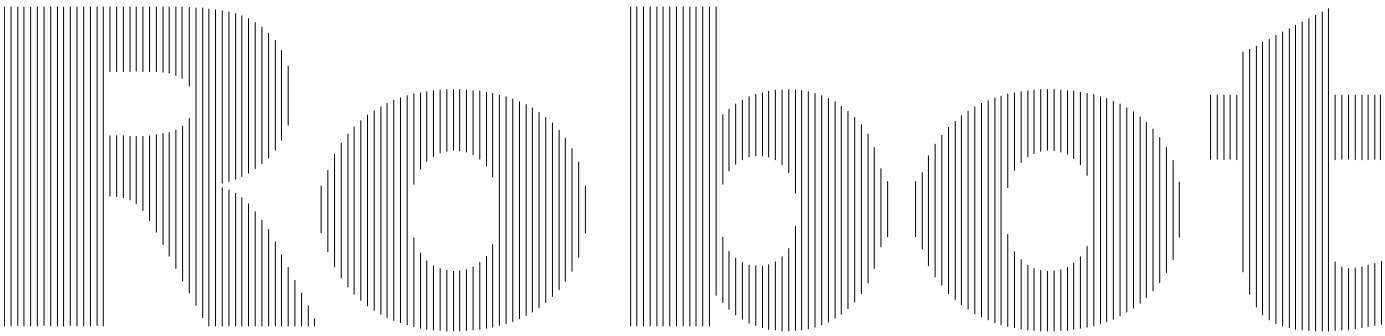
Simple and friendly

Kawasaki

Kawasaki Robot Controller
F Series Controller
(Explosion-proof Specification)

Installation and Connection Manual



Kawasaki Heavy Industries, Ltd.

90202-1293DEA

Preface

This manual describes the installation and connection of the F series controller (explosion-proof specification).

This manual covers the installation and wiring of the controllers and connection with external power. Please refer to "Operation Manual" and "External I/O Manual" for the operation of the controller.

Please be sure to fully understand the content of this manual and ensure safety when performing an operation.

This manual describes only the installation and connection of the controller. For the robot arms, please refer to the separate manuals "Installation and Connection Manual" for arms.

This manual also describes devices equipped as an option; however, all the controllers might not include the devices explained here.

[NOTE]

This manual is applicable to the following F series controller models.
F25 (Explosion-proof specification for Japan/China/Korea)
F35 (Explosion-proof specification for North America)
F45 (Explosion-proof specification for Europe)

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

Symbols

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

[NOTE]

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

⚠ WARNING

1. **The accuracy and effectiveness of the diagrams, procedures, and detail explanations given in this manual cannot be confirmed with absolute certainty. Accordingly, it is necessary to give one's fullest attention when using this manual to perform any work. Should any unexplained questions or problems arise, please contact Kawasaki.**
2. **The safety-related contents described in this manual apply to specific items related to this manual, and are not applicable to other general items or other matters. In order to perform every work in safety, read and fully understand "Safety Manual," all pertinent laws, regulations and related materials as well as all the safety explanations described in each chapter, and prepare safety measures suitable for actual work.**

Explosion-proof Specification

The explosion-proof specification robot is compound explosion-proof with an internal pressure explosion-proof and intrinsically safe explosion-proof structure.
The internal pressure explosion-proof structure is a built-in pressurizing mechanism that sends air to the sealed container (internal pressure container) that contains the electrical equipment and keeps the inside of the container at a higher pressure than the outside, in order to prevent explosive gases in the surrounding from entering. This structure is applied to the motors, encoders (at normal operation) and painting equipment inside the robot arm.

The internal pressure explosion-proof specification painting robot protects the motors and machine harnesses in the arm from explosive gases using pressurized air. However, this protection does not extend to the separate harness connecting the arm with the controller. Make sure the separate harness is not directly exposed to a large quantity of solvent, since the solvent may damage cable coatings causing ground faults or short circuits that may lead to fire. Also, inspect the surface of cable and protecting tube regularly for damage, and replace the separate harness every three to five years.

Purge all explosive gases first before supplying power to equipment in the container. Install a pressure detection device in the container that activates automatically if air pressure drops due to error, etc. so that power supply can be cut off immediately (Interlock). Also, power supply must be disabled until the purging is confirmed to be complete properly, even if the error is cancelled.

An intrinsically safe explosion-proof structure is designed to prevent explosion when the product is operated in any way in an environment containing explosive gases, by limiting the energy supplied to the electrical equipment. This structure is applied to the explosion-proof teach pendant, pressure detector (for detecting pressure of the internal pressure container) and encoders (in backup mode only) in this robot.

The explosion-proof specification robot is certified as explosion-proof by registered type examination agencies in each country in order to prove that it is safe. Therefore, the explosion-proof structure and electric machinery largely relate to the explosion-proof system performance, and only approved parts should be used for maintenance. Contact Kawasaki in case these parts fail, etc.

⚠ DANGER

Robots with explosion-proof specification have an explosion-proof construction that enables operation in an environment containing explosive gases such as organic solvents used for painting (compound explosion-proof of internal pressure explosion-proof and intrinsically safe explosion-proof). If handled incorrectly, there is a risk of major accidents such as explosions. Handle with care.

Table of Contents

1 Safety

This chapter only describes safety precautions during installation and connection of the controller. For all other safety matters, refer to the "Safety Manual," a separate-volume.

Note For details on CoreCubic-S, refer to the separate "CoreCubic-S Instruction Manual."

1.1 Precautions During Transportation and Storage of Controller

When installing the Kawasaki Robot controller, strictly observe the following cautions while carrying out the transportation, installation and storage work.

[NOTE]

The installation shall be made by qualified installation personnel and should conform to all national and local codes.

⚠ WARNING

1. **When transporting a controller with a crane, never support the controller manually.**
2. **During the transportation by a crane, stay out from under and around the lifted controller.**

⚠ CAUTION

1. **Since the controller is composed of precision parts, be careful not to apply excessive shocks or vibrations to the controller during transportation.**
2. **To carry out smooth and safe installation, remove all obstacles before installing a controller. Clear a passage for the transportation of controller before using a crane or forklift.**
3. **When transporting, installation or storing a controller:**
   - **(1) Ambient storage temperature: -10 to 60°C (Ambient temperature during operation: 0 to 45°C, see "3.3 Controller Specification.")**
   - **(2) Relative humidity: 35 to 85%RH (there must be no condensation)**
   - **(3) Do not subject the equipment to excess impact, shock, or vibration.**

1.2 Installation Environments of Robot Controller

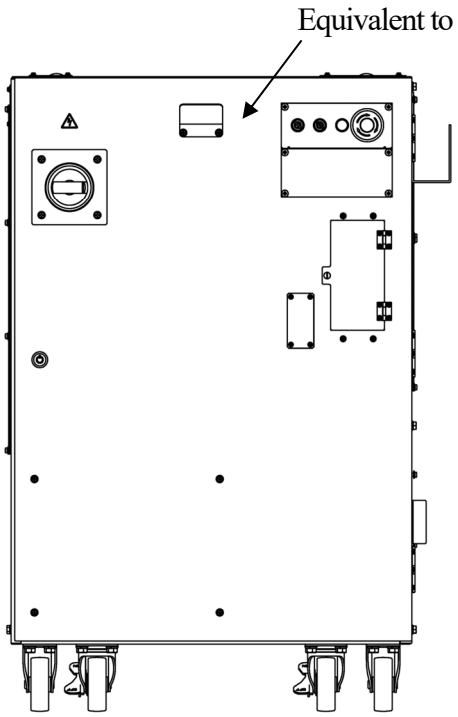
Install the controller in a site that satisfies all the following environmental conditions:

1. Ambient temperature: The ambient temperature must be within a range of 0 to 45°C.
2. Relative humidity: Relative humidity must be 35% to 85% RH.
   (In addition, there must be no condensation.)
3. Elevation: 0 to 1,000 m above sea level
4. Environmental conditions relating to foreign objects
   - The pollution degree must be 3 or lower (in addition, there must be no condensation)[*1]
     ***1** The pollution degree is specified in IEC60664-1.
     Regarding the protection rating of controller under IEC60529, see the figures below.

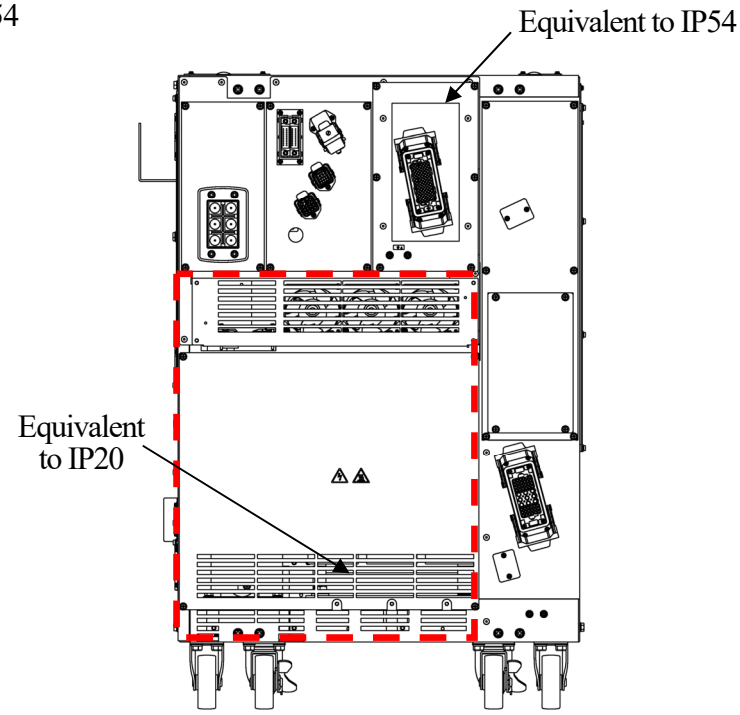
⚠ CAUTION

1. **It may not be possible to guarantee an adequate level of resistance against oil. Oil must not come into contact with the controller, and it must not be used in an environment where oil mist is suspended in the air.**
2. **If using in environments in which there is water or oil, take appropriate measures to ensure no water or oil is splashed onto the controller.**
3. **Do not install the controller in environments in which contaminants such as metal powders are generated, such as in the following types of work.**
   - **Polishing/grinding of metal objects**
   - **Handling of polished/ground metal objects**
   - **Deburring metal objects**
   - **Handling deburred metal objects**
   - **Shot blasting of metal objects**
   - **Cutting aluminum packaging (produces cutting scraps)**
   - **Other types of work processes generating metal powder**
4. **To ensure sealability, be sure to follow the instructions below when using the controller. If sealability is not ensured, foreign objects may enter the controller from outside, causing internal electrical components to fail.**
   - **Close the controller doors and lock the coin lock.**
   - **Close the accessory panel.**
   - **Attach caps to the bolt holes of the top plate.**
   - **Do not remove the blank plates attached to the controller.**
     In addition, attach screws to all screw holes of the blank plates.
5. **Use a cable entry to route wiring from the circuit board located inside the controller, etc. See "8.1 Cautions to Observe When Connecting" for instructions on using cable entries.**

Protection rating of controller



Front



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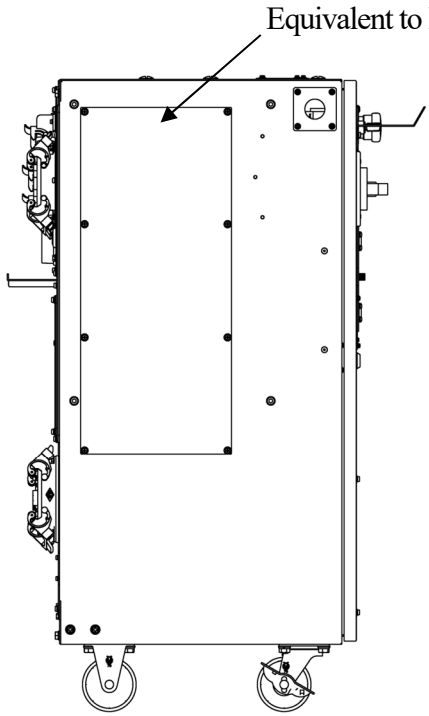
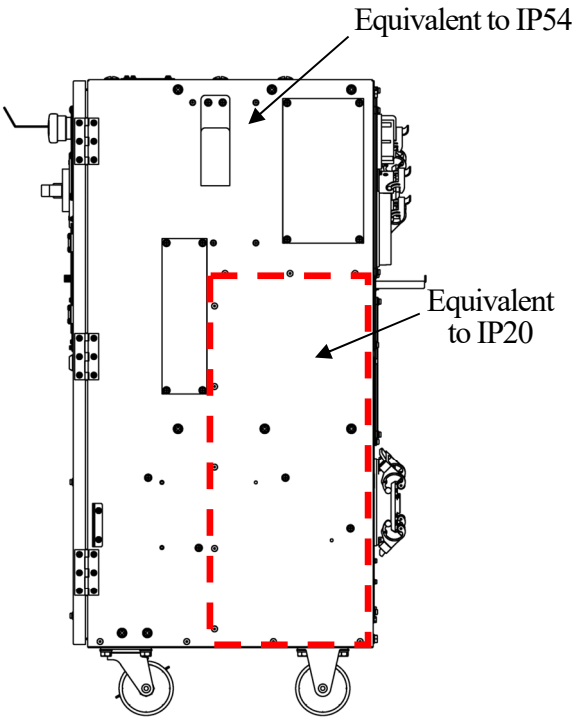


Left

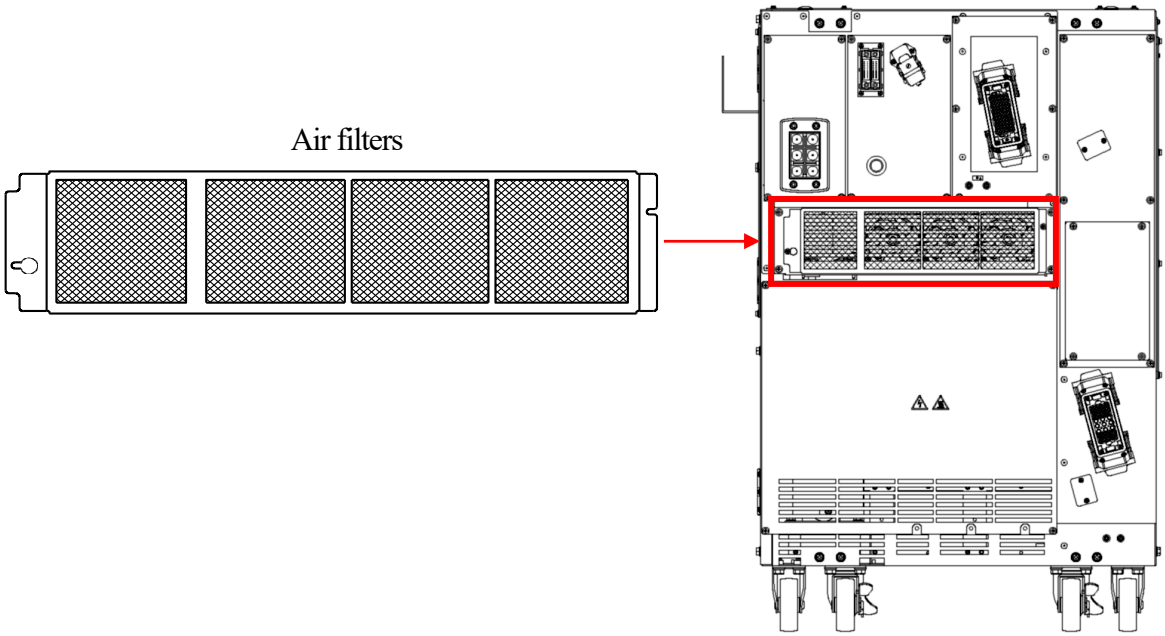


Right

Note Optional air filters are provided to reduce the accumulation of dust entering the air fans. Use them as necessary.

CAUTION

Inspect and clean the air filters periodically.
Continuously using the air filters with dust, etc., excessively accumulated may result in errors such as abnormal temperature due to improper cooling.



5. Installation location
   - The location must have good electrical noise conditions.
     (Controller external power supply noise: 1 kV/1 μs or less)

> **⚠ CAUTION**
>
> **For equipment which produces high levels of electrical noise such as electromagnetic contactors, electromagnetic brakes, electromagnetic solenoids, and induction motors installed near the installation site, use an appropriate surge protector to suppress any generated noise.**

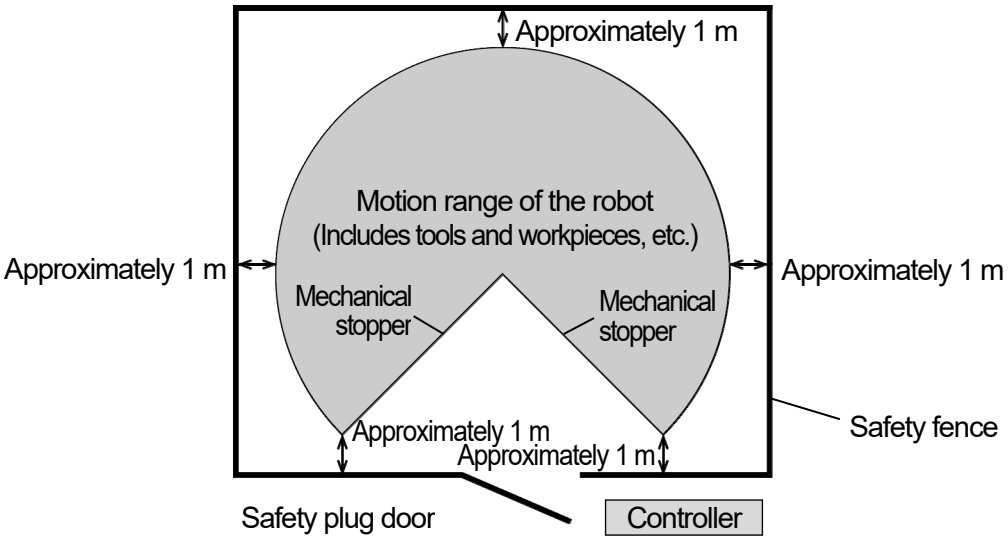
   - The location must have no flammable or corrosive fluids or gases, etc.
   - The location must not be subject to excess shock, impact, or vibration.
   - The location must satisfy the required power supply specifications for robots.
     (Variability: ±10% or less)
   - The location must be able to support dedicated class A and class D grounding (F25) and protective grounding (F35, F45) for robots.

6. Safety fence installation conditions
   - Install the safety fence with an allowance of at least 1 m beyond the motion range of the robot (including tools and workpieces, etc.).

⚠ CAUTION

Do not install the controller within the motion range of the robot, or within the cell or the safety fence.

   - When installing the safety fence, bear the following points in mind.
     - Ensure sufficient space to allow the controller to be easily accessed for maintenance.
     - Install a door with a safety plug on the safety fence.
     - For more detailed information regarding safety fences, refer to the relevant requirements for your region.
       (ISO 13854 to 13855, 13857, 14119 to 14120, etc.)



1.3 Precautions When Connecting the Harness

Strictly observe the following precautions when connecting the robot with the robot controller.

⚠ WARNING

To prevent electric shocks, do not connect the external power supply until the connection between the robot and the controller is complete.

⚠ CAUTION

1. **When connecting a harness, make sure the connector is connected at the correct point. Forcing a connection may lead to connector damage or electrical system failure.**
2. **Be sure not to twist hard, pull, bend, ride on, place objects on, or step on by people or vehicles (forklifts, etc.) the motor and signal harnesses. Stepping on or running over the harness could damage it or cause electrical system failure.**
3. **Keep the harness separate from the robot wiring and from high voltage power lines.**
   - **(1) Do not wire the harness close to or in parallel with other power lines.**
   - **(2) Do not bundle the wires.**
   - **(3) Keep the wiring at least 1 m clear of high voltage or current power lines. Failure to do so may lead to malfunctions caused by noise from the power cables.**
4. **Even if the harness is long, be sure to avoid winding, bending, or bundling the cables/wires. Bundling prevents generated heat from escaping, causing the harness to overheat. This could damage the cables and cause a fire.**

1.4 Precautions When Connecting the External Power

Strictly observe the following precautions when connecting the external power.

⚠ DANGER

1. **Before connecting an external power supply, make sure that the external power supply for the controller is turned OFF. Connecting while powered on could cause an electric shock.**
2. **Until the external power supply connection is all completed, put a tag on the breaker indicating that work is in progress or assign another technician for supervision to ensure that the breaker will not be turned ON.**

⚠ WARNING

1. **Check that the specification of the power supply connected to the controller is the same as the stated specification on the rating plate. Connecting power supplies with different specifications may cause the internal electrical components to fail.**
2. **Always provide grounding as a countermeasure against electric shock and noise.**
   (F25) ···Two types of grounding are required: Class A (10 Ω or less) and Class D (100 Ω or less). Class A grounding is particularly important to maintain intrinsically safe explosion-proof performance. Be sure to connect each ground line to each specified place. Use ground wire of recommended cable size or above, as shown in "3.3 Controller Specification."
   (F35/F45) ···Protective earthing (PE) is required. This is also important to maintain intrinsically safe explosion-proof performance. Be sure to connect the ground line to the specified place. Use ground wire of recommended cable size or above, as shown in "3.3 Controller Specification."
3. **Grounding should never share ground wires or negative electrodes (base material) with welding machines, etc.**
4. **Be sure to observe the following when arc welding.**
   (1) Connect the negative electrode (base material) on the power supply used for welding directly to the base material or to the jig.
   (2) Never have the main robot unit and the controller share grounding, and ensure they are grounded in isolation of each other.
5. **Before turning on the external power supply, ensure that the power supply for the controller is connected securely, and that all covers are mounted correctly. Failure to do so could lead to electric shock.**

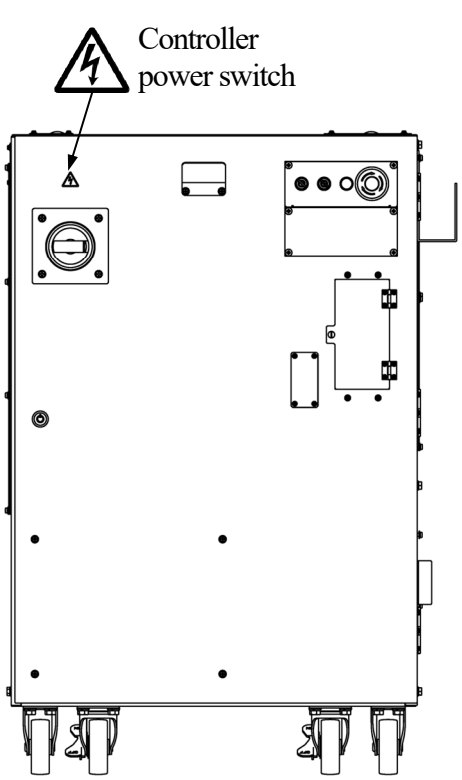
⚠ CAUTION

1. **Be sure to use an external power supply which meets the specifications of the controller for instantaneous power interruptions, voltage fluctuations and capacity, etc. In the event of instantaneous power interruption from the external power supply, or in the event of voltage fluctuations exceeding the specification range, the power supply monitoring circuit will operate, cutting off power and generating an error.**
2. **If there is a risk of noise from the external power supply becoming mixed in, reduce the noise level by adding a noise filter or similar.**
3. **Check first that there are no devices with poor noise tolerance*1 in the vicinity. Devices with poor noise tolerance can malfunction due to the effects of PWM noise generated by the robot motor.**
4. **The robot's external power supply switch (breaker) should not be used in combination with welding machines or other power equipment.**
5. **To prevent electric leakages, a time-delay electric leakage breaker (with a current sensitivity of 100 mA or higher) should be used as the external power supply switch.**
6. **If there is a risk of voltage surges from the external power supply such as those caused by lightning surges, reduce the surge voltage level by adding a surge absorber or equivalent.**
7. **The surge protection device (SPD) used for the equipment must be compliant with NFPA79.**

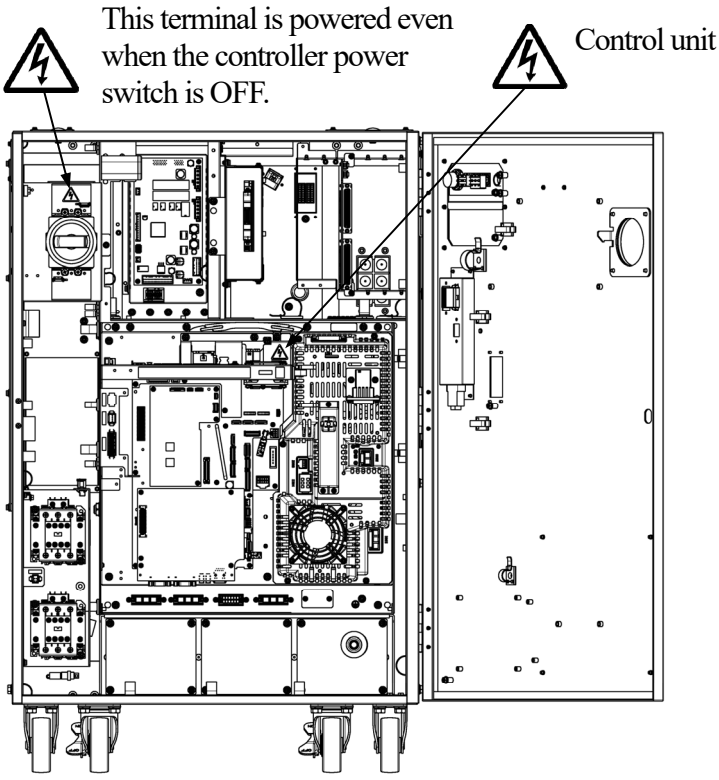
*1 Proximity switch directly connected with power line etc. may suffer from the influence.

