

EPSON

RC620

Safety and Installation

Read this manual first

Rev.9

EM129B2345F

RC620 Safety and Installation Rev.9

RC620 Safety and Installation

Rev.9

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FOREWORD

Thank you for purchasing our robot products.

This manual contains the information necessary for the correct use of the Operator Panel.

Please carefully read this manual and other related manuals before installing the robot system.

Keep this manual handy for easy access at all times.

WARRANTY

The robot system and its optional parts are shipped to our customers only after being subjected to the strictest quality controls, tests, and inspections to certify its compliance with our high performance standards.

Product malfunctions resulting from normal handling or operation will be repaired free of charge during the normal warranty period. (Please ask your Regional Sales Office for warranty period information.)

However, customers will be charged for repairs in the following cases (even if they occur during the warranty period):

1. Damage or malfunction caused by improper use which is not described in the manual, or careless use.
2. Malfunctions caused by customers' unauthorized disassembly.
3. Damage due to improper adjustments or unauthorized repair attempts.
4. Damage caused by natural disasters such as earthquake, flood, etc.

Warnings, Cautions, Usage:

1. If the robot system associated equipment is used outside of the usage conditions and product specifications described in the manuals, this warranty is void.
2. If you do not follow the WARNINGS and CAUTIONS in this manual, we cannot be responsible for any malfunction or accident, even if the result is injury or death.
3. We cannot foresee all possible dangers and consequences. Therefore, this manual cannot warn the user of all possible hazards.

TRADEMARKS

Microsoft, Windows, and Windows logo are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Other brand and product names are trademarks or registered trademarks of the respective holders.

TRADEMARK NOTATION IN THIS MANUAL

Microsoft® Windows® XP Operating system

Microsoft® Windows® Vista Operating system

Microsoft® Windows® 7 Operating system

Throughout this manual, Windows XP, Windows Vista, and Windows 7 refer to above respective operating systems. In some cases, Windows refers generically to Windows XP, Windows Vista, and Windows 7.

NOTICE

No part of this manual may be copied or reproduced without authorization.

The contents of this manual are subject to change without notice.

Please notify us if you should find any errors in this manual or if you have any comments regarding its contents.

INQUIRIES

Contact the following service center for robot repairs, inspections or adjustments.

If service center information is not indicated below, please contact the supplier office for your region.

Please prepare the following items before you contact us.

- Your controller model and its serial number
- Your manipulator model and its serial number
- Software and its version in your robot system
- A description of the problem

SERVICE CENTER



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For Customers in the European Union



The crossed out wheeled bin label that can be found on your product indicates that this product and incorporated batteries should not be disposed of via the normal household waste stream. To prevent possible harm to the environment or human health please separate this product and its batteries from other waste streams to ensure that it can be recycled in an environmentally sound manner. For more details on available collection facilities please contact your local government office or the retailer where you purchased this product. Use of the chemical symbols Pb, Cd or Hg indicates if these metals are used in the battery.

This information only applies to customers in the European Union, according to DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC and legislation transposing and implementing it into the various national legal systems.

For other countries, please contact your local government to investigate the possibility of recycling your product.

The battery removal/replacement procedure is described in the following manuals:

Controller manual / Manipulator manual (Maintenance section)

Before Reading This Manual

Do not connect TP1 to the following Robot Controllers. Connecting to the following Robot Controllers may result in malfunction of the device since the pin assignments are different.

RC90 / RC420 / RC520 / SRC5** / SRC-3** / SRC-2**

Be careful of the operating instructions of the TP1 when connecting it to the Robot

Controller RC180, it is different from the explanation in this manual.

When using the TP1 with the RC180, refer to the *RC180 Option Teach Pendant TP1*.

Do not connect the followings to the TP port of RC620. Connecting to the followings may result in malfunction of the device since the pin assignments are different.

OPTIONAL DEVICE dummy plug

Operation Pendant OP500

Operator Pendant OP500RC

Operator Panel OP1

Jog Pad JP500

Teaching Pendant TP-3**

Teach Pendant TP2

Concerning the security support for the network connection:

The network connecting function (Ethernet) on our products assumes the use in the local network such as the factory LAN network. Do not connect to the external network such as Internet.

In addition, please take security measure such as for the virus from the network connection by installing the antivirus software.

Security support for the USB memory:

Make sure the USB memory is not infected with virus when connecting to the Controller.

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1. Safety




Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

Please read this manual and other related manuals before installing the robot system or before connecting cables.

Keep this manual handy for easy access at all times.

1.1 Conventions

Important safety considerations are indicated throughout the manual by the following symbols. Be sure to read the descriptions shown with each symbol.


 WARNING	This symbol indicates that a danger of possible serious injury or death exists if the associated instructions are not followed properly.
 WARNING	This symbol indicates that a danger of possible harm to people caused by electric shock exists if the associated instructions are not followed properly.
 CAUTION	This symbol indicates that a danger of possible harm to people or physical damage to equipment and facilities exists if the associated instructions are not followed properly.

1.2 Design and Installation Safety

Only trained personnel should design and install the robot system. Trained personnel are defined as those who have taken robot system training held by the manufacturer, dealer, or local representative company, or those who understand the manuals thoroughly and have the same knowledge and skill level as those who have completed the training courses.

To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the Installation and Design Precautions in the Safety chapter of the EPSON RC+ User’s Guide.

The following items are safety precautions for design personnel:

 <p>WARNING</p>	<ul style="list-style-type: none">■ Personnel who design and/or construct the robot system with this product must read the <i>Safety</i> chapter in the <i>EPSON RC+ User’s Guide</i> to understand the safety requirements before designing and/or constructing the robot system. Designing and/or constructing the robot system without understanding the safety requirements is extremely hazardous, and may result in serious bodily injury and/or severe equipment damage to the robot system.■ The Manipulator and the Controller must be used within the environmental conditions described in their respective manuals. This product has been designed and manufactured strictly for use in a normal indoor environment. Using the product in an environment that exceeds the specified environmental conditions may not only shorten the life cycle of the product but may also cause serious safety problems.■ The robot system must be used within the installation requirements described in the manuals. Using the robot system outside of the installation requirements may not only shorten the life cycle of the product but also cause serious safety problems.
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Further precautions for installation are mentioned in the following manuals. Please read this chapter carefully to understand safe installation procedures before installing the robots and robotic equipment.



Relevant Manuals



- This manual : 2. Installation
- Manipulator manual : Setup & Operation 3. Environment and Installation
- Controller manual : Setup & Operation 3. Installation

1.3 Operation Safety

The following items are safety precautions for qualified Operator personnel:

 <p>WARNING</p>	<ul style="list-style-type: none">■ Please carefully read the <i>Safety-related Requirements</i> in this manual before operating the robot system. Operating the robot system without understanding the safety requirements is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.■ Do not enter the operating area of the Manipulator while the power to the robot system is turned ON. Entering the operating area with the power ON is extremely hazardous and may cause serious safety problems as the Manipulator may move even if it seems to be stopped.■ Before operating the robot system, make sure that no one is inside the safeguarded area. The robot system can be operated in the mode for teaching even when someone is inside the safeguarded area. The motion of the Manipulator is always in restricted status (low speeds and low power) to secure the safety of an operator. However, operating the robot system while someone is inside the safeguarded area is extremely hazardous and may result in serious safety problems in case that the Manipulator moves unexpectedly.■ Immediately press the Emergency Stop switch whenever the Manipulator moves abnormally while the robot system is operated. Continuing the operating the robot system while the Manipulator moves abnormally is extremely hazardous and may result in serious bodily injury and/or severe equipment change to the robot system.
 <p>WARNING</p>	<ul style="list-style-type: none">■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, pull out the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

Safety-related Requirements

Specific tolerances and operating conditions for safety are contained in the manuals for the robot, controller and other devices. Be sure to read those manuals as well.

For the installation and operation of the robot system, be sure to comply with the applicable local and national regulations.

Robot systems safety standards and other examples are given in this chapter. Therefore, to ensure that safety measures are complete, please refer to the other standards listed as well.

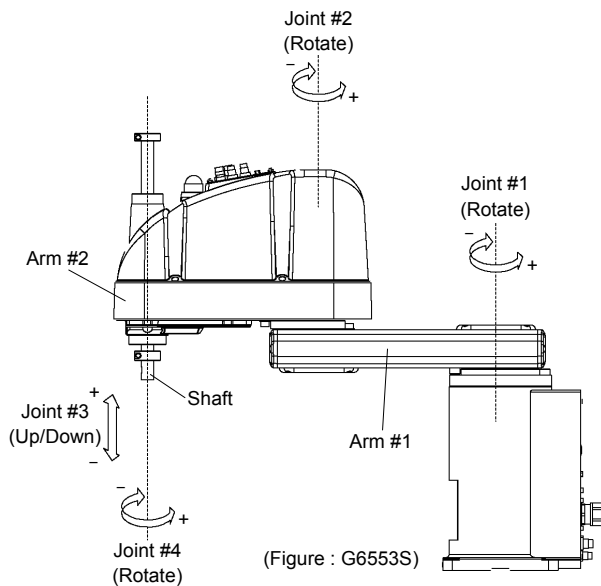
(Note: The following is only a partial list of the necessary safety standards.)

- ENISO12100-1 Safety of machinery - Basic concepts, general principles for design
- ENISO12100-2 Part 1. Basic terminology, methodology
Part 2. Technical principles and specifications
- ENISO14121 Safety of machinery Principles for risk assessment
- EN13849-1 Safety of machinery-Safety related parts of control systems
- ENISO13850 Safety of machinery – Emergency stop – principles for design
- ENISO13855 Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body.
- ENISO13857 Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs.
- ENISO 14120 General requirements for design and construction of guards (EN953)
- ISO10218 Robots for industrial environments -- Safety requirements
- ANSI /RIA R15.06 American National Standard; Industrial Robots and Robot Systems - Safety Requirements
- IEC204-1 Safety of machinery - Electrical equipment of machines (EN60204-1)
Part 1. Specification for general requirements
- EN55011 Limits and methods of measurement of radio disturbance characteristic of industrial scientific and medical (ISM) radio frequency equipment.
- EN61000-6-2 Electromagnetic compatibility (EMC)
Part 6-2: Generic standards - Immunity for industrial environments

Part Names and Arm Motion

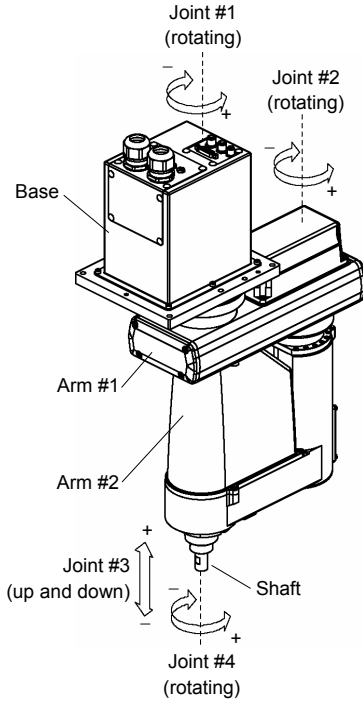
G series

The motion range of each arm is shown in the figure below. Take all necessary safety precautions.



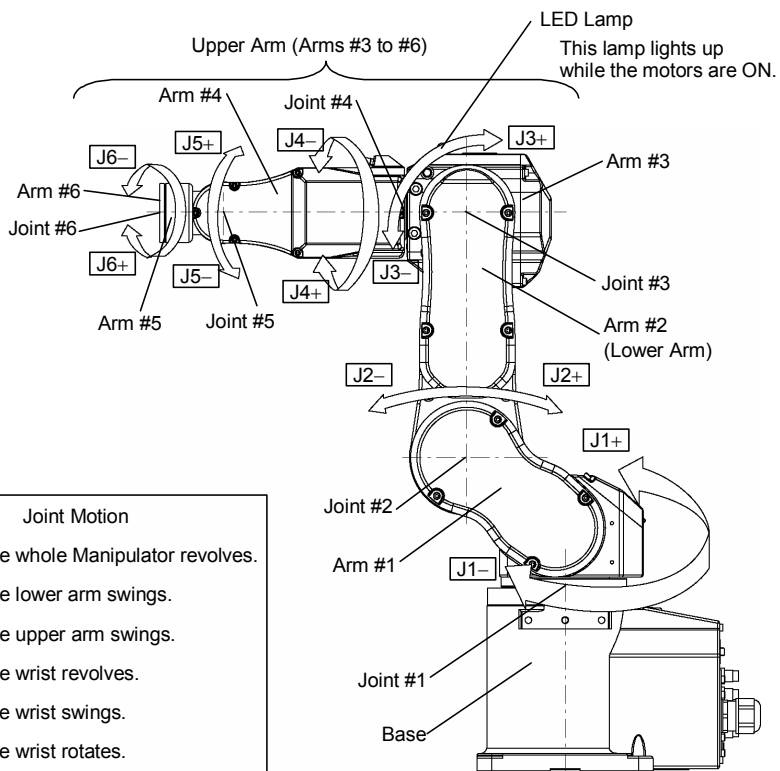
RS series

The motion range of each arm is shown in the figure below. Take all necessary safety precautions.



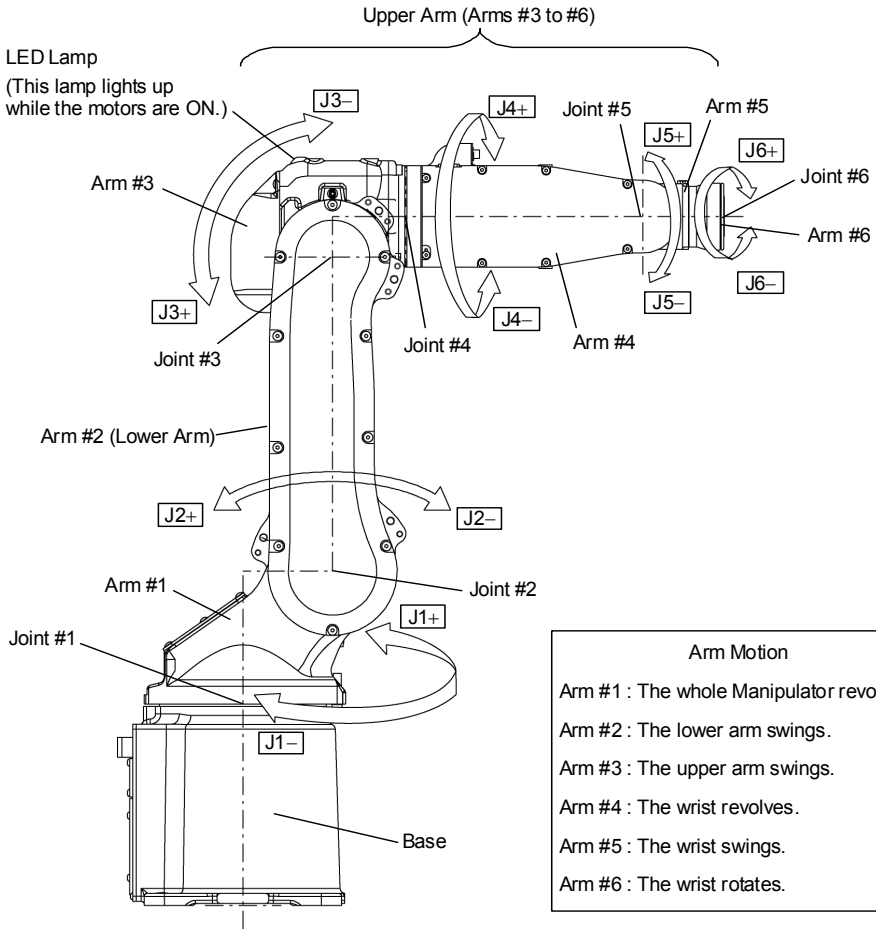
C3 series

The motion range of each arm is shown in the figure below. Take all necessary safety precautions.



S5 series

The motion range of each arm is shown in the figure below. Take all necessary safety precautions.



X5 series

The operation varies with different module combination. For details, refer to the *EZ Module X5 Series manual*.

1.4 Maintenance Safety

Please read this section, *Maintenance* of the Manipulator manual, *Maintenance* of the Controller manual, and other related manuals carefully to understand safe maintenance procedures before performing any maintenance.

Only authorized personnel who have taken the safety training should be allowed to maintain the robot system. The safety training is the program for the industrial robot operator that follows the laws and regulations of each nation.

The personnel who have taken the safety training acquire knowledge of industrial robots (operations, teaching, etc.), knowledge of inspections, and knowledge of related rules/regulations. Only personnel who have completed the robot system-training and maintenance-training classes held by the manufacturer, dealer, or locally-incorporated company should be allowed to maintain the robot system.



WARNING

- Do not remove any parts that are not covered in this manual. Follow the maintenance procedure strictly as described in this manual, the *Maintenance* of the Manipulator manual, and *Maintenance* of the Controller manual. Improper removal of parts or improper maintenance may not only cause improper function of the robot system but also serious safety problems.
- Keep away from the Manipulator while the power is ON if you have not taken the training courses. Do not enter the operating area while the power is ON. Entering the operating area with the power ON is extremely hazardous and may cause serious safety problems as the Manipulator may move even though it seems to be stopped.
- When you check the operation of the Manipulator after replacing parts, be sure to check it while you are outside of the safeguarded area. Checking the operation of the Manipulator while you are inside of the safeguarded area may cause serious safety problems as the Manipulator may move unexpectedly.
- Before operating the robot system, make sure that both the Emergency Stop switches and safeguard switches function properly. Operating the robot system when the switches do not function properly is extremely hazardous and may result in serious bodily injury and/or serious damage to the robot system as the switches cannot fulfill their intended functions in an emergency.



WARNING

- Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, pull out the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system.


- Before performing any replacement procedure, turn OFF the Controller and related equipment, and then pull out the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

- Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) The unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system.



CAUTION

- Carefully use alcohol, liquid gasket, and adhesive following respective instructions and also instructions below. Careless use of alcohol, liquid gasket, or adhesive may cause a fire and/or safety problems.
 - Never put alcohol, liquid gasket, or adhesive close to fire.
 - Use alcohol, liquid gasket, or adhesive while ventilating the room.
 - Wear protective gear including a mask, protective goggles, and oil-resistant gloves.
 - If alcohol, liquid gasket, or adhesive gets on your skin, wash the area thoroughly with soap and water.
 - If alcohol, liquid gasket, or adhesive gets into your eyes or mouth, flush your eyes or wash out your mouth with clean water thoroughly, and then see a doctor immediately.

 <p>CAUTION</p>	<ul style="list-style-type: none">■ Wear protective gear including a mask, protective goggles, and oil-resistant gloves during grease up. If grease gets into your eyes, mouth, or on your skin, follow the instructions below.<ul style="list-style-type: none">If grease gets into your eyes : Flush them thoroughly with clean water, and then see a doctor immediately.If grease gets into your mouth: If swallowed, do not induce vomiting. See a doctor immediately. If grease just gets into your mouth, wash out your mouth with water thoroughly.If grease gets on your skin: Wash the area thoroughly with soap and water.
--	--

1.5 Emergency Stop

If the Manipulator moves abnormally during operation, immediately press the Emergency Stop switch. The motor power will be turned OFF, and the arm motion by inertia will be stopped with the electromagnetic brake and dynamic brake.

However, avoid pressing the Emergency Stop switch unnecessarily while the Manipulator is running normally. Otherwise, the Manipulator may hit the peripheral equipment since the operating trajectory while the robot system stops is different from that in normal operation.

To place the robot system in emergency mode during normal operation, press the Emergency Stop switch when the Manipulator is not moving.

Refer to the Controller manual for instructions on how to wire the Emergency Stop switch circuit.

Do not press the Emergency Stop switch unnecessarily while the Manipulator is operating. Pressing the switch during the operation makes the brakes work. This will shorten the life of the brakes due to the worn friction plates.

Normal brake life cycle: About 2 years (when the brakes are used 100 times/day)

Before using the Emergency Stop switch, be aware of the followings.

