

**Kawasaki Robot Controller  
F Series Controller**

**Installation and  
Connection Manual**

**-Arc Welding Application-**

**Robot**

Kawasaki Heavy Industries, Ltd.

## Preface

This manual describes installation and connection procedures for Arc Welding Robot which is controlled by Kawasaki Robot F series controller.

Read and understand the contents of this and safety manuals thoroughly and strictly observe all rules for safety before proceeding with any operation. Installation and connection methods in this manual apply only to arc welding equipment. For information about the installation and connection of other general robot arms, read “Installation and Connection Manual” for Robot Arm. For the installation and connection for BA series, refer to “BA Series Installation and Connection Manual – Arc Welding Application –”.

For information about the installation and connection of the controller and cables, read “Installation and Connection Manual” for Controller.

### [NOTE]

This manual is applicable to the following robots.

RA005L F60  
RA006L F60/F01  
RA010N F60/F01  
RA010L F01  
RA020N F01


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

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


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

 **DANGER**

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

 **WARNING**


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

 **CAUTION**

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

**[NOTE]**

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

 **WARNING**

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

## Safety

When installing and connecting the Arc Welding Robot, carefully read the following precautions together with the safety precautions in the “Installation and Connection Manual” for Robot Arm and Controller.

### ■ Installation Environment of Robot Arm

1. Install the safety fence in consideration of not only the motion range of the robot arm but also the distance that protects operators/personnel from any possible exposure to arc spatter.
2. Provide light shield in order to protect operators/personnel from arc burning and eye injury caused by direct viewing of arc beam.
3. Do not put any flammable/combustible materials around the Arc Welding Robot.

### ■ Installation of the Robot Arm

1. Be sure to isolate the robot arm from the torch and welding wires.

### ■ Installation and Connection of Controller

1. Provide an external power switch exclusively for the robot. Do not share the switch with the welder and other equipment.
2. Use the dedicated ground (100  $\Omega$  or less). Never share the ground with welder, etc. for grounding wire or grounding electrode.
3. Never wire the motor cable and the signal cable through under the welder.
4. To avoid influence by electromagnetic noises generated from welding arc, install precision equipment, etc. away from welding arc and supply input power separately.



#### CAUTION

**When there is equipment which generates high levels of noise, such as electromagnetic contactors, brakes, solenoids and induction motors, around the installation site, attach an appropriate surge killer to them to prevent from generating the noise.**

## ■ Cable Connection

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



### WARNING

**Do not connect the primary power before connection between the robot and robot controller. Otherwise, there is a possibility of electrical shock.**



### CAUTION

- 1. Be careful not to misconnect cables when connecting the cables. Forcible connection of cables may result in damage to connectors or break in the electrical system.**
- 2. Do not step on the motor and signal cables or put objects on them. In addition, place the motor and signal cables where personnel or vehicles do not step on. If the motor and signal cables are stepped on, damage on the cables and failure in electrical system may occur.**
- 3. Separate the harness from any nearby high voltage lines (min. 1 m apart). Do not bundle or run the harnesses in parallel with other power lines. The noise generated from power lines will cause malfunctions.**

## ■ Primary Power Connection



### DANGER

**Prior to connecting the primary power, confirm that the primary power supply for the controller is cut off. To prevent primary power from being turned ON accidentally, tag the breaker and indicate clearly that work is in progress, or assign a supervisor to prevent accidents caused when someone accidentally turns ON the breaker until all the connections are complete. Connecting components while power is supplied is extremely dangerous and may cause electric shock.**



### WARNING

- 1. Connect with ground to prevent electrical noise and shock without fail.**
- 2. Use a dedicated ground (100  $\Omega$  or less) and connect via the ground wire whose size is larger than that of the recommended cable size shown below (3.5 to 8 mm<sup>2</sup>).**
- 3. Never share the ground with welder, etc. for grounding wire or minus pole (base material).**
- 4. When using the minus pole of the weld power supply (base material) for arc welding, etc., connect it to a jig or directly to base metal. Do not share the ground with the robot and the robot controller, and isolate without fail.**
- 5. Prior to turning ON the primary power to controller, make sure the power supply is connected and all the covers are reattached properly without fail. Failure to do so may cause electrical shock.**

**CAUTION**

1. **Prepare primary power that meets the specifications of the controller in terms of momentary power interruption, voltage fluctuation, power capacity, etc. If the power is interrupted or the voltage goes out of the controller's specified range (above/below ratings) instantaneously, then the power monitoring circuit activates cutting off the power, and an error is returned.**
2. **If the primary power may emits electrical noises, set up a noise filter to reduce the noise level.**
3. **Provide a primary power switch (breaker) exclusively for the robot, do not share the switch with welder, etc.**
4. **To prevent electrical leakage, attach a breaker with anti-leak specification on the primary power switch. (Use a Time Delay Relay with sensitivity of 100 mA or more.)**

**■Connection with Welding Equipment**

1. Use only the welding cable with no damages.
2. Use and handle the gas cylinders with caution.
3. Firmly fix the gas cylinders so as not to fall over.
4. Use only the gas hose and water-cooling torch hose with no damages.
5. Conduct gas and water piping without gas or water leakage.
6. When using a gas flowmeter, check if it is for gas cylinders or for the factory piping, and use the appropriate flow meter.

**■Arc Welding Work**

1. Enclose the source of arc ray with welding screen/plate. Arc rays can injure eyes and burn skin. Never look at the arc ray directly.
2. All operators and supervisors must wear welding glasses or masks with sufficient protection grade to protect their eyes from arc ray, spatter and slag or filler wires.
3. Use suitable welding curtain to protect the eyes of nearby persons from the arc rays.
4. Always wear welding glasses in a welding area.
5. Wear appropriate protective clothing such as leather gloves, long-sleeve shirts, leggings, leather apron, etc. in order to avoid burns caused by hot workpieces after welding and by spatter and slag.
6. Do not use flammable materials such as paint, grease, etc. near the welding area.
7. Remove flammables and combustibles well away from the welding area.
8. Always have someone watch for fire.
9. Use enough ventilation to keep hazardous fumes and gases away from the breathing zone.
10. When welding, keep your head as far away as possible from the fume to minimize the amount of fume inhaled.
11. To prevent intoxication or to eliminate possible oxygen deficiency, supply adequate ventilation by an exhaust system located as close to the work area as possible or by respiratory protection per pertinent laws and regulations, such as Industrial Safety and Health Law, Ordinance on Prevention of Hazards due to Dust.
12. Properly insulate and ground each of the required devices according to instructions for each device.
13. Electric arc welding produces electromagnetic field which may have bad influences on the pacemaker. Therefore, persons with pacemakers should not go near welding operations until they have consulted their doctor.
14. The electromagnetic noise produced in arc welding may cause malfunction of peripheral devices without noise protection.

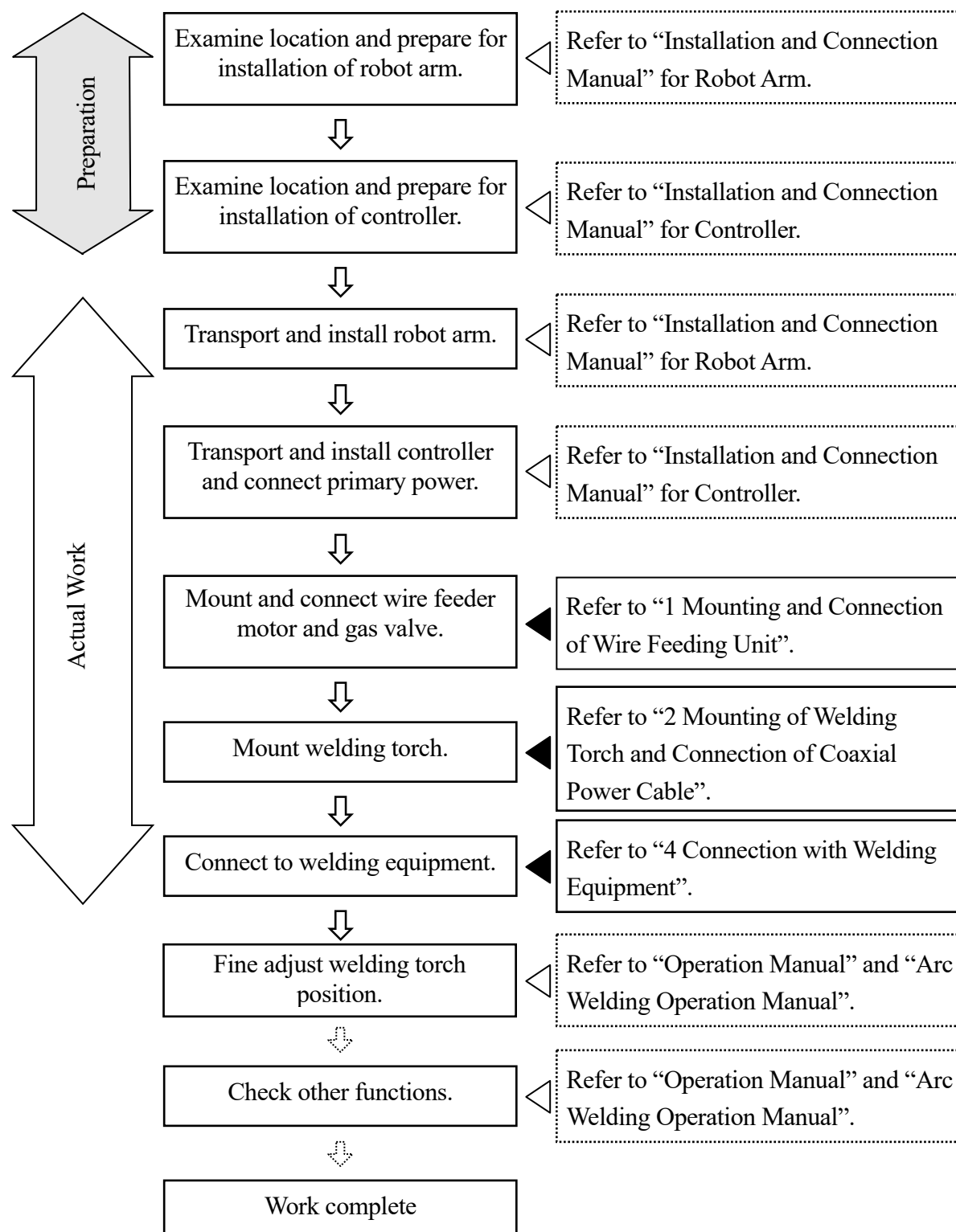


15. When using the I/O function of the arm ID board together with high frequency equipment, avoid close parallel runs and overlapping runs of the coaxial power cable and the I/O cable to keep electrical noise from affecting the wiring.
16. Use the laser sensor in accordance with the instructions from the manufacturer when using laser welder, laser sensor and so on.
17. Incorrect usage of laser devices may result in severe injuries. Especially, take proper eye safety precautions, since there is a risk for blindness. Laser beams may also burn skin, clothing or ignite surrounding volatile substances such as alcohol.

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## Work Flow at Installation and Connection of Arc Welding Robot



## 1 Mounting and Connection of Wire Feeding Unit

This manual describes how to mount and connect the wire feeding unit, taking a DAIHEN (OTC) wire feeder CMRE-742 as an example. For other wire feeders, give due consideration or contact Kawasaki.



### WARNING

1. Before starting mounting of wire feeder motor and gas valve, move the robot arm to a place where the work can be done easily and turn OFF the motor power and the controller power.
2. Keep isolation between the wire feeder motor and the robot arm by bakelite board etc. without fail. Otherwise welding current might short to the robot arm due to the isolation failure.

### 1.1 Installation on Wall/Ceiling

The wire feeding unit mounting location on a wall-mounted or ceiling-mounted robot depends on the operation conditions. Carry out an appropriate installation procedure in consideration of the workpiece and other obstacles.

### 1.2 Installation on Floor/Shelf

#### 1.2.1 RA006L, RA010N/L, RA020N

Follow the procedures below to mount wire feeding unit on the shoulder part of arm. The fixing brackets are separately required for mounting. Be sure to use them.

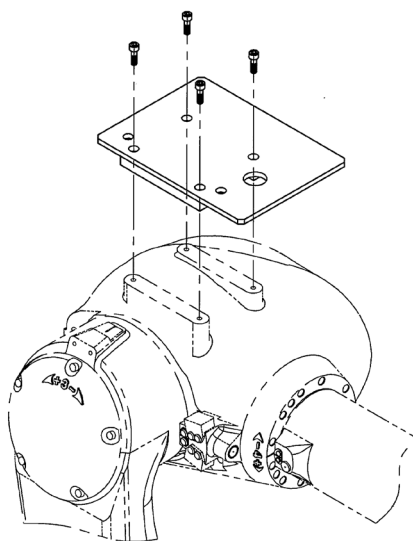


Fig. 1.1 Mounting of fixing bracket  
(Procedure 1)

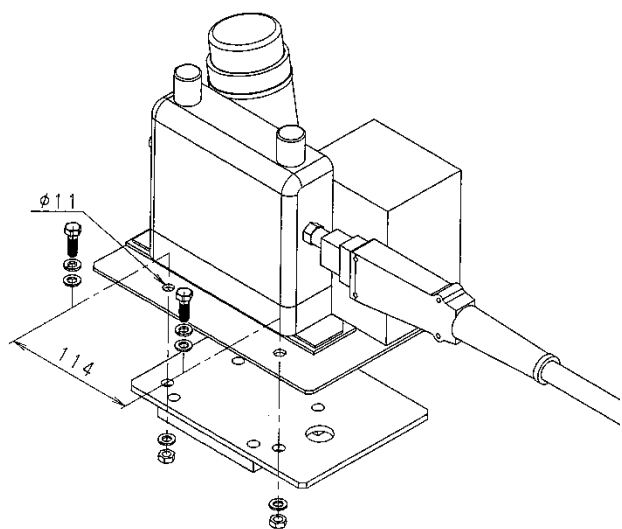


Fig. 1.2 Mounting of wire feeding unit  
(Procedure 2)

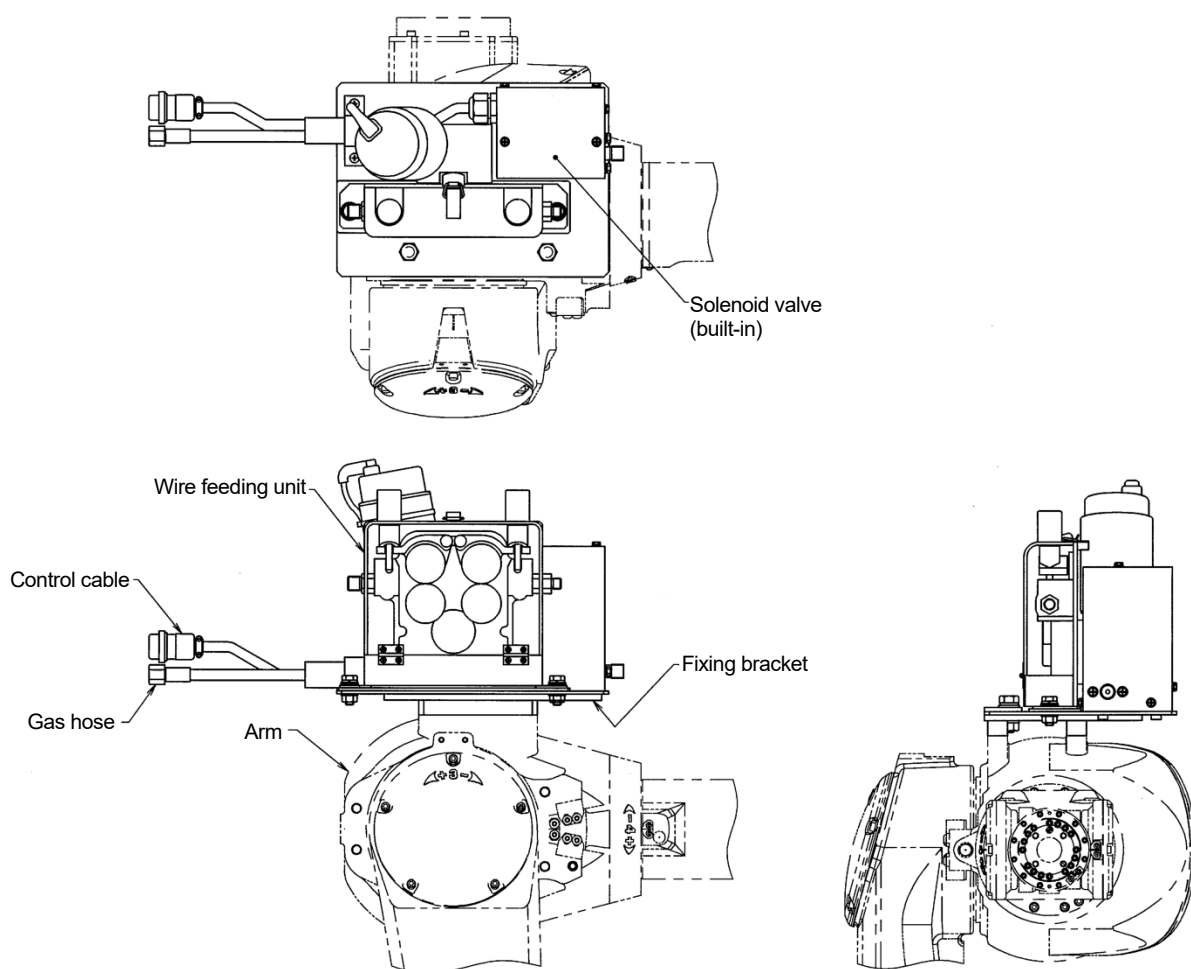


Fig. 1.3 Connection of control cable connector (Procedure 3)

1. Referring to Fig. 1.1, mount the fixing bracket onto the shoulder part of arm.
2. Referring to Fig. 1.2, mount the wire feeding unit to the fixing bracket. For mounting, use the hexagon head bolts and washers and nuts provided with the wire feeding unit.
3. Referring to Fig. 1.3, connect control cable (the motor cable, the encoder cable and the voltage detection cable) connector of wire feeding unit with the specified connector.

