FANUC Robot series

R-30*i*B/ R-30*i*B Plus/ R-30*i*B Mate/ R-30*i*B Mate Plus CONTROLLER

ARC Welding Power Supply Option (FRONIUS TPS/i Welding Power Supply)

OPERATOR'S MANUAL

B-83614EN-4/02

●   **Original Instructions**

Thank you very much for purchasing FANUC Robot.

Before using the Robot, be sure to read the "FANUC Robot series SAFETY HANDBOOK (B-80687EN)" and understand the content.

- No part of this manual may be reproduced in any form.
- All specifications and designs are subject to change without notice.

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Should you wish to export or re-export these products, please contact FANUC for advice.

In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible".

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to enable the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.

For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.
For safe use of FANUC robots, you must read and follow the instructions in the "FANUC Robot series SAFETY HANDBOOK (**B-80687EN)**".

1   PERSONNEL

Personnel can be classified as follows.

Operator:
*   Turns the robot controller power ON/OFF
*   Starts the robot program from operator panel

Programmer or Teaching operator:
*   Operates the robot
*   Teaches the robot inside the safeguarded space

Maintenance technician:
*   Operates the robot
*   Teaches the robot inside the safeguarded space
*   Performs maintenance (repair, adjustment, replacement)

-       The operator is not allowed to work in the safeguarded space.
-       The programmer or teaching operator and maintenance technician are allowed to work in the safeguarded space. Work carried out in the safeguarded space include transportation, installation, teaching, adjustment, and maintenance.
-       To work inside the safeguarded space, the person must be trained on proper robot operation.

Table 1 (a) lists the work outside the safeguarded space. In this table, the symbol "O" means the work allowed to be carried out by the specified personnel.

Table 1 (a) List of work outside the Safeguarded Space

	Operator	Programmer or Teaching operator	Maintenance technician
Turn power ON/OFF to Robot controller	O	O	O
Select operating mode (AUTO/T1/T2)		O	O
Select remote/local mode		O	O
Select robot program with teach pendant		O	O
Select robot program with external device		O	O
Start robot program with operator's panel	O	O	O
Start robot program with teach pendant		O	O
Reset alarm with operator's panel		O	O
Reset alarm with teach pendant		O	O
Set data on teach pendant		O	O
Teaching with teach pendant		O	O
Emergency stop with operator's panel	O	O	O
Emergency stop with teach pendant	O	O	O
Operator's panel maintenance			O
Teach pendant maintenance			O

During robot operation, programming and maintenance, the operator, programmer, teaching operator and maintenance technician take care of their safety using at least the following safety protectors:

- Use clothes, uniform, overall adequate for the work
- Safety shoes
- Helmet

2 DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with **"WARNING"** or **"CAUTION"** according to its severity. Supplementary information is indicated by **"NOTE"**. Read the contents of each **"WARNING"**, **"CAUTION"** and **"NOTE"** before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

PREFACE

Prior to the use of the arc welding robot package FANUC Robot welding power supply option, this chapter provides an introduction to this manual and describes safety precautions.
Before using the robot, be sure to read and understand this documentation.

MANUALS

About this manual

The arc welding package " FANUC R-30*i*B/R-30*i*B Plus/R-30*i*B Mate/R-30*i*B Mate Plus CONTROLLER Arc Welding Power Supply Option(FRONIUS TPS/i Welding Power Supply) OPERATOR'S MANUAL B-83614EN-4" describes how to operate a welding machine incorporating a robot and controller.
This manual provides descriptions of the models indicated in the table below, and uses the abbreviations of the model names below in the text.

Model name	Abbreviation
FANUC Robot ARC Mate 100*i*D	ARC Mate 100*i*D series
FANUC Robot ARC Mate 100*i*D/10L	

SAFETY PRECAUTIONS

Introduction

⚠**WARNING**
- Before using this machine, read this operator's manual thoroughly to use the machine correctly.
- The precautions in this manual are presented so that you can use the equipment safely and that injuries and damages to you and other people can be prevented.
- This equipment is designed and manufactured with sufficient consideration given to safety. When using the equipment, observe the precautions described in this operator's manual. Disregarding these precautions can cause serious accidents resulting in a human injury or death.

General precautions

⚠**WARNING**
- Observe the laws and your company's standards when performing power supply construction on the input side, selection of an installation place, handling and storing of high-pressure gas, piping, storing of welded products, waste disposal, and so forth.
- A person who uses a heart pace maker must keep away from the operating welding machine unless he or she gets permission from the doctor. When powered, the welding machine generates a magnetic field which affects pace maker operation adversely.
- For safety, installation, inspection, and repair of this equipment must be done by qualified persons or those who are familiar with the welding machine.
- For safety, operation of this equipment must be performed by those who are familiar with this operator's manual and have knowledge and skill to operate this equipment safely.
- Do not use this equipment for purposes other than welding.

Precautions relating to maintenance

> ⚠ **WARNING**
>
> When performing maintenance work, turn off the power to the robot and system where possible. If the power is on, some maintenance operations present a danger of electric shock. As necessary, provide a lock not to prevent other persons from turning on the power. If you have to perform maintenance work with the power on, press the emergency stop button where possible.

> ⚠ **CAUTION**
>
> The following parts will heat, so care must be taken. If you have to touch such a part when it is hot, prepare protectors such as heat-resistant gloves.
> - Servo motor
> - Inside of the controller
> - Welding torch

> ⚠ **CAUTION**
>
> When replacing parts, be careful to the dust intrusion into the robot.

Electric shock

> ⚠ **WARNING**
>
> - Do not touch any charged part.
> - Grounding the case of the welding power supply, a base metal, and a jig electrically connected to the base metal, and so forth must be performed according to the law (the electric facility engineering standard) by a person qualified as an electrician.
> - Before starting maintenance and inspection, be sure to turn off the switch of the power panel (the power supply of the factory). The capacitor may be charged even after the input power supply is turned off, so wait at least five minutes.
> - Do not use cables with insufficient capacities, damaged cables, and cables of which conductors are exposed.
> - Cable connection parts must be tightened securely then insulated.
> - Do not use the machine with the case or cover of the welding power supply left removed.
> - Do not use broken or wet gloves.
> - Maintenance and inspection must be performed periodically, and any damaged parts must be repaired before the use of the machine.

Weld fumes and gases

⚠️**WARNING**

- In places defined by the laws (the labor safety and health regulation and the regulation for preventing anoxia and so forth), provide sufficient ventilation or use a device such as an air respirator to prevent gas poisoning and suffocation.
- To prevent dust troubles and poisoning due to fumes and so forth, use a local exhaust system defined by the laws (the labor safety and health regulation and the regulation for preventing dust troubles) or a respiratory protector.
- Carbon dioxide gas and other gases that are heavier than air stay in a bottom part. Therefore, when performing robot welding operation in the bottom part or a narrow place, provide sufficient ventilation, or use an air respirator.
- Do not perform robot welding near the places where degreasing, cleaning, and spraying are performed. Otherwise, toxic gas may be generated in such environments.
- When welding coated steel, be sure to provide sufficient ventilation or use a respiratory protector. Welding coated steel generates toxic gas or fumes.

Prevention of fires and explosions

⚠️**WARNING**

- A base metal immediately after spattering or cutting is heated and can cause a fire.
- A portion where a cable is connected incompletely or an incomplete contact in the current path on the base metal side such as a steel frame can be heated when the power is on, which can cause a fire.
- Generating arc in a container of a combustible substance such as gasoline can cause explosion.
- Get rid of any combustible substance so that a spatter does not splash over the substance. If a combustible substance cannot be removed, cover the substance with a non-combustible cover.
- Do not perform welding near the presence of a combustible gas.
- Cable connection parts must be tightened securely and insulated.
- The cable should be connected on the base metal side as close as possible to the portion to be welded.
- Install a fire extinguisher near the welding place in preparation for emergency.

Arc light, spatter, and noise

⚠️**CAUTION**

- The arc light can cause eye inflammation or skin burning.
- Splashing a spatter and slag can cause eye injury or burning.
- Noise can cause abnormality in hearing.
- When supervising welding work, wear safety glasses that provide sufficient glare protection or wear a safety mask for welding.
- Wear safety glasses to protect the eyes from spatter and slag.
- Wear protectors such as leather gloves for welding, long-sleeved clothes, foot covers, and a leather apron.
- Install a safety curtain around the welding place to prevent the arc light from reaching the eyes of other persons.
- If the noise level is high, use a noise protector.

Gas cylinder and gas regulator

> ⚠️**WARNING**
> ■ If the gas cylinder falls, an accident can be caused, resulting in a human injury or death.
> ■ High-pressure gas is encapsulated in the gas cylinder.
>   Therefore, incorrect handling of the gas cylinder can cause high-pressure gas to blow out, which can lead to an accident resulting in a human injury or death.
> ■ When handling the gas cylinder, observe the law and the in-house standard.
> ■ Use the gas flow rate controller supplied by FANUC or recommended by FANUC.
> ■ Before using the gas flow rate controller, read the relevant operator's manual and observe the precautions described in the manual.
> ■ Secure the gas cylinder on a dedicated gas cylinder stand.
> ■ Do not subject the gas cylinder to a high-temperature environment.
> ■ When opening the valve of the gas cylinder, keep your face away from the outlet.
> ■ Whenever the gas cylinder is not in use, be sure to mount the protection cap on the cylinder.

Welding wire

> ⚠️**CAUTION**
> The wire can protrude suddenly from the tip of the welding torch, which can result in an eye, face, or body injury.
> ■ Do not perform inching with your eyes or face close to the tip of the welding torch. Should the wire protrude unexpectedly, the wire can injure the eyes, face, or body.

SAFETY MEASURES

Safety precautions

Unlike ordinary automatic machines, robots have arms and wrists which can be moved. This means that robots can adopt any posture quite easily, but it also means that they are quite dangerous. Usually, a robot and peripheral equipment make up an automatic system.

Therefore, the user of the robot must take safety precautions for the entire system. The safety precautions are described below.

Safety precautions for installation and layout

- Use signals such as warning lamps to indicate that the robot is in operation.
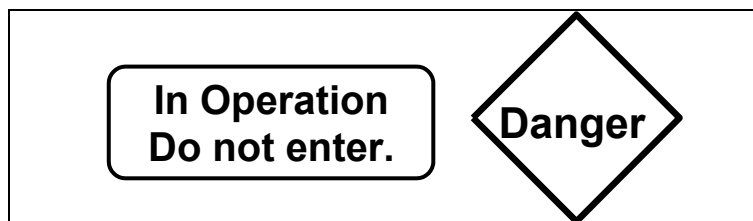

Fig. 1 Example of Alarm indications

- Install a safety fence with a safety door so that a worker can enter the inside of the fence only by opening the door, and opening the door causes the robot to stop.

> **NOTE**
> The controller brings the robot to a deceleration stop when the safe speed (XSFSPD) input signal is turned off.

- Install the safety fence so that it encloses the robot operation area completely. Install the controller outside the safety fence.
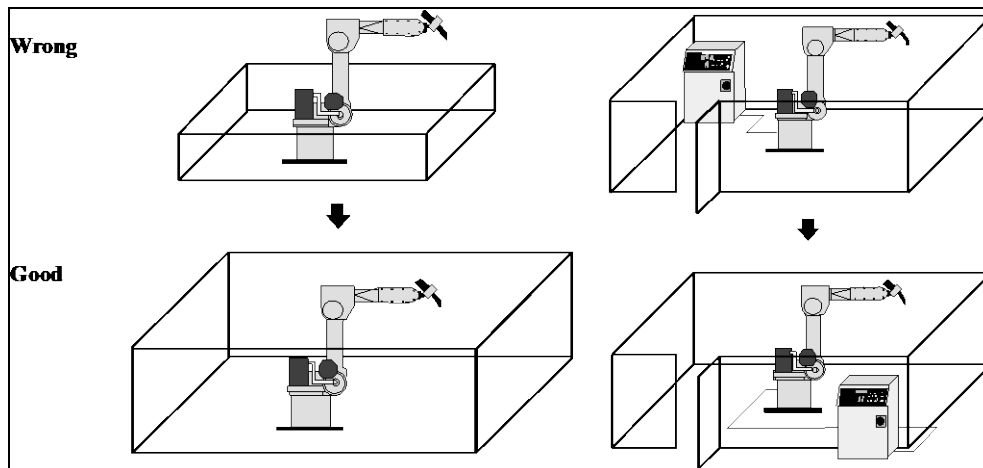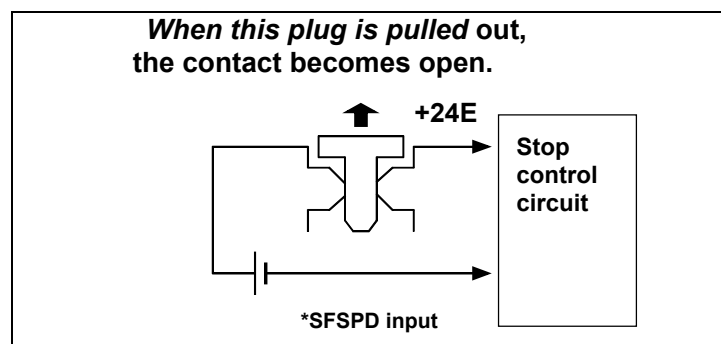

Fig. 2 Safety fence

Fig. 3 Safety plug

- Install an emergency stop button in a place that allows the operator to press it immediately.

> **NOTE**
> Upon receiving the emergency stop signal, the controller brings the robot to an emergency stop.

Safety precautions for system design

- Install a safety joint between the robot's joints forming a tool so that if an abnormal external force is applied to the robot the safety joint breaks and the robot stops.

> **NOTE**
> When the hand break (XHBK) input signal is turned off, the controller brings the robot to an emergency stop.

- Ground all peripheral units properly.
- When an available operating area is smaller than the maximum operating area of the robot, the operating area can be specified by parameters.
- The robot can receive several types of external interlock signals.

By sending the operating status of a peripheral unit to the robot, robot operation can be suspended or stopped.
- Install a lock as required so that only authorized workers can turn on the power.

NOTE
    A padlock can be installed on the circuit breaker of the controller door to prevent the power from being turned on by an unauthorized person.
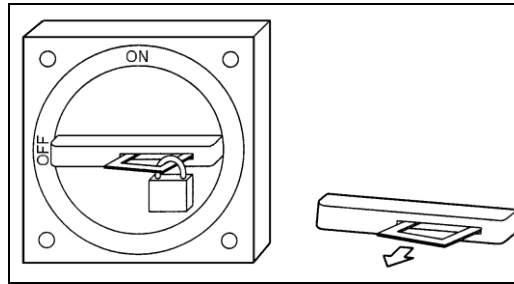

Fig. 4 Locking the circuit breaker

Safety precautions for inspection and maintenance

- Before starting inspection and maintenance, turn off the power to the controller whenever possible. Lock the circuit breaker or place a guard to prevent an unauthorized person from turning on the power.
- Before disconnecting the pneumatic system, release the supply pressure.
- Before making an electrical check that requires no robot operation, press the emergency stop button.
- When making an inspection that requires robot operation, carefully observe the motion of the robot so that the emergency stop button can be immediately pressed whenever required.
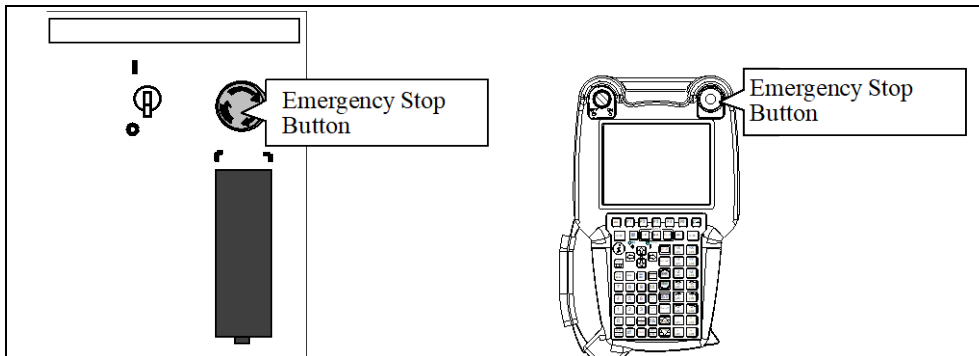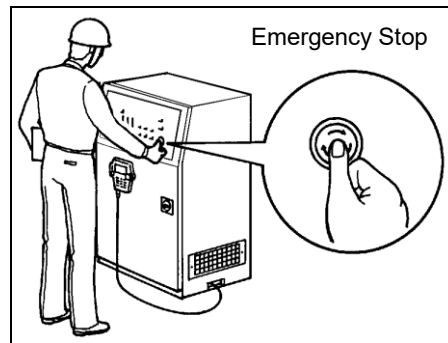
Emergency Stop

Emergency Stop Button

Emergency Stop Button

Fig. 5 Emergency stop button

Safety precautions for transportation
- Before lifting the robot with a crane or carrying the robot with a forklift, firmly secure the robot to the crane or forklift.
- Carefully inspect the carrier (crane forklift, etc.) and also carefully inspect the grips of the product.
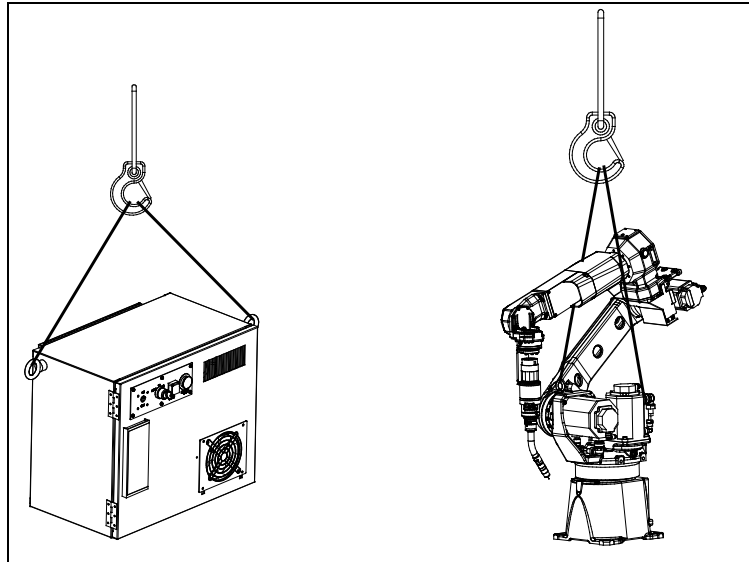

Fig. 6 Transportation of robot

Safety precautions for operation
- All robot system users are requested to attend FANUC training courses to acquire sufficient knowledge about the safety precautions and robot functions.
- Before working within the operating area of the robot -even when the robot is not running-, turn off the power to the robot or the press the emergency stop button. In addition, place a guard, warning sign, or other provision to prevent an unauthorized person from entering the operating area of the robot or activating the robot using the operator's panel or some other device.
- While working in the operating area of the robot, for example, to teach the robot a program, place a guard so that the robot can be immediately stopped in an emergency.
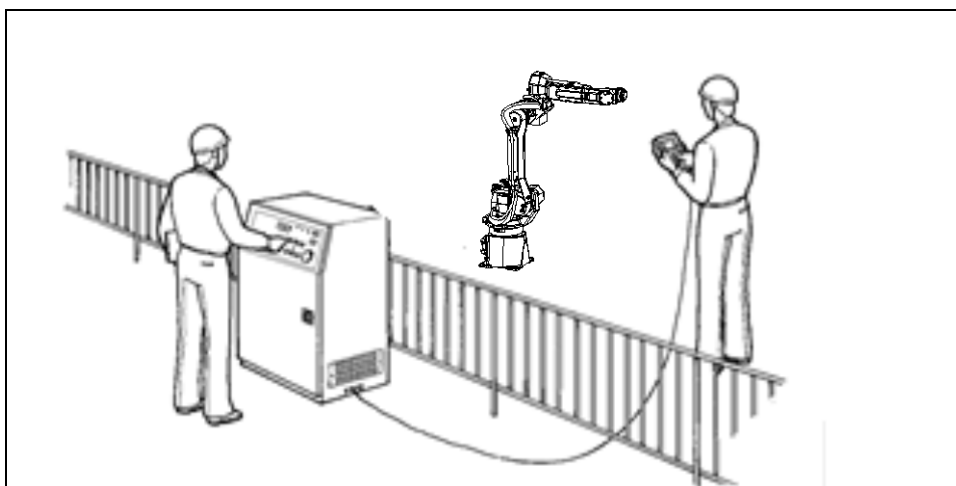

Fig. 7 Additional worker to watch for danger

Table 1 Safety precautions

Operator	Workshop	Transportation and installation
Avoid dangerous behavior. Wear safety clothes. Wear safety shoes and a helmet.	Keep the work environment neat, tidy, and clean. Provide a safety fence and warning indications. Provide ventilation. Never bring flammable materials into the workshop.	Keep the transportation path free of obstacles. When carrying the robot on a carrier such as a crane or forklift, ensure that the robot is firmly secured to the carrier. Allow sufficient clearance. Make connections properly.
Operation	**Maintenance · Check**	**Welding power supply · Torch**
Attend training classes. Master the operating procedures. Exclude unauthorized persons.	Perform repair work using FANUC products only. Before starting maintenance and inspection, turn off the power. Keep the controller door closed.	Check and maintain the cables. Check the pneumatic system. Insulate the robot from the welding gun. Provide a spatter shield. Check for cooling water leakage.

Fig. 8 Safety Clothes and Safety Helmet

- Before approaching the robot to teach a program to it, hold the teach pendant, press the enabling device (deadman switch), then turn on the teach pendant enable switch.

NOTE
The enabling device, if released when the teach pendant ON/OFF switch is on, brings the robot to an emergency stop.

Teach Pendant ON/OFF switch
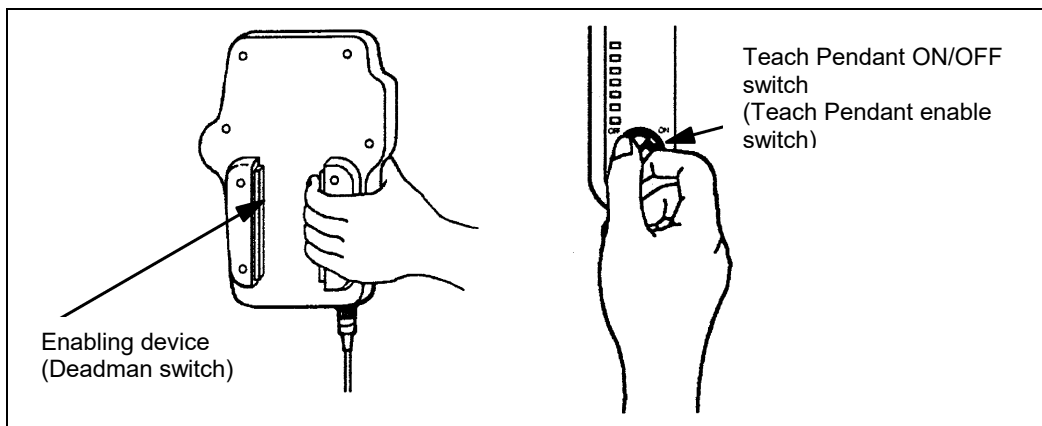(Teach Pendant enable switch)

Enabling device
(Deadman switch)

Fig. 9 Enabling device and teach Pendant ON/OFF switch

- Before starting to jog the robot, carefully observe the operation of the jog keys and the robot.
- During jogging, use a sufficiently low robot override speed.

> **NOTICE**
> The warning indications attached to the product and the contents of this operator's manual are created based on the product-related legislation, standards, requirements, regulations, and so forth (referred to as the related laws). The related laws are subject to amendment. If restrictions on the use of the product which are defined on the user side based on the related laws need to be modified because of amendment of the related laws, the modification should be made on the user's responsibility.

RELATED MANUALS

Safety handbook **B-80687EN**
All persons who use the FANUC Robot and system designer must read and understand thoroughly this handbook
		Intended readers:
		    Operator , system designer
		Topics:
		    Safety items for robot system design, Operation, Maintenance

R-30*i*B/R-30*i*B Plus/ R-30*i*B Mate/ R-30*i*B Mate Plus CONTROLLER	OPERATOR'S MANUAL (Basic Operation) **B-83284EN**
	OPERATOR'S MANUAL (Alarm Code List) **B-83284EN-1**
	OPERATOR'S MANUAL (Optional Function) **B-83284EN-2**
	ARC WELDING FUNCTION OPERATOR'S MANUAL **B-83284EN-3**
		Intended readers :
		    Operator, programmer, Teaching operator, Maintenance engineer, System designer
		Topics :
		    Robot functions, Operations, Programming, Setup, Interfaces, Alarms
		Use :
		    Robot operation, Teaching, System design

	MAINTENANCE MANUAL
	R-30*i*B/ R-30*i*B Plus : **B-83195EN**
	R-30*i*B Mate/R-30*i*B Mate Plus: **B-83525EN**
		Intended readers :
		    Maintenance engineer, System designer
		Topics :
		    Installation, Connection to the controller, Maintenance
		Use :
		    Installation, Start-up, Connection, Maintenance

FANUC Robot FANUC Robot ARC Mate 100*i*D,M-10*i*D Mechanical unit	OPERATOR'S MANUAL **B-83944EN**	Intended readers:
		    System designer, Maintenance engineer
		Topics:
		    Installation, Connection to controller, Maintenance
		Use:
		    Installation, Start-up, Connection, Maintenance

Torch	Refer to manual of the torch (*)	
Welding power supply Wire feeder	Refer to manual of the welding power supply (*)	

(*) If there is indispensability, please make a demand in your local FANUC representative.

TABLE OF CONTENTS

APPENDIX

1   OVERVIEW

This chapter describes the basic configuration and component of the robot with arc welding power supply option.

1.1   STANDARD CONFIGURATION

Robot with welding power supply consists of a robot mechanical section, controller, welding power supply, controller, wire feeder, welding torch, wire reel stand, and so forth.
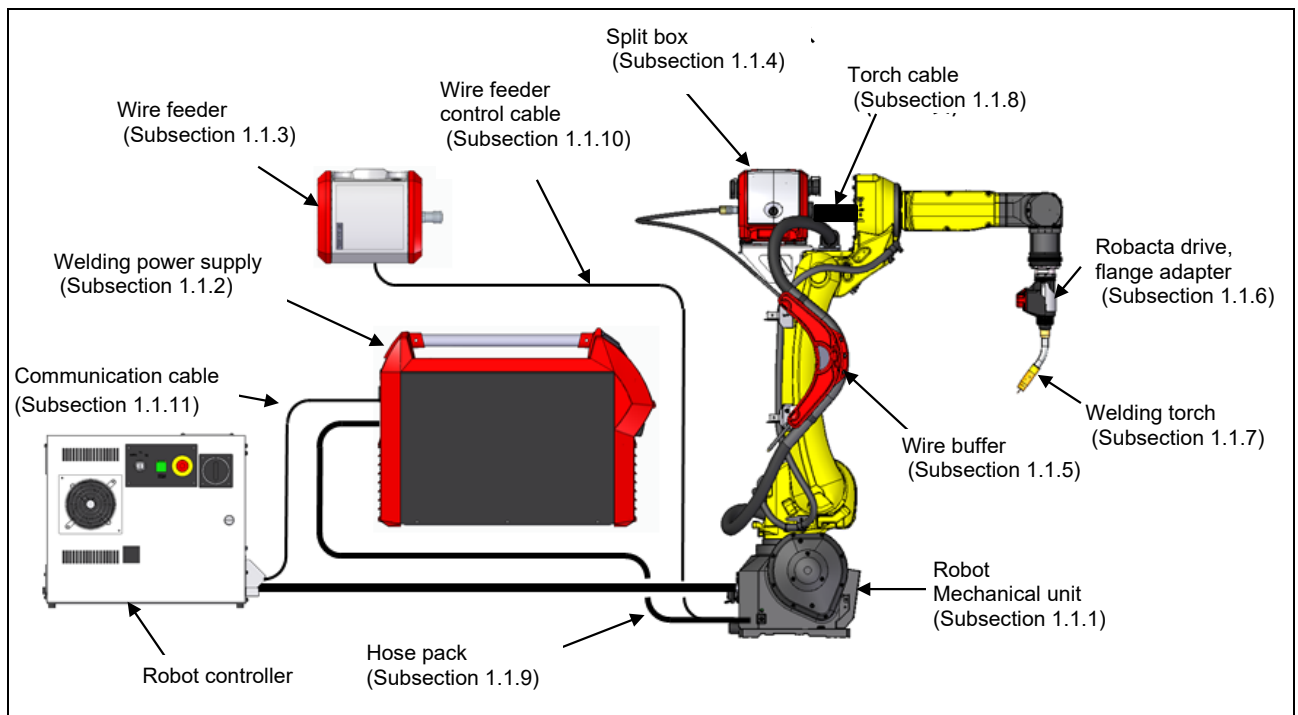
Fig. 1.1 (a) Configuration of robot with welding power supply option

1.1.1 Mechanical Unit Specification

Table 1.1.1 (a) Specifications (NOTE 1) (ARC Mate 100*i*D, /10L)

Item				Specification	
Model				ARC Mate 100*i*D, M-10*i*D/12	ARC Mate 100*i*D/10L, M-10*i*D/10L
Type				Articulated type	
Controlled axes				6 axes(J1, J2, J3, J4, J5, J6)	
Installation				Floor, Upside-down, Wall & Angle mount *Floor, Upside-down for 4 brake type (NOTE 2)	
Motion range (NOTE 3)	J1-axis	Upper limit /Lower limit		170°(2.97rad)/-170°(-2.97rad) 185°(3.23rad)/-185°(-3.23rad) (option)	
	J2-axis	Upper limit /Lower limit		145°(2.53rad)/ -90°(-1.57rad)	
	J3-axis	Upper limit /Lower limit		275°(4.80rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit		190°(3.31rad)/-190°(-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated type	140°(2.44rad)/-140°(-2.44rad)	
			External cable type	180°(3.14rad)/-180°(-3.14rad)	
			Dustproof wrist cover type	120°(2.09rad)/-120°(-2.09rad)	
	J6-axis	Upper limit /Lower limit	Cable integrated type	270°(4.71rad)/-270°(-4.71rad)	
			Dustproof wrist cover type		
			External cable type	450°(7.85rad)/-450°(-7.85rad)	
Maximum speed (NOTE 4)	J1-axis			260°/s(4.54rad/s)	
	J2-axis			240°/s(4.19rad/s)	
	J3-axis			260°/s(4.54rad/s)	
	J4-axis			430°/s(7.50rad/s)	
	J5-axis			450°/s(7.85rad/s)	
	J6-axis			720°/s(12.57rad/s)	
Maximum load	At wrist			12 kg	10 kg
	On J3 arm (NOTE 5)			12 kg	12 kg
Allowable load moment at wrist	J4-axis			26.0 N·m	22.0 N·m
	J5-axis			26.0 N·m	22.0 N·m
	J6-axis			11.0 N·m	9.8 N·m
Allowable load inertia at wrist	J4-axis			0.90 kg·m^2	0.65 kg·m^2
	J5-axis			0.90 kg·m^2	0.65 kg·m^2
	J6-axis			0.30 kg·m^2	0.17 kg·m^2
Repeatability (NOTE 6)				±0.02 mm	±0.03 mm
Mass				145 kg	150kg
Acoustic noise level				Less than 70dB (NOTE 7)	
Installation environment				Ambient temperature: 0 to 45℃ (NOTE 8) Ambient humidity: Normally 75%RH or less (No condensation allowed.) Short time (Within 1 month) 95%Rh or less (No condensation allowed.) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2(0.5G) or less Free of corrosive gases (NOTE 9)	

NOTE

1   Even if the robot is used according to the defined specifications, motion programs might shorten reducer life or cause the robot to overheat. Use ROBOGUIDE (system design support tool by FANUC) for further evaluation before running production.

2   If the robot is installed as wall & angle mount, the motion range will be limited. See Section 3.6 of the mechanical unit operator's manual (B-83944EN)..

3   Cable integrated type and external cable type are not prepared for M-10iD/12 dustproof wrist cover type.

4   During short distance motions, the axis speed may not reach the maximum value stated.

5   Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of the mechanical unit operator's manual (B-83944EN)for detail.

6   Compliant with ISO9283.

7   This value is equivalent continuous A-weighted sound pressure level, which applied with ISO11201 (EN31201). This value is measured with the following conditions.
    -   Maximum load and speed
    -   Operating mode is AUTO

8   When the robot is used in a low temperature environment that is near to 0°C, or not operated for a long time in the environment that is less than 0°C (during a holiday or during the night), a collision detection alarm (SRVO-050) etc. may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

9   Contact the service representative, if the robot is to be used in an environment or a place subjected to hot/cold temperatures, severe vibrations, heavy dust, water, water vapor, cutting oil, cleaning fluid splash and or other contaminations.

1.1.2   Welding Power Supply

Table 1.1.2 (a) Specification of welding power supply (TPS 400i /MV/nc)

Item	Specifications
Welding power supply spec.	A05B-1295-H105#G(gas cooling), A05B-1295-H105#W(water cooling)
Welding type	MIG/MAG/CMT/TIG
Rated input voltage・phase, spec.	AC 200/230/380/400/460V, 3 phase
Input frequency	50/60Hz
Rated input power	17.0kVA
Output current	DC 10 A to 420 A
Output voltage	DC 14.2 V to 34.0V
Mass	47.1kg
Maker type	4,075,174,830
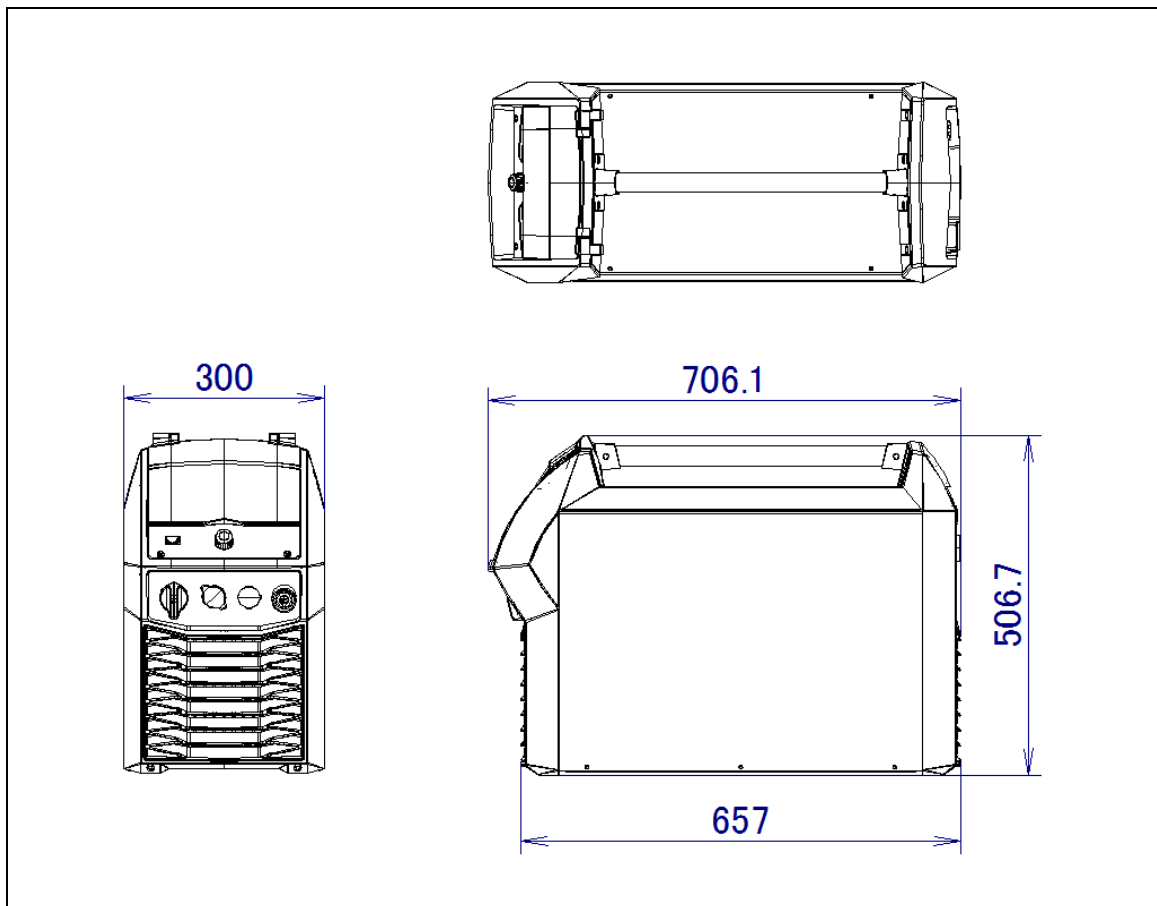
Fig. 1.1.2 (a) External dimensions of the welding power supply

Standard use rate

Refer to the following table for use rate of power supply main body and each machine.

Table 1.1.2 (b) Standard use rate of machines

Machine	Duty cycle	Remarks
Welding power supply (TPS400i)	40% at 400A 100% at 320A	
Gas cooling torch (MTB 350i G R)	60% at 350A, 100% at 300A (CO2) 60% at 300A, 100% at 250A (MAG)	
Water cooling torch (MTB 500i W R)	100% at 500A	Common to CO2 and MAG
Robacta drive (gas cooling)	60% at 260A 100% at 210A	Common to CO2 and MAG For CMT
Robacta drive (water cooling)	100% at 280A	Common to CO2 and MAG For CMT
Torch cable (gas cooling)	60% at 400A, 100% at 320A (CO2) 60% at 320A, 100% at 260A (MAG)	
Torch cable (water cooling)	100% at 500A	Common to CO2 and MAG
Hose pack (gas cooling)	60% at 365A, 100% at 320A	
Hose pack (water cooling)	60% at 450A, 100% at 360A	
Split box	100% at 500A	

Refer to the following table for use rate of the whole welding system.

Table 1.1.2 (c) Standard use rate of welding systems

Item	Duty cycle	Remarks
Gas cooling (without cooling machine)	60% at 260A 100% at 210A	Common to CO2 and MAG For CMT
Water cooling (with cooling machine)	100% at 280A	Common to CO2 and MAG For CMT

Installation method of the welding power supply

For intake and exhaust, of the welding power supply, we recommend use in the environment that can take distance more than 0.5m to welding power supply circumference.

The quantity advance of the welding power supply in the environment with much mine dust

If there is a risk of the mine dust and sputtering is scattered, set welding power supply on a stand of around 30cm to prevent absorb them.

Please refer to Setup section of welding power supply manual.
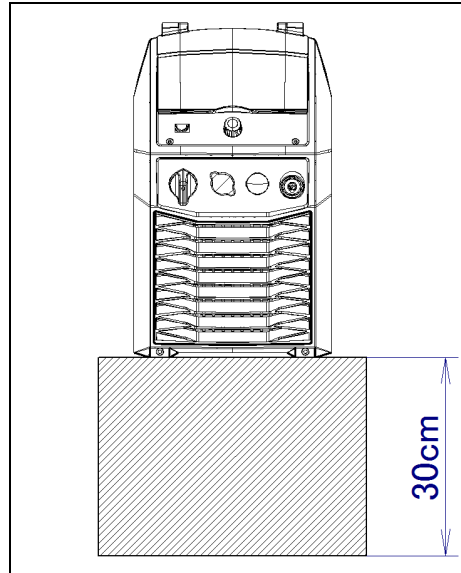
Fig. 1.1.2 (b) Quantity advance of welding power supply

Transportation method of welding power supply

When transporting welding power supply only, use a crane. When lifting it, be sure to carry out it by two persons or more.
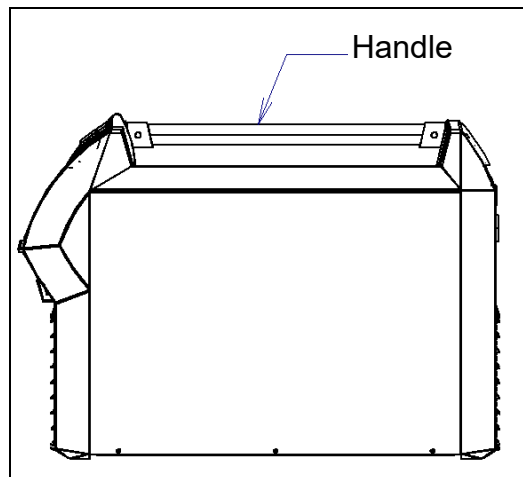
Fig. 1.1.2 (c) Transportation of welding power supply

1.1.3   Wire Feeder

Table 1.1.3 (a)   Specification of wire feeder (WF 25i REEL R/4R/G/W)

Specification	A05B-1295-H233#10 (including feeder rolls for 0.9/1.0mm wire) A05B-1295-H233#12 (including feeder rolls for 1.2mm wire)
Drive system	4 rollers driving
Mass	4.8kg
Wire speed	1 to 25m/min
Standard wire diameter	Mild steel, Aluminum or SUS Φ0.8 to 2.4
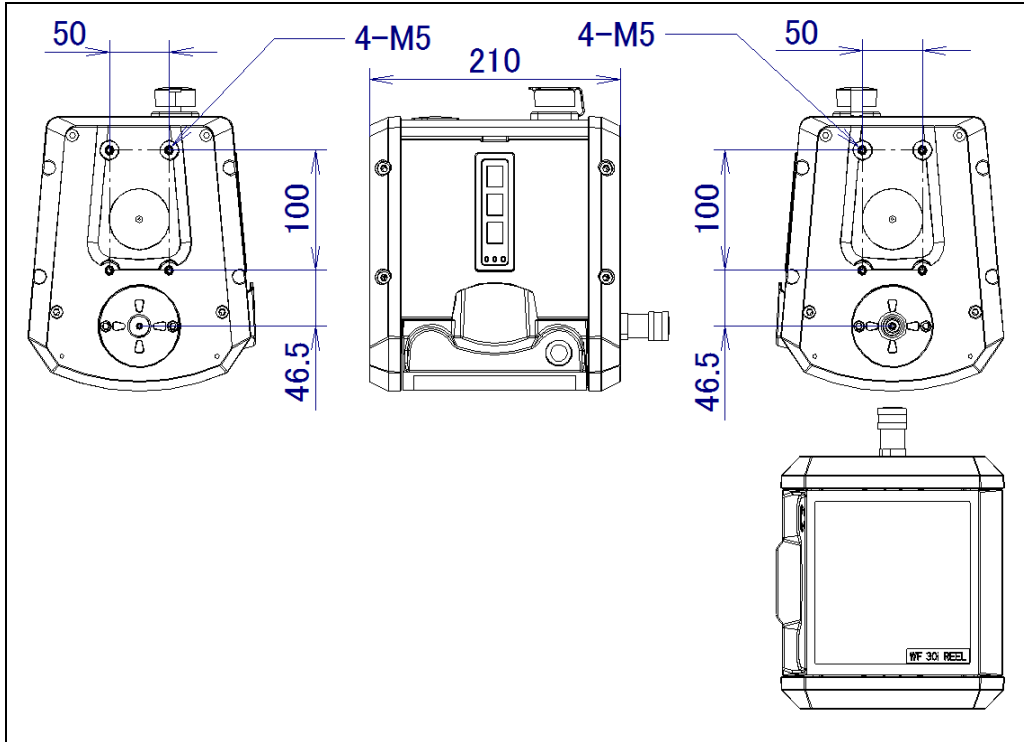
Fig. 1.1.3 Wire feeder external dimensions

1.1.4   Split Box

Table 1.1.4 (a) Specification of the split box (SB 500i R /PAP/G/W/FSC)

	Specification
Split box(for ARC Mate 100*i*D, ARC Mate 100*i*D/10L)	A05B-1295-H241#100ID
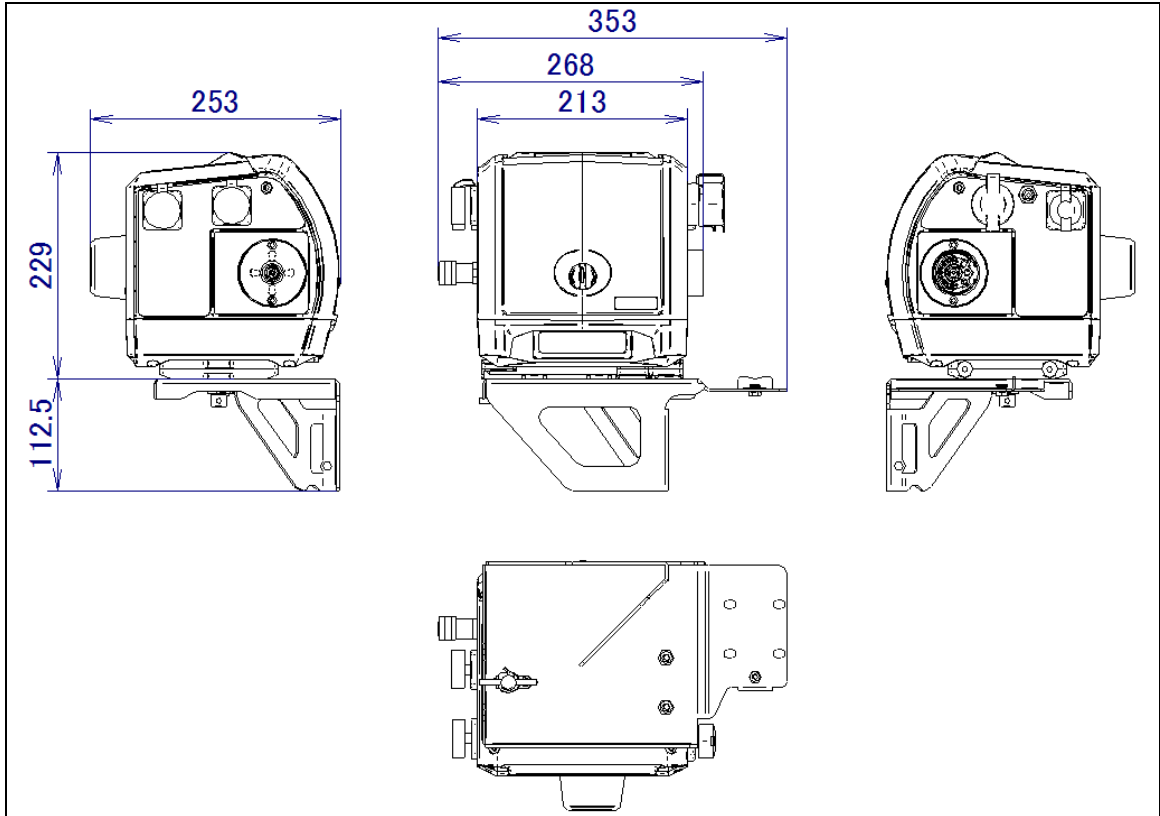
Fig. 1.1.4 External dimensions of the split box

1.1.5   Wire Buffer

The wire buffer absorb extra length of the wire which is rewound by the CMT welding and control the wire feeding amount.

Table 1.1.5 (a) Specifications of the wire buffer

	Specification
Wire buffer (for ARC Mate 100*i*D, ARC Mate 100*i*D/10L)	A05B-1295-H225#100ID
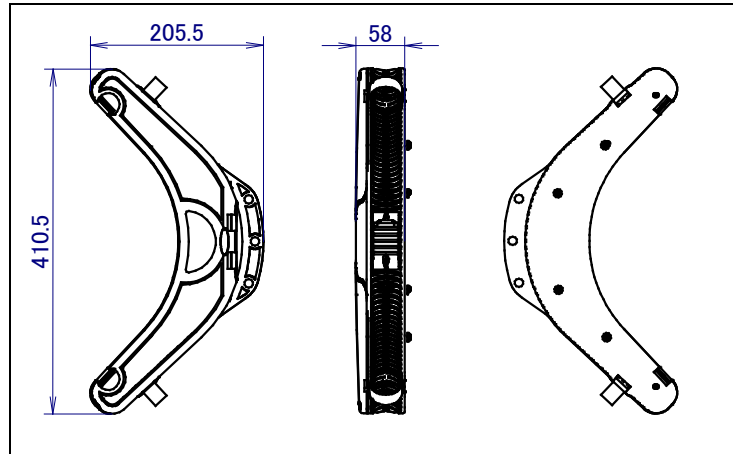
Fig. 1.1.5 (a) External dimensions of the wire buffer

1.1.6   Robacta Drive and Flange Adapter

Table 1.1.6 (a) Robacta drive (WF 60i Robacta Drive CMT)

Items	Specifications
Specification	A05B-1295-H213 (gas cooling), A05B-1295-H214 (water cooling)
Drive roll	1 drive roll and 1 driven roll
Wire speed	1 to 60m/min
Electrode wire	Mild steel, Aluminum or SUS Φ0.8 to 1.6
Nominal current	1.5A RMS
Supply voltage	DC 60 V
Maker type	4,036,391 (gas cooling), 4,036,390 (water cooling)

Table 1.1.6 (b) Flange adapter

Items	Specifications
Flange adapter (For ARC Mate 100*i*D, ARC Mate 100*i*D/10L)	A05B-1295-H394#ID

1.1.7   Welding Torch

Table 1.1.7 (a) Specification of torch

	Specification
MTB350i G R/36° (gas cooling torch)	A05B-1295-H305
MTB500i W R/36° (water cooling torch)	A05B-1295-H315

TCP and payload setting of torch is below.

Table 1.1.7 (b) TCP and payload setting of torch

	MTB 350i G R/36°	MTB 500i W R/36°	
TCP X	-125	-84.8	[mm]
TCP Y	0	0	[mm]
TCP Z	569.5	476.3	[mm]
TCP W	180	180	[degree]
TCP P	-36	-36	[degree]
TCP R	0	0	[degree]
PAYLOAD	4.20	4.10	[kg]
PAYLOAD CENTER X	-1	-0.9	[cm]
PAYLOAD CENTER Y	0	0.2	[cm]
PAYLOAD CENTER Z	17.1	16.2	[cm]
PAYLOAD INERTIA Ix	0.62	0.47	$[kgf \cdot cm \cdot s^2]$
PAYLOAD INERTIA Iy	0.64	0.48	$[kgf \cdot cm \cdot s^2]$
PAYLOAD INERTIA Iz	0.050	0.043	$[kgf \cdot cm \cdot s^2]$
ARM LOAD AXIS (AXIS 3)	7	7	[kg]

*Above-mentioned TCP is the one of 15mm in the wire thrusting out length.
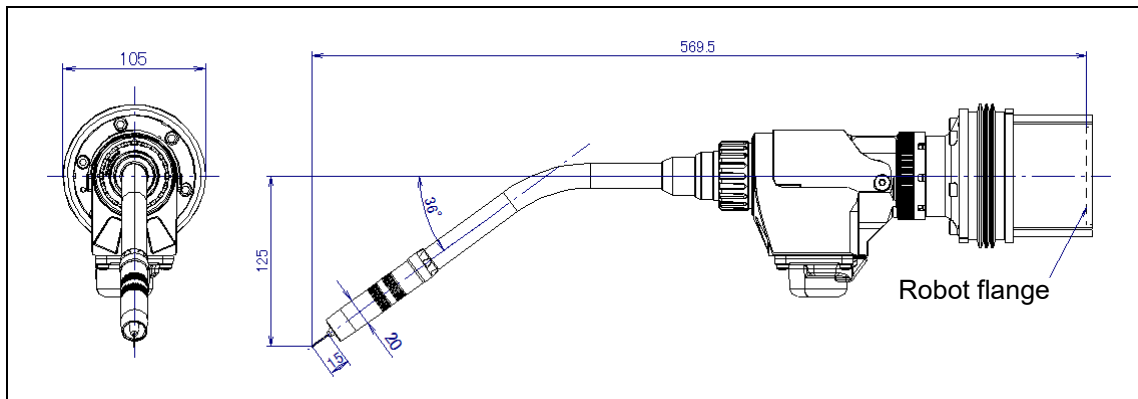
Fig. 1.1.7 (a) MTB350i G R/36° external dimensions
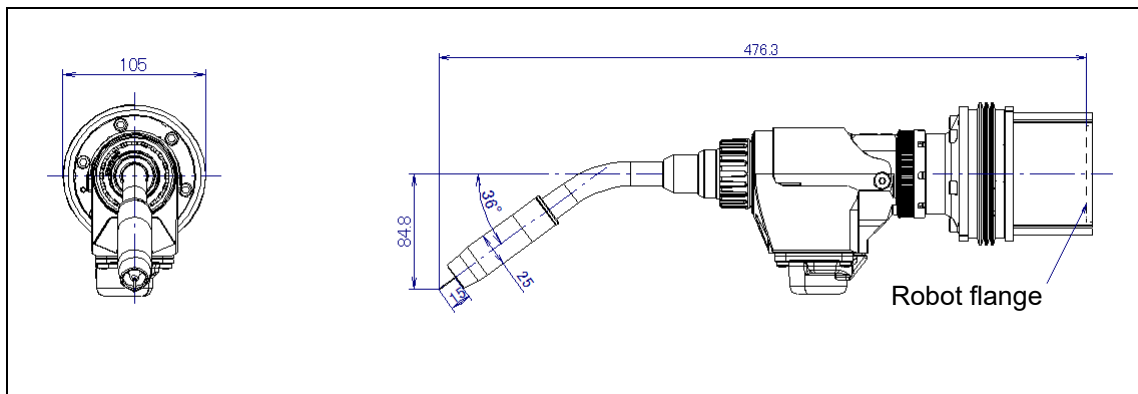
Fig. 1.1.7 (b) MTB500i W R/36° external dimensions

1.1.8 Torch Cable

Table 1.1.8 (a) Specification of torch cables

	Specifications
Gas cooling torch cable (for ARC Mate 100*i*D)	A05B-1295-H641#100ID
Gas cooling torch cable (for ARC Mate 100*i*D/10L)	A05B-1295-H641#LG
Water cooling torch cable (for ARC Mate 100*i*D)	A05B-1295-H651#100ID
Water cooling torch cable (for ARC Mate 100*i*D/10L)	A05B-1295-H651#LG

1.1.9 Hose Pack

The welding power cable, the communication cable and the gas hose etc. are bundled up to one body at the hose pack.

Table 1.1.9 (a) Specifications of the hose packs

	Specifications
Integrated type gas cooling hose pack 4.0m	A05B-1295-H621#4M
Integrated type gas cooling hose pack 8.0m	A05B-1295-H621#8M
Separate type gas cooling hose pack 8.0m	A05B-1295-H622#8M
Separate type gas cooling hose pack 13.0m	A05B-1295-H622#13M
Separate type gas cooling hose pack 18.0m	A05B-1295-H622#18M
Integrated type water cooling hose pack 4.0m	A05B-1295-H631#4M
Integrated type water cooling hose pack 8.0m	A05B-1295-H631#8M
Separate type water cooling hose pack 8.0m	A05B-1295-H632#8M
Separate type water cooling hose pack 13.0m	A05B-1295-H632#13M
Separate type water cooling hose pack 18.0m	A05B-1295-H632#18M

There are integrated type and the separate type. In case of separate type, the hose pack is interrupted as shown in Fig. 1.1.9 (a).

Integrated type   Separate type
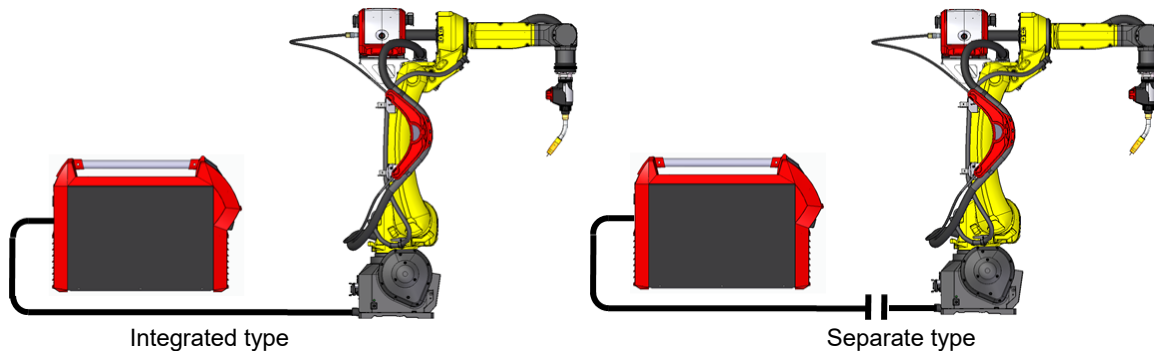
Fig. 1.1.9 (a) Type of the hose pack

1.1.10 Wire Feeder Control Cable (SpeedNet cable)

Wire feeder control cable (SpeedNet cable) is wire feeder signal and power cable. It is connected to between the split box and the wire feeder.

Table 1.1.10 (a) Specifications of the SpeedNet cable

	Specifications
SpeedNet cable 5.0m	A05B-1295-H691#5M
SpeedNet cable 10.0m	A05B-1295-H691#10M

1.1.11   Communication Cable Specifications

Table 1.1.11 (a) Communication cables

	Specification	Controller type
Ethernet cable 3.0m	A05B-2602-J230	R-30*i*B/R-30*i*B Plus controller A-cabinet
Ethernet cable 7.0m	A05B-2602-J231	
Ethernet cable 14.0m	A05B-2602-J232	
Ethernet cable 3.0m	A05B-2604-J230	R-30*i*B Plus Controller B-cabinet
Ethernet cable 7.0m	A05B-2604-J231	
Ethernet cable 14.0m	A05B-2604-J232	
Ethernet cable 3.0m	A05B-2652-J230	R-30*i*B Mate Plus Controller
Ethernet cable 7.0m	A05B-2652-J231	
Ethernet cable 14.0m	A05B-2652-J232	

1.2   OPTION CONSTITUTION
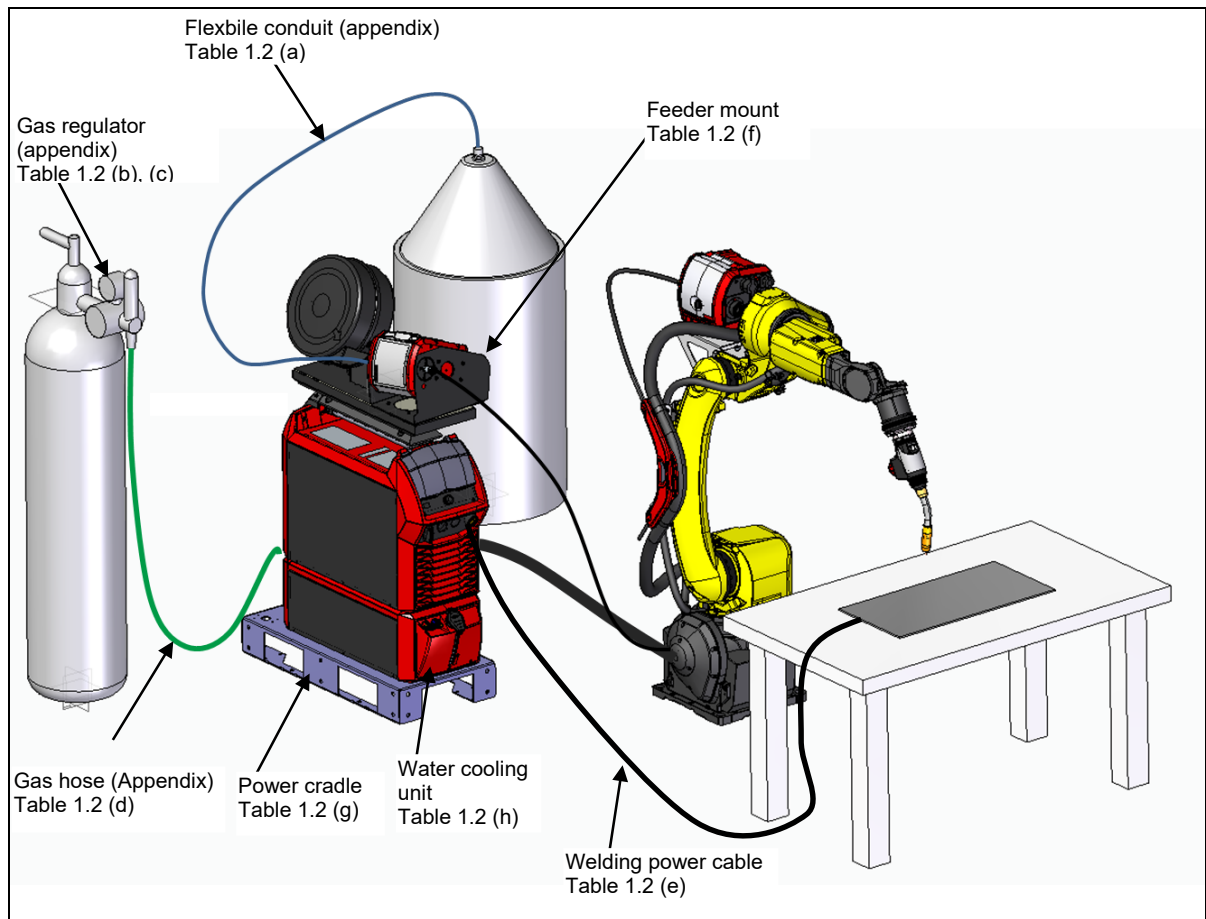
Fig. 1.2 (a) Option constitution

Table 1.2 (a) Flexible conduit specifications

	Specifications
Flexible conduit 4.6m	A05B-1291-H411
Flexible conduit 7.6m	A05B-1291-H412
Flexible conduit 3.0m	A05B-1291-H413
Flexible conduit 4.0 m for aluminum wire	A05B-1295-J312

Table 1.2 (b) Specification of the regulator (1/2)

Specifications		A05B-1291-J101
Maker		Yutaka.LTD
Decompression method		Two step decompression method
Basic performance	Inlet pressure gauge	0 to 25MPa
	Inlet pressure	Ar, MAG: 0 to 14.8MPa CO2: 0 to 12MPa
	Measurement flow quantity range	1 to 25L/min
	Safety valve	20MPa or more
	Regulated pressure	0.25MPa
Coupling	Inlet	W22-14 (R)
	Outlet	Φ8.5 hose mouth
Heating device performance	Voltage	100V
	Heating capacity	200W
	Power supply code	2P(2m)
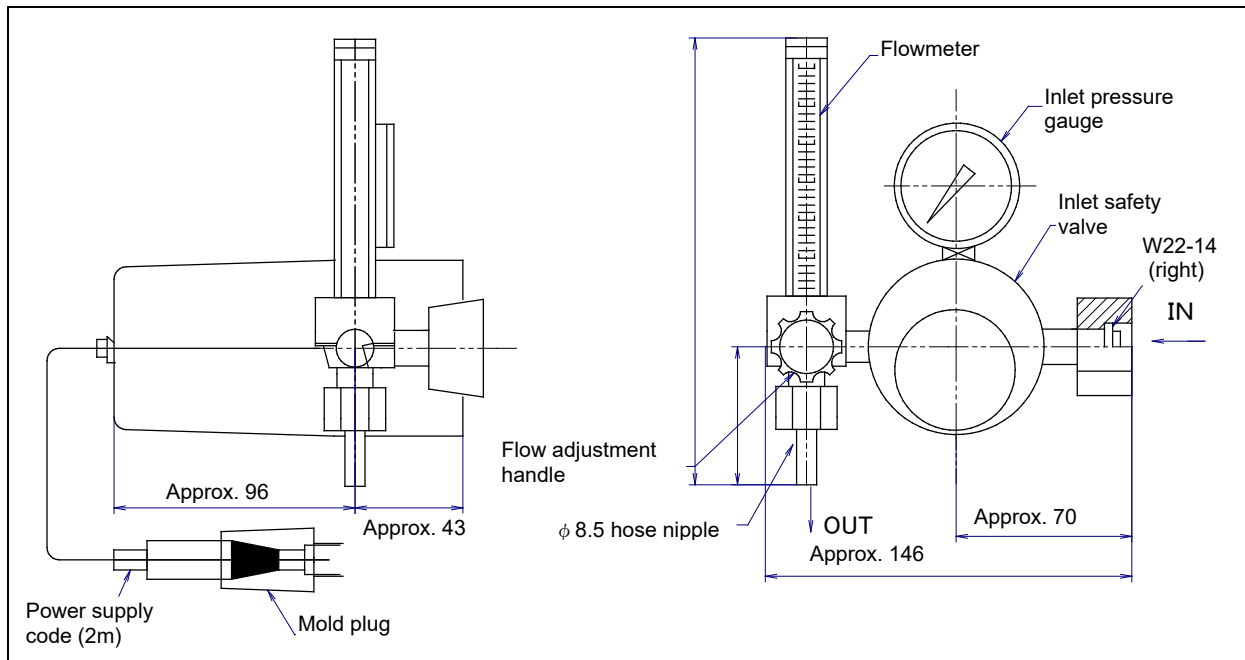
Fig. 1.2 (b) Regulator external dimensions (A05B-1291-J101)

Table 1.2 (c) Specification of regulator (2/2)

Specifications		A05B-1220-J383
Maker		Yutaka.LTD
Maker type		FR-IA
Basic performance	Gas type	For Argon gas
	Inlet pressure gauge	25MPa
	Inlet pressure	0 to 14.8MPa
	Adjustment pressure	0.25MPa
	Flow range	1 to 25L/min
	Type of flowmeter	OUT type
	Proof pressure	0.25MPa
Connection	Inlet	W22-14 O.R.
	Outlet	Φ8.5 hose nipple
Appendix	Gasket fiber x 2 pcs	
Weight (Approx)	1.6kg	
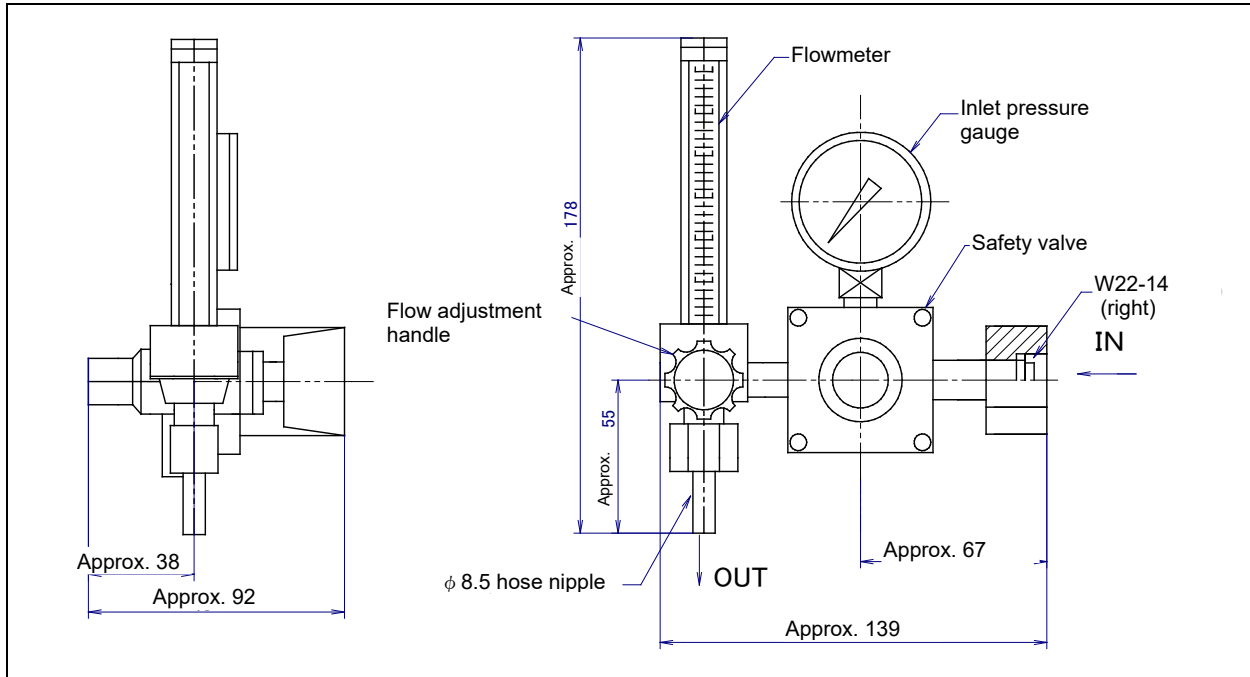
Fig. 1.2 (c) Regulator external dimensions   (A05B-1220-J383)

Table 1.2 (d) Gas hose specifications

	Specifications
Gas hose 10m	A05B-1291-J151
Gas hose 15m	A05B-1291-J152
Gas hose 20m	A05B-1291-J153
Gas hose 25m	A05B-1291-J154

Table 1.2 (e) Welding power cables specifications

	Specifications
Welding power cable(not for movable part) 38SQ 6m	A05B-1293-K701
Welding power cable(not for movable part) 38SQ 10m	A05B-1293-K702
Welding power cable(not for movable part) 38SQ 15m	A05B-1293-K703
Welding power cable(not for movable part) 38SQ 20m	A05B-1293-K704
Welding power cable(not for movable part) 60SQ 5m	A05B-1293-H711
Welding power cable(not for movable part) 60SQ 10m	A05B-1293-H712
Welding power cable(not for movable part) 60SQ 15m	A05B-1293-H713
Welding power cable(not for movable part) 60SQ 20m	A05B-1293-H714

(*)   When 2 welding power supplies are used in system, be sure to separate each power cable when forming them.

⚠ **WARNING**
1   These cables cannot be used for the moving part such as the cable carriers. (Except for movable) Please contact your local FANUC representative beforehand when the application such as the cable carriers to the moving part is necessary. Please insulate the seam of the sheath and the terminal of the welding power cable firmly. There is danger of breaking the robot when the seam touches the robot.
2   Please consider covering the cable with the rubber mule for protection etc. when hanging it with the balance device etc. that set up the cable in the surrounding for the welding outside so that it plans, the limited part is bound in the cable tie etc., and power should not concentrate on a specific part.

Table 1.2 (f) Feeder mount

	Specifications
Feeder mount	A05B-1295-J204
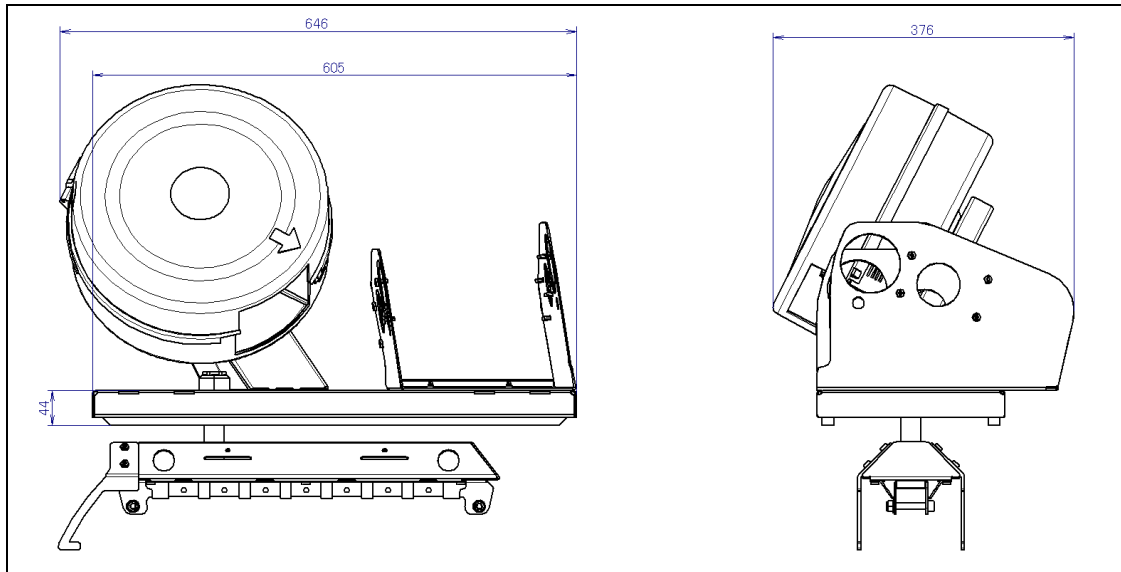
Fig. 1.2 (d) Feeder mounts external dimensions

Table 1.2 (g) Power cradle

	Specifications
Power cradle	A05B-1295-J203
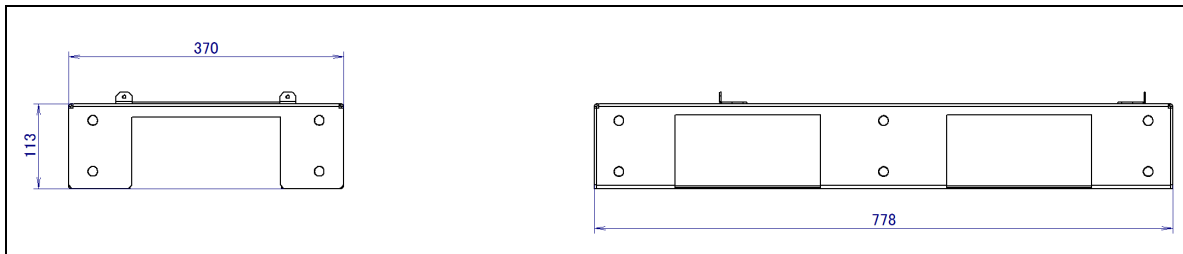
Fig. 1.2 (e) Power cradle external dimensions

Table 1.2 (h) Water cooling units

	Specifications
CU 1400i Pro	A05B-1295-J702
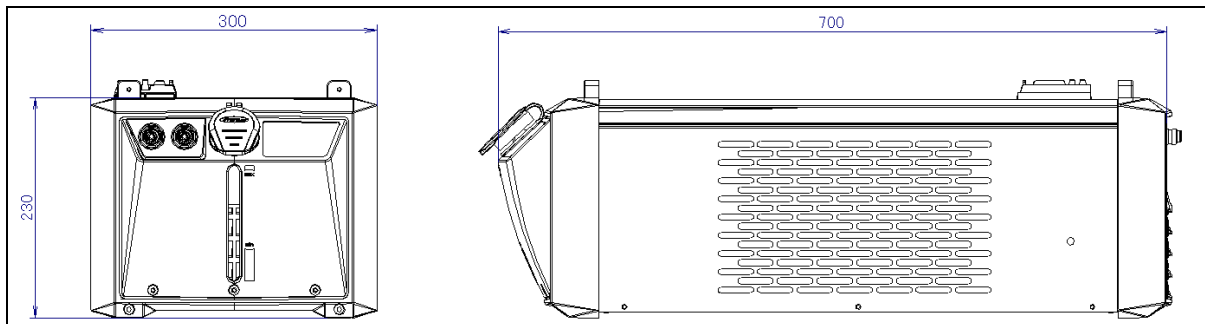
Fig. 1.2 (f) Cooling system external dimensions

2   BASIC OPERATION (QUICK REFERENCE)

2.1   FLOW FOR WELDING

1. Connection

▼

2. Turning on the power

▼

3. Jogging

▼

4. Create Weld Procedure

▼

5. Wire inching

▼

6. Making sample program

▼

7. Test cycle

▼

8. Execute welding
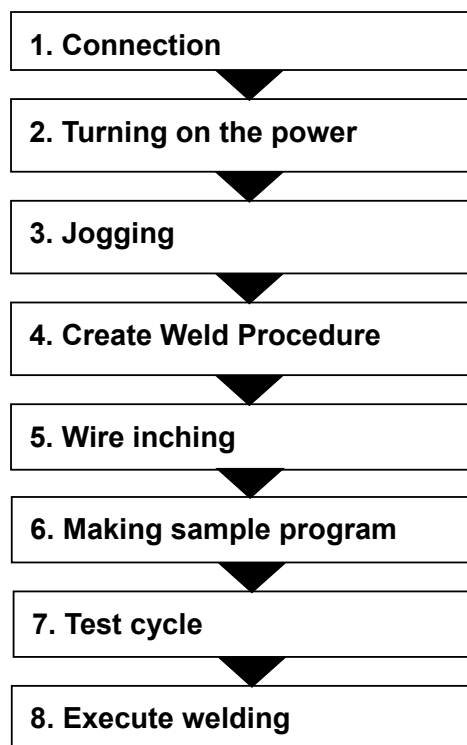
This chapter describes the shortest procedure for installing robot to carry out arc welding.
This chapter is intended for beginners of FANUC Robot.
You may skip this chapter if you are familiar with the subject.
Please refer to Chapter 3 BASIC OPERATION to Chapter 9 INITIAL SETTING and Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3) for more details of arc welding robot operation method.

2.2   CONNECTION

Fig. 2.2 shows connection contents of a robot, a controller and welding power supply.
Refer to Subsection 2.2.1 to 2.2.5 for details.

Subsection 2.2.4
Connection of the input power
supplly to the welding power supply

Subsection 2.2.3
Connection of the robot controller
and the welding power supply

Subsection 2.2.2
Connection of Input Power Supply
 to Controller

Subsection 2.2.1
Connection of Robot and Controller
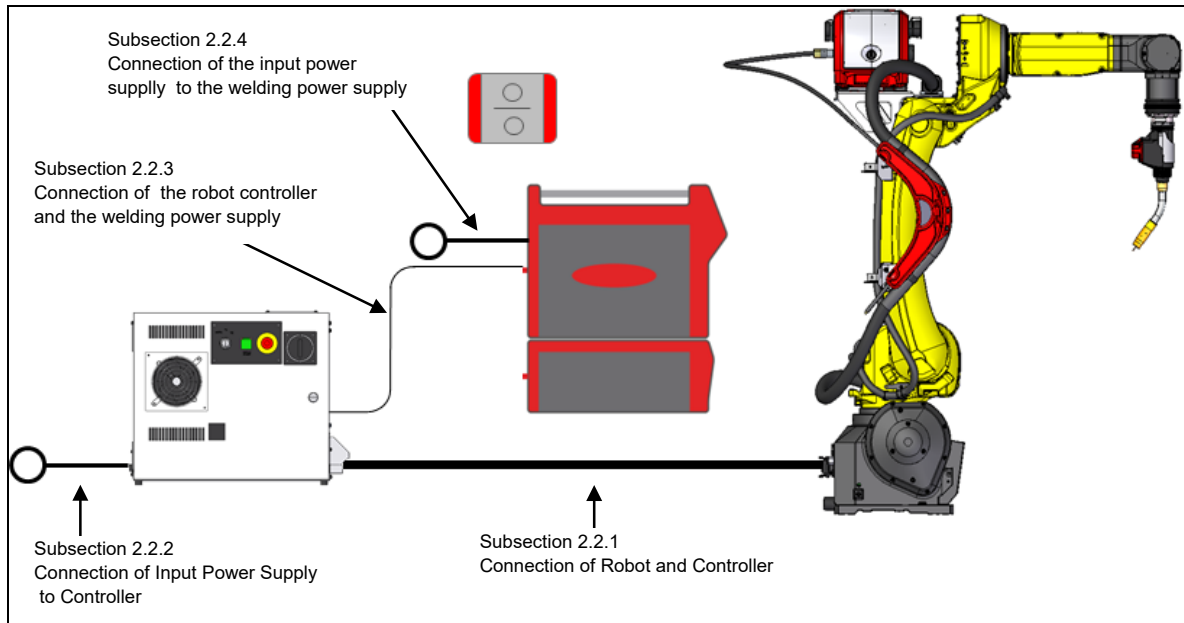
Fig. 2.2 (a) Connection contents (1/2)

Subsection 2.2.5
Connection of the wire
feeter

Section 2.13.
Adjustment of the flexible
conduit length

Subsection 2.2.5
Connection of the hose pack
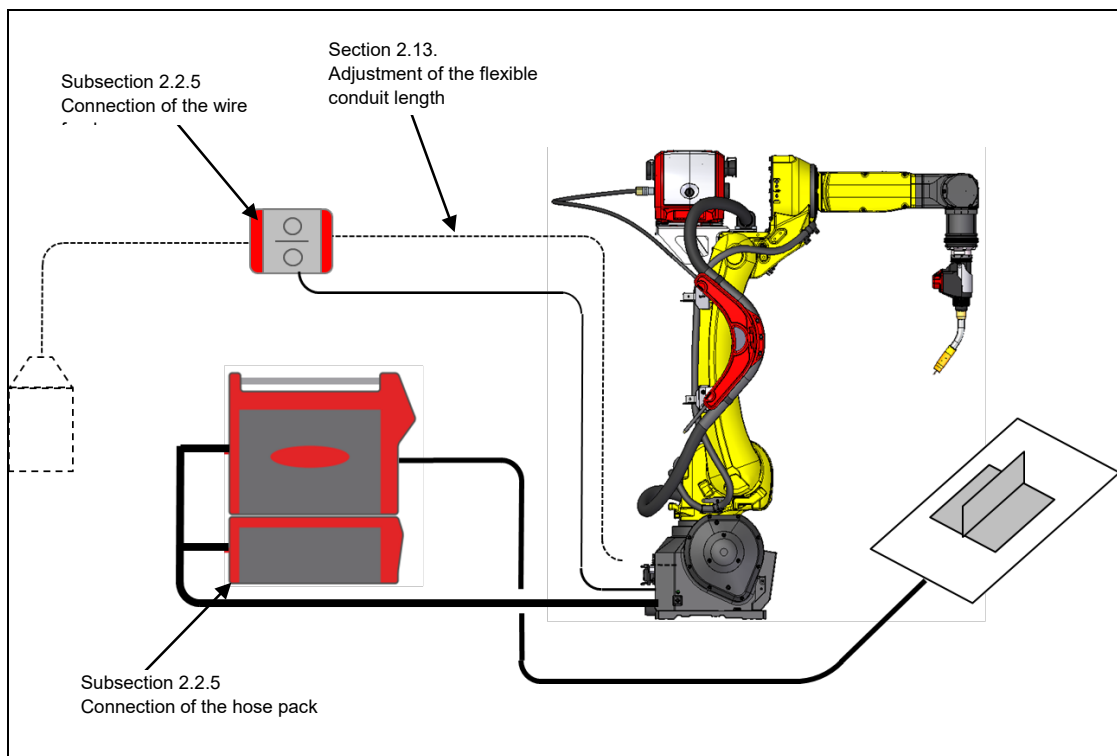
Fig. 2.2 (b) Connection contents (2/2)

2.2.1 Connection of Robot and Controller

The robot is connected with the controller via the power and signal cable and earth cable. Connect these cables to the connectors on the back of the base.

> ⚠ **WARNING**
> Before turning on controller power, be sure to connect robot and controller with the earth line. Otherwise, there is the risk of electrical shock.

> ⚠ **CAUTION**
> 1 Before connecting the cables, be sure to turn off the controller power.
> 2 Don't use 10m or longer coiled cable without untying. The long coiled cable will heat and damage itself.

Controller

Robot mechanical unit

Robot connection cable
(power, signal cable, earth line)

Air

Connector for
Power line and
Signal line

Earth terminal
(M8 bolt)
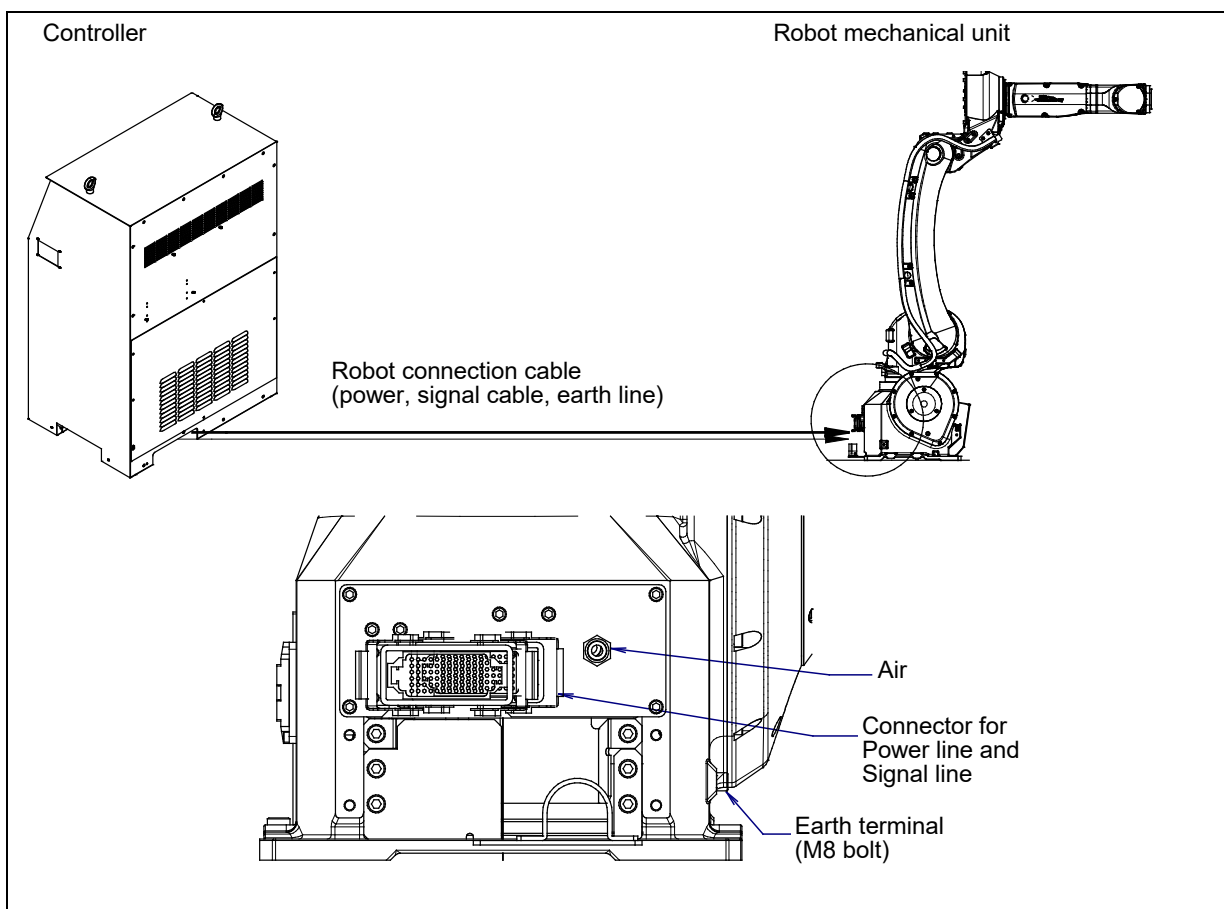
Fig. 2.2.1 (a)   Cable connection figure

2.2.2   Connection of Input Power Supply to Controller
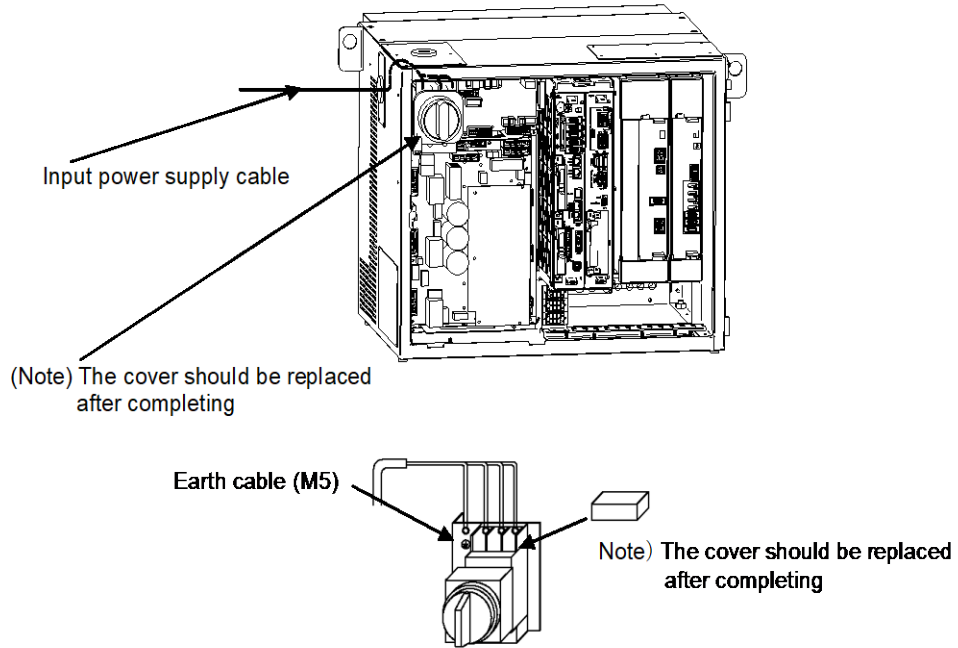
Fig. 2.2.2 (a) Connecting the input power cable (R-30*i*B/R-30*i*B Plus Controller, A-cabinet)

⚠ **WARNING**
The cover for primly terminal of main breaker should be replaced after completing.

