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 Welding Power Supply）

OPERATOR'S MANUAL

B-83614EN-3/02

- **Original Instructions**

Thank you very much for purchasing FANUC Robot.

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

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

The products in this manual are controlled based on Japan's “Foreign Exchange and Foreign Trade Law". The export from Japan may be subject to an export license by the government of Japan. Further, re-export to another country may be subject to the license of the government of the country from where the product is re-exported. Furthermore, the product may also be controlled by re-export regulations of the United States government. 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 must be read before using the robot.

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 “FANUC Robot SAFETY HANDBOOK (**B-80687EN)**”.

1 DEFINITION OF USER

The 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 safety fence

Maintenance engineer:
- Operates the robot
- Teaches the robot inside the safety fence
- Maintenance (repair, adjustment, replacement)

- Operator is not allowed to work in the safety fence.
- Programmer/Teaching operator and maintenance engineer is allowed to work in the safety fence. Works carried out in the safety fence include transportation, installation, teaching, adjustment, and maintenance.
- To work inside the safety fence, the person must be trained on proper robot operation.

Table 1 lists the work outside the safety fence. In this table, the symbol "○" means the work allowed to be carried out by the worker.

Table 1 List of work outside the fence

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

In the robot operating, programming and maintenance, the operator, programmer/teaching operator and maintenance engineer 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.

- Check this manual thoroughly, and keep it handy for the future reference.

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 CONTROLLER Arc Welding Power Supply Option(FRONIUS Welding Power Supply) OPERATOR'S MANUAL B-83614EN-3" 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*C/12	ARC Mate 100*i*C series
FANUC Robot ARC Mate 100*i*C/7L	
FANUC Robot ARC Mate 120*i*C	ARC Mate 120*i*C series
FANUC Robot ARC Mate 120*i*C/10L	
FANUC Robot ARC Mate 120*i*C/12L	

Definition of WARNING, CAUTION, and NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety.
Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

Serious injuries mentioned below are those injuries that have after-effects and those that require hospitalization or reception of long-term hospital treatment as outpatients, such as loss of eyesight, wounds, burns (high-temperature and low-temperature burns), electric shocks, fractures, and poisoning. Medium troubles and minor injuries are those wounds, burns, electric shocks, and so forth that do not require hospitalization or reception of long-term hospital treatment as outpatients. Equipment damages refer to property damages and extended damages related to device damages.

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.

- Check this manual thoroughly, and keep it handy for the future reference.

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.

⚠WARNING
- 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.

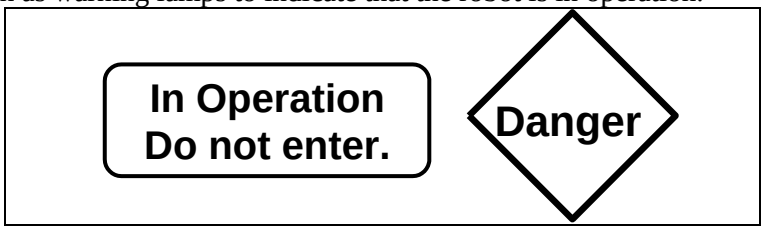


Fig. 1 Example of Alarm indications

- 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.

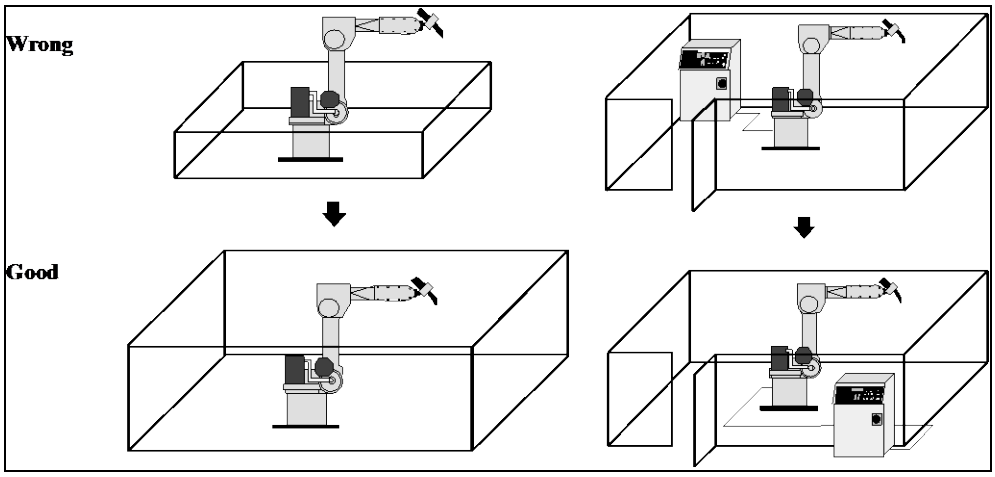


Fig. 2 Safety fence

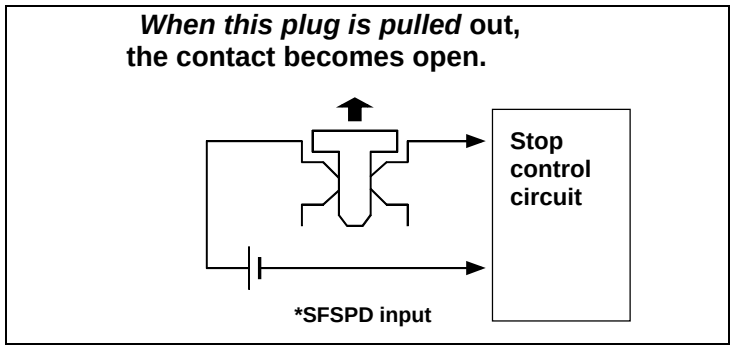


Fig. 3 Safety plug

- 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.

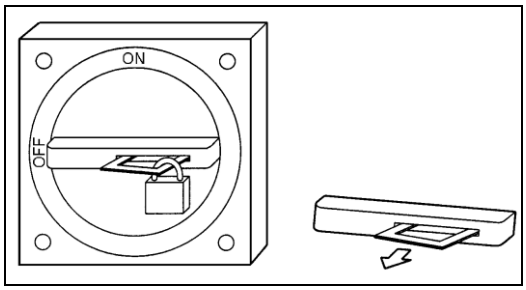
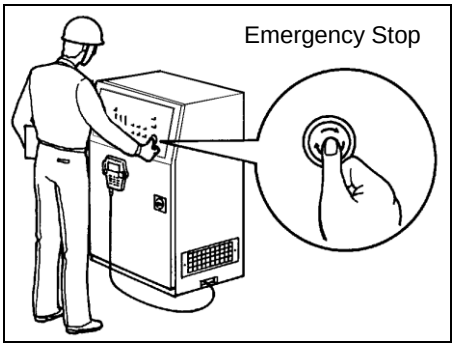


Fig. 4 Locking the circuit breaker

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.



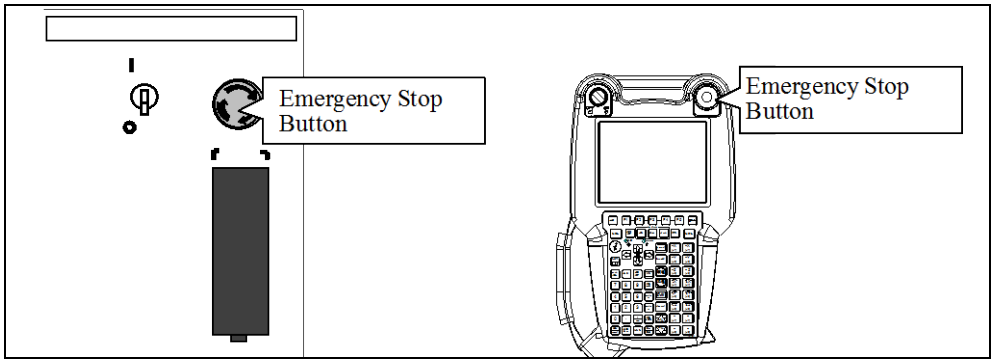


Fig. 5 Emergency stop button

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.

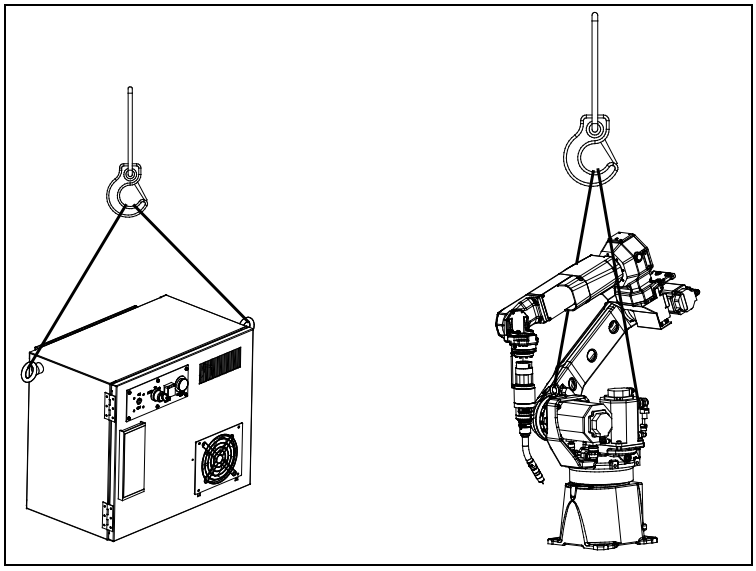


Fig. 6 Transportation of robot

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.

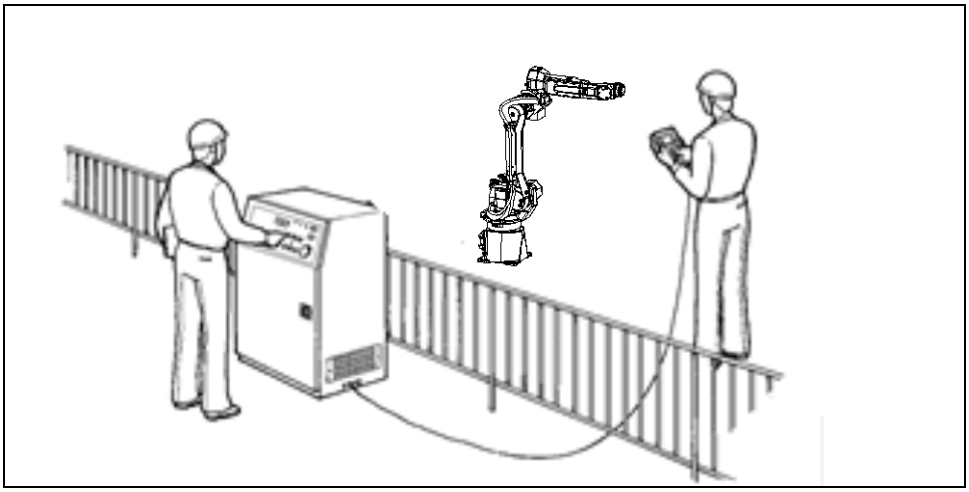


Fig. 7 Additional worker to watch for danger

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.

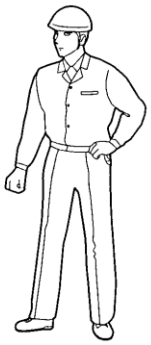


Fig. 8 Safety Clothes and Safety Helmet

- Before approaching the robot to teach a program to it, hold the teach pendant, press the deadman's switch, then turn on the teach pendant enable switch.

NOTE
The deadman's switch, if released when the teach pendant enable switch is on, brings the robot to an emergency stop.

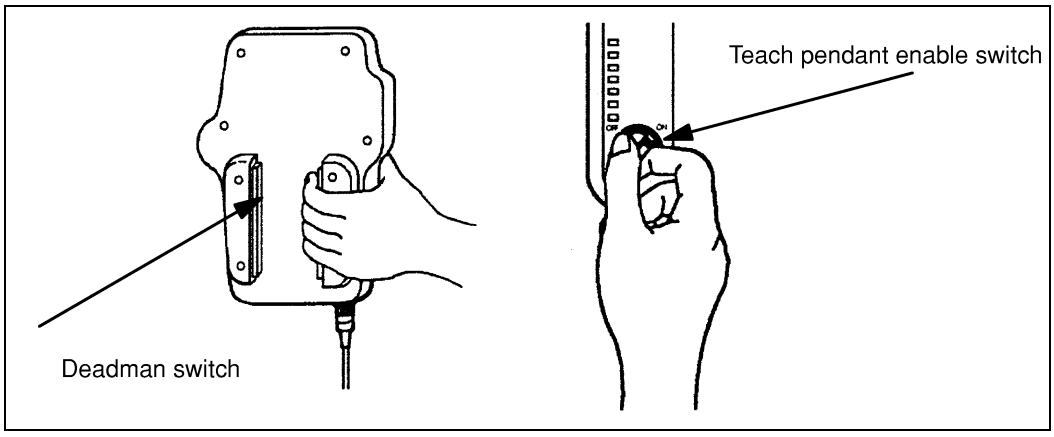


Fig. 9 Deadman switch and Teach pendant enable switch

- 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*C/12/7L/12S,M-10*i*A/12/7L/12S** **Mechanical unit**	OPERATOR'S MANUAL **B-83654EN**	Intended readers: System designer, Maintenance engineer Topics: Installation, Connection to controller, Maintenance Use: Installation, Start-up, Connection, Maintenance
FANUC Robot ARC Mate 120*i*C,M-20*i*A **Mechanical unit**	OPERATOR'S MANUAL **B-82874EN**	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

SAFETY PRECAUTIONS s-1

PREFACE p-1

1 OVERVIEW 1
1.1 STANDARD CONFIGURATION 1
1.1.1 Mechanical Unit Specification 2
1.1.2 Robot Controller 7
1.1.3 Welding Power Supply 14
1.1.4 Wire Feeder 17
1.1.5 Wire Buffer 18
1.1.6 Welding Torch 18
1.1.7 Communication Cable Specifications 20
1.2 OPTION CONSTITUTION 20

2 BASIC OPERATION (QUICK REFERENCE) 25
2.1 FLOW FOR WELDING 25
2.2 CONNECTION 26
2.2.1 Connection of Robot and Controller 26
2.2.2 Connection of Input Power Supply to Controller 27
2.2.3 Connection of Controller and Welding Power Supply 29
2.2.4 Connection of Welding Power Supply and Robot 31
2.2.5 Adjustment of the Flexible Conduit Length 34
2.2.6 Pressurization Power Adjustment of the Roller 35
2.2.7 Connection of Input Power Supply of the Welding Power Supply 36
2.3 TURNING ON THE POWER 37
2.4 MOVING THE ROBOT MANUALLY (JOGGING) 38
2.5 WIRE INCHING / RETRACT 41
2.6 ALIGNMENT WORK 41
2.7 CREATING MOTION PROGRAM 42
2.8 SPECIFY ARC WELD SCHEDULE 46
2.9 MANUAL OPERATION FOR WELDING 50
2.10 TEST OPERATION 51
2.11 EXECUTION OF WELD PROGRAM 54

3 BASIC OPERATION 56
3.1 BASIC OPERATION FOR TS/TPS WELDER 56
3.1.1 Operating Mode 56
3.1.2 Setting of Weld Procedure 57
3.2 PARAMETER OF WELD SCHEDULE 59
3.3 EDITING OPERATION OF PROGRAM 60
3.3.1 Selecting and Editing of Program 60
3.3.2 Editing of Motion Instruction 61
3.3.3 Correcting a Position 63
3.3.4 Edit by Using Program Edit Instructions 66

3.4 TEACHING AND EDITING OF ARC WELD INSTRUCTION 69
3.4.1 Arc Weld Start Instruction 69
3.4.2 Arc Weld End Instruction 69
3.4.3 Note while Teaching Arc Weld Instruction 70
3.4.4 Teaching of Arc Indirect Instruction 70
3.4.5 Teaching of Arc Direct Instruction 71

4 ARC WELDING FUNCTIONS 73
4.1 FUNCTION OF ARC WELDING START TIMING 73
4.1.1 Gas Control Just before Weld Start 73
4.1.2 Adjustment of Weld Schedule at Weld Start Position 74
4.1.3 Retry after Weld Start Failed 76
4.2 FUNCTION OF ARC WELDING END TIMING 79
4.2.1 Check and Reset of Wire Stick 79
4.2.2 Gas Control at Weld End Timing 80
4.3 OTHER FUNCTION RELATED TO ARC WELDING 81
4.3.1 Auto Recovery to Pause Position 81
4.3.2 Gas Control by External Devices 83
4.3.3 Wire Feed Control by External Devices 84
4.3.4 Monitoring Functions 85
4.3.5 Weld External Output Function 89
4.3.6 Torch Guard Function 90
4.3.7 Auto Recovery of TCP Gap 91
4.3.8 Arc Abnormal Monitor Function (Option) 92
4.3.9 Arc Welding Analogue Meter Displaying Function (Option) 93
4.3.10 Touch Sensing (Option) 94
4.3.11 TAST Tracking (Fronius Welder) 95
4.4 OPERATION FOR TS/TPS WELDING MACHINE 96
4.4.1 Preparation 96
4.4.2 Operation Method of Fronius Xplorer 100
4.4.3 Alignment Work 103
4.4.4 Parameter Correction of the Special 2-step 105
4.4.5 Parameter Correction of Gas Preflow/Post Flow 106
4.4.6 Backup 106

5 CHECKS AND MAINTENANCE 108
5.1 ROUTINE INSPECTION 108
5.1.1 Welding Power Supply 108
5.1.2 Wire Feeder 109
5.1.3 Welding Torch 109
5.1.4 Cable 110
5.1.5 Water cooling unit 111
5.1.6 Welding Wire 111
5.1.7 Checking Gas Flow Rate 111
5.2 6-MONTH (1920 HOURS) CHECKS 112
5.3 1-YEAR (3840 HOURS) CHECKS 112
5.4 REPLACING CONSUMABLES 113
5.4.1 Wire 113
5.4.2 Gas 114
5.4.3 Nozzle 115
5.4.4 Tip 115
5.4.5 Liner 115
5.4.6 Coolant 115

5.5 PROGRAM BACK-UP 116

6 TROUBLE SHOOTING 117

6.1 TROUBLE SHOOTING ABOUT ALARM 117
6.2 TROUBLE SHOOTING AGAINST SITUATIONS 122
6.2.1 Welding Output does not be Obtained According to The Welding Command. 124
6.2.2 Malfunction at The Switching Characteristic Line 125
6.2.3 Occurrence of error-E30 127
6.2.4 Communication error with welding power supply 127
6.3 REMEDY FOR TROUBLES 129
6.3.1 Confirmation of the Alarm History 130
6.3.2 Acquisition of All Backup 130
6.3.3 Acquisition of Image Backup 130

7 REPLACING UNITS 132

7.1 REPLACING THE WELDING POWER SUPPLY 132
7.2 REPLACING HOSE PACK (TORCH CABLE CHANGING) 133
7.3 REPLACING THE LINER 138
7.4 REPLACING THE FEEDER ROLLS 141
7.5 REPLACING THE FEED ROLLER AND THE FOLLOW ROLLER 142
7.6 REPLACING THE TORCH NECK 143
7.6.1 Air Cooling Torch 143
7.6.2 Water Cooling Torch 144
7.7 REPLACING THE NOZZLE HOLDER (IN CASE OF AIR COOLING TORCH) 145
7.8 REPLACING THE GUIDE NOZZLE 146
7.8.1 REPLACING PARTS OF ROBACTA DRIVE AND TORCH SIDE 146
7.8.2 REPLACING PARTS OF ROBACTA DRIVE AND ROBOT SIDE 147
7.8.3 REPLACING PARTS OF THE WIRE FEEDER 147
7.9 REPLACING THE WIRE FEEDER 147
7.10 REPALCING THE WATER COOLING UNIT 148

8 MAINTENANCE PARTS 149

9 PROCESS MODE 152

9.1 LIST OF PROGRAM NUMBER OF TS/TPS WELDER 152

10 INITIAL SETTING 155

10.1 INTRODUCITON 155
10.2 PREPARATION FOR TS/TPS WELDER 155
10.2.1 Examination for the Number of Using I/O 155
10.2.2 Setting of Multi-Process Function 156
10.2.3 Preparation of EtherNet Communication 157
10.2.4 Preparation of DeviceNet Communication 157
10.3 SETTING OF WELDER MANUFACTURER 158
10.4 SETTING AFTER SETTING OF WELDER MANUFACTURER 160
10.4.1 Setting of Robot Ethernet IP Address 160
10.4.2 Setting of Ethernet IP Scanner 162

APPENDIX

A WELD CONDITION ADJUSTMENT 167
A.1 INFLUENCE BY ADJUSTMENT OF WELDING CONDITION 167
A.2 COUNTERMEASURE TO WELDING DEFECTS 168

B PERIODIC MAINTENANCE TABLE 170

C STRENGTH OF BOLT AND BOLT TORQUE LIST 172

D CABLE FORMING ROUT FOR USING MULTI WELDING POWER SUPPLY 173

1 OVERVIEW

This chapter describe 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.

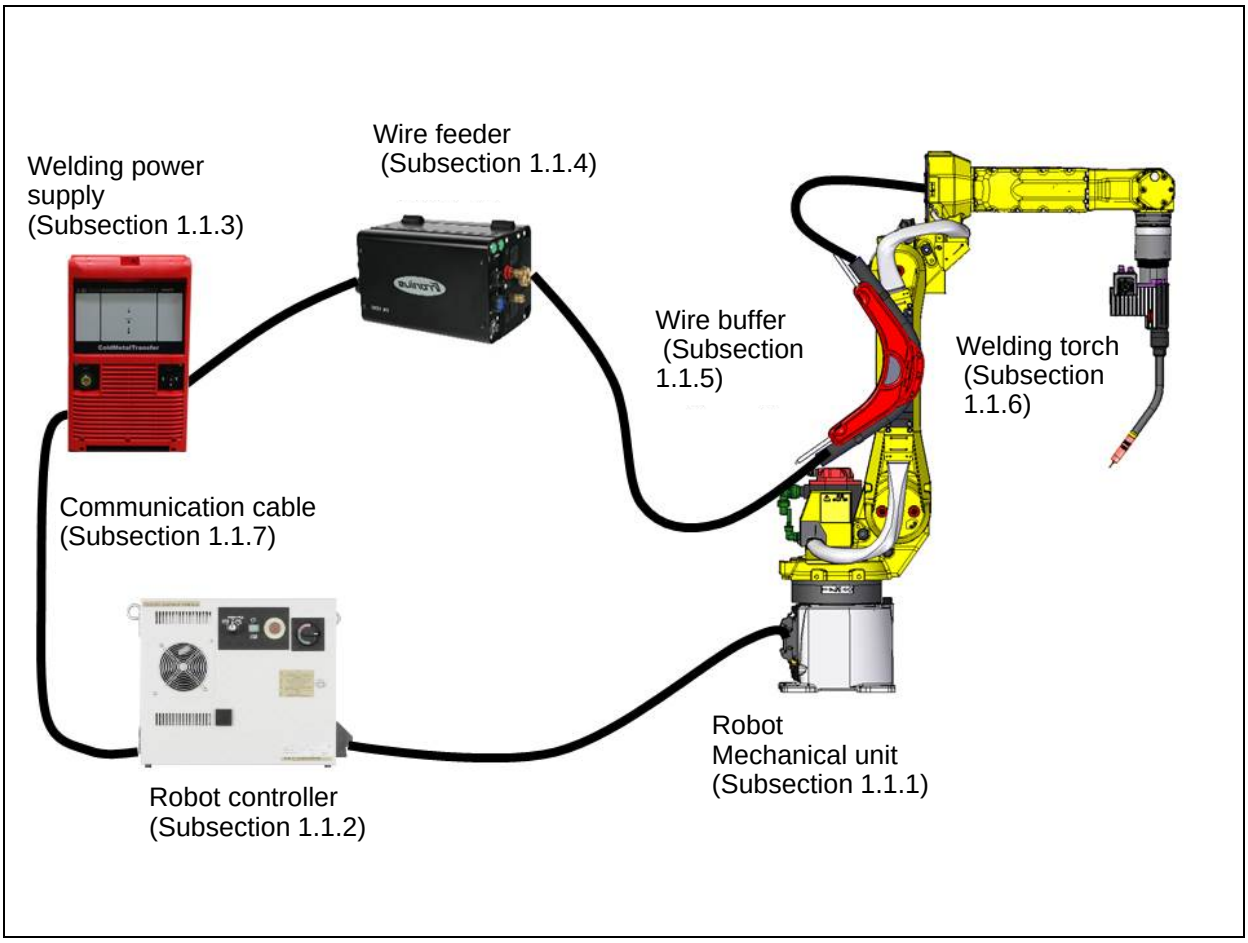


Fig. 1.1 Configuration of robot with welding power supply option

1.1.1 Mechanical Unit Specification

Table 1.1.1 (a) Specifications

Item		Specification		
Model		ARC Mate 100*i*C/12		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 1)		
Load setting		3 kg (Standard welding torch mode)		12 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 2)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist	3 kg (Note 3)		12 kg (Note 3)
	On J3 arm (Note 4)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		22.0 N·m
	J5-axis	7.7 N·m		22.0 N·m
	J6-axis	0.2 N·m		9.8 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.65 kg·m^2
	J5-axis	0.24 kg·m^2		0.65 kg·m^2
	J6-axis	0.0027 kg·m^2		0.17 kg·m^2
Repeatability		±0.08 mm		
Mass		130 kg		
Acoustic noise level		Less than 70dB (Note 5)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 6) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 7)		

NOTE
1 There is not the limit in the motion range in all installation.
2 During short distance motions, the axis speed may not reach the maximum value stated.
3 When arc tool is specified, robot is shipped with 3kg payload setting.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) for detail.
5 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
6 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
7 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, cutting oil splash and or other foreign substances.

Table 1.1.1 (b) Specifications

Item		Specification		
Model		ARC Mate 100*i* C/7L		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 1)		
Load setting		3 kg (Standard welding torch mode)		7 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	170° (2.97rad)/-170° (-2.97rad) 180° (3.14rad)/-180° (-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160° (2.79rad)/-90° (-1.57rad)	
	J3-axis	Upper limit /Lower limit	267°(4.66rad)/-180°(-3.14rad)	
	J4-axis	Upper limit /Lower limit	190° (3.31rad)/-190° (-3.31rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140° (2.44rad)/-140° (-2.44rad)
			Conventional dress-out	190° (3.31rad)/-190° (-3.31rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270° (4.71rad)/-270° (-4.71rad)
			Conventional dress-out	360° (6.28rad)/-360° (-6.28rad)
Maximum speed (Note 2)	J1-axis	230°/s(4.01rad/s)		
	J2-axis	225°/s(3.93rad/s)		
	J3-axis	230°/s(4.01rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist	3 kg (Note 3)		7 kg (Note 3)
	On J3 arm (Note 4)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		15.7 N·m
	J5-axis	7.7 N·m		10.1 N·m
	J6-axis	0.2 N·m		5.9 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.63 kg·m^2
	J5-axis	0.24 kg·m^2		0.38 kg·m^2
	J6-axis	0.0027 kg·m^2		0.061 kg·m^2
Repeatability		±0.08 mm		
Mass		135 kg		
Acoustic noise level		Less than 70dB (Note 5)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 6) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 7)		

NOTE

1 There is not the limit in the motion range in all installation.
2 During short distance motions, the axis speed may not reach the maximum value stated.
3 When arc tool is specified, robot is shipped with 3kg payload setting.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) for detail.
5 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
6 When robot is used in low temperature environment that is near to 0ºC,or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
7 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, cutting oil splash and or other foreign substances.

Table 1.1.1 (c) Specifications

Item		Specification		
Model		ARC Mate 100*i*C/8L		
Type		Articulated type		
Controlled axes		6 axes(J1, J2, J3, J4, J5, J6)		
Installation		Floor, Upside-down, Wall & Angle mount (Note 1)		
Load setting		3 kg (Standard welding torch mode)		8 kg (Standard inertia mode)
Motion range	J1-axis	Upper limit /Lower limit	185°(3.23rad) /-185°(-3.23rad) 180°(3.14rad) /-180°(-3.14rad) (option)	
	J2-axis	Upper limit /Lower limit	160°(2.79rad) / -95°(-1.66rad)	
	J3-axis	Upper limit /Lower limit	277°(4.83rad) /-185°(-3.23rad)	
	J4-axis	Upper limit /Lower limit	200°(3.49rad) /-200°(-3.49rad)	
	J5-axis	Upper limit /Lower limit	Cable integrated J3 arm	140°(2.44rad)/-140°(-2.44rad)
			Conventional dress-out	180°(3.14rad)/-180°(-3.14rad)
	J6-axis	Upper limit /Lower limit	Cable integrated J3 arm	270°(4.71rad)/-270°(-4.71rad)
			Conventional dress-out	450°(7.85rad)/-450°(-7.85rad)
Maximum speed (Note 2)	J1-axis	200°/s(3.49rad/s)		
	J2-axis	200°/s(3.49rad/s)		
	J3-axis	210°/s(3.66rad/s)		
	J4-axis	430°/s(7.50rad/s)		
	J5-axis	430°/s(7.50rad/s)		
	J6-axis	630°/s(11.0rad/s)		
Maximum load	At wrist	3 kg (Note 3)		8 kg (Note 3)
	On J3 arm (Note 4)	12 kg		
Allowable load moment at wrist	J4-axis	7.7 N·m		16.1 N·m
	J5-axis	7.7 N·m		16.1 N·m
	J6-axis	0.2 N·m		5.9 N·m
Allowable load inertia at wrist	J4-axis	0.24 kg·m^2		0.63 kg·m^2
	J5-axis	0.24 kg·m^2		0.63 kg·m^2
	J6-axis	0.0027 kg·m^2		0.061 kg·m^2
Repeatability		±0.08 mm		
Mass		150 kg		
Acoustic noise level		Less than 70dB (Note 5)		
Installation environment		Ambient temperature: 0 to 45℃ (Note 6) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 7)		

NOTE

1 There is no limit of operating space for all the installation types.
2 During short distance motions, the axis speed may not reach the maximum value stated.
3 When arc tool is specified, robot is shipped with 3kg payload setting.
4 Maximum load on J3 arm is influenced by load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-83654EN) for detail.
5 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
6 When robot is used in low temperature environment that is near to 0ºC, or not operated for a long time in the environment that is less than 0ºC in a holiday or the night, 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.
7 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, cutting oil splash and or other foreign substances.

Table 1.1.1 (d) Specifications

Item			Specification	
Model			ARC Mate 120*i*C	
Type			Articulated type	
Controlled axes			6axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (Note 1)	
Load setting			3 kg mode (Standard welding torch mode)	20 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad) / -185° (-3.23rad)	
	J2-axis		160° (2.79rad) / -100° (-1.75rad)	
	J3-axis		273° (4.77rad) / -185° (-3.23rad)	
	J4-axis		200° (3.49rad) / -200° (-3.49rad)	
	J5-axis	(Note 2)	140° (2.44rad) / -140° (-2.44rad)	
		(Note 3)	180° (3.14rad) / -180° (-3.14rad)	
	J6-axis	(Note 2)	270° (4.71rad) / -270° (-4.71rad)	
		(Note 3)	450° (7.85rad) / -450° (-7.85rad)	
Maximum speed (Note 4)	J1-axis		195°/s(3.40rad/s)	
	J2-axis		175°/s(3.05rad/s)	
	J3-axis		180°/s(3.14rad/s)	
	J4-axis		360°/s(6.28rad/s)	
	J5-axis		360°/s(6.28rad/s)	
	J6-axis		550°/s(9.60rad/s)	
Maximum load	At wrist		3kg	20kg
	On J3 arm (Note 5)		12kg	
Allowable load moment at wrist	J4-axis		7.7N·m	44N·m
	J5-axis		7.7N·m	44N·m
	J6-axis		0.22N·m	22N·m
Allowable load inertia at wrist	J4-axis		0.24kg·m^2	1.04kg·m^2
	J5-axis		0.24kg·m^2	1.04kg·m^2
	J6-axis		0.0027kg·m^2	0.28kg·m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 6)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)	

NOTE

1 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) for detail.
2 The specification of "Cable integrated J3 Arm".
3 The specification of "Conventional dress-out".
4 During short distance motions, the axis speed may not reach the maximum value stated.
5 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) for detail.
6 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
7 When robot is used in low temperature environment that is near to 0ºC, or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 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, cutting oil splash and or other foreign substances.

Table 1.1.1 (e) Specifications

Item			Specification	
Model			ARC Mate 120*i*C/12L	
Type			Articulated type	
Controlled axes			6axes(J1, J2, J3, J4, J5, J6)	
Installation			Floor, (Upside-down, Wall & Angle mount) (Note 1)	
Load setting			3 kg mode (Standard welding torch mode)	12 kg mode (High inertia mode)
Motion range Upper limit /Lower limit	J1-axis		185° (3.23rad)	/ -185° (-3.23rad)
	J2-axis		160° (2.79rad)	/ -100° (-1.75rad)
	J3-axis		275.6° (4.81rad)	/ -185° (-3.23rad)
	J4-axis		200° (3.49rad)	/ -200° (-3.49rad)
	J5-axis	(NOTE 2)	140° (2.44rad)	/ -140° (-2.44rad)
		(NOTE 3)	180° (3.14rad)	/ -180° (-3.14rad)
	J6-axis	(NOTE 2)	270° (4.71rad)	/ -270° (-4.71rad)
		(NOTE 3)	450° (7.85rad)	/ -450° (-7.85rad)
Maximum speed (Note 4)	J1-axis		200°/s (3.49rad/sec)	
	J2-axis		175°/s (3.05rad/sec)	
	J3-axis		190°/s (3.32rad/sec)	
	J4-axis		430°/sec (7.50rad/sec)	
	J5-axis		430°/sec (7.50rad/sec)	
	J6-axis		630°/sec (11.00rad/sec)	
Maximum load	At wrist		3kg	12kg
	On J3 arm (Note 5)		12kg	
Allowable load moment at wrist	J4-axis		7.7N・m	22N・m
	J5-axis		7.7N・m	22N・m
	J6-axis		0.22N・m	9.8N・m
Allowable load inertia at wrist	J4-axis		0.24kg・m^2	0.65kg・m^2
	J5-axis		0.24kg・m^2	0.65kg・m^2
	J6-axis		0.0027kg・m^2	0.17kg・m^2
Repeatability			±0.08 mm	
Robot mass			250kg	
Acoustic noise level			Less than 70dB (Note 6)	
Installation environment			Ambient temperature: 0 to 45℃ (Note 7) Ambient humidity: Normally 75%RH or less (No dew or frost allowed) Short time 95%Rh or less (Within 1 month) Permissible altitude: Above the sea 1000m or less Vibration acceleration : 4.9m/s^2 (0.5G) or less Free of corrosive gases (Note 8)	

NOTE

1 Under the installation condition within ( ), motion range will be limited only when high inertia mode. See Section 3.6 MECHANICAL UNIT OPERATOR'S MANUAL B-82874EN.
2 The specification of "Cable integrated J3 Arm".
3 The specification of "Conventional dress-out".
4 During short distance motions, the axis speed may not reach the maximum value stated.
5 Maximum load on J3 arm depends on load of wrist. See Section 4.2 of MECHANICAL UNIT OPERATOR'S MANUAL (B-82874EN) in detail.
6 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
7 When robot is used in low temperature environment that is near to 0ºC,
or robot is not operated for a long time in the environment that is less than 0ºC in a holiday or the night, because viscous resistance of the drive train is so big that may cause occurrence of collision detect alarm (SRVO –050) etc. In this case, we recommend performing the warm up operation for several minutes.
8 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, cutting oil splash and or other foreign substances.

1.1.2 Robot Controller

Table 1.1.2 (a) Controller specification (R-30*i*B/R-30*i*B Plus Controller)

Item	Model	Specification/condition
Rated Voltage	All models	Trans. Type E:380-415, 440-500, 500-575VAC(*1) Trans. Type D: 380-400,200-230VAC 50/60Hz 3phases (*1) In case of NRTL controller with UL/CSA breaker (600V Rating), 500-575VAC tap can be used.
Tolerant fluctuation	All models	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power source capacity	ARC Mate 120*i*C	3kVA
	ARC Mate 100*i*C	2kVA
Average power consumption	All models	1kW
Permissible ambient temperature	All models	Operating 0°C to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	All models	Normal: 75%RH or less, no condensation Short period(less than 1 month): 95%RH or less, no condensation
Surrounding gas	All models	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, and/of salt).
Installation category	All models	Installation categoryⅢ, Pollution degree 3, IEC60664-1 and IEC61010-1
Vibration acceleration	All models	4.9m/s^2 (0.5G) or less. When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	All models	Operating:Up to 1,000m above sea level Non-operating:Up to 12,000m above sea level
Ionized and non-ionized radiation	Common to all models	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	A-cabinet	120kg
	B-cabinet	180kg
Degree of protection	A-cabinet	IP54
	B-cabinet	
	Teach pendant	

NOTE

The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.

If the acceleration/deceleration override (ACC) greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.

In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.

NOTE

In case of CE controller

R-30*i*B controller is a group 1, class A product according to IEC55011.

This means that this product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection / analysis purpose and that it is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

There may be potential difficulties in ensuring electromagnetic compatibility in environments other than industrial, due to conducted as well as radiated disturbances.

This product must not be used in residual areas.

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

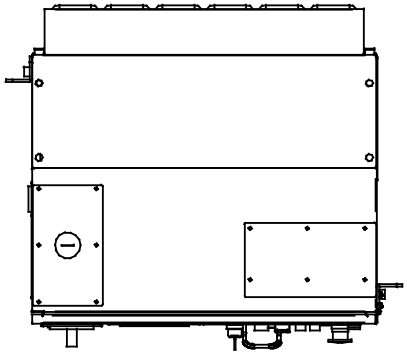
Table 1.1.2 (b) Controller specification (R-30*i*B Mate/R-30*i*B Mate Plus Controller)

Item	Specification/condition
Rated Voltage	200-230VAC 50/60Hz Single Phase
	200-230VAC 50/60Hz 3 phase
Tolerant fluctuation	Tolerant voltage fluctuation: +10% -15% Tolerant frequency fluctuation: ±1Hz
Input power supply capacity	2.0KVA
Average power consumption	1.0KW
Permissible ambient temperature	Operating 0℃ to 45°C Storage, Transport -20°C to 60°C Temperature change 0.3°C/minute or less
Permissible ambient humidity	Normal: 75%RH or less, no condensation Short period (less than 1 month): 95%RH or less, no condensation
Surrounding gas	An additional protective provision is necessary if the machine is installed in an environment in which there are relatively large amounts of contaminants (dust, dielectric fluid, organic solvent, acid, corrosive gas, salt, etc.).
Installation Category	Installation Category Ⅱ, Pollution Degree 3, IEC60664-1 and IEC61010-1 (NOTE2)
Vibration	Vibration acceleration : 4.9m/s^2 (0.5G) or less When using the robot in a location subject to serious vibration, consult with your FANUC sales representative.
Altitude	Operating: Up to 1000m Non-operating: Up to 12000m
Ionized and non-ionized radiation	A shielding provision is necessary if the machine is installed in an environment in which it is exposed to radiation (microwave, ultraviolet rays, laser beams, and/or X-rays).
Mass of controller	40kg
Degree of protection	IP54

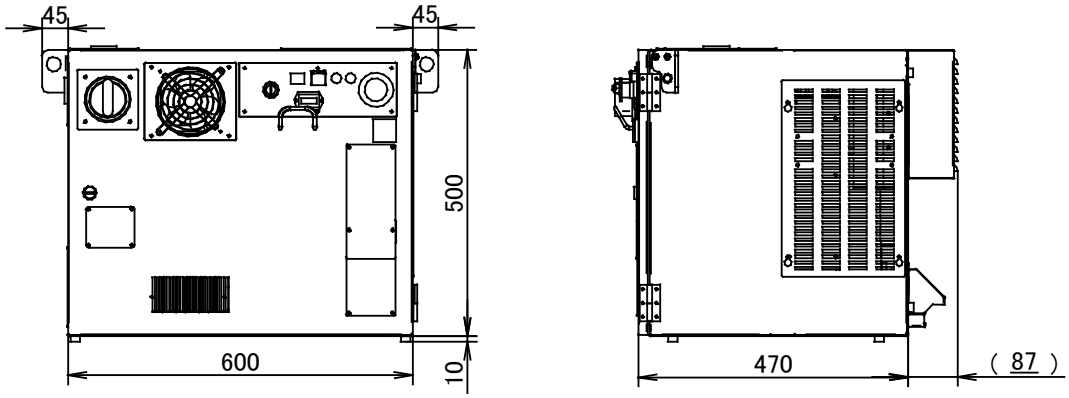
NOTE

1 The power rating indicated above is sufficient as the continuous rating. However, when the robot is rapidly accelerating, the instantaneous requirement may increase to several times the continuous rating.
If the acceleration/deceleration override (ACC) greater than 100% is set in the robot program, the extreme current may flow to the robot controller instantaneously and the input voltage of robot controller will drop.
In this case, if the supply voltage is decreased 10% or more per rated voltage, Power supply alarm, Move error excess alarm, DCLV alarm of servo amplifier may occur.

2 In case of connected with Input power supply of Installation category Ⅲ, set up isolated transformer between Input power supply and controller.



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black



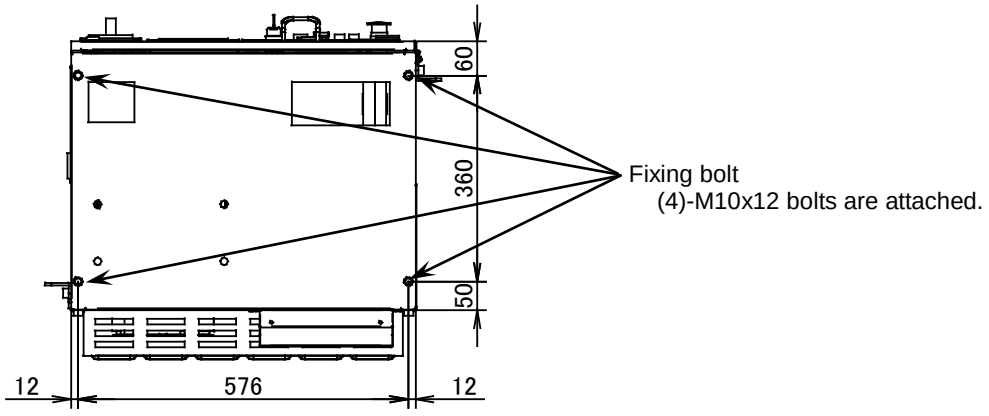
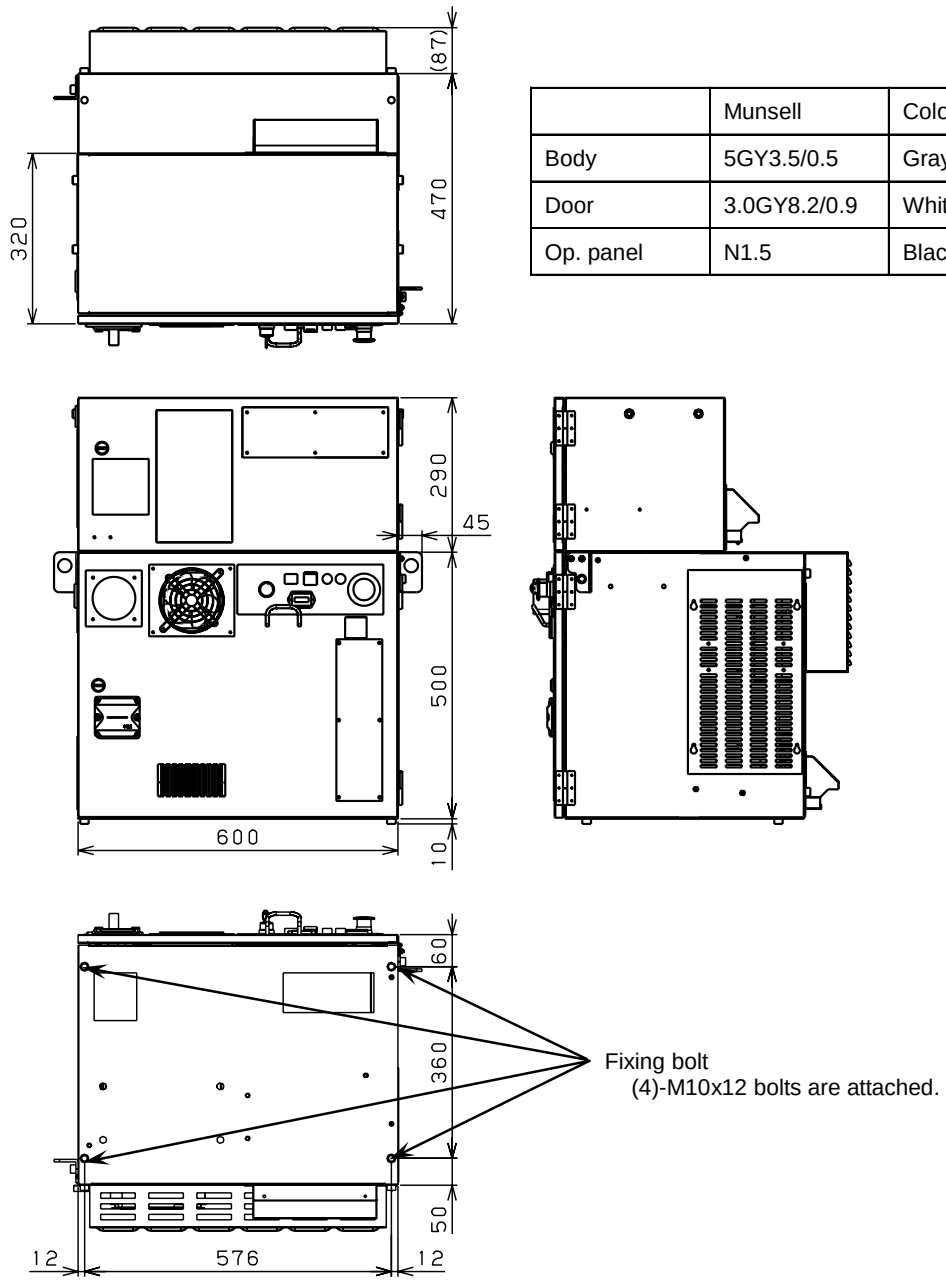
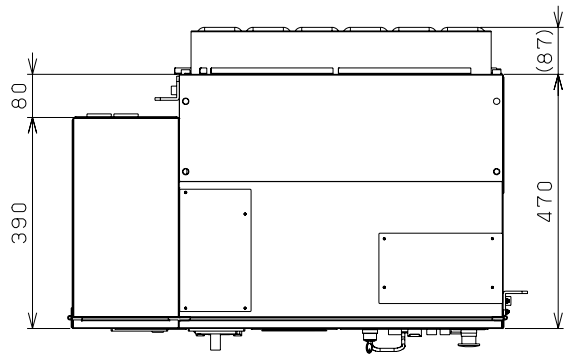


Fig. 1.1.2 (a) External dimensions (A-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

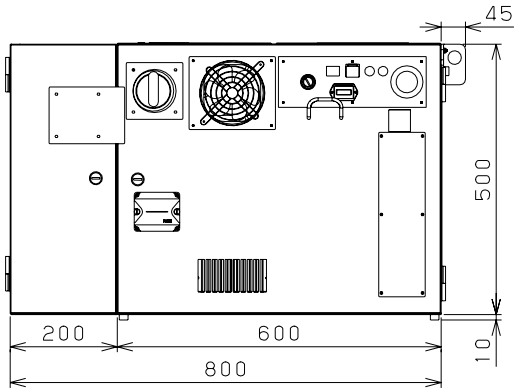


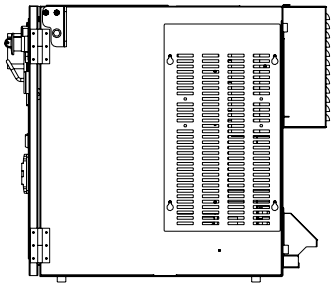
	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

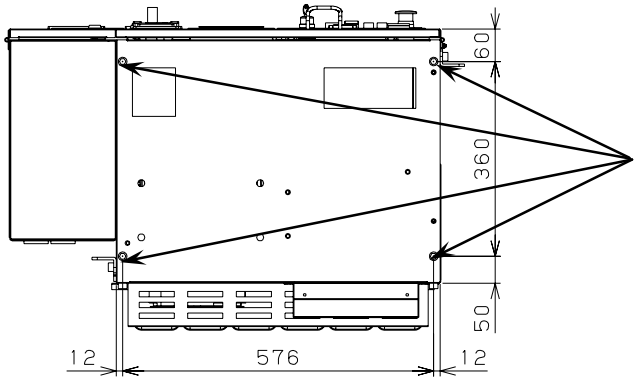
Fig. 1.1.2 (b) External dimensions (A-cabinet with Top box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

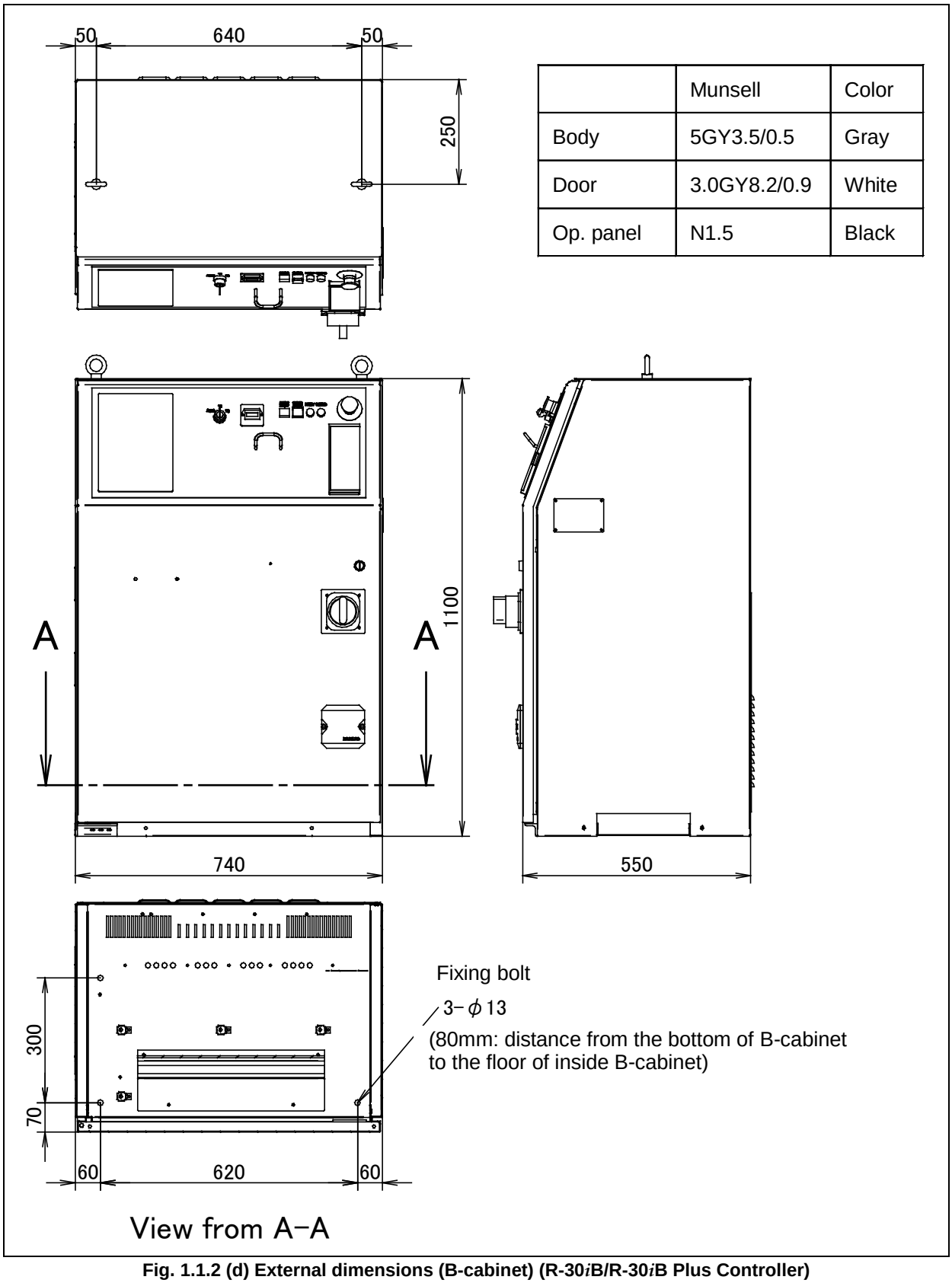






Fixing bolt
(4)-M10x12 bolts are attached.

