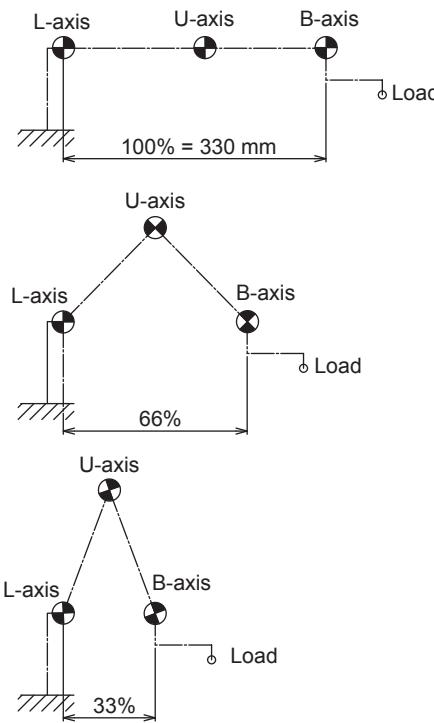
5 Basic Specifications

5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.4 Stopping Distance and Time for Stop Category 1: S-, L-, and U-Axes

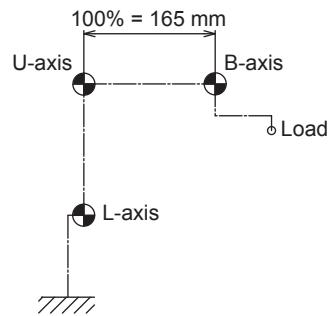
5.4.4.1 Extension

Refer to *fig. 5-4 “S-Axis Extension”*, *fig. 5-5 “L-Axis Extension”*, and *fig. 5-6 “U-Axis Extension”* for each axis arm extension.