Fix the cable

(Note) The cover should be
replaced after completing

Earth cable (M5)
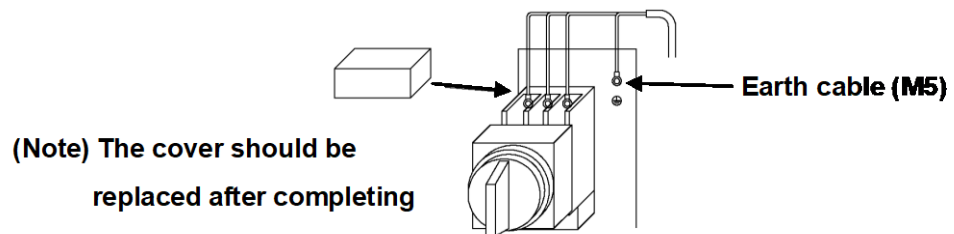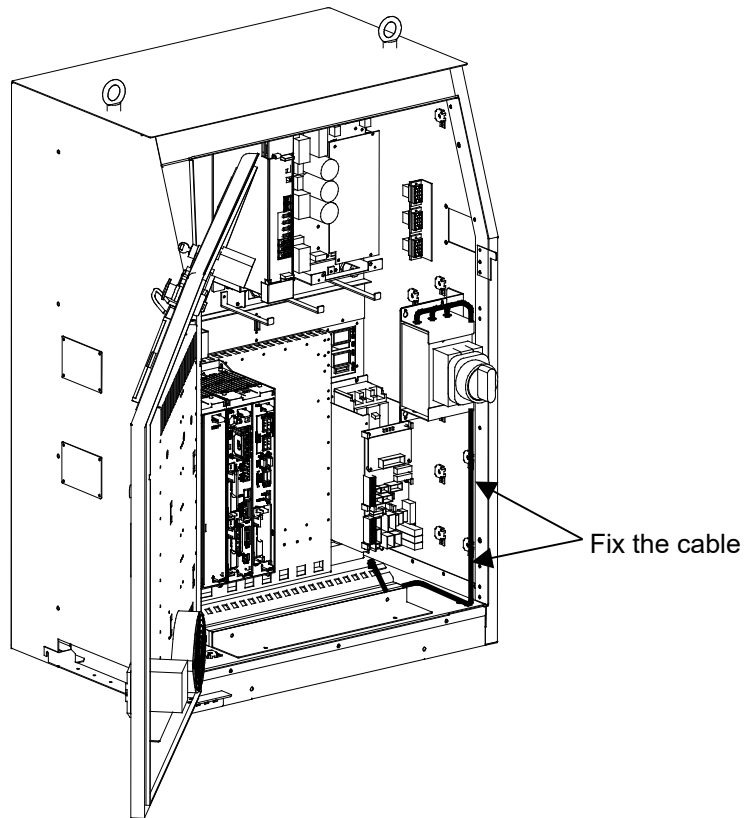
Fig. 2.2.2 (b) Connecting the input power cable (R-30iB/R-30iB Plus Controller, B-cabinet)

⚠ **WARNING**
The cover for primly terminal of main breaker should be replaced after completing.

Note) The cover should be replaced after completing

Input power supply cable

Earth cable (M5)

Note) The cover should be replaced after completing
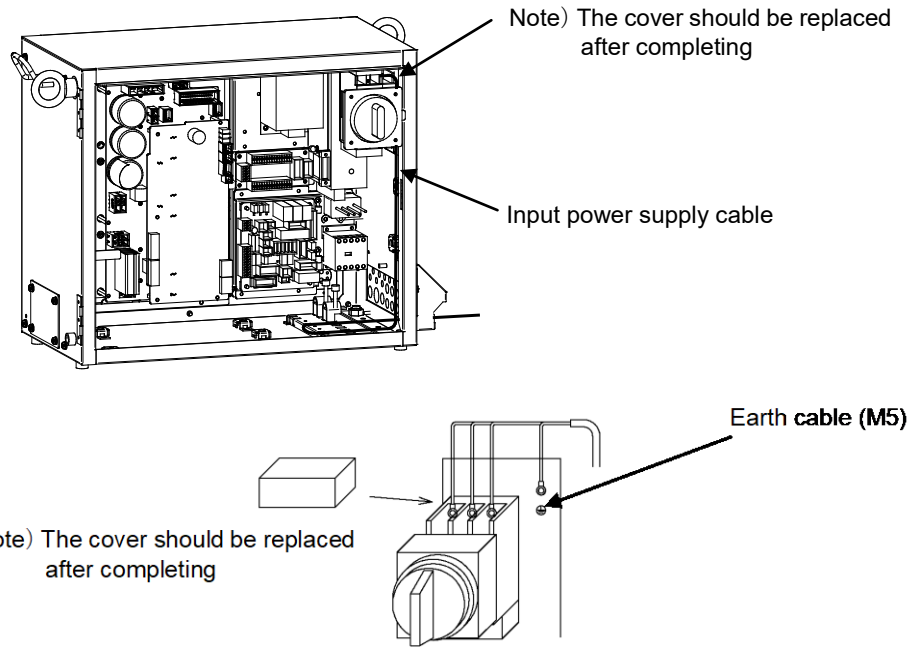
Fig. 2.2.2 (c) Connecting the input power cable (R-30*i*B Mate/R-30*i*B Mate Plus Controller)

NOTE
   Use the wire which size is from AWG14 (2mm^2) to AWG10 (5.5mm^2) for input power supply cable and earth cable.

2.2.3   Connection of Controller and Welding Power Supply

For this type of controller, the cable is drawn out only from the front of the controller. See the outline drawing of each type of board for the location of the connector.

The radius of the cable must be 70 mm or more.

Twist pair cable

Cable clamp

Earth plate
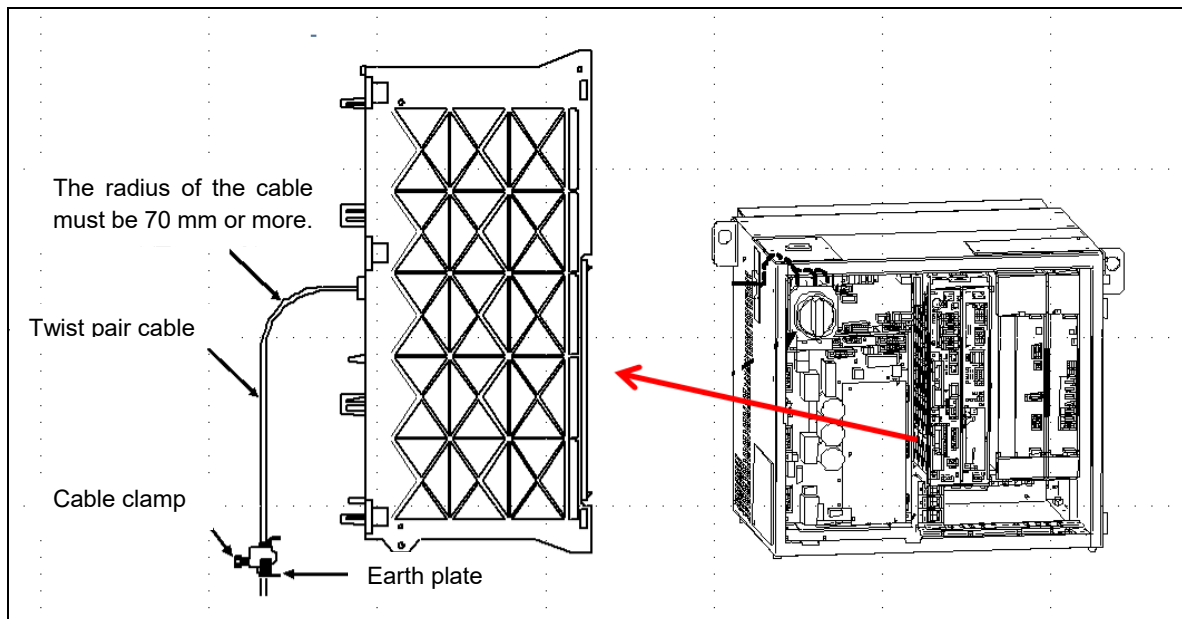
Fig. 2.2.3 (a) Connection of Ethernet cable (R-30*i*B/R-30*i*B Plus controller)
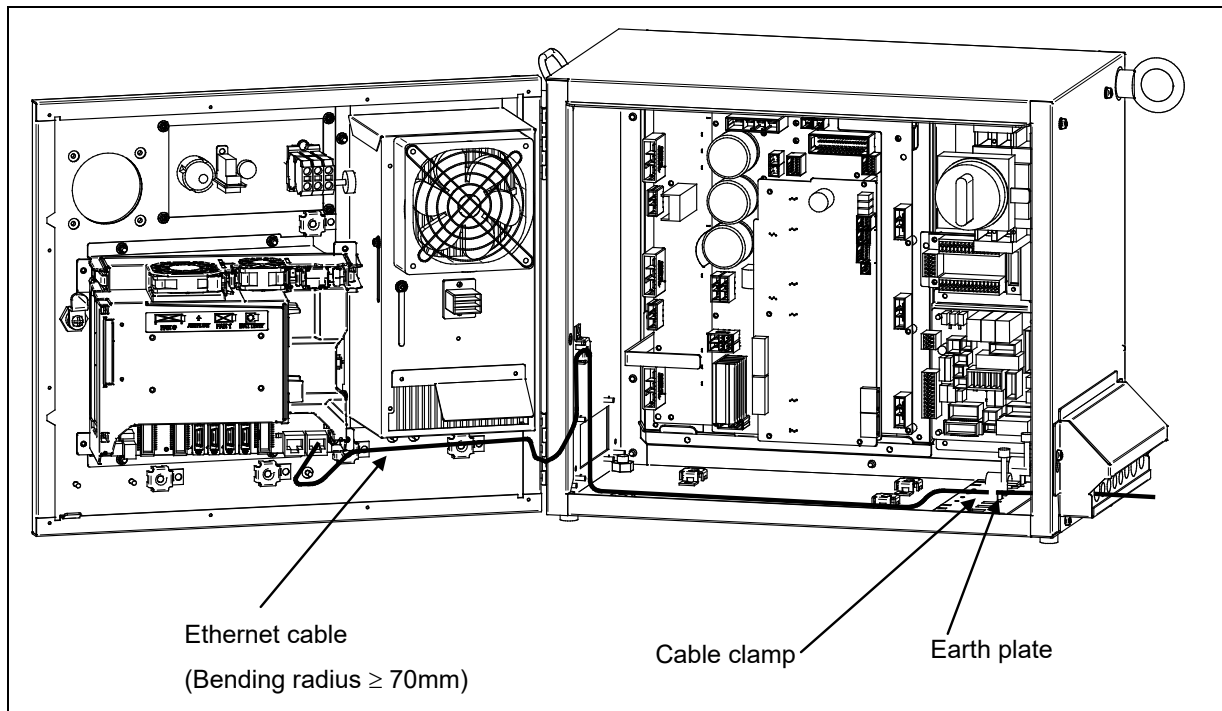
Fig. 2.2.3 (b) Connection of Ethernet cable (R-30*i*B Mate/R-30*i*B Mate Plus controller)

If one robot controller is used to control multiple welding power supply, a hub is required.
In case of R-30*i*B/R-30*i*B Plus controller, connect the CD38B port of the controller and the hub, and then connect the hub and each welding power supply.

In case of R-30*i*B Mate/R-30*i*B Mate Plus Controller

- Robot controller has only CD38A port: Connect the cable to CD38A, and then connect the hub and the each welding power supply
- Robot controller has CD38A and CD38B ports: Connect the cable to CD38B, and then connect the hub and each welding power supply.

The Ethernet cable must be fastened by a cable clamp to prevent tension being applied to the modular connector (RJ-45) that connects the cable to the controller even if the Ethernet cable is pulled directly. Connect this cable to the welding power supply back side.
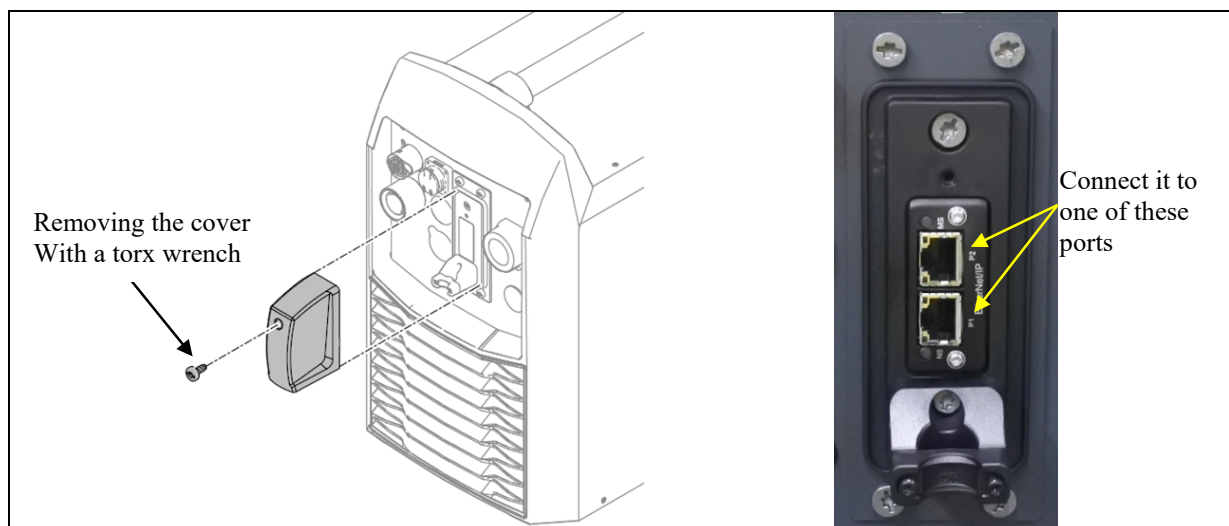
Fig. 2.2.3 (c) Connection of Ethernet cable

2.2.4 Connection of the Input Power Supply to the Welding Power Supply

1   Prepare the primary power cable. Select moderate thickness cables according to the used voltage referring to Table 2.2.4 (a).

Table 2.2.4 (a) The cross –sectional area of the cable

Used voltage	Cable section
200-230V 3-phase	AWG6 (4G6)
460V 3-phase	AWG10 (4G4)

2   Treat the line length and the terminal of the primary power cable. Refer to Fig. 2.2.4(a). Use the bar terminal (ferrule terminal) for the crimp terminal.
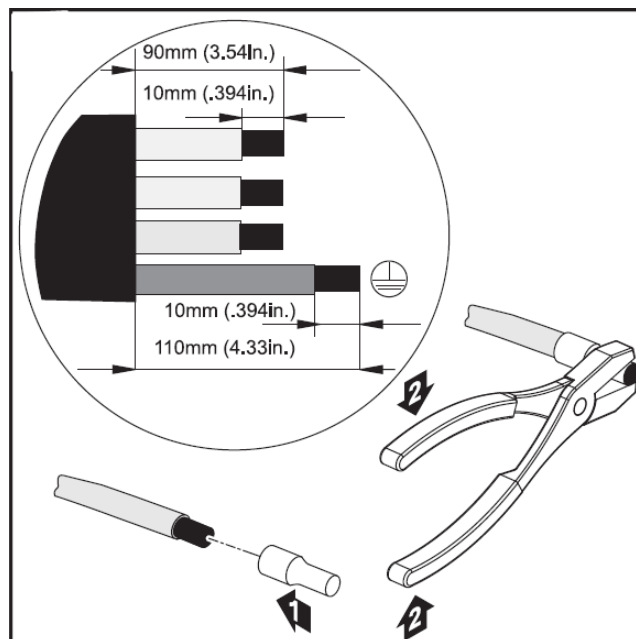
Fig. 2.2.4 (a) Treatment of the primary power cable tip

3   Remove the side panel of the welding power supply referring to Fig. 2.2.4 (b).
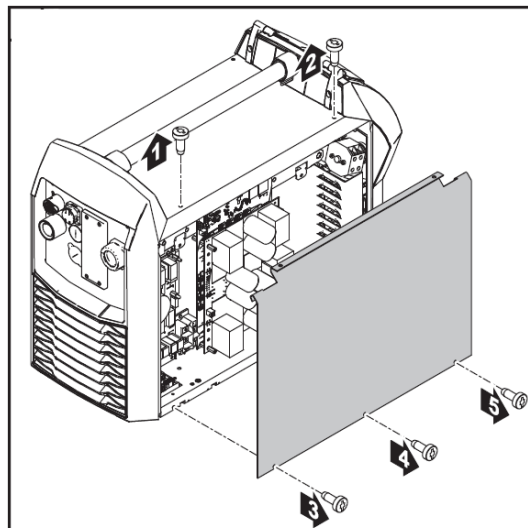
Fig. 2.2.4 (b) Connection of the input power supply

- 23 -

4   Remove the cable which is front of the primary power cable mounting terminal.

Fig. 2.2.4 (c) Connection of the input power supply

5   Pass the primary power cable into the power supply inside through the welding power supply backside rubber boot, then connect it the terminal.
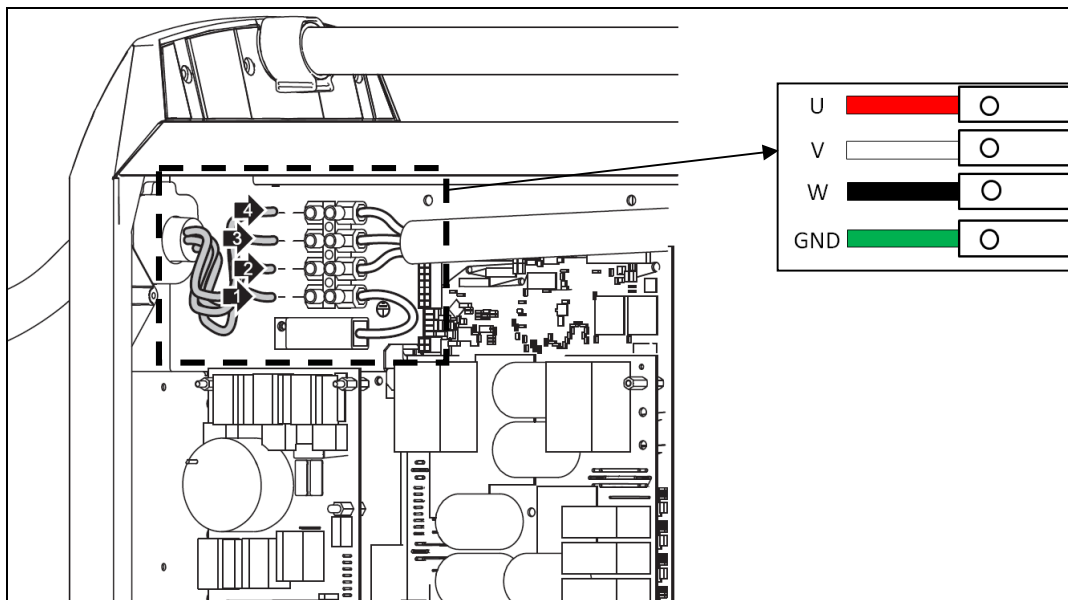
Fig. 2.2.4 (d) Connection of the input power supply

6   Connect the cable which is removed at step 4.
7   Attach the side panel to the original position.

2.2.5   Connection of Welding Power Supply and Robot

1   Connect the outfitted hose pack to the welding power supply and the robot referring to Fig. 2.2.5 (a).
2   Connect the minus side welding power cable referring to Fig. 2.2.5 (b).
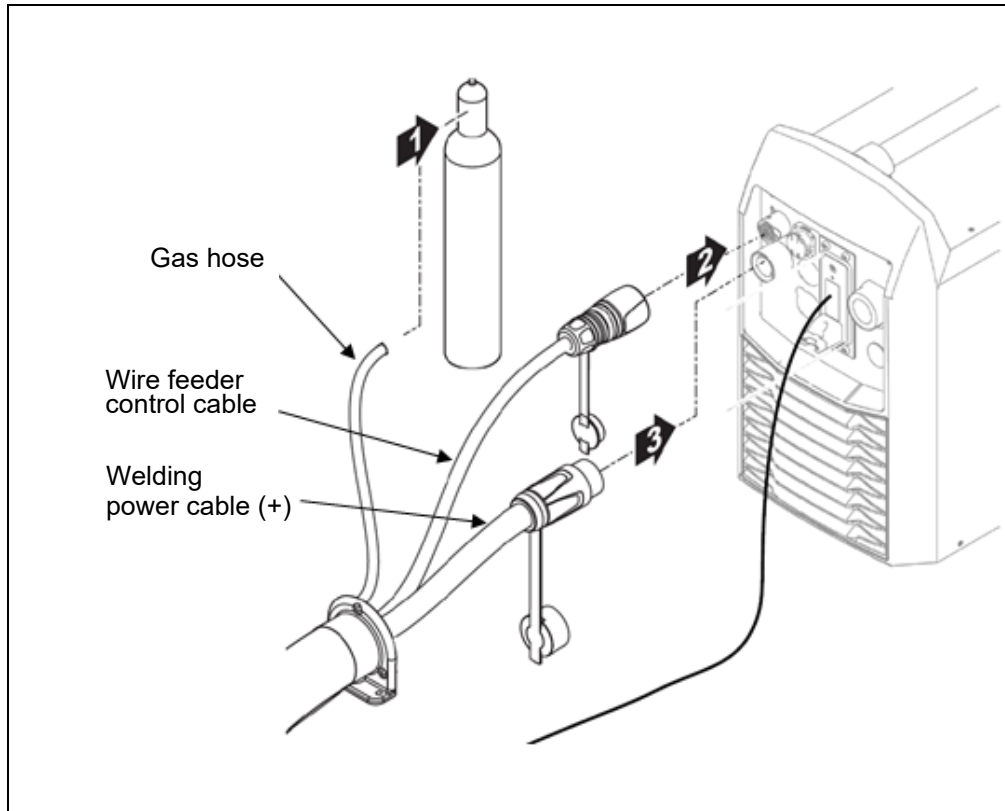
Fig. 2.2.5 (a)   Connection of welding power supply (1/2)
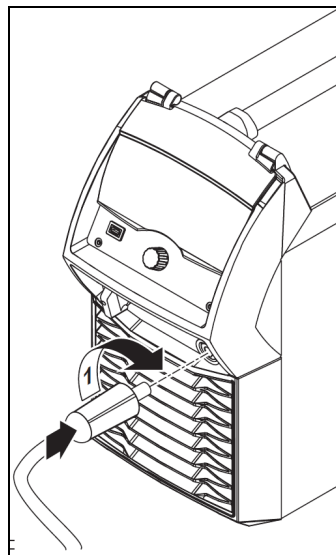
Fig. 2.2.5 (b)   Connection of welding power supply (2/2)

∗ Please be careful twist power is not applied after connecting the power cable to the welding power supply.

3   If water cooling unit is ordered, connect the cooling hoses to the cooling unit. Refer to Fig. 2.2.5 (c).
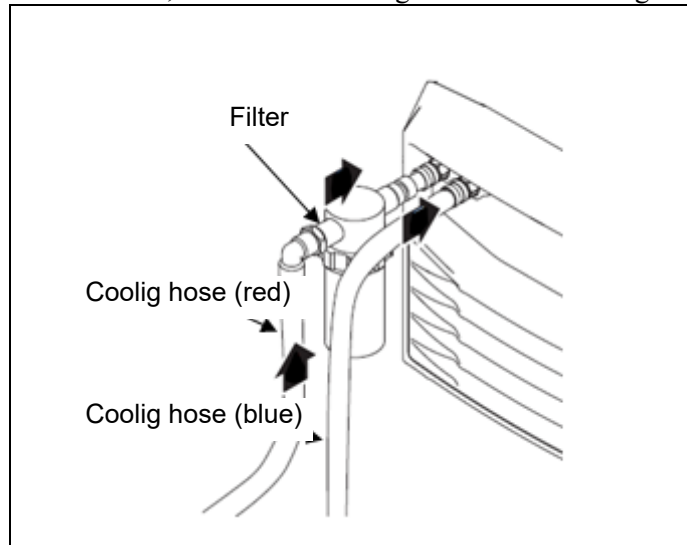
Fig. 2.2.5 (c)   Connection of water cooling unit

4   Connect the flexible conduit and the wire feeder cable installed to the robot to the wire feeder. Refer to Fig. 2.2.5 (d).

5   If supplying wire to the wire feeder using the flexible conduit thorough the wire reel or the pack wire, domestic specification flexible conduit can be connected by using the flexible conduit adapter A05B-1295-J302.   (Special adapter is attached to A05B-1295-J312.)
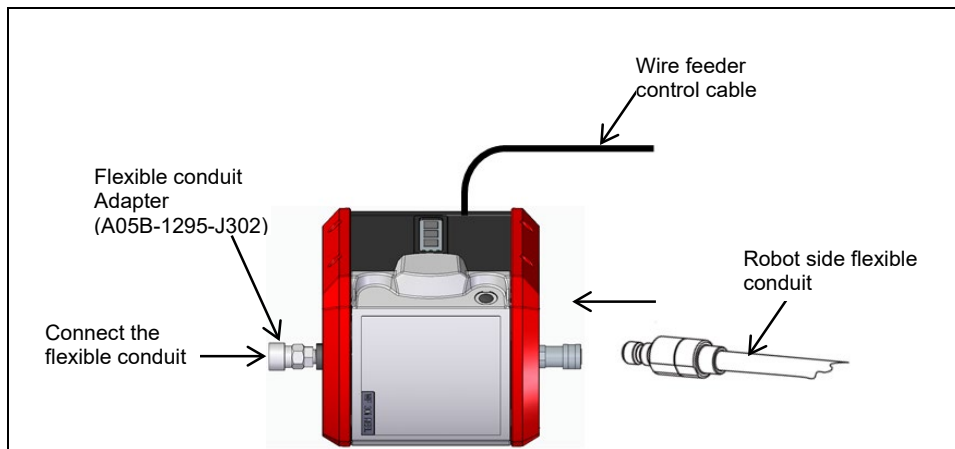
Fig. 2.2.5 (d) Connection to the wire feeder

2.3   TURNING ON THE POWER

When connection is completed, turn on the robot controller and welding power supply. Dozens of seconds later, communication connection between robot controller and welding power supply is completed, and it becomes possible to perform the operation of welding power supply from robot controller. Turn them on according to Procedure 2-3.

Procedure 2-3   Turning on the power

Step
1   Before turning on the power, check working area such as robot, controller and processing cells. Confirm that the all safety devices work correctly, and working area for worker is safe.
2   Turn ON the robot controller.
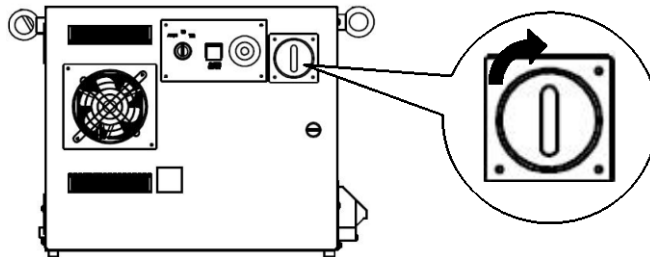
Fig. 2.3 (a) Turning on the robot controller

3   Turn ON the welding power supply.
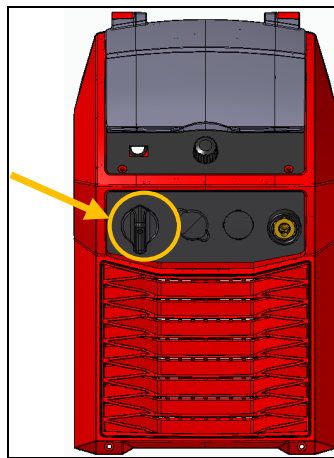
Fig. 2.3 (b) Turning on the welding power supply

4   When approximately dozens of seconds has passed since completion of turning on the welding power supply, please confirm ARC-124 alarm does not generate after pressing alarm reset key.

> ⚠ **WARNING**
> Please cancel turning on power when you found some kind of abnormality or potential danger element. It might cause a serious accident when turning on the power by insufficient check.

2.4 MOVING THE ROBOT MANUALLY (JOGGING)

Jogging is an operation to move the robot to an arbitrary position by manipulating keys on the teach pendant. During program teaching, the positions of the robot are recorded by actually moving the robot.

> **NOTE**
> This chapter explains minimum jogging operation to move a robot.
> Please refer to Subsection 5.2.3 of OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for more details of jogging operation.

Procedure 2-4 Jogging

Step

1. If robot controller has 3 mode switch, insert key and change switch to T1 mode. Turn on the teach pendant switch.
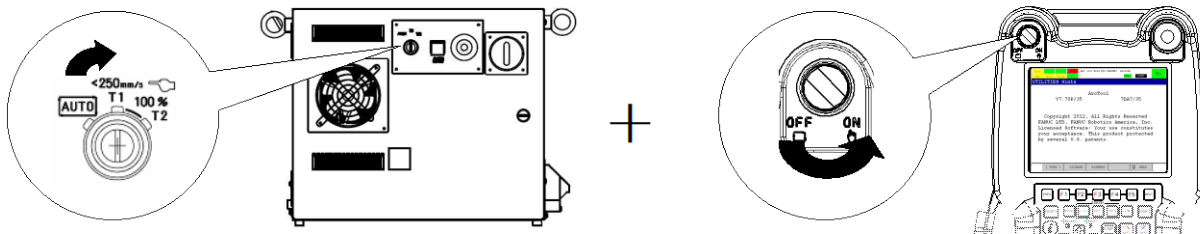
Fig. 2.4 (a) Setting of 3 modes switch and teach pendant switch

2. Decide the kind of the jogging. Kind of jobs are shown in Fig.2.4 (b). Change jogging variation by pressing manual-feed coordinate system key on teach pendant. You can confirm the present jogging by screen of Fig.2.4 (c).

Joint-axis jogging   Rectangular jogging   Tool jogging
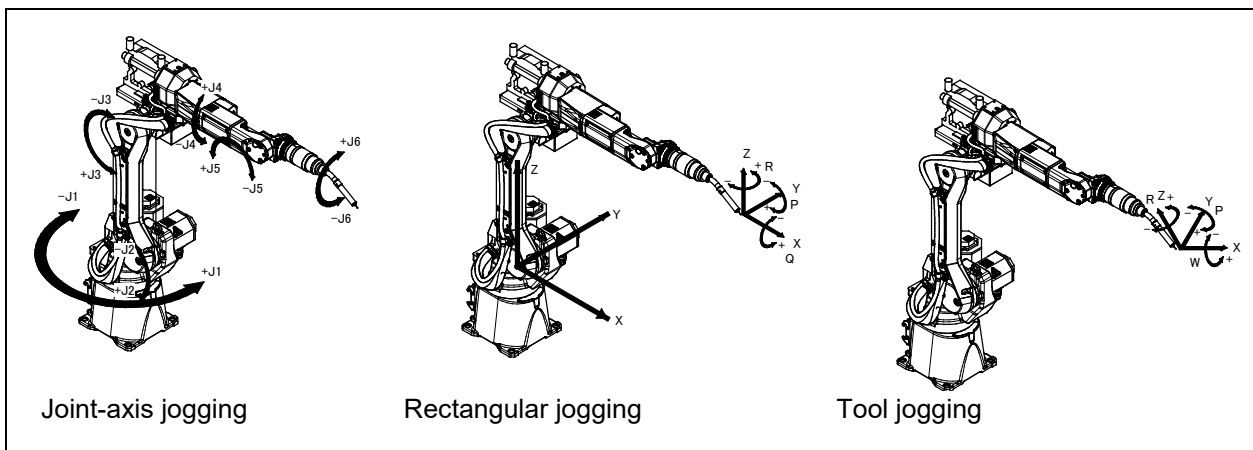
Fig. 2.4 (b) the kind of jogging

Table 2.4(a) Jog modes

Jog modes	Description
Joint jog	Directs the robot axes (joint axes) by manipulating corresponding keys on the teach pendant.
Cartesian jog	Moves the robot rectilinearly along the axes of a Cartesian coordinate system (jogging coordinate system or user coordinate system). Rotation can also be performed to change the tool posture. **The jogging coordinate system** is a Cartesian coordinate system set specifically for jogging. **The user coordinate system** is a Cartesian coordinate system set in the work space.

Jog modes	Description
Tool jog	Moves the robot rectilinearly along the axes of the current tool coordinate system. Rotation can also be performed to change the tool posture. The tool coordinate system is a Cartesian coordinate system set to match the orientation of the tool.
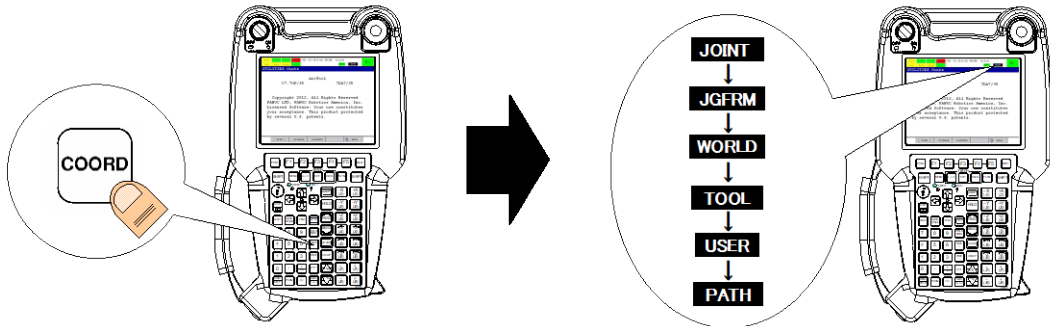
Fig. 2.4 (c) Change of jogging variation by manual-feed coordinate system key

3   Press override key on teach pendant, and decide robot motion speed. The amount of change of the value becomes large by pressing shift key and override key together. Please refer to Table 2.4 (b) for details.
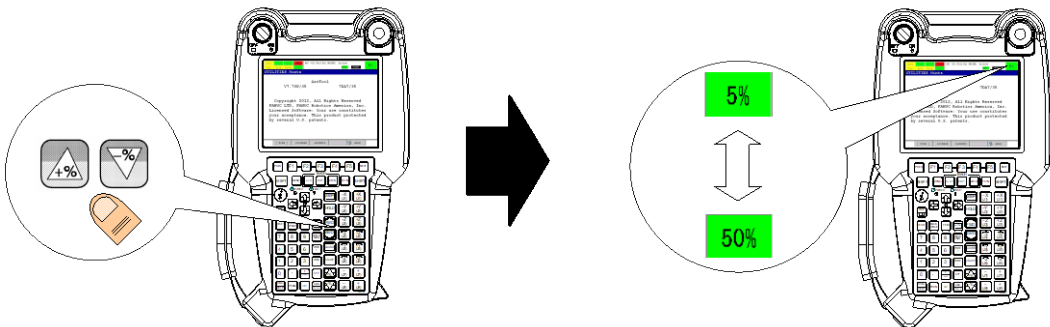
Fig. 2.4 (d) Operation of override key

Table 2.4 (b) the change of the value when override key is pressed

Override key	VFINE $\rightarrow$ FINE $\rightarrow$ 1% $\rightarrow$ 5% $\rightarrow$ 100%
	Steps of 1% Steps of 5%
Shift $+$ Override key	VFINE $\rightarrow$ FINE $\rightarrow$ 5% $\rightarrow$ 25% $\rightarrow$ 50% $\rightarrow$ 100%

4   Grasp the teach pendant and press deadman switch. Afterward, keep the deadman switch on while performing a jogging. When an alarm occurs, press the [RESET] key and release the alarm.
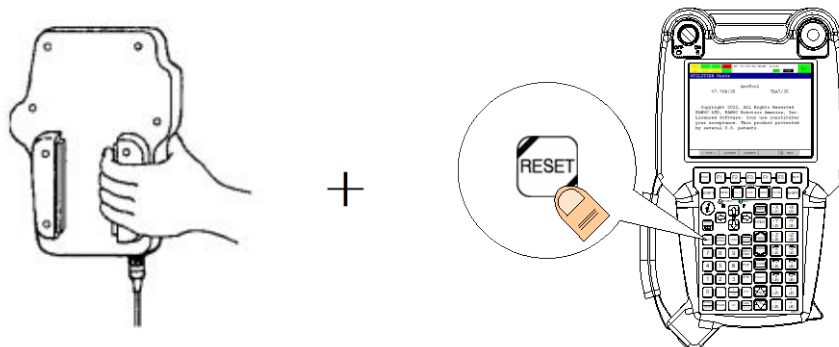
Fig. 2.4 (e) Operation of deadman switch and alarm release key

5   Execute a jogging. When shift key and jog key are pressed, the robot moves to the direction decided by jog mode and jog key.
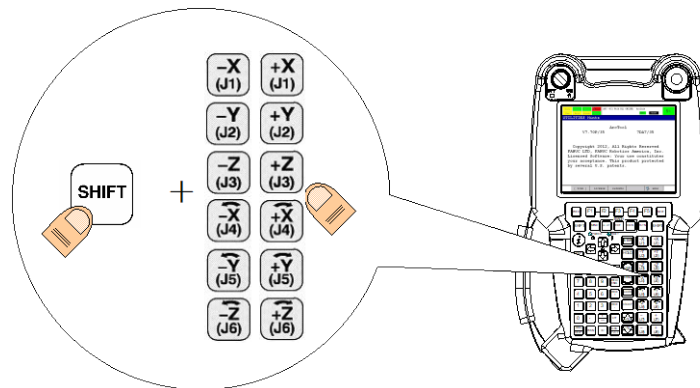
Fig. 2.4 (f) Operation of jog key

> ⚠ **WARNING**
> At the beginning of operation, please set the value of the override in low speed (10% around). If the robot speed is fast, you cannot deal with an emergency. In addition, please confirm that no person is in the work area when you start to move a robot.

2.5   ADJUSTMENT OF ROLLER PRESSURIZATION POWER

Pressurization powers at Robacta drive and wire feeder for each wire materials are in the following table. Please check pressurization power periodically and adjust it according to the following to keep stable wire feeding.

Table 2.5 (a) Adjustment of roller pressurization power

Wire material	pressurization power	
	Robacta drive	Wire feeder
Iron, stainless	6-8	4-5
Blazing	5-7	
Al-Si-based alloy	1-2	0.5-1.5
Al-Mg-based alloy	2-4	
FCW	3-5	2-3

Procedure 2-5 (a)   Adjustment of Robacta drive pressurization power

Step
1   Pull up the head of the knob for adjustment referring to Fig. 2.5 (a).
2   Rotate the knob, Adjust the scale of the pressurization power referring to Table 2.5 (a).
3   Return the knob to the original position.
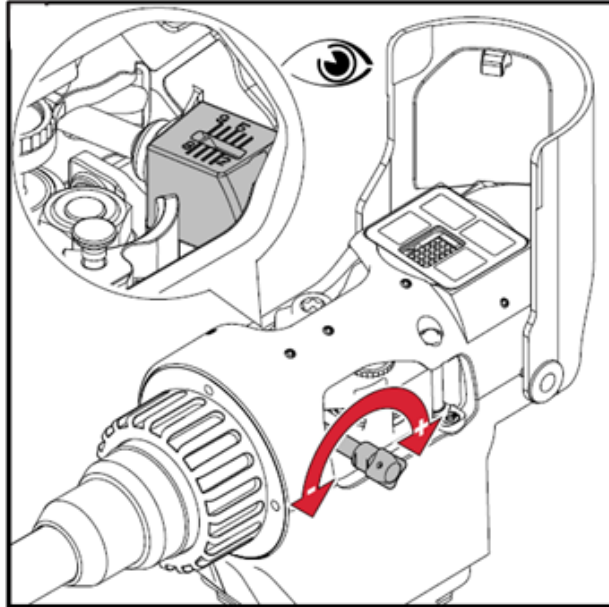
Fig. 2.5 (a) Adjustment of Robacta drive pressurization power

Procedure 2-5 (b)   Adjustment of the wire feeder pressurization power

Step
1   Rotate the knob of the idol arm upper side referring to Fig. 2.5 (b).
2   Adjust the scale of the idol arm part to moderate value referring to Table 2.5 (a).

Check the scale
At the knob
lower end.
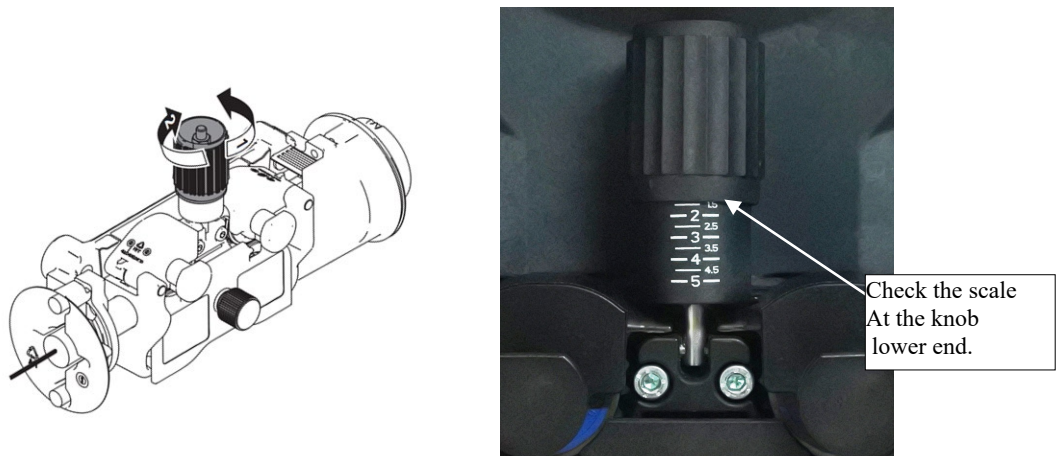
Fig. 2.5 (b) Adjustment of the wire feeder pressurization power

2.6 WIRE INCHING / RETRACT

It is possible to perform wire inching/retract by key operations on Teach Pendant. By this operation, you can pass a wire through a conduit or can adjust wire stickout. Wire feed speed can be changed on welding equipment setting screen.

Procedure 2-6   Manual Wire Inching

Step

1   Press the [WIRE+] key on Teach Pendant. Wire is fed while pressing the key.
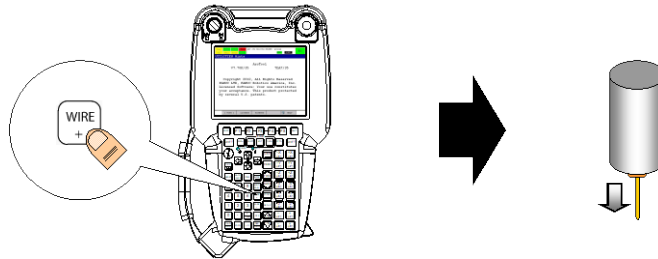
Fig. 2.6 (a) Wire Inching

2   Press the [WIRE-] key on Teach Pendant. Wire is retracted while pressing the key.
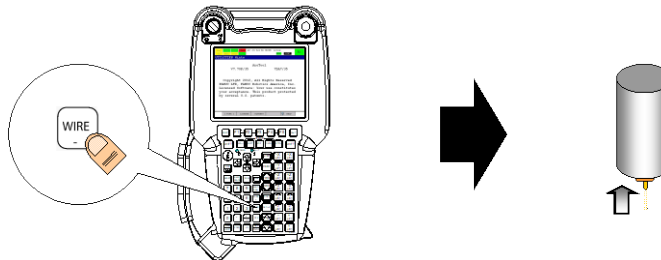
Fig. 2.6 (b) Wire Retract

> ⚠ **CAUTION**
> Do not perform wire inching when wire is stuck to the tip, or when wire is clogged up.

2.7   ALIGNMENT WORK

TPS/i welding power supply can record welding accuracy by recording the impedance and inductance of the circuit to be welded as a parameter. If the measurement is done only once at startup, there is no need to set it later.

> **NOTE**
> The resistance will change due to the tip contact status. So perform the measure some times and check the value does not change largely.

Procedure 2-7   Alignment Work

Step
1   Confirm that the cable wiring and the installation status of the fixture are the same as when actually using.
2   Remove the nozzle at the tip of the torch and expose the tip.
3   Move the robot and bring the tip and the work or the fixture vertically into contact.

Fig. 2.7 (a) Alignment Work

4   Select the "Process Parameter" button on the left side of the power panel.
5   Select "R / L adjustment" in ② of Fig. 2.7 (b).
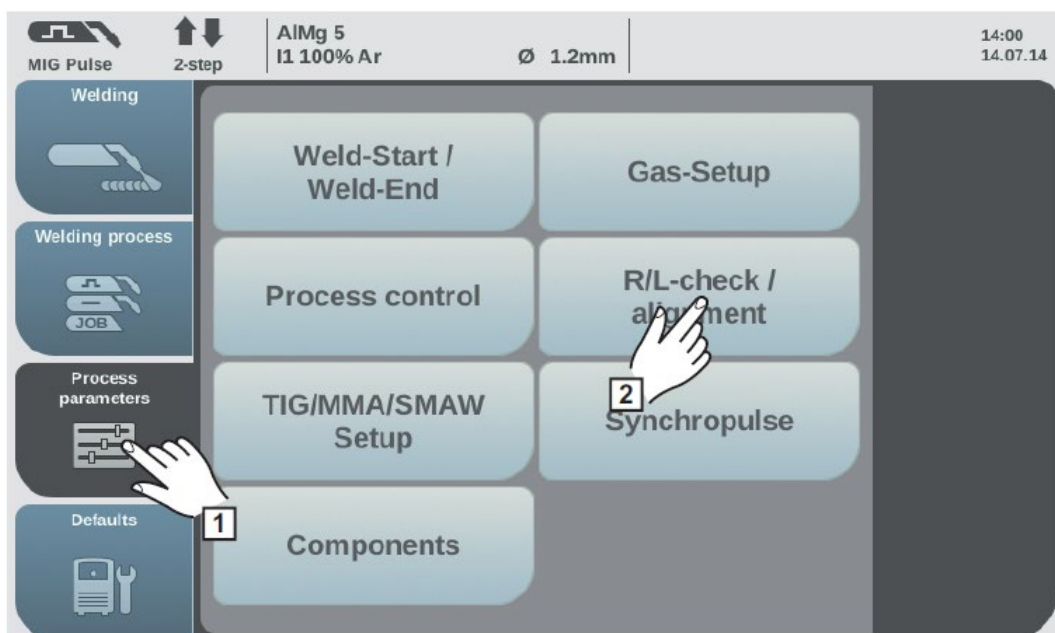
Fig. 2.7 (b) Alignment Work

6   As shown in Figure 2.7 (c), the recorded resistance value and inductance are displayed. Select "Next".

Fig. 2.7 (c) Alignment Work

7   After the welding circuit confirmation screen is displayed, confirm the instruction and select "Next".
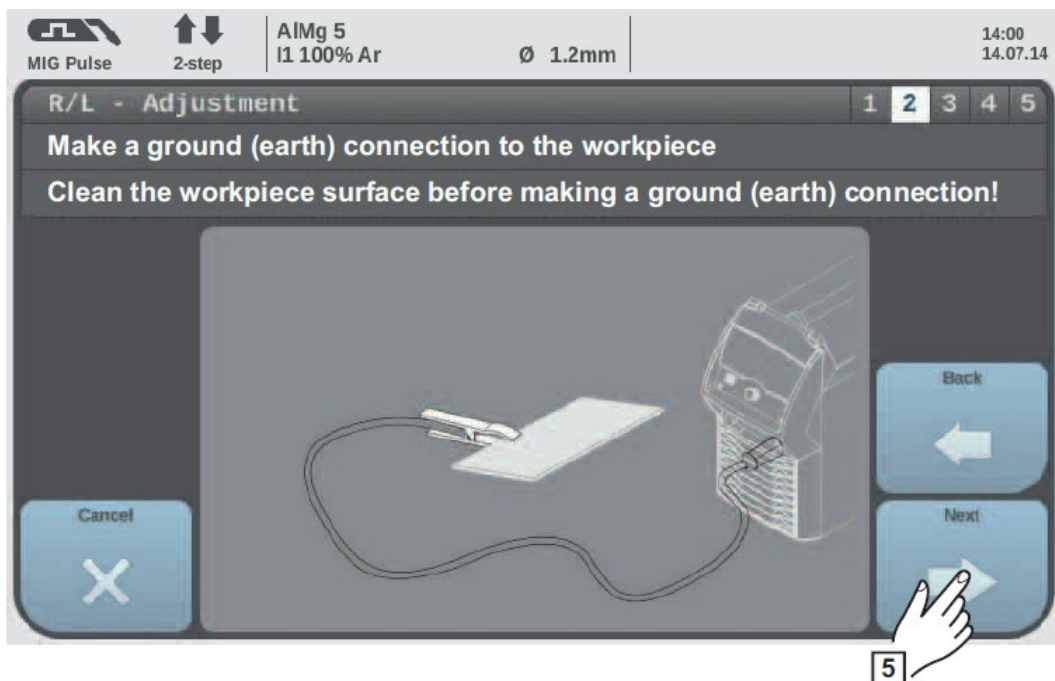
Fig. 2.7 (d) Alignment Work

Fig. 2.7 (e) Alignment Work
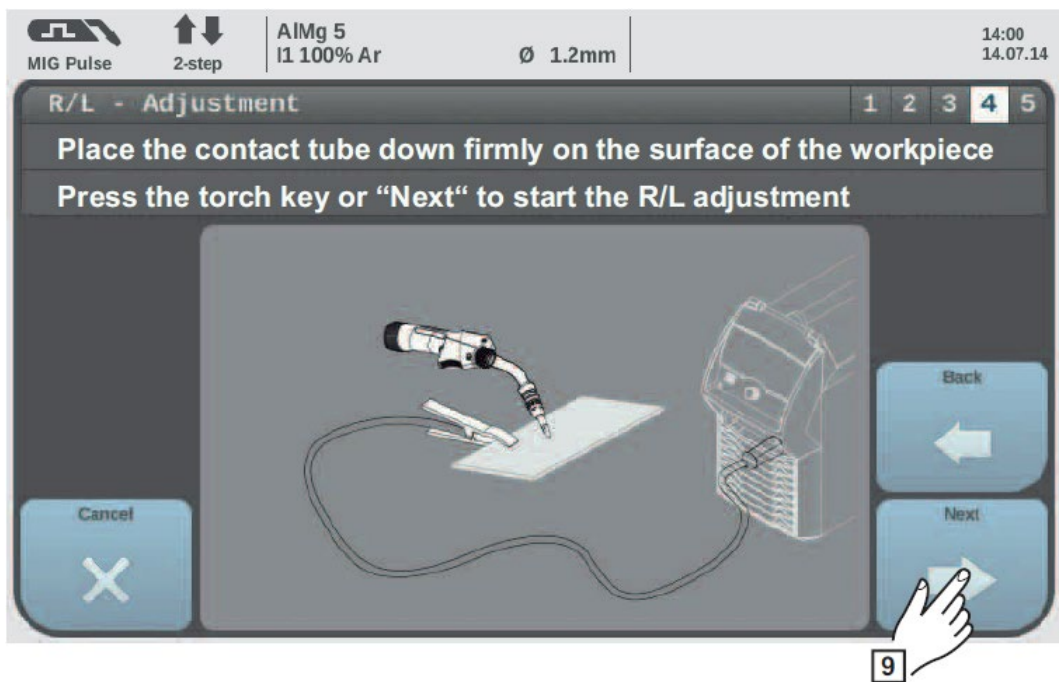
Fig. 2.7 (f) Alignment Work

8   The screen shown in Figure 2.7 (g) will be displayed after the measurement is completed. Select "Exit" on the right side of the screen.
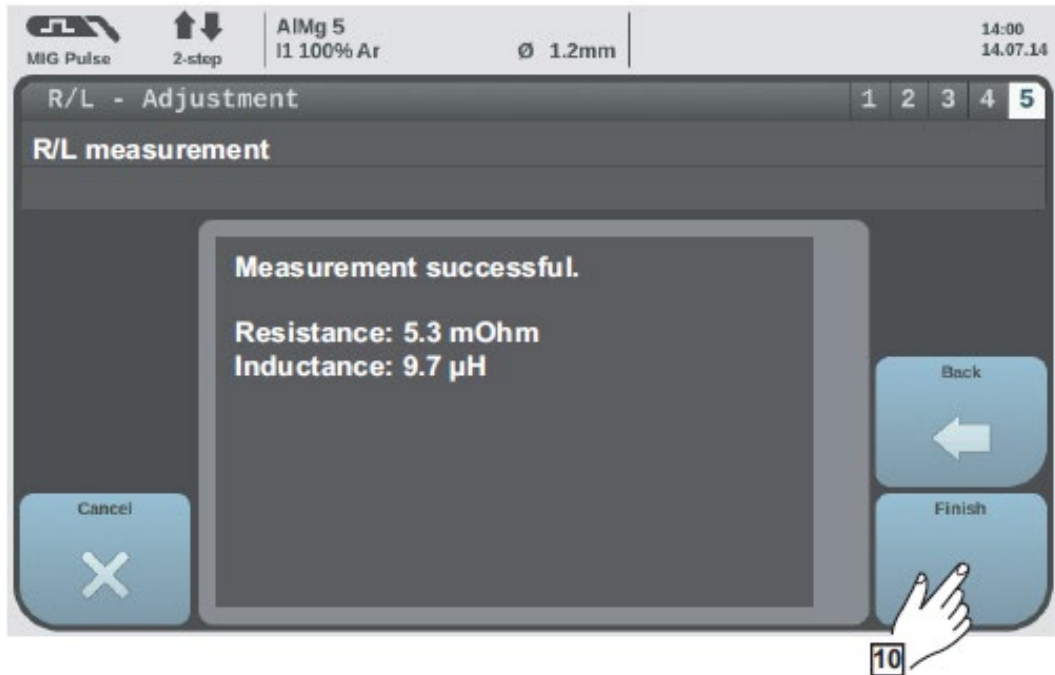
Fig. 2.7 (g) Alignment Work

2.8   CREATING MOTION PROGRAM

Next, create a program for arc welding. As an easier arc welding program, the creating procedure of a sample program of arc welding for a lap joint like the following is explained. In this section, the creation of robot motion part of the program is explained. Move the robot manually referring Section 2.4, and following Procedure 2-8 shows the procedure for creating a robot motion program of Fig. 2.8 (a).


```
ARC_WELD
                                 7/7
  1:J  P[1] 10% CNT100           Move to reference position
  2:L  P[2] 100mm/sec CNT100     Move to approach position
  3:L  P[3] 100mm/sec FINE       Move to Weld Start position
  4:L  P[4] 60cm/min FINE        Move to Weld End position
  5:L  P[5] 100mm/sec CNT100     Move to escape position
  6:J  P[1] 10% FINE             Return to reference position
[End]
```
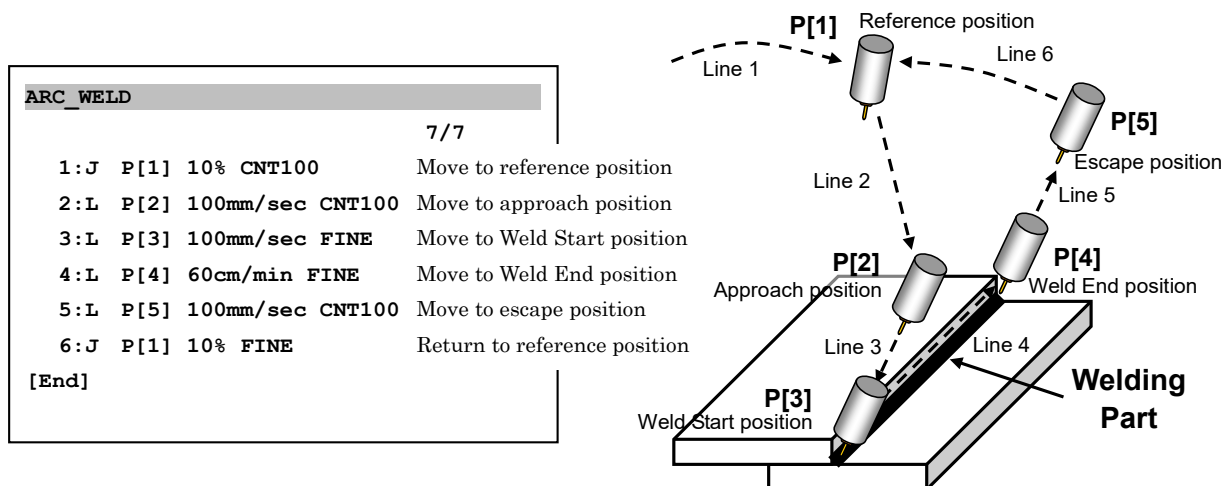
Fig. 2.8 (a) Sample Program

> **NOTE**
> This section explains the basic operation for creating sample program. If you would like to know more details about program edit, please refer to Section 3.3 "EDITING OPERATION OF PROGRAM".

Procedure 2-8   Creating Motion Program

Step

1   Set a workpiece for arc welding on the place electrified to the weld power cable (-). In this timing, Please fix the workpiece tightly to prevent a gap during the program creation.

2   Adjust the wire stickout by wire inching operation. Usually, recommended stickout is "13-15mm". However, it varies depending on process mode.
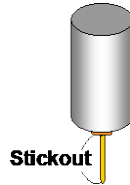
Stickout

Fig. 2.8 (b) Adjustment of Wire Stickout

3   Press the [MENU] key on a teach pendant. Following Program List screen is displayed.

```
Select                                                    .
                1039556 bytes free      1/9
    No.   Program name      Comment
     1   -BCKEDT-        [              ]
     2   GETDATA    MR  [Get PC Data    ]
     3   REQMENU    MR  [Request PC Menu ]
     4   SENDDATA   MR  [Send PC Data   ]
     5   SENDEVNT   MR  [Send PC Event  ]


    [TYPE]   CREATE   DELETE   MONITOR   [ATTR]   >
```

4   Press F2[CREATE] key. A screen for entering program name is displayed. Additionally, a list of [Alpha input 1] is displayed at the lower right. In this operation example, define the sample program name as "ARC_WELD". Move the cursor on "Upper Case" and enter the program name by using F1-F5 function keys.

```
        ---  Create Teach Pendant Program  ---

    Program name:
    ARC_WELD
                            -- End  --
                           ┌─────────────┐
                           │Alpha input 1│
                           │ Words       │
                           │ Upper Case  │
                           │ Lower Case  │
                           │ Options     │
                           └─────────────┘
    Enter program name
    ABCDEF   GHIJKL   MNOPQR   STUVWX   YZ_@*   >
```

5   After finishing the input of program name, press the [ENTER] key. After that, press F3[EDIT] and complete the input of program name. The screen is automatically moved to Program Edit screen.

```
ARC_WELD                                              .
                                          1/1
    [End]



    POINT   WELD_ST   WELD_PT   WELDEND   TOUCHUP   >
```

6   Move the robot on the reference position by jogging. Any places are allowed if there is no obstacle between this position and Weld Start position.

7   Teach a motion instruction for moving to the reference position. Press F1[POINT] when the cursor is
     placed on [End]. Select "2 J P[] 100% CNT100" from a displayed list. Next, move the cursor on a
     value "100" in 100%, and then enter "10" by numerical keys, and press the [ENTER] key.

```
ARC_WELD                                        .
                                          1/2

    1:J @P[1] 10% CNT100
  [End]



   POINT    WELD_ST    WELD_PT   WELDEND   TOUCHUP   >
```
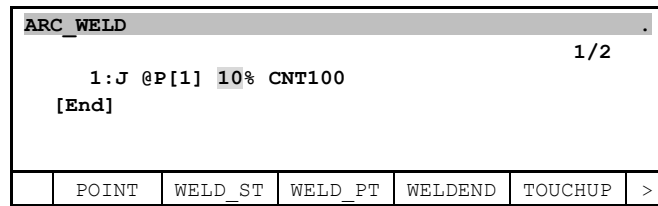
8   Jog the robot to an appropriate posture for welding, and then jog the robot to the position that is
     diagonally upper 100mm away from Weld Start position (approach position).
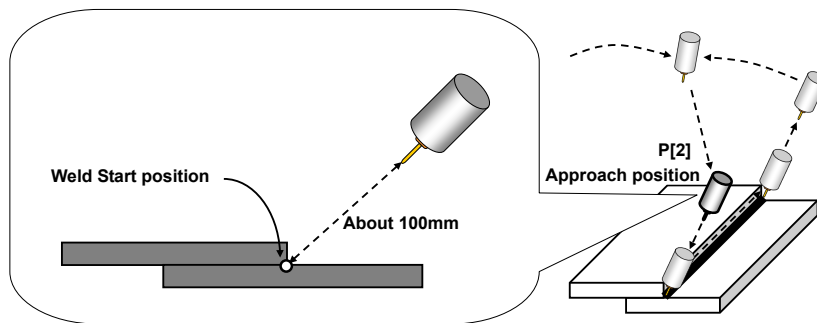
Fig. 2.8 (c) Jog to Approach Position

9   Teach a motion instruction for moving to the approach position. Press F1[POINT] when the cursor is
     placed on [End]. Select "4 L P[] 100mm/sec CNT100" from a displayed list.

```
ARC_WELD                                        .
                                          3/3

    1:J  P[1] 10% CNT100
    2:L @P[2] 100mm/sec CNT100
  [End]

   POINT    WELD_ST    WELD_PT   WELDEND   TOUCHUP   >
```
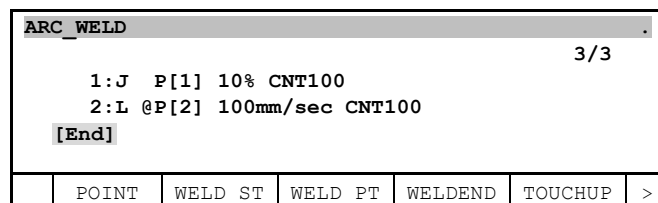
10   Jog the robot to Weld Start position.
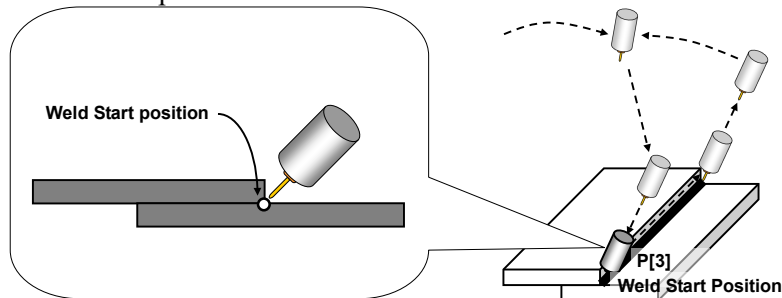
Fig. 2.8 (d) Jog to Weld Start Position

11   Teach a motion instruction for moving to Weld Start position. Press F1 [POINT] when the cursor is
     placed on [End]. Select "3 L P [] 100mm/sec FINE" from a displayed list.

```
ARC_WELD                                              .
                                                   4/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L @P[3] 100mm/sec FINE
 [End]

  POINT  | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```
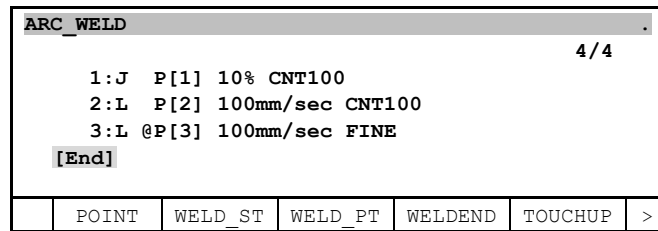
12   Jog the robot to Weld End position.
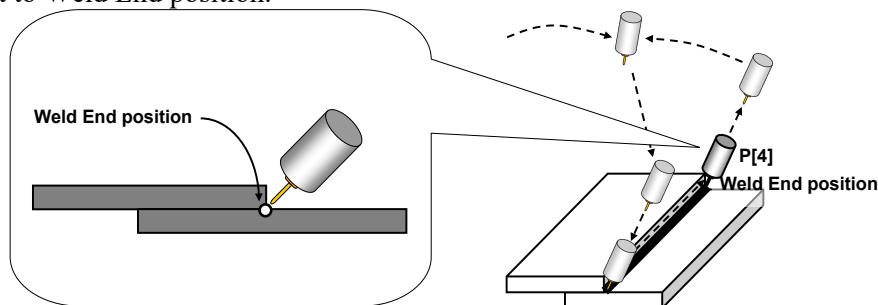
Fig. 2.8 (e) Jog to Weld End Position

13   Teach a motion instruction for moving to Weld End position. Press F1[POINT] when the cursor is placed on [End]. Select "3 L P[] 100mm/sec FINE" from a displayed list.

```
ARC_WELD                                              .
                                                   5/5
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
   4:L @P[4] 100mm/sec FINE
 [End]

  POINT  | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```
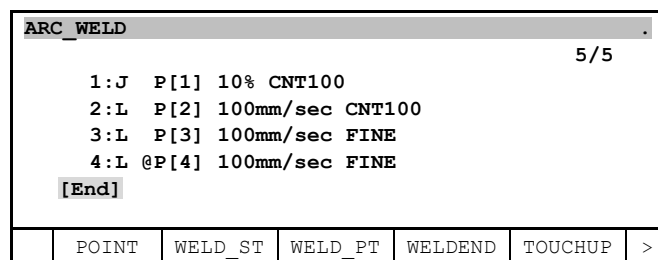
14   Next, input weld speed. The motion speed on the motion instruction for moving from Weld Start position to Weld End position becomes weld speed. Move the cursor on "100" value and press F4[CHOICE] key. Select "cm/min" from the displayed list. Then, enter "60" by numerical keys.

```
ARC_WELD                                              .
                                                   5/5
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
   4:L @P[4] 60cm/min FINE
 [End]
  POINT  | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```
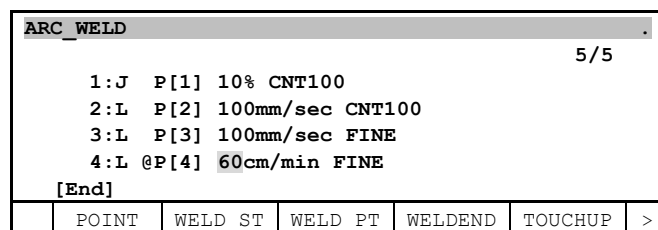
15   Jog the robot to the position that is diagonally upper 100mm away from Weld End position (escape position).
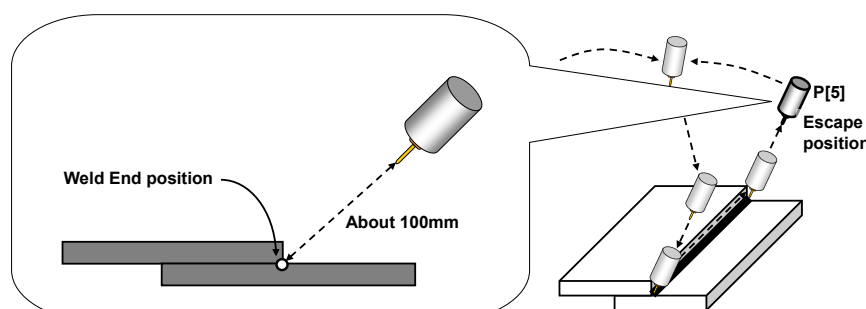
Fig. 2.8 (f) Jog to Escape Position

16   Teach a motion instruction for moving to the escape position. Press F1[POINT] when the cursor is placed on [End]. Select "4 L P[] 100mm/sec CNT100" from a displayed list.

```
ARC_WELD                                            .
                                            6/6
      1:J  P[1] 10% CNT100
      2:J  P[2] 100mm/sec CNT100
      3:L  P[3] 100mm/sec FINE
      4:L  P[4] 60cm/min FINE
      5:L @P[5] 100mm/sec CNT100
   [End]

   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | > |
```

17   Teach a motion instruction for returning to the reference position. Press F1[POINT] when the cursor is placed on [End]. Select "1 J P[] 100% FINE" from a displayed list. Next, move the cursor on a value "6" in P[6] and input "1" by numerical key, and press the [ENTER] key. Move the cursor on a value "100" in 100% and input "10" by numerical keys, and then press the [ENTER] key.

```
ARC_WELD                                            .
                                            6/7
      1:J  P[1] 10% CNT100
      2:L  P[2] 100mm/sec CNT100
      3:L  P[3] 100mm/sec FINE
      4:L  P[4] 60cm/min FINE
      5:L @P[5] 100mm/sec CNT100
      6:J  P[1] 10% FINE
   [End]

   | POINT | WELD_ST | WELD_PT | WELDEND | TOUCHUP | > |
```

NOTE
This section explains one operation example for creating easy sample program. However, you can create a sample program even if you do not follow the operation in this section. About details of program edit, please refer to Section 5.4 in OPERATOR'S MANUAL (Basic Operation) (B-83284EN).

2.9   SPECIFY ARC WELD SCHEDULE

It is impossible to achieve arc welding by only the motion program created on Section 2.8. For achieving arc welding, it is necessary to specify an arc weld schedule by procedure 2-9, and also necessary to specify this schedule on Weld Start and Weld End instructions.
Arc welding robot performs arc welding on the section between Weld Start and Weld End instructions.
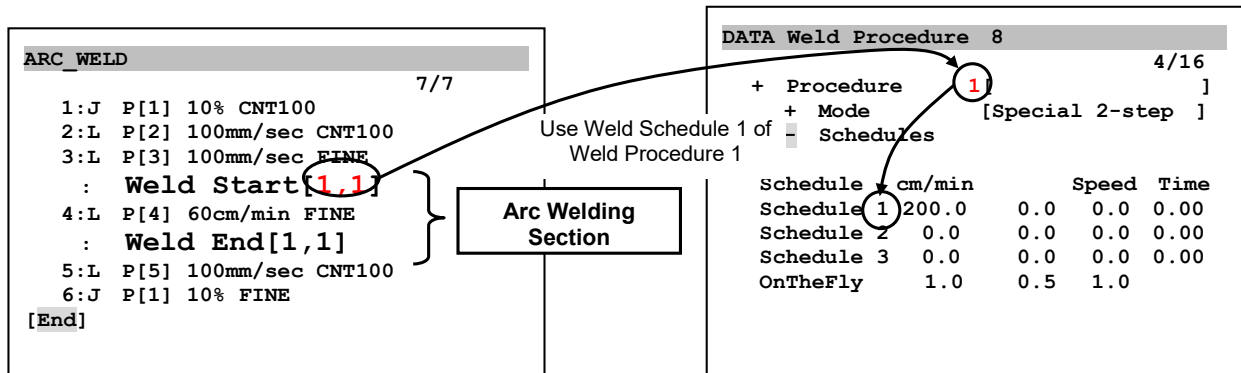
Fig. 2.9 (a) Relationship between Sample Program and Arc Weld Schedule

> **NOTE**
> This section explains the basic operation for operating arc weld instructions. If you would like to know more details about arc weld instructions, please refer to Section 3.4 "TEACHING AND EDITING OF ARC WELD INSTRUCTION".

Procedure 2-9   Specify Arc Weld Schedule

Step

1   Press the [DATA] key.
2   Press F1[TYPE] and select "Weld Procedure".
3   Here is the most basic procedure for welding. There is Welding mode of "Special 2-step" operating mode from the beginning, so move the cursor on "+" at the left of operating mode setting line and press the [ENTER] key.
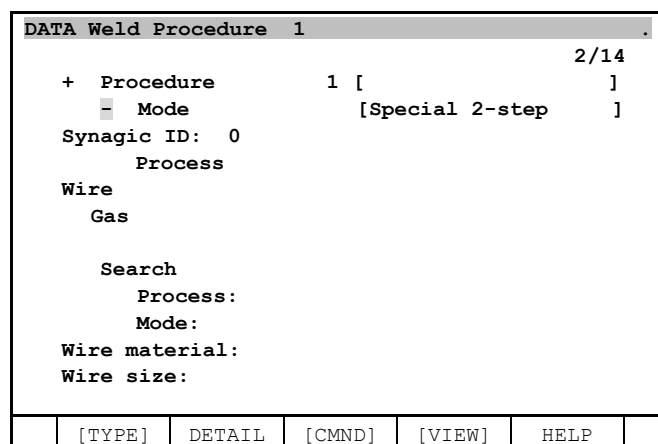
4   Input the "Synagic ID". Synergic ID is the welding mode number of the Fronius welding machine. If you do not know, you can search by specifying "Search". By pressing F4 "CHOICE" on the cursor position (process, mode, wire material, wire diameter) of each condition, the conditions that can be specified are displayed. After specifying the search condition, if you perform "4 Search" from F3 "CMMD" menu, a list of the modes satisfying the search condition is displayed. Move the cursor to the desired mode and press F2 "SELECT".

```
┌─────────────────────────────────────────────────────┐
│ DATA Weld Procedure  1                             . │
│                                         2/14          │
│    +  Procedure        1 [              ]             │
│       ▄ Mode             [Special 2-step   ]          │
│         Synagic ID:  0                                │
│         Process                                       │
│   Wire                                                │
│         Gas                                           │
│    ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐       │
│    │  Search                                  │       │
│   Process:              MAG,MIG              │        │
│   Mode:        Pulse                         │        │
│   Wire material: Steel                       │        │
│   Wire size:     1.2mm                       │        │
│    └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘        │
├─────────────────────────────────────────────────────┤
│  [TYPE]   DETAIL   [CMND]   [VIEW]   HELP            │
└─────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────┐
│ SETUP Eq Search                                    . │
│                                      1/20             │
│    #   WIRE DIA        DESCRIPTION                    │
│  1 2769 0.8 mm   [Pulse      universal ]              │
│           [Steel                       ]              │
│           [M21 Ar+15-20%CO2            ]              │
│                                                       │
│  2 2783 0.9 mm   [Pulse      universal ]              │
│           [Steel                       ]              │
│           [M21 Ar+15-20%CO2            ]              │
│                                                       │
│  3 2784 1.0 mm   [Pulse      universal ]              │
│           [Steel                       ]              │
│           [M21 Ar+15-20%CO2            ]              │
├─────────────────────────────────────────────────────┤
│  [TYPE]   Select   More            HELP              │
└─────────────────────────────────────────────────────┘
```

NOTE
- Please confirm turning on the power supply and the state of communication cable. When this step is performed with no communication, the prompt message of "Weld EQ is OFFLINE" is displayed and user input operation is canceled. If the communication is not established correctly, please recover the communication by referring the Subsection 6.2.3.
- Please confirm that the desired Synagic ID is set correctly. If you input a number that does not exist or a number that is not licensed on the welding machine side, input is permitted, but the message "Firmware(Weld table) does not support it" is displayed on the screen.

---

5   Information on the specified synaptic ID is displayed.

```
┌─────────────────────────────────────────────────┐
│ DATA Weld Procedure  1                        .  │
│                                        2/14      │
│   +  Procedure        1 [              ]         │
│      -  Mode            [Special 2-step    ]     │
│  ┌ ─ ─Synagic─ID:─ 2785─ ─ ─ ─ ─ ─ ─ ─ ─ ┐     │
│  │     Process      Pulse   universal      │     │
│  Wire     1.2   Steel                      │     │
│  │     Gas         M21 Ar+15-20%CO2        │     │
│  └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘     │
│                                                  │
│      Search                                      │
│  Process:                  MAG,MIG               │
│  Mode:           Pulse                           │
│  Wire material: Steel                            │
│  Wire size:      1.2mm                           │
│                                                  │
├──────────┬─────────┬─────────┬────────┬─────────┤
│ [TYPE]   │ DETAIL  │ [CMND]  │ [VIEW] │  HELP   │
└──────────┴─────────┴─────────┴────────┴─────────┘
```

6   Next, move the cursor to "+" on the left side of "Schedules" of the welding data and press "ENTER" key.

```
┌─────────────────────────────────────────────────┐
│ DATA Weld Procedure  1                        .  │
│                                        3/13      │
│   +  Procedure        1 [              ]         │
│      +  Mode            [Special 2-step    ]     │
│      -  Schedules                                │
│                                                  │
│  Schedule      cm/min          Speed   Time      │
│  Schedule  1    0.0    0.0     100.0   0.00      │
│  Schedule  2    0.0    0.0     100.0   0.00      │
│  Schedule  3    0.0    0.0     100.0   0.00      │
│                                                  │
├──────────┬─────────┬─────────┬────────┬─────────┤
│ [TYPE]   │ DETAIL  │ [CMND]  │ [VIEW] │  HELP   │
└──────────┴─────────┴─────────┴────────┴─────────┘
```

7   Move the cursor on unused weld schedule (in this example, Weld Schedule 1), and press F2[DETAIL]. Detail screen for the weld schedule is displayed.

```
┌─────────────────────────────────────────────────┐
│ DATA Weld Procedure                           .  │
│                                        1/9       │
│                                                  │
│    1 Weld Procedure  1 [              ]          │
│      Mode              [Special 2-step    ]      │
│                                                  │
│    2 Weld Schedule   1 [Schedule       ]         │
│    3 Wire feed speed    0.0 cm/min               │
│    4 ArcLength corr     0.0                       │
│    5 Pulse/Dyn corr     0.0                       │
│    6 Travel speed       100.0 cm/min             │
│    7 Delay time         0.00 sec                 │
│                                                  │
├──────────┬─────────┬─────────┬────────┬─────────┤
│ [TYPE]   │ SCHEDULE│         │        │         │
└──────────┴─────────┴─────────┴────────┴─────────┘
```

8   Setup "Wire feed speed" (or "current"). It is OK to leave other command value (On the above-mentioned screen, they are values of line 4 to 7) 0.0. Details of each value are written in Section 3.2.

9   Display the edit screen of the motion program created on Procedure 2-8. Press [EDIT] key, or press [SELECT] key and select the sample program name which was set by Step 4 in Procedure 2-8 (in this example, ARC_WELD). Then, move the cursor on a blank part just behind "FINE" on line 3.

```
┌──────────────────────────────────────────────┐
│ ARC_WELD                                     . │
│                                          3/7   │
│     3:L  P[3] 100mm/sec FINE...                │
│     4:L  P[4] 60cm/min FINE                    │
│     5:L @P[5] 100mm/sec CNT100                 │
│     6:J  P[1] 10% FINE                         │
│    [End]                                       │
│                                                │
├────┬────┬────┬────┬──────────┬────┬─────────┤
│    │    │    │    │ [CHOICE] │    │    >     │
└────┴────┴────┴────┴──────────┴────┴─────────┘
```

10   Press F4[CHOICE]. The list of additional motion instructions are displayed. Select "Weld Start[]" from the list. Weld Start instruction is taught at the last of line 3.

```
        ┌────────────────────┐
        │  Motion Modify 1   │
        │ 1 No option        │
        │ 2 Weld Start[ ]    │
        │ 3 Weld End[ ]      │
        │ 4 ACC              │
        │ 5 Skip,LBL[]       │
        │ 6 BREAK            │
        │ 7 Offset/Frames    │
        │ 8 --next page--    │
        └────────┬───────────┘
                 ▼
┌──────────────────────────────────────────────┐
│ ARC_WELD                                     . │
│                                          3/7   │
│     3:L  P[3] 100mm/sec FINE                   │
│      :   Weld Start[...,..]                    │
│     4:L  P[4] 60cm/min FINE                    │
│     5:L @P[5] 100mm/sec CNT100                 │
│     6:J  P[1] 10% FINE                         │
│    [End]                                       │
│                                                │
│    Enter procedure number.                     │
├──────────┬────┬────────┬──────────┬────┬─────┤
│ REGISTER │    │ VALUE  │ [CHOICE] │    │     │
└──────────┴────┴────────┴──────────┴────┴─────┘
```

11   Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 7 (in this example, 1) to the second argument.

```
┌──────────────────────────────────────────────┐
│ ARC_WELD                                     . │
│                                          4/7   │
│      :   Weld Start[1,1]                       │
│     4:L  P[4] 60cm/min FINE                    │
│     5:L @P[5] 100mm/sec CNT100                 │
│     6:J  P[1] 10% FINE                         │
│    [End]                                       │
│                                                │
├────────┬────┬────┬────┬──────────┬─────────┤
│ [INST] │    │    │    │ [EDCMD]  │    >     │
└────────┴────┴────┴────┴──────────┴─────────┘
```

12   Next, move the cursor on a blank part just behind "FINE" on line 4.

```
┌──────────────────────────────────────────────┐
│ ARC_WELD                                     . │
│                                          4/7   │
│     4:L  P[4] 60cm/min FINE...                 │
│     5:L @P[5] 100mm/sec CNT100                 │
│     6:J  P[1] 10% FINE                         │
│    [End]                                       │
│                                                │
├────────┬────┬────┬────┬──────────┬─────────┤
│ [INST] │    │    │    │ [EDCMD]  │    >     │
└────────┴────┴────┴────┴──────────┴─────────┘
```

13   Press F4[CHOICE]. The list of additional motion instructions is displayed. Select "Weld End[]" from the list. Weld End instruction is taught at the last of line 4.

```
ARC_WELD                                                .
                                                   4/7
       :  Weld Start[1,1]
     4:L  P[4] 60cm/min FINE
       :  Weld End[...,...]
     5:L @P[5] 100mm/sec CNT100
     6:J  P[1] 10% FINE
     [End]


     Enter procedure number.
```
| REGISTER | | VALUE | [CHOICE] | | |

14   Input the Weld Procedure number (in this example, 1) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 7 (in this example, 1) to the second argument. In this stage, sample program for arc welding was completed. In this sample program, processing is performed between P[3] and P[4] at the Schedule 1 of Weld Procedure 1.

```
ARC_WELD                                                .
                                                   5/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
       :  Weld Start[1,1]
     4:L  P[4] 60cm/min FINE
       :  Weld End[1,1]
     5:L @P[5] 100mm/sec CNT100
     6:J  P[1] 10% FINE
     [End]
```
| [INST] | | | | [EDCMD] | > |

15   You can directly specify parameters like "Wire feed speed" for arc weld schedule in Weld Start/Weld End instructions on Program Edit screen. If you would like to directly specify parameters like "Wire feed speed", please perform following procedure.

16   Move the cursor on the argument part in Weld Start instruction and press F3[DIRECT]. It becomes possible to input parameters like "Wire feed speed" to Weld Start instruction directly. You can also directly specify parameters like "Wire feed speed" in Weld End instruction by same operation.

```
ARC_WELD                                                .
                                                   4/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
       :  Weld Start[1, 0.0cm/min, 0.000%, 0.0ms]
     4:L  P[4] 60cm/min FINE
       :  Weld End[1, 0.0cm/min,  0.000%, 0.0ms, 0.0s]
     5:L @P[5] 100mm/sec CNT100
     6:J  P[1] 10% FINE
     [End]
     Enter Wave Control
```
| REGISTER | SCHED | | [CHOICE] | | |

NOTE
The operation procedure in this section assumes the status just after factory shipment. If Weld Procedures or weld schedules have already been set, please create the new Weld Procedure and use it or use unused weld schedule for preventing the change of existing setup.

2.10   MANUAL OPERATION FOR WELDING

As preparations for arc welding, following weld-related manual operations are required.
- Gas Check
- Switching Weld Enabled/Disabled

Gas Check

Open the valve for shield gas and check a gas pressure and a gas flow before performing arc welding.

Procedure 2-10 (a)   Manual gas check

Step

1   Press the [GAS/STATUS] key once while pressing the [SHIFT] key on Teach Pendant. Gas is left out from the top of the torch. When 10 seconds have passed, the gas flow stops automatically.
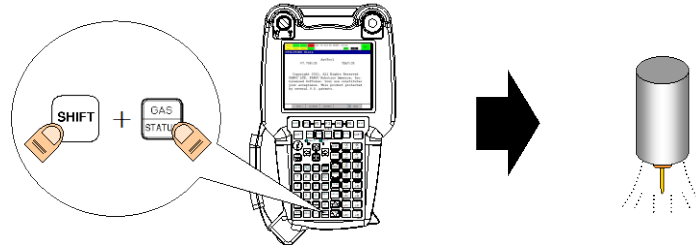
Fig. 2.10 (a) Gas Check by Gas Purge Key Operation

2   During the gas flow, you can also stop the gas flow manually by pressing [GAS/STATUS] and the [SHIFT] key simultaneously again before passing Gas Purge Time.

3   If you would like to change the gas purge time from 5 seconds, please perform the following steps. Press the [MENU] key and select "6 SETUP". Then, press F1[TYPE] and select "Weld System". Weld System Setup screen is displayed.