Fig. 1.1.2 (c) External dimensions (A-cabinet with Side box) (R-30*i*B/R-30*i*B Plus Controller)



	Munsell	Color
Body	5GY3.5/0.5	Gray
Door	3.0GY8.2/0.9	White
Op. panel	N1.5	Black

Fig. 1.1.2 (d) External dimensions (B-cabinet) (R-30*i*B/R-30*i*B Plus Controller)

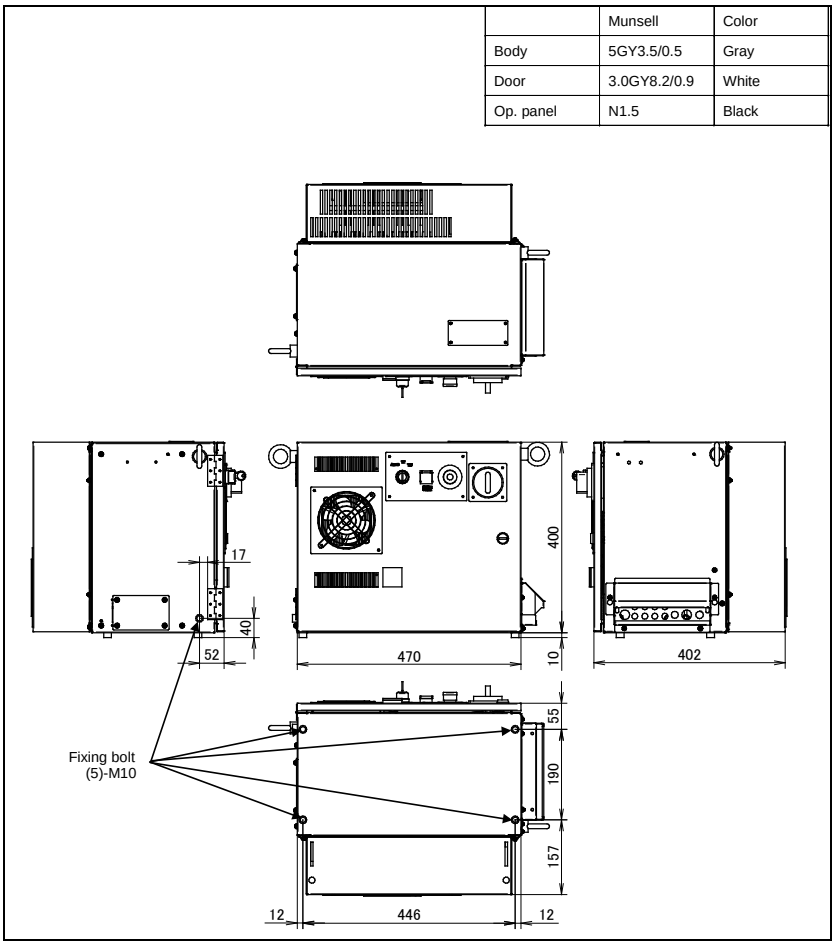


Fig. 1.1.2 (e) Controller external dimensions (R-30*i*B Mate Controller)

1.1.3 Welding Power Supply

Table 1.1.3 (a) Specification of welding power supply

Item	Specifications
Welding type	MIG/MAG/CMT/TIG
Rated input voltage	AC 200 to 240, 380 to 460V ,3ϕ: A14L-0195-0102
Input frequency	50/60Hz
Rated input power	10.6 to 12.4kVA
Output current	DC 3 A to 400 A
Output voltage	DC 14.2 V to 34 V
Mass	35.2kg
Maker type	4,075,138,630,R

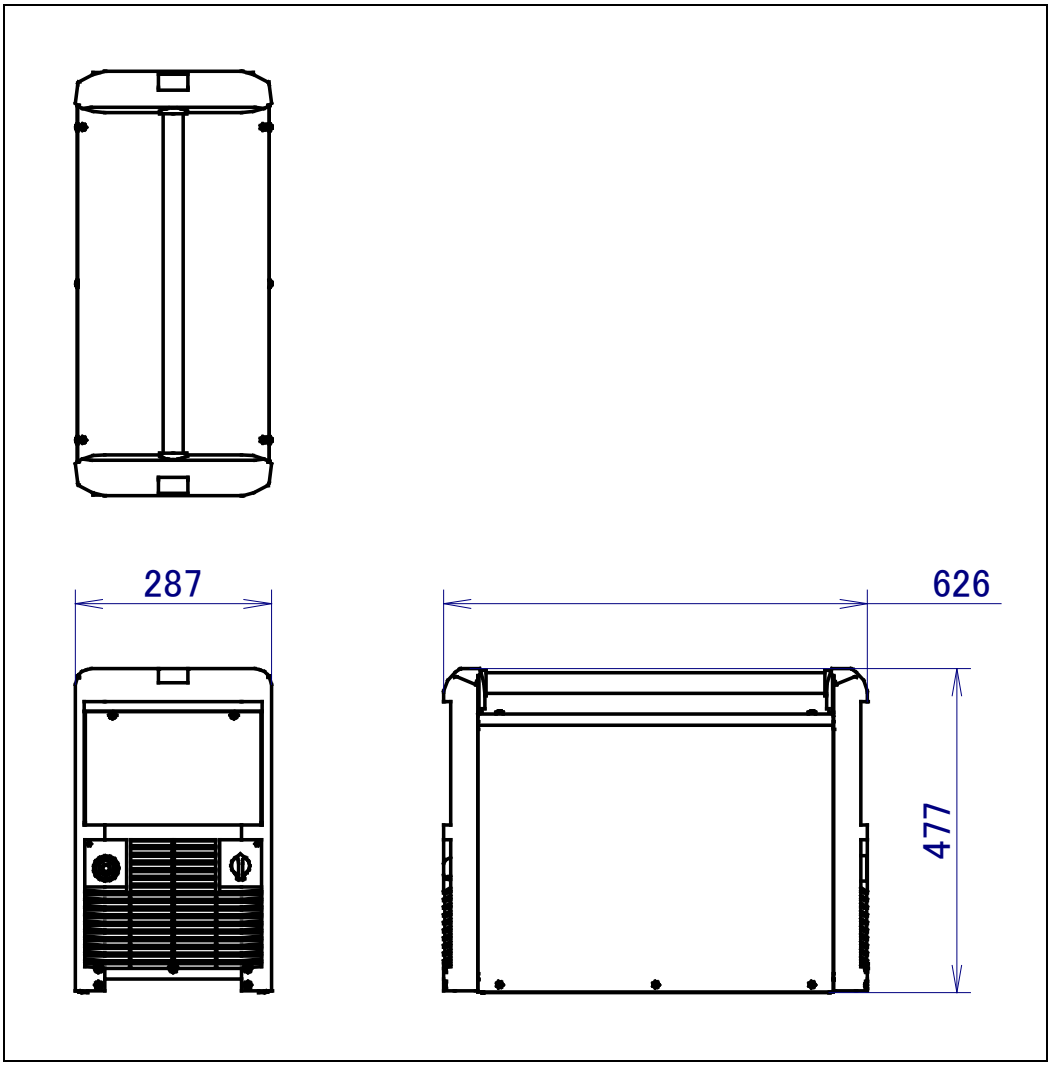


Fig. 1.1.3 (a) External dimensions of the welding power supply

Standard use rate

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

Machine	Duty cycle
Welding power supply main body (TPS4000)	50% at 400A 60% at 365A 100% at 280-320A
Air cooling torch (MTB 350d G R)	60% at 350A 100% at 300A
Water cooling torch (MTB 500d W R)	100% at 500A
Robacta drive (air cooling)	60% at 320A 100% at 250A
Robacta drive (water cooling)	40% at 500A 60% at 450A 100% at 360A
Hose pack	100% at 360A

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

Item	Duty cycle
Air cooling (without cooling machine)	60% at 320A 100% at 250A
Water cooling (with cooling machine)	50% at 400A 60% at 365A 100% at 280-320A

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 are 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.

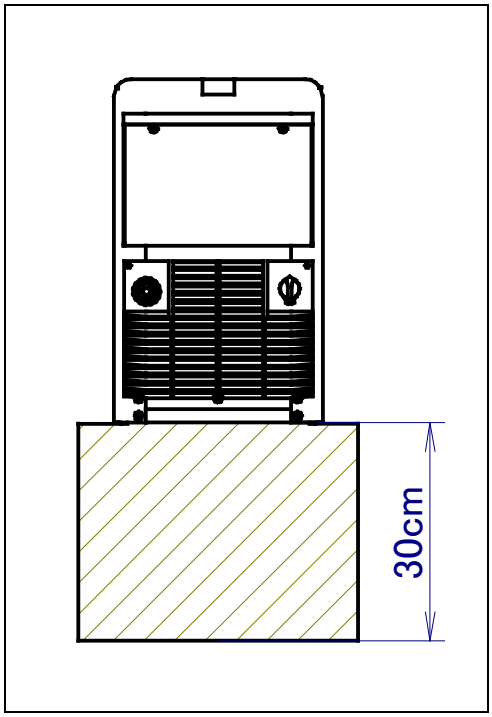


Fig. 1.1.3 (b) Quantity advance of welding power supply

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.

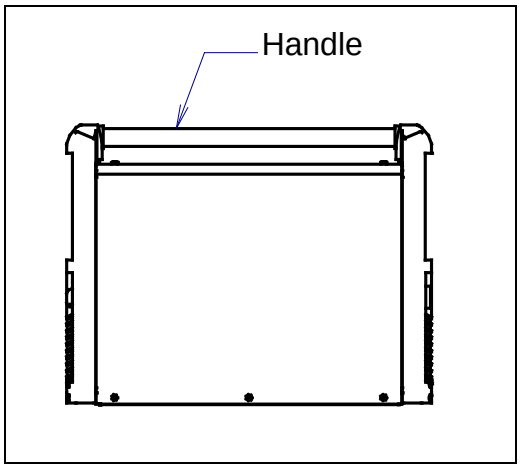


Fig. 1.1.3 (c) Transportation of welding power supply

1.1.4 Wire Feeder

Table 1.1.4 Wire feeder

Specification	A14L-0195-0231 (for iron), A14L-0195-0232 (for aluminum)
Drive system	2 driving and 2 driven rolls (for iron), 4 driving (for aluminum)
Mass	7kg
Wire speed	0.5～22m/min
Standard wire diameter	Mild steel, Aluminum or SUS Φ0.8 to 1.6

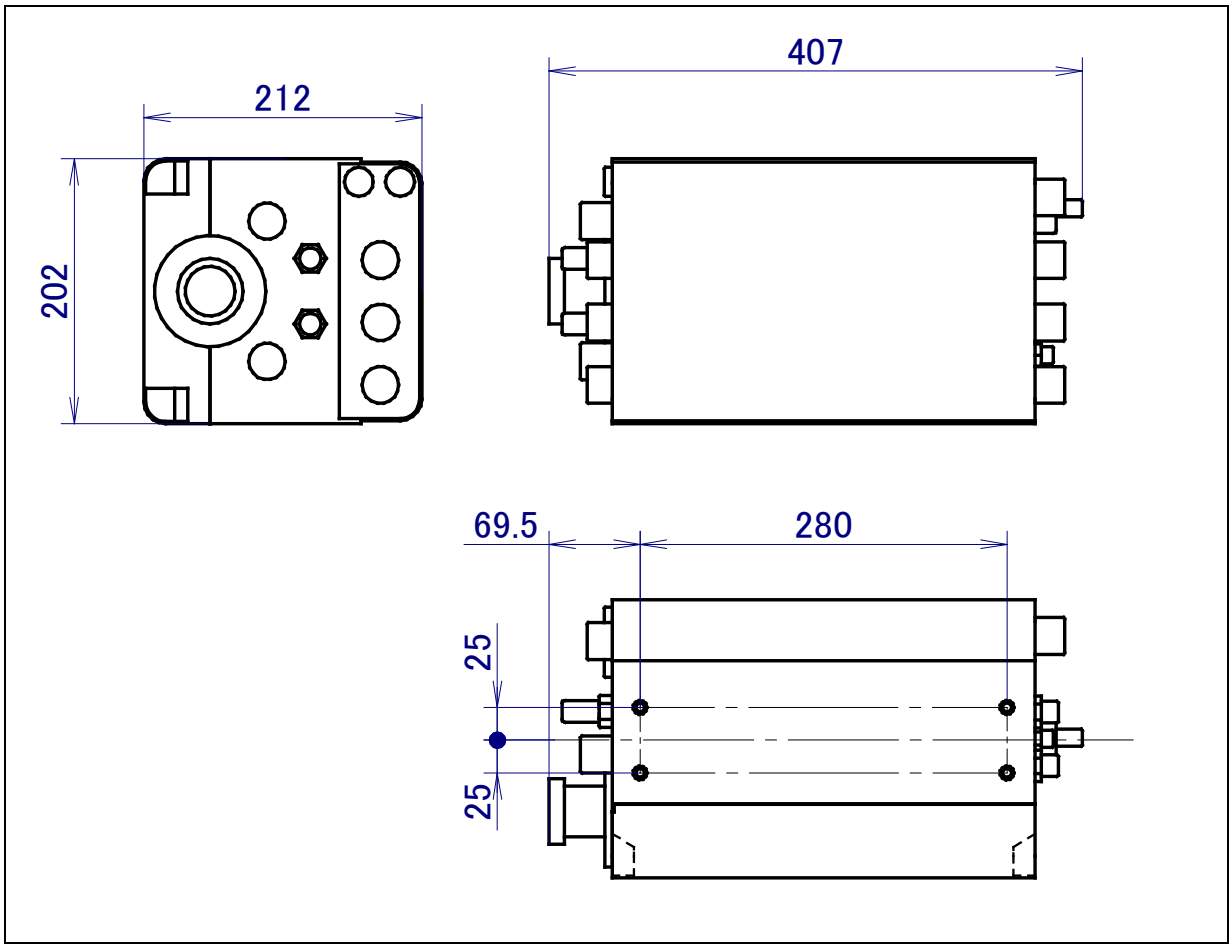


Fig. 1.1.4 Wire feeder external dimensions

NOTE
Please perform insulation when installing the wire feeder.

1.1.5 Wire Buffer

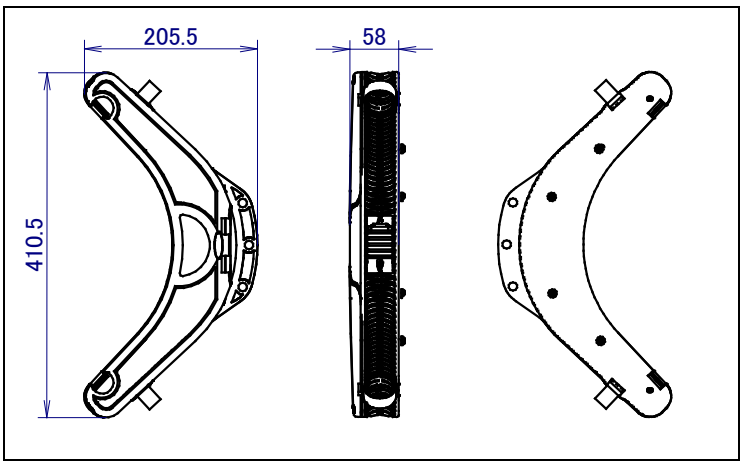


Fig. 1.1.5 External dimensions of the wire buffer

The following parts are appended.

Table 1.1.5 Specifications of the wire buffer

	Specification	Model
Wire buffer	A14L-0195-0221	ARC Mate 100*i*C/12L/7L
Wire buffer	A14L-0195-0222	ARC Mate 120*i*C
Wire buffer	A14L-0195-0223	ARC Mate 100*i*C/8L

1.1.6 Welding Torch

Table 1.1.6 (a) Specifications of Robacta Drive

	Specification
Air cooling	A05B-1295-H211
Water cooling	A05B-1295-H212

Table 1.1.6 (b) Specification of torch

	Specification
MTB350d G R/36° (air cooling torch)	A05B-1295-H303
MTB500d W R/36° (water cooling torch)	A05B-1295-H311

TCP and payload setting of torch is below.

Table 1.1.6 (c) TCP and payload setting of torch

	MTB 350d G R/36˚	MTB 500d W R/36˚	
TCP X	-108.5	-77.1	[mm]
TCP Y	0	0	[mm]
TCP Z	595	483.8	[mm]
TCP W	180	180	[degree]
TCP P	-36	-36	[degree]
TCP R	0	0	[degree]
PAYLOAD	3.46	3.2	[kg]
PAYLOAD CENTER X	0	0	[cm]
PAYLOAD CENTER Y	1.5	1.5	[cm]
PAYLOAD CENTER Z	23.8	23.8	[cm]
PAYLOAD INERTIA Ix	0.03	0.03	[kgf·cm·s^2]
PAYLOAD INERTIA Iy	0.03	0.03	[kgf·cm·s^2]
PAYLOAD INERTIA Iz	0.27	0.27	[kgf·cm·s^2]
ARM LOAD AXIS (AXIS 3)	7	7	[kg]

∗Above-mentioned TCP is the one of 15mm in the wire thrusting out length.

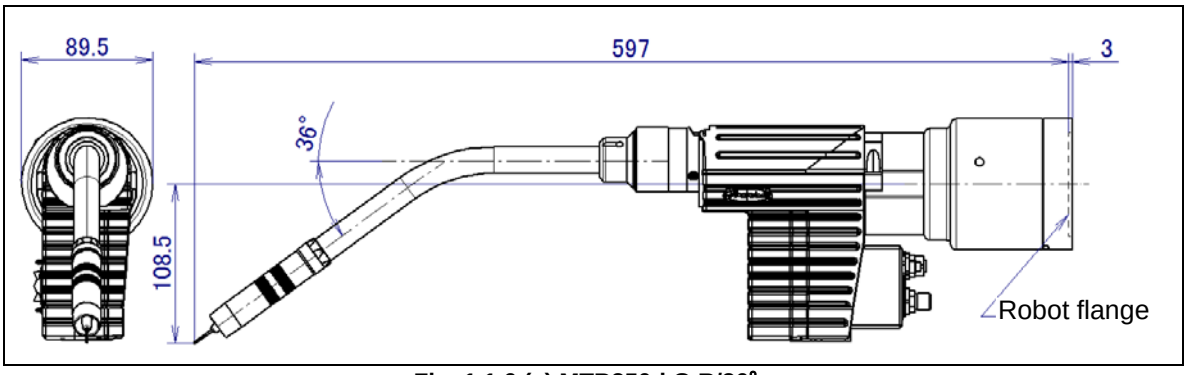


Fig. 1.1.6 (a) MTB350d G R/36˚

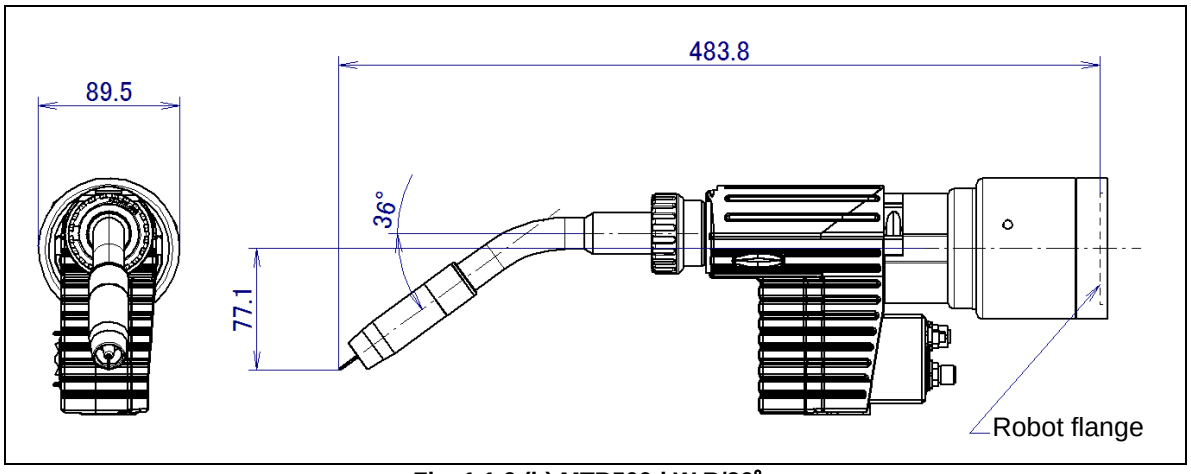


Fig. 1.1.6 (b) MTB500d W R/36˚

1.1.7 Communication Cable Specifications

Table 1.1.7 Communication cables

	Specification	Controller type
Ethernet cable 3.0m	A05B-2602-J235	R-30*i*B/R-30*i*B Plus controller A-cabinet
Ethernet cable 7.0m	A05B-2602-J236	
Ethernet cable 14.0m	A05B-2602-J237	
Ethernet cable 3.0m	A05B-2604-J235	R-30*i*B/R-30*i*B Plus Controller B-cabinet
Ethernet cable 7.0m	A05B-2604-J236	
Ethernet cable 14.0m	A05B-2604-J237	
Ethernet cable 3.0m	A05B-2652-J235	R-30*i*B Mate Controller
Ethernet cable 7.0m	A05B-2652-J236	
Ethernet cable 14.0m	A05B-2652-J237	

1.2 OPTION CONSTITUTION

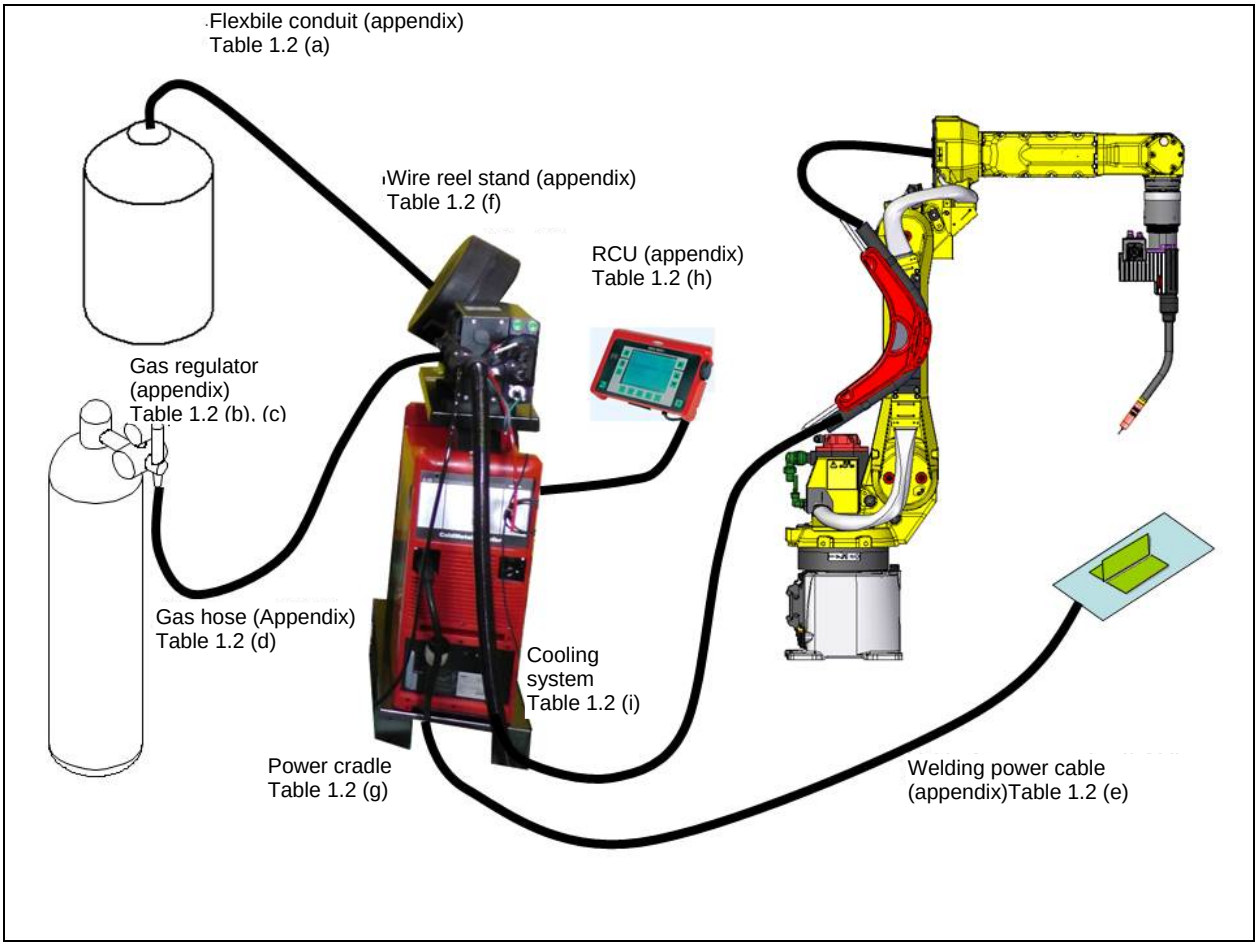


Fig. 1.2 (a) Option constitution

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

Table 1.2 (b) Specification of 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)

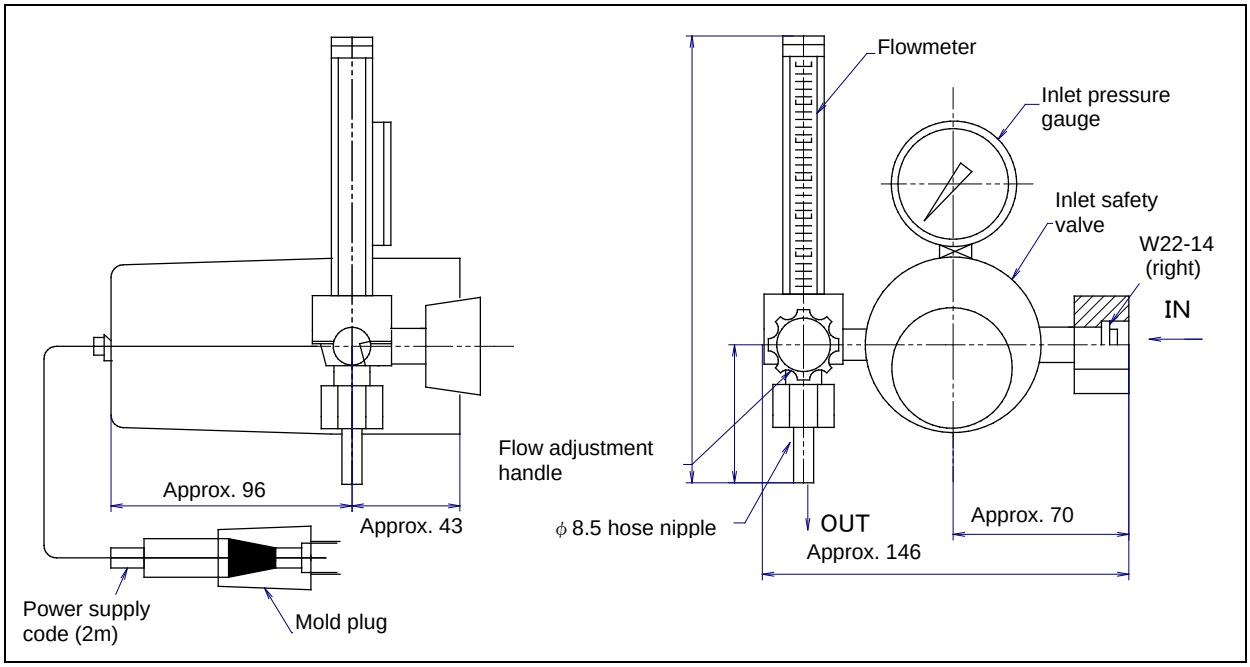


Fig. 1.2 (b) Regulator external dimensions (A05B-1291-J101)

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 ～ 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	

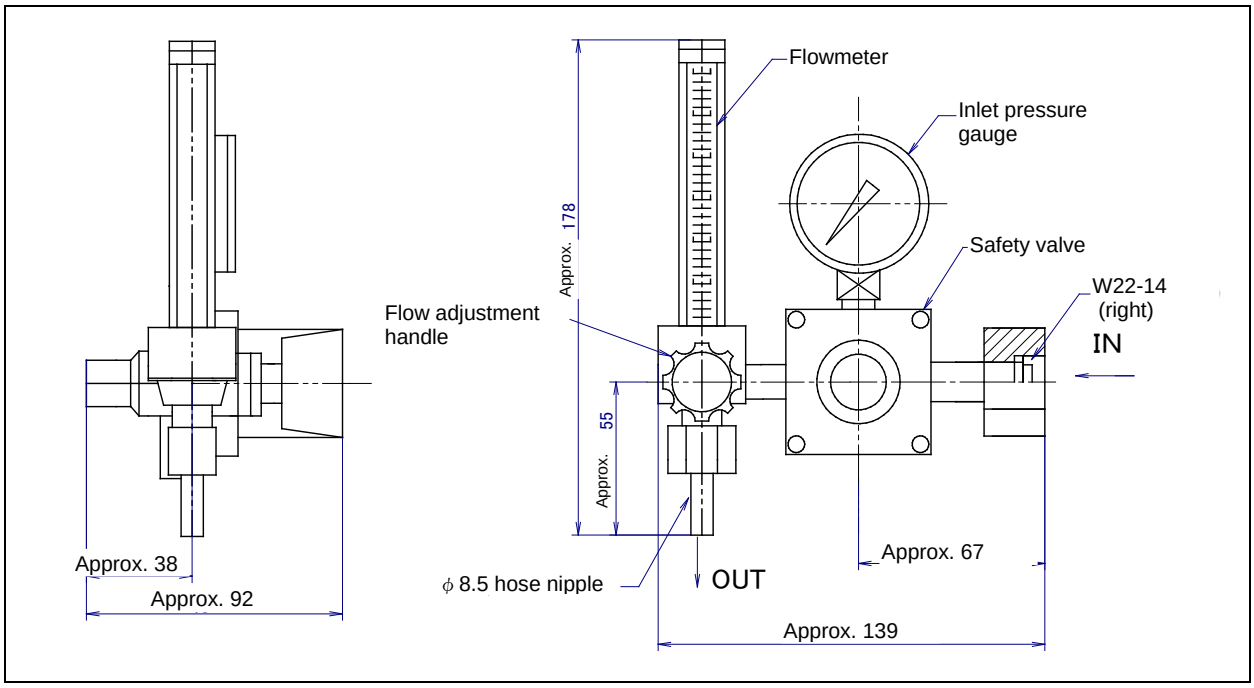


Fig. 1.2 (c) Regulator external dimensions (A05B-1220-J383)

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) Wire reel stand

	Specifications
Wire reel stand (stationary)	A05B-1295-J202

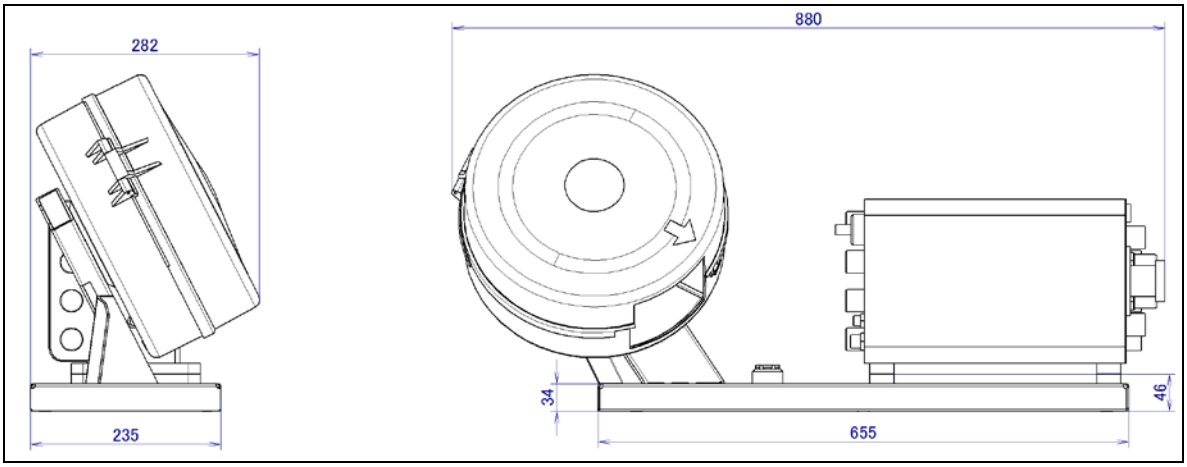


Fig. 1.2 (d) Wire reel stand external dimensions

Table 1.2 (g) Power cradle

	Specifications
Power cradle	A05B-1295-J201

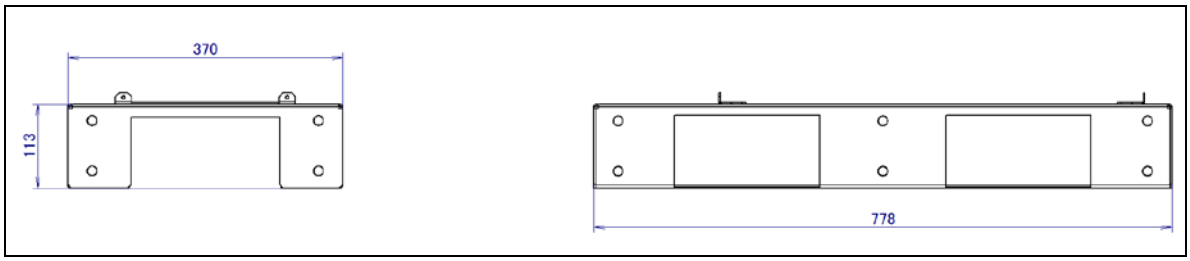


Fig. 1.2 (e) Power cradle external dimensions

Table 1.2 (h) Remote control unit

	Specifications
RCU 5000	A05B-1295-J101

Table 1.2 (i) Wire reel stand

	Specifications
FK 4000R-FC	A05B-1295-J701

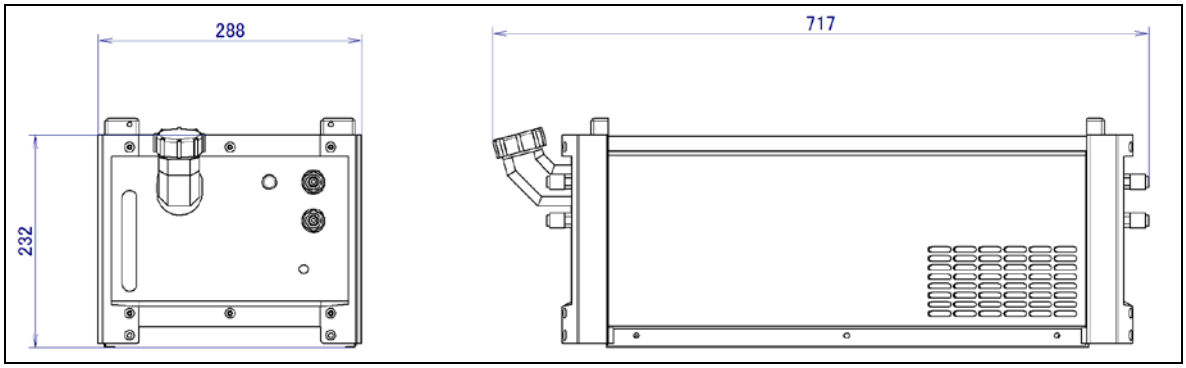


Fig. 1.2 (f) Cooling system external dimensions

Additional axis option

If additional axis cabinet (option) is added to the controller, it supports additional axis positioner.

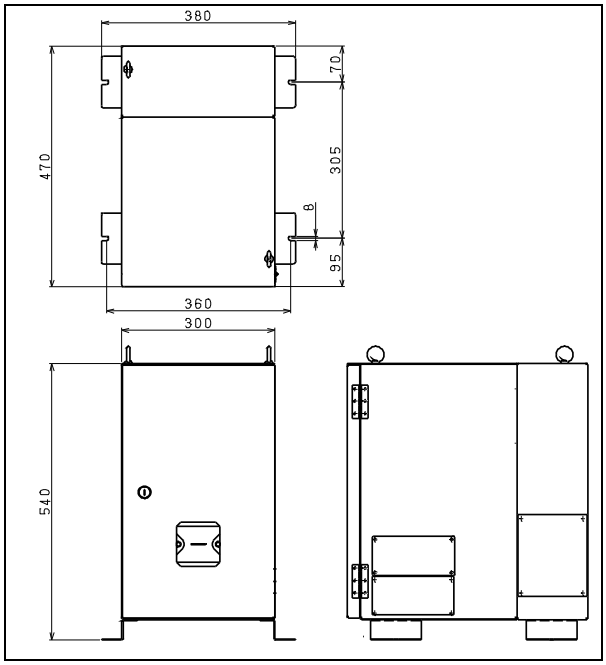
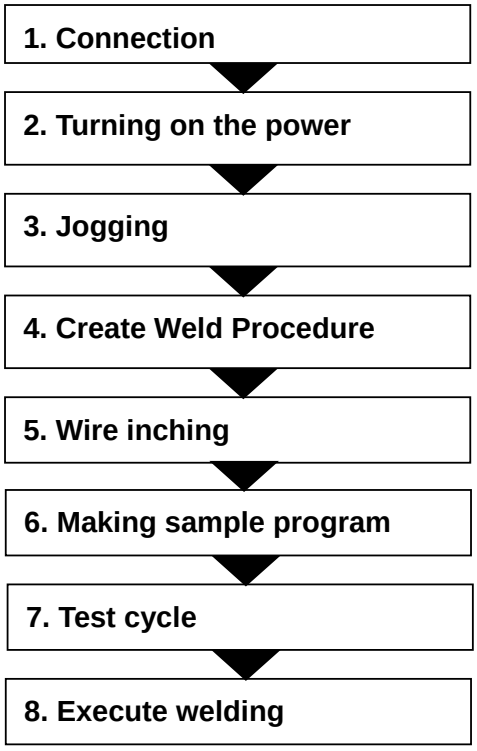


Fig. 1.2 (g) Additional axis cabinet external dimensions

2 BASIC OPERATION (QUICK REFERENCE)

2.1 FLOW FOR 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 10 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.

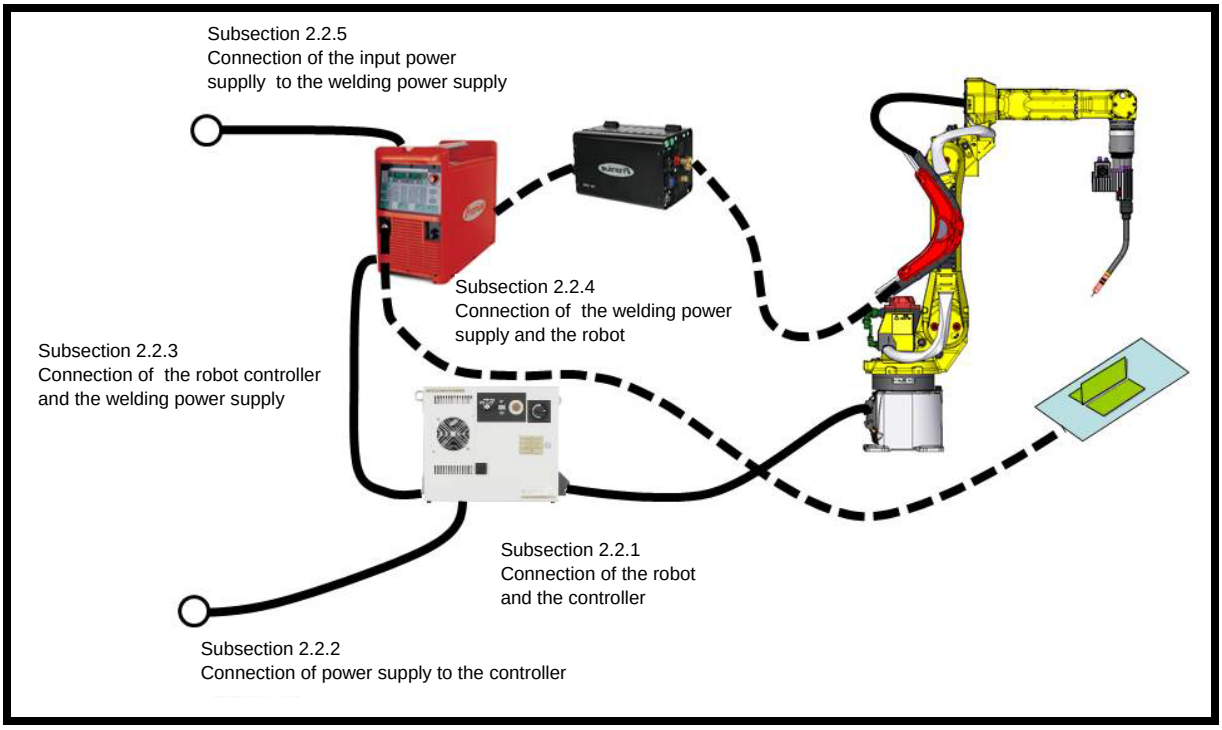


Fig. 2.2 Connection contents

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.

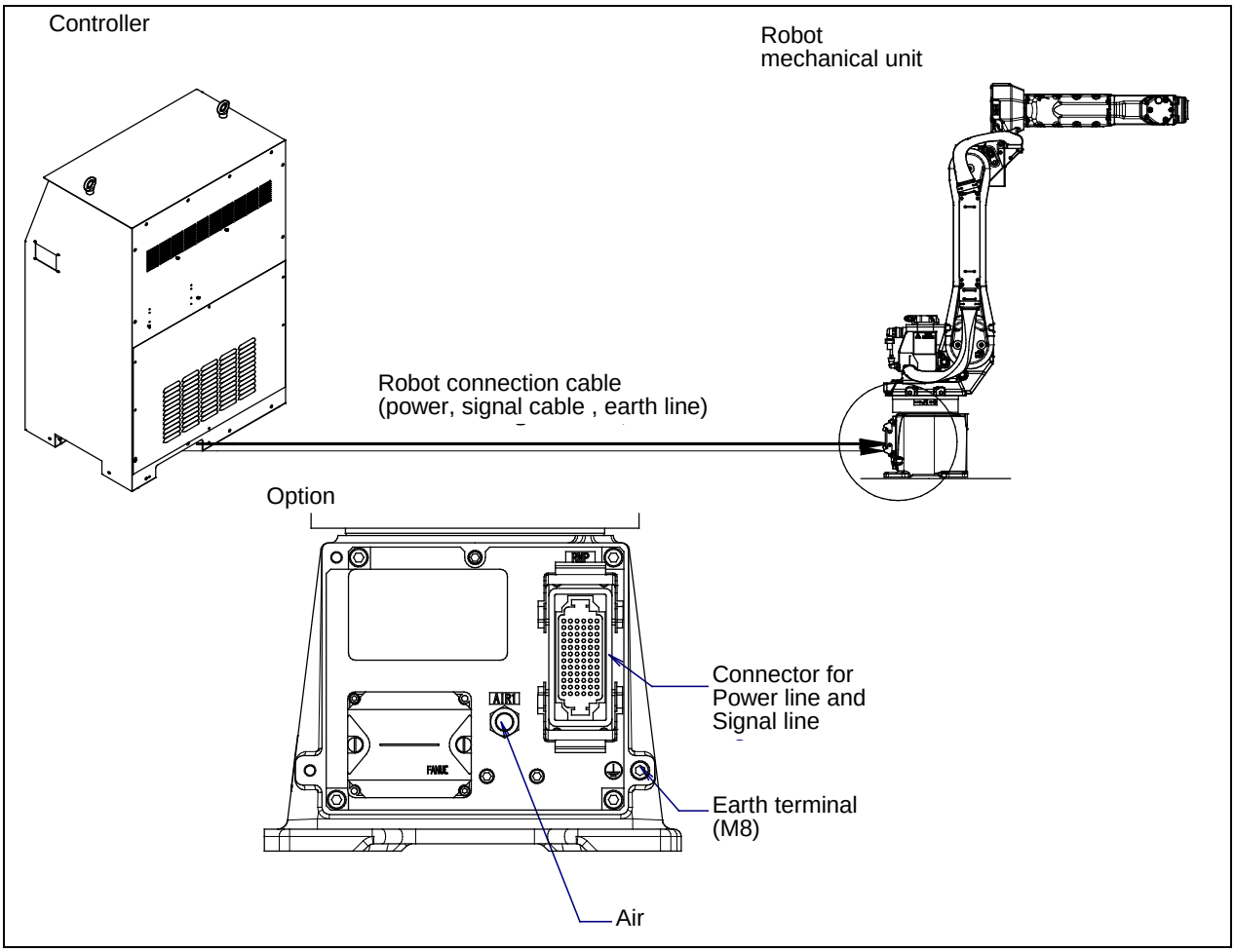
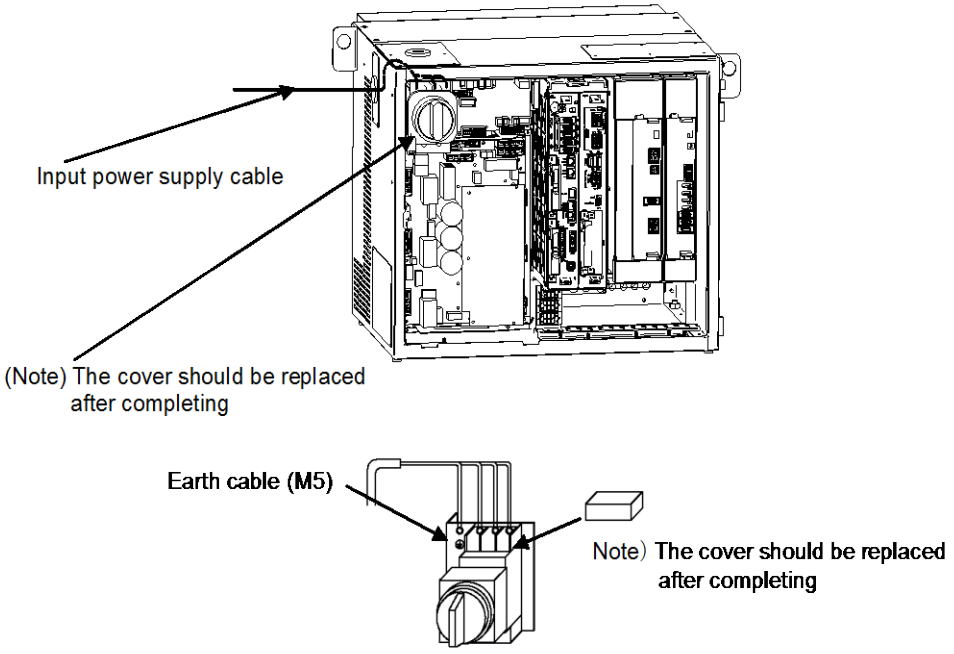


Fig. 2.2.1 Cable connection figure

2.2.2 Connection of Input Power Supply to Controller



(A-cabinet)

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.

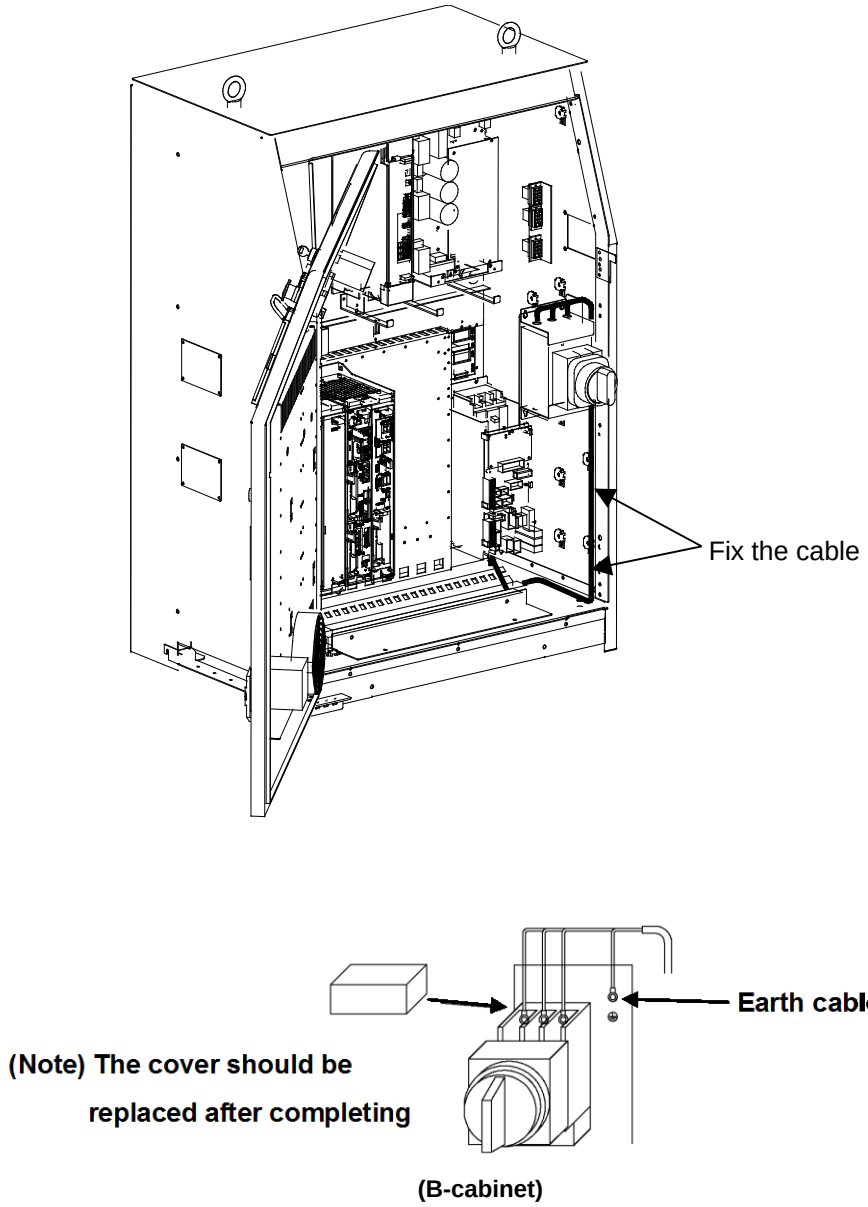


Fig. 2.2.2 (b) Connecting the input power cable (R-30*i*B/R-30*i*B Plus Controller, B-cabinet)

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

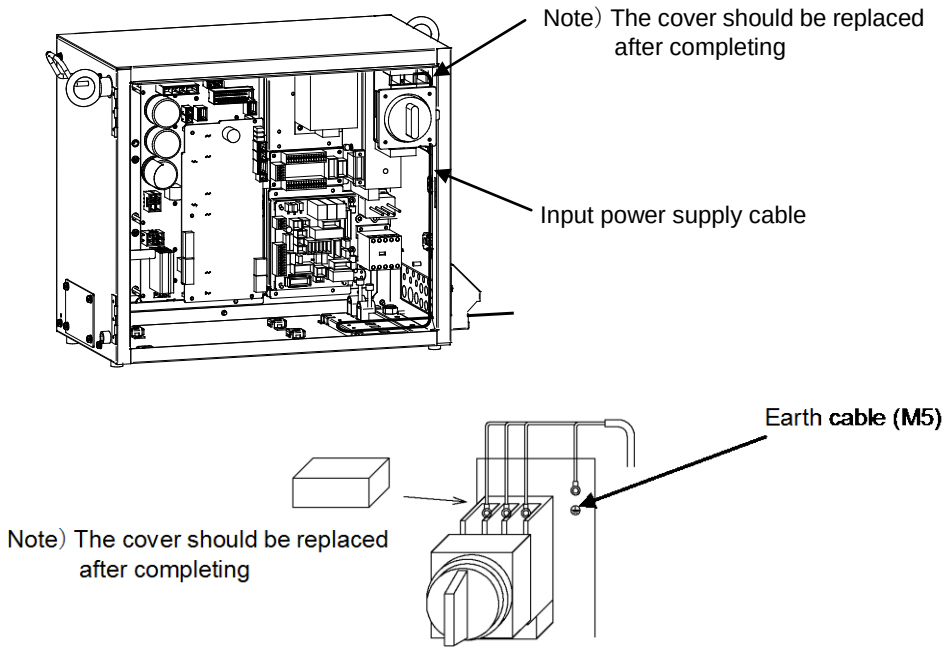


Fig. 2.2.2 (c) Connecting the input power cable (R-30*i*B Mate Controller)

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.