Fig. 5-4: S-Axis Extension*Fig. 5-5: L-Axis Extension*

5 Basic Specifications
5.4 Stopping Distance and Time for S-, L-, and U-Axes

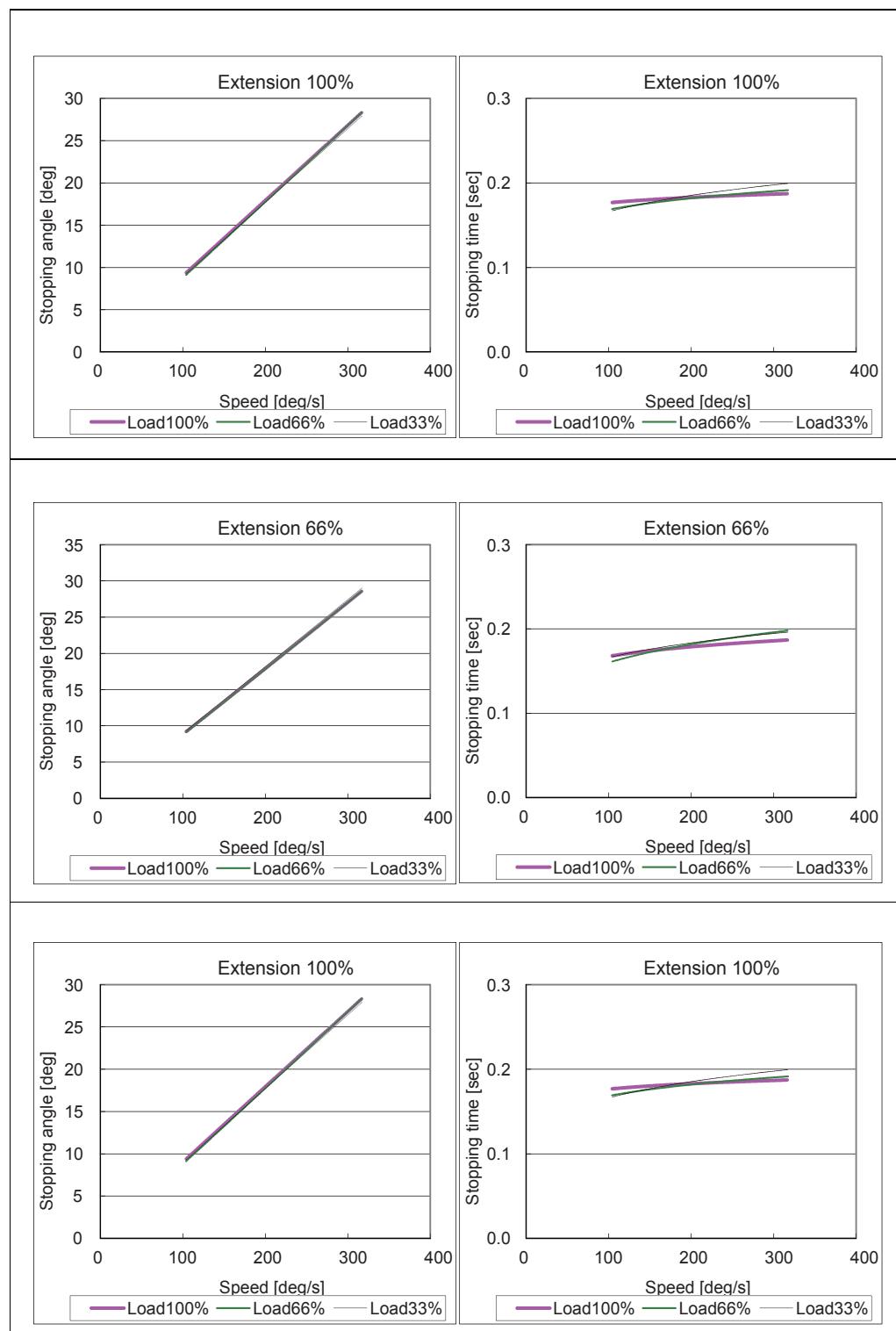
Fig. 5-6: U-Axis Extension



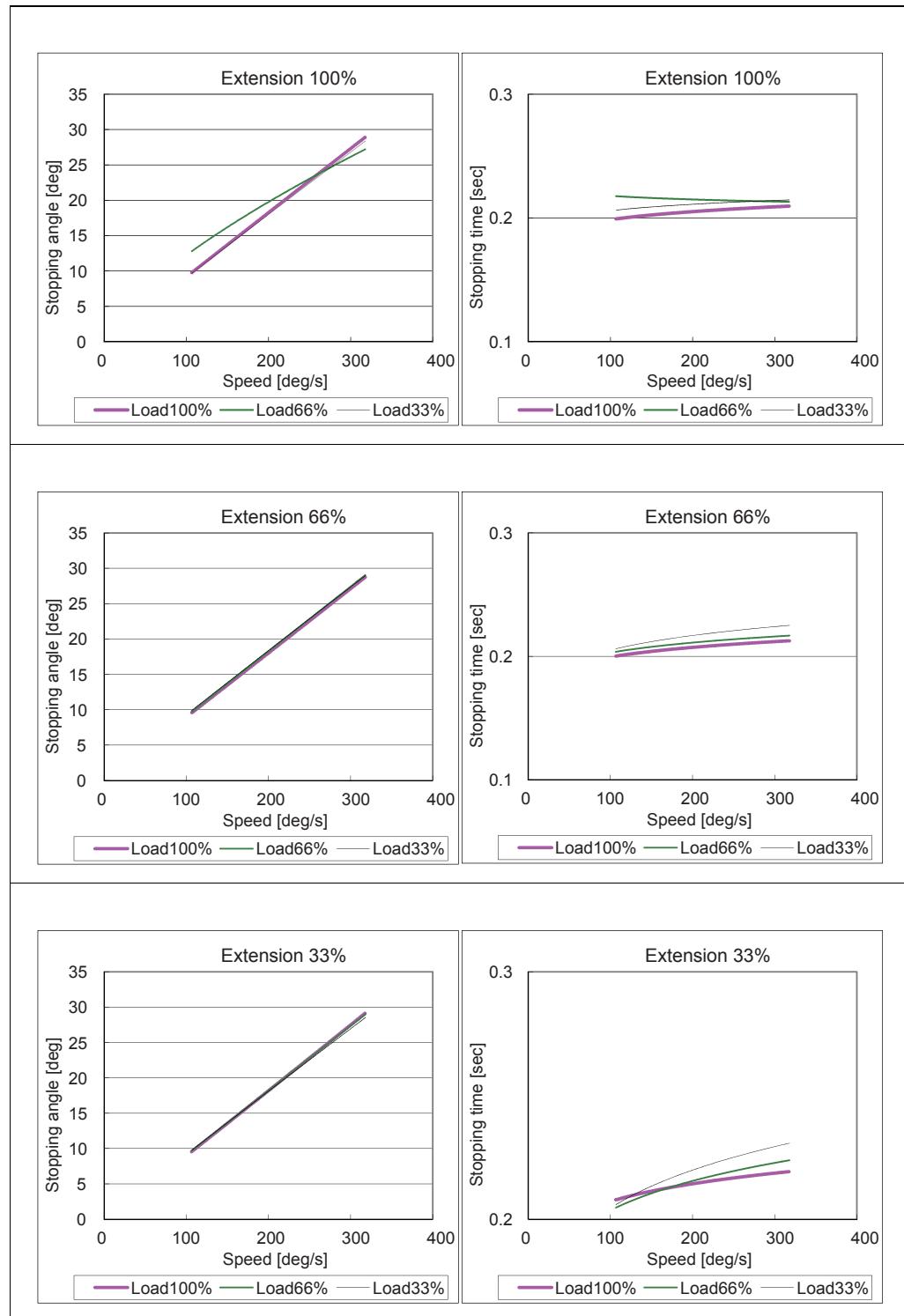
5 Basic Specifications

5.4 Stopping Distance and Time for S-, L-, and U-Axes

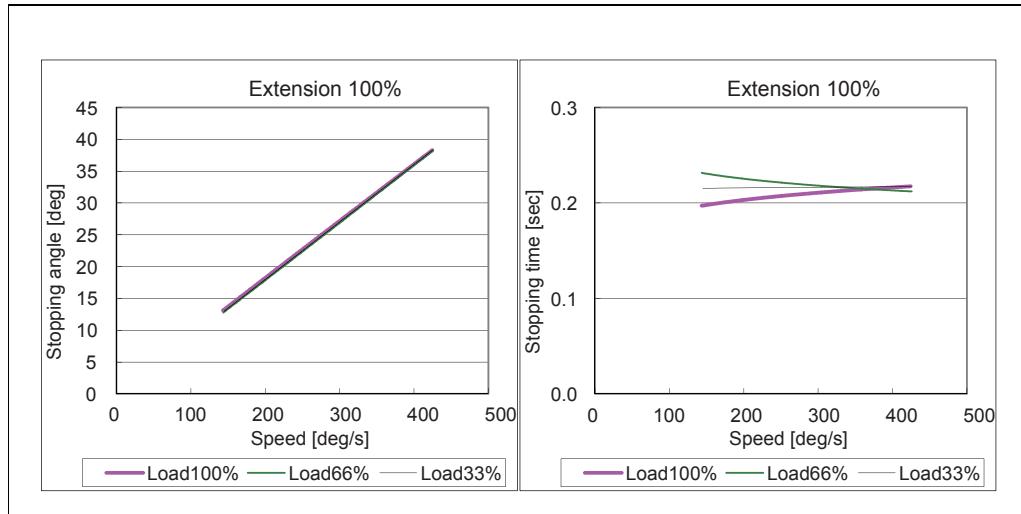
5.4.4.2 Stopping Distance and Time for Stop Category 1: S-Axis



5 Basic Specifications**5.4 Stopping Distance and Time for S-, L-, and U-Axes**

5.4.4.3 Stopping Distance and Time for Stop Category 1: L-Axis

5 Basic Specifications**5.4 Stopping Distance and Time for S-, L-, and U-Axes**

5.4.4.4 Stopping Distance and Time for Stop Category 1: U-Axis

5.5 Alterable Operating Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in *table 5-2 “S-Axis Operating Range”*. If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-2: S-Axis Operating Range

Item	Specifications
S-Axis Operating Range	-170° - +170° (standard) -150° - +150° -120° - +120° -90° - +90° -60° - +60° -50° - +50° -40° - +40° -30° - +30°

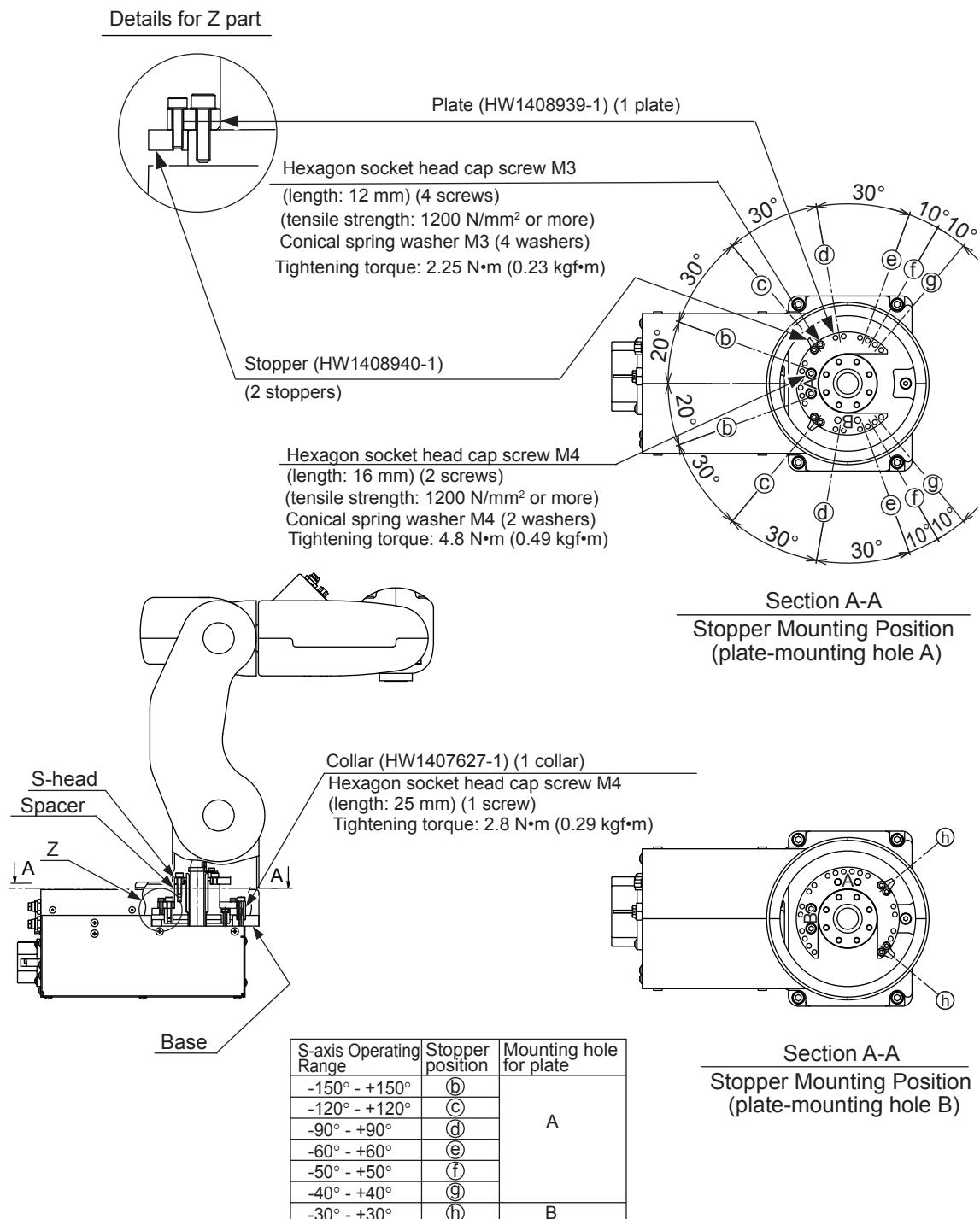
5.5.1 Components for Altering Operating Range

When modifying the angle of S-axis, prepare the components listed in *fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”*.