- The Emergency Stop (E-STOP) switch should be used to stop the Manipulator only in case of emergencies.
- To stop the Manipulator operating the program except in emergency, use Pause (halt) or STOP (program stop) commands.
Pause and STOP commands do not turn OFF the motors. Therefore, the brake does not function.
- For the Safeguard system, do not use the circuit for E-STOP.

For details of the Safeguard system, refer to the following manuals.

EPSON RC+ User's Guide

2. Safety - Installation and Design Precautions - Safeguard System
Safety and Installation

2.6 Connection to EMERGENCY Connector

To check brake problems, refer to the following manuals.

Manipulator Manual Maintenance

2.2.2 Inspection While the Power is ON (Manipulator is operating)

Safety and Installation

5.2 Inspection Point - Inspection While the Power is ON
(Manipulator is operating)

Free running distance in emergency

The operating Manipulator cannot stop immediately after the Emergency Stop switch is pressed.

However, remember that the values vary depending on conditions such as the weight of the end effector and work piece, Weight/Speed/Accel settings, operating pose, etc.

1.6 Labels






Labels are attached around the locations of the Controller and Manipulator where specific dangers exist.

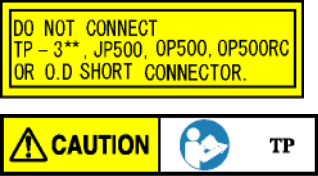
Be sure to comply with descriptions and warnings on the labels to operate and maintain the Robot system safely.

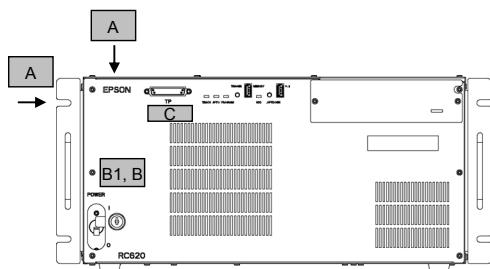
Do not tear, damage, or remove the labels. Use meticulous care when handling those parts or units to which the following labels are attached as well as the nearby areas:

Label types differ according to the specifications.

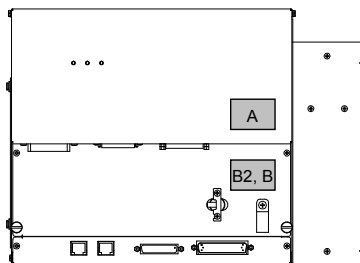
Controller

Location	Label	Note
A		Residual voltage exists. To avoid electric shock, do not open the cover while the Power is ON, or for 3 minutes after the Power is OFF.
		Residual voltage exists. To avoid electric shock, do not open the cover while the Power is ON, or for 300 seconds after the Power is OFF.
B1 B2 B		Disconnect and lockout main power before performing maintenance and repair.
		
		

Location	Label	Note
C		<p>Do not connect the followings to TP port of RC620. Connecting to the followings may result in malfunction of the device.</p> <p>OPTIONAL DEVICE dummy plug, OP500, OP500RC, JP500, OP1 and TP-3**, and TP2</p> <p>Refer to <i>4.2 Connection and Display Language of Option TP1</i></p>



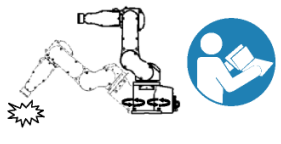
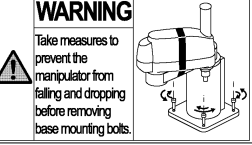







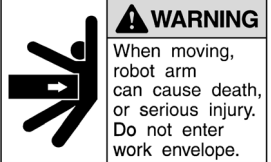



Controller







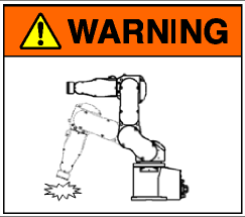


Drive unit


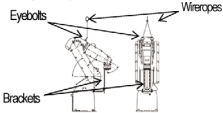





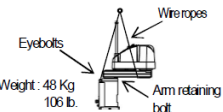



Manipulator

Location	Label	Note
A	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">  <p>WARNING</p> <ul style="list-style-type: none"> • Take measures to prevent the manipulator from falling and dropping before removing base mounting bolts. • Follow the instruction manual during lifting / transportation. • Arm weight may cause arm to fall after release of brakes. </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <div style="background-color: #ff8c00; color: white; padding: 5px; text-align: center;">  <p>WARNING</p> </div>  </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>WARNING</p> <p>Take measures to prevent the manipulator from falling and dropping before removing base mounting bolts.</p>  </div> <div style="border: 1px solid black; padding: 5px;"> <div style="background-color: #ff8c00; color: white; padding: 5px; text-align: center;">  <p>WARNING</p> </div>  </div>	<p>Before loosening the base mounting screws, hold the arm and secure it tightly with a band to prevent hands or fingers from being caught in the Manipulator.</p> <p>Follow the directions in this manual for installation and transportation.</p>


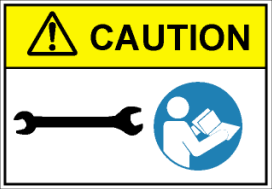

Location	Label	Note
B	     	<p>Do not enter the operation area while the Manipulator is moving. The robot arm may collide against the operator. This is extremely hazardous and may result in serious safety problems.</p>
C		<p>Hazardous voltage exists while the Manipulator is ON. To avoid electric shock, do not touch any internal electric parts.</p>

1. Safety

Location	Label	Note
D	  	<p>You can catch your hand or fingers between the shaft and cover when bringing your hand close to moving parts.</p> <p>Manipulators with bellows do not have this label for no danger of your hand or fingers being caught</p>
E	 	<p>Be careful of the arm falling due to the arm's own weight while the brake release button is being pressed.</p> <p>* This label is attached to the option brake release box.</p>
	 	<p>Be careful of the shaft falling due to the hand's own weight while the brake release button is being pressed.</p>

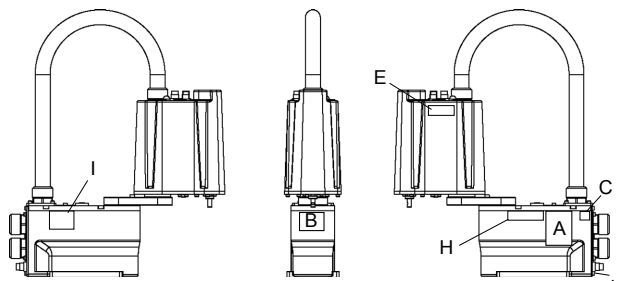
Location	Label	Note
F	<div style="border: 1px solid black; padding: 5px;">  <p>WARNING</p> <ol style="list-style-type: none"> 1. Do not lift without the shipping brackets. 2. To pick up the manipulator arm, use two wireropes of equal length connected to eyebolts on the J3 arm. 3. Remove the shipping brackets and eyebolts before turning power on. 4. Follow the instruction manual during lifting / transportation.  </div>	<p>Do not lift without the shipping bracket.</p> <p>To pick up the manipulator arm, use two wire ropes of equal length.</p> <p>Remove the shipping brackets and eyebolts before turning power on.</p> <p>Follow the directions in this manual for installation and transportation.</p>
	<div style="border: 1px solid black; padding: 5px;">  <p>WARNING</p>    </div>	
	<div style="border: 1px solid black; padding: 5px;">  <p>WARNING</p> <ol style="list-style-type: none"> 1. Do not lift without arm retaining. 2. To pick up the manipulator arm, use two wire ropes of equal length connected to the eyebolts on the J1 arm. 3. Remove the arm retaining bolt before turning power on. 4. Follow instructions manual during lifting and transportation.  <p>Weight : 48 Kg 106 lb.</p> </div>	
	<div style="border: 1px solid black; padding: 5px;">  <p>WARNING</p>   </div>	

1. Safety

Location	Label	Note
G	 	<p>Arm weight may cause arm to fall during disassembly operation.</p> <p>Follow the directions in this manual for disassembly operation.</p>
H	 <p>(Only UL model)</p>	<p>Only authorized personnel should perform sling work and operate a crane and a forklift.</p> <p>When these operations are performed by unauthorized personnel, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.</p>
I	<p>MODEL : G3-351S</p> <p>SERIAL NO. : 0001</p> <p>MANUFACTURED : 10/2007</p> <p>WEIGHT : 14kg MAX PAYLOAD : 3kg</p> <p>MOTOR POWER</p> <p>AXIS1 : 200W AXIS2 : 150W</p> <p>AXIS3 : 150W AXIS4 : 150W</p> <p>SEIKO EPSON CORPORATION</p> <p>3-5,OWA 3-CHOME,SUWA-SHI NAGANO-KEN,392-8502 JAPAN</p>	
J	<p>Air pressure max. 0.59Mpa, 86psi</p>	

Location of Labels

G1



1. Safety

G3

Common

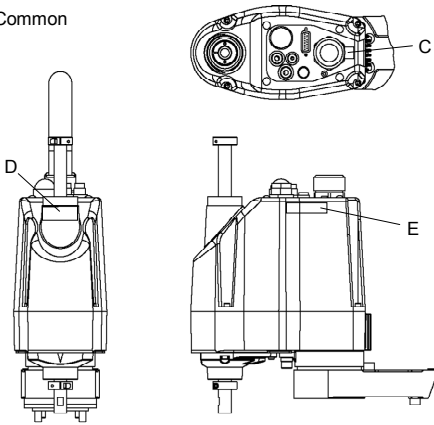
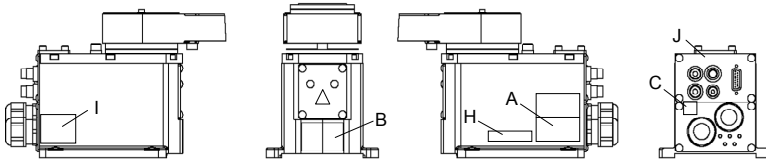
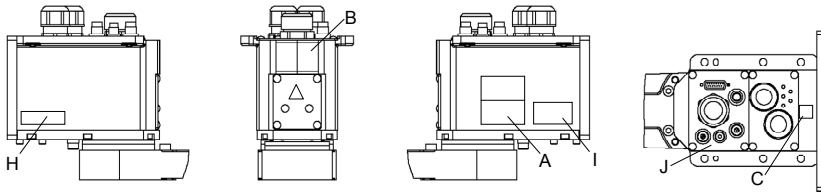


Table Top Mounting

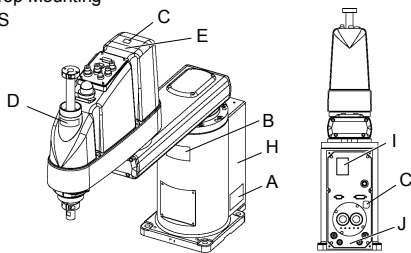


Multiple Mounting

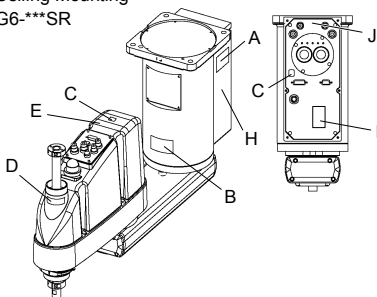


G6

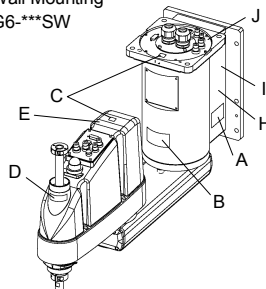
Table Top Mounting
G6-***S



Ceiling Mounting
G6-***SR



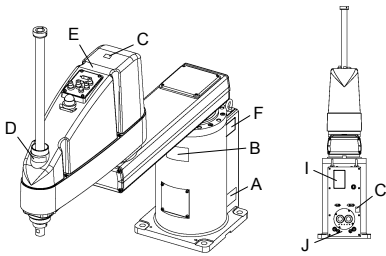
Wall Mounting
G6-***SW



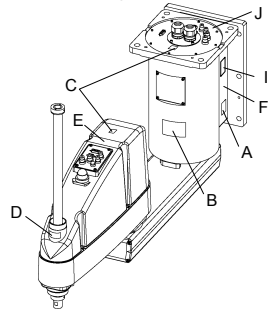
1. Safety

G10/G20

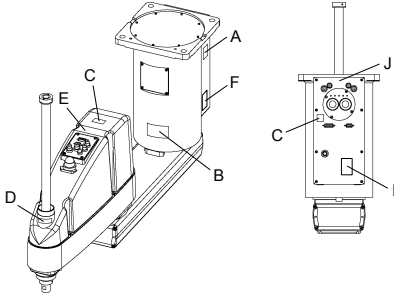
Table Top Mounting: G10/G20-****



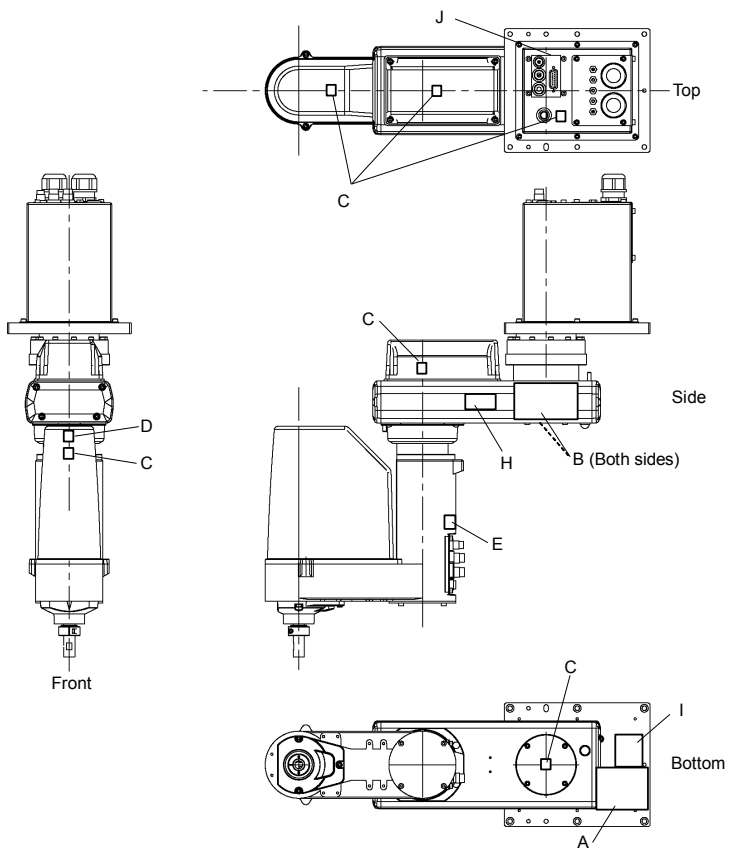
Wall Mounting: G10/G20-****W



Ceiling Mounting: G10/G20-****R



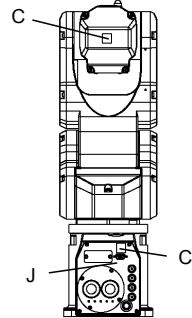
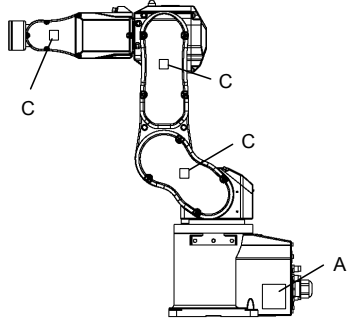
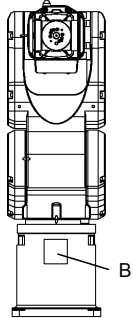
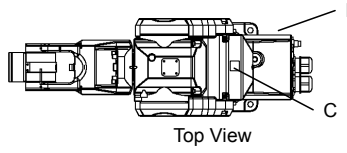
RS



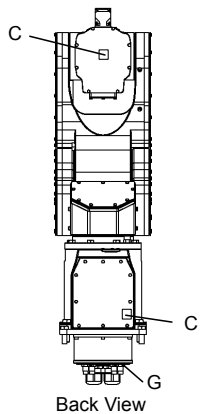
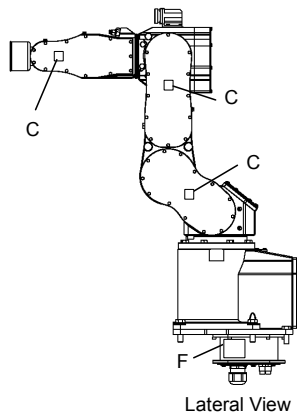
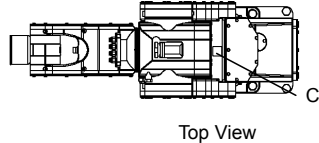
1. Safety

C3

S/C model



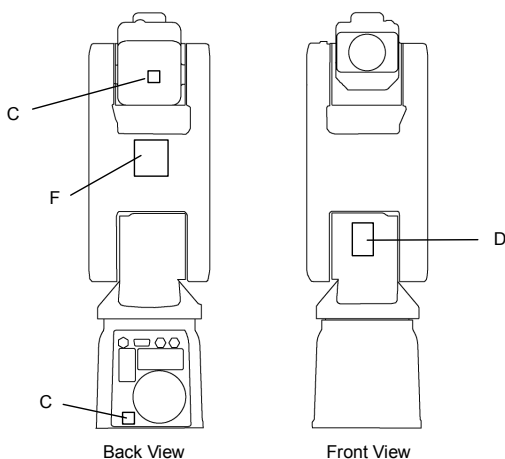
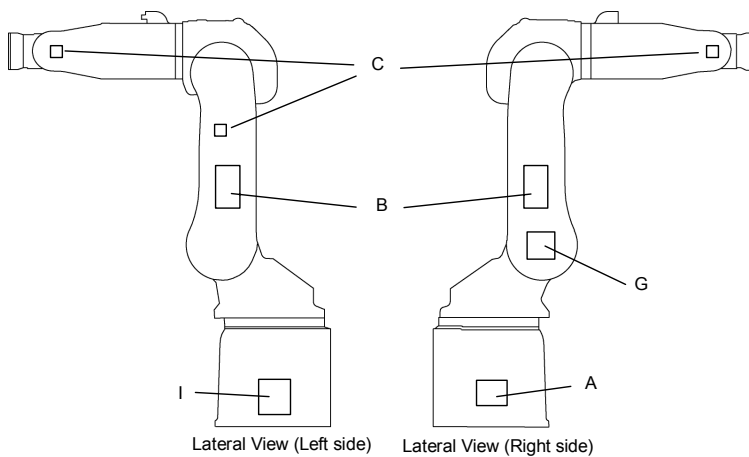
V/P model



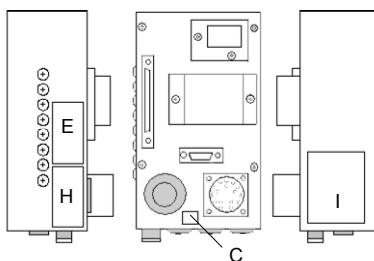
C: The label is inside the cover.

A, B: Labels are not attached on the Manipulator. Attach the labels to easy-to-see locations outside the system

S5



X5



Label E is for the manipulator of up/down axis.

1.7 Safety Features

The robot control system supports safety features described below. However, the user is recommended to strictly follow the proper usage of the robot system by thoroughly reading the attached manuals before using the system. Failure to read and understand the proper usage of the safety functions is highly dangerous.

Among the following safety features, the Emergency Stop Switch and Safety Door Input are particularly important. Make sure that these and other features function properly before operating the robot system.

For details, refer to the *2.5 Controller Installation - Safety Door Switch and Latch Release Switch*.

Emergency Stop Switch

The EMERGENCY connector on the Controller has expansion Emergency Stop input terminals used for connecting the Emergency Stop switches.

Pressing any Emergency Stop switch can shut off the motor power immediately and the robot system will enter the Emergency Stop condition.

Safety Door Input

In order to activate this feature, make sure that the Safety Door Input switch is connected to the EMERGENCY connector at the Controller.

When the safety door is opened, normally the Manipulator immediately stops the current operation, and the status of Manipulator power is operation-prohibited until the safety door is closed and the latched condition is released. In order to execute the Manipulator operation while the safety door is open, you must change the mode selector key switch on the Teach Pendant to the “Teach” mode. Manipulator operation is available only when the enable switch is on. In this case, the Manipulator is operated in low power status.