1.5 Warning Labels

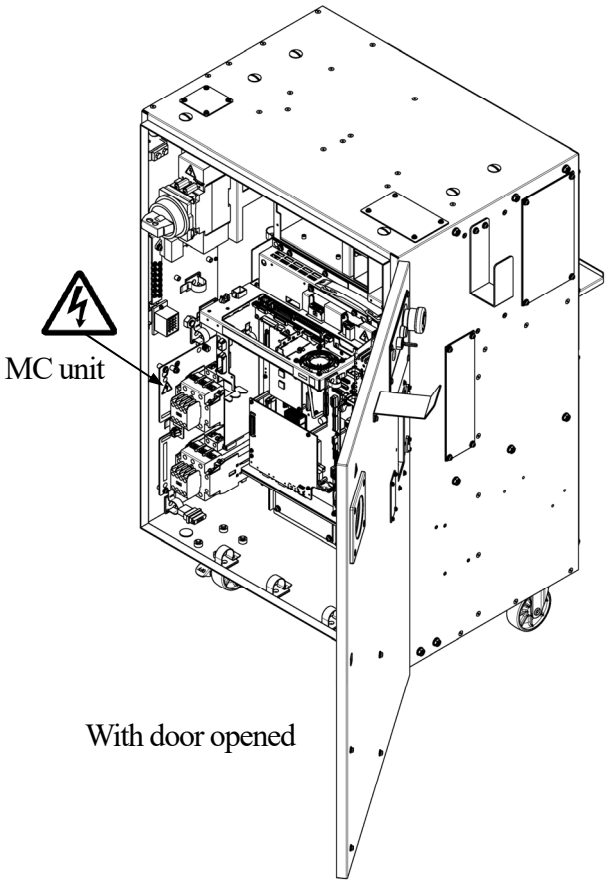
Warning labels for electric shock and high temperature are located on the controllers shown below.



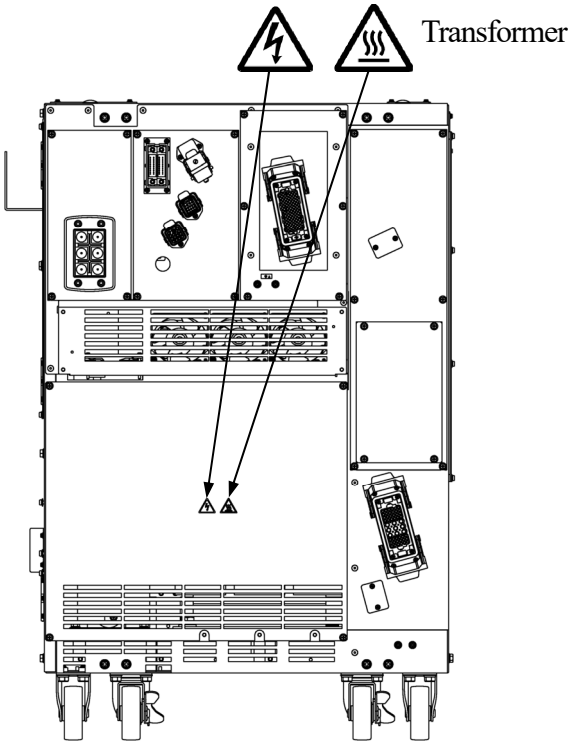
Front



Front (with door opened)



With door opened



Rear

1.6 Battery and Fuse Use and Disposal

Batteries are used for data backup in the controller. Figures on the next page show the location of the batteries on the 2AA board and that for the encoder backup.

If not used and disposed of properly, these batteries may malfunction, ignite, overheat, explode, corrode, leak, etc. Strictly observe the following precautions.

⚠ WARNING

1. **Only use batteries specified by Kawasaki.**
2. **Never re-charge, dismantle, convert and/or overheat batteries.**
3. **Never dispose of batteries into water or fire.**
4. **Batteries with damaged cases may short internally and must not be used.**
5. **Never short the positive and negative poles of a battery with material such as wire.**

⚠ CAUTION

Never dispose of depleted batteries with garbage that is disposed of in an incinerator, land-fill, dumping-ground, etc. When disposing of batteries, insulate with tape so as not to contact other metal. Comply with local regulations and rules for battery disposal.

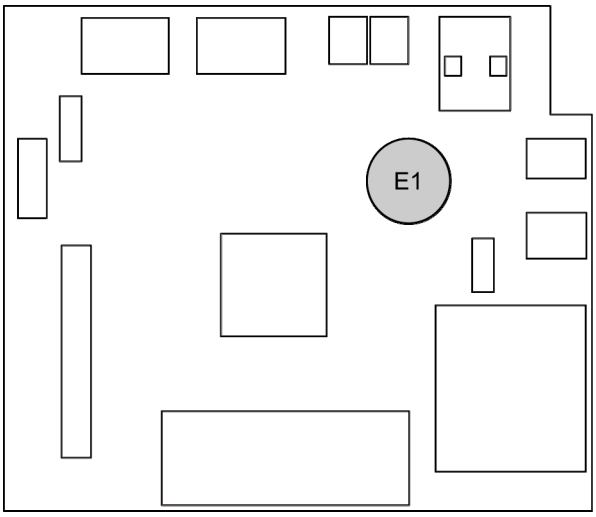
Locations of Batteries

2AA board (in control unit)

Location Number: E1

Model: BR2032

Manufacturer: Panasonic

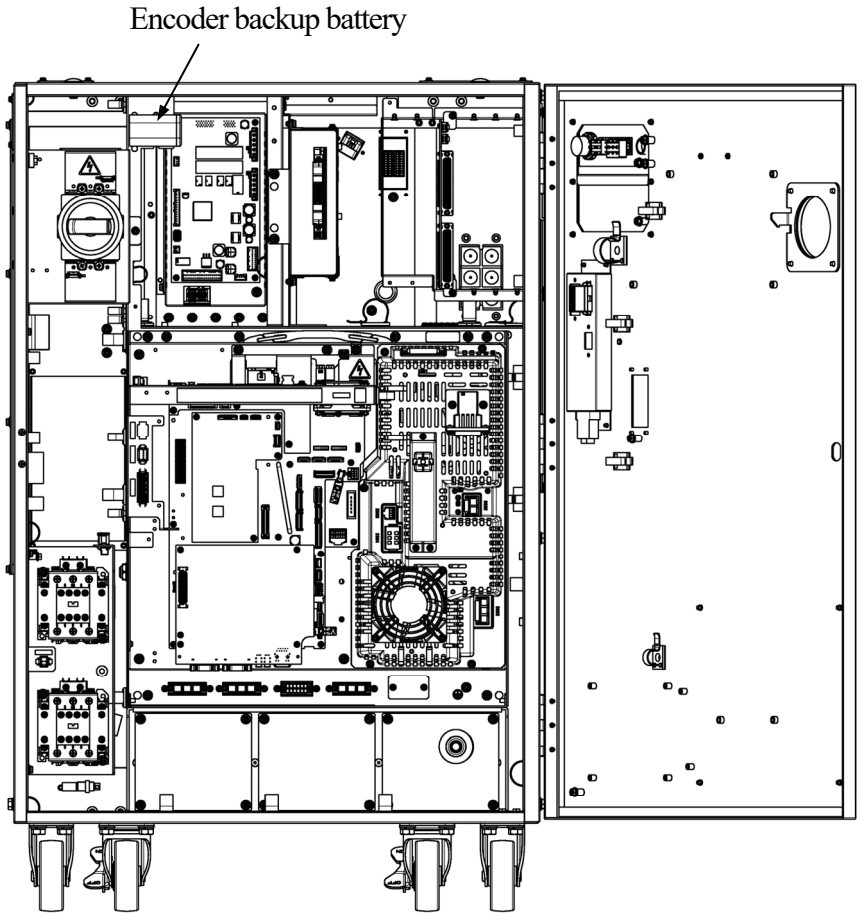


2AA board

Encoder battery

Part Number: 50750-1007, 50750-1018, or 50750-0034

Manufacturer: KHI



1.7 Safety Features

To safeguard the user, Kawasaki robot systems are equipped with the following features:

1. All emergency stops are hard-wired.
2. All robot controllers are equipped with a redundant dual channel safety circuit. Both channels of the safety circuit must be closed to allow for robot operation in teach and repeat modes. For details, see the separate "External I/O Manual."
3. Safety circuits of controllers satisfy requirements of PLe in category 4 defined by ISO 13849-1. Category and Performance level (PL) are determined by the whole system and conditions.
4. (For the arms which are equipped with servo lamp ON) When servo motor power is supplied, the servo ON lamp is illuminated.
5. The teach pendant and operation panel are equipped with emergency stop switches. And all robot controllers have external emergency stop inputs.
6. The teach pendant is equipped with three-position, enable switch. The enable switch must be pressed to enable motor power in teach and check modes.
7. TCP speeds in teach and check modes are limited to a maximum of 250 mm/s (10.0 in/s).
8. The speed limit can be 250 mm/s (10.0 in/s) or more in the Fast Check Mode if an optional Fast Check Mode switch is used (defined by ISO 10218-1).
9. Enabling CoreCubic-S functions allows you to use their respective safety functions. For details on each safety function, refer to the separate "CoreCubic-S Instruction Manual."

⚠ WARNING

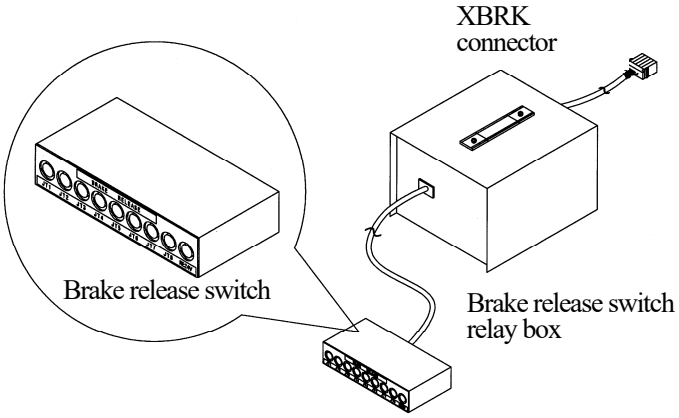
When operating a robot using the Fast Check function, evacuate all personnel from the safeguarded space and check the operation outside the safety fence.

1.8 Moving the Robot Arm Without a Motor Driven Power Supply (During Emergencies or in Abnormal Situations)

The brake release switches allow the operator to move robot arm without using motor drive power for maintenance and emergency situations (option).

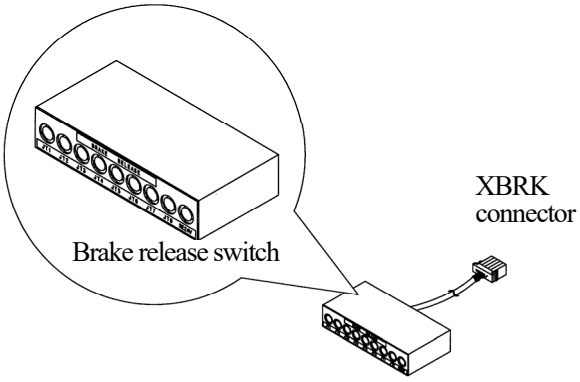
Specification with relay box

Part number: 50818-0065



Specification without relay box

Part number: 50818-0064



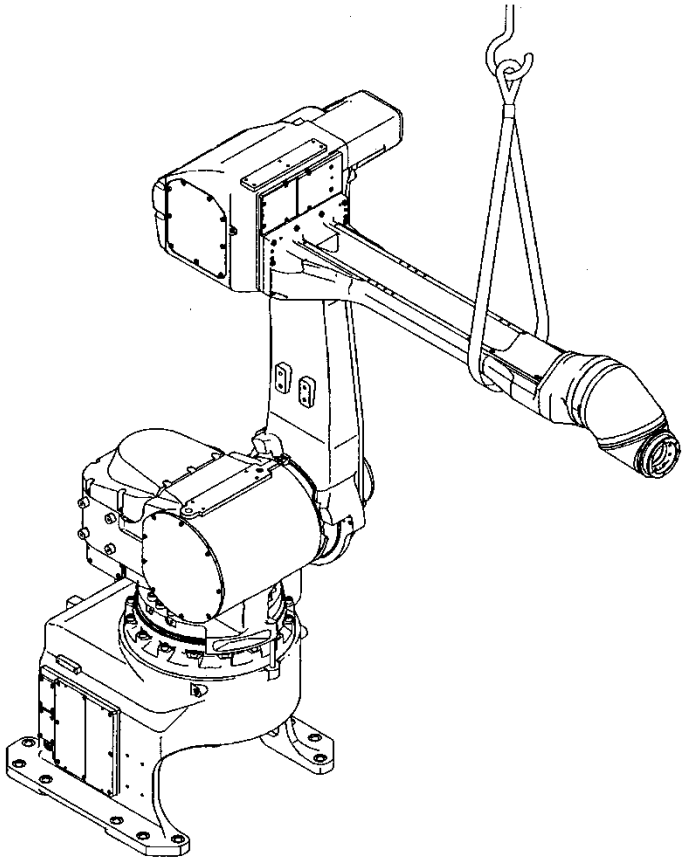
⚠ WARNING

When no motor drive power is applied, electromagnetic brakes lock to maintain the robot posture. Unsupported axes may fall when the brake release switch is pressed. Axes which are overhung, particularly JT2 and JT3, will fall down the fastest, depending on robot posture, weight of the end-of-arm tooling, and wrist axis position. Position yourself to observe the entire robot and keep your eyes on the arm when operating this switch.

■ Work procedure

Follow the instructions below when manually releasing each individual axis brake.

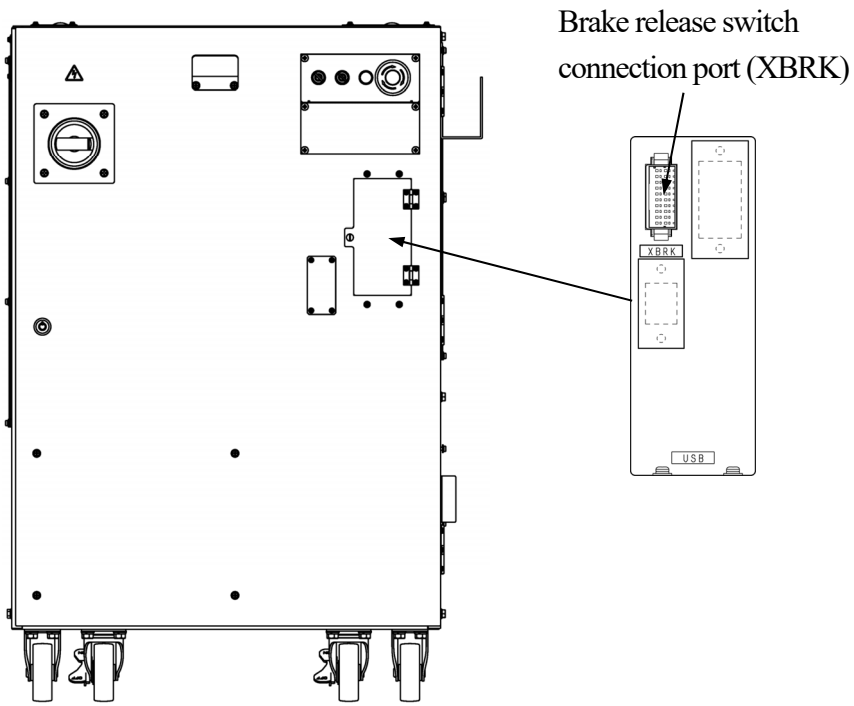
1. Turn OFF the motor power.
2. Ensure that there are no people around and that all safety measures are in place.
3. If there is a possibility of physical injury and/or damage to equipment, take appropriate measures to support the robot arm, and the load and the tool at the end of the arm, before using the brake release switch.
   The robot arm can be supported using a crane and a wire. (Figure below)



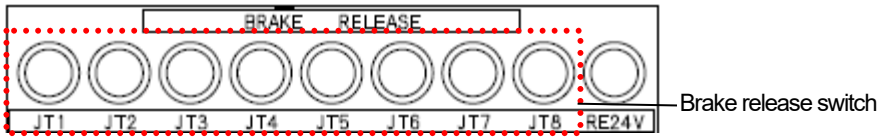
⚠ WARNING

Failure to take these measures could lead to an accident and/or robot failure.

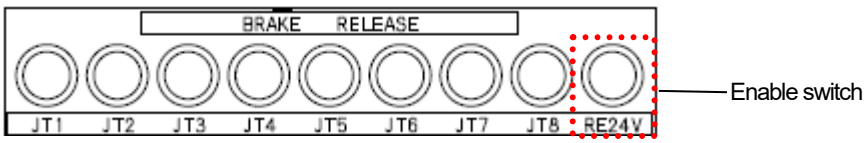
4. Connect the harness from the brake release switch relay box/brake release switch to the brake release switch connection port.
   - Brake release switch connection port diagram



5. Ensure the switches are in the OFF position and in operating condition.
6. Check that the brake is not released with a single switch. If the brake is released, stop using it immediately.
   (1) Momentarily press the brake release switch for the target axis.



   (2) Press and hold down the enable switch (RE24V switch).



CAUTION

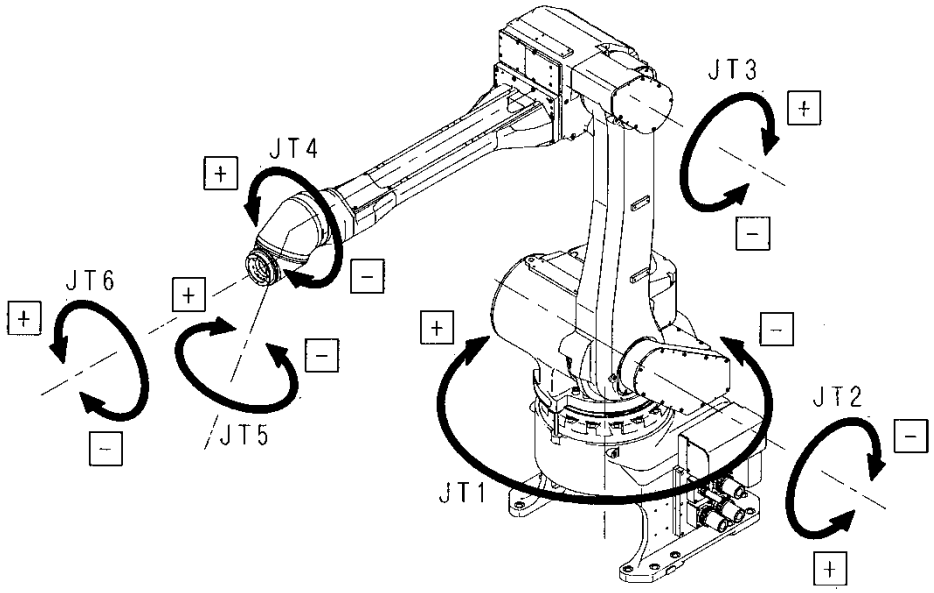
If the electromagnetic brake is released when a single switch is pressed, immediately stop using the brake release switch. The switch may be malfunctioning.

7. While holding down the enable switch, press the brake release switch of the axis you wish to release.

CAUTION

To ensure safety, release the brake for one axis at a time. Pressing two or more switches at the same time may result in an accident or robot malfunction.