- Plate (HW1408939-1) (1 plate)
- Stopper (HW1408940-1) (2 stoppers)
- Hexagon socket head cap screw M4 (length: 16 mm) (2 screws)
(Tensile strength: 1200 N/mm² or more)
- Conical spring washer M4 (2 washers)
- Hexagon socket head cap screw M3 (length: 12 mm) (4 screws)
(Tensile strength: 1200 N/mm² or more)
- Conical spring washer M3 (4 washers)

5 Basic Specifications
5.5 Alterable Operating Range

Fig. 5-7: Components of the S-Axis Stopper and Stopper Mounting Position



5.5.2 S-Axis Stopper Installation Procedures

The mechanical stoppers for the S-axis must be installed with a combination of parts as shown in fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”.

Mount the mechanical stoppers for the S-axis by following procedures.

1. Unscrew the hexagon socket head cap screw M4 (length: 25 mm) and remove the collar (HW1407627-1) from the base.
2. Mount the plate (HW1408939-1) from the side of the spacer. Be sure that the letters marked on the plate faces up.
3. Mount the stoppers (HW1408940-1) on the stopper-position of the plate with the hexagon socket head cap screws M3 (length: 12 mm) and four conical spring washers M3. (Appropriate torque management is required.) When installing, by turning the plate, make sure that there is no interference with tools.
(The rear side of S-head is recommended.)
4. Turn the plate to confirm the mounting-hole A or B of the plate and the hole of the spacer are aligned.
5. Fix the plate to the spacer with the hexagon socket head cap screws M4 (length: 16 mm) and two conical spring washers M4.
(Appropriate torque management is required.)
6. Mount the collar on the base and secure them with the hexagon socket head cap screw M4 (length: 25 mm).
(Appropriate torque management is required.)

The S-axis stopper can be set within the operating range shown in table 5-3 “The Settable Angle for S-Axis Stopper”.

For the operating range of -30° to +30°, the positions of the plate-mounting holes are different from those holes for the operating ranges other than -30° to +30°. Be sure to use the appropriate plate-mounting holes.

- **When the operating range is set to other than -30° to +30°**
Use plate-mounting hole A to fix the plate to the spacer.
- **When the operating range is set to the range of -30° to +30°**
Use plate-mounting hole B to fix the plate to the spacer.



1. Be sure to use the specified screw when mounting the S-Axis mechanical stopper.
2. Turn OFF the power supply before mounting.

5.5.3 Adjustment to the Pulse Limitation of S-Axis

For limiting the range of motion of S-Axis, modify the parameter as shown in the following table using the programming pendant by referring to “YRC1000micro GENERAL OPERATOR’S MANUAL chapter 6.13 Softlimit Setting Function (manual No. RE-CSO-A058)”.

5 Basic Specifications
5.5 Alterable Operating Range

Degree	$\pm 30^\circ$	$\pm 40^\circ$	$\pm 50^\circ$	$\pm 60^\circ$	$\pm 90^\circ$
Number of Pulse	± 34816	± 46422	± 58027	± 69632	± 104448

Degree	$\pm 120^\circ$	$\pm 150^\circ$	$\pm 170^\circ$
Number of Pulse	± 139264	± 174080	± 197291



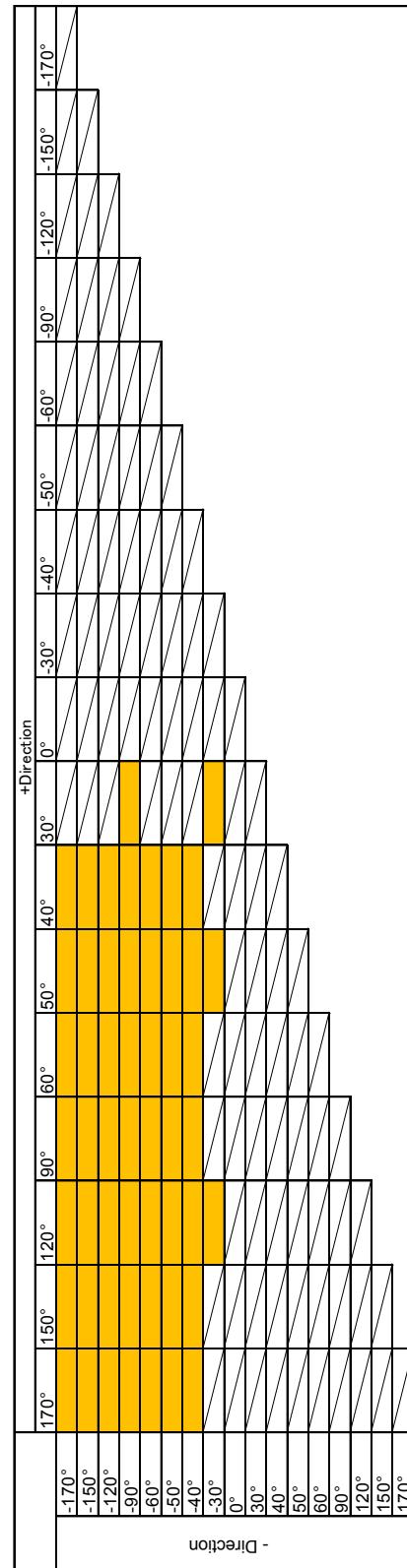
Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.

5 Basic Specifications

5.5 Alterable Operating Range

The settable angles for S-axis stopper are shown in a *table 5-3 “The Settable Angle for S-Axis Stopper”*.

Table 5-3: The Settable Angle for S-Axis Stopper



"Table 5-3 The Settable Angle for S-Axis Stopper" indicates the angle range which allows S-axis to be set for + direction and - direction angles.
(Ex. -150° to +150° is settable, however 0° to +120° is not settable)



6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load



The allowable payload of the wrist axis is 0.5 kg. However, the requirements listed in *table 6-1 “Allowable Total Moment of Wrist”* must be satisfied regarding the moment and the inertia.

Even if the load is not applied as mass but applied as force, the values in *table 6-1* must not be kept.

In case it exceeded the values shown in *table 6-1*, the manipulator may break earlier than expected.

Table 6-1: Allowable Total Moment of Wrist

Axis	Moment N·m (kgf·m) ¹⁾	Allowable moment of inertia (GD2/4) kg·m ²
R-axis	0.42 (0.043)	0.00378
B-axis	0.42 (0.043)	0.00378
T-axis	0.37 (0.038)	0.00299

1 (): Gravitational unit

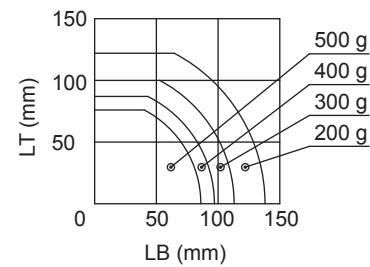
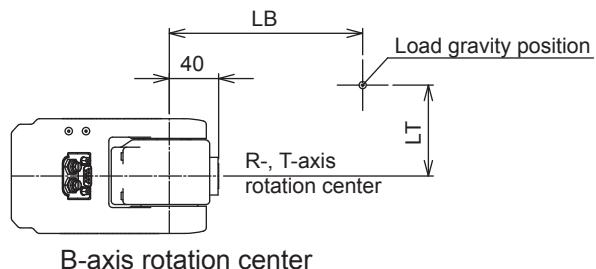
When the volume of the load is relatively small, refer to the moment arm rating (L_B , L_T) shown in *fig. 6-1 “Moment Arm Rating”*.

Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

When a tool is installed, the tool information and the load information must be set. For the setting, refer to “Chapter 8.3 Tool Data Setting” and “Chapter 8.4 ARM Control” of YRC1000micro INSTRUCTIONS (RE-CTO-A222).