Low Power Mode

The motor power is reduced in this mode.

Executing a power status change instruction will change to the restricted (low power) status regardless of conditions of the safety door or operation mode. The restricted (low power) status ensures the safety of the operator and reduces the possibility of peripheral equipment destruction or damage caused by careless operation.

Dynamic Brake

The dynamic brake circuit includes relays that short the motor armatures. The dynamic brake circuit is activated when there is an Emergency Stop input or when any of the following errors is detected: encoder cable disconnection, motor overload, irregular motor torque, motor speed error, servo error (positioning or speed overflow), irregular CPU, memory check-sum error and overheat condition inside the Motor Driver Module.

Encoder Cable Disconnection Error Detection

The dynamic brake circuit is activated when the Motor Encoder Signal cable is disconnected.

Motor Overload Detection

The dynamic brake circuit is activated when the system detects that the load on the motor has exceeded its capacity.

Irregular Motor Torque (out-of-control manipulator) Detection

The dynamic brake circuit is activated when irregularity with motor torque (motor output) is detected (in which case the Manipulator is out of control).

Motor Speed Error Detection

The dynamic brake circuit is activated when the system detects that the motor is running at incorrect speed.

Positioning Overflow -Servo Error- Detection

The dynamic brake circuit is activated when the system detects that the difference between the Manipulator's actual position and commanded position exceeds the margin of error allowed.

Speed Overflow -Servo Error- Detection

The dynamic brake circuit is activated when the Manipulator's actual speed is detected to mark an overflow (the actual speed is outside the nominal range) error.

CPU Irregularity Detection

Irregularity of CPU that controls the motor is detected by the watchdog timer. The system CPU and the motor controlling CPU inside the Controller are also designed to constantly check each other for any discrepancies. If a discrepancy is detected, the dynamic brake circuit is activated.

Memory Check-sum Error Detection

The dynamic brake circuit is activated when a memory check-sum error is detected.

Overheat Detection at the Motor Driver Module

The dynamic brake circuit is activated when the temperature of the power device inside the Motor Driver module is above the nominal limit.

Relay Deposition Detection

The dynamic brake circuit is activated when relay deposition is detected.

Over-Voltage Detection

The dynamic brake circuit is activated when the voltage of the Controller is above the normal limit.

AC Power Supply Voltage Drop Detection

The dynamic brake circuit is activated when the drop of the power supply voltage is detected.

Temperature Anomaly Detection

The temperature anomaly is detected.

Fan Malfunction Detection

Malfunction of the fan rotation speed is detected.

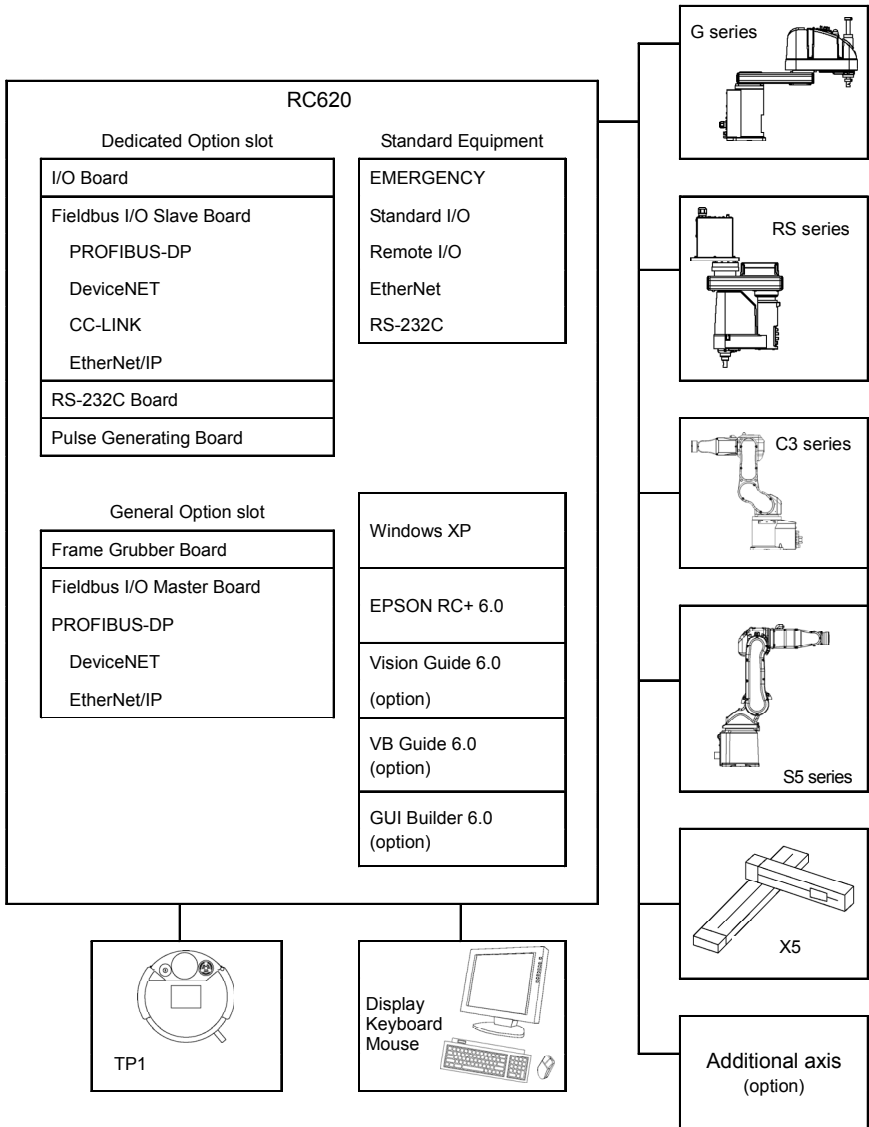
2. Installation

This chapter contains precautions for safe and accurate installation of the robot system.

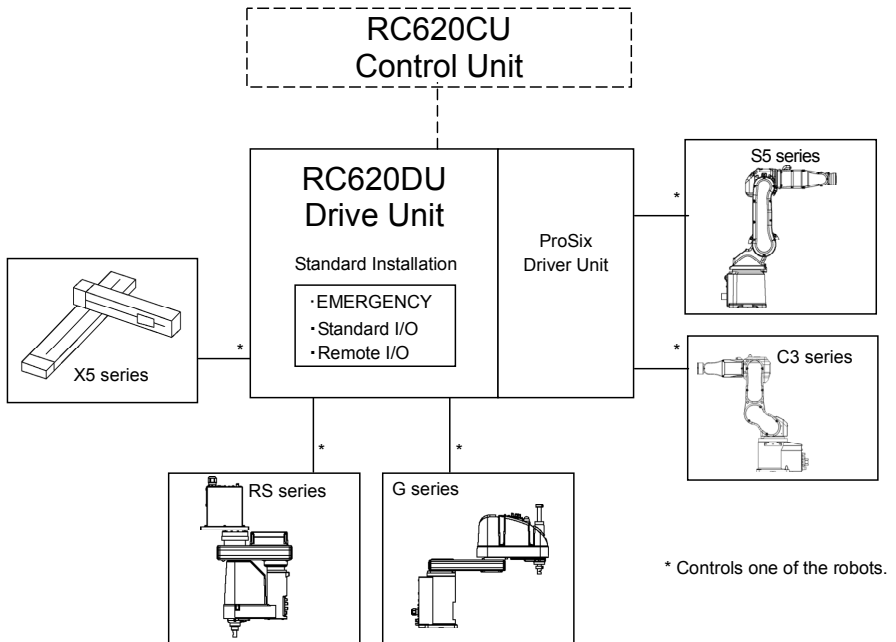
The outline to install the robot system is indicated on 2.1 Outline from Unpacking to Operation of Robot System. Refer to each section and/or the Manipulator manual and the Controller manual for unpacking, transportation, and installation.

System Example

Control Unit only



Control Unit and Drive Unit



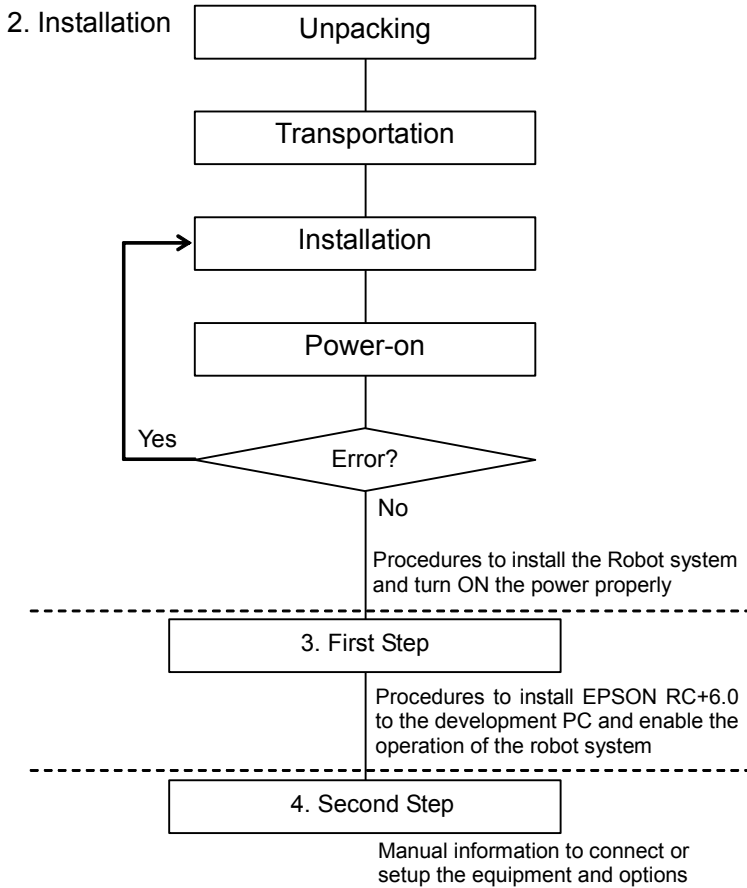
Drive Unit is the auxiliary unit connected with the control unit using the special cable.

Drive Unit cannot operate alone.

One or Two Drive Unit(s) can be used per robot system.

RC620 Control Unit can be described as RC620CU (Control Unit) to distinguish from RC620DU (Drive Unit).

2.1 Outline from Unpacking to Operation of Robot System



2.2 Unpacking

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

Using a cart or similar equipment, transport the Manipulator in the same conditions as it was delivered. Observe the following when unpacking the Manipulator.

Unpacking Precautions

Transportation procedure

- : Only authorized personnel should perform sling work and operate a crane or forklift. When these operations are performed by unauthorized personnel, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

Vibration at transportation

- : Avoid excessive vibration or shock during Manipulator transporting. Excessive vibration or shock may cause equipment damage to and/or malfunction of the Manipulator.

Anchor bolt

- : When removing the anchor bolts, support the Manipulator to prevent falling. Removing the anchor bolts without supporting the Manipulator may get hands, fingers, or feet caught as the Manipulator will fall.

Wire tie

- : Do not remove the wire tie securing the arm until you finish the installation. You may get your hands caught in the Manipulator when the wire tie is removed before completing the installation.

2.3 Transportation

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

Transportation Precautions

Transportation procedure

- : Using a cart or similar equipment, transport the Manipulator in the same conditions as it was delivered. Observe the following when unpacking the Manipulator.

Only authorized personnel should perform sling work and operate a crane or forklift. When these operations are performed by unauthorized personnel, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

Vibration at transportation

- : Avoid excessive vibration or shock during Manipulator transporting. Excessive vibration or shock may cause equipment damage to and/or malfunction of the Manipulator.

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Wire tie

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You may get your hands caught in the Manipulator when the wire tie is removed before completing the installation.

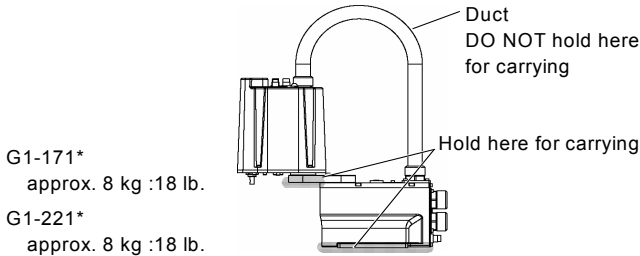
Hoisting procedure

- : Stabilize the Manipulator with your hands when hoisting it. Unstable hoisting is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as the fall of the Manipulator.

Manipulator Transportation

G1

To carry the Manipulator, secure the Manipulator to the delivery equipment or hold the areas indicated in gray in the figure (bottom of Arm #1 and bottom of the base) by hand. Never hold the duct to carry the Manipulator.



G3

To carry the Manipulator, have two or more people to work on it and secure the Manipulator to the delivery equipment or hold the areas indicated in gray in the figure (bottom of Arm #1 and bottom of the base) by hand.

When holding the bottom of the base by hand, be very careful not to get your hands or fingers caught.

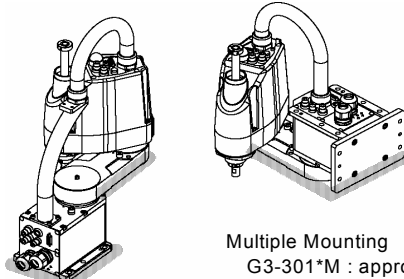


Table Top Mounting

G3-251* : approx. 14 kg: 31 lb.

G3-301* : approx. 14 kg: 31 lb.

G3-351* : approx. 14 kg: 31 lb.

Multiple Mounting

G3-301*M : approx. 14 kg: 31 lb.

G3-351*M : approx. 14 kg: 31 lb

2. Installation

G6

To carry the Manipulator, have two or more people to work on it and secure the Manipulator to the delivery equipment or hold the areas indicated in gray in the figure (bottom of Arm #1 / bottom of the base) by hand. When holding the bottom of the base by hand, be very careful not to get hands or fingers caught.

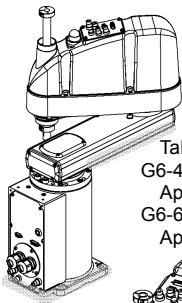
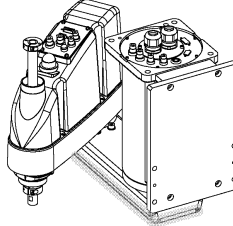
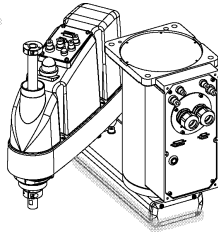


Table Top Mounting
G6-45**/G6-55**
Approx. 27 kg: 60 lb.
G6-65**
Approx. 28 kg: 62 lb.



Wall Mounting
G6-45**W/G6-55**W
Approx. 29 kg: 64 lb.
G6-65**W
Approx. 29.5 kg: 65 lb.

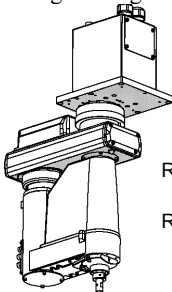


Ceiling Mounting
G6-45**R/G6-55**R
Approx. 27 kg: 60 lb.
G6-65**R
Approx. 28 kg: 62 lb.

RS

To carry the Manipulator, have two or more people to work on it and secure the Manipulator to the delivery equipment or hold the areas indicated in gray in the figure (bottom of Arm #1 and bottom of the base) by hand.

When holding the bottom of the base by hand, be very careful not to get your hands or fingers caught.

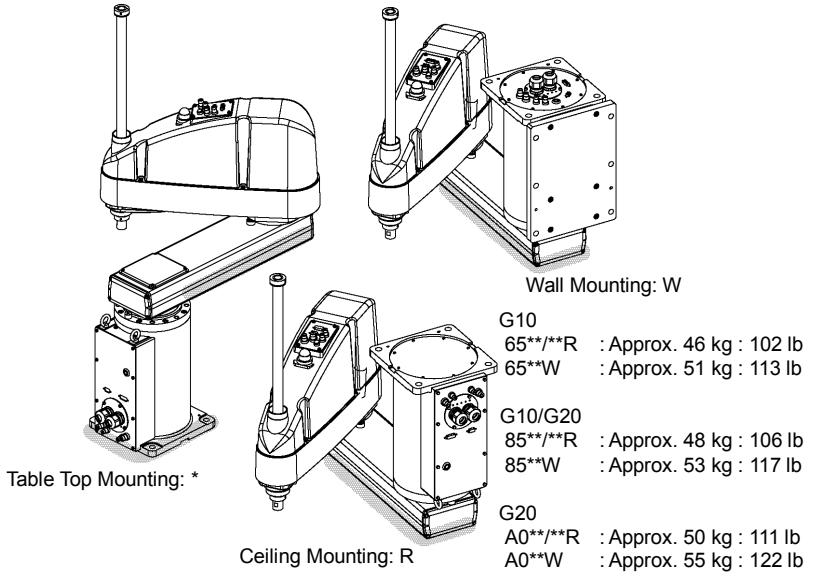


RS3-351* : approx. 17 kg : 38 lb.
(except cables)

RS4-551* : approx. 19 kg : 42 lb.
(except cables)

G10 / G20

To carry the Manipulator, secure the Manipulator to the delivery equipment, or pass belts through the eyebolts and hoist it with your hands. Make sure to hold the areas indicated in gray in the figure (bottom of Arm #1 and bottom of the base) by hand.



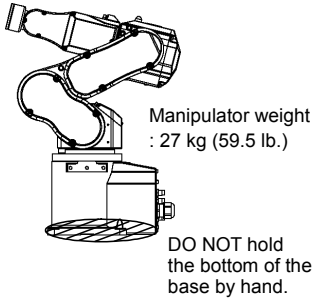
2. Installation

C3

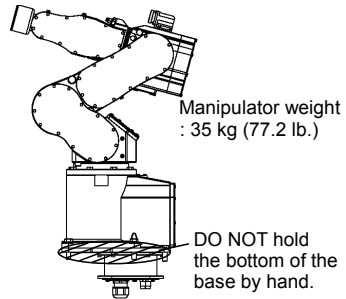
To carry the Manipulator, have at least 2 people to work on it and secure the Manipulator to the delivery equipment or hold it by hand.

Do not hold the bottom of the base (the screened parts in the figure). Holding these parts by hand is extremely hazardous and may cause your hands and fingers to be caught.

S/C model



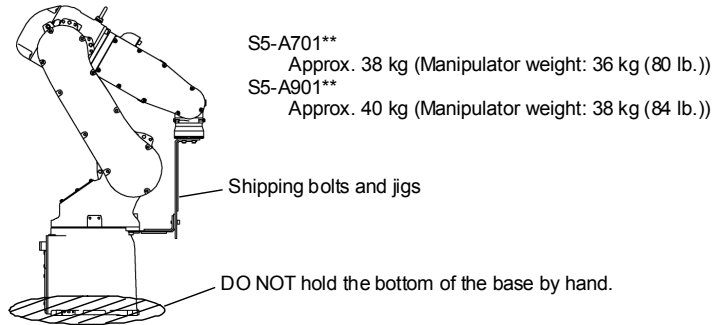
V/P model



S5

To carry the Manipulator, have at least 3 people to work on it and secure the Manipulator to the delivery equipment or hold it by hand.

Do not hold the bottom of the base (the screened parts in the figure). Holding these parts by hand is extremely hazardous and may cause your hands and fingers to be caught or cut by the grounding electrode.