### 1.2.2 RA005L

For RA005L, the wire feeding unit cannot be mounted on the arm. Accordingly, mount it separately from the arm by yourself with consideration of workpieces and other obstacles.

## 2 Mounting of Welding Torch and Connection of Coaxial Power Cable

This manual describes how to mount and connect the welding torch and the coaxial power cable unit, taking a DAIHEN (OTC) RT3500H and related parts as an example. For other welding torches, give due consideration or contact Kawasaki.



### WARNING

**Before mounting the welding torch, move the robot arm to a place where work can be done easily and turn OFF the motor power and the controller power of the robot controller. When replacing/mounting a welding torch that is connected to the welder, turn OFF the power to the welder before starting the work without fail.**

### 2.1 Mounting Non-Kawasaki Shock Sensor on Wrist Flange

1. Mount a torch holder and welding torch whose total weight is within the load capacity of the robot, specified in separate “Installation and Connection Manual” for Robot Arm.
2. Keep isolation between wrist flange and welding torch without fail.

## 2.2 Mounting of Shock Sensor and Torch Mounting Bracket

### 2.2.1 RA006L, RA010N

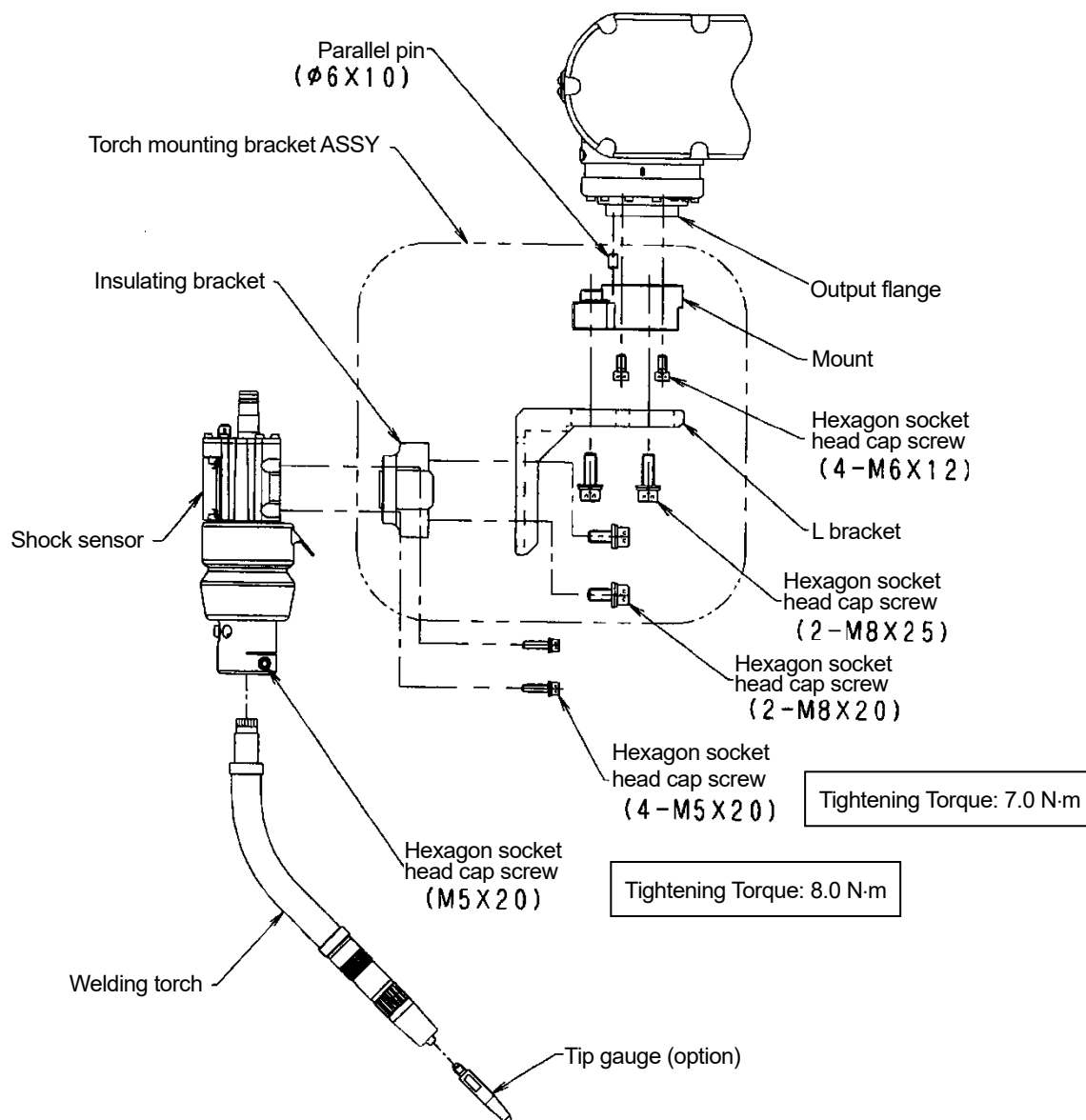


Fig. 2.1 Mounting of torch and shock sensor

1. Mount the mount onto the output flange of arm with parallel pin ( $\phi 6 \times 10$ ) and 4 hexagon socket head cap screws (M6  $\times$  12).
2. Mount the L bracket to the mount with 2 hexagon socket head cap screws (M8  $\times$  25).
3. Mount the insulating bracket to the L bracket with 2 hexagon socket head cap screws (M8  $\times$  20).
4. Mount the shock sensor onto the insulating bracket with 4 hexagon socket head cap screws (M5  $\times$  20).
5. Loosen the hexagon socket head cap screw of the shock sensor (M5  $\times$  20) to insert and fix the welding torch.

## 2.2.2 RA010L, RA020N

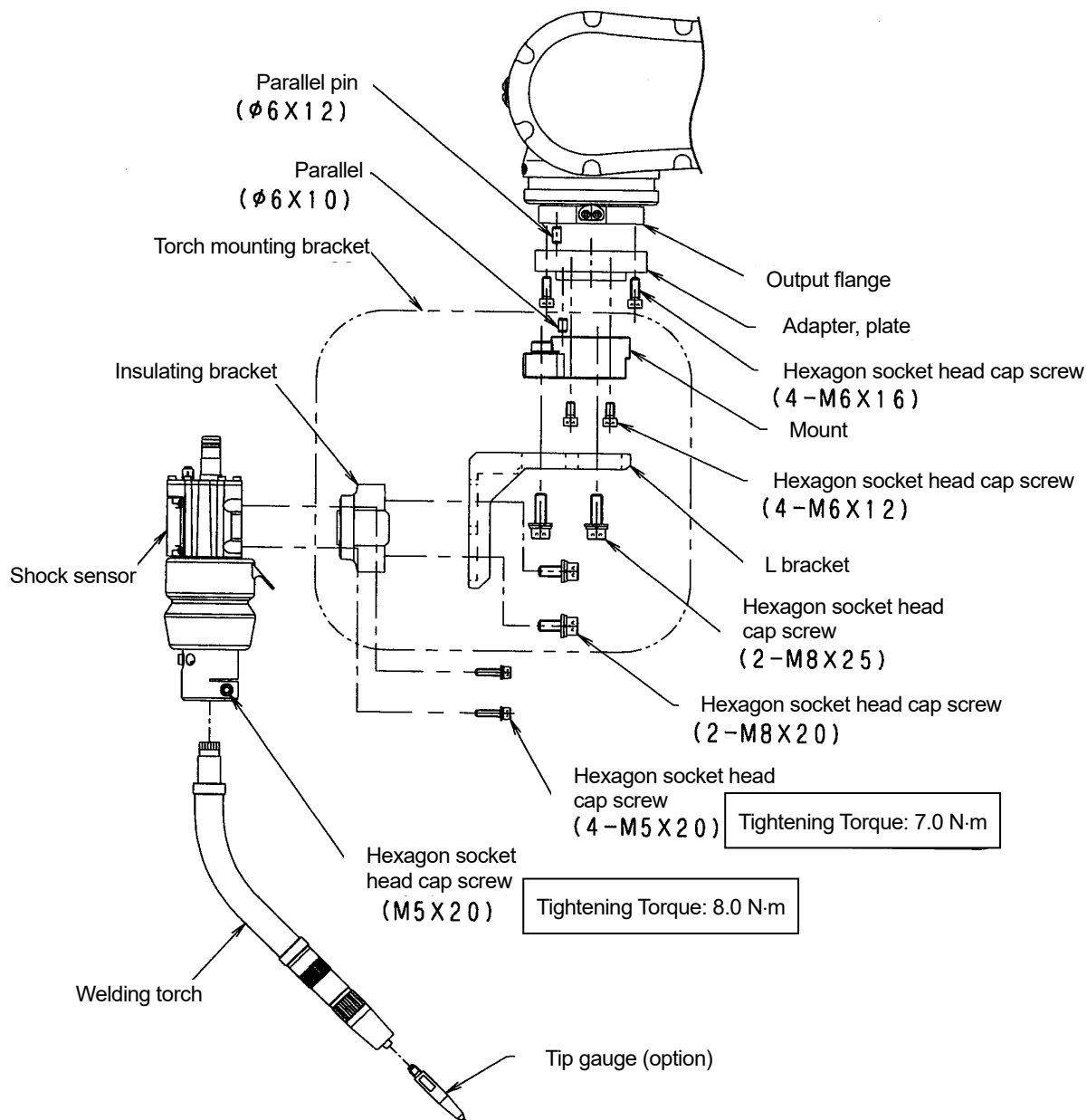


Fig. 2.2 Mounting of torch and shock sensor

1. Mount the adapter and the plate onto the output flange of arm with parallel pin ( $\phi 6 \times 12$ ) and 4 hexagon socket head cap screws (M6 $\times$ 16).
2. Mount the mount to the adapter and the plate with parallel pin ( $\phi 6 \times 10$ ) and 4 hexagon socket head cap screws (M6 $\times$ 12).
3. Mount L bracket to the mount with 2 hexagon socket head cap screws (M8 $\times$ 25).
4. Mount the insulating bracket to the L bracket with 2 hexagon socket head cap screws (M8 $\times$ 20).



5.   Mount the shock sensor onto the insulating bracket with 4 hexagon socket head cap screws (M5×20).
6.   Loosen the hexagon socket head cap screw of the shock sensor (M5×20) to insert and fix the welding torch.

### 2.2.3 RA005L

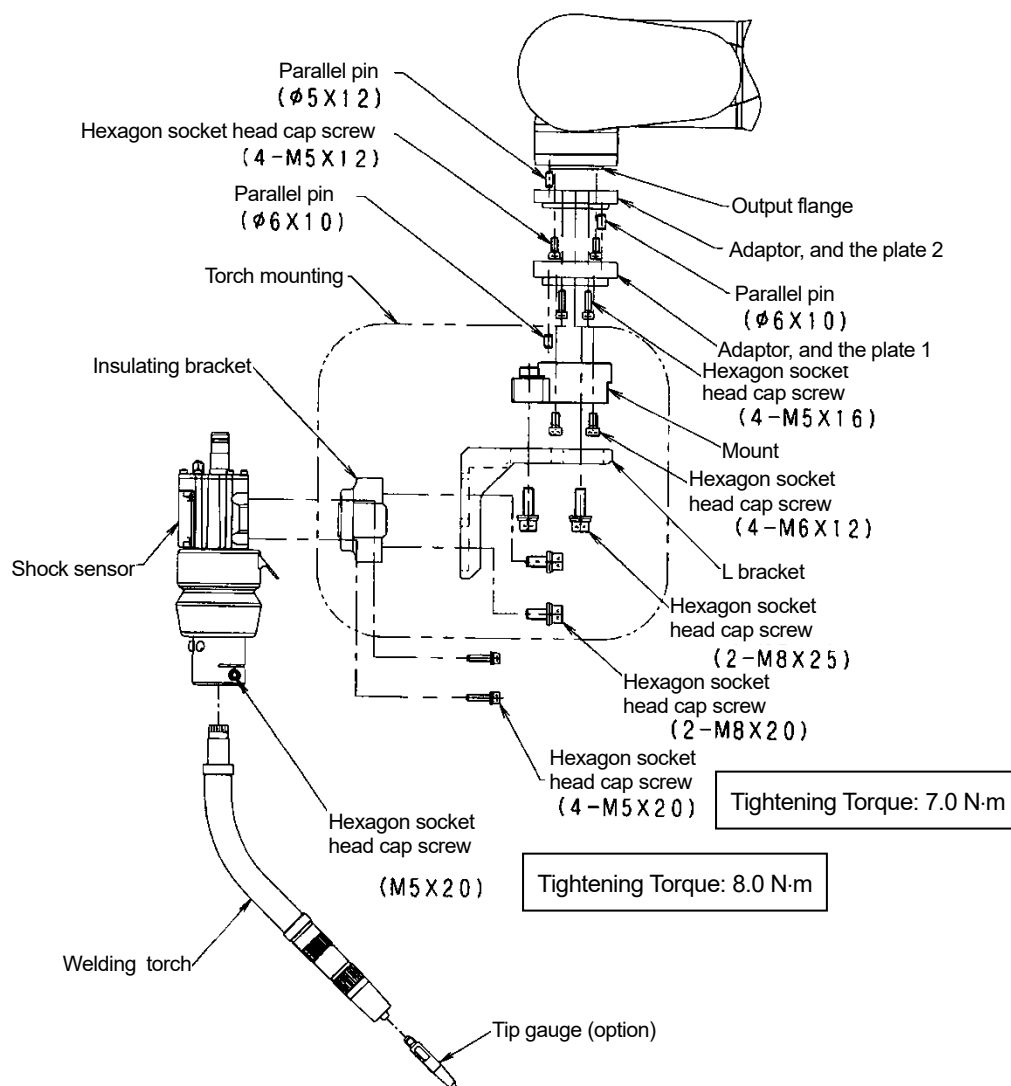


Fig. 2.3 Mounting of torch and shock sensor

1. Mount the adaptor and the plate 2 onto the output flange of arm with parallel pin ( $\phi 5 \times 12$ ) and 4 hexagon socket head cap screws (M5 $\times$ 12).
2. Mount the adaptor and the plate 1 onto the adaptor and the plate 2 with parallel pin ( $\phi 6 \times 10$ ) and 4 hexagon socket head cap screws (M5 $\times$ 16).
3. Mount the mount onto the adaptor and the plate 1 with parallel pin ( $\phi 6 \times 12$ ) and 4 hexagon socket head cap screws (M6 $\times$ 12).
4. Mount the L bracket to the mount with 2 hexagon socket head cap screws (M8 $\times$ 25).
5. Mount the insulating bracket to the L bracket with 2 hexagon socket head cap screws (M8 $\times$ 20).
6. Mount the shock sensor onto the insulating bracket with 4 hexagon socket head cap screws (M5 $\times$ 20).
7. Loosen the hexagon socket head cap screw of the shock sensor (M5 $\times$ 20) to insert and fix the welding torch.

## 2.3 Mounting of Torch Gauge (Option)

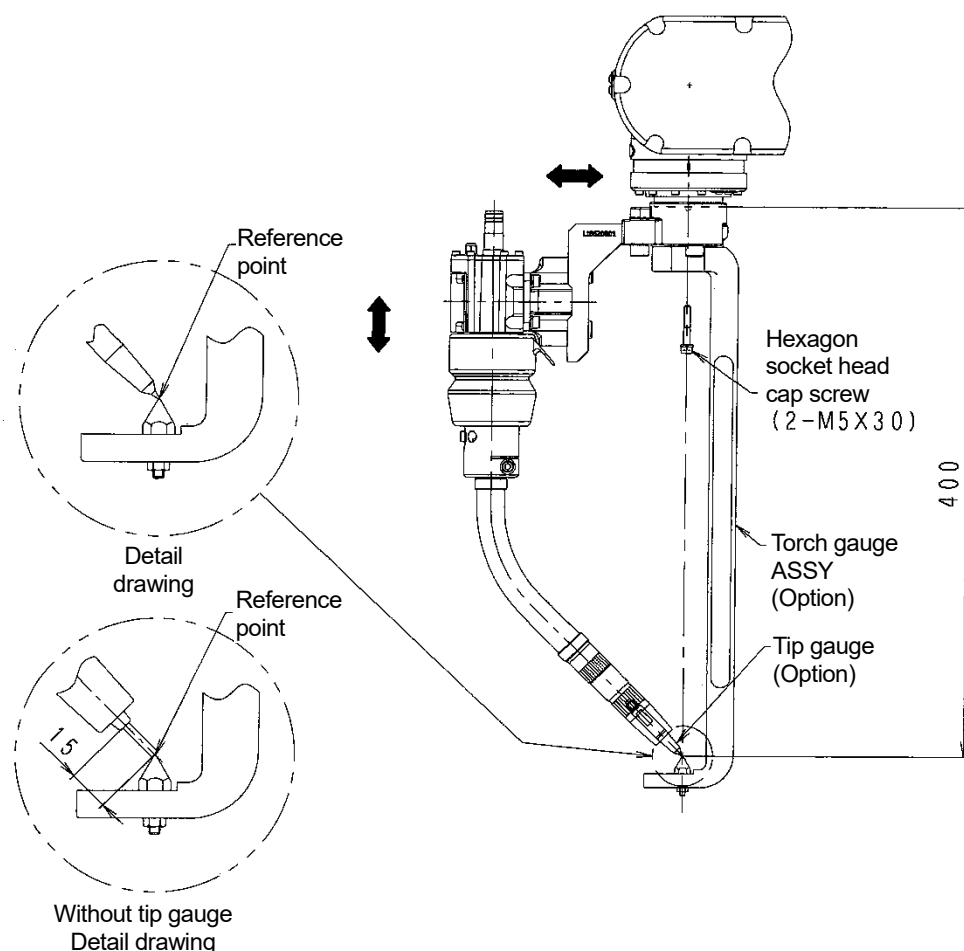


Fig. 2.4 Mounting of torch gauge

1. Remove the nozzle and the contact tip from the torch.
2. Mount the tip gauge to the torch firmly.
3. Mount the torch gauge ASSY using 2 hexagon socket head cap screws (M5×30) attached with the torch gauge ASSY.
4. Make sure that the reference point of the torch gauge coincides with the tip gauge end. If not, adjust the end position of the tip gauge so that its end coincides with the reference point of the torch gauge. (Refer to “2.4 Torch Adjustment Method” for torch adjustment method.)