6 Allowable Load for Wrist Axis and Wrist Flange
6.1 Allowable Wrist Load

Fig. 6-1: Moment Arm Rating



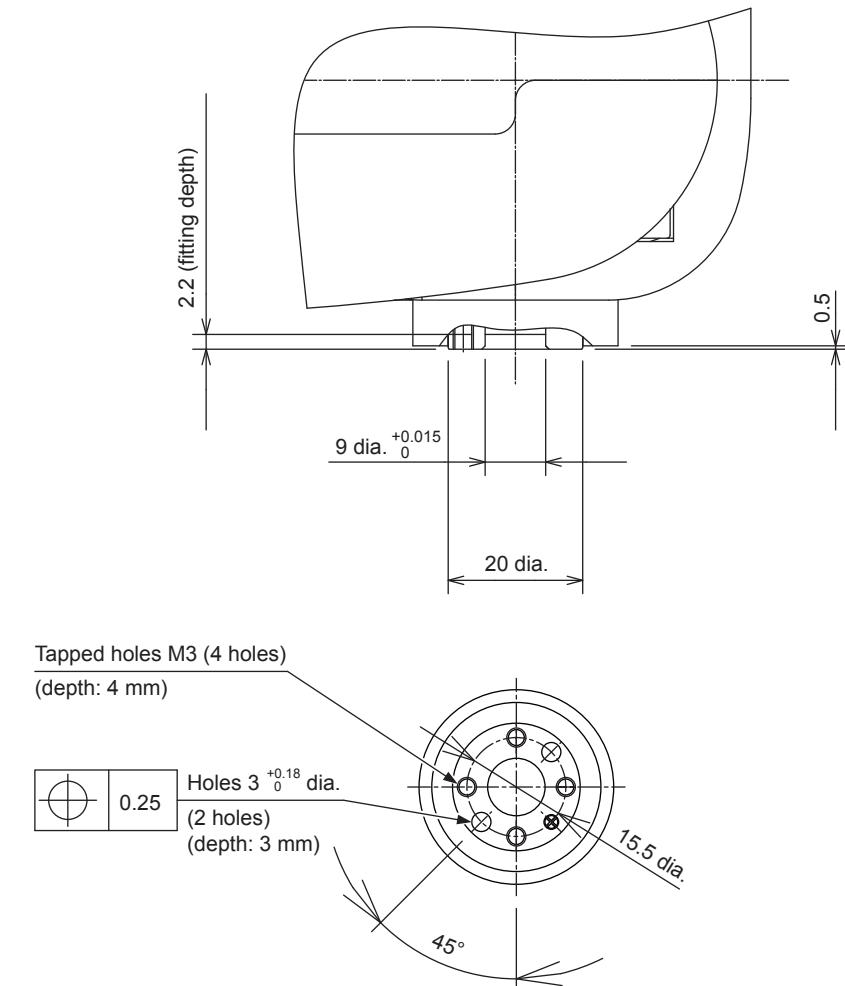
 6 Allowable Load for Wrist Axis and Wrist Flange
 6.2 Wrist Flange

6.2 Wrist Flange

The wrist flange dimensions are shown in fig. 6-2 "Wrist Flange".

The fitting depth must be 2.2 mm or less when the attachment is mounted.

Fig. 6-2: Wrist Flange



7 System Application

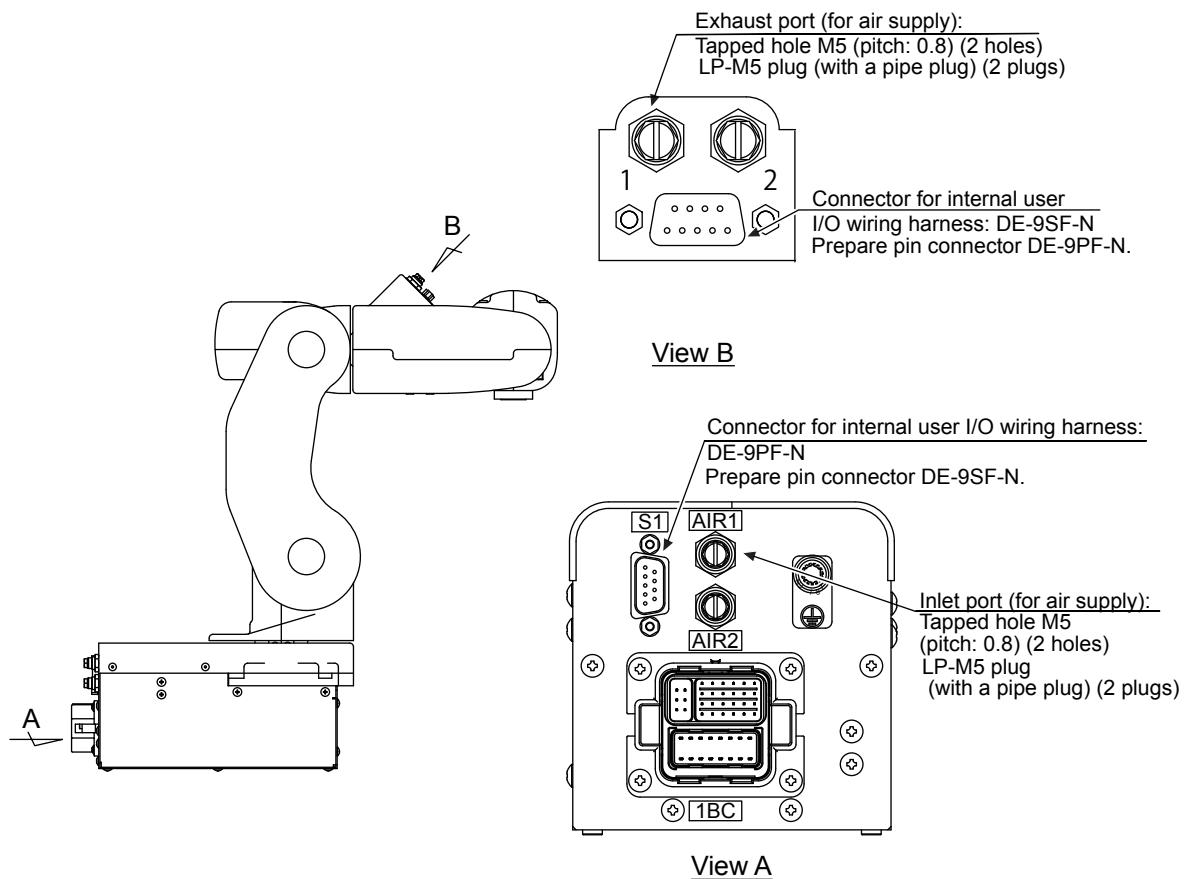
7.1 Internal User I/O Wiring Harness and Air Lines

Internal user I/O wiring harness (0.05 mm^2 : 8 wires) and two air lines are incorporated in the manipulator for the drive of peripheral devices as shown in *fig. 7-1 “Connectors for Internal User I/O Wiring Harness and Air Lines”*.

The connector pins 1 to 8 are assigned as shown in *fig. 7-2 “Details of the Connector Pin Numbers”*. Wiring must be performed by users.

Items	Conditions
The allowable current for internal user I/O wiring harness	1.4 A or less per a wire.
The maximum pressure for the air line	490 kPa (5.0 kgf/cm ²) or less (The air line inside diameter: 2 mm.)