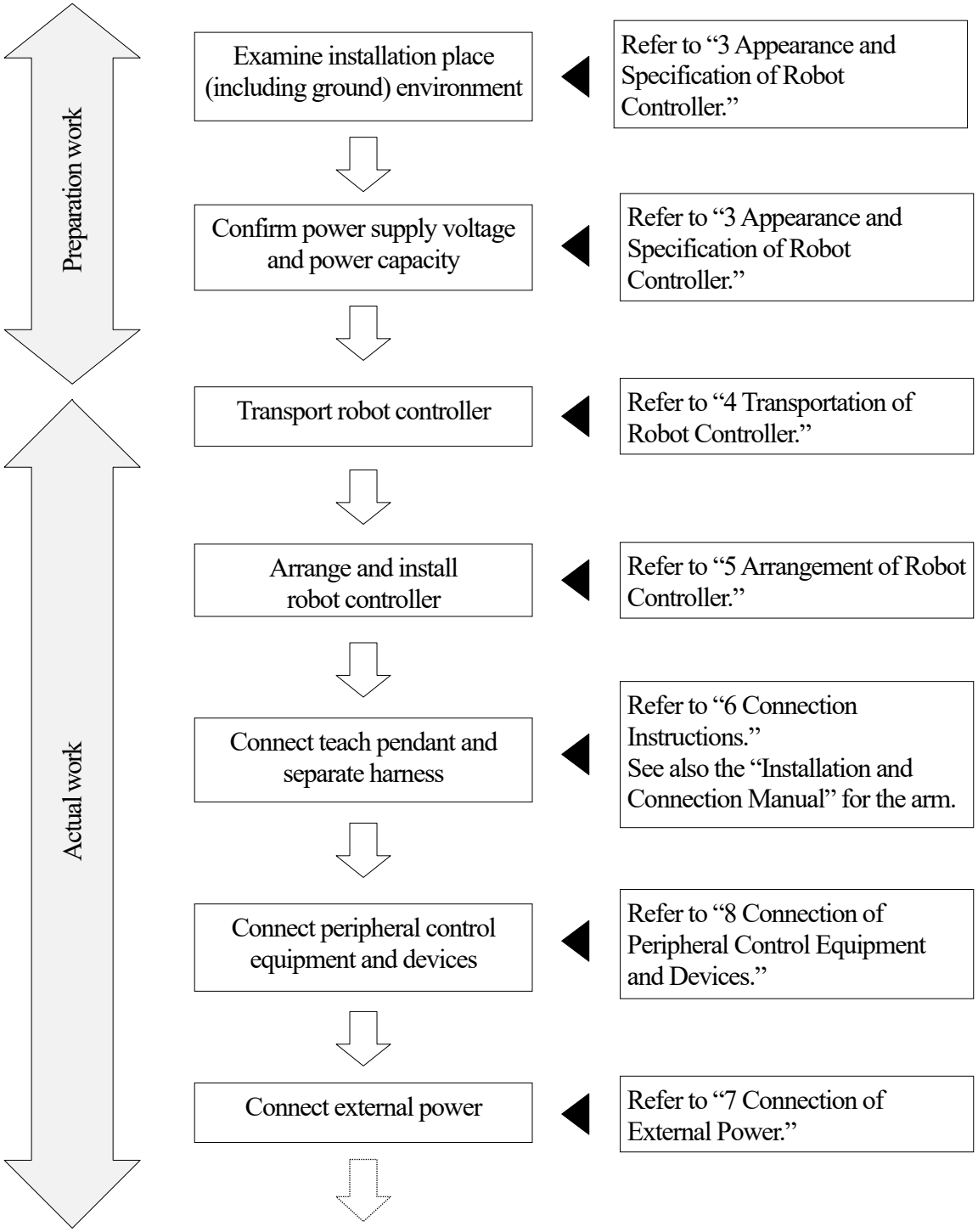
8. The brake remains released until the brake release switch is released.
   - Brake release axis of robot

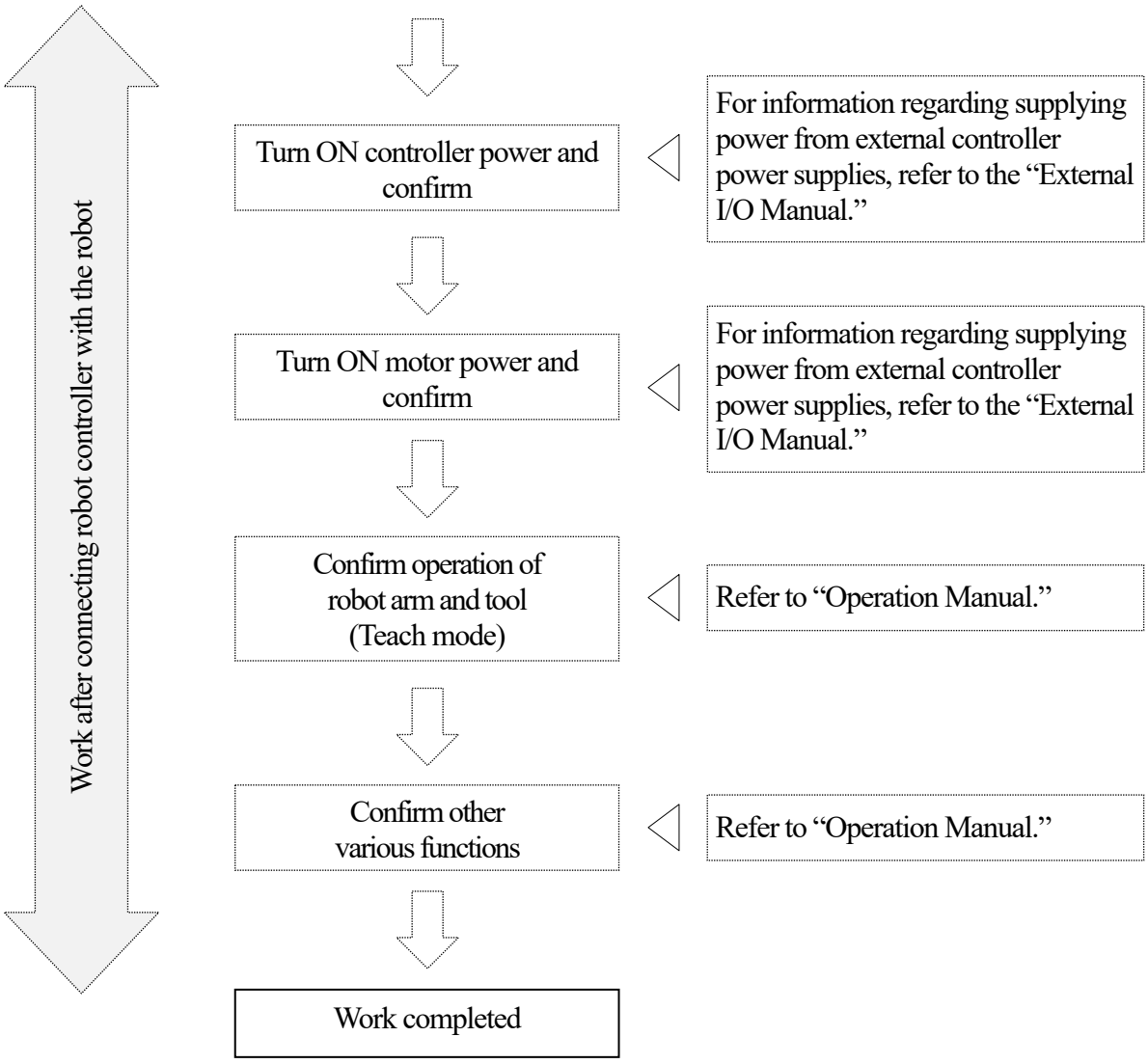


9. After using the brake release switches, remove the harness in the brake release switch relay box/brake release switch from the brake connection port and close the accessory panel.

2 Workflow - Robot Controller Installation and Connection

This workflow describes only the robot controller. See the arm's "Installation and Connection Manual" for more information regarding the arm section of the robot.





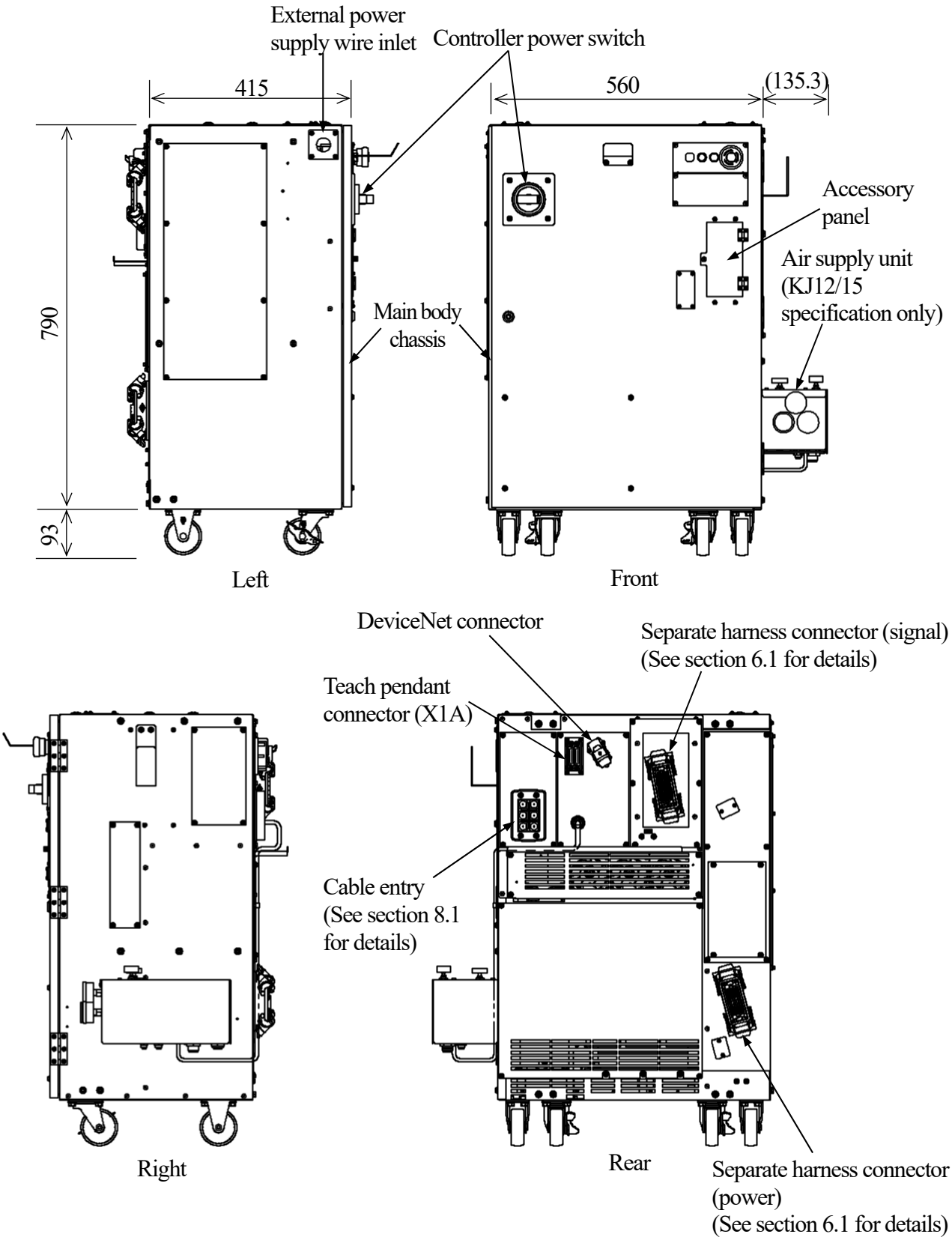
[NOTE]

This manual only describes procedures up to "Connect external power."

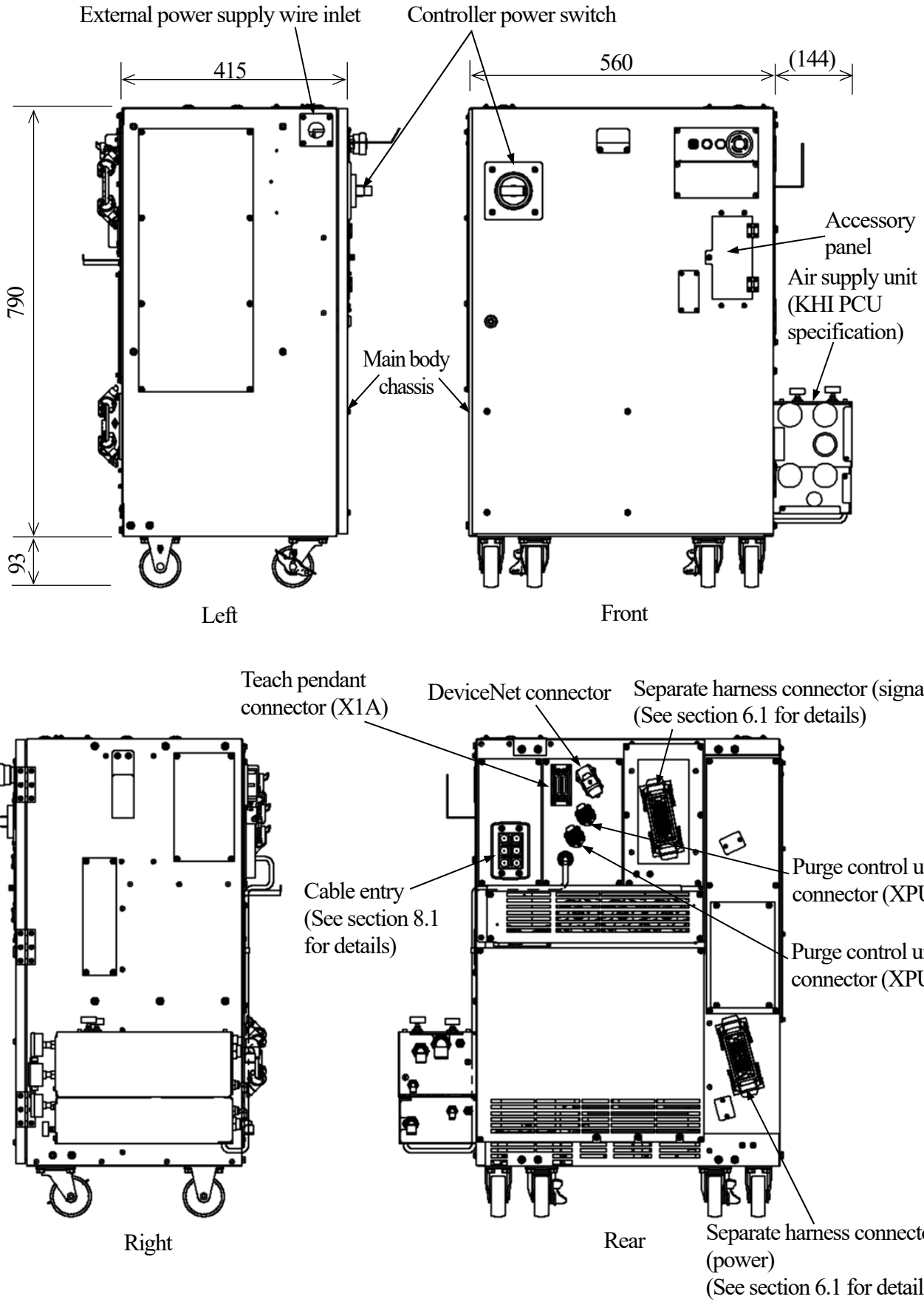
3 Appearance and Specification of Robot Controller

3.1 Controller Appearance

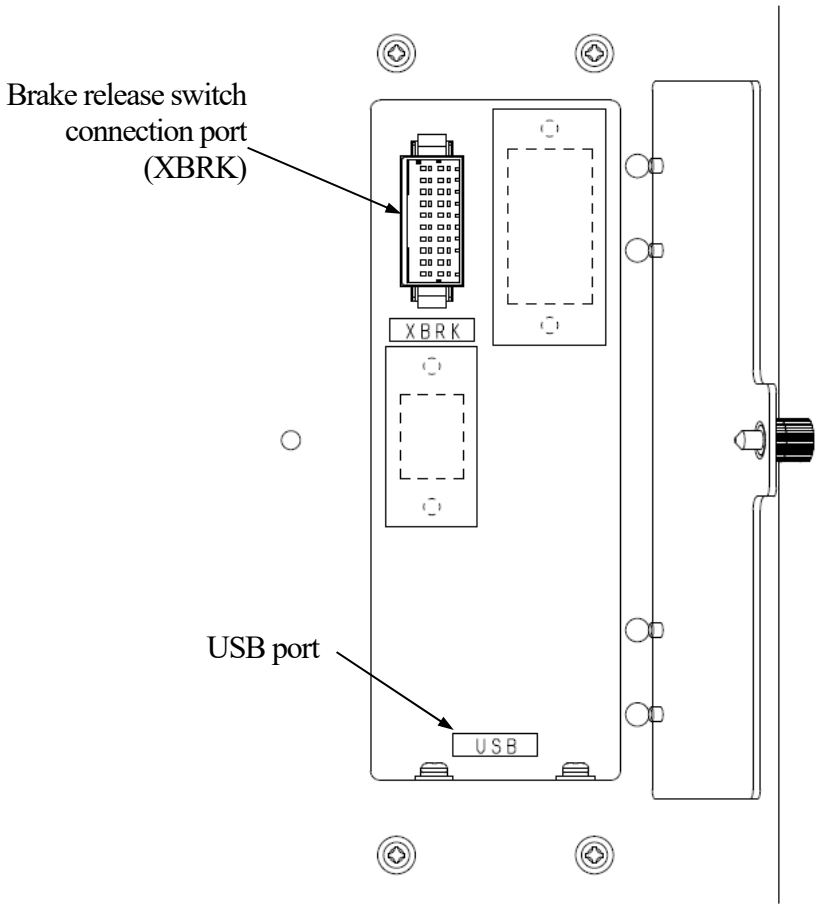
F25/F35 controller



F45 controller



Accessory port



Internal accessory panel connection ports

3.2 Teach Pendant Appearance

■Explosion-proof teach pendant

Explosion-proof teach pendant

3.3 Controller Specification

F25 Explosion-proof specification for Japan/China/Korea

Structure		Sealed structure, indirect cooling system
Mass[*1]		70 kg
Ambient environment	Temperature	0 to 45°C
	Humidity	35 to 85%RH (Non condensing)
	Altitude	0 to 1,000 m above sea level
	Pollution degree[*2]	3 or below
Power source		AC 200-220 V ±10%, 50/60 Hz, 3-Phase
Power capacity		Refer to the table below.
Grounding		Class A (10 Ω or less: intrinsically safe explosion-proof circuit) Class D (100 Ω or less: general circuit)
Length of teach pendant cable		10 m (standard)
Length of separate harnesses		Inside the booth[*3]: 3 m (standard) Outside the booth[*4]: 3 m (standard) Inside + outside the booth: 40 m or less

***1** With no other options installed.

***2** The pollution degree is specified in IEC60664-1.

***3** Harness length between explosion-proof booth wall and robot arm

***4** Harness length between controller and explosion-proof booth wall

Power source capacity for external power connection and cable specifications

Destination	Arm model	Power capacity	Recommended power cable size (Including ground wire)	Power cable length
F25 controller	K series	10 KVA max.	5.5 mm^2 or more (AWG #10 or more)	200 m or less

Circuit breaker specifications for external power connection

Destination	Rated current	Rated voltage	Rated interrupting capacity
F25 controller	40 A	AC230 V	7.5 kA (Icu)

F35 Explosion-proof specification for North America

Structure		Sealed structure, indirect cooling system
Mass*1		95 kg
Ambient environment	Temperature	0 to 45°C
	Humidity	35 to 85%RH (Non condensing)
	Altitude	0 to 1,000 m above sea level
	Pollution degree*2	3 or below
Power source		AC 440-480 V ±10%, 60 Hz, 3-Phase
Power capacity		Refer to the table below.
Grounding		Protective earthing (PE)
Length of teach pendant cable		10 m (standard)
Length of separate harnesses		Inside the booth*3: 3 m (standard) Outside the booth*4: 3 m (standard) Inside + outside the booth: 40 m or less

***1** With no other options installed.

***2** The pollution degree is specified in IEC60664-1.

***3** Harness length between explosion-proof booth wall and robot arm

***4** Harness length between controller and explosion-proof booth wall

Power source capacity for external power connection and cable specifications

Destination	Arm model	Power capacity	Recommended power cable size (Including ground wire)	Power cable length
F35 controller	K series	9.9 KVA max.	5.5 mm^2 or more (AWG #10 or more)	200 m or less

Circuit breaker specifications for external power connection

Destination	Rated current	Rated voltage	Rated interrupting capacity
F35 controller	15 A	AC480 V	30 kA (UL489)

Note Short circuit current rating of the controller (UL508A): 30 kA

F45 Explosion-proof specification for Europe

Structure		Sealed structure, indirect cooling system
Mass*1		100 kg
Ambient environment	Temperature	0 to 45°C
	Humidity	35 to 85%RH (Non condensing)
	Altitude	0 to 1,000 m above sea level
	Pollution degree*2	3 or below
Power source		AC 380-415 V ±10%, 50/60 Hz, 3-Phase
Power capacity		Refer to the table below.
Grounding		Protective earthing (PE)
Length of teach pendant cable		10 m (standard)
Length of separate harnesses		Inside the booth*3: 3 m (standard) Outside the booth*4: 3 m (standard) Inside + outside the booth: 40 m or less

***1** With no other options installed.

***2** The pollution degree is specified in IEC60664-1.

***3** Harness length between explosion-proof booth wall and robot arm

***4** Harness length between controller and explosion-proof booth wall

Power source capacity for external power connection and cable specifications

Destination	Arm model	Power capacity	Recommended power cable size (Including ground wire)	Power cable length
F45 controller	K series	9.9 KVA max.	5.5 mm^2 or more (AWG #10 or more)	200 m or less

Circuit breaker specifications for external power connection

Destination	Rated current	Rated voltage	Rated interrupting capacity
F45 controller	20 A	AC400 V	5 kA (Icu)
		AC415 V	

4 Transportation of Robot Controller

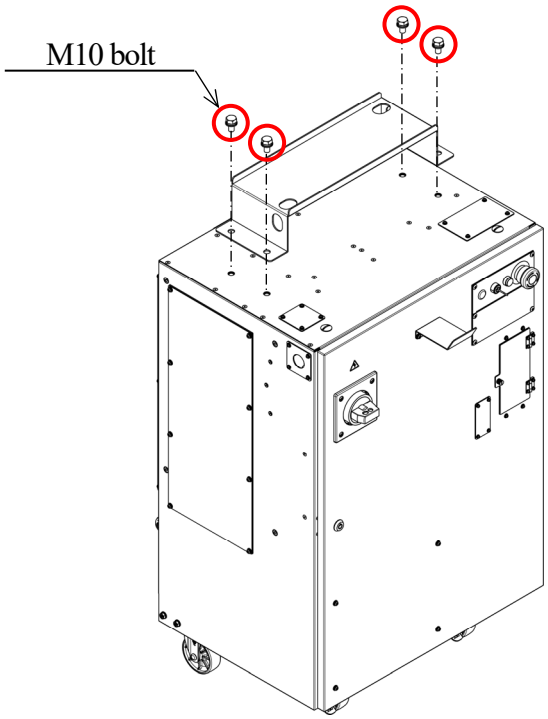
When transporting the controller, strictly observe the following precautions and perform work.
Use the bracket set (option) below when transporting.