```
SETUP Weld System                                  .
                                        1/22
          NAME                VALUE
     Monitoring Functions
      1 Arc loss:             ENABLED
      2 Gas shortage:         DISABLED
      3 Wire shortage:        DISABLED
      4 Wire stick:           DISABLED
      5 Power supply failure: ENABLED


     [TYPE]              ENABLED  DISABLED
```

4   Move the cursor below on the screen, and move the cursor on "Gas Purge Time". Then, input appropriate time by numerical keys and press the [ENTER] key.

```
SETUP Weld System                                  .
                                        22/22
     18 Weld from teach pendant: ENABLED
     19 Remote gas purge:        DISABLED
     20 Remote wire inch:        DISABLED
     21 Gas purge key:           ENABLED.
     22 Gas purge time:          20   sec


     [TYPE]              ENABLED  DISABLED
```

Switching Weld Enabled/Disabled

Arc welding can be performed with Weld Enabled status when arc weld instruction is executed. On the other hand, arc welding is never performed with Weld Disabled status even when arc weld instruction is executed. Switching operation of Weld Enabled/Disabled is achieved by the following procedure.

Procedure 2-10 (b)   Switching Weld Enabled/Disabled

Step

1   Press the [WELD ENBL] key while pressing the [SHIFT] key on Teach Pendant. "Weld" software LED on Teach Pendant is switched to yellow and green alternately.
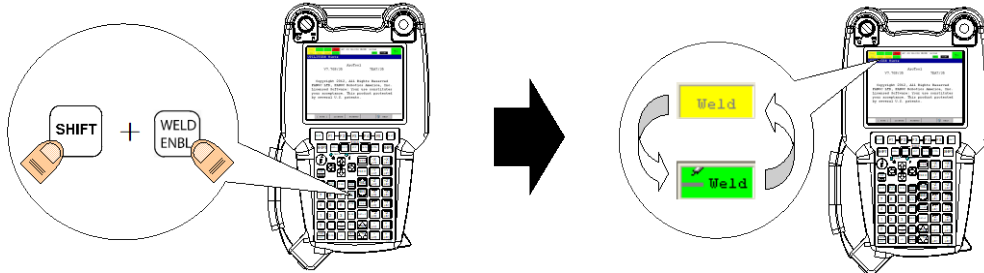
Fig. 2.10 (b) Switching Operation of Weld Enabled/Disabled by WELD ENBL Key

2   When "Weld" software LED is yellow, arc welding is not performed even if arc weld instruction is executed. When "Weld" software LED is green, arc welding is performed if arc weld instruction is executed.

2.11   TEST OPERATION

Before performing arc welding, test operation is required for the motion check of created program. Test operation has step operation and continuous operation. Normally, step operation is performed first, and then continuous operation is performed next.

Procedure 2-11 (a)   Step Operation

Step

1   Grasp Teach Pendant, press dead man switch and turn the Enable switch on Teach Pendant ON.
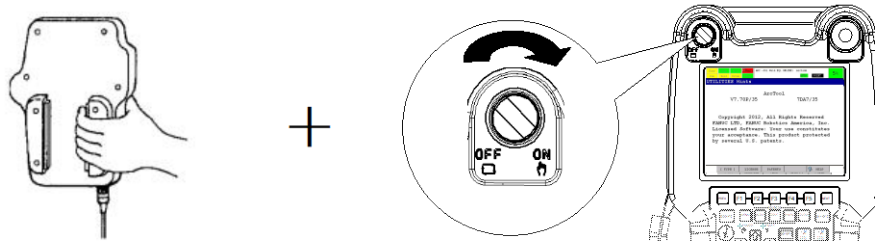
Fig. 2.11 (a) Operation of Dead Man Switch and Teach Pendant Enable Switch

2   Set the robot speed during program execution by override keys.
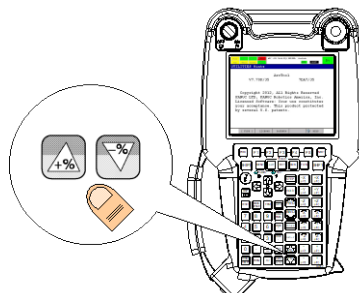
Fig. 2.11 (b) Setup of Override

> ⚠ **WARNING**
> Please set the value of the override in low speed (10% around). If the speed of the robot is fast, you cannot deal with an emergency.

3   Display the edit screen of the arc welding program created by Procedure 2-8 and Procedure 2-9. Press [EDIT] key, or press the [SELECT] key and select the sample program name which was set by Step 4 in Procedure 2-8 (in this example, ARC_WELD). Then, move the cursor on the top of line 1.

```
ARC_WELD                                                    .
                                                      1/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
      :   Weld Start[1,1]


      [INST]                                    [EDCMD]   >
```

4   Press [STEP] key and set "Step" software LED on Teach Pendant to yellow status.
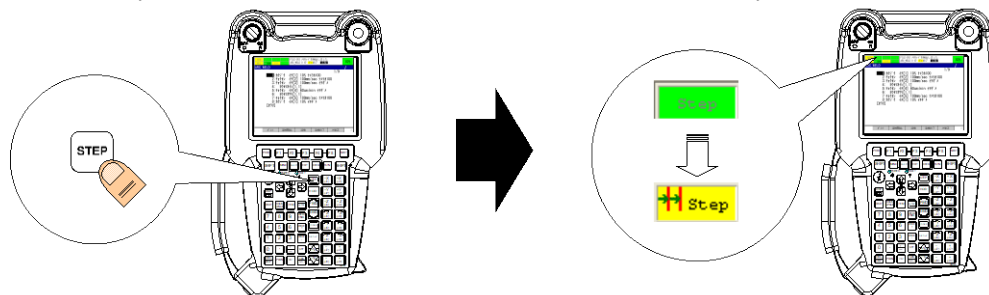
Fig. 2.11 (c) Switch to Step Mode

> ⚠ **WARNING**
> Program instructions will be executed and the robot will move by the next step. The robot may perform unexpected motion by program contents. Please check that there is no person in the working area and please check there is no needless equipment sufficiently. Additionally, during next or later steps, if you would like to pause the program before the program execution completes, please release [SHIFT] key or dead man switch, or please press [HOLD] key or Emergency Stop button.

5   Start the program execution. Press the [FWD] key while pressing the [SHIFT] key. After the robot starts to move, release only the [FWD] key, but keep the [SHIFT] key pressed. The robot stops after the robot arrives at the taught position of line 1. The cursor on Teach Pendant moves on the line 2 of the program.
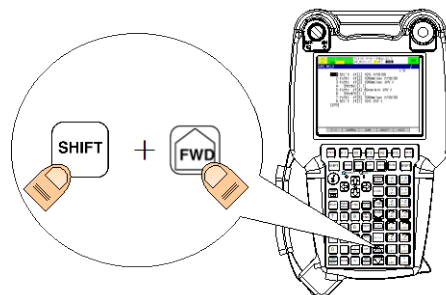
Fig. 2.11 (d) Step Operation of Program

6   When [FWD] key is pressed while pressing [SHIFT] key again, the execution of line 2 on the program
     is started. Please check the motion path of the robot by repeating the operation.

> **NOTE**
> Arc weld instructions are never executed during Step Operation. Therefore, arc
> welding is not performed even with Weld Enabled status.

Procedure 2-11 (b)   Continuous Operation

Step

1   Move the cursor on the top of line 1.

```
ARC_WELD                                       .
                                         1/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
      :  Weld Start[1,1]


    [INST]                              [EDCMD]    >
```

2   Set continuous operation mode. Press the [STEP] key and set "Step" software LED on Teach Pendant
     to green status.
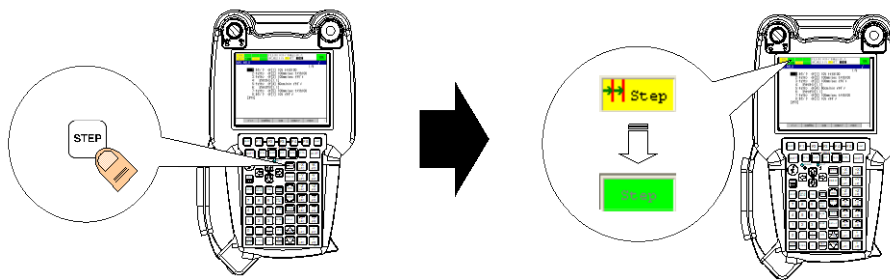
Fig. 2.11 (e) Switch to Continuous Operation Mode

3   Set Weld Disabled status. Press the [WELD ENBL] key and set "Weld" software LED on Teach
     Pendant to yellow status.
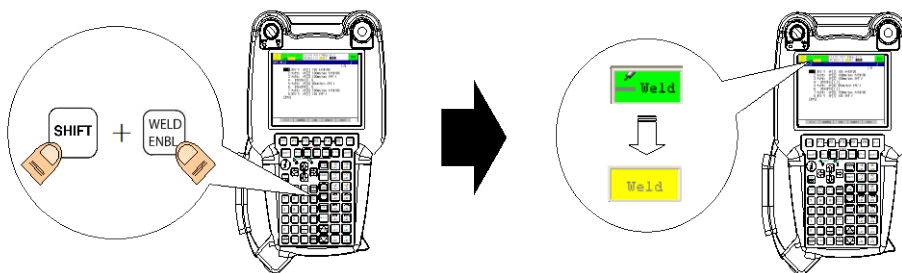
Fig. 2.11 (f) Switch to Weld Disabled

4   Set the robot speed during program execution by override keys.
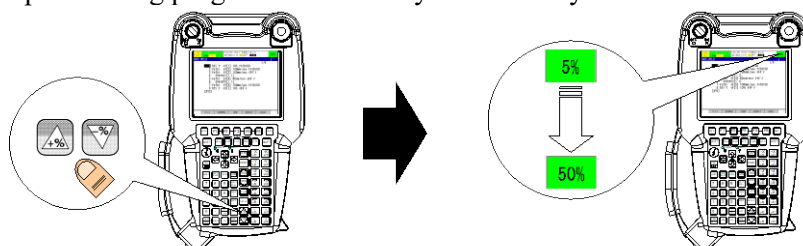
Fig. 2.11 (g) Setup of Override

- 49 -

5   Start the program execution. Press the [FWD] key while pressing the [SHIFT] key. After the robot
     starts to move, release only the [FWD] key, but keep [SHIFT] key pressed. The program is
     continuously executed to the last line without stop. This is the different point between continuous
     operation and step operation.
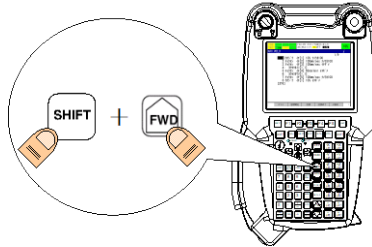
Fig. 2.11 (h) Continuous Execution of Program

2.12   EXECUTION OF WELD PROGRAM

For executing arc welding, the program must be executed with Weld Enabled status, 100% override and
continuous operation.

Procedure 2-12   Execution of Weld Program

Step
1   Set Weld Enabled status. Press the [WELD ENBL] key and set "Weld" software LED on Teach
     Pendant to green status.
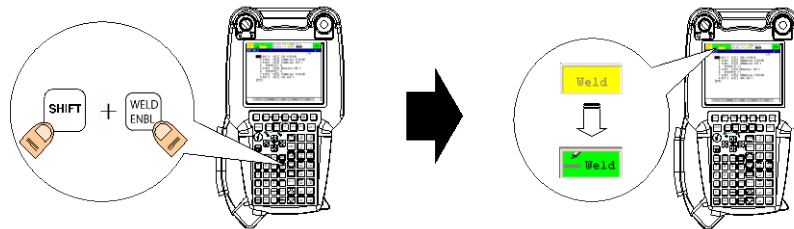
Fig. 2.12 (a) Switch to Weld Enabled

2   Set 100% override by override key.
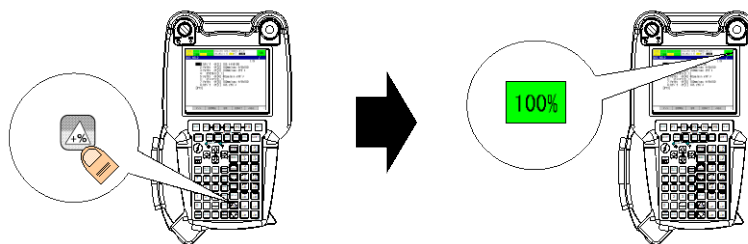
Fig. 2.12 (b) Set 100% Override

3   Move the cursor on the top of line 1 and then perform the program execution.
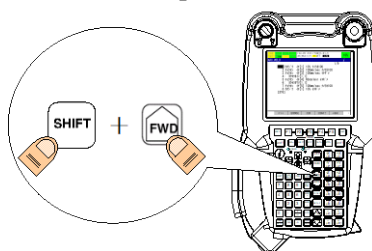
Fig. 2.12 (c) Continuous Operation of Weld Program

4   Arc welding is performed when the motion instruction that is put between Weld Start and Weld End
     instructions is executed.
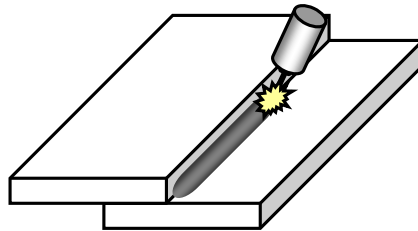
Fig. 2.12 (d) Execution of Arc Welding

> **NOTE**
> 1   If Weld Start instruction is executed without 100% override, "ARC-033 Override
>   must be 100% to weld" alarm is posted and the program pauses. In this case,
>   please change override to 100% and then perform program execution again.
> 2   If arc is not generated at Weld Start position, "ARC-013 Arc Start failed" alarm is
>   posted and the program pauses. Then, please investigate the cause of arc failure
>   referring to Chapter 6 "TROUBLE SHOOTING".

2.13   Check the J5/J6-axis motion range

J5-axis movable range is $\pm 140^{o}$ and I6-axis movable range is $\pm 270^{o}$. For life extension measure of the
torch cable, we recommend J5-axis inside $\pm 110^{o}$ and J6-axis inside $\pm 210^{o}$

2.14   Adjustment length of the hose pack

The hose is insert into the J1 base of the robot mechanical unit when the it is shipped. You must adjust the
hose pack length between the J1 base and he wire buffer (shaded portion of Fig. 2.14 (a)) depending on the
robot motion and peripheral equipment placement. Check the whole operation of the robot, adjust the hose
pack length during being careful to the following points.
   ● Check that no load is applied on the hose pack
   ● Check there is no interference with the robot mechanical unit and scrubbing

If the hose pack position is not stable, prepare a fixing component to the robot/peripheral equipment and fix
the hose pack.
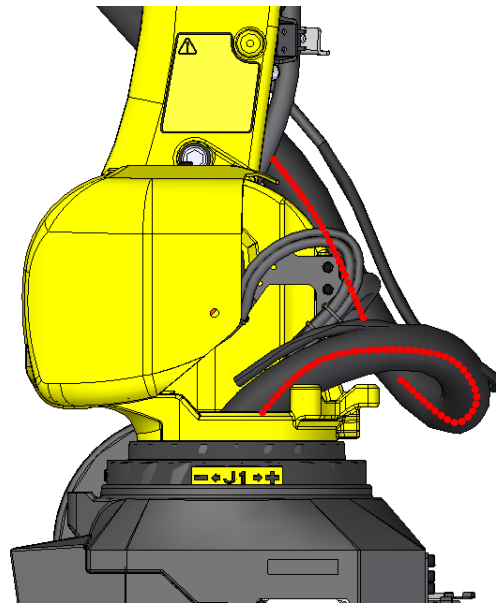
Fig. 2.14 (a) Adjustment of the hose pack

2.15   ADJUSTMENT OF THE FLEXIBLE CONDUJIT

To perform stable welding, make the bent of the flexible conduit between the wire feeder and the wire buffer short and make install length short as far as possible. The flexible conduit is shipped with 6.0m length. If conduit length is excessive after installing the system, adjust it to moderate length according to the following procedure. If forming it not through the robot mechanical unit J1 base, required conduit length differs depending on the robot posture. Be sure to check the whole of the robot motion before adjusting.
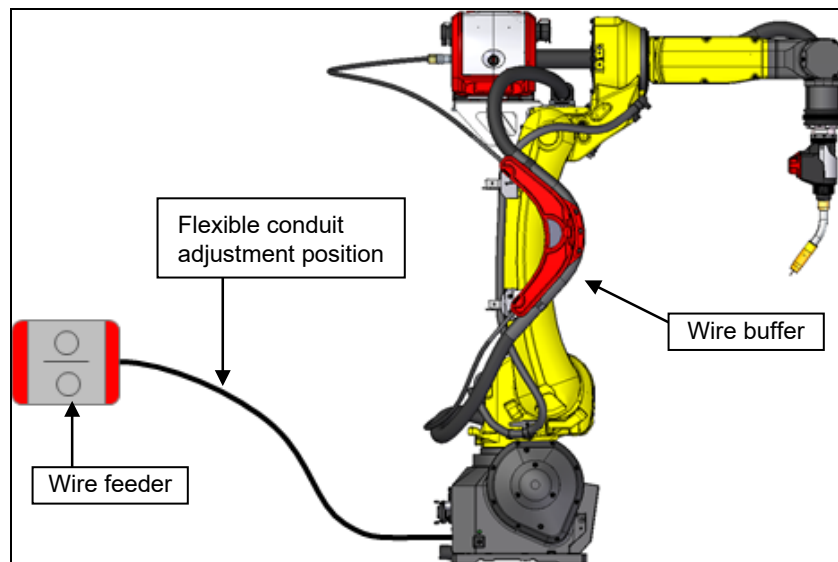
Fig. 2.15 (a) Connection of the flexible conduit

1   Confirm the length to be cut, mark the conduit tube.
2   Remove the flexible conduit from the wire buffer and the wire feeder.
3   Remove the clamping nut referring to Fig. 2.15 (b).
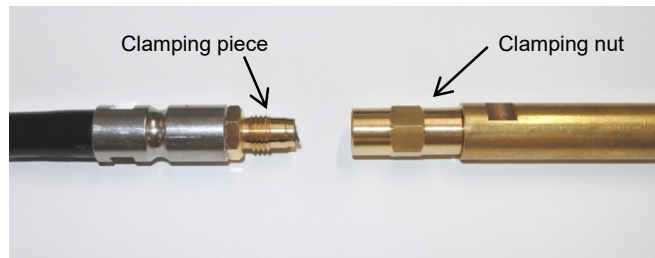
Fig. 2.15 (b) Replacing the liner

4   Referring to Fig. 2.15 (c), Pull out the liner from the opposite side joint, then pull out the tube.
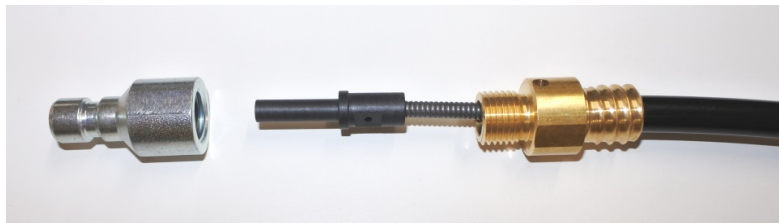
Fig. 2.15 (c) Replacing the liner

5   Cut the conduit tube.
6   Screw the joint part to the conduit tube head.
7   Pass the liner through the tube, and match it to the edge surface of the clamping piece head.
8   Cut the liner at the joint part edge surface.
9   Pull out the liner then screw the resin.
10   Return the liner to the original position, then assemble those in the reversed sequence.

3   BASIC OPERATION

This Chapter describes about robot basic operation except contents which are already described in Chapter 2 "QUICK REFERENCE".

3.1   BASIC OPERATION FOR TPS/i WELDER

In this Section, the information about TPS/i welder is shown.

3.1.1   Operating Mode

There is a concept called "Operating Mode" in the TPS/i welder. Please refer to the following table about the "Operating Mode". One Operating Mode is assigned to each Weld Procedure. "Operating Mode" number of selected Weld Procedure is output to the welder as GO[51] (In case of normal setting) (Oper Mode).

Table 3.1.1 (a) Operating Mode of TPS/i

Operating Mode	Value of GO[51]	Description
Special 2 step	1	The welding output is decided based on the weld schedule set at the robot. Short circuiting welding, pulse welding, CMT welding, etc. are all supported.
Job Mode	2	The welding output is decided based on the weld schedule that is set in the Fronius welder (this is called "JOB" in the Fronius system). Robot commands job number that you want to use.
Internal mode	0	The welding output is decided based on the weld schedule that is set in the Fronius welder. At the point where the difference with the job mode is just using present effective welding schedule at the welder. The robot orders only welding start and end timing.

And, there is a concept called "Synergic ID" in the TPS/i welder. "Synergic ID" is a welding characteristic file prepared by welder according to weld technique (short circuit, pulse, CMT etc.), materials and diameter of the used wire and the used gas. At the Weld Procedure which specified the special 2 steps, one "Synergic ID" is specified at each Weld Procedure. Synergic ID information of the selected Weld Procedure is output by welder as GO[52] (Job# / Syn#)(In case of normal setting).

On the other hand, it is not necessary to assign the "Synergic ID" to the Weld Procedure in Job Mode (all are set by the Job that is set at the welder). The Job number that is commanded by the robot is output to the welder as GO[52] (Job# / Syn#)(In case of normal setting). This manual does not have information about the procedure of creating/setting Job. Please refer to the Fronius welder manual about it.

3.1.2   Setting of Weld Procedure

This Subsection describes about setting of Weld Procedure to perform processing by Fronius welder.

"Weld Procedure" has setups which decide welding sequence. It is possible to create weld procedure up to 20. Additionally, one weld procedure can have weld schedules up to 32.

Please refer to Section 3.5 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3) for basic operations on Weld Procedures screen.

Procedure 3-1-2   Setting of Weld Procedure

Step

1 Press the [MENU] key and select "-- NEXT –". Select [DATA].
2 Press F1[TYPE] and select "Weld Procedure". The following screen will be displayed.

```
DATA Weld Procedure        1                    .
                                        1/9
     +  Procedure         1 [           ]
        +  Mode              [Special 2-step ]
        +  Schedules


     ------------------------------------------------


     +  Procedure         2 [           ]
           Mode              [Job Mode     ]
        +  Schedule


     ------------------------------------------------


     +  Procedure         3 [           ]
           Mode              [Internal Mode ]
        +  Schedule


   |   [TYPE]  | DETAIL | [CMND] | [VIEW] |  HELP  |   |
```

3 At the status just after factory shipment, there are 3 types of Weld Procedure with preassigned operating modes. About procedures to edit existing Weld Procedures, please refer to the Procedure 2-8. The following procedure shows the procedures to create new Weld Procedure and to set up it.

4 Press F3[CMND] and select "Create WP" (It is also possible to create new Weld Procedure by copying existing Weld Procedure. In this case, press F3[CMND] key and select "Copy WP" after move cursor to the original Weld Procedure.). The following message is displayed on the lower of the screen. Input the Weld Procedure number that you would like to create (1-99).

```
Enter new procedure number :
```

5 The following message will be displayed on the lower of the screen. Press F4[YES].

```
Create new procedure xx :
```

6 If Weld Procedure setup guide screen is displayed, press F5[DISABLE] (Weld Procedure setup guide function is not supported by Fronius welder).

7 Weld Procedure which has the number specified at Step 4 is created. Move the cursor to that Weld Procedure.

8 Move the cursor to the comment field of "Mode" and press F4[CHOICE]. The following menu will be displayed.

```
                             1
        1 Internal Mode
        2 Special  2-Step
        3 Job Mode
        4
```

9 Select the desired Operating Mode.

10 In case of special 2 step, "+" will be displayed at the first position of "Mode" line. Move the cursor to the area of "+" and press the [ENTER] key or F2[DETAIL]. The Mode tree view will be expanded and the following screen will be displayed. Enter the desired synergic ID. If you do not know it, you can search it by specifying the search condition. If F4[CHOICE] is pressed at cursor positions (process, mode wire materials and wire diameter) of each conditions, selectable condition will be displayed.

After specifying search conditions, if [4 Search] in F3 [CMND] menu is performed, the list of a synergic ID that matches to search condition will be displayed. Move the cursor to the desired mode, then press F2[SELECT].

```
DATA Weld Procedure        1                    .
                                        2/14
    +  Procedure         1  [              ]
       -     Mode             [Special 2-step ]
             Synergic ID:       0
             Process
             Wire
             Gas
      ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
      │ Search                      │
      │  Process:        MAG,MIG    │
      │  Mode:           Pulse      │
      │  Wire material:  Steel      │
      │  Wire size:      1.2mm      │
      └─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘

   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

```
SETUP Eq Search                                .
                                        1/20
     #   WIRE DIA        DESCRIPTION
  1 2769 0.8 mm  [Pulse        universal  ]
            [Steel                        ]
            [M21 Ar+15-20%CO2             ]

  2 2783 0.9 mm   [Pulse        universal  ]
            [Steel                        ]
            [M21 Ar+15-20%CO2             ]

  3 2784 1.0 mm   [Pulse        universal  ]
            [Steel                        ]
            [M21 Ar+15-20%CO2             ]



   [TYPE]   SELECT                     HELP
```

By the way, this search process is performed against the XML file. Information of search result is acquired by XML. (Refer to Subsection 10.4.3 for XML file.）.

In the case of Job Mode and internal mode, it is not necessary to set the synergic ID. So "+" is not displayed at the first position of "Mode" line. Set desirable items such as JOB by operating the welding machine.

NOTE
- It is necessary to establish the communication with welding power supply before performing this step. Please confirm turning on the power supply and the state of communication cable. When this step is performed with no communication, the prompt message of "Weld EQ is OFFLINE" is displayed and user input operation is canceled. If the communication is not established correctly, please recover the communication by referring the Subsection 6.2.3.
- Please confirm that the desired Synergic ID is set correctly. If nonexistent number or not allowed number by welder side is input, input is allowed, However, the prompt message of "Firmware(Weld table) does not support it" will be displayed.

---

11   In addition, in case of Special 2-step, detailed setting of the Fronius welder can be performed. Move the cursor to "+" at the head of the "Procedure" setting line, then press [ENTER] key or F2

[DETAIL].   Then, by moving the cursor to the "< *DETAIL* >" of expanded tree and pressing the [ENTER] key or F2 [DETAIL], the following screen will be displayed.

```
┌─────────────────────────────────────────────────┐
│ DATA Weld Procedure        1                    .│
│                                          3/21    │
│     +  Procedure              1 [         ]      │
│        Weld equipment:        1                  │
│        Manufacturer:          Fronius            │
│        Model:                 TPSi Extend Enet   │
│        File name:             AWE1WP01           │
│        Schedule:              3                  │
│                                                  │
│        Fronius EQ SETUP:      〈 *DETAIL* 〉      │
│        Runin:                 DISABLED           │
│        Ramping:               DISABLED           │
│        Heatwave:              0                  │
│ ┌──────────────────────────────────────────────┐│
│ │ [TYPE] │ DETAIL │ [CMND] │ [VIEW] │ HELP │    ││
│ └──────────────────────────────────────────────┘│
└─────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────┐
│ SETUP Fronius Equip                             .│
│                                          1/19    │
│     Special 2-step                               │
│      Weld Start                                  │
│       1 Current                  : 100%          │
│       2 Arc Length Correction    : 0.0           │
│       3 Duration                 : 0.1 sec       │
│       4 Slope 1                  :  0.1 sec       │
│      Weld End                                    │
│       5 Current                  : 40%           │
│       6 Arc Length Correction    : 0.0           │
│       7 Duration                 : 0.1 sec       │
│       8 Slope 2                  :  0.1 sec       │
│ ┌──────────────────────────────────────────────┐│
│ │ [TYPE] │ DETAIL │ [CMND] │ [VIEW] │ HELP │    ││
│ └──────────────────────────────────────────────┘│
└─────────────────────────────────────────────────┘
```

For details of setting in this screen, refer to Section 3.2.

12   Continuously, the weld schedule is set at the Weld Procedure screen. However, it is not necessary to perform following steps if user wants to teach the weld schedule in TP program directly. (Refer to Section 3.4 for details.)

13   Move the cursor to "+" in the head of "Schedules" line and press the [ENTER] key or F2[DETAIL]. Tree view is expanded and following screen is displayed.

```
┌─────────────────────────────────────────────────┐
│ DATA Weld Procedure        1                    .│
│                                          12/16   │
│ ------------------------------------------------ │
│                                                  │
│     +  Procedure          99 [              ]    │
│        +  Mode               [Special 2-Step ]   │
│        -  Schedules                              │
│                                                  │
│     Schedule    Amps       Speed    Time         │
│     Schedule 1  0.0    0.0  100.0   0.00         │
│     Schedule 2  0.0    0.0  100.0   0.00         │
│     Schedule 3  0.0    0.0  100.0   0.00         │
│     OnTheFly    5.0    0.5  100.0                │
│ ┌──────────────────────────────────────────────┐│
│ │ [TYPE] │ DETAIL │ [CMND] │ [VIEW] │ HELP │    ││
│ └──────────────────────────────────────────────┘│
└─────────────────────────────────────────────────┘
```

14   Move the cursor to desired "Schedule" and press F2[DETAIL].

```
DATA Weld Procedure                                    .
                                              1/14
         1 Weld Procedure 99  [            ]
           Mode                [Special 2-Step  ]

         2 Weld Schedule    1 [Schedule      ]
         3 Current               0.0 Amps
         4 ArcLength Corr        0.00
         5 Pulse/Dyn Corr        0.00
         6 Hi PwrTim Corr        0.00
         7 Lo PwrTim Corr        0.00
         8 Low Power Corr        0.00

     [TYPE]    SCHDULE           INCR    DECR
```

15   Set the weld schedule. For more details of each parameter, please refer to the Section 3.2. In the job
mode, since there is "Job Number" in one of the parameters, enter the job number to use here.

3.2   SPECIAL 2 STEP AND PARAMETER OF WELD SCHEDULE

This section explains about special 2 step and each welding parameter in the weld schedule.
Special 2 step is a function which can specify welding start condition and crater process condition in
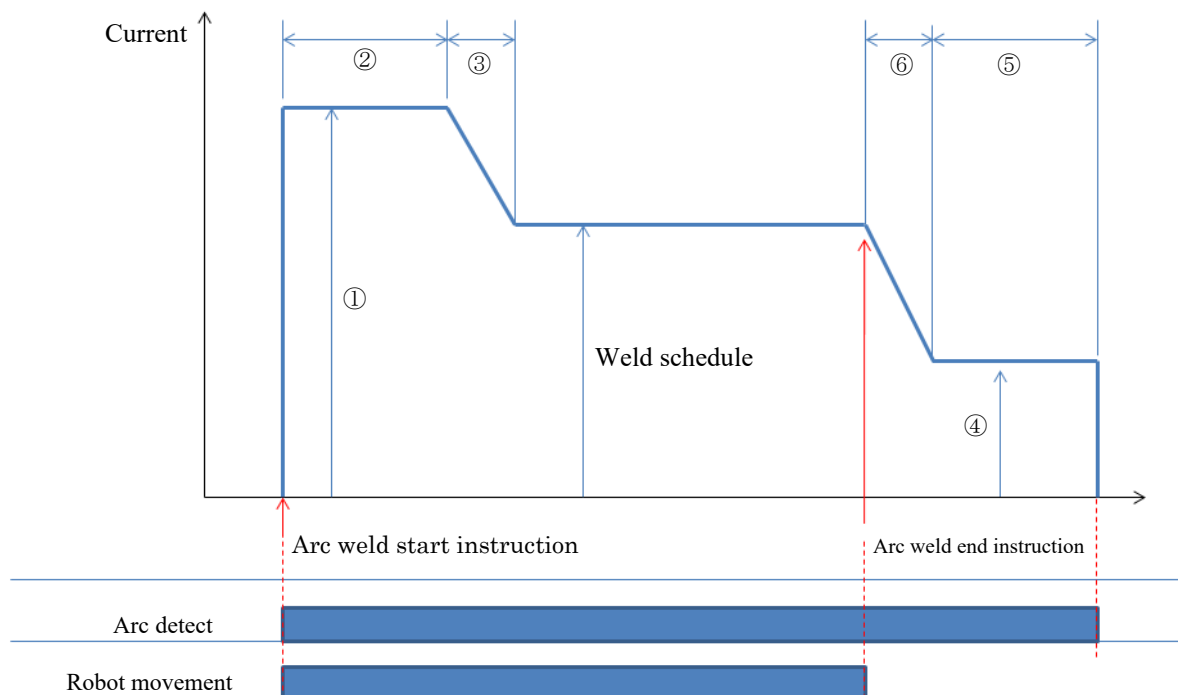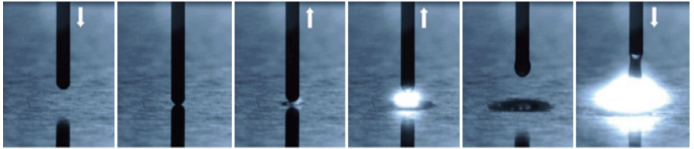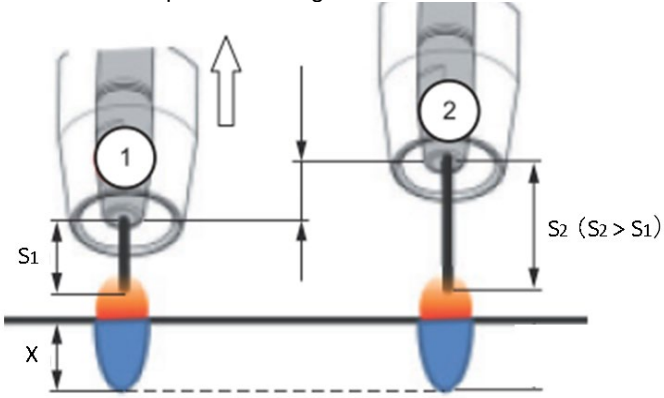addition to weld schedule as the following figure.
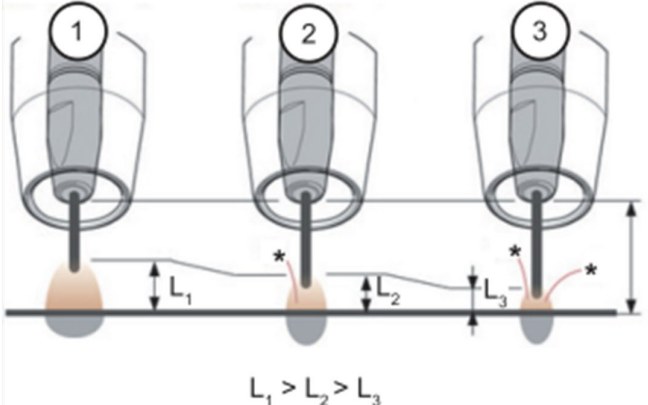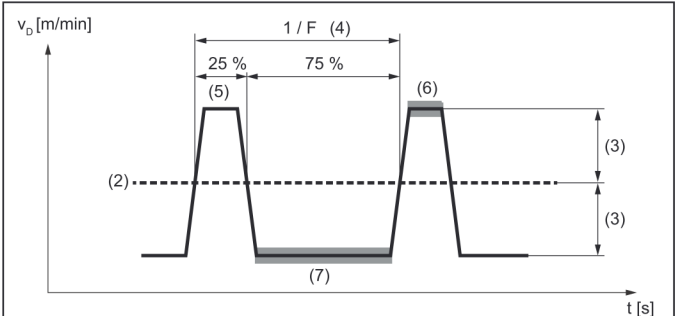
Fig. 3.2 (a) Parameter of the special 2 step

Table 3.2(a) Special 2 step

Parameter name		Detail
Weld Start	Current	Specify by the ratio to the weld schedule using the current value of ① in the above figure
	Arc Length Correction	Specify the voltage adjustment value in the output of ①
	Duration	Specify output ① time at period ②.
	Slope 1	Specify the switching time from the welding start condition to the weld schedule by using the interval ③ in the above figure.
Weld End	Current	Specify by the ratio to the weld schedule using the current value of ④ in the above figure
	Arc Length Correction	Specify voltage adjustment value of ④'s output.
	Duration	Specify output time of ④ at the period of ⑤.
	Slope 2	Specify the switching time from the welding start condition to the weld schedule by using the interval ⑥ in the above figure.
	Retraction of wire	After the welding is finished, the length of wire protrusion is adjusted. The larger the value is rewound.
Optional Functions （Whether or not it is supported is determined for each Synergic ID）	SFI (SpatterFreeIgnition)	This function reduces the amount of sputtering generated at the start of welding by generating an arc while pulling back the wire.
	SFI Hot Start	This function is to increase the penetration amount at the welding start position by setting the spray arc period (state where the welding output is strong) at the start of welding by SFI.
	Penetration Stabilizer	This function controls the melting amount. Even if the wire extrusion length changes due to work variation or the like, the desired melting amount can be secured. The larger this value, the greater the control amount of welding output depending on the variation in wire protrusion length.

Parameter name		Detail
Optional Functions （Whether or not it is supported is determined for each Synergic ID）	Arc Length Stabilizer	This function is for adjusting arc length. This function can be used for desired bead forming such as thick bead with shallow melting depth and thin bead with deep melting depth. The larger this value, the arc length will be short. $L_1 > L_2 > L_3$
Synchro Pulse （Low frequency pulse welding）	Synchro Pulse	Specify "enable / disable" of the function to make the welding waveform pulsed (periodically switch the weak weld schedule). For aluminum welding, it can be used when you want to secure bead width while avoiding melting down.
	Delta Wire Speed	(2) in the above figure is the wire feed speed (or current) command value specified by weld schedules. It sets the amount of increase (3) centered on (2). Only increment / decrement (3) is supported for specifying wire feed speed.
	Frequency	Specify frequency of the (4) in the above figure.
	Duty Cycle	Specify rate of (5) in the above figure.
	Arc Length Correction Hi	Specify voltage adjustment value of the period of (6) in the above figure.
	Arc Length Correction Lo	Specify voltage adjustment value of the period of (7) in the above figure.

Welding parameters differ according to the specified operating mode. For more detailed information, refer to Fronius manual.

Table 3.2(b) Weld schedule

Parameter name		Detail
Parameters used in special 2 steps	**Wire feed speed or Current**	This welding parameter decides wire feed speed. Standard unit is cm/min. In the case of the current command method, it becomes Current instead of Wire feed speed. The unit is A.
	ArcLength Corr	This welding parameter decides weld voltage. When this value is set to 0.00%, standard voltage (It is recommended voltage by Fronius at specified wire feed speed) is output. When this parameter is specified larger, voltage also becomes larger.
	Pulse/Dyn Corr	This welding parameter adjusts the weld wave shape and standard value is 0.00. ＜**Standard, L S C**＞ When this value becomes larger to plus side, peak current at short circuit decreases and cycle of short circuit becomes shorter. In the case of minus side, it reverses. ＜**Pulse, P M C**＞ When this value becomes larger to plus side, the welding output increases and droplet transfer is performed at larger grain. In the case of minus side, it reverses. ＜**C M T**＞ When this value becomes larger to plus side, peak current at short circuit decreases and heat quantity of melt pool decreases. In the case of minus side, it reverses.
Parameters to be used when special 2 steps are in use and the synjic ID is in MIX mode	**Hi PwrTim Corr**	It is a valid parameter only in MIX mode (a mode in which two welding methods of different types are periodically switched). Adjust the period during high welding output side mode.
	Lo PwrTim Corr	This parameter is valid only in MIX mode excepting CMT. Adjust the period during low welding output side mode.
	Lo PwrCMT cycle	This parameter is valid only in CMT MIX mode. Adjust the number of cycles during low welding output side mode(= CMT).
	Low Power Corr	This parameter is valid only in MIX mode. Adjust wire feeding speed (or current) value in low welding output side mode.
Parameters used in job mode	**Job Number**	Job number is displayed only when Operating Mode is Job Mode. This parameter decides JOB Number which is used.

3.3   EDITING OPERATION OF PROGRAM

This section explains the basic editing operation of program. This explanation overlaps with the explanation of Chapter 2. So there is no problem to ship reading the explanation if it is known.

3.3.1   Selecting and Editing of Program

About the method for creating new program, procedure 2-7 "Creating Motion Program" explains. This Subsection explains the procedure for selecting and editing the program that already exists.

Procedure 3-3-1   Selecting and editing of program

Step

1   Select a program on the program selection screen.
Press the [MENU] key and select "SELECT" from the displayed menu. Or, press [SELECT] key.
Program selection screen will be displayed.

```
Select
               1039556 bytes free            1/9
      No. Program name         Comment
       1   -BCKEDT-        [                ]
       2   ARC_WELD        [                ]
       3   GETDATA      MR [Get PC Data     ]
       4   REQMENU      MR [Request PC Menu]
       5   SENDDATA     MR [Send PC Data    ]
       6   SENDEVNT     MR [Send PC Event   ]


     [TYPE]   CREATE   DELETE   MONITOR   [ATTR]   >
```

2   Move the cursor on the program that you would like to select and press the [ENTER] key. The program is selected and the edit screen for this program is displayed.

```
ARC WELD
                                              1/7
       1:J  P[1] 10% CNT100
       2:L  P[2] 100mm/sec CNT100
       3:L  P[3] 100mm/sec FINE
          :    Weld Start[1,1]
       4:L  P[4] 60cm/min FINE
          :    Weld End[1,1]
       5:L  P[5] 100mm/sec CNT100
       6:J  P[1] 10% FINE
       [End]


     POINT   WELD_ST   WELD_PT   WELDEND   TOUCHUP   >
```

3   The program name of currently selected can be confirmed at status line that is in the window at the top of the teach pendant. So the selected program can be confirmed even if another screen is displayed.

```
                  ARC_WELD  LINE 4  T1  ABORTED  JOINT  30%
                             ↑
              Program name
```
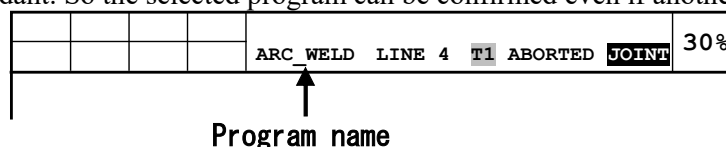
4   Press the [MENU] key and select the "EDIT" from the displayed menu if displaying the program edit screen for currently selected is required. Or, press [EDIT] key.

3.3.2   Editing of Motion Instruction

About the teaching of motion instruction, procedure 2-7 "Creating Motion Program" explains. This Subsection explains the procedure for editing the motion instruction that is already taught.

Motion instruction is composed of move type and position data type, move speed, positioning type (Refer to Fig. 3.3.2 (a)). Procedure 3-3-2 explains about the editing method of those four compositions.
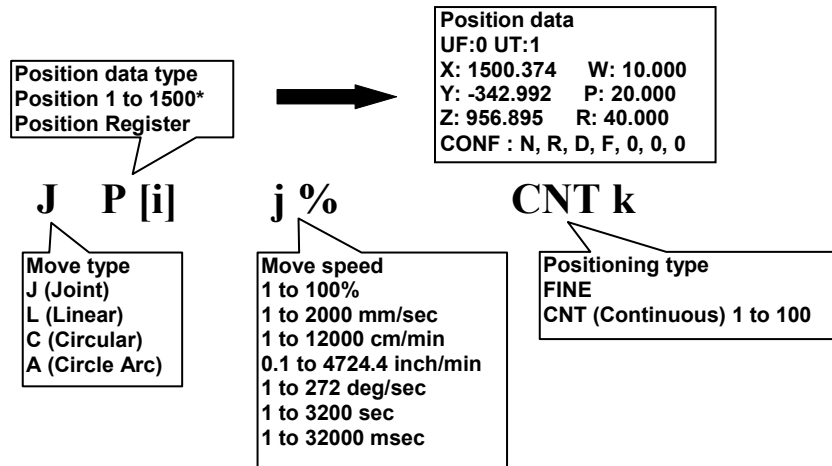
* A position number can be as large as memory allows.
The maximum move speed differs according to robot model.

Fig. 3.3.2 (a)   Composition of motion instruction

Procedure 3-3-2   Editing of motion instruction

Step

1   In case of changing move type, move the cursor to move type and press F4[CHOICE]. Sub menu for selecting move type is displayed.
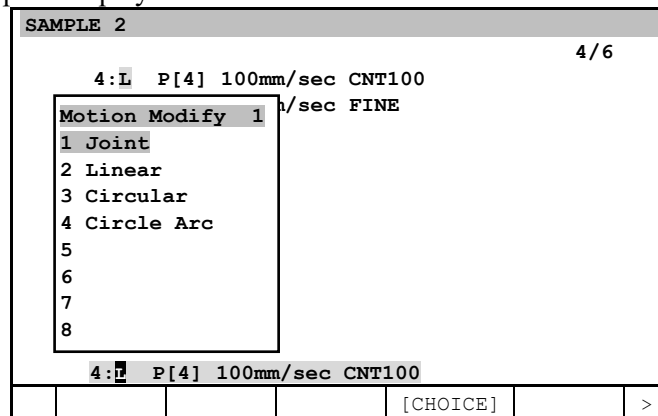
2   When the move type is selected from the sub menu, move type is changed. If it is changed, move speed and its unit are also changed according to the move type.
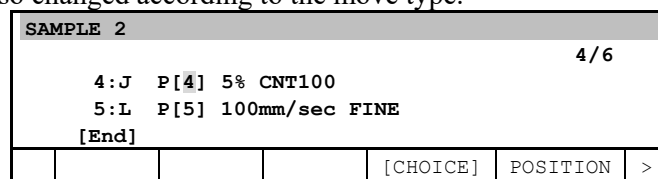
3   In case of changing position data number, move the cursor to the position data number and input new position data number.

```
┌─────────────────────────────────────────────┐
│ SAMPLE 2                                      │
│                                        4/6    │
│     4:J  P[4] 5% CNT100                       │
│     5:L  P[5] 100mm/sec FINE                  │
│   [End]                                       │
│                                               │
│   Enter value or press ENTER                  │
├──────┬──────┬──────┬──────┬────────┬──────────┤
│      │      │      │      │[CHOICE]│ POSITION │ > │
└──────┴──────┴──────┴──────┴────────┴──────────┘
```

4   In case of changing move speed, move the cursor to move speed and input new value.

```
┌─────────────────────────────────────────────┐
│ SAMPLE 2                                      │
│                                        4/6    │
│     4:J  P[4] 5% CNT100                       │
│     5:L  P[5] 100mm/sec FINE                  │
│   [End]                                       │
│                                               │
│   Enter value                                 │
├──────┬──────┬──────┬──────┬────────┬─────┬────┤
│      │      │      │      │[CHOICE]│     │ >  │
└──────┴──────┴──────┴──────┴────────┴─────┴────┘
```

5   In case of changing the unit of move speed, move the cursor to move speed and press F4 [CHOICE].
     Sub menu for selecting the unit is displayed. Select new unit from the sub menu. If it is changed, the
     value of move speed is automatically converted to new unit.

```
┌─────────────────────────────────────────────┐
│ SAMPLE 2                                      │
│                                        4/6    │
│     4:L  P[4] 5% CNT100                       │
│  ┌──────────────────┐ n/sec FINE              │
│  │ Motion Modify  1 │                         │
│  │ 1 %              │                         │
│  │ 2 sec            │                         │
│  │ 3 msec           │                         │
│  │ 4                │                         │
│  │ 5                │                         │
│  │ 6                │                         │
│  │ 7                │                         │
│  │ 8                │                         │
│  └──────────────────┘                         │
│     4:L  P[4] 5% CNT100                        │
├──────┬──────┬──────┬──────┬────────┬─────┬────┤
│      │      │      │      │[CHOICE]│     │ >  │
└──────┴──────┴──────┴──────┴────────┴─────┴────┘
```
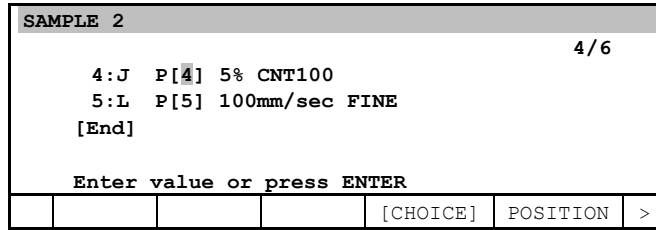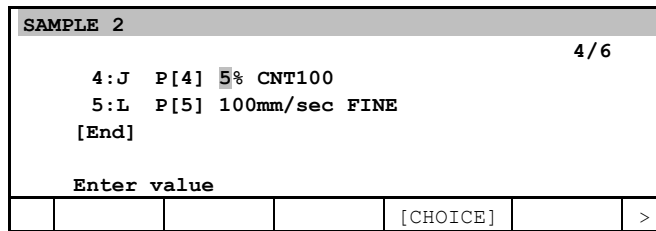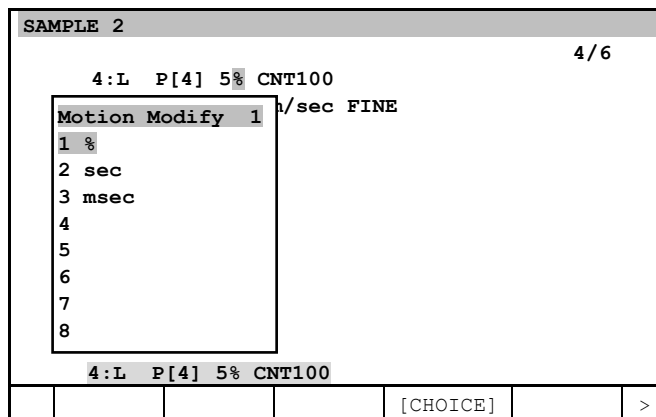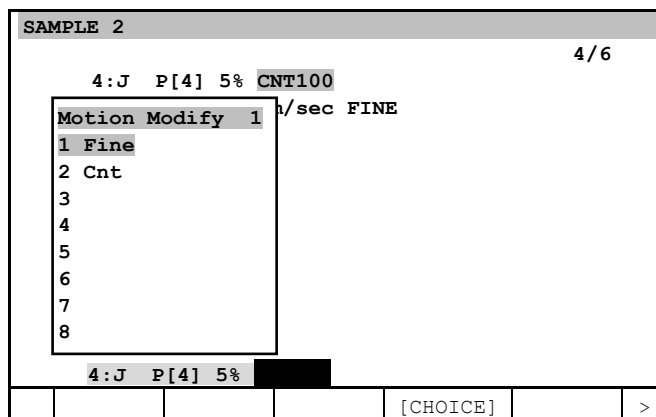
6   In case of changing the positioning type, move the cursor to positioning type and press F4 [CHOICE].
     Sub menu for selecting positioning type is displayed. Select new positioning type from the sub menu.

```
┌─────────────────────────────────────────────┐
│ SAMPLE 2                                      │
│                                        4/6    │
│     4:J  P[4] 5% CNT100                       │
│  ┌──────────────────┐ n/sec FINE              │
│  │ Motion Modify  1 │                         │
│  │ 1 Fine           │                         │
│  │ 2 Cnt            │                         │
│  │ 3                │                         │
│  │ 4                │                         │
│  │ 5                │                         │
│  │ 6                │                         │
│  │ 7                │                         │
│  │ 8                │                         │
│  └──────────────────┘                         │
│     4:J  P[4] 5%                              │
├──────┬──────┬──────┬──────┬────────┬─────┬────┤
│      │      │      │      │[CHOICE]│     │ >  │
└──────┴──────┴──────┴──────┴────────┴─────┴────┘
```

7   If "Cnt" is selected as the positioning type, move the cursor to the value field of positioning type and
     input new value.

```
┌─────────────────────────────────────────────────────┐
│ SAMPLE 2                                             │
│                                               4/6   │
│   4:J  P[4] 5% CNT30                                 │
│   5:L  P[5] 100mm/sec FINE                           │
│  [End]                                               │
│                                                      │
│   Enter value                                        │
├──────┬──────┬──────┬──────┬──────────┬──────┬──────┤
│      │      │      │      │ [CHOICE] │      │  >   │
└──────┴──────┴──────┴──────┴──────────┴──────┴──────┘
```

3.3.3   Correcting a Position

If the robot does not track the ideal path, it is necessary to modify the position that is taught by motion instruction. Operator can touch-up the position data in motion instruction after moving the robot to the position that should be corrected by jog feed. Please refer to procedure 3-3-3 (a).

Operator can confirm the taught position data in motion instruction. Operator can also modify the taught position data by changing the position number in motion instruction. Please refer to procedure 3-3-3 (b).
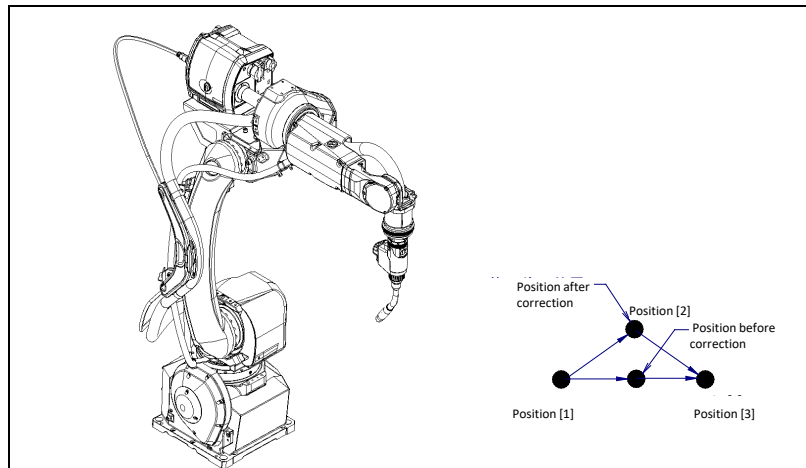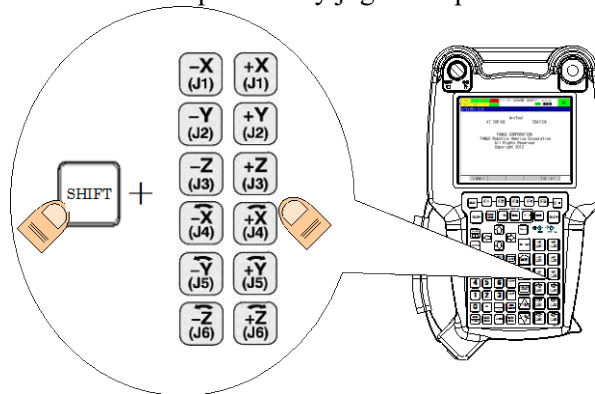

Fig. 3.3.3 (a) Correcting a position

Procedure 3-3-3 (a)   Correcting a position

Step

1   Move the cursor to the beginning of motion instruction line that correction is required.

```
┌─────────────────────────────────────────────────────┐
│ SAMPLE 3                                             │
│                                               3/4   │
│   1:J  P[1] 10% CNT100                               │
│   2:L  P[2] 100mm/sec CNT100                         │
│   3:L  P[3] 100mm/sec FINE                           │
│  [End]                                               │
│                                                      │
├──────┬────────┬─────────┬─────────┬─────────┬──────┤
│      │ POINT  │ WELD_ST │ WELD_PT │ WELDEND │TOUCHUP│ > │
└──────┴────────┴─────────┴─────────┴─────────┴──────┘
```
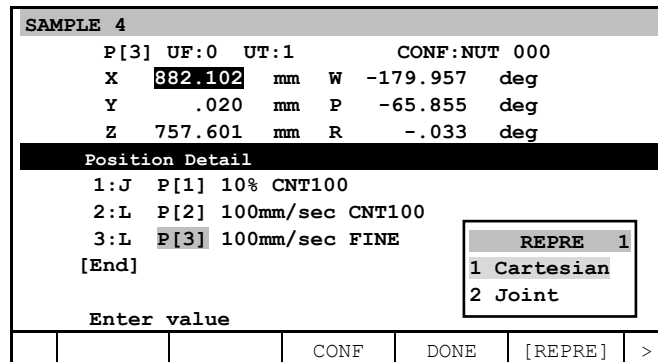
2   Move the robot TCP to the desired position by jog feed operation.

3   Press F5[TOUCHUP] with holding [SHIFT] key. The position data in the motion instruction of current cursor position (it is P[3] in the following example screen) is modified to the current robot TCP position.

```
SAMPLE 3
                                              3/4
    1:J  P[1] 10% CNT100
    2:L  P[2] 100mm/sec CNT100
    3:L @P[3] 100mm/sec FINE
    [End]

  POINT  | WELD_ST | WELD_PT | WELDEND | TOUCHUP | >
```

Procedure 3-3-3 (b)   Confirm position data and Change position data number

Step
1   Move the cursor to the position data number.

```
SAMPLE 4
                                              3/4
    1:J  P[1] 10% CNT100
    2:L  P[2] 100mm/sec CNT100
    3:L  P[3] 100mm/sec FINE
    [End]

                              | [CHOICE] | POSITION | >
```

2   Press F5[POSITION] key. Sub menu for position data is displayed. In standard, the position is displayed based on the cartesian coordinate system (world coordinate system).

```
SAMPLE 4
    P[1] UF:0  UT:1        CONF:NUT 000
    X   882.102   mm   W  -179.957   deg
    Y      .020   mm   P   -65.855   deg
    Z   757.601   mm   R     -.033   deg
  Position Detail
  1:J  P[1] 10% CNT100
  2:L  P[2] 100mm/sec CNT100
  3:L  P[3] 100mm/sec FINE
  [End]

   Enter value
                    | CONF  | DONE  | [REPRE] | >
```

3   Move the cursor to desired coordinate position data and input the desired value with numeric key. After that, press the [ENTER] key.

4   It is possible to change the format of position data. Press F5[REPRE] and select the desired format. For example, display changes as follows when the format of position data is changed from "Cartesian" to "Joint".

```
┌──────────────────────────────────────────────────┐
│ SAMPLE 4                                           │
│     P[3] UF:0  UT:1        CONF:NUT 000            │
│     X  ▓882.102▓  mm  W  -179.957   deg            │
│     Y     .020    mm  P   -65.855   deg            │
│     Z   757.601   mm  R     -.033   deg            │
│    Position Detail                                 │
│    1:J  P[1] 10% CNT100                            │
│    2:L  P[2] 100mm/sec CNT100                      │
│    3:L  P[3] 100mm/sec FINE      ┌──────────────┐  │
│   [End]                          │   REPRE   1  │  │
│                                  │ 1 Cartesian  │  │
│                                  │ 2 Joint      │  │
│    Enter value                   └──────────────┘  │
├──────────────────────────────────────────────────┤
│          │        │     │ CONF │ DONE │[REPRE]│ > │
└──────────────────────────────────────────────────┘
```

5   When the confirmation / changing position data ends, press F4[DONE]. Display is returned to program edit screen.

3.3.4   Edit by Using Program Edit Instructions

It is possible to modify / edit the program efficiently by using the program edit instructions. Kind of those are shown in following Table 3.3.4 (a). In those instructions, "Insert" and "Delete", "Copy" are often used. So those are explained in procedure 3-3-4 (a) to (c).

Table 3.3.4 (a) Kind of program edit instructions

Insert	Inserts blank lines, the number of which is specified, between the existing lines of a program.
Delete	Deletes a series of instructions from a program.
Copy	Copies a series of instructions and inserts the instruction range into another location in the program.
Find	A specified element of a program instruction is found.
Replace	Replaces an item of the specified program instruction with another item.
Renumber	Renumbers the position number in ascending order.

Procedure 3-3-4 (a)   Insert blank lines

Step
1   Move the cursor to the head of line where blank lines are inserted.

```
┌──────────────────────────────────────────────────┐
│ SAMPLE 5                                           │
│                                          3/4       │
│    1:J  P[1] 10% CNT100                            │
│    2:L  P[2] 100mm/sec CNT100                      │
│    3:L  P[3] 100mm/sec FINE                        │
│   [End]                                            │
│                                                    │
├──────────────────────────────────────────────────┤
│   POINT │ WELD_ST │ WELD_PT │ WELDEND │ TOUCHUP │ > │
└──────────────────────────────────────────────────┘
```
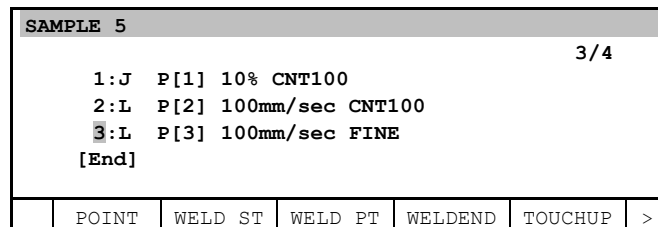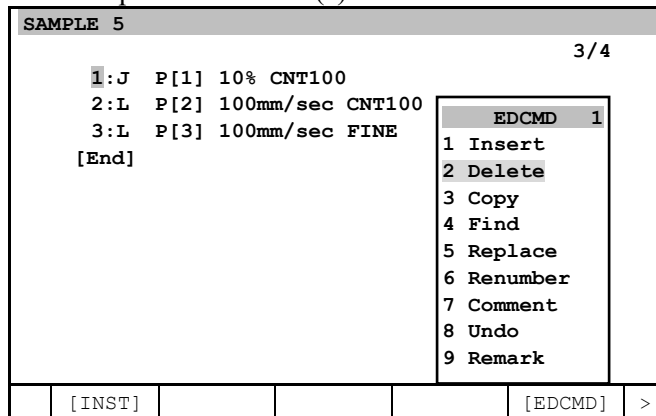
2   Press the [NEXT] key then the next page of function key menu will be displayed.

```
SAMPLE 5
                                          3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     [End]

       [INST]                           [EDCMD]   >
```

3   Press F5[EDCMD] then the EDCMD menu will be displayed.

```
SAMPLE 5
                                          3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100        ┌─────────────┐
     3:L  P[3] 100mm/sec FINE          │   EDCMD   1 │
     [End]                             │ 1 Insert    │
                                       │ 2 Delete    │
                                       │ 3 Copy      │
                                       │ 4 Find      │
                                       │ 5 Replace   │
                                       │ 6 Renumber  │
                                       │ 7 Comment   │
                                       │ 8 Undo      │
                                       │ 9 Remark    │
                                       └─────────────┘
       [INST]                           [EDCMD]   >
```

4   Select "Insert" from the displayed menu. Input the number of lines to insert by numeric key and press
     the [ENTER] key.

```
SAMPLE 5
                                          3/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE


      How many lines to insert ? : 3
       [INST]                           [EDCMD]   >
```

5   The number of specified blank lines are added to specified cursor position.

```
SAMPLE 5
                                          3/7
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:
     4:
     5:
     6:L  P[3] 100mm/sec FINE
     [End]
       [INST]                           [EDCMD]   >
```

Procedure 3-3-4 (b)   Delete lines

Step

1   Move the cursor to the head of line where the line is deleted.

```
SAMPLE 5
                                          1/4
     1:J  P[1] 10% CNT100
     2:L  P[2] 100mm/sec CNT100
     3:L  P[3] 100mm/sec FINE
     [End]
       POINT   WELD_ST   WELD_PT   WELDEND   TOUCHUP   >
```

2   Perform the step 2 and 3 in procedure 3-3-4 (a) then the EDCMD menu will be displayed.

```
SAMPLE 5

                                          3/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE        EDCMD   1
   [End]                        1 Insert
                                2 Delete
                                3 Copy
                                4 Find
                                5 Replace
                                6 Renumber
                                7 Comment
                                8 Undo
                                9 Remark

      [INST]                              [EDCMD]   >
```

3   Select "Delete" from the displayed menu. Press the F4[YES] after specifying the delete range by using cursor keys (up / down arrow keys).

```
SAMPLE 5

                                          2/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
   [End]

   Delete line(s) ?
                                 YES       NO
```
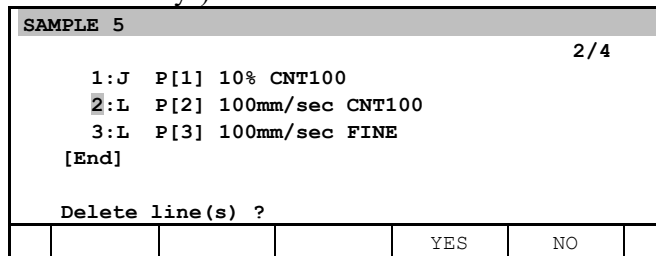
4   The specified range of lines are deleted.

```
SAMPLE 5

                                          1/2
   1:L  P[3] 100mm/sec FINE
   [End]


      [INST]                              [EDCMD]   >
```
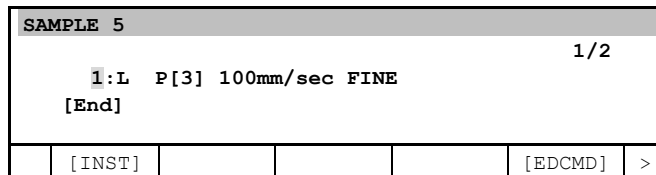
Procedure 3-3-4 (c)   Copy lines

Step

1   Perform the step 2 and 3 in procedure 3-3-4 (a) then the EDCMD menu will be displayed. Select "Copy" from the displayed menu.

```
SAMPLE 5

                                          1/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE        EDCMD   1
   [End]                        1 Insert
                                2 Delete
                                3 Copy
                                4 Find
                                5 Replace
                                6 Renumber
                                7 Comment
                                8 Undo
                                9 Remark

      [INST]                              [EDCMD]   >
```
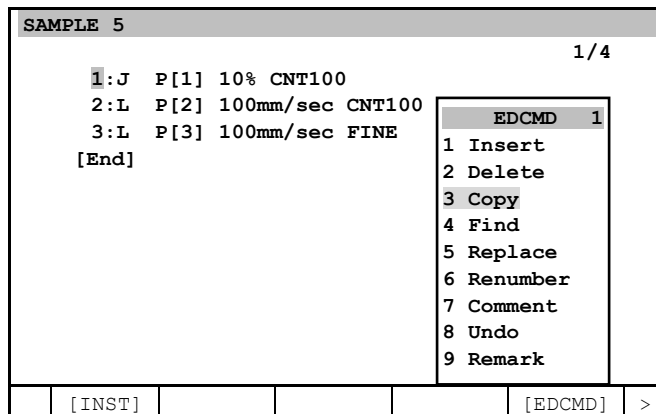
2   The message of "Select lines" is displayed at prompt lines. Press F2[COPY] after moving the cursor to beginning of copy range.

3   The message of "Move cursor to select range" is displayed at prompt lines. Press F2[COPY] after
     moving the cursor to ending of copy range. The specified range of program lines is stored to the
     internal memory.

```
SAMPLE 5
                                            2/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
 [End]

 Move cursor to select range
            COPY                    PASTE
```

4   Press F5[PASTE] after moving the cursor to the position where that is pasted.

```
SAMPLE 5
                                            4/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
 [End]

 Select lines
            COPY                    PASTE
```

5   The message of "Pate before this line?" is displayed at prompt line. Select the copy mode by pressing
     F2 or F3 or F4 key. Program lines stored by step 3 and 4 are inserted. About the copy mode, please refer
     to the following table.

```
SAMPLE 5
                                            4/4
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
 [End]

 Paste before this line ?
           LOGIC  POSID  POSITION  CANCEL  >
```

```
SAMPLE 5
                                            6/6
   1:J  P[1] 10% CNT100
   2:L  P[2] 100mm/sec CNT100
   3:L  P[3] 100mm/sec FINE
   4:J  P[1] 10% CNT100
   5:L  P[2] 100mm/sec CNT100
 [End]

 Select lines
            COPY                    PASTE   >
```

Table 3.3.4 (b) Kind of program edit instructions

F2 LOGIC	The position number of pasted motion instruction becomes "..."(initial state).
F3 POSID	The position number of pasted motion instruction succeeds the position number of copied motion instruction.
F4 POSITION	The position number of pasted motion instruction becomes unused position number.

3.4   TEACHING AND EDITING OF ARC WELD INSTRUCTION

Arc weld instruction performs the arc welding start / end. Though the Procedure 2-8 explains briefly about teaching of arc weld instruction, this section explains it in detail.

3.4.1   Arc Weld Start Instruction

The arc weld start instruction requests to start an arc welding. Once arc welding has started, welding pass becomes the robot movement path. The welding is continued until requesting the arc weld end instruction. There are two methods in arc weld start instruction. One is arc indirect instruction, two is arc direct instruction.
Following shows the example of those two instructions.

Indirect   Weld Start [Weld Procedure number, Weld schedule number] DirectWeld   Start [Weld Procedure number, Command1, Command2, …]

The kind of each commands and the number of the command changes according to the selected Operating Mode and synagic ID. Please refer to the Section 3.2 about the meaning of each command.

3.4.2   Arc Weld End Instruction

The arc welding end instruction requests to end an arc welding. When an arc welding ends, the craterfill is performed. The craterfill schedule is specified in this instruction. Craterfill is a function to avoid the crater hole generation due to a rapid voltage decrease.
In the craterfill schedule, it is necessary to specify craterfill time in addition to various command values. If you do not perform the craterfill, set the craterfill time to 0sec. There are two methods in arc weld end instruction well as arc weld start instruction.

Indirect : Weld End [Weld Procedure number, Weld schedule number] Direct   : Weld End [Weld Procedure number, Command1, Command2,   …,delay]

The kind of each commands and the number of the command changes according to the selected Operating Mode and synagic ID. Please refer to the Section 3.2 about the meaning of each command.

NOTE   In case of schedule directly specified, all commands are cleared to 0 when the weld procedure number is changed (This is measures to prevent original commands from becoming outside the range that is for the weld procedure after changed). Please always set each commands after setting the weld procedure number.

In TPS/i welding machine, there are also craterfills which can be set as special 2 step. (Refer to Section 3.2) For example, "Weld End[2, 3]"command is executed, (Craterfill of special 2 step is already set in Weld Procedure 2,   craterfill time is already set at weld schedule number 3),   First, cratefill by weld schedule number 3 will be performed, then craterfill of special 2 step by Weld Procedure 2 will be performed.

> **NOTE**
> For example, welding is performed at "Weld End[1, 1]", welding is complete at "Weld End[2, 3]", (Craterfill of special 2 step is already set in Weld Procedure 2, craterfill time of the weld schedule number 3 is set to 0sec = invalid), in normal, craterfill of special 2 step of Weld Procedure 2 will be performed. However, as this example, Weld Procedure number is change before completion of the welding, there is a possibility that communication for this change is not in time, and craterfill of special 2 step of the Weld Procedure 2 is not performed. In this case, this can be avoided by inputting 0.01 sec as craterfill time of weld schedule 3 of the Weld Procedure 2.

3.4.3   Note while Teaching Arc Weld Instruction

- Please use the FINE motion when robot moves to arc welding start position.
- Please use the linear or circular, C-circular with CNT motion when robot moves to pass point during arc welding.
- Please use the linear or circular, C-circular with FINE motion when robot moves to arc welding end position.
- Please set torch to appropriate angle against welding object.
- Please use the appropriate welding schedule.
- Do not execute arc weld start instruction on condition that welding wire touches to the welding object. It may cause the welding trouble. Welding wire should not touch to the welding object at arc start point. In case of those touching, please confirm stick out length at last arc end point, etc.

3.4.4   Teaching of Arc Indirect Instruction

Arc indirect instruction performs the welding according to the specified weld schedule that is set in weld procedure. The weld schedule must be set beforehand at weld procedure screen. It is necessary to specify the weld procedure number and schedule number in the use of arc indirect instruction.
In the weld procedure screen, please set the process mode number at first. Next, please set each weld command values (Amps, Volts, etc.).
Teaching procedure is shown in Procedure 3-4-4.

Procedure 3-4-4   Teaching of arc indirect instruction

Step
1   Press the [MENU] key and select [0 -- NEXT --]. Select [3 DATA].
2   Press the F1 [TYPE] and select [Weld Procedure]. Then, Weld Procedure screen will be displayed.
3   Move the cursor to "Schedules" included in weld procedure used by arc indirect instruction. Press F2 [DETAIL] or the [ENTER] key. Weld schedule list is displayed as the followings.

```
DATA Weld Procedure  1
                                  3/13
    + Procedure       1 [                ]
      +  Mode            [Special 2-step  ]
      -  Schedules


    Schedule       Amps          Speed  Time
    Schedule  1     0.0     0.0  100.0   0.00
    Schedule  2     0.0     0.0  100.0   0.00
    Schedule  3     0.0     0.0  100.0   0.00
    OnTheFly        5.0     0.5  100.0

    -------------------------------------------------


    [ [TYPE]  │ DETAIL  │ [CMND]  │ [VIEW]  │  HELP  │   ]
```

4   Move the cursor to schedule that you would like to use and press F2 [DETAIL]. The following screen
      will be displayed.

```
DATA Weld Procedure  1
                                          1/10

     1 Weld Procedure  1 [              ]
       Mode              [Special 2-step  ]

     2 Weld Schedule  1 [Schedule        ]
     3 Current            0.0 Amps
     4 ArcLength corr     0.00
     5 Pulse/Dyn corr     0.00
     6 Hi PwrTim          0.00
     7 Lo PwrTim          0.00
     8 Low Power          0.00


     [TYPE]    SCHEDULE          INCR   DECR
```

5   Input commands (Wire feed speed, etc.).
6   Input the weld schedule number to the arc indirect instruction in the TP program.

3.4.5   Teaching of Arc Direct Instruction

In arc direct instruction, you specify the weld procedure number and each command (wire feed speed, etc.)
directly in TP program.
Teaching procedure is shown in Procedure 3-4-5.

Procedure 3-4-5   Teaching of Arc direct instruction

Step

1   Teach the arc weld instruction in TP program. Move the cursor to inside "[]" of the arc weld instruction
      and press F3 [VALUE] key. Arc direct instruction will be displayed.

```
TEST1
                                         2/3
   2:L  P[1]   250cm/min FINE
    : Weld Start [0, 0.0cm/min, 0.0%, 0.0%, 0.0ms]
  [End]

   REGISTER   SCHED        SHOICE            >
```

2   Move the cursor to the first parameter and input the weld procedure number here.
3   After inputting the weld procedure number, input values of each parameter.

NOTE
The input parameters (EX: wire feed speed, etc.) are reset to 0 when you change the weld procedure number. Please input the weld procedure number first before inputting commands for each parameter.

4   ARC WELDING FUNCTIONS

This Chapter describes about setting operation of functions related to arc welding depending on using situation (when starting arc welding, when finishing arc welding, others, and when operating weld equipment)

4.1   FUNCTION OF ARC WELDING START TIMING

Functions related to arc welding start timing are follow.
- Gas control just before weld start (Gas purge/ Gas pre flow function)
- Adjustment of weld schedule at weld start position (Runin function)
- Retry after weld start failed (Repeat touch retry function, Scratch start function)

This section explains overview and using method of these functions.

4.1.1   Gas Control Just before Weld Start

There are two functions for executing gas control just before weld start: Gas Purge function and Gas Preflow function.

Gas Purge

Gas purge function improves arc start quality without increasing cycle times by starting gas flowing before robot arrives arc start position and still be moving. Only the additional motion instruction type weld instructions support the function.

Gas Preflow Function

On the other hand, gas preflow function also improves quality by starting gas flowing during assigned time after robot arrived. The additional motion instruction type and single type weld instructions support the function but the cycle time increases preflow time. If the special 2 step is specified in the Weld Procedure, this function of the robot side will be used. Gas preflow function of the welder side switched to disabled automatically. On the other hand, If JOB mode or internal mode are used in the Weld Procedure, gas preflow setting of welder side is abled, so we recommend not to use this function of the robot side. If both functions are used, preflow is performed for those total time, so it may cause unexpected behavior.
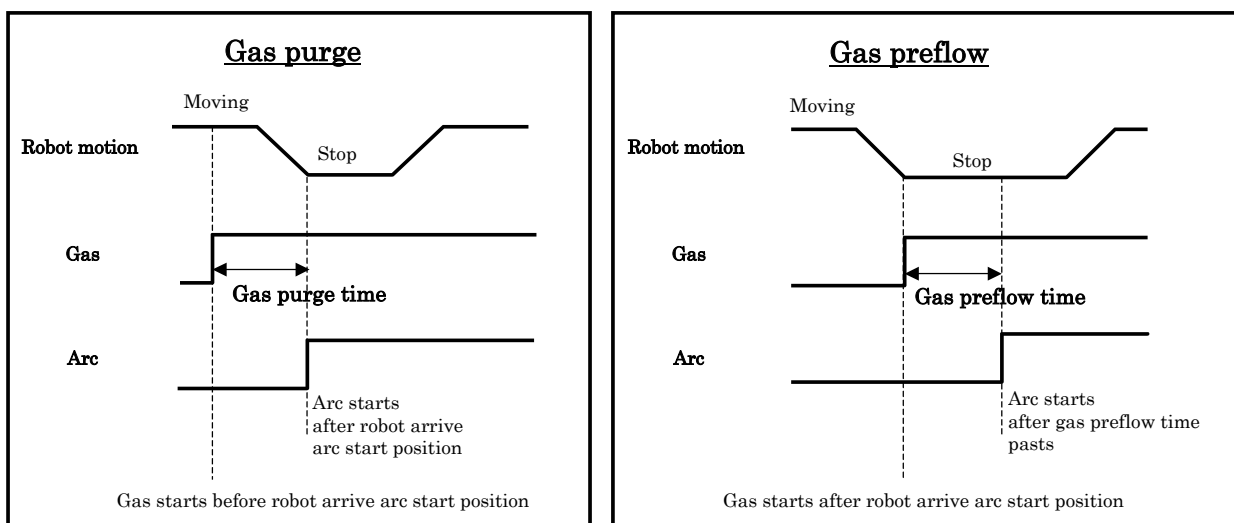
Fig. 4.1.1 (a) Timing chart of gas purge and gas preflow

Gas purge time and gas preflow time are setup in each weld procedure. When a time is zero, the corresponding function becomes disabled.

Default setting is that gas purge time is 0.35 sec and gas preflow time is 0 sec, so gas purge function is executed every additional motion instruction type weld instruction and gas preflow function is never executed without setup the time manually.

```
DATA Weld Procedure                                    .
                                             1/8
    -  Procedure            1 [                    ]
       Weld equipment       1
       Manufacturer:        Fronius
       Model:               TPSi Extend ENet
       File name:           AWE1WP01
       Schedules:           3

       Fronius EQ SETUP:            <*DETAIL*>
       Runin:                        DISABLED
       Ramping:                      DISABLED

       Gas purge:                0.35  sec
       Gas preflow               0.00  sec
       Gas postflow:             0.00  sec


    [TYPE]    DETAIL    [CMND]    [VIEW]    HELP
```

> **NOTE**
> 1 When gas purge time is longer than the moving time of the weld start added motion instruction, gas purge is executed during the moving time.
> 2 When both of gas purge time and gas preflow time are set to over 0 sec in a weld procedure, both of the functions are executed in the use of additional motion instruction type weld instructions that the weld procedure number is specified.

4.1.2   Adjustment of Weld Schedule at Weld Start Position

Runin Function

Runin function requests specified welding commands with the torch stops at the arc start position. This function is used for arc start executes smoothly by requested different commands of welding (welding commands such as wire feed speed during welding). Command values and delay time for runin can be specified on each weld procedure.

Default setting is that the function is disabled. Fronius welding power supply has standard function that is for controlling the schedule of arc start and craterfill(= special 2-step). So we recommend not to use runin function.
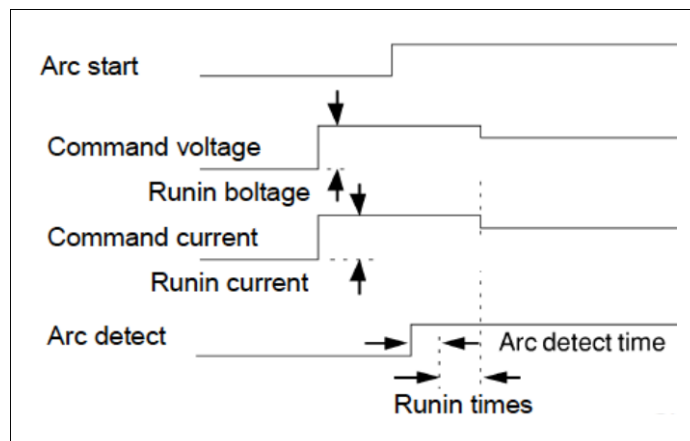
Fig. 4.1.2 Runin function

Procedure 4-1-2   Setup of Runin Function

Step

1   Press the [DATA] key and press F1[TYPE] and select "Weld Procedure". Weld Procedure data screen is displayed.

2   Move cursor to "Procedure" you would like to use and press F2 [DETAIL]. The following screen is displayed.

```
Data Weld Procedure                         .
                                   1/8
  -  Procedure          1 [                ]
     Weld equipment     1
     Manufacturer:      Fronius
     Model:             TPSi Extend ENet
     File name:         AWE1WP01
     Schedules:         3

     Fronius EQ SETUP:          <*DETAIL*>
     Runin:                      DISABLED
     Ramping:                    DISABLED


   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

3   Move the cursor to [Runin]. If it needs to be enabled, press F4 [ENABLED]. If it needs to be disabled it, press F5 [DISABLED].

4   Next, setup Runin schedule. Move cursor on "Schedules" in the weld procedure and press F2 [DETAIL]. The following screen is displayed.

```
DATA Weld Procedure        1                .
                                   7/12
   +  Mode         1 [Special 2-step     ]
   -  Schedule

   Schedule#  cm/min      SPEED  TIME
   Runin        0.0    0.0        0.00
   Schedule 1   0.0    0.0   0.0  0.00
   Schedule 2   0.0    0.0   0.0  0.00
   Schedule 3   0.0    0.0   0.0  0.00
   OnTheFly     5.0    0.5 100.0

   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

5   Move cursor to the schedule of Runin and input the command value.

> **⚠ CAUTION**
> 1   Even if the Runin is enable, Runin is not executed when "Delay Time" is 0sec.
> 2   When you set the Runin enable and Delay Time, it is applied to all the welding parts where the corresponding process selection number is used. When both the Runin applying part and the Runin not applying part exists for one process mode, please assign the process mode number to two process selection number. One side set the Delay Time and the other side does not set the Delay Time.

4.1.3   Retry after Weld Start Failed

There are two functions to retry weld start after weld start failed: Repeat Touch Retry Function and Scratch Start Function. Those functions are disabled in the default setting. Fronius welder has equal functions, so usually it is recommended to disable both Repeat Touch Retry Function and Scratch Start Function.

Repeat Touch Retry Function

When arc is not generated at arc start instruction, Repeat Touch Retry Function retry start of welding at the same position (arc start position) by the motion of the Figure below. If arc is not generated after this motion, Scratch Start function of next Section works.
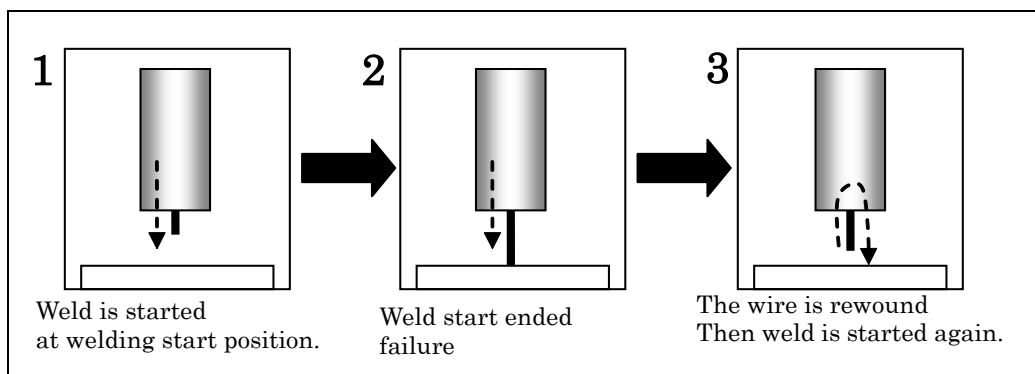
Fig. 4.1.3 (a) Repeat Touch Retry Function

The following procedure 4-1-3 (a) shows the setup procedure of Repeat Touch Retry function.

Operation 4-1-3 (a)   Setup of Repeat Touch Retry Function

Step
1   Press the [MENU] key and select [6 SETUP].
2   Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen will be displayed. Move the cursor to below and the following screen will be displayed.

```
SETUP Weld System                                          .
                                              10/22
     Scratch Start Function
     10 Scratch Start:          ENABLED
     11 Distance:               5     mm
     12 Return to start speed:  100   mm/s
     13 Retry count:            1
     Repeat Touch Retry Function
     14 Repeat Touch Retry:     ENABLED
     15 Retry count:            2


     [TYPE]                          ENABLED   DISABLED
```

3   Move the cursor to [14 Repeat Touch Retry]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4   Change the value of [Retry count] if necessary.