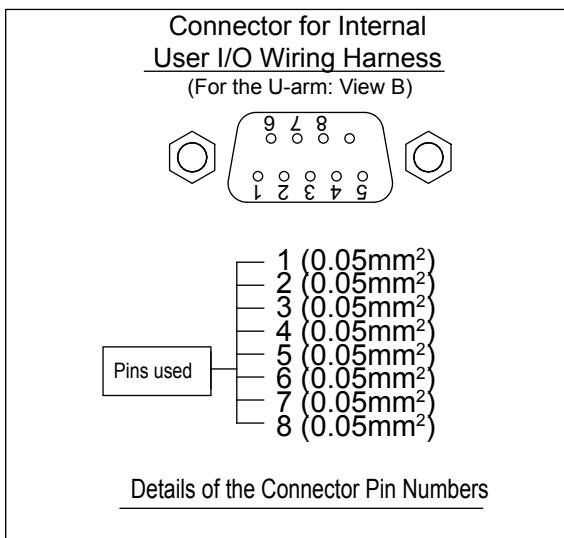
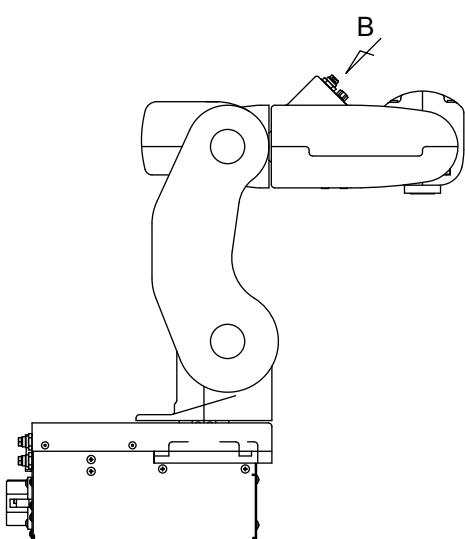
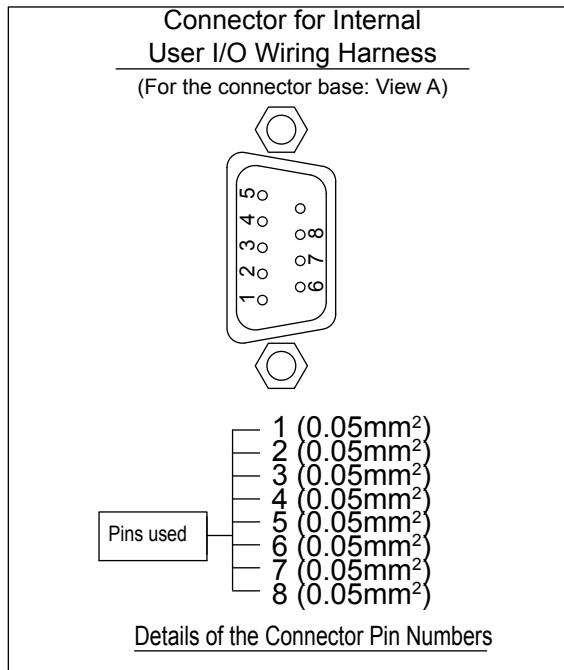
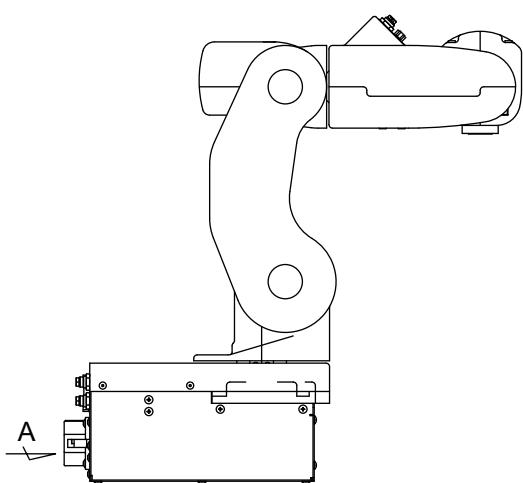
Fig. 7-1: Connectors for Internal User I/O Wiring Harness and Air Lines



7 System Application

7.1 Internal User I/O Wiring Harness and Air Lines

Fig. 7-2: Details of the Connector Pin Numbers



7.2 S-, R-, B-, and T-Axes without Brake

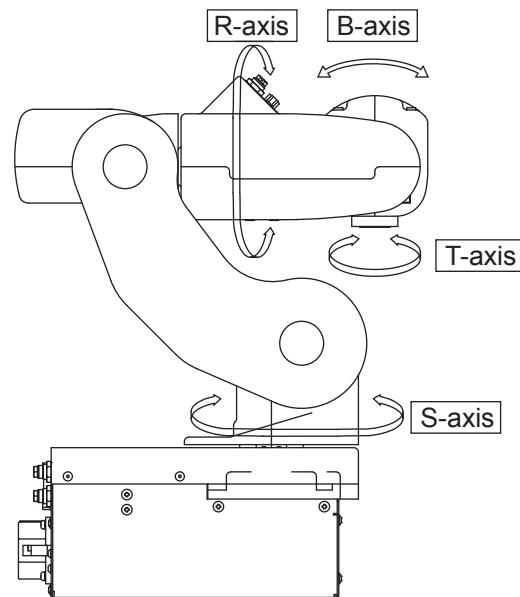


CAUTION

- Brakes are not equipped to S-, R-, B-, and T-axes of MotoMINI.
- The manipulator's posture may change if the SERVO or the power supply is turned OFF when the gravity load is applied to the axes to which a brake is not equipped.

Handle the manipulator carefully to avoid injury or damage to workpieces.

Fig. 7-3: Axes without Brake and Locations



Brakes are not equipped to S-, R-, B-, and T-axes of MotoMINI. When the servo or the power supply is turned OFF while the gravity load is applied to these axes, the manipulator's posture may change. And it may contact with a person, pinch parts of the body, or cause damage to workpiece. Be careful with the manipulator's operation.

 7 System Application
 7.2 S-, R-, B-, and T-Axes without Brake

Following alarms may occur when the servo or the power supply is turned ON while the gravity load is applied to the axes to which the brake is not equipped.

It is recommended to keep the manipulator halting in a posture without a gravity load applied to these axes.

- **DROP-VALUE OUT OF RANGE (AL-4511)**

This alarm occurs when the difference in the manipulator's position pulse between the last time the servo was turned OFF and this time the servo is turned ON is more than 100 pulses.

Reset the alarm and turn ON the SERVO again.

Table 7-1: Angle Equivalent to 100 Pulses for Axis without a Brake

Axis	Angle equivalent to 100 pulses (°)
S	0.086
R	0.293
B	0.293
T	0.293

- **SERVO ON SPEED ERROR (AL-4307)**

This alarm occurs when the motor is moving while the SERVO is turned ON.

Confirm that the manipulator is completely stopped, then turn ON the SERVO again.

- **ABSOLUTE DATA OUT OF RANGE (AL-4107)**

This alarm occurs when the difference in the manipulator's position pulse between the last time the power was shut down and this time the power is turned ON is more than 4096 pulses.

Reset the alarm and move the manipulator to the home position, then confirm the position.