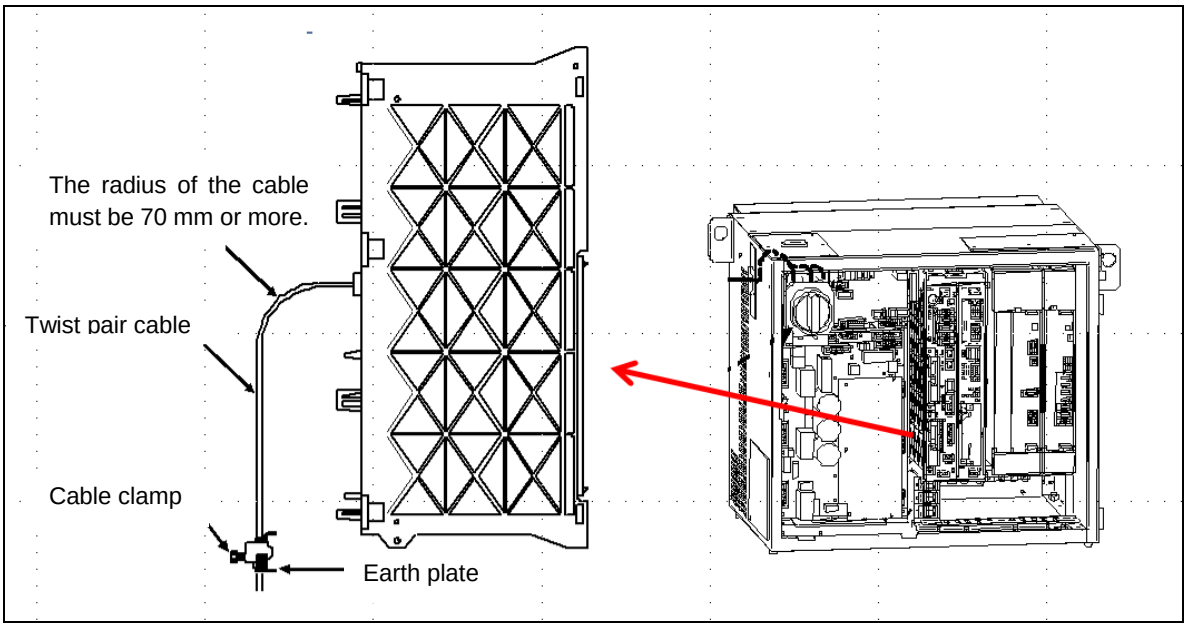


Fig. 2.2.3 (a) Connection of Eternet cable (R-30*i*B/R-30*i*B Plus controller)

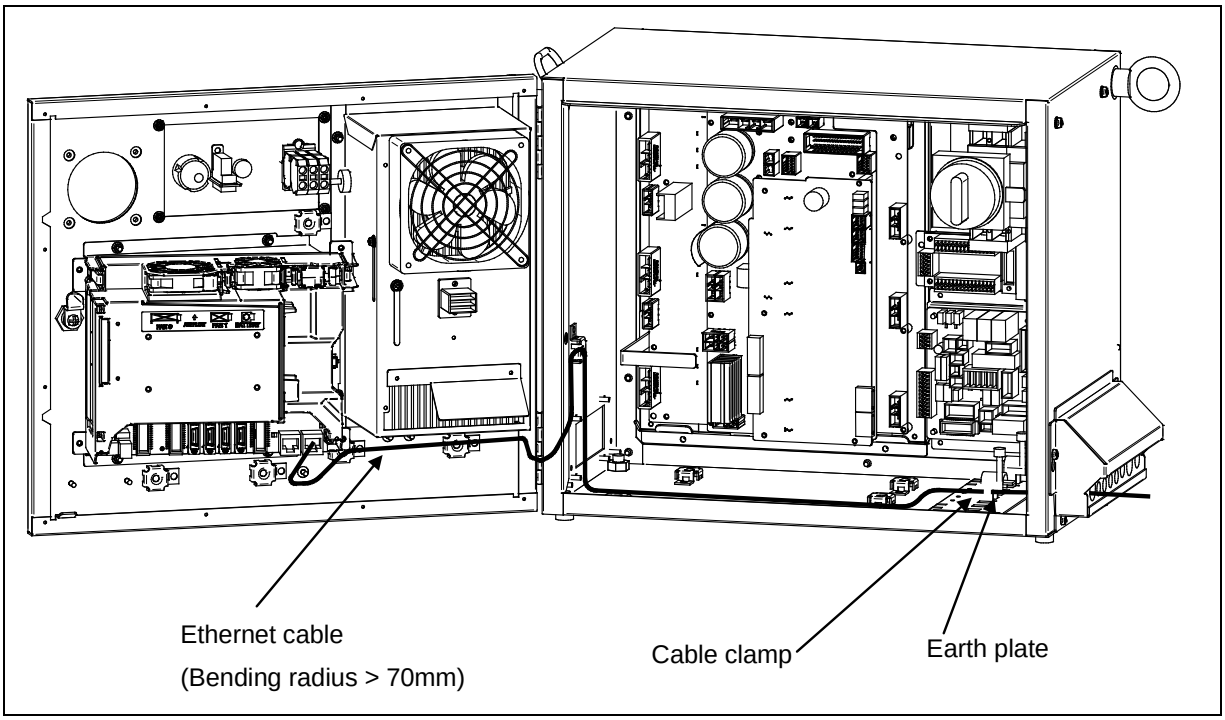


Fig. 2.2.3 (b) Connection of Eternet cable (R-30*i*B Mate controller)

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, then connect the hub and each welding power supply.

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

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

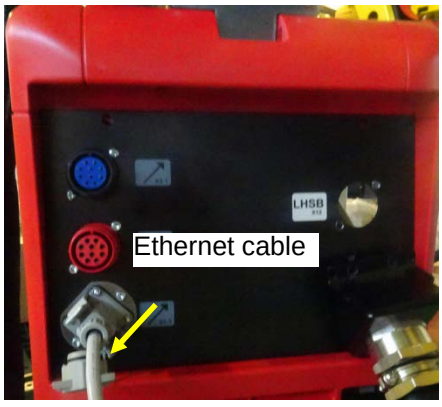


Fig. 2.2.3 (c) Connection of Ethernet cable

2.2.4 Connection of Welding Power Supply and Robot

Connect welding power supply and the robot. Refer to Fig .2.2.4 (a) to (d).

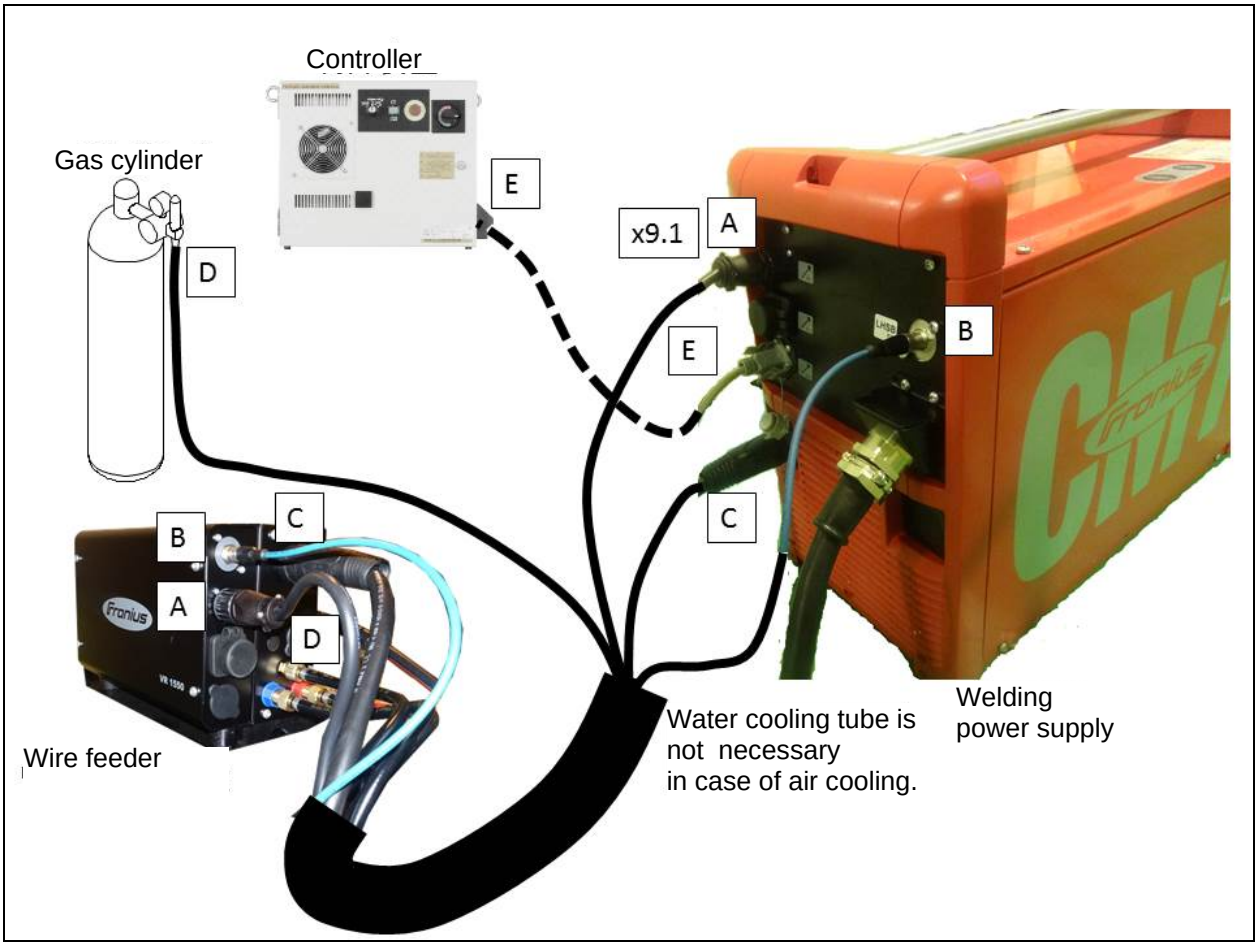


Fig. 2.2.4 (a) Connection of welding power supply

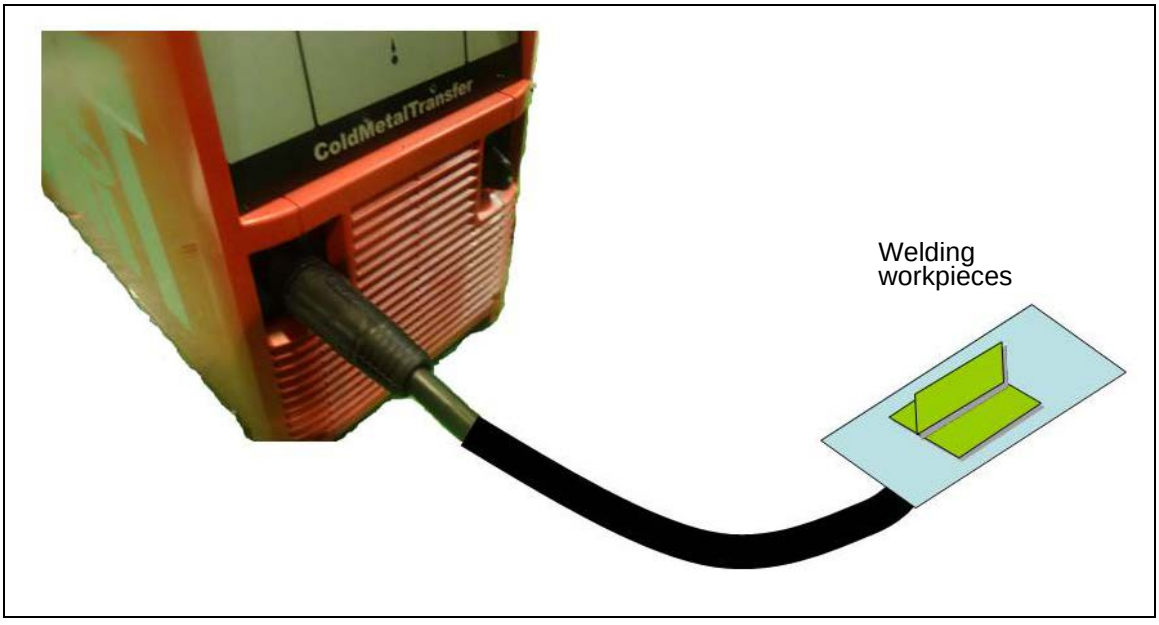


Fig. 2.2.4 (b) Connection of welding power supply

※ **Please avoid twist force is applied after connecting the power cable to the welding power supply.**

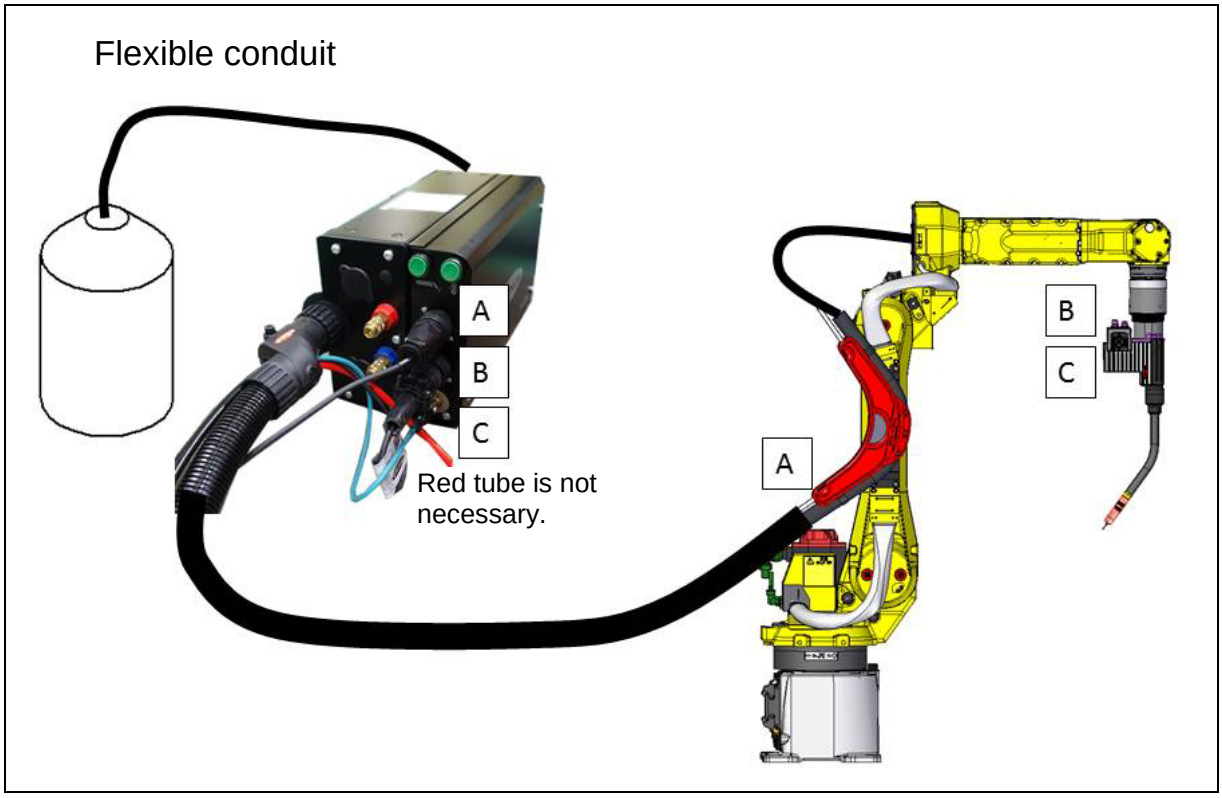


Fig. 2.2.4 (c) Connection to the wire feeder

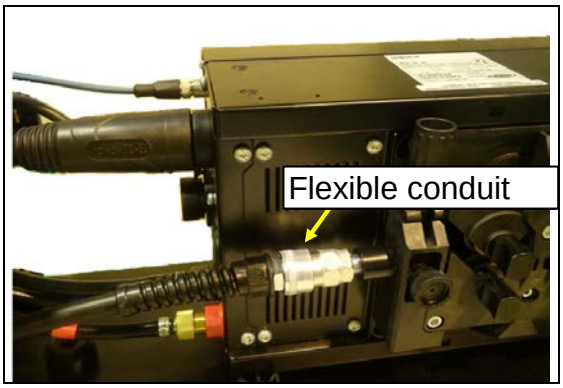


Fig. 2.2.4 (d) Connection to flexible conduit

In case of water cooling

In case of water cooling specification, connecting the water cooling hoses, which are included in the connection hose pack between the power source and wire feeder, is required. Perform connection referring to Fig. 2.2.4 (e), matching the red and blue markings in the vicinity of the connectors. The water cooling hose pack between the wire feeder and the torch also has water cooling hoses. Match the color (red and blue) and connect them to the wire feeder referring to Fig. 2.2.4 (f).

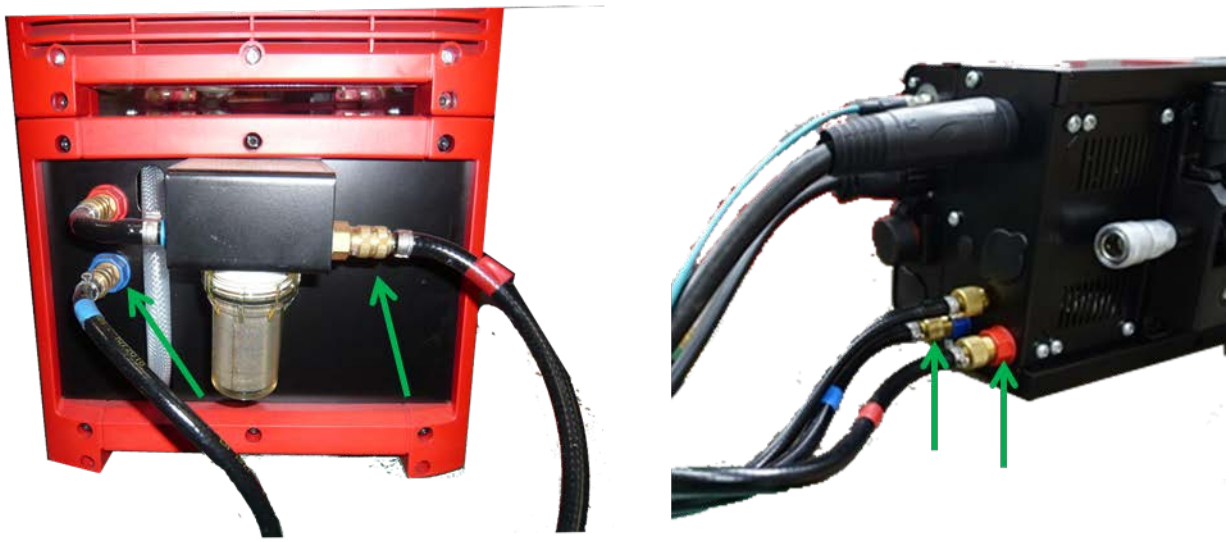


Fig. 2.2.4 (e) Connection of the water cooling hose between water cooling unit and the feeder

Fig. 2.2.4 (f) Connection of water cooling hose between the feeder and the hose pack

2.2.5 Adjustment of the Flexible Conduit Length

Make the bent of the flexible conduit between the wire feeder and the wire buffer small, and make the length as short as possible for stable welding. If the flexible conduit it too long, adjust the flexible conduit length according to the following procedure.

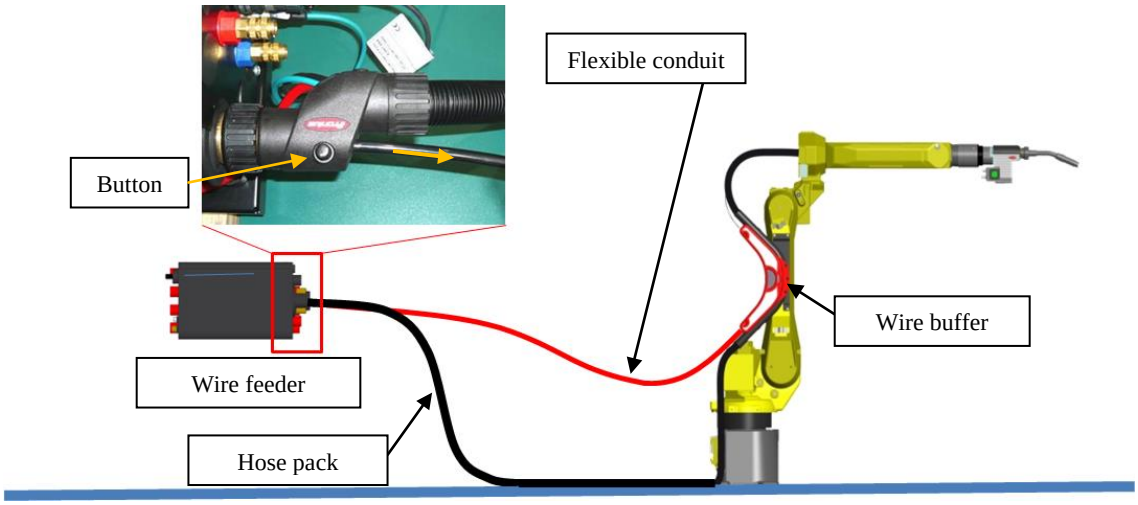


Fig. 2.2.5 (a) Adjustment of the flexible conduit length

Fig. 2.2.5 (b) Connection of the flexible conduit

1 When the robot is shipped, the flexible conduit between the wire buffer and the wire feeder is fixed on the hose pack as shown in Fig. 2.2.5 (b). Remove the flexible conduit from the resin part, then pull out the flexible conduit during pressing the button of the hose pack edge.
2 Depending on use environment, examine the placement of the flexible conduit.
Confirm the flexible conduit curvature is small and there are not lack of the length and excessive oscillation in the operation of the robot.
3 Take out the liner from the flexible conduit referring to Section 7.3.
4 In reference to Fig. 2.2.5 (c), remove the metal part of the flexible conduit edge.
5 Cut the flexible conduit with the most suitable length which is confirmed in step 2.
6 Install the metal par which is removed at step 4 to the flexible conduit edge.
7 In reference to Section 7.3, cut off the liner to the length of the flexible conduit and attach it.
8 Insert the flexible conduit to the hose pack according to the reversed sequence of step 1.

Fig. 2.2.5 (c) Connection of the flexible conduit

2.2.6 Pressurization Power Adjustment of the Roller

The following table shows pressurization power of each used wire for the wire feeder and the Robacta drive. Periodically confirm the pressurization power and adjust it according to the following procedure for stable feeding of the wire.

Contact pressure adjustment of the Robacta drive

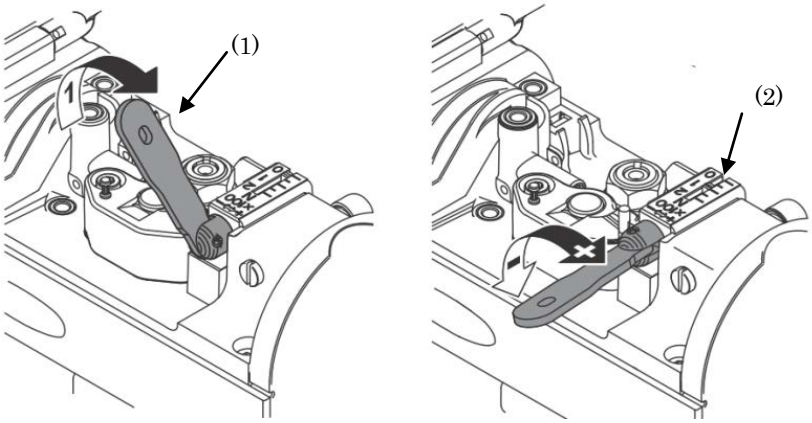


Fig. 2.2.6 (a) Contact pressure adjustment of the Robacta drive

1 Raise the roller fixation part (1) and release the fixation referring to Fig. 2.2.6 (a).
2 Lay down the part (1) with hinge of the root.
3 Rotate the part (1), Adjust the scale of the contact pressure of (2) position referring to Table 2.2.6.
4 Fix the roller according to the reversed sequence.

Table 2.2.6 Contact pressure adjustment of the roller

Wire materials	Adjustment point	
	Wire feeder	Robacta drive
Al-Si system alloy	1.5	0.8-1.2 (80-120N)
Al-Mg system alloy		1.0-1.5 (100-150N)
Iron, stainless		1.5-2.0 (150-200N)

Pressurization power adjustment of the wire feeder

1 Rotate the knob of the idol arm upper side referring to Fig. 2.2.6 (b). Match the scale of the idol arm to the moderate value referring to Table 2.2.6.

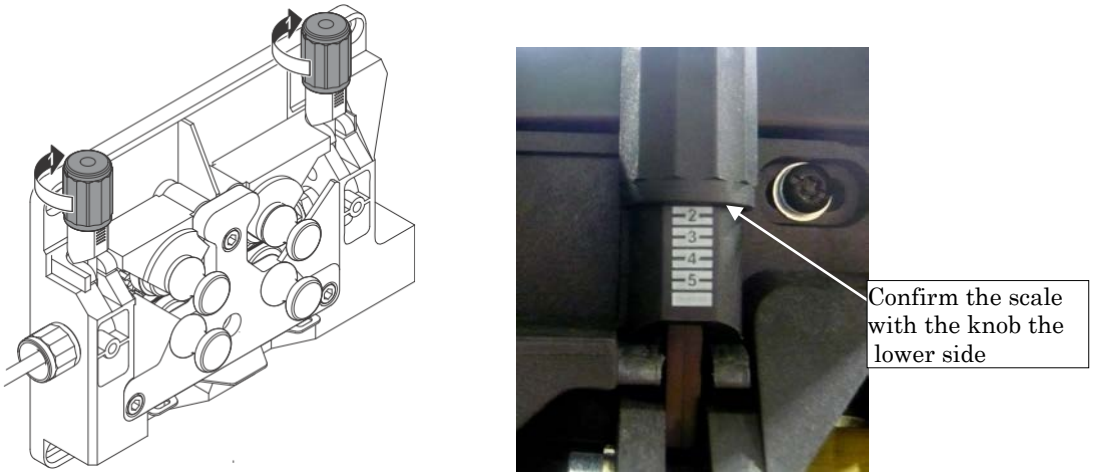


Fig. 2.2.6 (b) Pressurization power adjustment of the wire feeder

2.2.7 Connection of Input Power Supply of the Welding Power Supply

Connect the input power supply of the welding power supply referring to Fig. 2.2.5.
Be sure to match the phase of the power supply when connecting it.

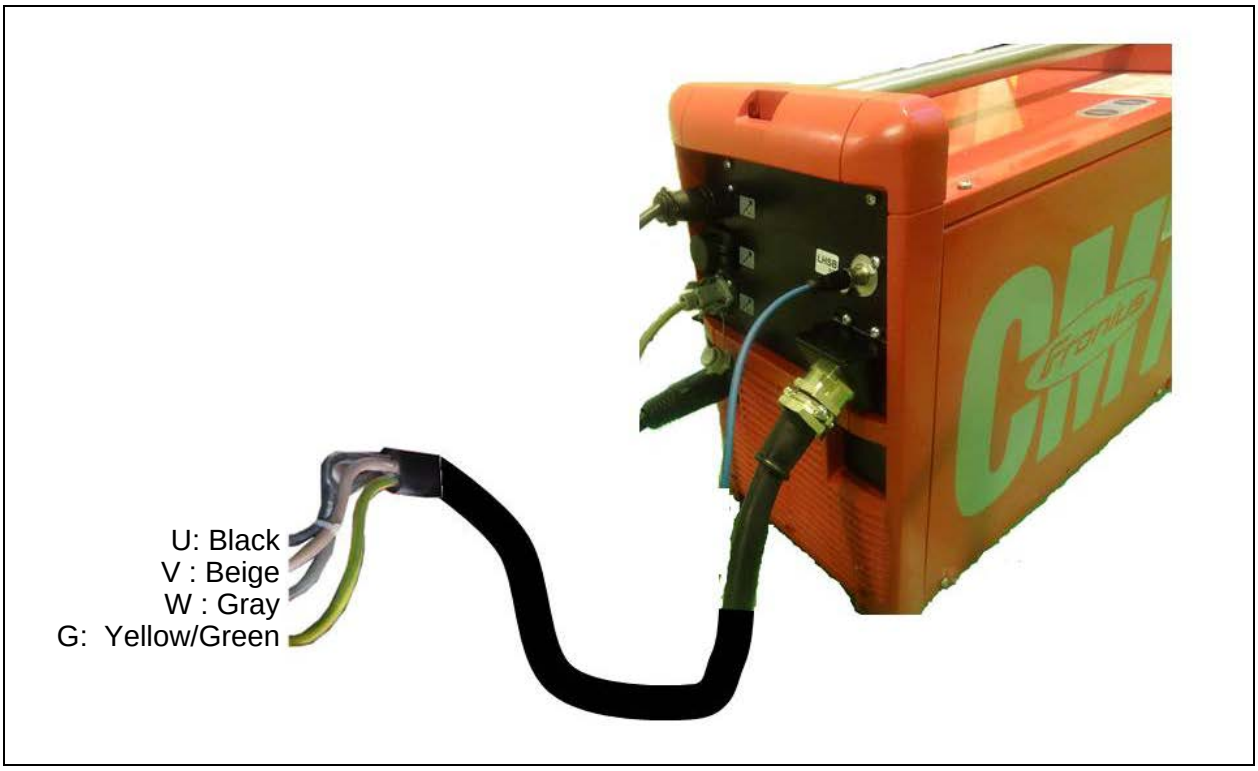


Fig. 2.2.7 Connection of Input Power Supply of the Welding power supply

* Distal portions of the welding power supply are cut off.

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.

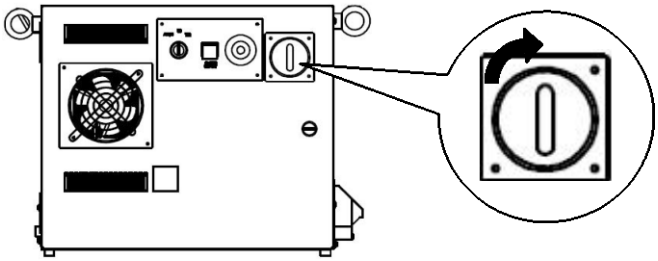


Fig. 2.3 (a) Turning on the robot controller

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.

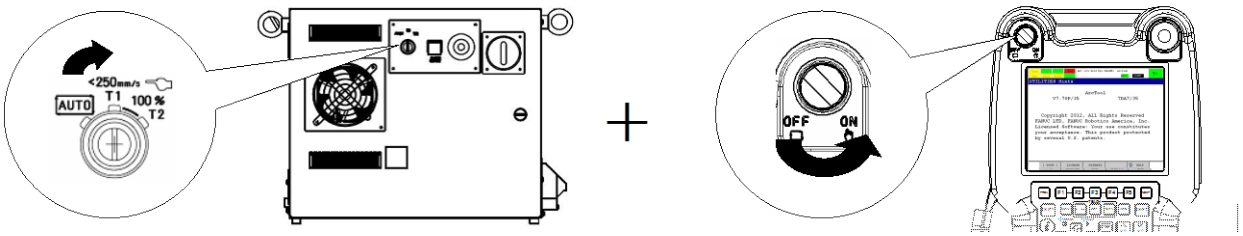


Fig. 2.4 (a) Setting of 3 mode switch and teach pendant switch

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).

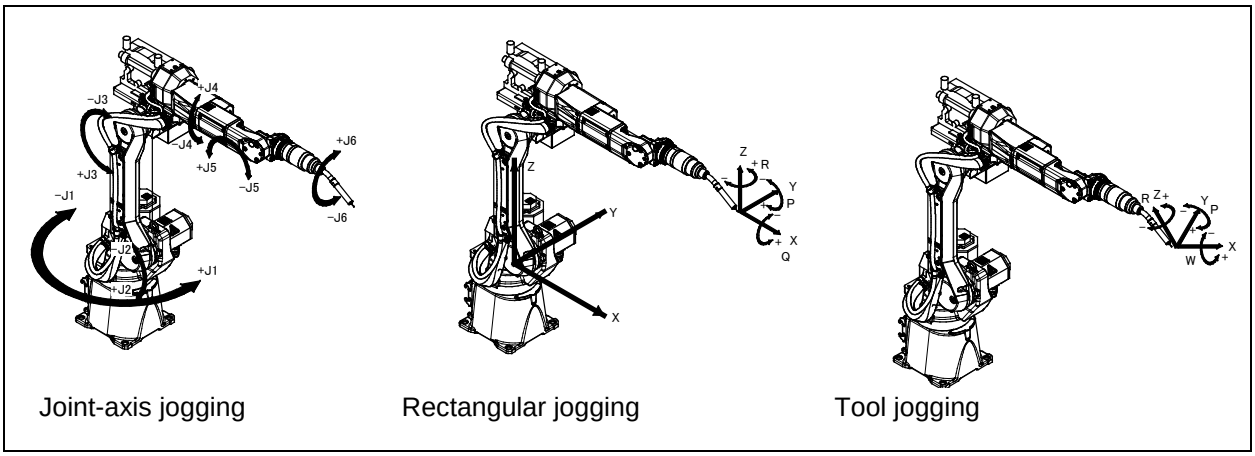


Fig. 2.4 (b) The kind of jogging

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.

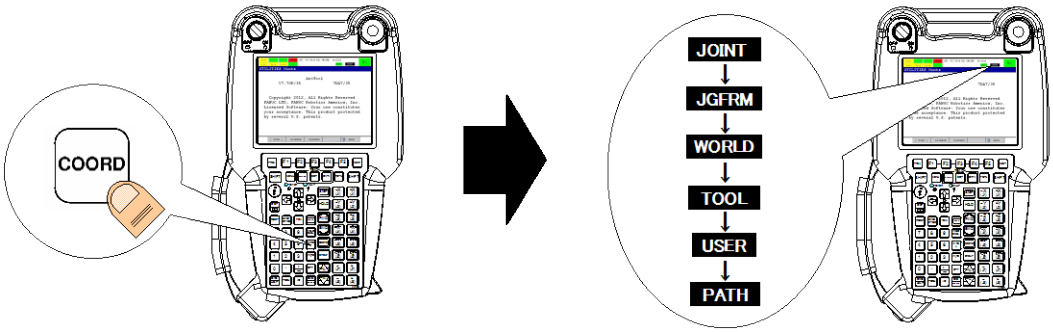


Fig. 2.4 (c) Change of jogging variation by manual-feed coordinate system key

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.

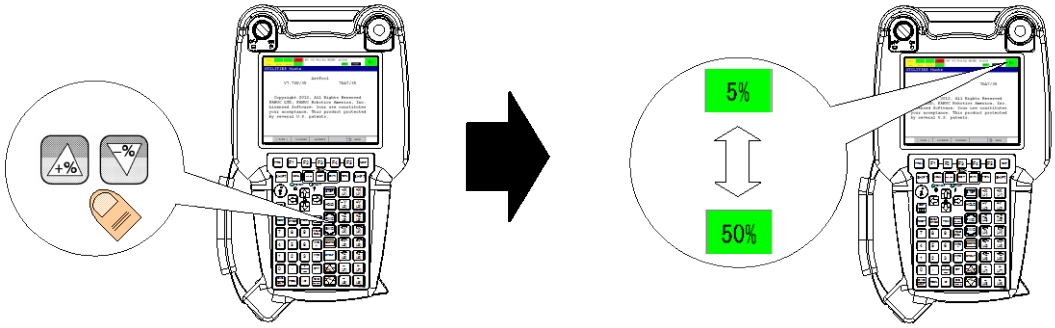


Fig. 2.4 (d) Operation of override key

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

Override key	VFINE → FINE → 1% → 5% → 100% Steps of 1% Steps of 5%
Shift + Override key	VFINE → FINE → 5% → 25% → 50% → 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.

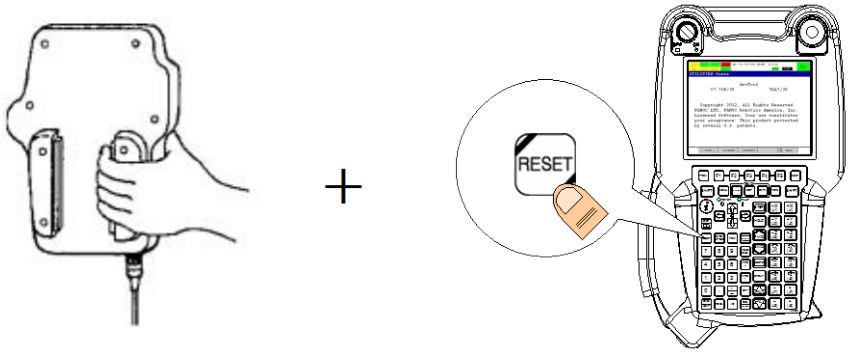


Fig. 2.4 (e) Operation of deadman switch and alarm release key

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.

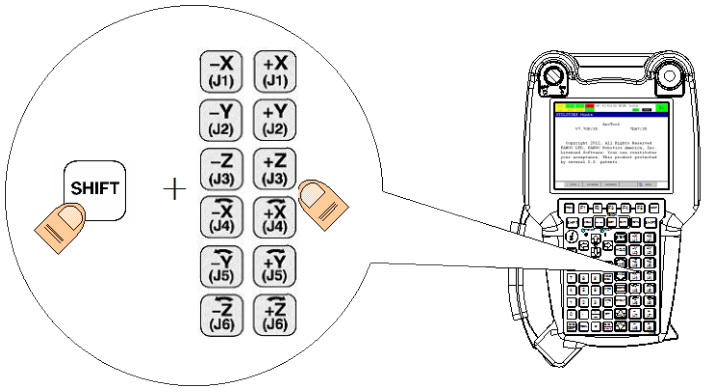


Fig. 2.4 (f) Operation of jog key

> ⚠ **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 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 is controlled by Fronius welder.

Procedure 2-5 Manual Wire Inching

Step

1 Press the [WIRE+] key on Teach Pendant. Wire is fed while pressing the key.

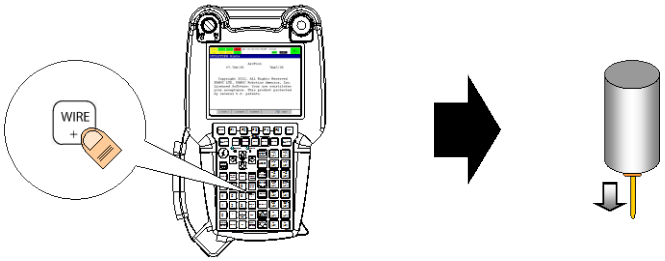


Fig. 2.5 (a) Wire Inching

2 Press the [WIRE-] key on Teach Pendant. Wire is retracted while pressing the key.

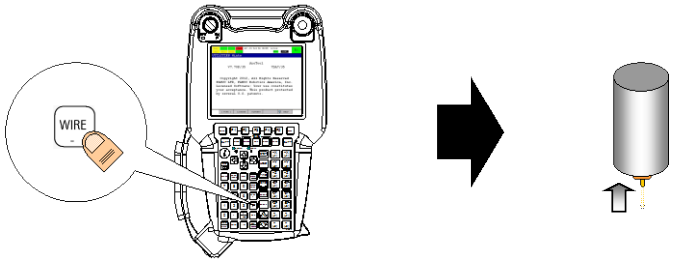


Fig. 2.5 (b) Wire Retract

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

2.6 ALIGNMENT WORK

You can measure the impedance and the inductance of the circuit for welding by using Fronius Xplorer or RCU5000 (option). Measurement result is recorded parameter of the welding power supply, you can raise precision of the welding. As for the measurement, the later setting is unnecessary if you perform it at the time of a setup once. Impedance and inductance will change due to welding fixture and cable setting, so be sure to perform alignment after arrangement of circuit surroundings is fixed. Refer to Subsection 4.4.3 of this manual for alignment procedure of Fronius Xplorer. Refer to the RCU manual for procedure using the RCU.

> ⚠ **CAUTION**
> If RCU5000(option) is used, remove it from the power source while using Fronius Xplorer.

2.7 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 2-7 shows the procedure for creating a robot motion program of following figure.

```
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]
```

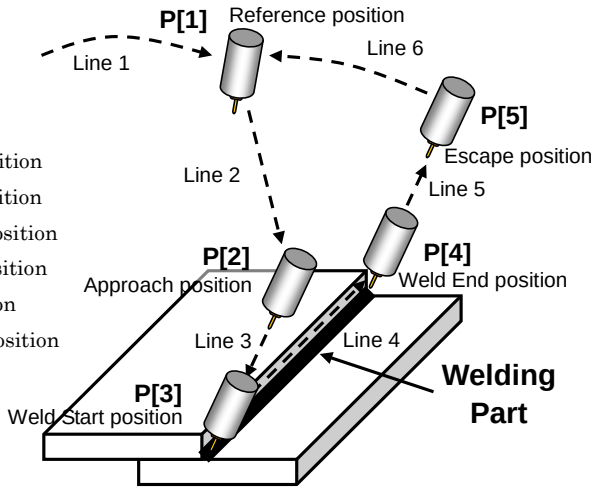


Fig. 2.7 (a) Sample Program

> **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 2-7 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.

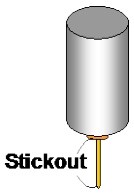
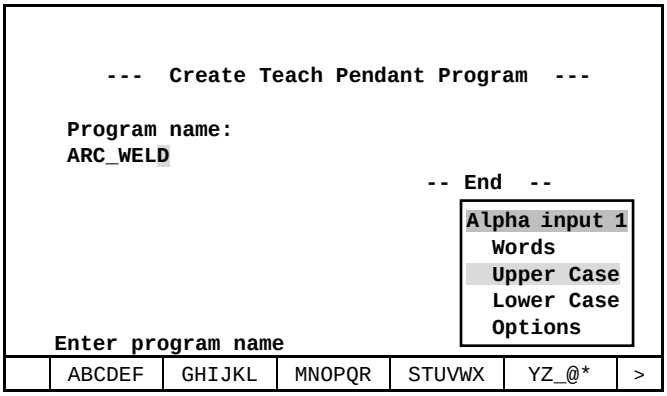