2. Installation

X5

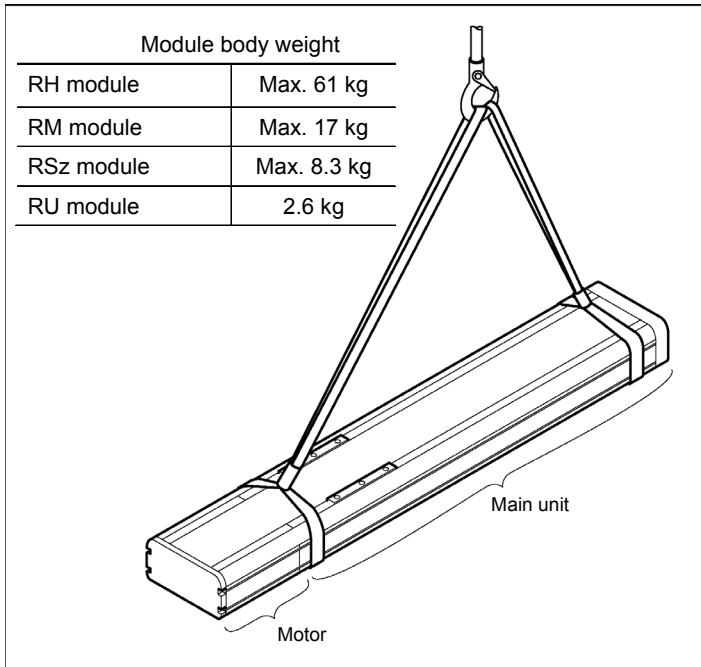
Transport separately

Make sure not to apply ropes to the motor unit, secure the other part of body instead when roping or transporting the manipulator.

Transport with multi-axis installed

To avoid colliding while transporting, use ropes or fittings to secure parts.

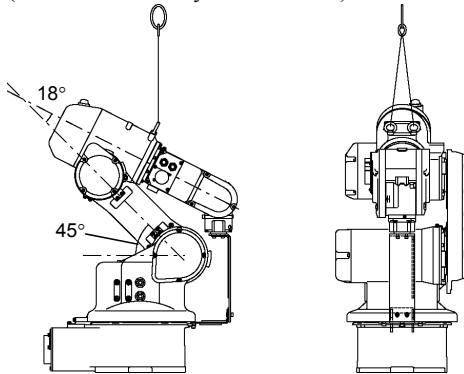
- Basically, transport the manipulator on module basis.



Using a Crane

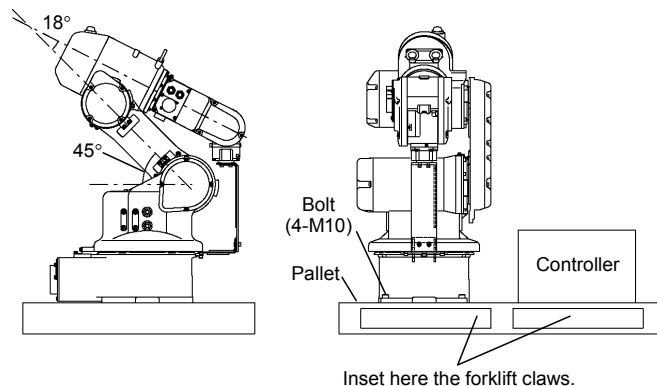
To hoist the Manipulator with a crane, secure the Manipulator with shipping bolts and jigs and posture the Manipulator as shown in the figures below (the posture at shipment from the manufacturer).

Use a cable threaded through the eyebolts attached to the Manipulator as shown. (Make sure that they are not loose.)



Using a Forklift

Position the Manipulator as shown in the figures below (the posture at shipment from the manufacturer) and secure it onto a pallet with shipping bolts and jigs. Insert the forklift claws under the pallet and transport the Manipulator together with the pallet. The pallet must have enough strength to bear the weight of the Manipulator. Transporting of the Manipulator must be performed slowly in order to avoid overturning or slippage.



2.4 Manipulator Installation

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes.

For details, refer to the Manipulator manual.

Installation Precautions

Safeguard installation

- : To ensure safety, a safeguard must be installed for the robot system. For details on the safeguard, refer to the *Installation and Design Precautions* in the *Safety* chapter of the *EPSON RC+ User's Guide*.

Space between safeguard and Manipulator

- : Install the Manipulator at a location with sufficient space so that a tool or a work piece on the end effector does not reach a wall or a safeguard when the Manipulator extends its arm fully while holding a work piece. Installing the Manipulator at a location with insufficient space is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as a tool or a work piece may collide with a wall and a safeguard.

Manipulator check before installation

- : Before installing and operating the Manipulator, make sure that all parts of the Manipulator are in place and have no external defects. Missing or defective parts may cause improper operation of the Manipulator. Improper operation of the Manipulator is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

Side mounting and ceiling mounting

- : When mounting the Manipulator on a wall or ceiling, secure the Manipulator to the wall or ceiling that has enough strength and rigidity. Mounting the Manipulator on a wall or ceiling that has insufficient strength and rigidity is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as the Manipulator may fall or vibrate.

Side mounting and ceiling mounting

- : When mounting the Manipulator on a wall or ceiling, for safety purposes, attach the support to the Manipulator base to prevent the Manipulator from falling. If the Manipulator falls, it is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

For Protected-model

- : Connect the power cable connection and the signal cable connector to the Manipulator immediately after the Manipulator installation. The Manipulator without connecting them may result in electric shock and/or malfunction of the robot system as it cannot ensure IP65.

Noise level

Noise level by movement of manipulator.

Manipulator		Level dB(A)	Operating conditions	Measurement point
G1 RS3 RS4		65	Under rated load, 4-joints, simultaneous motion, maximum speed, maximum acceleration, and duty 50%	In front of the Manipulator, 1000 mm apart from the motion range, 50 mm above the base-installed surface
LS3 LS6 G3 G6 G10 G20		70		
X5	RH	75.3	Under rated load, maximum speed, maximum acceleration, and duty 50%	In front of the Manipulator, 1000 mm apart from the motion range, 50 mm above the base-installed surface
	RM	76.5		
	RG-HM	75.1		
	YZ-MS	76.8		
	RP-HMSz	76.2		
RU-HMSz	76.2			
C3		76	Under rated load, All arm simultaneous operation, maximum speed, maximum acceleration, and duty 50%	1000mm apart from the Back of the Manipulator
S5		80		

2. Installation

Base Table

A base table for anchoring the Manipulator is not supplied. Please make or obtain the base table for your Manipulator. The shape and size of the base table differs depending on the use of the robot system. For your reference, we list some Manipulator table requirements here.

The torque and reaction force produced by the movement of the Manipulator are as follows:

G / RS series

	G					RS	
	G1	G3	G6	G10	G20	RS3	RS4
Max. Reaction torque on the horizontal plate (Nm)	100	300	500	1000	1000	500	500
Max. Horizontal reaction force (N)	200	2000	2500	4500	7500	1200	1400
Max. Vertical reaction force (N)	300	1000	1500	2000	2000	1100	1100
Threaded holes for Mounting screw	M6	M8	M8	M12	M12	M6	M6

The plate for the Manipulator mounting face should be 20 mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25 μ m or less.

C3 / S5 series

	C3	S5	
		701	901
Max. Reaction torque on the horizontal plate (Nm)	500	600	900
Max. Horizontal reaction force (N)	800	1000	1400
Max. Reaction torque on the vertical plate (Nm)	600	800	900
Max. Vertical reaction force (N)	2500	3000	3500
Threaded holes for Mounting screw	M8	M10	M10

The plate for the Manipulator mounting face should be 30 mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25 μ m or less.

X5

	Single axis	2-axis		3-axis	4-axis
	RH, RM	RG-HM	YZ-MS	RP-HMSz	RU-HMSz
Max. Horizontal reaction force (N)	1400N	2000N	1400N	2000N	2000N
Max. Vertical reaction force (N)	—	—	1050N	1050N	1050N
Max. Reaction torque on the horizontal plate (Nm)	—	—	—	—	40Nm

The flatness of the mounting base shall be 0.1 mm or less and the surface shall be free of interfering protrusions.

Adjust the flatness of mounting base using shims when clearance exists between the module surface and the mounting base around the mounting holes

Use mounting bolts with specifications conforming to ISO898-1 property class: 10.9 or 12.9.

The table must be secured on the floor or wall to prevent it from moving.

The Manipulator must be installed horizontally.

When using a leveler to adjust the height of the base table, use a screw with M16 diameter.

2. Installation

Installation Procedure



When the Manipulator is Clean-model, unpack it outside of the clean room. Secure the Manipulator not to fall, and then wipe off the dust on the Manipulator with a little alcohol or distilled water on a lint-free cloth. After that, carry the Manipulator in the clean room. Connect an exhaust tube to the exhaust port after installation.


G1

There are 6 threaded holes for the Manipulator base. The mounting bolt must be M6 size (Length: 25 mm + Spring washer + Plain washer) conforming to the strength, ISO898-1 property class: 6.9. Secure outward four points.

G1-171* : approx. 8 kg :18 lb.

G1-221* : approx. 8 kg :18 lb.

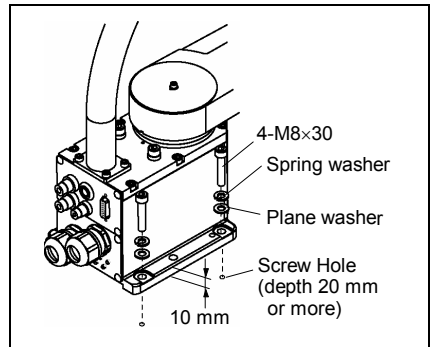
G3 : Table Top Mounting

 <p>CAUTION</p>	<ul style="list-style-type: none"> ■ Install the Table Top Mounting Manipulator with two or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. G3-251* : approx. 14 kg: 31 lb. G3-301* : approx. 14 kg: 31 lb. G3-351* : approx. 14 kg: 31 lb.
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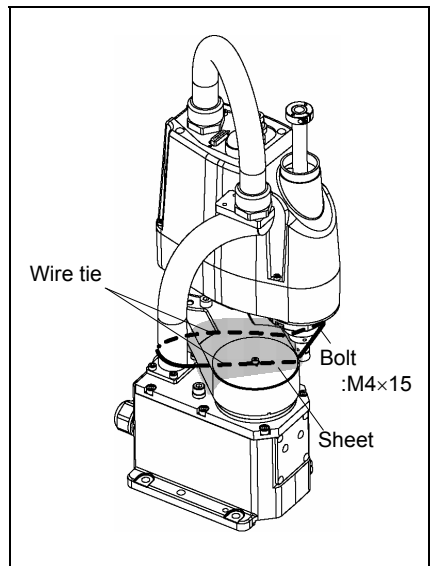
- (1) Secure the base to the base table with four bolts.



NOTE Use bolts with specifications conforming to ISO898-1
Property Class: 10.9 or 12.9.




- (2) Using nippers, cut off the wire tie binding the shaft and arm retaining bracket on the base.
- (3) Remove the bolts securing the wire ties removed in step (2).
- (4) Remove the shipping bolt and jigs.

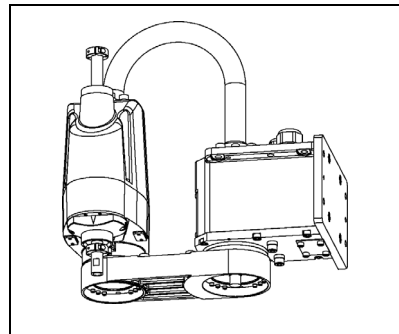


2. Installation

G3 : Multiple Mounting

 <p>WARNING</p>	<ul style="list-style-type: none">■ Install the Multiple Mounting Manipulator with two or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. G3-301*M : approx. 14 kg: 31 lb. G3-351*M : approx. 14 kg: 31 lb.■ When installing the Manipulator to the wall, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.
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- (1) Unpack the manipulator with retaining the arm posture.

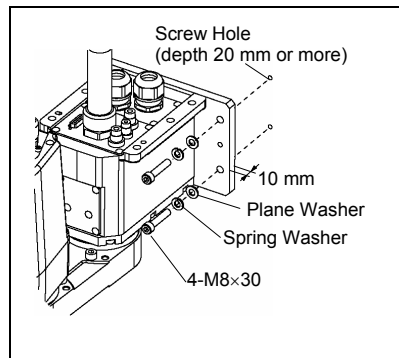


- (2) Secure the base to the wall with four bolts.




NOTE Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

- (3) Remove the shipping bolt and jigs.



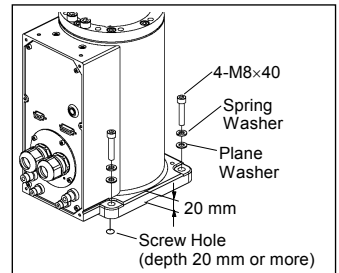
G6 : Table Top Mounting

 <p>WARNING</p>	<ul style="list-style-type: none"> ■ Install the Table Top Mounting Manipulator with two or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. G6-45** : Approximately 27 kg: 60 lb. G6-55** : Approximately 27 kg: 60 lb. G6-65** : Approximately 28 kg: 62 lb.
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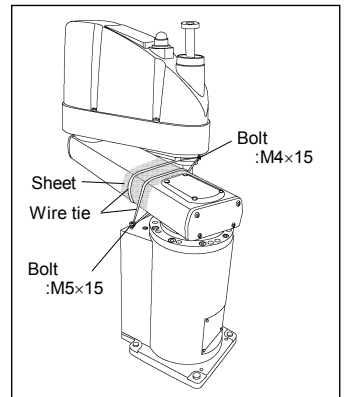
- (1) Secure the base to the base table with four bolts.



NOTE Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.



- (2) Using nippers, cut off the wire tie binding the shaft and arm retaining bracket on the base.
- (3) Remove the bolts securing the wire ties removed in step (2).
- (4) Remove the shipping bolt and jigs.



2. Installation

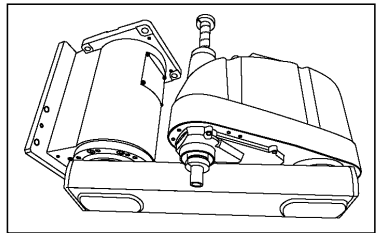
G6 : Wall Mounting



WARNING

- Install the Wall Mounting Manipulator with two or more people.
The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator.
G6-45**W : Approximately 29 kg: 64 lb.
G6-55**W : Approximately 29 kg: 64 lb.
G6-65**W : Approximately 29.5 kg: 65 lb.
- When installing the Manipulator to the wall, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.

- (1) Unpack the manipulator with retaining the arm posture.



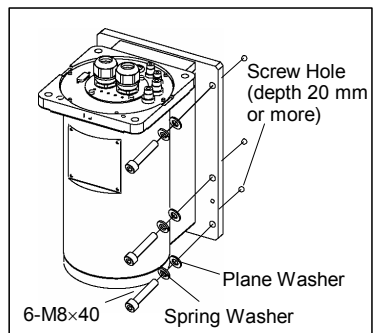
- (2) Secure the base to the wall with six bolts.

NOTE




Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

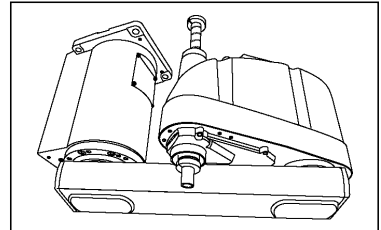
- (3) Remove the shipping bolt and jigs.



G6 : Ceiling Mounting

 WARNING	<ul style="list-style-type: none"> ■ Install the Ceiling Mounting Manipulator with two or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. G6-45**R : Approximately 27 kg: 60 lb. G6-55**R : Approximately 27 kg: 60 lb. G6-65**R : Approximately 28 kg: 62 lb. ■ When installing the Manipulator to the ceiling, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.
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- (1) Unpack the manipulator with retaining the arm posture.

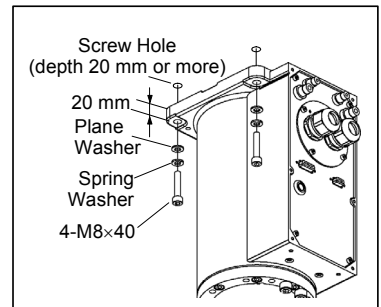


- (2) Secure the base to the ceiling with four bolts.



NOTE Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

- (3) Remove the shipping bolt and jigs.



2. Installation

G10/G20 : Table Top Mounting



CAUTION

- Install the Table Top Mounting Manipulator with four or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator.

G10-65** : Approximately 46 kg :102 lb.

G10/G20-85** : Approximately 48 kg :106 lb.

G20-A0** : Approximately 50 kg :111 lb.

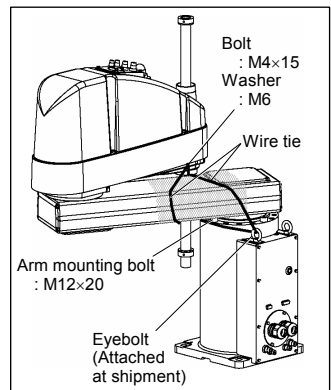
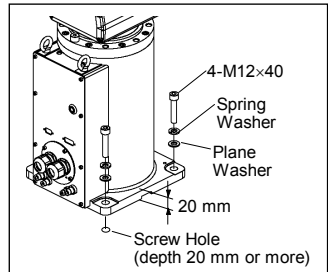
- (1) Secure the base to the base table with four bolts.




NOTE Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

Tightening torque
: 7350 N·cm (750 kgf·cm)

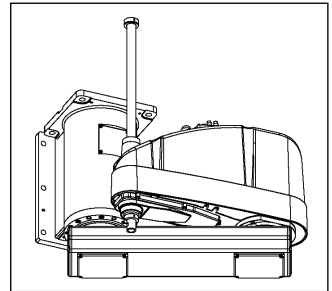
- (2) Using nippers, cut off the wire tie binding the shaft and arm retaining bracket on the base.
- (3) Remove the bolts securing the wire ties removed in step (2).
- (4) Remove the shipping bolt and jigs.



G10/G20 : Wall Mounting

 WARNING	<ul style="list-style-type: none"> ■ Install the Wall Mounting Manipulator with four or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. <ul style="list-style-type: none"> G10-65**W : Approximately 51 kg :113 lb. G10/G20-85**W : Approximately 53 kg :117 lb. G20-A0**W : Approximately 55 kg :122 lb. ■ When installing the Manipulator to the wall, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.
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- (1) Unpack the manipulator with retaining the arm posture.

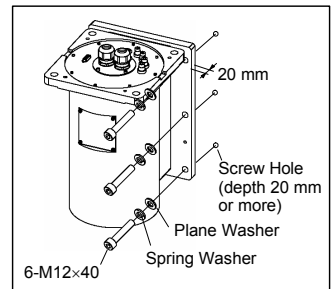


- (2) Secure the base to the wall with six bolts.




NOTE Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

- (3) Remove the shipping bolt and jigs.

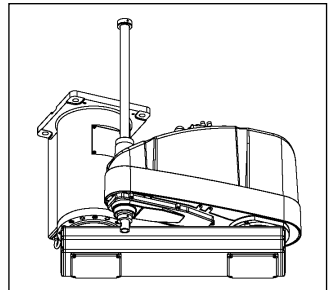


2. Installation

G10/G20 : Ceiling Mounting

 <p>WARNING</p>	<ul style="list-style-type: none">■ Install the Ceiling Mounting Manipulator with four or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. G10-65**R : Approximately 46 kg :102 lb. G10/G20-85**R : Approximately 48 kg :106 lb. G20-A0**R : Approximately 50 kg :111 lb.■ When installing the Manipulator to the ceiling, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.
--	---

- (1) Unpack the manipulator with retaining the arm posture.

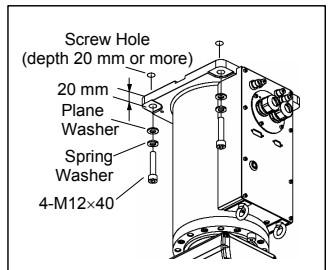


- (2) Secure the base to the ceiling with four bolts.




Use bolts with specifications conforming to ISO898-1 Property Class: 10.9 or 12.9.

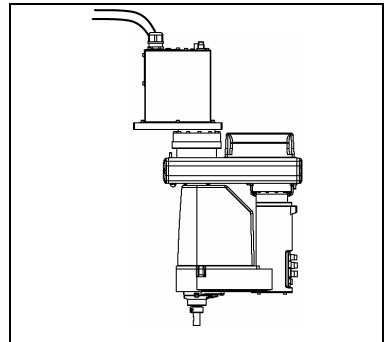
- (3) Remove the shipping bolt and jigs.