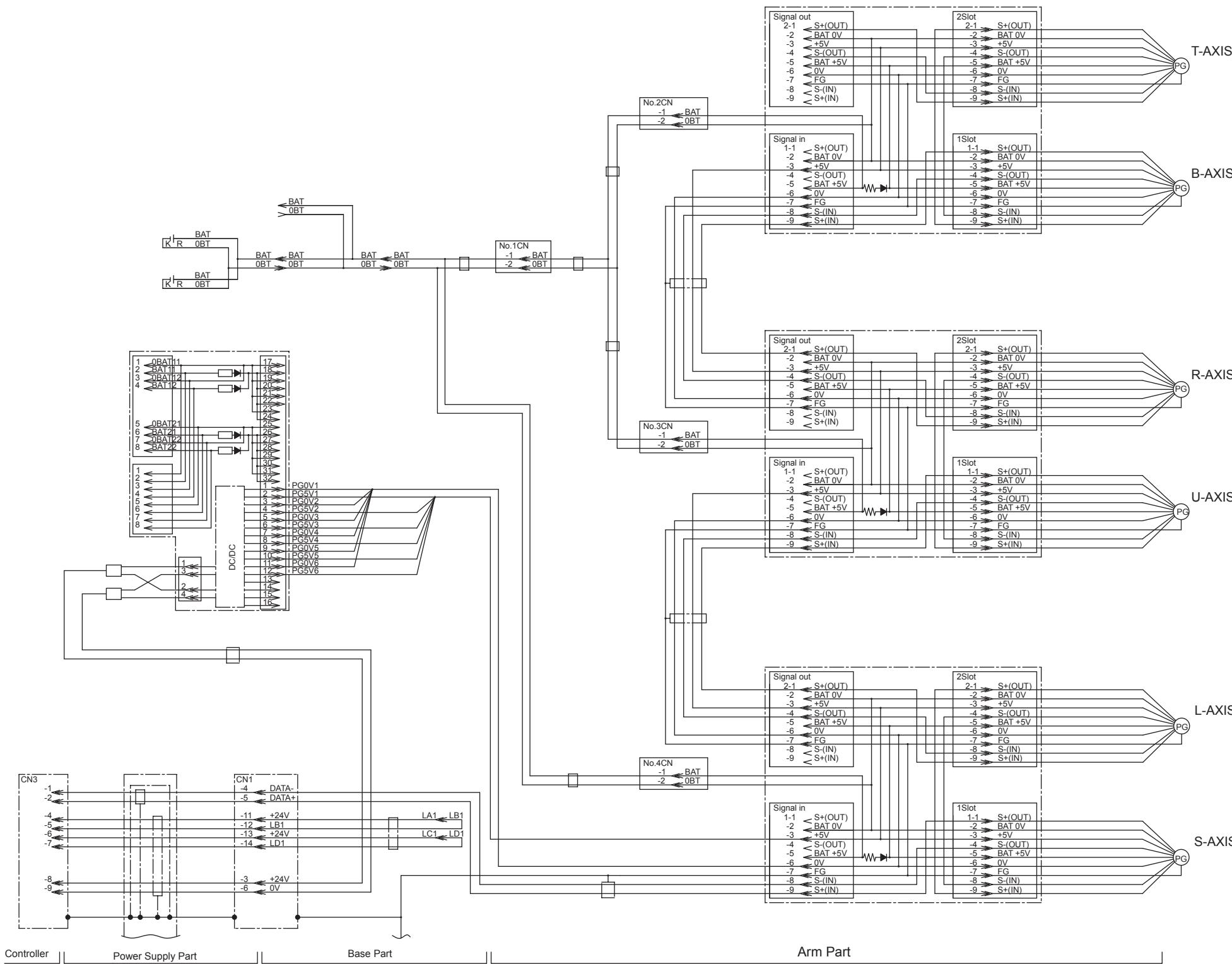
8 Electrical Equipment Specification

8.1 Internal Connections

Diagram for internal connections of the manipulator are shown in
fig. 8-1(a) “Internal Connection Diagram” and *fig. 8-1(b) “Internal Connection Diagram”*

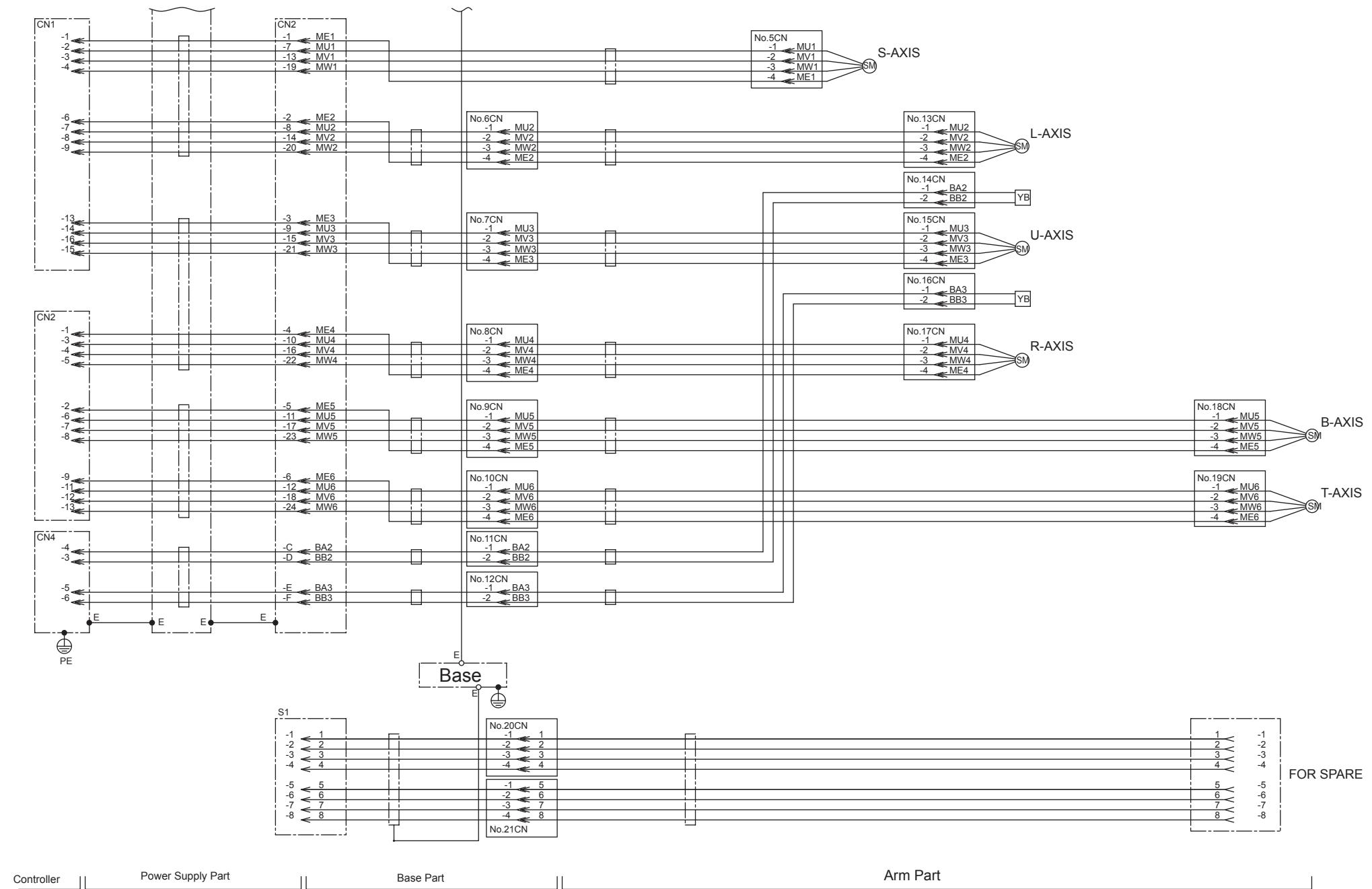
8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-1(a): Internal Connection Diagram



8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-1(b): Internal Connection Diagram



9 Maintenance and Inspection



WARNING

- For disassembly or repair not stated in *table 9-1 "Inspection Items"*, contact your YASKAWA representative listed in the table or on the back cover of this instruction manual.
- Before maintenance, inspection or wiring, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

Failure to observe this warning may result in electric shock or injury.

NOTICE

- Do not perform the maintenance operation which is not stated in *fig. 9-1*.

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in *table 9-1*.

In *table 9-1*, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by trained personnel, and operations to be performed by service company personnel. Only specified personnel shall perform the inspection work.



- The inspection interval depends on the total servo operation time.
- Replace the manipulator when it operates abnormally.