Fig. 2.7 (b) Adjustment of Wire Stickout

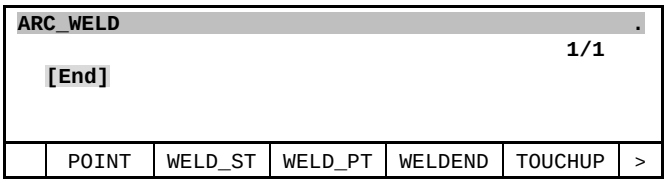
3 Press the [MENU] key on a teach pendant. Following Program List screen is displayed.

```
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.

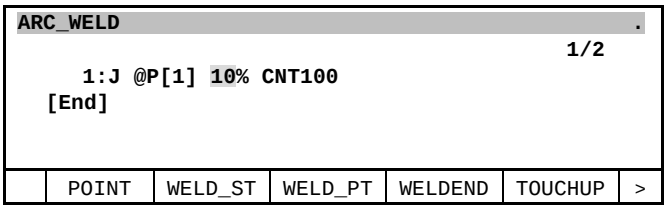


5 After finishing the input of program name, press the [ENTER] key. After that, press F3[EDIT] and complete the input of program name. The screen is automatically moved to Program Edit screen.



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.



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).

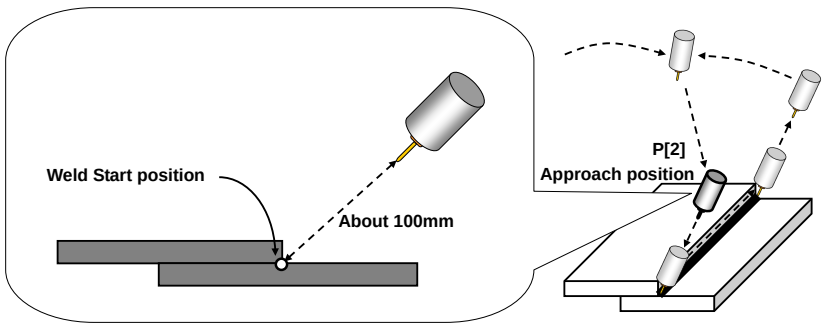
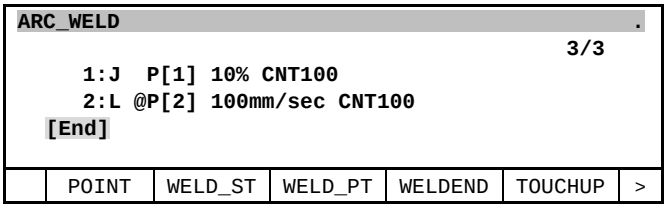


Fig. 2.7 (c) Jog to Approach Position

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.



10 Jog the robot to Weld Start position.

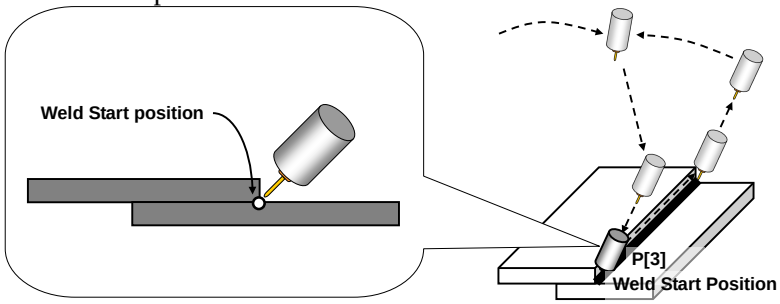
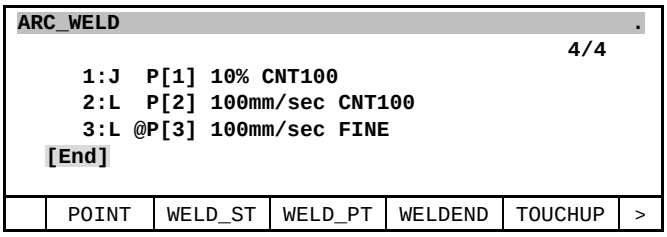


Fig. 2.7 (d) Jog to Weld Start Position

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.



12 Jog the robot to Weld End position.

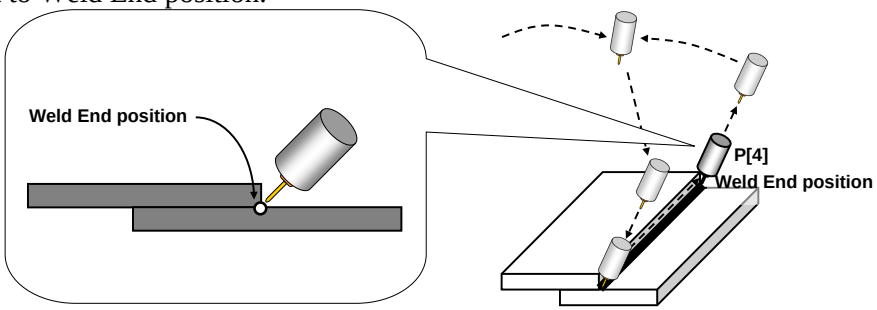
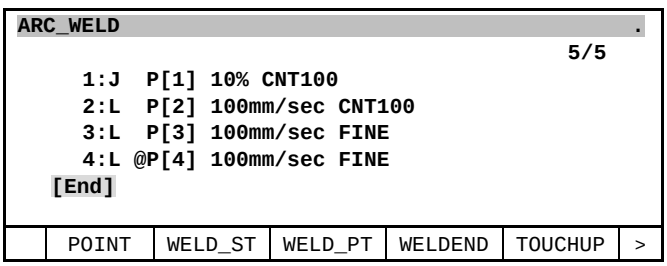


Fig. 2.7 (e) Jog to Weld End Position

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.



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).

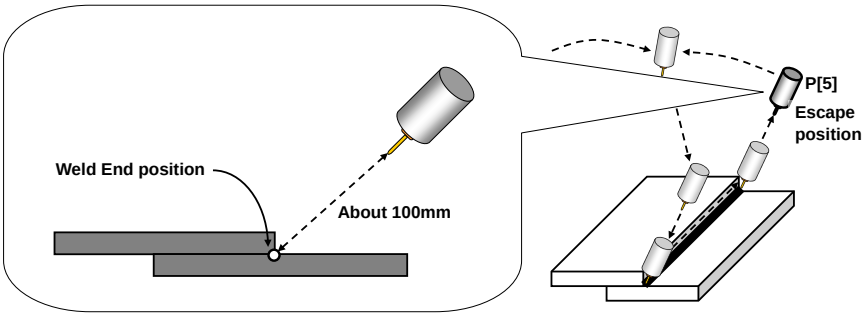


Fig. 2.7 (f) Jog to Escape Position

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).

2.8 SPECIFY ARC WELD SCHEDULE

It is impossible to achieve arc welding by only the motion program created on Section 2.7. For achieving arc welding, it is necessary to specify an arc weld schedule by procedure 2-8, 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.

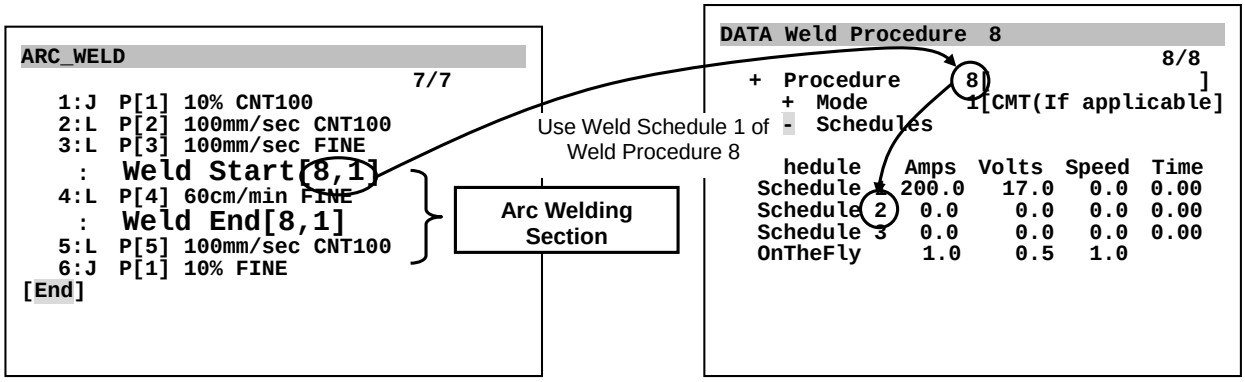


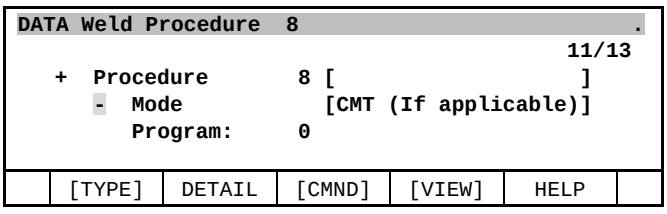
Fig. 2.8 Relationship between Sample Program and Arc Weld Schedule

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 2-8 Specify Arc Weld Schedule

Step

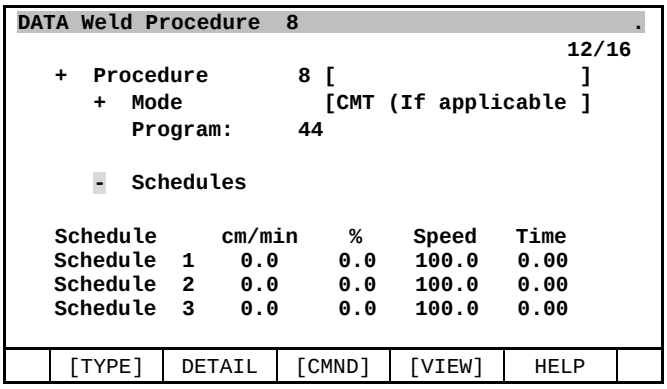
1 Press the [DATA] key.
2 Press F1[TYPE] and select "Weld Procedure". Then Weld Procedures screen is displayed.
3 Here, the basic procedure to perform CMT welding is shown. There is the Weld Procedure whose Operating Mode is "CMT (If applicable)", so move the cursor on "+" at the left of "Mode" of it and press the [ENTER] key. If there is not "CMT (If applicable)", perform step 4 - 10 of Procedure 3-1-2.



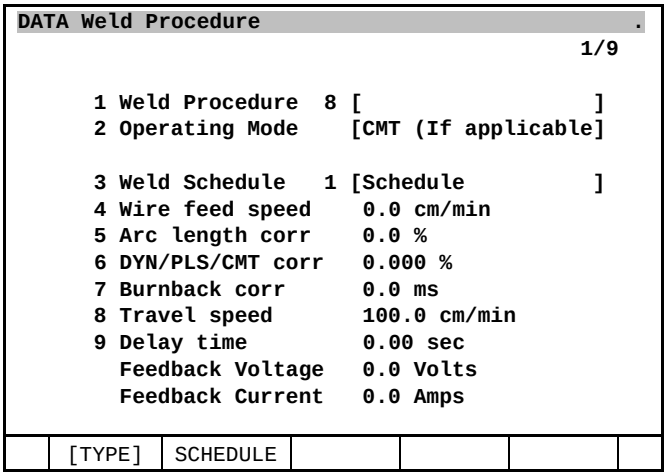
4 Input the "Program" Number. Program Number means Process Mode number. For more detail, please refer to the Section 9.1. For example, when wire is 1.2 mm Steel and gas is CO2, Program Number is 44.

NOTE
- When the software version is 7DC3 series (V8.30) P31 or later, 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 “Specified weld mode info cannot be read” is displayed and user input operation is canceled. If the communication is not established correctly, please recover the communication by referring the Subsection 6.2.4.
- Please confirm that the desired program number is set correctly. When “Schedules” tree is expanded and the cursor is moved to wire feed speed command, available command range of the specified program number is displayed at the prompt line. Please confirm that the range matches to the range described at the Table in Section 9.1. If it does not match, please perform Procedure 6-2-1 to setup scaling.

5 Next, move the cursor on “+” at the left of “Schedules” and press the [ENTER] key.

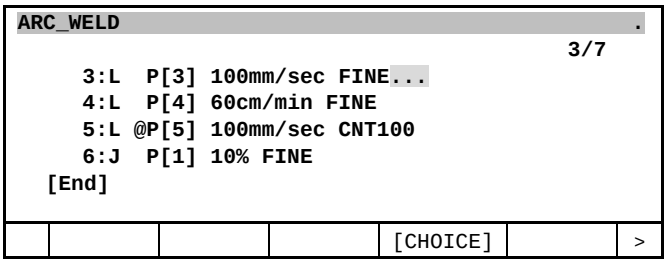


6 Move the cursor on unused weld schedule (in this example, Weld Schedule 1), and press F2[DETAIL]. Detail screen for the weld schedule is displayed.

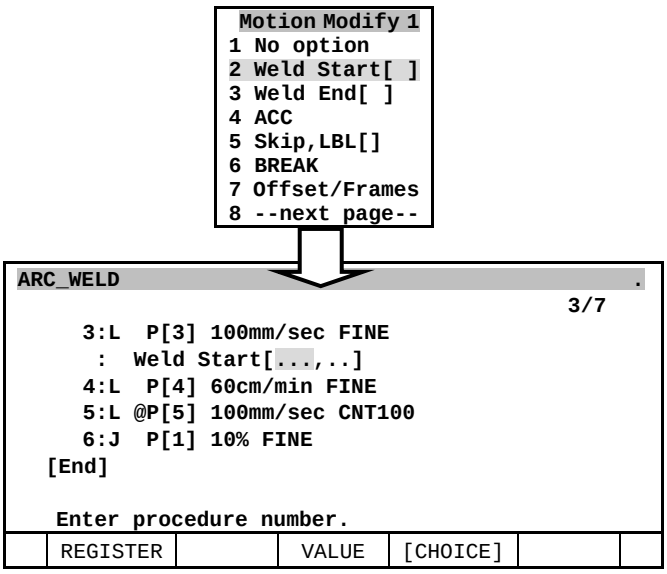


7 Setup “Wire feed speed”. It is OK to leave other command value (On the above-mentioned screen, they are values of line 5 to 7) 0.0. Details of each value are written in Section 3.2.

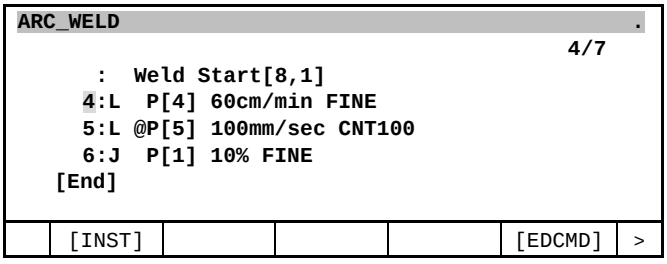
8 Display the edit screen of the motion program created on Procedure 2-7. Press [EDIT] key, or press [SELECT] key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on a blank part just behind “FINE” on line 3.



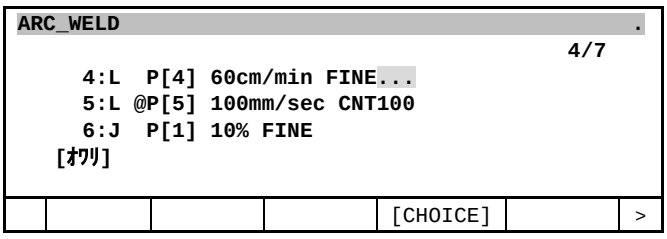
9 Press F4[CHOICE]. The list of additional motion instructions are displayed. Select “Weld Start[]” from the list. Weld Start instruction is taught at the last of line 3.



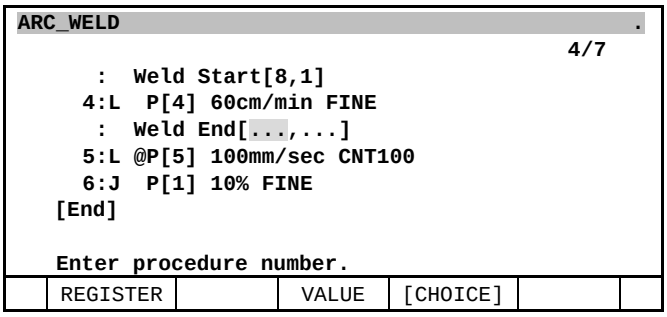
10 Input the Weld Procedure number (in this example, 8) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 5 (in this example, 1) to the second argument.



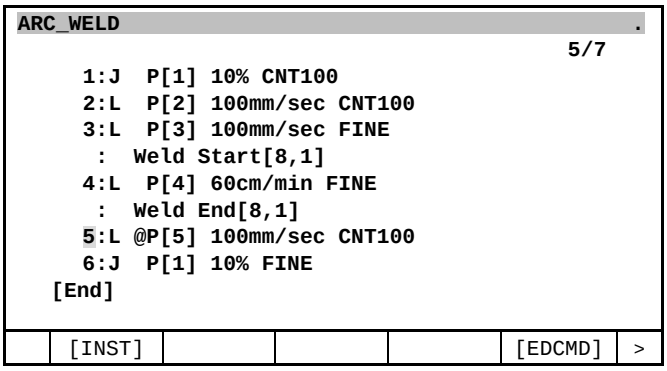
11 Next, move the cursor on a blank part just behind “FINE” on line 4.



12 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.

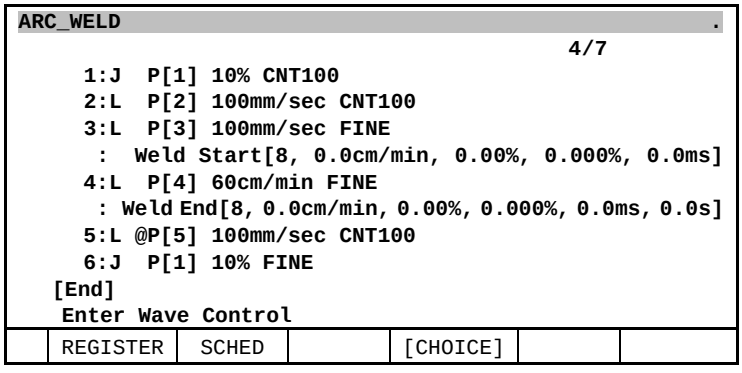


13 Input the Weld Procedure number (in this example, 8) to the first argument of Weld Start instruction. Next, input the weld schedule number that is specified in Step 5 (in this example, 1) to the second argument. In this stage, sample program for arc welding was completed. In this sample program, processing is performed between P[3] and P[4] at the Schedule 1 of Weld Procedure 8.



14 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.

15 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.



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.

2.9 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 2-9 (a) Manual gas check

Step

1 Press the [GAS/STATUS] key once while pressing [SHIFT] key on Teach Pendant. Gas is left out from the top of the torch. When 5 seconds have passed, the gas flow stops automatically.

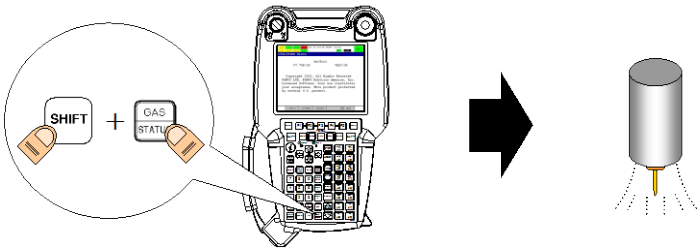


Fig. 2.9 (a) Gas Check by Gas Purge Key Operation

2 During the gas flow, you can also stop the gas flow manually by pressing [GAS/STATUS] and [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                                    .
                                                 1/19
        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                                    .
                                                19/19
    15 Weld from teach pendant: ENABLED
    16 Remote gas purge:        DISABLED
    17 Remote wire inch:        DISABLED
    18 Gas purge key:           ENABLED.
    19 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 2-9 (b) Switching Weld Enabled/Disabled

Step

1 Press the [WELD ENBL] key while pressing [SHIFT] key on Teach Pendant. “Weld” software LED on Teach Pendant is switched to yellow and green alternately.

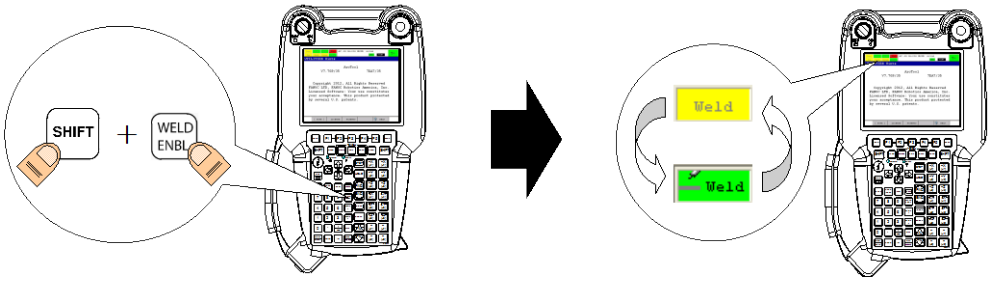


Fig. 2.9 (b) Switching Operation of Weld Enabled/Disabled by WELD ENBL Key

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.

2.10 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 2-10 (a) Step Operation

Step

1 Grasp Teach Pendant, press dead man switch and turn the Enable switch on Teach Pendant ON.

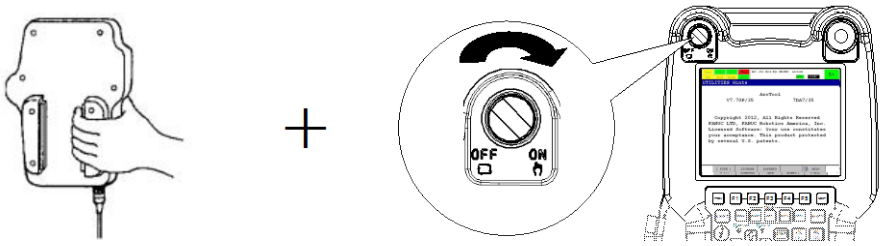


Fig. 2.10 (a) Operation of Dead Man Switch and Teach Pendant Enable Switch

2 Set the robot speed during program execution by override keys.

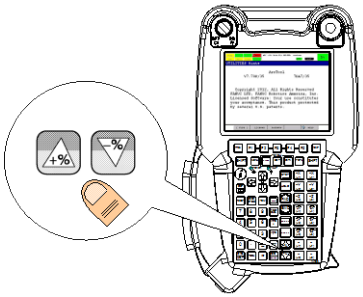
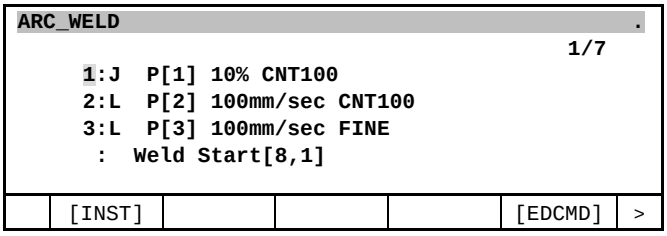


Fig. 2.10 (b) Setup of Override

> ⚠ **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. Press [EDIT] key, or press [SELECT] key and select the sample program name which was set by Step 4 in Procedure 2-7 (in this example, ARC_WELD). Then, move the cursor on the top of line 1.



4 Press [STEP] key and set “Step” software LED on Teach Pendant to yellow status.

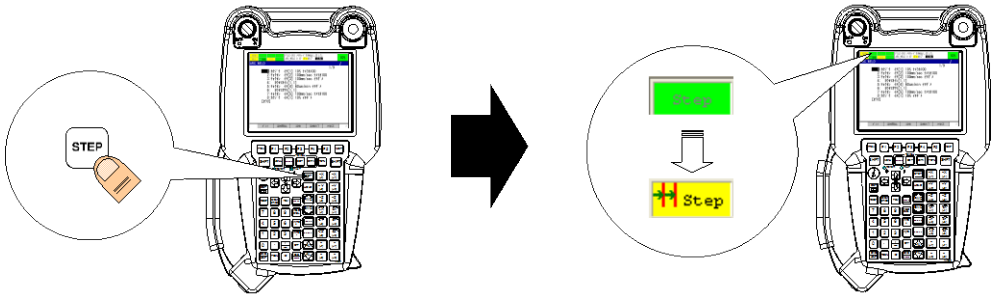


Fig. 2.10 (c) Switch to Step Mode

> ⚠ **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 [FWD] key while pressing [SHIFT] key. After the robot starts to move, release only [FWD] key, but keep [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.

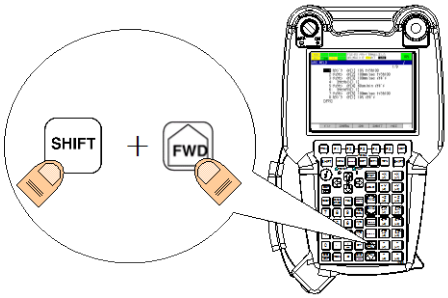


Fig. 2.10 (d) Step Operation of Program

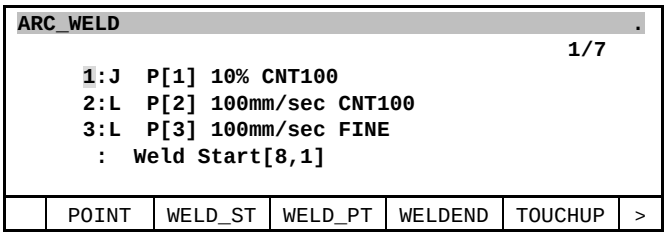
6 When [FWD] key is pressed while pressing [SHIFT] key again, the execution of line 2 on the program is started. Please check the motion path of the robot by repeating the operation.

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

Procedure 2-10 (b) Continuous Operation

Step

1 Move the cursor on the top of line 1.



2 Set continuous operation mode. Press the [STEP] key and set “Step” software LED on Teach Pendant to green status.

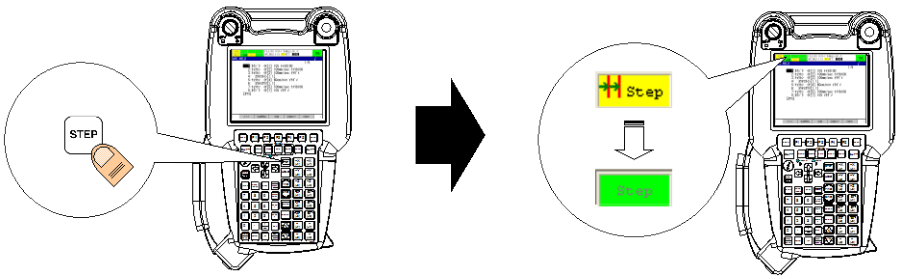


Fig. 2.10 (e) Switch to Continuous Operation Mode

3 Set Weld Disabled status. Press the [WELD ENBL] key and set “Weld” software LED on Teach Pendant to yellow status.

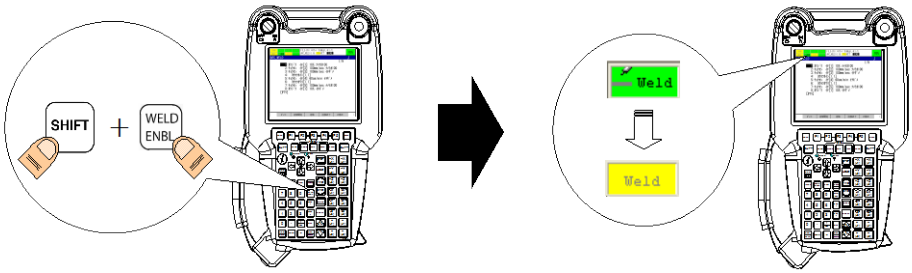


Fig. 2.10 (f) Switch to Weld Disabled

4 Set the robot speed during program execution by override keys.

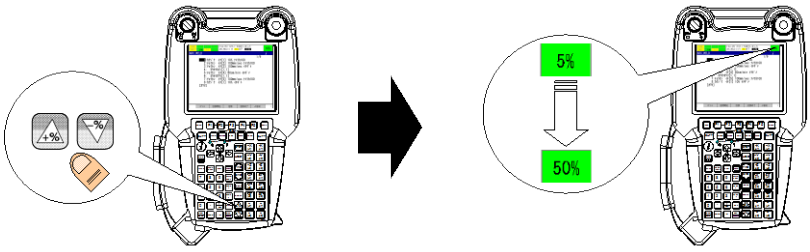


Fig. 2.10 (g) Setup of Override

5 Start the program execution. Press the [FWD] key while pressing [SHIFT] key. After the robot starts to move, release only [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.

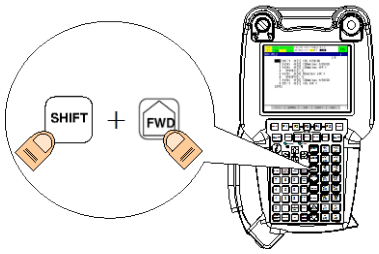


Fig. 2.10 (h) Continuous Execution of Program

2.11 EXECUTION OF WELD PROGRAM

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

Procedure 2-11 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.

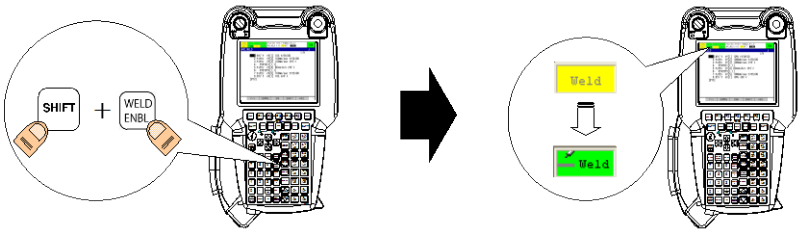


Fig. 2.11 (a) Switch to Weld Enabled

2 Set 100% override by override key.

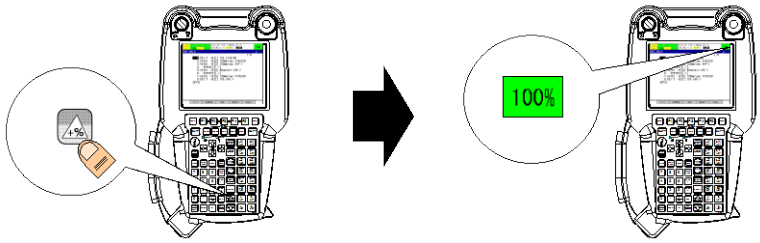


Fig. 2.11 (b) Set 100% Override

3 Move the cursor on the top of line 1 and then perform the program execution.

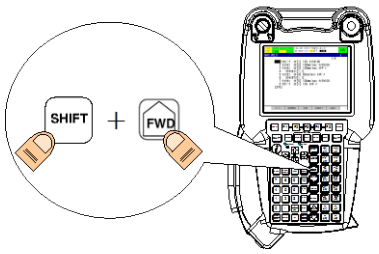


Fig. 2.11 (c) Continuous Operation of Weld Program

4 Arc welding is performed when the motion instruction that is put between Weld Start and Weld End instructions is executed.

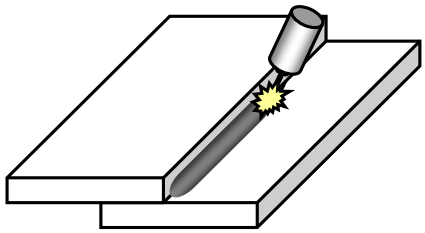


Fig. 2.11 (d) Execution of Arc Welding

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”.

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 TS/TPS WELDER

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

3.1.1 Operating Mode

There is a concept called “Operating Mode” in the Fronius 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[1] (Oper Mode).

Table 3.1.1 Operating Mode of TS/TPS

Operating Mode	Value of GO[1]	Description
Synergic	0	This is short circuit welding mode. The welding output is decided based on the weld schedule that is set in the robot.
Pulsed-Synergic	1	This is pulse welding mode. The welding output is decided based on the weld schedule that is set in the robot.
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). Though the robot basically commands the Job number only, the robot can also command for adjustment of the JOB welding. That means, the robot commands to the welder by % (from -100% to +100%). Then, the weld schedule of JOB can be adjusted by %.
Setup (NO-WELD)	3	This mode is not for welding. Though the Operating Mode number is output to the welder as GO[1] as shown in the above-mentioned, the welder may limit the operation (For example, creating JOB, editing JOB and etc.) depending on the input number. When this mode is used, the above-mentioned limit is released.
Manual Mode	4	Though this is for manual welding option offered by Fronius, this is basically not used.
CC/CV (If applicable)	5	Though this is for CC/CV (hybrid) welding option offered by Fronius, this is basically not used.
TIG (If applicable)	6	Though this is for TIG welding option offered by Fronius, this is basically not used.
CMT (If applicable)	7	This mode is supported by the CMT welder only. This is CMT (Cold Metal Transfer) welding mode. The welding output is decided based on the weld schedule that is set in the robot.

And, there is a concept called “Program Number” in the TS/TPS welder. “Program Number” means process mode (It is a welding characteristic file that is prepared corresponding to wire material / wire diameter / shield gas). When the Operating Mode is Synergic or Pulsed-Synergic or CMT, one “Program Number” is assigned to each Weld Procedure. The “Program Number” of selected Weld Procedure is output to the welder as GO[3] (Prg Number). Please refer to the Section 9.1 about the list of “Program Number”.
On the other hand, it is not necessary to assign the “Program Number” 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[2] (Job number). 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

"Operating Mode" and "Program Number" are assigned to "Weld Procedure". Then Weld Procedure which is assigned the desired Operating Mode and Program Number are specified on arc weld instruction, and it is possible to achieve the switching of output characteristic from arc welding robot to arc welding power supply.

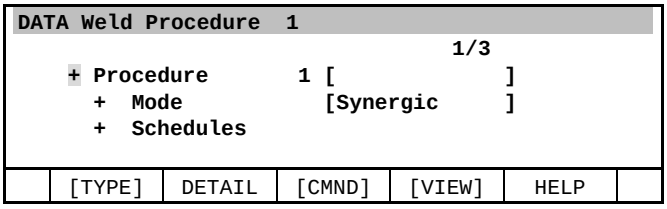
"Weld Procedure" has setups which decide welding sequence. It is possible to create weld procedure up to 20. Additionally, one weld procedure can have weld schedules up to 32.

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



3 At the status just after factory shipment, there are eight Weld Procedures which are assigned different Operating Modes beforehand. 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 F1[CMND] and select "Create WP" (It is also possible to create new Weld Procedure by copying existing Weld Procedure. In this case, press the [ENTER] 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 :

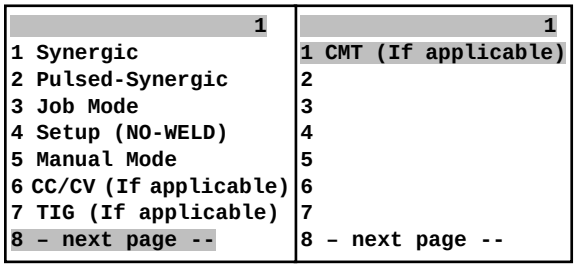
5 The following message will be displayed on the lower of the screen. Press F4[YES].

Create new procedure xx :

6 If Weld Procedure setup guide screen is displayed, press F5[DISABLE] (Weld Procedure setup 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 "+" in the head of "Procedure" and press the [ENTER] key. Then, Weld Procedure tree view is expanded. Confirm that settings of "Procedure" tree are as follows. If not, change settings as follows. Depends on a software version, there is a case that the following settings are not displayed. In that case, following settings are automatically set as follows.

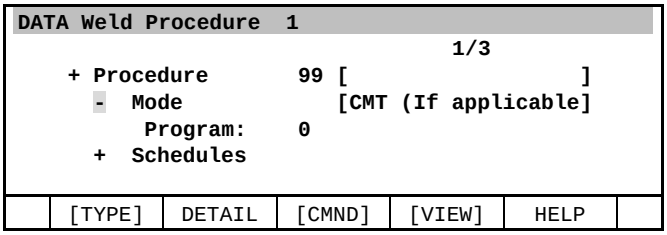
Runin : DISABLED
Burnback : DISABLED
Wirestick resets : DISABLED

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



10 Select the desired Operating Mode.

11 “+” will be displayed at the first position of “Mode” line when Synergic or Pulsed-Synergic or CMT is selected. Move the cursor to the area of “+” and press the [ENTER] key or F2[DETAIL]. The Mode tree view is expanded and the following screen is displayed. Enter the desired Program Number. Refer to the Section 9.1 about the list of Program Number.



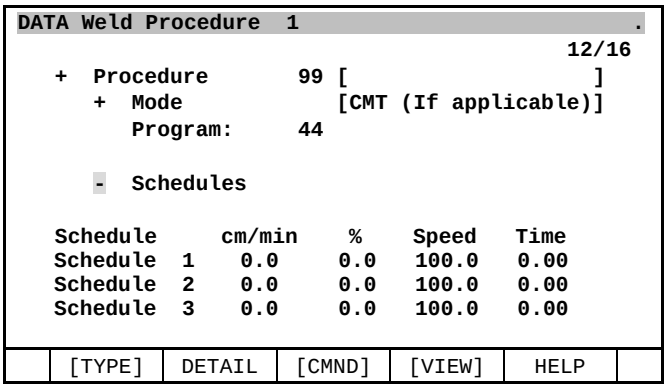
In the case of Job Mode, it is not necessary to set the Program Number. So “+” is not displayed at the first position of “Mode” line.

NOTE

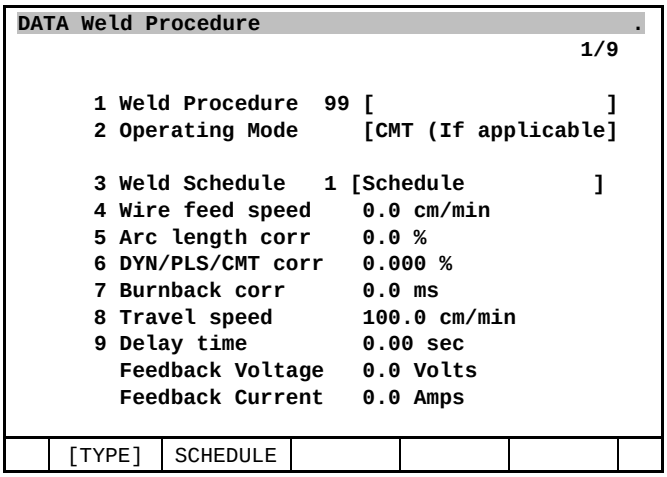
- When the software version is 7DC3 series (V8.30) P31 or later, it is necessary to establish the communication with welding power supply before performing this step. Please confirm turning on the power supply and the state of communication cable. When this step is performed with no communication, the prompt message of “Specified weld mode info cannot be read” is displayed and user input operation is canceled. If the communication is not established correctly, please recover the communication by referring the Subsection 6.2.4.
- Please confirm that the desired program number is set correctly. When “Schedules” tree is expanded and the cursor is moved to wire feed speed command, available command range of the specified program number is displayed at the prompt line. Please confirm that the range matches to the range described at the Table in Section 9.1. If it does not match, please perform Procedure 6-2-1 to setup scaling.

12 Continuously, the weld schedule is set at the same screen. However, it is not necessary to perform following steps if user wants to teach the weld schedule in TP program directly.

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.



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



15 Set the weld schedule. For more details of each parameter, please refer to the Section 3.2.

3.2 PARAMETER OF WELD SCHEDULE

This section explains about each weld parameter in weld schedule in detail. Weld parameters are changed by setting of Operating Mode. For more detail, please refer to the Fronius manual.

Table 3.2 Weld parameters

Weld Parameter	Detail
Wire feed speed	This welding parameter decides wire feed speed. Standard unit is cm/min.
Arc length correction	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.

Weld Parameter	Detail
DYN/PLS/CMT correction	In the case of short circuit welding, this welding parameter means DYN (= Dynamic). In the case of pulse welding, this welding parameter means PLS (= Pulse). In the case of CMT welding, this welding parameter means CMT (= Cold Metal Transfer). This welding parameter adjusts the weld wave shape and standard value is 0.000%. <Dynamic correction> 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 correction> 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. <CMT correction> 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.
Burnback correction	This welding parameter decides wire burnback time.
Power correction And Arc length correction	Power correction is displayed only when the welder is TS/TPS welder and Operating Mode is Job Mode. Arc length correction is displayed even not Job Mode, but it is different at Job Mode. In the case of Job Mode, weld schedule is decided by JOB which is set at welder side. This welding parameter increases or decreases weld schedule with % based on the JOB welding. When this value is 0.0%, the JOB welding is used directly.
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.

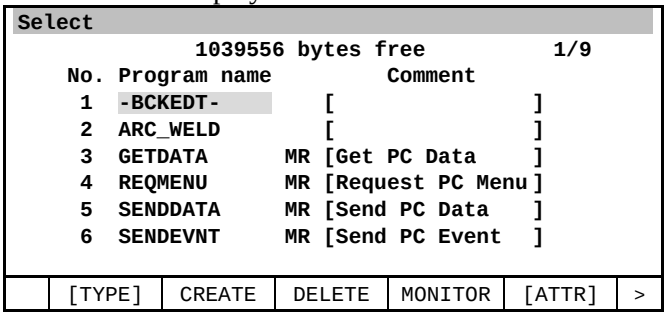
3.3.1 Selecting and Editing of Program

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.

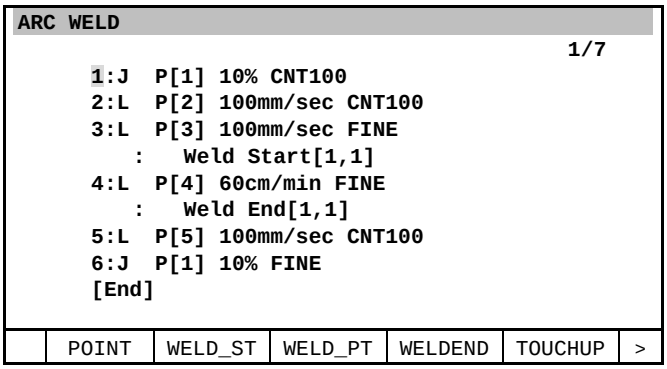
Procedure 3-3-1 Selecting and editing of program

Step

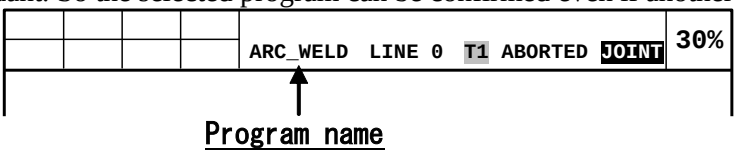
1 Select a program on the program selection screen.
Press the [MENU] key and select “SELECT” from the displayed menu. Or, press [SELECT] key.
Program selection screen will be displayed.



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.



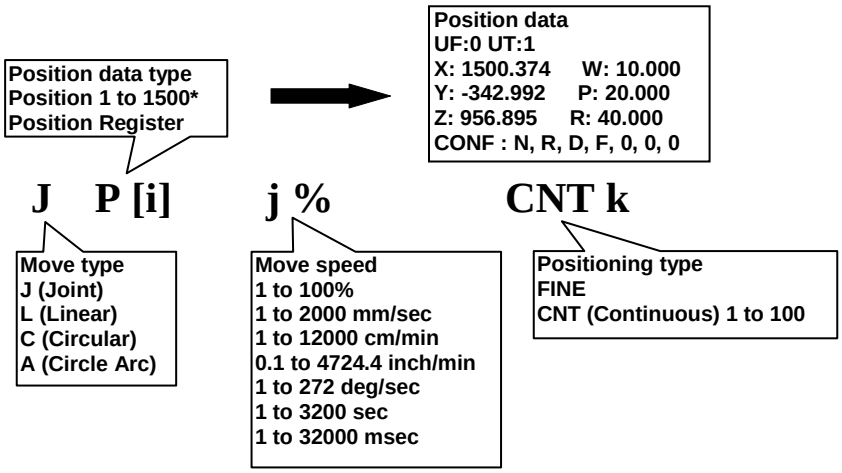
3 The program name of currently selected can be confirmed at status line that is in the window at the top of the teach pendant. So the selected program can be confirmed even if another screen is displayed.



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). Procedure 3-3-2 explains about the editing method of those four compositions.



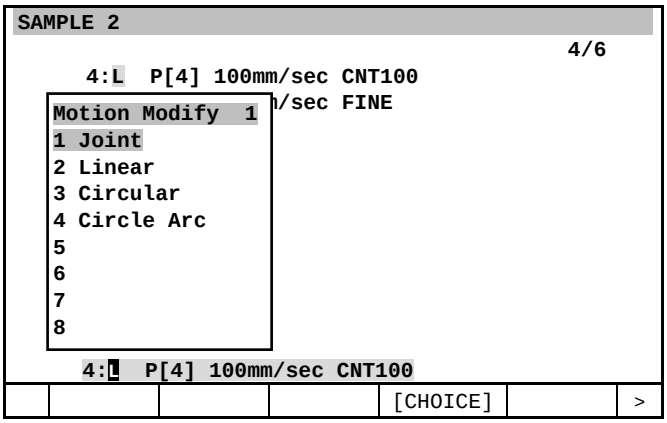
*** A position number can be as large as memory allows.**
The maximum move speed differs according to robot model.

Fig. 3.3.2 Composition of motion instruction

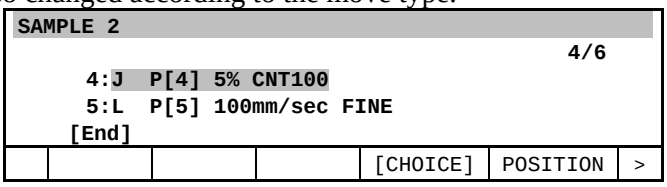
Procedure 3-3-2 Editing of motion instruction

Step

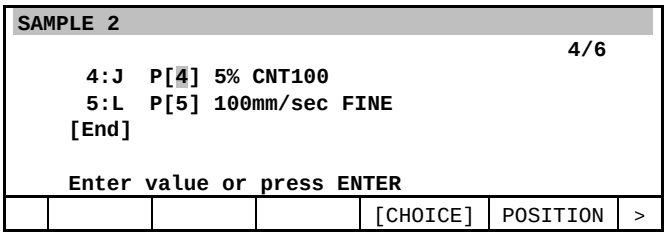
1 In case of changing move type, move the cursor to move type and press F4[CHOICE]. Sub menu for selecting move type is displayed.



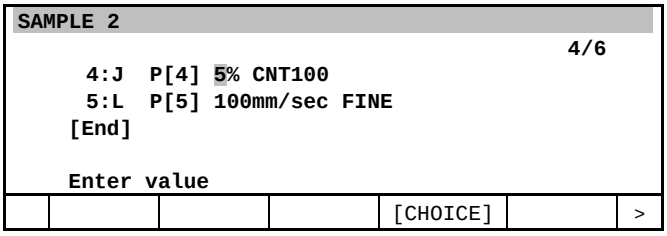
2 When the move type is selected from the sub menu, move type is changed. If it is changed, move speed and its unit are also changed according to the move type.



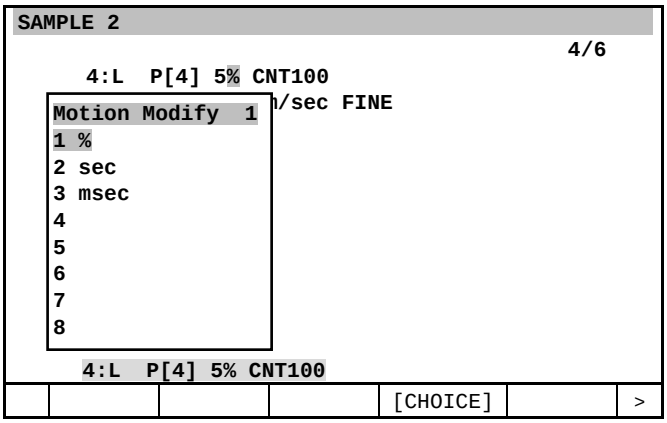
3 In case of changing position data number, move the cursor to the position data number and input new position data number.



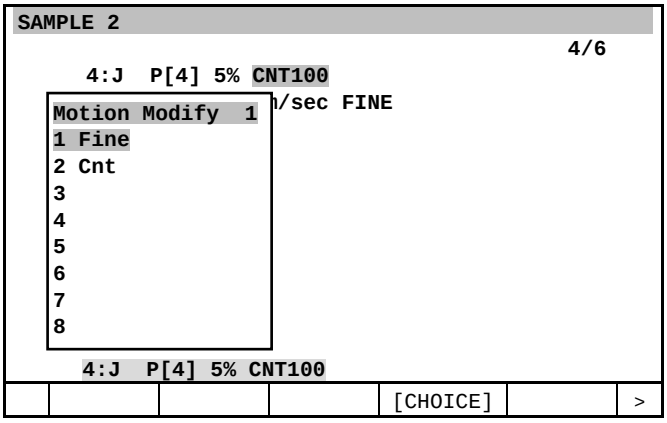
4 In case of changing move speed, move the cursor to move speed and input new value.



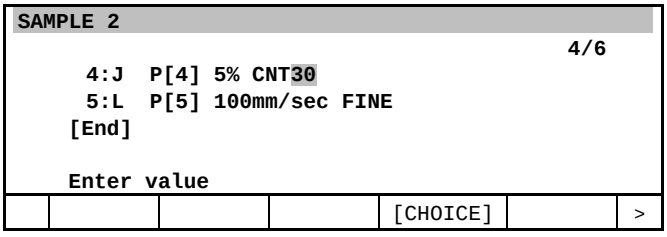
5 In case of changing the unit of move speed, move the cursor to move speed and press F4 [CHOICE]. Sub menu for selecting the unit is displayed. Select new unit from the sub menu. If it is changed, the value of move speed is automatically converted to new unit.



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.



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



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).

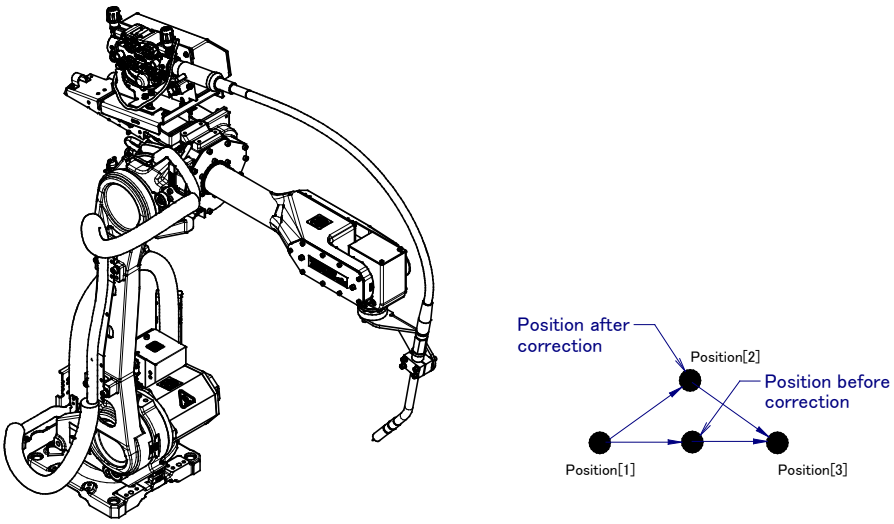
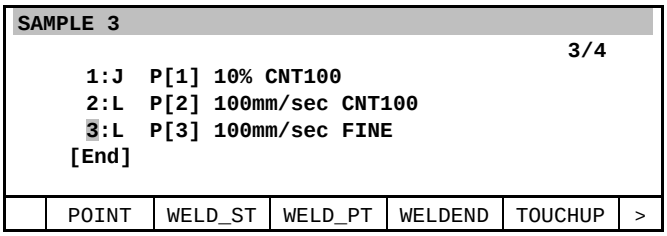


Fig. 3.3.3 Correcting a position

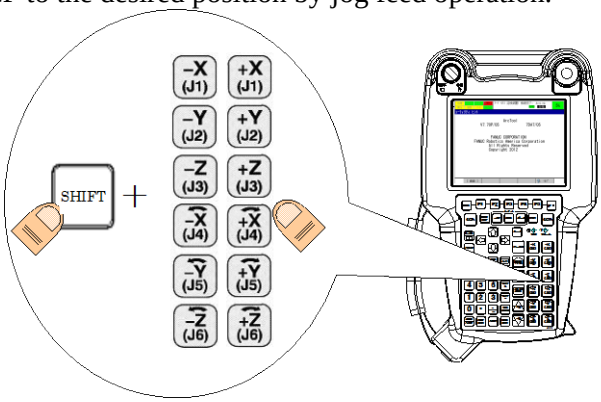
Procedure 3-3-3 (a) Correcting a position

Step

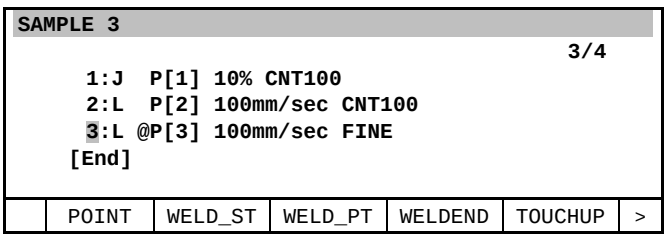
1 Move the cursor to the beginning of motion instruction line that correction is required.



2 Move the robot TCP to the desired position by jog feed operation.



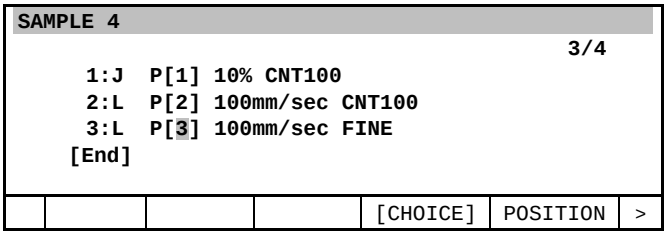
3 Press F5[TOUCHUP] with holding [SHIFT] key. The position data in the motion instruction of current cursor position (it is P[3] in the following example screen) is modified to the current robot TCP position.



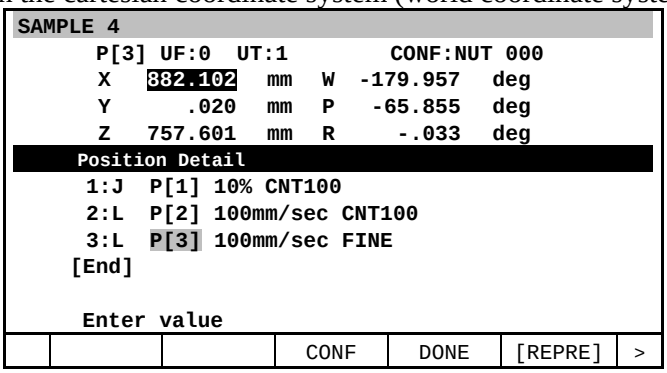
Procedure 3-3-3 (b) Confirm position data and Change position data number

Step

1 Move the cursor to the position data number.

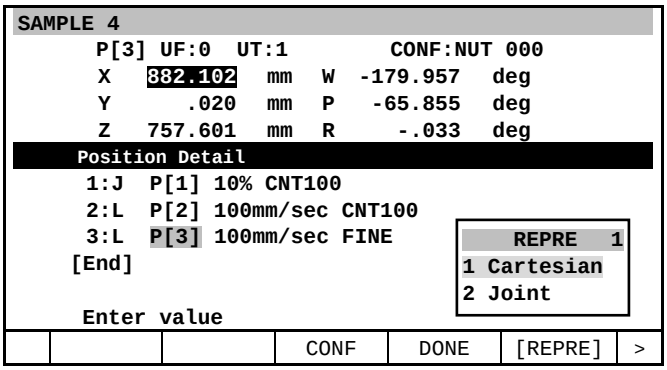


2 Press F5[POSITION] key. Sub menu for position data is displayed. In standard, the position is displayed based on the cartesian coordinate system (world coordinate system).



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”.



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).

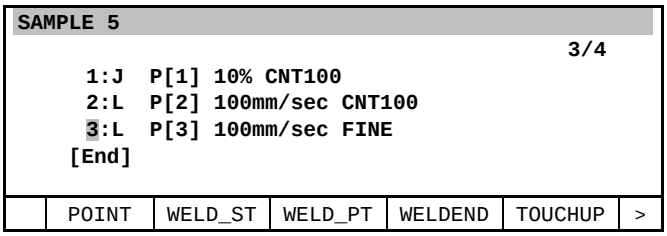
Table 3.3.4 (a) Kind of program edit instructions

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.

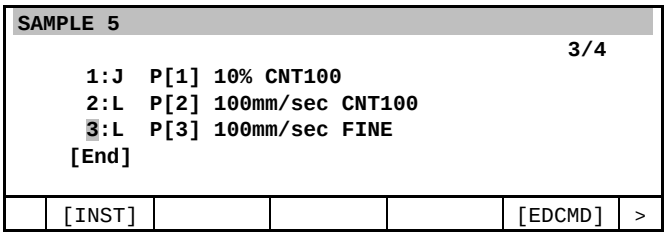
Procedure 3-3-4 (a) Insert blank lines

Step

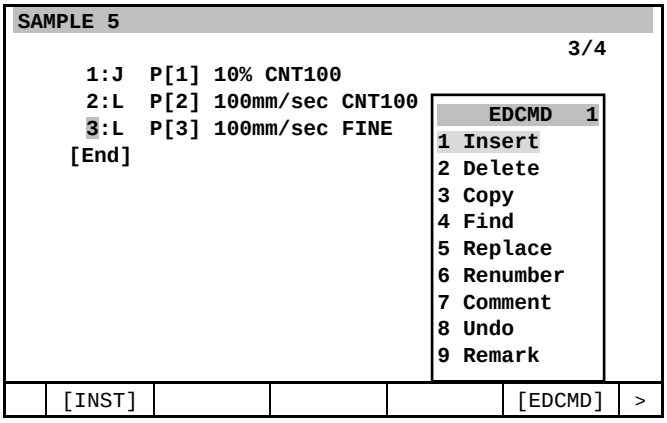
1 Move the cursor to the head of line where blank lines are inserted.



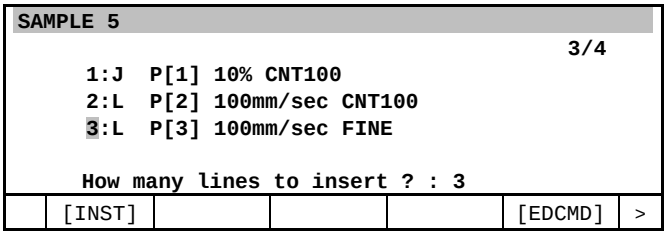
2 Press the [NEXT] key then the next page of function key menu will be displayed.



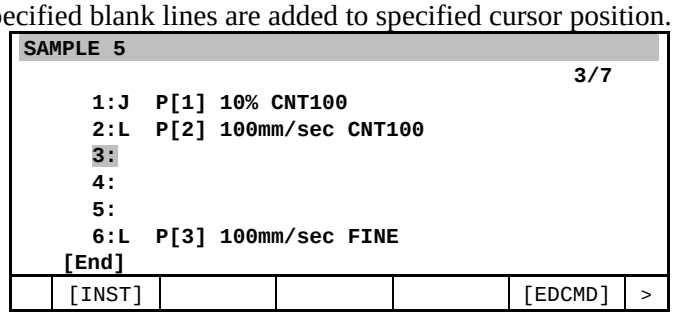
3 Press F5[EDCMD] then the EDCMD menu will be displayed.



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



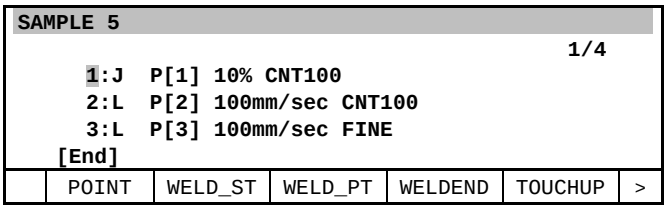
5 The number of specified blank lines are added to specified cursor position.



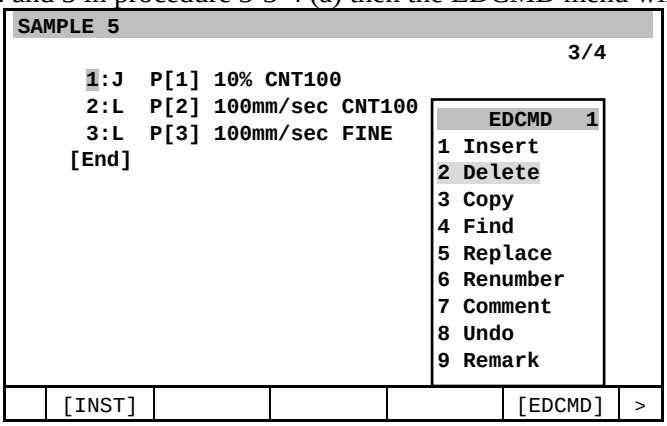
Procedure 3-3-4 (b) Delete lines

Step

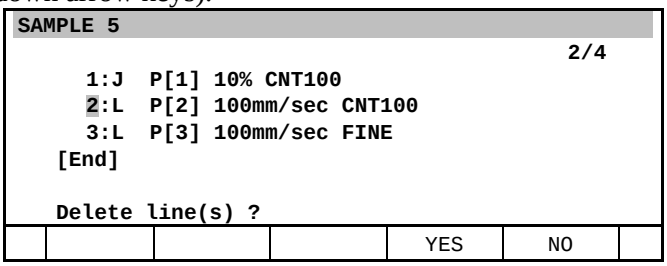
1 Move the cursor to the head of line where the line is deleted.



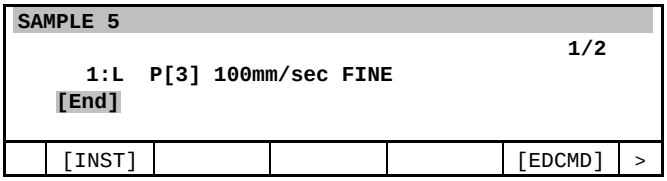
2 Perform the step 2 and 3 in procedure 3-3-4 (a) then the EDCMD menu will be displayed.



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



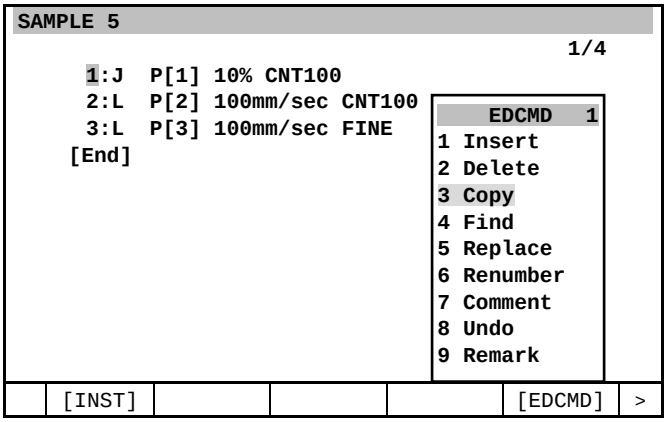
4 The specified range of lines are deleted.



Procedure 3-3-4 (c) Copy lines

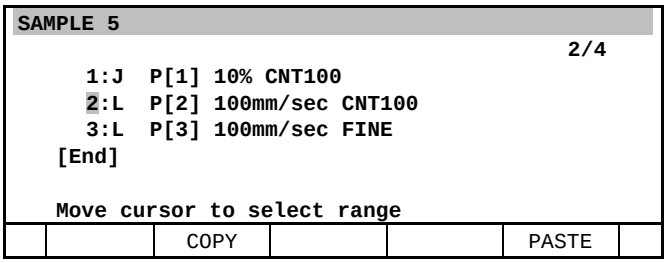
Step

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.

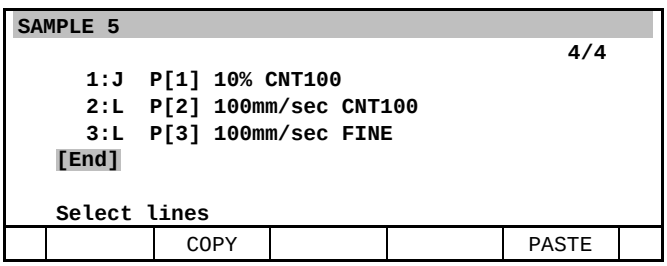


2 The message of "Select lines" is displayed at prompt lines. Press F2[COPY] after moving the cursor to beginning of copy range.

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.



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



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.

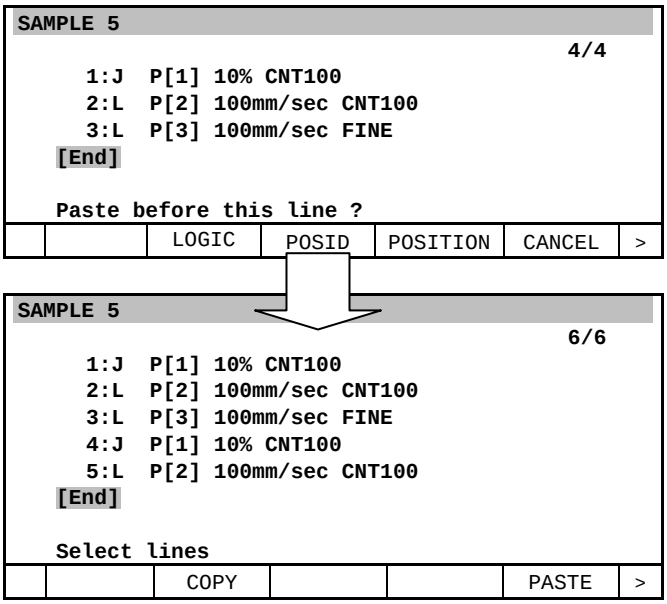


Table 3.3.4 (b) Kind of program edit instructions

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 / Program Number. 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 / Program Number. 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.

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.

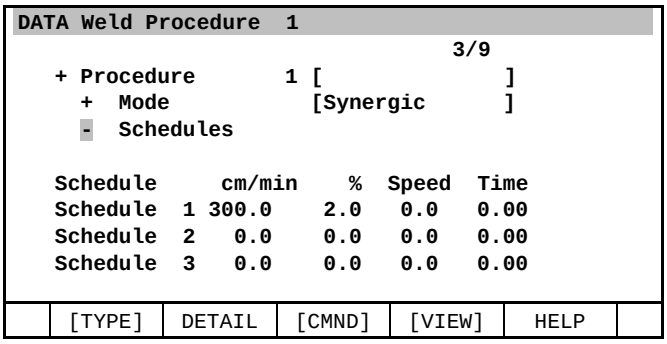
3.4.4 Teaching of Arc Indirect Instruction

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.

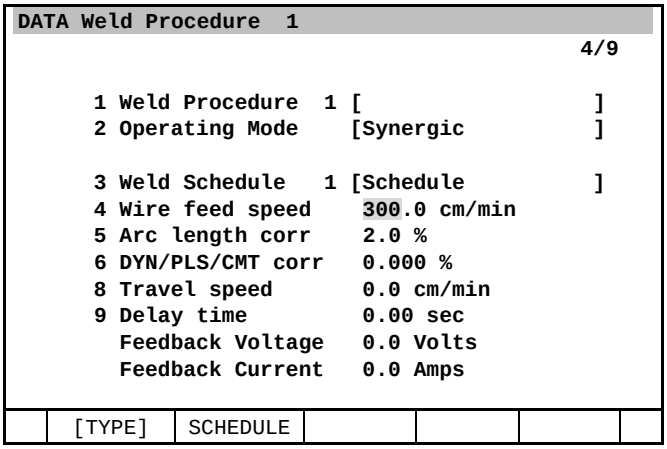
Procedure 3-4-4 Teaching of arc indirect instruction

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.



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



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

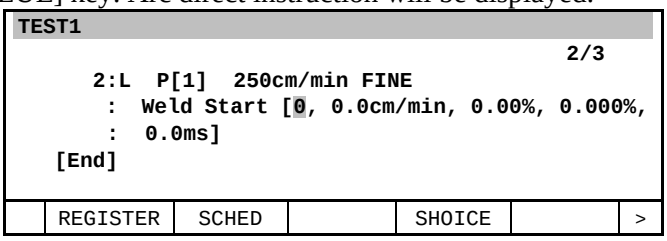
3.4.5 Teaching of Arc Direct Instruction

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.



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. **Gas preflow can be specified at Fronius welding power supply so please disable (set to 0 sec) this function at robot side. If both are used, it causes an unexpected behavior because both total time of preflow is performed. Please refer Subsection 4.4.5 about the preflow of welding power supply.**

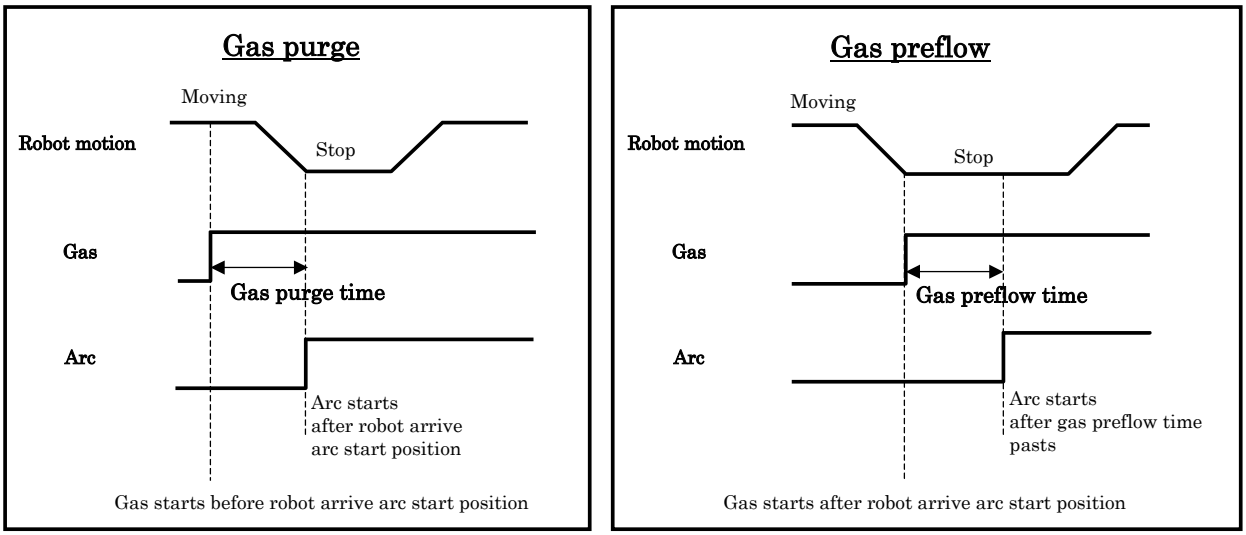


Fig. 4.1.1 Timing chart of gas purge and gas preflow

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              2 [                      ]
     Weld equipment         1
     Manufacturer:          Fronius
     Model:                 TPSi Inside ENet
     File name:             AWE1WP02
     Schedules:             3

     Runin :                          DISABLED
     Burnback:                        DISABLED
     Wirestick reset:       3         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 (= special 2-step) that is for controlling the schedule of arc start and craterfill. So please do not use this function of robot side. Depends on the robot software version, this setting items is not displayed (= disable). Please refer Subsection 4.4.4 about this function of welder side.

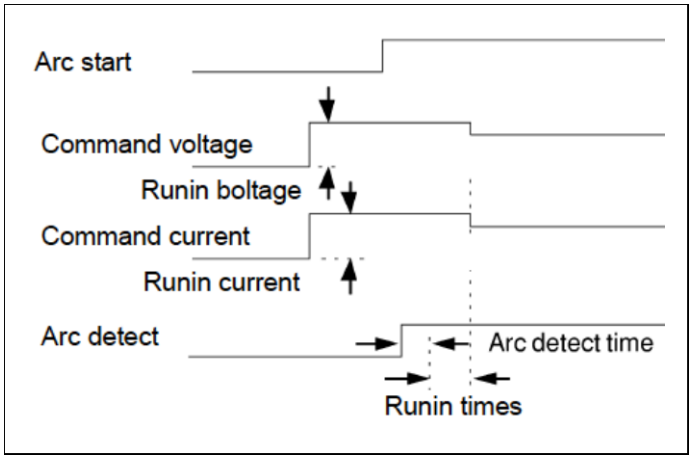


Fig. 4.1.2 Runin function

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              2 [                    ]
     Weld equipment         1
     Manufacturer:          Fronius
     Model:                 TPSi Inside ENet
     File name:             AWE1WP02
     Schedules:             3

     Runin :                          DISABLED
     Burnback:                        DISABLED
     Wirestick reset:       3         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. However, 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.

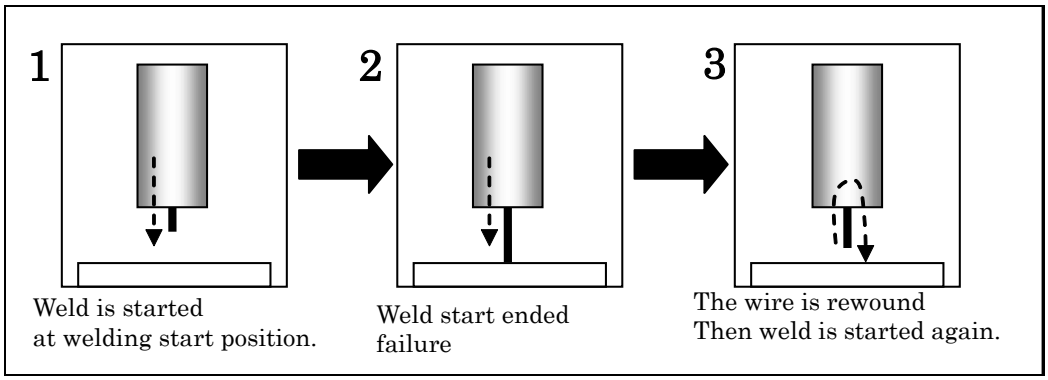


Fig. 4.1.3 (a) Repeat Touch Retry Function

In default setting, Repeat Touch Retry is enabled and retry count is 2. 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.

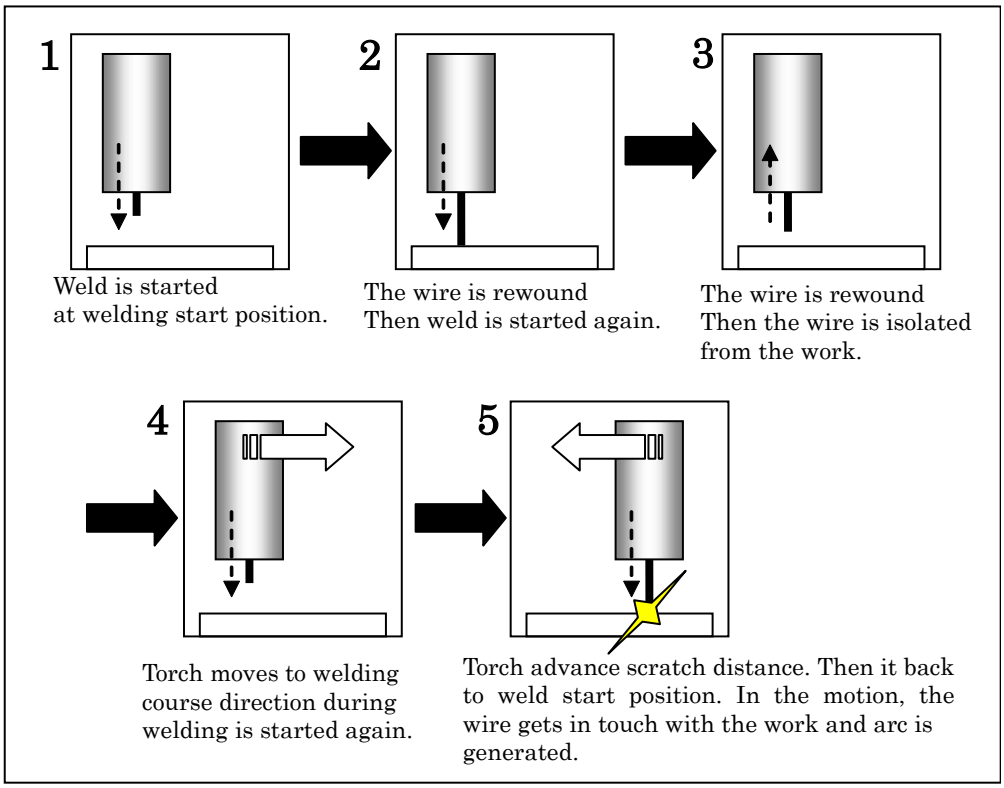


Fig. 4.1.3 (b) Scratch start function

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.

In the default setting is that scratch start is enabled, scratch distance is 5 mm and scratch return speed is 100 mm/sec. Retry count is 1. Those settings support various welding from thin metal welding to heavy welding.
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] |  |  |  | HELP |  |
```