RS

 CAUTION	<ul style="list-style-type: none"> ■ Install the Manipulator with two or more people. The Manipulator weights are as follows. Be careful not to get hands, fingers, or feet caught and/or have equipment damaged by a fall of the Manipulator. RS3-351*: approx. 17 kg : 38 lb. (except cables) RS4-551*: approx. 19 kg : 42 lb. (except cables) ■ When installing the Manipulator to the ceiling, support the Manipulator, and then secure the anchor bolts. Removing the support without securing the anchor bolts properly is extremely hazardous and may result in fall of the Manipulator.
---	---

- (1) Unpack the Manipulator with retaining the arm posture.

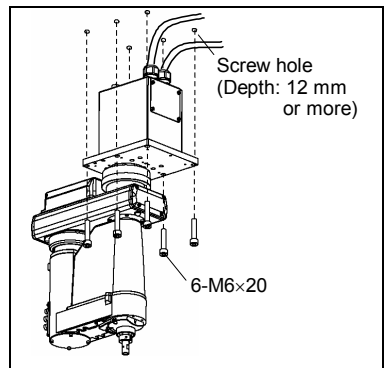


- (2) Secure the base to the wall with 6 bolts.



NOTE Intensity of the bolts should be equivalent to ISO898-1 Property Class 10.9 or 12.9.

- (3) Remove the shipping bolt and jigs.



2. Installation

C3

S/C model: There are four threaded holes for the Manipulator base.
Use M8 mounting bolts conforming to the strength of ISO898-1 property class 12.9.

V/P model: There are six threaded holes for the Manipulator base.
Use attached stainless M8 mounting bolts and M8 stainless washer which are chemical resistance conscious.

S5

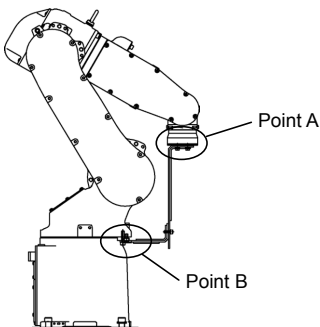
The shipping bolts and jigs are attached to the Manipulator as shown the figure below (points A, B) for protecting the Manipulator from various external forces during transportation.

Be sure to remove the bolts from the Point A first, and then, remove the bolts from Point B.

The jigs are painted yellow.

Point A : 6-M5×14 hexagon socket head cap bolts
with plain washers and disc spring washers

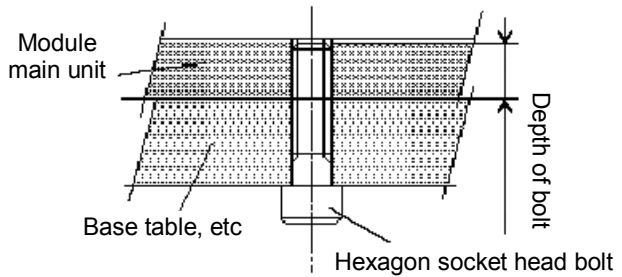
Point B : 2-M6×10 hexagon socket head cap bolts
with plain washers and disc spring washers



X5

If using the tap hole on the back side of the module unit and directly securing the main body:

- Process the through hole on the base table and secure from the back side.
- In addition, using $\varnothing 8H7$ hole on the back side of the body, you can decide where to secure. In this case, see the figure below for the pin on the base table.



	RH module	RM module
Bolt diameter	M8	M6
Depth of bolt	12-16 mm	9-12 mm
Tightening torque	33.3N·m	14.7N·m

If using the mounting bracket (option) and secure the module unit from the upper side:

- Mount the mounting bracket on the module main unit with the attached bolt.
- Process a screw on the mounting base table and secure the module unit from the upper side.

2. Installation

	RH module mounting bracket	RM module mounting bracket	YZ-MS mounting bracket
Code	R114X4E001	R114X4E002	R114X4E005
Attached bolt diameter × Length (units)	M8 × 20 (4)	M6 × 20 (4)	M8 × 20 (4) M6 × 20 (4)
Tightening torque	33.3N·m	14.7N·m	33.3N·m (M8) 14.7N·m (M6)
(Recommended) Units to use	RH400 : 2 RH600 : 2 RH800 : 3 RH1000 : 3	RM350 : 2 RM550 : 2 RM750 : 3	RM350 : 1 RM550 : 2 RM750 : 2
Weight	approx. 2.4 kg	approx.1.8 kg	approx.3.6 kg
Applicable module	RH RG-HM RD-HM RP-HMSz RU-HMSz	RM RG-MS RD-MS RP-MSSz	YZ-MS

2.5 Controller Installation

Installation Precautions

Environment conditions

- : The Controller must be used within the environmental conditions described in their manuals. This product has been designed and manufactured strictly for use in a normal indoor environment. Using the product in the environment that exceeds the conditions may not only shorten the life cycle of the product but also cause serious safety problems.

For Clean-room installation

- : The Controller is not designed for clean-room specification. If it must be installed in a clean room, make sure to install it in the proper enclosure with adequate ventilation and cooling.

Installation procedure

- : Before performing any installation procedure, turn OFF the Controller and related equipment, and then pull out the power plug from the power source.

Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

Cable

- : Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) The unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure.

Damaged cables, disconnection, or a contact failure is extremely hazardous and may result in electric shock and/or improper function of the system.

2. Installation

Installation - Controller

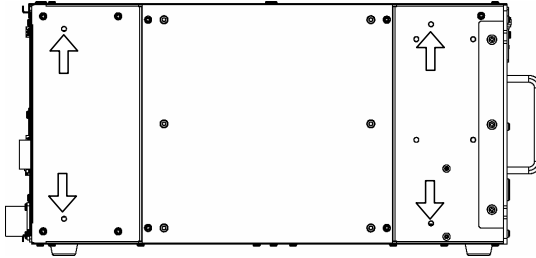
The controller can be placed vertically and horizontally.

When you place it vertically, place the left side (from front side view) down.

Also, put the rubber feet on the bottom to the left side.

Use the same screws for securing the rubber feet.

Position of set screws for rubber feet



Make sure to keep the controller away from the peripherals for the air supply and exhaust.

Controller Front side: 100 mm // Rear side: 150 mm

The rear side exhausts the hot air (approx. 10 deg C higher than ambient temperature). Therefore, make sure that heat sensitive devices are not placed near the outlet.

There must be room in front of the Controller so that the entire Controller can be pulled outward.

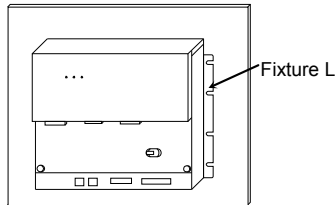
There must also be room behind the Controller so that one can attach and remove cables.

Use a base table that is at least 100 mm off the floor. Placing the Controller directly on the floor could allow dust penetration leading to malfunction.

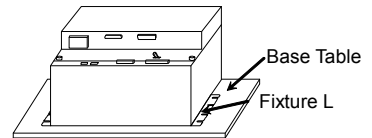
Installation – Drive Unit

- Mount the Drive unit mounting screws with 80 to 110 Ncm torque.
- Install the Drive unit on a flat surface such as wall, floor, and Drive unit box in the direction shown from (A) to (D).

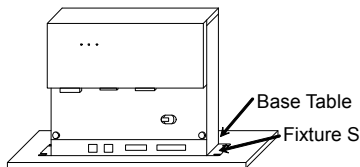
(A)



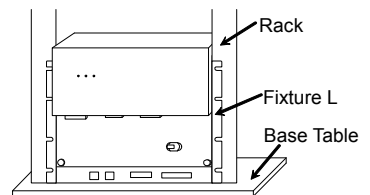
(B)



(C)



(D)



There are two types of fixtures. Mount the fixture to the Drive unit with the four attached screws.

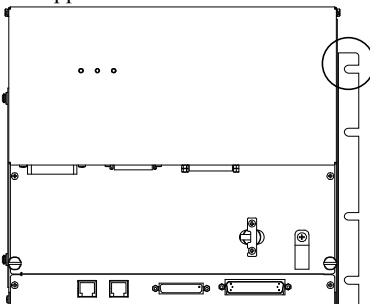
Fixture L: Used in (A), (B), and (D)

Fixture S: Used in I

NOTE



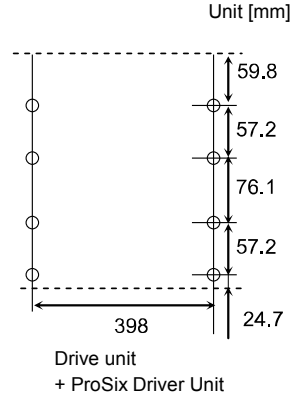
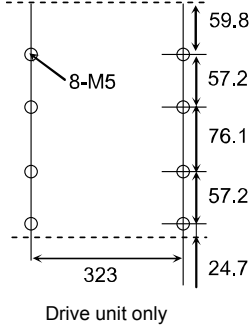
The length from the edge of fixture L differs by the side. Refer to the following figure and mount the side with shorter distance from the edge to the screw hole on the Upper side.



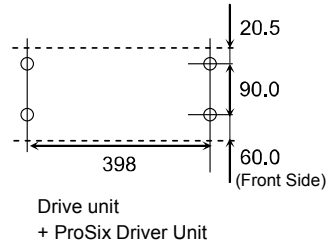
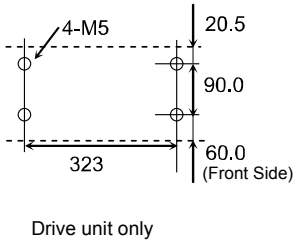
2. Installation

- For Drive unit installation to the Drive unit box or the base table, process screw hole drilling as follows.

When mounting direction is (A) or (B)

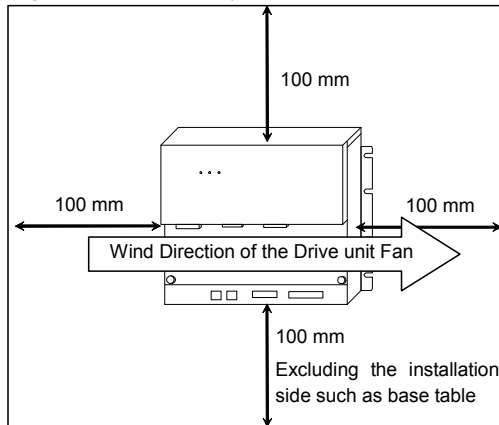


When mounting direction is (C) : Fixture S



- No screw hole processing is required for mounting direction (D). Secure it to the rack with screws and nuts.

- Ensure the draft around the in/out and also install the Drive unit by keeping the distance as follows to prevent the nose influence from other equipments such as large contactor and relay.




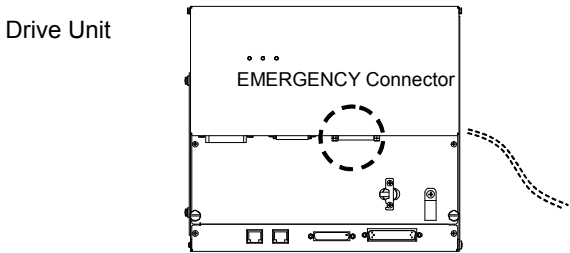
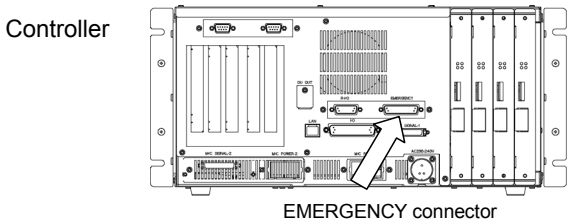
- Hot air with higher temperature than the ambient temperature (about 10 deg.C) comes out from the Drive unit.
Make sure that heat sensitive devices are not placed near the outlet.

2.6 Connection to EMERGENCY Connector

Connect a safeguard switch or Emergency Stop switch to the Controller / Drive Unit EMERGENCY connector for safety.

When nothing is connected to the EMERGENCY connector, Controller does not operate normally.

 CAUTION	<ul style="list-style-type: none"> Before connecting the connector, make sure that the pins are not bent. Connecting with the pins bent may damage the connector and result in malfunction of the robot system.
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Safety Door Switch and Latch Release Switch

The EMERGENCY connector has input terminals for the Safety Door switch and the Emergency Stop switch. Be sure to use these input terminals to keep the system safe.

Connector	Standard
EMERGENCY connector (Controller / DriveUnit side)	D-sub25 Pin (male) Mounting style #4-40

* The E-STOP BOX, connector cable, terminal block, and connector kit are offered as options.

Safety Door Switch

 WARNING	<ul style="list-style-type: none"> ■ The interlock of the Safety Door must be functioning when the robot system is operated. Do not operate the system under the condition that the switch cannot be turned ON/OFF (e.g. The tape is put around the switch.). Operating the robot system when the switch is not functioning properly is extremely hazardous and may cause serious safety problems as the Safety Door input cannot fulfill its intended function.
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In order to maintain a safe working zone, a safeguard must be erected around the Manipulator. The safeguard must have an interlock switch at the entrance to the working zone. The Safety Door that is described in this manual is one of the safeguards and an interlock of the Safety Door is called a Safety Door switch. Connect the Safety Door switch to the Safety Door input terminal on the EMERGENCY connector.

The Safety Door switch has safety features such as temporary hold-up of the program or the operation-prohibited status that are activated whenever the Safety Door is opened.

Observe the following in designing the Safety Door switch and the Safety Door.

- For the Safety Door switch, select a switch that opens as the Safety Door opens, and not by the spring of the switch itself.
- The signal from the Safety Door (Safety Door input) is designed to input to two redundant signals. If the signals at the two inputs differ by two seconds or more, the system recognizes it to be a critical error. Therefore, make sure that the Safety Door switch has two separate redundant circuits and that each connects to the specified pins at the EMERGENCY connector on the Controller.
- The Safety Door must be designed and installed so that it does not close accidentally.

Latch Release Switch

The controller software latches the following conditions:

- The safety door is open.
- The operation mode is “TEACH”.

The EMERGENCY connector has an input terminal for a latch release switch that cancels the latched conditions.

2. Installation

Open : The latch release switch latches conditions that the safety door is open or the operation mode is “TEACH”.

Closed : The latch release switch releases the latched conditions.



When the latched TEACH mode is released while the safety door is open, the status of Manipulator power is operation-prohibited because the safety door is open at that time.

To execute a Manipulator operation, close the safety door again, and then close the latch release input.

Checking Latch Release Switch Operation

After connecting the safety door switch and latch release switch to the EMERGENCY connector, be sure to check the switch operation for safety by following the procedures described below before operating the Manipulator.

- (1) Turn ON the Controller while the safety door is open in order to boot the controller software.
- (2) Make sure that the Controller LCD displays the one of the following.



- (3) Make sure that “Safety” is displayed on the status bar.
- (4) Close the safety door, and turn ON the switch connecting to the latch release input. Make sure that the “Safety” is dimmed on the status bar.

The information that the safety door is open can be latched by software based on the latch release input condition.

Open : The latch release switch latches condition that the safety door is open.
To cancel the condition, close the safety door, and then close the safety door latch release input.

Closed : The latch release switch does not latch the condition that the safety door is open.



The latch release input also functions to acknowledge the change of TEACH mode.

In order to change the latched condition of the TEACH mode, turn the mode selector key switch on the Teach Pendant to “Auto”. Then, close the latch release input.

Emergency Stop Switch

If it is desired to create an external Emergency Stop switch(es) in addition to the Emergency Stop on the Teach Pendant and Operator Panel, make sure to connect such Emergency Stop switch(es) to the Emergency Stop input terminal on the EMERGENCY connector.

The Emergency Stop switch connected must comply with the following:

- It must be a push button switch that is “normally closed”.
- A button that does not automatically return or resume.
- The button must be mushroom-shaped and red.
- The button must have a double contact that is “normally closed”.



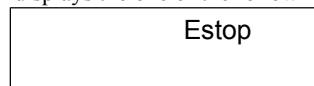
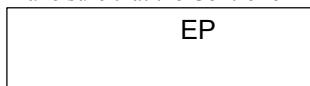
The signal from the Emergency Stop switch is designed to use two redundant circuits.

If the signals at the two circuits differ by two seconds or more, the system recognizes it as a critical error. Therefore, make sure that the Emergency Stop switch has double contacts and that each circuit connects to the specified pins on the EMERGENCY connector at the Controller. Refer to the *RC620 Controller Manual: Setup & Operation 8.4 Circuit Diagrams*.

Checking Emergency Stop Switch Operation

Once the Emergency Stop switch is connected to the EMERGENCY connector, continue the following procedure to make sure that the switch functions properly.

- (1) Turn ON the Controller to boot the controller software while pressing the Emergency Stop switch.
- (2) Make sure that the Controller LCD displays the one of the following.



- (3) Make sure that “E.Stop” is displayed on the status bar on the main window.
- (4) Release the Emergency Stop Switch.
- (5) Execute the RESET command.
- (6) Make sure that LCD display in step (2) is turned off and that “E-Stop” is dimmed on the main window status bar.

2. Installation

Pin Assignments

The EMERGENCY connector pin assignments are as follows:

Pin No.	Signal	Function	Pin No.	Signal	Function
1	ESW11	Emergency Stop switch contact (1) ^{*3}	14	ESW21	Emergency Stop switch contact (2) ^{*3}
2	ESW12	Emergency Stop switch contact (1) ^{*3}	15	ESW22	Emergency Stop switch contact (2) ^{*3}
3	ESTOP1+	Emergency Stop circuit 1 (+)	16	ESTOP2+	Emergency Stop circuit 2 (+)
4	ESTOP1-	Emergency Stop circuit 1 (-)	17	ESTOP2-	Emergency Stop circuit 2 (-)
5	NC	^{*1}	18	SDLATCH1	Safety Door Latch Release
6	NC	^{*1}	19	SDLATCH2	Safety Door Latch Release
7	SD11	Safety Door input (1) ^{*2}	20	SD21	Safety Door input (2) ^{*2}
8	SD12	Safety Door input (1) ^{*2}	21	SD22	Safety Door input (2) ^{*2}
9	24V	+24V output	22	24V	+24V output
10	24V	+24V output	23	24V	+24V output
11	24VGND	+24V GND output	24	24VGND	+24V GND output
12	24VGND	+24V GND output	25	24VGND	+24V GND output
13	NC				

*1 Do not connect anything to these pins.

*2 A critical error occurs if the input values from the Safety Door 1 and Safety Door 2 are different for two or more seconds. They must be connected to the same switch with two sets of contacts.

*3 A critical error occurs if the input values from the Emergency Stop switch contact 1 and Emergency Stop switch contact 2 are different for two or more seconds. They must be connected the same switch with two sets of contacts.