Scratch Start Function

When arc is not generated at arc start instruction, scratch start function is performed. The top of the wire moves from arc start position to next target position by specified distance. When arc generates during this process, the top of the wire returns to welding starting position at once and the welding program is continued.
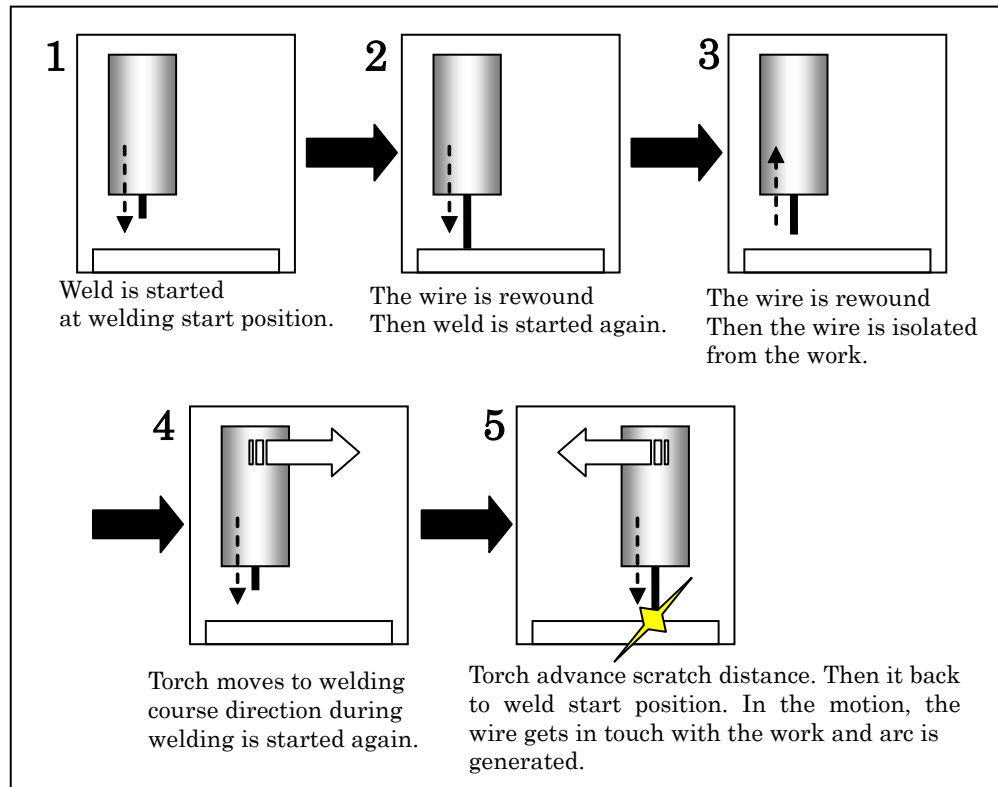
Fig. 4.1.3 (b) Scratch start function

Scratch start has the following three setting items.

Scratch return speed

This is the returning speed from the arc generating position during scratch motion. When this value is too low, some holes are generated at work since heat gain increases by the arc output during returning motion. So please set this value to high as much as possible.

When robot approach change rapidly in the motion like a circular motion, robot cannot reach the speed; for example, when robot approach changes rapidly, the scratch return speed may become 30 mm/sec even if the command is 100 mm/sec.

Scratch distance

This is the maximum distance that robot moves during scratch motion. When the arc does not generate even if the top of the wire moves by this distance, alarm is generated. When this value is too long, the area of heat insertion becomes large. So please set this value to short as much as possible.

Retry count

Specify the number of times of Scratch Return.

The following procedure 4-1-3 (b) shows the setup procedure of scratch start function.

Procedure 4-1-3 (b)   Setup of Scratch Start Function

Step

1   Press the [MENU] key and select [6 SETUP].
2   Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen is displayed. Move the cursor to below and the following screen is displayed.

```
SETUP Weld System                                        .
                                             10/22

Weld Restart Function
   7 Return to path:              ENABLED
   8 Overlap distance:            0     mm
   9 Return to path speed:        200   mm/s
Scratch Start Function
  10 Scratch start:               ENABLED
  11 Distance                     5     mm
  12 Return to start speed:       100   mm/s
  13 Retry count:                 1
   [TYPE]                    ENABLED  DISABLED
```

3   Move the cursor to [10 Scratch start]. When you set this function ENABLE, press F4 [ENABLED]. When you set this function DISABLE, press F5 [DISABLED].
4   Change the value of [Distance], [Return to start speed] and [Retry count] if necessary.

⚠**CAUTION**

- It is necessary to perform some setup for using this function effectively. For more detail, please refer to "Adjustment of wire rewind time before scratch start running" in Subsection A.2.3 of ARC Welding Function OPERATOR'S MANUAL (B-83284EN-3).

- When scratch start function executes with higher arc start schedule to thin work, it may occur penetration at the start point, since the heat input becomes too huge. In the situation like this, please set "Distance" to 2mm and "Return to start speed" to 100mm/sec.

- Scratch start function doesn't work if COORD instruction isn't applied to the motion instruction that approach to arc start position at coordinated weld system.

- When the scratch start is executed in circular or circle arc motion, scratch return motion becomes linear motion. Please set [distance] to short because there is a possibility that the torch interferes with work in circular motion.

- If program has paused while scratch motion, the robot goes back to the point of break at scratch start motion just after restart, it isn't arc start position.

- Even if motion instruction has Arc Weld Start instruction as additional motion instruction and position is taught with position register, scratch start works. However, scratch start does not work when the next position is taught with position register. This can be avoided by using LOCK PREG instruction.

- If OFFSET instruction or TOOL OFFSET instruction is added to the motion instruction which is located just after Arc Weld Start instruction, scratch start does not work normally. If you would like to use scratch start on the program which has OFFSET instruction or TOOL OFFSET instruction, please execute LOCK PREG instruction before Arc Weld Start instruction.

4.2   FUNCTION OF ARC WELDING END TIMING

Functions related to arc welding end timing are follows.
- Check and reset of wire stick (Wire stick detect/reset function)
- Gas control at weld end timing (Gas end flow / post flow functions)

This section explains overview and using method of these functions.

4.2.1   Check and Reset of Wire Stick

In Fronius welding power supply, wire stick detect/reset function by the robot controller is not needed. It is controlled automatically by Fronius welding power supply. **Default setting is that this function is disabled.**

Since the robot position is too difficult for cutting the wire, please jog the robot to refer to the following procedure.

Procedure 4-2-1 (a)   Wire Cutting after Jogging a Robot

Step
1   Change 3 Mode Switch to T1 or T2.
2   Change a Teach Pendant Switch to ON.
3   **Press the [RESET] key while pressing [SHIFT] key.** The severity of ARC-030 alarm changes from STOP.L to WARN. As a result, you can jog a robot.
4   Set a low speed override and carefully jog a robot. Then, cut the wire.
5   After cutting the wire, **once press the [RESET] key.** At the timing, wire stick detect is performed again and alarm is reset.

> **NOTE**
> You can jog a robot during wire stick state, but you cannot execute/resume a program. If you resume a program when the severity of ARC-030 is WARN, "INTP-106 Continue request failed" is posted.

External Output of Wire Stick Alarm

It is possible to output the wire stick state by Wire Stick Alarm Output Signal.

Wire Stick Alarm Output Signal is continued to output while the wire sticks (Wire Stick Detect Input Signal is ON) with Wire Stick Detect Function ENABLED (Weld System Setup Screen). If Auto Wire Stick Reset Function is ENABLED (Weld Procedure data setup screen), the signal is output after wire stick reset and wire stick is still detected.

About the assignment of Wire Stick Alarm Output Signal, refer to Procedure 4-2-1 (b).

Procedure 4-2-1 (b)   Assignment of wire stick alarm output signal

Step
1   Press the [MENU] key and select "5 I/O". Then press F1[TYPE] key and select "Weld". Either Weld Input screen or Output screen will be displayed.
2   When Weld Input screen is displayed, press F3 "IN/OUT".
3   Move cursor on "Wire stick alarm".

```
I/O Weld Out                                          .
                                               10/11


        5[Weld start       ] DO[ 257] U OFF
        6[Gas start        ] DO[ 260] U OFF
        7[Inch forward     ] DO[ 258] U OFF
        8[Inch backward    ] DO[ 259] U OFF
        9[Wire stick cmd   ] DO[ 261] U OFF

       10[Wire stick alarm] *[****] * ***

    [TYPE] |  HELP   | IN/OUT  |   ON    |   OFF   | >
```

4   Press the [NEXT] key and F3 "Config", the following screen is displayed.

```
I/O Weld Out                                          .
                                                1/2
        WELD SIGNAL         TYPE  #
     1 [Wire stick alarm]    ▢   [***]


     2 Polarity: NORMAL

    [TYPE] | MONITOR | VERIFY  |[CHOICE] |  HELP   | >
```
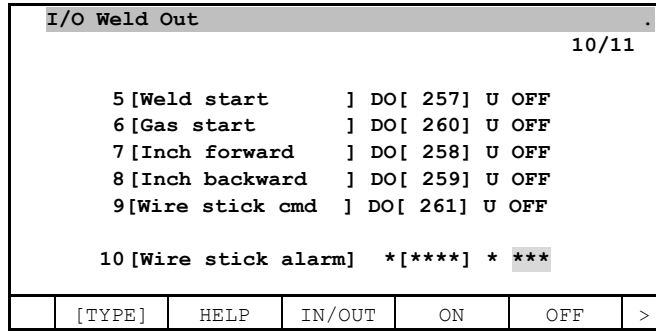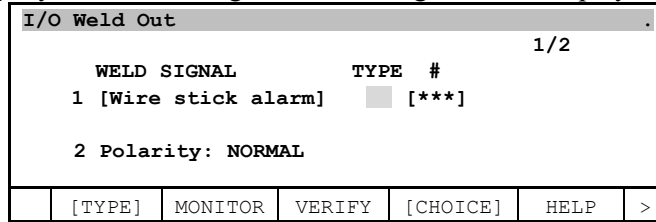
5   Select signal type and number.
6   Press F3 "VERIFY" after press F2 "MONITOR" to check selected signal whether exists or not.
7   Cycle power the controller. After reboot it, selected signal is assigned as wire stick alarm output signal.

4.2.2   Gas Control at Weld End Timing

At the weld end timing, gas flow continues automatically until all the weld end processes (burnback, wire stick detect, reset, etc.) are finished. This is called "Gas End Flow". The time of gas end flow becomes the time of both burnback and wire stick detect/reset processes, but the time for wire stick detect process is changed by the wire stick status. Therefore, gas end flow time never becomes constant.

After craterfill process, if you always would like to perform gas flow with the constant time over gas end flow time on the weld end point, you can use gas post flow function.
If special 2 step is specified in the Weld Procedure, use robot side this function. Gas post flow function of welder side becomes invalid automatically. On the other hand, if job mode or internal mode is specified in the Weld Procedure, we recommend do not use robot side this function, because gas post flow function of welder side become valid. If both functions are used, both post flow treatment will executed, so it causes unexpected behavior.
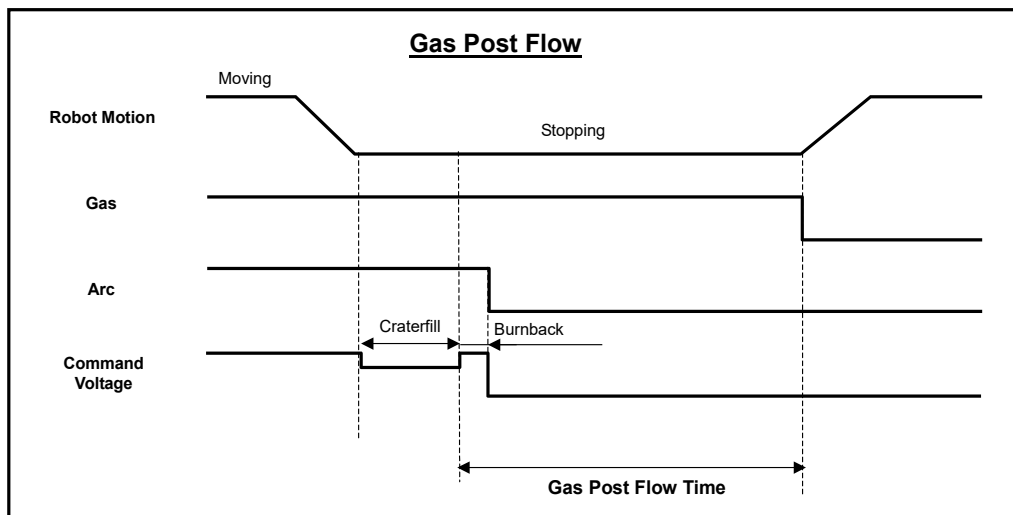
Fig. 4.2.2 (a) Timing Chart of Gas Post Flow

Robot stops until finishing gas post flow, so the setup of gas post flow time influences the cycle time. As Fig 4.2.2, the count of gas post flow time starts just after craterfill process is completed, so burnback time and wire stick detect/reset time (gas end flow time) are included in gas post flow time. As a result, gas flow stops and robot moves to the next motion after finishing the longer process between gas end flow and gas post flow.

Gas post flow function is applied when the weld procedure which sets the gas post flow time is specified on Weld End instruction. When 0 sec is specified as gas post flow time, this function becomes disabled. 0 sec is specified as default, so normally gas end flow is applied.
Gas post flow can be used with both additional-motion instruction or single instruction of Weld Start instruction.

```
Data Weld Procedure                                  .
                                        1/8
    -   Procedure            1 [                    ]
        Weld equipment       1
        Manufacturer:        Fronius
        Model:               TPSi Extend ENet
        File name:           AWE1WP01
        Schedules:           3

        Fronius EQ SETUP:              <*DETAIL*>
        Runin:                          DISABLED
        Ramping:                        DISABLED

        Gas purge:                0.35  sec
        Gas preflow               0.00  sec
        Gas postflow:             0.00  sec


    [TYPE]    DETAIL    [CMND]    [VIEW]    HELP
```

4.3 OTHER FUNCTION RELATED TO ARC WELDING

This section describes several useful functions supporting arc welding with robots.
- Auto recovery to pause position (Return to Path Function)
- Gas control by external devices (Remote Gas Purge Function)
- Wire feed control by external devices (Remote Wire Inching Function)
- Monitoring Functions
- Weld External Output Function
- Torch Guard Function
- Auto recovery of TCP gap (Torch Mate Function)
- Arc Abnormal Monitor Function
- Arc Welding Analogue Meter Displaying Function
- Touch Sensing Function
- Arc Sensing Function

4.3.1 Auto Recovery to Pause Position

Return to Path Function (Original Path Resume Function) enables the weld from a breakpoint if the weld motion is interrupted by HOLD or Alarm and then the robot is move away. First, a robot moves to a breakpoint without welding and then restarts welding from the point by resuming a program. For resuming a welding from a breakpoint, you need to set a weld to ENABLED.
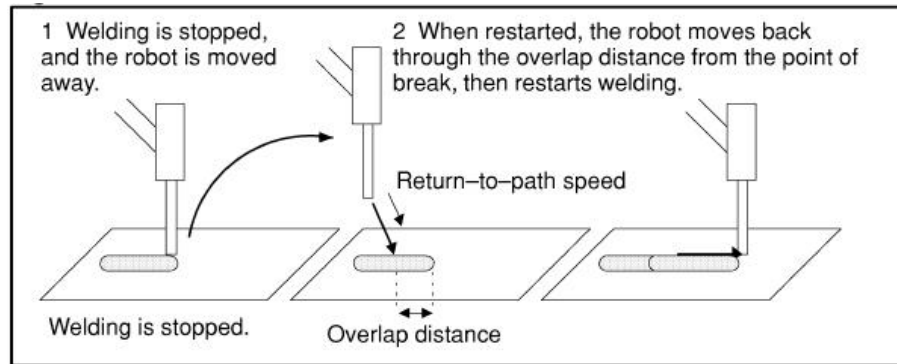
Fig. 4.3.1 (a) Return to path function

Additionally, when a program is stopped without welding and robot moves to away, robot moves to break point at first and restart the program.

The following two setting items are prepared for Return to Path Function.

Overlap Distance
When directed to restart, the robot moves back from the breakpoint through the overlap distance, then restarts welding. This is intended to prevent the sequence of beads from being out. If the specified overlap distance extends beyond the previous teaching point, the actual overlap distance is limited to within that teaching point.

Return to Path Speed
Specifies the return-to-path speed at which the robot moves to the breakpoint when restarted.

In the default setting is that return to path function is enabled, Overlap distance is 0 mm and Return to path speed 200 mm/sec. Normally, please use it with enabled.

⚠**CAUTION**
1   In the case of this function DISABLE, welding is restarted from current position when JOG operation is executed during welding. The welding pass becomes from current position to the next target position. So please set this function enable normally.
2   When operator restarts the program after robot is moved by JOG at HOLD for avoiding interference with work, welding restarting position is the position that HOLD is executed. So robot returns the HOLD position. To avoid this problem, please do the backward execution momentarily at the JOG position.

NOTE
Overlap distance is used only when a program is stopped during welding motion. When robot restart with weld disabled or the program is stopped without welding, the distance is ignored.

Following procedure 4-3-1 shows the setup procedure for return to pass function.

Procedure 4-3-1   Setup of Return to Pass Function

Step
1   Press the [MENU] key and select [6 SETUP].
2   Press F1 [TYPE] key and select [Weld System]. SETUP Weld System screen is displayed. Move the cursor to below. The following screen will be displayed.

```
SETUP Weld System                                       .
                                        7/22
  Weld Restart Function
  7 Return to path:            ENABLED
  8 Overlap distance:          0     mm
  9 Return to path speed:      200   mm/s
Scratch Start Function
 10 Scratch start:             ENABLED
 11 Distance                   5     mm
 12 Return to start speed:     100   mm/s


     [TYPE]              ENABLED  DISABLED
```

3   Move the cursor to [7 Return to path]. When you set this function ENABLE, press F4 [ENABLED].
     When you set this function DISABLE, press F5 [DISABLED].
4   Please change the value of [Overlap distance] and [Return to path speed] if necessary.

4.3.2   Gas Control by External Devices

Remote Gas Purge Function

Remote gas purge function is the function to execute the gas purge by the external input signal. When you
use this function, gas check can be executed without teach pendant.

If you would like to use this function, please execute the following setting procedure.

Procedure 4-3-2   Setup Remote Gas Purge Function

Step

1 Press the [MENU] key and select "6. Setup". Then press F1[TYPE] key and select "Weld System", Weld
System Setup screen is displayed. Move a cursor to the bottom and then the following screen will be
displayed.

```
SETUP Weld System                                       .
                                       19/22
  Weld Speed Function
   16 Default speed:           100 cm/min
  Other Functions
   17 On-The-Fly:              ENABLED
   18 Weld from teach pendant: ENABLED
   19 Remote gas purge:        DISABLED
   20 Remote wire inch:        DISABLED
   21 Gas purge key:           ENABLED
   22 Gas purge time:          5     sec


     [ TYPE ]            ENABLED  DISABLED
```

2   Move cursor on "Remote gas purge", when it needs to be enabled, press F4 "ENABLED" when it
     needs to be disabled press F5 "DISABLED".
3   Next, assign the input signal. Press the [MENU] key and select "5 I/O". Then press F1[TYPE] key and
     select "Weld". Either Weld Input screen or Weld Output screen will be displayed.
4   When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld In                                          .
                                       11/11

    4 [Arc detect      ] DI[ 265] U  OFF
    5 [Power fault     ] GI[  57] U   0
    6 [Wirestick       ] DI[ 269] U  OFF

    7 [Gas fault       ]   [****] *  ***
    8 [Wire fault      ]   [****] *  ***
    9 [Water fault     ]   [****] *  ***
   10 [Arc enable      ]   [****] *  ***
   11 [Remote gas purge]   [****] *  ***

    [TYPE]    HELP    IN/OUT    ON       OFF    >
```

5   "Remote gas purge" signal will be appeared at the bottom of Weld Input screen only when remote gas
    purge function is enabled at step 2 in the procedure
6   Move cursor on "Remote gas purge" and press the [NEXT] key and F3 "Config", the following screen
    will be displayed.

```
I/O Weld In                                          .
                                       1/2
    WELD SIGNAL          TYPE  #
   1 [Remote gas purge]      [***]

   2 Polarity: NORMAL

    [TYPE]   MONITOR  VERIFY  [CHOICE]   HELP    >
```

7   Select signal type and number.
8   Press F3 "VERIFY" after press F2 "MONITOR" to check selected signal whether exists or not.
9   Cycle power the controller. After reboot it, selected signal is assigned as remote gas purge output
    signal.
10 When a signal is input through the signal assigned as remote gas purge signal (remote gas purge input
    signal becomes ON), robot request gas output signal and gas purge will be operated.

4.3.3   Wire Feed Control by External Devices

Remote Wire Inching Function

Remote wire inching function is the function to execute the wire inching (forward / backward) by the external
input signal. When you use this function, wire inching can be executed without teach pendant. **Wire inching
speed can be change by weld equipment setup screen.**

If you would like to use this function, please execute the following setting procedure.

Procedure 4-3-3   Setup Remote Wire Inching Function

Step
1   Press the [MENU] key and select "6. Setup". Then press F1[TYPE] key and select "Weld System", Weld
    System Setup screen is displayed. Move a cursor to the bottom and then the following screen will be
    displayed.

```
SETUP Weld System                                    .
                                         20/22
   Weld Speed Function
    16 Default speed:              100 cm/min
    Other Functions
    17 On-The-Fly:                 ENABLED
    18 Weld from teach pendant:    ENABLED
    19 Remote gas purge:           DISABLED
    20 Remote wire inch:           DISABLED
    21 Gas purge key:              DISABLED
    22 Gas purge time:             5    sec


   [ TYPE ]               ENABLED  DISABLED
```

2   Move cursor on "Remote wire inching", press F4 "ENABLED" when it needs to be enabled, or press F5 "DISABLED" when it needs to be disabled.

3   Next, assign the input signal. Press [MENU] key and select "5 I/O" and Press F1[TYPE] key and select "Weld". Either Weld Input screen or Weld Output screen will be displayed.

4   When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld In                                          .
                                         11/11

     4 [Arc detect       ] DI[ 265] U   OFF
     5 [Power fault       ] GI[  57] U    0
     6 [Wirestick         ] DI[ 269] U   OFF

     7 [Gas fault         ]    [****] *   ***
     8 [Wire fault        ]    [****] *   ***
     9 [Water fault       ]    [****] *   ***
    10 [Arc enable        ]    [****] *   ***
    11 [Remote inch fwd ]     [****] *   ***
    12 [Remote inch bwd ]     [****] *   ***

   [TYPE]    HELP    IN/OUT    ON      OFF     >
```

5   "Remote inch fwd" and "Remote inch bwd" signals will be appeared at the bottom of Weld Input screen only when remote gas purge function is enabled at step 2 in the procedure.

6   Move cursor on "Remote inch fwd" and press the [NEXT] key and F3 "Config", the following screen is displayed.

```
I/O Weld In                                          .
                                          1/2
     WELD SIGNAL         TYPE   #
    1 [Remote inch fwd]         [***]

    2 Polarity: NORMAL

   [TYPE]   MONITOR  VERIFY  [CHOICE]   HELP    >
```

7   Select signal type and number.
8   Press F3 "VERIFY" after press F2 "MONITOR" to check selected signal whether exists or not.
9   Assign "Remote inc bwd" with same steps (Refer to step.6 to 8)
10 Cycle power the controller. After cycle power, selected signal is newly assigned.
11 When "Remote inch fwd" signal becomes ON, wire feeding to forward, on the other hand, "Remote inch bwd" signal becomes ON, wire feeding to backward.

4.3.4   Monitoring Functions

These functions are for monitoring abnormal state during arc welding. Monitoring functions have following six functions.

- Arc Loss Detect
- Gas Shortage Detect
- Wire Shortage Detect
- Wire Stick Detect
- Power Supply Failure Detect
- Coolant Shortage Detect

Subsection 4.2.1 describes wire stick detect function more detailed, please see the subsection about it.

Arc Loss Detect

The function posts an alarm and stops the welding and robot motion if the arc is lost during the fixed time of the welding.

Enabled/Disabled this function is set by Weld System Setup Screen. Allowance time of arc loss is defined on Weld Equipment Setup screen. If the arc detect signal is not returned over the time, the following alarm occurs and the welding and robot motion are stopped.

"ARC-018 Lost arc detect"

In the default setting in that this function is enabled. Normally, please use it with enabled.

Procedure 4-3-4 (a)   Setup Arc Loss Detect

Step
1   Press the [MENU] key and select "6. SETUP".
2   Press F1[TYPE] key and select "Weld System". The following screen will be displayed.

```
SETUP Weld System                                .
                                          1/22
          NAME                  VALUE
      Monitoring Functions
       1 Arc loss:             ENABLED
       2 Gas shortage:         DISABLED
       3 Wire shortage:        DISABLED
       4 Wire stick:           ENABLED
       5 Power supply failure: ENABLED
       6 Coolant shortage:     DISABLED


    [ TYPE ]              ENABLED  DISABLED
```

3   Move cursor on "Arc Loss". When it needs to be enabled, press F4 "ENABLED" when it needs to be disabled press F5 "DISABLED".
4   When the function becomes enabled in step 3, setup arc error detect time.
     Press F1[TYPE] key and select "Weld Equip". Weld Equipment Setup screen will be displayed.
5   Move cursor to the bottom and "Arc loss error time" will be displayed.

```
SETUP Weld Equip                                        .
                                          7/8
     Timing
       5 Arc start error time:        2.00  sec
       6 Arc detect time:             0.005 sec
       7 Arc loss error time:         0.25  sec
       8 Gas detect time:             0.05 sec

       [TYPE]                                   HELP
```

6   In the standard is that the time is 0.25 sec, change the command value if necessary.

7   The status of arc loss can output other devices through digital output, for more details, please see Subsection 4.3.5 Weld external output function.

Power Supply Failure Detect

Power Supply Failure Detect signal will become ON if internal of weld equipment is abnormal. If the welding is requested when the input signal is ON, or if the signal becomes ON during welding, the following alarm occurs and the welding and robot motion are stopped.

"ARC-008 Power supply fault"

If the input signal is ON, please specify the cause by using "6.3 REMEDY FOR TROUBLES".
In the standard in that this function is enabled. Normally, please use it with enabled.

Gas, Wire, Coolant Shortage Detect

These functions are not supported as default. Therefore, they are DISABLED as factory default. If you use these functions, please prepare and mount the sensors yourself and operate Procedure 4-3-4 (b). (FANUC does not prepare these sensors.)

When gas/wire/coolant supply become abnormal, sensors detect it and send some signals to the robot controller. The robot controller is monitoring them and when it receives the signals, the following alarms occurs, and the welding and robot motion are stopped.

- **Gas Shortage Detect**   ---   **"ARC-005 Gas fault"**
- **Wire Shortage Detect**   ---   **"ARC-006 Wire fault"**
- **Coolant Shortage Detect**   ---   **"ARC-007 Water fault"**

Enabled/disabled the functions are set on Weld System Setup screen. Next, the assignment of input signals from sensors to the robot controller is required.

Gas shortage detect function has the setup item "Gas Shortage Detect Time". Normally, this delay time exists since robot controller outputs gas signal and gas valve opens until gas arrives to the sensor for gas shortage detect. "Gas Shortage Detect Time" allows the delay time. If the alarm signal is input after the delay time passed, a weld alarm occurs. You should set appropriate value to Gas Shortage Detect Time according to your gas system structure.

⚠️**CAUTION**
1 If Gas Shortage Detect Function becomes ENABLED, the delay time for Gas Shortage Detect Time is generated at arc start timing. Therefore, the cycle time is also increased. Do not set Gas Detect Function to ENABLED if you do not use the sensor for gas shortage detect.
2 If Gas Shortage Detect Time is too short, "ARC-005 Gas fault" might occur at every arc start timing. If so, set it longer time.

Procedure 4-3-4 (b)   Setup of Gas, Wire, Coolant Shortage Detect Function

Step

1   Press the [MENU] key and select [6 SETUP].
2   Press F1 [TYPE] and select [Weld System]. The following screen will be displayed.

```
SETUP Weld System                                      .
                                          2/22
            NAME                    VALUE
      Monitoring Functions
        1 Arc loss:                 ENABLED
        2 Gas shortage:             DISABLED
        3 Wire shortage:            DISABLED
        4 Wire stick:               ENABLED
        5 Power supply failure:     ENABLED
        6 Coolant shortage:         DISABLED


      [ TYPE ]                  ENABLED  DISABLED
```

3   Move the cursor on the item, which you would like to set. If you set the function to ENABLED, press
     F4 "ENABLED". If you set the function to DISABLED, press F5 [DISABLED].
4   Next, assign the input signals. Press the [MENU] key and select "5 I/O". Then press F1[TYPE] key
     and select "Weld". Either Weld Input screen or Weld Output screen will be displayed.
5   When Weld Output screen is displayed, press F3[IN/OUT] and change to Weld Input screen.

```
I/O Weld In                                            .
                                          11/16

        4 [Arc detect      ] DI[ 265] U  OFF
        5 [Power fault      ] GI[  57] U    0
        6 [Wirestick         ] DI[ 269] U  OFF

        7 [Gas fault         ]     [****] *  ***
        8 [Wire fault        ]     [****] *  ***
        9 [Water fault       ]     [****] *  ***
       10 [Arc enable        ]     [****] *  ***
       11 [Remote gas purge]      [****] *  ***


      [TYPE]    HELP    IN/OUT    ON     OFF    >
```

6   Move the cursor on Gas Alarm, Wire Alarm or Coolant Alarm. Then, Press F-> key and press
     F3[CONFIG]. The following screen will be displayed. (Following screen is the example of Gas
     Alarm.)

```
I/O Weld Input                                         .
                                          1/2
        WELD SIGNAL           TYPE  #
      1 [Gas fault        ]     [****]


      2 Polarity: NORMAL

      [TYPE]    MONITOR   VERIFY  [CHOICE]   HELP   >
```

7   Select the port type and port number for the input signal from the sensor.
8   Check the existence of the selected signal by F3 [VERIFY], and press F2 [MONITOR].
9   Cycle power the controller. After reboot it, the selected signal will be newly assigned.
10   If Gas Shortage Detected Function is set, you must also set Gas Shortage Detect Function. Please also
     carry out Step 11 or later
11   Press the [MENU] key and select [6 SETUP]. Press F1 [TYPE] and Select [Weld Equip].
12   Move the cursor to below. [Gas detect time] is displayed. Input the desired value to this item.

```
┌─────────────────────────────────────────────────┐
│ SETUP Weld Equip                            .    │
│                                        8/8       │
│                                                  │
│    Timing:                                       │
│       5 Arc start error time:     2.00  sec      │
│       6 Arc detect time:          0.005 sec      │
│       7 Arc loss error time:      0.25  sec      │
│       8 Gas detect time:          0.05 sec       │
│                                                  │
│   ┌──────┬──────┬──────┬──────┬──────┬──────┐    │
│   │[TYPE]│      │      │      │ HELP │      │    │
│   └──────┴──────┴──────┴──────┴──────┴──────┘    │
└─────────────────────────────────────────────────┘
```

13   You can output the gas, wire and coolant shortage state to external as digital signal. Please refer to [Weld External Output Function] and setup.

4.3.5   Weld External Output Function

Weld external output function is a function to output various signals that relate to the welding to an outside device such as PLC. The screen to set this function is shown below. Table 4.3.5 shows setup items on this screen and the explanation. Setup procedure of this function is shown in Procedure 4-3-5.

```
┌─────────────────────────────────────────────────┐
│ I/O Weld External Output                    .    │
│                                        1/9       │
│      SIGNAL              INPUT      OUTPUT        │
│    1 Arc enable          ********   DO[  0]       │
│    2 Weld simulated      ********   DO[  0]       │
│    3 AS failed           ********   DO[  0]       │
│    4 Arc loss            ********   DO[  0]       │
│    5 Power fault         ********   DO[  0]       │
│    6 Gas fault           DI[****]   DO[  0]       │
│    7 Wire fault          DI[****]   DO[  0]       │
│    8 Water fault         DI[****]   DO[  0]       │
│    9 Touch detect        DI[ 269]   DO[  0]       │
│                                                  │
│   ┌──────┬──────┬──────┬──────┬──────┬──────┐    │
│   │[TYPE]│      │      │      │ HELP │      │    │
│   └──────┴──────┴──────┴──────┴──────┴──────┘    │
└─────────────────────────────────────────────────┘
```

Table 4.3.5 (a) weld signals and the explanation

Signal	Explanation
Arc enable	This signal is output when weld enable. This signal is turned ON/OFF according to the state (weld enable/disable of each equipment). The state of weld enable/disable is displayed on the TEST CYCLE Arc screen.
Weld Simulated	This signal is output when weld simulated mode is enabled. Regarding to the details of weld simulated mode, please refer to Section 5.7 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).
AS failed	This signal is output when Arc Start fails. When this signal is ON, an alarm of **[ARC-013 Arc Start failed]** generates at the same time. When this alarm is reset, this signal is OFF.
Arc loss	This signal is output when the Arc loss generates. When this signal is ON, an alarm of **[ARC-018 Lost arc detect]** generates at the same time. When this alarm is reset, this signal is OFF.
Power fault	This signal is output when it is impossible to communicate with the weld equipment. Moreover, this signal is also output when ArcTool software detects the abnormal state in the weld equipment. This signal is output until [ARC-051 Weld EQi ONLINE: ArcLink] is displayed after turning on the power supply.
Gas fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Gas fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Gas shortage] on the SETUP weld system screen.(If the signal is valid and becomes ON, ARC-003 or ARC-005 alarm occurs as conventionally.)

Signal	Explanation
Wire fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Wire fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Wire shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-006 alarm occurs as conventionally.)
Water fault	An external sensor is necessary to use this signal. This signal is output according to the state of the input signal allocated to the item of **[Water fault]** of weld I/O input screen. This signal is invalid when the input signal is not assigned. This signal doesn't depend on a setting item of [Coolant shortage] on the SETUP weld system screen. (If the signal is valid and becomes ON, ARC-007 alarm occurs as conventionally.)
Touch detect	Touch detect signal is output when the wire contact with a work. This signal is output according to the state of the Touch sensing input signal. The signal is used for touch sensing function and torch mate function. **Reference:** The Touch sensing input signal turns ON in the state of Touch sensing output signal is ON when the wire contact with a work.

Procedure 4-3-5 Setup of Weld external output function

Step
1   Press the [MENU] key then screen menu is appeared.
2   Select the "5 I/O".
3   Press the F1 [TYPE] and select "Weld Ext DO". Following screen will be displayed.

```
I/O Weld External Output                          .
                                        1/9
        SIGNAL              INPUT      OUTPUT
   1 Arc enable          ********    DO[  0]
   2 Weld simulated      ********    DO[  0]
   3 AS failed           ********    DO[  0]
   4 Arc loss            ********    DO[  0]
   5 Power fault         ********    DO[  0]
   6 Gas fault           DI[****]    DO[  0]
   7 Wire fault          DI[****]    DO[  0]
   8 Water fault         DI[****]    DO[  0]
   9 Touch detect        DI[ 269]    DO[  0]


     [TYPE]                              HELP
```

4   Set the external output signal corresponding to each usage. When you set OUTPUT to 0, the output signal is invalid. When the specified value has already been used as weld input, [This NO. is already used as Weld Output] is displayed, back to before editing. When the specified value does not exist, [Port assignment is invalid] is displayed, back to before editing.

> ⚠ **CAUTION**
> In Step 4, the setting of the specified output signal is reflected at once. Therefore, there is a possibility that the signal is immediately turned on after this setting. Please confirm the number well before setting up it.

5   Concerning to [Gas fault], [Wire fault] and [Water fault], it requests to assign the signal of external sensor to weld I/O input. Please refer to Procedure 4-3-4 (b) about the method to assign.

4.3.6　Torch Guard Function
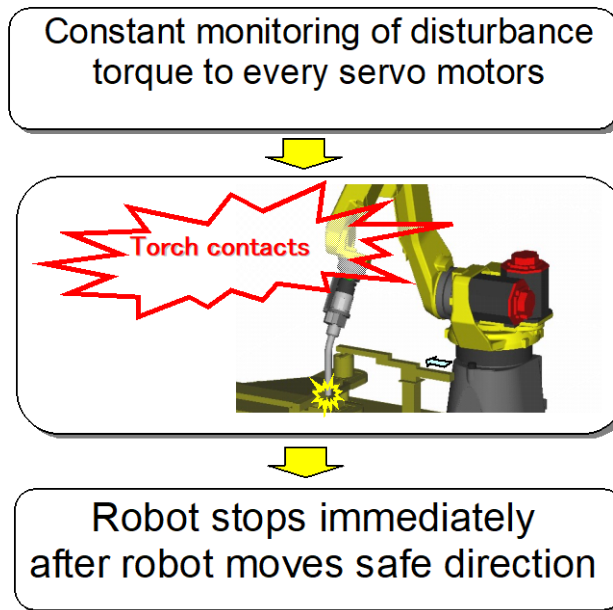
Torch guard function avoid TCP(Tool Center Point) error with reducing damage to robot at torch interference by stopping robot motion immediately. Since TCP error doesn't occur, even if an unexpected robot contact is occurs, the function provides to avoid time-consuming operation; re-setup TCP and re-teach weld program etc.

Since the contact is detected through constant monitoring of disturbance torques for every servo motors, the function detect contacts without additional sensor; shock sensor etc. and the robot stops after it moves to minimize disturbance torques, the damage to torch will be minimized.

This function can detect the contact between jig etc. and not torch but mechanical section of robot.

In the default setting is that the function is enabled and it isn't required some setting

4.3.7　Auto Recovery of TCP Gap

Torch Mate Function

Torch mate function detects and recoveries TCP(Tool Center Point) error with executing macro program for a few seconds. This function minimizes restoration time from abnormal status, since the function avoid re-teach weld program even if TCP error occurs.
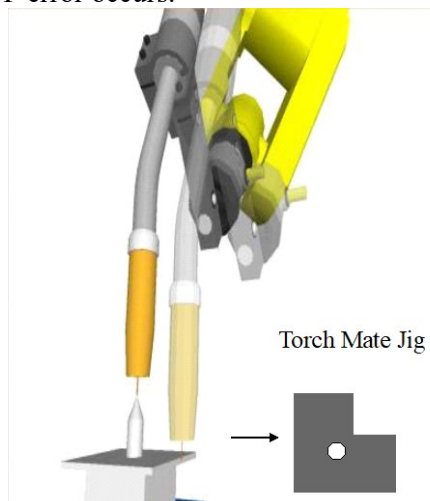
Fig. 4.3.7 (a) Torch Mate Function

Torch Mate function requires special software and hardware. The software has been installed, so it isn't required an arrangement.

At hardware, torch mate jig and electric circuit (touch sensor circuit); detect to the wire touch the torch mate jig are required. Fronius welding power supply has wire stick detection circuit as default and it can be used for touch sensing, so it isn't required an arrangement.

About details of approach in the use of torch mate function, refer to Chapter 12 in Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3).

Assignment of I/O for Torch Mate Function

To use touch sensor circuit on welding power supply for Torch Mate function, specify the port number of I/O of Torch Mate function on Torch Mate setup screen after confirming them on Weld I/O screen.

In the case of TS/TPS welder, 13th digital output signal (Touch Sense ON) is used as the touch sensor output signal. And, 17th or 25th (Wirestick) digital input signal is used as the touch sensor input signal (This depends on the welder firmware so please confirm it by test beforehand).

Please set the touch sensor I/O by the following procedure after confirming port number which you should specify.

Procedure 4-3-7   Assignment of I/O for Torch Mate Function

Step

1   Press the [MENU] key and select "6 SETUP", and press F1[TYPE] key and select "Torch Mate". Torch Mate setup screen will be displayed.
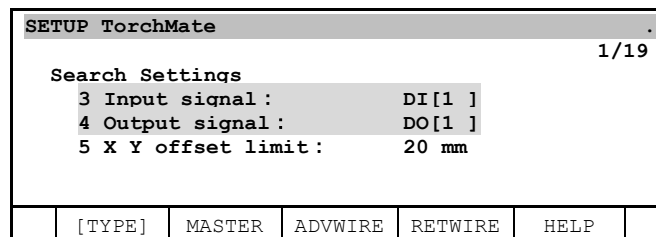
```
SETUP TorchMate                                      .
                                                 1/19
  Search Settings
    3 Input signal :             DI[1 ]
    4 Output signal :            DO[1 ]
    5 X Y offset limit :         20 mm



     [TYPE]    MASTER   ADVWIRE   RETWIRE    HELP
```

2   Specify the port number of touch sensor input signal and output signal which are confirmed on Torch Mate setup.

4.3.8   **Arc Abnormal Monitor Function (Option)**

Arc Abnormal Monitor Function monitors the actual current and voltage during arc welding, and it can inform the operator that some bad weldings occurred quickly by some alarms and output signals when these values exceed the thresholds. This function makes the root cause analysis of the bad welding easier. Additionally, Arc Weld Log function is included in Arc Abnormal Monitor Function. The function can save the actual current and voltage in output device for each weld bead, and it can also display graphs such as Fig. 4.3.8 (b) on Teach Pendant.
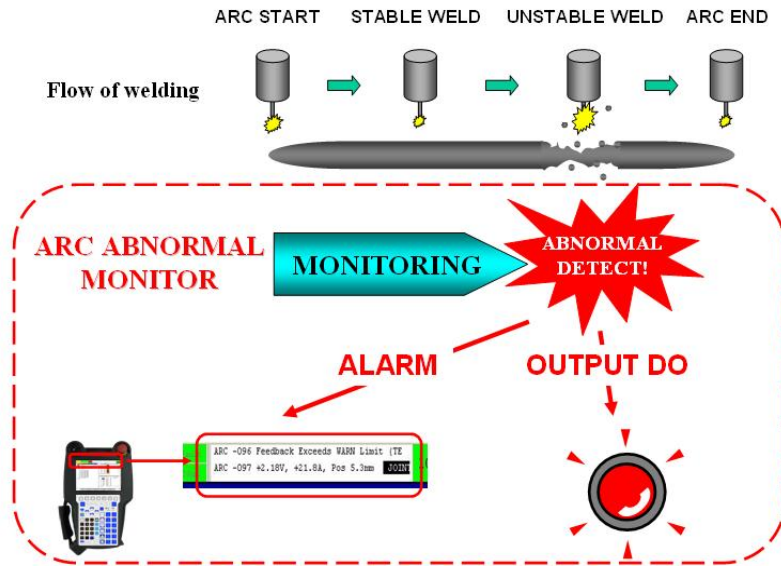
Fig. 4.3.8 (a) Outline of arc abnormal monitor function
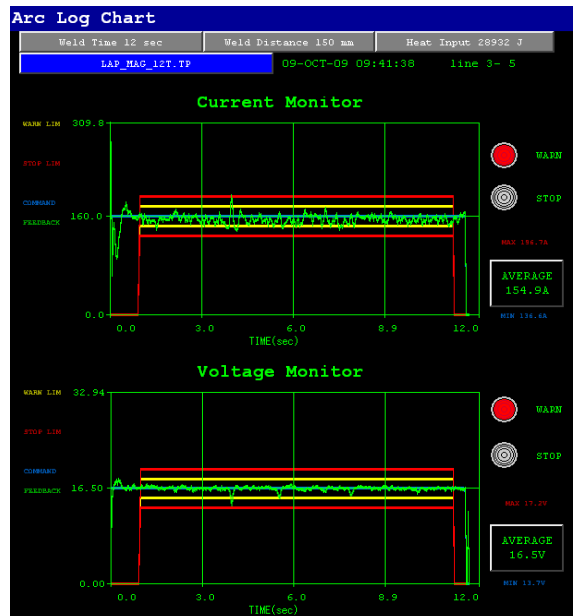
Fig. 4.3.8 (b) Arc weld log – chart function

Arc abnormal monitor function is an optional function. Detail of this function is written in Chapter 19 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3). Please refer to it.

4.3.9   Arc Welding Analogue Meter Displaying Function (Option)

Arc welding analogue meter function is the graphical user interface of displaying welding command/feedback voltage and current. In the case of Fronius welder, please note that the displaying of WFS (Wire Feed Speed) feedback is not supported.
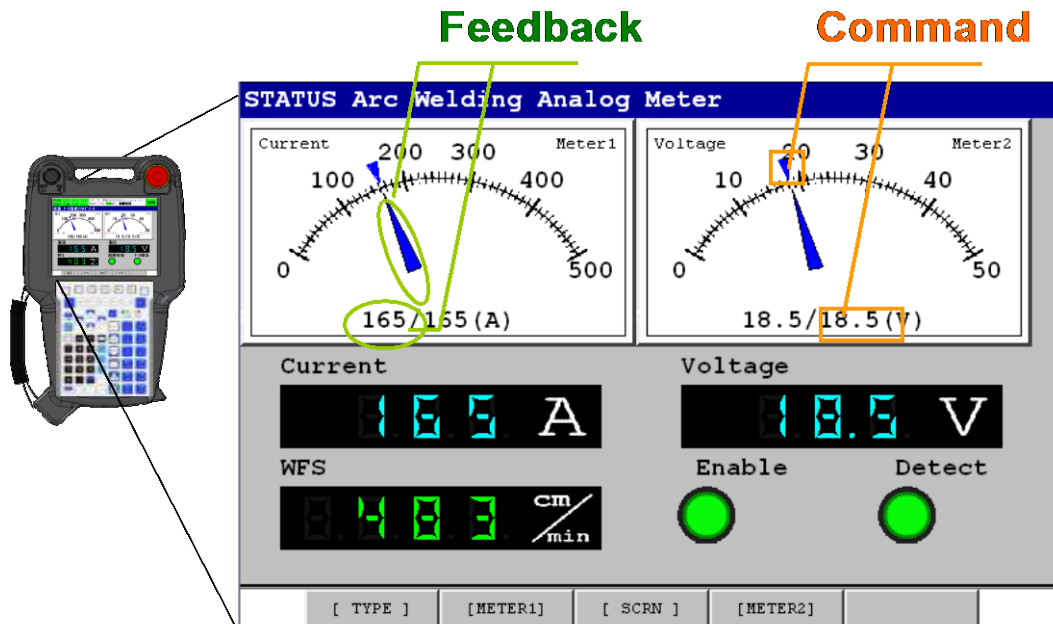
Fig. 4.3.9 (a) Arc Welding Analogue Meter Displaying Function

The screen of arc welding analogue meter displaying function displays not only the contents on arc welding status screen but also the following contents.

- Show Current/Voltage/Wire feed speed as analog meter format.
- Average of welding voltage, current and wire feed speed per a welding
- The name of currently-running TP program
- The line number of the latest arc start instruction in currently-running TP program
- Currently using weld mode
- Weld distance and welding speed
- Arc on time per a welding

Arc welding analogue meter displaying function is an optional function. Detail of this function is written in Chapter 18 of Arc Welding Function OPERATOR'S MANUAL (B-83284EN-3). Please refer to it.

4.3.10   Touch Sensing (Option)

Touch sensing allows the robot to change a path automatically to compensate for object displacement. Touch sensing consists of two phases: Search Motion phase and Touch Offset phase.

Search Motion

Search Motion can detect the current position of workpiece.
- Move touch sensor part (on arc welding robot, the top of wire = TCP) toward the workpiece using pre-defined robot motion, speed, and direction.
- Use an input signal to indicate that the robot has come into the contact with the object.
- Store the found location of the workpiece, or position offset information, in position registers.

The example of search motion is shown below.
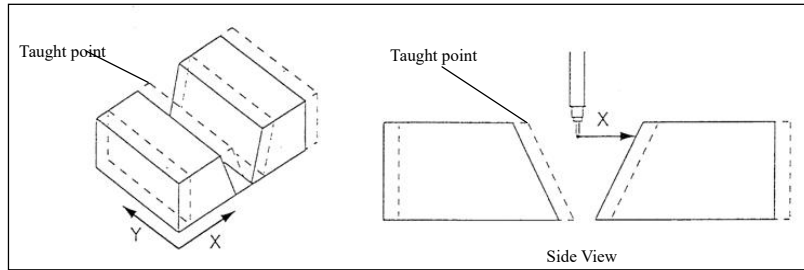
Fig. 4.3.10 (a) Search motion for detecting shift of X direction
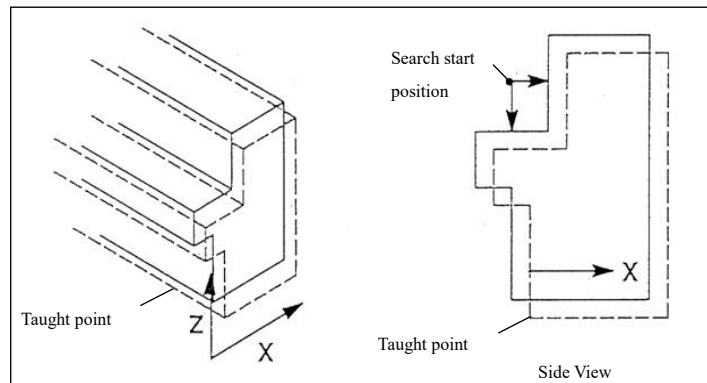
Fig. 4.3.10 (b) Search motion for detecting shift of X, Z directions
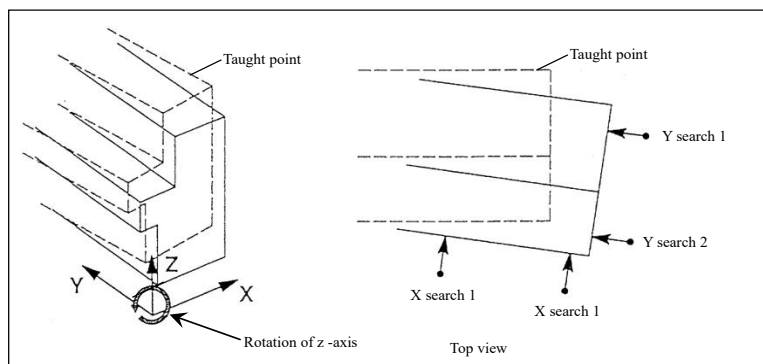
Fig. 4.3.10 (c) Search motion for detecting shift of X, Y directions and Z rotation

Touch Offset

Touch offset is performed with using the amount of offset that is acquired by search motion, it shifts the teaching pass (teaching pass matches to the current position of welding object).

Touch sensing is an optional function. Detail of this function is written in Chapter 39 of Optional Function OPERATOR'S MANUAL (B-83284EN-2). Please refer to it.

Assignment Touch sensor I/O

To use touch sensor circuit on welding power supply for torch sensing function, specify touch sensor I/O port numbers on touch sensing I/O setup screen after confirming them on Weld I/O screen.
In the case of the TPS/i welder, DO[525] (in case of normal setting) is used as the touch sensor output signal. (It is 13th of the digital output signal for communication with welder.) DI[520] (in case of normal setting) is used as the touch sensor input signal. (It is 8th of the digital input signal for communication with the welder.)

Please set the touch sensor I/O by the following procedure after confirming port number which you should specify.

> **NOTE**
> I/O port numbers of touch sensor is depended on assignment range of I/O. Be
> sure to confirm touch sensor I/O port number and setup it.

Procedure 4-3-10   Assignment Touch sensor I/O

Step
1   Press the [MENU] key and select [SETUP], and press F1[TYPE] and select [Touch I/O]. The
following screen will be displayed.

```
Touch I/O Setup                              .
                                          1/5
          NAME               VALUE
 1 Touch Sensing type :      Wire Touch
 1 Sensor port type :        DI
 2 Sensor port number :      520
 3 Circuit port type :       DO
 4 Circuit port number :     525


    [TYPE]                [CHOICE]   HELP
```

2   Specify the port number of touch sensor input signal and output signal which are confirmed.

4.3.11   TAST Tracking (Fronius Welder)

When the TAST tracking function (A05B-xxxx-J511) is ordered, this function can be used in the Fronius
configuration.

In TPS/i   welder, GI[54] (in case of normal setting) is used as an input signal for tracking. (It is 4th of the
group input signal for communication with the welder) This signal is not electrical current feedback , it is
signal for the tracking. This signal is supported from TPS/i.

4.4   OPERATION FOR TPS/i WELDING MACHINE

TPS/i welding machine has an Ethernet port called "service port" at the back side. You can check and edit
various information about the welding machine, by connection to   PC and using web browser soft such as
Internet Explorer and Google Chrome. The following shows major items can be performed by connection with
the service port.
- ● Acquisition and restore of the welding machine backup
- ● Check and edit of JOB
- ● Check and edit of IP address for communication device with robots.
- ● Updating the welding machine firmware

Procedure 4-4-1 Acquisition and restore of welding machine backup

Preparation
- PC which the web browser soft such Internet Explorer and Google Chrome are installed. (to Windows10
  or before is supported)
- Ethernet cable (commercial goods)

Step
1   Connect the service port of the welding machine backside to the PC with an Ethernet cable.
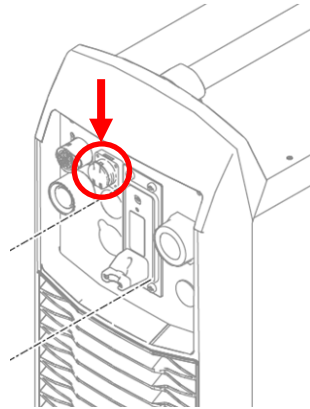
Fig.4.4.1 (a) Service port position

2   Operate the front panel of the welding machine, display the following screen.
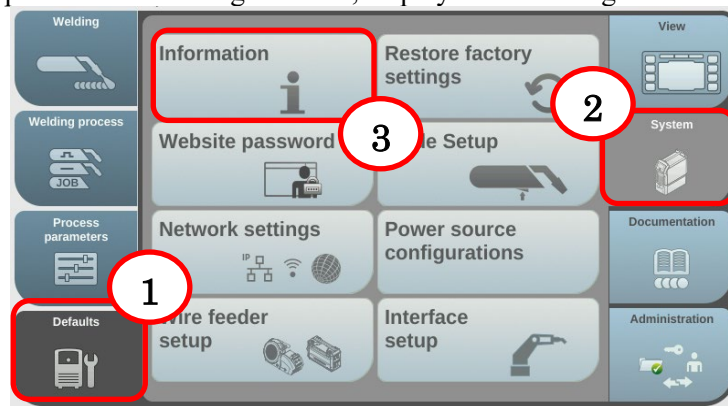
Fig. 4.4.1 (b) Screen selection

3   The following screen will be displayed. Displayed IP address is the address for the service port, take a note.

Fig. 4.4.1 (c) IP address display

4   Operate the PC, start the web browser soft such as Internet Explorer or Google Chrome.
5   Input the address confirmed at step 3. In this example, input "https://192.168.0.102/".
6   If the warning about security is displayed, continue reading.
7   Log in by the displayed screen. User name and password is "admin" in the default setting.
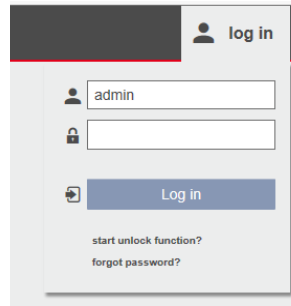
Fig. 4.4.1 (d) Log in screen

8   If the following screen is displayed, connection is complete. The screen can be changed by dotted area.
     Displayed language can be changed by the tab of the top right of the screen.
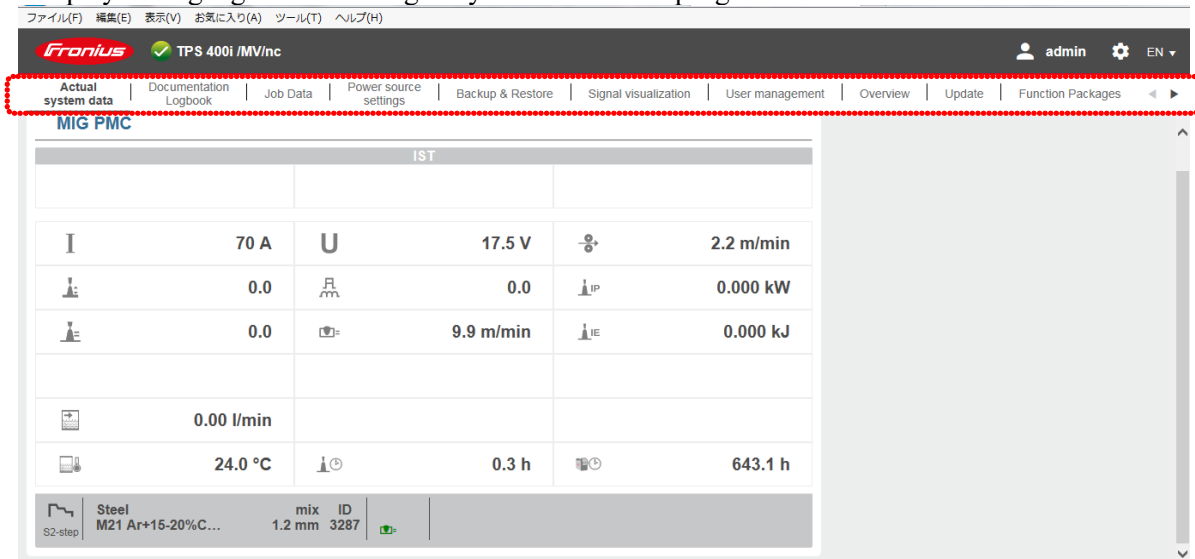
Fig.4.4.1 (e) Actual system data display

NOTE
> If the connection cannot be performed, check the IP address of the PC. In this example,
> communication can be performed by using such as the following IP address and subnet
> mask.
>
>   IP address : 192.168.0.100
>   Subnet mask : 255.255.255.0

---

9   Check and edit of JOB can be performed in "JOB Data" screen. Acquisition and restore of the welding
     machine can be performed in "Backup & Restore" screen. Welding machine firmware updating can be
     performed at "Update" screen.   Check and edit of IP address of communication device with robots can
     be performed at "RI FB/I Fanuc 1.0" screen. For detailed operation method, refer to the Fronius manual.
10   Here shows the procedure for acquiring backup of welding machine as an example. Click the
     following "Backup & Restore" of "1". In that screen, click "Start backup" of "2".
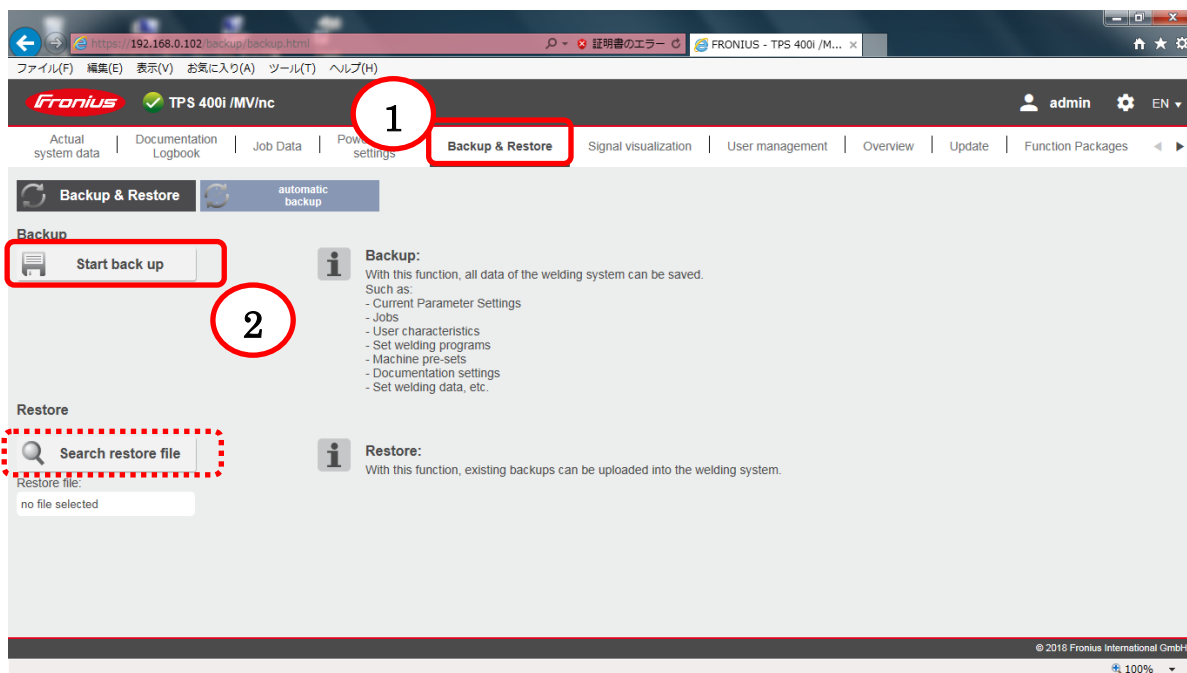
Fig. 4.4.1 (f) Backup & Restore display

11 Save the welding machine backup in the PC.
12 On the other hand, to read welding machine backup, click the dotted are "Search restore file" in the above figure, then specify welding machine backup to be load.

For your reference, the following shows a procedure of editing the IP address of the Ethernet communication module. This module is communication device with robot.

Procedure 4-4-2   Check and edit of IP address of device for communication with robots

Preparation
- PC which the web browser soft such Internet Explorer and Google Chrome are installed. (to Windows10 or before is supported)
- Ethernet cable (commercial goods)

1 Perform step 1 to 8 of Procedure 4-4-1.
2 Search "RIFB/I Fanuc 1.0" in the dotted area in step 8 of the procedure 4-4-1, then click it. "RI FB INSIDE/I" will be displayed depending on the used communication device. The following screen will be displayed, set the desirable IP address and subnet mask.
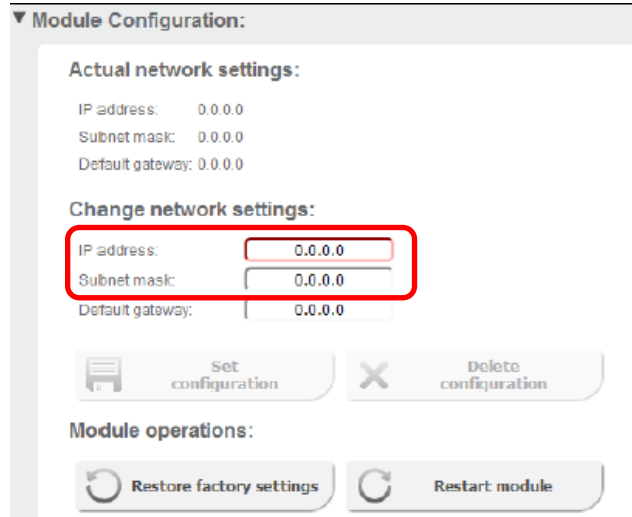
Fig.4.4.2 IP address setting display

3   Click "Set configuration", then click "Restart module".
4   Cycle power of the welding machine.
5   Display screen in step 11 again, check the desired setting is saved.

NOTE
   To edit IP address on the PC, all DIP switches on Ethernet communication modules need to be turned off. Please refer to Chapter 9.2.3 to set the DIP switches.

---

5 CHECKS AND MAINTENANCE

This chapter describes the method of routine and periodic inspection and maintenance of the welding power supply section of welding power supply option.

- For the method of inspection and maintenance of the robot mechanical section, refer to "ARC Mate 100*i*D, M-10*i*D OPERATOR'S MANUAL". (B-83944EN)
- For the robot controller, refer to "R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL". (B-83195EN)
- For the robot controller, refer to "R-30*i*B Mate/R-30*i*B Mate Plus CONTROLLER MAINTENANCE MANUAL". (B-83525EN)

> **NOTE**
> The periodic maintenance procedures described in this chapter assume that the FANUC robot is used for up to 3840 hours a year. In cases where robot use exceeds 3840 hours/year, adjust the given maintenance frequencies accordingly. The ratio of actual operation time/year vs. the 3840 hours/year should be used to calculate the new (higher) frequencies. For example, when using the robot 7680 hours a year with a recommended maintenance interval of 3 years or 11520 hours, use the following calculation to determine the maintenance frequency: 3 years / 2 = perform maintenance every 1.5 years.

5.1 CHECKS AND MAINTENANCE CONTENT

Perform checks and maintenance for each welding equipment shown in Fig. 5.1 (a).
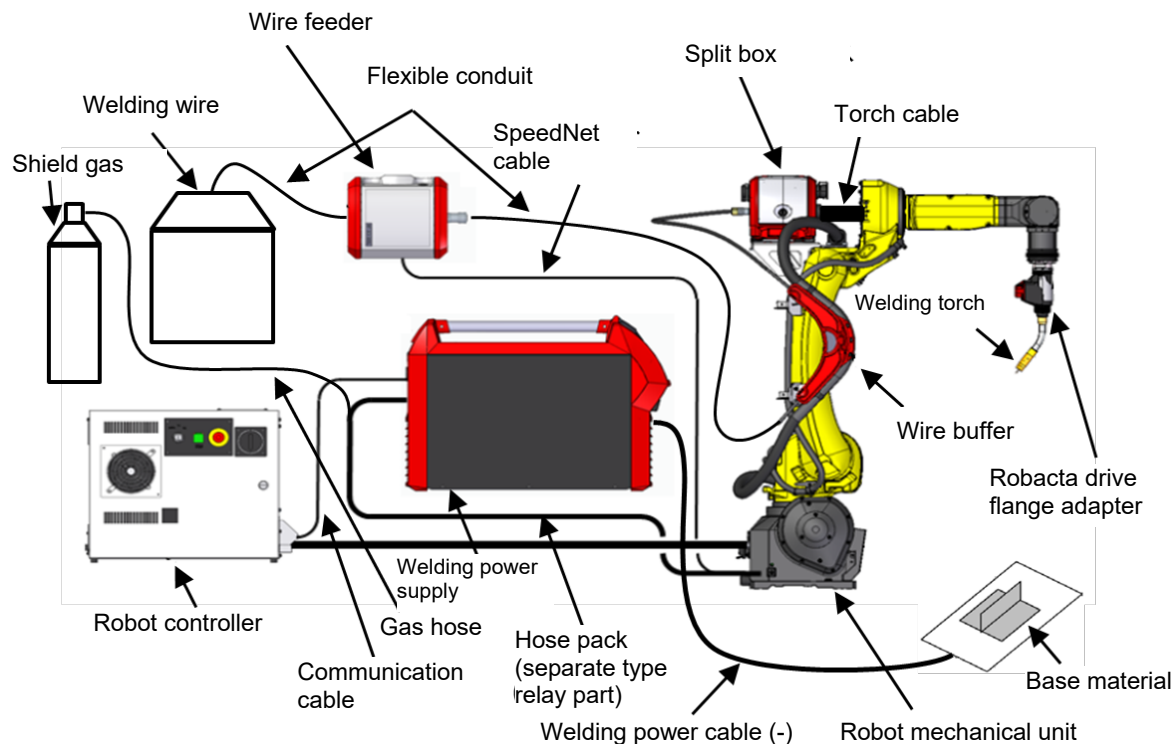
Fig.5.1 (a) TPS/i CMT power supply structure

> ⚠ **WARNING**
>
> Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on. Otherwise, a serious accident resulting in an electrical shock or burn can occur.

To make full use of the welding machine and ensure safe operation in daily work, routine inspection is indispensable. For keep the performance and function, be sure to use specified replacing parts by us.

5.1.1   Daily Checks

Clean each part, and visually check component parts for damage before daily system operation. Check the following items when necessary.   (● : Items required order of maintenance parts)

Locations	Check and maintenance item	Check points, management and maintenance method	Check time
Torch	Check gas nozzle and diffuser	Check them, clean and replace parts. ●**"8.1.2 Maintenance parts for air cooling torch」 / "8.1.3 Maintenance parts for water cooling torch"**	0.1H
	Checking the neck liner	Confirm the clogged and abrasion. ⇒**"5.2.1 Check the neck liner」** ●**"8.3 Maintenance parts for liner, flexible conduit"**	0.2H
	Replacing the tip	Replace the tip if necessary. ●**"8.1.1 Contact tip"**	0.1H
Flexible conduit	Check the flexible conduit	Check the joint installation, abrasion and bend and so on. ⇒**"5.2.2 Check the flexible conduit"** ●**"8.3 Maintenance parts for the liner and the flexible conduit"**	0.1H
Robacta drive	Check the gas saver nozzle	Check the stuck out of the gas saver nozzle, crack of the front liner guide tube, neck liner length (when cutting). ⇒**"5.2.3 Check the gas saver nozzle"** ●**"8.2 Maintenance parts for Robacta drive"**	0.1H
	Wire feed status	Check the roller behavior and noise during wire inching. ⇒**"5.2.4 Check the wire feed status"** ●**"8.2 Maintenance parts for Robacta drive"**	0.1H
	Pressure	Check that the scale is in the correct position. ⇒**"5.2.5 Check the roller pressure"**	0.1H
	Roller status	Check the feed roller groove and the bearing status. ⇒**"5.2.6 Check the roller status (Robacta drive)"** ●**"8.2 Maintenance parts for Robacta drive"**	0.2H
	Cleaning by air	Clean the feed roller surroundings with clean air (Max. 7bar).	0.1H
Wire buffer	Check the plastic liner	Check that the plastic liner is in the lever and no damage is seen. ⇒**"5.2.7 Replacing the plastic liner"** ●**"8.4 Maintenance parts for wire buffer"**	0.1H
Wire feeder	Wire feed status	Check the roller movement and abnormal noise during the wire inching. ⇒**"5.2.4 Check the wire feed status"**	0.1H
	Pressure	Check the scale is in moderate position. ⇒**"5.2.5 Check the roller pressure"**	0.1H
	Roller status	Check the groove. ⇒**"5.2.8 Check the roller status (wire feeder)"** ●**"8.5 Maintenance parts for wire feeder"**	0.1H

Locations	Check and maintenance item	Check points, management and maintenance method	Check time
Wire feeder	Liner of the connector joint	Check there is no clogged part or abrasion. ⇒"5.4.5 (F) Replacing the liner of the wire feeder connection joint」 ●"8.3 Maintenance parts of liner and flexible conduit"	0.2H
	Cleaning by air	Clean the feed roller surroundings with clean air (Max. 7bar).	0.1H
Water cooling unit	Water level of coolant	Check the water level is in the moderate area. ⇒"5.2.9 Water level of coolant" ●"8.7 Maintenance parts for water cooling unit"	0.1H
Others	Welding wire	Check there is no deposits such as rust or oil.	0.1H
	Gas supply	Check the gas flow rate is in the moderate area. ⇒"5.2.10 Checking Gas Flow Rate"	0.1H

5.1.2   Periodic check

Check the following items at the intervals recommended below based on the period or the accumulated operating time, whichever comes first.   (○： Items required performing / ● : Items required order of maintenance parts)

Check and maintenance intervals (Period, Accumulated operating time)					Locations	Check and maintenance item	Check points, management and maintenance method	Check time
1 month 320h	3 months 960h	6 months 1920h	1 year 3840h	2 years 7680h				
		○			Welding power supplyr	Check the fan	Check the fan operates correctly. ⇒"5.3.1 Check the fan"	0.1H
		○				Check the abnormal noise and vibration	Check there is no abnormal noise or vibration.	0.2H
	●				Wire feeder	Replacing the liner	Replace each liner. ⇒"5.4.5 Liner" ●"8.3 Maintenance parts for the liner and the flexible conduit	0.5H
	●					Replacing the gas saver nozzle	Replace the gas saver nozzle. ⇒"5.4.6 Gas saver nozzle" ●"8.2 Maintenance parts for Robacta drive"	0.2H
	●					Replacing feed roller (Robacta drive)	Replace the feed roller of the Robacta drive. ⇒"5.4.8 Replacing the feed roller (Robacta drive)" ●"8.2 Maintenance parts for Robacta drive"	0.1H
			●			Replacing feed roller (wire feeder)	Replace the feed roller of the wire feeder. ⇒"5.4.9 Replacing the feed roller (wire feeder)" ●"8.5 Maintenance parts for wire feeder"	0.1H
○						Wire buffer lever	Check the damage of the lever. ⇒"5.3.2 Check the wire buffer"	0.1H
○					Cables	Check the welding power cable connector	Check the tightness. ⇒"5.3.3 Check the power supply terminal of the welding power cable"	0.2H
○						Check the SpeedNet cable	Check the connector tightness and failure and the cable damage ⇒"5.3.4 Check the SpeedNet cable"	0.1H

Check and maintenance intervals (Period, Accumulated operating time)					Locations	Check and maintenance item	Check points, management and maintenance method	Check time
1 month 320h	3 months 960h	6 months 1920h	1 year 3840h	2 years 7680h				
○						Check the wire buffer cable	Check the connector tightness and failure and the cable damage ⇒"5.3.5 Check the wire buffer connection cable"	0.1H
		○				Check the connection section of the fixture and the minus side power cable	Check the connection to the fixture.	0.1H
			●			Replacing the torch cable	Replace the torch cable. ⇒"7.4 Replacing the torch cable" ●"8.10.6 Torch cable"	1.0H
			●			Replace hose pack/SpeedNet cable/wire buffer cable	Replace the hose pack and movable part SpeedNet cable. ⇒"7.5 Replacing the hose pack and cables" ● 8.4 Maintenance parts for wire buffer "8.10.5 Hose pack" / "8.10.7 Peripheral equipment"	3.0H
○					Torch	Check the welding torch connection part	Check there is no abnormality on the torch connection part. ⇒"5.3.6 Check the welding torch connection part」	0.2H
○					Water cooling unit	Check the coolant route	Check the dirtiness of the filter and status of the connection part and the water stop valve. ⇒"5.3.7 Check the coolant route"	0.3H
		○				Check the fan	Check the fan operates correctly.	0.1H
			●	●		Replace coolant	Replace coolant. If periodical replacement is not performed, water leak might leak. ⇒"5.4.10 Coolant"	0.5H
			○		Bracket	Check the wire buffer and bracket for split box	Check the fixation to the robot. ⇒"5.3.8 Check the bracket"	0.2H

5.2   Work procedure

Perform checks and maintenance of the each welding power supply equipment as shown in Fig. 5.1 (a).

5.2.1   Checking the neck liner

1   Turn off power of the welding power supply.
2   Using a attached special tool, as show in Fig. 5.2.1 (a), loosen the nut of the torch neck.

45,0200,1261
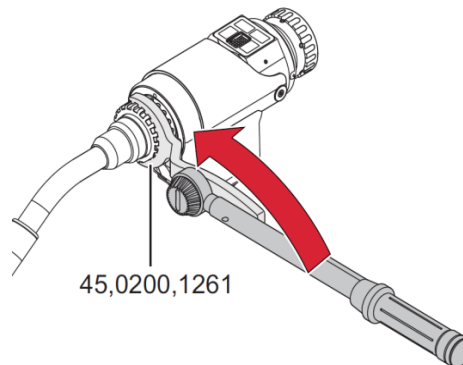
Fig. 5.2.1 (a) Removing the torch neck

3   Remove the neck liner from the torch neck. Then check that there is no abnormality on the neck liner.
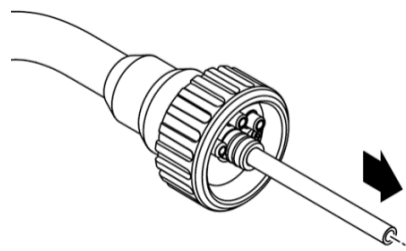
Fig. 5.2.1 (b) Removing the neck liner

4   It abrasion powders of the wire are seen inside the neck liner, clean it by means of air blow etc.
5   If abrasion power is clogged or abnormality is found, replace the neck liner.
6   If using the new neck liner, using fixture as shown in Fig. 5.2.1 (c), adjust the neck liner length. Cut the neck liner so that it length is 1mm or less against the fixture edge or the inside.

If it is too long, the front liner guide tube might break. If it is too short, problems might occur during wire feeding.

Fixture for check

Insert the liner to the end of torch and check that it was not stuck out from the fixture
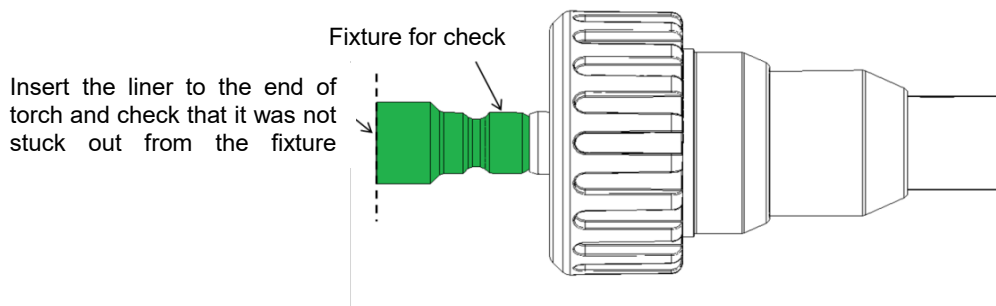
Fig. 5.2.1 (c) Checking the liner length

7   Check there is no burr at the neck liner edge inside and outside. If there is burr, it might affect the welding.
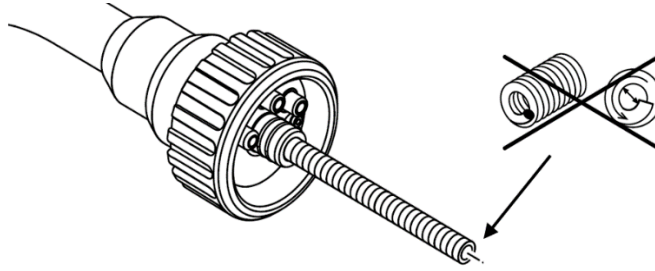
Fig. 5.2.1 (d) Checking the burr

> **NOTE**
> In case of plastic liner for aluminum wire, check the burr in the same way.

8   Adjust the position and phase so that the torch connection part contact point and the joint matches. Then attach the torch again.

> **NOTE**
> In case of water cooling torch, wipe off and confirm so that coolant does not adhere to the Robacta drive connection part.

9   Connect the torque wrench which insert angle 9.5mm to the attached special tool. Then tighten the nut with torque of 18Nm.
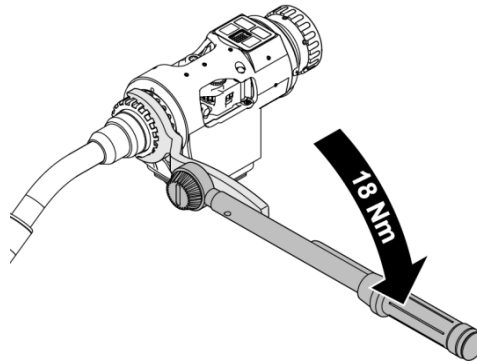
Fig. 5.2.1 (e)   Attaching the torch neck

5.2.2 Check of the flexible conduit

1 Check there is no breakage, or large bended part on the flexible conduit.

Flexible conduit A
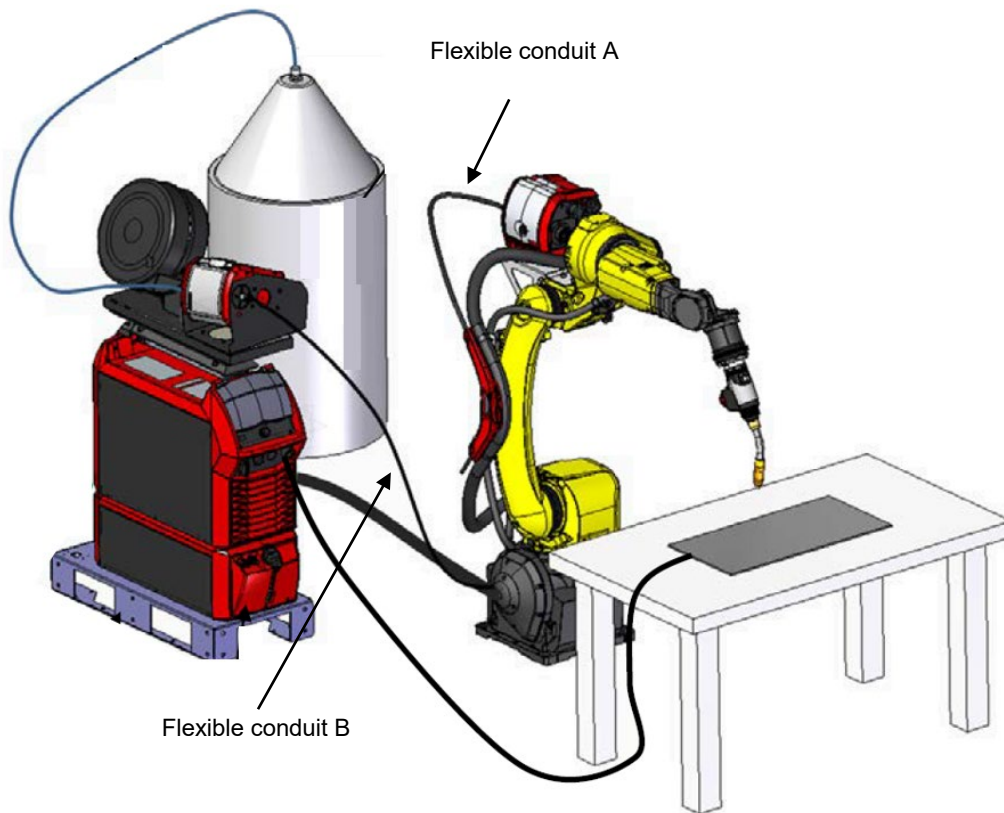
Flexible conduit B

Fig. 5.2.2 (a) Flexible conduit A and B

2 Remove the welding wire from the flexible conduit, the Robacta drive and the wire feeder.
3 Remove the flexible conduit A and B. Check the damage and tightness of the tube edge.
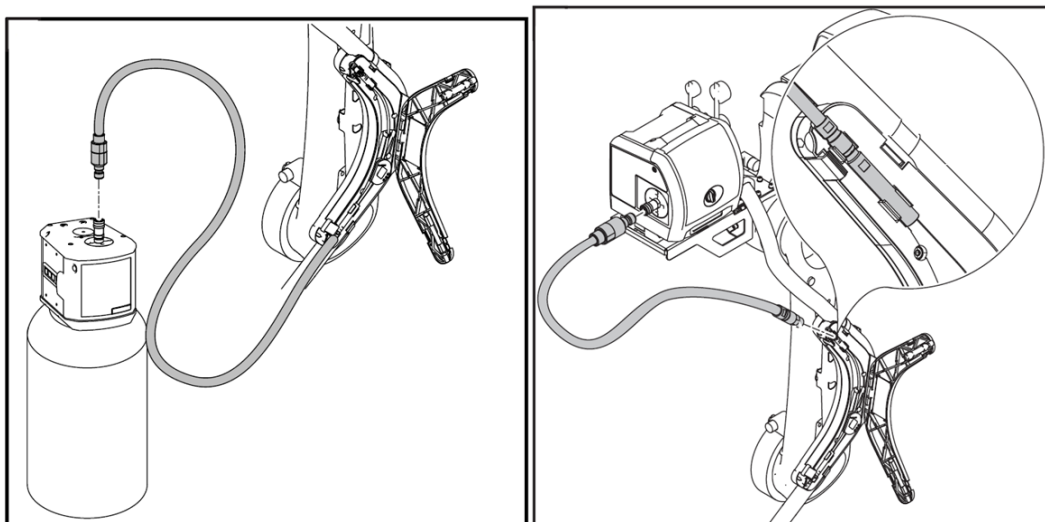
Fig. 5.2.2 (b) Desorption of the flexible conduit

4 Check there is no garbage or dirt inside. Remove garbage and dirt. If inside is clogged by garbage, replace the liner.

5.2.3   Check the gas saver nozzle

The gas saver nozzle is at the front side of the Robacta drive. It prevent overflowing of gas from the torch neck.
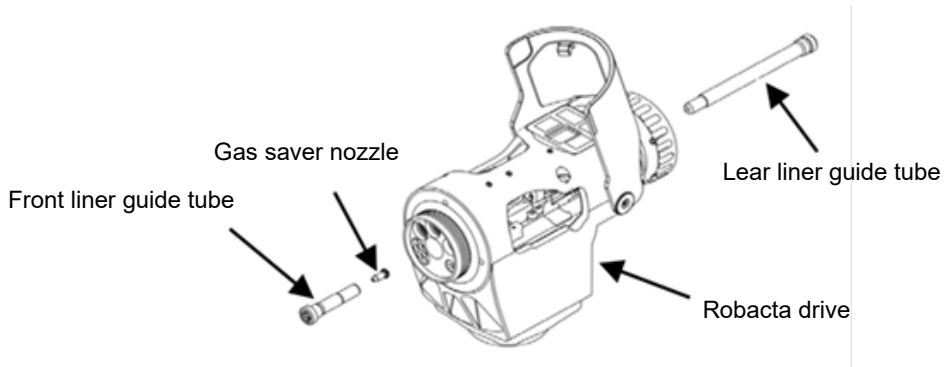
Fig. 5.2.3 (a) Robacta drive

Operation 5-2-3   Check the gas saver nozzle

1   Open the Robacta drive cover. Then perform visual check of the followings.
  ➢ Check the gas saver nozzle does not come out from the front liner guide tube. (See Fig. 5.2.3 (b))
  ➢ Check there is no dirt part in the front/rear liner guide tube
  ➢ Check there is no crack, abrasion or damages
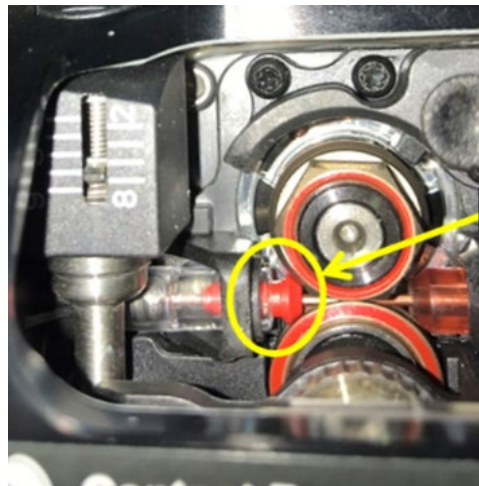
Fig. 5.2.3 (b) Protrusion of the gas saver nozzle

2   If a protrusion is seen, remove the torch neck and remove the front liner guide tube.
3   When removing the front liner guide tube, use the attached torque driver.
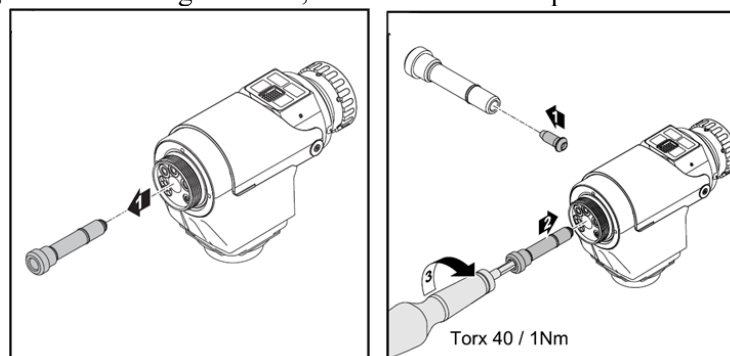
Fig. 5.2.3 (c) Taking out of the front liner guide tube

4   Before assembling the front liner guide tube, check the following.
  ➢   Check there is no accumulation of dirt
  ➢   Check that there is no crack or damage
  ➢   The gas saver nozzle was not come off easily when pushing it to the correct position

Fig. 5.2.3 (d) Normal gas saver nozzle installation status

5   If damage is seen on the gas saver nozzle or the front liner guide tube, replace parts and reinstall them to the Robacta drive. Refer to Subsection 5.4.8.