Part number	Part name
49094-0812	Lifter bracket set

4.1 Installation of Lifter Bracket

⚠ CAUTION

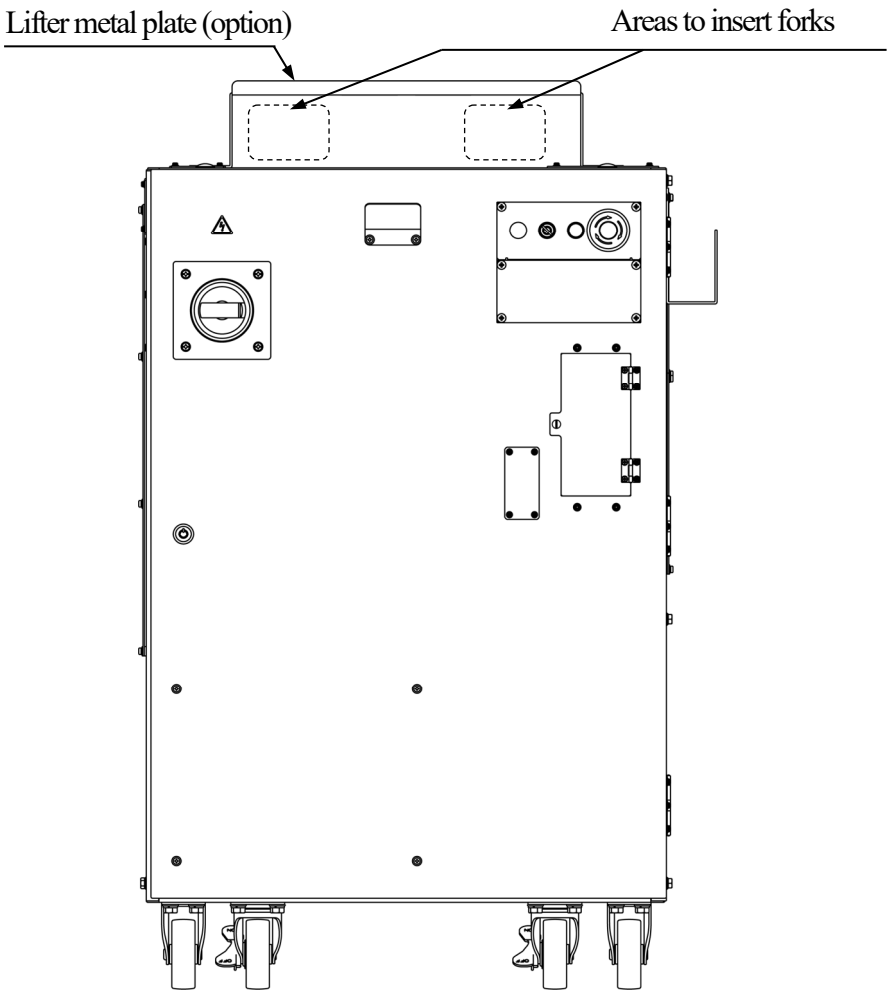
1. **Use the M10 bolts included with the lifter bracket set to install the lifter bracket. (M10 torque: 24.5 N·m)**
2. **During transport, be careful not to subject the unit to shock or impact.**
3. **Make sure that the cables do not get caught on other equipment, etc.**
4. **Do not transport controllers when multiple controllers are connected or stacked. Transport one controller at a time.**



4.2 By Forklift

CAUTION

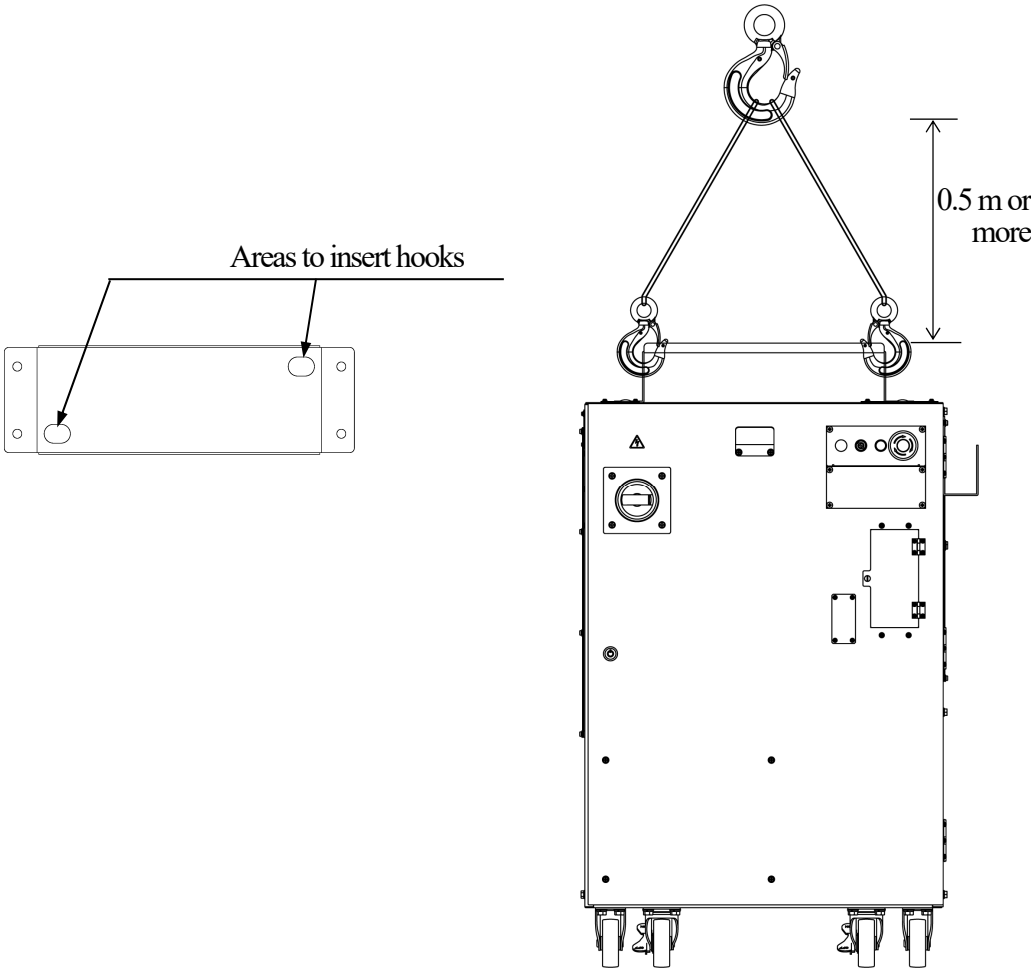
1. **When transporting with a forklift, insert forks in the areas shown in the below figure. Note that the forks cannot be inserted from the side. Also, please remove teach pendant and the teach pendant holder.**
2. **During transport, be careful not to subject the unit to shock or impact.**
3. **Make sure that the cables do not get caught on other equipment, etc.**
4. **Do not transport controllers when multiple controllers are connected or stacked. Transport one controller at a time.**
5. **Attach caps to the top plate bolt holes when work is complete.**



4.3 By Crane

⚠ CAUTION

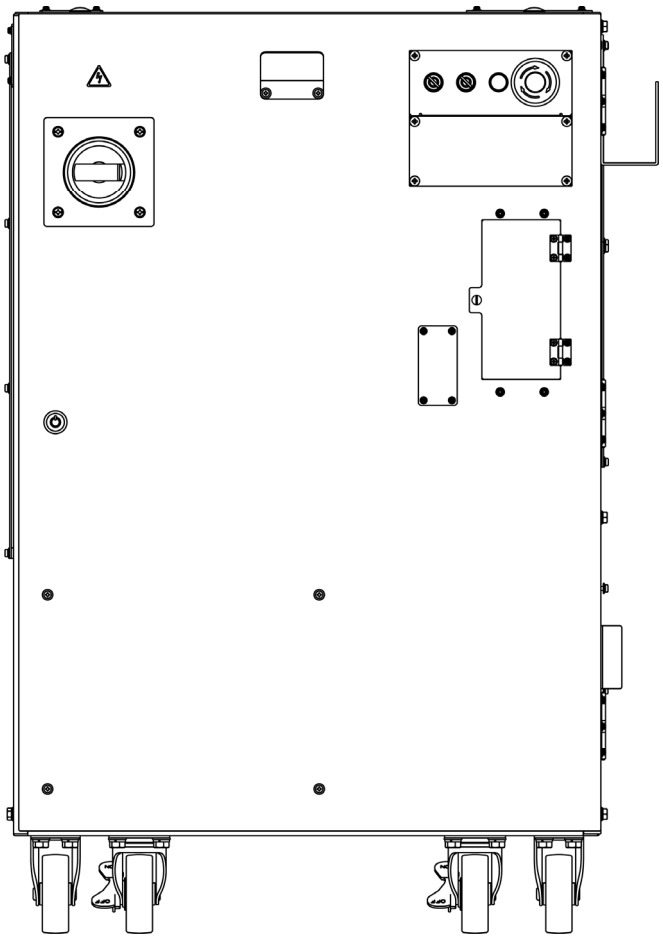
1. **Use wires, cranes, and other equipment which is able to withstand loads of 200 kg or greater when the full complement of optional products are installed on the controller.**
2. **When transporting with a crane, insert forks in the areas shown below to lift. Also, remove the teach pendant, teach pendant holder, and separate harness.**
3. **During transport, be careful not to subject the unit to shock or impact.**
4. **Make sure that the cables do not get caught on other equipment, etc.**
5. **Do not transport controllers when multiple controllers are connected or stacked. Transport one controller at a time.**
6. **Wire length should be 0.5 m or more, as shown in the figure below.**
7. **Be aware that the controller may tilt when lifted.**
8. **Attach caps to the top plate bolt holes when work is complete.**



4.4 Moving with Casters

WARNING

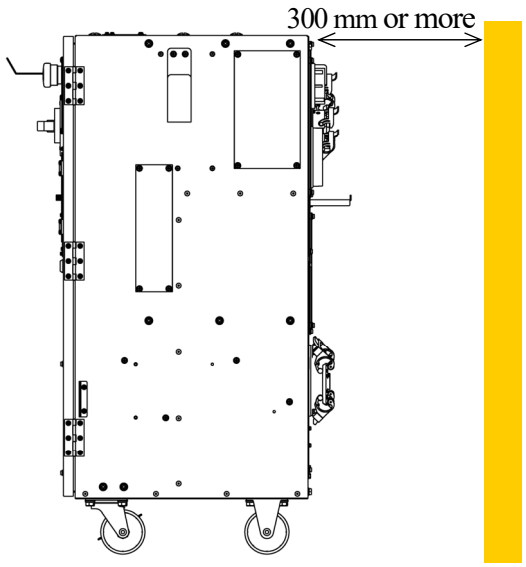
1. **When using casters to move the controller, move only on paths where planes are guaranteed. Moving the unit over tilted or uneven surfaces may lead to its tipping, causing great damage.**
2. **Tilting the controller forward/backward 10° or more, or to the left/right 20° or more, will lead to the unit to tip over.**



5 Arrangement of Robot Controller

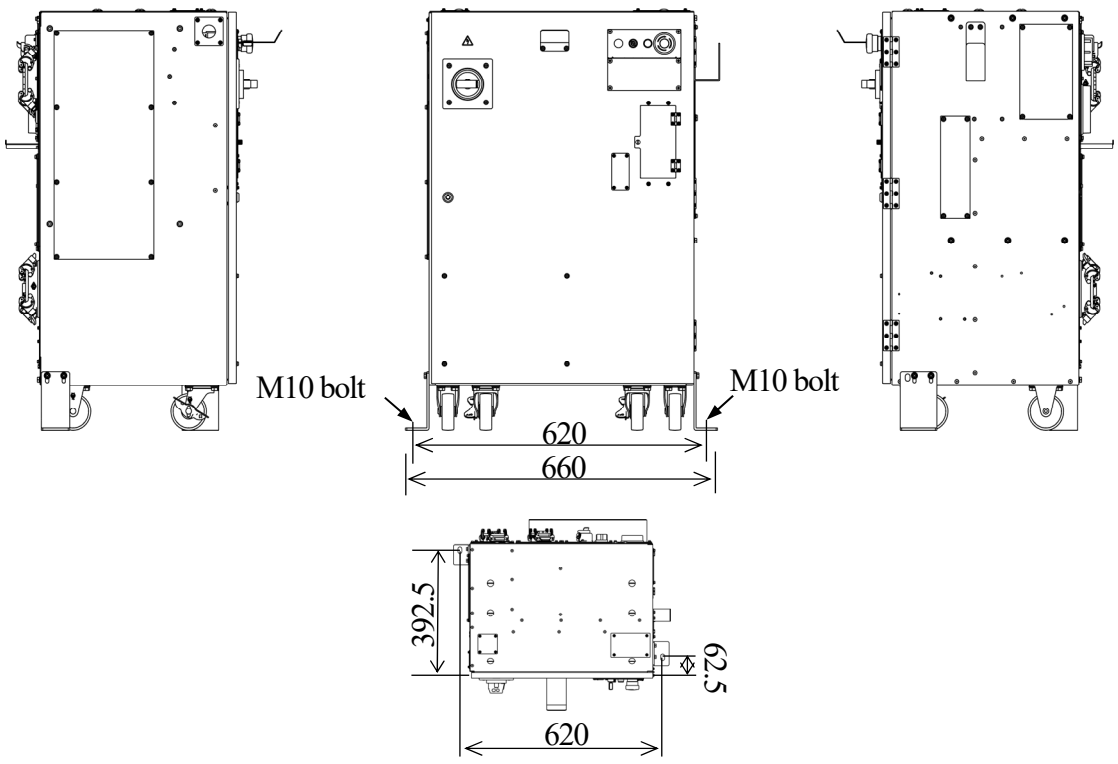
5.1 Installation Using Anchor Brackets

Please follow the below procedures when arranging the controller.



1. Arrange the controller on a horizontal stand.
2. Leave a gap of at least 300 mm between the rear side of the controller and the wall.
3. Leave enough space in front of the controller for the controller's ins and outs and the doors' opening and closing.

When using casters (option) and to fix the controller in place, use fixing brackets and M10 bolts for securing, as shown below.



Anchor location for securing bracket

5.2 Stacked Installation of Controllers

Please follow the below procedures when stacking the controllers.
When stacking, use the stacking bracket set (option) below to secure the controllers.

Part number	Part name
49094-1880	Stacking bracket set

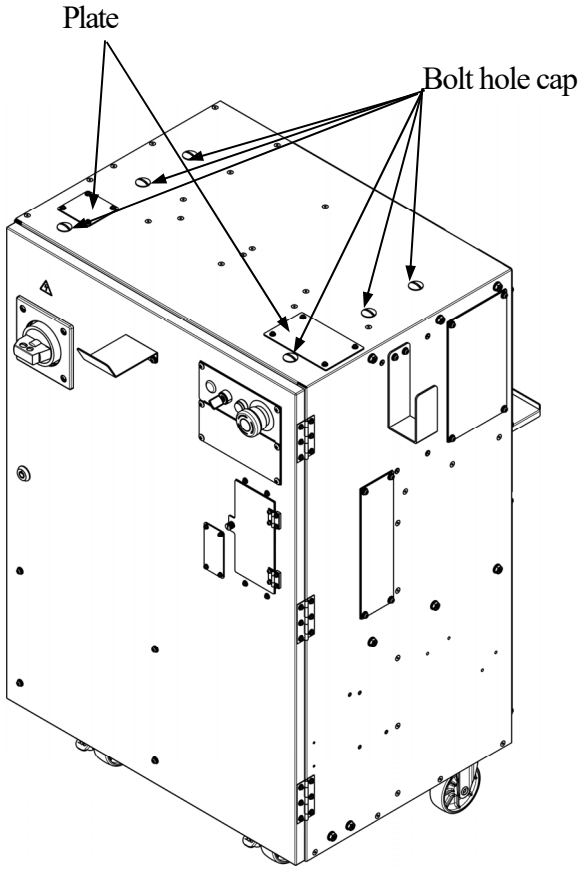
⚠ CAUTION

1. **Stacking is up to two tiers.**
2. **Install the controller directly on a stable floor or stand.**

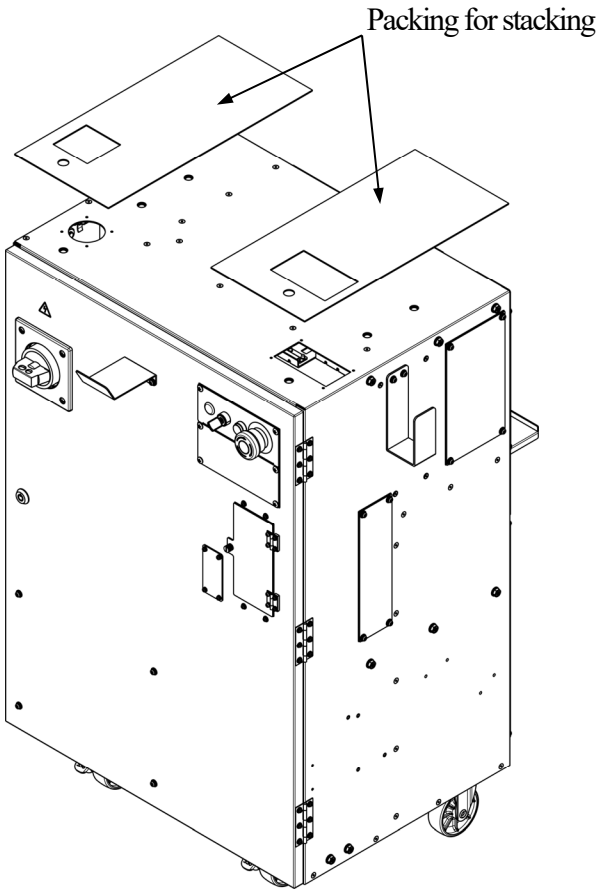
[NOTE]

Stacking is possible when casters are used.

1. Remove six bolt hole caps and two plates on the top of controller that is to be placed on the lower tier.



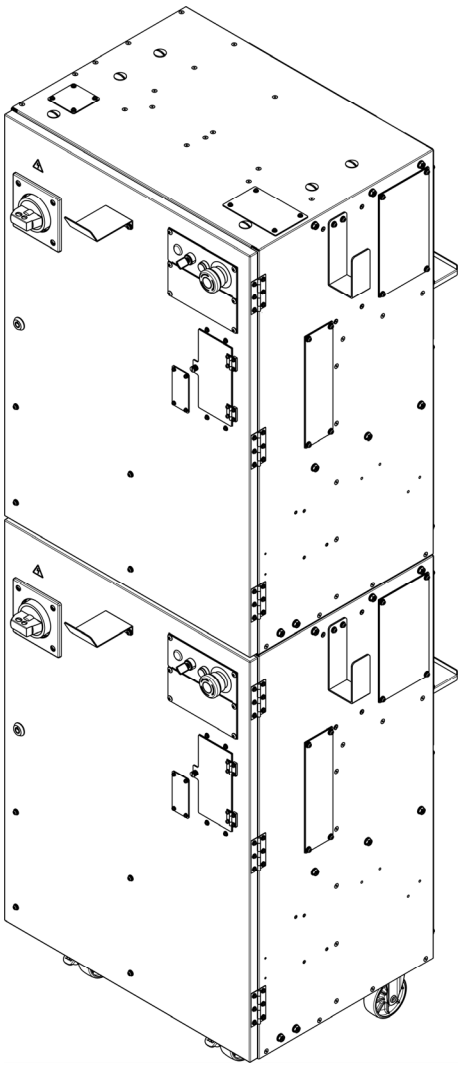
2. Spread the packing for stacking onto the top of the controller and affix it with double-sided tape. Check that the hole positions of the packing and the screw positions of the controller are aligned.



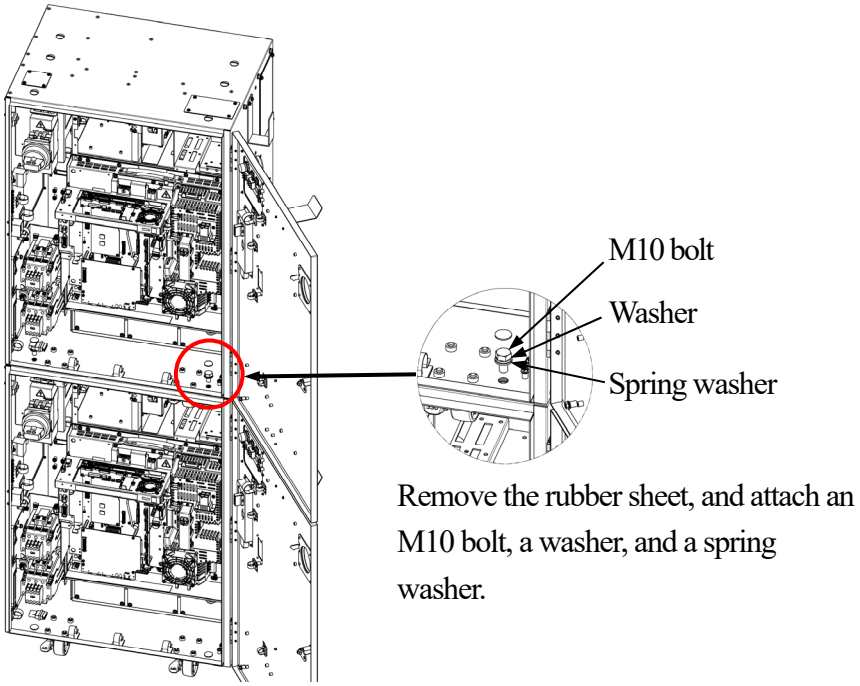
3. Remove the caster of the controller to be placed on the upper tier as described in "5.4 Removal of the Caster."
4. Use a crane, forklift, etc., to stack the controllers.

⚠ CAUTION

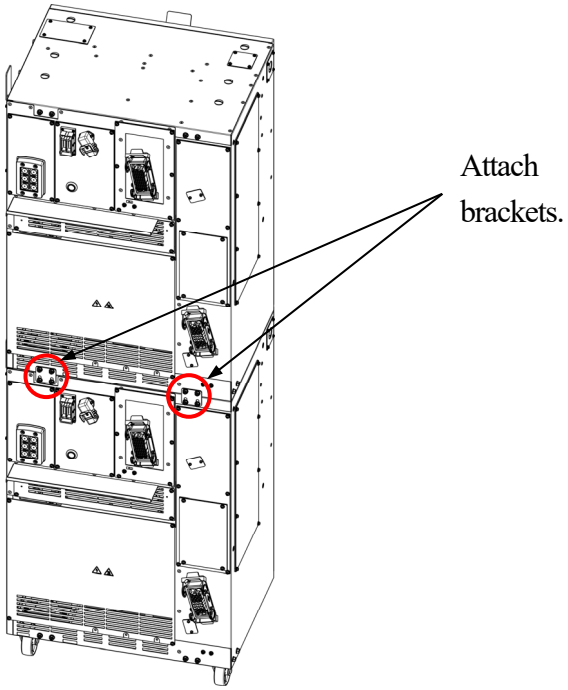
1. **Be careful not to tip over or be pinched.**
2. **Attach caps to the top plate bolt holes when work is complete.**



5. Remove the rubber sheet of the controller on the upper tier and secure the upper and lower controllers using an M10 bolt, a washer, and a spring washer. (Tightening torque: 24.5 N·m)
   Note Be careful not to damage the surrounding harnesses when tightening the M10 bolt.



6. On the rear of controllers, use brackets to secure the upper and lower controllers. (Tightening torque: 5.6 N·m)



CAUTION

Use the anchor bracket to secure the controller on the lower tier to prevent tipping when stacking.

5.3 Adjacent Arrangement of Controllers

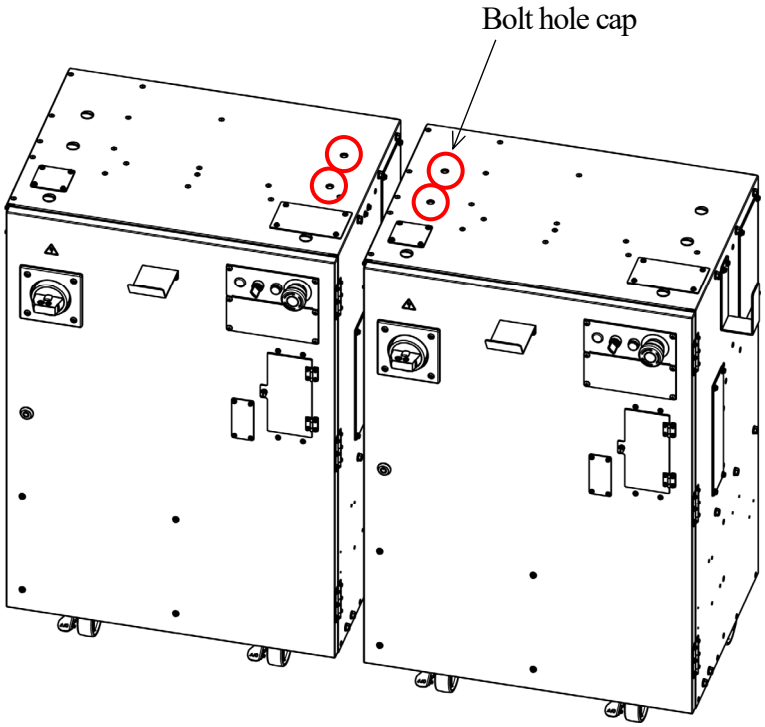
Please follow the below procedures when arranging controllers adjacent to each other.
When arranging controllers adjacent to each other, use the adjacent arrangement bracket set (option) below to secure the controllers.

Part number	Part name
49094-0992	Adjacent arrangement bracket set

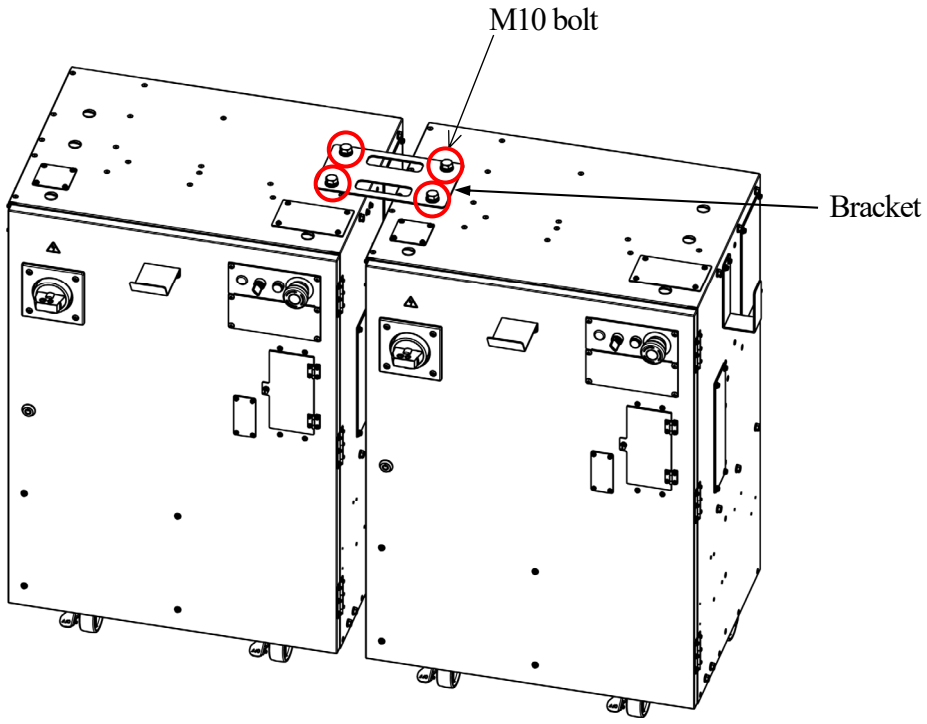
CAUTION

1. **If options such as coolers are installed on the sides of the controllers, the adjacent arrangement described in this section cannot be used.**
2. **For adjacent arrangement, remove the teach pendant cable hook on the controller to be placed on the left to fill the bolt hole with the bolt securing the hook.**

1. Remove the bolt hole caps on the top of the controller.



2. Use M10 bolt brackets to connect the left and right controllers. (Tightening torque: 24.5 N·m)



5.4 Removal of the Caster

Casters can be removed from the controller during installation.
When removing the casters of the controller, prepare the "M8 bolt set for dust prevention on the bottom without casters" and follow the instructions below using the caster removal jig.