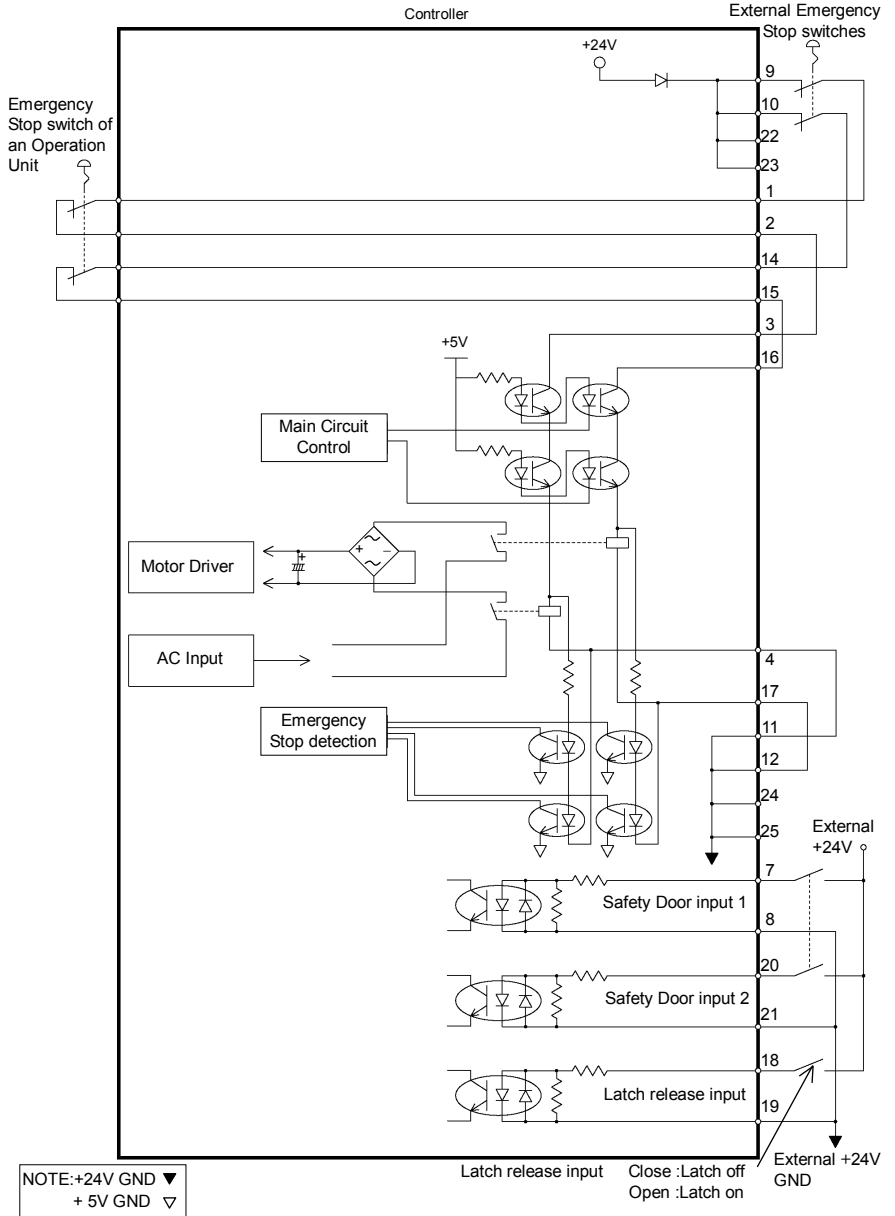
Emergency Stop switch output rated load	+30 V 0.3 A or under	1-2, 14-15 pin
Emergency Stop rated input voltage range Emergency Stop rated input current	+24 V ±10% 47.5 mA/+24V input	3-4, 16-17 pin
Safety Door rated input voltage range Safety Door rated input current	+24 V ±10% 10 mA/+24V input	7-8, 20-21 pin
Latch Release rated input voltage range Latch Release rated input current	+24 V ±10% 10 mA/+24 V input	18-19 pin



NOTE The total electrical resistance of the Emergency Stop switches and their circuit should be 1 Ω or less.

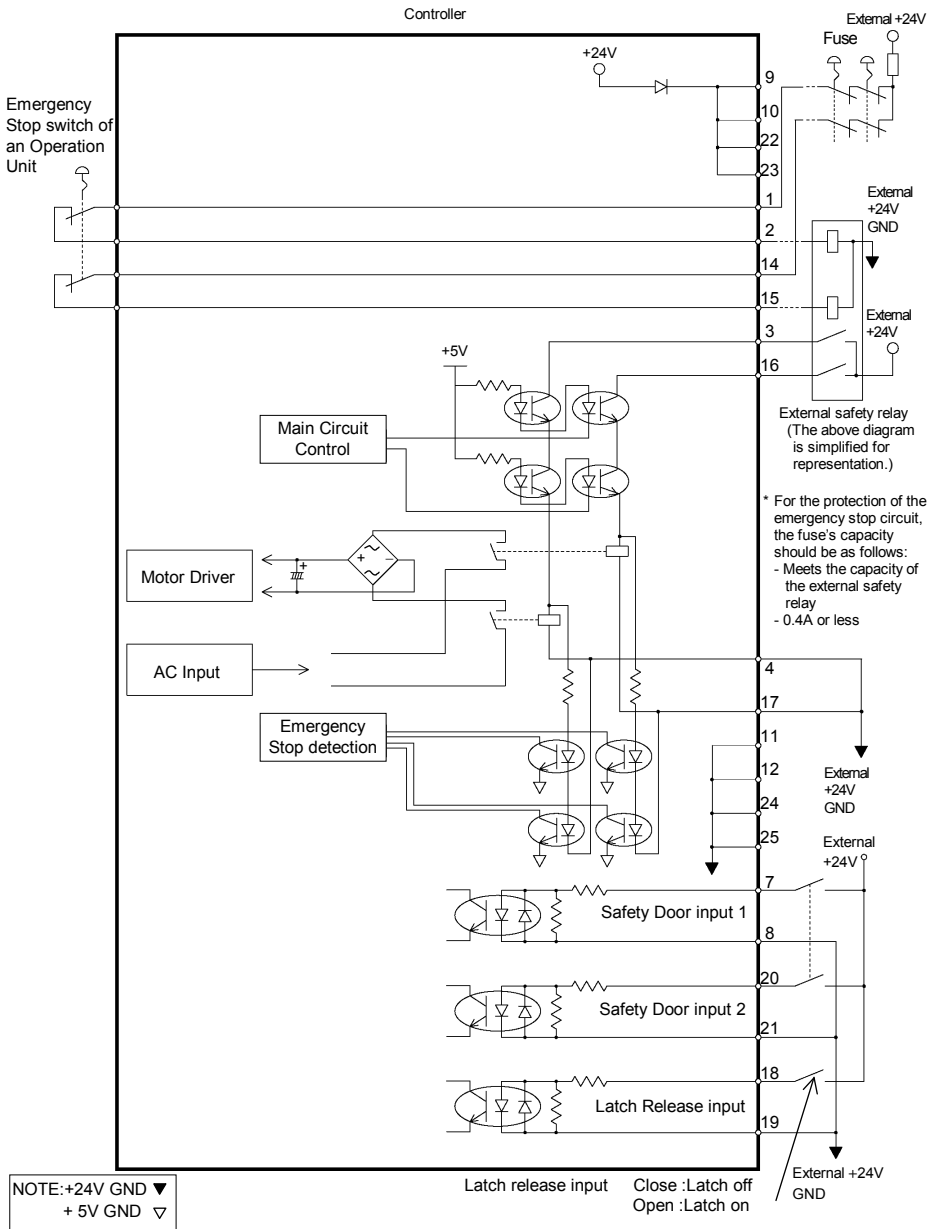
Circuit Diagrams – Controller

Example 1: External emergency stop switch typical application



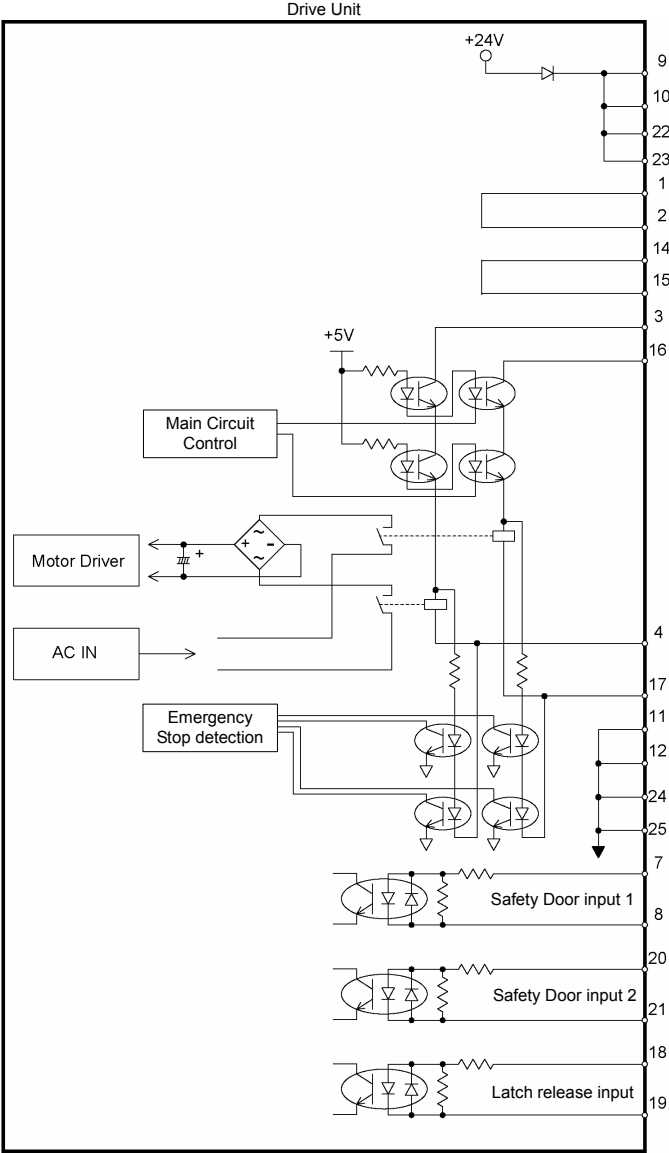
2. Installation

Example 2: External safety relay typical application



Circuit Diagrams – Drive Unit

Circuit Diagram

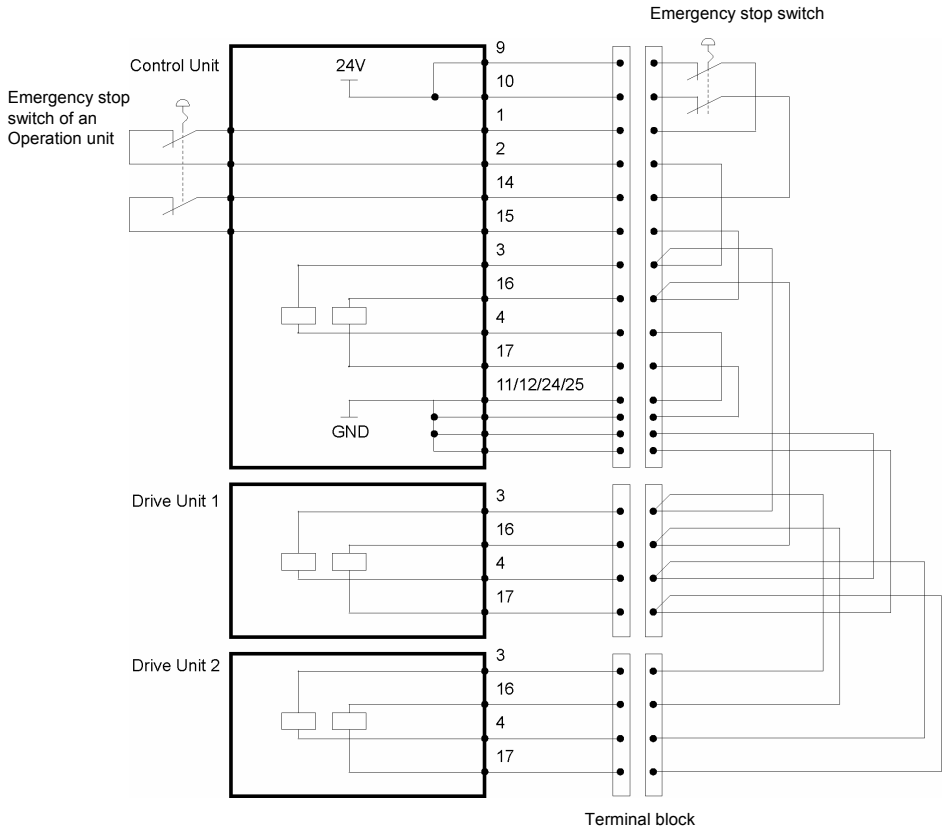


NOTE : +24V GND ▼
+5V GND ▽

2. Installation

Wiring Example for Emergency Stop

Example 1 : External emergency stop switch typical application

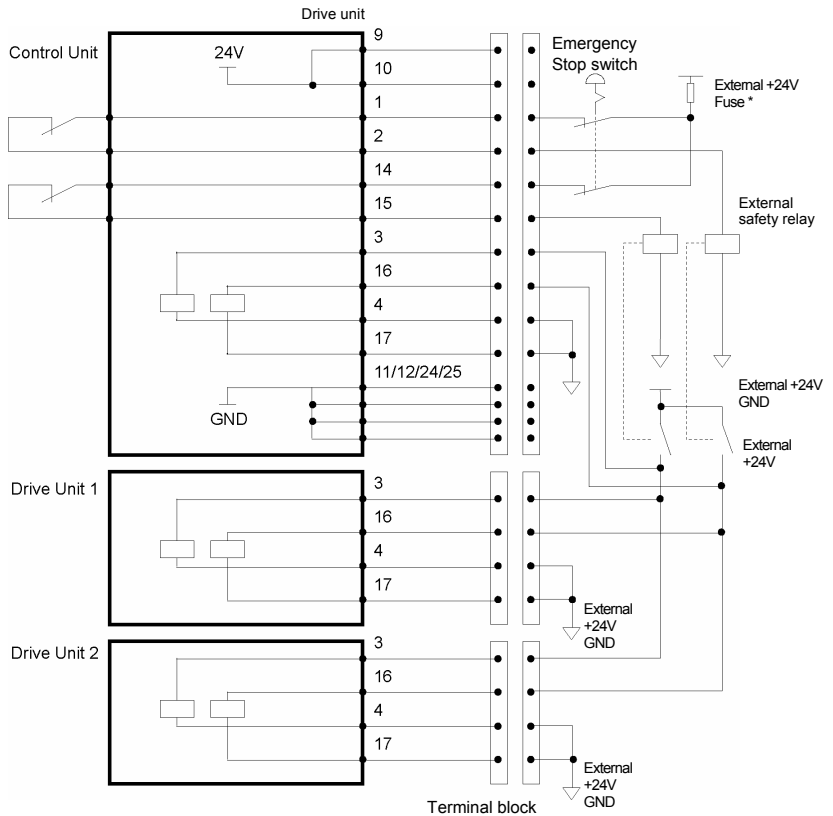


NOTE



- The Emergency cable, Emergency cable kit, and Terminal block are offered as options.
- Design the cables connecting the units within 20 m long.

Example 2 :External safety relay typical application



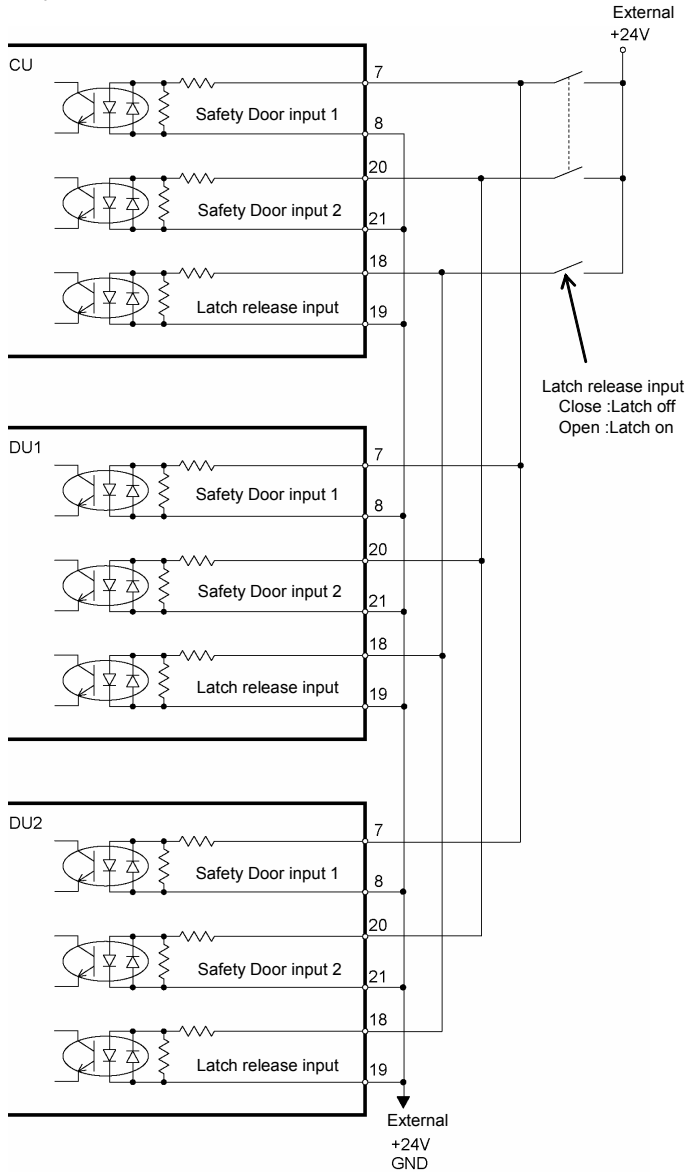
* Fuse

For the protection of the emergency stop circuit, the fuse's capacity should be as follows:

- Meets the capacity of the external
- 0.4A or less

2. Installation

Wiring Example for Safety Door Input / Latch Release Input




NOTE : +24V GND ▼

NOTE



- Design the cables connecting the units within 20 m long.

2.7 AC power cable

 WARNING	<ul style="list-style-type: none"> ■ Be sure to connect the AC power cable to a power receptacle. DO NOT connect it directly to a factory power source. To shut off power to the robot system, pull out the power plug from the power source. Performing any work while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system ■ Make sure that cable manufacturing and connection are done by a qualified personal. When proceeding, be sure to connect the earth wire of the AC power cable colored green/yellow on the Controller to the earth terminal of the factory power supply. The equipment must be grounded properly at all times to avoid the risk of electric shock. Always use a power plug and receptacle for power connecting cable. Never connect the Controller directly to the factory power supply. (Field wiring)
---	--

The AC plug is not attached to the AC power cable delivered at shipment.


Refer to the wire connection specification and attach a proper plug to the cable that is suitable for the factory power supply. (A plug is prepared as option.)

Cable Wire Connection Specification

Purpose	Color
AC power wire (2 cables)	Black
Ground wire	Green / Yellow

Cable length: 3 mm (Standard)

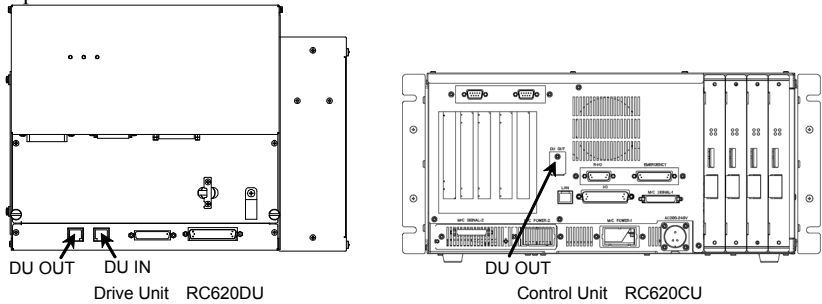
For RC620-UL, RC620DU-UL

 WARNING	<ul style="list-style-type: none"> ■ Branch Circuit protection (Rated current: 15 A or less) shall be installed in the external AC power supplying side in accordance with the National Electrical Code. A disconnecting means shall be installed in accordance with the National Electrical Code and provide the ability for lockout and tagout.
---	--

2.8 Drive Unit Connection

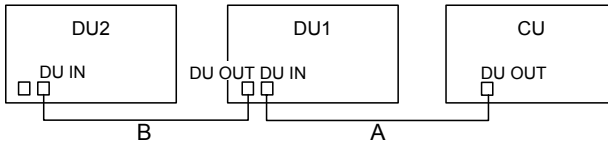
Drive Unit is connected to the Control Unit using the attached connection cable.

Up to two Drive Units can be connected to the Control Unit.



A: Control Unit and 1st Drive Unit (CU-DU1)

B: 1st Drive Unit and 2nd Drive Unit (DU1-DU2)



NOTE



- When you use one Drive Unit:

Connect nothing to DU OUT of the 1st Drive Unit (DU1). Otherwise, it results in the robot controller malfunction.

- When you use two Drive Units:

Connect nothing to DU OUT of the 2nd Drive Unit (DU2). Otherwise, it results in the robot controller malfunction.

- Do not use any LAN cables on the market. Otherwise, it results in the robot controller malfunction.