### [NOTE]

When the tip gauge is not used, adjust the torch by wire cut to a specified length, etc.

## 2.4 Torch Adjustment Method

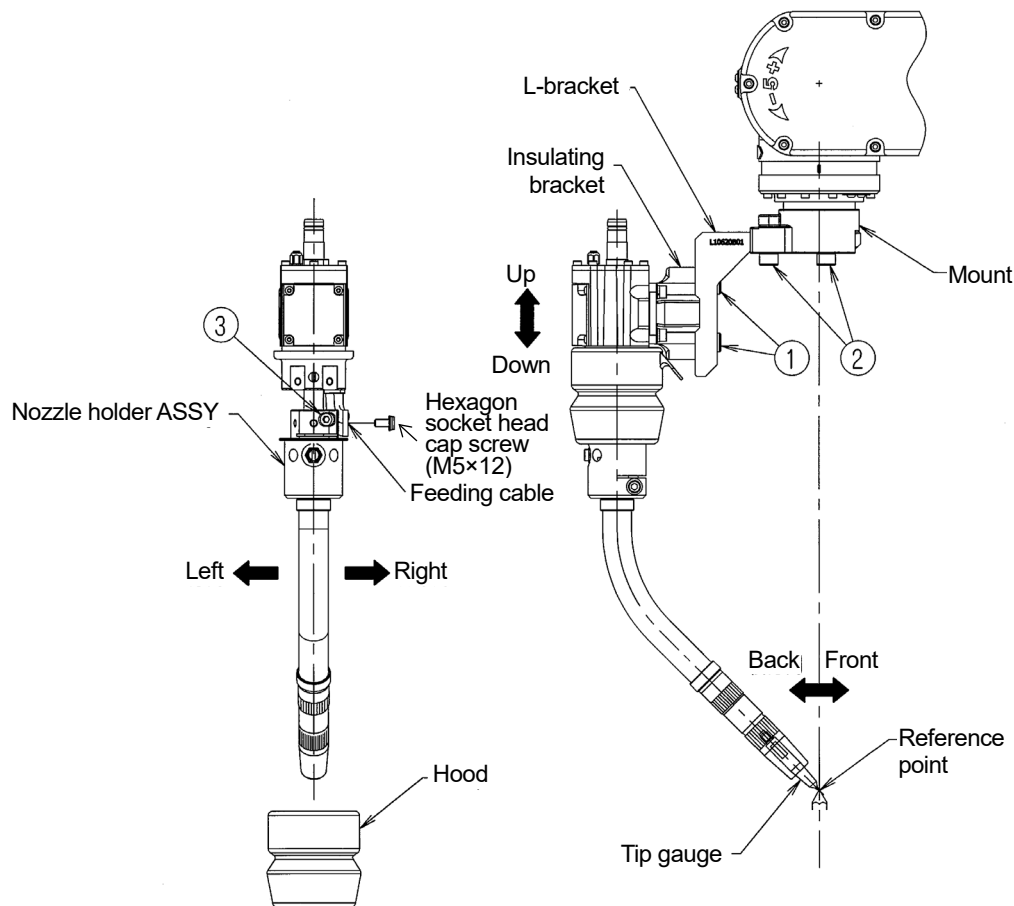


Fig. 2.5 Torch adjustment method

1. If the torch end deviates in vertical direction, loosen 2 hexagon socket head cap screws ① (M8×20) that fix the insulating bracket onto the L bracket. Correct the position, moving the torch end in the direction that the torch end deviates (upward or downward), and then fix it firmly by tightening the hexagon socket head cap screws.
2. If the torch end deviates in front-back direction, loosen 2 hexagon socket head cap screws ② that fix the mount onto the L bracket (M8×25). Correct the position, moving the torch end in the direction in which the torch end deviates (backward or forward), and then fix it firmly by tightening the hexagon socket head cap screws.
3. If the torch end deviates in horizontal direction, adjust in the following procedure referring to the “Fig. 2.6 Adjustment method of torch (right/left direction)”.
  - (1) Remove the hood.
  - (2) Remove the hexagon socket head cap screw (M5×12) fixing feeding cable connected to the nozzle holder ASSY.
  - (3) Loosen the hexagon socket head cap screw ③ (M5×20) and rotate the holder in the proper direction (right/left direction) so that the deviation is eliminated.
  - (4) After fixing the nozzle holder and the feeding cable firmly, remount the hood.

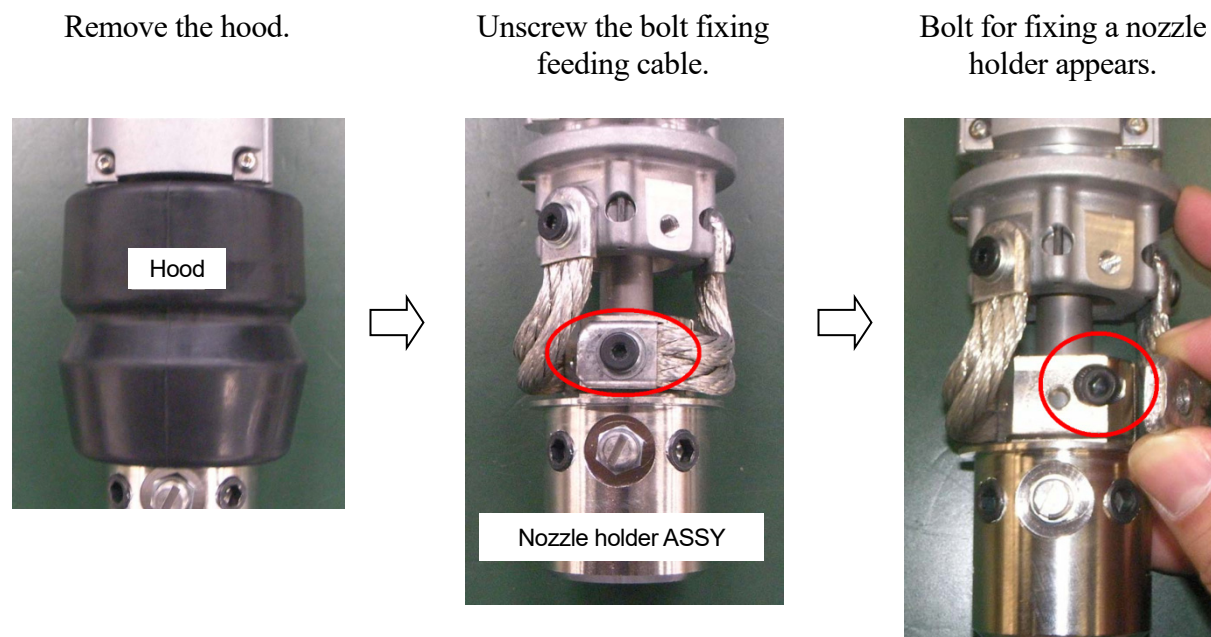


Fig 2.6 Adjustment method of torch (right/left direction)

## 2.5 Deformation of Welding Torch and Replacement

During welding by the robot, the welding torch may interfere with the workpiece due to an unexpected trouble, and this may result in bending or damage to the torch. In this case, repair or replace the torch and adjust it as described below.

## 2.6 Torch Adjusting Method Using a Fixed Teaching Point

After completing installation and adjustment of the robot and the jig, mark a point on a stationary section of the jig. Then teach the wire tip so as to face vertically with the wire extended to the length used when welding. It can be used to reduce the amount of teaching correction by checking the amount of deviation and bending at the time of torch interference and correcting the bending of the torch according to the marked point. It is recommended to give a name to the teaching program, which is distinguishable from other programs.

## 2.7 Connection of Coaxial Power Cable

The coaxial power cable is used to lead the wire, shield gas and shock sensor cable from the wire feeding unit to the torch. Refer to the Table 2.1 below to select the coaxial power cable according to the arm.

Table 2.1 Types of coaxial power cables

Applicable arm	Cable length (m)
RA005L	*1
RA006L	1.3
RA010N	1.1
RA010L	1.4
RA020N	1.2

\*1 For RA005L, the wire feeding unit cannot be mounted on the arm. To mount it separately, determine the length of the coaxial power cable.

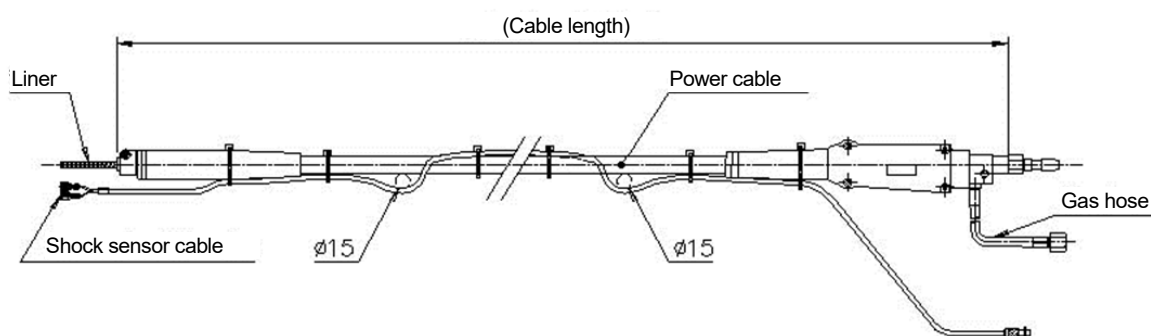


Fig. 2.7 Outline drawing of the coaxial power cable

### 2.7.1 RA006L, RA010N/L, RA020N

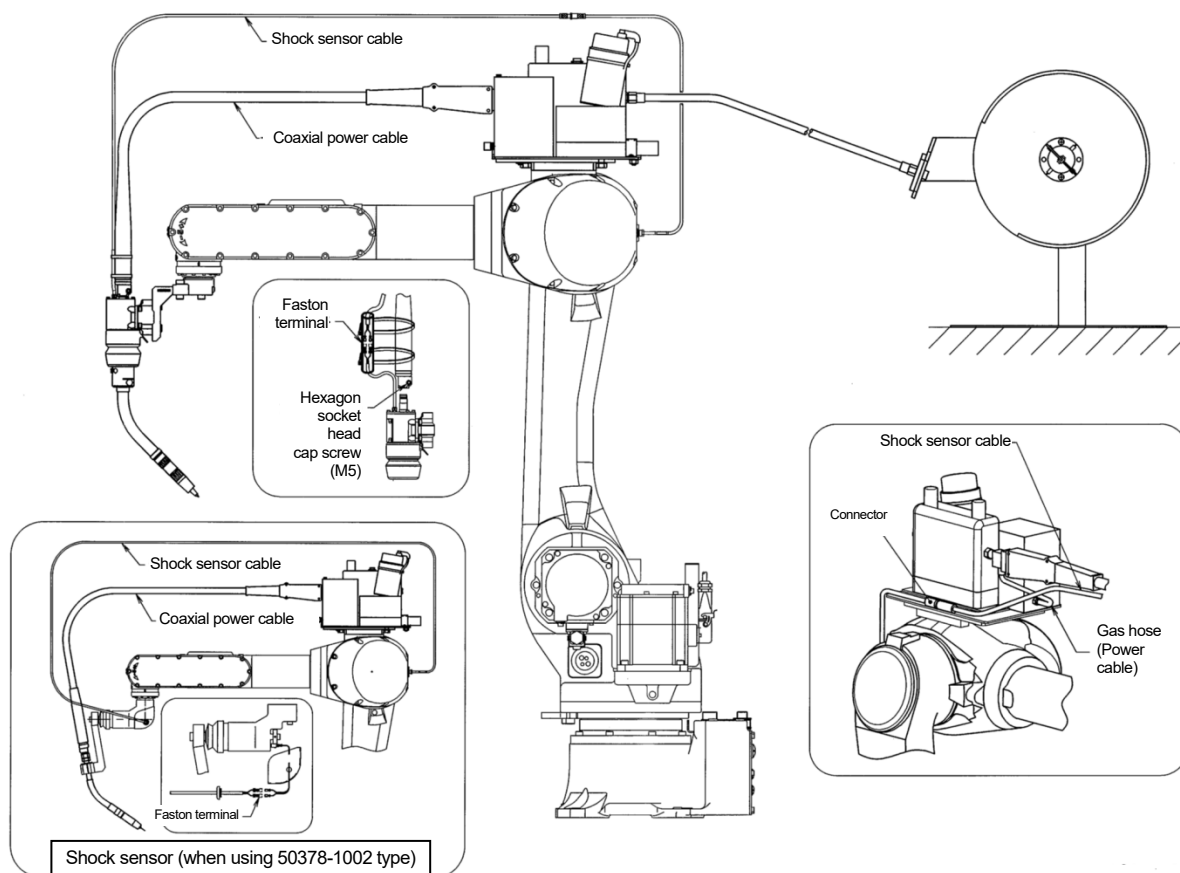


Fig. 2.8 Connection of the coaxial power cable

Protect the FASTON terminal of the shock sensor cable with the silicon glass tube supplied with the coaxial power cable, and then fix it to the coaxial power cable with the tying band.

## 2.7.2 RA005L

The coaxial power cable is used to lead the wire, shield gas and shock sensor cable from the wire feeding unit to the torch. For RA005L, the wire feeding unit cannot be mounted on the arm. To mount it separately, determine the length of the coaxial power cable.

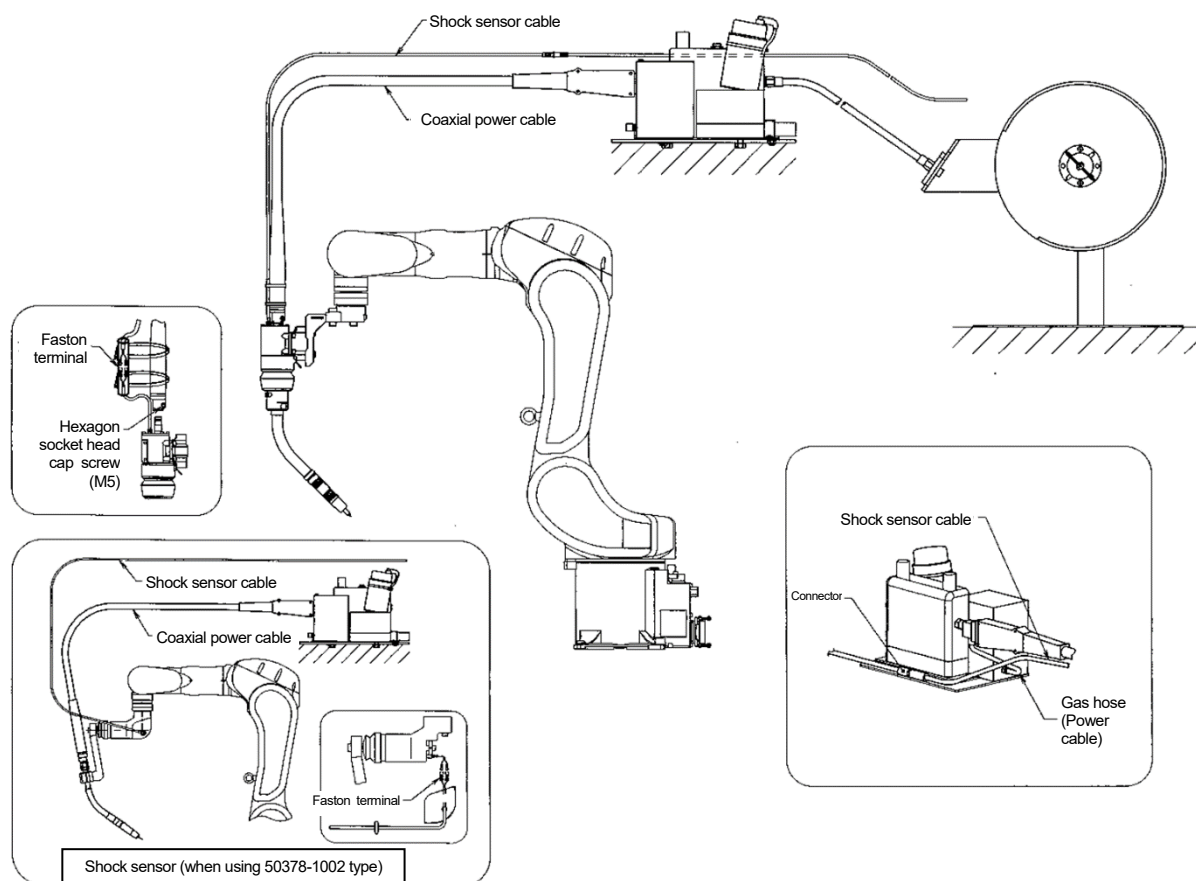


Fig. 2.9 Connection of the coaxial power cable

Protect the Faston terminal of the shock sensor cable with the silicon glass tube supplied with the coaxial power cable, and then fix it to the coaxial power cable with the tying band.