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". and 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                                              .
                                                    10/14

  2 [Current          ] GO[  53] U    0.0
  3 [Wave Control     ] GO[  56] U    0.0
  4 [Wire inch        ] GO[  52] U    0.0

  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. Though gas post flow function can be used by setting gas post flow time, **it can be specified at Fronius welding power supply so please disable (set to 0 sec) this function at robot side. If both are used, it causes an unexpected behavior because both gas post flow processes are performed. Please refer Subsection 4.4.5 about the post flow of welding power supply.**

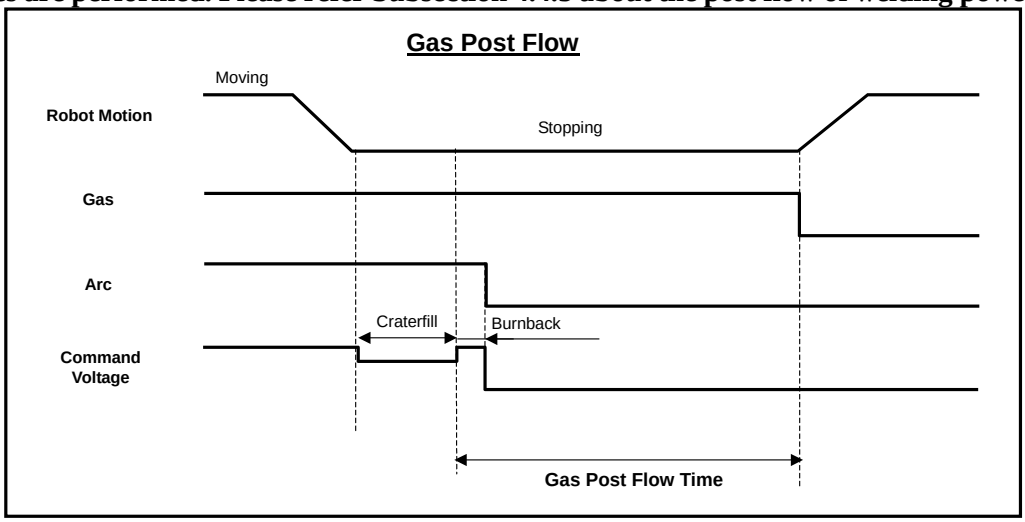
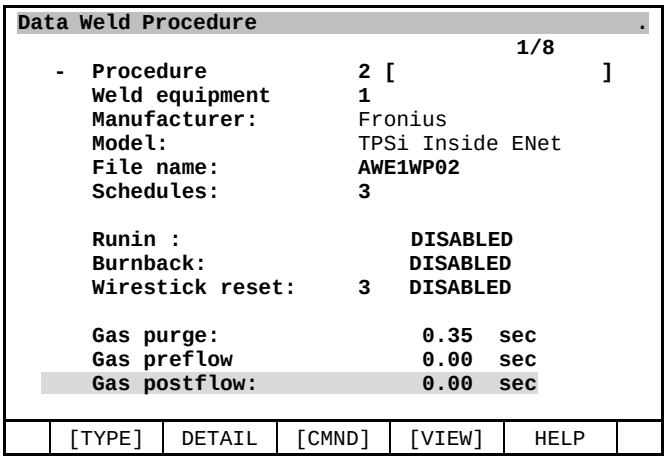


Fig. 4.2.2 Timing Chart of Gas Post Flow

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.



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.

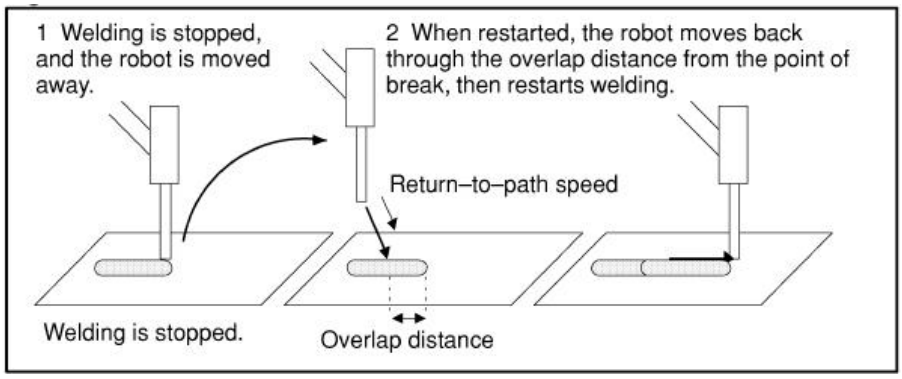


Fig. 4.3.1 Return to path function

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

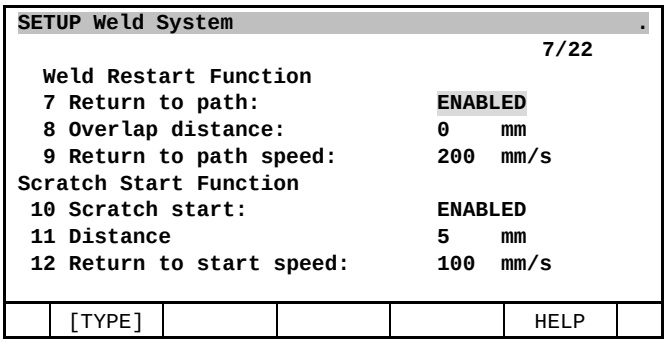
Overlap distance is used only when a program is stopped during welding motion. When robot restart with weld disabled or the program is stopped without welding, the distance is ignored.

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.



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

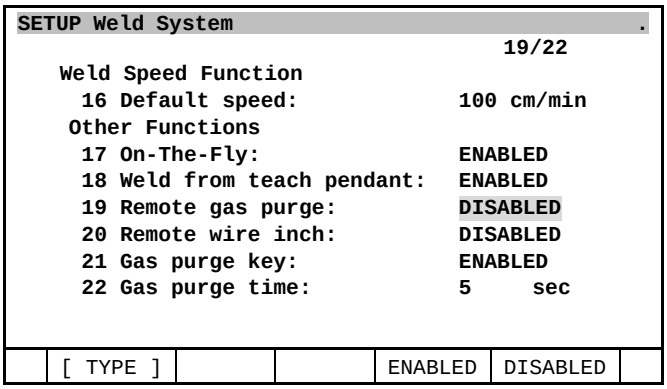
Remote gas purge function is the function to execute the gas purge by the external input signal. When you use this function, gas check can be executed without teach pendant.

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

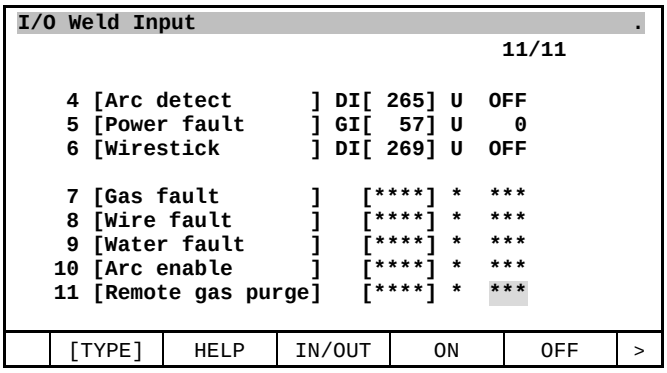
Procedure 4-3-2 Setup Remote Gas Purge Function

Step

1 Press the [MENU] key and select “6. Setup”. and 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.

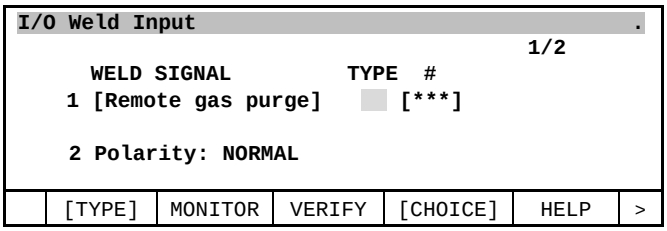


2 Move cursor on “Remote gas purge”, when it needs to be enabled, press F4 “ENABLED” when it needs to be disabled press F5 “DISABLED”.
3 Next, assign the input signal. Press the [MENU] key and select “5 I/O” and Press F1[TYPE] key and select “Weld”. Either Weld Input screen or Weld Output screen will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



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.



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 is controlled automatically by Fronius welder.**

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”. and 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:              125 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 Input                                       .
                                              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 Input                                       .
                                               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.

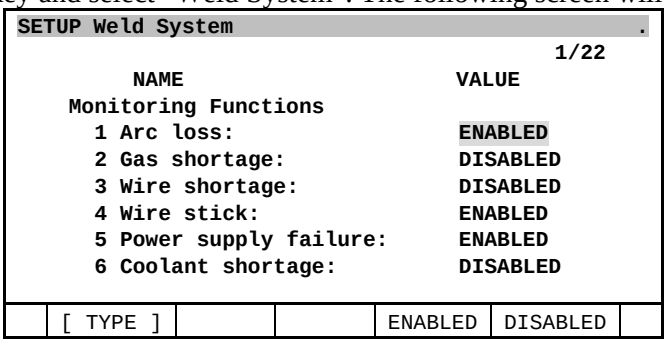
"ARC-018 Lost arc detect"

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

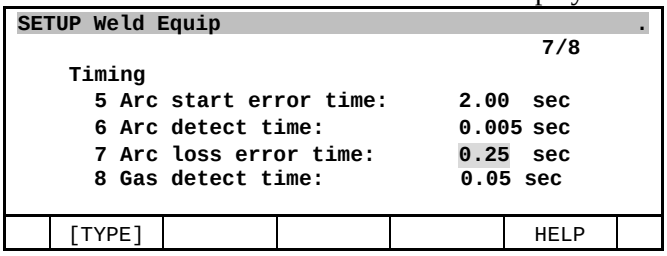
Procedure 4-3-4 (a) Setup Arc Loss Detect

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.



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.



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.

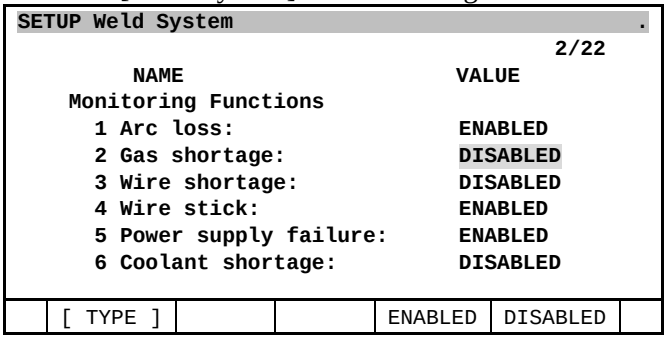
Gas shortage detect function has the setup item "Gas Shortage Detect Time". Normally, this delay time exists since robot controller outputs gas signal and gas valve opens until gas arrives to the sensor for gas shortage detect. "Gas Shortage Detect Time" allows the delay time. If the alarm signal is 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.

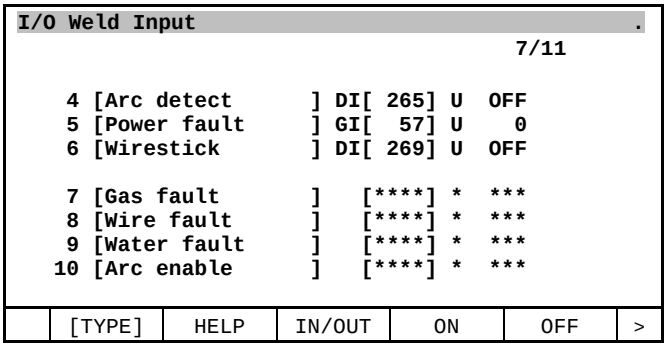
Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function

Step

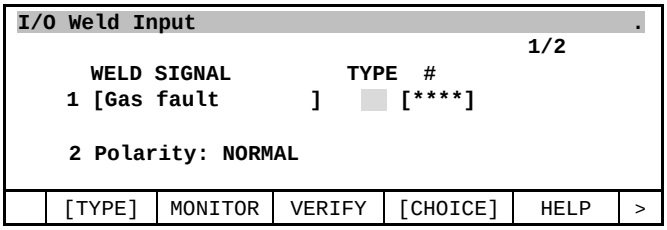
1 Press the [MENU] key and select [6 SETUP].
2 Press F1 [TYPE] and select [Weld System]. The following screen will be displayed.



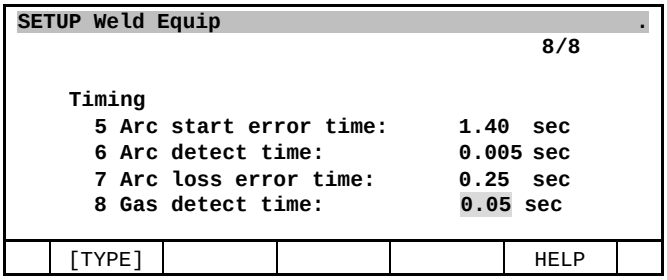
3 Move the cursor on the item, which you would like to set. If you set the function to ENABLED, press F4 “ENABLED”. If you set the function to DISABLED, press F5 [DISABLED].
4 Next, assign the input signals. Press the [MENU] key and select “5 I/O” and press F1[TYPE] key and select “Weld”. Either Weld 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.



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.)



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.



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.

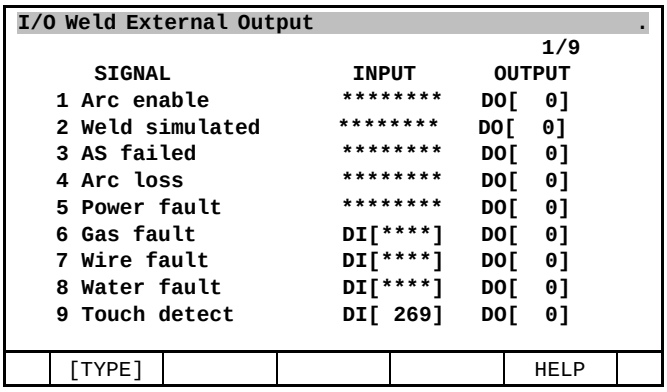


Table 4.3.5 weld signals and the explanation

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.)
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.