5.2.4   Check the wire feed status

In this Subsection, confirm the Robacta drive, the motor of the wire feeder and the wire feed.

1   Remove the welding wire from the Robacta drive, the wire feeder and the flexible conduit etc. Then prevent the roller is feed when the feed roller is rotated.
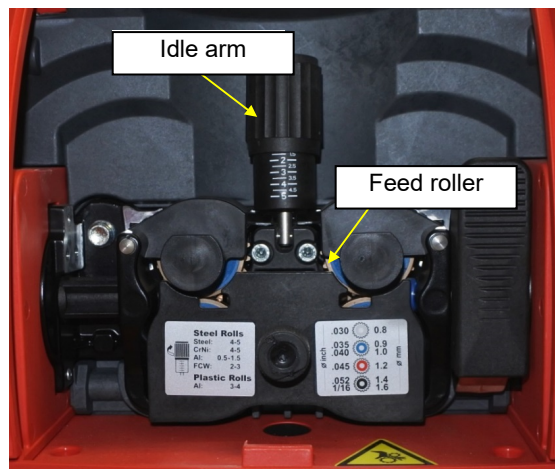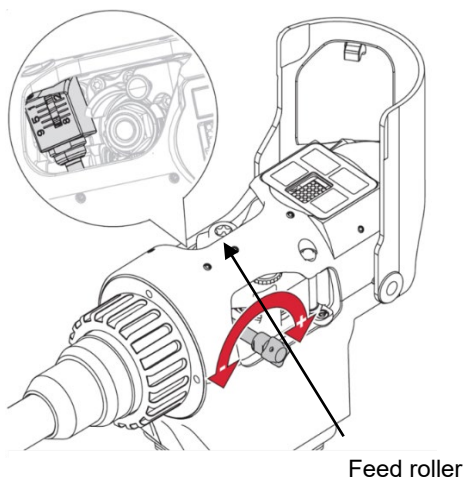
Feed roller

Fig. 5.2.4 (a)   Feed roller of the Robacta drive and wire feeder

2   Idle the feed roller and the follow roller at feed speed 6m/min, perform visual check of the rotation status and check there is no abnormal noise. Pressurize the follow roller and observe the follow roller motion. Then check there is no rattling or axis vibration during rotation.
3   Operate the front panel of the welding machine. Then display the motor electrical current.On the front panel, select the tab as shown in Fig .5.2.4 (b), in order of "Defaults", "View", "System data".
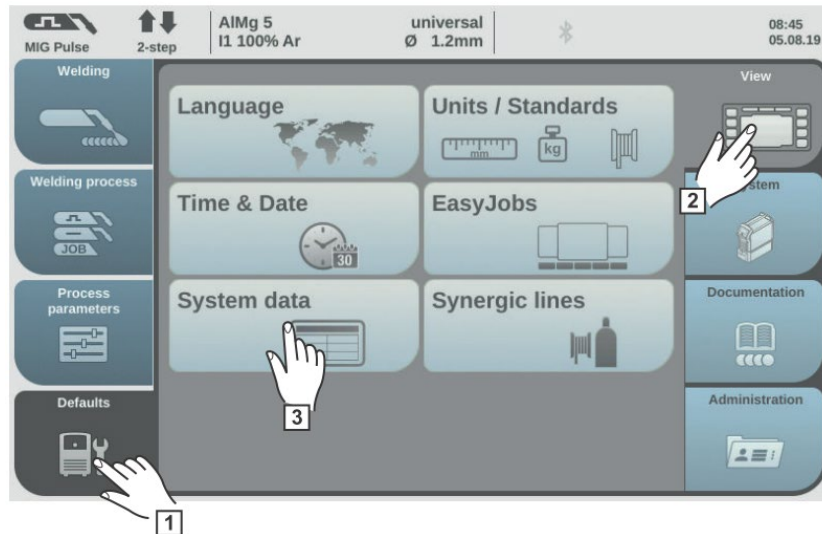
Fig. 5.2.4 (b)   Operation of the front panel
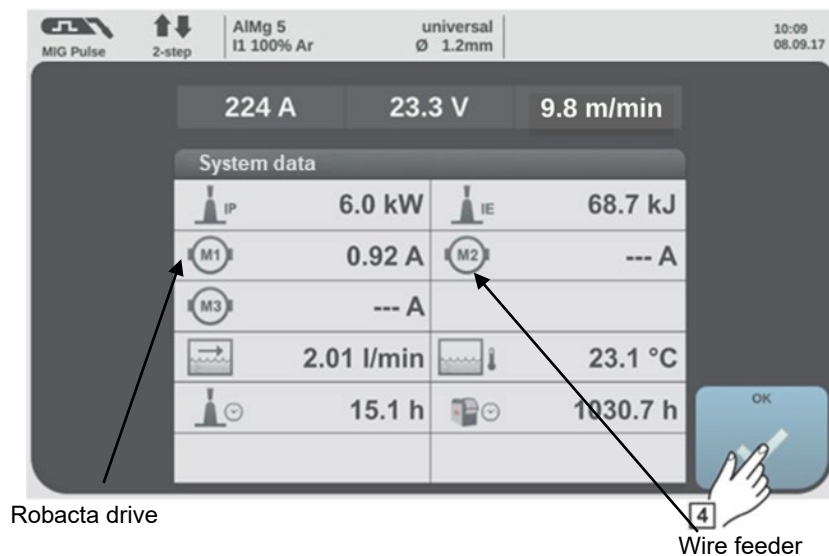
Fig.5.2.4 (c)   Display of the motor current

4   Idle the feed roller at feed speed 6m/min. Then record the motor current. Check the motor electrical current is in the following standard value. If value exceeded the standard value, the feed roller, the Robacta drive or the wire feeder might be defective.

Robacta drive : 0.4A

Wire feeder : 0.6A

5   Pass the wire and perform inching. Check the wire feeding is performed correctly.

6   Perform wire inching at feed speed 6m/min, then record the motor current. Check the motor current in the following standard value. If the value exceeded the standard value the wire feed resistance may be too large. Voltage is applied during inching. So be careful to the electric shock.

Robacta drive : 0.8A

Wire feeder : 1.0A

7   Push and pull the wire with a plier etc. from the torch neck tip without wire inching, check the wire is fixed certainly by the feed roller of the Robacta drive. Perform inching the wire a little, then repeat the procedure 6. It there is sliding between the wire and the feed roller, check the pressure and there is no interfering material in the feed roller grove and the feed roller surroundings.

5.2.5   Check of the roller pressure

Check the feed roller pressure of the Robacta drive and the wire feeder. According to the following procedure check the pressure. According to Table 5.2.5 (a), adjust it to the moderate pressure.

Table 5.2.5 (a)   Used wire material and recommended pressure

Wire material	Pressure	
	Robacta drive	Wire feeder
Iron, stainless	6-8	4-5
Blazing	5-7	
Al-Si alloy	1-2	0.5-1.5
Al-Mg alloy	2-4	
FCW	3-5	2-3

Operation 5-2-5 (a)   Check pressure of the Robacta drive

Procedure
1   Open the Robacta drive cover. Then check the scale according to the figure.
2   If the pressure is not moderate, pull out the knob, then adjust the scale by rotating it.
3   When adjustment finished, push the knob to the original position.

Check and adjust the scale

Pull out the knob

of the pressure lever
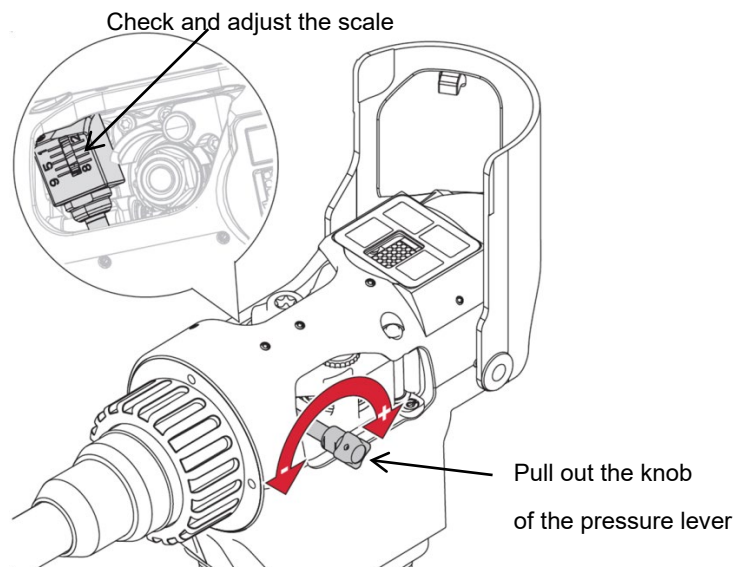
Fig. 5.2.5 (a)   Pressure adjustment of the Robacta drive roller

Operation 5-2-5 (b)   Check the pressure of the wire feeder

Procedure
1   Open the wire feeder cover.
2   Check the pressure by the scale under the idol arm knob.
3   If the pressure is not appropriate, rotate the knob and adjust the pressure.

Fig. 5.2.5 (b)   Roller pressure adjustment of the wire feeder

5.2.6   Check the roller status (Robacta drive)

Prepare a special torque drive as shown in Section 8.9 (C). (It is attached when ordered.)

Operation 5-2-6 (a)   Check the drive roller

Procedure
1   According to Fig. 5.2.6 (a), install the attached torque drive to the drive roller. Then remove the roller. In this time, push the button on the side of the drive roller, fix the roller rotation.
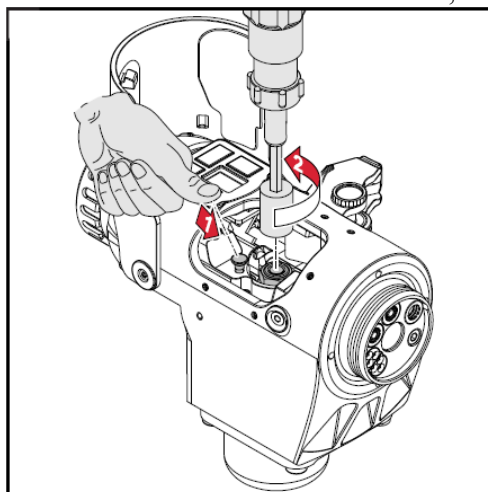
Fig. 5.2.6 (a) Desorption of drive roller

2   If there is garbage or dirt on the roller groove, remove them.
3   If there is damage or abrasion on the roller groove, replace the roller by new one.
4   Replace the drive roller. Then fix the roller in the reversed sequence. Tight it with torque of 5.0Nm.

Operation 5-2-6 (b)   Check the follow roller

Procedure

1   Pull out the follow roller pressure adjustment lever tip. Then lay down it to the torch side.
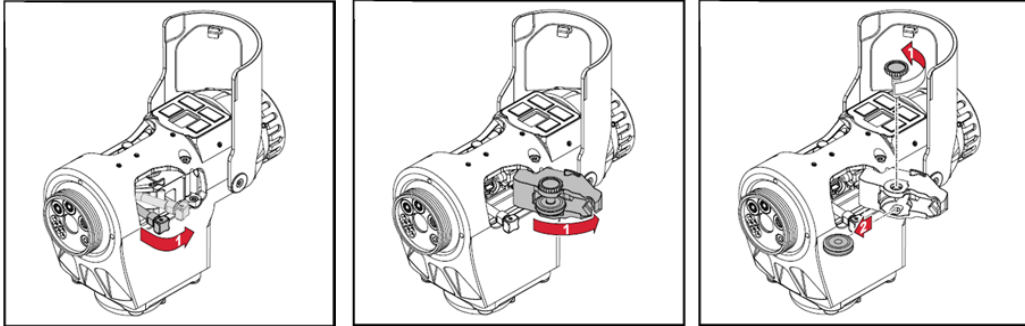
Fig. 5.2.6 (b) Desorption of follow roller

2   Loosen the screw. Then remove the follow roller.
3   If the garbage or dirty portion on the roller groove, remove them.
4   If there is damage or abrasion on the roller groove, replace the roller by new one.
5   Insert the follow roller to the screw, check the bearing rotation is normal. If abnormality was found, replace the follow roller. The bearing abnormality might cause bad influence on the wire feed.
6   Insert the follow roller to the screw. Then check he bearing shaft runout. If abnormality was found, replace the follow roller.
7   Attach the follow roller to the Robacta drive. Then adjust the pressure in the proper range.
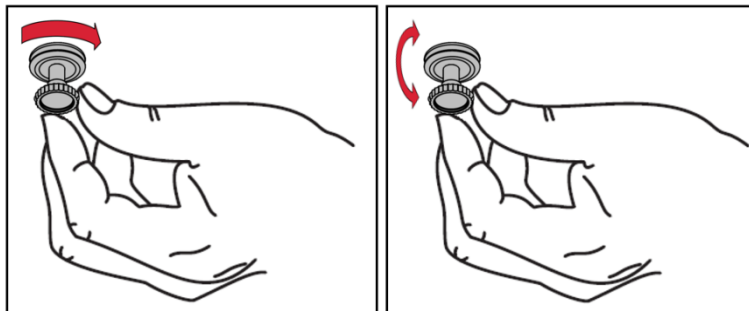
Fig. 5.2.6 (c) Check the follow roller bearing

5.2.7 Replacing the plastic liner

1   Open the wire buffer cover.
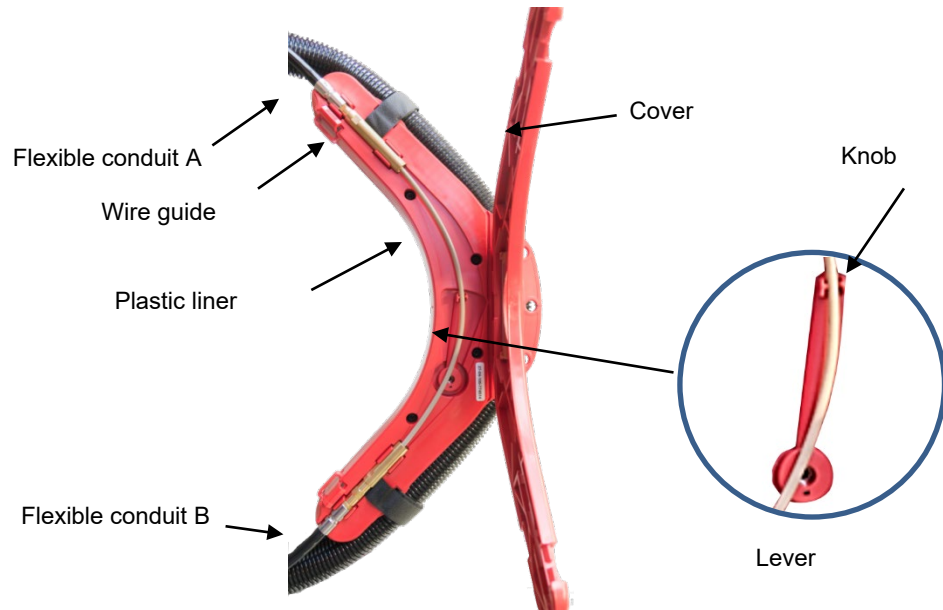
Fig. 5.2.7 (a) Wire buffer

2   Check the following points of the plastic liner.
- ➢ Check the abrasion and damage on the appearance
- ➢ The plastic liner is not stuck out from the knob of the lever tip knob
- ➢ Check the plastic liner was not stuck out from the wire guide
- ➢ Check there is no garbage or contaminations at the wire guide surroundings

5.2.8 Check the roller status (wire feeder)

1   Open the wire feeder cover.
2   Lay down the idol arm to the front side and release the pressure, then perform visual check of the feed roller.
3   If garbage is found, remove them, if abrasion is seen, replace the feed roller.
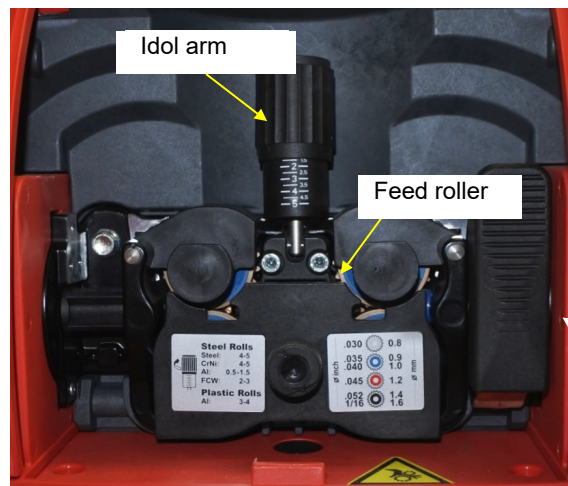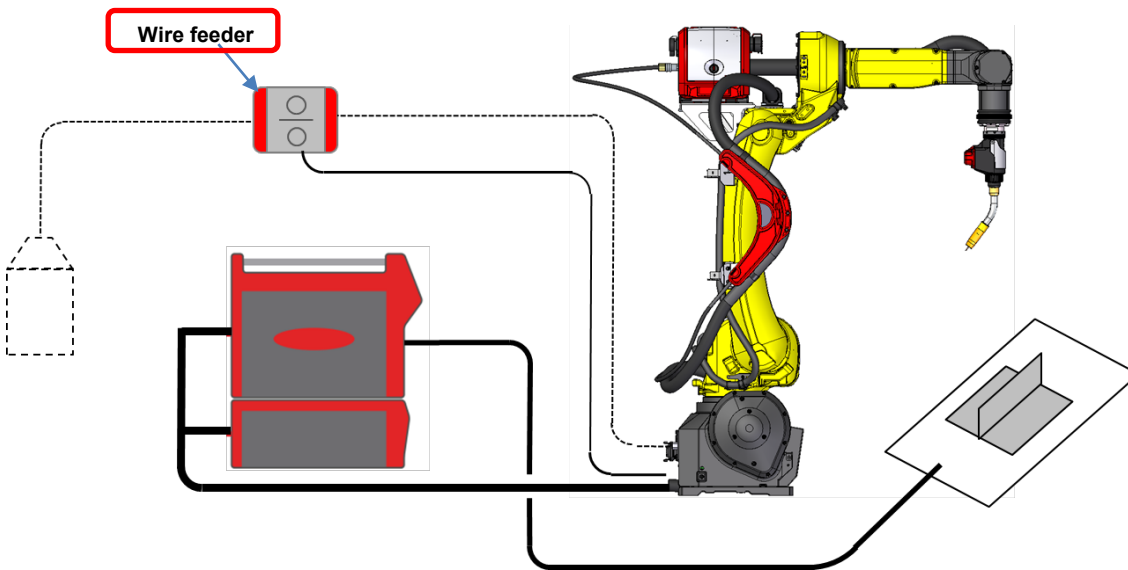
5.2.9   Water level of the coolant

1   From the water cooling unit front window, check the water level is in the normal area as shown in Fig. 5.2.9 (a)
2   Always keep the water level is over the center of the "max" and "min".
3   If the water lever suddenly rose, check there is no water leak. (See Subsection 5.3.7)
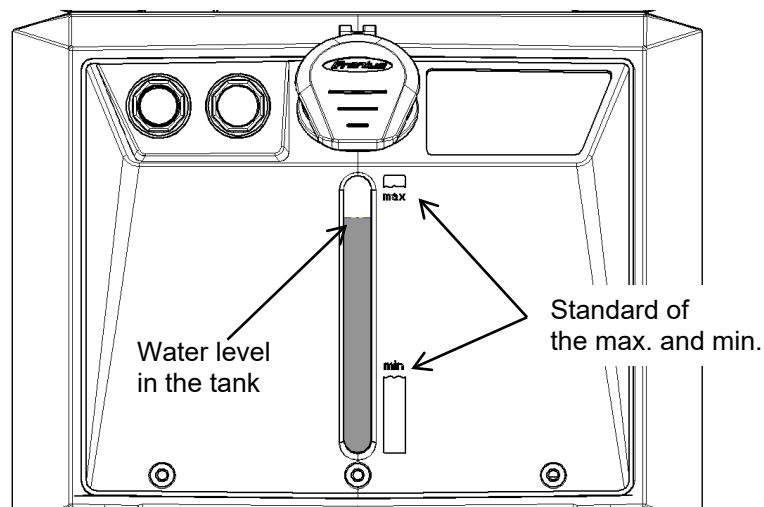
Fig. 5.2.9 (a) Check the water level of the coolant

5.2.10   Checking Gas Flow Rate

The gas flow rate is an important factor in ensuring stable arc welding.   The gas flow rate can vary depending on the primary gas pressure.   So, check the gas flow rate every day.

Use the procedure below when checking the gas flow rate.
1   When gas is not output, check that the specified gas pressure is observed.

> **NOTE**
> The maximum input pressure of the gas controller is 11.8 MPa for CO2 gas, and
> 15.7 MPa for argon gas and mixed gas (CO2 + argon).

2   Make a gas check from the teach pendant. Refer to [Section 2.10   manual gas check] about this operation.
3   Meanwhile, read the value of the gas flow meter.
4   Check that the read value satisfies the specification.   If the specification is not satisfied, adjust the flow rate control to set the specified flow rate.
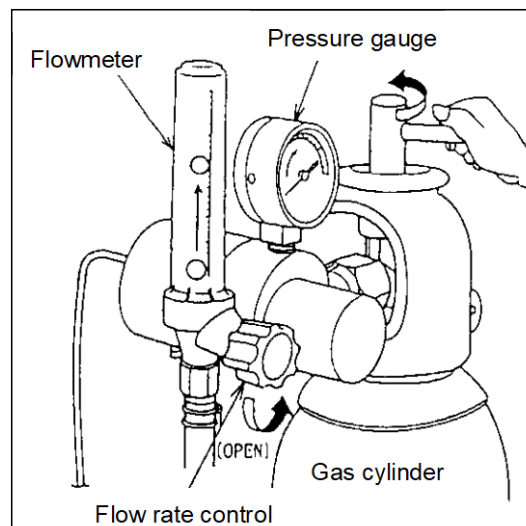
*   When reading a flow rate value, read the scale mark at enter of the float as shown below.
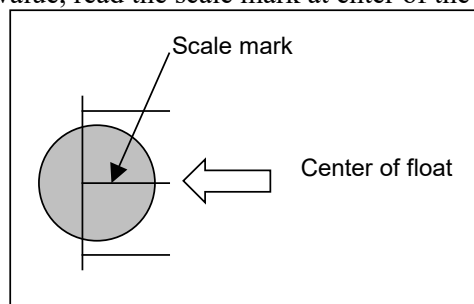
5.3 Work procedure of periodic maintenance

5.3.1 Check the fan

If inside temperature of the Fronius TPS/I welding machine exceeded 70° C, the fan will rotate to cool the main body inside. Intake from the backside and vomit to the front side. If waste head is not performed correctly, it might cause failure of the welding power supply. Keep the 0.5 m or more space at the surrounding of the welding power supply.
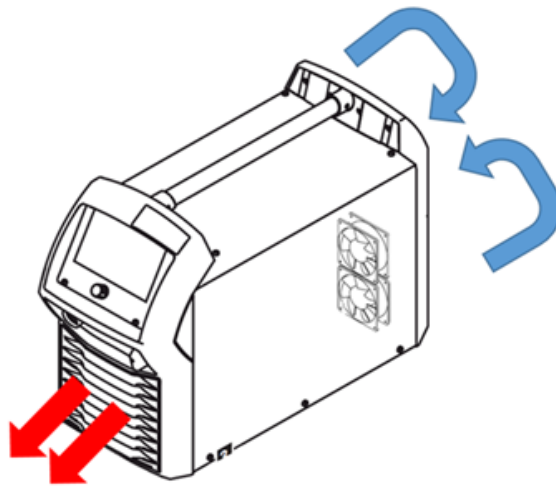
Fig. 5.3.1 (a) Intake and exhaust by fan

Procedure

1 Turn off the power switch of the welding power supply. Then then fan will rotate during about 1 second. Stand at the front of the welding power supply, check the exhaust port status of the front.
2 Turn off the power switch. Then confirm that wind comes from the exhaust port of the front. If wind does not come out, the fan might be defective or the intake and exhaust port might be clogged.

5.3.2 Check the wire buffer

The following shows check points and contents.

Parts	Check points	Remarks
Lever	Check there is no deterioration or damage on the notch of the tip. (holding plastic liner part)	If abnormality is found, replace it by new one.
Plastic liner	Check there is no abrasion or breakage	If abnormality is found, replace it by new one.
Flexible conduit cage	Check there is no backlash between the flexible conduit and the cage	If abnormality is found, replace the wire buffer.
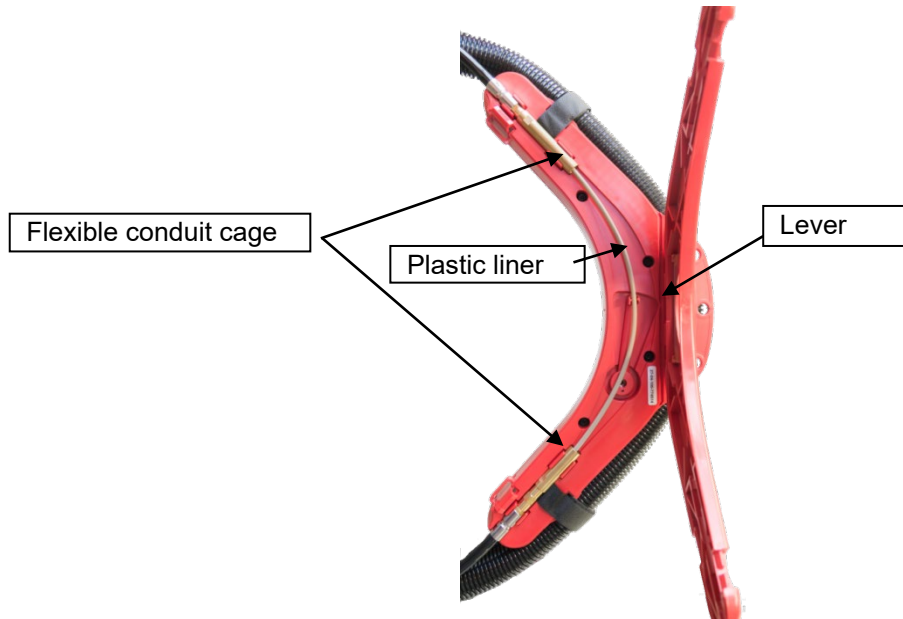
Fig. 5.3.2 (a) Check points of the wire buffer

Operation 5-3-2   Replacing the lever

Procedure

1   Insert the bolt which is attached to the maintenance parts for the lever into the lever hole. By tightening bolts, the lever is removed from the wire buffer.
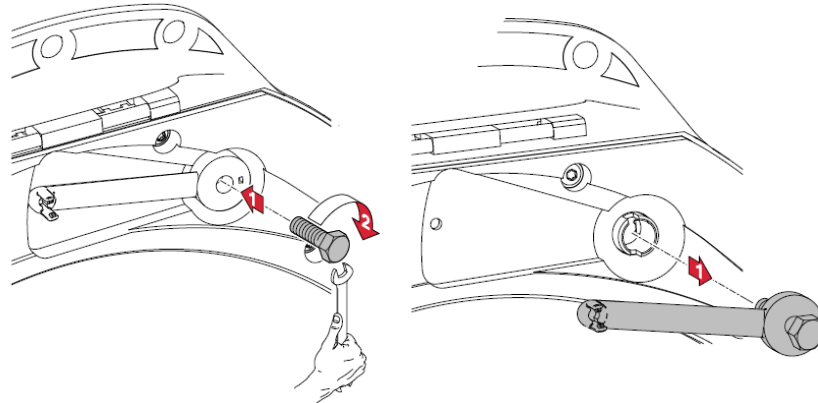
Fig.5.3.2 (b)   Removal of the lever

2   Match the phase of the notch. Then attach the new lever on the wire buffer.
     Tighten the attached screw with the wing nut on the lever of the wire buffer main body.
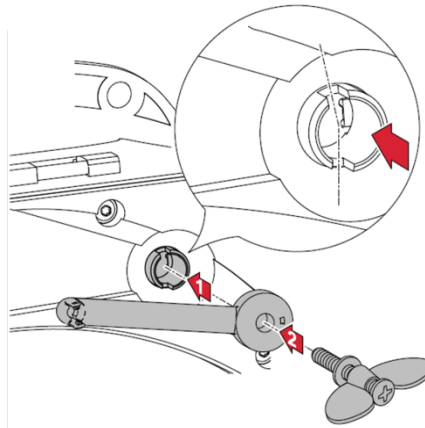
Fig. 5.3.2 (c)   Lever installation

3   Tighten the screw and the wing nut. Then insert the lever into the wire buffer.
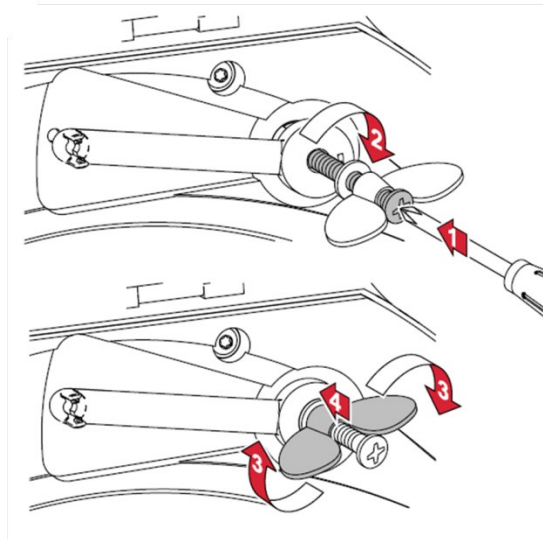
Fig. 5.3.2 (d)   Inserting of the lever

4   If the lever is inserted, remove the screw.

5.3.3   Check the power supply terminal of the welding power cable

Check the following power supply terminal.
 1   Hose pack relay part (in case of separate type hose pack)
 2   Welding power supply backside
 3   Split box front
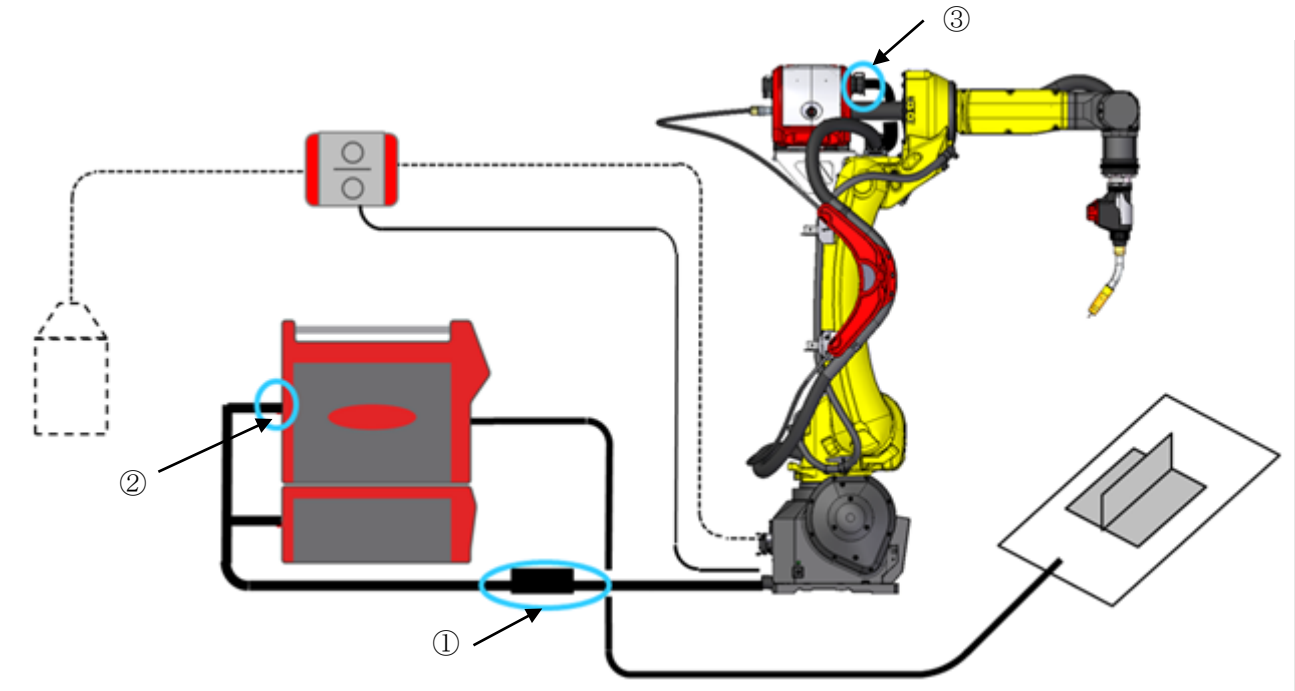
Fig. 5.3.3 (a) Check point of the power supply terminal

Procedure
 1 Turn off the power switch of the welding power supply.
 2 Check there is no gap on the marking of the power supply terminal between terminals.
 3 Rotate the power supply terminal by hand and the check the tightness.
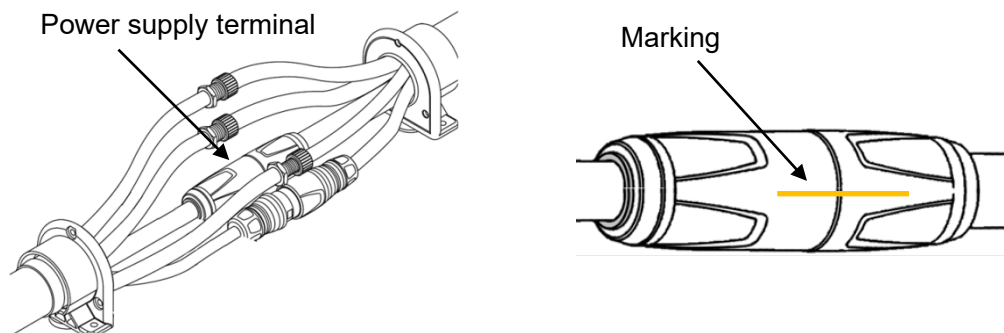
Fig. 5.3.3 (b) Marking on the power supply terminal

 4 If the marking is not seen or the terminal is loosen, remove the power supply terminal then perform the work after procedure 5.
 5 Check there is no contamination or abnormality in the power supply terminal. Remove contaminations. If there is abnormality, replace the welding power cable.

Fig. 5.3.3 (c) Conduction part of the power supply terminal

6   Tighten the power supply terminal so that the conductive part is adhered certainly.
7   Check the tightness, then perform marking on the power supply terminal.

> **NOTE**
> The terminal surrounding is covered with the rubber, checking the adhesion might
> be difficult.

5.3.4   Check the SpeedNet cable

Procedure
1   Check the following points of the SpeedNet cable.
   ➢   Check the tightness and damage of the connector
   ➢   Check the damage of the cable cover.
   ➢   Check the cable ties are attached correctly
   ➢   Check there is no interference during the robot motion
   ➢   Check there is no cable pulled part

Split box

Wire feeder

SpeedNet cable

Welding power supply

Hose pack
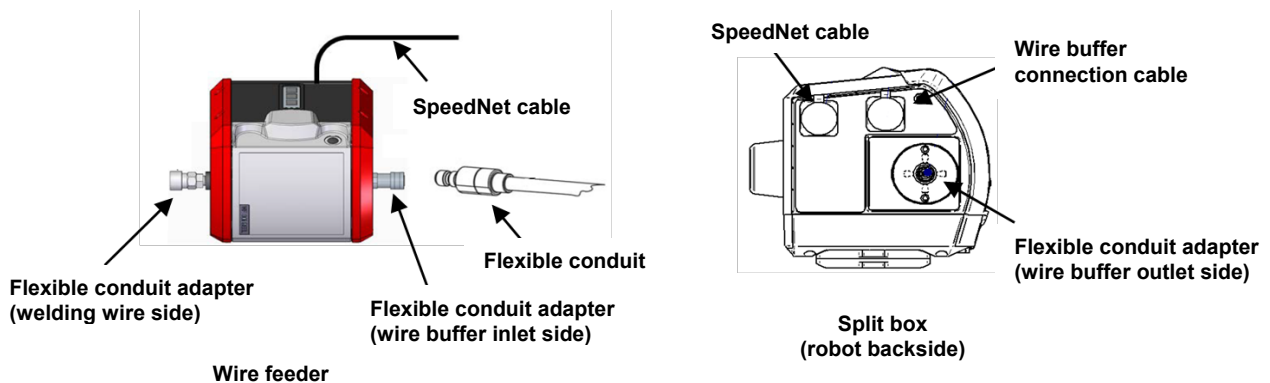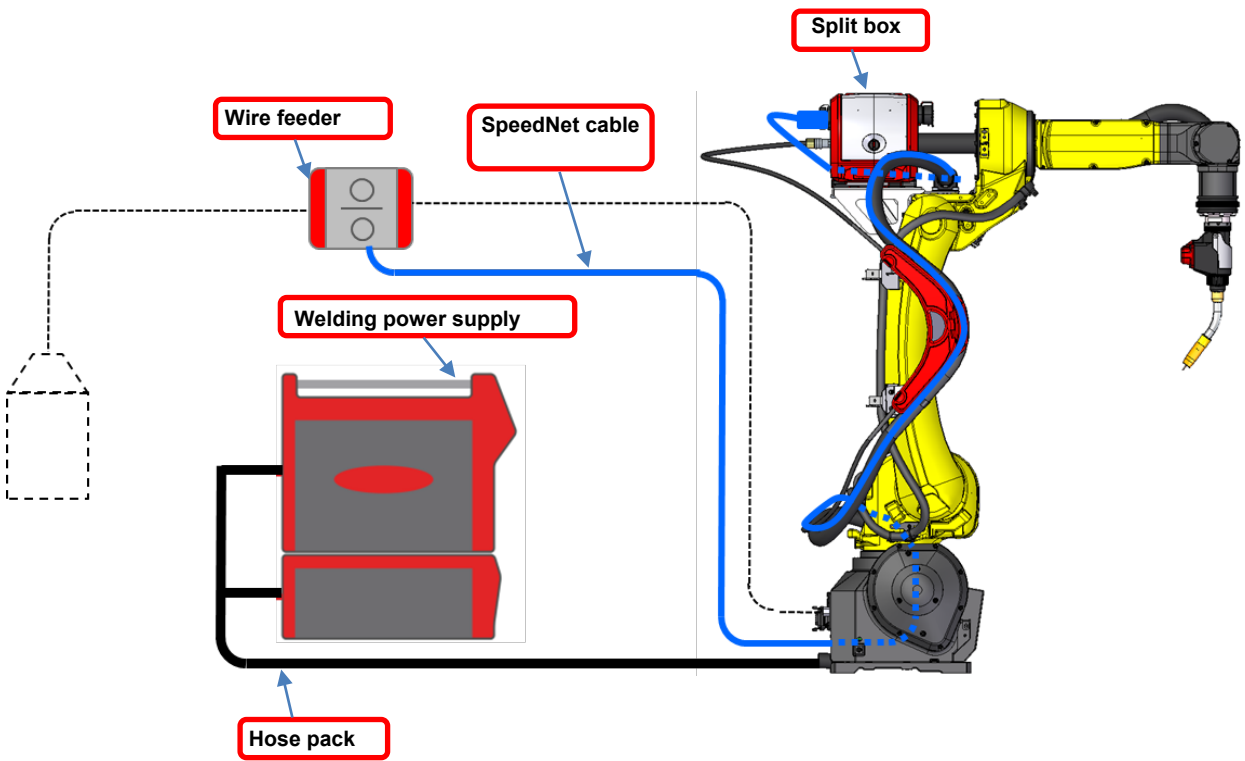
＊**Including the SpeedNet cable**

5.3.5 Check the wire buffer connection cable

Procedure

Check the following points of the wire buffer connection cable.

- ➢ Tightness and damage of the connectors
- ➢ Damage of the cable coating
- ➢ Check parts are fixed with cable ties
- ➢ Interference by the robot motion
- ➢ Cable pulled parts
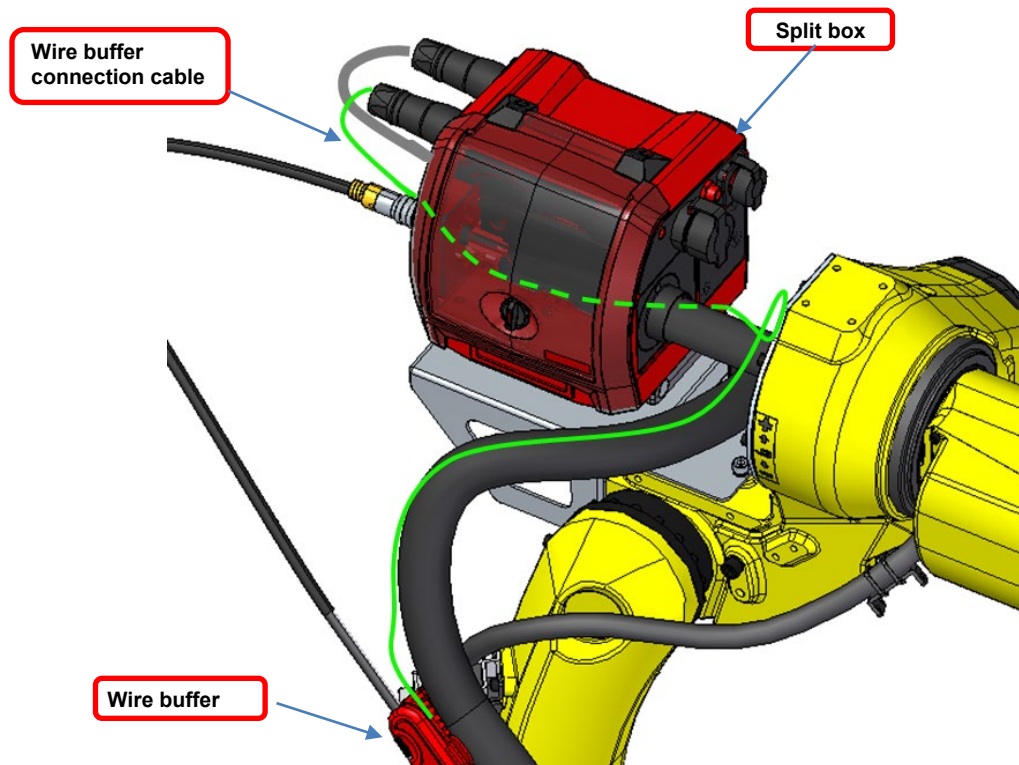
Fig. 5.3.5 (a) Wire buffer connection cable

5.3.6   Check the welding torch connection part

Procedure
1   Turn off power switch of the welding power supply.
2   Remove the welding torch from the Robacta drive.
3   At the welding torch connect surface, check the followings.
   ➢ Check there is no contaminations or corrosion at the contact point surroundings.
   ➢ In case of the water cooling torch, check there is no water leak from the coolant route valve.
   ➢ Check the dirt or contaminations on the contact surface
4   If there is no problem, reinstall the welding torch.

Terminal of the electrical circuit

Welding torch side surface

Welding torch connector front

Coolant

Contact point

Welding torch side connection surface

Robacta drive side connection surface
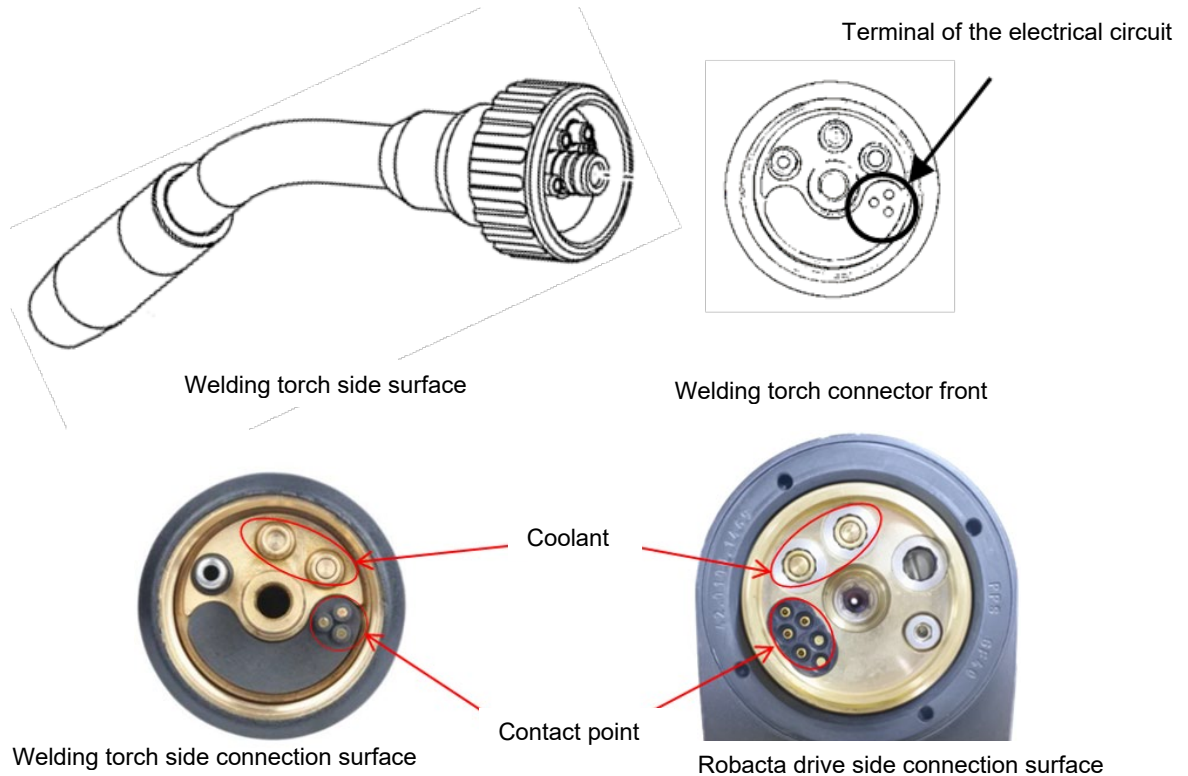
Fig. 5.3.6 (a) Connection part of the welding torch

5.3.7   Check the coolant route

Procedure

Check the following points at the coolant route.
  ➢   Check there is no damage or kink on the tube.
  ➢   Check the connection joint is connected correctly
  ➢   Check there is no water drop on the coolant route surroundings
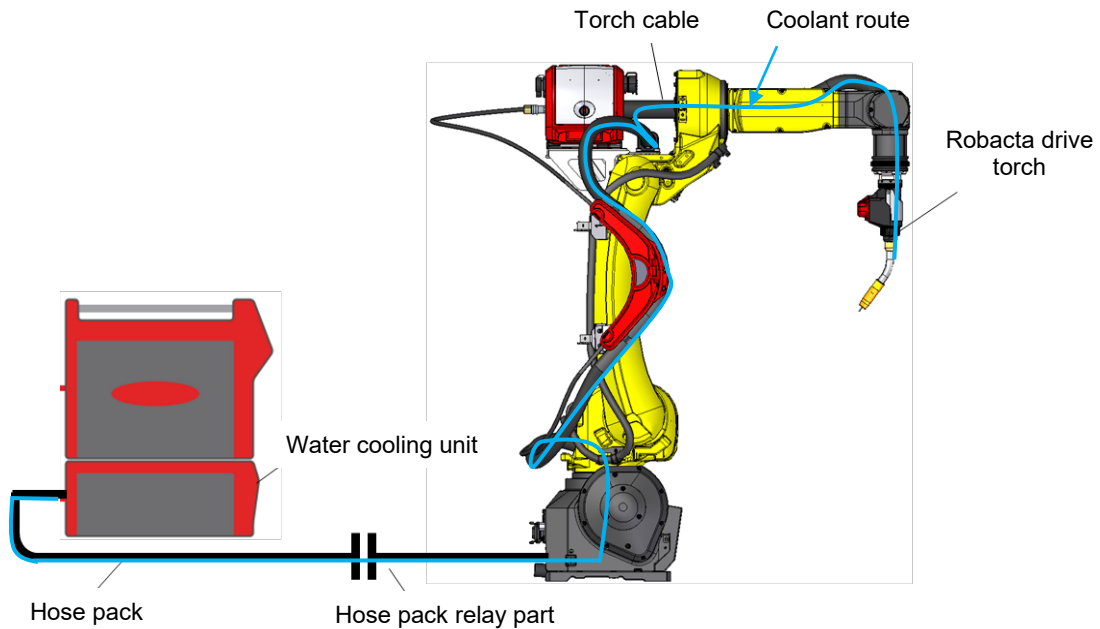
Fig.5.3.7 (a) Check the coolant route

In addition, for the water cooling unit, check the following points.
  ➢   Check there is no dirt deposition on the water cooling unit backside filter (See Fig.5.3.7 (b))
  ➢   Check there is no discoloration or floated dirt in the coolant of the water cooling unit coolant tank
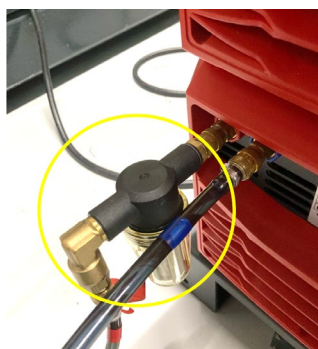
Fig. 5.3.7 (b) Filter

If the filter is dirty, clean it by the following procedure.

Operation 5-3-7   Cleaning the filter

Procedure

1   Remove the joints of the filter both edge. Then close the hose of the hose pack side.
2   According to Fig. 5.3.7 (c), disassemble the unit, remove the inside reticulated filter.
3   Wash the filter inside with running water or a brush.
4   Check there is no damage on the reticulated filter. Then make it to the original status.
5   Connect the reassembled filter to the water cooling unit.
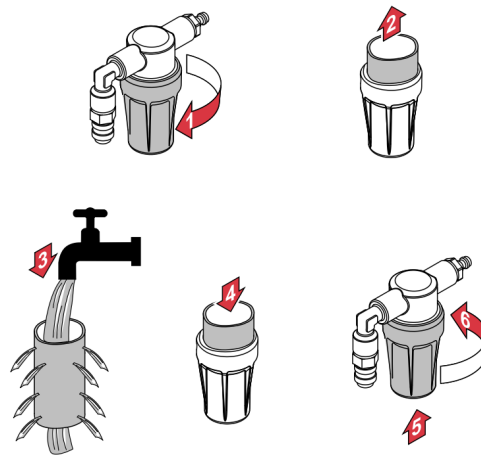
Fig. 5.3.7 (c) Cleaning the filter

> **NOTE**
> According to each law and ordinance, discard the discharged coolant.

5.3.8   Check the bracket

Procedure

1   Check the abnormality of the bolts for the wire buffer bracket. Then retighten them with torque of 10.5Nm.
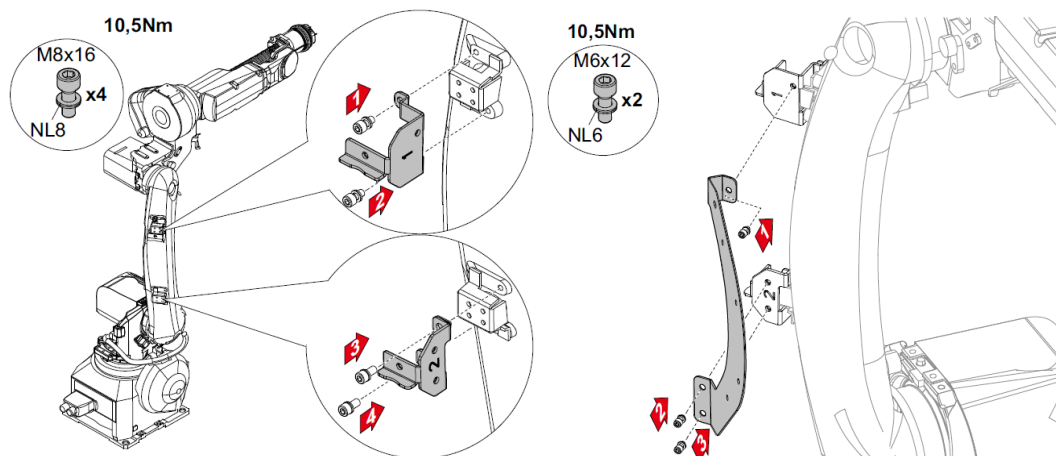
Fig. 5.3.8 (a) Check the bracket (1)

2   Check the abnormality of the wire buffer and the bracket mounting part. Then retighten them with torque of 2.5Nm.
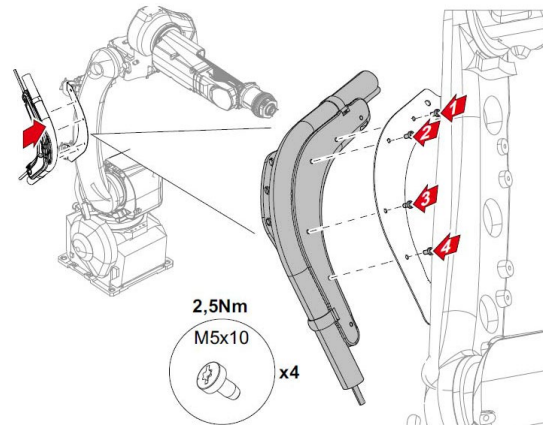
Fig. 5.3.8 (b) Check the bracket (2)

3   Check the abnormality of the bolts of the bracket for the split box. Then retighten them with torque of 10.5Nm.
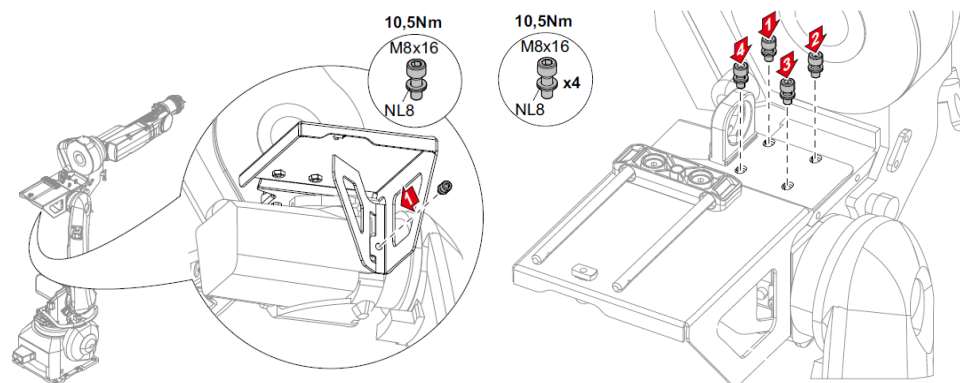
Fig. 5.3.8 (c) Check the bracket (3)

5.4 REPLACING CONSUMABLES

> **⚠ WARNING**
> Before inspection, adjustment, and replacement, be sure to turn off the switch of the switch box and confirm safety at all times except when an inspection is required while the power is on.
> Otherwise, a serious accident resulting in an electrical shock or burn can occur.

This section describes how to replace consumables.
Use consumables supplied by FANUC at all times except wire and gas. Use special care when selecting a wire and gas.

5.4.1   Wire

1   When wire remains in the conduit, pull out the wire.
2   Detach the empty wire reel from the wire reel stand.
3   Attach a new wire reel.
4   Run the wire.

5.4.2   Gas

> ⚠️**WARNING**
> When handling a gas cylinder, observe the high-pressure gas regulation, and manage the gas cylinder according to the standard defined in your company.   A gas cylinder contains high-pressure gas.   If a gas cylinder is handled incorrectly, high-pressure gas can blow out, and can cause an accident resulting in a human injury or death.   Be sure to observe the following items:
> ・ When a gas cylinder falls, an accident resulting in a human injury or death can occur.
> ・ Secure a gas cylinder to a dedicated cylinder stand.   Be sure to secure a gas cylinder vertically.   When using a gas cylinder, do not lay it.
> ・ The internal pressure of a gas cylinder varies with temperature.   If a gas cylinder is exposed to direct sunlight or placed close to a heat source, the internal pressure increases, and the safety valve of the gas cylinder can be actuated.
> ・ Before mounting a gas controller onto the gas cylinder, check that a cylinder packing is inserted in the cylinder mounting nut of the gas controller.   If no cylinder packing is inserted, be sure to insert a cylinder packing.
> When opening the valve of the gas cylinder, open the valve step by step until the valve is fully open.

1   Close the valve of the gas cylinder.
2   Detach the gas controller.
3   Replace the gas cylinder.
4   Mount the gas controller.
    Mount the gas controller onto the gas cylinder with a mounting nut.   Tighten the nut sufficiently with a monkey wrench.
5   Open the valve of the gas cylinder.
6   Check the gas pressure and gas flow rate.

For gas check operation, see Subsection 5.1.10, "CHECKING GAS FLOW RATE ".
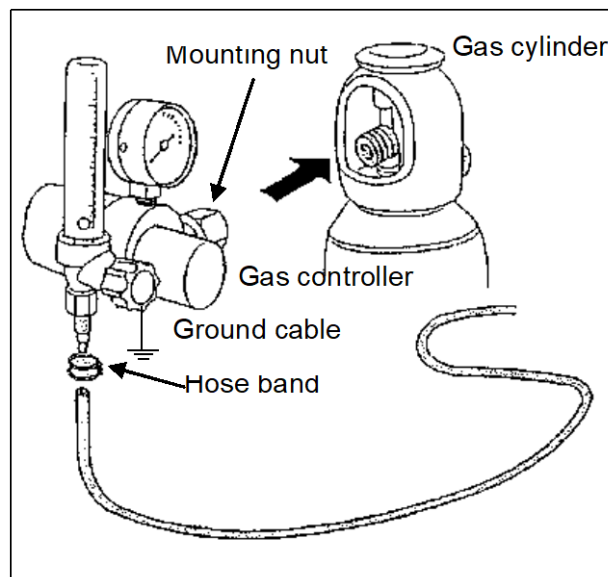
5.4.3   **Nozzle**

Before starting operation, make a check every day.   Replace the nozzle if distorted.
1   Remove the nozzle.
2   Attach a new nozzle.

> ⚠️**CAUTION**
>   Remember to mount a gas diffuser (orifice).

5.4.4   **Tip**

Before starting operation, make a check every day.   Replace the tip if its hole is enlarged.
1   Remove the nozzle.
2   Remove the tip.
3   Mount a new tip.

> **NOTE**
>   Mount a tip that matches the diameter of wire used.

4   Mount a nozzle.

> **NOTE**
>   Remember to mount a gas diffuser (orifice).

5.4.5   **Liner**

> **NOTE**
>   Use the liner which is compatible with the used wire size.

The liner is in the position as shown in Fig.5.4.5 (a).
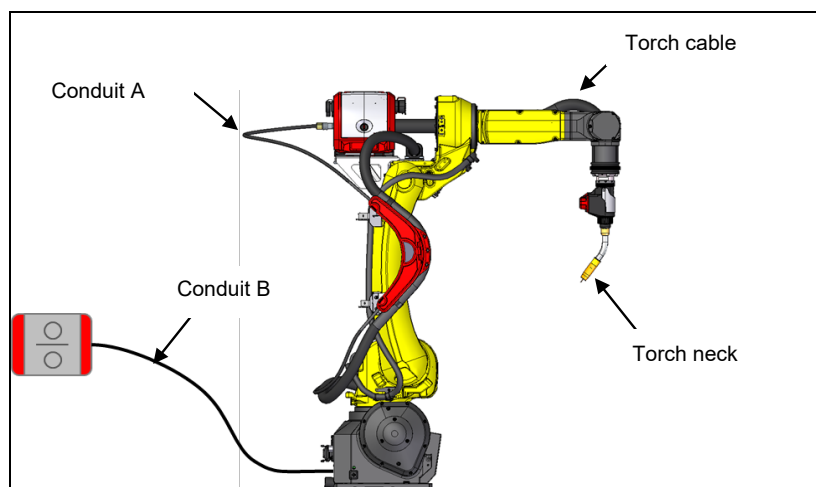
Fig. 5.4.5 (a)   Liner used location

NOTE
When cutting the metallic liner, install it after removing burr. In addition, when cutting the liner for aluminum, be careful so that the liner is not crushed on the cutting surface.

Operation 5-4-5 (a)   Replacing the liner at the conduit A

Procedure
1   Remove the conduit A from the wire buffer and the split box.
2   Remove the side CMP piece as shown in Fig. 5.4.5 (b) with a spanner.
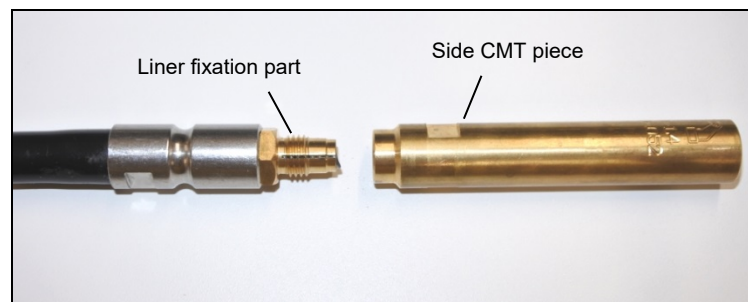
Fig. 5.4.5 (b)   Side CMT piece and liner fixation part

3   Pull out the fixation part and the liner. If the liner cannot be removed from the fixation part, rotate it to the right screw direction.
4   Insert the new liner and the fixation part into the conduit A. Pass it until they adhere to the opposite side edge.
5   Cut the liner at the fixation part edge. Remove burr of the inside and the outside.
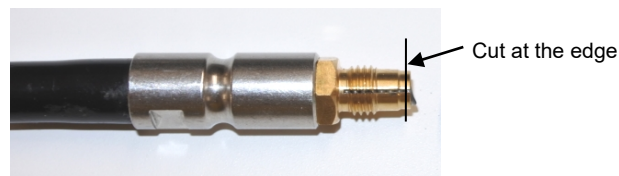
Fig. 5.4.5 (c) Liner cutting position

6   Attach the side CMT piece, then fix the liner.
7   Attach the conduit A to the wire buffer and the split box.
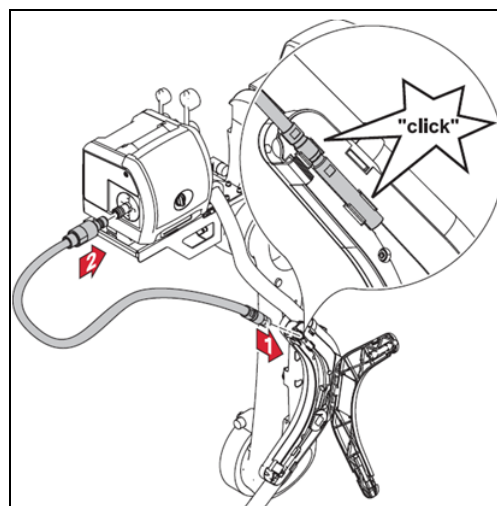
Fig. 5.4.5 (d) Conduit A installation

- 131 -

Operation 5-4-5 (b)   Replacing the liner of the conduit B

Procedure
1   Remove the conduit B from the wire buffer and the wire feeder.
2   Remove the clamping nut in Fig.5.4.5 (e). Then remove the liner fixation part.
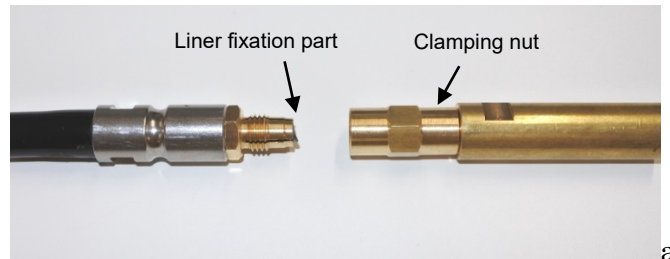
Fig. 5.4.5 (e) Clamping nut and the liner fixation part

3   Remove the DFS coupling. Then remove it with the option clamp.
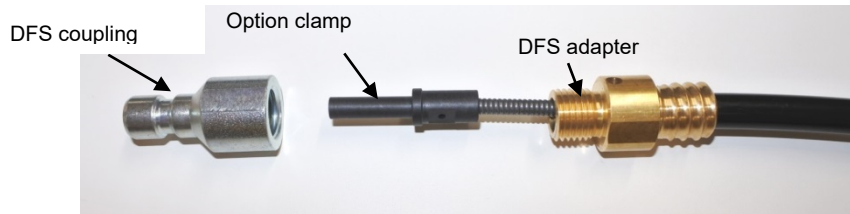
Fig. 5.4.5 (f) DFS coupling and the option clamp

4   Press the liner by hand.   Rotate the option clamp to the right screw direction and remove it. There is a tap inside the option clamp.
5   Insert the new liner into the conduit B. Then tighten the option clamp to the liner. During seeing the option clamp hole, insert the liner to the option clamp back.
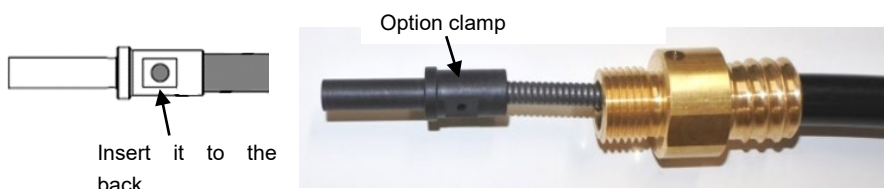
Fig. 5.4.5 (g) Installation of the option clamp

6   Attach the DFS coupling to the DFS adapter.
7   Attach the liner fixation part to the liner opposite side. Then cut the liner at the fixation part edge. Remove burr of the inside and the outside.

Fig. 5.4.5 (h) Cutting positon of the liner

8   Attach the clamping nut. Then fix the liner.
9   Attach the conduit B to the wire buffer and the wire feeder. Check that the plastic liner for the wire buffer is installed to the tab of the lever.
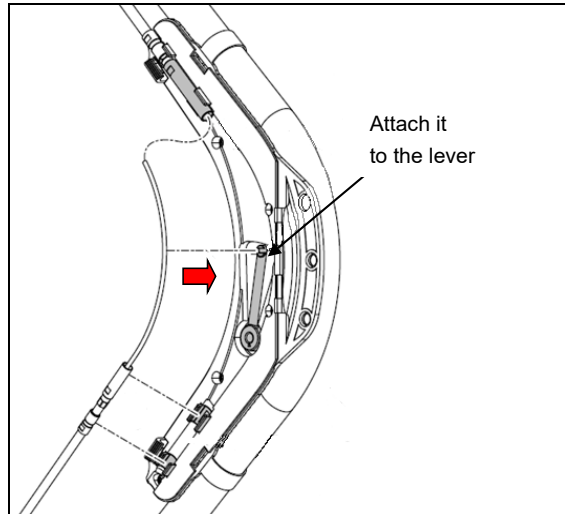
Fig. 5.4.5 (i) Installation of the plastic liner

Operation 5-4-5 (c)   Assembly of the joint

Procedure

1   The joint installed to the conduit A and B is composed by the DFS coupling, the guide piece, the option clamp and the DFS adapter.

DFS coupling   Guide piece/ option clamp   DFS adapter
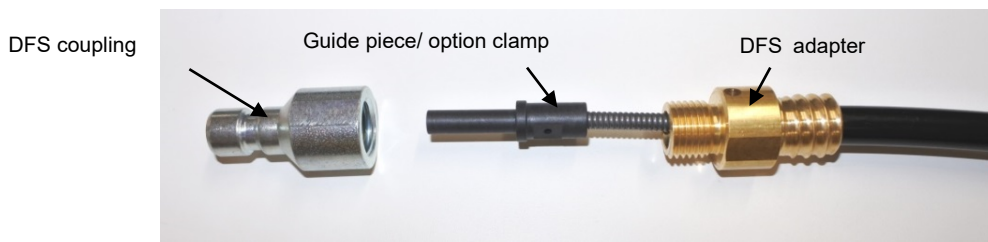
Fig. 5.4.5 (j) Joint of the conduit A and B

2   Attach the DFS adapter to the wire feed hose. From the adapter hole, check the wire feed hose is in the hole center surrounding.

Wire feed hose

Fig. 5.4.5 (k) Installation of the DFS adapter

3   Attach the guide piece to the conduit A. Attach the option clamp to the conduit B. Tighten the liner to the option clamp back.

Option clamp   Guide piece
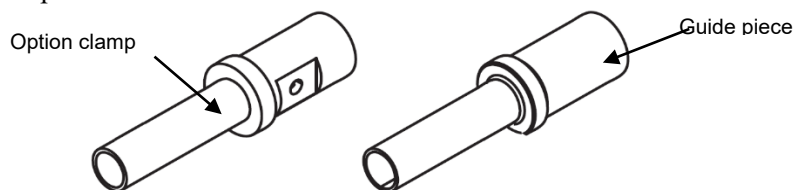
Fig. 5.4.5 (l) Option clamp and guide piece

4   Attach the DFS coupling to the DFS adapter.

Operation 5-4-5 (d)   Replacing the plastic liner

Procedure
1   Remove the flexible conduit B from the wire buffer.
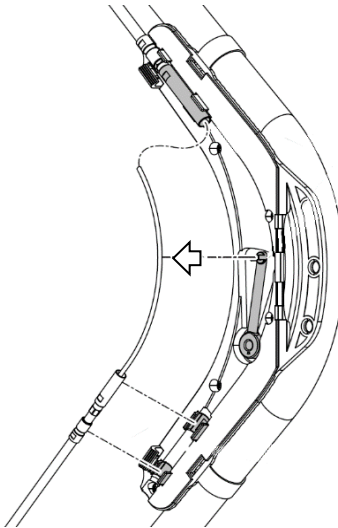
Fig. 5.4.5 (m) Desorption of the conduit B

2   Remove the clamping piece CMT from the clamping nut.
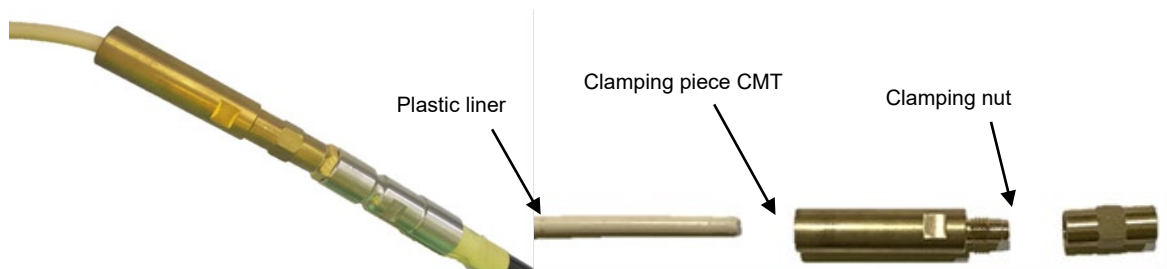
Fig. 5.4.5 (n) Clamping piece CMT and the clamping nut

3   During rotating the plastic liner to the right screw direction, remove it from the clamping piece CMT.
4   During rotating the new plastic liner to the right screw direction, tighten it to the clamping piece CMT. Match the edge of the plastic liner and the clamping piece CMT.
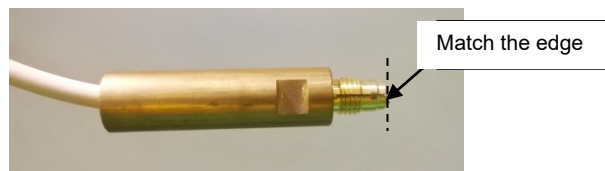
Fig. 5.4.5 (o) Installation of the plastic liner

5   Attach the clamping piece CMT to the clamping nut. Then attach the flexible conduit B to the wire buffer.

- 134 -

Operation 5-4-5 (e)   Replacing the torch cable liner

Procedure

1   Remove the conduit A from the split box backside.
2   Remove the liner from the split box.
3   Prepare a new liner.
4   According to Fig. 5.4.5 (p), insert the liner till it hit the Robacta drive.
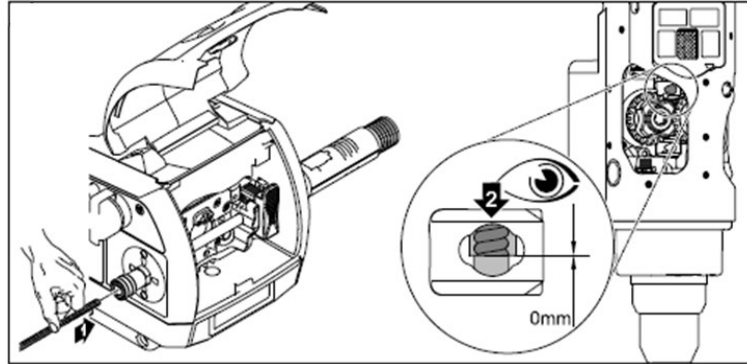
Fig. 5.4.5 (p) Replacing the torch cable liner

5   According to Fig. 5.4.5 (q), insert the fixture to liner form the split box backside.
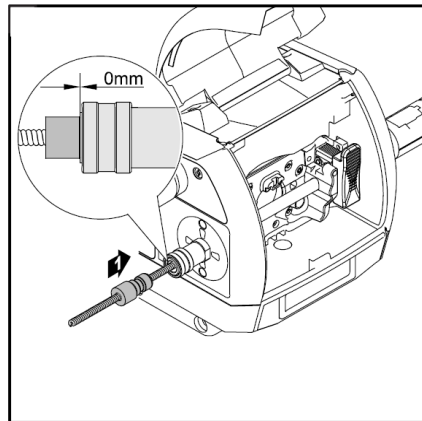
Fig. 5.4.5 (q) Fixture installation

6   Cut the liner at the fixture edge. Then remove the burr of the inside and the outside.

Operation 5-4-5 (f)　　　Replacing the liner of the wire feeder connection joint

Procedure
1　Remove the conduit B from the wire feeder.
2　Pull out the liner from the wire feeder connection joint.
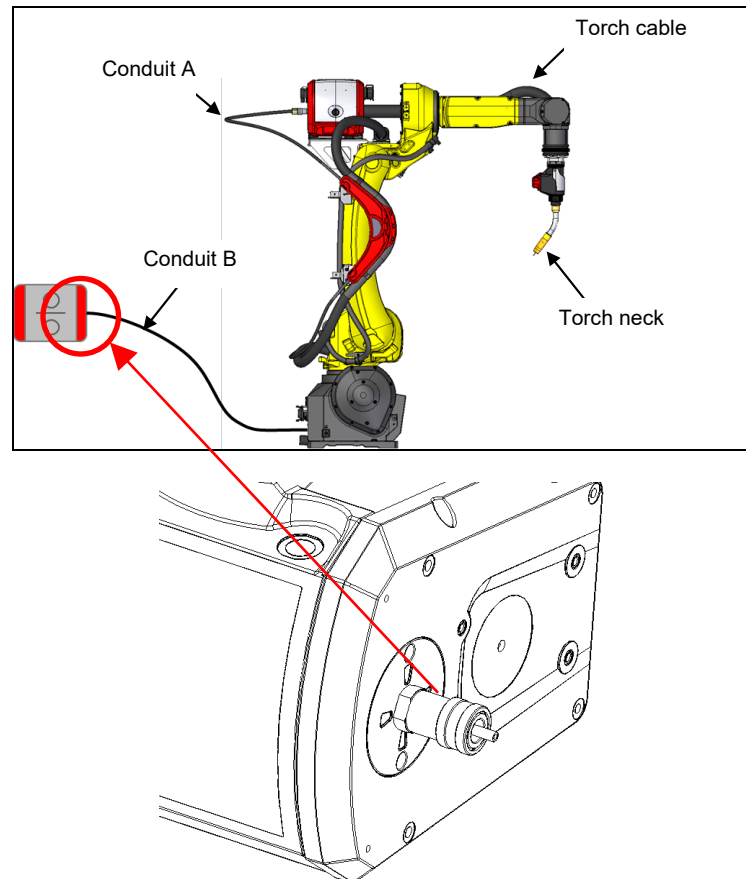
Fig. 5.4.5 (r) Replacing the liner of the wire feeder connection joint

3　Insert the new liner (Liner A for aluminum : A14L-0195-0040#00010533), then cut the liner with a special fixture and the nipper so that it length becomes about 80mm.
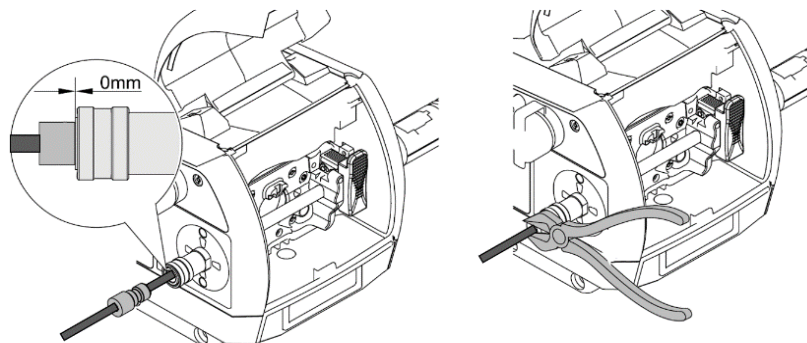
Fig.5.4.5 (s) Liner cutting position

4　Attach the conduit B on the wire feeder.

5.4.6   Gas saver nozzle

1   Turn off power of the welding power supply.
2   According to Subsection 5.2.1, remove the torch neck from the Robacta drive.
3   According to Fig. 5.4.6 (a), insert the torque drive (appendix) to the center hole of the Robacta drive.
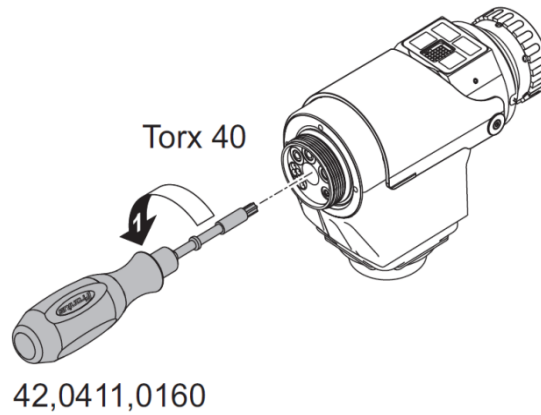
Fig. 5.4.6 (a) Use of the special torque driver

4   Rotate the torque driver. Then remove the front liner guide tube.
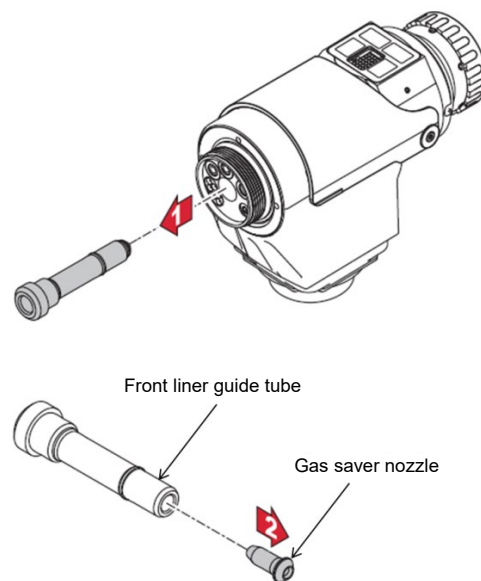
Fig. 5.4.6 (b) Removal of the front liner guide tube

5   Check there is no crack, damage or dirty part on the front liner guide tube.
6   Remove the gas saver nozzle. Then clean the front liner guide tube. Insert the new gas saver nozzle to the front liner guide tube. Then push it until the edge hits the surface.
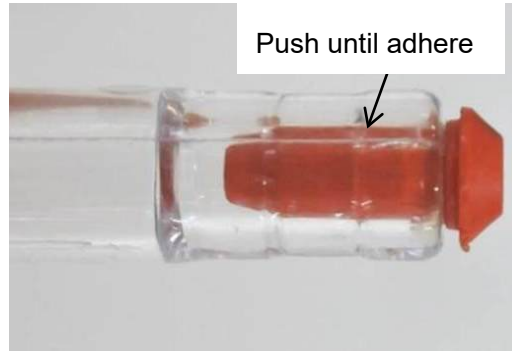
Fig. 5.4.6 (c)   Installation of the gas saver nozzle

⚠ **CAUTION**
    If the gas saver nozzle installation is insufficient, it might interfere with the feed roller during operation.

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7   Check the gas saver nozzle was not pulled out easily. Install the front liner guide tube to the Robacta drive with q toque driver. Tighten till clicking sound is generated by the torque driver.
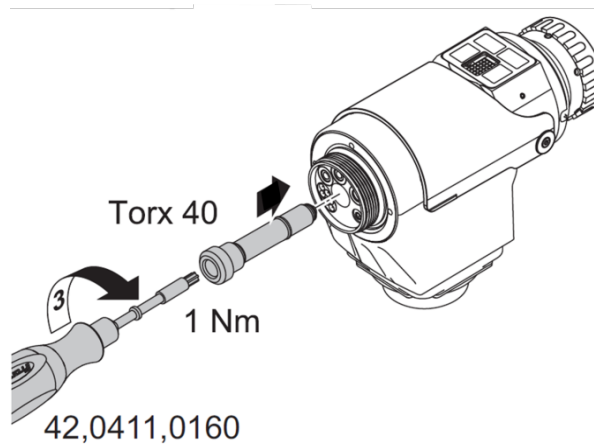
Fig. 5.4.6 (d) Installation of the front liner guide tube

8   Install the torch neck.

5.4.7   Lear liner guide tube

1   According to Section 7.4, remove the Robacta drive from the torch cable.
2   According to Fig. 5.4.7 (a), remove the guide tube.
3   Attach the new part. Tighten it wit torque of 1.0Nm with a torque drive of the appended.