## 2.8 Cutting the Liner

Cut the liner according to the length of each torch, referring to Fig. 2.10, Fig. 2.11, Table 2.2 and Table 2.3. Rasp the edge of the liner's cut section to eliminate burrs, etc. Also, take enough care not to bend a liner or burr the hole when cutting.

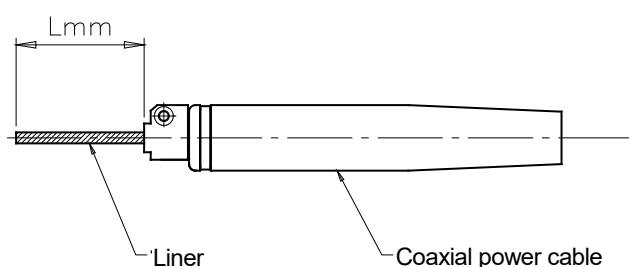


Fig.2.10 Cut length of liner from coaxial power cable

Table 2.2 Cut length of liner from coaxial power cable (rough)

DAIHEN torch (model)	L (mm)
RT3500S	291
RT3500H	360
RT3500L	331
RT5000S	274
RT5000H	343
RT5000L	314
RTW5000S	288
RTW5000H	356
RTW5000L	338
RZ3500S	207
RZ3500H	277
RZ3500L	263

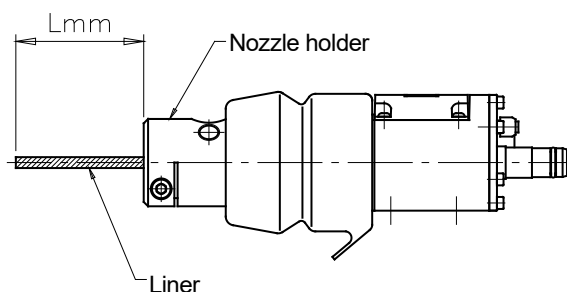


Fig.2.11 Cut length of liner from nozzle holder

Table 2.3 Cut length of liner from nozzle holder (rough)

DAIHEN torch (model)	L (mm)
RT3500S	128
RT3500H	197
RT3500L	168
RT5000S	111
RT5000H	180
RT5000L	151
RTW5000S	124
RTW5000H	193
RTW5000L	174
RZ3500S	44
RZ3500H	115
RZ3500L	100

## 2.9 Liner Clamp Function

A liner clamp is equipped with the nozzle holder of each shock sensor.

During welding, weld wire may become floppy and it causes unstable wire feeding depending on clearance between the sensor and the liner in the coaxial power cable. This problem will result in faulty weld arc start or fluctuations in the protrusion length of weld wire.

The liner clamp unit has the effect of reducing the behavior of weld wire by binding the coil liner.

1. Loosen the lock nut, and then thoroughly pull out the clamp screw.
2. Insert the coaxial power cable.
3. Gradually turn the clamp screw until it hits against the liner, and then make it 1/4 turns.
4. Clamp the liner with the lock nut.

### [NOTE]

1. Turning the clamp screw excessively will damage the liner and disables weld wire feeding.
2. To remove the coaxial power cable or the liner, unclamp the liner clamp first.

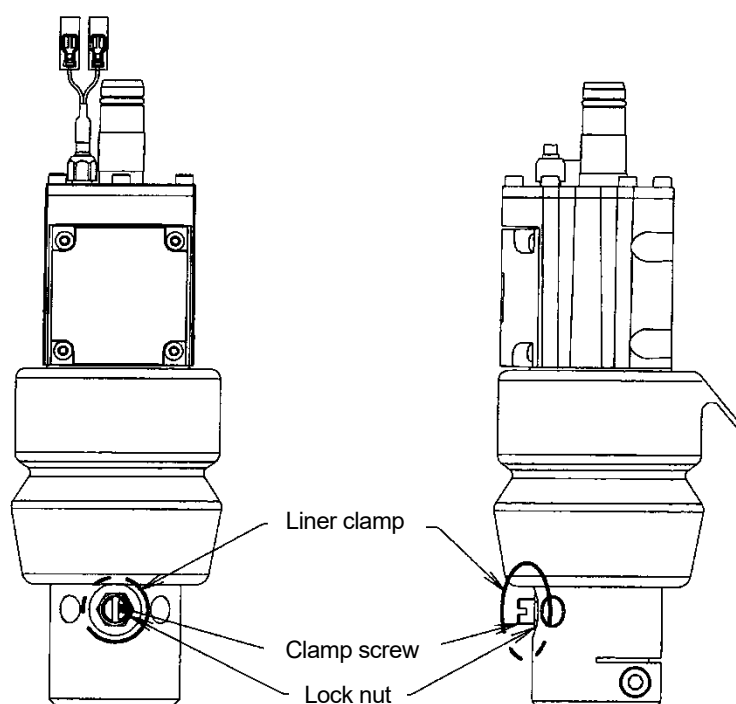


Fig. 2.12 Liner clamp

### 3 Grounding Method



#### WARNING

1. Never share the ground among the robot controller, robot arm, welder, other equipment and etc.
2. For the controller and robot arm, use a dedicated ground (100  $\Omega$  or less) as the ground line shown below.
3. If grounding and insulation of the controller and the robot arm are insufficient, malfunction caused by noise from ground lines, breakage or electrical shock may occur. Accordingly, strictly observe below. In addition, make sure that the controller and the robot are connected with dedicated ground lines and check that they are isolated from other equipment and devices via a circuit tester, etc.

Robot controller : 3.5 mm<sup>2</sup> (AWG #12)

Robot arm : 3.5 mm<sup>2</sup> (AWG #12)

For the multi axes robot, use a ground line whose size is larger than that of the power supply line.

Isolate the wire feeding unit and welding torch from the robot arm using Bakelite etc. (Refer to “Safety” in this manual.)

Grounding is extremely important to prevent noise and electrical shock, etc. Connect the grounding wire by the method shown in the Fig. 3.1.

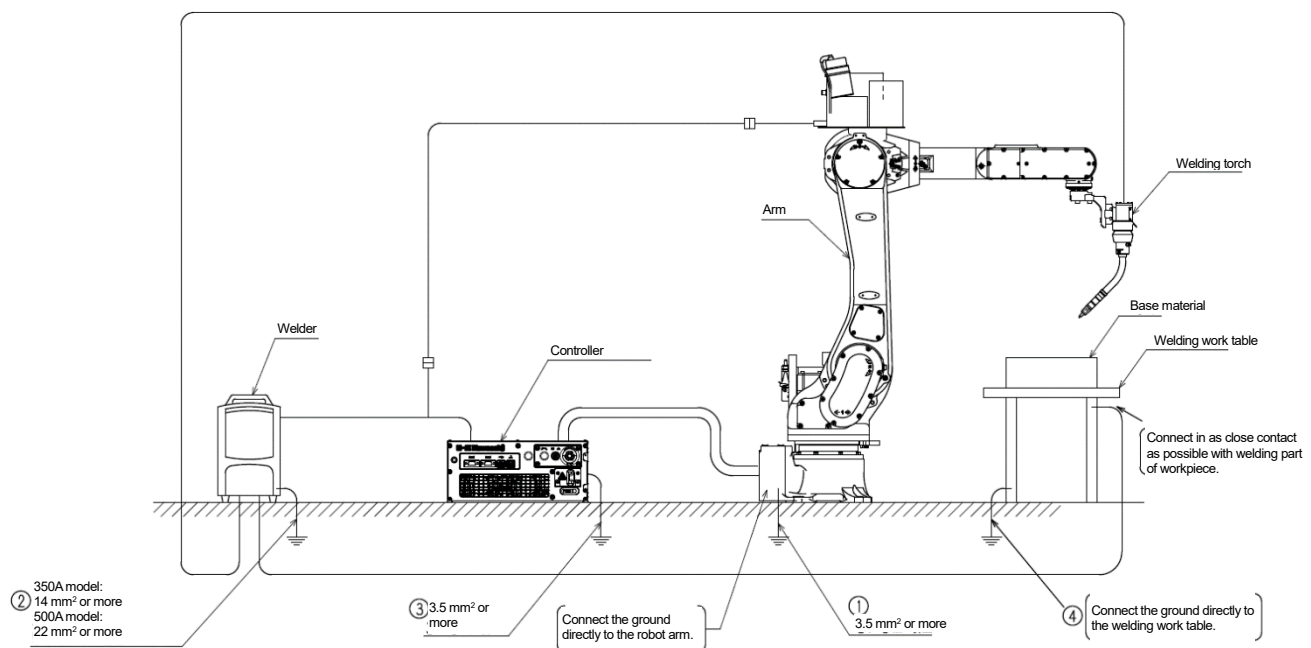


Fig. 3.1 Grounding for the robot and its surroundings

## 4 Connection with Welding Equipment



### WARNING

1. **Before connecting the robot arm with welding equipment, move the robot arm to a place where the work can be done easily. Then turn OFF the motor power and the controller power.**
2. **Before connecting the robot arm with welding equipment, turn OFF the welder power supply without fail.**

An example of connection to an arc welder, etc. is shown below. For details of handling and connection of power cables, etc. to the welder, refer to its instruction manual.

1. Connect the arc welding interface board in the controller (Refer to “Appendix 2 Arc Welding Interface Board”.) to the welder via the I/F cable.
2. For CO<sub>2</sub> welding, a heater and gas flowmeter are normally connected to the gas cylinder. Non-heater type gas cylinder is also available. If a factory piping is used instead of cylinders, connect a flowmeter designed for factory piping.
3. Connect welding cable (ground) on the base material with the welding work table.
4. For the wire feeding unit, a reel type machine is shown in the figure. However, when a pack is used, connect the wire feeding unit with the pail pack.

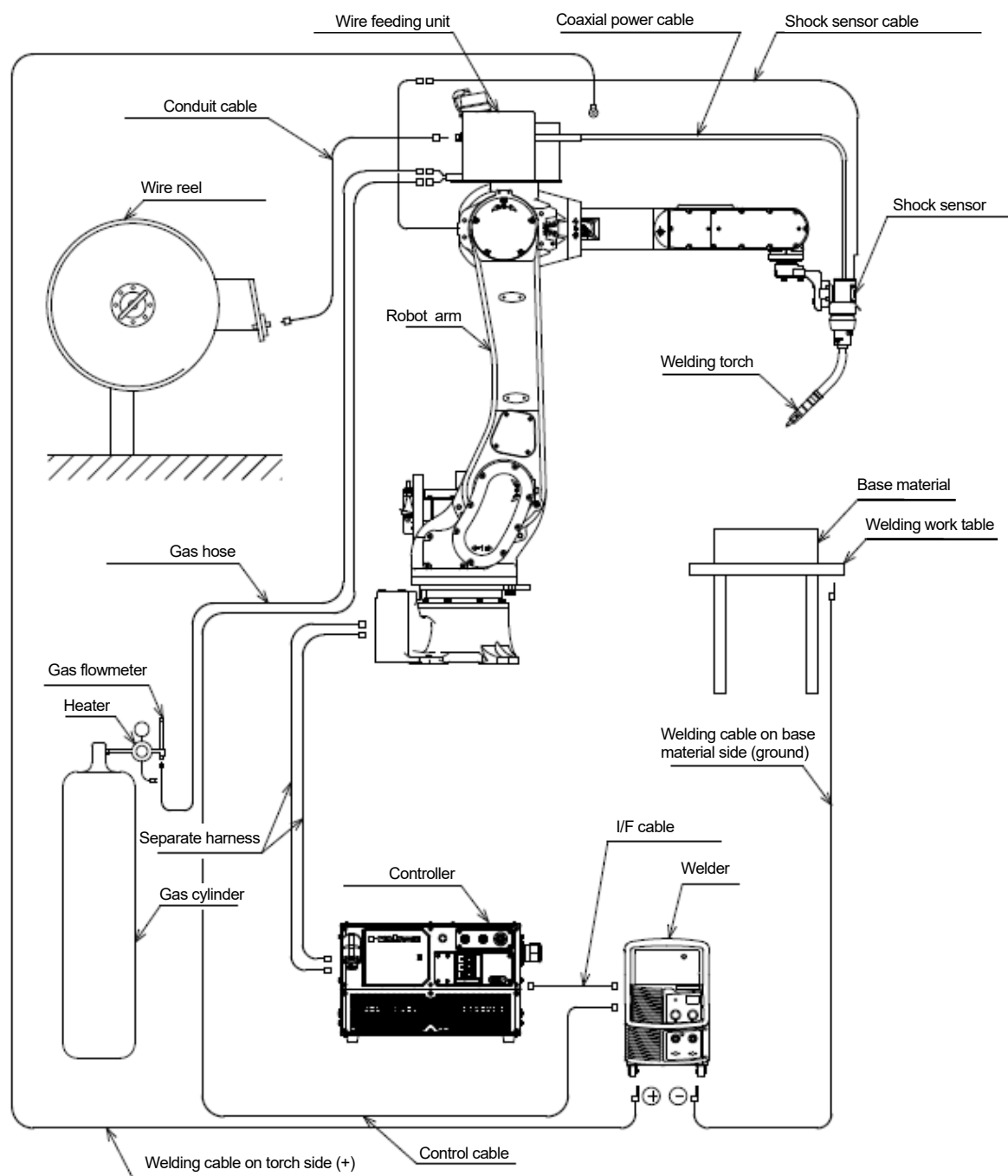
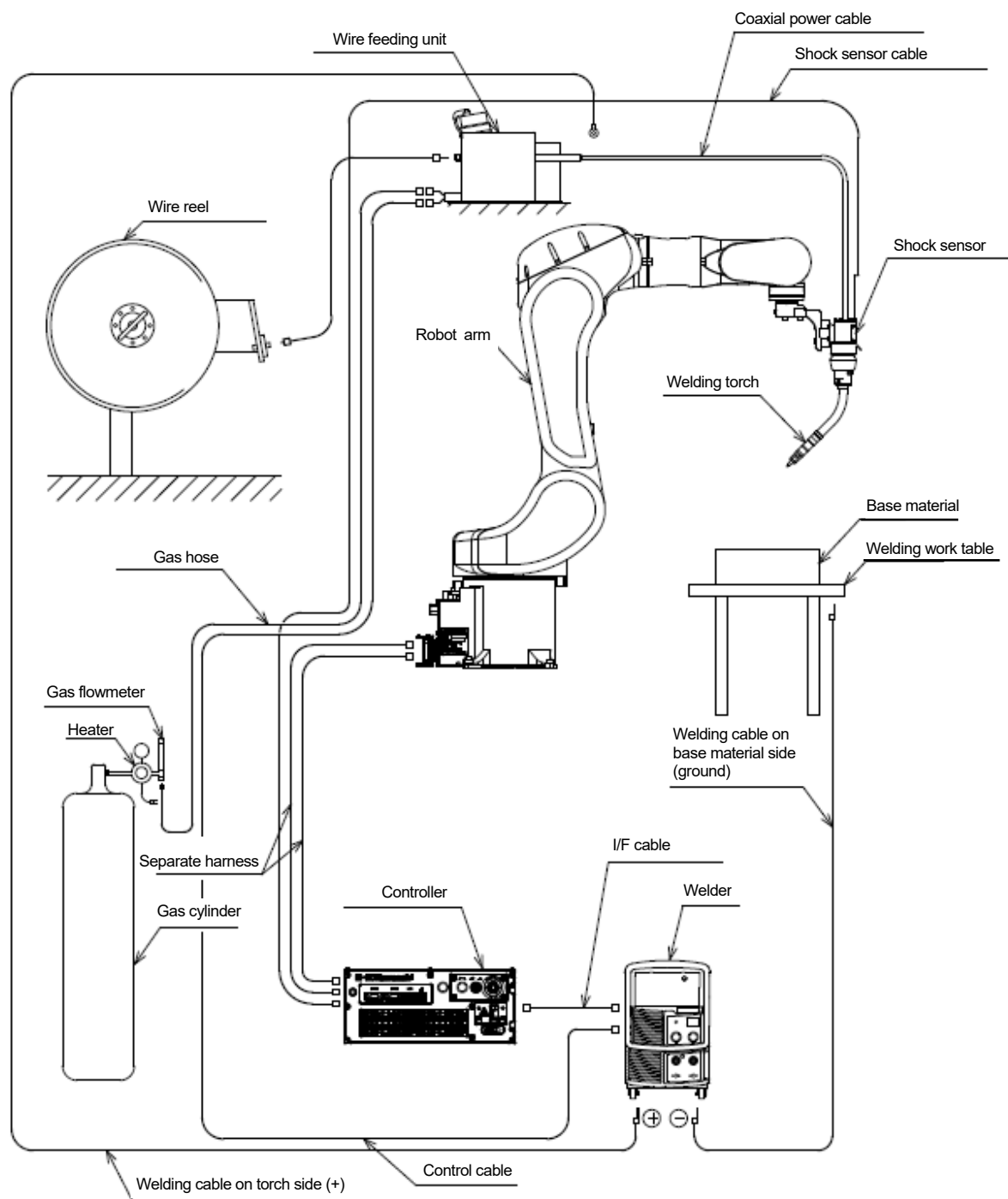
**4.1 RA006L, RA010N/L, RA020N**

Fig. 4.1 Welding equipment connection example (DAIHEN welder WB-M350)

## 4.2 RA005L



Note External appearance of controller depends on the controller model.