Table 9-1: Inspection Items

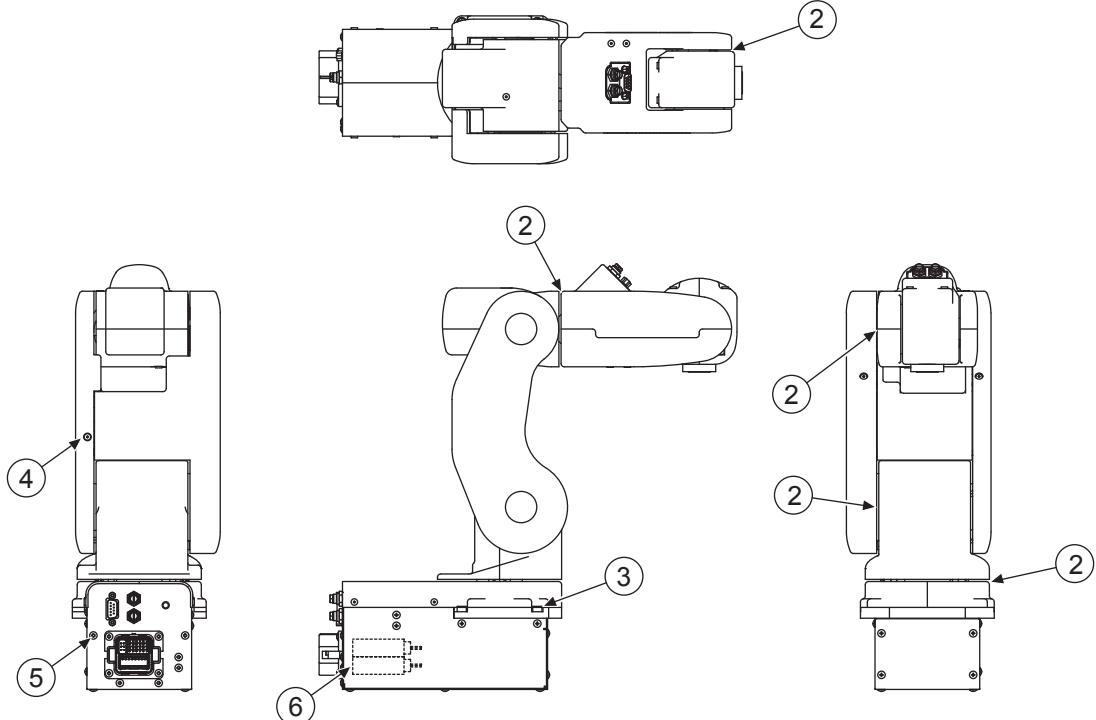
Items ¹⁾	Schedule	Method	Operation	Inspection Charge	
				Specified Personnel	Service Company
1 Whole exterior of manipulator	•	Visual	Clean the work area if dust or spatter is present. Check for damage and outside cracks.	•	•
2 All axes joint parts	•	Visual	Check for grease leakage.	•	•
3 Baseplate mounting bolts	•	Spanner Wrench	Check for lost or loose bolts. Tighten loose bolts.	•	•
4 Cover mounting screws	•	Screwdriver, Wrench	Check for lost or loose bolts.	•	•
5 Connector base	•	Manual	Check for loose connectors.	•	•
6 Battery pack in manipulator		• Tester	Replace the battery pack when the battery alarm occurs or when the manipulator has been operated for 15000H.		
7 Overhaul		•			•

1 Inspection No. correspond to the numbers in fig. 9-1 "Inspection Items".

9 Maintenance and Inspection
9.1 Inspection Schedule

The numbers in *fig. 9-1 "Inspection Items"* correspond to the numbers in *table 9-1 "Inspection Items"*.

Fig. 9-1: Inspection Items

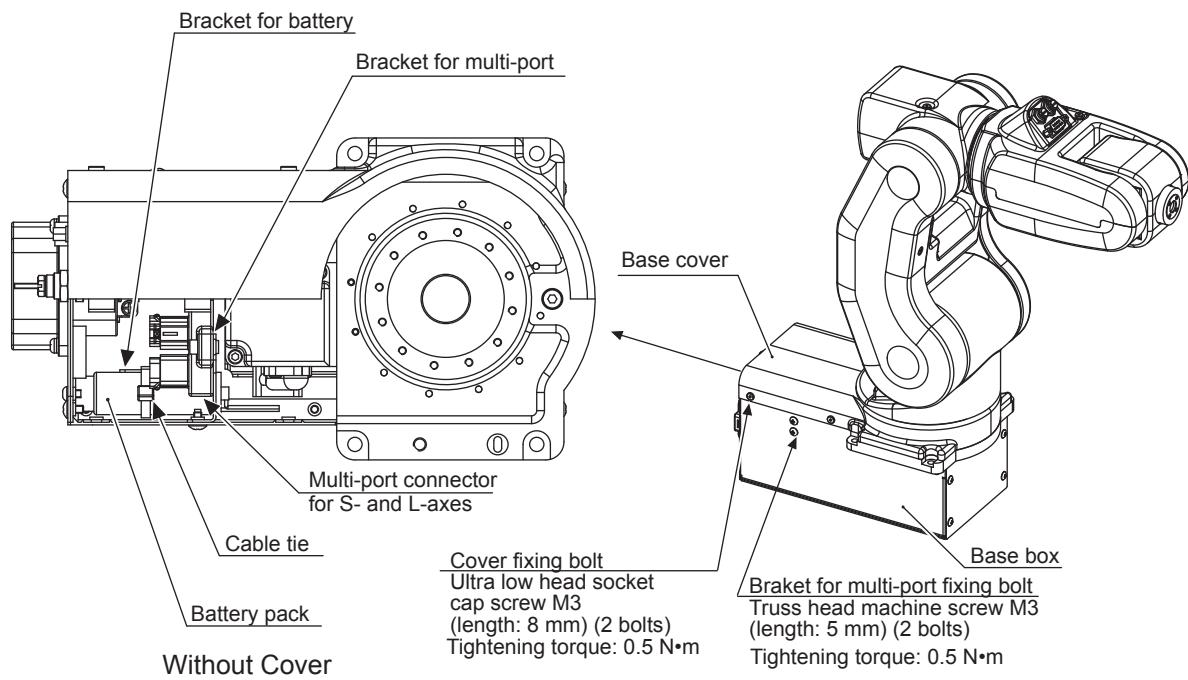


9.2 Replacement of the Battery Pack

A battery pack is installed in the position shown in *fig. 9-2 "Location of the Battery"*.

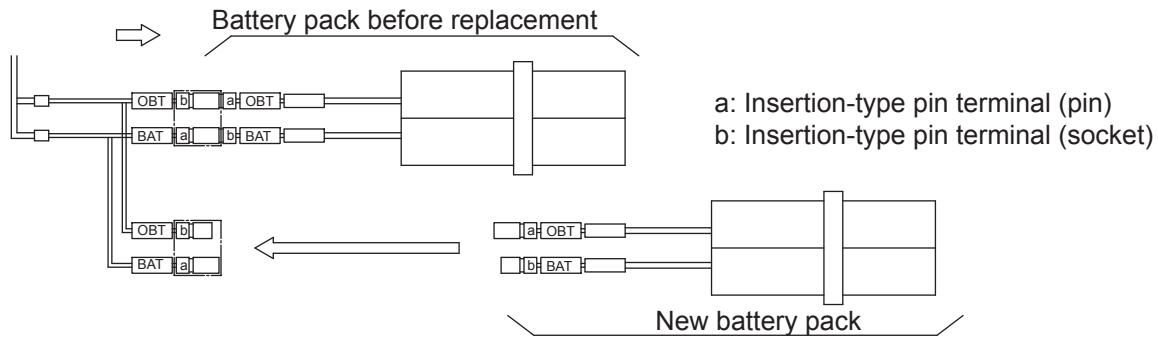
Refer to *fig. 9-2* and *fig. 9-3 "Battery Connection"* to replace the battery according to the following procedures.

Fig. 9-2: Location of the Battery



9 Maintenance and Inspection
9.2 Replacement of the Battery Pack

Fig. 9-3: Battery Connection



1. Loosen the base cover mounting bolts and remove the base cover.
2. From the base box, remove the bracket for the multi-port, which is fixed.
3. The old battery pack is fixed to the battery bracket with the cable tie. Cut the cable tie to remove the old battery pack.
4. Remove the plastic tape (insulating tape) which is protecting the connection part of the battery pack inside the manipulator.
5. Connect the new battery pack.
6. Remove the old battery pack.



- Before removing the old battery pack, make sure to connect the new battery pack to prevent the encoder absolute data from disappearing.
- Do not disconnect the connectors between the motor and the multi-port. The home position data may disappear.