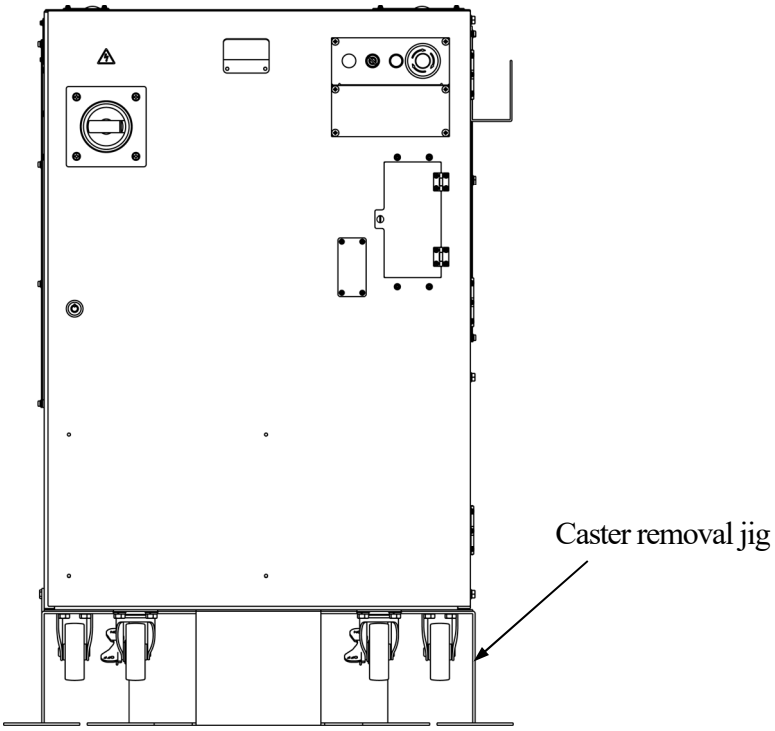
Part number	Part name
49094-1883	M8 bolt set for dust prevention on the bottom without casters
50833-0627	Caster removal jig

Note When removing casters for stacking the controller, the above set does not need to be prepared because the stacking bracket set includes the "M8 bolt set for dust prevention on the bottom without casters."

1. Place the controller on the caster removal jig using a crane or forklift.

⚠ CAUTION

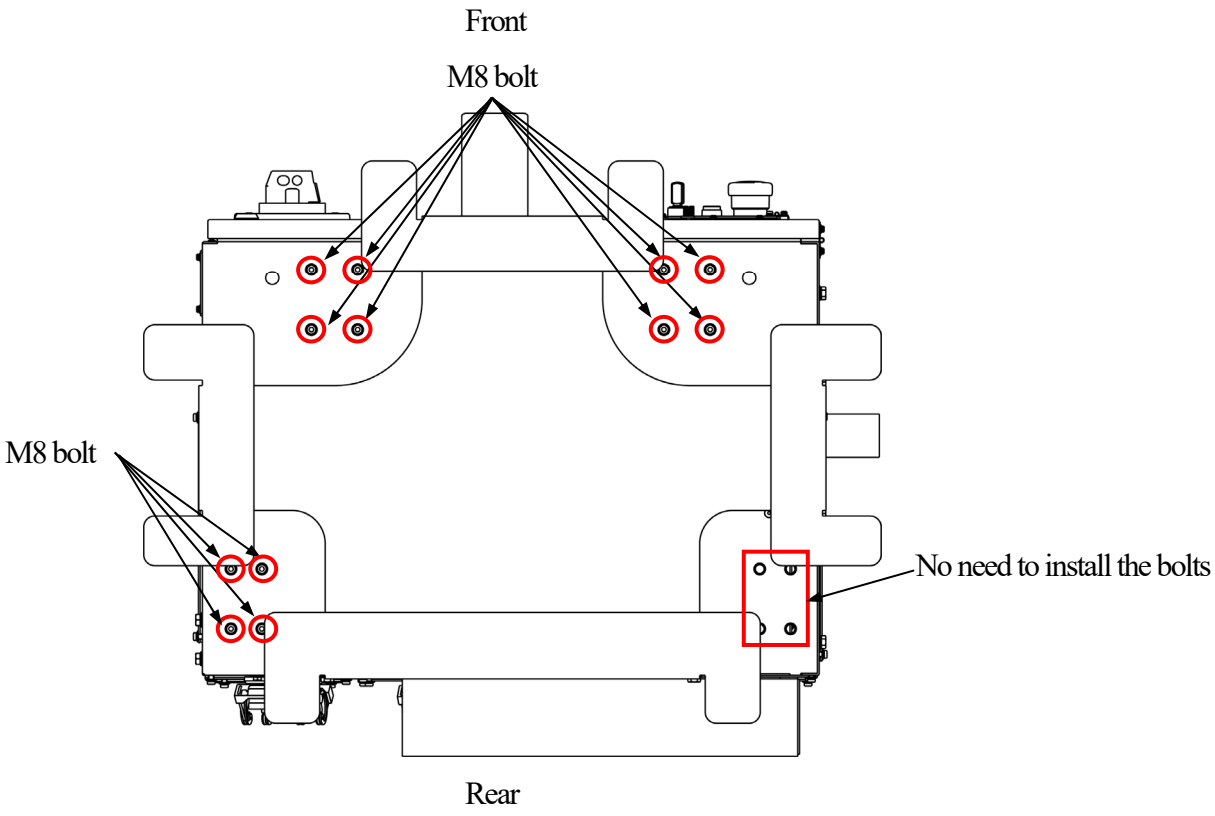
Be careful not to tip over or be pinched.



2. Remove the M8 bolts (4 locations x 4 pcs = 16 pcs) securing the caster from the bottom of the controller to remove the caster. (The bolts will not be used again)
3. Install the 12 bolts of "M8 bolt set for dust prevention on the bottom without casters" at the positions indicated in the figure below.

   Note Apply threadlockers to the bolts.

   Note There is no need to install the bolts under the regenerative resistor as it is an IP20 area.



View from the bottom of the controller

4. Unload the controller from the caster removal jig using a crane or forklift.

⚠ CAUTION

Install caps to the bolt holes on the top plate after the work is complete.

6 Connecting the Controller to the Robot Components

6.1 Connection Between Controller and Robot

⚠ WARNING

Do not connect the external power until connections between controller and robot are complete. Accidents such as electric shock may occur.

⚠ CAUTION

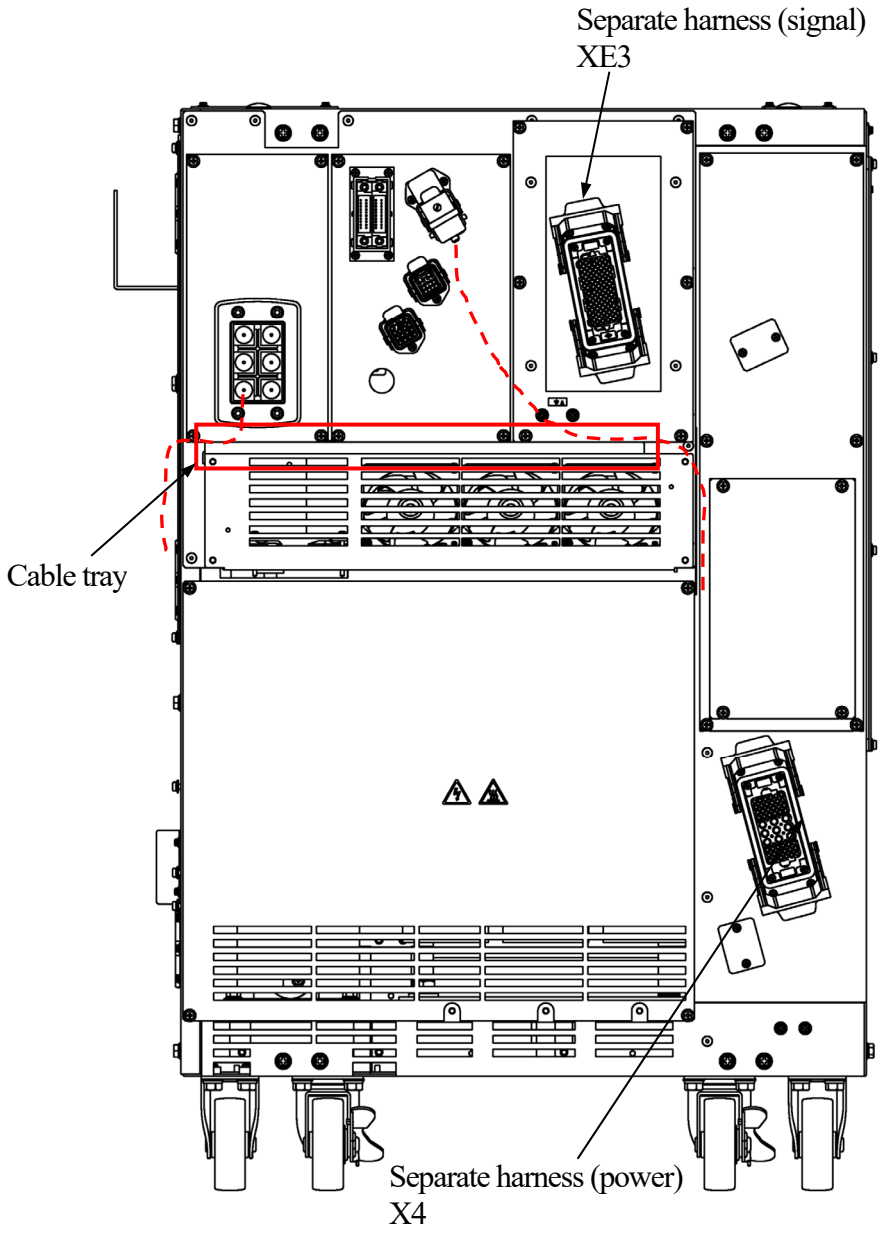
1. **Do not mistake the destination of connectors when connecting the harnesses. Forcing to connect the harness wrongly may damage connectors or cause a break in the electrical system.**
2. **Be sure not to twist hard, pull, bend, ride on, place objects on, or step on by people or vehicles (forklifts, etc.) the motor and signal harnesses. Otherwise, the harness may become damaged or the electrical system may break.**
3. **Keep the harness separate from the robot wiring and from high voltage power lines.**
   - **(1) Do not wire the harness close to or in parallel with other power lines.**
   - **(2) Do not bundle the wires.**
   - **(3) Keep the wiring at least 1 m clear of high voltage or current power lines. Failure to do so may lead to malfunctions caused by noise from the power cables.**
4. **Even if the harness is long, be sure to avoid winding, bending, or bundling the cables/wires. Bundling prevents generated heat from escaping, causing the harness to overheat. This could damage the cables and cause a fire.**
5. **Wire the communication cables and sensor cables separately from the robot motor harness.**
   - **(1) Do not wire them close to or in parallel with other cables.**
   - **(2) Do not bundle the wires.**
6. **Use twisted pair shielded cables for the communication and sensor cables, and connect the outer sheath of the shielded wire appropriately. If the connection is not done appropriately, PWM noise could affect the cable adversely, leading to communication errors.**
7. **Separate the welder secondary cable from the robot's signal harness. Do not wire them in the same duct.**
8. **The motor harness (power line) between the robot and the controller will generate PWM noise due to the PWM control driving the motors. This noise may cause interference with signal lines. Strictly observe the following precautions to prevent the interference:**
   - **(1) Separate the power and signal lines as much as possible.**
   - **(2) Use the shortest length for the power line.**
   - **(3) Avoid bundling, wiring in parallel with the power and signal lines as much as possible.**
   - **(4) Do not wire the power and signal lines within the same duct/conduit.**
   - **(5) Set and secure a firm ground line connection for the controller.**

Connect the separate harnesses in the positions indicated in the figure below.

CAUTION

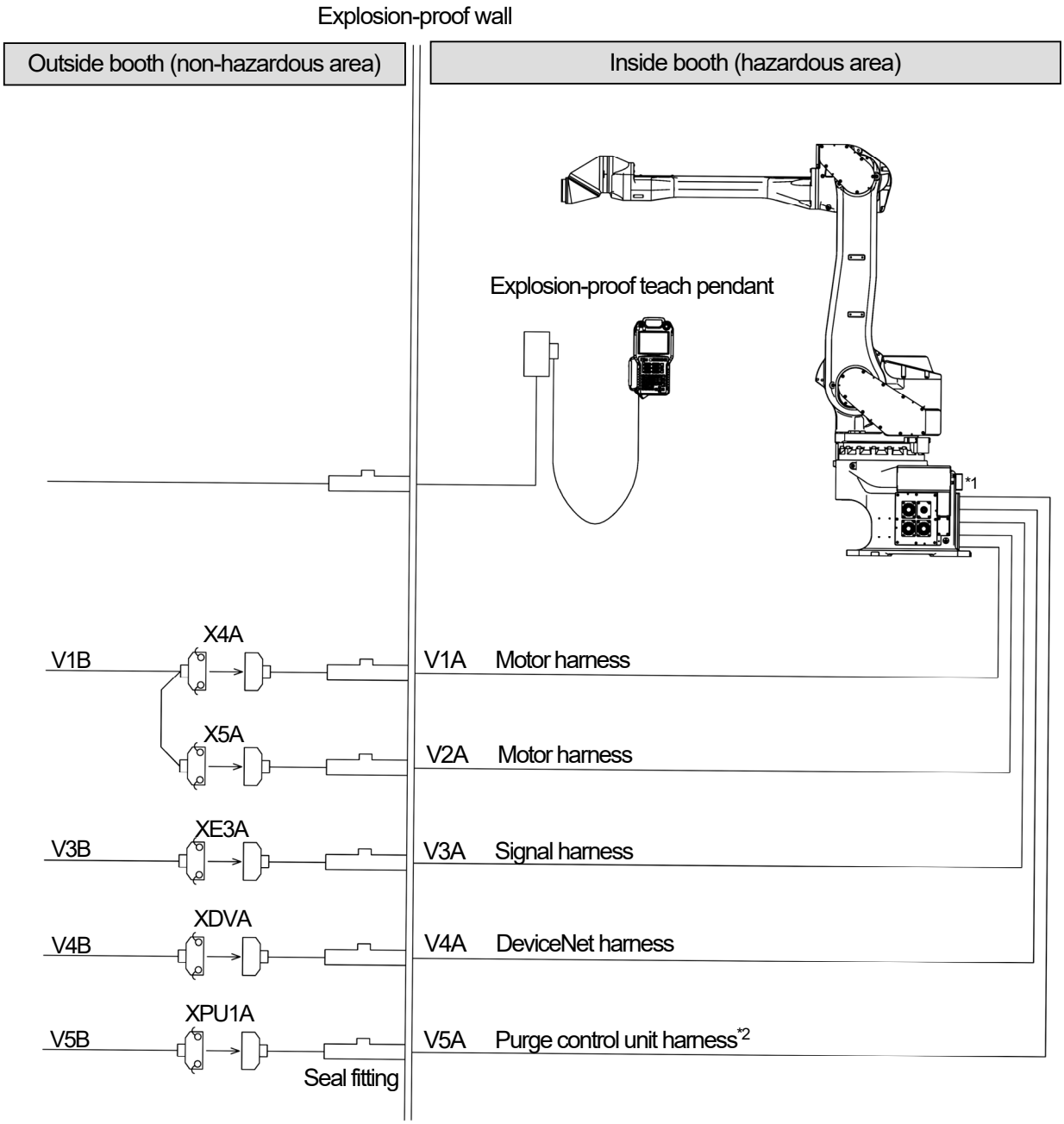
1. **Be sure to secure each connector properly.**
   If connectors come unplugged, malfunctions might occur.
2. **Connect a separate harness when stacking controllers so that the exhaust port on the rear surface of the lowest controller does not become blocked.**
3. **Connect the harnesses using a cable tray so that the inlet and exhaust ports are not blocked.**

1. Controller side



2-1. Robot arm side (KJ19x, 24x, 26x, 31x, KL262)

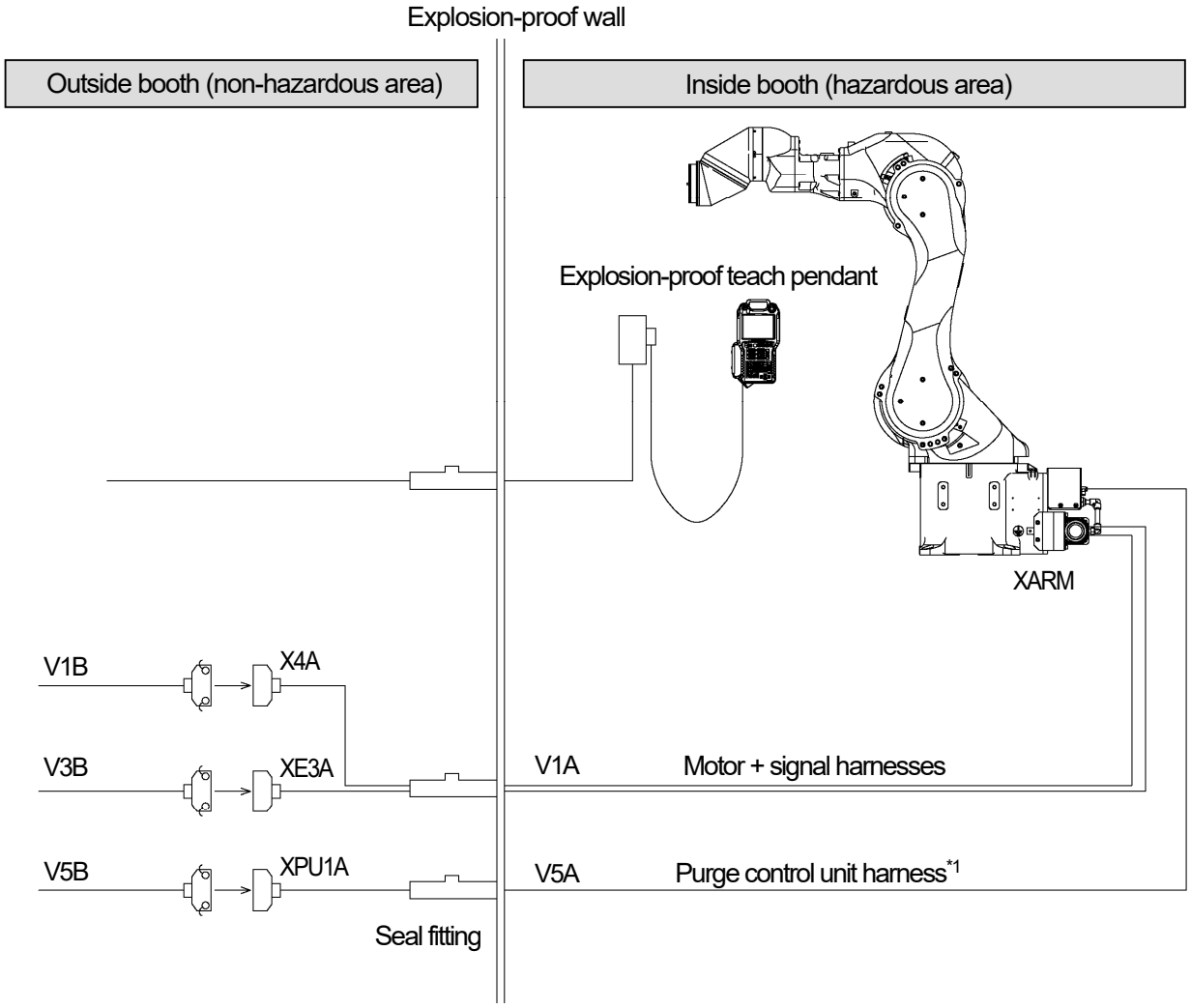
First, check the labels of the harness connectors. Follow the figure below to pair the connectors properly, and at the end lock the lock levers to firmly connect the connectors.



*1 For North America specification, cables in hazardous area need protection by metal conduits to comply with National Electric Code (NEC). Refer to the separate "Connection Manual" for the concrete wiring procedure. If the robot is installed on a traverse unit and cables in the hazardous area move, the protection by metal conduits is not possible and flexible braided cables are allowed to use as moving cables in this case.

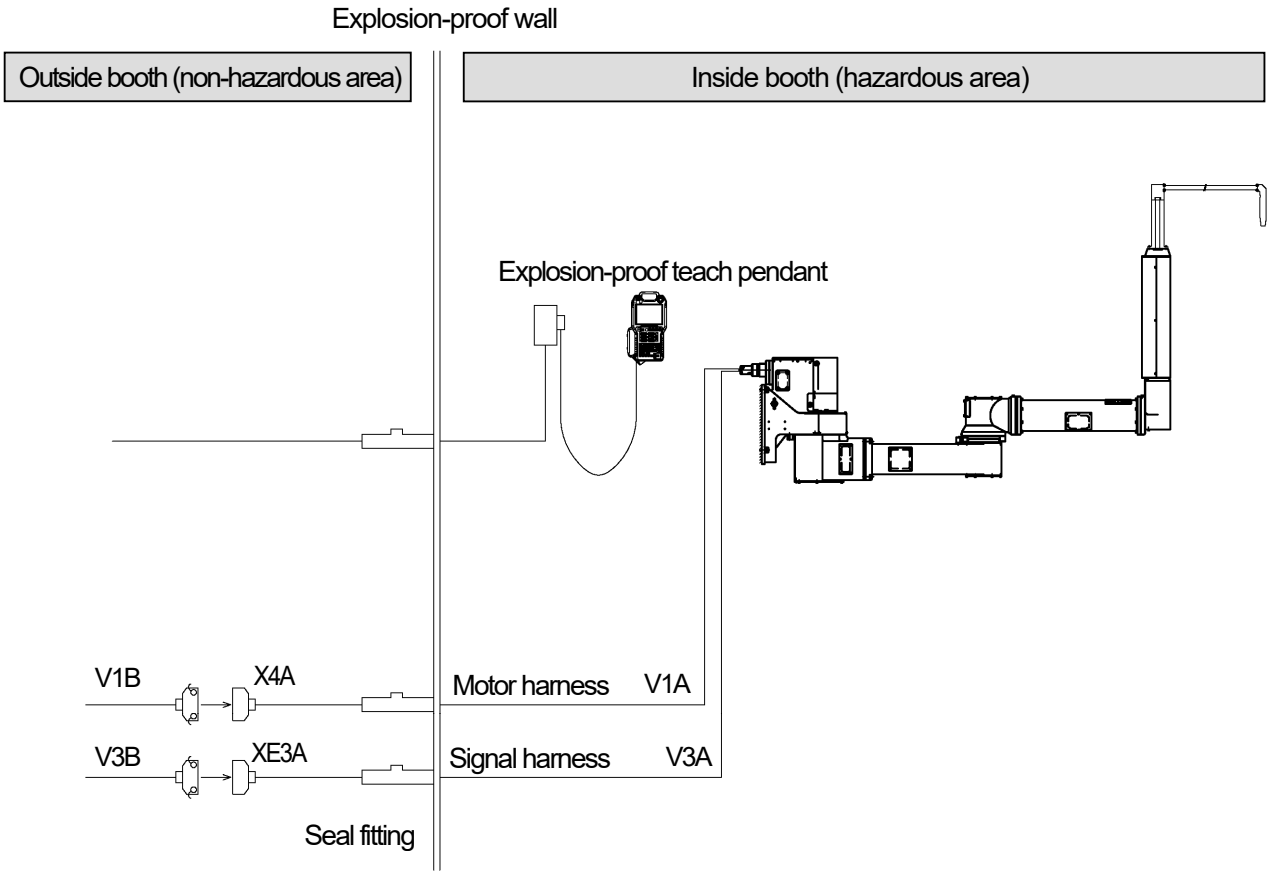
*2 This harness and PCU are available for F45 only.