Fig. 4.2 Welding equipment connection example (DAIHEN welder WB-M350)

## 5 Arc Welding Interface Board (2AN) Installation Procedure

This chapter explains the procedure for installing the arc welding interface board (2AN) on the F60/F01 controller.

### 5.1 F60 Controller Installing on OP1

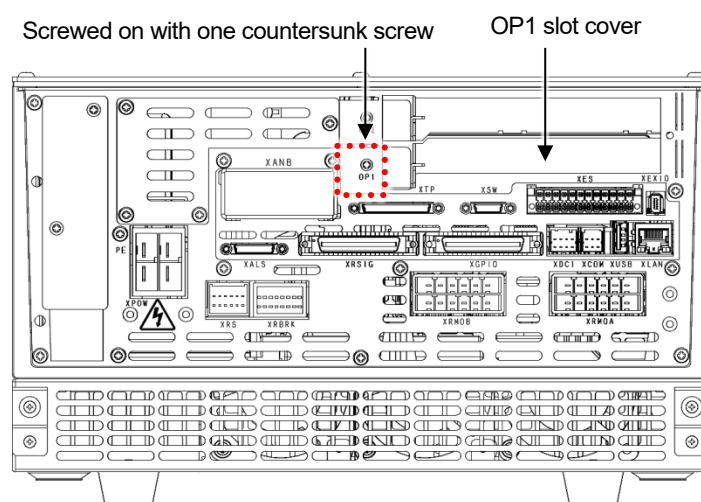
1. The following table lists the parts required to install the arc welding interface board.

Check to make sure that you have the correct parts before installing them on the controller.

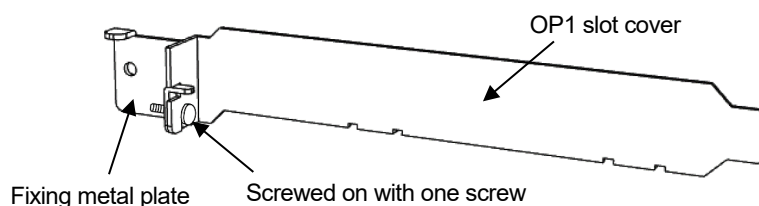
No.	Part number	Part name	Remarks
1	49094-0551	2AN board set	
Components of 1	1-1	50999-0719	Arc welding interface board (2AN)
	1-2	60835-3582	Plate to secure the optional board
	1-3	50977-4835LA0	Optional board harness
	1-4	60302-1296	Fixing screw To secure the board x 3

2. Make sure that the controller power is turned OFF.

3. Remove the countersunk screw, and remove the slot cover from OP1.

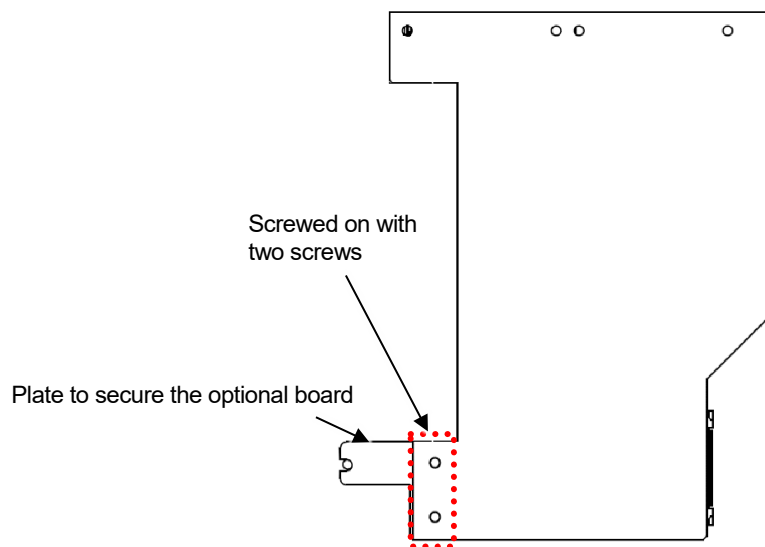


4. Remove the screw, and detach the fixing metal plate and the slot cover.

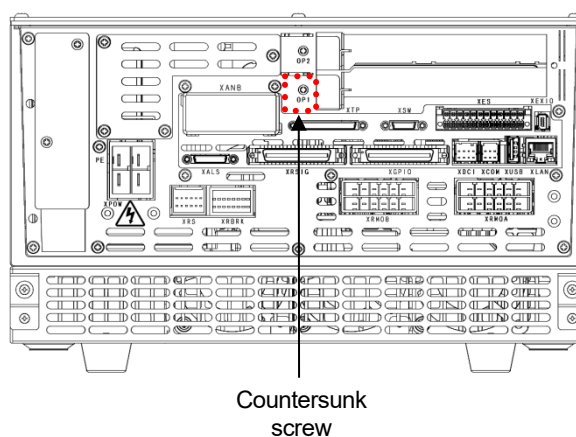
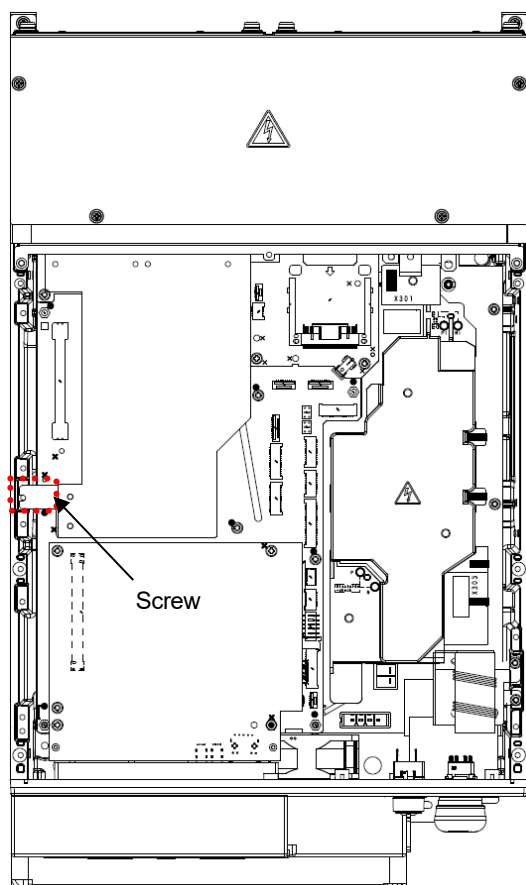




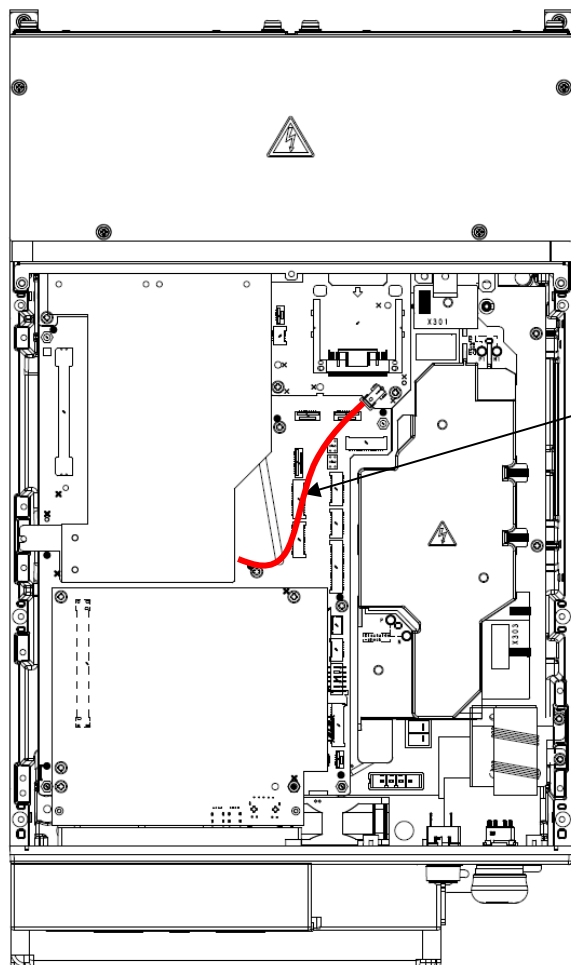
5. Secure the 2AN board onto the fixing metal plate with a screw, instead of the slot cover.
6. Attach the plate to secure the optional board to the 2AN board with two screws.



7. Install the 2AN board to which the fixing plate was attached in step 6 on the controller with one countersunk screw and one screw removed in step 3.



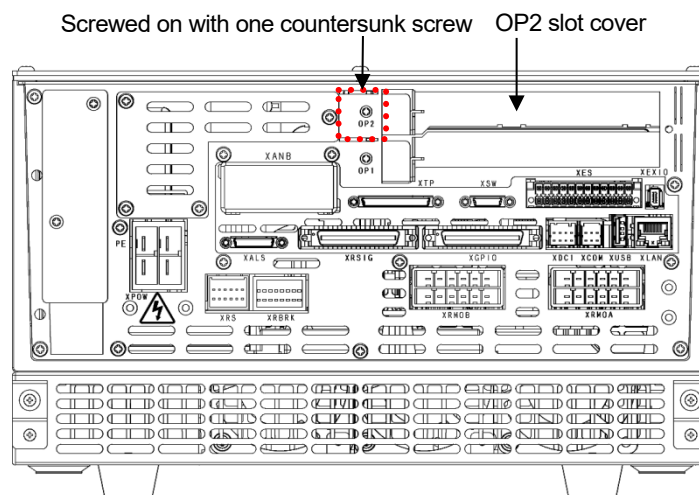
8. Connect the optional board harness.



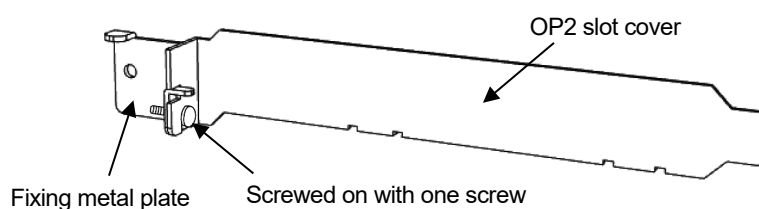
Optional board harness (EXIO-CN1)

## 5.2 F60 Controller Installing on OP2

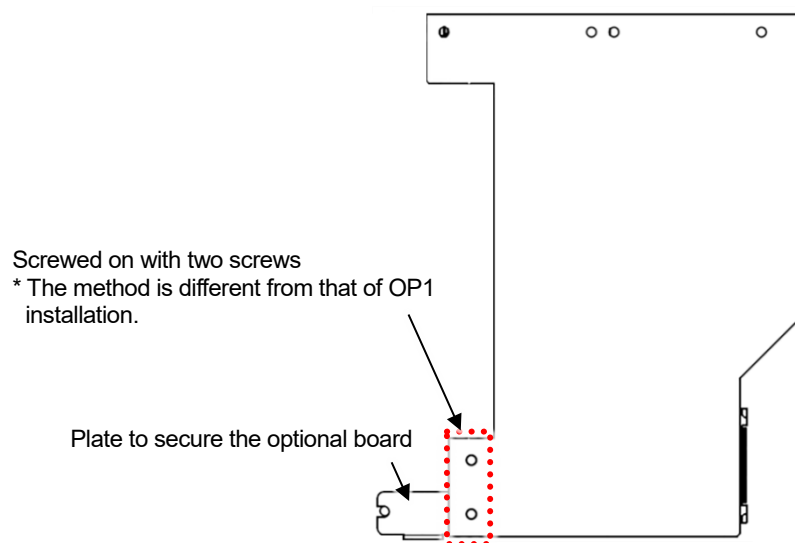
1. Check to make sure that correct parts are selected before installing them on the controller.
2. Make sure that the controller power is turned OFF.
3. Remove the countersunk screw, and remove the slot cover from OP2.



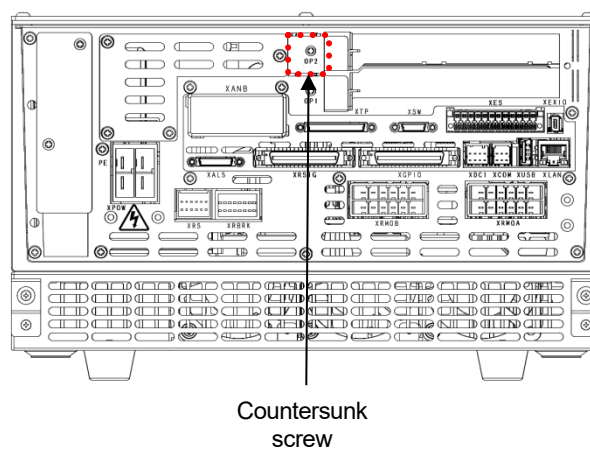
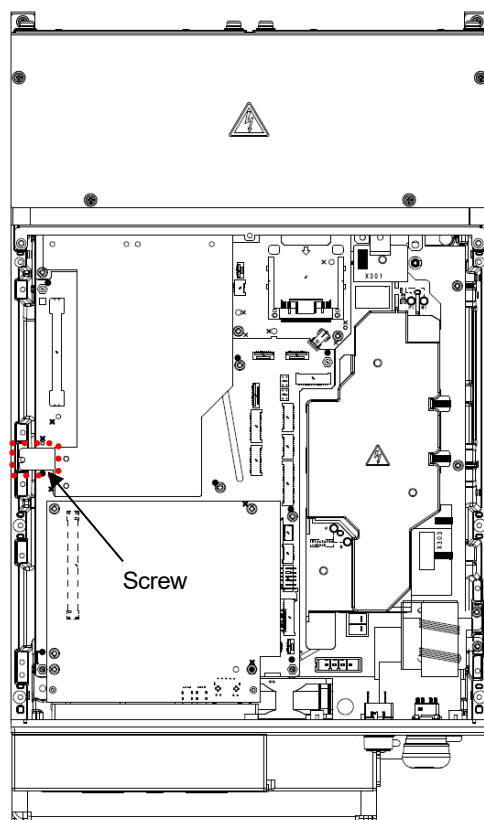
4. Remove the screw, and detach the fixing metal plate and the slot cover.



5. Secure the 2AN board onto the fixing metal plate with a screw, instead of the slot cover.
6. Attach the plate to secure the optional board to the 2AN board with two screws.

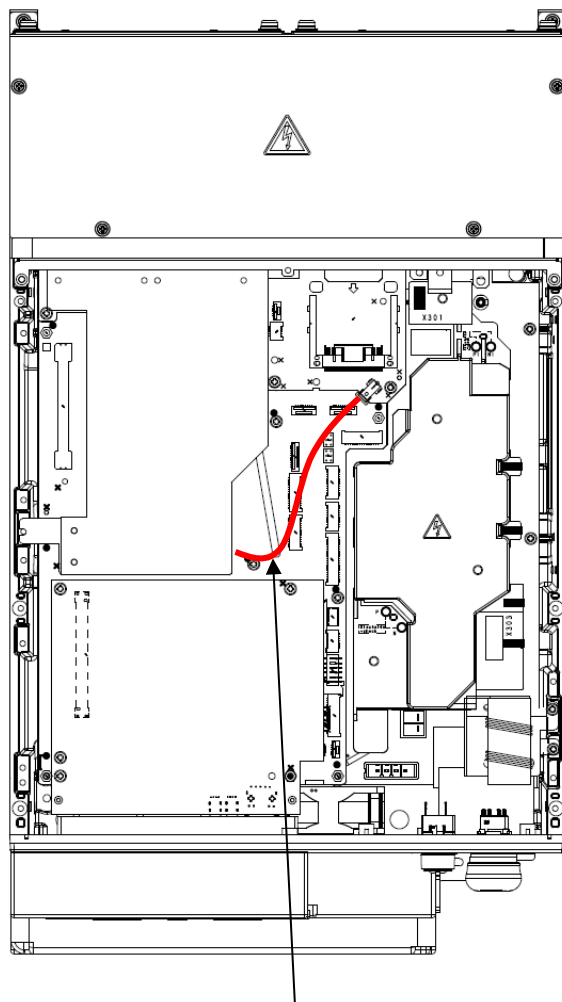


7. Install the 2AN board to which the fixing plate was attached in step 6 on the controller with one countersunk screw and one screw removed in step 3.

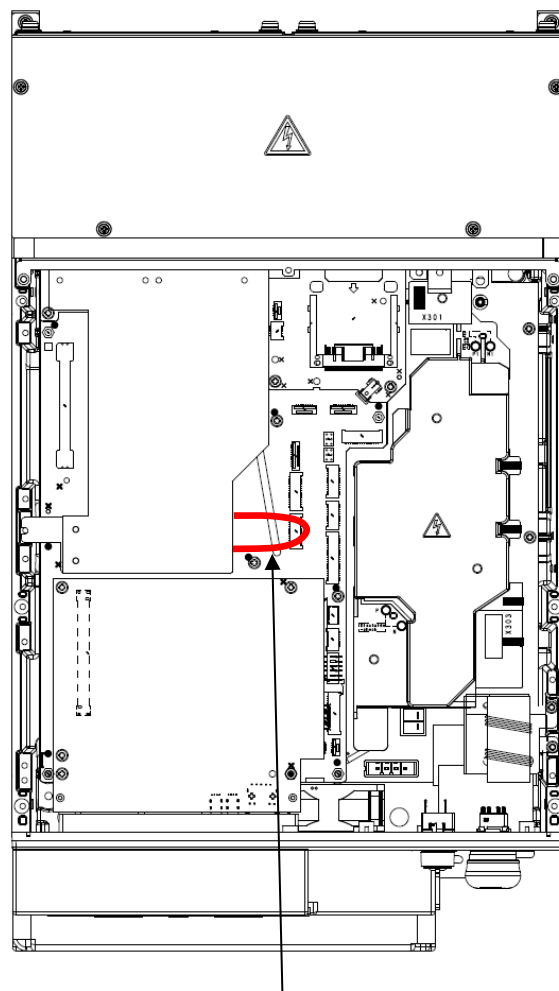


## 8. Connect the optional board harness.

- If 2AW or 2AH board **is not installed on** OP1, connect EXIO-CN1.
- If 2AW or 2AH board **is installed on** OP1, connect CN1 of CN2-OP2 on OP1.