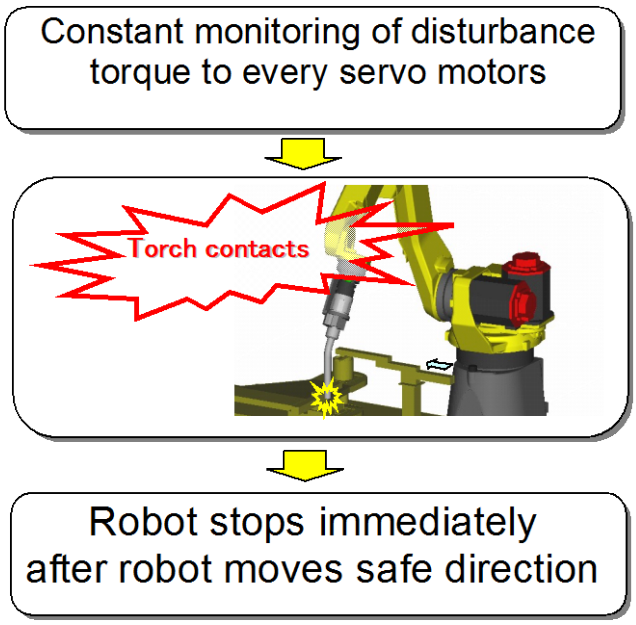
```
I/O Weld External Output                                .
                                                    1/9
      SIGNAL                  INPUT       OUTPUT
  1 Arc enable              ********    DO[  0]
  2 Weld simulated          ********    DO[  0]
  3 AS failed               ********    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 seeting 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.

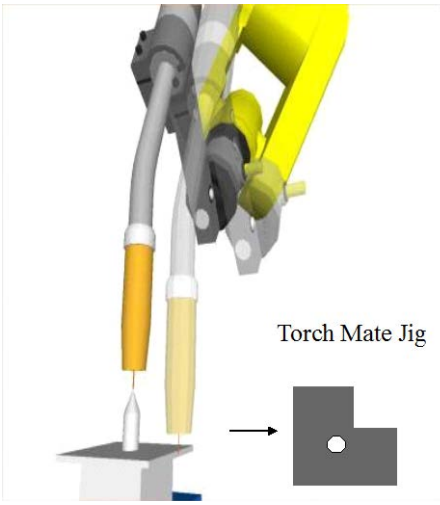


Fig. 4.3.7 Torch Mate Function

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

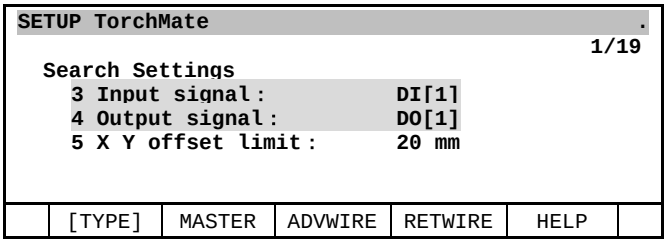
To use touch sensor circuit on welding power supply for Torch Mate function, specify the port number of I/O of Torch Mate function on Torch Mate setup screen after confirming them on Weld I/O screen.
In the case of TS/TPS welder, 13th digital output signal (Touch Sense ON) is used as the touch sensor 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.



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.

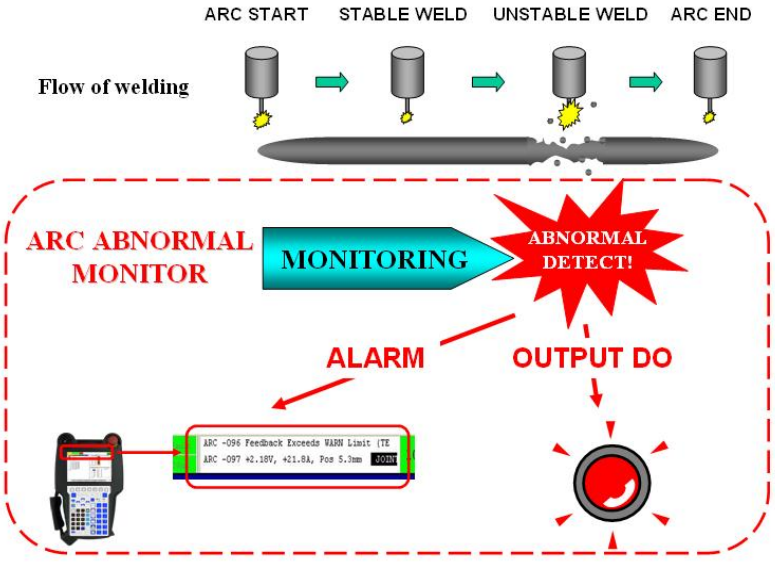


Fig. 4.3.8 (a) Outline of arc abnormal monitor function

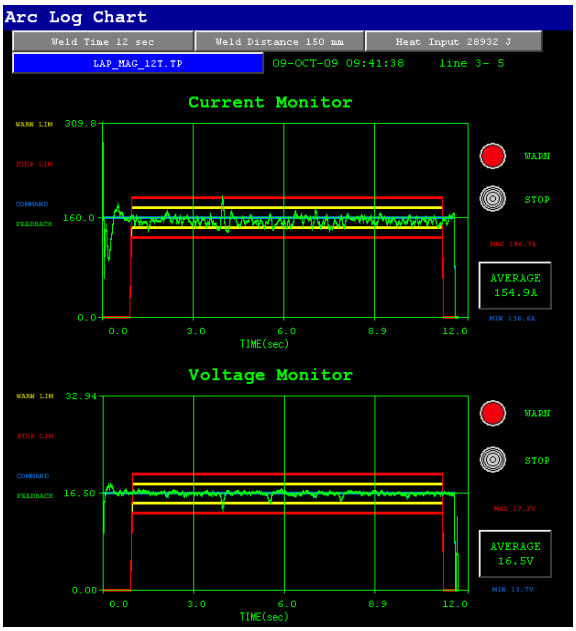


Fig. 4.3.8 (b) Arc weld log – chart function

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.

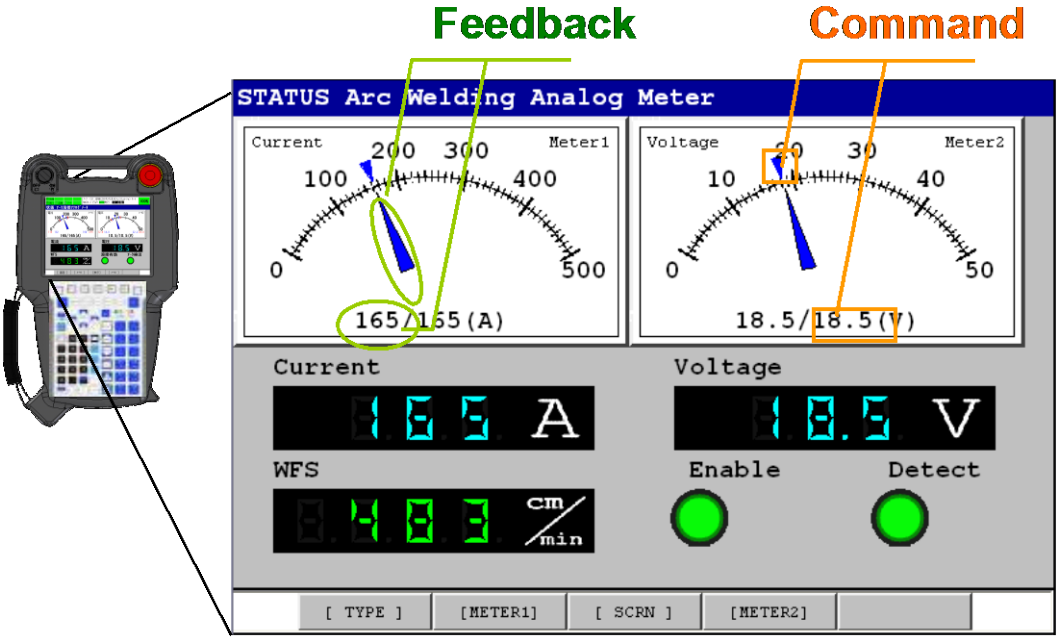


Fig. 4.3.9 Arc Welding Analogue Meter Displaying Function

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.

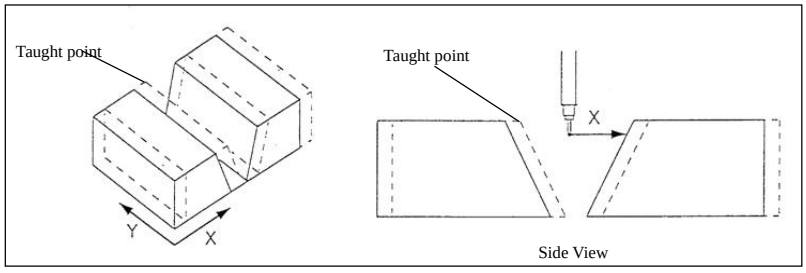


Fig. 4.3.10 (a) Search motion for detecting shift of X direction

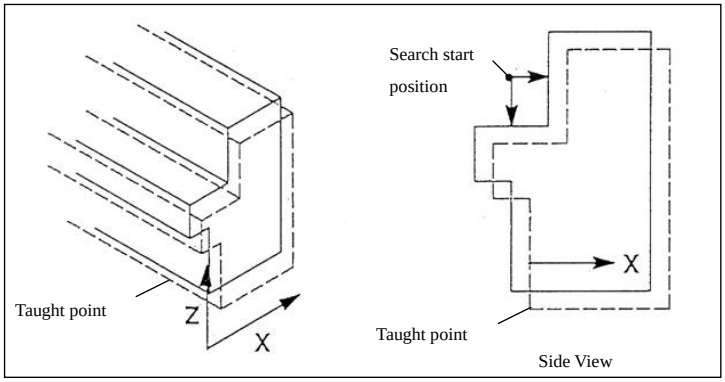


Fig. 4.3.10 (b) Search motion for detecting shift of X, Z directions

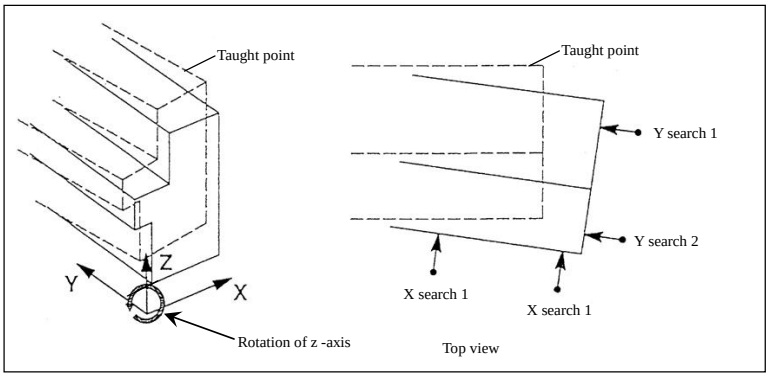


Fig. 4.3.10 (c) Search motion for detecting shift of X, Y directions and Z rotation

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 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.

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                                    .
                                                 1/4
        NAME                        VALUE
  1 Sensor port type :               DI
  2 Sensor port number :             17
  3 Circuit port type :              DO
  4 Circuit port number :            13

 [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.

4.4 OPERATION FOR TS/TPS WELDING MACHINE

If you have RCU5000 (Option hardware for TPS welding machine) , such as welding machine parameter detail setting and backup of welding condition can be performed. (Refer to Fronius manual for operation method.) If you don't have RCU5000, operation described above can be performed using special PC software Fronius Xplorer. This section describe about Fronius Xplorer operation method.

4.4.1 Preparation

The following preparations are necessary beforehand.

- Note PC(Windows7 or before is supported)
- Install disc (Appendix to the welding power supply)
- Welding power supply-RS232C conversion cable(A05B-1295-K101)
- RS232C-USB conversion cable (commercial goods)

> ⚠ **CAUTION**
> Install the driver for RS232C-USB conversion cable before the work, confirm whether connection with the PC does not have a problem. RS232C-USB conversion cable must be recognized by PC's device manager.

Perform Fronius software install during welding power supply is connected with the cable.
Connect the conversion cable with the RS232C connector as shown below.

Fig. 4.4.1 (a) Connection of cables

Connect conversion cable to welding machine backside connector. Connect the cable to the USB port of the PC, too.

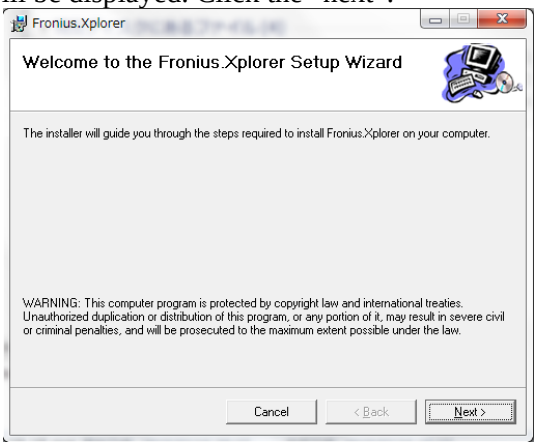
Fig. 4.4.1 (b) Connection of cables

Turn on power of the PC and the welding power supply. This completes preparation.

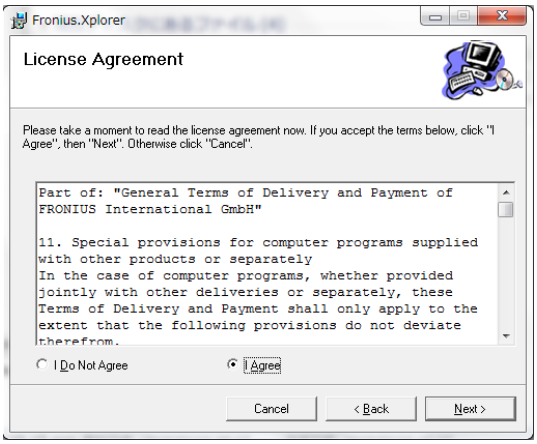
Procedure 4-4-1 Install of Fronius Xplorer and BASICLoad

Step

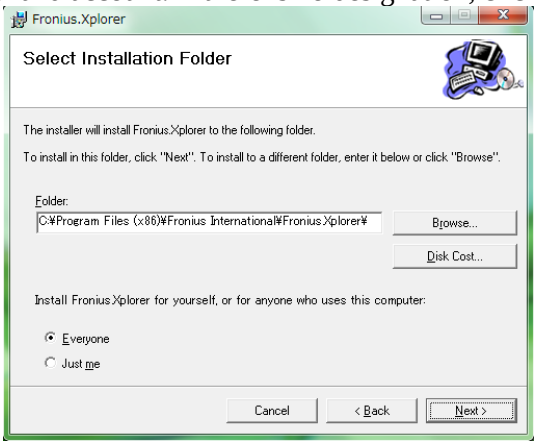
1 Insert the install disc to the PC, display the disc content. Open the “PC Software” folder.
2 Select ”Fronius Xplorer” from the software.
3 A folder and pdf manual are restored. Open the folder.
4 Double click the Fronius.Xplorer-****.exe in the folder and execute it. (**** means version)
5 The following screen will be displayed. Click the “next”.



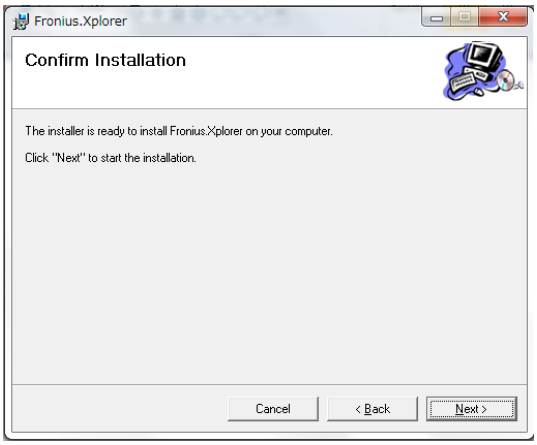
6 The following agreement will be displayed. Check “I Agree”, then click the “next”.



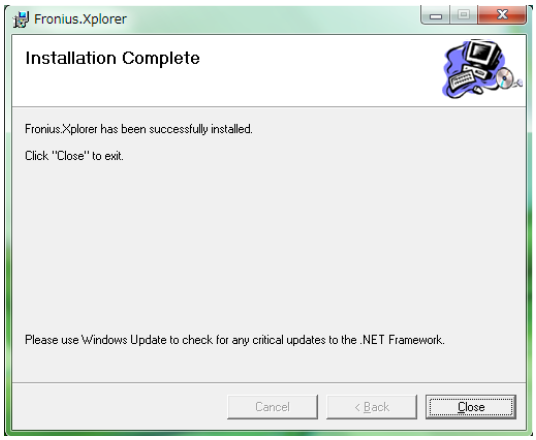
7 Specify the install folder and account. If there is no designation, click the “next”.



8 Install confirmation screen will be displayed. If “next” is clicked, install will start.

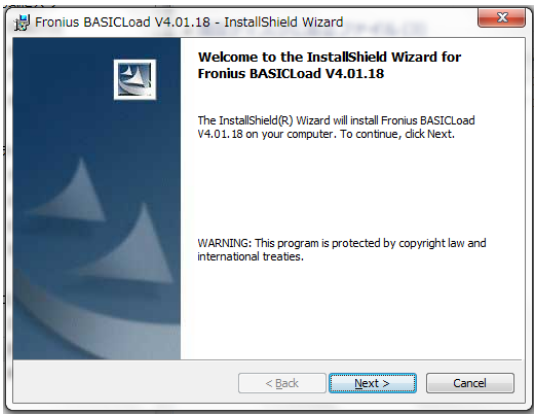


9 If install is finished, the following screen will be displayed. Click the “close”, close the window.

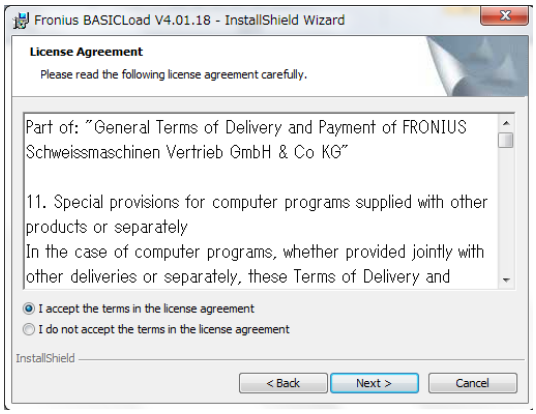


10 Next, install the “BASICLoad” for communication to power supply. Open the “Basicloader” in the “PC Software”.

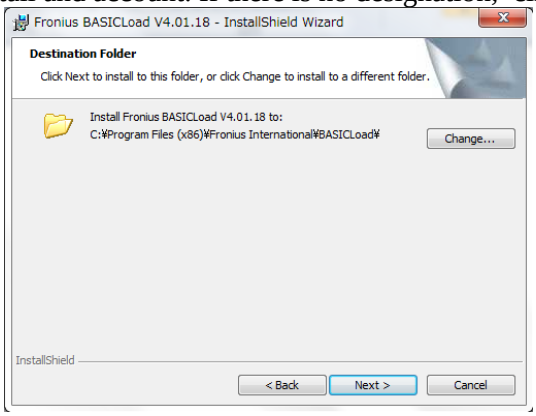
11 Execute “BASICLoad V***.exe” in the “Basicloader”. The following install screen will be displayed, click the “next”.



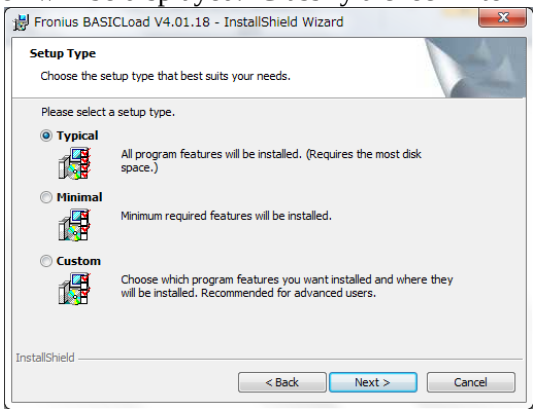
12 The following agreement will be displayed. Classify a check into an agreement column, then click the “next”.



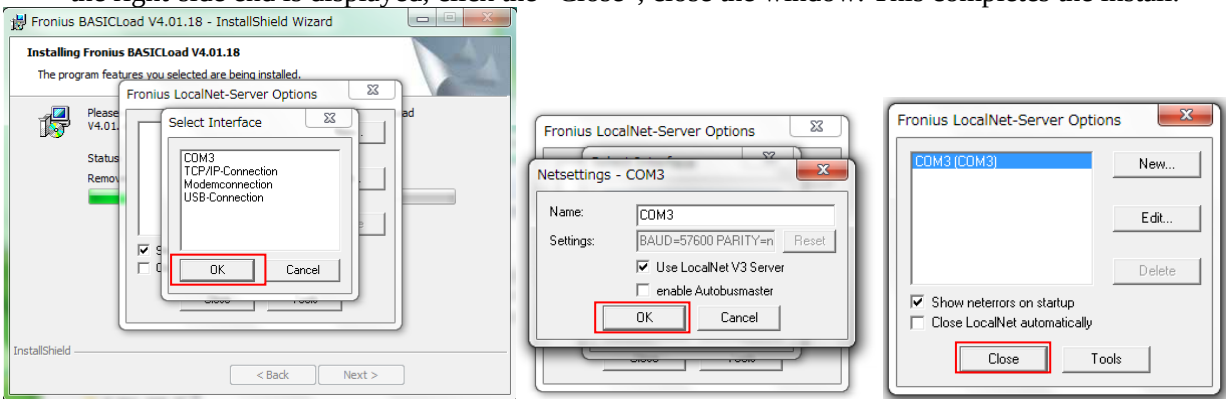
13 Specify the folder for install and account. If there is no designation, click the “next”.



14 The following select screen will be displayed. Classify a check into “Typical” then go to next step.



15 Select the correction method. Select “COM3”, click the “OK” then perform setting. If the screen of the right-side end is displayed, click the “Close”, close the window. This completes the install.



16 If setting is blocked by fire wall in the step 15, permit the access. If the install is stopped, perform the setting again.

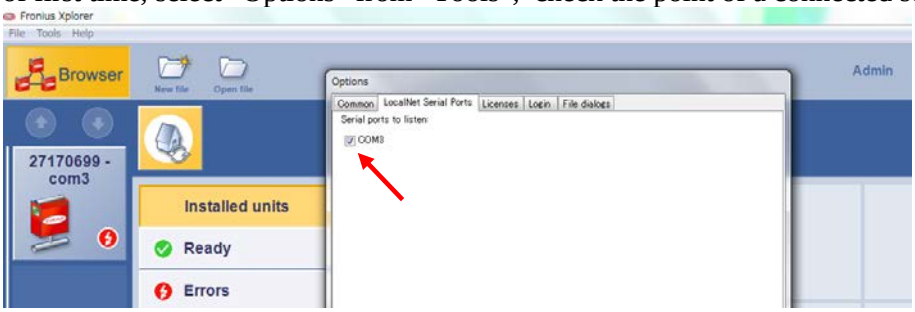
4.4.2 Operation Method of Fronius Xplorer

In this subsection describes about Fronius Xplorer operation method.

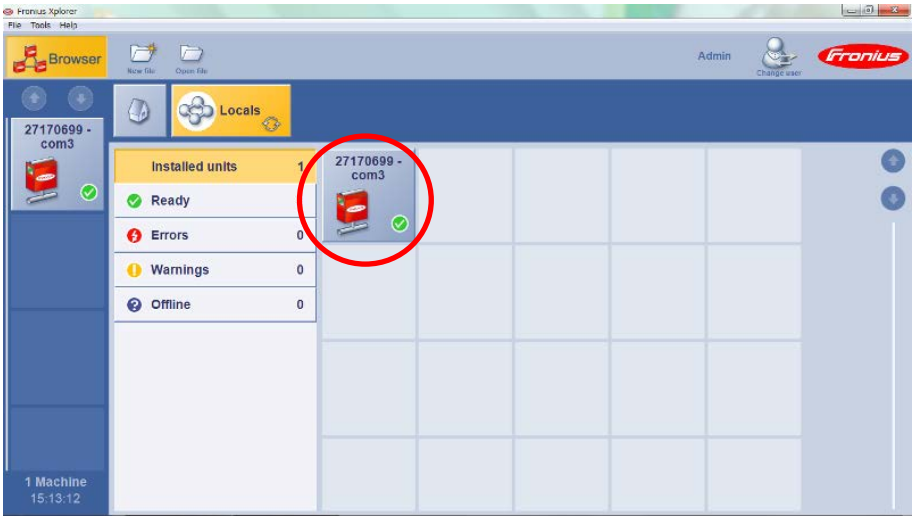
Procedure 4-4-2 Operation method of Fronius Xplorer

Step

1 Turn on the PC and the welding power supply, then connect them with cables.
2 Start the Fronius Xplorer.
3 In case of first time, select “Options” from ”Tools”, check the point of a connected serial port.

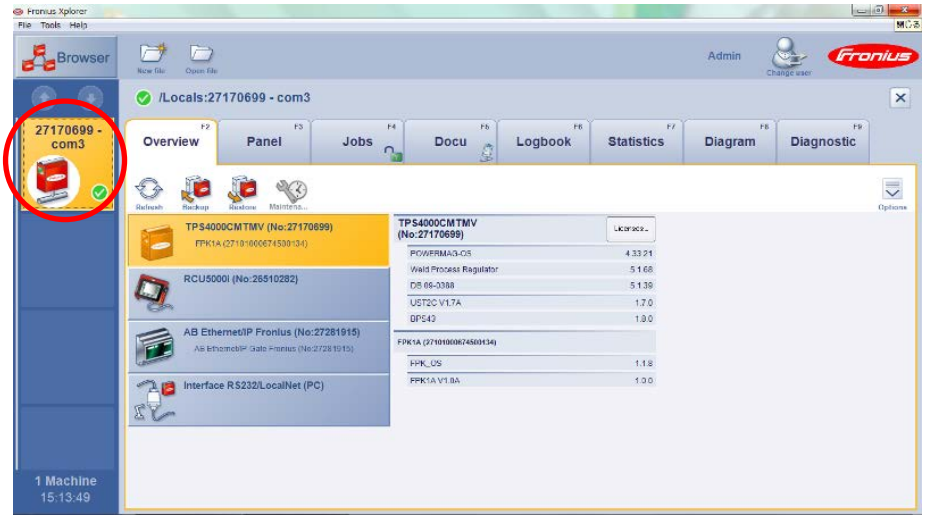


4 If it is connected to the power supply, the following screen will be displayed. After first setting, when Fronius Explorer is started, automatically connected to the power supply, welding machine icon will be displayed as the following figure. If welding machine icon does not exist or offline, click “Locals” and update the display.

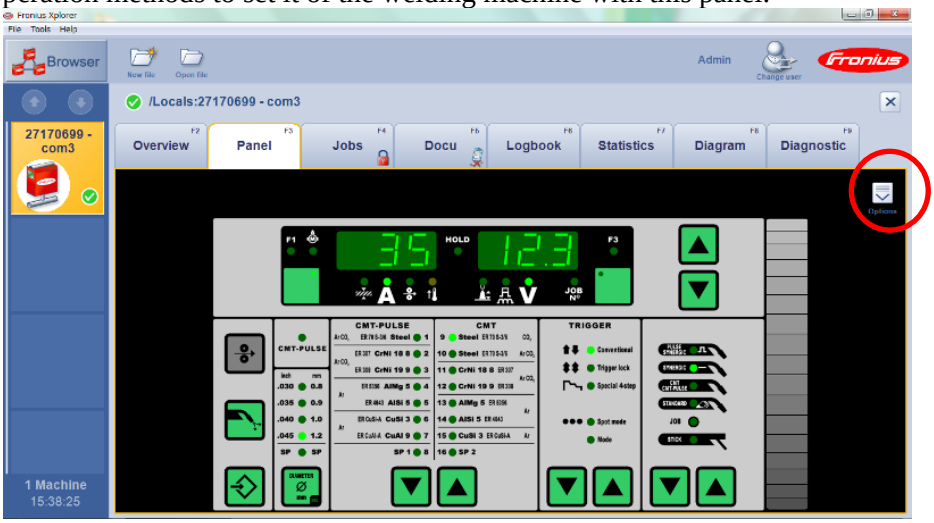


⚠ CAUTION
If connection cannot be performed, Restart the Fronius Explorer or release the robot abnormal.

5 If welding machine icon is double clicked, welding machine icon will be added to the left edge. If added icon is clicked, move to screen which can refer to each setting of the welding machine.



6 Display the “Panel” tab. The panel for welding machine setting will be displayed. Press the option of the right-side end, then select control panel for CMT. In the following procedure, we describe the various operation methods to set it of the welding machine with this panel.



BASIC OPERATION OF THE CONTROL PANEL

Use button A, B and C mainly to set the parameter as shown in Fig. 4.4.2 (a). Refer to welding power supply manual for other buttons information.

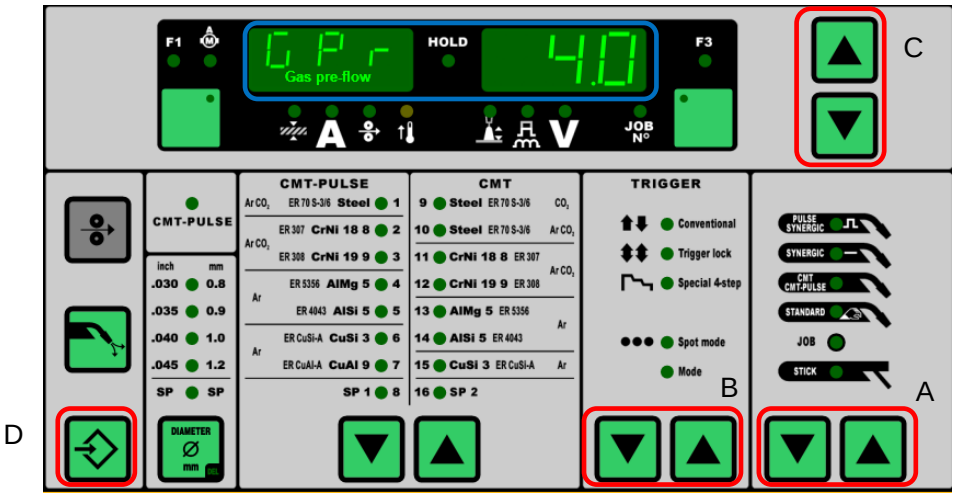


Fig. 4.4.2 (a) Summary of the control panel

The following parameters can be adjusted by the control panel.

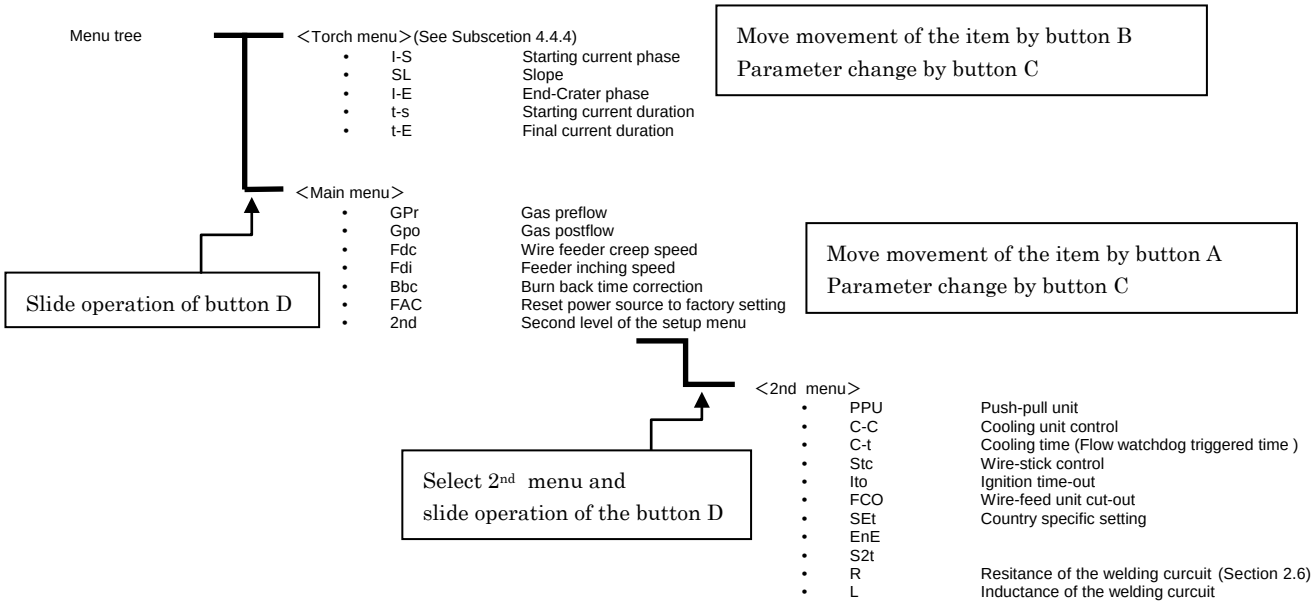


Fig. 4.4.2 (b) Menu constitution of the control panel

When you move to each setting parameter in the “Torch mode menu”、” Main Menu” and each setting parameter of、” Second Menu”, in reference to Fig. 4.4.2 (c), slide to upper side during clicking button D, after confirming button D turned to orange, by pressing torch menu or main menu button of the panel lower right, you can move to inside the menu.

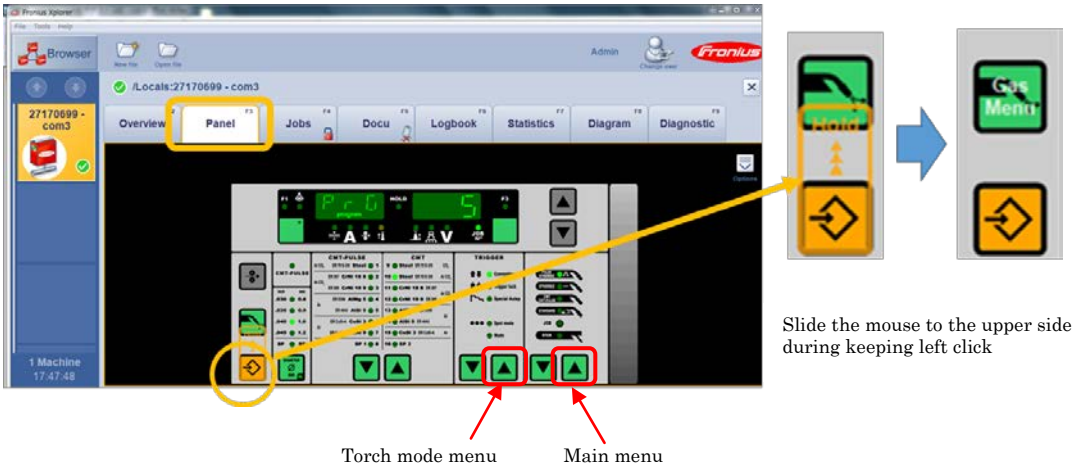


Fig. 4.4.2 (c) Slide operation of the button D

When moving to second menu, select ”Second Menu” in the main menu, then slide the button D, press the button of the main menu.

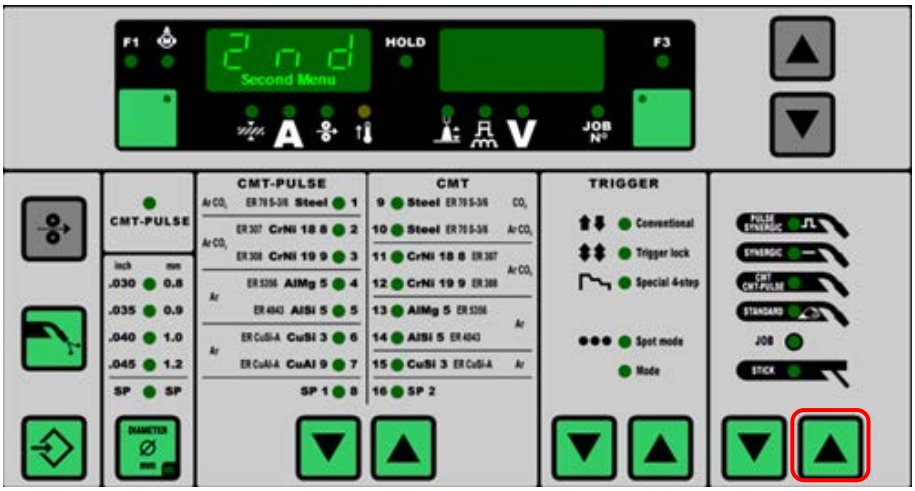


Fig. 4.4.2 (d) Operation at the time of the second menu movement

> ⚠ **CAUTION**
> After parameter was changed, to restore the parameter, press button D to back to the original screen. Be sure to back to original screen after change setting.

4.4.3 Alignment Work

Fronius welding power supply can measure impedance and inductance of the welding circuit and record them as one of the welding parameter to improve its performance. The measurement is required only first time and setting is not necessary afterwards. This subsection describes how to operate the measurement by using Fronius Xplorer.

> ⚠ **CAUTION**
> If you have RCU5000 (option), Remove RCU5000 from the welding power supply when Fronius Xplore is used.

Procedure 4.4.3 Alignment work using Fronius Xplorer

Step

1 Confirm the cable forming and the fixture installation are same to at the time of real use.
2 Remove the nozzle of the torch, then let a tip expose.
3 Move the robot and let the tip come in contact with a work or a fixture perpendicularly.

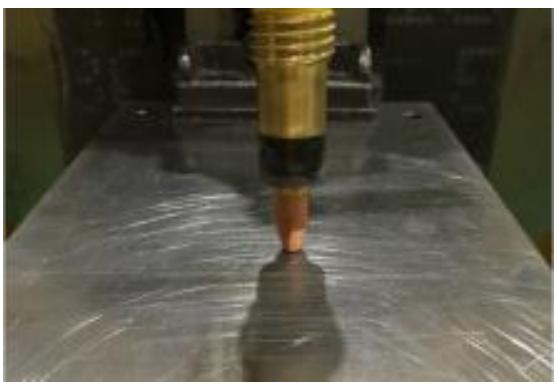


Fig. 4.4.3 (a) Contact of the contact tip

4 Start the Fronius Xplorer with PC, then connect it to the welding power supply. Refer to Section 4.4 for method of staring the Fronius Xplorer.

5 Display the control panel tab referring to Subsection 4.4.2, make parameters in “second menu” can be referred.
6 Display the resistance measurement screen in “second menu”.

Fig. 4.4.3 (b) Resistance measurement screen

7 Push the wire inching button of the Robacta drive.

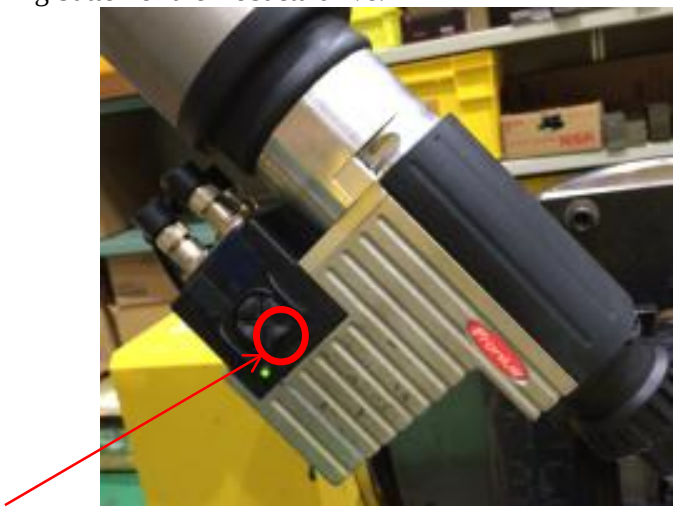


Fig. 4.4.3 (c) Button position of the Robacta drive

8 A letter of "RUN" is displayed for an instant by the digital indication window of the screen upper part right side, and, at the moment when you pushed the button, the measurement will be performed.
9 If the measurement finished, measured value will be displayed on the digital indication window of the screen upper part right side. The unit of the resistance becomes [a milliohm].
10 Inductance is measured and recorded when resistance is measured. Measurement result can be confirmed in the following screen of the second menu. The result will be displayed on the window of the upper part right side. The unit becomes [μH].

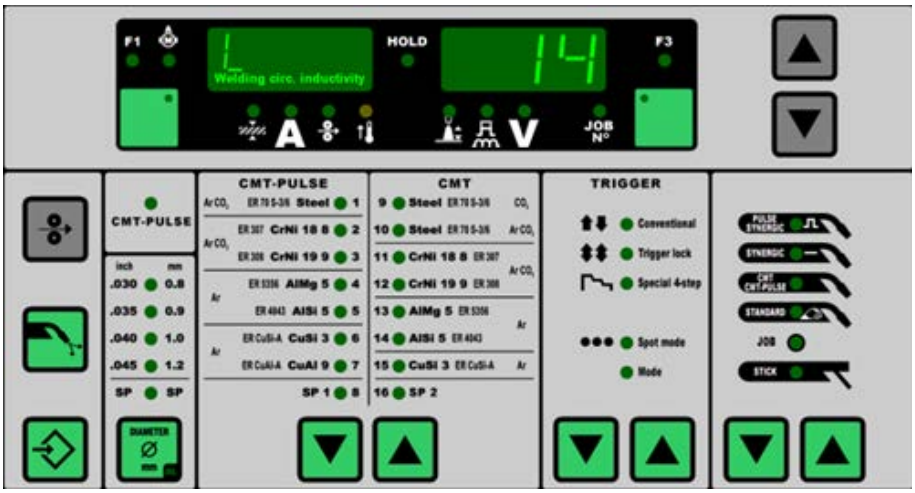
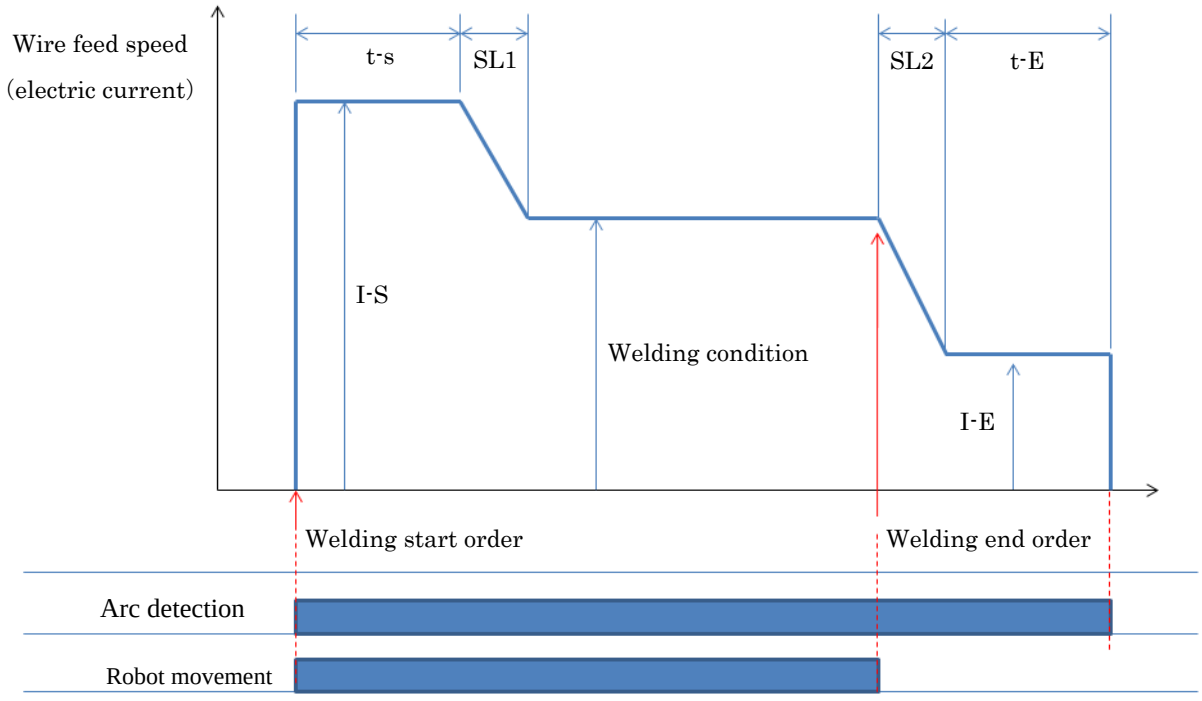


Fig. 4.4.3 (d) Alignment work

11 Left Click the D button in Fig. 4.4.2 (a), and return to an original screen. If this step is not performed, measured value is not loaded, so be sure to perform it.

4.4.4 Parameter Correction of the Special 2-step

Fronius power supply have function which is called special 2-step. Special welding condition for welding start point and special welding condition for crater treatment can be specified by this function.



- I-S : Starting current phase (rate for welding condition)
- t-s : Starting current duration (second)
- SL : Slope (second) (common to SL1 and 2)
- I-E : End-Crater phase (rate for welding condition)
- t-E : Final current duration (second)

Fig. 4.4.4 Parameter of the special 2-step

The following table shows the recommended value of the parameter by the wire materials. Steel parameter is set when power supply is shipped.

Table 4.4.4 The recommended value of the parameter by the wire materials

	I-S(%)	I-E(%)	t-S(sec)	t-E(sec)	SL1 (sec)	SL2 (sec)
Steel, SUS	120	40	0.2	0.2	0.3	0.3
Aluminum	135	30	0.3	0.3	0.4	0.4

To change the setting, adjust each parameter in the torch menu referring to Subsection 4.4.2.

4.4.5 Parameter Correction of Gas Preflow/Post Flow

Gas preflow function improves quality by starting gas flowing during assigned time after robot arrived. Gas preflow/post flow items exists right under the main menu. To change the setting, adjust those referring to Subsection 4.4.2.

4.4.6 Backup

Settings such as impedance, inductance and special 2-step of the welding circuit are stored in the welding power supply side, so be sure to acquire backup after change setting.

Procedure 4-4-6 (a) Backup method

Step

1 Display the following screen. Click the icon for backup.
2 Specify the destination and store the file. File name is “Welding machine name (serial number) year month date.man”

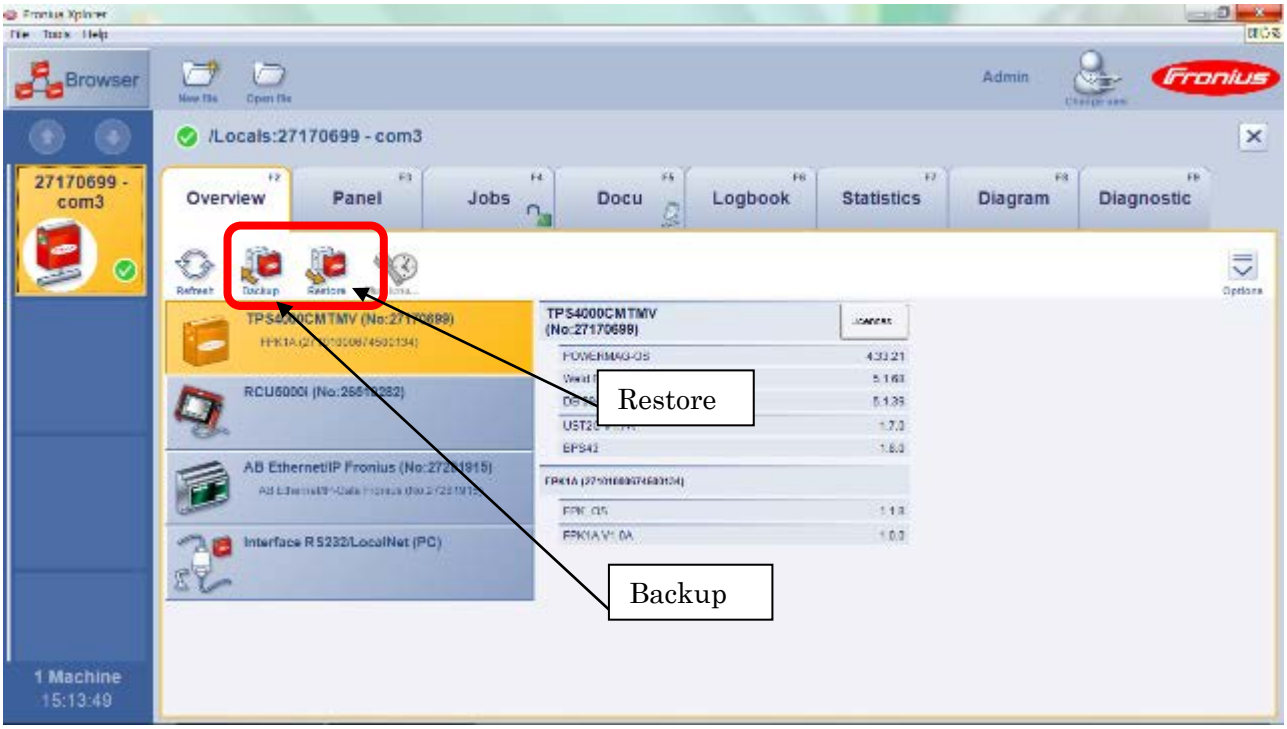


Fig. 4.4.6 Icon position of the back up

Procedure 4-4-6 (b) Restoring backup data method

Step

1 Click the “Restore” in the screen of Fig.4.4.6 .
2 Specify the file to be restored, then click “Open”.
Restoring setting date will start, wait until it finished.

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*C/12/7L/12S, M-10*i*A/12/7L/12S OPERATOR’S MANUAL”. (B-83654EN)
- For the method of inspection and maintenance of the robot mechanical section, refer to “ARC Mate 120*i*C/M-20*i*A OPERATOR’S MANUAL”. (B-82874EN)
- 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)

5.1 ROUTINE INSPECTION

⚠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.
In routine inspection, check the components listed below, centering on the checking of the welding torch and wire feeder for worn, deformed, and clogged consumable parts. Replace or clean components as required.
For component replacement, be sure to use a component specified by FANUC in order to maintain the performance and functions.

5.1.1 Welding Power Supply

Component	Point of inspection	Remarks
Front	- Check that equipment is securely mounted. - Check that equipment (such as a switch) is not broken	If there is a problem, perform an internal inspection, additional tightening, part replacement, or other measures. Refer to the welding power supply for details.
Side	- Check that the "Input Voltage" switch is correctly set. - Check that equipment and terminal covers are securely mounted. - Check that the rotation sound of the cooling fan is normal and that cool air flows normally (from the rear to the front). (The cooling fan operates by internal temperature.)	
Peripheral	- Check that cases are securely mounted on the top board or other sections.	If it is loosened, perform additional tightening.
General	- Check that there is no visual sign of overheating such as discoloration. - Check the looseness of connector - Confirm the tightening of cable terminal connection part of secondary side - During power-on, Check that there is no abnormal vibrations or whines. Check that there is no abnormal smell.	If there is an abnormality, make an internal inspection.

Caution when abnormal is founded

Capacitor discharge procedure

Before inspection and maintenance, be sure to take enough time till discharge of capacitor completely finished. (this may take several minutes)

5.1.2 Wire Feeder

Component	Point of inspection	Remarks
Idle arm	Check if the pressurization power of the roller is moderate or not.	Unstable wire feed and unstable arc operation can occur.
Drive roll(2pcs)	Check the matching between the welding wire diameter and the nominal diameter of the feed roller. Check if the feed roller groove is clogged and if the cut groove is worn.	Wire chips can be generated, resulting in a clogged conduit tube and unstable arc operation. If any of these problems is found, replace them with a new articles.
General	Clean each parts. Check the looseness of bolts and other connection parts.	

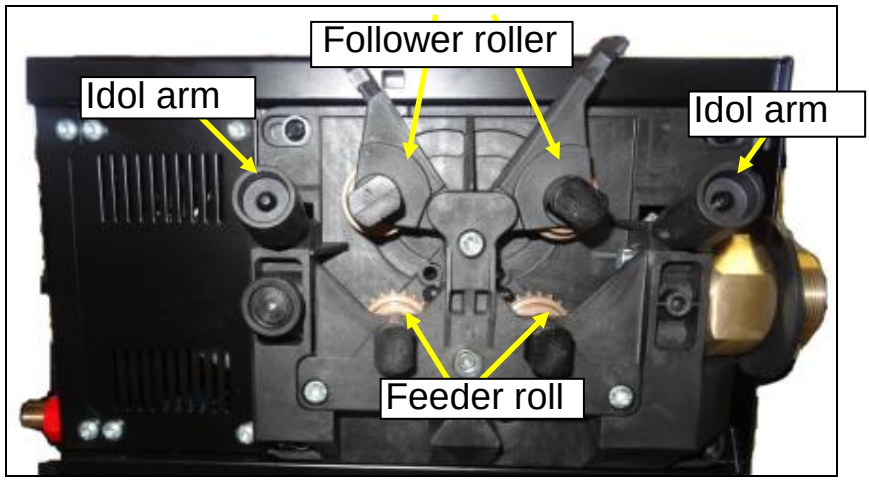


Fig. 5.1.2 Wire feeder

5.1.3 Welding Torch

(Part constitution is different by a torch slightly.)

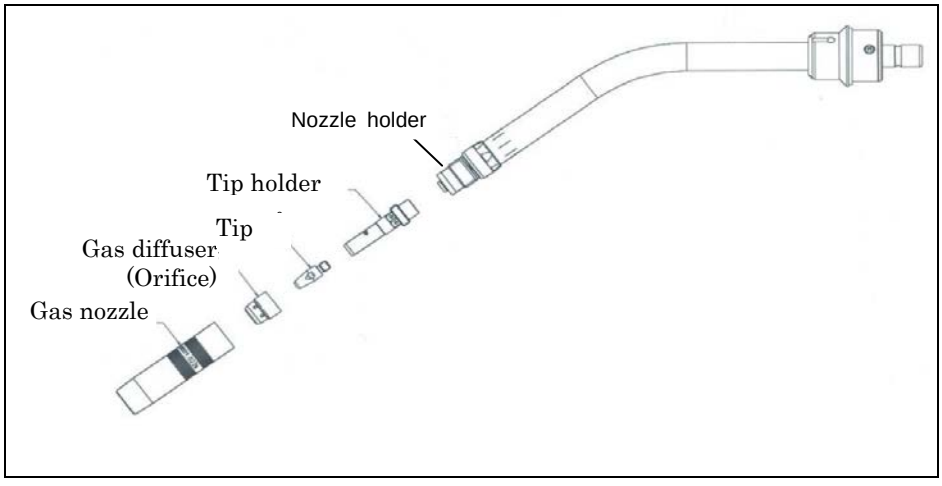


Fig. 5.1.3 Welding torch

Component	Point of inspection	Remarks
Nozzle	Loose attachment and tip deformation	A blow hole can result.
	Sputter attachment	The torch can burn, or a blown hole can result. (The use of a sputter attachment protection agent is useful.) Clean frequently to prevent accumulation of spatter.
Nozzle holder	Insulator abrasion or lost Nozzle fixation screw abrasion	It might cause nozzle falling.
Tip	Loose attachment	The screws of the main torch body can be damaged.
	Tip damage, and hole wear and clogging	Unstable arc operation and intermittent stop of operation can occur.
Gas diffuser (Orifice)	Check if no gas diffuser is installed, the gas diffuser is cracked, the hole is clogged, or a gas diffuser of another supplier is installed.	A welding defect (such as a blow hole) can occur due to a gas shielding failure or the main torch body can burn (spark in the main body). Take necessary action.
General	- Check the looseness of bolts and other connection parts. - Perform air blow using dried air.	

5.1.4 Cable

Component	Point of inspection	Remarks
Hose pack	Check if the hose pack installation part is tightened. Check if the hose pack is bent excessively.	Wire feed can fail. The arc can flicker due to irregular wire feed, or unstable arc operation can occur.
Output side cable	Check if the cable insulator is worn or broken. Check if the cable joint is exposed (insulator is broken) or if the cable connection is loose (at the base metal connection point of the welding power supply terminal or between cables).	To ensure human safety and stable arc operation, conduct an inspection suitable for the status of the factory floor. ○ Make rough and simple checks in routine instruction. ○ Make detailed and through checks in periodic inspection.
Input side cable	Check if the cables on the input/output terminal on the input protective device of the switch box are loosely connected. Check if the fuse mounting section is not securely fastened. Check if the connections on the input terminal of the welding power supply are not securely fastened. Check if the cable insulator is worn, broken, or exposed in the input-side cabling.	
Ground wire	Check if the ground wire for welding power supply grounding is disconnected or loosely connected. Check if the ground wire for base metal grounding is disconnected or loosely connected.	To ensure safety against an unexpected leakage accident, be sure to perform routine inspection.
Confirm connection part of hose	Stop the main cylinder valve and confirm pressure go down.	
Confirm the installation place	Check there is combustibles or water and remove them.	

5.1.5 Water cooling unit

Component	Point of inspection	Remarks
Coolant	Check if there is no water leak from each part Check the coolant is stable and does circulate. Check if cooling water is sufficient.	Be sure to check routinely for prevention of unexpected electric leakage accident
Cooling fan	Confirm the filter is not dirty. Confirm the fan is not dirty.	
Filter	Confirm there is no blocking of the coolant filter.	Check it once in 2 months.

5.1.6 Welding Wire

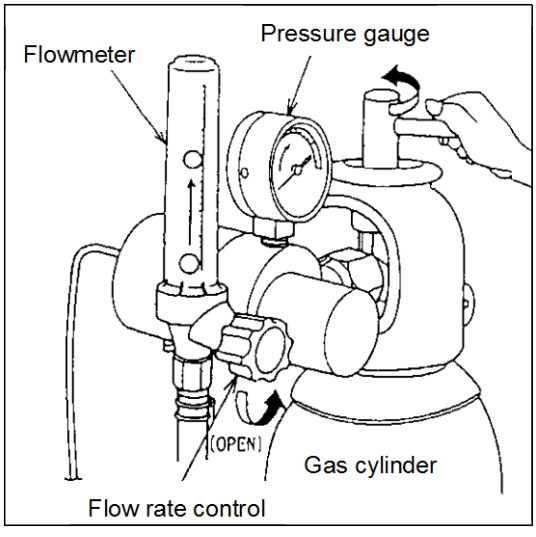
Point of inspection	Remarks
Confirm there is rust or oil, and remove them	

5.1.7 Checking Gas Flow Rate

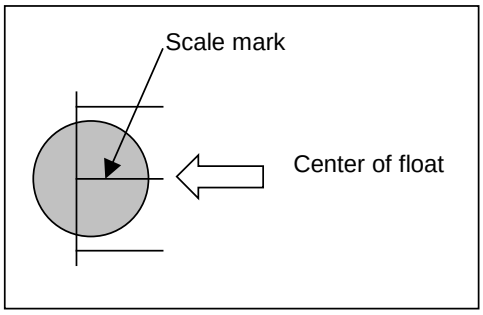
The gas flow rate is an important factor in ensuring stable arc welding. The gas flow rate can vary depending on the primary gas pressure. So, check the gas flow rate every day.

Use the procedure below when checking the gas flow rate.

1 When gas is not output, check that the specified gas pressure is observed.
   * The maximum input pressure of the gas controller is 11.8 MPa for CO_2 gas, and 15.7 MPa for argon gas and mixed gas (CO_2 + argon).
2 Make a gas check from the teach pendant. Refer to [Procedure 2-9 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.



5.2 6-MONTH (1920 HOURS) CHECKS

Check the following items at the intervals based on every 6 months and every 1920 hours, whichever comes first. Refer to maintenance and check parts of welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	Perform air blow using dried air. (Note)
2		Confirm the damage situation of fan	Confirm whether a fan is not damaged.
3		Check the allophone and vibration	Check there is allophone and vibration.
4	Wire feeder	Cleaning each parts	Perform air blow using dried air.
5		Check the tighten of bolts and other connection parts.	Check the looseness of torch mounting parts. and retighten the terminal of power source parts.
6		Check the length of wire feeding	Check the length of inching is regulated degrees.
7		Check the gas valve	Check opening and shutting is normal And check whether there are not forwarding irregularities when opening and shutting is normal.
8	Water cooling unit	Clean the inside	Perform air blow using dried air.

(NOTE) Cleaning the welding power supply inside

Discharge the capacitor before cleaning it.

5.3 1-YEAR (3840 HOURS) CHECKS

Check the following items at the intervals based on every 1 year and every 3840 hours, whichever comes first. Refer to maintenance and check parts of welding power supply manual.

Item	Check items		Check points
1	Welding power supply	Cleaning inside the welding power supply	See Section 5.1.
2		Confirm the damage situation of fan	See Section 5.1.
3		Check the allophone and vibration	See Section 5.1.
4	Wire feeder	Cleaning each parts	See Section 5.1.
5		Check the tighten of bolts and other connection parts.	See Section 5.1.

Item	Check items		Check points
6		Check the length of wire feeding	See Section 5.1.
7		Check the gas valve	See Section 5.1.
8	Welding torch	Check the hose pack	Confirm whether it is not damaged. If it is damaged, replace it by new one. (See Chapter 7.)
9		Replacing liner	Confirm whether it is not damaged. If it is damaged, replace it to new one. (See Chapter 7.)
10	Around cable	Confirm reel side conduit.	Confirm whether it is not damaged. Check whether it is moderate length and bending radius is not to small.
11	Water cooling unit	Replacing coolant	

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

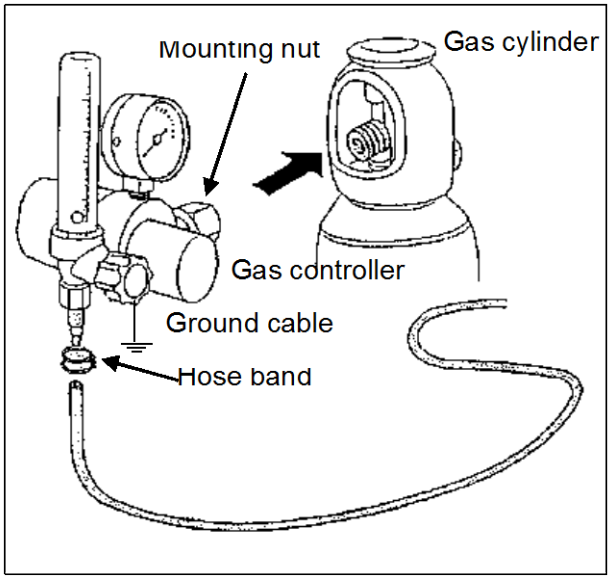
When handling a gas cylinder, observe the high-pressure gas regulation, and manage the gas cylinder according to the standard defined in your company. A gas cylinder contains high-pressure gas. If a gas cylinder is handled incorrectly, high-pressure gas can blow out, and can cause an accident resulting 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 5.1.6, " 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

Clean the liner with an air blow at least once a week. Replace the liner if it has lost elasticity or is broken. Replace the liner at least once in 4 months.

1 Remove the welding torch from the wire feeder.
2 Replace liner to new one (See Section 7.4.)

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

3 Paying attention to the following, mount the welding torch onto the wire feeder:

- When mounting the welding torch onto the wire feeder, push the welding torch sufficiently up to the base. Otherwise, trouble such as gas leakage, wire distortion in the torch due to a caught wire, and feed failure can occur.

5.4.6 Coolant

1 Prepare a container for old coolant.
2 Remove the tank cap.
3 Pull ot the drain hose of the cooling machine backside, then remove the cap.
Because coolant comes out, put the drain hose into the tank, wait for water discharge.
4 Put the drain hose back.
5 Remove the coolant tube, press the joint center (2) in Fig, 5.4.6 (b) with a thin stick, then open the valve.
6 Supply coolant.
7 Press (1) of Fig. 5.4.6 (b), put the valve back, then connect the coolant tube again.
8 Put the tack cap back.

NOTE
Confirm coolant does not lead in the machine surroundings.

Fig. 5.4.6 (a) Replacing coolant

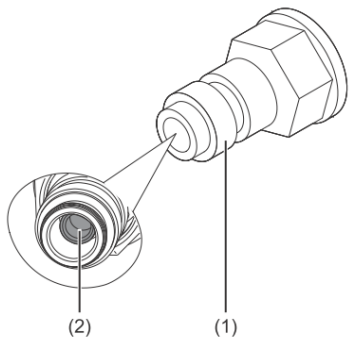


Fig. 5.4.6 (b) Replacing coolant

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

This section describes about main cause of a displayed alarm / message and the measures related to welding power supply.

NOTE
The following symbols are used in alarm codes
%d : Decimal number
%f : Floating number
%x : Hexadecimal
%s : String
Number may be inserted after "%". It means display width.

ARC-008 STOP.L Weld power supply fault (%s, %d)
Cause: A problem generates in the welding power supply.
Remedy: Please check the content of ARC-124 alarm which is posted simultaneously. Then please contact your local FANUC representative.

ARC-022 WARN Weld AO scaling limit used (%s, %d)
Cause: The warning message is posted when command values in weld schedules for arc instruction (or command values in direct arc instruction) become out of range. Then, command values are clamped by upper or lower limits.
Remedy: Set the command values within a range. The range for command values is different in each process mode. Therefore, if you change the assignment of Weld Procedure or process mode number, please confirm that the command values in arc instruction that uses the process mode number are not out of range. Additionally, please also confirm command values of weld processes (Runin and Wirestick Reset) are not out of range. You can see the range for each process mode on Weld Procedure screen.

ARC-040 STOP.L EQ%d Missing I/O: %s
Cause: When Weld I/O is not allocated definitely, it occurs.
Remedy: If the missing I/O name is "gas alarm", "wire alarm" or "coolant alarm", assign these signals by manual operation in reference to Subsection “4.3.4 Gas, Wire, Coolant Shortage Detect”. If you do not use these signals, please disable the detection function by “Procedure 4-3-4 (b) Setup of Gas, Wire, Coolant Shortage Detect Function”.

ARC-045 WARN Weld EQ is OFFLINE
Cause: A robot controller tried communication with the welding power supply, but this alarm is displayed when communication cannot be established. A status of EtherNet/IP communicated with the welding power supply must be set <RUNNING>.
The first message becomes alarm handling, but becomes the warning message after having pushed the reset. Though arc welding cannot be performed during this message, robot can be operated.
Remedy: Please try following procedures and confirm the status changes to <RUNNING>.
1. Please confirm that the power of weld equipment is ON.
2. Please confirm that a communication of EtherNet is connected referring Chapter 9 in EtherNet/IP manual (B-82854EN). Please confirm EtherNet cable and connector when the connection is not OK.

3. Please confirm the alarm of EtherNet/IP by following procedures when the status doesn't change to <RUNNING>.
   1. Turn FALSE a connection for the welding power supply.
   2. Turn FALSE Reconnect referring Subsection 4.2.4 in EtherNet/IP manual (B-82854EN).
   3. Turn TRUE a connection for the welding power supply.
   4. Confirm alarms of EtherNet/IP and implement the remedy.
   5. After confirm the connection, turn TRUE Reconnect by above procedures.
4. If this alarm is continuously posted, the assignment of I/O may be wrong. Please refer Subsection 6.2.4 and recover the assignment of communication I/O.

ARC-046 WARN Weld EQ communication error

Cause: There was a communication error detected between Arc Tool and the welding power supply.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-046 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

ARC-047 WARN Not allowed during a weld

Cause: The operation that cannot be performed during a stop at one time during welding or the welding was going to be performed.

Remedy: Operate it after a program is finished or forces it, and having been finished

ARC-049 WARN Process %d switch to %d failed

Cause: The Reshuffling of the welding process is failed. The power of the welding power supply becomes OFF, or communication is not established.

Remedy: Confirm that the welding power supply is switched on, and establish communication.

ARC-050 WARN Process %d NOT found

Cause: A process mode allocated for Weld Procedure that appointed on a welding power supply was not found.

Remedy: Confirm whether a process mode allocated for Weld Procedure that appointed is a thing allocated definitely. In reference to 3-1-2 operation, allocate an appropriate process mode number for Weld Procedure. Even when Weld Procedure number is not set on arc direct type instruction, this alarm produces (when it is 0).

ARC-051 WARN Weld EQ %d ONLINE： EthernetIP

Cause: It is the message which is displayed when the communication between a robot controller and a welding power supply are established.

Remedy: Because it is not an alarm, the remedy is unnecessary. A message disappears when reset is done.

ARC-059 STOP.L Gas purge stopped

Cause: By the gas purge operation(pressing both SHIFT key and STATUS key), the following operations are executed in the state of gas ON. To prevent the gas being left ON, gas is automatically stopped when this alarm is generated.

- Start the program
- Teach Pendant disabled or switched to AUTO mode
- Changed the setting item of [Gas purge key] to DISABLED in the Weld System screen.

Remedy: Please do not execute the above operation while gas is ON by the gas purge operation. Please stop the gas flow before executing the above operation.

ARC-092 STOP.L Weld Cmd error EQ%d (%d,%d)

Cause: An error occurred when sending the welding command to the power supply.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to Subsection 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-092 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is not possible, please deal in reference to countermeasures to ARC-045.

ARC-093 STOP.L Wire Feed Cmd error EQ%d (%d,%d)

Cause: An error occurred sending the command to the wire feeder.

Remedy: 1 Please confirm whether other alarms occur at the same time on the alarm history screen (Refer to 6.3.1). If other alarms occur, please execute the remedy of the alarm and after that, check that ARC-093 is also resolved.

2 Please operate the weld after establishing communication with the welding power supply. When the communication establishment with the welding power supply is impossible, please deal in reference to countermeasures to ARC-045.

ARC-124 WARN EQ %d E: %d %s

Cause: An error occurred in Fronius welding power supply. [Fron err cod] of the group input signal is assigned to the 8 bit error number from the Fronius TS/TPS welder. When this error happens, ARC-124 alarm is posted in the robot side. This alarm message shows the weld equipment number that error happens or the binary information of error code, error text, etc.

Remedy: Please confirm the error number and the error text after "E:". The following table shows the list. However, it is necessary to refer the Fronius welder manual if you would like to know no described error or more detailed information.

No.	Problems	Remedy
1	Setting of mode is wrong.	Confirm the setting such as wire material, wire diameter or process.
2	Overtemperature is detected by secondary sensor 1	Cool down the machine.
3	Overtemperature is detected by secondary sensor 2	
4	Overtemperature is detected by secondary sensor 3	
5	Overtemperature is detected by primary sensor 1	
6	Overtemperature is detected by primary sensor 2	
7	Overtemperature is detected by primary sensor 3	
8	Overtemperature is detected by primary sensor 4	
9	Overtemperature is detected by primary sensor 5	
10	Overtemperature is detected by primary sensor 6	
11	Error occurs in secondary thermosensor.	Change the secondary thermosensor.
12	Error occurs in primary thermosensor.	Change the primary thermosensor.
16	Error occurs in sensor 6.	Change the BPS 25/ 42/ 50.
17	Internal error is detected by DSP.	Update the UST software, otherwise change the UST board.
18	BSP error is detected by DSP.	Update the UST software, otherwise change the UST board or BPS 25/ 42/ 50.

No.	Problems	Remedy
19	Primary overcurrent is detected.	Power transistors, secondary diode, welding transformer , or secondary suppressor circuit is defective. Change the BPS 25/ 42/ 50, secondary diode or welding transformer.
20	Error is detected by DSP	Update the UST software, otherwise change the UST board.
21		
22	Error occurs during Flex loading.	
23	UST-Cfg-Mem error occurs.	
24	BSP-Cfg-Mem error occurs.	
25	UST-Cfg-Mem error occurs.	
26	Cfg-Mem error occurs.	Check whether the CfgMem has good contact to the connecting cables and in the plug.
27	One of the VCC's is outside the limits.	Measure the +24 VDC of NT 24, otherwise change the UST board.
28	Cooling-unit temperature sensor is defective.	Change the cooling-unit temperature sensor.
29	DSP-Softcom error occurs.	Update the UST software, otherwise change the UST board.
30	Wirefeed error occurs.	Refer to Subsection 6.2.3.
31	EEProm memory error occurs.	Update the UST software, otherwise change the UST board.
32	BSP configuration error occurs.	Install primary power module.
33	Overtemperature is detected by the temperature sensor on the UST board.	Cool down the machine.
34	Temperature sensor on the UST board is defective.	Change the UST board.
35	Internal error (Version conflict) occurs.	Update UST and RCU software, otherwise change the UST board.
36		
37	U-secondary measurement is polarity-reversed or defective.	Change over the polarity of the two cables, otherwise change the UST board.
38	The "Quickstop" input on the robot interface has been activated.	Check the cause that the "Quickstop" input on the robt interface has been activated.
39	Insufficient coolant-flow is detected by the cooling-unit rate-of-flow watchdog.	Check the coolant level and (if appropriate) the coolant return-flow rate.
40	The license key is incorrect.	Confirm the license key.
49	Phase of power supply is failure.	Check 3phases of mains power supply.
50	Symmetry error occurs in the intermediate circuit.	Change the intermediate circuit electrolytic capacitors and/or the BPS 25/ 42/ 50.
51	Undervoltage fault occurs in the intermediate circuit.	Mains voltage is too low or NT 24 is defective.
52	Overvoltage occurs in the intermediate circuit.	Mains voltage is too high or NT 24 is defective.
53	Earth-fault detector has been triggered.	Low-resistance connection between secondary and machine housing, so find out the cause.
54	Wire-stick is detected.	Adjust the burnback schedule.
55	Ignition time-out error occurs because no ignition has place within the pre-set length of wire.	Check whether the distance and energization between the wire tip and the work are correct. If both correct, check whether the setting of ignition time-out is correct.
56	Wire-end error occurs because the wire-end sensor detected that there is no more wire.	Check how much wire is left on the spool. If necessary, change the spool.
57	Gas pressure error occurs.	Check what volume of gas is still available and the gas solenoid valve.
58	Arc loss occurs.	Check the seam.

No.	Problems	Remedy
62	TP08 Overtemperature occurs.	Cool down the machine.
63	Interface error occurs.	Contact Fronius representative.
64	Temperature sensor error of cooling unit occurs.	Change the temperature sensor error of cooling unit.
65	Overtemperature occurs in the cooling unit.	Cool down the machine.
66	Overtemperature occurs in the Jobmaster.	Cool down the machine.
67	Jobmaster thermosensor is faulty.	Contact Fronius representative.
69	Illegal mode change occurs while welding.	Don't perform illegal operation such as mode change while welding.
70	Gas sensor error occurs.	Check gas sensor, gas level and valve.
71	Limit error of welding command occurs.	Check the seam and whether welding command exceeds the limit.
72	Configuration was changed.	Check LHSB connection.
73	No host was found.	Check the connection between UST and RCU and the firmware.
77	Main motor or PPU motor current is abnormal.	Contact Fronius representative.
78	Emergency-stop was performed.	Contact Fronius representative.
100	Unknown command is detected.	Update the UST software, otherwise change the UST board.
101	Instruction in illegal format is detected.	
102	Instruction to uneven address is detected.	
103	Jump to uneven address is detected.	
104	Access to non-defined bus is detected.	
105	Internal error occurs.	
106	Stack overflow.	
107	Stack underflow.	
108	Internal error occurs.	
109		
110		

ARC-250 WARN Process active ON after weld

Cause: Though the welder performs the burnback and gas post flow processes at the weld end, the robot waits finishing those processes. When the waiting time is in time-out, the above-mentioned alarm is posted.

Remedy: Please adjust the time-out period by performing the following procedure.

1 Confirm that the welder setting of wend end (burnback, gas post flow, etc.) are correctly set. If those settings are correct but ARC-250 is posted, following steps are proceeded.
2 Display the System Variable screen ([MENU] key -> SYSTEM -> Variables).
3 Move the cursor to $AWEUPR and press the [ENTER] key.
4 Move the cursor to weld equipment number where this problem occurs and press the [ENTER] key.
5 Increase the value of $MAX_END_TIM a little (about 0.1).

> ⚠ **CAUTION**
> When this problem is not solved even if this procedure is performed, please increase the value of $MAX_END_TIM little by little (about 0.1).

ARC-253 STOP.L I/O polarity is inverted:E %d

Cause: Some I/O polarities are set to Inverse.

Remedy: Please power OFF/ON. This alarm continues to be posted until performing power OFF/ON.

ARC-254 WARN Please power OFF/ON.
Cause: This is a cause code for ARC-253.
Remedy: Please power OFF/ON.

6.2 TROUBLE SHOOTING AGAINST SITUATIONS

Table 6.2 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 6.2.4.
		An idle arm does not go up	Put up an idle arm.
2	Wire feed is not stable (Wire feeding speed is too fast or there is allophone while wire feeding)	There is a problem to idle arm or drive roll.	In reference to "wire feeder" of Subsection 5.1.2, please perform maintenance check of wire feeder.
		There is the slack in the joint of the blowtorch cable	Please confirm whether the slack does not occur in a joint with the blowtorch cable installation metal fittings.
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 6.2.4.
		The valve of the gas cylinder, a gas adjustment knob do not open.	In reference to “Checking Gas Flow Rate" of Subsection 5.1.7, please confirm the gas flow quantity.
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 TS/TPS 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 5.1.7, and please confirm that gas appears definitely.
		A welding process choosing, a welding mode are wrong	In reference to “BASIC OPERATION FOR TS/TPS 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 "5.1.3 welding torch".
		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.