Torx 40 / 1Nm
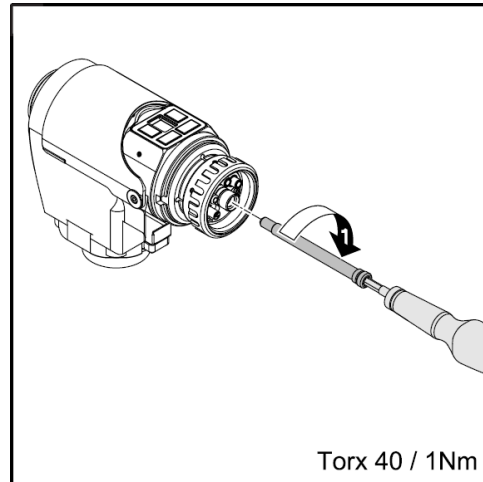
Fig. 5.4.7 (a) Replacing the guide tube

5.4.8   Feed roller (Robacta drive)

Operation 5-4-8 (a)   Replacing the drive roller

Procedure
1   Prepare the appended 5.0Nm torque driver.
2   According to Fig. 5.4.8 (a), insert the torque drive to the drive roller. Then remove the roller.
     At this time, push the drive roller side button and fix the roller rotation.
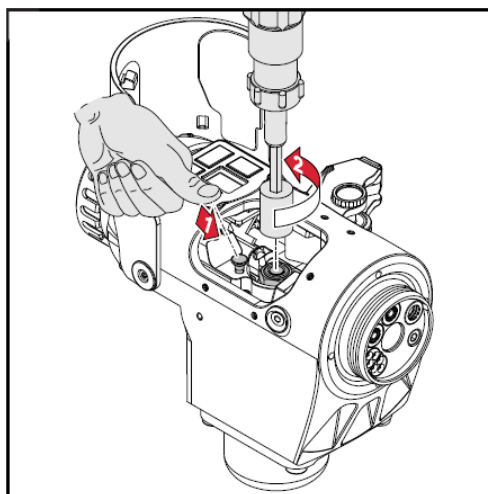
Fig. 5.4.8 (a) Replacing the drive roller

3   Replace the drive roller. Fix the roller by the reversed sequence. Tighten it with torque of 5.0Nm.

Operation 5-4-8 (b)   Replacing the follow roller

Procedure
1   Pull out the tip of the follow roller adjustment lever. Then lay it down to the torch neck side.
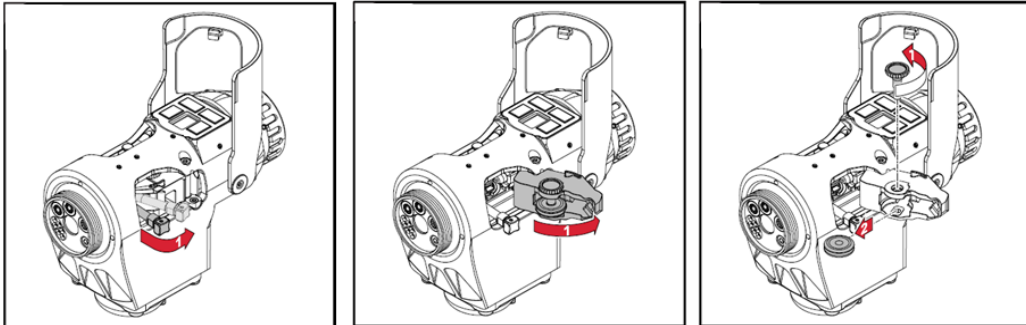
Fig. 5.4.8 (b) Replacing the follow roller

2   Loosen the screw and replace the follow roller. Then fix it with a screw.

5.4.9   Feed roller (Wire feeder)

1   Turn off the power switch of the welding power supply.
2   Open the wire feeder cover.
3   Lay down the pressure adjustment lever to lower side. (See Fig. 5.4.6 (a))
4   According to Fig. 5.4.9 (a), pull out the pin and remove the follow roller.
5   Attach the new follow roller. Attach the pins to the original position.
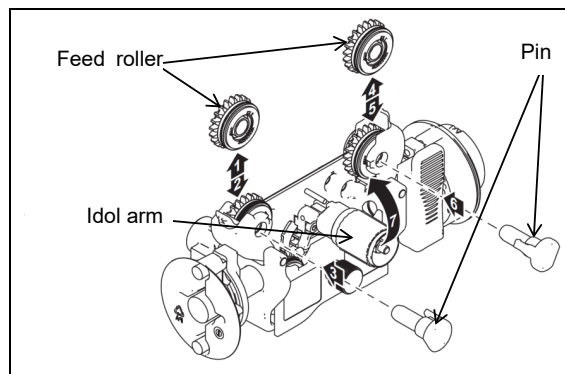
Fig. 5.4.9 (a) Replacing the roller

6   Loosen the knob of the plate center as shown in Fig. 5.4.6 (b). Then remove the plate.
7   Remove the wire guide. Then remove the two drive roller.
8   Attach the new drive roller and the wire guide.
9   Attach the plate again. Then tighten the knob.
10   Adjust the roller pressure.
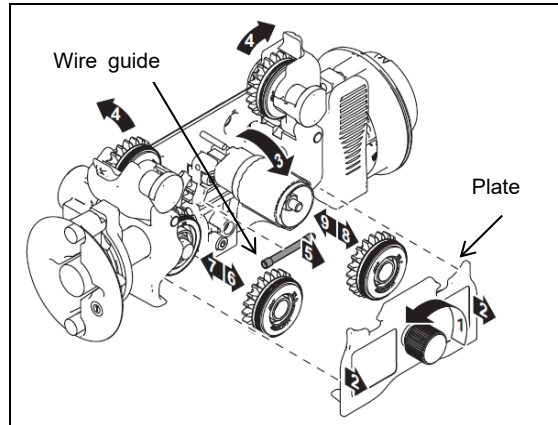
Fig. 5.4.9 (b) Replacing the roller

5.4.10   Coolant

> ⚠ **CAUTION**
> 1   The coolant gradually change to acidic. If the coolant is not replaced for a long time, there is possibilities that the welding power cable bronze corrosion or water vapor intrusion into the Robacta drive due to the water stop valve deterioration occurred.
> 2   Replacing interval differs depending on the coolant kinds and operating time as the following.
>   ➢ Normal coolant (A14L-0195-0040#00090046) : 1 year for 8 hours/day,   6 months for 24 hours/day
>   ➢ FCL10 (A14L-0195-0040#00090180)   :2 years for 8 hours/day,   1 year for 24 hours/day

1   Prepare a container for waste liquid.
2   Turn off the welding device. Then shut down the primary power.
3   Remove the cooling unit side panel.
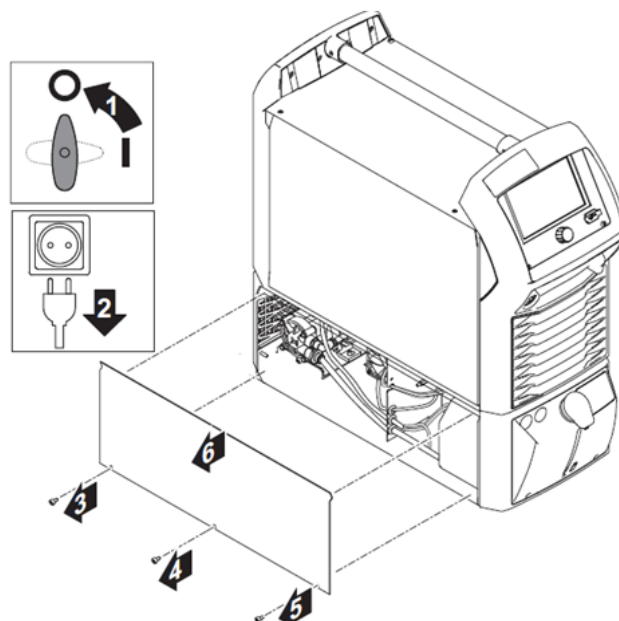
Fig. 5.4.10 (a) Replacing the coolant

4   According to Fig. 5.4.10 (b), remove the tube connected to the pomp from the coolant tank.

⚠**CAUTION**
Water will come out when removing the tube. So protect the surrounding with
waste cloth etc. and prepare to close the tube tip immediately.

Remove the joint from the hose. Water
will leak. So cover the surrounding
with waste cloth and close the hose
immediately with a finger.
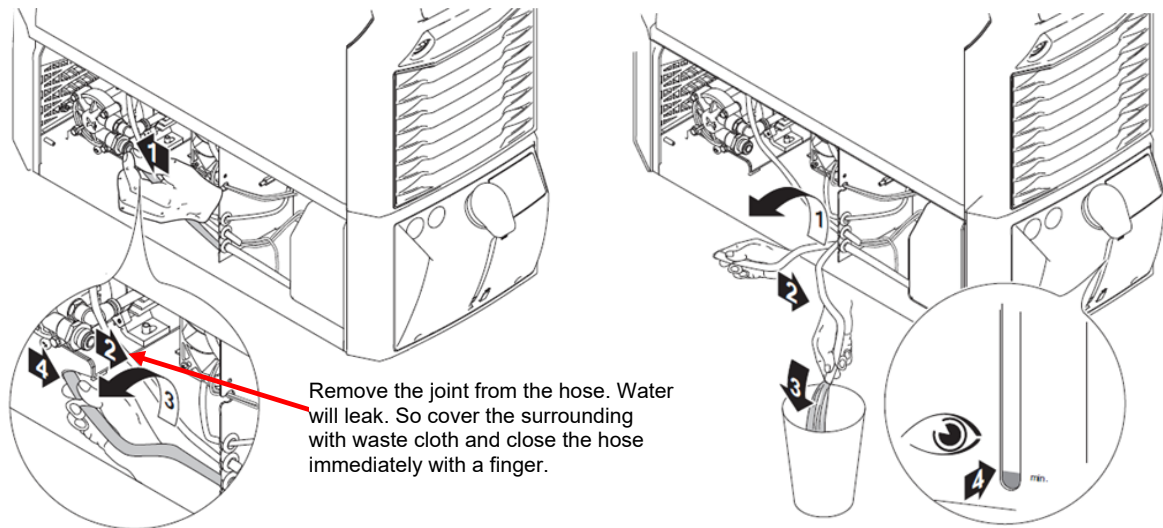
Fig. 5.4.10 (b) Replacing the coolant

5   Insert a hose to the container. Wait until coolant discharge finished.
6   Insert the tube to the joint again. Then check the fixation.
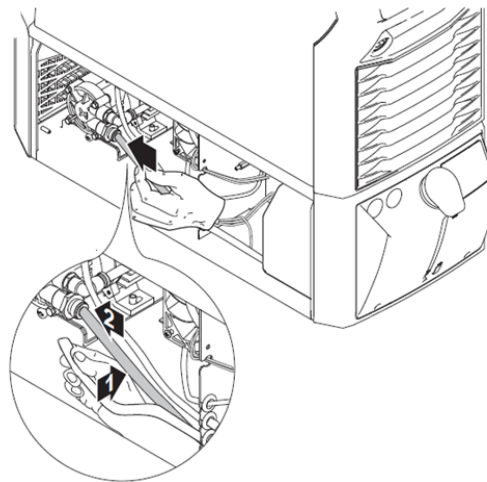
Fig. 5.4.10 (c) Replacing the coolant

7   Remove the blue joint connection of the water cooling unit backside. Push the joint center with a thin stick and open the valve.
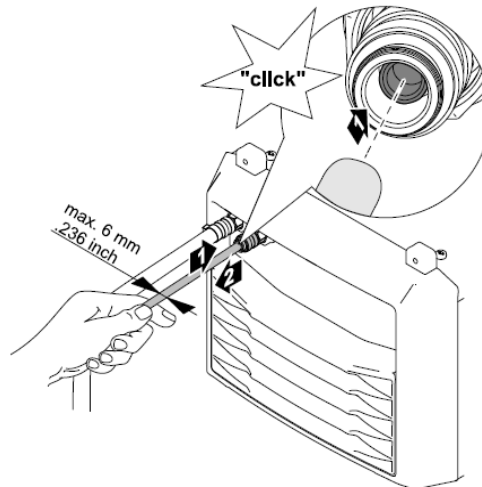
Fig. 5.4.10 (d) Replacing the coolant

> **NOTE**
> When supplying coolant without opening the valve, there is a possibility that the pomp is not filled by water and alarm occurs.

8   Open the tank lid of the water cooling unit front. Supply the coolant to the "max" scale.
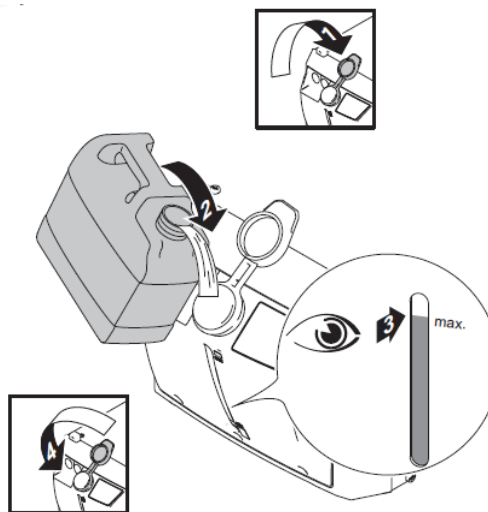
Fig. 5.4.10 (e) Replacing the coolant

9   According to Fig. 5.4.10 (f), return the valve opened at procedure 6 to its original state.
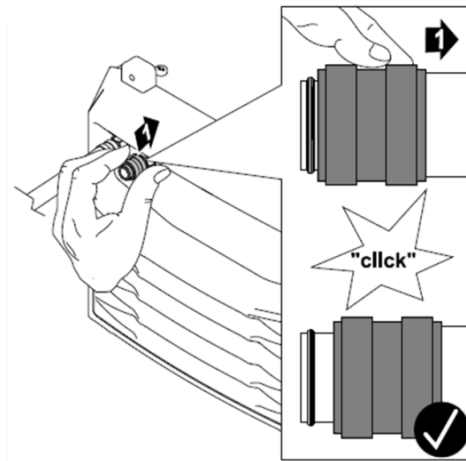
Fig. 5.4.10 (f) Replacing the coolant

10 Check there is no water leak at the water cooling unit inside and surroundings, and make the side panel to the original position.
11 Connect the hose pack.
12 Turn on the welding power supply power. Then select the panel of the power supply front by order of Fig.5.4.10 (g).
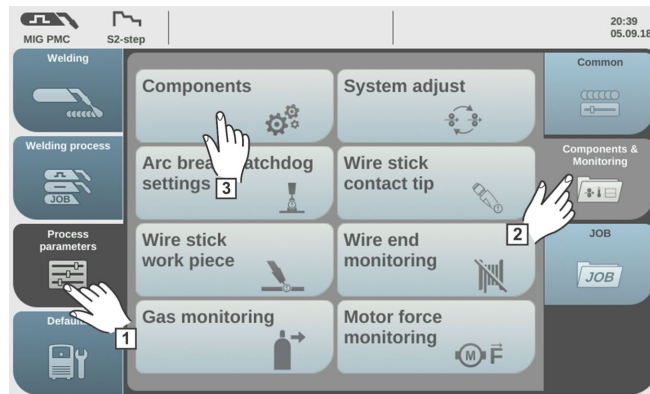
Fig. 5.4.10 (g) Replacing the coolant

13 Push the dial on the panel at "Cooling Unit mode" and change the mode to "ON" by rotating the dial. Then operate the pomp 1 minutes.
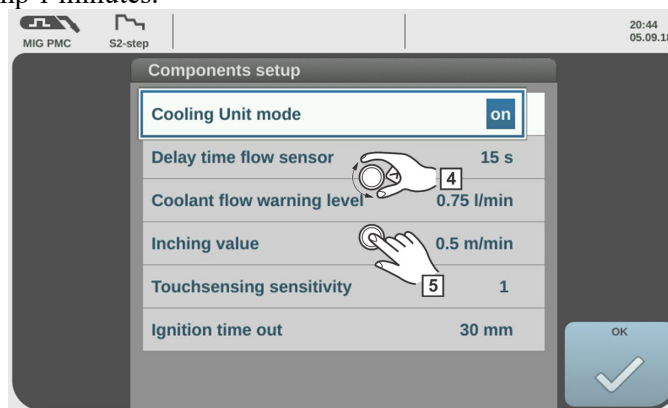
Fig. 5.4.10 (h) Replacing the coolant

14 Check the water come to the water cooling unit front tank normally. Then close the tank lid.

> **NOTE**
> According to each law and ordinance, discard the discharged coolant.

5.5   PROGRAM BACK-UP

Usually, programs are stored in the memory internal to the robot controller. Even when the power is turned off, this memory is powered by a battery so that information stored in the memory is not lost. However, it is recommended to back up programs stored in the memory, considering an accidental damage to the memory or battery life expiration. Moreover, when a modification is to be made to a taught program, it is recommended that the program be backed up before and after the modification. By backing up programs in this way, a program or position data lost by an incorrect operation can be restored.

You can use "Flash ATA memory Card".

About backup, please refer to Subsection 6.3.2 Acquisition of All Backup, 6.3.3 Acquisition of Image Backup and Section 8.4 SAVING FILES in OPERATOR'S MANUAL (Basic Operation) (B-83284EN).

> ⚠ **CAUTION**
> Flash ATA memory card.
> In order to protect against accidental loss of data from a flash ATA memory card, it is recommended to back up the files of the flash ATA memory card to another medium such as a memory card.

6   TROUBLE SHOOTING

6.1   TROUBLE SHOOTING ABOUT ALARM

6.1.1   Error code for Fronius TPS/I welding power supply

This section describe about Fronius TPS/i welding power supply major error code and remedy.
You can refer to the error codes from the front panel of the power supply main body according to Subsection 6.3.1

Error 5 Torch body identification not possible.	
[Cause]	It is communication error between the electrical circuit inside the welding torch and the welding power supply.
[Remedy 1]	Turn off the welding power supply switch and desorb the welding torch. According to the figure below, confirm that there is no dirt or contamination intrusion at the connector of the welding torch.
[Remedy 2]	Turn off switch of the welding power supply, and then replace the welding torch.
[Remedy 3]	If the error does not disappear, between the welding torch and the welding power supply may have problem. Check the connector tightness and abnormality of the Robacta drive, the torch cable and the split box. If you cannot recover, contact your local FANUC representative.

Connector

Fig. 6.1.1(a)   Error-5

Error 14 Selected process/synergic line will not work with the connected feed system.	
[Cause]	If selected welding mode is not applicable for present welding system, this alarm will be displayed. If this error occurred suddenly and welding cannot be performed, it might be communication failure between the equipment, especially the wire buffer related parts defective.
[Remedy 1]	According to Subsection 6.3.1, check the error history of the welding power supply and the robot. If there are other errors related to communication, perform countermeasure for the error.
[Remedy 2]	According to Fig. 6.1.1(b), check the abnormality of the cable connection between the wire buffer cable and the split box.
[Remedy 3]	If error occurs frequently, it might be failures of the wire buffer or the split box. Contact your local FANUC representative.

Error 382 Invalid pc-board detected.	
[Cause]	It means failures of the main board in the welding power supply.
[Remedy 1]	It might be failures of the welding power supply. Contact your local FANUC representative.

Error 439	Wire feeder not ready or connected.
[Cause]	It is communication error between the welding power supply and the wire feeder or the Robacta drive. It might occur secondary with errors associated with the wire feeder.
[Remedy 1]	Check the tightness of the SpeedNet cable connection.
[Remedy 2]	According to Subsection 6.3.1, check the error history of the welding machine and the robot, If other errors concurrent, perform countermeasure for the error. If error 16711 occurs at the same time, replace the expendables such as the neck liner and the contact tip. If the error reoccurred, change the robot motion at the before welding start, suppress the wire buffer vibration. Prevent suddenly change of the wire slack in the wire buffer.
[Remedy 3]	If error reoccurred, There is a failure at the machine as shown in Fig. 6.1.1 (b). It caused communication failure. Contact your local FANUC representative.
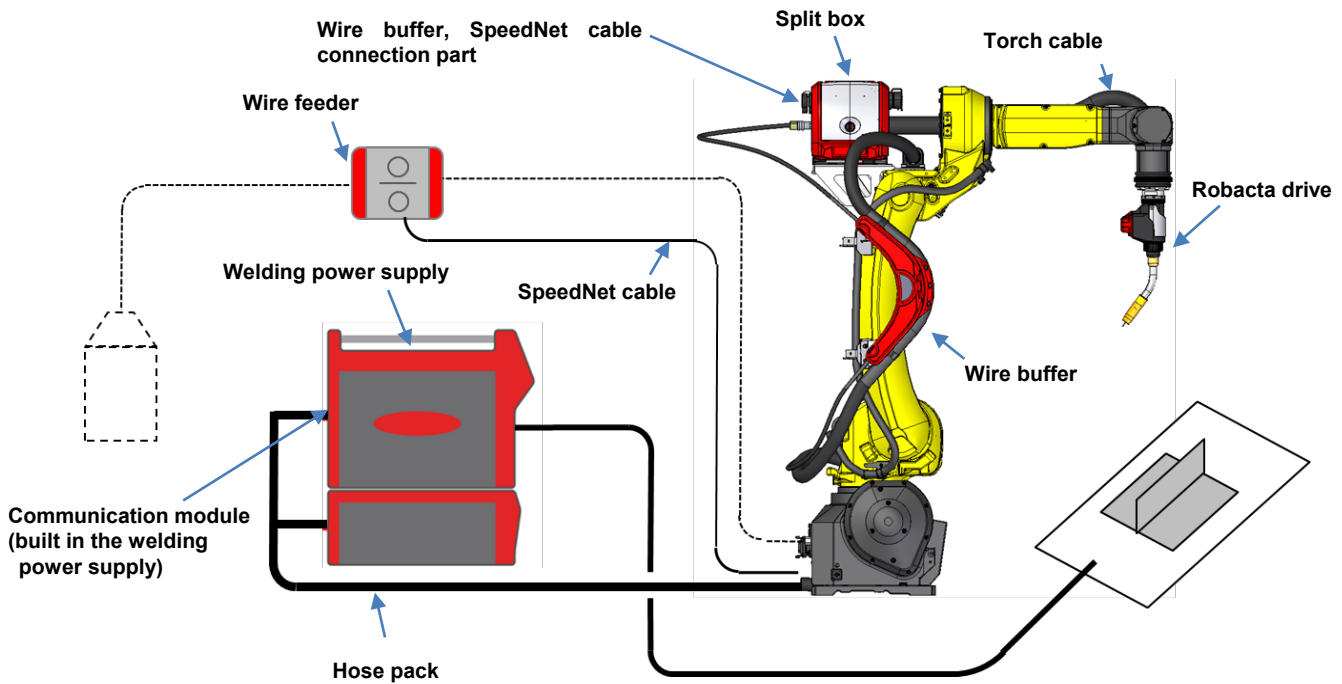
Fig. 6.1.1(b) Places which might cause communication jamming

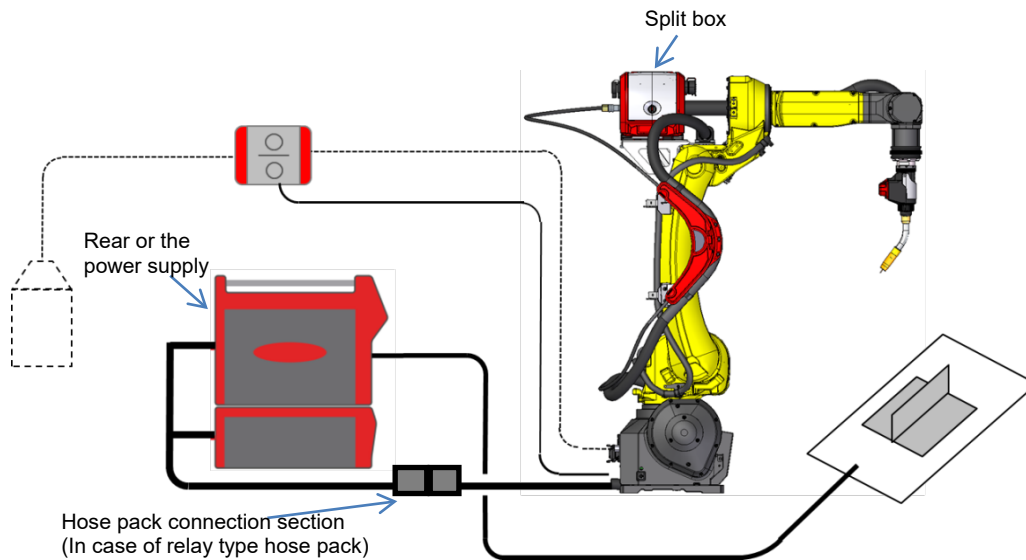| Error 560	Ignition timeout. No current flow detected within the set wire length.
[Cause]	When staring the welding, arc was not generated during inching of the specified distance wire inching.
[Remedy 1]	On the robot teach pendant, select the [MENU] key →[SETUP]→[Weld Equip], Increase the value of the arc start maximum feed. If the values are 0, this alarm will not occur even if the arc is not generated.
[Remedy 2]	Check the poor continuity at the following parts. Contact tip /torch cable/welding power cable connector / Power supply part to fixtures and the workpiece
[Remedy 3]	Check there is no abnormality on the wire feeding.
[Remedy 4]	According to Subsection 6.3.1, check the error resume of the welding power supply and the robot. If others errors occurred, perform the countermeasures
[Remedy 5]	It there is no other errors, confirm the followings. Check that the wire feed and gas purge If you cannot perform wire feeding correctly, replace expendables such as the contact tip, the neck liner, the torch liner and the feed roller. Check the tightness of connectors such as the SpeedNet cable. Perform the R/L adjustment. If the value is larger than the following standard value several time, it might be poor continuity. Criterion at the R/L adjustment R: 10mΩ or less L: 20μH or less
[Remedy 6]	If the error reoccurred, failure of the any device in Fig. 6.1.1 (b) might cause communication inihibition. Contact your local FANUC representative.

Split box

Rear or the
power supply

Hose pack connection section
(In case of relay type hose pack)

Fig. 6.1.1(c)   Check points of the welding power cable connector

Error 6577	Main switch got turned off.
[Cause]	This alarm occurs when turning off power. If this alarm occurred when turning off power, it is not normal.
[Remedy 1]	If the error occurs when turning on power, check the input voltage to the welding machine is normal.
[Remedy 2]	If you cannot solve the problem by the remedy 1, the welding power supply is defective. Contact your local FANUC representative.

Error 6715	Intermediate circuit under voltage.
[Cause]	Undervoltage was detected at intermediate circuit of the welding power supply.
[Remedy 1]	Check that the input voltage to the welding power supply is normal.
[Remedy 2]	If you cannot solve the problem by remedy 1, the welding power supply is defective. Contact your local FANUC representative.

| Error 7156	Earth current detected. Possible dangerous Voltage on power source casing
[Cause]	More than 8A current was detected at the primary power earth by the current sensor inside the welding power supply. If this error occurs during welding, there may be a problem at the welding power cable connection. If this error occurred during except the welding, it might be equipment side problem. In addition, Short-circuit of the power supply secondary side circuit occurred due to reason such as water leak, this error might occur by malfunction of the electrical current sensor.
[Remedy 1]	Check that the connection at surrounding of the minus side welding power cable.
[Remedy 2]	In case of water cooling specification, check that there is no water leak at each part.
[Remedy 3]	The housing of the welding power supply does not conduct to the trestle etc.
[Remedy 4]	Remove only the primary power cable earth (GND). Then start the welding power supply. If the error does not occur, check and correct the facility side earth.
[Remedy 5]	If you cannot solve the error, the welding power supply is defective. Contact your local FANUC representative.
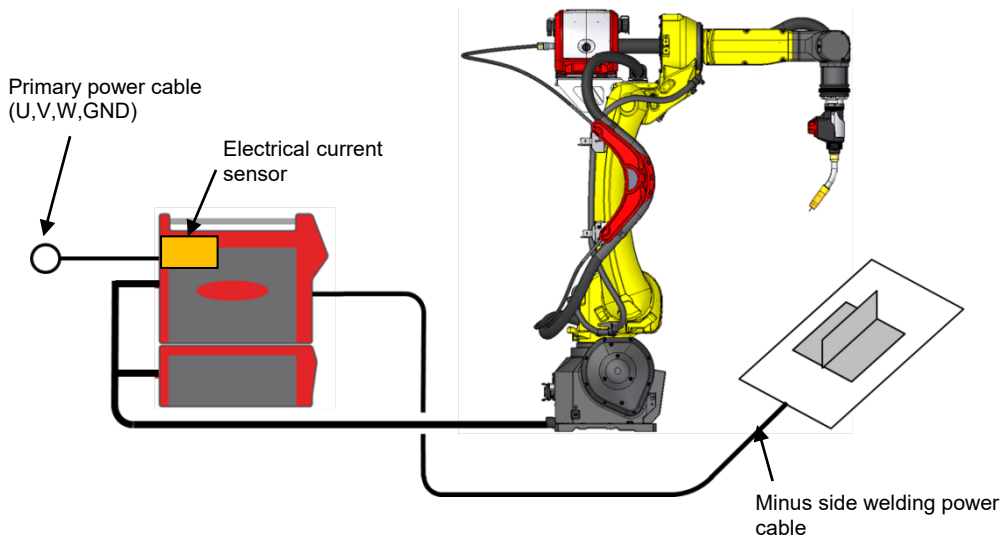
Fig. 6.1.1(d)   Error-7156

Error 7415   Power module initialization failed.

[Cause] When starting the welding power supply, initialization of the internal board failed.
          This error might occur due to the communication error between welding machines secondary.
 	
[Remedy 1]   According to Subsection 6.3.1, check the error history of the welding power supply and the robot.
               If other errors related to the communication, perform remedies for them.
[Remedy 2]   If you cannot solve the problem by remedy 1, the welding power supply is defective. Contact your local
               FANUC representative.

Error 9649   Arc break detected. Maximum arc break time was exceeded.
[Cause] Arc break was detected by the arc break watchdog function. [Remedy 1]   According to operation 6-1-1, adjust the arc break watchdog setting. [Remedy 2]   As with error 560, improve the arc start.

Operation 6-1-1   Arc break watchdog setting

Arc break watchdog function detect arc break by the welding power supply and stop operation by error.

1   Operate the front panel of the welding power supply, open "Arc break watchdog".

Fi. 6.1.1(e)Setting screen 1   **Fig. 6.1.1(f) Setting screen 2**
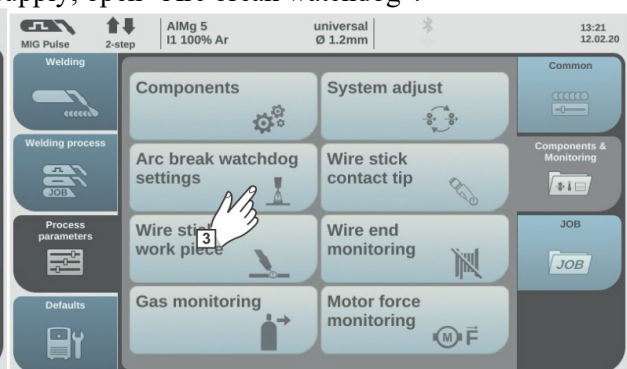
2   If the reaction of the arc loss is "ignore", change it to "error".
3   If the arc loss time is more than 0.1 second, change it to 0.1 second.
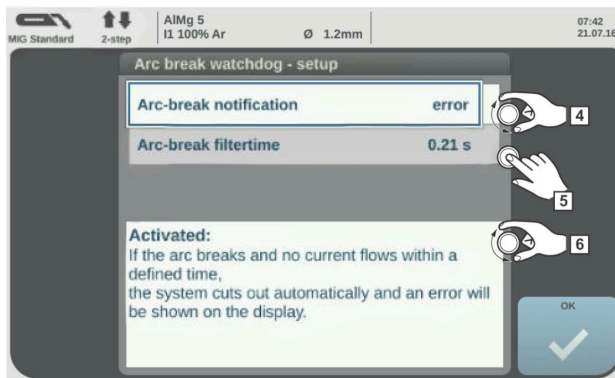
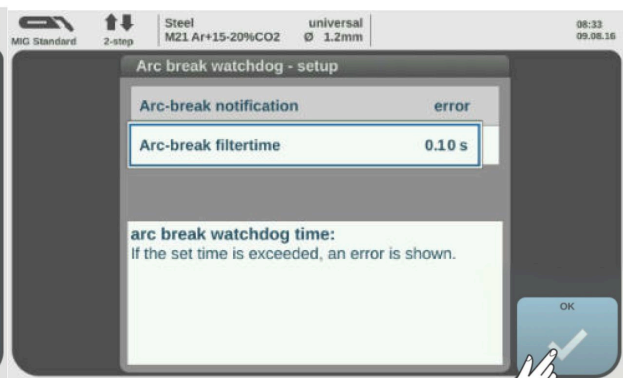**Fig. 6.1.1(g) Setting screen 3**   **Fig. 6.1.1(h) Setting screen 4**

4   By reducing the setting time, the arc loss detection sensitivity will decrease. However, false detection will increase, too. Adjusting the arc break watchdog may be necessary for each system.

Error 16684	Reading of motor Device-ID failed.
[Cause]	It is a communication error with the wire feeder or he Robacta drive motor.
[Remedy 1]	Check the connection status and damage of the torch cable, the SpeedNet cable and the hose pack.
[Remedy 2]	If you cannot restore, the machine between the welding power supply to the wire feeder/Robacta drive is defective as shown in Fig. 6.1.1 (i). Contact your local FANUC representative.

Error 16694	Motor supply voltage out of range.
[Cause]	The voltage supplied to the wire feeder or the Robacta drive motor exceeded the threshold.
[Remedy 1]	Check the connection status and damage of the torch cable, the SpeedNet cable and the hose pack.
[Remedy 2]	Check there is no problem on the primary power supply wiring to the welding power supply and the facility side problem.
[Remedy 3]	If you cannot restore, the machine between the welding power supply to the wire feeder/Robacta drive is defective as shown in Fig. 6.1.1 (i). Contact your local FANUC representative.
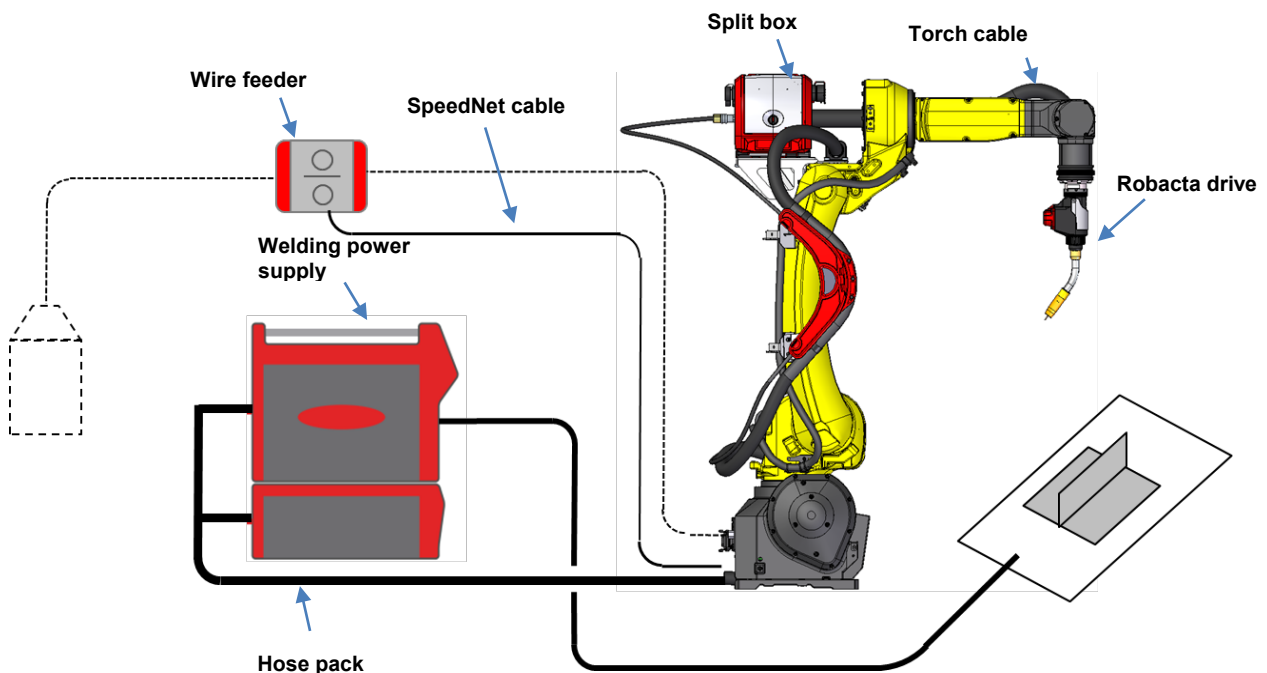
Fig. 6.1.1(i)   Error-16684

Error 16700	Loss of data between torch and motor controller.
[Cause]	There is a problem on the torch cable communication. Date forwarding between the Robacta drive and the split box failed.
[Remedy 1]	Check the connection of the torch cable, the Robacta drive and the split box.
[Remedy 2]	If you cannot recover it. The torch cable, the Robacta drive or the split box might be defective. Contact your local FANUC representative.

Error 16705	Rotor adjustment failed.
[Cause]	If calibration of the wire feeder is not performed after replacing the Robacta drive or the wire feeder, it rarely occurs. In addition, when turning on the welding power supply, the wire feeder diagnose function will operate automatically. If the feed roller does not move correctly, this error will occur.
[Remedy 1]	According to operation 2-1-6, perform the calibration of the wire feeder.
[Remedy 2]	Check there is no biting of contaminations or interference on the feed roller. Replace the expendables such as the flexible conduit, the torch liner, the neck liner, the contact tip and the feed roller. Then check the wire feed resistance does not increase. Then check that the wire feed resistance does not increase.
[Remedy 3]	Remove the pressure adjustment lever of the wire feeder and the Robacta drive. Then cycle power of the welding power supply. If the status is restored by this operation, the wire feed resistance may be too large. Replace the expendables such as the flexible conduit, the torch liner, the neck liner, the contact tip and the feed roller.
[Remedy 4]	If you cannot recover, there may be a bad connection of the cables or bad communication due to deterioration. Check the cable connection.
[Remedy 5]	If you cannot recover by remedy 4, the torch cable or the Robacta drive or the split box or the wire feeder or the SpeedNet cable is defective. Contact your local FANUC representative.

Error 16707	Lost connection between welding torch and wire feeder during welding process.
[Cause]	It is communication error between the Robacta drive and the split box. The main board inside the Robacta drive might be defective or contact failure of the torch cable might be the cause.
[Remedy 1]	Check the connection of the torch cable and the Robacta drive and the split box.
[Remedy 2]	If you cannot recover, the torch cable or Robacta drive or the split box might be defective. Contact your local FANUC representative.

Error 16711	Error on the wire feed system. The deviation from the set wire feed speed to the real value is to much.
[Cause]	The difference of the command value and return value of the wire feed speed is too large. Excessive wire feed resistance, bad feeding or abnormal communication between welding machines cause this error.
[Remedy 1]	Replace the expendables such as the flexible conduit, the torch liner, the neck liner, the contact tip and the feed roller. Then check the wire feed resistance does not increase.
[Remedy 2]	According to error 16825/16826, perform remedy for wire feed problem.
[Remedy 3]	According to Error 439 in this manual, perform countermeasure to the communication failure.

Error 16766	Faulty data transmission between power source and wire feeder on SpeedNet.
[Cause]	Data forwarding between the welding power supply and the welding machine failed.
[Remedy 1]	According to Error 439 in this manual, perform countermeasure to the communication failure.

Error 16767	Bad quality of SpeedNet Connection.
[Cause]	A communication problem occurred between the welding machine and the welding equipment.
[Remedy 1]	According to Error 439 in this manual, perform countermeasure to the communication failure.

Error 16813	Issue with Option connected to "sensor port 1"; Device ID fault.
[Cause]	It is wire buffer communication alarm.
[Remedy 1]	Check the abnormality of the wire buffer cable and connectors.
[Remedy 2]	If error occurs frequently, the wire buffer or the split box might be defective. Contact your local FANUC representative.

Error 16825	Wire buffer full.
[Cause]	Slack in the wire buffer became larger, and then the lever in the wire buffer swing to the outside of the wire buffer curve. If the wire feeding suddenly stopped or much spatters are accumulated on the tip, they might cause this error.
[Remedy 1]	According to Subsection 6.3.1, check the error history of the welding power supply. If the other error occurred right before this error, ignore this error and perform the remedy for the other error.
[Remedy 2]	Check wire feeding operates normally, adjustment of the pressure lever is moderate and the feed resistance is not too large.
[Remedy 3]	Check there is no contamination biting or interference. Replace the expendables such as the flexible conduit, the torch liner, the neck liner, the contact tip and the feed roller. Then check the wire feed resistance does not increase.
[Remedy 4]	Check there is no poor continuity on the following parts. Welding torch/Contact tip/Welding power cable connector/Hose pack relay part /Power supply part to the fixture and the workpiece

Error 16826	Wire buffer empty.
[Cause]	Slack in the wire buffer became smaller, then the lever in the wire buffer swing to the inside of the wire buffer curve. If the wire feed stops during the welding, this error might occur.
[Remedy 1]	According to Subsection 6.3.1, check the error history of the welding power supply. If the other error occurred right before this error, ignore this error and perform the remedy for the other error.
[Remedy 2]	Check wire feeding operates normally, adjustment of the pressure lever is moderate and the feed resistance is not too large.
[Remedy 3]	Replace the expendables such as the flexible conduit, the torch liner, the neck liner, the contact tip and the feed roller.
[Remedy 4]	Check there is no poor continuity on the following parts. Welding torch /Contact tip /Welding power cable connector/Power supply part to the fixture and the workpiece

Error 16827	External motor (e.g. Pull Mig) not ready.
[Cause]	The weld start command is performed during the staring of the welding system. There is a possibility that the bad communication between the welding machines occurred.
[Remedy 1]	After starting the welding system, start the welding.
[Remedy 2]	According to error 439 in this manual, perform the remedy for poor conductive.

Error 17012	Low Coolant level detected.
[Cause]	In the water cooling unit pomp, the water lever of the coolant is low.
	When using the water cooling unit for the first time, circulation of the coolant is not performed enough, so this error might occur.
[Remedy 1]	Supply the coolant, change the water cooling unit operation mode to "ON" and operate the pomp for few minutes.
	To change the water cooling unit operation mode,　at the robot teach pendant select 「MENU」 key → 「SETUP」 →[Weld Equip], then change it to the cooling unit mode. Operate the pomp for few minutes, and then set the cooling unit mode the original setting.
[Remedy 2]	If water does not flow inside the hose, release the hose joint valve of the unit backside as shown in Fig. 6.1.1(j), bleed the air. Then perform remedy 1 again.
[Remedy 3]	When this error occurred with the normal operated system, the water cooling unit is defective. Contact your local FANUC representative.
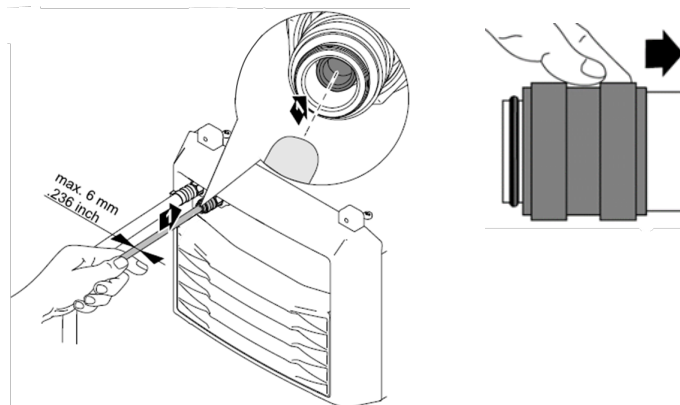
Fig. 6.1.1(j) Error 17012

Error 17015	Missing 24V supply of pump.
[Cause]	24V is not supplied to the water cooling unit pomp.
[Remedy 1]	According to Section 7.2, check the water cooling unit is correctly connected to the welding power supply.
[Remedy 2]	If you cannot recover, the water cooling unit is defective. Contact your local FANUC representative.

Error 17453	Level sensor was disconnected.
[Cause]	The water lever sensor in the water cooling unit tank is not connected.
[Remedy 1]	Check that the water cooling unit is correctly connected to the welding power supply.
[Remedy 2]	If you cannot recover, the water lever sensor is defective. Contact your local FANUC representative.

Error 17456	Low Coolant level
[Cause]	The coolant water level in the water cooling unit tank is low.
[Remedy 1]	Check there is no water leak at each part.
[Remedy 2]	Check the coolant water lever. If is low add the coolant.
[Remedy 3]	If you cannot recover, the water cooling unit is defective. Contact your local FANUC representative.

Open the tank lid, then supply the coolant.

Supply it to [max] scale. Then close the lid.
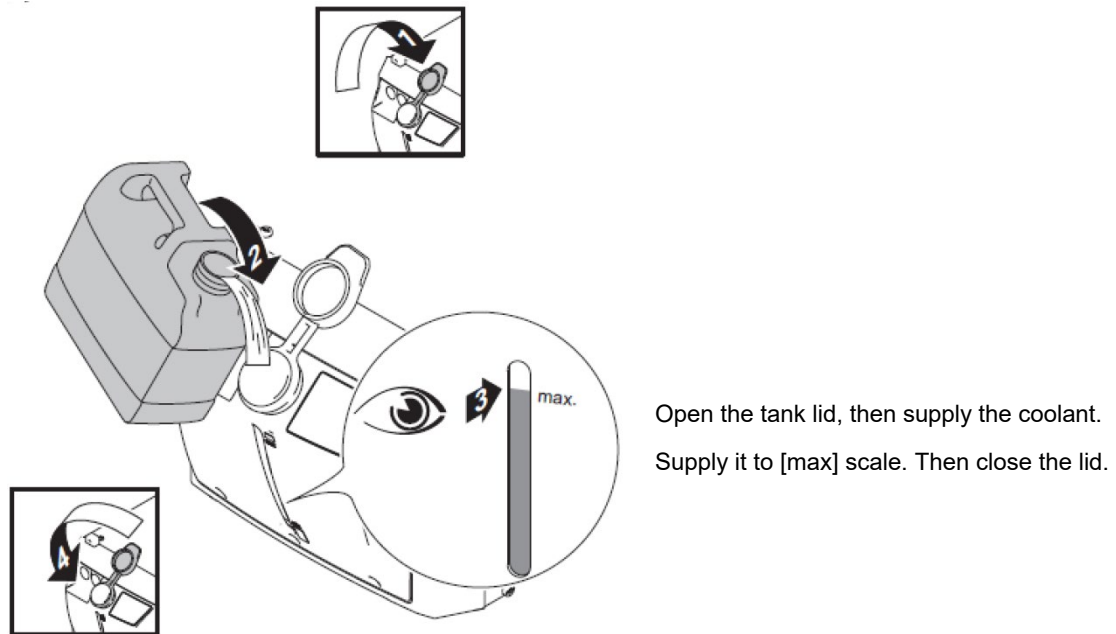
Fig. 6.1.1(k) Error 439

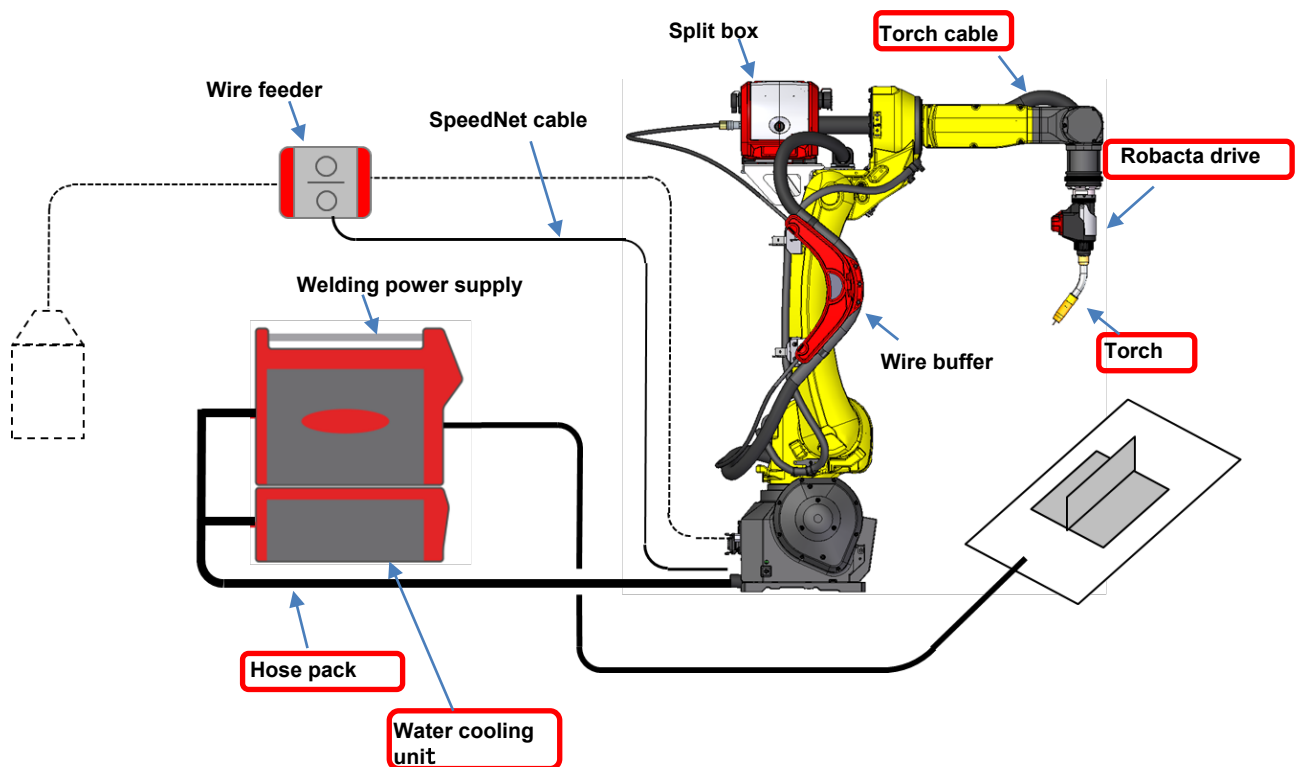| Error 17581 Coolant flow less than 0.7 liter/minute. |
|---|
| [Cause]   Coolant flow is less than 0.7 liter/minute. |
| [Remedy 1]   Check there is no water leak at each part and check there is no kink at the coolant hose in the hose pack. |
| [Remedy 2]   Pull out and insert the hose joint. |
| [Remedy 3]   If the hose is normal, the water cooling unit or the torch or the Robacta drive or the torch cable might be defective. Contact your local FANUC representative. |

Error 17582 Coolant flow less than 0.4 liter/minute.
[Cause]   Coolant flow is less than 0.4 liter/minute.
[Remedy 1]   Check there is no water leak at each part and check there is no kink at the coolant hose in the hose pack.
[Remedy 2]   Pull out and insert the hose joint.
[Remedy 3]   If the hose is normal, the water cooling unit or the torch or the Robacta drive or the torch cable might be defective. Contact your local FANUC representative.

Fig. 6.1.1(I) Error 439

Error 17582 Coolant flow less than 0.4 liter/minute.
[Cause]   The coolant flow rate is less than 0.4ℓ/minute.
[Remedy 1]   Check water leak of each part and kink of the coolant hose in the hose pack.
[Remedy 2]   Pull out and insert the hose joint.
[Remedy 3]   If the hose is normal, the water cooling unit or the torch or the Robacta drive or the torch cable might be defective. Contact your local FANUC representative.

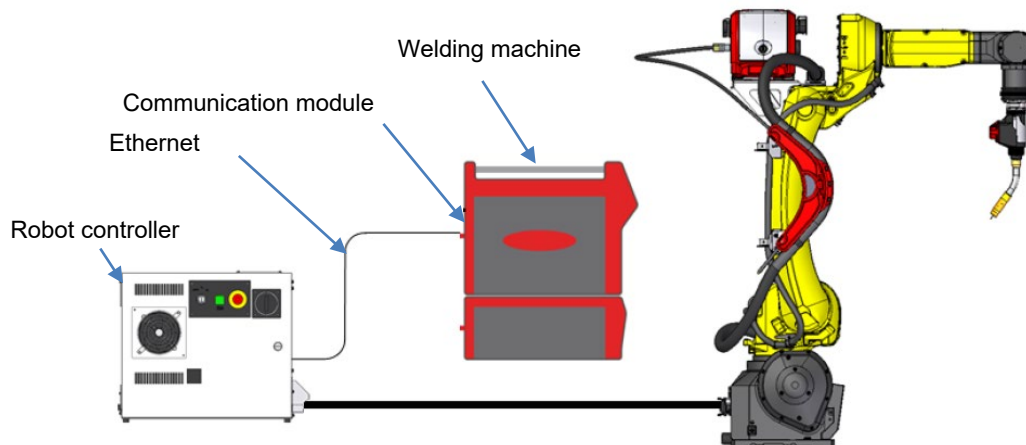| Error 18224	Robot is not ready. Robot ready signal is not set.
[Cause]	Ready signal on the robot controller is off. There are four cases, which cause this error as the following. - Case 1 : Communication between the robot and the welding power supply was not performed correctly. ⇒**Perform this remedy.** - Case 2 : In the middle of the normal communication between the robot and the welding power supply, only this error occurred. ⇒**Perform this remedy.** - Case 3 : In the middle of the normal communication between the robot and the welding power supply, any error occurred and the robot stopped by errors. ⇒**This remedy is not required.** - Case 4 : In the middle of the normal communication between the robot and the welding power supply, any error occurred at the welding power supply side and the error stop of the robot occurred by receiving it. ⇒**This remedy is not required.** **NOTE** At case 3 and case 4, If the robot stop by error, the ready signal gets off at the same time. If the ready signal is off, the welding power supply stop be error and this error occurs. At case 3, the root cause is the error at the robot side. At the case 4, welding power supply side error is the root cause. This error occurs with other problem, so perform remedy for the root cause.
[Remedy 1]	Perform the remedy for ARC-045 as shown in Subsection 6.1.2.
[Remedy 2]	According to Subsection 6.3.1, check there is no errors occurred except the ARC-045 by the robot error history.
[Remedy 3]	Make clearance between the Ethernet cable and the welding power cable when wiring.
[Remedy 4]	Check the earth of the robot controller and the welding power supply.
[Remedy 5]	If you cannot solve the problem after performing the remedy, the communication module of the welding power supply backside or the welding power supply main body is defective. Contact your local FANUC representative.

Fig.6.1.1(m)   Error 439

Error 18228	SpeedNet connection to robot interface lost.
[Cause]	A communication error occurred between the robot and the welding power supply. This error might occur due to the communication error between welding machines secondary.
[Remedy 1]	As with error-439, perform remedy for poor continuity.
[Remedy 2]	If the problem cannot be solved, the communication module of the welding power supply backside or the welding power supply main body is defective. Contact your local FANUC representative.

6.1.2 Error code for the robot controller

These errors will be displayed on the teach pendant of the robot controller.

ARC-008 STOP.L Weld power supply fault (%s, %d)	
[Cause]	A problem occurred in the welding power supply.
[Remedy 1]	The error number occurred at the welding power supply is displayed at the ARC-124 message which occurred with this alarm. Check the error number. Then perform the remedy according to Subsection 6.1.1.

ARC-013 Arc Start failed (%s^4,%d^5)	
[Cause]	When start the welding, arc generation cannot be detected in the arc detection maximum wait time. (This item can be set at the welding equipment setting screen) If this error occurs rarely, it is normal. After resetting the alarm, you can perform the program again. We recommend to cut the wire tip and perform again. If this error occurs frequently or occur at the special position, try the following remedies.
[Remedy 1]	Check the used welding condition and the taught position. If the used welding condition is not appropriate, the arc start will get worse. In addition, by such as dimensional error of the workpiece, the welding start position, the posture, and stuck out length might be not intended status.
[Remedy 2]	In the welding equipment setting screen ([MENU] key ⇒ [SETTING] ⇒ [Welding Equip]), check the following setting values. Arc detection maximum wait time : Default value is 1.4 sec. Normally, set to 1.4 to 3.0 sec. Arc detection determine time : Default value is 0.064 sec. Normally, set to 0.064 to 0.2sec.
If both are set to the moderate range, increase the arc detection time gradually and check the frequency diminish or not and keep monitoring the operation.	
[Remedy 3]	Perform the remedy for error 560 in Subsection 6.1.1.

ARC-018 Lost arc detect (%s^4,%d^5)	
[Cause]	Arc was generated when starting the welding and arc is continuously generated during the arc detection determine time (This item can be set in the weld equipment setting screen.), the welding start succeeded. However, the arc detection signal (Arc Stable signal) is not detected during between after that and welding end. If this error occurs rarely, there is no problem. After resetting the alarm, you can restart the program. However, check the welding bead is not abnormal when the welding finished. (on-off bead, goo/bad judgement of bead shape)
[Remedy 1]	Check the used welding condition, the welding speed and the taught route. If the used welding condition or welding speed is not appropriate, arc stability will get worse. In addition, by such as dimensional error of the workpiece, the welding start position, the posture, and stuck out length might be not intended status.
[Remedy 2]	In the welding equipment setting screen （[MENU] key ⇒ SETTING ⇒ Weld Equip） Check the following setting values. ● Arc detection determine time : Default value is 0.064 sec. Normally, set to 0.064 to 0.2sec. ● Arc loss detection time : Default value is 0.25 sec. Normally, set to 0.1 to 0.25 sec. If this error occurred at the welding start point surroundings, it means that determining the arc detection was successful, but the arc became unstable immediately. Gradually increase the arc detection determine time and check the frequency reduce or not. f this error occurred during the middle of the welding route, adjust the arc loss detection time If reducing the arc loss detection time, alarm stop will occur due to little arc instability. If the sensitivity is too large, gradually increase the arc loss detection time. By the more increasing arc detection time, the more arc instability will be ignored. If the sensitivity is too low, reduce the arc loss time gradually.
[Remedy 3]	Perform the remedy for error 9649 in Subsection 6.1.1.

ARC-045 WARN Weld EQ is OFFLINE

[Cause]   A robot controller tried communication with the welding power supply, but this alarm will be displayed when communication cannot be established. This error is treated as an alarm when it occurred first. If you press the [RESET] key, it is treated as a warning. The welding cannot be performed; however, the robot motion is possible.

[Remedy 1]   Please confirm that the power of weld equipment is ON.

[Remedy 2]   According to the following figure, check the connection of the Ethernet cable, which connect the welding power supply and the robot controller. At the robot side, connect it the Ethernet port 2 of the main board. If there is only one Ethernet port on the main board, connect it to the port.
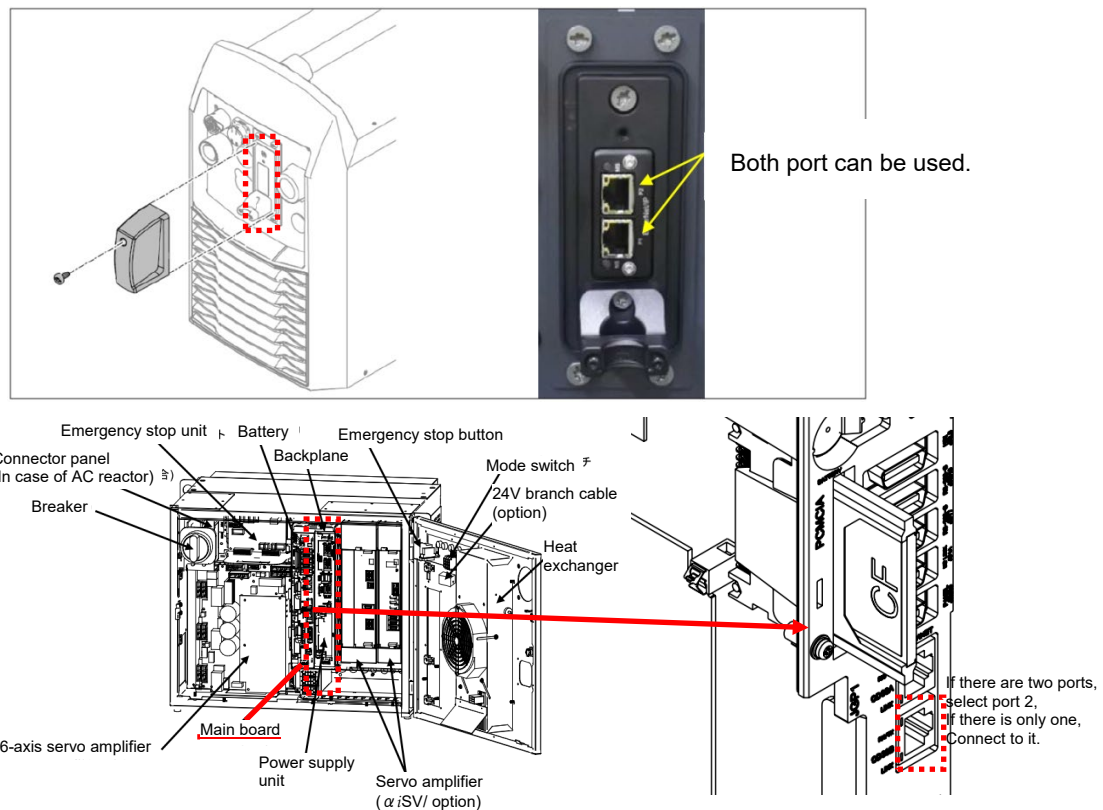
[Remedy 3]   Check the Ethernet IP address is correct. The concrete procedure is the following.
1.   Press the [MENU] key and select the [SETUP].
2.   Press the F1 [TYPE], then select the [Host Comm].
3.   The protocol-setting screen will be displayed. Move the cursor to the first line (TCP/IP). Then press F3 [DETAIL].
4.   Press the F3 [PORT], change the screen to the port setting screen for communication with the welding power supply.
5.   Check the IP address is correct. Normally, (If you do not change the network setting by manual.) it is "192.168.0.1".
6.   If IP address is changed at procedure 5, press F8 [INIT], then select [YES] in the displayed screen. Setting change will be performed.

[Remedy 4]   Check the Ethernet IP function of the robot is correct. The concrete procedure is the following.
1.   Press the [MENU] key then select [I/O].
2.   Press the F1 [TYPE]. Then select [Ethernet/IP].
3.   The Ethernet/IP screen will be displayed. Move the cursor to the 1st row of the 「Fronius_EQ x」（x is machine number）line. Press the F4 [CONFIG].
4.   In the displayed screen, check the [Host/IP address] is correct. Normally, (If you do not change the network setting by manual) it is "192.168.0.2". To change the IP address, perform F3 [PREV], Move the cursor to the third row of the "Fronius_EQ x" line. Then press F5 [FALSE]. Move the cursor to

the 1st row and press F4 [CONGIF]. Input [Host/IP address].

5. Press F3 [PREV].   In case of chaged [Host/IP address] in procedure 4, move the cursor to the third low of the [Fronius_EQ x]. Then press F4 [TRUE].

6. Cycle power of the robot controller and the welding power supply. Then check this error occurs after start.

[Remedy 5]   Check the Ethernet IP address of the welding power supply setting is correct. For concrete procedure, refer to operation 2-1-2 to 2-1-4.

ARC-047 WARN Not allowed during a weld

[Cause]   The operation that cannot be performed during the welding or the at the pause of the welding was going to be performed.

[Remedy 1]   Operate after program finished or after performing forced termination. To perform the forced termination, press the [FCTN] then select [ABORT (ALL)] from the menu. If forced termination is performed, you cannot restart the program. Be careful.

ARC-051 WARN Weld EQ %d ONLINE: Ethernet IP

[Cause]   It is the message which is displayed when the communication between a robot controller and a welding power supply are established.

[Remedy 1]   Because it is not an alarm, the remedy is unnecessary. The message will disappear when reset is done.

ARC-124 WARN EQ %d E: %d %s

[Cause]   An error occurred in welding power supply.

[Remedy 1]   Number after "EQ" shows machine number. (If it is not the multi device, it is always 1) The value after "E:" implies the error number. Perform the remedy described in Subsection 6.1.1.

ARC-250 Arclink ch%d CAN-Enet conflict

[Cause]   When welding finished, the robot waits the completion notice of the welding power supply welding completion process. If the notification did not come in specified time, the time out error will occur.

[Remedy 1]   Check that the Arc-124 occurred at the same time.   (Operation2-4-1)   If it occurred, perform remedy for ARC-124.

[Remedy 2]   Check the welding power supply error occurred at the same time. (Operation 2-1-1) If the error occurred, check the error number and perofm the remedy in Subsection 6.1.1.

[Remedy 3]   The welding end treatment might be unstable. Perform the remedy for error-16825 in Subsection 6.1.1. In addition, check that the taught position and the welding target is not too near, the welding end condition is appropriate.

ARC-251 Arclink ch%d CAN-Enet conflict

[Cause]   When welding finished, the robot waits the completion notice of the welding power supply welding completion process. If the notification did not come in specified time, the time out error will occur.

[Remedy 1]   Perform the remedy for ARC-250.

ARC-257 Torch collision is detected	
[Cause]	The crush box at the root of the Robacta drive is removed from the magnetic ring. This error is output by the robot when the signal from the welding power supply to the robot is blocked. If this error occurs even if the crush box is normal, there is a possibility that the signal from the crush box is cut off due to poor continuity between the welding machines.
[Remedy 1]	Reinstall the crush box to the magnetic ring. If the mounting face is dirty or contamination is found, remove them.
[Remedy 2]	Check the pins inside the crush box are not broken.
[Remedy 3]	If you cannot restore, the torch cable or the split box is defective. Contact your local FANUC representative.
[Remedy 4]	You can ignore this alarm temporarily. On the robot teach pendant, select the [MENU]→[I/O]→[Digital]. Display "DI", set the signal written [Torch Colli] is written in the comment section to [SIM] and "ON". The collision detection function of the robot is valid. However, the torch collision detection will get invalid.
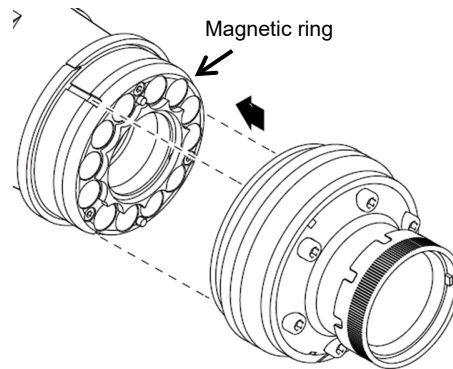
Magnetic ring

Fig. 6.1.2 (a) Magnetic ring

Fig. 6.1.2 (b) Pin inside the crush box

6.1.3 Error code of the welding power supply

No.	Problems	Remedy
1	Over temperature of welding torch.	Wait until the welding torch temperature goes down. Check there is no damage on the welding torch. Check the water level of the coolant. Check the welding condition Check the use rate of the welding torch.
2	Update of torch body failed.	Remove the welding torch. Then reconnect it. Replace the welding torch. For details, refer to Subsection 6.1.1.
3	Communication between torch body and wire feeder was interrupted.	
5	Torch body type identification not possible.	
6	Over temperature of torch body.	Wait until the welding torch temperature goes down. Check there is no damage on the welding torch. Check the water level of the coolant. Check the welding condition Check the use rate of the welding torch.
8	Welding not possible without recognized torch.	Remove the welding torch. Then reconnect it. Replace the welding torch.
12	Incomplete pairing process of 2nd motor controller.	Check the connection between the welding machines. Replace the SpeedNet cable. If you cannot restore it after replacing the wire feeder, Robacta drive, the torch cable and the split box, the welding power supply is defective. Contact your local FANUC representative.
13	Wire feeder is not recognized at weld start.	Check the connection to the wire feeder. When starting-up the welding power supply or after updating the firmware, wait for a while before start welding.
14	Selected process/synergic line will not work with the connected feed system.	Check the selected process/welding mode number. For details, refer to Subsection 6.1.1.
16	Bus-timeout of On-Wire-Devices.	Confirm the communication between the wire feeder and the welding torch.
17	Selected synergic line/job does not exist or is not available	Check that the appropriate welding mode number, the job and the welding process are selected.
25	Power source is locked out or current logged on user does not have the permissions needed to weld.	Logon by the welding allowed user or contact the user administrator.
42	Connected welding torch was not recognized.	Update the farm ware to latest version.
316	Reading Device-ID on process controller was not possible.	Check the connection between the welding machines. Replace the Speednet cable. If you cannot restore it after replacing the wire feeder, Robacta drive, the torch cable and the split box, the welding power supply is defective. Contact your local FANUC representative.
317	The Device-ID on the process controller has an invalid type number.	Update the farm ware to latest version. Check the connection between the welding machines. Replace the Speednet cable. If you cannot restore it after replacing the wire feeder, Robacta drive, the torch cable and the split box, the welding power supply is defective. Contact your local FANUC representative.
350	New hardware version of a PC-board is not compatible with the currently installed software version.	Update the farm ware to latest version.
382	Invalid pc-board detected.	The welding power supply is defective. Contact your local FANUC representative.
437	No connection to wire feeder.	Check the connection to the wire feeder.
439	Wire feeder not ready or connected.	Check the connection between the welding power supply, the wire feeder and the welding torch. For details, refer to Subsection 6.1.1.
560	Ignition timeout. No current flow detected within the set wire length.	Increase the arc start max feed value by the robot teach pendant. For details, refer to Subsection 6.1.1.
651	Update of pc-board TPC failed.	The welding power supply is defective. Contact your local FANUC representative.
942	Coolant temperature to high	Wait until the water cooling unit temperature goes down. Check the use rate.
2349	Temperature sensor on primary power module faulty.	The welding power supply is defective. Contact your local FANUC representative.
2350	Primary over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.

No.	Problems	Remedy
2351	Use the power source in a warmer environment.	Raise the ambient temperature. Then use the welding power supply.
2413	Temperature sensor on secondary power module defective. (broken lead/temperature sensor)	The welding power supply is defective. Contact your local FANUC representative.
2414	Secondary over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2415	secondary under temperature.	Raise the ambient temperature. Then use the welding power supply.
2471	ATA under temperature detected.	
2477	Temperature sensor on primary rectifier defective.	The welding power supply is defective. Contact your local FANUC representative.
2478	Primary rectifier over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2479	primary rectifier under temperature.	Raise the ambient temperature. Then use the welding power supply.
2541	Temperature sensor on booster heat-sink faulty.	The welding power supply is defective. Contact your local FANUC representative.
2542	Booster over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2543	Booster under temperature.	Raise the ambient temperature. Then use the welding power supply.
2605	Temperature sensor on process controller defective	The welding power supply is defective. Contact your local FANUC representative.
2606	Process controller over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2607	Process controller under temperature.	Raise the ambient temperature. Then use the welding power supply.
2637	Temperature sensor on TCP pc-board defective.	The welding power supply is defective. Contact your local FANUC representative.
2638	TPC over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2639	TPC under temperature.	Raise the ambient temperature. Then use the welding power supply.
2669	Temperature sensor on power module pc-board faulty.	The welding power supply is defective. Contact your local FANUC representative.
2670	Power board over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2671	Power board under temperature.	Raise the ambient temperature. Then use the welding power supply.
2733	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
2734	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2735	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
2797	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
2798	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2799	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
2861	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
2862	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.

No.	Problems	Remedy
2863	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
2925	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
2926	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2927	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
2989	Temperature sensor of power board defective.	The welding power supply is defective. Contact your local FANUC representative.
2990	Power board over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
2991	Power board under temperature.	Raise the ambient temperature. Then use the welding power supply.
3053	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3054	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3055	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3117	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3118	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3119	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3181	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3182	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3183	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3245	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3246	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3247	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3309	Temperature sensor on Transformer defective.	The welding power supply is defective. Contact your local FANUC representative.
3310	Transformer over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3311	Transformer under temperature.	Raise the ambient temperature. Then use the welding power supply.
3373	Temperature sensor on Transformer defective.	The welding power supply is defective. Contact your local FANUC representative.
3374	Transformer over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3375	Transformer under temperature.	Raise the ambient temperature. Then use the welding power supply.
3693	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3694	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.

No.	Problems	Remedy
3695	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3757	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3758	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3759	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3821	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3822	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3823	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3885	Temperature sensor of power board module defective.	The welding power supply is defective. Contact your local FANUC representative.
3886	Power board module over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3887	Power board module under temperature.	Raise the ambient temperature. Then use the welding power supply.
3949	Temperature sensor on secondary rectifier defective.	The welding power supply is defective. Contact your local FANUC representative.
3950	Secondary rectifier over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3951	Secondary rectifier under temperature.	Raise the ambient temperature. Then use the welding power supply.
3981	Temperature sensor on booster PC-board faulty	The welding power supply is defective. Contact your local FANUC representative.
3982	Over temperature on Multi-Voltage board (Booster)	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
3983	Under temperature on Multi-Voltage board (Booster)	Raise the ambient temperature. Then use the welding power supply.
4013	Temperature sensor on secondary rectifier defective.	The welding power supply is defective. Contact your local FANUC representative.
4014	Secondary rectifier over temperature.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4015	Secondary rectifier under temperature.	Raise the ambient temperature. Then use the welding power supply.
4045	Temperature sensor on booster PC-board faulty	The welding power supply is defective. Contact your local FANUC representative.
4046	Over temperature on Multi-Voltage board (Booster)	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4047	Under temperature on Multi-Voltage board (Booster)	Raise the ambient temperature. Then use the welding power supply.
4077	Temperature sensor on ATA pc-board defective.	The welding power supply is defective. Contact your local FANUC representative.
4078	ATA over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4079	ATA under temperature detected.	Raise the ambient temperature. Then use the welding power supply.
4109	Temperature sensor on booster PC-board faulty	The welding power supply is defective. Contact your local FANUC representative.
4110	Over temperature on Multi-Voltage board (Booster)	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.

No.	Problems	Remedy
4111	Under temperature on Multi-Voltage board (Booster)	Raise the ambient temperature. Then use the welding power supply.
4141	Temperature sensor on ATA pc-board defective.	The welding power supply is defective. Contact your local FANUC representative.
4142	ATA over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4143	ATA under temperature detected.	Raise the ambient temperature. Then use the welding power supply.
4173	Temperature sensor on booster PC-board faulty	The welding power supply is defective. Contact your local FANUC representative.
4174	Over temperature on Multi-Voltage board (Booster)	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4175	Under temperature on Multi-Voltage board (Booster)	Raise the ambient temperature. Then use the welding power supply.
4205	Temperature sensor on ATA pc-board faulty.	The welding power supply is defective. Contact your local FANUC representative.
4206	ATA over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4207	ATA under temperature detected.	The welding power supply is defective. Contact your local FANUC representative.
4237	Temperature sensor on booster PC-board faulty	
4238	Over temperature on Multi-Voltage board (Booster)	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4239	Under temperature on Multi-Voltage board (Booster)	Raise the ambient temperature. Then use the welding power supply.
4269	Temperature sensor on ATA pc-board faulty.	The welding power supply is defective. Contact your local FANUC representative.
4270	ATA over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4301	Temperature sensor on UPS pc-board defective.	The welding power supply is defective. Contact your local FANUC representative.
4302	UPS over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4303	UPS under temperature detected	Raise the ambient temperature. Then use the welding power supply.
4333	Temperature sensor on UPS defective.	The welding power supply is defective. Contact your local FANUC representative.
4334	UPS (PFC) over temperature detected	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4335	UPS (PFC) under temperature detected	Raise the ambient temperature. Then use the welding power supply.
4365	Temperature sensor on UPS pc-board defective.	The welding power supply is defective. Contact your local FANUC representative.
4366	UPS over temperature detected.	Wait until the welding power supply temperature goes down. Check the use rate. Check the welding power supply fan operates correctly.
4367	UPS under temperature detected	Raise the ambient temperature. Then use the welding power supply.
4400	Mainboard defective; Primary current error, comparator faulty.	The welding power supply is defective. Contact your local FANUC representative.
4464	Mainboard defective; Primary current error, comparator faulty.	
4528		If the error occurs when staring the welding, perform the RL adjustment. Check the input voltage to the welding power supply. The welding power supply is defective. Contact your local FANUC representative.
4592	Primary overcurrent.	
6450	Unbalanced intermediate circuit.	The welding power supply is defective. Contact your local FANUC representative.

No.	Problems	Remedy
6451	Supply, phase loss.	Check the input voltage to the welding power supply. The welding power supply is defective. Contact your local FANUC representative.
6453	Communication between process controller and power module was interrupted.	The welding power supply is defective. Contact your local FANUC representative.
6463	+17V power module supply missing.	
6514	Unbalanced intermediate circuit.	
6515	Supply Voltage , phase loss.	
6517	Communication between process controller and power module was interrupted.	
6527	+17V power module supply missing.	
6577	Main switch got turned off.	This alarm occurs when turning of the welding power supply. It occurs when there is no abnormality. If the error occurred when the main switch is ON, the welding power supply is defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
6641	Main switch got turned off.	If the error occurred when the main switch is ON, the welding power supply is defective. Contact your local FANUC representative.
6710	Actual value of intermediate circuit not transferred.	The welding power supply is defective. Contact your local FANUC representative.
6714	Intermediate circuit over voltage.	Check the input voltage to the welding power supply. For details, refer to Subsection 6.1.1.
6715	Intermediate circuit under voltage.	
6774	Actual value of intermediate circuit not transferred.	The welding power supply is defective. Contact your local FANUC representative.
6778	Intermediate circuit over voltage.	Check the input voltage to the welding power supply.
6779	Intermediate circuit under voltage.	The welding machine might be defective. Contact your local FANUC representative.
6838	Actual value of intermediate circuit not transferred.	The welding machine might be defective. Contact your local FANUC representative.
6842	Main supply overvoltage.	Check the input voltage to the welding power supply.
6843	Main supply under voltage.	The welding machine might be defective. Contact your local FANUC representative.
6902	Actual value of intermediate circuit not transferred.	The welding machine might be defective. Contact your local FANUC representative.
6906	Intermediate circuit overvoltage.	Check the input voltage to the welding power supply.
6907	Intermediate circuit under voltage.	The welding machine might be defective. Contact your local FANUC representative.
6966	Actual value of intermediate circuit not transferred.	The welding machine might be defective. Contact your local FANUC representative.
6970	Intermediate circuit overvoltage.	Check the input voltage to the welding power supply. The welding machine might be defective. Contact your local FANUC representative.
6971	Intermediate circuit under voltage.	
7030	Actual value of intermediate circuit not transferred.	The welding machine might be defective. Contact your local FANUC representative.
7034	Main supply over voltage.	Check the input voltage to the welding power supply.
7035	Main supply under voltage.	The welding machine might be defective. Contact your local FANUC representative.
7093	No communication between booster and process controller	The welding machine might be defective. Contact your local FANUC representative.
7095	Booster not ready.	
7096	Booster not function.	
7156	Earth current detected. Possible dangerous Voltage on power source casing	Stop power supply to the welding power supply. Check the potential of the welding power supply housing is normal. Remove the earth and power supply cable. Then make the welding power supply insulate status. The welding power supply is defective. Contact your local FANUC representative.
7284	Earth current detected.	Correct the earth connection. Make the welding power supply to the insulated state.
7355	Driver supply voltage on process controller too low	The welding machine might be defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
7415	Power module initialization failed.	
7479	Power module initialization failed.	
7560	Internal power modules are updating.	If the error does not disappear after few seconds, the welding power supply is defective. Contact your local FANUC representative.
7596	Power module initialization failed.	The welding power supply is defective. Contact your local FANUC representative.
7597	Intermediate circuit under voltage on UPS power module.	Check the input voltage to the welding power supply. The welding machine might be defective. Contact your local FANUC representative.
7598	Supply overvoltage on UPS power module.	The welding machine might be defective. Contact your

No.	Problems	Remedy
7599	Intermediate circuit overvoltage on UPS power module.	local FANUC representative.
7600	Intermediate circuit overcurrent on UPS power module.	
7607	UPS is not ready.	
7608	Power module defective.	
9017	Data of synergic line is incomplete.	Check the welding mode number. The welding power supply is defective. Contact your local FANUC representative.
9081	Emergency stop.	Check the emergency stop signal.
9113	Welding blocked by external source.	Set the external PLC welding signal to valid.
9145	Connection between master control unit and process controller was interrupted.	Update the firmware. The welding machine might be defective. Contact your local FANUC representative.
9649	Arc break detected. Maximum arc break time was exceeded.	Increase the arc break watchdog time of the welding power supply. For details, refer to Subsection 6.1.1.
9702	Wire stick to work piece detected.	Adjust the welding condition.
9716	Wire stick on contact tip detected.	Check the tip and the wire feed route. Check the wire welding detection setting.
11061	Communication between secondary inverter and process controller was interrupted.	The welding machine might be defective. Contact your local FANUC representative.
11063	Secondary power module not ready after start of the system.	If the error does not disappear after 10 seconds, cycle power of the welding power supply.
11124	Inverter hardware fault.	
11184	Supply voltage on Inverter pc-board is faulty.	The welding machine might be defective. Contact your local FANUC representative.
11216		
11248	Inverter hardware fault.	
11280		
12608		
12609		
12610		
12611		
12612		
12613		
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12615		
12672		
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12674		
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12678		
12679		
12736		
12737		
12738		
12739		
12740		Cycle power of the welding power supply.
12741		Update the software again.
12742	Data transfer during software update failed.	Update might take one minute. If you cannot solve the problem, the welding power supply
12743		is defective. Contact your local FANUC representative.
12800		
12801		
12802		
12803		
12804		
12805		
12806		
12807		
12864		
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12873		
12928		
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12930		
12931		
12932		

No.	Problems	Remedy
12933		
12937		
12992		
12993		
12994		
12995		
12996		
12997		Cycle power of the welding power supply.
13001		Update the software again.
13056	Data transfer during software update failed.	Update might take one minute.
13057		If you cannot solve the problem, the welding power supply
13058		is defective. Contact your local FANUC representative.
13059		
13060		
13061		
13065		
13130		
13194	Power source update in progress.	Do not turn off the welding power supply.
13258		Wait until the update complete.
13322		
14713	External stop is activated. Wire inching possible.	Check the safety circuit. Then reset the welding power supply.
15980	Coolant flow rate below warning level.	Check there is no water leak. Adjust the warning level of the flow rate.
15981	Cooler temperature over warning level	Check the amount and flow rate of the fan and the coolant.
16684		
16685	Reading of motor Device-ID failed.	
16686		Check the connection between the welding machines.
16687	Temperature sensor of wire feed motor defective.	
16689	Writing of motor Device-ID failed.	
16690	ignition not successful	Perform the welding again. Check there is no slag between the workpiece and the wire.
16691	Reading of motor adjustment-data failed.	Check the connection between the welding machines. For
16692	Saving of motor adjustment-data failed.	details, refer to Subsection 6.1.1.
16693	Motor overcurrent.	Check the wire feed resistance. If you cannot restore after replacing expendables, the wire feeder, the Robacta drive or the split box is defective. Contact your local FANUC representative.
16694	Motor supply voltage out of range.	Check the connection between the welding machines. For
16695	Motor disconnected	details, refer to Subsection 6.1.1.
16696	Motor over temperature	Check the wire feed resistance. Wait until the wire feeder temperature goes down.
16697	Motor I2t over temperature	Check the wire feed status. If you cannot restore after replacing expendables, the wire feeder, the Robacta drive or the split box is defective. Contact your local FANUC representative.
16698	Motor alignment was not successful.	Check the communication between the welding machine and wire feed status. For details, refer to Subsection 6.1.1.
16699	PullMig Torch is connected to the wrong motor controller.	Check the connection between the welding machines. For
16700	Loss of data between torch and motor controller.	details, refer to Subsection 6.1.1.
16701	Motor is not supported by installed firmware	Update the firmware. The wire feeder, the Robacta drive, the split box or the welding machine might be defective. Contact your local FANUC representative.
16702	Unknown motor in the system.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding machine might be defective. Contact your local FANUC representative.
16703	Invalid configuration of Device-ID and Motor.	Check the connection between the welding machines. The wire feeder, the Robacta drive or the welding power supply is defective. Contact your local FANUC representative.
16704	Unknown motor detected.	Update the firmware. Check the connection between the welding machines. The wire feeder, the Robacta drive, the split bot or the welding power supply is defective. Contact your local FANUC representative.

No.	Problems	Remedy
16705	Rotor adjustment failed.	Check the communication between the welding machine and wire feed status. For details, refer to Subsection 6.1.1.
16706	Motor-Encoder signal invalid.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split bot or the welding power supply is defective. Contact your local FANUC representative.
16707	Lost connection between welding torch and wire feeder during welding process.	Check the torch cable. The torch cable, the Robacta drive or the split box is defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
16711	Error on the wire feed system. The deviation from the set wire feed speed to the real value is to much.	Check the wire feed resistance and the communication between the welding machines. For details, refer to Subsection 6.1.1.
16712	Motor current limit exceeded.	Check the wire feed resistance. If you cannot restore after replacing expendables, the wire feeder, the Robacta drive or the split box is defective. Contact your local FANUC representative.
16713	Wire touch sensing failed.	Perform the touch sensing again.
16748	Motor controller over temperature.	Check the wire feed resistance. Wait until the wire feeder temperature goes down.
16749	Wire feeder unknown or not supported.	Update the firmware. Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16750	Motor controller settings could not be stored.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16751	Motor controller settings could not be stored.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16752	Loss of Data on SpeedNet bus.	Update the firmware. Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16753	Supply voltage on motor controller out of range.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16754	Device XML of motor controller not found.	Update the firmware. Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16759	Motor controller not paired.	Check the connection between the welding machines. The SpeedNet cable is defective. Contact your local FANUC representative. The wire feeder, the Robacta drive, the torch cable, the split box or the welding power supply is defective. Contact your local FANUC representative.
16760	Loss of Data on SpeedNet bus.	Update the firmware. Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16764	Unknown wire feed system. To many wire feeders in the system.	Check the connection between the welding machines. The wire feeder, the Robacta drive, the split box or the welding power supply is defective. Contact your local FANUC representative.
16765	Invalid SR63 PC-Board version installed.	The wire feeder or the split box is defective. Contact your local FANUC representative.
16766	Faulty data transmission between power source and wire feeder on SpeedNet.	Check the communication between the welding machines. The cables are defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
16767	Bad quality of SpeedNet Connection.	Check the communication between the welding machines. The cables are defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
16770	Temperature sensor of wire feeder PCB-board defective.	The wire feeder or the split box is defective. Contact your local FANUC representative.

No.	Problems	Remedy
16812	Option connected to "sensor port 1" is unknown.	The split box and the wire buffer are defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
16813	Issue with Option connected to "sensor port 1"; Device ID fault.	
16814		
16815	Option connected to "sensor port 2" is unknown.	The split box is defective. Contact your local FANUC representative.
16816	Issue with Option connected to "sensor port 2"; Device ID fault.	
16817		
16823	Actual value of Option connected to connector "sensor port 1" is out of tolerance. Sensor defective	The split box and the wire buffer are defective. Contact your local FANUC representative.
16824	Actual value of Option connected to connector "sensor port 2" is out of tolerance. Sensor defective	
16825	Wire buffer full.	Replace the expendables. For details, refer to Subsection 6.1.1.
16826	Wire buffer empty.	Replace the expendables. For details, refer to Subsection 6.1.1.
16827	External motor (e.g. Pull Mig) not ready.	Wait until the welding system starts. For details, refer to Subsection 6.1.1.
16829	Low Gas pressure.	Check the gas pressure.
16830	No gas valve detected.	The split box is defective. Contact your local FANUC representative.
16831	Gas valve electrically disconnected.	The split box is defective. Contact your local FANUC representative.
16832	Set value of gas flow not reached.	Check the gas supply. Check there is no twisted part on the gas tube.
16833	Gas flow detected although gas valve should be closed.	Check the gas supply. The split box is defective. Contact your local FANUC representative.
16834	No gas flow.	Check the gas supply. Check there is no twisted part on the gas tube.
16839	Lower gas flow limit exceeded	Check the gas supply and the lower limit setting value. Check there is no twisted part on the gas tube.
17004	Device ID of pump not unknown.	Update the firmware. Check the water cooling unit is connected to the welding power supply correctly. The water cooling unit is defective. Contact your local FANUC representative.
17005	Device ID of pump not detected.	Check the water cooling unit is connected to the welding power supply correctly. The water cooling unit may be defective. Contact your local FANUC representative.
17006	No data found on Pump Device ID / possibly empty Device ID	
17007	Wrong Device ID of pump detected.	Update the firmware. The water cooling unit is defective. Contact your local FANUC representative.
17008	Device ID of pump not detected.	Check the water cooling unit and the welding power supply is connected correctly. The water cooling unit is defective. Contact your local FANUC representative.
17009		
17010	Writing of pump device ID failed.	
17011	Over temperature on cooling unit pump.	Check the cooling fan operates. Wait until the water cooling unit gets cold.
17012	Low Coolant level detected.	Supply the coolant. For details, refer to Subsection 6.1.1.
17013	Cooling Pump doesn`t reach the required rotations.	Check the water cooling unit is connected to the welding power supply correctly. The water cooling unit may be defective. Contact your local FANUC representative.
17014	Cooling unit detected a coolant blockage.	Check there is no twisted part on the water cooling hose. Check the coolant flow rate by the system data screen (Select "Defaults" and "View" on the screen).
17015	Missing 24V supply of pump.	Check the water cooling unit is connected to the welding power supply correctly. The water cooling unit may be defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
17016	Failed communication with pump.	The water cooling unit may be defective. Contact your local FANUC representative.
17030	Cooling unit pump - Temperature of the pump has reached the warning level.	Check the water cooling unit air vent and the water cooling hose. The water cooling unit may be defective. Contact your local FANUC representative.
17068	Over temperature on cooling controller.	Check the cooling fan operates. Wait until the water unit gets cold. Check there is clearance between the water cooling unit and other equipment and the wall.
17069	Incorrect cooling system configuration.	The water cooling unit is defective. Contact your local FANUC representative.
17070	No Cooling unit device ID detected	
17071	Reading of cooler Device ID failed	
17072	Device ID could not be read.	