Optional board harness



Optional board harness

**CAUTION**

Be sure to connect both ends of the optional board harness to the connector.  
If one end of the optional harness is not connected, a serial communication error may result.

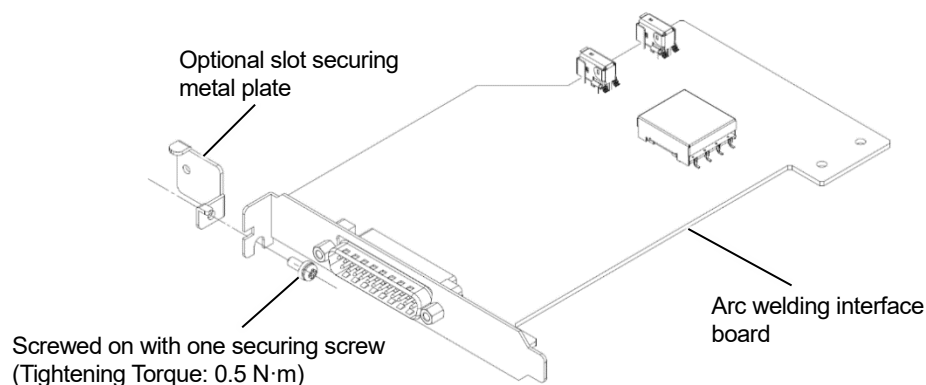
### 5.3 F01 Controller Installing on OP1

**Note** Do not overtighten, as this could cause damage.

- The following table lists the parts required to install the arc welding interface board. Check to make sure that you have the correct parts before installing them on the controller.

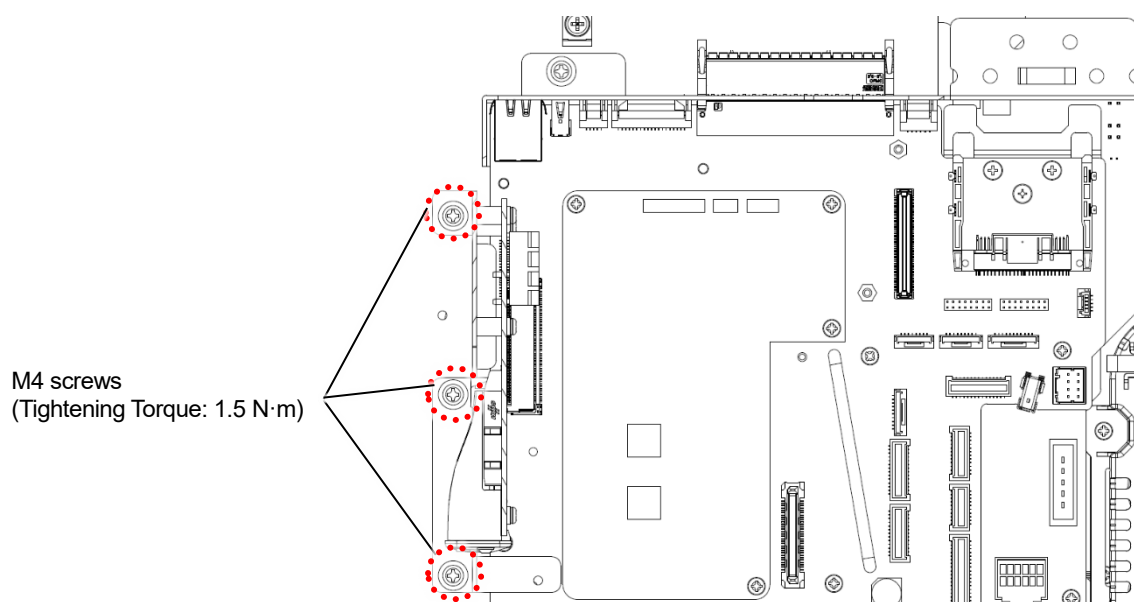
		No.	Part number	Part name	Remarks
Components of 1	{	1	49094-1665	2AN board set	
		1-1	50999-0719	Arc welding interface board (2AN)	
		1-2	50977-4835LA0	Optional board harness	L=90mm
		1-3	60835-3530	Optional slot securing metal plate	
		1-4	60302-0425	Pan head screws	3 pcs
Components of 2	{	2	50833-0475	F0x optional board securing metal plate set	
		2-1	60835-4564	PCIe expansion board securing metal plate	1 pc
		2-2	60302-0270	Securing screws for PCIe expansion board securing metal plate	M4-8 P=4 3 pcs
		3	60334-3231	Hexagonal spacer	19mm×1 pc

- Install the optional slot securing metal plate (No.1-3) to the arc welding interface board (No.1-1). Use a fixing screw (No.1-4) to secure in one location.  
(Tightening Torque: 0.5 N·m)



3. Make sure that the controller power is turned OFF.
  4. Remove the top plate from the controller.
  5. Install the PCIe expansion board securing metal plate (No.2-1) to the chassis. Secure in three places with the supplied M4 screws (No.2-2). (Tightening Torque: 1.5 N·m)
- Note** Skip this step if a PCIe expansion board (2DX board) described in chapter 6 of “F0x Series Controller Options Installation Manual” (90210-1446) is already installed.

- Enlarged view of installation location

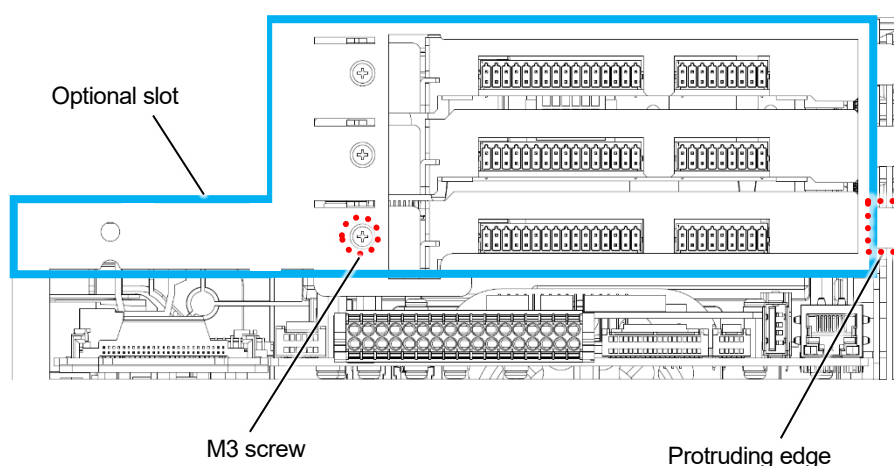


6. Install the arc welding interface board assembly assembled in step 2. to the optional slot. Install by inserting the protruding edge of the metal plate into the insertion hole of the optional slot. After inserting, secure in one location with a supplied M3 screw (No.1-4). (Tightening Torque: 0.5 N·m)

**Note** Install to the location marked by an “OP1” sticker.

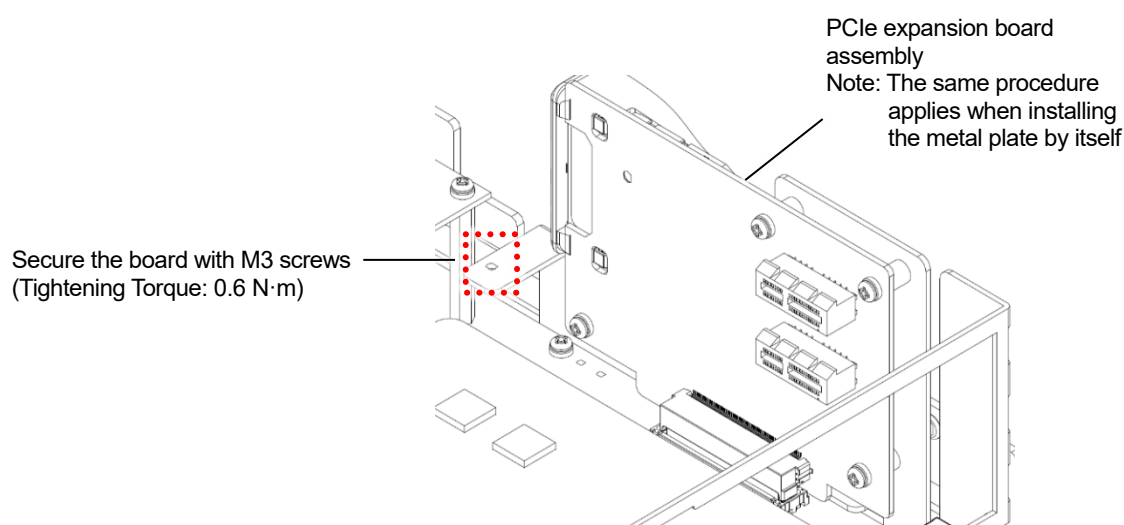
**Note** Take care not to interfere with surrounding boards or metal plates while installing.

- Optional slot area diagram



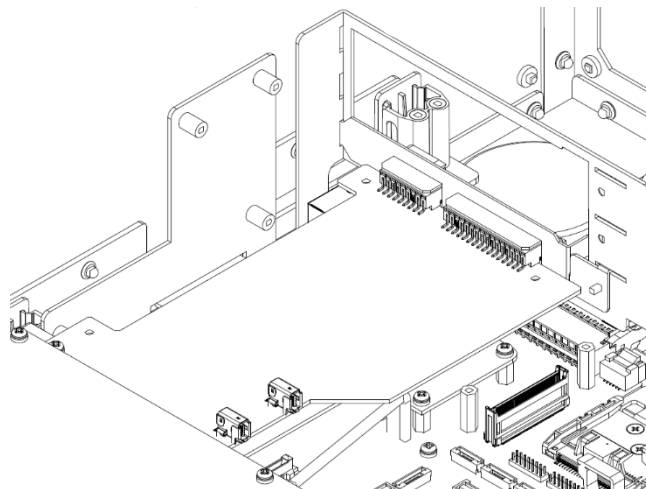
7. Secure the arc welding interface board installed in step 6. to the PCIe expansion board metal plate installed in step 5. with the supplied M3 screws (1-4). (Tightening Torque: 0.6 N·m)

- Metal plate enlarged view



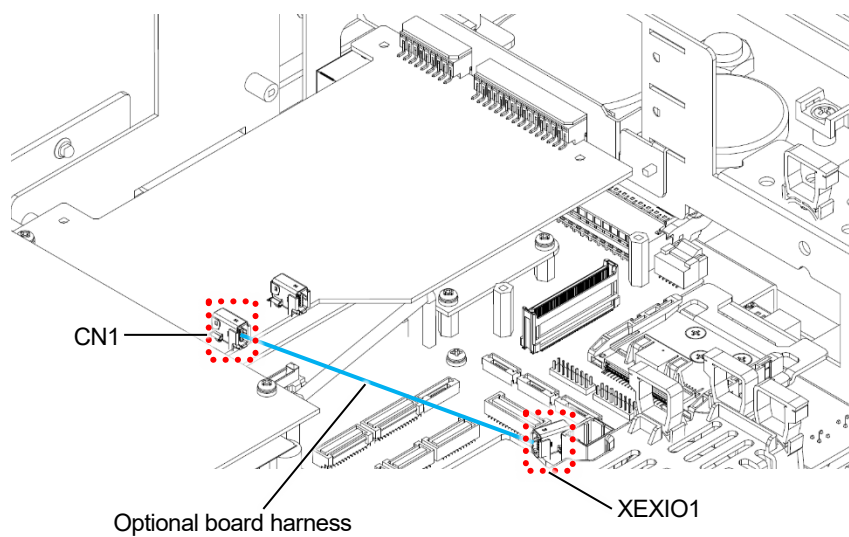


- Optional board installation diagram



8. Connect the optional board harness (No.1-2).

**Note** Connect XEXIO1 on the 2FB board to CN1 on the general extension arc welding interface board.



9. Install the top plate to the controller and secure it in place with the screws.

## 5.4 F01 Controller Installing on OP2

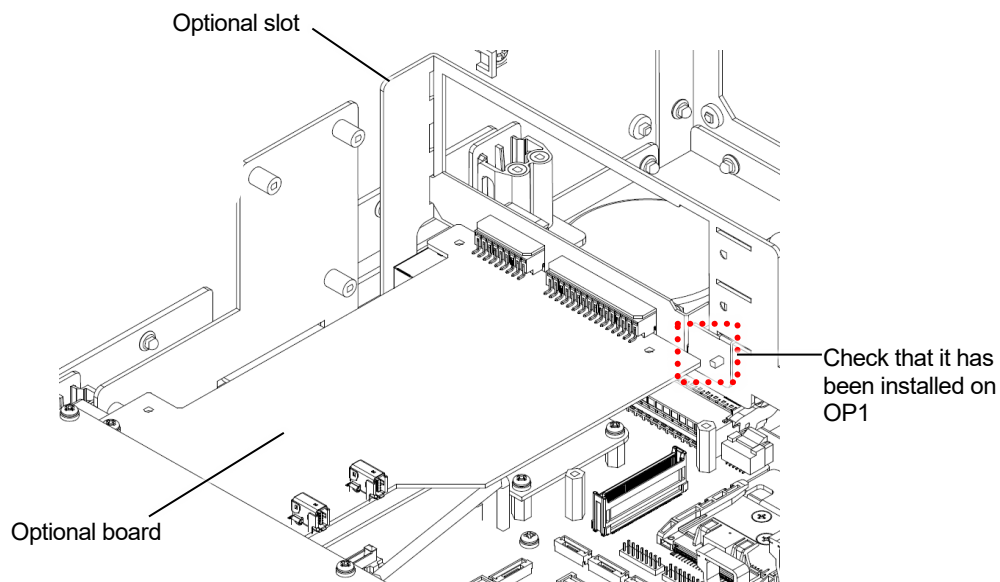
### [NOTE]

When installing on optional slot (OP2), an optional board must be installed on optional slot (OP1).

**Note** Do not overtighten, as this could cause damage.

1. Check to make sure that the correct parts are selected before installing them on the controller.  
Refer to the table in step 1. of “5.3 F01 Controller Installing on OP1.”
2. Make sure that the controller power is turned OFF.
3. Remove the top plate from the controller.
4. Check that the optional board is installed on optional slot (OP1).  
An arc welding interface board (No.1-1) can be installed on optional slot (OP2) if conditions match the figure below.

- Optional slot OP1 installation diagram



5. Assemble the arc welding interface board (No.1-1) and optional slot securing metal plate (No.1-3) in the same way described in step 2. of “5.3 F01 Controller Installing on OP1.”

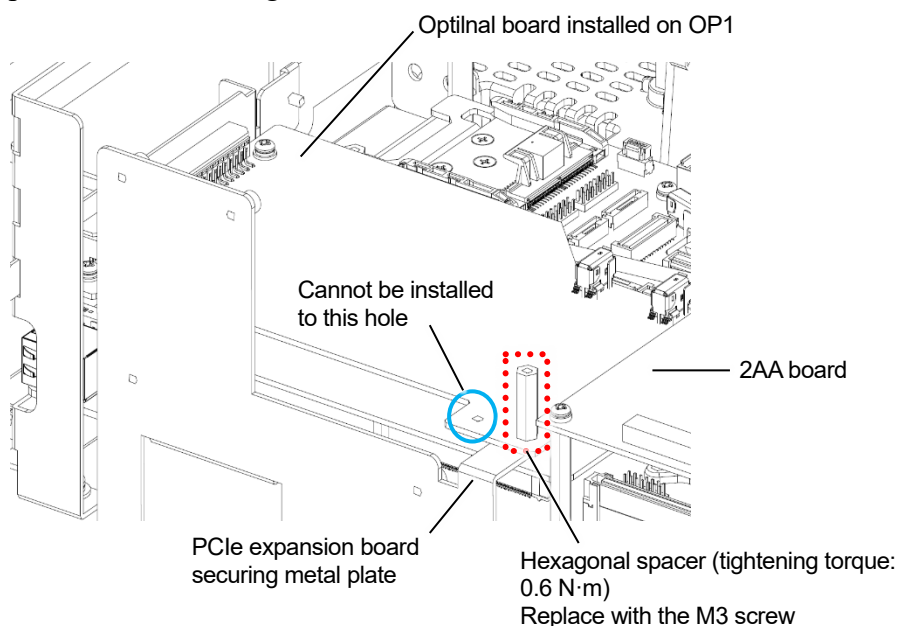
6. Install the hexagonal spacer (No.3) to the optional board installed on optional slot (OP1). Remove the M3 screw securing the board and replace it with the hexagonal spacer. (Tightening torque: 0.6 N·m)

**Note** Dispose of the removed M3 screw, as it will no longer be used.

**Note** The spacer can only be installed to the hole on the 2AA board side.

It cannot be installed underneath the hole on the optional slot side (circled in the figure below), as there is no metal plate there.