2-2. Robot arm side (KJ12x, 15x)



*1 This harness and PCU are available for F45 only.

2-3. Robot arm side (KD010)

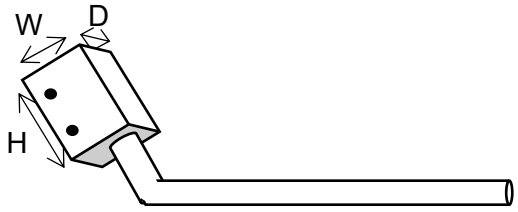


See the tables below for the external size, minimum bend radius and weight of each cable, connector and fitting.

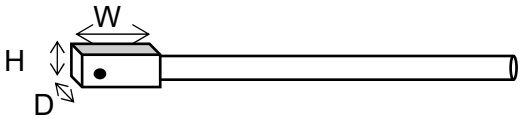
■ Outside-booth harness

Robot	Harness type	Connector name	Cable diameter (mm)	Minimum cable bend radius (mm)	Cable weight (kg/m)	Connector size*1 (mm)		
						D	H	W
KJ19x/24x/ 26x/31x KL262	V1B	X4	26.8	160.8	1.33	43	94	76
	V3B	XE3	23	138	0.62	43	94	76
	V4B	XDV	12	60	0.175	27	28	60
	V5B	XPU1	9.9	49.5	0.15	28	55	39
KJ12x/15x KD010	V1B	X4	20	120	1.33	43	94	76
	V3B	XE3	23	138	0.62	43	94	76
	V5B	XPU1	9.9	49.5	0.15	28	55	39

*1 Connector size (V1B/V2B/V3B/V5B) Connector size (V4B)



Controller side Robot side



Controller side Robot side

■ Inside-booth harness (1)

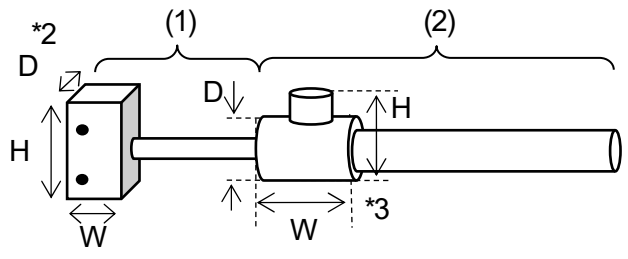
Robot	Harness type	Connector name	Cable diameter (mm)	Minimum cable bend radius (mm)	Cable weight (kg/m)	Connector size*2 (mm)		
						D	H	W
KJ19x/24x/ 26x/31x KL262	V1A	X4A	26	156	1.01	43	91	93.5
	V2A	X5A	27	162	0.86	43	85	73
	V2A (KJ31x)	X5A	25	150	0.86	43	85	73
	V3A	XE3A	25	150	0.63	43	91	93.5
	V4A	XDVA	9	45	0.085	27	28	60
	V5A	XPU1A	9.9	49.5	0.15	27	28	60
KJ12x/15x	V1A	X4A	19	95	0.5	43	83	93.7
		XE3A	16.3	81.5	0.35	43	83	93.7
	V5A	XPU1A	9.9	49.5	0.15	27	28	60
KD010	V1A	X4A	25	150	0.7	43	91	93.5
	V3A	XE3A	25	150	0.63	43	91	93.5

■ Inside-booth harness (2)

Robot	Harness type	Connector name	Flexible conduit radius (mm)	Minimum cable + flexible conduit bend radius (mm)	Cable + flexible conduit weight (kg/m)	Fitting size*3 (mm)		
						D	H	W
KJ19x/24x/ 26x/31x KL262 Resin flexible conduit (Explosion-proof specification for Japan/China)	V1A	X4A	50	Fixed: 156 Moving: 260	1.22	60	116	130
	V2A	X5A		Fixed: 162 Moving: 260	1.07			
	V2A (KJ31x)	X5A		Fixed: 150 Moving: 260	1.07			
	V3A	XE3A		Fixed: 150 Moving: 260	0.84			
	V4A	XDVA	20	Fixed: 45 Moving: 90	0.15	30	75	90
KJ19x/24x/ 26x/31x Blade flexible conduit (Explosion-proof specification for Europe/North America/Korea)	V1A	X4A	47.5	160	2.41	83	89.5	144
	V2A	X5A			2.26			
	V3A	XE3A			2.03			
	V4A	XDVA	23	65	0.59	27	28	60
	V5A	XPU1A			0.65			
KJ12x/15x Resin flexible conduit (Explosion-proof specification for Japan/China)	V1A	X4A	50	Fixed: 110 Moving: 230	1.06	60	116	130
KJ12x/15x Blade flexible conduit (Explosion-proof specification for Europe/North America/Korea)	V1A	X4A	47.5	160	2.25	83	89.5	144
	V5A	XPU1A	23	65	0.65	27	28	60
KD010 Resin flexible conduit	V1A	X4A	50	Fixed: 150 Moving: 260	0.91	60	116	130
	V3A	XE3A			0.84			

*2 Connector size

*3 Fitting size

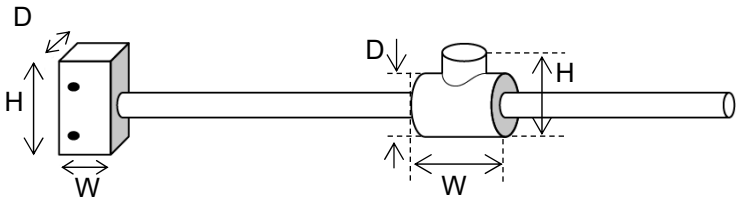


Controller side Robot side

■ External axis harness

Robot	Harness type	Connector name	Flexible conduit radius (mm)	Minimum cable + flexible conduit bend radius (mm)	Cable + flexible conduit weight (kg/m)	Connector size*4 (mm)			Fitting size*4 (mm)		
						D	H	W	D	H	W
KJ12x/15x/19x/24x/26x/31x KL262 KD010 Resin flexible conduit (Explosion-proof specification for Japan/China)	V6A + V7A V8A + V9A V10A + V11A	XJT7MA XJT8MA XJT9MA	20	Fixed: 78 Moving: 90	0.30	43	58	60	30	75	90
		XJT7EA XJT8EA XJT9EA		Fixed: 57.5 Moving: 90	0.19						
KJ12x/15x/19x/24x/26x/31x KD010 Blade flexible conduit (Explosion-proof specification for Europe/North America/Korea)	V6A + V7A V8A + V9A V10A + V11A	XJT7MA XJT8MA XJT9MA	23	78	0.74						
		XJT7EA XJT8EA XJT9EA		65	0.63						

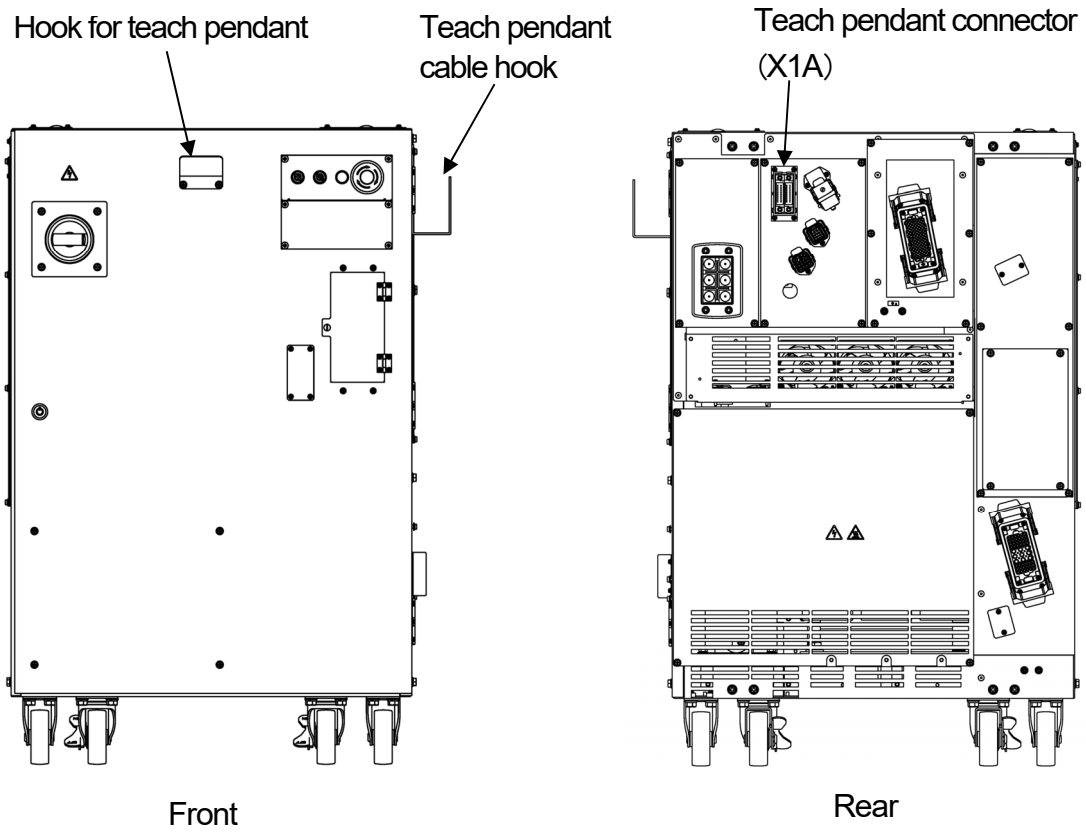
*4 Connectors and fittings are available only when a relay box is used.
When a relay box is not used, there is no connectors or fittings because harnesses are pulled in.



Controller side External axis side

6.2 Connection Between Controller and Teach Pendant

1. Connect the teach pendant cable to the connector (X1A) on the rear side of the controller. Lift the lever and insert the connector, then lower the lever to lock.
2. Hang the teach pendant on the hook for the controller's teach pendant and the cable of the teach pendant on the cable hook.

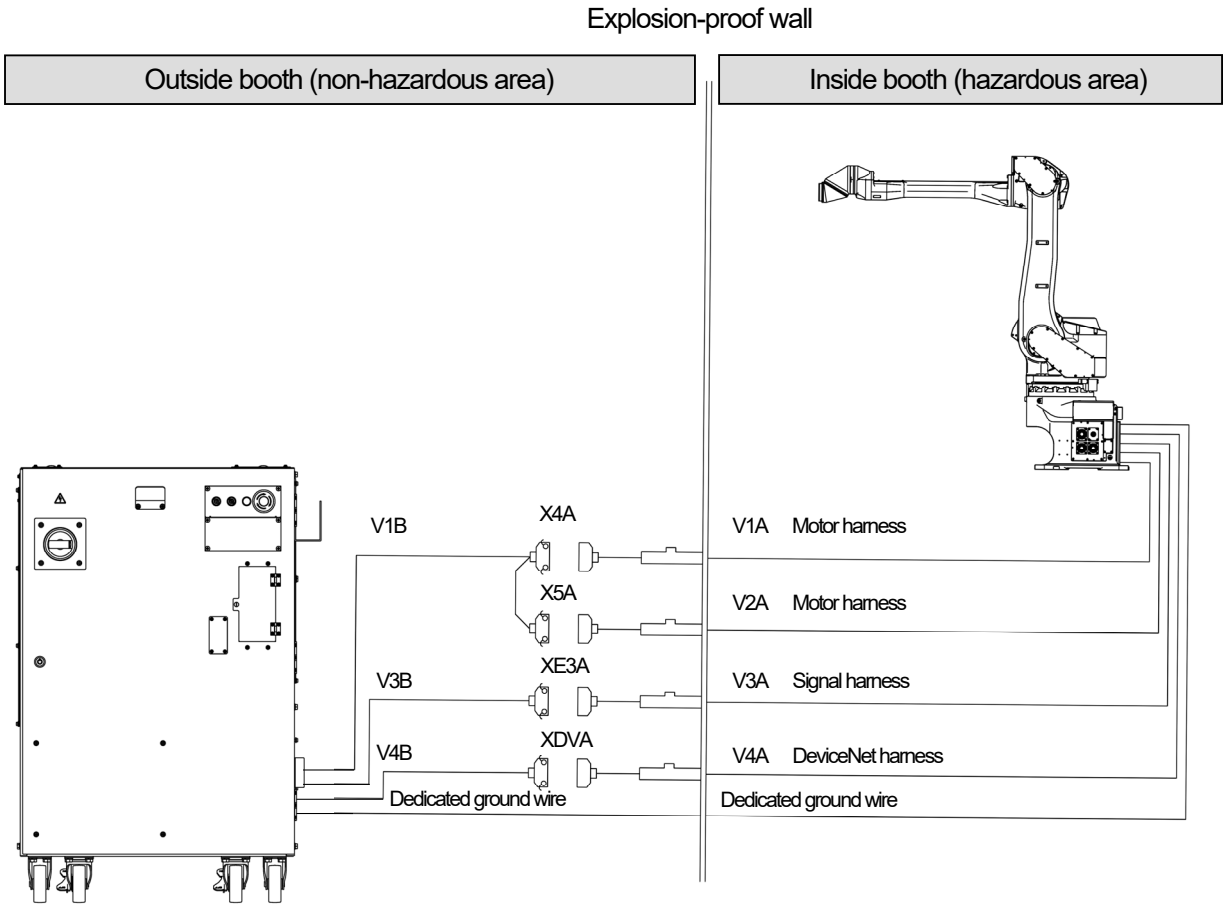


⚠ CAUTION

Do not hang anything other than a teach pendant or cable on the hook.

6.3 Connection of Dedicated Ground Wire Between Controller and Arm

For the explosion-proof specification for North America and Europe, connect the controller and robot arm with a dedicated ground wire.



1. Material specification of dedicated ground wire

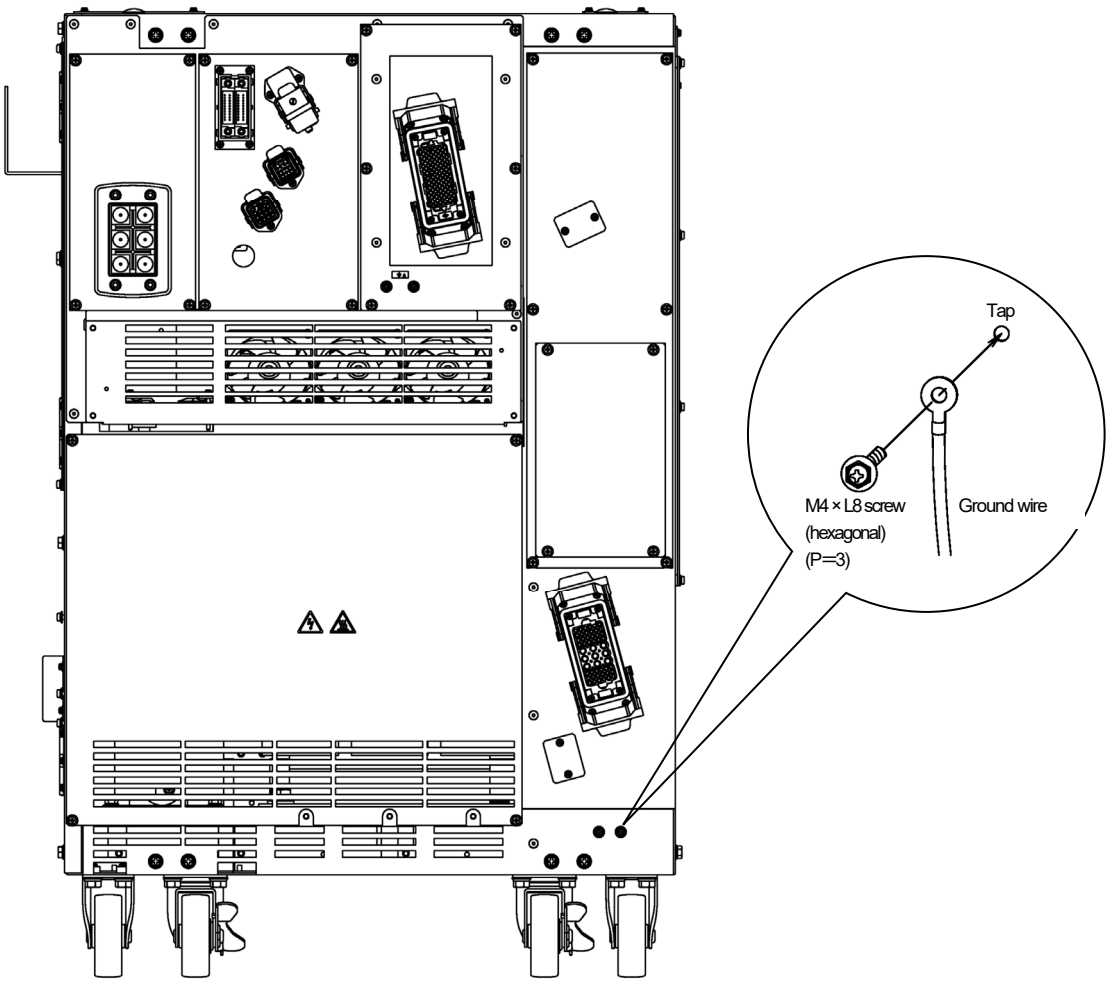
   UL1015AWG10 (5.5 sq) green/yellow (green/yellow color ratio: ratio of one color to the other must be within 30 to 70%.)

   [In North America, green wire can also be used.]

⚠ WARNING

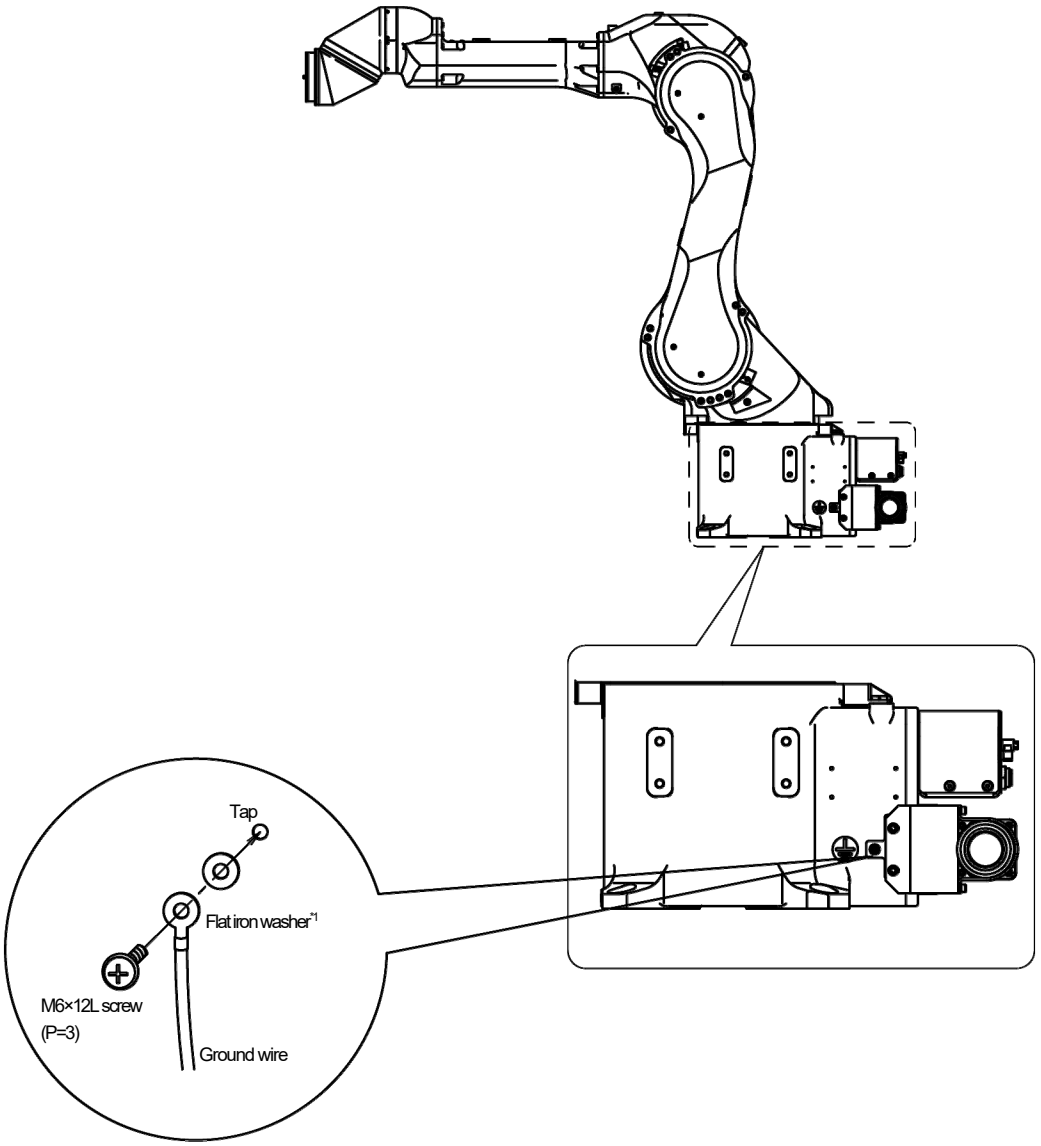
In the case of the North America and Europe explosion-proof specification, a dedicated ground wire is necessary in order to conform to the explosion-proof standard. Without connecting a ground wire or connecting it incompletely may cause an explosion or a fire, so make sure to connect it securely.