No.	Problems	Remedy
17073	Cooling unit data connection lost.	
17080	PC-board temperature in cooling unit reached warning level.	Check the water cooling unit air vent and the water cooling hose. The water cooling unit is defective. Contact your local FANUC representative.
17132	Option device ID on connector "sensor 1" faulty.	The water cooling unit is defective. Contact your local FANUC representative.
17133	Option connected to "sensor 1" is unknown.	
17134	Issue with Option connected to "sensor 1"; Device ID fault.	
17135		
17136		
17196	Option connected to "sensor 2" is unknown.	
17197	Issue with Option connected to "sensor 2"; Device ID fault.	
17198		
17199		
17200		
17236	Fan 2 blocked.	
17260	Fan faulty.	
17261		
17262	Fan 1 blocked.	
17324	Fan faulty.	
17325		
17326		
17388		
17389		
17390		
17452	Level sensor faulty.	
17453	Level sensor was disconnected.	The water cooling unit is defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
17454	Level sensor defective.	The water cooling unit is defective. Contact your local FANUC representative.
17455		
17456	Coolant level low!	Supply coolant. For details, refer to Subsection 6.1.1.
17457		
17470		
17516	Temperature sensor1 not detected.	The water cooling unit is defective. Contact your local FANUC representative.
17517	Temperature sensor 1 defective.	
17518		
17519		
17520	High Coolant temperature. (More than 70°C)	Check the fan, the coolant amount and the flow rate.
17521	Coolant temperature reached 68°C.	
17522	Temperature sensor 1 defective.	The water cooling unit is defective. Contact your local FANUC representative.
17523	Temperature sensor 2 defective.	
17524		
17525		
17526		
17527	High Coolant temperature. (More than 70°C)	Check the fan, the coolant amount and the flow rate.
17528	Coolant temperature reached 68°C.	
17529	Temperature sensor defective.	The water cooling unit is defective. Contact your local FANUC representative.
17550	Coolant temperature reached 68°C.	Check the fan, the coolant amount and the flow rate.
17580	Flow sensor defective.	The water cooling unit is defective. Contact your local FANUC representative.
17581	Coolant flow less than 0.7 liter/minute.	Check there is no dirty part, twisted part or damage on the water cooling hose. For details, refer to Subsection 6.1.1.
17582	Coolant flow less than 0.4 liter/minute.	Check there is no dirty part, twisted part or damage on the water cooling hose. For details, refer to Subsection 6.1.1.
17600	Coolant flow rate below warning level.	Check there is no dirty part, twisted part and damage on the water cooling hose. Adjust the warning level of the flow rate of the coolant.
17964	Torch-motor Device-ID unknown.	Update the firmware. The Robacta drive, the wire feeder or the torch cable is defective. Contact your local FANUC representative.
17970	Error on the torch-motor. The deviation from the set wire feed speed to the real value is too much.	Perform the calibration.
17976	Over temperature of motor.	Check the wire feed resistance. Wait until the wire feeder and the Robacta drive goes down.
18028	Over temperature of PullMig pc-board.	Check the wire feed resistance. Wait until the wire feeder, the Robacta drive and the split box goes down.
18029	The connected PullMig is not supported.	Update the firmware. Use the supported welding torch.

No.	Problems	Remedy
18030	Error on Robacta Drive.	The Robacta drive is defective. Contact your local FANUC representative.
18033	Supply voltage on motor controller is out of range.	The Robacta drive, the wire feeder, the split box or the torch cable is defective. Contact your local FANUC representative.
18034	Welding torch Device-ID unknown.	Update the farm ware. The welding torch, the Robacta drive, the wire feeder, the split box or the torch cable is defective. Contact your local FANUC representative.
18037	Supply voltage on PullMig pc-board out of range.	The Robacta drive is defective. Contact your local FANUC representative.
18221	The Anybus-CC-Module is not properly connected or the connector is damaged.	The CC module is the part on the Ethernet communication module, which has two ports. Check this is installed to the main body correctly by checking the connection terminal. The Ethernet communication module or the welding power supply is defective. Contact your local FANUC representative.
18222	The Anybus-CC-Module is not supported.	The CC module is the part on the Ethernet communication module which has two ports. The Ethernet communication module or the welding power supply is defective. Contact your local FANUC representative.
18223	The configuration of the process data width is not supported by this module.	Check the dip switch setting of the robot interface.
18224	Robot is not ready. Robot ready signal is not set.	Check the robot signal. For details, refer to Subsection 6.1.1.
18225	Invalid synergic line is selected (retro mode)	Check the welding mode number is assigned correctly.
18226	Selected synergic line is not existing or available	Check the welding mode number.
18227	An invalid working mode was selected from the robot	Check the welding mode number is assigned correctly.
18228	SpeedNet connection to robot interface lost.	The power supply might be defective. Contact your local FANUC representative. For details, refer to Subsection 6.1.1.
18233	Incompatible version of Power Source and Interface Firmware.	Revert the firmware of the welding power supply and the Ethernet communication module. The Ethernet communication module or the welding power supply is defective. Contact your local FANUC representative.

6.2 TROUBLE SHOOTING AGAINST SITUATIONS

Table 6.2 (a)   Trouble shooting against some situations

No.	Problems	Cause	Remedy
1	Wire inching is not performed.	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. Please perform the remedy of ARC-045 in Section 6.1 and Subsection 6.2.3.
		An idle arm does not go up	Put up an idle arm.
2	Failure of wire feeding occurs during welding	It is wear and damage of consumables. Feed resistance is excessive.	In reference to Subsection 6.2.4, please check the cause of the wire feeding defective and take countermeasures.
3	A gas purge (a gas check) is not possible by manual operation	A robot controller and the communication establishment of the welding power supply are not done	Please confirm whether the welding power supply is switched on. Please confirm whether a robot controller is connected to a welding power supply definitely. Please perform the remedy of ARC-045 in Section 6.1 and Subsection 6.2.3.
		The valve of the gas cylinder, a gas adjustment knob do not open.	In reference to "Checking Gas Flow Rate" of Subsection 5.2.10, please confirm the gas flow quantity.

No.	Problems	Cause	Remedy
4	There is much sputtering at the time of the arc start	A welding process choosing, a welding mode are wrong	In reference to "BASIC OPERATION FOR TPS/i WELDER" of Section 3.1 and "TEACHING AND EDITING OF ARC WELD INSTRUCTION" of Section 3.4, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it
5	There is much spattering at the time of the welding or an arc is unstable or is poor in welding	Gas flow quantity is insufficient (or do not appear)	Perform a gas check in reference to "Checking Gas Flow Rate of Subsection 5.2.10, and please confirm that gas appears definitely.
		A welding process choosing, a welding mode are wrong	In reference to "BASIC OPERATION FOR TPS/i WELDER" of Section 3.1 and "TEACHING AND EDITING OF ARC WELD INSTRUCTION" of Section 3.4, select the proper weld data or weld mode number for the Arc Instruction.
		Stick out is not reasonable.	Confirm stick out of the welding program inside, and revise it
		There is a problem to welding torch	Please perform maintenance check of the welding torch in reference to "5.1.1 Daily Checks".
		Wire feeding is unstable	Carry out No. 2 remedy.
6	The Power Lamp is not Turned on.	Power is not supplied correctly.	Check if power is fed correctly. If the power lamp is not turned on when power is fed correctly, contact your local FANUC representative.
7	The Robot Collided with a Fixture		Recover it according to the procedure below. 1 Stop the motion of the robot by pressing the emergency stop button, then enter within the safety fence. 2 Correct the cause of collision. 3 Exit from within the safety fence. 4 Reset the emergency stop button. 5 Cycle power of the controller.
8	The Emergency Stop Button was Pressed during Operation.		Recover it according to the procedure below/. 1 Reset the emergency stop button. 2 Reset the system error. 3 Cycle power of the controller.

No.	Problems	Cause	Remedy
9	When welding is performed with JOB mode, unexpected JOB number is commanded	Weld Procedure setting or arc welding instruction setting is incorrect	In the case where the weld schedule number method (Arc Indirect Instruction) is used, confirm the welding data setting. 1 Press the [DATA] key. 2 Press F1[TYPE] and select "Weld Procedure". 3 Move the cursor to the Weld Procedure of the job mode being used. 4 Move the cursor to the weld schedule you are using and press F2[DETAIL] key. 5 Confirm that the command value of "job number" is the intended number. Although input with real number is possible, please be careful because you need to enter job number as an integer. On the other hand, in case where the weld command method (arc direct instruction), confirm the setting of the statement. 1 Displays the editing screen of the TP program you are using. 2 Confirm that the command value "Job Number" of the arc direct instruction being used is the intended number. Although input with real number is possible, please be careful because you need to enter job number as an integer.
10	Welding output does not be obtained according to the welding command.		Please refer to the Subsection 6.2.1.
11	When the welding is performed with switching characteristic line, the phenomenon of "Welding different from the commanded characteristic line is momentarily performed at the beginning part of welding" generates.		Please refer to the Subsection 6.2.2.
12	When you operate Fronius welding power supply, it is impossible to edit setting of related JOB or related non-JOB.	For example, there is a concept to limit editing operation of related JOB when Weld Procedure whose Operating Mode is Job Mode is selected.	Please perform following procedure. 1 Press the [DATA] key. 2 Press F1[TYPE] and select "Weld Procedure". 3 When the Weld Procedure whose Operating Mode is "Internal Mode" already exists, move the cursor to that Weld Procedure. When the Weld Procedure whose Operating Mode is "Internal Mode" does not exists, create that Weld Procedure (Please refer to Procedure 3-1-2) and move the cursor to the created Weld Procedure. 4 Select "Select WP" on the menu displayed after press F3[CMND]. 5 During this state, perform desired operation at Fronius welding power supply.

6.2.1 Welding Output does not be Obtained According to the Welding Command.

When the Operating Mode is Special 2-step, robot sends the welding commands (Wire Feed Speed or Current or Voltage Adjustment or Waveform Adjustment or High Power Time Adjustment or Base Power Time Adjustment, Base Power Adjustment) to the welder. Those commands are sent to the welder after scaling according to the specification of welder. Although the main synergic ID can be used with the default settings, some initialization scaling may not achieve the welding output as requested with some synergic IDs. In that case, please follow the procedure below.

Procedure 6-2-1   Setting of scaling

Step

1   Confirm that Operating Mode is used Special 2-step in the welding that the welding output does not be obtained according to the welding command. (This problem does not occur in cases other than the Special 2-step).
2   Display the Weld Procedure screen ([MENU] key -> DATA -> Weld Procedure).
3   Select the Weld Procedure that specifies the Operating Mode of Special 2-step. If there are two or more, it does not care even if which Weld Procedure is selected. However, please note that the scaling setting can be set for each Operating Mode, not for each Weld Procedure and synergic ID. Selected Weld Procedure number will be displayed at the upper part of screen as shown below.

```
DATA Weld Procedure        2
                                         1/6
   +  Procedure       1 [              ]
      +  Mode             [Synergic      ]
      +  Schedules

   +  Procedure       2 [              ]
      +  Mode             [CMT (If applicable)]
      +  Schedules


   [TYPE]    DETAIL    [CMND]    VIEW    HELP
```

4   By operating the panel on the front of the welding machine, you can check the available lower and upper limits of each command value of the Synergic ID that can not obtain the output as directed.
5   Display the Weld I/O output screen ([MENU] key -> I/O -> Weld ->Weld Out screen by pressing F3[IN/OUT]).

```
I/O Weld out
                                         1/21
        WELD SIGNAL       TYPE #   SIM STATUS
   1 [Wire feed      ]  GO[53]   U   0.0
   2 [Arclength Corr ]  GO[54]   U   0.0
   3 [Pulse/Dyn Corr ]  GO[55]   U   0.0
   4 [Hi PwnTim Corr ]  GO[58]   U   0.0
   5 [Lo PwnTim Corr ]  GO[59]   U   0.0
   6 [Low Power Corr ]  GO[60]   U   0.0


   [TYPE]    HELP    IN/OUT
```

6   Move the cursor to a signal that can not obtain the output as specified, and press F8[CONFIG].
     Following screen will be displayed.

```
I/O Weld Out                             ∧ □
                                      1/4
    1 GO[   4] ^
       (Volts) |
              |                            *
    2   10.000 + - - - - - - - *
              |             *    |
    3    0.000 + - - *            |
            *     |            |
              +-----+----------+------>
    4        152.400    2197.100
            Wire feed (cm/min)
```
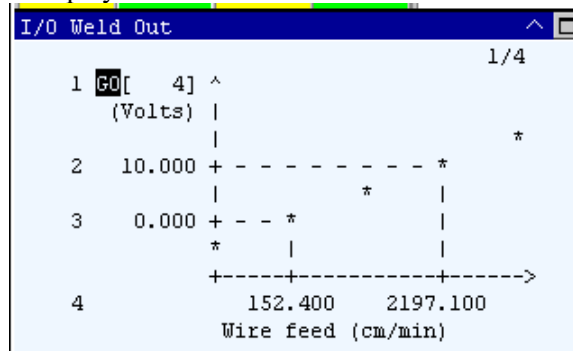
7   The numerical value on the axis of abscissa (In the above-mentioned sample screen, lower limit is
     152.400 and upper limit is 2197.100) is the numerical value handled by the robot side.   Rewrite   to
     the numerical value confirmed in step 4. The numerical value on the axis of ordinate is the numerical
     value after scaling, and it is the numerical value handled by the welding machine side.
8   After pressing F3[VERIFY], return to the previous screen by pressing F2[MONITOR].
9   Cycle power of the controller.

6.2.2   Malfunction at the Switching Characteristic Line

When the welding is performed with switching characteristic line, there is a possibility that the
phenomenon of "Welding different from the commanded characteristic line is momentarily performed at
the beginning part of welding" generates. Or, following alarms are posted at the weld start instruction.
     ARC-008 "Weld power supply fault"
     ARC-124 "Fronius no program selected"

Though the robot sends following information to the welder as the group output signal, there is a "delay"
in the welder when the value of those signals is changed.
-    Operating Mode
-    Synergic ID (in the case of Special 2 step Weld Procedure)
-    Job number (in the case of Job Mode)

"delay" means time from "welder receives the change of those signals" to "welder can perform welding".
The above-mentioned phenomenon is generated when the welding is performed without waiting for the
"delay".

Though there are two solutions about the above-mentioned phenomenon, please examine which solutions
are appropriate in your system with considering merit / demerit of each solution.

Solution 1 : "delay" is absorbed by using gas preflow
The merit of this solution has no restriction about a teaching of TP program (There is the restriction in
Solution 2). The demerit is to worsen the cycle time because of using gas preflow.
The procedure of this solution is shown Procedure 6-2-2 (a).

Procedure 6-2-2 (a)   Setting of gas preflow

Step
1   Display the Weld Procedure screen ([MENU] key -> DATA -> Weld Procedure). As shown below,
     set the gas preflow to [0.5 sec].

```
DATA Weld Procedure          1
                                      1/3
   -  Procedure       1 [                    ]

   ------------------------------------

     Gas purge:          0.35  sec
     Gas preflow:        0.50  sec
     Gas postflow:       0.00  sec


   [TYPE]   DETAIL   [CMND]   [VIEW]   HELP
```

2   Perform the step 1 with all weld procedure that are used.

⚠ CAUTION
1   When the phenomenon is not solved even if this procedure is performed, please increase the value of gas preflow little by little.
2   If the Operating Mode is other than Special 2-step, it is possible to set the gas preflow in the welder side. In this case, it is not necessary to perform the above-mentioned procedure (There is nothing to set in robot side).

Solution 2 : Timing of command from robot to welder is performed ahead for "delay" time
The merit of this solution is not to worsen the cycle time as long as the teaching restriction described later is defended. The demerit is to restrict the teaching of TP program
The procedure to set gas purge is shown below Procedure 6-2-2 (b).

TEACHING RESTRICTION
1   When using weld procedure number is switched, it is necessary to teach the weld start instruction as additional motion instruction. And, it is necessary to take 500 msec in the motion from the P[2] to P[3] in the following sample TP program.

       J P[1] 100% FINE
       L **P[2]** 100mm/sec CNT 100
       L **P[3]** 100mm/sec FINE **Weld Start[1, 1]**

2   Even if using weld procedure number is not switched, it is necessary to teach the weld start instruction as additional motion instruction if you want not to worsen the cycle time. And, it is necessary to take 100 msec in the motion from the P[2] to P[3] in the above-mentioned sample TP program.

Procedure 6-2-2 (b)   Setting of gas purge

Step
1   Display the System Variable screen ([MENU] key -> SYSTEM -> Variables).
2   Move the cursor to $AWEUPR and press the [ENTER] key.
3   Move the cursor to [1] and press the [ENTER] key.
4   Move the cursor to $MOD_SEL_TIM and input 100.
5   In the case of multi-equipment configuration, return to step 3 and perform step 4 in all except [1].
6   Continuously, display the Weld Procedure screen ([MENU] key -> DATA -> Weld Procedure).
7   As shown below, set the gas purge to [0.5 sec].

```
DATA Weld Procedure        1
                                        1/3
   -  Procedure        1 [                    ]


      -------------------------------------
     ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
     │ Gas purge:           0.50  sec │
     └─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
       Gas preflow:         0.00  sec
       Gas postflow:        0.00  sec


    [TYPE]    DETAIL    [CMND]    [VIEW]    HELP
```

8   Perform the step 7 with all weld procedure that are used.

> ⚠ **CAUTION**
> When the phenomenon is not solved even if this procedure is performed, please increase the value of gas purge little by little.

6.2.3   Communication Error with Welding Power Supply

Though the communication setting with welding power supply is correctly set at shipment timing, there is a case that the communication setting becomes illegal by various causes. Major causes are shown below.

- The assignment of communication I/O with welding power supply (DI, DO, GI, GO) are wrongly deleted (Though the communication is restored by restoring the original assignment, the communication cannot be restored if the assignment is moved to another area)
- In the case of Ethernet communication, the IP address of welding power supply is not set correctly at the setting screen of Ethernet /IP (MENU -> I/O -> EtherNet/IP)
- In the case of Ethernet communication, the IP address of robot is not set correctly at the setting screen of Host Comm (MENU -> SETUP -> Host Comm -> TCP/IP)

If following problems occurs, the communication state is not correct.
- Gas ON/OFF and inching operation by teach pendant cannot be performed
- In the weld procedure setup screen, the input operation of program number that is sure to exist cannot be accept
- [ARC-257 Torch collision is detected] alarm cannot be reset

Please restore by performing following procedure. Moreover, please perform following procedure if you want to move the current assignment area of communication I/O with welding power supply to another area.

Procedure 6-2-3   Restore the communication setting

Step
1   Confirm that the setting described in Subsection 9.4.1 [Setting of Robot Ethernet IP Address] and 9.4.2 [Setting of Ethernet IP Scanner] are performed correctly. Even if the communication is not restored, perform the following step. Also, perform the following step if you want to move the current assignment area of communication I/O with welding power supply to another area.
2   Acquire all backup (For more detail, please refer to Subsection 6.3.2).
3   If you want to move the current I/O assignment area, examine the total number of using I/O in your system by referring Section 9.1 and Subsection 9.2.1. Perform Procedure 9-2-1 if necessary.
4   Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start]. The following screen will be displayed.

```
ArcTool Setup

  2 Welding setup:          Japan
  3 Wire speed units:       cm/min
  4 Weld speed units:       cm/min
  5 Weld speed:             100

  6 Manufacturer:           Fronius
  7 Model:                  TPSi Extend ENet


      [TYPE]            CHECK            HELP
```

5   Move the cursor to "Manufacturer" and press F4[SELECT] key. Once, change manufacturer to "General Purpose". Current I/O assignment for communication with welding power supply is deleted by this operation (Another I/O assignments are not deleted).

6   Press the [FCTN] key and select [START (COLD)] then perform it.

7   Current I/O assignment for communication with welding power supply is deleted. So, assign another usages I/O arbitrarily in the following Digital I/O assignment screen ([MENU] key -> select [I/O] -> select [Digital] -> press F2[CONFIG]). In the later step, I/O for communication with welding power supply is assigned at the free space. In the software before V8.30P/31, it is necessary to match the start point of DI/DO for communication with welding power supply. So, memorize the common vacant area of DI and DO by referring the following sample.

```
I/O Digital In                    .        I/O Digital Out                   .
                          1/2                                       1/2
  #    RANGE      RACK SLOT START STAT.       #    RANGE      RACK SLOT START STAT.
  1 DI[   1- 22]   0    1    19 ACTIV         1 DO[   1- 20]   0    1    21 ACTIV
  2 DI[  23- 512]  0    0     0 UNASG         2 DO[  21- 512]  0    0     0 UNASG

              Common vacant area of DI and DO is from 23 to 512
```

8   Perform Procedure 9-3. If the software is before V8.30P/31, note that it is necessary to select "YES" at Step 5 in Procedure 9-3 and input the desired start point (this must be the common vacant area that is memorized at Step 7 in this Procedure 6-2-3). Then, I/O for communication with welding power supply can be moved to the specified free space.

9   Perform the setting described in Subsection 9.4.1 [Setting of Robot Ethernet IP Address] and 9.4.2 [Setting of Ethernet IP Scanner].

10   Press the [RESET] key and confirm that there is no alarm concerning to communication with welding power supply.

11   Confirm that inching operation (refer to Section 2.5) and gas ON/OFF operation (refer to Section 2.9) can be performed from Teach Pendant. And, confirm that Program Number input operation is accepted at the Weld Procedure setup screen (refer to Step 10 in Procedure 3-1-2).

12   By the procedure that has been performed up to now, the setting data of Weld Procedures were initialized. Only when you want to restore the setting data of Weld Procedures, perform following steps.

13   Press the [MENU] key and select "--NEXT--". Select [DATA].

14   Press F1[TYPE] and select "Weld Procedure". As shown below screen, initialized Weld Procedures are displayed.

```
DATA Weld Procedure  1

                                              1/12
      + Procedure      1 [              ]
         + Mode          [Internal Mode   ]
         + Schedules
      ------------------------------------
      + Procedure      2 [              ]
         + Mode          [Internal Mode   ]
         + Schedules
      ------------------------------------
      + Procedure      3 [              ]
         + Mode          [Internal Mode   ]
         + Schedules


      [TYPE]     DETAIL    [CMND]    [VIEW]    HELP
```

15   Delete all Weld Procedures. Weld Procedure on the current cursor position can be deleted by pressing F3[CMND] and selecting "Delete WP".
16   Press the [MENU] key and select "FILE".
17   Press F1[TYPE] and select "File". FILE screen of all backup that are acquired at the Step 2 is displayed. If it is not displayed, specify the device that all backup is acquired by pressing F5[UTIL] and selecting "Set Device".
18   Press F2[DIR] and select "*.VR".
19   Load All "AWExWPyy.VR" (x : Weld Equipment number, yy : Weld Procedure number). Press F3[LOAD] key after moving the cursor to the desired file name. When the message of "Convert?" is displayed at the prompt line, press F4[YES].
20   Cycle power the controller.
21   Confirm that Weld Procedures are restored correctly.

6.2.4   Wire Feed is not Carried Out Correctly

In the CMT welding system, Exact wire feed control is performed by the wire feeder and the Robacta drive. So it there are problems in the wire feed route, problems such as the following may occur.
•   Wire inching is not carried out correctly
•   Alarm related to the wire buffer occurred during welding and welding stops.
•   Arc is not generated when staring welding, and it stops by alarms.

In such cases, check the cause of wire feed abnormality according to the following procedure.

Table 6.2.4 (a) Check points and countermeasure for wire feed abnormality

No.	Check points	Countermeasure
1	Check the wire buffer lever swings largely. Check the swing direction.	By checking swing direction referring to Fig. 6.2.4 (a), you can distinguish the cause point of wire feed abnormality. Please check each point.
2	If the wire buffer lever swings largely, Check the timing of lever swing largely during welding.	If abnormality occurs after a while of the welding start, Thrusting out length or robot posture might cause this problem. Please confirm whether there are factors which change at the time of the abnormality occurs.
3	Check there is no obstacles in the feed wire feed route.	If there is a large bent point in the wire feeding route or feeding route swings largely by robot motion, feed resistance become large, so correct the route of the cables.
4	Check there is no consumption or welding on the tip	Replace the tip by new one.

No.	Check points	Countermeasure
5	Check replacing interval of expendables and abrasion status	When liner, the wire guide or feed roller are worn out, replace parts. In addition, clean abrasion powders and refuse of the wire.
6	Check the wire reel status is normal	Check there is point causing feed resistance large such as reel rotates slowly.
7	Check quality of the wire and the tips	If the wire quality or low or a tip except the pure article is used, there is a possibility that wire feeding is no carried out correctly.
8	Check the robot is taught correctly	If thrusting out length is out of the normal area, there is a possibility that wire feeding is not carried out correctly. If there are problems, correct the teaching.
9	Check the feed roller status is normal	Check the pressure and the consumable situation.
10	Check the welding conditions	When there is a command which change wire speed suddenly during welding, it cause large swing of the wire buffer.
11	Check the conductivity	If conductivity of the welding circuit is not good, the wire does not melt enough, and it interference with the workpiece.
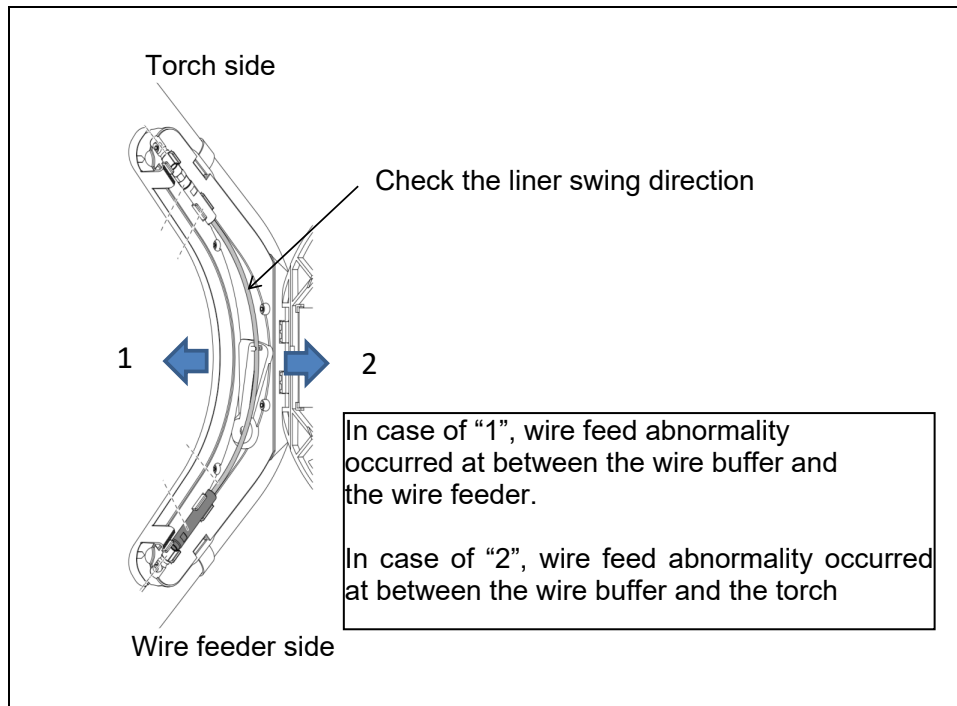
Fig. 6.2.4 (a) Check points and countermeasure for wire feed abnormality

6.3   REMEDY FOR TROUBLES

We gathered up the contents which would like you to do when the following troubles occurred in a procedure.

・A robot and a welding power supply do not communicate
・Welding is not possible (it stops by alarm etc.)
・Wire inching, a gas check are not possible

In this case, please operate the following because the identification of the cause is difficult only for the symptom mentioned above.

Confirming procedure
1   The confirmation of the alarm history
2   Get all back up
3   Get image back up (If possible)
4   Acquisition of welding machine backup

6.3.1   Confirmation of the Alarm History

Procedure 6-3-1 (a)   Confirmation of alarm history of welding power supply

Step
1   Operate the front panel of Welding power supply in the order of "1" to "3" in Fig.6.3.1(a) to select the "log list".
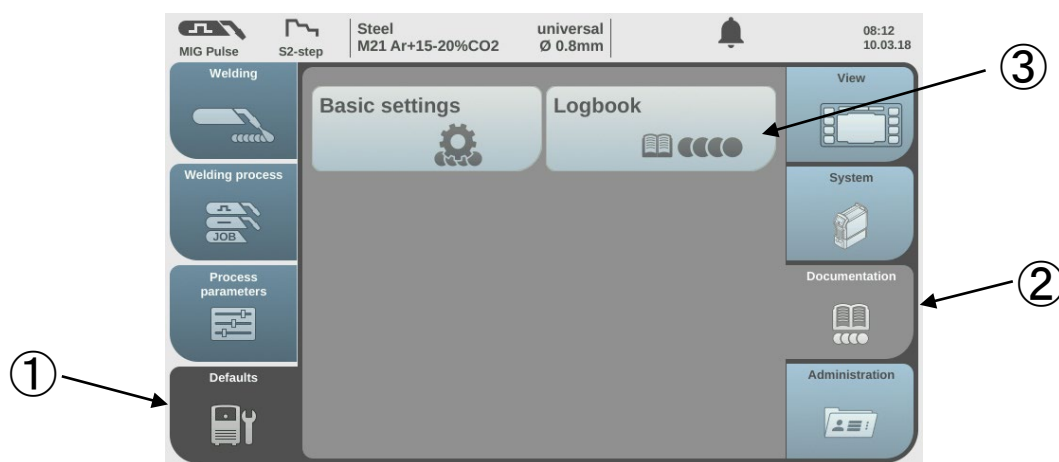
Fig. 6.3.1 (a) Operation procedure on front panel

2   Error history, warnings, and welding conditions are displayed up to the latest 100. Select the information to be displayed from the icon on both sides of the screen.
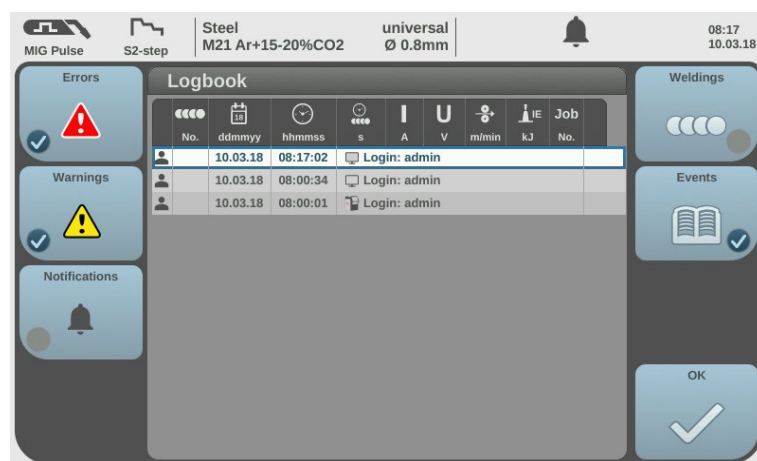
Fig. 6.3.1 (b) Confirmation of alarm history of welding power supply

Procedure 6-3-1 (b)   Confirmation of the alarm history of robot controller

Step
1   Press the [MENU] key, select 4 alarm」
2   Active alarm screen is displayed. Press F3[history] key.
3   Alarm history screen is displayed.

4   Press F1[TYPE] and select [application]. Only an arc-related alarm history is displayed.
5   Please confirm ARC alarms.
6   After the confirmation, press F1[SCREEN] and select [alarm] , return it to an original state

6.3.2   Acquisition of All Backup

Next, acquire all back up

Operation 6-3-2 is procedure of back up.

Procedure 6-3-2   Acquisition of all backup

Step
1   Please insert an empty memory card or USB memory in a robot controller.
2   Select 「7 FILE」 .
3   Press F5[UTIL] and select [Set Device]. In case of memory card, select [MC],In case of USB memory ,select [UDI].
4   Select F4[BACKUP] and select [All of above]. When the message "Delete XXXX before backup files?" is displayed, please select "YES".
5   When backup is completed, press F5[UTIL] and select [Set Device]. then correct it at an original.

6.3.3   Acquisition of Image Backup

If possible, acquire image backup.
Please do not perform this during robot operation.

Operation 6-3-3 is procedure of image back up.

Procedure 6-3-3   Acquisition of all Image backup

Step
1   Please insert an empty memory card or USB memory in a robot controller.
2   Select [7 FILE].
3   Press F5[UTIL] and select [Set Device]. In case of memory card, select [MC],In case of USB memory ,select [UDI].
4   Select F4[BACKUP] and select [Image].
5   The message "Please cycle power." is displayed. Please cycle power of the robot controller.
6   When you turn the robot controller ON, image back up is started.
7   When backup is completed, If the massage "Image backup completed successfully." is displayed, the image backup was successfully obtained.
8   Press F5[UTIL], select [Select Device] then correct it at an original device.

6.3.4   Acquisition of welding machine backup

The following three types of files can be obtained by connecting the welder to a PC.

・Welding machine backup ：Settings retained by the welder (e.g., JOB settings)
・Error log ：History of welding conditions and errors when failures occur
・Configuration file ：Information on welder and peripherals (serial number, firmware, etc)

Above information is not included in backup of robot (all backup and image backup mentioned aforesaid).

Procedure 6-3-4 (a)   Acquisition of welding machine backup

Preparation
- PC with web browser such as Microsoft Edge or Google chrome (compatible with OS up to Windows 10)
- Ethernet cable (commercial product)

Step
1   Connect the service port on the back of the welding machine to the PC with an Ethernet cable.
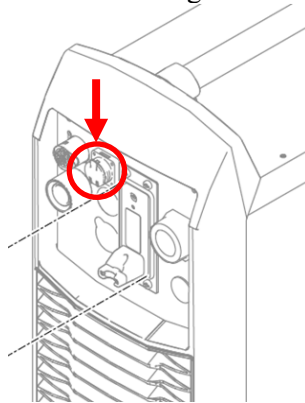
Fig. 6.3.4 (a) Service port position

2   Operate the front panel of the welding machine according to the Fig.6.3.4(b).
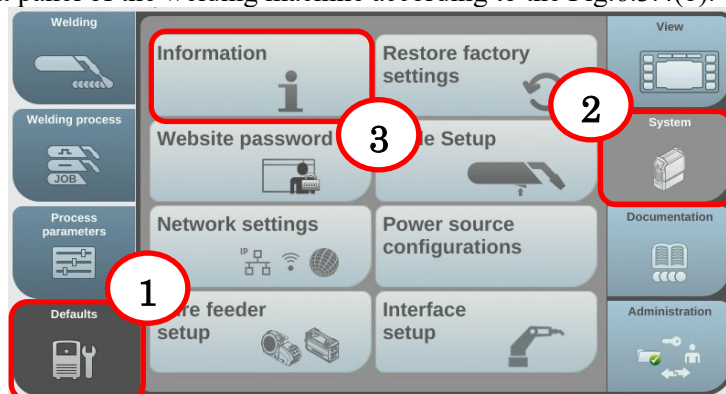
Fig. 6.3.4 (b) Operation procedure on welder front panel

3   The following screen will be displayed. Note down the IP address of service port.

Fig. 6.3.4 (c) IP address of service port

4   Operate the PC and start the web browser.
5   Enter the IP address you note down. In this example, enter "https://192.168.0.102/".
6   If a security warning displayed, continue browsing.

7   Log in on the screen that appears. Username and password are both "admin" in the default setting.
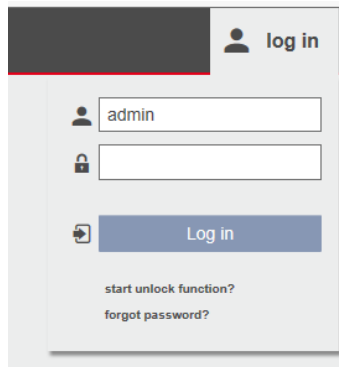
Fig. 6.3.4 (d) Login screen

8   If the following screen is displayed, connection is complete. The screen can be changed by dotted area. Displayed language can be changed by the tab of the top right of the screen.
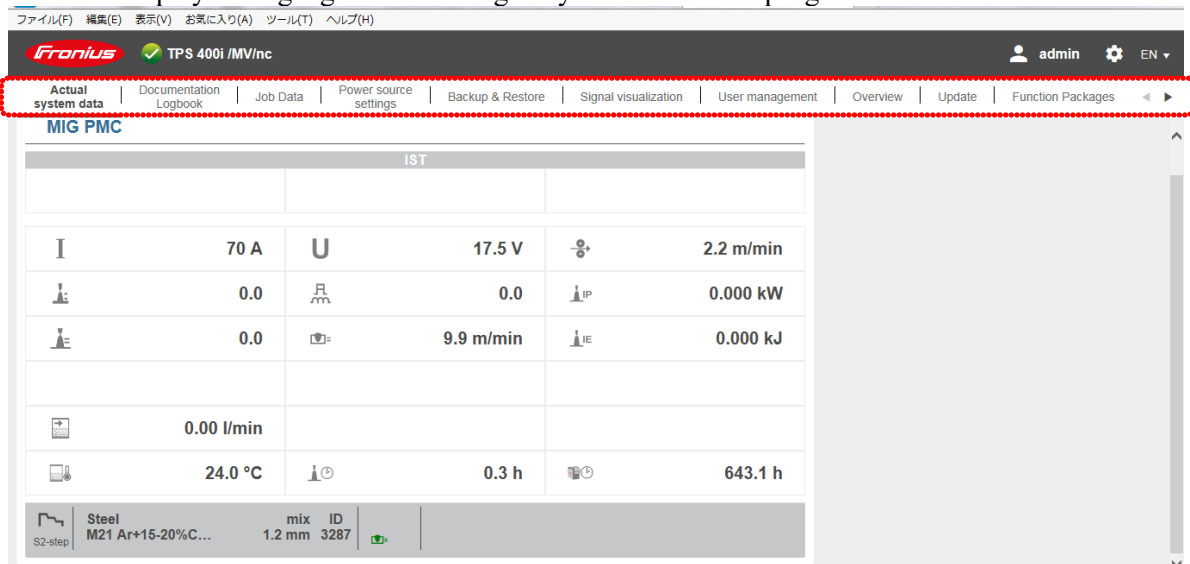
Fig. 6.3.4 (e) Actual system data display

⚠ **CAUTION**

If the connection cannot be performed, check the IP address of the PC. In this example, communication can be performed by using such as the following IP address and subnet mask.

IP address   :   192.168.0.100
Subnet mask :   255.255.255.0

---

9   Click the following "Backup & Restore" of "1". In that screen, click "Start backup" of "2".
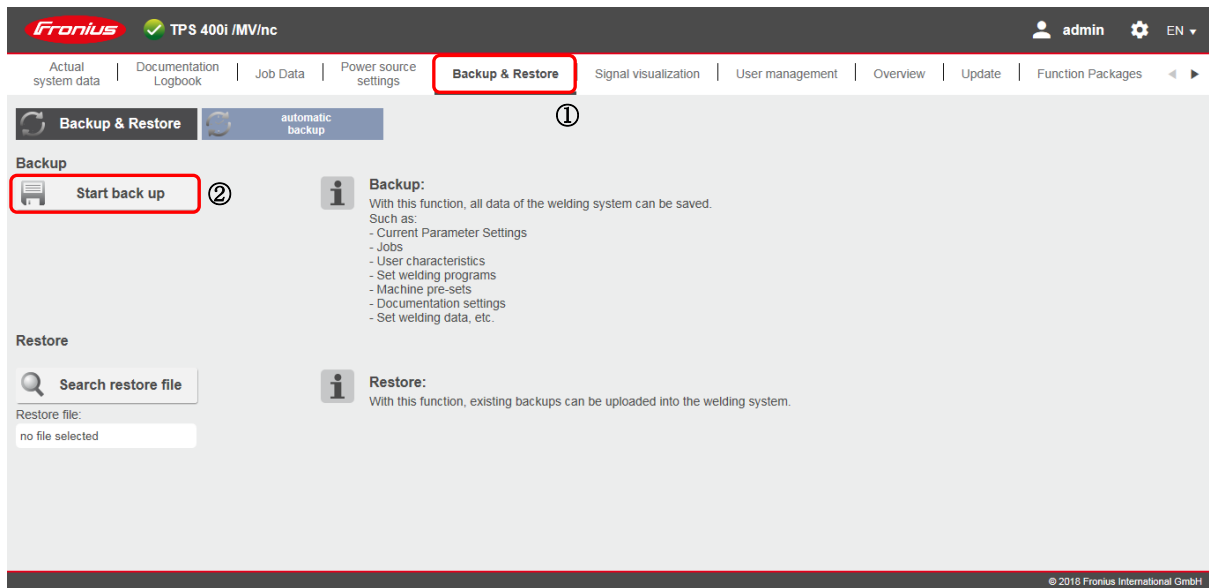
Fig. 6.3.4 (f) Backup & Restore display

10   Save the welding machine backup in the PC.

Procedure 6-3-4 (b)   Acquisition of error log

Preparation
- PC with web browser such as Microsoft Edge or Google chrome (compatible with OS up to Windows 10)
- Ethernet cable (commercial product)

Step
1   Refer to the procedure 6-3-4(a) to connect the PC to the welding power supply.
2   Click "Documentation Logbook" of "1" to display the following screen.
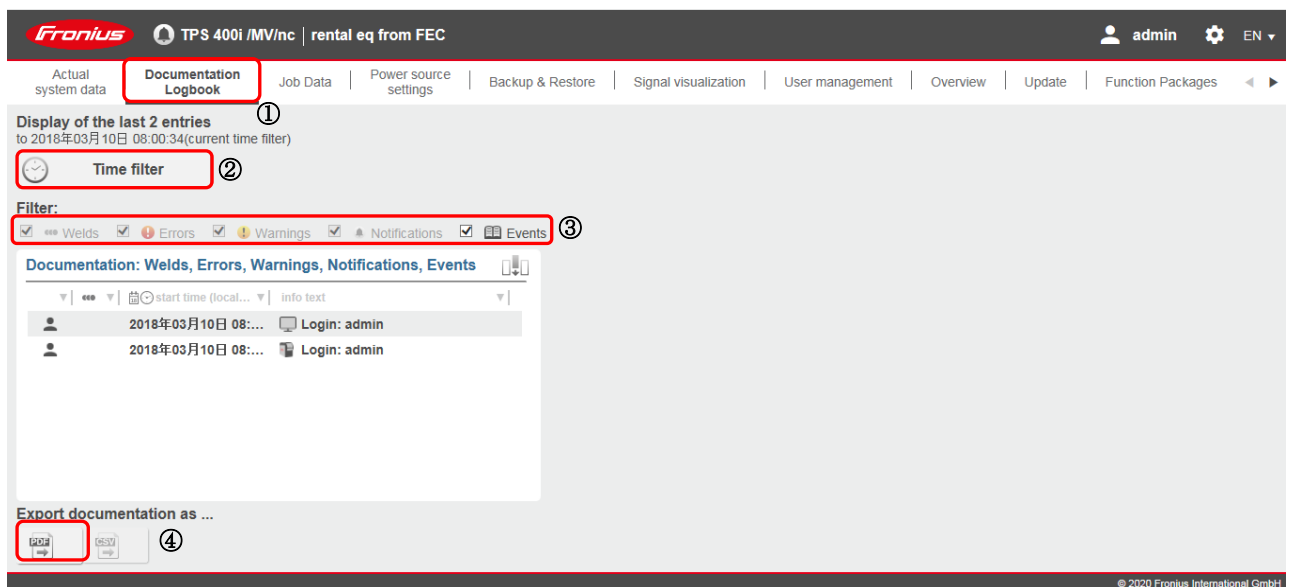
Fig. 6.3.4 (g) Documentation Logbook display

3   Normally, the error log outputs the latest 100 logs. If you want to review earlier data, click on "Time filter" and set the time period for the output.

> ⚠ **CAUTION**
> The amount of log data that can be stored in the power supply is limited, and the oldest data is deleted first. The amount of stored data is approximately one month of normal operation.

Fig. 6.3.4 (h) Time filter

4   Select the items you wish to save using the checkboxes in "3". Normally, check all items.
5   Click "4" and save the generated pdf file.

Procedure 6-3-4 (c)   Acquisition of welding machine configuration file

Step
1   Refer to the procedure 6-3-4(a) to connect the PC to the welding power supply.
2   Click "Overview" of "1" to display the following screen.

Fig. 6.3.4 (i) Acquisition of welding machine configuration file

3   Click "2" and save the generated configuration file.

7 REPLACING UNITS

This chapter describes the method of replacing each unit.

> ⚠ **WARNING**
> Before replacing a unit, be sure to turn off the main power and pull the cable plug out the socket. When replacing a unit, ensure a safe state where peripheral equipment is not operating.

*For the robot mechanical unit, contact your local FANUC representative about replacing

*For the robot controller, refer to the following maintenance manual.
  FANUC Robot series R-30*i*B/R-30*i*B Plus CONTROLLER MAINTENANCE MANUAL B-83195EN
  FANUC Robot series R-30*i*B Mate/R-30*i*B Mate Plus CONTROLLER MAINTENANCE MANUAL
                                                                              B-83525EN

After replacing a part, be sure to check the corresponding item(s).
The table below indicates replacement parts and the corresponding check items.   Make checks according to the table below.

Replacement part	Check item
Hose pack	(a) Liner replacement
	(b) Wire feed capability
Liner	(a) Wire feed capability
Roller	(b) Pressurization power of the roller

7.1 REPLACING THE WELDING POWER SUPPLY

1   Turn off controller power.
2   Remove welding power cable (-), cables of the hose pack and Ethernet cable from welding power supply. Refer to Fig. 7.1 (a), (b).
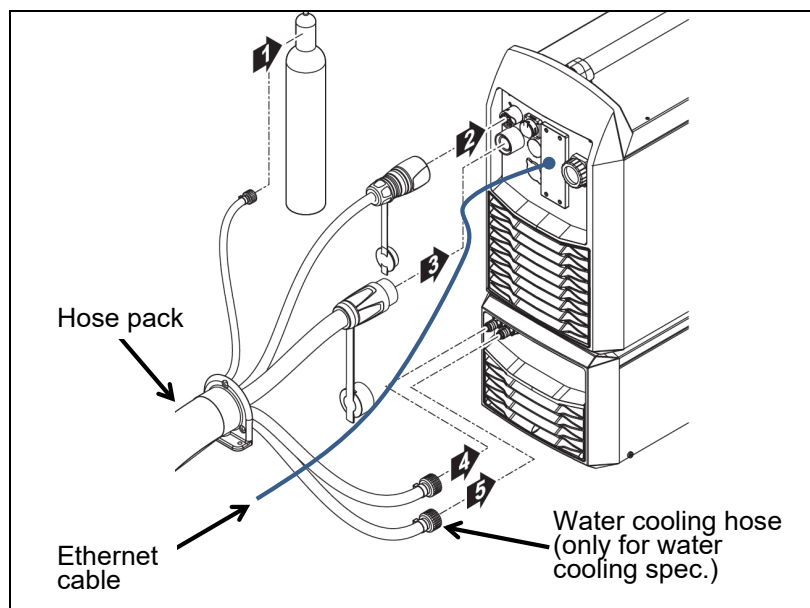
Fig. 7.1 (a)   Replacing the welding power supply (1/2)
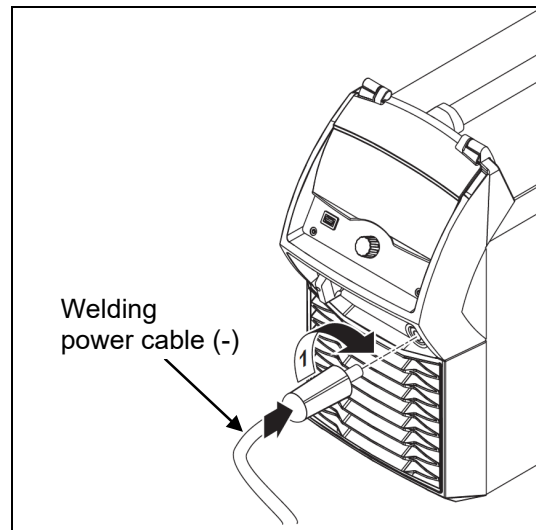
Fig. 7.1 (b)   Replacing the welding power supply (2/2)

3   Remove the side panel, then remove the primary power cable.
4   If it is fixed on the power cradle (A05B-1295-J203), remove four bolts of power supply lower side using a torque wrench.
5   If it is fixed on the water cooling unit (A05B-1295-J701), refer to Fig. 7.1 (c) and remove four bolts of power supply lower side using a torque wrench
6   When the feeder mount (A05B-1295-J204) is ordered, pull out the unit top from the prop, remove the bolts in Fig. 7.1 (d), then remove the member.
7   Replace old welding power supply by new one. When connecting it to the water cooling unit, open the lid of the power supply lower side in Fig. 7.1 (c)(1) and connect it.
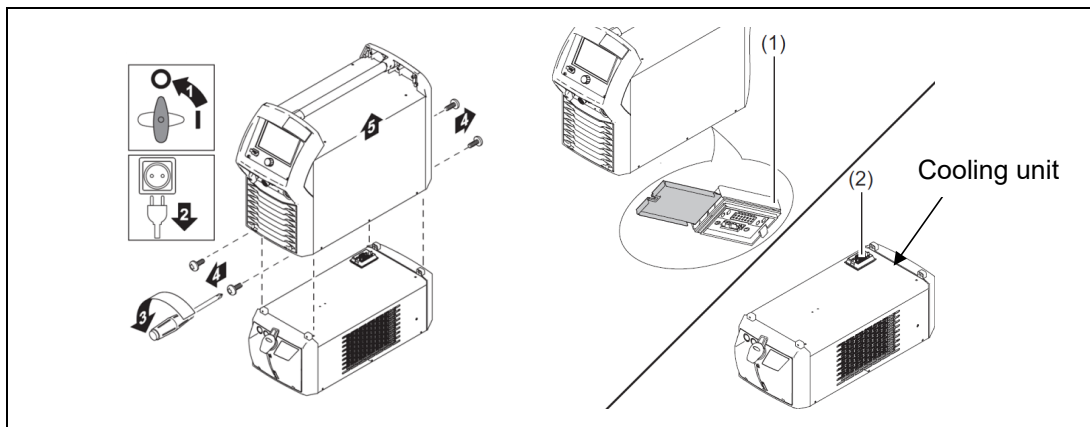
Fig. 7.1 (c) Separating the water cooling unit
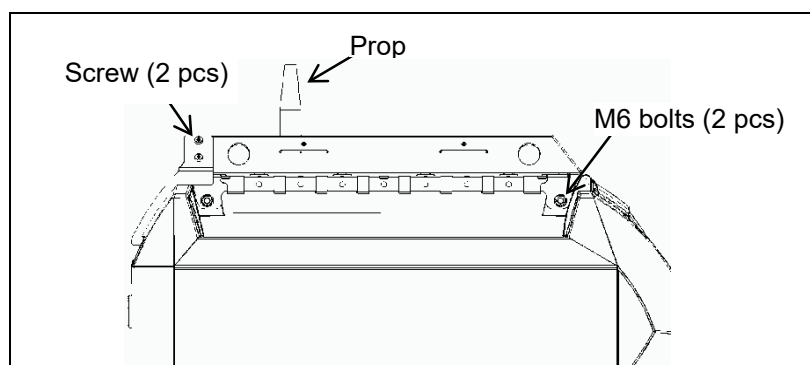
Fig. 7.1 (d) Separating the feeder mount

- 189 -

8   Connect the cradle, water cooling unit and cables in the reversed sequence.
9   Perform alignment work according to Section 2.7.

NOTE
When it it shipped, the IP address and the subnet mask are set as the following by the DIP switch.
  IP address   : 192.168.0.2
  Subnet mask   : 255.255.255.0
To change the IP address, set it according to Subsection 9.2.3.

7.2   REPLACING THE WATER COOLING UNIT

1   Remove the hoses and the filter connected to the water cooling unit referring to Fig. 7.2 (a).
2   Remove bolts which fix the welding power supply main body and the water cooling unit, then remove the water cooling unit.   Refer to Fig. 7.1 (c).
3   If the water cooling unit is fixed on the power cradle (A05B-1295-J203), remove four bolts of the power supply lower side using a torques wrench.
4   Refer to Fig. 7.1 (c) and fix the new water cooling unit on the welding power supply and the cradle.
5   Connect the water cooling hose and the filter.
6   Supply coolant.
7   Supply coolant according to Subsection 5.4.10.
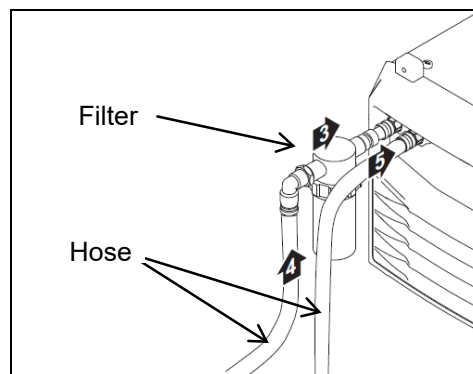
Fig. 7.2 (a) Connection to the water cooling unit

7.3   REPLACING THE SPLIT BOX

1   Move the robot posture to J4=J5=J6=0º, The J1-J3 axis is not cared about by arbitrary posture.
2   Remove the flexible conduit of the wire feeder, cut the wire, feed the wire until it does not come from the roller part, then pull out the wire from the tip end.
3   Loosen the screw of the split box bracket lower side, then put the split box to the backside.
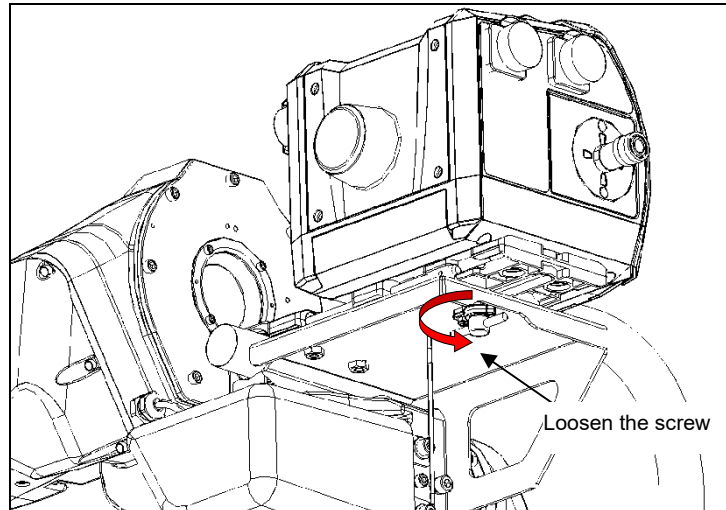
Fig. 7.3 (a) Replacing the split box

4   Remove cables connected to the split box referring to Fig. 7.3 (b). Refer to Section 7.4 for method of removing the torch cable.
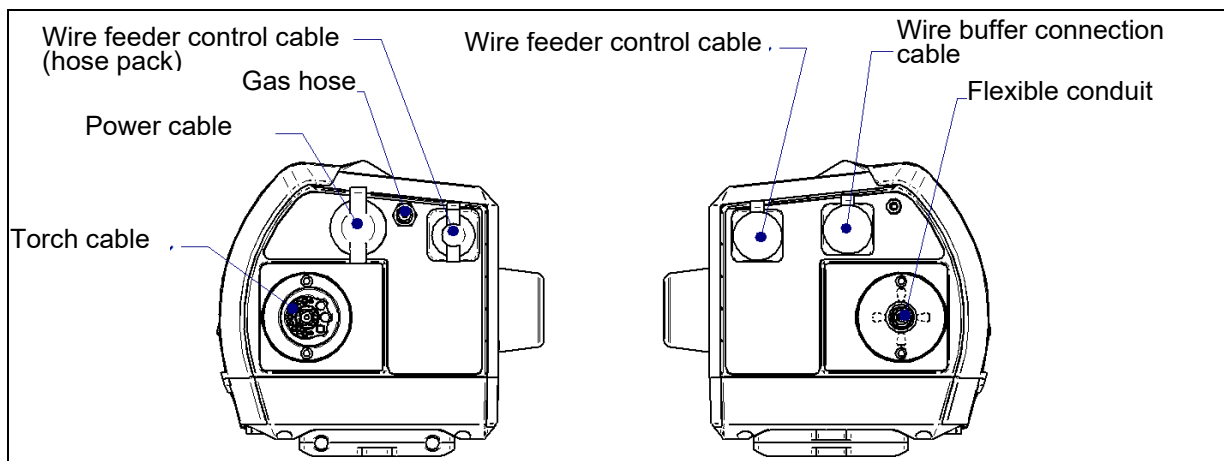
Fig. 7.3 (b) Replacing the split box

5   Loosen the screw which is loosened at step 3 and lower it, then remove the split box.
6   Attach the new split box to the bracket.
     Nut in the split box lower side can move freely.   If inserting the split box during putting the nut behind until it strike the bracket, the screw position match the nut. In this status, tighten the nut.
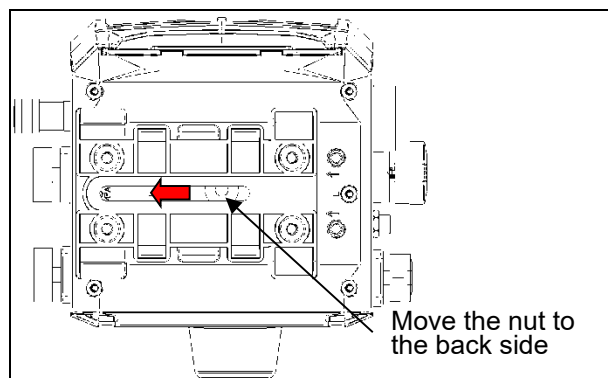
Fig. 7.3 (c) Replacing the split box

7   Reconnect the cables removed at step 4, Push the split box to forward and tighten it until it strike.

7.4   REPLACING THE ROBACTA DRIVE AND THE TORCH CABLE

1   Move the robot posture to J4=J5=J6=0º. In case of water cooling specification, to prevent the water leak, move the J3-axis to 0º or more.
2   Remove the flexible conduit of the split box and the wire feeder, then cut the wire. Remove the wire from the flexible conduit and the torch cable.
3   Turn off welding power supply.
4   Pull out the liner in the torch cable from the split box back side.

Pull out the liner
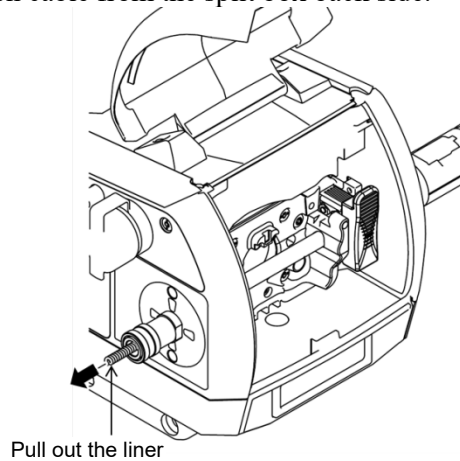
Fig. 7.4 (a) Replacing the torch cable

5   In case of water cooling, remove the water cooling cable. To prevent the water leak, close the lid of the connection part immediately after removing the water cooling hose.

Water cooling hose joint

Close the lid
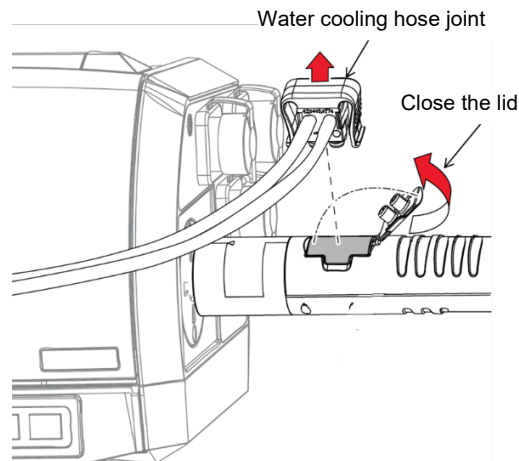
Fig. 7.4 (b) Replacing the torch cable

6   Remove the lever in the splint box.
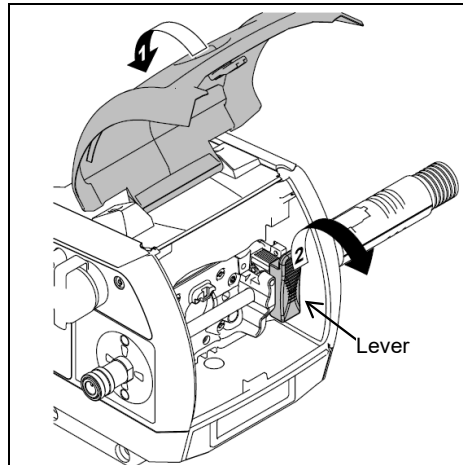
Fig. 7.4 (c) Replacing the torch cable

7   Loosen the fixation of the Robacta drive root using a special tool.
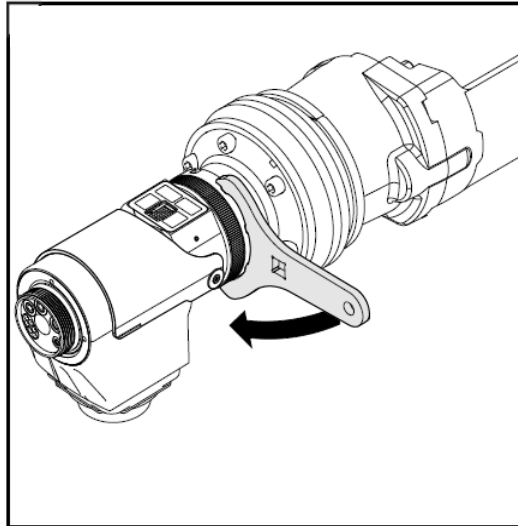
Fig. 7.4 (d) Replacing the torch cable

8   Pull out the torch cable from the split box and the robot arm.

> **NOTE**
>   When removing the torch cable, the O-ring (for dust invention
>   prevention) inside the flange may be removed. In this time, install the
>   O-ring to the groove of the flange hollow hole.

9   Loosen the nut using the special tool.
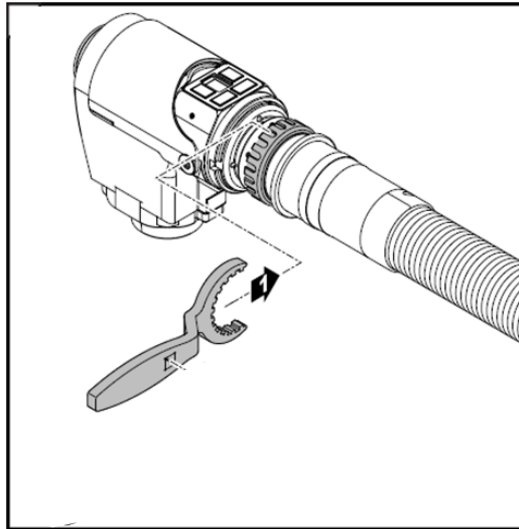
Fig. 7.4 (e) Replacing the torch cable

10   Fix the new torch cable on the Robacta drive with torque of 11Nm. Attach the torque wrench (width across flat 9.5mm) to the special tool and tighten it.

NOTE
  Before tightening, check the cleanness and water leak of the connection surface of the torch cable and the Robacta drive.
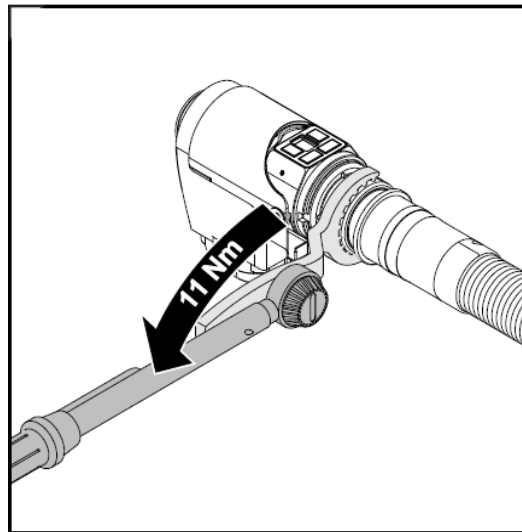
Fig. 7.4 (f) Replacing the torch cable

11 Loosen the screw at the split box bracket lower side, and then move the split box to backside.

Move to the backside

Loosen it a little.
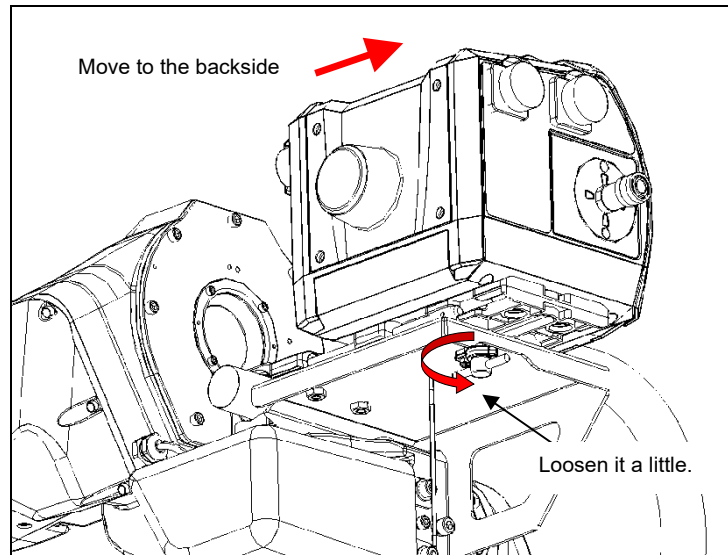
Fig. 7.4 (g) Replacing the torch cable

12 Insert the torch cable from the wrist hollow, and put it so that the Robacta drive key matches the crash box groove. In that state, tighten the nut and fix it.

> **NOTE**
>   If the nut is tightened forcibly, the screw thread will break. Bure to
>   match the key of the Robacta drive before tightening.

0mm
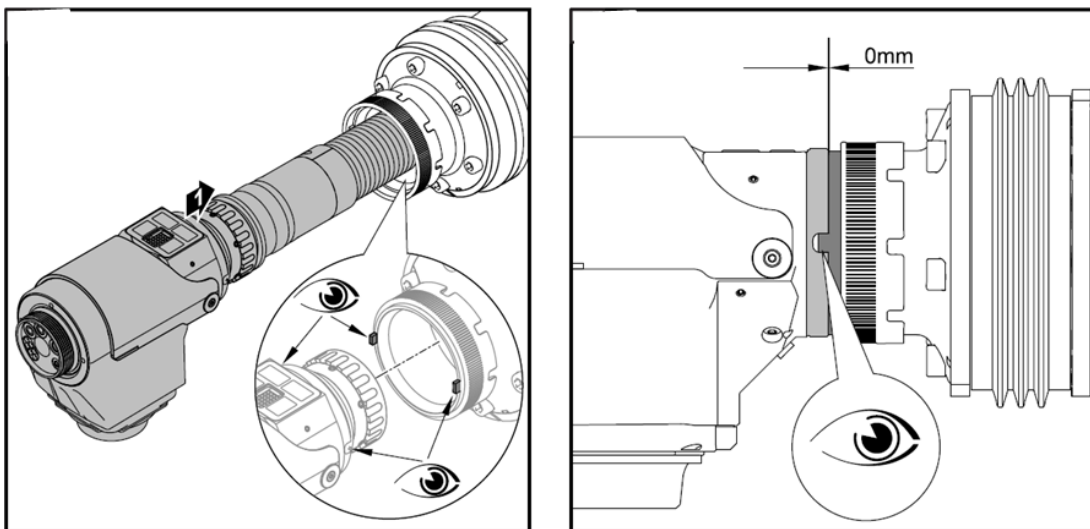
Fig. 7.4 (h) Replacing the torch cable

13 Connect the torque wrench (width across flat 9.5mm) to the attached special tool, and then tighten the nut with torque of 18Nm.
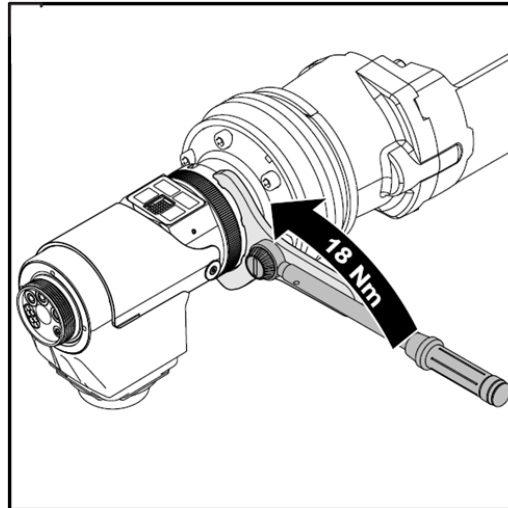
Fig. 7.4 (i) Replacing the torch cable

14 Insert the torch cable into the split box, push it until the mark as shown in Fig. 7.4 (i) matches. Lock the lever removed at step 5.

Check triangle
Marks match

Fig. 7.4 (j) Replacing the torch cable

15   Press the split box until it hits. Then tighten the screw.
16   In case of water cooling torch cable, according to Fig. 7.4 (k), connect the water cooling hose joint of the hose pack.
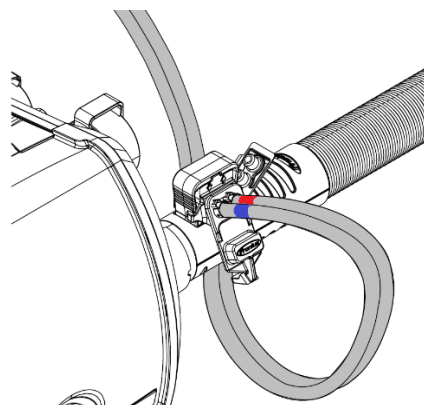
Fig. 7.4 (k)   Connection of the water cooling hose

17   Check that the water cooling hose with blue label is at the split box side and the hose with red label is at the torch side. Check the knobs of the water cooling hose joint both side matched.
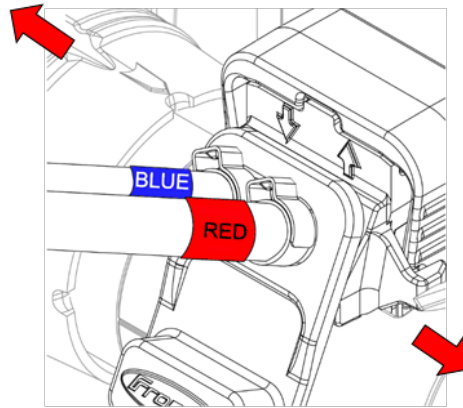
Split box side

Fig. 7.4 (l)   Check the label position

Torch side

Fig. 7.4 (m) Notch of the water cooling hose joint both edge

18   According to Section 7.9, perform calibration of the wire feeder and the Robacta drive.

7.5   REPLACING THE HOSE PACK AND CABLES

7.5.1   Replacing the hose pack

1   Turn off welding power supply.
2   According to Fig. 7.5.1 (a), loosen the split box mounting screws then move the split box to the backside.

Loosen the screw
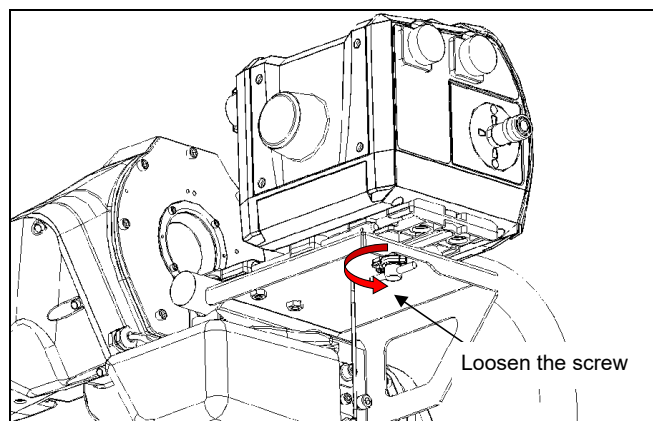
Fig. 7.5.1 (a) Replacing the hose pack (1)

3   According to Fig. 7.5. 1 (b),   remove connectors on the split box.

In case of water cooling specification, remove the water cooling hose from the torch cable.
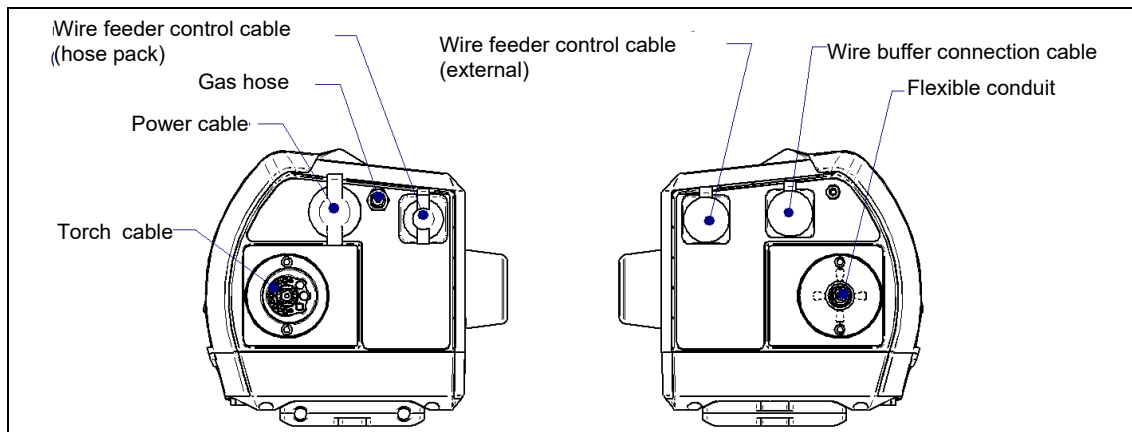
Fig. 7.5.1 (b) Replacing the hose pack (2)

4   According to Fig. 7.5.1 (c), remove the welding power supply side connectors.
    In case of water cooling specification, coolant will drop from the coolant hose. Be careful.
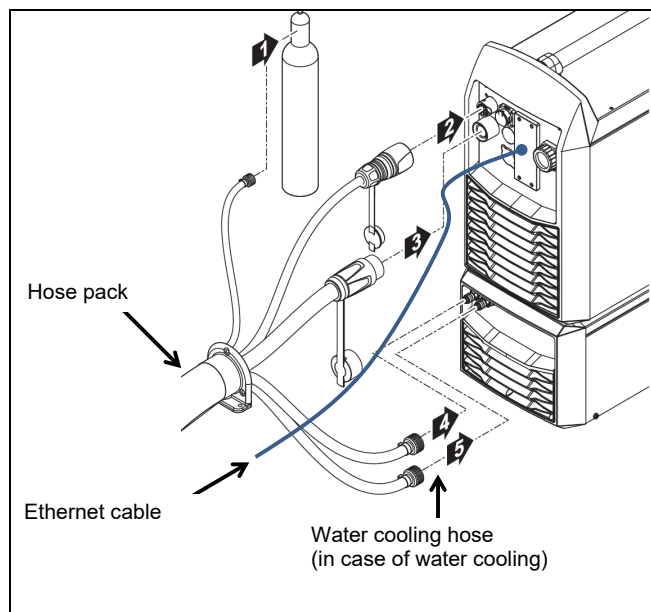
Fig. 7.5.1 (c) Replacing the hose pack (3)

5   Remove the Velcro tape. Then remove the wire buffer cable.
6   Remove the cable tie. Then remove the SpeedNet cable.
7   Remove the clamp of the bracket and two wire buffer mounting bolts.
8   Remove the hose pack
9   Prepare a new hose pack, then install it to the mechanical unit.
10 Attach the clamp and bolts remove at procedure 7. Fig. 7.5. 1 (d) shows fixation position when
    shipment.
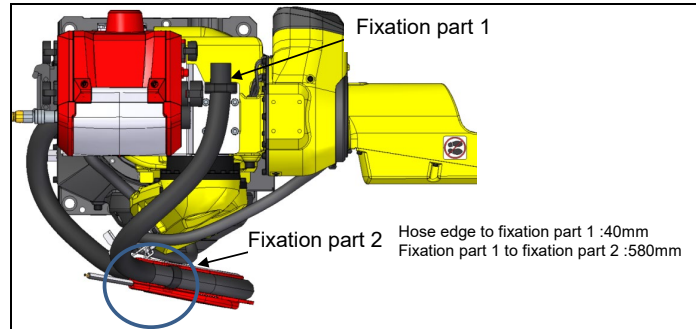
Fig. 7.5.1 (d) Replacing the hose pack (4)

11   Attach the connectors of the hose pack to the split box.
12   Match the wire buffer cable to the hose pack, then fix it with Velcro tape. When the robot is shipped, at interval of 150mm places are fixe from the fixation part (Fig.7.5.1 (d)) to tip side. Attach the wire buffer cable to the split box. Then bind the cable extra length with Velcro tape according to Fig. 7.5.1 (e).
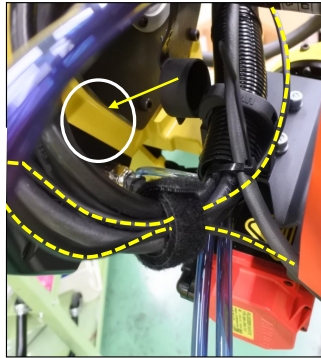
Fig. 7.5.1 (e) Replacing the hose pack (5)

13   Match the SpeedNet cable to the hose pack. Then fix it with cable ties. Fix the SpeedNet cable so that the fixation position of cable does not shift and it does does not overlap with the wire buffer cable.

7.5.2   Replacing the hose pack relay part

1   Turn off welding power supply.
2   Open the fastener of the relay part protection cover.
3   Remove the relay part cable. In case of water cooling specification, coolant may drop from the water cooling hose. Be careful.
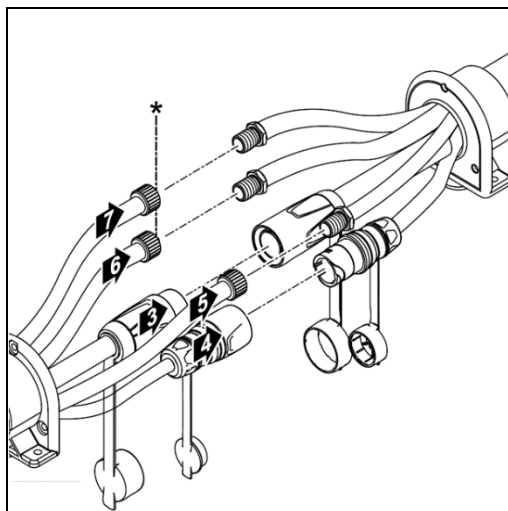
Fig. 7.5.2 (a) Replacing the hose pack relay part (1)

4   After removing the hose pack, connect cables. In case of water cooling hose, check that the red and blue label colors matches.

5   Attach the cover on the connection part. According to Fig. 7.5.2 (b), match the lid to the cable, prevent the connector lid is tangled when attaching the cover.
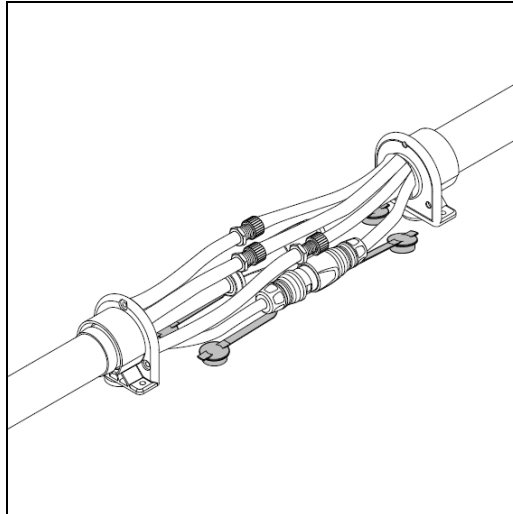
Fig. 7.5.2 (b) Replacing the hose pack relay part (2)

7.5.3   Replacing the SpeedNet cable

1   Turn off welding power supply.
2   The SpeedNet cable is fixed on the hose pack with cable ties.
     Before removing the SpeedNet cable, mark the fixation part with a pen etc.
3   Remove cable ties. Then remove the SpeedNet cable from the robot.
4   According the marking position of the procedure 2, mark the fixation part of the new cable.
5   Fix the SpeedNet cable with cable ties.
6   Connect the both side connectors to the wire feeder and the split box.
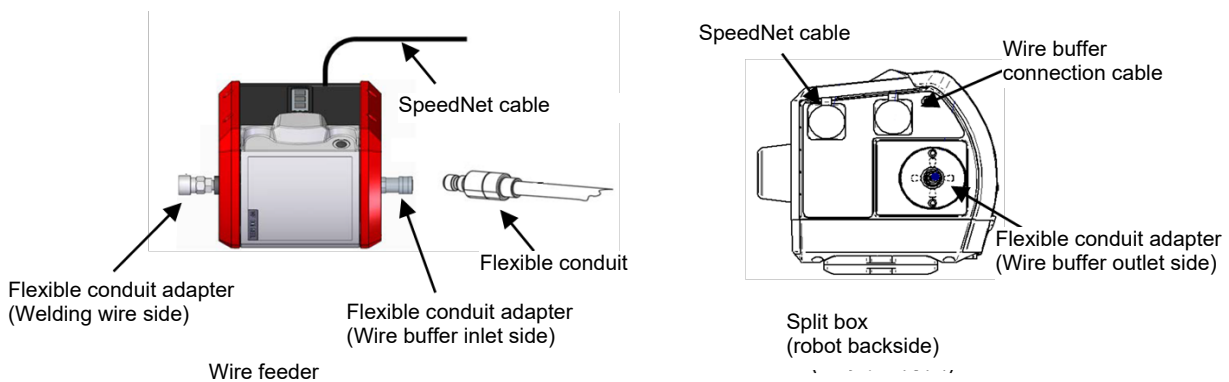
Fig. 7.5.3 (a) SpeedNet cable

7.5.4   Replacing the wire buffer cable

1   Turn off welding power supply.
2   The wire buffer cable is fixed on the hose pack with a Velcro tape. Before removing the Velcro tape, mark the fixation part with a pen etc.
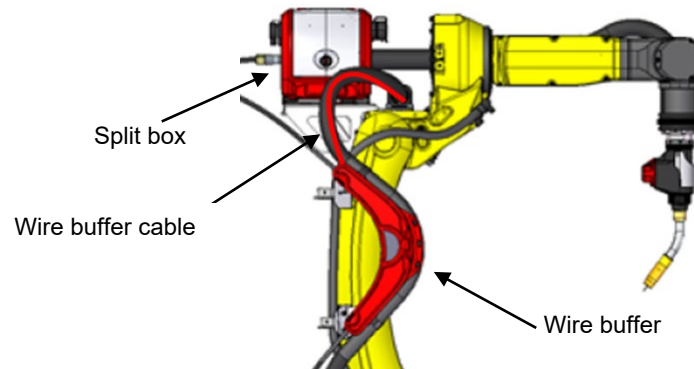
Fig. 7.5.4 (a) Replacing the wire buffer cable (1)

3   Remove the wire buffer cable connector at the backside of the split box.
4   Remove the Velcro tape.
5   Remove the band which fix the wire buffer and the hose pack. Then remove the hose pack.
6   Open the lid of the wire buffer center.
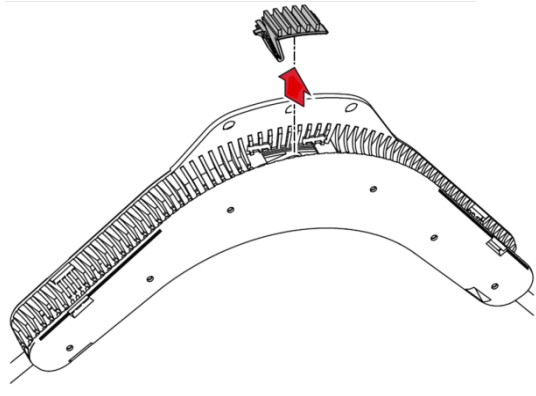
Fig. 7.5.4 (a) Replacing the hose pack relay part (2)

7   Remove the connector. Then remove the cable.
8   According to the marked position at procedure 2, mark the fixation part of the new cable.
9   Connect the new cable to the connector.