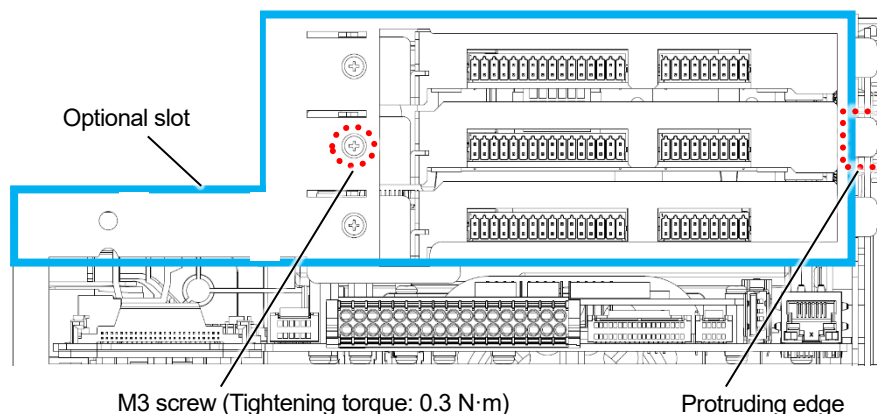
- Spacer installation diagram



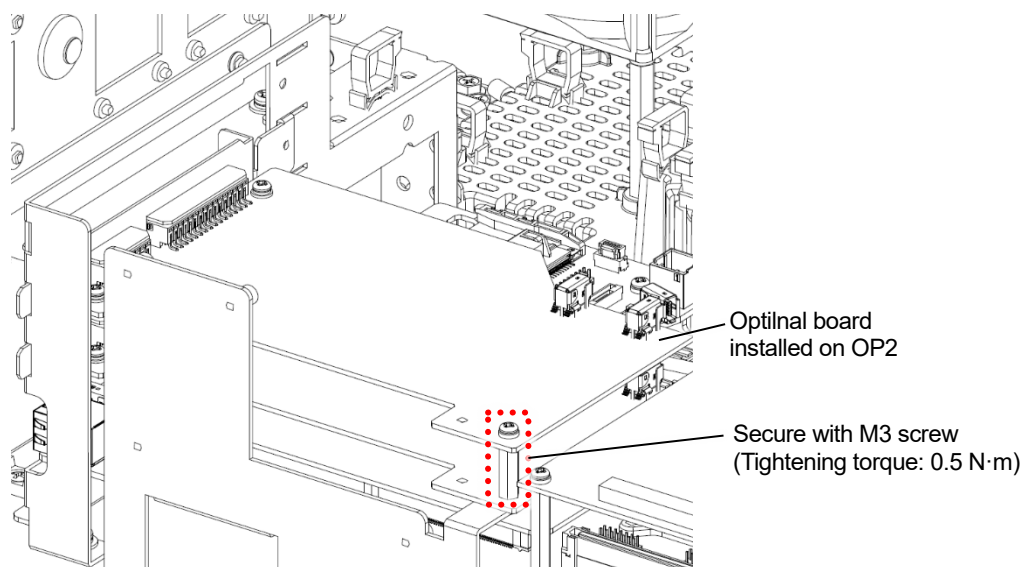
7. Install the arc welding interface board assembly assembled in step 5. to the optional slot. Install by inserting the protruding edge of the metal plate into the insertion hole of the optional slot. After inserting, secure in one location with a supplied M3 screw (No.1-4). (Tightening torque: 0.3 N·m)

**Note** Install to the location marked by an “OP2” sticker.

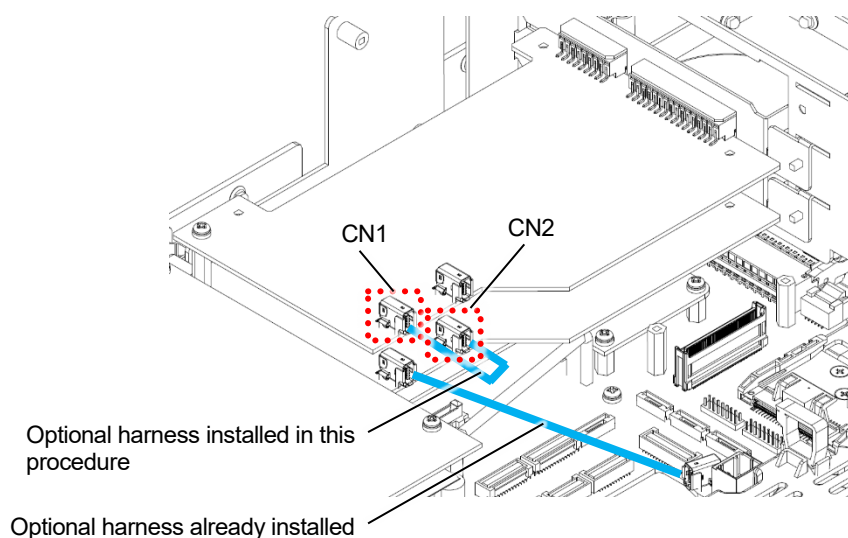
**Note** Take care not to interfere with surrounding boards or metal plates while installing.



8. Secure the arc welding interface board installed in step 7. to the hexagonal spacer installed in step 6. with the M3 screw (No.1-4). (Tightening torque: 0.5 N·m)



9. Connect CN2 of the optional board installed on OP1 to CN1 of the arc welding interface board installed on OP2 using the optional board harness (No.1-2).

**CAUTION**

**Be sure to connect both ends of the optional board harness to the connector.  
If one end of the optional harness is not connected, a communication error  
may occur.**

10. Install the top plate to the controller and secure it in place with the screws.

## 5.5 F01 Controller Installing on OP3

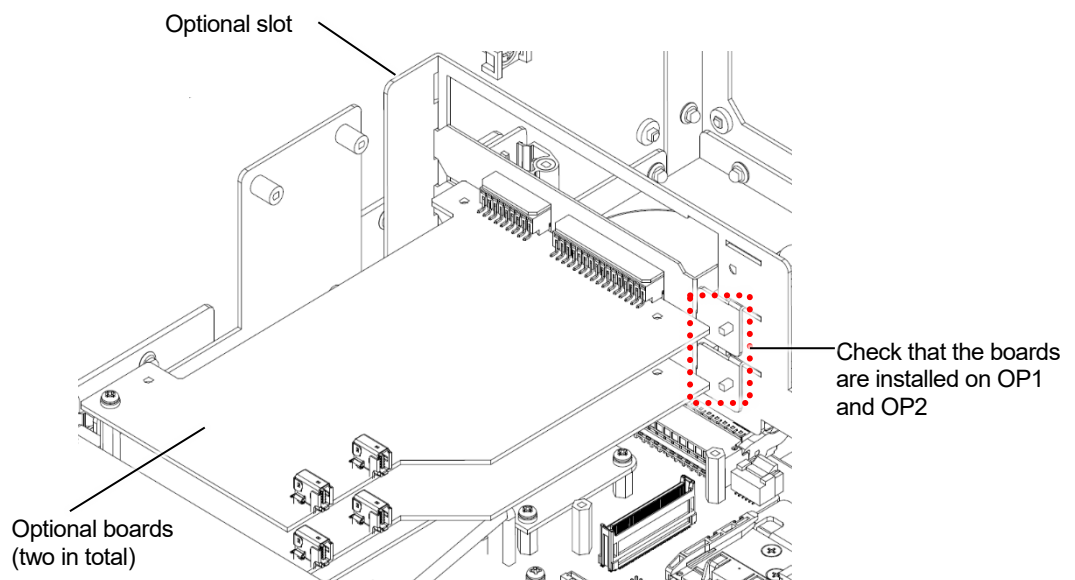
### [NOTE]

When installing on optional slot (OP3), an optional board must be installed on optional slot (OP1), and optional slot (OP2).

**Note** Do not overtighten, as this could cause damage.

1. Check to make sure that correct parts are selected before installing them on the controller.  
Refer to the table in step 1. of “5.3 F01 Controller Installing on OP1.”
2. Make sure that the controller power is turned OFF.
3. Remove the top plate from the controller.
4. Check that the optional boards are installed on optional slot OP1 and optional slot OP2.  
An arc welding interface board can also be installed on optional slot OP3 if conditions match the figure below.

- Optional slots OP1 and OP2 installation diagram

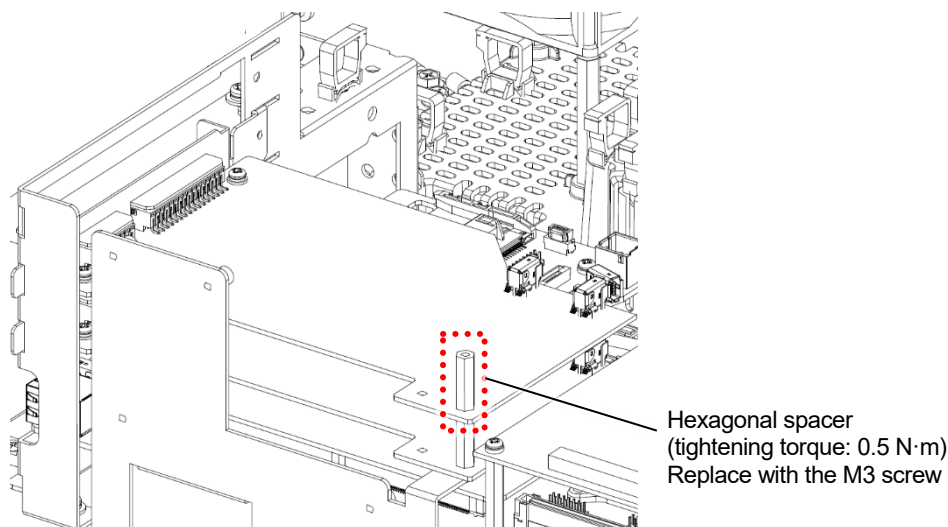


5. Assemble the arc welding interface board (No.1-1) and optional slot securing metal plate (No.1-3) in the same way described in step 2. of “5.3 F01 Controller Installing on OP1.”

6. Install the hexagonal spacer (No.3) to the arc welding interface board installed on optional slot OP2. Remove the M3 screw securing the board and replace it with the hexagonal spacer. (Tightening torque: 0.5 N·m)

**Note** Dispose of the removed M3 screw, as it will no longer be used.

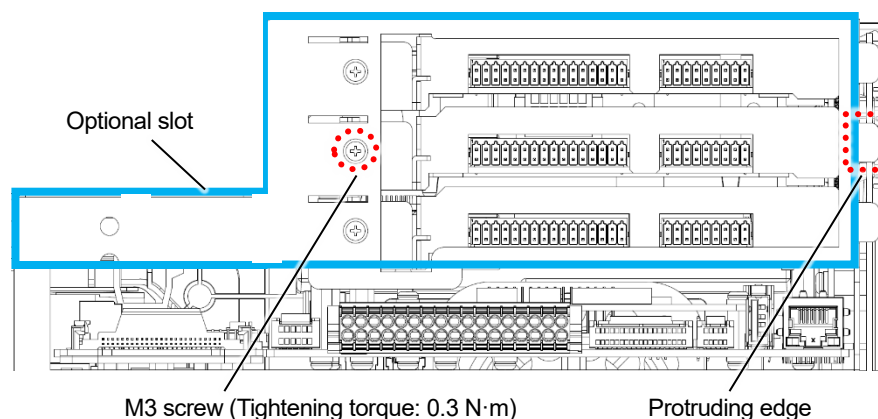
- Spacer installation diagram



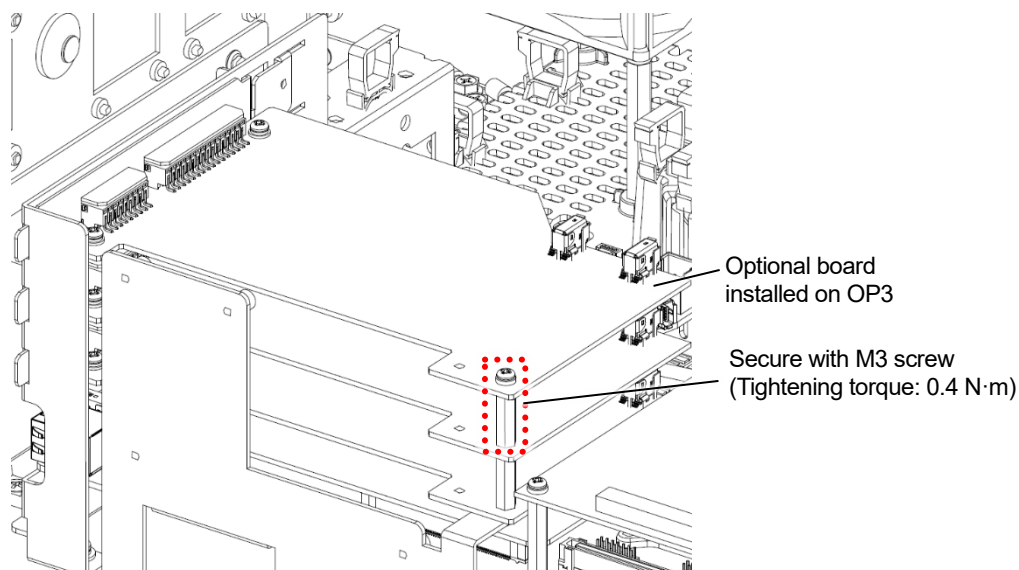
7. Install the arc welding interface board assembly assembled in step 2. to the optional slot. Install by inserting the protruding edge of the metal plate into the insertion hole of the optional slot. After inserting, secure in one location with a supplied M3 screw (No.1-4). (Tightening torque: 0.3 N·m)

**Note** Install to the location marked by an “OP3” sticker.

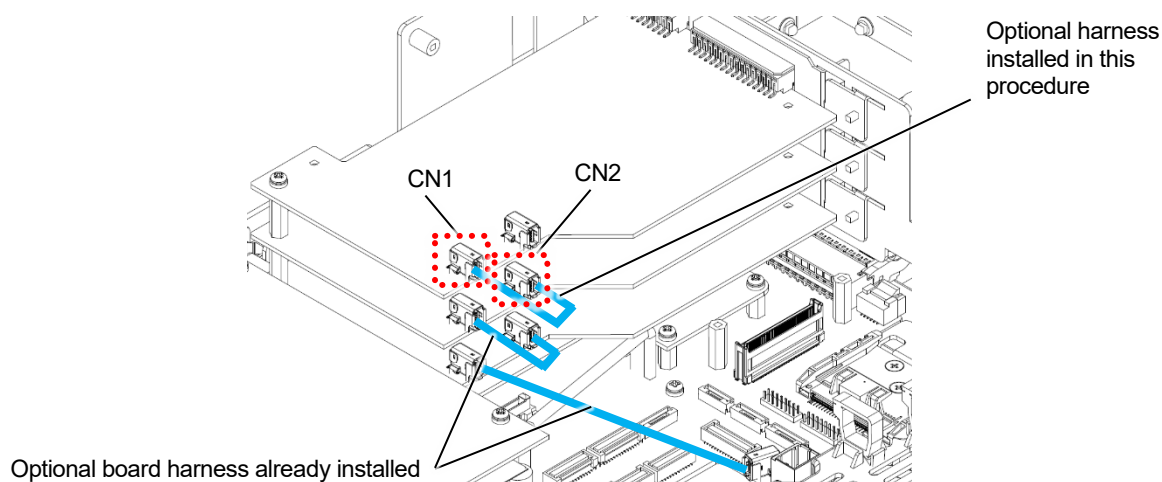
**Note** Take care not to interfere with surrounding boards or metal plates while installing.



8. Secure the arc welding interface board installed in step 6. to the hexagonal spacer installed in step 6. with the M3 screw (No.1-4). (Tightening torque: 0.4 N·m)

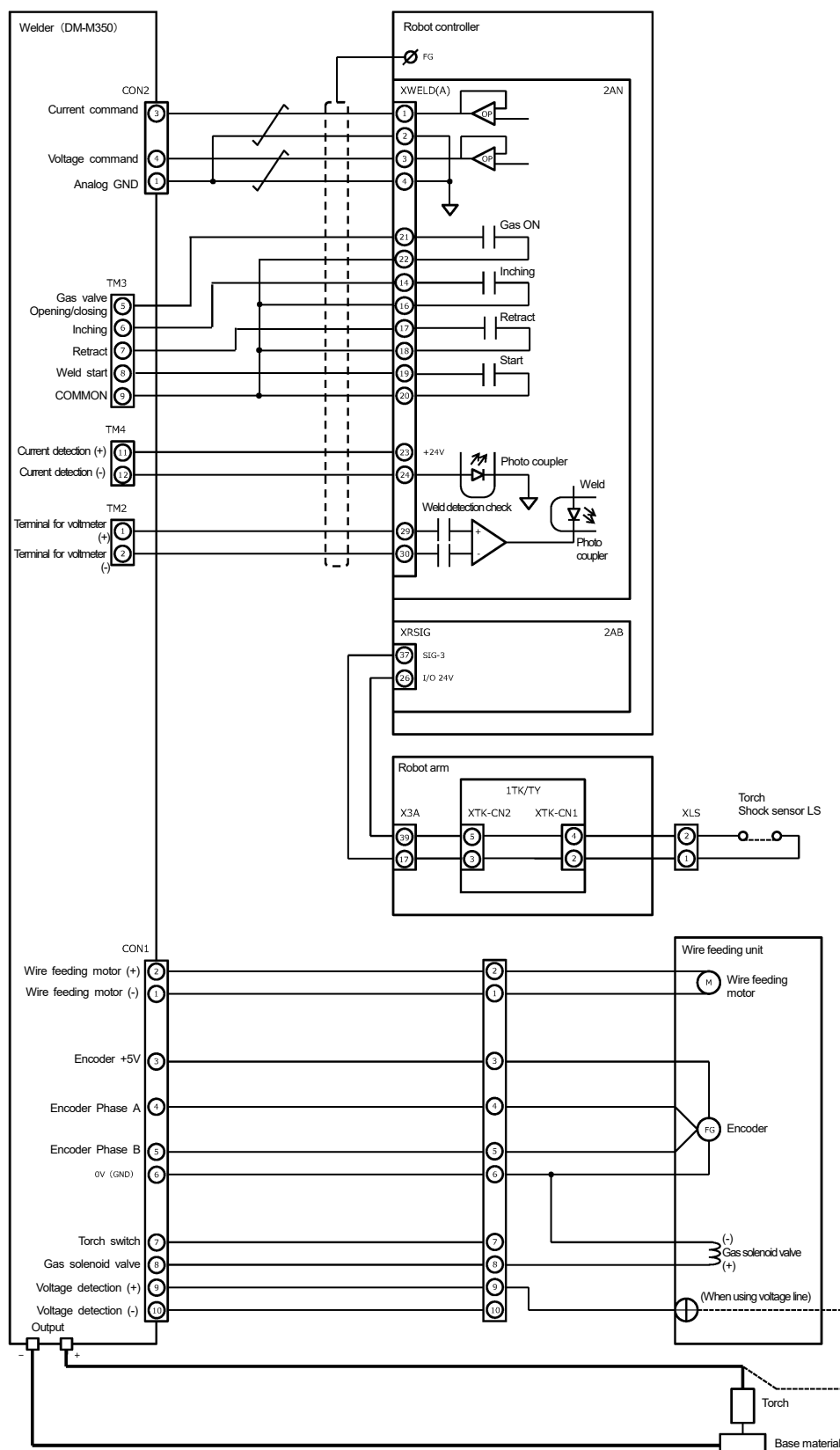


9. Connect CN2 of the arc welding interface board installed on OP2 to CN1 of the arc welding interface board installed on OP3 using the optional harness (No.1-2).