2. Connection with the controller



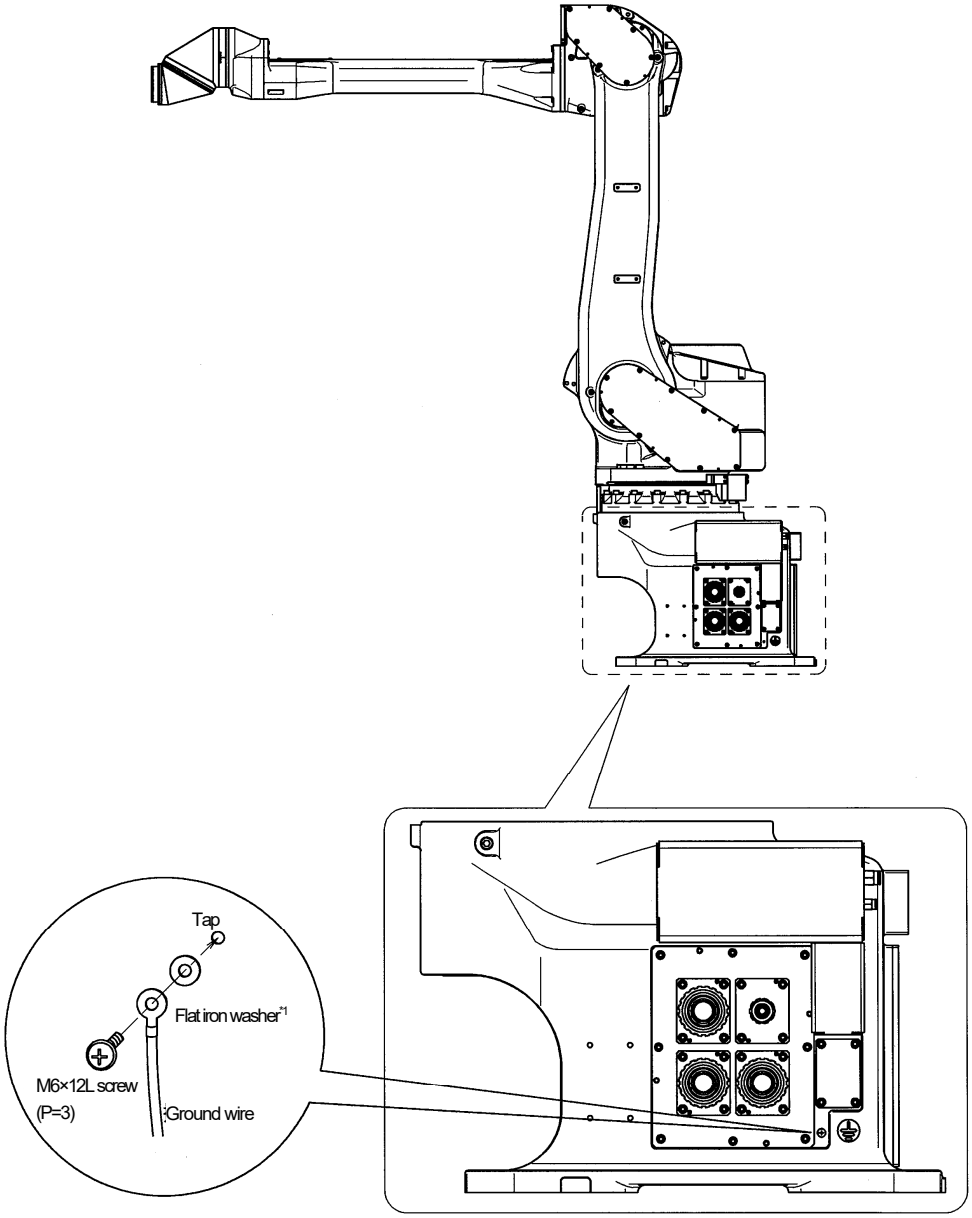
3. Connection with the arm

(1) KJ125/155



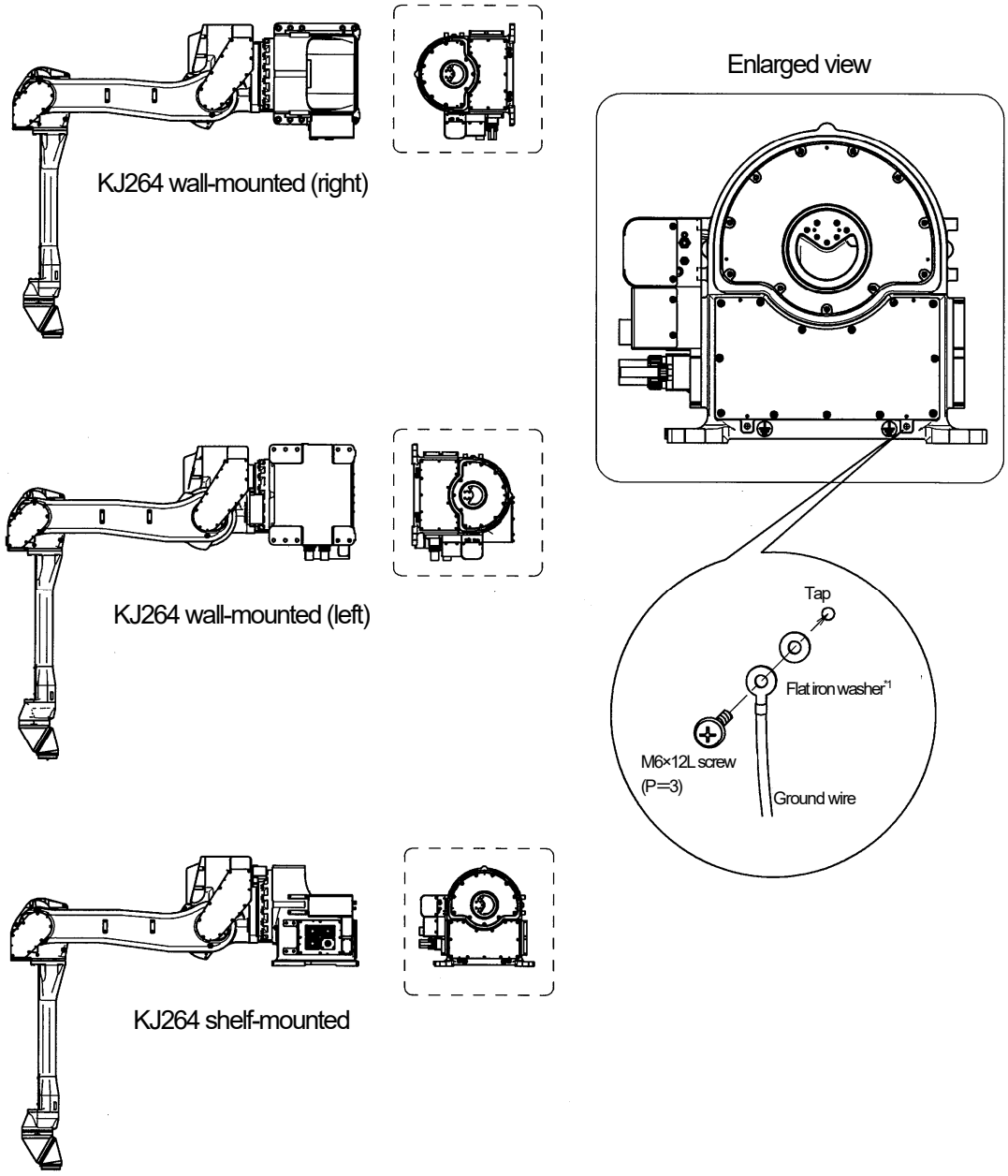
*1 Insert a flat iron washer between the arm unit and the ground wire in order to ground securely and prevent corrosion. The figure shows the case of KJ155, but the connection point of the ground wire for KJ125 is the same.

(2) KJ194/244/264/KL262 (floor-standing specification)



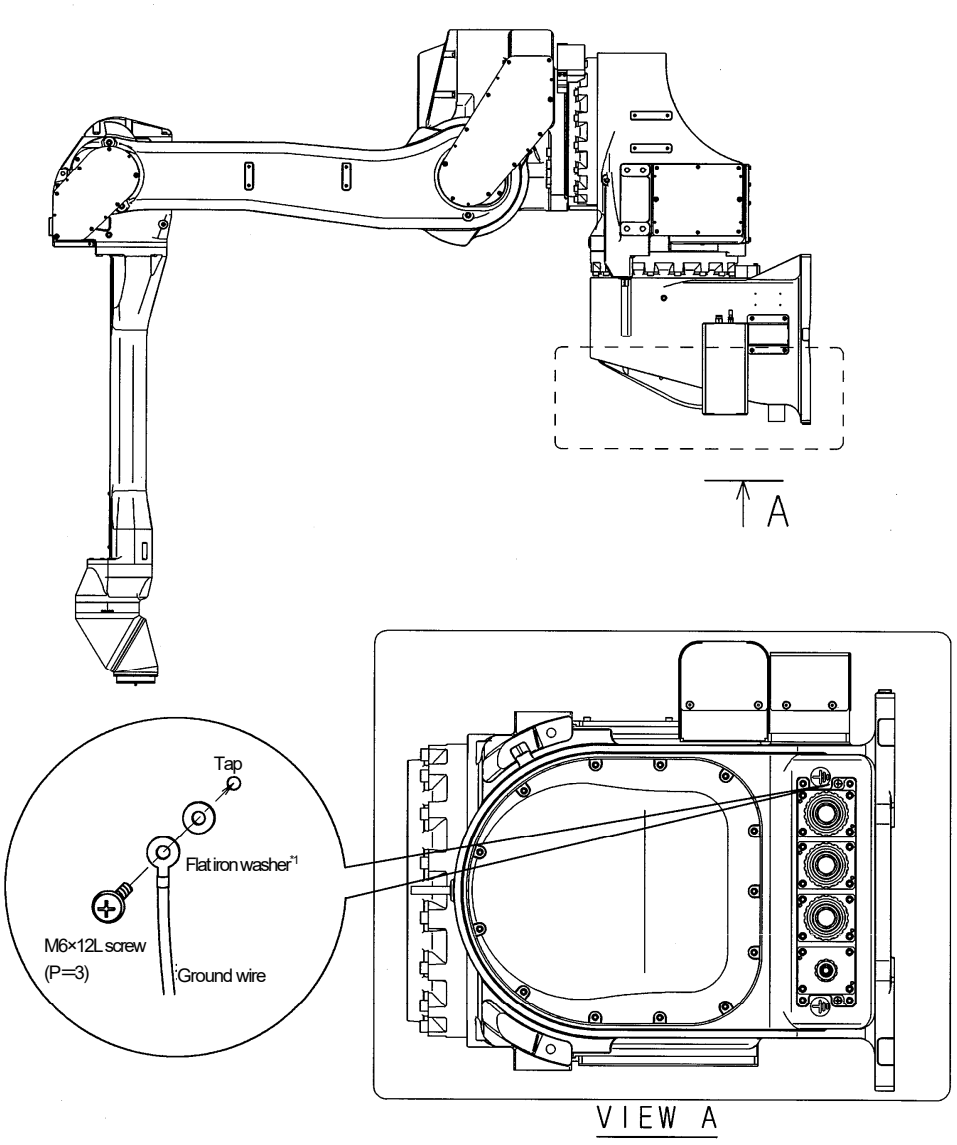
*1 Insert a flat iron washer between the arm unit and the ground wire in order to ground securely and prevent corrosion. The figure shows the case of KJ264, but the connection point of the ground wire for KJ194/244/KL262 is the same.

(3) KJ194/244/264/KL262 (wall-mounted specification, shelf-mounted specification)



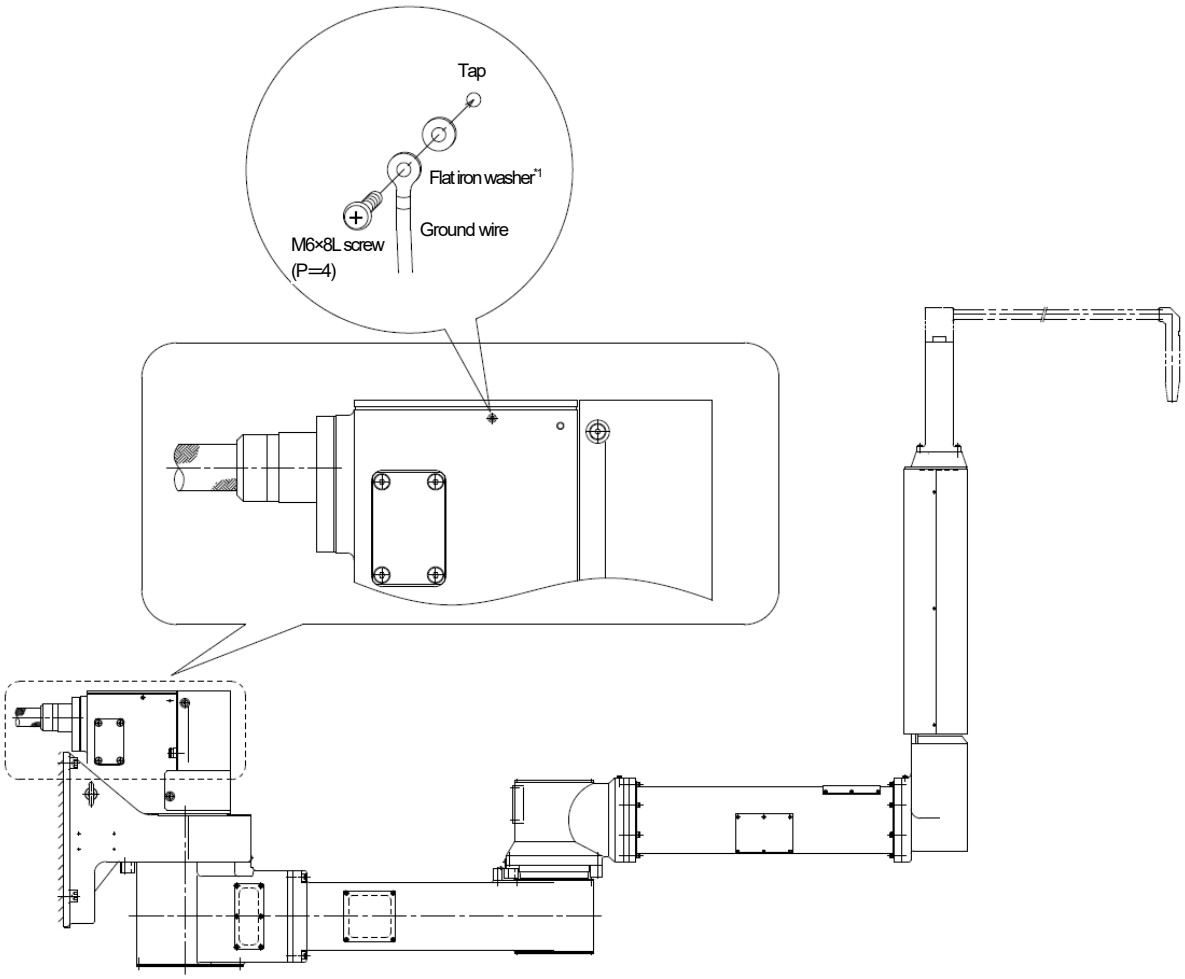
*1 Insert a flat iron washer between the arm unit and the ground wire in order to ground securely and prevent corrosion. The figure shows the case of KJ264, but the connection point of the ground wire for KJ194/244/KL262 is the same.

(4) KJ312/314



*1 Insert a flat iron washer between the arm unit and the ground wire in order to ground securely and prevent corrosion. The figure shows the case of KJ314, but the connection point of the ground wire for KJ312 is the same.

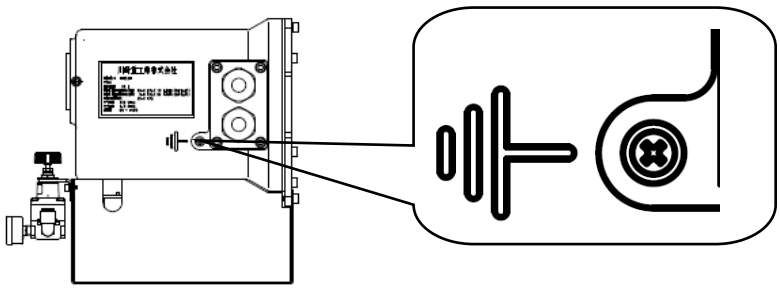
(5) KD010



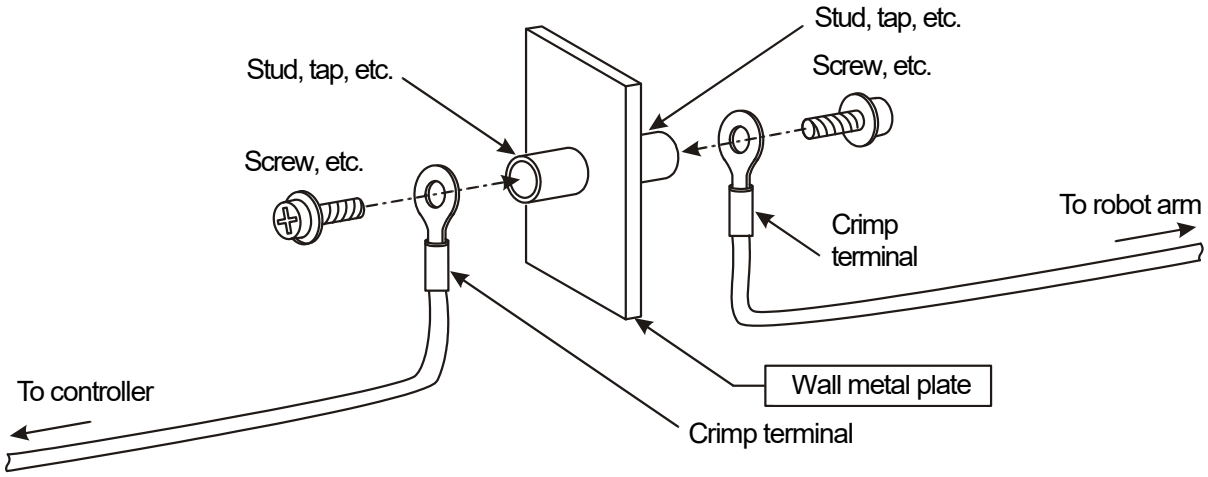
*1 Insert a flat iron washer between the arm unit and the ground wire in order to ground securely and prevent corrosion.

4. Connection with the external axis motor unit

If the separate harness between the robot/external axis branch box and the external axis motor unit exceeds 10 m, connect the external axis motor unit and class D grounding with a dedicated grounding wire.



5. When using metal plate for the explosion-proof wall



7 Connection of External Power

Strictly observe the following precautions when connecting the external power.

DANGER

1. **Before connecting an external power supply, make sure that the external power supply for the controller is turned off. Connecting while powered on could cause an electric shock.**
2. **Until the external power supply connection is completed, put a tag on the breaker indicating that work is in progress or assign another technician for supervision to ensure that the breaker will not be turned ON.**

WARNING

1. **Check that the specification of the power supply connected to the controller is the same as the stated specification on the rating plate. Connecting power supplies with different specifications may cause the internal electrical components to fail.**
2. **Always provide grounding as a countermeasure against electric shock and noise.**
   (F25) ···Two types of grounding are required: Class A (10 Ω or less) and Class D (100 Ω or less). Class A grounding is particularly important to maintain intrinsically safe explosion-proof performance. Be sure to connect each ground line to each specified place. Use ground wire of recommended cable size or above, as shown in "3.3 Controller Specification."
   (F35/F45) ···Protective earthing (PE) is required. This is also important to maintain intrinsically safe explosion-proof performance. Be sure to connect the ground line to the specified place. Use ground wire of recommended cable size or above, as shown in "3.3 Controller Specification."
3. **Grounding should never share ground wires or negative electrodes (base material) with welding machines, etc.**
4. **Be sure to observe the following when arc welding.**
   (1) Connect the negative electrode (base material) on the power supply used for welding directly to the base material or to the jig.
   (2) Never have the main robot unit and the controller share grounding, and ensure they are grounded in isolation of each other.
5. **Before turning on the external power supply, ensure that the power supply for the controller is connected securely, and that all covers are mounted correctly. Failure to do so could lead to electric shock.**

⚠ CAUTION

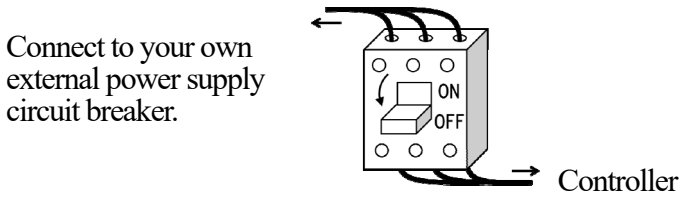
1. **Be sure to use an external power supply which meets the specifications of the controller for instantaneous power interruptions, voltage fluctuations and capacity, etc. In the event of instantaneous power interruption from the external power supply, or in the event of voltage fluctuations exceeding the specification range, the power supply monitoring circuit will operate, cutting off power and generating an error.**
2. **If there is a risk of noise from the external power supply becoming mixed in, reduce the noise level by adding a noise filter or similar.**
3. **Check first that there are no devices with poor noise tolerance*1 in the vicinity. Devices with poor noise tolerance can malfunction due to the effects of PWM noise generated by the robot motor.**
4. **The robot's external power supply switch (breaker) should not be used in combination with welding machines or other power equipment.**
5. **To prevent electric leakages, a time-delay electric leakage breaker (with a current sensitivity of 100 mA or higher) should be used as the external power supply switch.**
6. **If there is a risk of voltage surges from the external power supply such as those caused by lightning surges, reduce the surge voltage level by adding a surge absorber or equivalent.**
7. **The surge protection device (SPD) used for the equipment must be compliant with NFPA79.**

*1 Proximity switch directly connected with power line etc. may suffer from the influence.

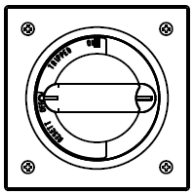
1. Connection of external power

Connect the external power according to the following procedure.

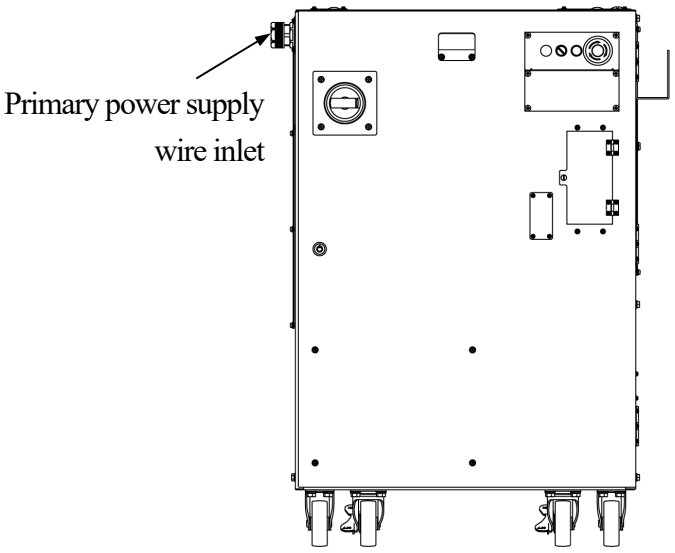
1. Turn OFF the external power for the controller.

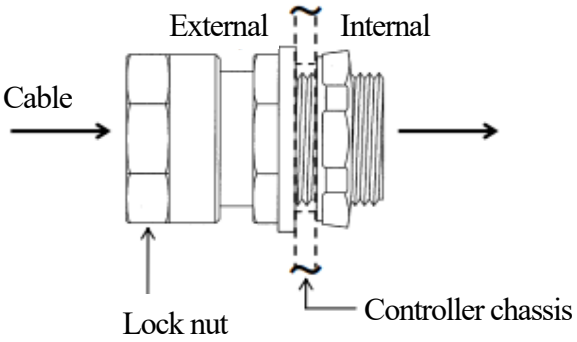


2. Set Controller Power switch on the controller to the OFF side without fail.



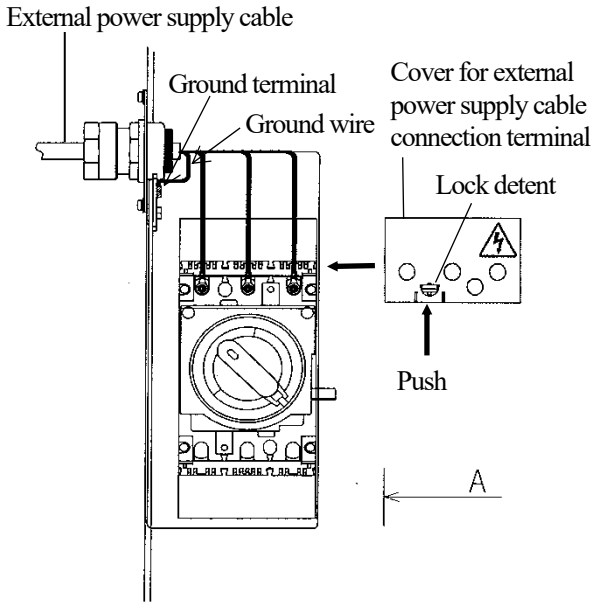
3. Run the primary power cable through the controller's primary power supply wire inlet.





⚠ CAUTION

1. **Confirm current requirements and select a power cable with adequate capacity. (See "3 Appearance and Specification of Robot Controller.")**
2. **Do not install wire that is too small in diameter, the voltage may drop or the cable may overheat.**
3. **Ensure that the ground is grounded. Failure to do so could lead to electric shock in the event of electrical leakage.**



4. Attach a round, crimp-type terminal on the end of the external power supply cable. Use a crimp terminal with insulator on the crimping part so that the metal part is not exposed.

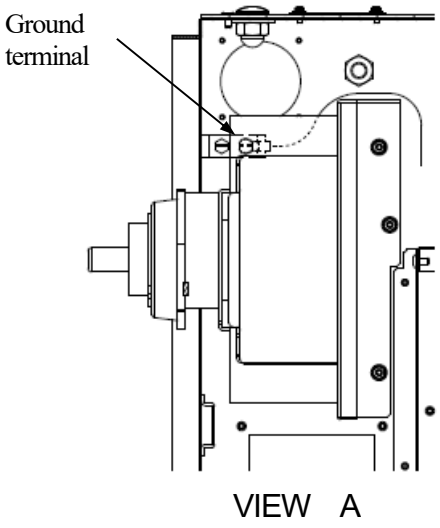
Note For the F35, remove the screws securing the cover for the external power supply cable connection terminals.