No.	Problems	Cause	Remedy
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.
9	When welding is performed with JOB mode, unexpected JOB number is commanded	Weld Procedure setup is incorrect	Perform the procedure below. 1 Press the [DATA] key. 2 Press F1[TYPE] and select “Weld Procedure”. 3 Move the cursor to the Job mode Weld Procedure that you want to use. 4 Move the cursor to “+” in the head of “Procedure” and press the [ENTER] key. Then, Weld Procedure tree view is expanded. 5 Runin and Burnback and Wirestick resets must be disabled (Those are controlled at welder side, so those are disabled at robot side). 6 Perform following steps only when heatwave is used. Move the cursor to “+” in the head of “Schedules” and press the [ENTER] key. Then, Schedules tree view is expanded. 7 Move the cursor to weld schedule that you want to use and press F2[DETAIL] key. 8 In the area of “Heatwave mode” setting, do not select [Ramp with weaving] (Do not ramping the command of job number).
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.

No.	Problems	Cause	Remedy
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 “Setup (NO-WELD)” already exists, move the cursor to that Weld Procedure. When the Weld Procedure whose Operating Mode is “Setup (NO-WELD)” 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.

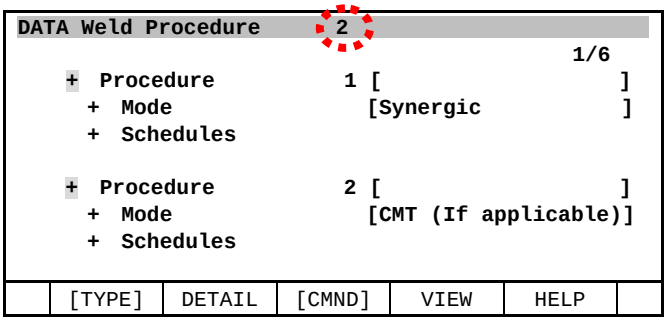
6.2.1 Welding Output does not be Obtained According to The Welding Command.

When the Operating Mode is Synergic or Pulsed-Synergic or CMT, robot sends the welding commands (Wire Feed Speed, Arc length correction, etc.) to the welder. Those commands are sent to the welder after scaling according to the specification of welder. When robot software is 7DC3 series (V8.30) P31 or later and Fronius Ethernet communication package (A05B-xxxx-J851) is ordered, the scaling setup is stored for each Weld Procedure. And it is automatically updated by communication with weld equipment when Program Number is set. In other software, the scaling setup is stored for each Operating mode (not Weld Procedure) and it is not updated automatically. However, initial scaling setting can be used in the main Program Number. On the other hand, there is a possibility that the welding output does not be obtained according to the welding command in a part of Program Number with the initial scaling setting. In that case, please perform the following procedure.

Procedure 6-2-1 Setting of scaling

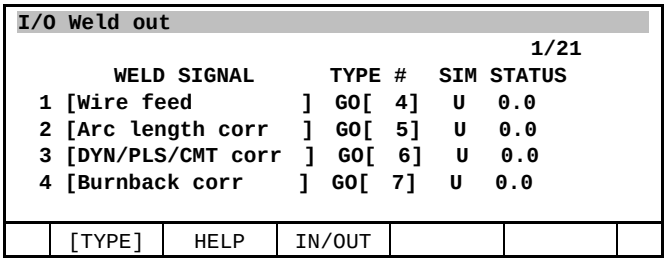
Step

1 Confirm which Operating Mode is used (Synergic or Pulsed-Synergic or CMT) in the welding that the welding output does not be obtained according to the welding command.
2 Display the Weld Procedure screen ([MENU] key -> DATA -> Weld Procedure).
3 Select the Weld Procedure that specifies the Operating Mode of step 1 (Move the cursor to Weld Procedure that you want to select -> F3[CMND] -> Select WP). 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 Modes, not for each Weld Procedure. Selected Weld Procedure number will be displayed at the upper part of screen as shown below.

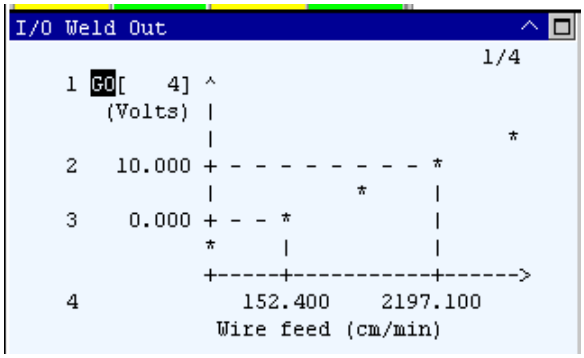


4 By checking the table described in the Section 9.1 (Or, by operating the welder), confirm the upper and lower limit value in the characteristic line that the welding output does not be obtained according to the welding command.

5 Display the Weld I/O output screen ([MENU] key -> I/O -> Weld ->Weld Out screen by pressing F3[IN/OUT]).



6 Move the cursor to the signal that the welding output does not be obtained according to the welding command (this is normally [Wire feed]) and press F8[CONFIG]. Following screen will be displayed.



7 Set the upper and lower limit value that are confirmed at step 4 to the axis of abscissas (In the above-mentioned sample screen, lower limit is 152.400 and upper limit is 2197.100). Please do not change values of vertical line.

8 After pressing F3[VERIFY], return to the previous screen by pressing F2[MONITOR].

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
- Program Number (in the case of Synergic or Pulsed-Synergic or CMT)
- 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.

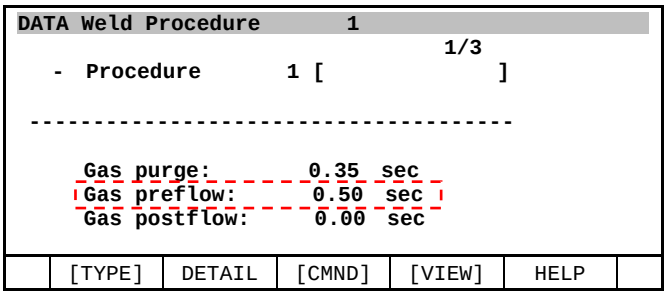
Solution 1 : "delay" is absorbed by using gas preflow

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 below.

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].



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 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.

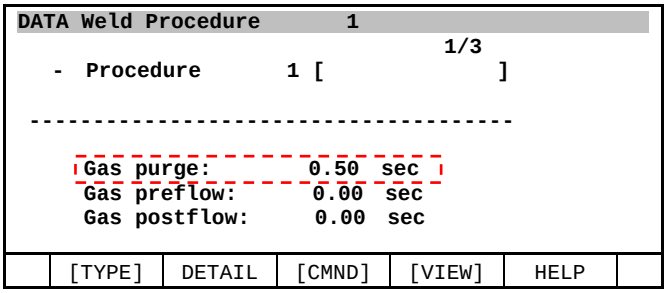
```
J P[1] 100% FINE
L P[2] 100mm/sec CNT 100
L P[3] 100mm/sec FINE Weld Start[1, 1]
```

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].



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 Occurrence of error-E30

ARC-124 "E30" error occurs when wire feeding performed incorrectly. Plural causes are thought for a problem of wire feeding. If this error occurred, perform the following confirmation and action.

Confirmation procedure

1 Confirm the cable connection and roller feed pressure. (See Section 2.2)
2 If large vibration is seen in the wire feeding pass during robot operation, correct the cable forming. (See Section 2.2)
3 Confirm there is no significant change of wire speed command feeding speed.
Confirm there is no suddenly robot posture change during the welding.

When improvement is not seen in the procedure mentioned above, because the trouble of the hardware is possible, please contact your local FANUC representative.

6.2.4 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 6-2-4 Restore the communication setting

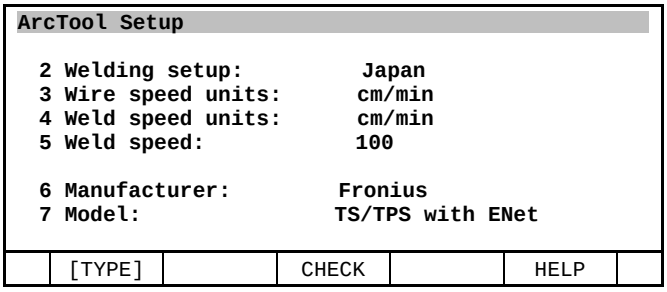
Step

1 Confirm that the setting described in Subsection 10.4.1 [Setting of Robot Ethernet IP Address] and 10.4.2 [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 10.1 and Subsection 10.2.1. Perform Procedure 10-2-1 if necessary.

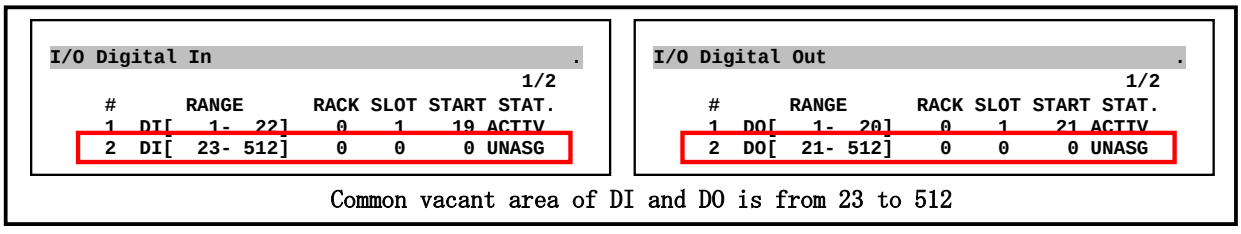
4 Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start]. The following screen will be displayed.



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).

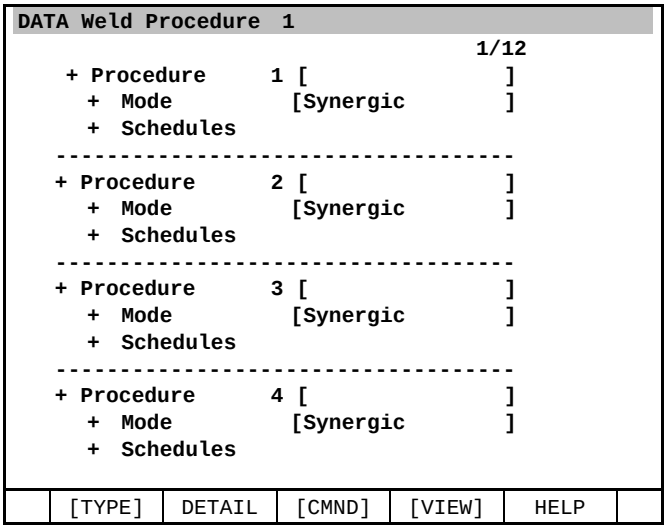
6 Press [FCTN] key and select [START (COLD)] then perform it.

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.



8 Perform Procedure 10-3. If the software is before V8.30P/31, note that it is necessary to select “YES” at Step 5 in Procedure 10-3 and input the desired start point (this must be the common vacant area that is memorized at Step 7 in this Procedure 6-2-4). Then, I/O for communication with welding power supply can be moved to the specified free space.

9 Perform the setting described in Subsection 10.4.1 [Setting of Robot Ethernet IP Address] and 10.4.2 [Setting of Ethernet IP Scanner].
10 Press [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 11 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 [MENU] key and select "--NEXT--". Select [DATA].
14 Press F1[TYPE] and select "Weld Procedure". As shown below screen, initialized Weld Procedures are displayed.



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 [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.

6.3 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)

6.3.1 Confirmation of the Alarm History

Open alarm history screen, Confirm whether arc alarm, LECO alarm are given.
Please contact us when alarm is given what kind of turn alarm is given with.
Please take the confirmation method of the alarm history in the following procedures.

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.

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 (Including the torch cable)	(a) Liner replacement (b) Wire feed capability
Liner Roller	(a) Wire feed capability

7.1 REPLACING THE WELDING POWER SUPPLY

1 Turn off the controller power.
2 Remove welding power cable (+),(-), wire feeder control cable and Ethernet cable from welding power supply. Refer to Fig. 7.1 (a), (b).

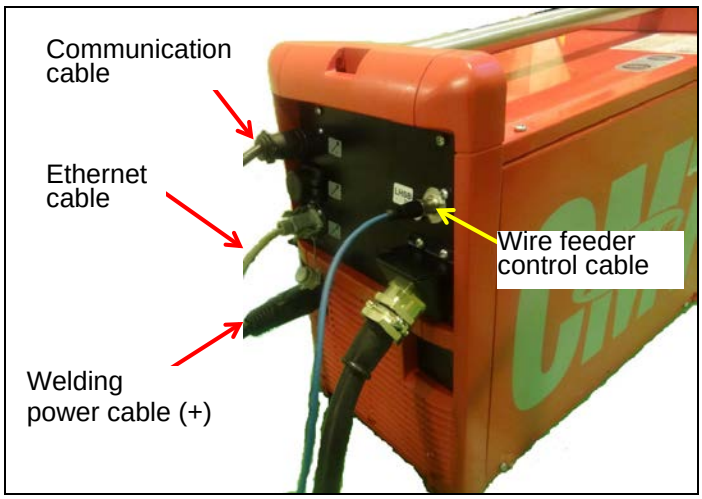


Fig. 7.1 (a) Replacing the welding power supply

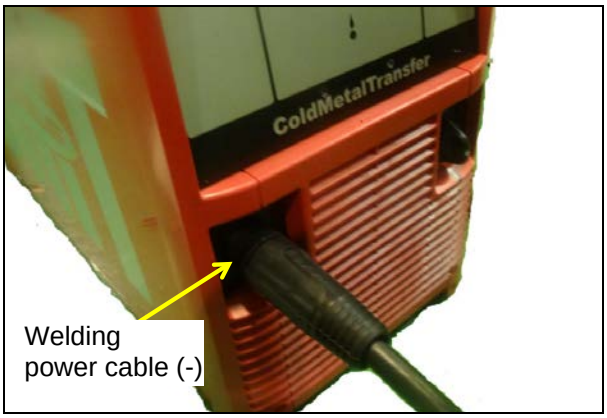


Fig. 7.1 (b) Replacing the welding power supply

3 Replace old welding power supply by new one. For its assembly, please apply the steps above in reverse sequence.

7.2 REPLACING HOSE PACK (TORCH CABLE CHANGING)

1 Move the robot posture to J4=J5=J6=0^{O}, The J1-J3 axis is not cared about by arbitrary posture.
2 Confirm that each hose does not intersect each other.
3 Remove the flexible conduit of wire feeder, cut the wire. Pull out the wire from the tip point after it supplies it until the wire cannot be sent.
4 Remove two bolts which fix the Robacta drive.

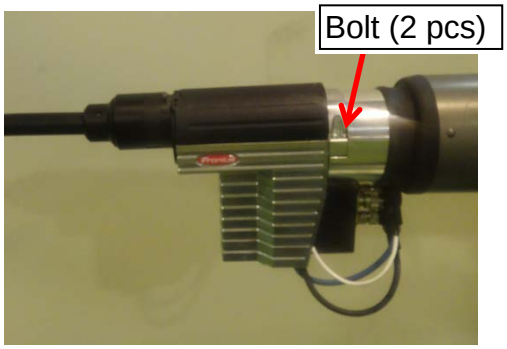


Fig. 7.2 (a) Removing the hose pack

5 Remove the Robacta drive, then remove the three connector in lower side.

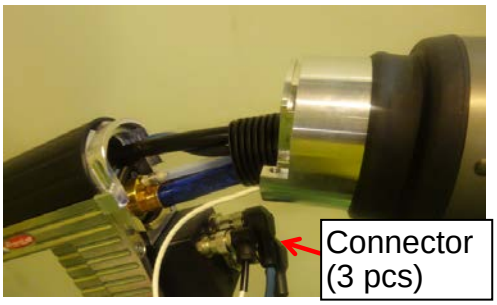


Fig. 7.2 (b) Removing the hose pack

6 Remove the inside bolts. In case of the air cooling refer to Fig.7.2 (c). In case of water cooling, refer to Fig. 7.2 (d). In case of water cooling, remove those by two time because one bolt is hidden.

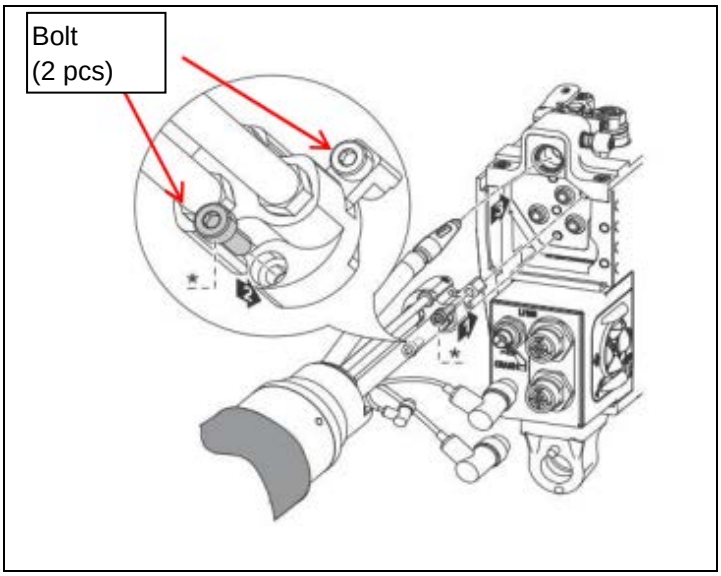


Fig. 7.2 (c) Removing the hose pack (air cooling)

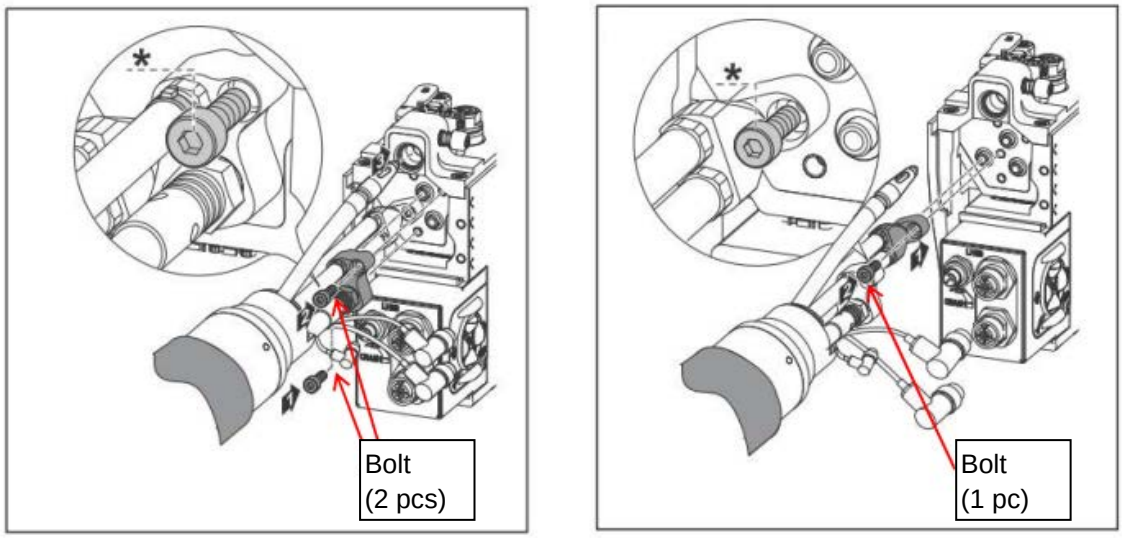


Fig. 7.2 (d) Removing the hose pack (water cooling)

7 Open the cover.

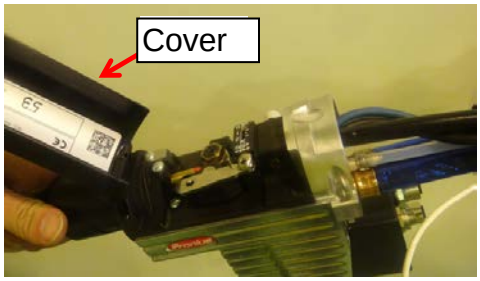


Fig. 7.2 (e) Removing the torch cable

8 Pull out the black tube during pushing the white button.

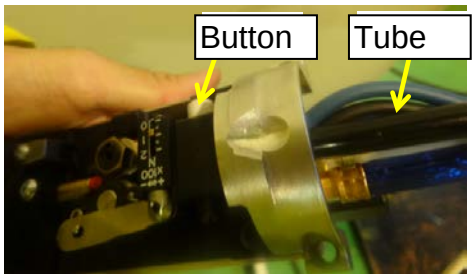


Fig. 7.2 (f) Removing the torch cable

9 Pull out the torch cable from the J3 casing backside.

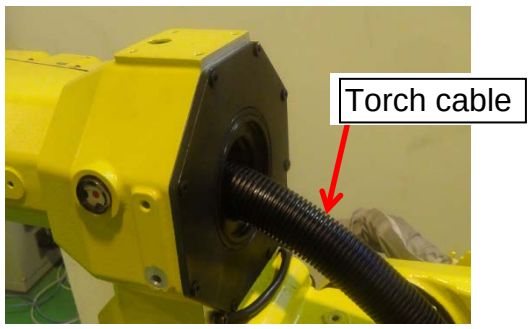


Fig. 7.2 (g) Removing the torch cable

10 Open the wire buffer cover.

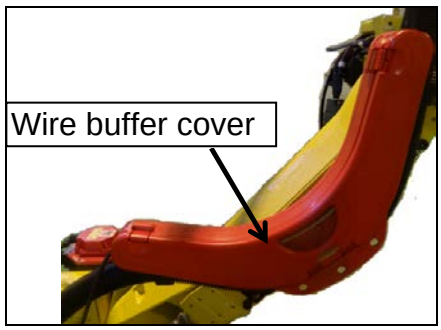


Fig. 7.2 (h) Removing the torch cable

11 Remove two Velcro, then remove the torch cable conduit from the wire buffer.

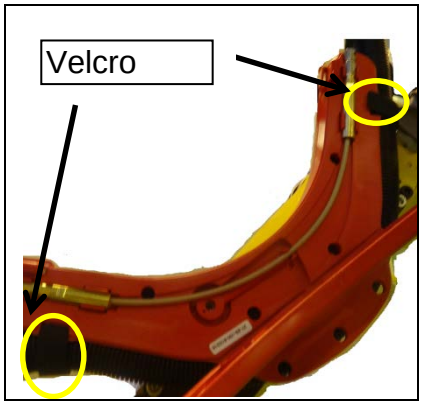


Fig. 7.2 (i) Removing the hose pack

12 Remove two metal parts in the wire buffer from the wire buffer. At this time, remove the metal part 2 and 3 on the torch side as shown in Fig. 7.2 (j) from the hose pack tube, because those are reused.

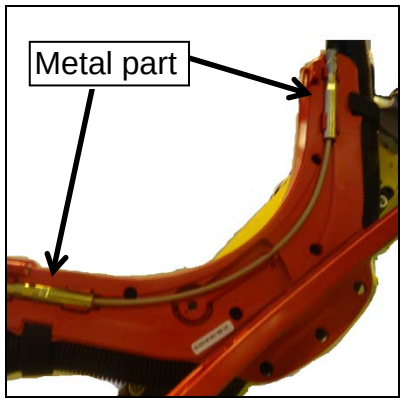


Fig. 7.2 (j) Removing the hose pack

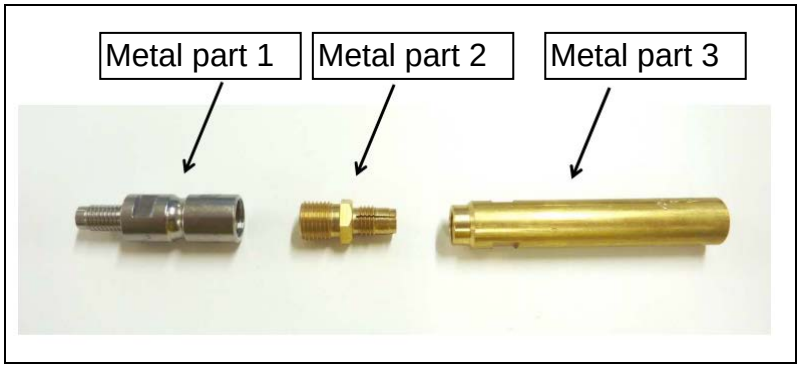


Fig. 7.2 (k) Removing the hose pack

13 Remove three connectors which are connected to the wire feeder. In case of water cooling, remove two coolant tubes, too.

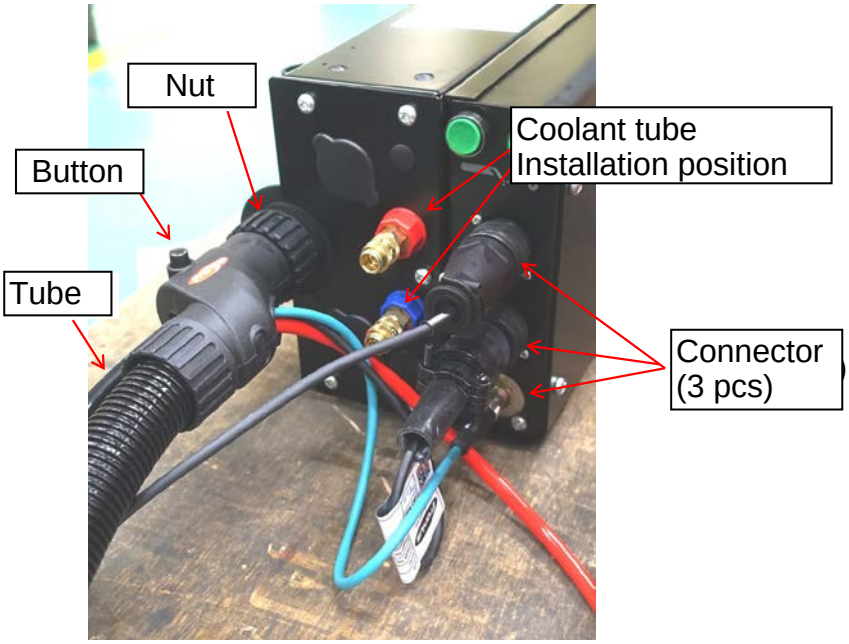


Fig. 7.2 (l) Removing the hose pack

14 Remove the nut for the hose pack and the wire feeder, then pull out the hose pack.
15 Pull out the tube during pressing the button on the hose pack edge.
16 Remove the resin part which fix the hose pack conduit and the tube, then separate the conduit and the tube.

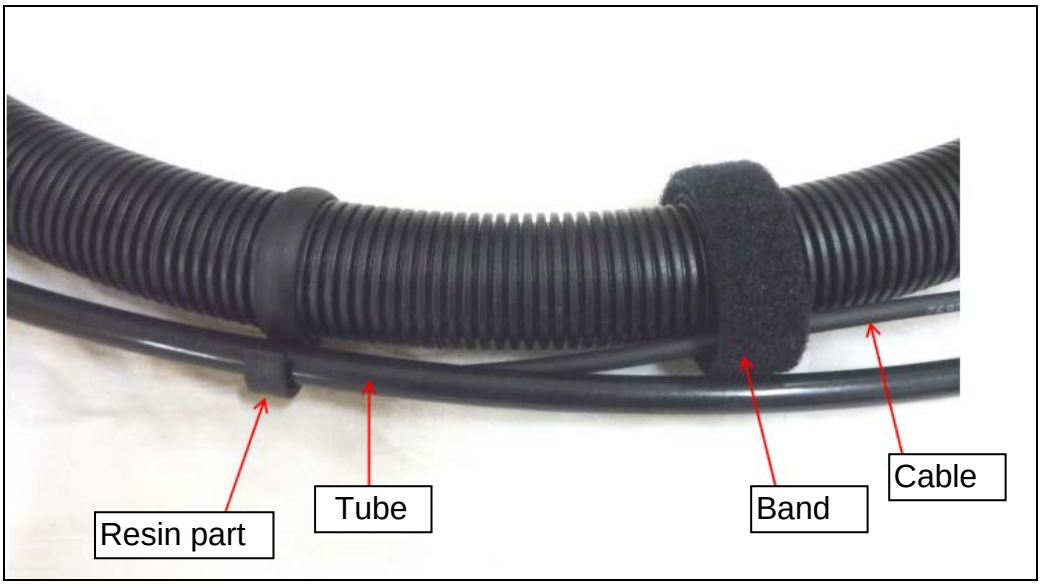


Fig. 7.2 (m) Removing the hose pack

17 Remove the band which is winded to the conduit, then separate the communication cable of the wire buffer from the conduit.

18 Replace the hose pack with a new one. Attach the metal part 1 in Fig. 7.2 (j) which appended to the hose pack to the black tube. In case of water cooling, remove a metal pipe for protection on the hose pack top.

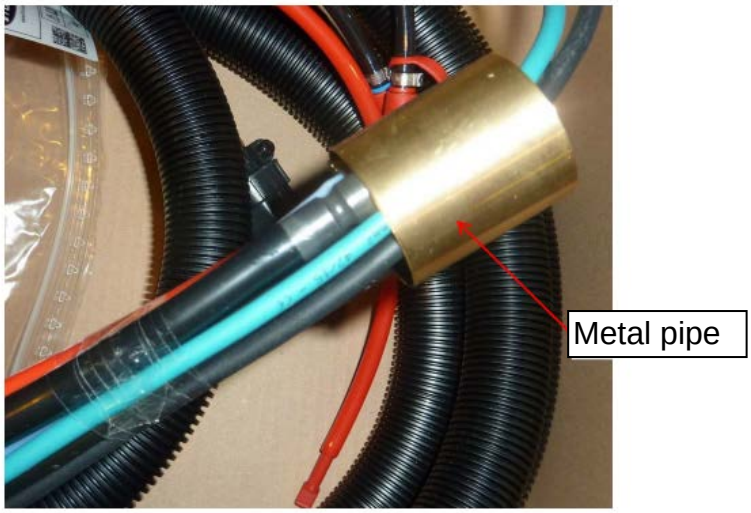


Fig. 7.2 (n) Removing the hose pack

19 Insert a liner to the torch side of the hose pack, then attach the metal part 2 and 3. Refer to Section 7.3. Reuse the top resin part (guide nozzle) from old hose pack.

20 Pass the hose pack from J3 casing back side to hollow hole. Remove the tape because the hose pack top was fix with tape.

21 Pull out the black tube of the hose pack top, insert a tube into the Robacta drive, confirm the clicking sound from the white button.

22 Fix the hose pack top to the Robacta drive inside referring to Fig. 7.2 (c) and Fig. 7.2 (d).Tightening torque of the bolt is 3.0[Nm].

23 Fix the Robacta drive with bolts referring to Fig. 7.2 (b). Tightening torque of the bolt is 3.0[Nm]. Confirm the Robacta drive is installed without gap.

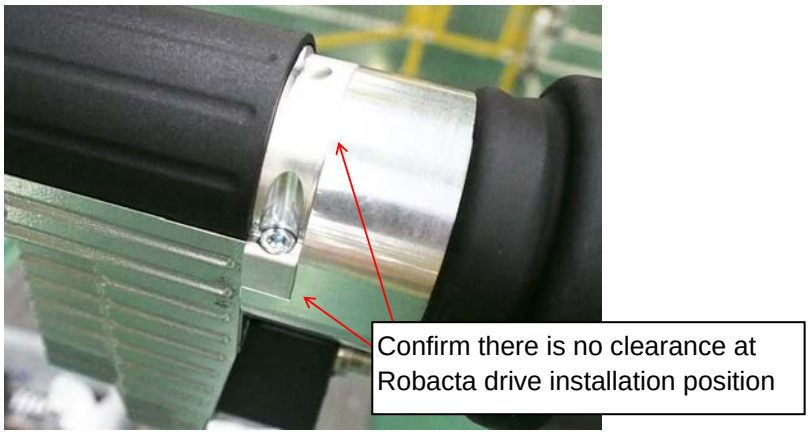


Fig. 7.2 (o) Removing the hose pack

24 Attach the connector of the Robacta drive lower side. Pass the cable through the Robacta drive side groove.
25 Attach the black tube (removed in step 16) to new hose pack. Press the button on the wire feeder side connection part, insert the metal part of the tube, then push it until confirming clicking sound.
26 Attach the metal part to the wire buffer both edges. Then insert the liner in the buffer into the upper side metal part. Fix the liner in the buffer to the arm inside the wire buffer, then adjust it so that the come to the center.
27 Let the hose pack conduit be along the tube from J3 casing back side. Then fix it with Velcro of the wire buffer.
28 Fix the hose pack to the wire feeder, tighten the nut and fix it. Attach the connector to the wire feeder.
29 Fix the wire buffer communication cable with band (appended to the hose pack) along with the conduit. In addition, fix the black tube and the conduit with a resin part.

7.3 REPLACING THE LINER

1 Turn off power of the welding power supply and the robot controller.
2 Remove the outlet.
3 Remove the flexible conduit of the wire feeder. Cut the wire, Feed the wire until it does not come out, then pull out the wire from the tip top.

Replacing the torch side liner

1 Remove the wire buffer cover.

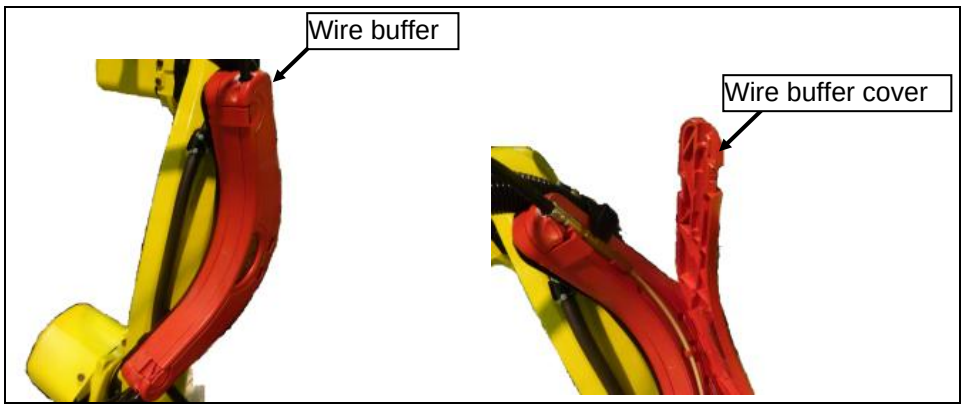


Fig. 7.3 (a) Replacing the liner

2 Remove the liner in the buffer.

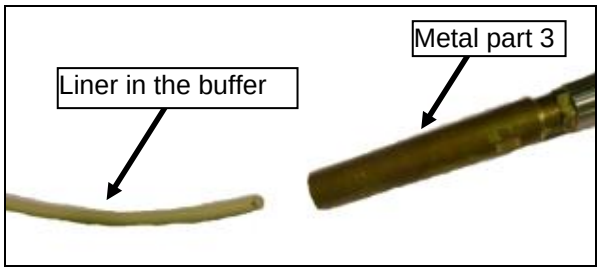


Fig. 7.3 (b) Replacing the liner

3 Remove the metal part 3 with a spanner.

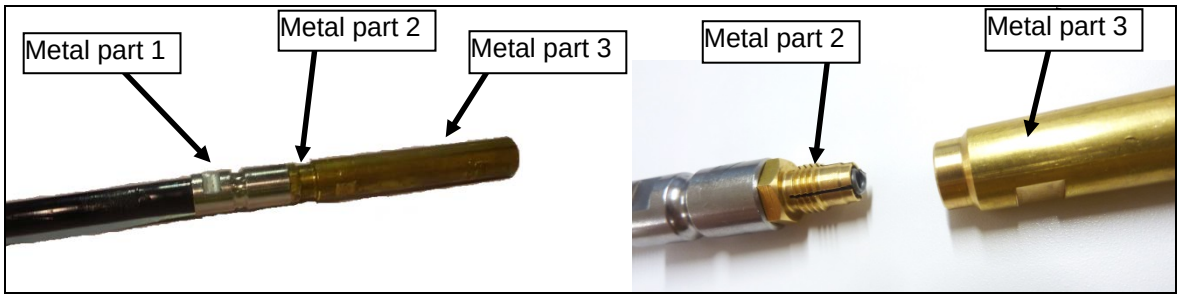


Fig. 7.3 (c) Replacing the liner

4 Pull out the liner.
5 Insert new liner into the hose pack. Hit the liner to the torch top guide nozzle (red) when inserting it.

Fig. 7.3 (d) Replacing the liner

6 Attach the metal part 2, Cut the liner at the metal part edge.

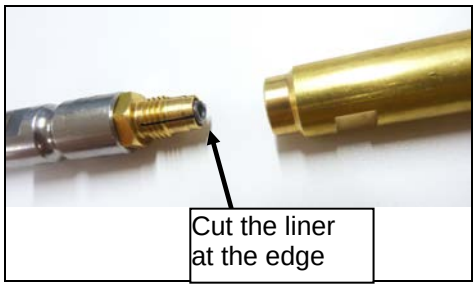


Fig. 7.3 (e) Replacing the liner

7 Attach the metal part 1.

Replacing the wire feeder side liner

1 Separate the tube which a conduit and a liner were inserted.
2 Pull out liner in the buffer during pushing a button which between the hose pack and the wire feeder.
3 Remove the nut for the guide nozzle at the tube metal part top.

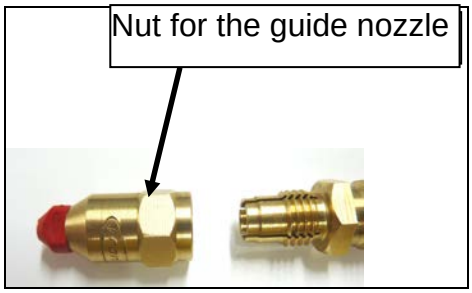


Fig. 7.3 (f) Replacing the liner

4 Pull out the liner.
5 Insert a new liner until it knocks to the opposite side.
6 Cut off the liner in the end face of the metal part 2.
7 Attach the nut for the guide nozzle.

Replacing the neck liner

1 Remove the torch from the Robacta drive referring to Section 7.6.
2 Pull out the neck liner.
3 Prepare a new neck liner. In case of air cooling, sharpen the tip in the shape of a tetrahedron referring to Fig. 7.3 (g).
4 Insert the neck liner. In case of air cooling, insert it from the sharpen side. In case of water cooling, insert it from metal part side.

Fig. 7.3 (g) Replacing the liner

5 Knock a pipe-shaped fix against the torch and cut off liner in the end face of the fixture referring to 7.3 (h). Treat the burr as step 3.
6 Attach the torch to the Robacta drive referring to Section 7.6.
7 Turn on the controller power then feed the wire to check that the wire is fed through the torch tip. Next, operate the robot slowly to check that no problem is found.

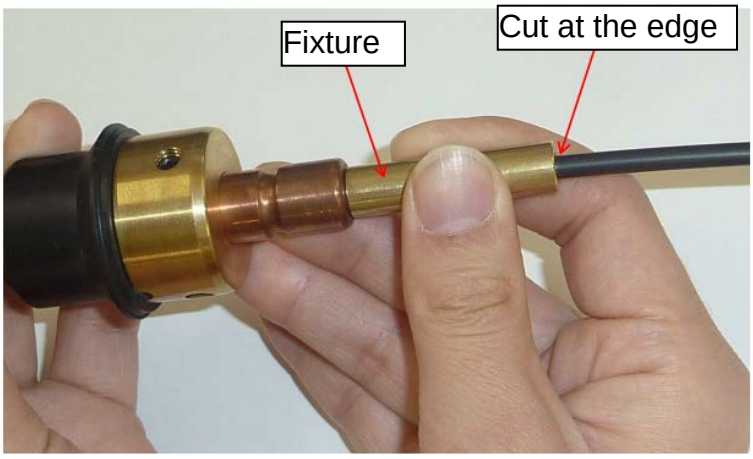


Fig. 7.3 (h) Replacing the liner

7.4 REPLACING THE FEEDER ROLLS

1 Turn off power of the welding power supply.
2 Remove the outlet.
3 Lay down the idol arm. (See Fig. 7.4 (a))
4 Lift up the cover.

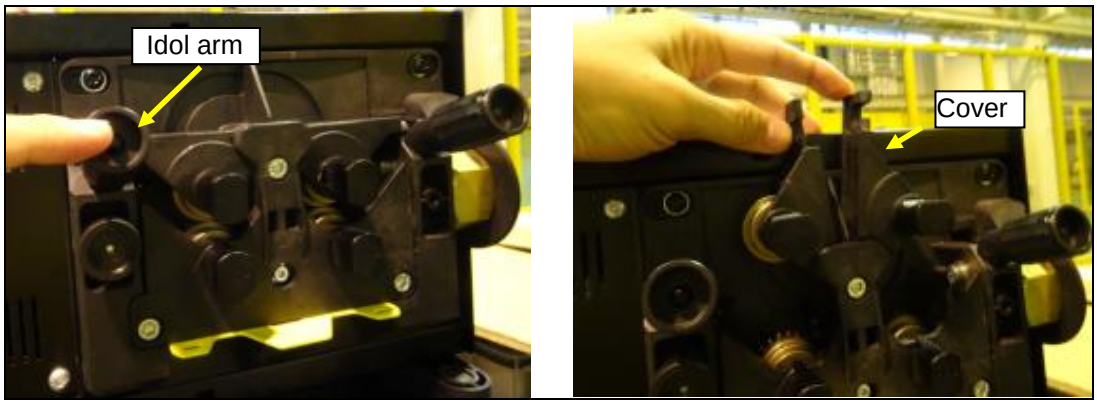


Fig. 7.4 (a) Replacing the feeder rolls

5 Remove the lower side plate during pushing it to lower side.
6 Remove bushes, then remove the feeder rolls and pressure rolls. (Fig. 7.4 (c))
In case of air cooling unit, lower 2 side 2 pieces are the feeder roll, upper side 2 pieces are the pressure roll. In case of water cooling, all four rolls are feeder roll.
7 Replace the feeder roll with a new one and assemble those in reverse sequence.
8 Adjust the roller pressure referring to Subsection 2.2.6.

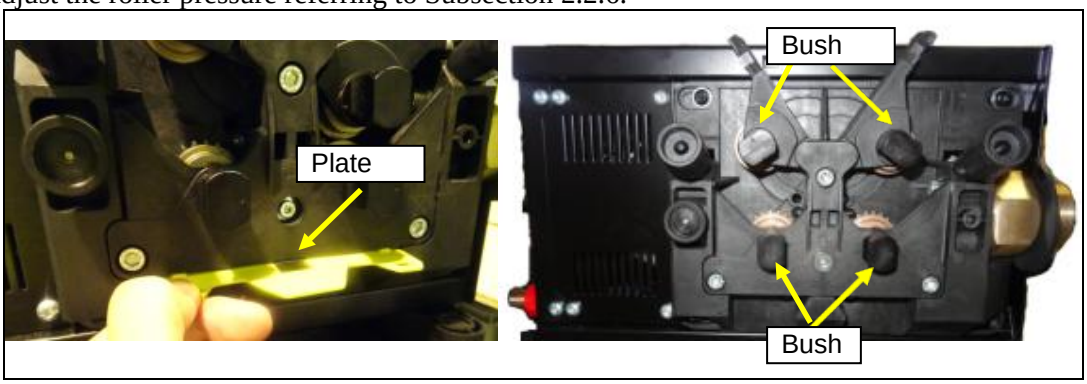


Fig. 7.4 (b) Replacing the feeder rolls

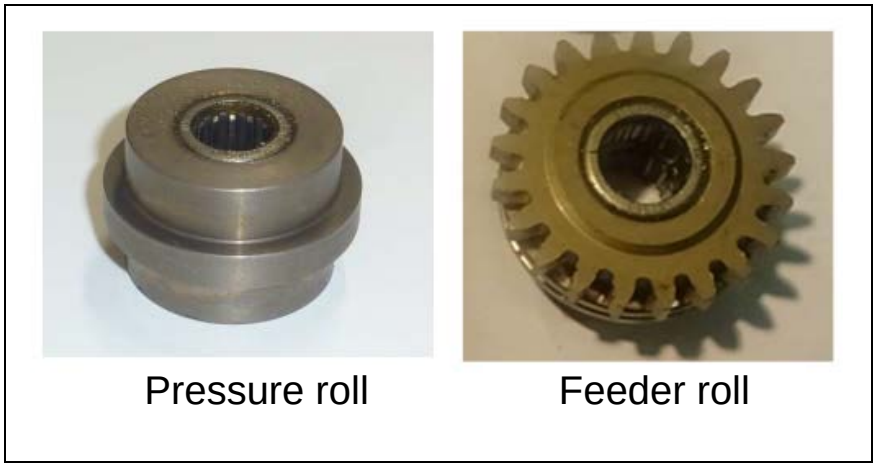


Fig. 7.4 (c) Replacing the feeder rolls/pressure rolls

7.5 REPLACING THE FEED ROLLER AND THE FOLLOW ROLLER

Prepare a special tool as shown in Fig .7.5 (a) and a spanner.

Fig. 7.5 (a) Special toll for replacing the rollers

Replacing the feed roller

1 Put the special tool under the feed roller.
2 Loosen the upper side screw with a spanner.

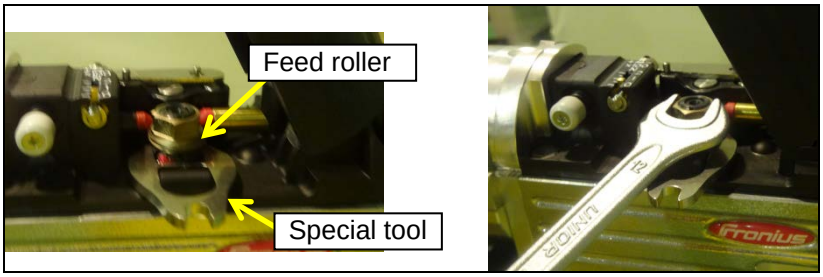


Fig. 7.5 (b) Replacing the feed roller

3 Replace the feed roller, then fix it with screws. Tightening torque is 5.0[Nm].

Replacing the follow roller

1 Hook the special tool to the pin on the follow roller, then pull out the pin to upper side.

Fig. 7.5 (c) Replacing the follow roller

2 Replace the follow roller then fix it with a pin.

Fig. 7.5 (d) Roller

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.
(Parts constitution differs depending on torches.)

7.6.1 Air Cooling Torch

1 Prepare a special tool as shown in Fig. 7.6.1 (a)

Fig. 7.6.1 (a) Special fixture for removing the torch neck

2 Remove the nozzle. (Refer to Fig. 7.6.1 (b))

Fig. 7.6.1 (b) Removing the nozzle

3 Loosen the torch neck with a special tool. Do not remove it. (Refer to Fig. 7.6.1 (c))

> ⚠ **CAUTION**
> An E ring for prevention of nut falling off got in the shaft part falls off when the nut was turned too much. Don remove the nut. Only loosen it.

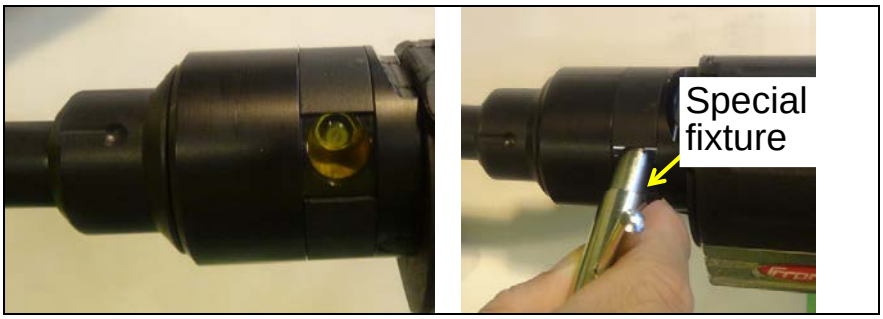


Fig. 7.6.1 (c) Removing the protection cap

4 Remove the special tool from the tightening position. If the tool is attached, torch can not be removed. Be careful.
5 Pull out the torch
6 Insert the neck liner to new torch, then assemble those in reverse sequence.

7.6.2 Water Cooling Torch

1 Remove the nozzle. (See Fig. 7.6.2)
2 Remove the nut, then remove the torch.

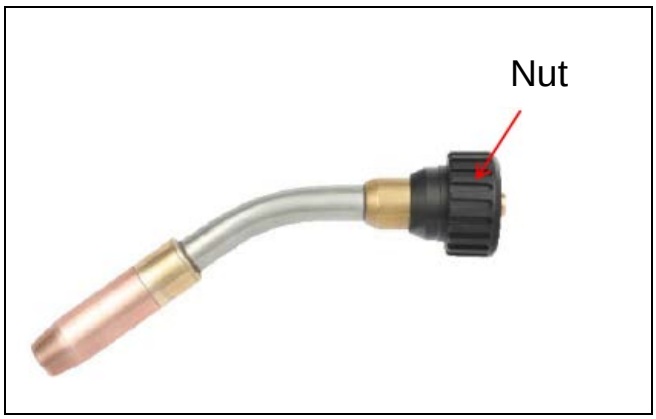


Fig. 7.6.2 Removing the nozzle

3 Insert a neck liner into the new torch (See Section 7.3.), then assemble it in reverse sequence.

7.7 REPLACING THE NOZZLE HOLDER (IN CASE OF AIR COOLING TORCH)

1 Remove the tip holder and other all parts referring to Fig. 7.7 (a).
2 Remove the nozzle holder with a special tool (A14L-0195-0044#04501938) in Fig. 7.7 (b).
Insert a tool into the nozzle holder referring to Fig. 7.7 (c), turn to counterclockwise and remove the nozzle holder.
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 Attach other parts in the reversed sequence.

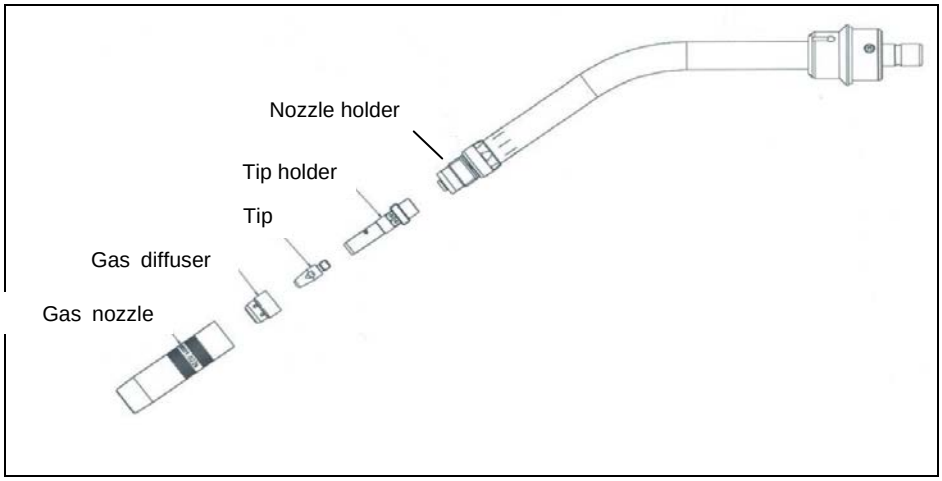


Fig. 7.7 (a) Replacing the nozzle holder

Fig. 7.7 (b) Replacing the nozzle holder

Fig. 7.7 (c) Replacing the nozzle holder

7.8 REPLACING THE GUIDE NOZZLE

As for the guide nozzle 2 pcs are use in the Robacta drive, and 1 pc is used in the wire feeder side top of the conduit.

7.8.1 REPLACING PARTS OF ROBACTA DRIVE AND TORCH SIDE

1 Remove the torch from the Robacta drive referring to Section 7.6.
2 Loosen the screw referring to Fig. 7.8.1 (a).
3 Insert a hexagon wrench to the torch connection part, remove the part in Fig. 7.8.1 (b).
4 Remove the guide nozzle from the removed part. Use the roller replacing tool top in Fig. 7.8.1 (c).

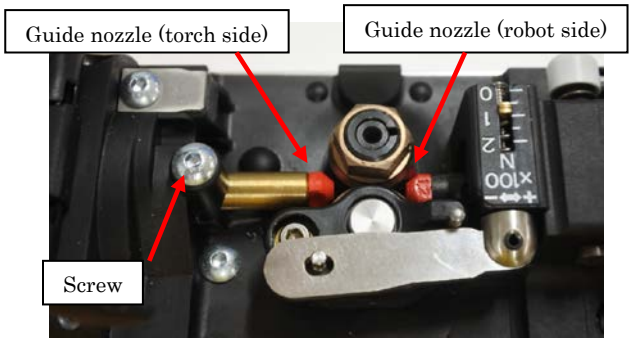


Fig. 7.8.1 (a) Replacing the guide nozzle

Fig. 7.8.1 (b) Replacing parts

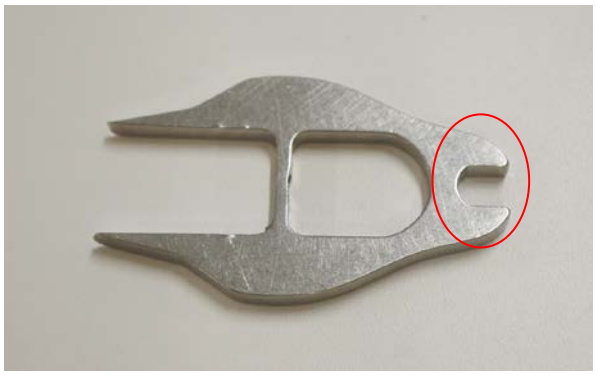


Fig. 7.8.1 (c) Replacing parts

7.8.2 REPLACING PARTS OF ROBACTA DRIVE AND ROBOT SIDE

1 Remove the Robacta drive mounting bolt referring to Section 7.2.
2 Pull out the conduit during pressing the button referring to Fig. 7.8.2 (a).
If the work is difficult, pull out the hose pack connection par in Fig. 7.8.2 (a).
3 Replace the guide nozzle of the conduit edge.
4 Assemble those in the reversed sequence.

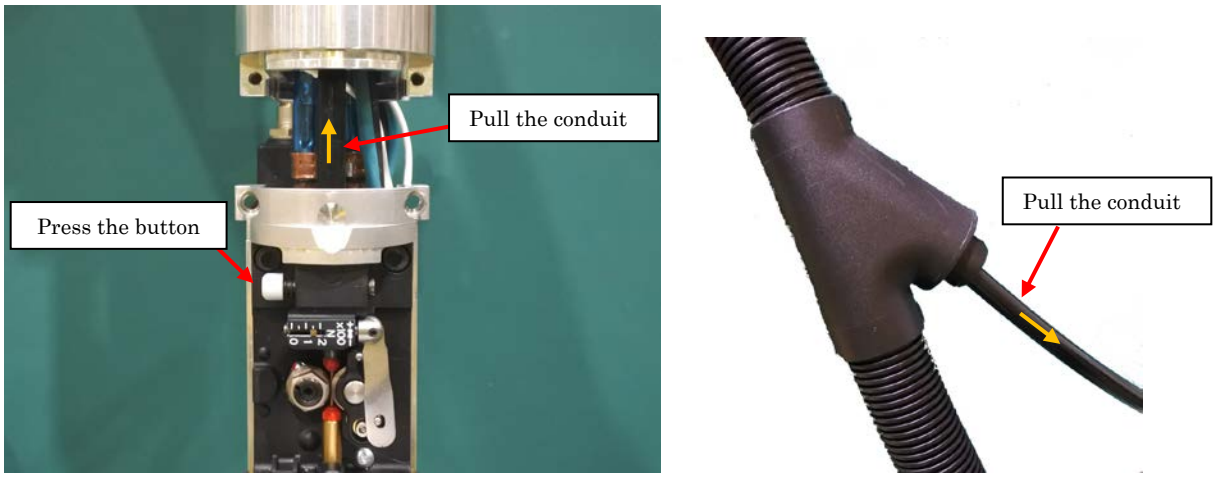


Fig. 7.8.2 (a) Removing parts

7.8.3 REPLACING PARTS OF THE WIRE FEEDER

1 Remove the conduit from the hose pack referring to Section 7.3.
2 Replace the guide nozzle of the top.
3 Attach it in the reversed sequence.

7.9 REPLACING THE WIRE FEEDER

1 Remove the flexible conduit of the wire feeder referring to Fig. 7.9, cut the wire, feed the wire until it does not come from the roller part, then pull out the wire from the tip end.
2 Remove the flexible conduit, cables to the welding power supply, the wire buffer cable and the torch cable from the wire feeder.
3 Replace old wire feeder by new one. For its assembly, please apply the steps above in reverse sequence.

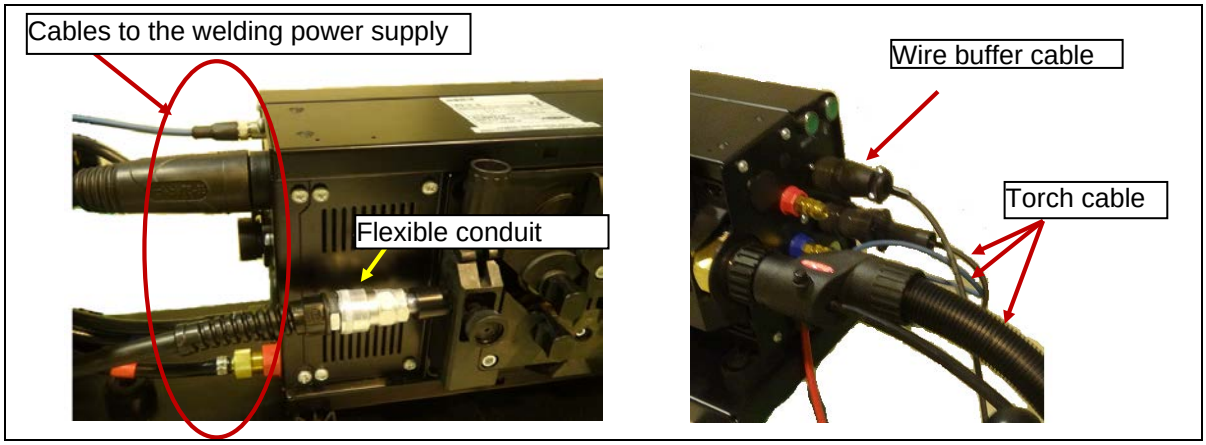


Fig. 7.9 Replacing the wire feeder

7.10 REPALCING THE WATER COOLING UNIT

1 Turn off power of the welding power supply.
2 Remove the outlet.
3 Remove four bolts which fix the welding power supply main body and the water cooling unit.

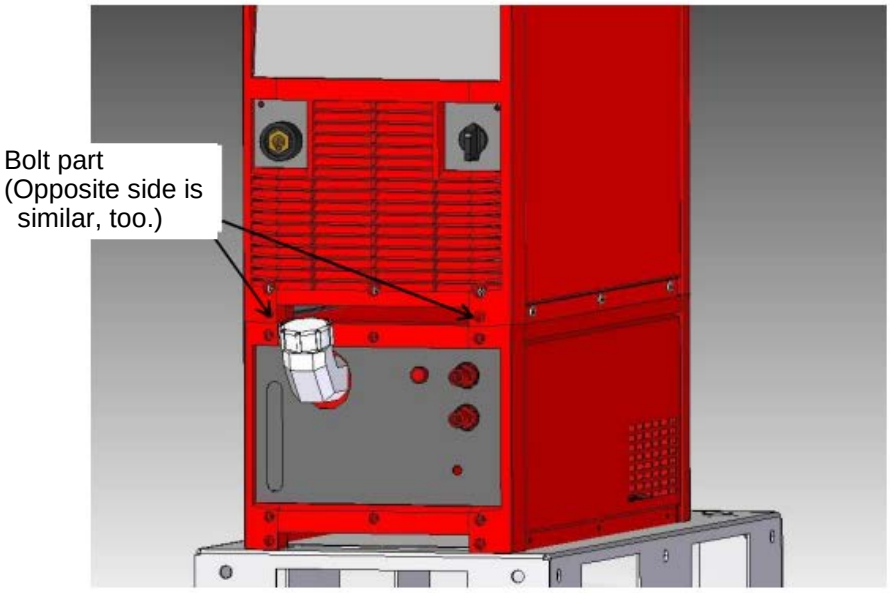


Fig. 7.8 (a) Replacing the water cooling unit

4 Hang the welding power supply, then float it 10 cm.
5 Remove the connector which connects the welding power supply and the water cooling unit.

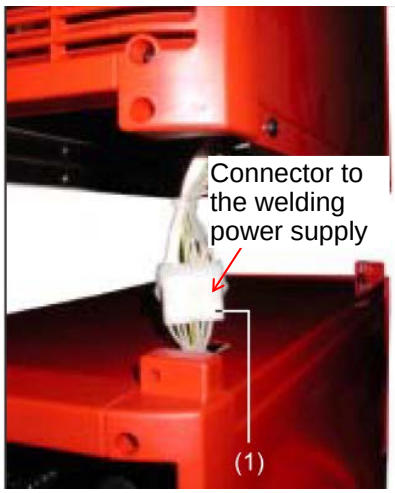


Fig. 7.8 (b) Replacing the water cooling unit

6 Replace the water cooling unit with a new one. Then assemble it in reverse sequence.

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.

Table 8 (a) Maintenance parts for the welding torch

Part No.	Parts name
A14L-0195-0042#00016564	Tip holder (*) air cooling
A14L-0195-0042#01000882	Gas diffuser (*) air cooling
A14L-0195-0042#00010226	Gas nozzle (straight) (*) air cooling
A14L-0195-0042#00010225	Gas nozzle (taper) air cooling
A14L-0195-0044#03504335	Nozzle holder air cooling
A14L-0195-0042#00014037	Tip holder (**) water cooling
A14L-0195-0042#04050854	Gas diffuser (**) water cooling
A14L-0195-0042#00014476	Gas nozzle (straight) (**) water cooling
A14L-0195-0042#00014462	M6 tip ϕ0.9/M6 air cooling
A14L-0195-0042#00014463	M6 tip ϕ1.0/M6 air cooling
A14L-0195-0042#00014464	M6 tip ϕ1.2/M6 (*) air cooling
A14L-0195-0042#00014750	M8 tip ϕ1.0/M8 water cooling for aluminum
A14L-0195-0042#00014751	M8 tip ϕ1.2/M8 (**) water cooling for aluminum
A14L-0195-0042#00014752	M8 tip ϕ1.6/M8 water cooling for aluminum
A14L-0195-0042#00016466	M8 tip ϕ1.0/M8 water cooling for iron
A14L-0195-0042#00016467	M8 tip ϕ1.2/M8 water cooling for iron

(*) These parts are installed when A05B-1295-H302 is shipped.
(**) These parts are installed when A05B-1295-H311 is shipped.

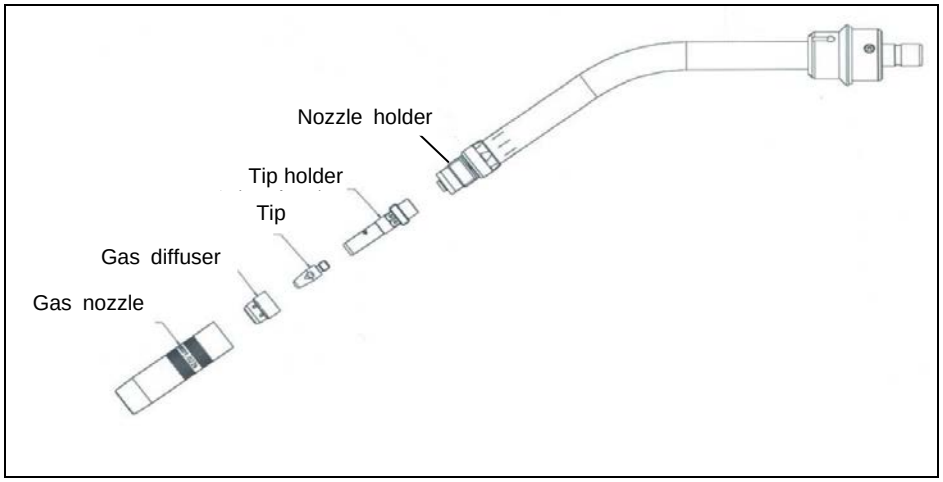


Fig. 8 (a) Figure for torch parts

Table 8 (b) Feeder roll (See Section 7.4)

Part No.	Parts name
A14L-0195-0044#00011184	Feeder roll 1.0H for aluminum
A14L-0195-0044#00011185	Feeder roll 1.2H (**) for aluminum
A14L-0195-0044#00011365	Feeder roll 0.9T for iron
A14L-0195-0044#00011227	Feeder roll 1.0T for iron
A14L-0195-0044#00011200	Feeder roll 1.2T (*) for iron
A14L-0195-0044#00011221	Pressure roll (*)

(*) These parts are installed when A05B-1295-H231 is shipped.

(**) These parts are installed when A05B-1295-H232 is shipped.

Table 8 (c) Drive roller, follow roller (See Section 7.5)

Part No.	Parts name
A14L-0195-0042#00015734	Drive roller ϕ1.0 CMT
A14L-0195-0042#00015772	Drive roller ϕ0.9 CMT
A14L-0195-0042#00015735	Drive roller ϕ1.2 CMT (*)
A14L-0195-0042#00015774	Follow roller ϕ0.9 CMT
A14L-0195-0042#00015731	Follow roller ϕ1.0 CMT
A14L-0195-0042#00015730	Follow roller ϕ1.2 CMT (*)

(*) These parts are installed when those are shipped.

Table 8 (d) Guide nozzle (See Section 7.2), Nut for the guide nozzle, part for liner fixation, wire guide

Part No.	Parts name
A14L-0195-0042#01001119	Guide nozzle ϕ1.0 blue
A14L-0195-0042#01001003	Guide nozzle ϕ1.2 red(*)
A14L-0195-0042#04001024	Nut for the guide nozzle
A14L-0195-0042#00015833	Part for liner fixation ϕ0.8 to 1.0
A14L-0195-0042#00015412	Part for liner fixation ϕ1.2 (*)
A14L-0195-0042#01000333	Wire guide (*)

(*) These parts are installed when those are shipped.

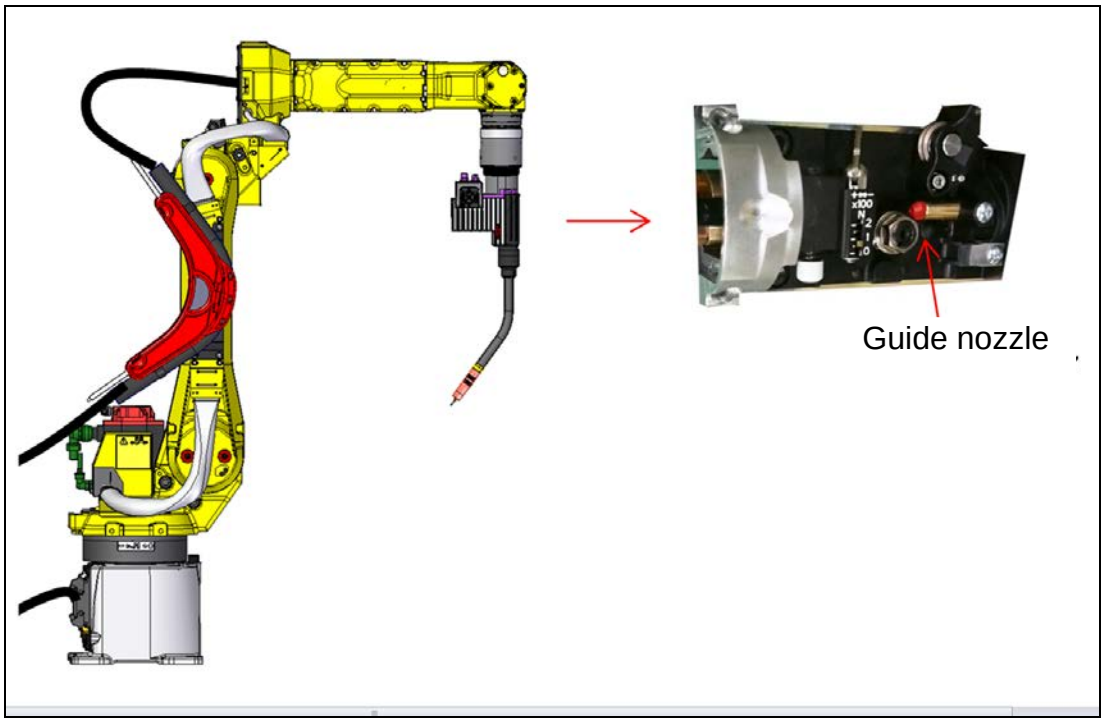


Fig. 8 (b) Parts figure.

Table 8 (e) Liner

Maintenance parts specifications	Maintenance parts name
A14L-0195-0040#00020002	Iron liner ϕ1.0 10.0m (***)
A14L-0195-0040#00020003	Iron liner ϕ1.2 10.0m (*)(***)
A14L-0195-0040#00010074	Aluminum liner ϕ1.0 10.0m
A14L-0195-0040#00010054	Aluminum liner ϕ1.2 10.0m (**)
A14L-0195-0044#03502444	Liner for the wire buffer (*)(**)

Table 8 (f) Neck liner

Maintenance parts specifications	Maintenance parts name
A14L-0195-0042#04041392	Iron neck liner ϕ1.2 0.42m (*)(***)
A14L-0195-0044#03501806	Neck liner for aluminum (**)
A14L-0195-0040#00020029	Bronze neck liner ϕ1.0 1.0m
A14L-0195-0040#00020015	Bronze neck liner ϕ1.2 1.0m

(*) These parts are installed when A05B-1295-H211 is shipped.
(**) These parts are installed when A05B-1295-H212 is shipped.
(***) For 1.0mm and 1.2mm, an iron liner can be used as a neck liner. Iron neck liner A14L-0195-0042#04041392 is shorter size of the iron liner A14L-0195-0040#00020003.

NOTE
The neck liner is a liner in the torch.

Table 8 (g) Water cooling

Maintenance parts specifications	Maintenance parts name
A14L-0195-0040#00090046	coolant

9 PROCESS MODE

This chapter describes about available process modes of Fronius welding power supply TS/TPS series (In the Fronius welding power supply, process modes means Program Number). About details of Process mode, please refer to Section 3.1 “BASIC OPERATION FOR TS/TPS WELDER”.

9.1 LIST OF PROGRAM NUMBER OF TS/TPS WELDER

> ⚠ **CAUTION**
> Available process modes will be changed by the installed firmware version and weld table version in the welding power supply. These lists is for the firmware / weld table that is installed at the shipment from our factory.

For example, Operating Mode is selected to “CMT (if applicable)” in a certain WP. In this WP, Program Number is set to “44”. The welder recognizes those setting from the robot as the characteristic line “1643” (CMT welding, wire is 1.2mm ER70 S-6, gas is C1 100%CO2).

Prg Num	Operating Number			Wire		Gas	Wire feed speed Command range (cm/min)	
	Synergic	Pulsed - Synergic	CMT	Material	Dia.		Min	Max
01	8			ER70 S-6	0.8	M21 Ar+18%CO2	210.0	2200.0
01		74		ER70 S-6	0.8	M21 Ar+18%CO2	150.0	2200.0
03	1084			ER70 S-6	1.0	M21 Ar+18%CO2	100.0	2200.0
03		346		ER70 S-6	1.0	M21 Ar+18%CO2	100.0	2200.0
04	375			ER70 S-6	1.2	M21 Ar+18%CO2	160.0	2200.0
04		378		ER70 S-6	1.2	M21 Ar+18%CO2	120.0	2200.0
06	149			ER307	0.8	M12 Ar+ 2,5% CO	100.0	2200.0
06		148		ER307	0.8	M12 Ar+ 2,5% CO	80.0	2200.0
08	102			ER307	1.0	M12 Ar+ 2,5% CO	270.0	2200.0
08		421		ER307	1.0	M12 Ar+ 2,5% CO	70.0	2200.0
08			1637	ER307	1.0	M12 Ar+ 2,5% CO	140.0	1350.0
09	33			ER307	1.2	M12 Ar+ 2,5% CO	200.0	2200.0
09		345		ER307	1.2	M12 Ar+ 2,5% CO	60.0	2200.0
09			1644	ER307	1.2	M12 Ar+ 2,5% CO	100.0	1100.0
11	9			ER308 L	0.8	M12 Ar+ 2,5% CO	470.0	2200.0
11		76		ER308 L	0.8	M12 Ar+ 2,5% CO	80.0	2200.0
11			959	ER308 L	0.8	M12 Ar+ 2,5% CO	140.0	2200.0
13	101			ER308 L	1.0	M12 Ar+ 2,5% CO	280.0	2200.0
13		414		ER308 L	1.0	M12 Ar+ 2,5% CO	60.0	2200.0
13			882	ER308 L	1.0	M12 Ar+ 2,5% CO	110.0	1000.0
14	11			ER308 L	1.2	M12 Ar+ 2,5% CO	190.0	2200.0
14		415		ER308 L	1.2	M12 Ar+ 2,5% CO	80.0	2200.0
14			929	ER308 L	1.2	M12 Ar+ 2,5% CO	100.0	950.0
16	138			ER5356	0.8	I1 100% Ar	990.0	2200.0
16		137		ER5356	0.8	I1 100% Ar	320.0	2200.0
18	14			ER5356	1.0	I1 100% Ar	580.0	2000.0

Prg Num	Operating Number			Wire		Gas	Wire feed speed Command range (cm/min)	
	Synergic	Pulsed - Synergic	CMT	Material	Dia.		Min	Max
18		408		ER5356	1.0	I1 100% Ar	100.0	2200.0
18			1070	ER5356	1.0	I1 100% Ar	150.0	1750.0
19	15			ER5356	1.2	I1 100% Ar	520.0	2200.0
19		191		ER5356	1.2	I1 100% Ar	100.0	2200.0
19			879	ER5356	1.2	I1 100% Ar	150.0	1300.0
21	142			ER4043	0.8	I1 100% Ar	770.0	2200.0
21		141		ER4043	0.8	I1 100% Ar	150.0	2200.0
23	132			ER4043	1.0	I1 100% Ar	620.0	2200.0
23		131		ER4043	1.0	I1 100% Ar	120.0	2200.0
23			1076	ER4043	1.0	I1 100% Ar	150.0	1600.0
24	16			ER4043	1.2	I1 100% Ar	500.0	1640.0
24		116		ER4043	1.2	I1 100% Ar	80.0	1800.0
24			881	ER4043	1.2	I1 100% Ar	140.0	900.0
28	104			ER CuSi-A	1.0	I1 100% Ar	230.0	2200.0
28		405		ER CuSi-A	1.0	I1 100% Ar	100.0	1600.0
28			884	ER CuSi-A	1.0	I1 100% Ar	160.0	950.0
29	153			ER CuSi-A	1.2	I1 100% Ar	200.0	2200.0
29		342		ER CuSi-A	1.2	I1 100% Ar	100.0	2200.0
31	18			ER Cu Al-A1	0.8	I1 100% Ar	350.0	1800.0
31		71		ER Cu Al-A1	0.8	I1 100% Ar	70.0	2200.0
33	103			ER Cu Al-A1	1.0	I1 100% Ar	230.0	2200.0
33		143		ER Cu Al-A1	1.0	I1 100% Ar	70.0	1400.0
33			883	ER Cu Al-A1	1.0	I1 100% Ar	80.0	1000.0
34	20			ER Cu Al-A1	1.2	I1 100% Ar	200.0	2200.0
34		113		ER Cu Al-A1	1.2	I1 100% Ar	60.0	1500.0
39			1640	ER70 S-6 dynamic	1.2	M21 Ar+18%CO2	100.0	1100.0
41	736			ER70 S-6	0.8	C1 100% CO2	150.0	2200.0
42	519			ER70 S-6	0.9	C1 100% CO2	140.0	2200.0
42			1702	ER70 S-6	0.9	C1 100% CO2	150.0	1400.0
43	737			ER70 S-6	1.0	C1 100% CO2	100.0	2200.0
43			1649	ER70 S-6	1.0	C1 100% CO2	60.0	1350.0
44	687			ER70 S-6	1.2	C1 100% CO2	100.0	2200.0
44			1643	ER70 S-6	1.2	C1 100% CO2	100.0	1200.0
46	602			ER70 S-6	0.8	M21 Ar+18%CO2	210.0	2200.0
46		735		ER70 S-6	0.8	M21 Ar+18%CO2	130.0	2200.0
47	808			ER70 S-6	0.9	M21 Ar+18%CO2	160.0	2200.0
47			1696	ER70 S-6	0.9	M21 Ar+18%CO2	140.0	1250.0
48	603			ER70 S-6	1.0	M21 Ar+18%CO2	160.0	2200.0
48		891		ER70 S-6	1.0	M21 Ar+18%CO2	100.0	2200.0
48			1646	ER70 S-6	1.0	M21 Ar+18%CO2	80.0	1050.0
49	783			ER70 S-6	1.2	M21 Ar+18%CO2	160.0	2200.0
49		271		ER70 S-6	1.2	M21 Ar+18%CO2	60.0	1500.0
49			1622	ER70 S-6	1.2	M21 Ar+18%CO2	100.0	900.0
56	765			ER316 L Si	0.8	M12 Ar+ 2,5% CO	220.0	2200.0

Prg Num	Operating Number			Wire		Gas	Wire feed speed Command range (cm/min)	
	Synergic	Pulsed - Synergic	CMT	Material	Dia.		Min	Max
56		766		ER316 L Si	0.8	M12 Ar+ 2,5% CO	100.0	2200.0
56			960	ER316 L Si	0.8	M12 Ar+ 2,5% CO	120.0	1500.0
57	524			ER316 L Si	0.9	M12 Ar+ 2,5% CO	200.0	2200.0
57		525		ER316 L Si	0.9	M12 Ar+ 2,5% CO	90.0	2200.0
58	767			ER316 L Si	1.0	M12 Ar+ 2,5% CO	200.0	2200.0
58		799		ER316 L Si	1.0	M12 Ar+ 2,5% CO	80.0	2200.0
58			1638	ER316 L Si	1.0	M12 Ar+ 2,5% CO	120.0	1300.0
59	538			ER316 L Si	1.2	M12 Ar+ 2,5% CO	190.0	2200.0
59		539		ER316 L Si	1.2	M12 Ar+ 2,5% CO	80.0	2200.0
59			1628	ER316 L Si	1.2	M12 Ar+ 2,5% CO	100.0	1020.0
63			1069	ER5356	1.0	I1 100% Ar	120.0	1050.0
64			1678	ER5356	1.2	I1 100% Ar	150.0	900.0
68			1075	ER4043	1.0	I1 100% Ar	100.0	1300.0
69			1659	ER4043	1.2	I1 100% Ar	130.0	650.0
71	220			ER CuSi-A	0.8	I1 100% Ar	350.0	2000.0
71		219		ER CuSi-A	0.8	I1 100% Ar	200.0	2200.0
71			920	ER CuSi-A	0.8	I1 100% Ar	150.0	1250.0
72	531			ER CuSi-A	0.9	I1 100% Ar	200.0	2200.0
72		530		ER CuSi-A	0.9	I1 100% Ar	100.0	1600.0
73	638			ER CuSi-A	1.0	I1 100% Ar	200.0	800.0
73		57		ER CuSi-A	1.0	I1 100% Ar	110.0	1560.0
73			878	ER CuSi-A	1.0	I1 100% Ar	100.0	1100.0
74			918	ER CuSi-A	1.2	I1 100% Ar	80.0	960.0
78			1119	ER430	1.0	M13 Ar+ 3% CO2	430.0	650.0
79			1406	ER430	1.2	M13 Ar+ 3% CO2	60.0	900.0

10 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.

10.1 INTRODUCITON

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) including this option. Following combinations of welder model and communication protocol are supported.

Table 10.1 Communication protocol pf Fronius welder

Welder Model	Description
ROB 5000	This model is communicated by using the FANUC Process I/O board (In this manual, a detailed setting method is not described).
TWIN with DNet (DeviceNet)	This model is communicated by using the DeviceNet (In this manual, a detailed setting method is not described).
TS/TPS with DNet （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）	There is no necessary hardware at the robot side. One of the following software options is required. A05B-xxxx-R785 Full channel Ethernet IP scanner A05B-xxxx-R889 1 channel Ethernet IP scanner A05B-xxxx-R890 2 channel Ethernet IP scanner 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.

10.2 PREPARATION FOR TS/TPS WELDER

Before switching the selection of welder manufacturer / model, it is necessary to perform the setup described in this Section.

10.2.1 Examination for the Number of Using I/O

Fronius welder requires a lot of digital I/O as shown below.

Table 10.2.1 Number of using I/O for Fronius welder

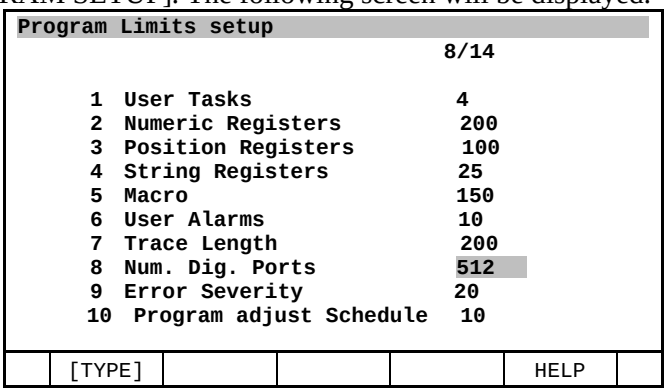
Welder Model	Number of required DI	Number of required DO
TS/TPS with DNet	104	96
TS/TPS with ENet	296	296

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 10-2-1 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.



4 Move the cursor to [Num. Dig. Ports] and change it to the desired points (The maximum is 4096).

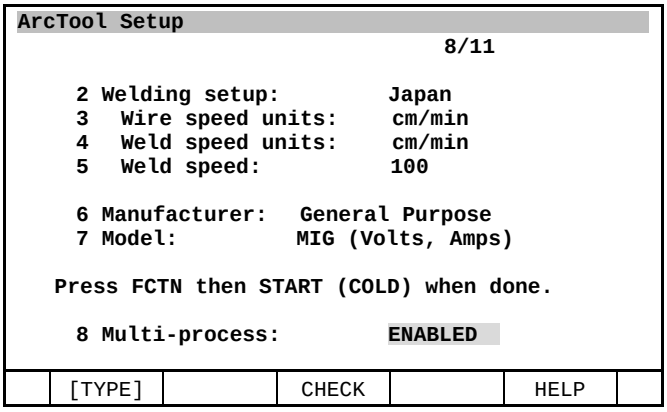
10.2.2 Setting of Multi-Process Function

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 10-2-2 Setting of multi-process function

Condition

- ArcTool setup screen is displayed after performing Controlled Start.



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.

10.2.3 Preparation of EtherNet Communication

In the case of TS/TPS welder and EtherNet communication, 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.**
There are following two procedures to set the IP address of the welder

A) SETUP by RSU (Remote Control Unit: It is option of Fronius welding power supply)
   - IP address and Subnet Mask can be set arbitrarily.
B) SETUP by Fronius Explore (PC tool) which is used after PC and service port are connected with dedicated cable (Local Net RS232-C: It is option of Fronius welding power supply)
   - IP address and Subnet Mask can be set arbitrarily.

For more details, please refer to the Fronius welder manual.

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**

10.2.4 Preparation of DeviceNet Communication

In the case of TS/TPS welder and DeviceNet communication, it is necessary to set the DIP switch of Device Net in the both robot side and welder side. **Settings in the robot were already set when robot was shipped, so those settings are usually not required.** For setting of DIP switch, please refer to the following table.

Table 10.2.4 (a) Setting of the DIP switch of DeviceNet board

Board number (= EQ number)	DIP switch of DeviceNet board					
	1	2	3	4	5	6
1	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF
3	OFF	OFF	ON	OFF	OFF	OFF
4	OFF	ON	ON	OFF	OFF	OFF

On the other hand, Fronius DeviceNet hardware (BECKHOFF) is required in the welder side. The following figure is setting example of BECKHOFF BK5200. Please refer to the Fronius welder manual about the detailed information or the setting of other devices.

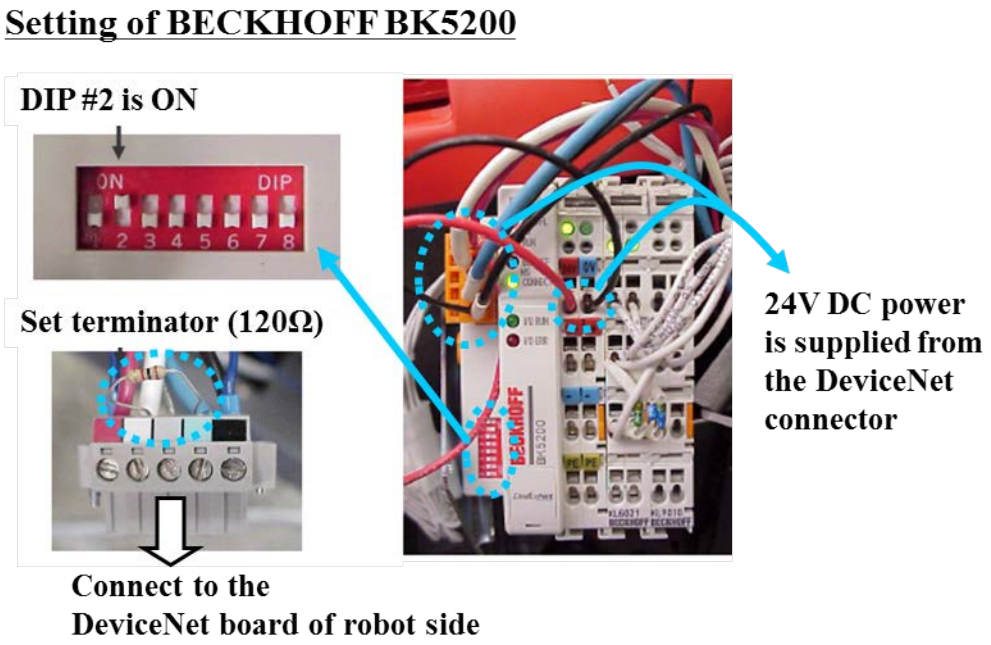


Fig. 10.2.4 Setting example of BECKHOFF BK5200

Fig. 10.2.4 is setting example for EQ1. In the case of multi equipment configuration, please refer to the following table about the setting of DIP switch for EQ2 and EQ3, EQ4.

Table 10.2.4 (b) Setting of DIP switch of BECKOFF

EQ Number	DIP switch of BECKHOFF								
	1	2	3	4	5	6	7	8	MAC ID
1	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	=2
2	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	=3
3	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	=4
4	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	=5

Please complete the preparation of hardware and the physical connection for DeviceNet communication in the both robot side and welder side.

10.3 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.

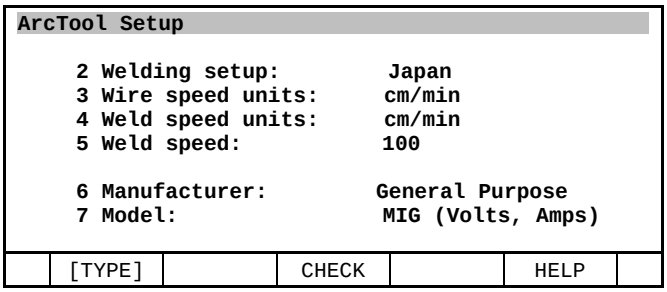
Procedure 10-3 Setting of welder manufacturer

Condition

- Fronius weld equipment library option (A05B-xxxx-R653) or Fronius Ethernet communication package (A05B-xxxx-J851) 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) is ordered.
- In the case of DeviceNet communication, DeviceNet hardware is connected and DeviceNet software option (A05B-xxxx-J753) is ordered.
- All preparations described in Section 10.2 are completed.

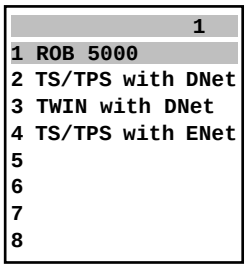
Step

1 Turn on the controller with the [PREV] and the [NEXT] key pressed. Then select [3 Controlled start]. The following screen will be displayed.

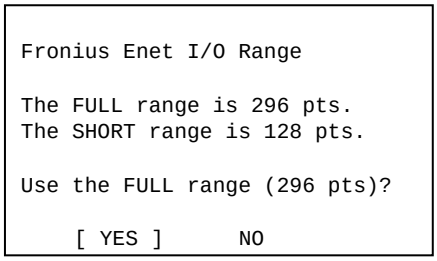


2 Move the cursor to [Manufacturer] and press F4[CHOICE]. Select the [Fronius]. ArcTool internal auto setup process is performed. [Model] is selected to ROB 5000 by default.

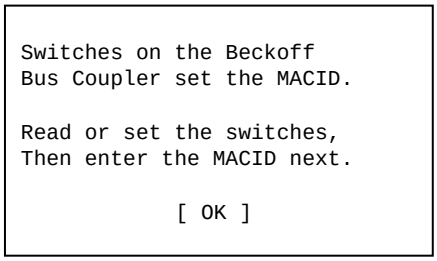
3 When other models are used, move the cursor to [Model] and press F4[CHOICE]. The following menu will be displayed, so select the desired model.



4 When [TS/TPS with ENet] is selected at step 3, the following screen will be displayed. Move the cursor to [YES] and press the [ENTER] key. Proceed to the step 5.

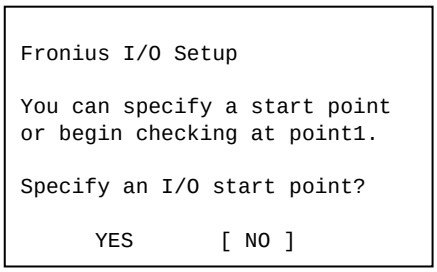


When [TS/TPS with DNet] is selected at step 3, following screen will be displayed. When the [ENTER] key is pressed, the input of MAC ID is required, so input “2” (In the case of multi equipment configuration, this changes according to the EQ number. Please input the MAC ID that is decided by the setting of BECKHOFF DIP switch, this is set at the Subsection 10.2.4). Proceed to the step 5.

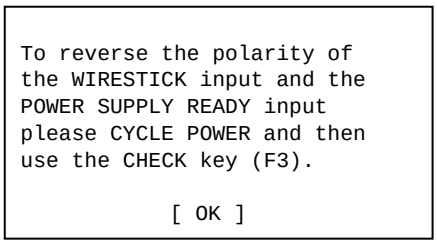


5 Continuously, following screen is displayed. If the start point of digital I/O range that is used in the communication with Fronius welder is not specified, select [NO]. In this case, it is automatically

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, …).



6 Continuously, following screen is displayed. Perform cycle power the robot controller after pressing the [ENTER] key for closing the following screen (It is not cold start).



7 Robot controller start up with controlled start again. Press F3[CHECK].
8 The procedure for setting of welder manufacturer / model is complete. Perform cold start from the [FCTN] menu.

10.4 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.

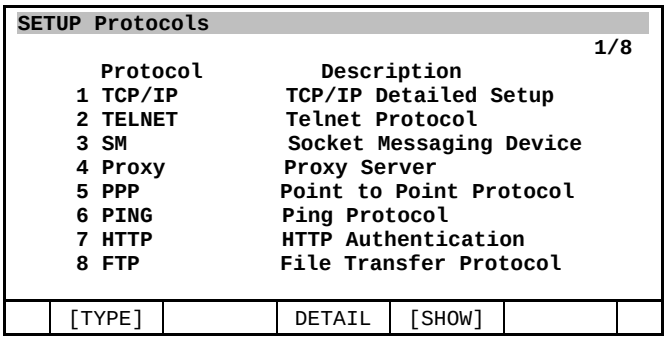
10.4.1 Setting of Robot Ethernet IP Address

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.

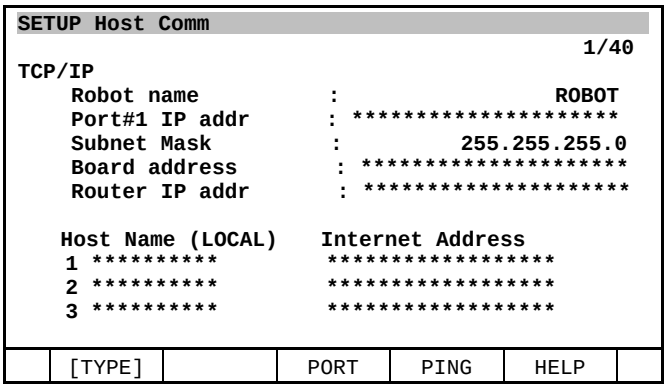
Procedure 10-4-1 Setting of robot Ethernet IP address

Step

1 Press the [MENU] key and select [SETUP]. Press F1[TYPE] and select [Host Comm]. The following screen will be displayed.



2 Move the cursor to the first line (TCP/IP) and press F3[DETAIL]. The following screen will be displayed.



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 10.2.3.
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).

10.4.2 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 10-4-2 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.