7. Protect the connection part of the battery pack inside the manipulator with the plastic tape (insulating tape).
8. Fix the new battery pack to the battery bracket with the T30L cable tie.
9. Mount the multi-port bracket using its mounting bolts with the tightening torque shown in *fig. 9-2 "Location of the Battery"*.
10. Reinstall the cover using the base cover mounting bolts with the tightening torque shown in *fig. 9-2*.



When reinstalling the cover, be careful not to get caught the cable.

9.3 Home Position Calibration

Home position calibration is necessary when the home position is lost due to out of battery while the manipulator is not connected to the YRC1000micro. The parts shown in *table 9-2 “Parts for Home Position Calibration”* must be prepared beforehand.

Table 9-2: Parts for Home Position Calibration

Name	Type	Manufacturer	Qty	Remarks
Bracket	HW1307150-1	YASKAWA Electric Corporation	1	Recommended spare parts
Bracket	HW1408771-1	YASKAWA Electric Corporation	1	Recommended spare parts
Pin	dia.3 (0/-0.025 recommended)	-	3	
Screw	Hexagon socket head cap screw M5 (length: 16 mm)	-	2	
Feeler gauge	0.5 mm	-	1	

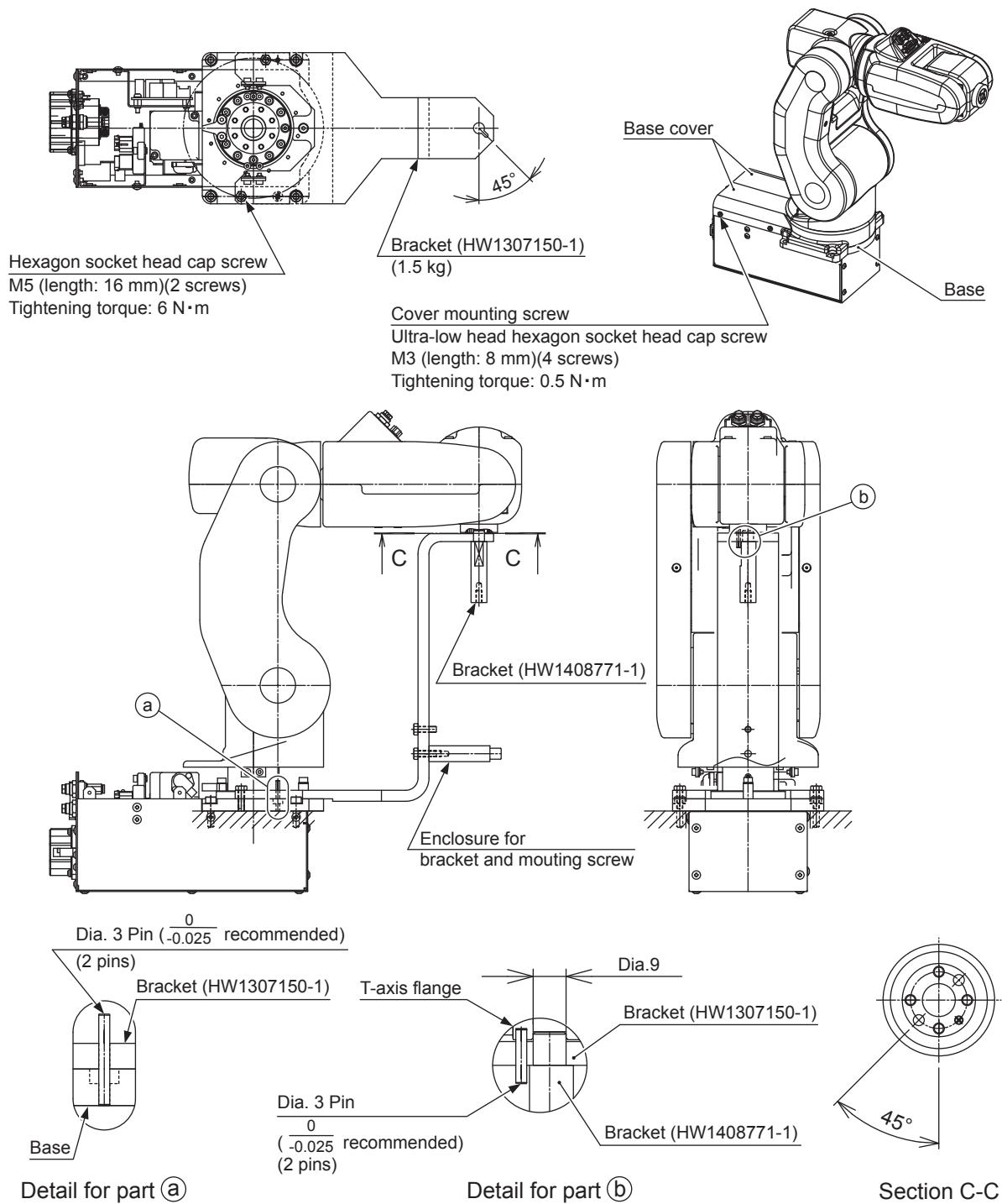
Refer to *fig. 9-4 “Home Position Calibration”* and perform home position calibration in accordance with the following procedures.

1. Unscrew the cover-mounting screw, and remove the base cover.
2. Align the hole of the base with the pin (dia.3), and mount the bracket (HW1307150-1) by tightening the hexagon socket head cap screws M5 (length:16 mm).
3. By moving each axis, align the hole of the bracket (HW1307150-1) with the hole of T-axis flange (dia.9) to install the bracket (HW140877-1).
4. When performing home position calibration for the S,L,U,R,B-axes, by using 0.5 mm feeler gauge, confirm there is the gap between the face of T-axis flange.(The home position must satisfy the step 3 and 4.)
5. After the home position calibration for S,L,U,R,B-axes is completed, perform the home position calibration for T-axis by turning the T-axis only until the pin (dia.3) can be installed. The phase angle must be confirmed when calibrating the home position for the T-axis.
6. When home position calibration is completed, remove the home-position bracket and reinstall the base cover. (Tighten the mounting screw for the base cover by using the tightening bolt shown in *fig. 9-4 “Home Position Calibration”*)

When performing this operation, refer to “YRC1000 INSTRUCTIONS Chapter 8.1 Home Position Calibration”.

9 Maintenance and Inspection
9.3 Home Position Calibration

Fig. 9-4: Home Position Calibration



10 Recommended Spare Parts

As our basic policy, malfunctioning manipulators are replaced. Companies that provide technical services (listed on the back cover) usually have replacements in stock. However, we recommend you to purchase a replacement in advance as they may not have any manipulators in stock.

The technical service companies will collect, diagnose, and repair malfunctioning manipulators, and then deliver it to customers. (On-site repair is not provided.)

We may ask customers to replace a battery unit when the battery alarm is displayed on the YRC1000micro.

Table 10-1: Spare Parts for the YR-1-06VX05-A00

Parts No.	Name	Type	Manufacturer	Qty	Remarks
1	MotoMINI	YR-1-06VX05-A00	YASKAWA Electric Corporation	1	
2	Battery Pack	HW9470917-F	YASKAWA Electric Corporation	1	
3	Bracket	HW1307150-1	YASKAWA Electric Corporation	1	
4	Bracket	HW1408771-1	YASKAWA Electric Corporation	1	

Table 10-2: Spare Parts for the YR-1-06VX05-A01

Parts No.	Name	Type	Manufacturer	Qty	Remarks
1	MotoMINI	YR-1-06VX05-A01	YASKAWA Electric Corporation	1	
2	Battery Pack	HW9470917-F	YASKAWA Electric Corporation	1	
3	Bracket	HW1307150-1	YASKAWA Electric Corporation	1	
4	Bracket	HW1408771-1	YASKAWA Electric Corporation	1	

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Specifications are subject to change without notice
for ongoing product modifications and improvements.

YASKAWA

YASKAWA ELECTRIC CORPORATION

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60/60