5. Connect the external power supply cable to the breaker terminals (three locations) and the dedicated ground terminal.

⚠ WARNING

Tighten the terminals firmly. Operating with loose terminals may lead to electric shock, robot malfunction, or electrical system failure.

Connect the ground wire to the ground terminal as shown below.



6. Mount the cover for external power supply cable connection terminal.

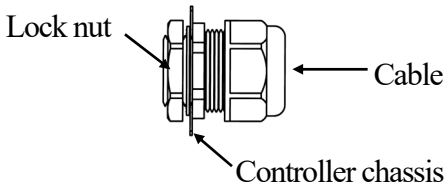
Note For the F35, secure the cover for the external power supply cable connection terminals with screws.

⚠ WARNING

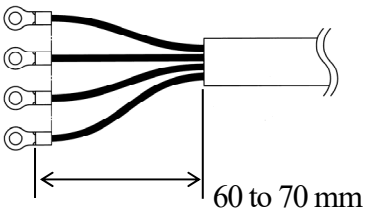
Make sure to mount the cover for external power supply cable connection terminal when the wiring is complete. Failing to do so may lead to electric shock due to accidental contact with the terminals.

■ Notes

- A seal connector for inserting external power supply wiring is provided on the left side of the controller. Use power cables with a diameter of between ⌀16 and ⌀20.



- Leave a cable sheath clearance of between 60 and 70 mm when inserting power cables from the right side of the controller.



- Use a crimp terminal when connecting to breakers. When using round or Y type terminals, use M8 for the F35 only, and use terminals for M5 screws for everything else.

- Source separately a seal connector which matches the diameter of the cable if the cable diameter is larger than ⌀20. The wire inlet hole diameter on the external power supply plate is ⌀28.

- The electronic components inside the controller may fail if the seal connector is not used or if the seal connector does not match the cable diameter and a gap is created. Make sure to insert cables so that no gaps are created.

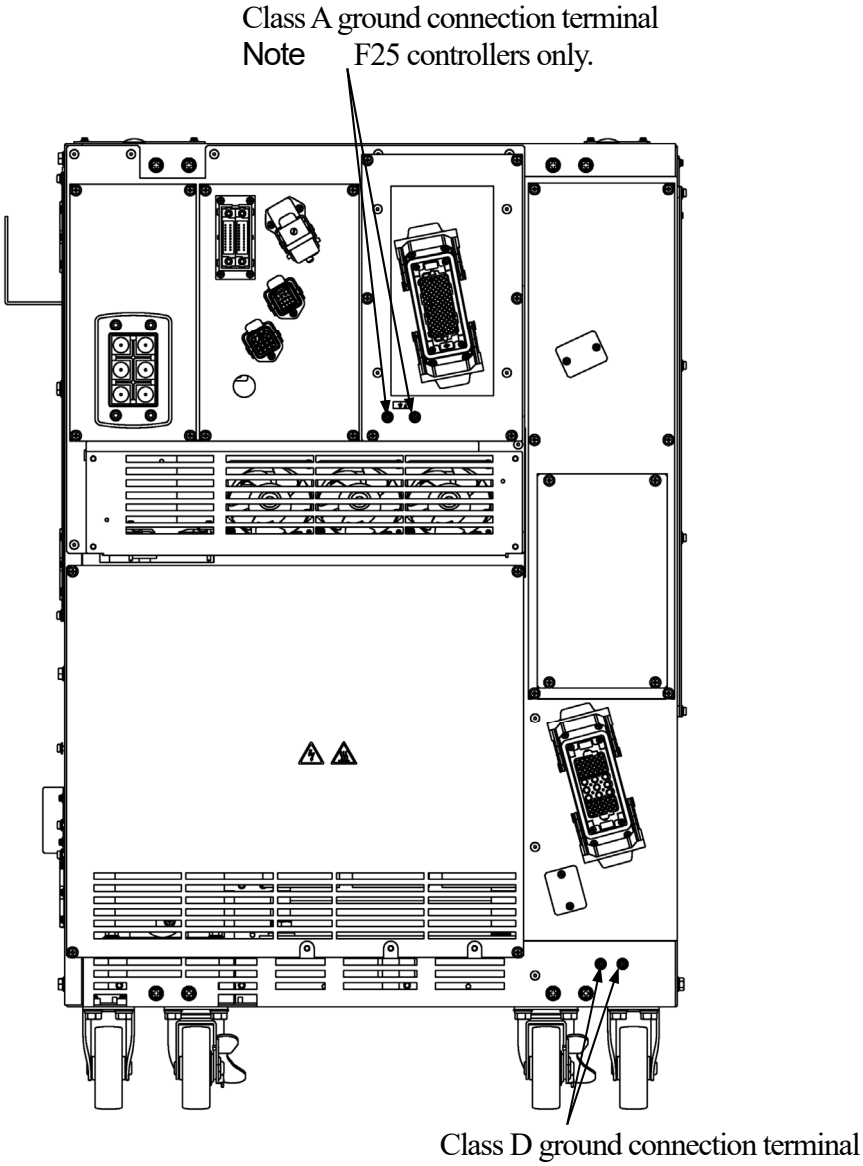
2. Connection of ground wire

F25 controller:
Use Class A ground wire for the Class A ground connection terminal, and Class D ground wire for the Class D ground connection terminals.

F35, F45 controller:
Use Class D ground wire for the Class D ground connection terminals.

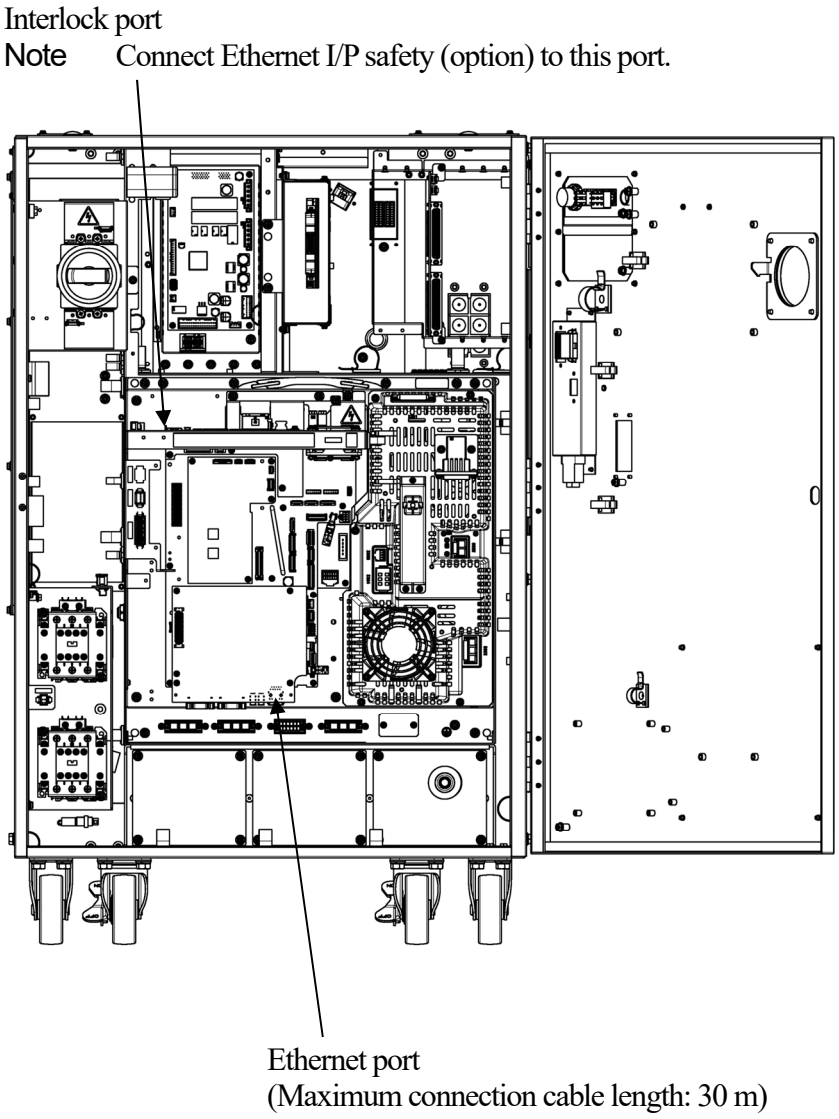
WARNING

Class A grounding is important to maintain intrinsically safe explosion-proof performance, so make sure to connect it.



8 Connection of Peripheral Control Equipment and Devices

When connecting the peripheral equipment and devices to the controller, refer to the figure below.



8.1 Cautions to Observe When Connecting

⚠ DANGER

1. **Prior to connecting the external I/O, check to make sure that the controller and external devices are all powered OFF. Connecting while powered ON could cause an electric shock.**
2. **Until the external I/O connection is completed, put a tag on the breaker indicating that work is in progress or assign another technician for supervision to ensure that the breaker will not be turned ON.**

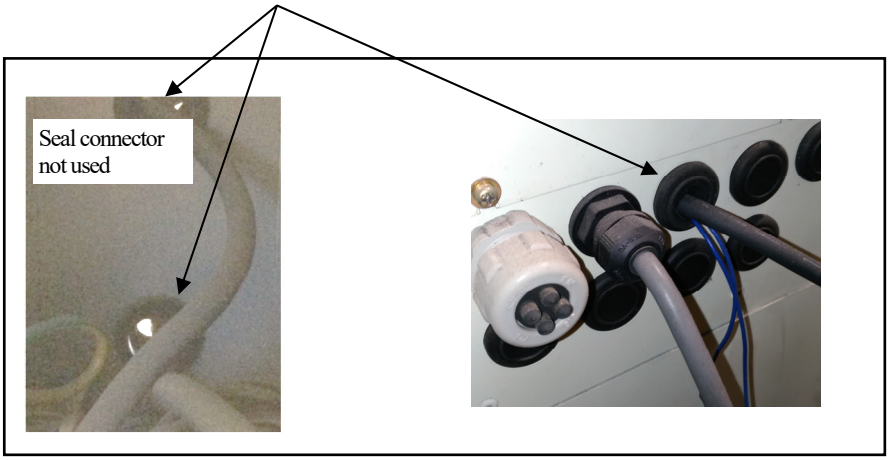
⚠ CAUTION

1. **Take the necessary noise countermeasures on equipment with external I/O connections to the controller. Electrical noise that interferes with the I/O signals may cause malfunction or damage to the electrical system.**
2. **Do not mistake pin Nos. on the connectors when connecting external I/O. Misconnecting pins may cause breakdown of the electrical system.**
3. **Prevent people or equipment (forklift, etc.) from stepping on or riding over the external I/O cables. Otherwise, the cable may become damaged or the electrical system may break.**
4. **Avoid wiring the external I/O cables and the power lines close together or in parallel as much as possible. Separate the cables and lines by at least 20 cm (either in or outside the controller). Electromagnetic induction noise from the robot motor cable, the power lines for peripheral equipment, welding cable, etc. may penetrate into the I/O cables and lead to malfunction.**
5. **Use a shield cable for the external I/O cable and ground the shield cable at both ends of the controller and the destination equipment.**
6. **Use the seal connector, etc. so that external I/O cables never cause insulation failure or disconnection at the inlet.**

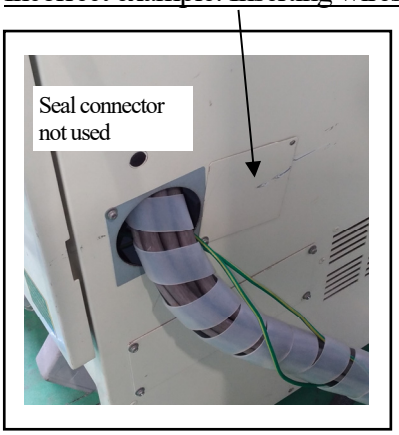
⚠ CAUTION

Use seal connectors, etc. when inserting external I/O cables. Gaps may be created if seal connectors, etc. are not used, and foreign objects may enter from outside and cause electronic components inside the controller to fail. For the protection rating of controllers, see "1.2 Installation Environments of Robot Controller."

Incorrect example: Inserting wires by opening holes on the packing



Incorrect example: Inserting wires with the controller metal plate cover opened

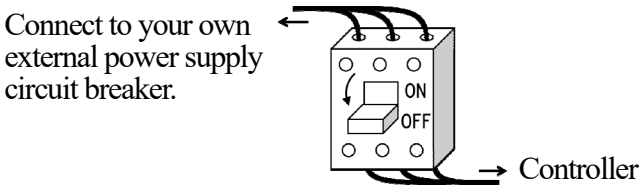


Foreign objects may enter and cause electronic components to fail if there are gaps.

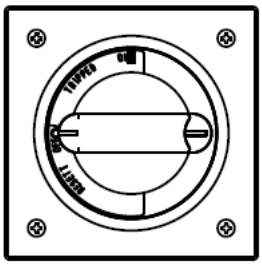
When connecting external I/O cables to the controller, use the cable entry located in the cable inlet to ensure the controller is protected from dust. Refer to the following for instructions on its use.

■ External I/O cable wiring procedure

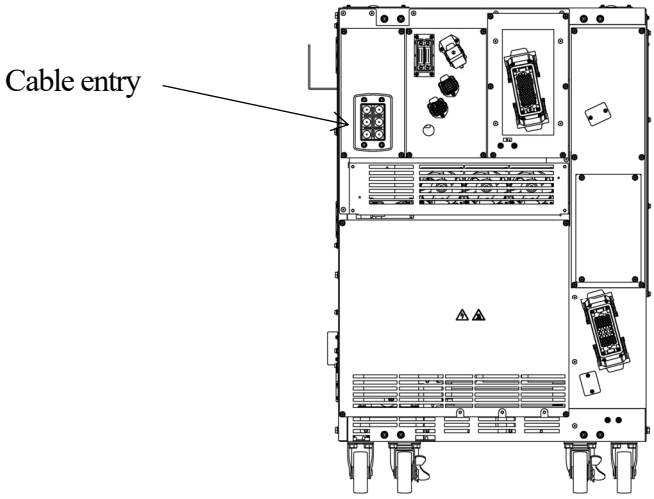
1. Turn OFF the external power supply to the controller.



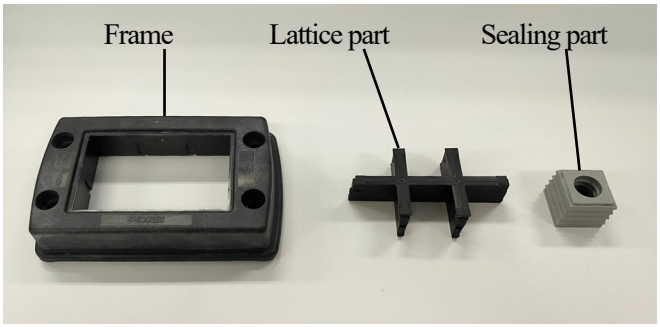
2. Turn the Controller Power switch to OFF.



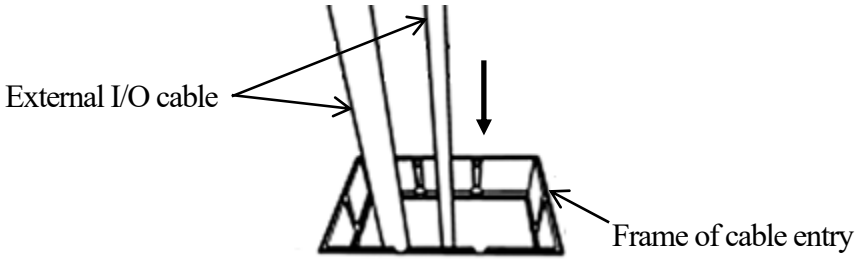
3. Remove the cable entry located on the rear of the controller.



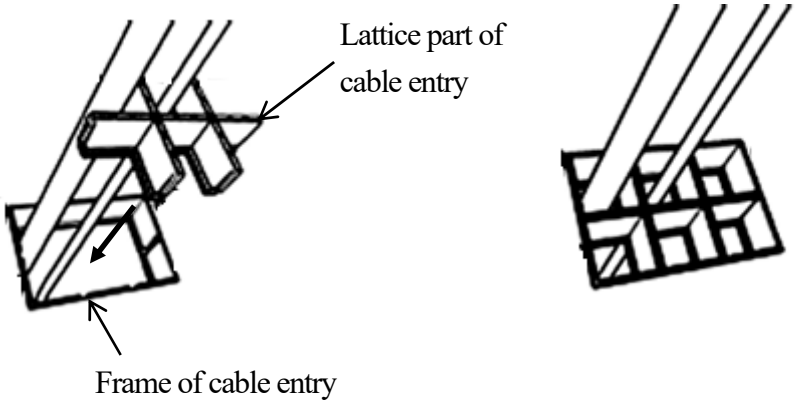
4. Separate the frame, lattice part, and sealing part of the removed cable entry.



5. Run the external I/O cable through the frame of the cable entry.

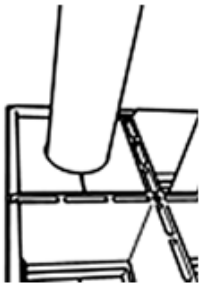


6. Attach the lattice part of the cable entry to the frame of the cable entry. When doing so, press down until a click is heard.

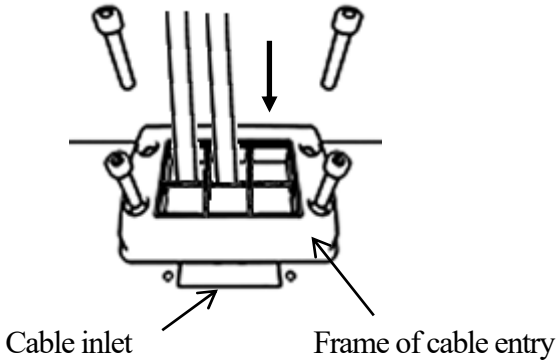


7. Attach the sealing part of the cable entry to the cable.

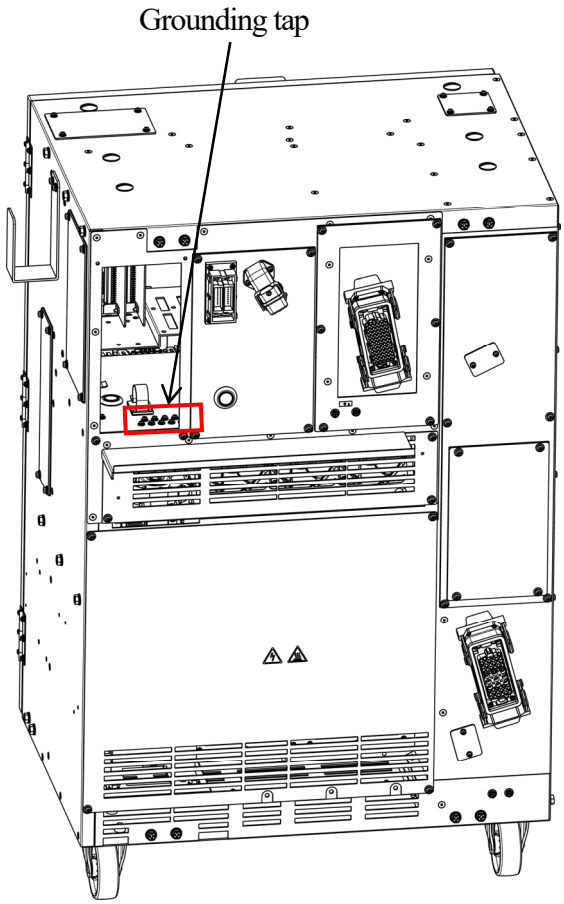
8. Push the sealing part of the cable entry into the lattice part until it is fully seated.



9. Attach the frame of the cable entry to the controller.



10. When installing a cable shield for external I/O cables, remove the screws on the plate on which the cable entry has been installed, and ground it to the grounding tap on the bottom inside of the cable entry.



11. Reattach the plate and fix it with screws.

■ Notes

Use external I/O cables with a diameter of ⌀11 to 12 mm.

It is necessary to carry out one of the following when using cables other than the above.

(1) Use the complete set of sealing parts of cable entry (option) (manufacturer: CONTACLIP) listed in the table below.

(2) Adjust the cable to an appropriate size.

When carrying out (2):

Wrap a heat shrinking tube, dustproof tape with adhesive, acetate tape, etc., around the cable sheath to adjust the cable size.

When using a foamed type dustproof tape to adjust the cable size, adjust so that the outer diameter after compression is within the allowable limit.

Applicable cable diameter	Part number	Manufacturer model	Remarks
⌀3-4	60341-0795	KDS-DE 3-4 GR	
⌀4-5	60341-0677	KDS-DE 4-5 GR	
⌀5-6	60341-0682	KDS-DE 5-6 GR	
⌀6-7	60341-0673	KDS-DE 6-7 GR	
⌀7-8	60341-0678	KDS-DE 7-8 GR	
⌀8-9	60341-0701	KDS-DE 8-9 GR	
⌀9-10	60341-0679	KDS-DE 9-10 GR	
⌀10-11	60341-0788	KDS-DE 10-11 GR	
⌀11-12	60341-0628	KDS-DE 11-12 GR	Attached before shipment
⌀12-13	60341-0789	KDS-DE 12-13 GR	
⌀13-14	60341-0790	KDS-DE 13-14 GR	
⌀14-15	60341-0791	KDS-DE 14-15 GR	
⌀15-16	60341-0680	KDS-DE 15-16 GR	
⌀4-5×2	60341-0706	KDS-DE 2 x 4-5 GR	
⌀5-6×2	60341-0792	KDS-DE 2 x 5-6 GR	
⌀5-6×3	60341-0793	KDS-DE 3 x 5-6 GR	
⌀3-4×4	60341-0794	KDS-DE 4 x 3-4 GR	

8.2 General Purpose Signal Connection

For details of connection, see the “External I/O Manual.”

8.3 Hardware-Dedicated Signal Connection

If the external emergency stop signal and the external hold signal are connected to the XES terminal block provided on the servo board (2FB board) inside the controller, a safety circuit can be configured using a hardware circuit.
For details of connection, see the “External I/O Manual.”

8.4 Safety Signal Connection

For details on connecting wires using safety I/O board, see the “External I/O Manual” and “CoreCubic-S Instruction Manual” (90201-1489).
When connecting the safety network devices and EtherNet/IP Safety, connect to the Ethernet port referring to “8 Connection of Peripheral Control Equipment and Devices.” (Supported connector: RJ45 connector) For details of the settings, see the “CoreCubic-S Instruction Manual.”

8.5 PC Connection

If a personal computer (PC) is connected, it can be used as a robot controller terminal.
For details, refer to “AS Language Reference Manual.”

- Connect a PC onto which KRterm/KCwin32 terminal software has been loaded, to the RS-232C port on the controller, using an RS-232C cable.
- Connect a PC onto which KRterm/KCwin TCPIP terminal software has been loaded, to the Ethernet port on the controller, using an Ethernet cable.

8.6 RS-232C Serial Signal Connection (Optional)

If you connect a host computer or equivalent to the RS-232C port in the controller, using an RS-232C cable, you will be able to use data communication. For details, refer to "Communication Option Manual."

8.7 Connection of Ethernet Communication Signal

It is possible to build an Ethernet LAN of 10Base-T/100Base-TX using the Ethernet port. Refer to the "Communication Option Manual" for details.

8.8 Fieldbus Connection (Optional)

Adding the fieldbus communication module (optional) to the XANB connector on top of the servo board (2FB board) inside the controller makes it possible to communicate with peripheral devices using a fieldbus network such as DeviceNet.
For details, see the "General Fieldbus I/O Usage Manual."

Kawasaki Robot Controller F Series Controller
(Explosion-proof Specification)

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2024-04 : 1st Edition

Publication : Kawasaki Heavy Industries, Ltd.
90202-1293DEA