How to turn on the power switch:

Check the connection first. Then, make sure to turn on the power switch of Drive Unit before turning on the power switch of Control Unit.

2.9 Drive Unit Configuration

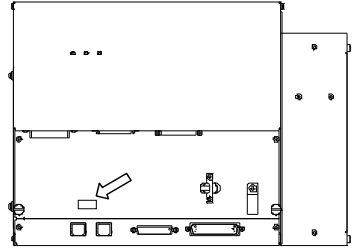
To confirm 1st or 2nd Drive Unit, use the following methods.

With DU number label:

Check the label attached on Drive Unit.

DU1 : 1st Drive Unit

DU2 : 2nd Drive Unit

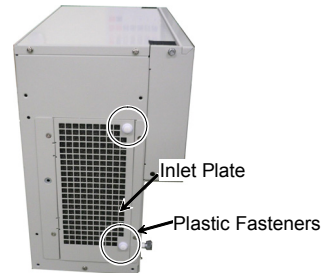


With SMB:

The DIP switch is equipped in SMB to configure 1st and 2nd Drive Unit.

Go on to the steps below and configure the Drive Unit.

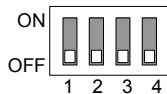
- (1) Turn OFF the Drive unit.
- (2) Pull out the two plastic fasteners indicated in the photo.



- (3) Change the DIP switch in SMB.

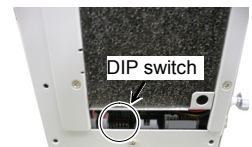
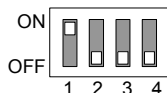
1st Drive Unit

ALL OFF



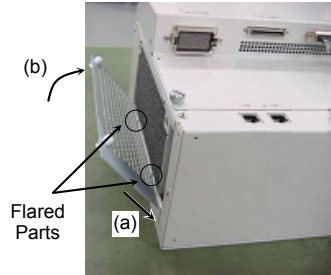
2nd Drive Unit

ON : 1
OFF : 2, 3, 4



2. Installation

- (4) Insert the two flared parts of the inlet plate into the opening of the Drive unit in the direction shown by arrow (a).



- (5) Push the two plastic fasteners in the direction shown by arrow (b) until they make a clicking sound to secure the inlet plate. Make sure that the plate is mounted properly.
- (6) Plug in the power connector. Turn ON the Drive unit.

2.10 Connecting Manipulator and Controller

Connecting Precautions

Before Connection

- : Before connecting the connector, make sure that the pins are not bent. Connecting with the pins bent may damage the connector and result in malfunction of the robot system.

Connecting procedure

- : Before performing any connecting procedure, turn OFF the Controller and related equipment, and then pull out the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and/or malfunction of the robot system.

Cable

- : Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. (Do not put heavy objects on the cables. Do not bend or pull the cables forcibly.) The unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure. Damaged cables, disconnection, or contact failure is extremely hazardous and may result in electric shock and/or improper function of the robot system.

Connection

- : When connecting the Manipulator and the Controller, make sure that the serial numbers on each equipment match. Improper connection between the Manipulator and Controller may not only cause improper function of the robot system but also safety problems.

The serial number of supported Manipulator is labeled on the controller.

If the G series Manipulator is connected to the Controller for the 6-axis robot, it may result in malfunction of the Manipulator.

Multi-Robot specification

- : If you purchased the controller of the multi-robot specification, the connection method is different for the each type.

Be careful! Note that improper connection can break the manipulator.

Wiring

- : Only authorized or certified personnel should be allowed to perform wiring. Wiring by unauthorized or uncertified personnel may result in bodily injury and/or malfunction of the robot system.

For Clean-model

- : When the Manipulator is a Clean-model, use it with an exhaust system. For details, refer to the Manipulator manual.

For Protected-model

- : Connect the power cable connection and the signal cable connector to the Manipulator immediately after the Manipulator installation. The Manipulator without connecting them may result in electric shock and/or malfunction of the robot system as it cannot ensure IP65.



NOTE Connect the Manipulator to the Controller using the Power cable and the Signal cable.

2.11 Power-on

Power-on Precautions

Manipulator check before installation

- : Before installing and operating the Manipulator, make sure that all parts of the Manipulator are in place and have no external defects. Missing or defective parts may cause improper operation of the Manipulator. Improper operation of the Manipulator is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

Shipping bolts and jigs check before turning ON

- : Before first turning ON the power, be sure to remove the shipping bolts and jigs from the Manipulator. Turning ON the power while the shipping bolts and jigs are attached may result in equipment damage to the Manipulator.

Multi-Robot specification

- : If you purchased the controller of the multi-robot specification, the connection method is different for the each type.
Be careful! Note that improper connection can break the manipulator.

Power activation

- : Anchor the Manipulator before turning ON the power to or operating the Manipulator. Turning ON the power to or operating the Manipulator that is not anchored is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system as the Manipulator may fall down

Power ON Procedure

- (1) Check the M/C power cable connection.
- (2) Check the M/C signal cable connection.
- (3) Check the EMERGENCY connector connection.
- (4) Connect the TP/OP bypass plug to the TP port.
- (5) Connect the AC power cable to the power supply socket.
- (6) When you use Drive Unit:
Check the Control Unit and Drive Unit connection.
Turn ON the Drive Unit RC620DU POWER switch. *
- (7) Turn ON the Control Unit RC620CU POWER switch. *

* For RC620-UL and RC620DU-UL, the POWER switch is not available.

Instead, turn ON the external disconnecting means.

- (8) The 1st line lights up and the 2nd line is turned off approximately 10 seconds after Controller starts up normally.

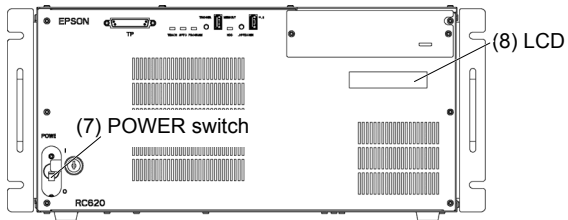
Then for few seconds, it displays as below:

EPSON Robot Controller

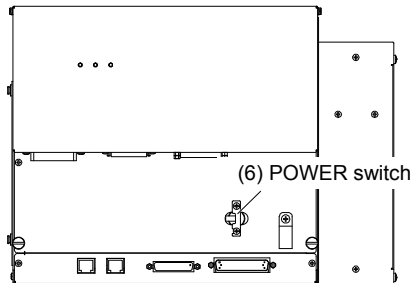
When an error appears, check the connection in step (1) to (5) to turn ON the power again.

If an error appears after checking the connection, contact the supplier.

Control Unit
RC620CU



Drive Unit
RC620DU



3. First Step

This section indicates the procedure to install the development PC EPSON RC+ 6.0, and execute simple program after connecting the development PC and Controller with a USB.

Make sure that the Robot system is installed safely by following the description in *1. Safety* and *2. Installation*. Then, operate the Robot system in the following procedures.

3.1 Starting EPSON RC+ 6.0

There are three ways to start EPSON RC+ 6.0. You can also configure the mode that EPSON RC+ 6.0 starts in.

Start Method 1

Double click on the EPSON RC+ 6.0 robot icon located on the Windows desktop.

Start Method 2

1. Click the Windows Start button.
2. Select the EPSON RC+ 6.0 Program Group.
3. Select EPSON RC+ 6.0.

Start Method 3

Configure EPSON RC+ 6.0 to start automatically after Windows starts. The details are described later in *Auto Start*.

NOTE



When using the VB Guide option, you do not need to start EPSON RC+ 6.0. The library provided with VB Guide will load EPSON RC+ 6.0 into your .NET application process automatically.

Startup Sequence

When EPSON RC+ 6.0 starts, it reads initial settings for the current user and local system from the Windows registry.

The remainder of the startup sequence depends on the following:

- a. EPSON RC+ 6.0 session number
- b. SPEL Controller Control Device setting
- c. SPEL Controller Independent Mode setting

For session 1 with independent mode off and any control device

If there are no project files specified on the startup command line, then the last project that was opened will be opened at startup time. The program files that were last opened will be opened again.

If the Start Mode is Auto, the Start Mode dialog is opened (see *4.2.4 Start Mode Dialog*).

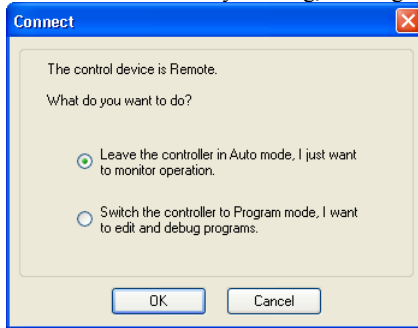
If the Start Mode is Program, the EPSON RC+ 6.0 GUI is opened.

For session 1 with independent mode on and control device is remote

If there are no project files specified on the startup command line, then the last project that was opened will be opened as read only at startup time. The program files that were last opened will be opened again.

If tasks are currently running, EPSON RC+ 6.0 will prompt to enter Monitor Mode.

If no tasks are currently running, a dialog below will be displayed.

**For sessions > 1**

EPSON RC+ should be started in Off-line mode. If there are no project files specified on the startup command line, then the last project that was opened will be opened as read only at startup time. A connection toolbar dropdown list is displayed allowing you to enter Monitor Mode to monitor session 1 operation.

For more information on Monitor Mode, refer to *4.2.8 Using Monitor Mode*.

Cooperative mode and Independent mode

The RC620 robot controller has two CPUs.

Real Part: Controls the SPEL⁺ program (Specialized for the real time control)

Windows Part : Controls the Windows applications (GUI)


The main function of the robot can be run by Real Part and some functions of the controller uses the Windows Part (See below).

Function	RC+ Enabled	PC Enabled
Detail of available function	Vision Guide (Frame Grabber) VB Guide Fieldbus master	PC file PC RS-232C Database access DLL calling

3. First Step

Real Part and Windows Part are started up separately at the each timing.

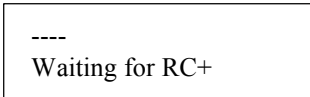
To operate the robot system without problem, you should synchronize these two parts. At the shipment of RC620 robot controller, the **Cooperative mode** that synchronizes these parts is applied.

NOTE  According to the design of robot system, it may not need to synchronize Real Part and Windows Part. In this case, change to **Independent mode**.

For the instructions of this settings, see the section below *How to set the Independent mode*.


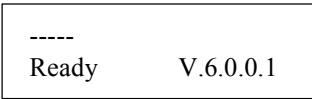
When the controller is in Cooperative mode, it has to wait until both of Real Part and Windows Part can start up without failure.

Meanwhile, the LCD on the controller face displays as below:



Then it also has to wait until Windows part is ready and RC+ can start up without failure.

This table shows the startup sequence when the controller is in Cooperative mode:

	LCD display	Console instruction	Background task
(1) Power ON		Not available	Not started yet
(2) Real Part starts up		Not available	Not started yet
(3) Windows part starts up		Not available	Not started yet
(4) RC+ starts up		Available	Already started

(Includes the startup of the Operator Window and VBGuide application)

This table shows the startup sequence when the controller is in Independent mode:


	LCD display	Console instruction	Background task
(1) Power ON	EPSON Robot Controller	Not available	Not started yet
(2) Real Part starts up	----- Ready V.6.0.0.1	Available *1	Already started
(3) Windows part starts up	----- Ready V.6.0.0.1	Available *1	Running
(4) RC+ starts up	----- Ready V.6.0.0.1	Available	Running

*1 When the console is “SELF” :

It waits the command execution from the Operator Window or VBGuide application.

When the console is “REMOTE” :

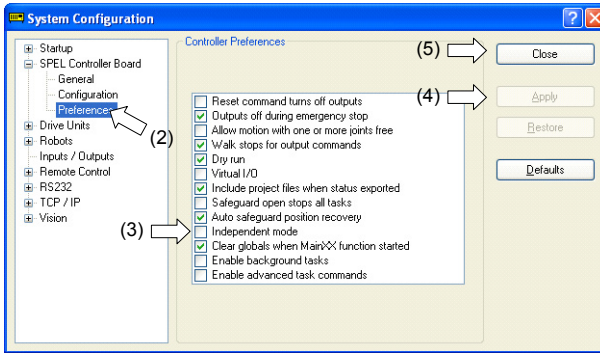
(2) As Real Part starts up, Remote function becomes enable and starts operating.

 **NOTE** When the controller is in Cooperative mode, the state does not back to wait for the RC+ connection even after RC+ shutdown. Also when the console is Remote, you need to be careful during the RC+ shutdown because the remote command is still executable.

How to set the Independent mode

- (1) Select the Setup | System Configuration from the main menu and displays the [System Configuration] dialog as shown below.
- (2) Select the SPEL Controller Board | Preferences.

3. First Step



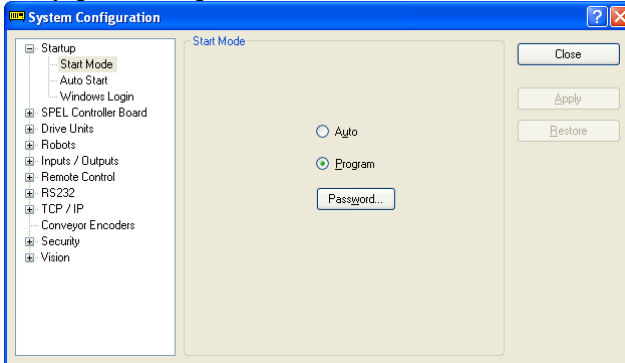
- (3) Set the [Independent mode] checkbox.
- (4) Click the **Apply** button.
- (5) Click the **Close** button.

Startup Configuration

To configure startup, select the [System Configuration] from the Setup Menu. The Startup section has pages for Start Mode, Auto Start, and Windows Login.

Start Mode

This page has settings for the EPSON RC+ 6.0 start mode.



There are two start modes:

Program This mode allows you to develop your projects. This is the default startup mode.

Auto This mode starts the system and displays the Operator Window. Use the **Password** button to change the start mode password.

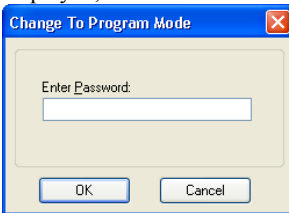
Start Mode Dialog

When the start mode is set for Auto, then a dialog is displayed at start up that allows you to change the startup mode using a password. After several seconds, if the **Change To Program Mode** button has not been clicked, the system will initialize and the Operator Window will be displayed.

You can disable this startup dialog using command line options described in the *EPSON RC+ 6.0 Users Guide: 4.2.10 Command Line Options*.



If you click the **Change To Program Mode** button, another dialog will be displayed, as shown below:



To change to Program mode, you must supply the password and click **OK**, or you can abort startup all together by clicking **Cancel**.

This allows authorized personnel to enter Program mode temporarily to make changes or adjustments.

NOTE



When you change to PROGRAM mode from this dialog, it is only temporary. The next time EPSON RC+ 6.0 runs, the original start mode setting will be used.

Start Mode: Program

Program mode is the default start mode. This is the EPSON RC+ 6.0 development environment, from which you can:

- Create / edit projects.
- Configure the controller and set preferences.
- Run and debug programs.

3. First Step

Start Mode: Auto

Auto mode displays the Operator Window. The Operator Window is configured according to the settings in Project | Properties.

The current controller Control Device sets the mode of Auto operation.

Control Device	Description
Self	The Operator Window can be used as a simple operator interface for production.
Remote I/O	The Operator window is displayed with no operator buttons to allow any diagnostic messages to be viewed.

Auto Start

You can configure EPSON RC+ 6.0 to automatically start when Windows starts.

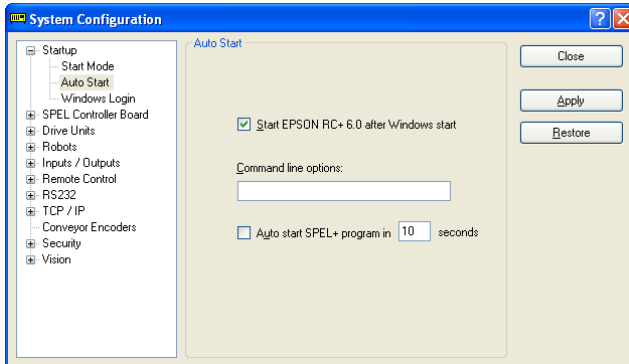
From the Setup | System Configuration | Auto Start page, set the **Start EPSON RC+ 6.0 after Windows start** check box.

In addition, if you set the checkbox above, you can specify EPSON RC+ 6.0 command line options (/auto, /nosplash, etc.) in the Command line options text box. Refer to the *EPSON RC+ 6.0 Users Guide: 4.2.10 Command Line Options*.

You can also specify if the main function should automatically be started after a delay. During the delay, the operator can click Stop to abort the automatic startup.



NOTE When using auto start, ensure that your application can automatically start safely and inform operators how to abort the startup.



3.2 Writing your first program

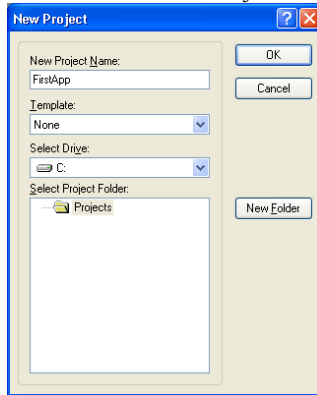
After installing the RC620 controller, robot, and EPSON RC+ 6.0 software on your PC, follow these instructions to create a simple application program so that you will become more familiar with the EPSON RC+ 6.0 development environment.

1. Start EPSON RC+ 6.0

Double-click the EPSON RC+ 6.0 icon on the desktop.

2. Create a new project

a. Select New from the Project menu.



b. Type in a name for a project, for example, FirstApp.

c. Click OK to create the new project.

When the new project is created, a program called Main.prg is created. You will see a window open with the title Main.prg with a cursor flashing in the upper left corner. Now you are ready to start entering your first program.

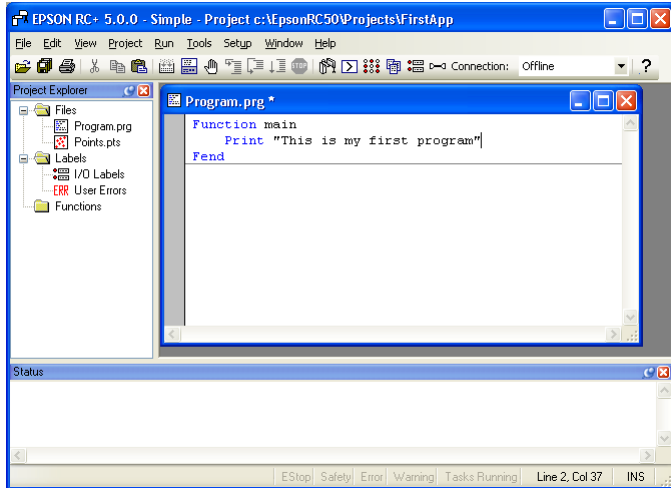
3. Edit the program

Type in the following program lines in the Main.prg edit window.

```
Function main
```

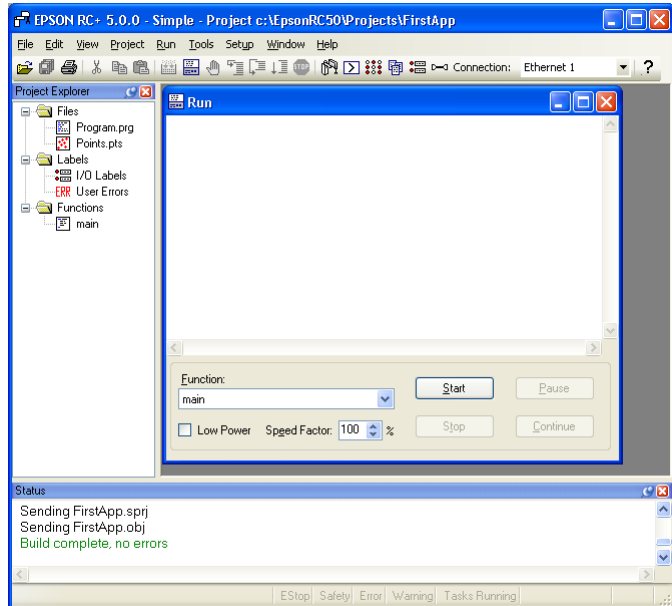
```
    Print "This is my first program."
```

```
End
```



4. Run the program

- (1) Press **F5** to run the program. (F5 is the hot key for the Run Window selection of the Run menu). You will see the Status window located at the bottom of the main window showing the build operation status.
- (2) During project build, your program is compiled and linked. Then communications is established with the controller and project files are sent to the controller. If there are no errors during build, the Run window will appear.