Push the cable into
the groove and fix it
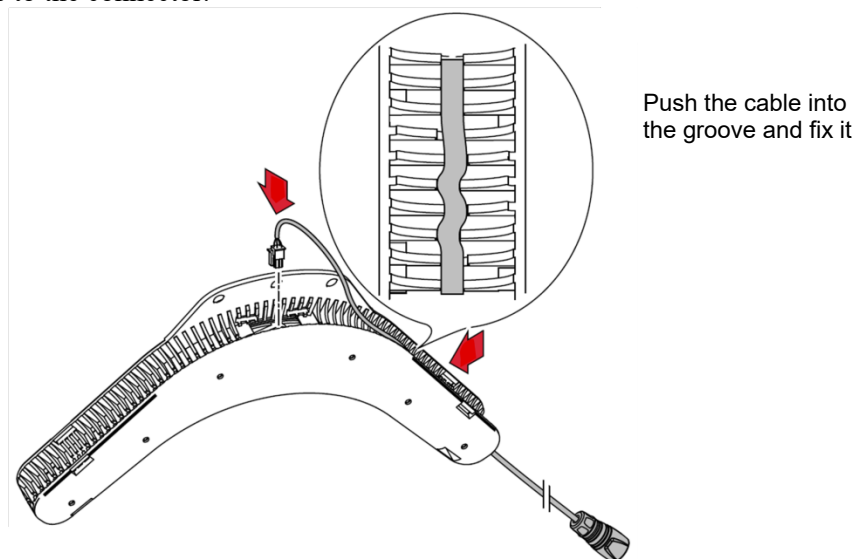
Fig. 7.5.4 (c) Replacing the hose pack relay part (3)

10   Close the lid of the wire buffer. Then insert the cable on the wire buffer groove.

11   Attach the hose pack on the wire buffer.
12   Match the cable to the hose. Then fix the marked positon with Velcro tape.
13   Connect the connector to the split box backside.

7.6   REPLACING THE TORCH NECK

When torch neck is broken, it is necessary to replace it. In this case, there is a possibility that TCP must be set again using torch recovery etc. Replace parts according to the following procedure.

1   Loosen the nut for torch fixation as shown in Fig. 7.6 (a).
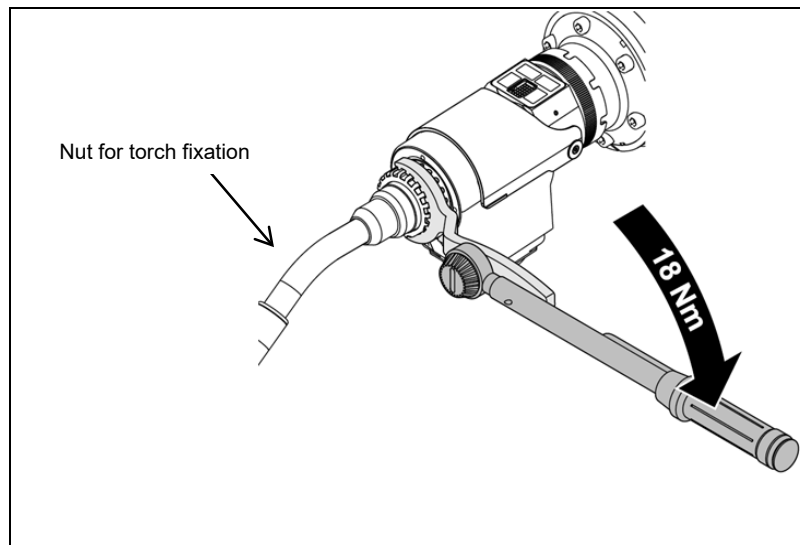
Fig. 7.6 (a) Replacing the torch neck

2   Remove the torch,
3   Attach the neck liner, tip etc. to the new torch neck.
4   Check there is no refuse or coolant, then attach the new torch.
5   Connect the torque wrench (width across flats 9.5mm)   to the attached special tool, then tighten the nut with a torque of 18Nm.

7.7   REPLACING THE NOZZLE HOLDER (IN CASE OF AIR COOLING TORCH)

1   Remove all part including tip holder referring to Fig. 7.7 (a).
2   Remove the nozzle holder using a special tool (A14L-0195-0044#04501938) in Fig. 7.7 (b).
     Insert the tool into the nozzle holder then rotate it to counterclockwise direction referring Fig. 7.7 (c).
3   Attach the new nozzle holder. Tightening torque of the nozzle holder is 10Nm. Special torque wrench (A14L-0195-0042#04119040) can be used, too.
4   Assemble other parts in the reversed sequence.
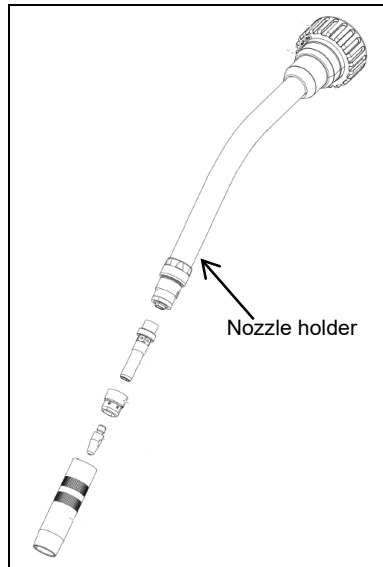
Fig. 7.7 (a)   Replacing the nozzle holder

Fig. 7.7 (b)   Replacing the nozzle holder

Fig. 7.7 (c)   Replacing the nozzle holder

7.8   REPLACING THE WIRE FEEDER

1 Remove the flexible conduit of the wire feeder in Fig. 7.8 (a), then pull out the wire of the wire feeder inside.
2 If the flexible conduit adapter is ordered, remove the adapter.
3 Remove the wire feeder control cable from the wire feeder.
4 Replace the wire feeder by new one. Then assemble it in the reversed sequence.
5 Install the feed roller.
6 Perform calibration according to Section 7.9.
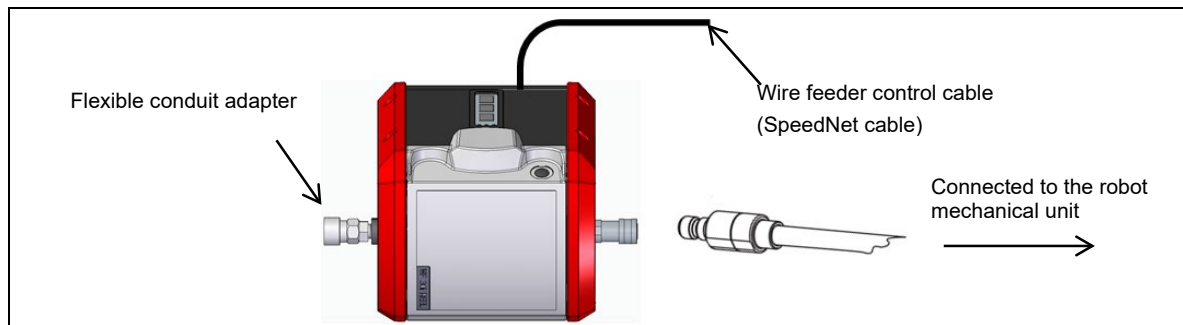
Fig. 7.8 (a) Replacing the wire feeder

7.9   CALIBRATION WORK

When the wire feeder or the Robacta drive is replaced, calibration between the feeders is required.

Operation 7-9   Calibration work

1 Lay down the idol arm of the wire feeder and the Robacta drive, release the pressure.
2 On the panel of the welding power supply front side, select tabs in Fig. 7.9 (a) in order of 1 to 2.
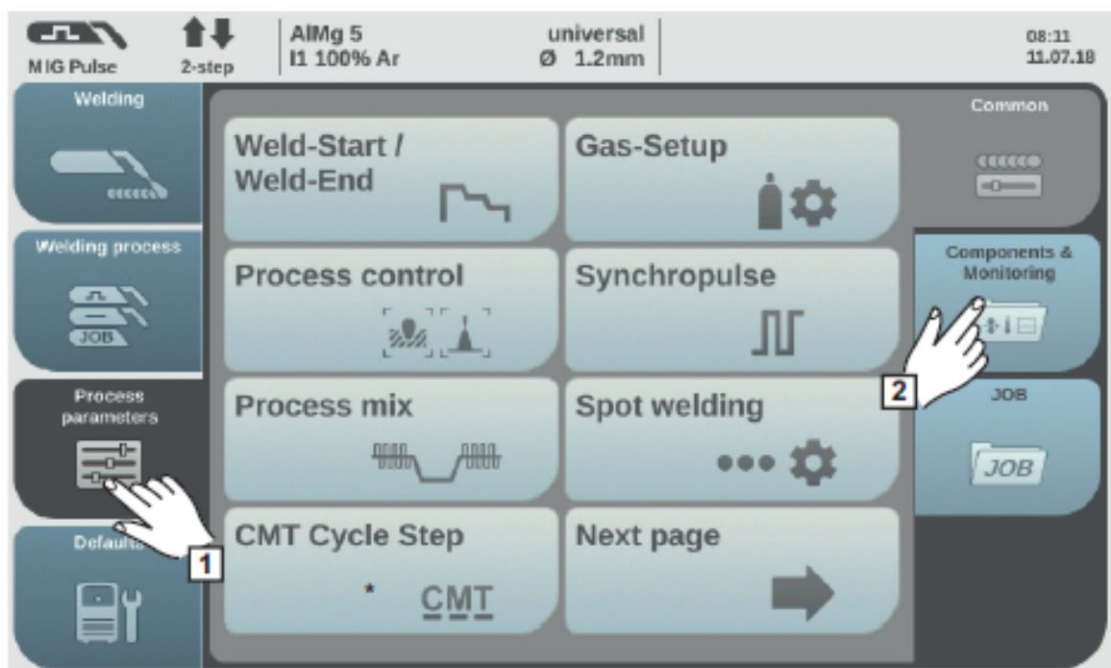
Fig. 7.9 (a) Calibration work

3   If the screen as shown in Fig. 7.9 (b) is displayed, select "system adjust".
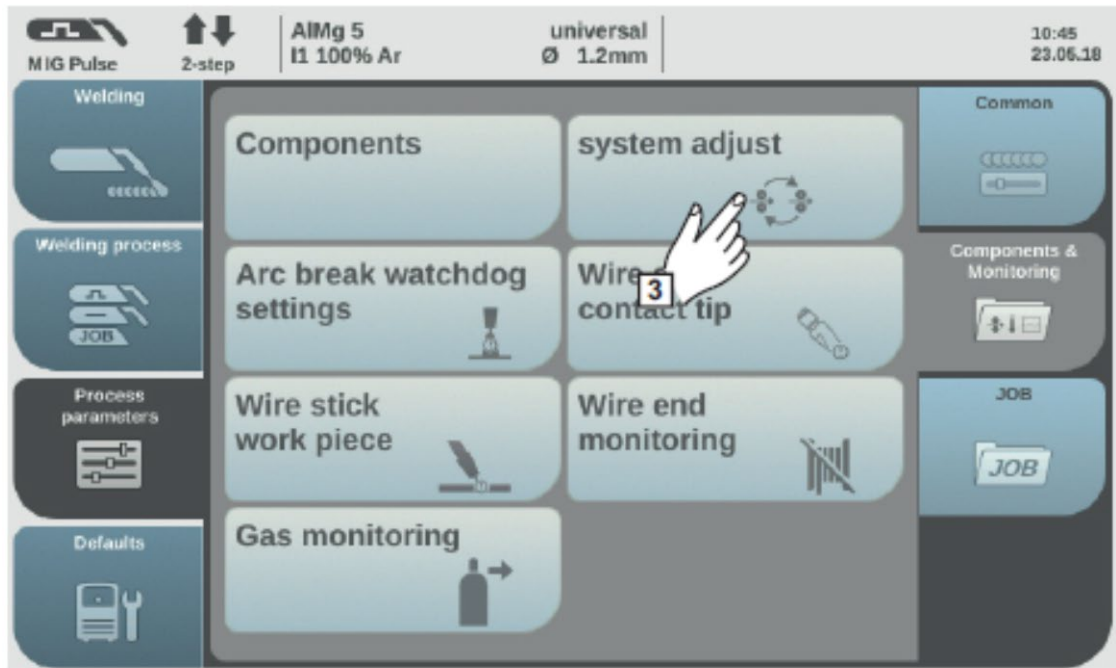
Fig. 7.9 (b) Calibration work

4   The feed roller will rate automatically. After about 20 minutes, the setting will complete.
5   Fix the wire feeder and the Robacta drive to the original position.

8   MAINTENANCE PARTS

When part unit is needed about welding power supply and welding torch, refer to this section.
Please inquire of our company about parts that not are described in this section.

8.1   MAINTENANCE PARTS OF THE TORCH

8.1.1   Contact Tip

M6 tips are used for air cooling torch A05B-1295-H305.   M8 tips are used for the water cooling torch.
In case of M8 tips, there are special tips for aluminum. Use those when using the aluminum.
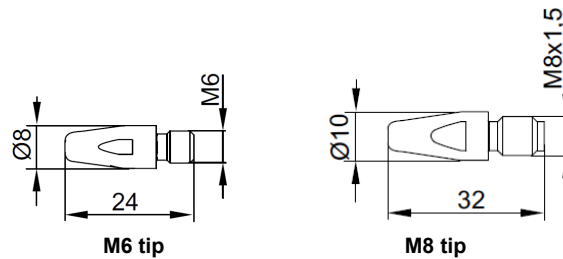
Fig. 8.1.1 (a)   Outline of the contact tips

Table 8.1.1 (a)   Maintenance parts for the welding torch

Maintenance parts name	Maintenance parts spec.	Fronius spec.
M6 tip　ϕ 0.9/M6 air cooling (10 pcs)	A14L-0195-0142#00014462	42,0001,4462,10
M6 tip　ϕ 1.0/M6 air cooling (10 pcs)	A14L-0195-0142#00014463	42,0001,4463,10
M6 tip　ϕ 1.2/M6 air cooling (10 pcs)	A14L-0195-0142#00014464	42,0001,4464,10
M8 tip　ϕ 1.2/M8 water cooling for aluminum (10 pcs)	A14L-0195-0142#00014751	42,0001,4751,10
M8 tip　ϕ 1.0/M8 water cooling for iron (10 pcs)	A14L-0195-0142#00016466	42,0001,6466,10
M8 tip　ϕ 1.2/M8 water cooling for iron (10 pcs)	A14L-0195-0142#00016467	42,0001,6467,10

8.1.2   Maintenance Parts for Air Cooling Torch
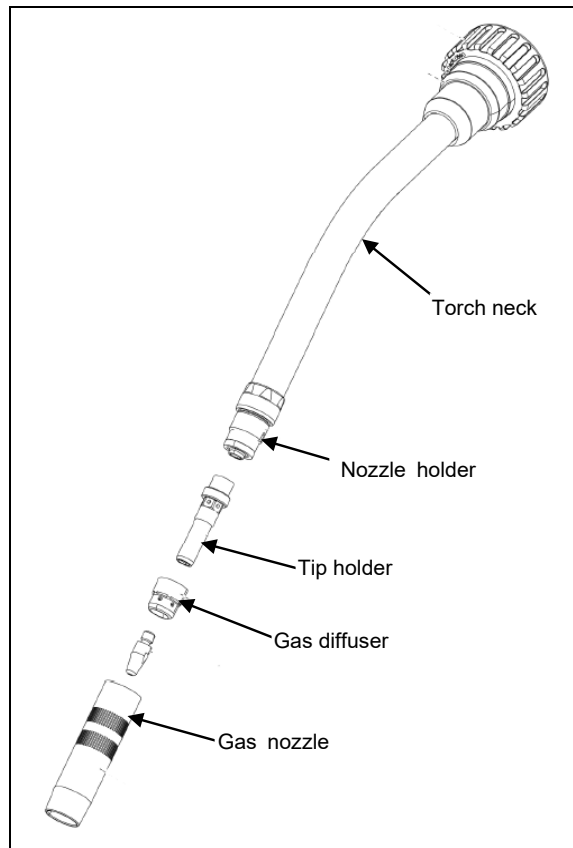
Fig. 8.1.2 (a)   Figure for air cooling torch parts

Table 8.1.2 (a)   Maintenance parts for air cooling torch

Maintenance parts name	Maintenance parts spec.	Fronius spec.
Tip holder (5 pcs)	A14L-0195-0142#00016564	42,0001,6564,5
Gas diffuser (5 pcs)	A14L-0195-0142#01000882	42,0100,0882,5
Gas nozzle (straight) (5 pcs)	A14L-0195-0142#00010226	42,0001,0226,5
Gas nozzle (taper) (5 pcs)	A14L-0195-0142#00010225	42,0001,0225,5
Nozzle holder (*)	A14L-0195-0044#03504335	44,0350,4335
Torch neck	A14L-0195-0044#03504309	44,0350,4309

(*)   A special tool   A14L-0195-0044#04501938 is required for replacing the nozzle holder.   Refer to
Section 7.7 for replacing method.

8.1.3   Maintenance Parts for Water Cooling Torch
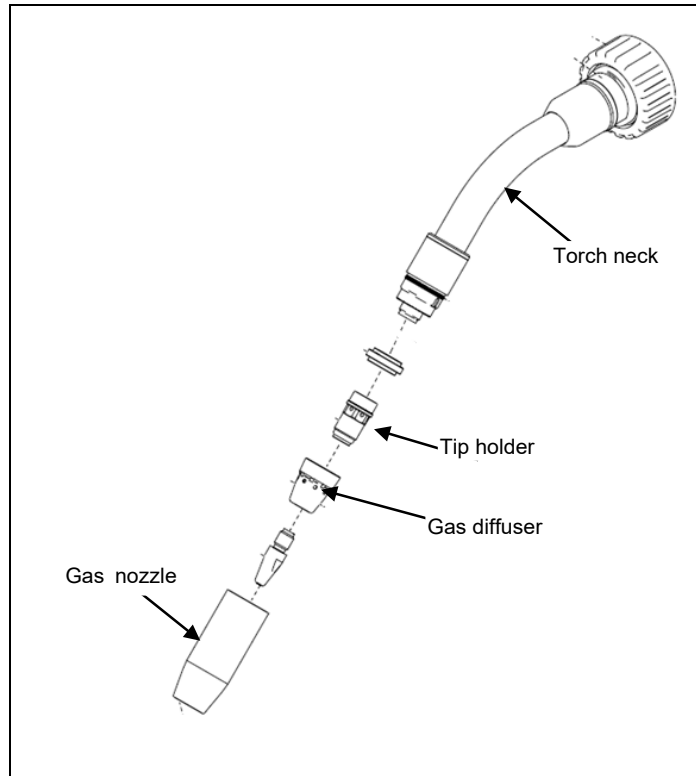
Fig. 8.1.3 (a)   Figure for water cooling torch parts

Table 8.1.3 (a) Maintenance parts of water cooling torch

Maintenance parts name	Maintenance parts spec.	Fronius spec.
Tip holder (5 pcs)	A14L-0195-0142#00014037	42,0001,4037,5
Gas diffuser (5 pcs)	A14L-0195-0142#04050854	42,0405,0854,5
Gas nozzle (straight) (5 pcs)	A14L-0195-0142#00014476	42,0001,4476,5
Insulator (5 pcs)	A14L-0195-0142#01001329	42,0100,1329,5
36° torch neck	A14L-0195-0044#03503495	44,0350,3495

8.2   MAINTENANCE PARTS OF THE ROBACTA DRIVE
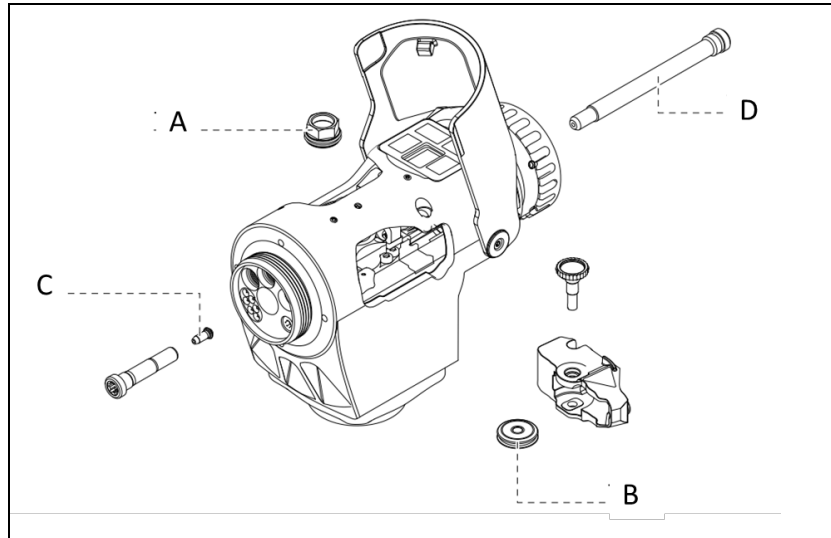
Fig. 8.2 (a)   Maintenance parts of the Robacta drive

Table 8.2 (a)   Maintenance parts of the Robacta drive

Locations	Wire dia.	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	0.9	Drive roller φ0.9 CMT	A14L-0195-0042#00015774	42,0001,5774
	1.0	Drive roller φ1.0 CMT	A14L-0195-0042#00015734	42,0001,5734
	1.2	Drive roller φ1.2 CMT	A14L-0195-0042#00015735	42,0001,5735
B	0.9	Follow roller φ0.9 CMT	A14L-0195-0042#00015772	42,0001,5772
	1.0	Follow roller φ1.0 CMT	A14L-0195-0042#00015731	42,0001,5731
	1.2	Follow roller φ1.2 CMT	A14L-0195-0042#00015730	42,0001,5730
C	0.9	Gas saver nozzle 1.0	A14L-0195-0042#04052051	42,0405,2051
	1.0			
	1.2	Gas saver nozzle 1.2	A14L-0195-0042#04052050	42,0405,2050
	1.4	Gas saver nozzle 1.4	A14L-0195-0042#04052049	42,0405,2049
D	Common	Lear liner guide tube	A14L-0195-0042#01001470	42,0100,1470
E	common	Front liner guide tube	A14L-0195-0042#01001471	42,0100,1471

Drive rollers and follow rollers are common regardless of the wire material.

8.3 MAINTENANCE PARTS OF LINER AND FLEXIBLE CONDUIT

Liner type differs in the wire buffer front and behind. Select moderate linter referring to Fig. 8.3 (a) and Table 8.3 (a), (b).
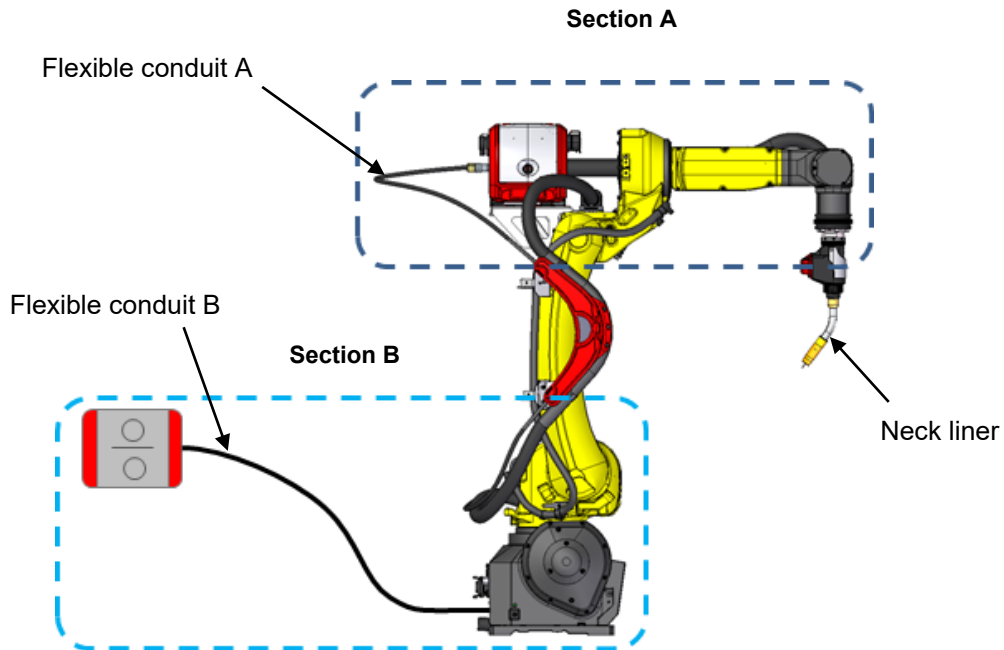
Fig. 8.3 (a) Parts corresponding view

Table 8.3 (a)   Liner (section A)

Material	Wire dia.	Maintenance parts name	Maintenance parts spec.	Fronius spec.
Iron	Common	Iron liner A (5m)	A14L-0195-0040#00020043	40,0002,0043
SUS		SUS liner A (5m)	A14L-0195-0040#00020047	40,0002,0047
Aluminum, copper		Aluminum liner A (10m)	A14L-0195-0040#00010533	40,0001,0533

Table 8.3 (b)   Liner (section B)

Material	Wire dia.	Maintenance parts name	Maintenance parts spec.	Fronius spec.
Iron	0.9	Iron liner B 1.0 (15m)	A14L-0195-0040#00020041	40,0002,0041
	1.0			
	1.2	Iron liner B 1.2 (15m)	A14L-0195-0040#00020042	40,0002,0042
SUS	0.9	SUS liner B 1.0 (15m)	A14L-0195-0040#00020045	40,0002,0045
	1.0			
	1.2	SUS liner B 1.2 (15m)	A14L-0195-0040#00020046	40,0002,0046
Aluminum, copper	0.9	Aluminum liner B 1.0 (10m)	A14L-0195-0040#00010530	40,0001,0530
	1.0			
	1.2	Aluminum liner B 1.2 (10m)	A14L-0195-0040#00010531	40,0001,0531

Table 8.3 (c)   Neck liner

Material	Wire dia.	Maintenance parts name	Maintenance parts spec.	Fronius spec.
Iron	0.9	Neck liner iron1.0 (0.65m)	A14L-0195-0042#04041398	42,0404,1398
	1.0			
	1.2	Neck liner iron 1.2 (0.65m)	A14L-0195-0042#04041399	42,0404,1399
SUS	0.9	Neck liner SUS 1.0 (0.65m)	A14L-0195-0042#04041395	42,0404,1395
	1.0			
	1.2	Neck liner SUS 1.2 (0.65m)	A14L-0195-0042#04041396	42,0404,1396
Aluminum (water cooling)	0.9	Neck liner AL 1.0 (0.65m)	A14L-0195-0044#03503719	44,0350,3719
	1.0			
	1.2	Neck liner AL 1.2 (0.65m)	A14L-0195-0044#03503720	44,0350,3720
Copper/ Aluminum (air cooling)	0.9	Neck liner copper 1.0 (0.65m)	A14L-0195-0044#03503724	44,0350,3724
	1.0			

Flexible conduit A
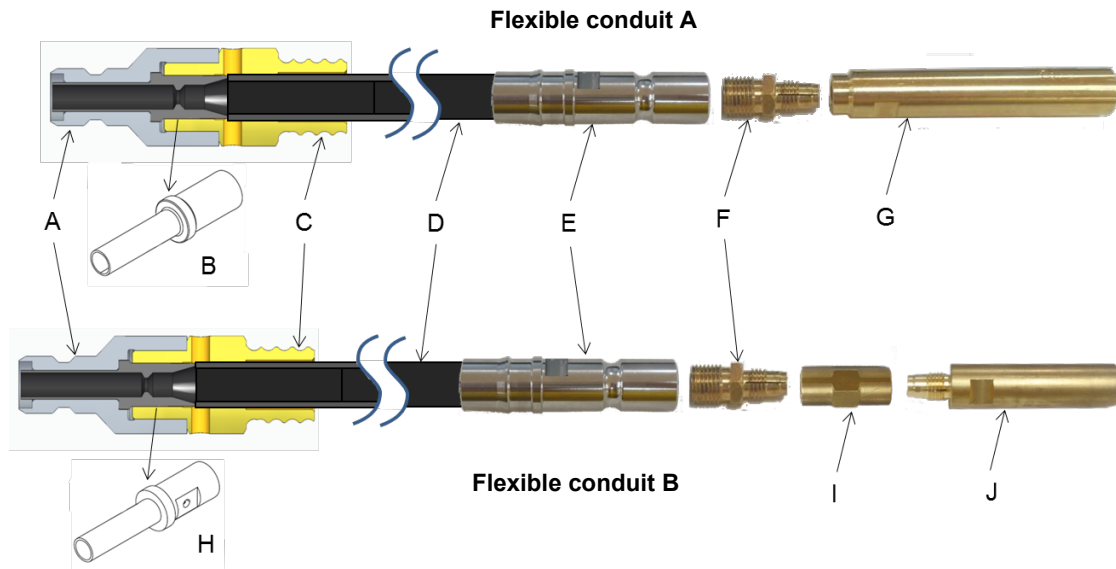
Flexible conduit B

Fig. 8.3 (b) Flexible conduit

Table 8.3 (d)   Flexible conduit joint

	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	DFS coupling	A14L-0195-0044#04900006	44,0490,0006
B	Guide piece	A14L-0195-0042#03003151	42,0300,3151
C	DFS adapter	A14L-0195-0042#10000511	42,1000,0510
D	Wire feed hose (6m)	A14L-0195-0040#00010395	40,0001,0395-6m
E	Wire feed hose inlet	A14L-0195-0042#10000510	42,1000,0511
F	Liner fixation part TPSi	A14L-0195-0042#00013583	42,0001,3583
G	Side CMT piece	A14L-0195-0042#00015724	42,0001,5724
H	Option clamp	A14L-0195-0042#03003173	42,0300,3173
I	Clamping nut	A14L-0195-0042#00015787	42,0001,5787
J	Clamping piece CMT	A14L-0195-0042#00015788	42,00015788

8.4 MAINTENANCE PARTS FOR THE WIRE BUFFER
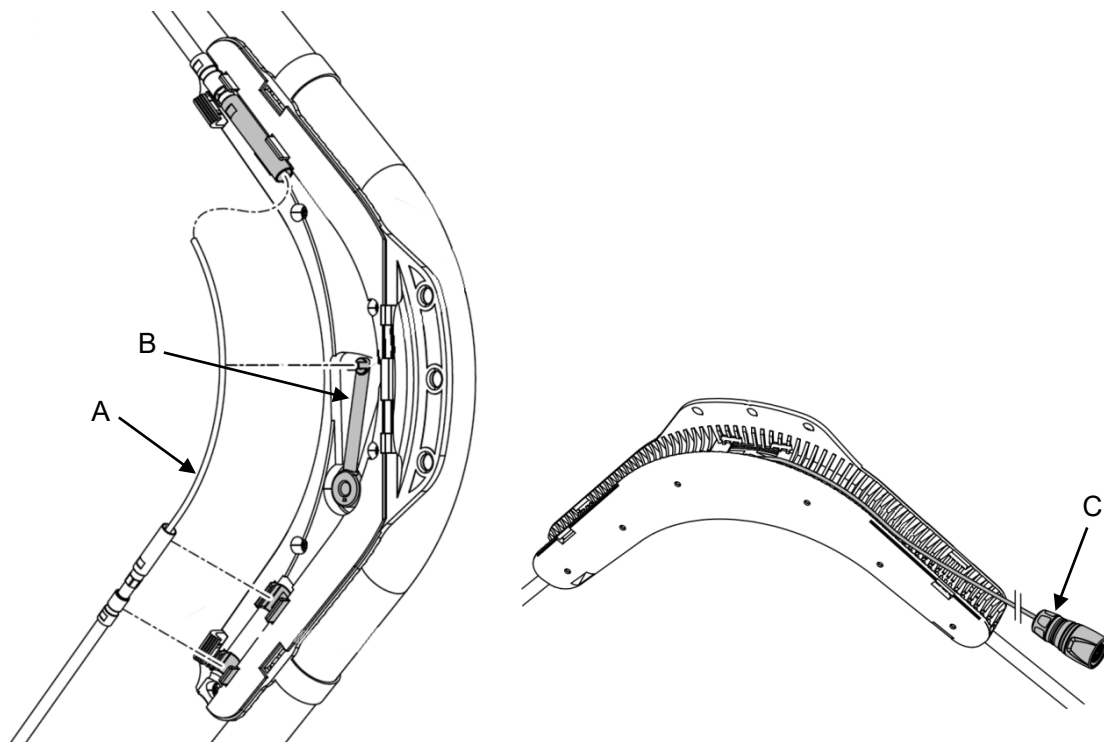
Fig. 8.4 (a)   Parts corresponding view

Table 8.4 (a)   Maintenance parts of the wire buffer

	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	Liner for wire buffer	A14L-0195-0044#03502444	44,0350,2444
B	Lever	A14L-0195-0040#01639	4,001,639
C	Cable for wire buffer	A14L-0195-0043#00044881	43,0004,4881

8.5 MAINTENANCE PARTS FOR THE WIRE FEEDER
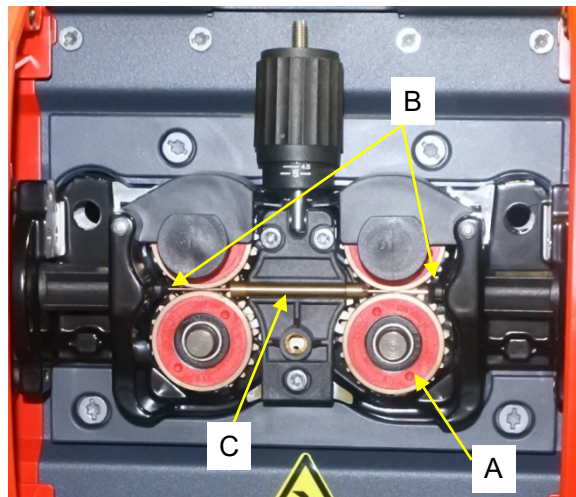
Fig. 8.5 (a) Parts corresponding view

Table 8.5 (a) Maintenance parts of the wire feeder

	Wire dia.	Maintenance parts name	Maintenance parts specifications	Fronius spec.
A	0.9	Feeder roll U 1.0	A14L-0195-0044#00011406	44,0001,1406
	1.0			
	1.2	Feeder roll U 1.2	A14L-0195-0044#00011407	44,0001,1407
B	Common	Guide nozzle 1.6 black	A14L-0195-0042#01001008	42,0100,1008
C	Common	Wire guide MSG d2.2	A14L-0195-0042#00013751	42,0001,3751

8.6   MAINTENANCE PARTS FOR HOSE PACK
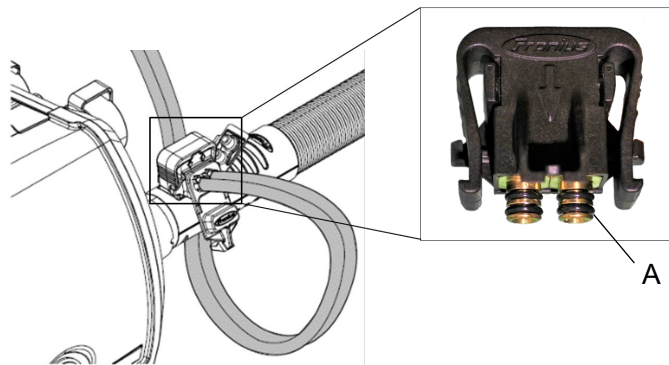
Fig. 8.6 (a)   Parts corresponding view

Table 8.6 (a) Maintenance part for hose pack

	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	O-ring	A14L-0195-0042#15000144	42,1500,0144

8.7   MAINTENANCE PARTS FOR WATER COOLING UNIT
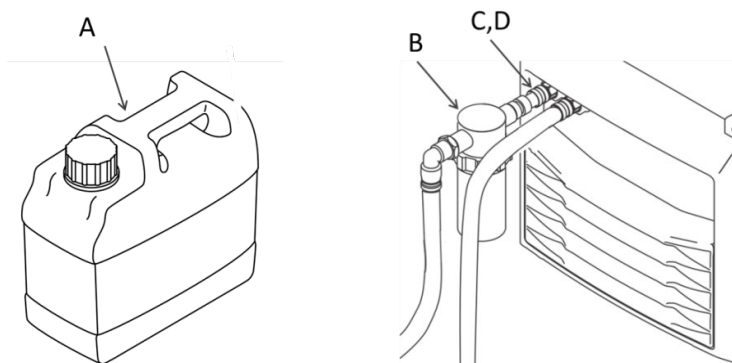
Fig. 8.7 (a)   Parts corresponding view

Table 8.7 (a)   Maintenance part of water cooling unit

	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	Coolant	A14L-0195-0040#00090046	40,0009,0046
B	Coolant FCL10	A14L-0195-0040#00090180	40,0009,0180
C	Filter	A14L-0196-0702#4100612	4,100,612
D	Joint for water cooling hose	A14L-0195-0044#00011398	44,000,11398
E	O-ring	A14L-0195-0042#04020236	42,0402,0236

8.8 MAINTENANCE PART FOR CRUSH BOX
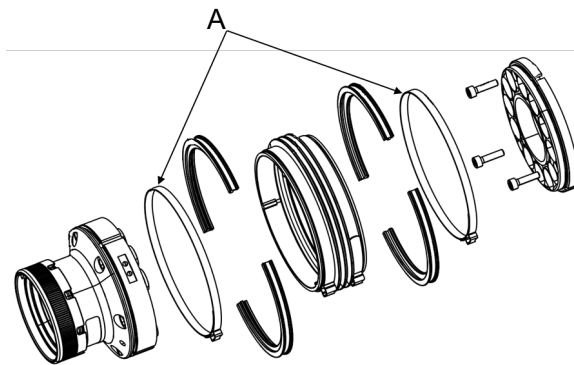
Fig. 8.8 (a) Parts corresponding view

Table 8.8 (a) Maintenance parts for crush box

	Maintenance parts name	Maintenance parts spec.	Fronius spec.
A	Clamp	A14L-0195-0042#15000144	42,1500,0144

8.9 SPECIAL TOOLS

aExcept the grease of H is attached when it is purchased. It they are broken or lost, you can order them by the following spec.
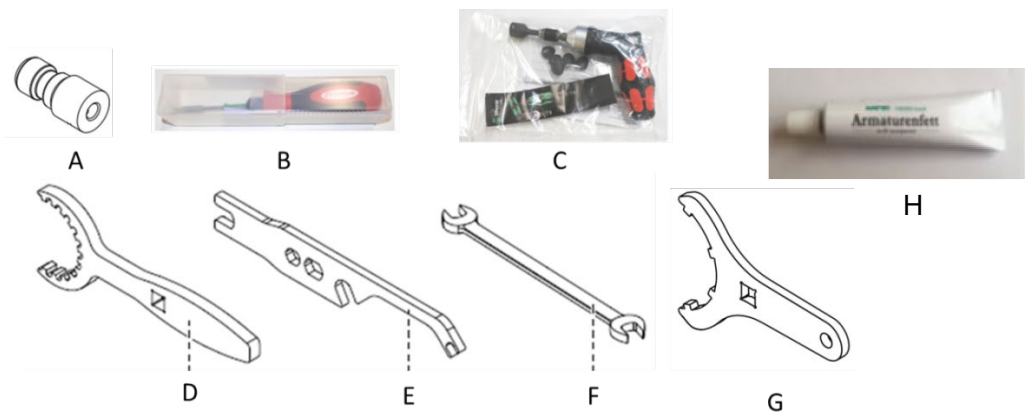
Fig. 8.9 (a) Parts corresponding view

Table 8.8 (a) Special tools

	Maintenance parts name	Maintenance parts spec.	Fronius spec.	Used locations
A	Cutting Aid	A14L-0195-0042#00014936	42,0001,4936	For liner cut
B	Torque driver 1Nm	A14L-0195-0042#04110160	42,0411,0160	Gas saver nozzle replacement
C	Torque driver 5Nm	A14L-0195-0042#04110168	42,041,10168	Feed roller replacement
D	Spanner	A14L-0195-0045#02001404	45,0200,1404	Tightening of the torch and the torch cable
E	Tool CMT Hand	A14L-0195-0042#02014973	42,0201,4973	Liner replacement
F	Wrench 10X12	A14L-0195-0042#04350067	42,0435,0067	Liner replacement
G	Assembly tool	A14L-0195-0213#BY20201	BY2,0201,4896	Crush box
H	Grease	A14L-0195-0040#00090044	40,0009,0044	For O-ring

8.10   PARTS REPLACED BY UNIT

8.10.1   Welding power supply

TPSi welding power supply differ depending on the installed software. When ordering the power supply for maintenance, check the order structure of the used power supply, then order same structure unit.
If soft construction differs from Table 8.10.1 (a), contact your local FANUC representative.

Table 8.10.1 (a)   Power supply for maintenance

Maintenance parts name	Built-in soft	Maintenance parts spec.
TPS 400i (water cooling)	A08B-9410-J970	A05B-1295-J105#WA
TPS 400i (water cooling)	A08B-9410-J970 A08B-9410-J971 (PULSE) A08B-9410-J972 (CMT) A08B-9410-J974 (PMC)	A05B-1295-J105#WB

8.10.2   Power supply peripheral equipment
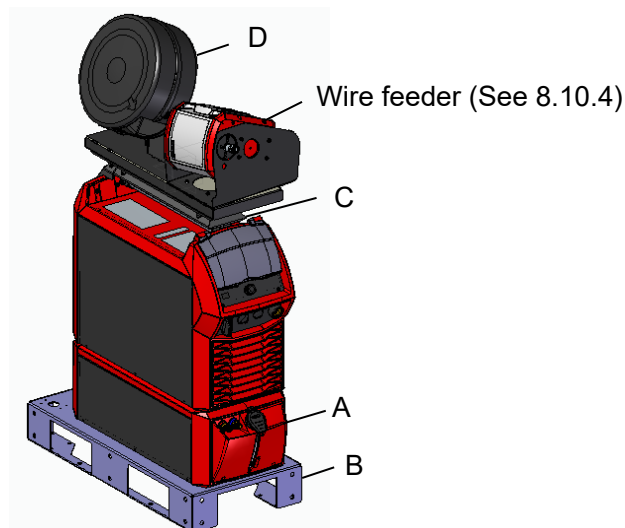
Fig. 8.10.2 (a)   Parts corresponding view

Table 8.10.2 (a) Power supply peripheral equipment

	Maintenance parts name	Maintenance parts spec.	Remarks
A	Water cooling unit	A14L-0196-0702	
B	Power supply stand	A14L-0196-0203	
C	Feeder mount (lower side)	A14L-0196-0204#PINTLE	
D	Feeder mount (upper side)	A14L-0196-0204#REEL	

8.10.3   Torch peripheral equipment
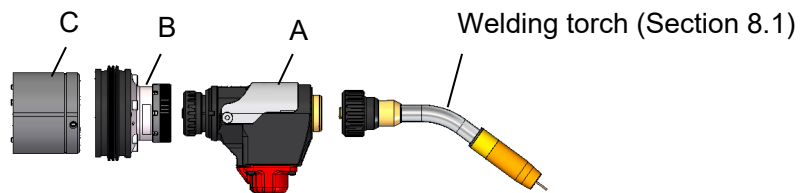
Fig. 8.9.3 (a)   Parts corresponding view

Table 8.10.3 (a) Torch peripheral equipment

	Maintenance parts name	Maintenance parts spec.	Remarks
A	Robacta drive (air cooling)	A14L-0195-0213	Rollers and expendables are not included
	Robacta drive (water cooling)	A14L-0195-0214	
B	Crush box	A14L-0195-0213#CLBOX	
C	Robot flange for ARC Mate *i*D	A14L-0195-0394	
	Robot flange for ARC Mate *i*C	A14L-0195-0394#IC	

8.10.4   Wire feeder
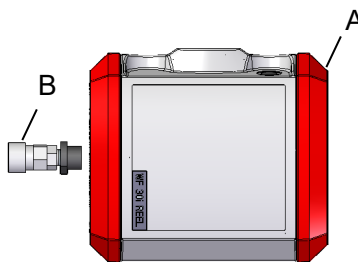
Fig. 8.10.4 (a)   Parts corresponding view

Table 8.10.4 (a)   Wire feeder

	Maintenance parts name	Maintenance parts spec.	Remarks
A	Wire feeder	A14L-0195-0233	Feed roller is not included
B	Flexible adapter	A05B-1295-J302	For iron wire

8.10.5 Hose pack

Integrated type   Separate type
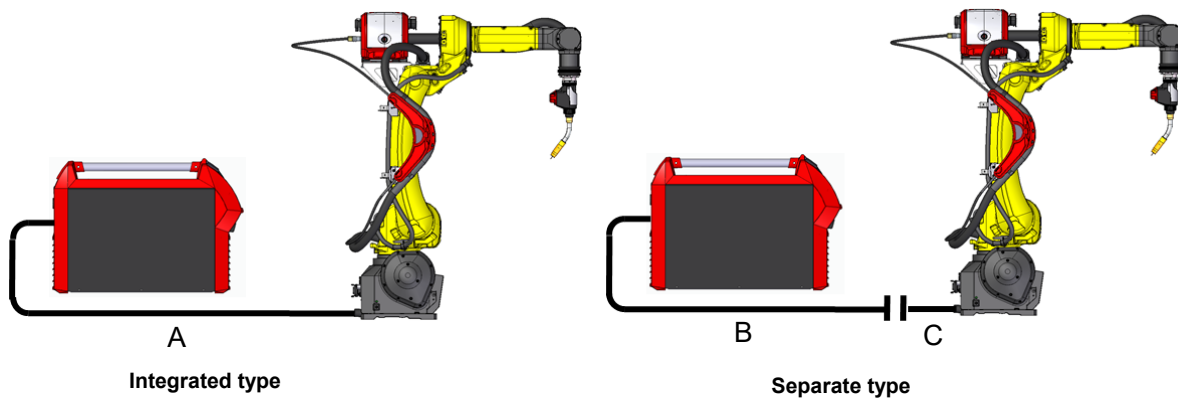
Fig. 8.10.5 (a)   Parts corresponding view

Table 8.10.5 (a) Hose pack

	Maintenance parts name	Maintenance parts spec.	Remarks
A	Hose pack (air cooling) 4m	A14L-0195-0621#4M	Integrated type
	Hose pack (air cooling) 8m	A14L-0195-0621#8M	
	Hose pack (water cooling) 4m	A14L-0195-0631#4M	
	Hose pack (water cooling) 8m	A14L-0195-0631#8M	
B	Power supply side hose pack (air cooling) 5m	A14L-0195-0622#CON5	Separate type Connect it to the robot side hose pack and use it.
	Power supply side hose pack (air cooling) 10m	A14L-0195-0622#CON10	
	Power supply side hose pack (air cooling) 15m	A14L-0195-0622#CON15	
	Power supply side hose pack (water cooling) 8m	A14L-0195-0632#CON5	
	Power supply side hose pack (water cooling) 10m	A14L-0195-0632#CON10	
	Power supply side hose pack (water cooling) 15m	A14L-0195-0632#CON15	
C	Robot side hose pack (air cooling) 3m	A14L-0195-0622#EXT	Separate type
	Robot side hose pack (air cooling) 3m	A14L-0195-0632#EXT	

8.10.6 Torch cable

Table 8.10.6 (a) Torch cable

Maintenance parts name	Maintenance parts spec.	Remarks
Torch cable (air cooling)	A14L-0195-0641#100ID	For ARC Mate 100iD
Torch cable (water cooling)	A14L-0195-0651#100ID	For ARC Mate 100iD
Torch cable (water cooling)	A14L-0195-0651#LG	For ARC Mate 100iD/10L

8.10.7 Peripheral equipment
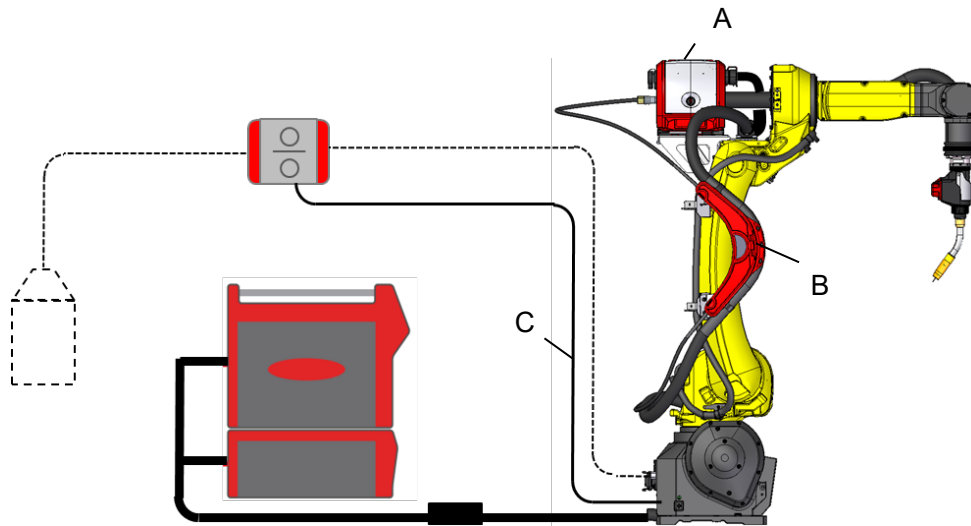
Fig. 8.10.7 (a)   Parts corresponding view

Table 8.10.7 (a) Peripheral equipment

	Maintenance parts name	Maintenance parts spec.	Remarks
A	Split box	A14L-0195-0241	The bracket is not included
B	Wire buffer	A14L-0195-0224	The bracket is not included
C	SpeedNet cable 5m	A14L-0195-0691#5M	
	SpeedNet cable 10m	A14L-0195-0691#10M	

9   INITIAL SETTING

This chapter describes initial setting of welding power supply. These were already set when robot was shipped, so those settings are usually not required.

9.1   INTRODUCTION

Fanuc ArcTool software can communicate with the Fronius welder by using the Fronius weld equipment library option (A05B-xxxx-R653) or Fronius Ethernet communication package (A05B-xxxx-J851) or Fronius EI Ethernet communication package (A05B-xxxx-J522) including this option. Following combinations of welder model and communication protocol are supported.

Table 9.1 (a) Communication protocol pf Fronius welder

Welder Model	Description
ROB 5000 (Analog)	This model is communicated by using the Analog (In this manual, a detailed setting method is not described).
TWIN with DNet (DeviceNet)	This model is communicated by using TWIN with DeviceNet (In this manual, a detailed setting method is not described).
TS/TPS with DNet （DeviceNet）	This model is communicated by using TS/TPS with DeviceNet. DeviceNet hardware and DeviceNet interface master option that is software option (A05B-xxxx-J753) are required in this configuration.
TS/TPS with ENet （Ethernet）	This model is communicated by using TS/TPS with Ethernet. There is no necessary hardware at the robot side. One of the following software options is required. <table><tr><td>A05B-xxxx-R785</td><td>Full channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R889</td><td>1 channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R890</td><td>2 channel Ethernet IP scanner</td></tr></table> Fronius Ethernet communication package (A05B-xxxx-J851) of 7DC3 series includes R785 option. Fronius Ethernet communication package (A05B-xxxx-J851) of 7DF1 series includes R889 option. This package is software for this method.
TPSi Inside ENet （Ethernet）	This model is communicated by using TPS/i with Ethernet. This method is used when the communication device on the welding machine side is Inside / i. There is no necessary hardware at the robot side. One of the following software options is required. <table><tr><td>A05B-xxxx-R785</td><td>Full channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R889</td><td>1 channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R890</td><td>2 channel Ethernet IP scanner</td></tr></table>
TPSi Inside PNet （Profinet）	This model is communicated by using TPS/i with Profinet. (In this manual, a detailed setting method is not described).
TPSi Extend ENet （Ethernet）	This model is communicated by using TPS/i with Ethernet. This method is used when the communication device on the welding machine side is Extend / i. There is no necessary hardware at the robot side. One of the following software options is required. <table><tr><td>A05B-xxxx-R785</td><td>Full channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R889</td><td>1 channel Ethernet IP scanner</td></tr><tr><td>A05B-xxxx-R890</td><td>2 channel Ethernet IP scanner</td></tr></table> Fronius EI Ethernet communication package (A05B-xxxx-J522) of 7DF1 series includes R889 option. This package is software for this method.

9.2   PREPARATION FOR TPS/i WELDER

Before switching the selection of welder manufacturer / model, it is necessary to perform the setup described in this Section.

9.2.1   Examination for the Number of Using I/O

Communication with Fronius welder requires a lot of digital I/O as shown below.

Table 9.2.1(a) Number of using I/O required for each Fronius welder

Welder Model	Number of required DI	Number of required DO
TS/TPS with DNet	104	96
TS/TPS with ENet	296	296
TPSi Inside ENet	320	320
TPSi Extend ENet	832	832

The number of digital I/O that can be displayed on the digital I/O screen is 512 by default. If system has two or more welder or other I/O (CELL I/O, PLC, etc.) will be configured, it is necessary to consider whether the number of using digital I/O exceeds 512 or not. If it exceeds, please perform the following procedure.

Procedure 9-2-1   Setting of maximum number of digital I/O

Step
1   Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start].
2   Press the [MENU] key and select the [0 – NEXT --].
3   Select the [PROGRAM SETUP]. The following screen will be displayed.

```
Program Limits setup
                              8/14

      1  User Tasks            4
      2  Numeric Registers     200
      3  Position Registers    100
      4  String Registers      25
      5  Macro                 150
      6  User Alarms           10
      7  Trace Length          200
      8  Num. Dig. Ports       512
      9  Error Severity        20
     10  Program adjust Schedule  10


    [TYPE]                        HELP
```

4   Move the cursor to [Num. Dig. Ports] and change it to the desired points (The maximum is 4096).

9.2.2   Setting of Multi-Process Function

When Fronius welding power supply is connected, it is necessary to set multi-process function to enable. Setting of multi-process function is performed in ArcTool setup screen after Controlled Start. **This is already set when robot is shipped, so it is usually not required.**

Procedure 9-2-2   Setting of multi-process function

Condition
・   ArcTool setup screen is displayed after performing Controlled Start.

```
ArcTool Setup
                                    8/11

   2 Welding setup:          Japan
   3   Wire speed units:     cm/min
   4   Weld speed units:     cm/min
   5   Weld speed:           100

   6 Manufacturer:   General Purpose
   7 Model:             MIG (Volts, Amps)

  Press FCTN then START (COLD) when done.

   8 Multi-process:          ENABLED


   [TYPE]              CHECK            HELP
```

Step

1   Move the cursor to below and confirm multi-process is ENABLED. If multi-process is DISABLED, match the cursor to "multi-process" then press F4「ENABLED」key.
2   Press [FCTN] key and select [START (COLD)] then perform it.

9.2.3   Preparation of Ethernet Communication Module for TPS/i (Inside/I, Extend/i)

In the case of TPS/i welder and Ethernet communication module Inside/i or Extend/I (RI FB/I Fanuc 1.0), it is necessary to set the IP address of welder. This is a setting of welder side, **but it was already set when robot was shipped, so those settings are usually not required.**

The backside of welder is shown below figure.

(a) (b)
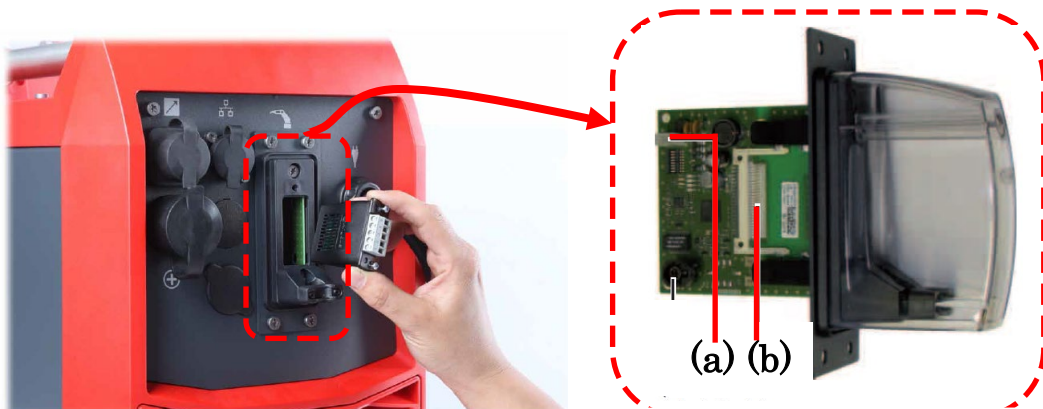
Ethernet communication module

There are following two procedures to set the IP address of the welder
A)   SETUP by DPI switch of EtherNet communication module
        - IP address can be set to 192.168.0.x (x :1 – 63, part of excluding x is fixed)
        - Subnet Mask is fixed to 255.255.255.0
B)   SETUP by communication between PC and service port
        - IP address and Subnet Mask can be set arbitrarily.

When robot was shipped, address of Fronius welder is set as follows.

IP address	:	192.168.0.2
Subnet Mask	:	255.255.255.0

If the above-mentioned address is used as EQ1, the network address is united as follows.

192.168.0.1 (IP address of robot Ethernet port that is for connecting to welder)
192.168.0.2 (IP address of welder 1)
192.168.0.3 (IP address of welder 2) *** Only multi equipment configuration**
192.168.0.4 (IP address of welder 3) *** Only multi equipment configuration**
192.168.0.5 (IP address of welder 4) *** Only multi equipment configuration**

Procedure 9-2-3   Setting of IP address of the welder

Please refer to Procedure A) about the above-mentioned A).
On the other hand, please refer to Procedure B) about the above-mentioned B).

Procedure A):

1   If Ethernet IP module installed in the welder, detach it
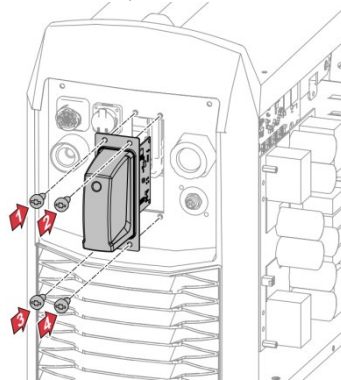
2   Confirm the state of DIP switch that is on (a). The IP address of welder can be set to "192.168.0.x". "x" means a node address that can be arbitrarily set to a value from 1 to 63. Please refer to the following table. Do not change both DIP switches 7 and 8 to OFF.
For example, only 2 of DIP switch is set to ON if you want to set the IP address to "192.168.0.2".

Node	DIP switch							
Address	1	2	3	4	5	6	7	8
1	ON	OFF	OFF	OFF	OFF	OFF		
2	OFF	ON	OFF	OFF	OFF	OFF		
3	ON	ON	OFF	OFF	OFF	OFF		
62	OFF	ON	ON	ON	ON	ON		
63	ON	ON	ON	ON	ON	ON		
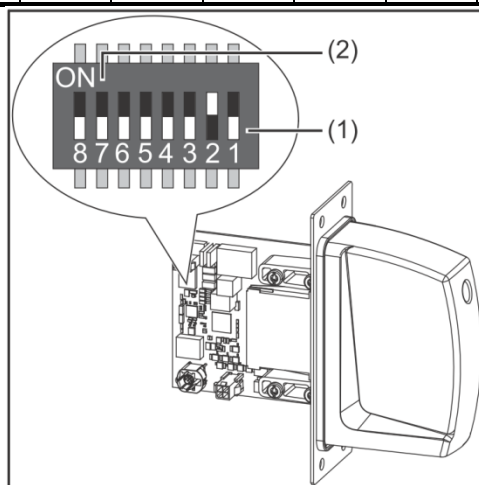
3   Attach the Ethernet IP module to the welder.

Procedure B):

1   Turn off all DIP switches on the Ethernet IP module by referring to the Procedure A.
2   Refer to section 4.4 to connect to PC and edit IP address.

9.3   SETTING OF WELDER MANUFACTURER

It is possible to set welder manufacturer by the following procedure. However, it was already set when robot was shipped, so it is usually not necessary.

Procedure 9-3   Setting of welder manufacturer

Condition

- Fronius weld equipment library option (A05B-xxxx-R653) or Fronius Ethernet communication package (A05B-xxxx-J851) or Fronius Ethernet communication package (A05B-xxxx-J522) is ordered.
- In the case of Ethernet communication, Ethernet IP scanner option (A05B-xxxx-R785 or R889 or R890) or Fronius Ethernet communication package (A05B-xxxx-J851) or Fronius Ethernet communication package (A05B-xxxx-J522) is ordered.
- All preparations described in Section 9.2 are completed.

Step

1   Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start]. The following screen will be displayed.
     Settings in following screen depends on the order configuration so there is no problem even if your system does not have the same settings.

```
ArcTool Setup

    2 Welding setup:        Japan
    3 Wire speed units:     cm/min
    4 Weld speed units:     cm/min
    5 Weld speed:           100

    6 Manufacturer:         General Purpose
    7 Model:                MIG (Volts, Amps)

   Press FCTN then START (COLD) when done.

    8 Multi-process:                ENABLED


    [TYPE]          CHECK           HELP
```

2   Move the cursor to [Manufacturer] and press F4[CHOICE]. Select the [Fronius]. ArcTool internal auto setup process is performed. [Model] is selected to ROB 5000 by default.
3   When other models are used, move the cursor to [Model] and press F4[CHOICE]. The following menu will be displayed, so select the desired model.

```
                    1
1 ROB 5000
2 TS/TPS with DNet
3 TWIN with DNet
4 TS/TPS with ENet
5 TPSi Inside ENet
6 TPSi Inside PNet
7 TPSi Extend ENet
```

4   When [TPSi Inside ENet] or [TPSi Extend ENet] is selected at step 3, following screen is displayed. Select [YES] only when the DIP switch is set by the Procedure A) described in Subsection 9.2.3. In the case of selecting [NO], proceed to step 5.

```
Did you change DIP switches

from default ?



    YES           [ NO ]
```

In the case of selecting [YES], following question is proceeded. Select [NO].

```
Has DIP #7 been set to ON

to enable ECO Image (128 I/O) ?



    YES           [ NO ]
```

Continuously, following question is proceeded. Though it is a repeated confirmation, select [YES] only when the DIP switch is set by the Procedure A) described in Subsection 9.2.3. In the case of selecting [NO], proceed to step 5.

```
Has any DIP switch #1-#6

been changed to modify

default EQ IP address ?



    YES           [ NO ]
```

In the case of selecting [YES], following question is displayed at the bottom of the screen. Input the node address (1 - 63) that is set by the Procedure A) described in Subsection 9.2.3.

```
Enter the IP Address node:
```

5   Continuously, following screen is displayed. If the start point of digital I/O range that is used in the communication with Fronius welder is not specified, select [NO]. In this case, it is automatically assigned to the first area where has enough I/O points that are required. If the start point of digital I/O range is specified, select [YES] and enter the desired point. In both the automatic assignment case and the manual assignment case, please note that the start point becomes the value that added 1 to multiple of 8 (1, 9, 17, …).

```
Fronius  Digital  I/O  Setup

You can specify a start point
or begin checking at point 1.

Specify an I/O start point ?

    YES           [ NO ]
```

6   Continuously, following screen is displayed. If the start point of Group Input that is used in the communication with Fronius welder is not specified, select [NO]. In this case, it is automatically

assigned to free space. If the start point of Group Input is specified, select [YES] and enter the desired point.

```
Fronius  Group  Input  Setup

You can specify a start point
or begin checking at point 1.

Specify an I/O start point ?

    YES           [ NO ]
```

7   Continuously, following screen is displayed. If the start point of Group Output that is used in the communication with Fronius welder is not specified, select [NO]. In this case, it is automatically assigned to free space. If the start point of Group Output is specified, select [YES] and enter the desired point.

```
Fronius  Group  Output  Setup

You can specify a start point
or begin checking at point 1.

Specify an I/O start point ?

    YES           [ NO ]
```

8   Press [FCTN] key and select [START (COLD)] then perform it.

9.4   SETTING AFTER SETTING OF WELDER MANUFACTURER

There are some necessary settings after setting of welder manufacturer / model. However, these were already set when robot was shipped, so those settings are usually not required.

9.4.1   Setting of Robot Ethernet IP Address

When a communication method is not an Ethernet, it is not necessary to perform the setting of this Subsection. This Subsection sets the IP address of robot controller Ethernet port. If the system is connected to the network such as Cell I/O, it is necessary to divide the network from the network for communicating the Fronius welder. Normally, the Ethernet port #2 of the robot controller is used for communicating with the Fronius welder.

Procedure 9-4-1   Setting of robot Ethernet IP address

Step

1   Press the [MENU] key and select [SETUP]. Press F1[TYPE] and select [Host Comm]. The following screen will be displayed.

```
SETUP Protocols
                                                    1/8
         Protocol            Description
       1 TCP/IP              TCP/IP Detailed Setup
       2 TELNET              Telnet Protocol
       3 SM                   Socket Messaging Device
       4 Proxy               Proxy Server
       5 PPP                 Point to Point Protocol
       6 PING                Ping Protocol
       7 HTTP                HTTP Authentication
       8 FTP                 File Transfer Protocol


        [TYPE]              DETAIL   [SHOW]
```

2 Move the cursor to the first line (TCP/IP) and press F3[DETAIL]. The following screen will be displayed.

```
SETUP Host Comm
                                                    1/40
TCP/IP
       Robot name          :               ROBOT
       Port#1 IP addr      : *********************
       Subnet Mask         :         255.255.255.0
       Board address       : *********************
       Router IP addr      : *********************

       Host Name (LOCAL)   Internet Address
       1 **********        ******************
       2 **********        ******************
       3 **********        ******************


        [TYPE]              PORT     PING    HELP
```

3 By pressing F3[PORT], change screen of port that is used for communicating the welder.
4 Confirm IP address setting. There is a case that the IP address has been already set. In this case, complete this procedure here.
5 When the IP address is initialization or [0.0.0.0], it must be set. Set the IP address of robot side Ethernet port according to the decision in the Subsection 9.2.3.
6 Confirm that the space is not included in the inputted IP address.
7 Press F8[INIT] and select [YES] in the displayed screen. This port is initialized and new IP address is applied (This procedure is also performed by the cycle power).

9.4.2   Setting of Ethernet IP Scanner

When a communication method is not an Ethernet, it is not necessary to perform the setting of this Subsection. This Subsection sets the Ethernet IP scanner option of the robot software function corresponding to the IP address of welder.

Procedure 9-4-2   Setting of Ethernet IP scanner

Step

1   Press the [MENU] key and select [I/O]. Press F1[TYPE] and select [EtherNet/IP]. The following screen will be displayed.

```
I/O EtherNet/IP
  EtherNET/IP List (Rack 89)                    1/32
    Description  TYP  Enable  Status      Slot
    Fronius EQ1  SCN  TRUE    OFFLINE      1
    Connection2  ADP  FALSE   OFFLINE      2    _
    Connection3  ADP  FALSE   OFFLINE      3
    Connection4  ADP  FALSE   OFFLINE      4
    Connection5  ADP  FALSE   OFFLINE      5


      [TYPE]    PING              CONFIG   HELP
```

2   When there is TRUE connection excluding [Fronius EQ x], disable it if it is not used. There is no problem that the assignment is deleted (Move the cursor to the third row that column and press F5[FALSE]. Then, move the cursor to the first row and press F4[CONFIG]. [Input size (words)] and [Output size (words)] are changed to 0 on the displayed screen. Next, press F1[TYPE] and select "Digital". Press F2[CONFIG] and move the cursor to the assignment of SLOT number of that connection whose RACK number is 89 and perform F4[DELETE] on the displayed screen. In addition, press F3[IM/OUT] to change the display of IN/OUT and delete above-mentioned assignment. (Perform cycle power.)

3   Move the cursor to the first row of the [Fronius EQ1] line and press F4[CONFIG]. The following screen will be displayed. Since the setting contents change depending on the configuration, there is no problem even if it is not as follows.

```
I/O EtherNet/IP
Scanner Configuration :            1/10
    Description      :    Fronius EQ1
    Name/IP address  :    **********
    Vendor Id    :    1332
    Device Type  :    12
    Product code :    832
    Input size (bytes)  :    52
    Output size (bytes) :    52


      [TYPE]    ADV     PREV    ANALOG   HELP
```

4   Confirm the setting of [Name/IP address]. There is a case that it has been already set. In this case, complete this procedure here.

5   When it is initialization or [0.0.0.0], it must be set. After returning to the previous screen by pressing F3[PREV] once, move the cursor to the third row of the [Fronius EQ1] line. Change this to FALSE.

6   Move the cursor to the first row of the [Fronius EQ1] line and press F4[CONFIG].

7   Set the IP address of welder to [Name/IP address] according to the decision in the Subsection 9.2.3.

8   Press F2[ADV]. The following screen will be displayed.

```
I/O EtherNet/IP
Advanced Configuration    :              1/13
  General
    I/O Data Type        :    16-BIT BYTES
    Timeout Multiplier   :    4
    Reconnect            :    FALSE
    Major Revision       :    0
    Minor Revision       :    0


      [TYPE]          PREV    [CHOICE]   HELP
```

9   If "Reconnect" is FALSE, change it to TRUE.
10   Press F3[PREV]. A previous screen will be displayed.
11   Press F3[PREV]. Another previous screen will be displayed.
12   Move the cursor to the third row of the [Fronius EQ1] line. Change this to TRUE.
13   Power OFF both the robot controller and the welder.
14   Confirm that the Ethernet connection between the robot controller Ethernet port and the welder. After that, power ON both the robot controller and the welder.
15   Confirm that the status of [Fronius EQ1] is "RUNNING" after displaying the Ethernet/IP screen (screen of step 1).

```
I/O EtherNet/IP
  EtherNet/IP List (Rack 89)                    1/32
    Desctiption  TYP  Enable  Status     Slot
    Fronius EQ1  SCN  TRUE    <RUNNING>  1
    Connection2  ADP  FALSE   OFFLINE    2    _

     [TYPE]     PING            CONFIG   HELP
```

16   Press the [RESET] key. Communication between robot and welding machine is established.

9.4.3   Preparation of XML File

Normally, it is necessary to perform a procedure in this Subsection. Welder has information of "synergiclines.xml" that has Synergic ID list (Please refer to the Section 3.1 about the Synergic ID). Robot has this XML file from the beginning and Weld Procedure setup screen show the XML information. Please perform this procedure only when the displayed XML information is old.

Procedure 9-4-3   Preparation of XML file

Condition
Beforehand, prepare the "synergiclines.xml" that is provided by Fronius (It is also possible to acquire from the welder. After confirming webpage can be displayed by performing steps 1 to 8 of Procedure 4-4), XML file can be acquired by inputting [http://x.x.x.x/dyn/synergiclines.xml] (x.x.x.x is Service Port IP address that can be confirmed by step 3) to address of web browser).

Step
1   Insert the memory card or USB memory that the "synergiclines.xml" is prepared to the robot controller.
2   Press the [MENU] key and select [FILE]. Press F1[TYPE] and select [File]. The following screen will be displayed.

```
ファイル
  MC:¥*.*                              1/31
    1 *           *    (all files)
    2 *           KL   (KAREL source)
    3 *           CF   (all command files)
    4 *           TX   (all text files)
    5 *           LS   (all KAREL listings)
    6 *           DT   (all KAREL data files)

     [TYPE]  [ DIR ]  LOAD  [BACKUP]  [UTIL]  >
```

3   Confirm current device that is selected. If it is not a device that is prepared at step 1, press F5[UTIL] and select [Set Device]. Select the device that is prepared at step 1.
4   Display all files and move the cursor to [SYNERGICLINES].
5   Press F7[COPY]. Move the cursor to [To Device:] and press F4[CHOICE].
6   Select [FROM Disk (FR:)].

7   Press F1[DO_COPY].
8   Confirm the following message is displayed at the bottom of the screen.

```
Copied to FR:¥¥SYNERGICLINES.XML
```

APPENDIX

A   WELD CONDITION ADJUSTMENT

This chapter describes general adjustment method of welding condition, welding defects and countermeasure.

A.1   INFLUENCE BY ADJUSTMENT OF WELDING CONDITION

Table A.1.(a) describes the effect of weld schedule to bead appearance and Table A.1.(b) describes the effect of weld schedule to welding.

Table A.1 (a)   Effect to appearance of each weld condition
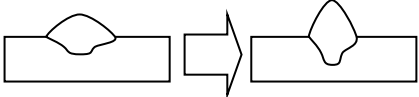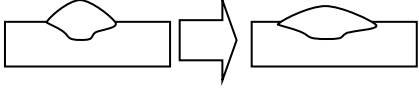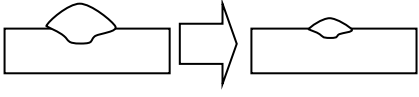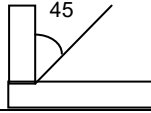
#	Factor	Change	Effect to bead	Notes
1	Wire feed speed or Weld current	Higher	Penetration becomes deeper Width of bead becomes wider Toe angle becomes smaller Less spatter	
2	Arc length correction (Weld Voltage)	Higher	Arc length becomes longer Penetration becomes shallower Width of bead becomes wider Convexity height becomes bigger spatter size becomes bigger	
3	Welding speed	Faster	Penetration becomes shallower Width of bead becomes narrower Toe angle becomes bigger Undercut may more occur	

Table A.1 (b)   Effect to weld of each weld condition.

#	Factor	Change	Effect to weld	Notes
1	Wire size	Wider	More spatter Arc generation becomes unstable Penetration becomes shallower	Robots support 0.9, 1.0 1.2 mm
2	Contact tip distance	Longer	Less current Arc length becomes longer Penetration becomes shallower Arc generation becomes unstable	Suggested distance ϕ1.2 mm : 15 mm ϕ0.9, 1.0mm: 12 mm (enlarge 1mm → welding electric current descends 5 to 8A.)
3	Torch angle	Wider	Penetration becomes deeper Width of bead becomes narrower Toe angle becomes smaller	Common 45 degree 45
4	Travel angle	Push/Pull	Pull angles are Penetration becomes deeper Width of bead becomes narrower Toe angle becomes smaller than push angle.	Push angle: Common attitude Pull angle Attitude for higher power Generally the angle it 10 to 20°
5	Gas	CO2/mixed	Mixed gas are Less spatter Arc generation becomes more stable Bead becomes better in appearance Penetration becomes shallower than CO2 gas	CO2 gas: Cheaper and popular. Mixed gas More expensive Use for appearance and thin metal.

A.2   COUNTERMEASURE TO WELDING DEFECTS

Table A.2. (a) describes the problems and counter plan for bead appearance, Table A.2.(b) describes the problems and counter plan for gas and surface pores and Table A.2.(c) describes Problem and Cause and counter plan for unstable arc.

Table A.2 (a)   Problems in appearance and counter plan

#	Problem in appearance	Counter plan
1	Unstable appearance	1. Correct a twist of conduit cable(Correct a twist of wire) 2. Change tip 3. Set contact tube distance shorter 4. Clean up groove face 5. Measure arc blow(Stable arc generation)
2	Convex bead or With of bead is narrow	1. Increase welding voltage 2. Set wire size wider 3. Use weaving function(Set the width of bead wider) 4. Set welding speed slower
3	Short leg length	1. Set wire feed speed or weld current higher 2. Set welding speed slower 3. Use weaving function(Set the width of bead wider) 4. Increase weld path
4	Different leg lengths (Bead falls Horizontal corner meat welding)	1. Move arc start position to vertical work side 2. Set torch angle wider 3. Set welding speed slower 4. Use weaving function(Set the width of bead wider) 5. Increase weld path 6. Set travel angle to push

#	Problem in appearance	Counter plan
5	Crater inferiority	1. Adjust crater-fill process schedule.
6	Burn-through	1. Set wire feed speed or weld current lower. 2. Set welding speed slower 3. Use weaving function(Set the width of bead wider) 4. Set gaps of joint shorter
7	Penetration shortage	1. Set wire feed speed or weld current higher 2. Set welding speed slower 3. Set travel angle to pull 4. Adjust arc start position 5. Change downward welding to upward welding
8	Undercut	1. Set wire feed speed or weld current lower 2. Decrease welding voltage 3. Set welding speed slower 4. Set torch angle wider 5. Clean up groove face
9	Overlap	1. Set wire feed speed or weld current higher 2. Increase welding voltage 3. Set welding speed faster 4. Set contact tube distance shorter 5. Clean up groove face

10	Bead crack	There are various forms for bead crack, and the factors are different in each. Please review a welding condition because the following causes are thought about.
		a. Hot crack (Vertical crack and lateral crack on the bead surface)
		  1. Set wire feed speed or weld current lower
		  2. Set weld speed slower
		  3. Less heat input
		b. Cold crack (crack inside the bead and crack of heat-affected zone)
		  1. More heat input
		  2. More preheating and postheating
		  3. Clean up wire and work
		  4. Stable gas flow.

Table A.2 (b)   Cause and counter plan for gas pore and surface pore

#	Cause	Counter plan
1	Dirt of work	Clean up oil, stain, paint, water and oxide scale on groove face completely
2	Dirt of wire	Use internal wire, since most outer wire will rust out
3	Dirt of nozzle	Remove spatter cohesion nozzle
4	Effect of wind	If welding part is exposed to wind, it may cause the disturbance of the shield gas, therefore air is involved to the arc and fusion zone. • Increase gas flow • Equip screen
5	Gas flow	• Change gas cylinder when 1st pressure is less than 10 kg/cm^2 • Confirm heat equipped gas flow controller • Confirm leak of gas hose and connection
6	Gas quality	• Confirm whether the purpose of the gas is welding. • Confirm mixture device
7	Contact tube distance	Adjust the distance
8	Weld schedule	• Set wire feed speed or weld current higher • Set welding speed slower

Table A.2 (c)   Problem and Cause and counter plan for unstable arc

#	Problem	Cause
1	Unstable wire feed	1. Wrong bore size of contact tip or attrition 2. Twist conduit cable. 3. Wire sniggles in the reel 4. Size of wire feed role is wrong Wire feed role is attrition Pressure to wire feed role is wrong. 5. Liner spring is clogging up
2	Unstable weld voltage	1. 1st input of weld equipment is unstable 2. Connection of power cable is loose-knit 3. Contact tube distance is too long 4. Unstable wire feed. 5. Wire size is wrong for weld schedule.
3	Arc blow occurs	1. Earth connection is wrong. 2. Use tab board 3. Set the gap of joint narrower
4	Increase spatter	1. Wrong wire feed speed or weld current, and weld voltage 2. Wire size is too big 3. Torch angle is too wide 4. Arc blow occurs

B   PERIODIC MAINTENANCE TABLE

Item	Locations	Every day	Every week	Every month
Torch	Tip	Replace moderately		
	Diffuser	Visual confirmation		
	Neck liner		Visual confirmation	
	Nozzle	Visual confirmation	Replacing	
	Torch connection part			Remove the torch then check dirt and damage by visual confirmation
Hose pack	Liner		Confirming abrasion status	
	Water cooling hose			Check the water leak
Robacta drive	Guide nozzle		Confirming abrasion status	
	Wire feeding status	Visual confirmation		Retighten the drive roller
	Roller status		Confirming abrasion status	
	Cleaning around the roller			
	Pressure		Confirmation	
Wire buffer	Cleaning the wire guide		Clean with air	
	Liner status		Confirming abrasion status	
	Probe			Check damage
Wire feeder	Wire feeding status		Visual confirmation	
	Gas supply	Push the gas button and check		
	Pressure		Confirmation	
	Clean the roller surrounding		Clean with air	
Water cooling unit	Amount of the cooling water	Confirmation		
	Fan status			Confirmation
	Cleaning			Confirmation

Arc welding power supply option	Periodic maintenance table

			Check times	First check 320	3 months 960	6 months 1920	9 months 2880	1 year 3840	4800	5760	6720	2 year 7680	8640	9600	10560
Welding power supply	1	Cleaning inside the welding power supply	0.5H			○		○		○		○		○	
	2	Confirm the damage situation of fan	0.1H			○		○		○		○		○	
	3	Check the allophone and vibration	0.2H			○		○		○		○		○	
Wire feeder	4	Cleaning each parts	0.5H			○		○		○		○		○	
	5	Check the tighten of bolts and other connection parts.	0.1H			○		○		○		○		○	
	6	Check the gas valve	0.1H			○		○		○		○		○	
Welding torch	7	Replacing the torch cable	1.0H					●				●			
Hose pack	8	Replacing the hose pack	3.0H									●			
Surrounding cable	9	Confirming the flexible conduit	0.1H					○				○			
Water cooling unit	10	Check and replacing of cooling water	0.5H					●				●			

*1   Refer to Chapter 5 about daily check and check items.
*2   ●: requires order of parts
       ○: doe not requires order of parts
*3   Be sure to refer to maintenance section of welding power supply manual.
*4   Be sure to refer to operator's manual about mechanical unit of robot.

3 years 11520	12480	13440	14400	4 years 15360	16320	17280	18240	5 years 19200	20160	21120	22080	6 years 23040	24000	24960	25920	7 years 23040	27840	28800	29760	Item
○		○		○		○		○		○		○		○		○		○		1
○		○		○		○		○		○		○		○		○		○		2
○		○		○		○		○		○		○		○		○		○		3
○		○		○		○		○		○		○		○		○		○		4
○		○		○		○		○		○		○		○		○		○		5
○		○		○		○		○		○		○		○		○		○		6
●				●				●				●				●				7
				●								●								8
○				○				○				○				○				9
●				●				●				●				●				10

C STRENGTH OF BOLT AND BOLT TORQUE LIST

> **NOTE**
> When applying LOCTITE to a part, spread the LOCTITE on the entire length of the engaging part of the female thread. If applied to the male threads, poor adhesion can occur, potentially loosening the bolt. Clean the bolts and the threaded holes and wipe off any oil on the engaging section. Make sure that there is no solvent left in the threaded holes. When finished, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes.

Use the following strength bolts. Comply with any bolt specification instructions.
Hexagon socket head bolt made of steel:
  Size M22 or less: Tensile strength 1200N/mm^2 or more
  Size M24 or more: Tensile strength 1000N/mm^2 or more
  All size plated bolt: Tensile strength 1000N/mm^2 or more
Hexagon bolt, stainless bolt, special shape bolt (button bolt, low-head bolt, flush bolt .etc.)
        Tensile strength 400N/mm^2 or more
Refer to the following tables if the bolts tightening torque is not specified.
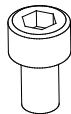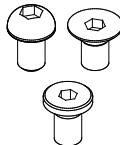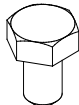
Recommended bolt tightening torques   Unit: Nm

Nominal diameter	Hexagon socket head bolt (steel)		Hexagon socket head bolt (stainless steel)		Hexagon socket head button bolt Hexagon socket head flush bolt Low-head bolt (steel)		Hexagon bolt (steel)	
	Tightening torque		Tightening torque		Tightening torque		Tightening torque	
	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit
M3	1.8	1.3	0.76	0.53	———	———	———	———
M4	4.0	2.8	1.8	1.3	1.8	1.3	1.7	1.2
M5	7.9	5.6	3.4	2.5	4.0	2.8	3.2	2.3
M6	14	9.6	5.8	4.1	7.9	5.6	5.5	3.8
M8	32	23	14	9.8	14	9.6	13	9.3
M10	66	46	27	19	32	23	26	19
M12	110	78	48	33	———	———	45	31
(M14)	180	130	76	53	———	———	73	51
M16	270	190	120	82	———	———	98	69
(M18)	380	260	160	110	———	———	140	96
M20	530	370	230	160	———	———	190	130
(M22)	730	510	———	———	———	———	———	———
M24	930	650	———	———	———	———	———	———
(M27)	1400	960	———	———	———	———	———	———
M30	1800	1300	———	———	———	———	———	———
M36	3200	2300	———	———	———	———	———	———

D CABLE FORMING ROUT FOR USING MULTI WELDING POWER SUPPLY

Bad example

In the following Fig. D (a) 1, 2, the welding power cables are installed parallel to the Voltage detection line, and then the noise breakout.
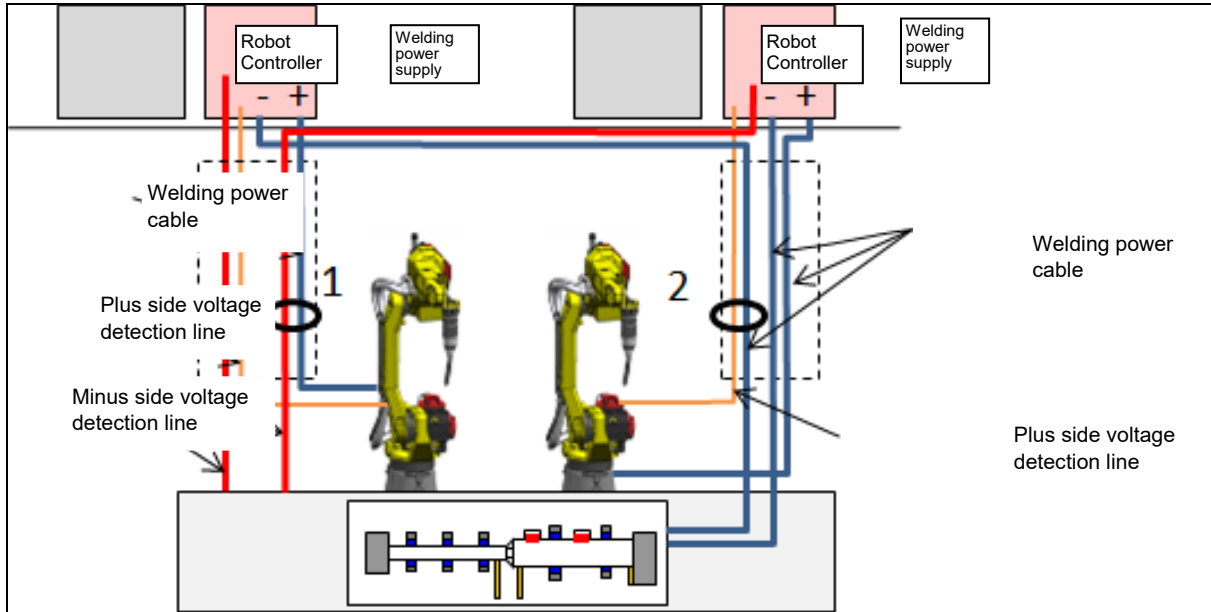
Fig. D (a) Bad wiring example

Good example

Wire each Welding power cable and Voltage detection line separately.

Locate the Welding power cable well away from the Voltage detection line, and the Welding power supply + and – abut.

Fig. D (b)   Good wiring example

INDEX

REVISION RECORD

Edition	Date	Contents
02	Jul.,2022	・Addition contents to quick reference, periodic maintenance, trouble shooting and maintenance parts ・Correction of errors
01	Nov.,2018	

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