**CAUTION**

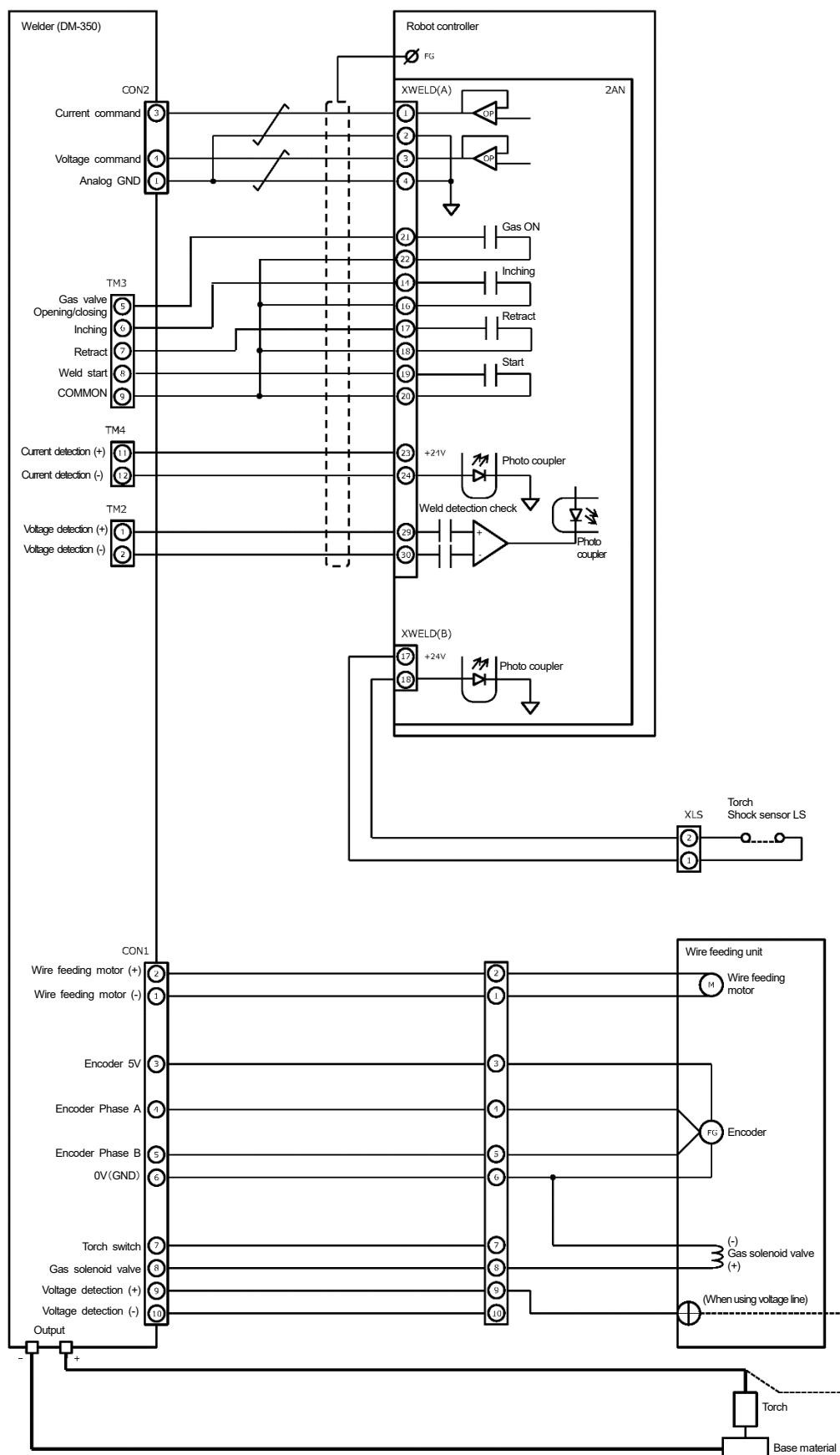
**Be sure to connect both ends of the optional board harness to the connector.  
If one end of the optional harness is not connected, a communication error may occur.**

10. Install the top plate to the controller and secure it in place with the screws.

**Appendix 1 Connection Diagram with Welder (WB-M350)****1. RA006L, RA010N/L, RA020N**



## 2. RA005L



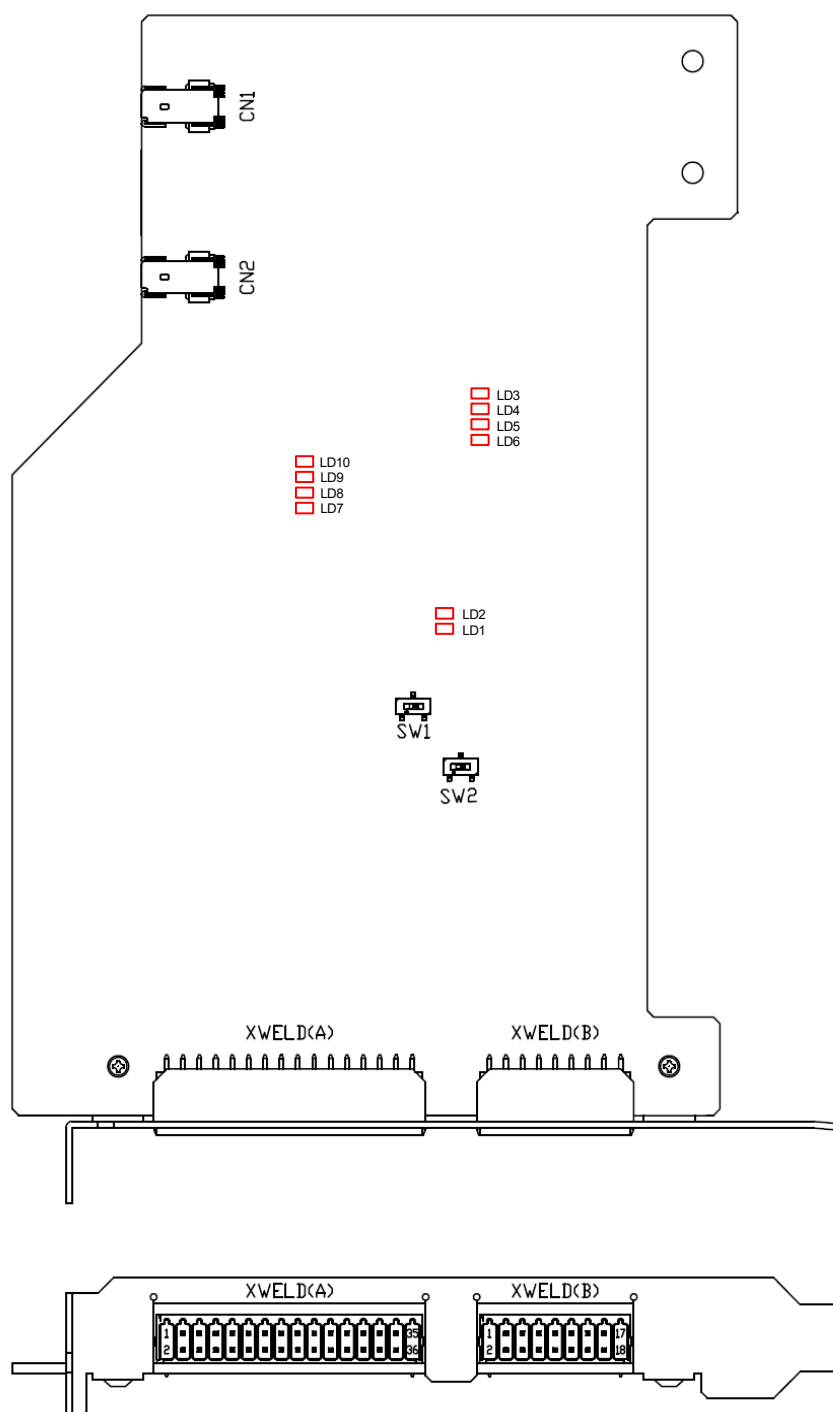
## Appendix 2 Arc Welding Interface Board

### 1. Connector specifications

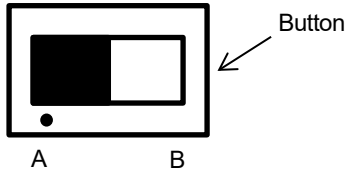
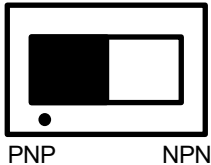
Set each output load capacity to  $3\ \mu\text{F}$  or less.

Board	Connector No.	Pin No.	Signal Name	Function
2AN board	XWELD(A) DMC 0.5/16-G1-2.54	1	A1_COMMAND	Analog voltage output for setting parameters (normally, for welding current) (Setting range: -15 V to +15 V)
		2	A1_COM_GND	GND for A1_COMMAND
		3	A2_COMMAND	Analog voltage output for setting parameters (normally, for welding current) (Setting range: -15 V to +15 V)
		4	A2_COM_GND	GND for A2_COMMAND
		5	A3_COMMAND	Analog voltage output for setting parameters (normally, for welding current) (Setting range: -15 V to +15 V)
		6	A3_COM_GND	GND for A3_COMMAND
		7	A4_COMMAND	Analog voltage output for setting parameters (normally, for welding current) (Setting range: -15 V to +15 V)
		8	A4_COM_GND	A4_COMMAND
		9	ROBOT_READY_A	Contact closed when welding is ready (Output)
		10	ROBOT_READY_B	
		11	WELDER_ERR_24V	+24 V power source for welder error detection signal
		12	WELDER_ERR_GND	GND for welder error detection signal
		13	WELDER_ERR	Welder error detection signal (Input)
		14	FEED_ON_A	Contact closed while the wire feeder motor is running (Output)
		15	WIRE_FWD_A	Contact closed while wire is being fed in the forward direction (Output)
		16	WIRE_FWD_B	FEED_ON_A common
		17	WIRE_REV_A	Contact closed while wire is being fed in the reverse direction (Output)
		18	WIRE_REV_B	
		19	WELD_ON_A	Contact closed when welding starts (Output)
		20	WELD_ON_B	
		21	GAS_ON_A	Contact closed when gas is supplied (Output)
		22	GAS_ON_B	
		23	ARC_DETECT_24V	+24 V power source for arc generation detection
		24	ARC_DETECT	+24 V input when arc generation is detected
		25	ARC_DETECT_EPS_A	+24 V input when arc generation is detected (external power supply type)
		26	ARC_DETECT_EPS_B	
		27	TORCH_SHORT_24V	+24 V power source for torch short circuit detection
		28	TORCH_SHORT	+24 V input when torch short circuit is detected
		29	WIRE_STICK_+	+15 V output when deposition is detected
		30	WIRE_STICK_-	GND for WIRE_STICK_+
		31	WIRE_HOLD	+24 V output when the wire hold signal is turned ON (for driving the solenoid valve)
		32	WIRE_HOLD_GND	GND for WIRE_HOLD
	XWELD(B) DMC 0.5/9-G1-2.54	1	WELD_ON_C	Contact closed when welding starts (Output)
		2	WELD_ON_D	
		3	WIRE_FWD_C	Contact closed while wire is being fed in the forward direction (Output)
		4	WIRE_FWD_D	
		5	WIRE_REV_C	Contact closed while wire is being fed in the reverse direction (Output)
		6	WIRE_REV_D	
		7	TOUCH_SENCE	+24 V output while touch sensing is being performed
		8	TOUCH_SENCE_24V	+24 V power source for TOUCH_SENCE
		9	TOUCH_SENCE_GND	GND for TOUCH_SENCE
		10	WIRE_TOUCH	+24 V input when wire touching is detected
		11	+16V	+16 V power source for current sensor
		12	-16V	+16 V power source for current sensor
		13	N.C.	
		14	N.C.	
		15	N.C.	
		16	N.C.	
		17	TORCH_LS_24V	+24 V power source for torch interference detection
		18	TORCH_LS	+24 V input when torch interference is detected

## 2. Appearance



Connector	Content	Remarks (location)
CN1	Communication connector (to the servo board)	Side surface of circuit board
CN2	Communication connector (to the extension I/O board)	Side surface of circuit board
XWELD (A)	I/O port 1	Rear panel
XWELD (B)	I/O port 2	Rear panel

Switch Name	Function
SW1	For the system 
SW2	WELDER_ERR signal common switching <ul style="list-style-type: none"> <li>“PNP”: 24 V input common, SOURCE/PNP type (standard)</li> <li>“NPN”: GND input common, SINK/NPN type</li> </ul> 

LED	Content	Color	Remarks
LD1 (#MON)	Extension I/O communication enabled	Green	Normal: ON Error: OFF
LD2 (DONA)	Extension I/O communication output enabled	Green	Normal: ON Error: OFF
LD7 (DONA)	Extension I/O communication output enabled (D/A)	Green	Normal: ON Error: OFF
LD8 (#MCARE)	Extension I/O communication error (2)	Red	Normal: ON Error: OFF
LD9 (#LCARE)	Extension I/O communication error (1)	Orange	Normal: ON Error: OFF
LD10 (#MON)	Extension I/O communication enabled (D/A)	Green	Normal: ON Error: OFF

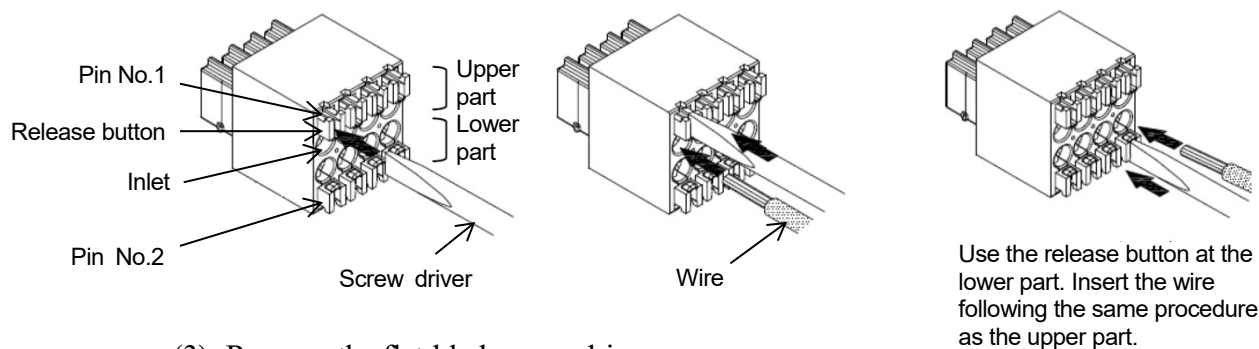
### 3. Gauge clamp connection

Connect the lead wires as shown below.

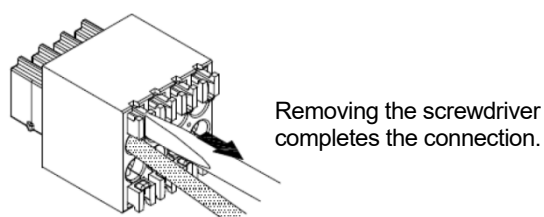
- (1) Use the wires specified in the table below. If the wire end needs to be terminated, fit a ferrule.

Board	Connector No.	Cross section		Stripped length
2AN	XWELD (A)	AWG26-20	0.14 to 0.5 mm <sup>2</sup>	6.5 to 7.5 mm
	XWELD (B)	AWG26-20	0.14 to 0.5 mm <sup>2</sup>	6.5 to 7.5 mm

- (2) Push in the wire with a 1.5 to 2.0 mm flat-blade screwdriver while depressing the release button.



- (3) Remove the flat-blade screwdriver.



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**Kawasaki Robot Controller**    F Series Controller  
Installation and Connection Manual  
- Arc Welding Application -

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