- (3) Click the **Start** button on the Run window to run the program.
- (4) You should see text similar to the following displayed in the Status window:


```
19:32:45 Task main started  
19:32:45 All tasks stopped
```

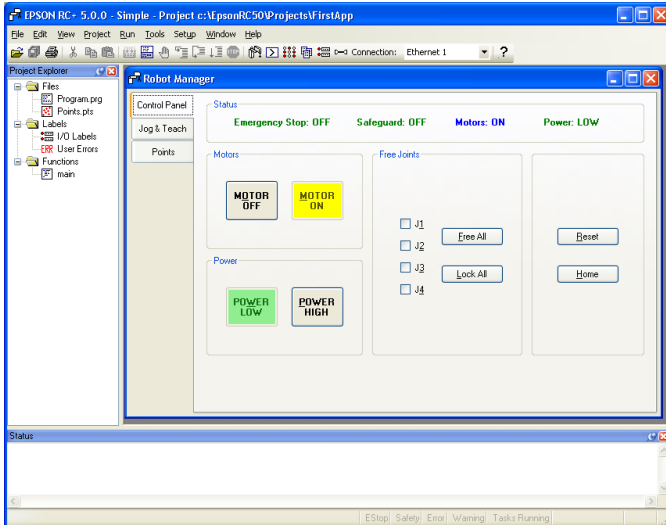
On the Run window, you will see the output of the print statement.

3. First Step

Now let's teach some robot points and modify the program to move the robot.

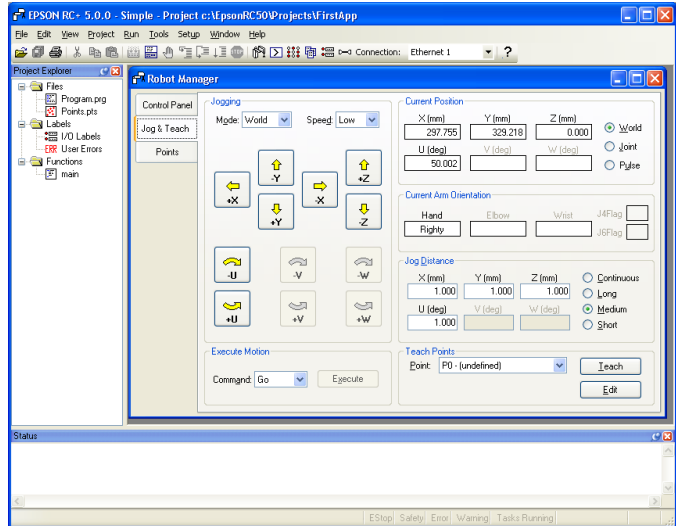
5. Teach robot points


- (1) Ensure that it is safe to operate the robot. Click the Robot Manager button  on the toolbar. You will see the Robot Manager window with the **Control Panel** page displayed.



- (2) Click on the Motor On button to turn on the robot motors. You will be prompted to confirm the operation. Answer Yes to continue.

(3) Click the Jog & Teach tab in the Robot Manager.



- (5) Click the Teach button in the lower right corner to teach point P0. You will be prompted for a point label and description.
- (6) Jog the robot by clicking the +Y jog button. Hold the button down to continue jogging. Let go when the robot is about half way out in the work envelope.
- (7) Jog the robot down by clicking the -Z button.
- (8) Now change the current point to P1 by selecting P1 in the Point dropdown list next to the Teach button.
- (9) Click the Teach button. You will see a confirmation message to teach the point. Answer Yes.
- (10) Click the +X button to jog the robot in the +X direction.
- (11) Change the current point to P2 by selecting P2 in the Point dropdown list.
- (12) Click the Teach button. You will see a confirmation message to teach the point. Answer Yes.
- (13) Click the Save Project  toolbar button to save the changes.

6. Modify the program to include robot motion commands

Insert three new Go statements into the Main.prg program as shown below:

```
Function main
    Print "This is my first program."
    Go P1
    Go P2
    Go P0
Fend
```

Run the program by pressing **F5** and then click on the **Start** button on the Run window. The robot should move to each of the points you taught.

7. Modify the program to change speed of robot motion commands

(1) Insert the Power, Speed, and Accel commands as shown in the program below:

```
Function main
    Print "This is my first program."
    Power High
    Speed 20
    Accel 20, 20
    Go P1
    Go P2
    Go P0
Fend
```

(2) Run the program by pressing **F5** and then click on the **Start** button on the Run window. The robot should go to each of the points you taught at 20% speed, acceleration, and deceleration. The Power High statement enables your program to run the robot at high (normal) power, which in turn allows the robot speed and acceleration to be increased.

8. Backup the project and system configuration

Even though this is only a sample project, we will backup the project and controller configuration. This is easy to do with EPSON RC+ 6.0. It is important that you keep regular backups of your applications on external media such as USB memory.

Follow these steps to backup the project and system configuration:

- a. From the Project menu, select Copy.
- b. Change the Destination Drive to a certain drive.
- c. Click OK. The project will be copied to the external media.

- d. From the Tools menu, select Controller.
- e. Click on the **Backup Controller** button.
- f. Select the certain drive.
- g. Click OK. The system configuration will be backed up on the external media.

Now that you have written your first program.

4. Second Step

Setup other necessary functions after operating the robot system as indicated in 3. *First Step*.

Manuals that indicate necessary setups and procedures are guided in this section.
(For descriptions of each manual, refer to 6. *Manuals*.)

4.1 Connection with External Equipment

Remote Control

EPSON RC+ 6.0 User's Guide

11. Remote Control

ROBOT CONTROLLER RC620 manual

Setup & Operation 10. I/O Remote Set Up

I/O

EPSON RC+ 6.0 User's Guide

10. I/O Setup

ROBOT CONTROLLER RC620

Setup & Operation 9. I/O Connector

Setup & Operation 11.2 Expansion I/O Board (Option)

Fieldbus I/O (Option)

ROBOT CONTROLLER RC620 Option Fieldbus I/O

Ethernet

ROBOT CONTROLLER RC620

Setup & Operation 6. LAN (Ethernet) Port

RS-232C (Option)

EPSON RC+ 6.0 User's Guide

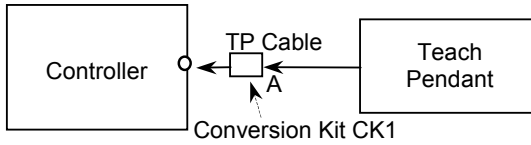
12. RS-232C Communication

ROBOT CONTROLLER RC620

Setup & Operation 11.4 RS-232C Board

4.2 Connection and Display Language of Option TP1

A: TP Cable A : Circular connector

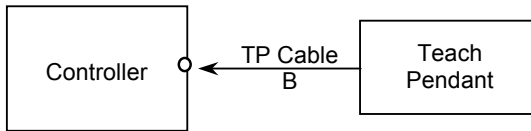


NOTE



Conversion Kit CK1 is necessary.

B: TP Cable B : D-sub connector



Connection

ROBOT CONTROLLER RC620

Setup & Operation 3. Installation 7. TP/OP Port

Changing Display Language

RC620 Operation 13.4.9 Language

5. General Maintenance

This chapter describes maintenance inspections and procedures. Performing maintenance inspections and procedures properly is essential for preventing trouble and ensuring safety.

Be sure to perform the maintenance inspections in accordance with the schedule.

5.1 Schedule for Maintenance Inspection

G / C3 / RS series

Inspection points are divided into five stages: daily, monthly, quarterly, biannual, and annual. The inspection points are added every stage.

If the Manipulator is operated for 250 hours or longer per month, the inspection points must be added every 250 hours, 750 hours, 1500 hours, and 3000 hours operation.

	Inspection Point				
	Daily	Monthly	Quarterly	Biannual	Annual
1 month(250 h)	Inspect every day	√			
2 months(500 h)		√			
3 months(750 h)		√	√		
4 months(1000 h)		√			
5 months(1250 h)		√			
6 months(1500 h)		√	√	√	
7 months(1750 h)		√			
8 months(2000 h)		√			
9 months(2250 h)		√	√		
10 months(2500 h)		√			
11 months(2750 h)		√			
12 months(3000 h)		√	√	√	√
13 months(3250 h)		√			
⋮	⋮	⋮	⋮	⋮	⋮

h = hour

S5 series

Inspection points are divided into five stages: daily, four months, two years, four years, and eight years. If the Manipulator is operated for predetermined hours of operation, perform maintenance inspections.

Inspection	Inspection Interval	Hours of operation
Daily	Inspect every day	
4-month	4 months	1000 hours
24-month	24 months	6000 hours
48-month	48 months	12000 hours
96-month	96 months	24000 hours

X5

Inspections	Recommended Intervals	Inspection items
Daily	Once a week	Loose bolts, connectors and cables
Periodical	Every half year	Inspect timing belt for damage and looseness.
Periodical replacement of expendable parts	Every two years	Replace cables.
		Replace timing belt.
	Every three years	Replace lithium battery.

5. General Maintenance

5.2 Inspection Point

Inspection While the Power is OFF (Manipulator is not operating)

Manipulator

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Check looseness or backlash of bolts/screws. Tighten them if necessary. (For the tightening torque, refer to <i>Tightening Hexagon Socket Head Cap Bolts.</i>)	End effector mounting bolts	√	√	√	√	√
	Manipulator mounting bolts	√	√	√	√	√
	Each arm locking bolts	√	√	√	√	√
	Bolts/screws around shaft					√
	Bolts/screws securing motors, reduction gear units, etc.					√
Check looseness of connectors. If the connectors are loosen, push it securely or tighten.	External connectors on Manipulator (on the connector plates etc.)	√	√	√	√	√
	Manipulator cable unit		√	√	√	√
Visually check for external defects. Clean up if necessary.	External appearance of Manipulator	√	√	√	√	√
	External cables		√	√	√	√
Check for bends or improper location. Repair or place it properly if necessary.	Safeguard etc.	√	√	√	√	√
Check tension of timing belts. Tighten it if necessary.	Inside of Arm #2: G1 G3 G6 G10 G20 LS RS Inside of Base and Arm #1, 2, 3, 4 : C3				√	√
Grease conditions	Refer to <i>Greasing.</i>					
Battery	-	Replace every year				

X5

Inspection point	Description
Bolts for securing the module	Check for a loose bolts by tightening them.
Bolts for securing the end effector	
Cables	Replace a cable or flexible tube if it has serious crack or breakage. Check for loose bolts by tightening them.

Controller

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Visually check for external defects. Clean up if necessary.	External appearance of Controller	√	√	√	√	√
Clean the fan filter	-		√	√	√	√
Battery	-	Replace every 5 years				

Inspection While the Power is ON (Manipulator is operating)

Manipulator (G / C3 / RS series)

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Check motion range	Each joint					√
Move the cables back and forth lightly to check whether the cables are disconnected.	External cables (including cable unit of the Manipulator)				√	√
Push each arm in MOTOR ON status to check whether backlash exists.	Each arm					√
Check whether unusual sound or vibration occurs.	Whole	√	√	√	√	√
Measure the accuracy repeatedly by a gauge.	Whole					√
Turn ON and OFF the Brake Release switch and check the sound of the electromagnetic brake. If there is no sound, replace the brake.	Brake	√	√	√	√	√

5. General Maintenance

Manipulator (S5 series)

Inspection Point	Inspection Space	Interval
Check for tram mark misalignment or damage at the home position. (Visual)	Tram mark	Daily
Clean the area of motion range for each joint if dust or spatter is present. Check for damage and outside cracks. (Visual)	Motion range and Manipulator	Daily
Tighten loose bolts. Replace if necessary. (Use Spanner, Wrench)	Base plate mounting bolts	4 month
Tighten loose screws. Replace if necessary (Use Spanner, Wrench)	Cover mounting screws	4 month
Check for loose connectors. (Manual)	Base connectors	4 month
Check for proper belt tension and wear. (Manual)	Joint #1 - Joint #6 timing belts	48 month
Check for conduction between the main connector of base and intermediate connector. Check for wear of protective spring. (Visual, Multimeter)	Cable unit	48 month
Replace the battery unit when an error warning that low battery status is occurring at startup of the software or every three years.	Battery unit	—

Controller

Inspection Point	Inspection Place	Daily	Monthly	Quarterly	Biannual	Annual
Check whether unusual sound or vibration is occurring.	Entire Controller	√	√	√	√	√
Make a backup of data.	Project and system data	Whenever data is changed.				

Tightening Hexagon Socket Head Cap Bolts

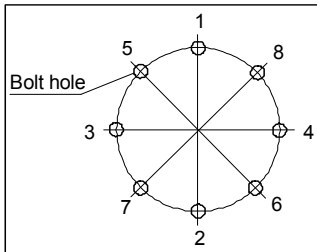
Hexagon socket head cap bolts are used in places where mechanical strength is required. (A hexagon socket head cap bolt will be called a “bolt” in this manual.) These bolts are fastened with the tightening torques shown in the following table. When it is necessary to refasten these bolts in some procedures in this manual (except special cases as noted), use a torque wrench so that the bolts are fastened with the appropriate tightening torques as shown below.

Bolt	Tightening Torque
M3	245 N·cm (25 kgf·cm)
M4	490 N·cm (50 kgf·cm)
M5	980 N·cm (100 kgf·cm)
M6	1,760 N·cm (180 kgf·cm)
M8	3,720 N·cm (380 kgf·cm)
M10	7,350 N·cm (750 kgf·cm)
M12	12,740 N·cm (1,300 kgf·cm)

Refer below for the set screw.

Set Screw	Tightening Torque
M3	147 N·cm (15 kgf·cm)
M4	245 N·cm (25 kgf·cm)
M5	392 N·cm (40 kgf·cm)

The bolts aligned on a circumference should be fastened in a crisscross pattern as shown in the figure below.




Do not fasten all bolts securely at one time. Divide the number of times that the bolts are fastened into two or three and fasten the bolts securely with a hexagonal wrench. Then, use a torque wrench so that the bolts are fastened with tightening torques shown in the table above.

Greasing

The ball screw spline and reduction gear units need greasing regularly. Only use the grease specified.

Parts and Interval when the greasing is necessary have been described. Refer to the manipulator manual for details of the greasing procedure.

 CAUTION	<ul style="list-style-type: none"> ■ Keep enough grease in the Manipulator. Operating the Manipulator with insufficient grease will damage sliding parts and/or result in insufficient function of the Manipulator. Once the parts are damaged, a lot of time and money will be required for the repairs. ■ If grease gets into your eyes, mouth, or on your skin, follow the instructions below. <p>If grease gets into your eyes :</p> <p style="padding-left: 40px;">Flush them thoroughly with clean water, and then see a doctor immediately.</p> <p>If grease gets into your mouth :</p> <p style="padding-left: 40px;">If swallowed, do not induce vomiting. See a doctor immediately.</p> <p style="padding-left: 40px;">If grease just gets into your mouth, wash out your mouth with water thoroughly.</p> <p>If grease gets on your skin</p> <p style="padding-left: 40px;">Wash the area thoroughly with soap and water.</p>
---	--

G / LS / RS series

	Greasing part	Greasing Interval	Remarks
Joint #1, #2	Reduction gear units	At the replacement of motor*	
Joint #3	Ball screw spline shaft	Every 6 months	
Joint #4	Backlash less gear	At greasing of Joint #3	Only for G10

* Under normal conditions, the reduction gear units (G, LS, RS series) shall be greased only when the motor is replaced. However, in case of severe working conditions (such as high duty, high speeds, large payloads, etc.), the reduction gear units must be greased every 10,000 hours.

C3

	Greasing part	Greasing Interval
Joint #1, #2, #4	Reduction gear units	When the reduction gear units are replaced*
Joint #6	bevel gear	Annually (every 8000 hours)

* Under normal conditions, the reduction gear units (C3 series) shall be greased only when the reduction gear units is replaced. However, in case of severe working conditions (such as high duty, high speeds, large payloads, etc.), the reduction gear units must be greased every 10,000 hours.

S5 series

	Greasing part	Greasing Interval
Joint #1,#2, #3, #4, #5, #6	Reduction gear units	Every 6000 hours

6. Manuals

Descriptions of manual contents are indicated in this section.
Manuals are supplied by Acrobat PDF to use the Robot system.

Select EPSON RC+ 6.0 | Help | PDF Manual to view the PDF manuals on a PC.
(From the Windows desktop, click <Start> | Program | EPSON RC+ 6.0.)

Software

EPSON RC+ 6.0 User's Guide

This manual indicates descriptions of the Robot system and program development software.

- Safety
- Robot System Operation and Configuration
- Operation of Program Development Software EPSON RC+ GUI
- SPEL⁺ Language and Application
- Configuration of Robot, I/O, Communication etc.

EPSON RC+ 6.0 SPEL⁺ Language Reference

This manual indicates descriptions of the SPEL⁺ language for robot program.

- Details of the commands
- Error Messages
- Precaution of EPSON RC+ 4.0 / EPSON RC+ 5.0 Compatibility etc.

EPSON RC+ 6.0 Option VB Guide 6.0

This manual indicates descriptions of the option VB Guide 6.0.

EPSON RC+ 6.0 Option Vision Guide 6.0

This manual indicates descriptions of the option Vision Guide 6.0.

EPSON RC+ 6.0 Option Vision Guide 6.0 Properties and Results Reference

This manual indicates details of the commands of the option Vision Guide 6.0.

EPSON RC+ 6.0 Option GUI Builder 6.0

This manual indicates descriptions of the option GUI Builder 6.0.

Controller

ROBOT CONTROLLER RC620

This manual indicates descriptions of the Robot Controller RC620, Robot system, and option TP1.

- Safety
- Specification, Installation, Operation, and Setup
- Backup and Restore
- Maintenance
- Verifying Robot System Operation etc.

Drive Unit

ROBOT CONTROLLER / Drive Unit RC620DU

This manual indicates descriptions of the Drive Unit RC620DU.

- Safety
- Specification, Installation, Operation, and Setup
- Maintenance etc.

Option

RC620 Option Fieldbus I/O

This manual indicates descriptions of the option Fieldbus I/O.

RC620 Option PG Motion System

This manual indicates descriptions of the option PG motion system.

Manipulator

The manuals indicate descriptions of the Manipulator(s) you purchased. There are manuals for each Manipulator.

EPSON ProSix : C3, S5

EPSON SCARA ROBOT : G1, G3, G6, G10/G20, RS3, RS4

EZ module : X5 series

- Safety
- Specification, Installation, Setting
- Maintenance
- Calibration etc.

7. Directives and Norms

These products conform to the following directives and norms.

For more details of Controllers and Manipulators, please refer to each manual.

Product Name	Model
Controller	RC620
Manipulator	G series RS series C3 series X5 series

Name	Definition
Directive 2006/42/EC	Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC
Directive 2004/108/EC	Directive 2004/108/EC relating to electromagnetic compatibility and repealing Directive 89/336/EEC
ENISO12100-1(2003)	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
ENISO12100-2(2003)	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles
ENISO10218-1(2008)	Robots for industrial environments - Safety requirements-Part 1: Robot
EN60204-1(2006)	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ENISO13849-1(2008) *	Safety of machinery - Safety - related parts of control systems - Part 1: General principles for design
ENISO13850(2008)	Safety of machinery - Emergency stop - principles for design
EN55011(2009)	Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement
EN61000-6-2(2005)	Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments

*Emergency stop circuit category3, PL d
Safety Door circuit category3, PL d