```
I/O EtherNet/IP
Scanner Configuration    :                    1/10
    Description          :    Fronius EQ1
    Name/IP address      :    ***********
    Vendor Id            :    90
    Device Type          :    12
    Product code         :    14
    Input size (bytes)   :    37
    Output size (bytes)  :    37

 [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.

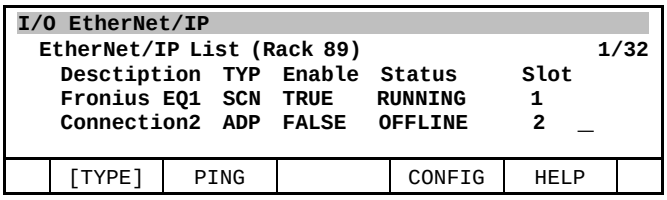
6 Move the cursor to the first row of the [Fronius EQ1] line and press F4[CONFIG].

7 Set the IP address of welder to [Name/IP address] according to the decision in the Subsection 10.2.3.

8 Press F2[ADV]. The following screen will be displayed.

```
I/O EtherNet/IP
Advanced Configuration    :                  1/13
 General
    I/O Data Type         :    8-BIT BYTES
    Timeout Multiplier    :    4
    Reconnect             :    FALSE
    Major Revision        :    0
    Minor Revision        :    0

 [TYPE]  [ ]  PREV  [CHOICE]  HELP
```

9 Set “Reconnect” 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).



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

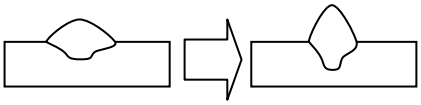
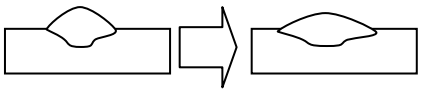
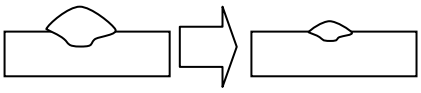
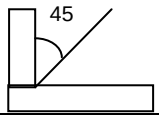
#	Factor	Change	Effect to bead	Notes
1	Wire feed speed or Weld current	Higher	Penetration becomes deeper Width of bead becomes wider Toe angle becomes smaller Less spatter	
2	Arc length correction (Weld Voltage)	Higher	Arc length becomes longer Penetration becomes shallower Width of bead becomes wider 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 
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°

#	Factor	Change	Effect to weld	Notes
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. Set Arc length correction (weld voltage) higher 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
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. Set Arc length correction (weld voltage) lower 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. Set Arc length correction (weld voltage) higher 3. Set welding speed faster 4. Set contact tube distance shorter 5. Clean up groove face

#	Problem in appearance	Counter plan
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/cm2 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 Arc length correction (weld voltage) 2. Wire size is too big 3. Torch angle is too wide 4. Arc blow occurs

B PERIODIC MAINTENANCE TABLE

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 length of wire feeding	0.1H			○		○		○		○		○	
	7	Check the gas valve	0.1H			○		○		○		○		○	
Welding torch	8	Replacing torch cable (Including conduit)	1.0H					●				●			
	9	Replacing liner	0.5H					●				●			
Around cable	10	Confirm the wire conduit	0.1H					○				○			
Water cooling unit	11	Replacing the coolant	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
○				○				○				○				○				11

C STRENGTH OF BOLT AND BOLT TORQUE LIST

NOTE

When applying LOCTITE to a part, spread the LOCTITE on the entire length area 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 the oil on the engaging section. Make sure that there is no solvent left in the threaded holes. In this case, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes.

Adopt following strength bolts. Comply with any bolt specification instructions as specified.
Hexagon socket head bolt made by steel:

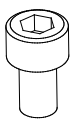
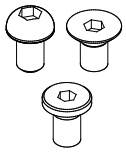
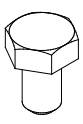
Size M22 or less: Tensile strength 1200N/mm^2 or more
Size M24 or more: Tensile strength 1000N/mm^2 or more
All size plating bolt: Tensile strength 1000N/mm^2 or more

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 are not specified.

Recommended bolt tightening torques **Unit: Nm**

Nominal diameter	Hexagon socket head bolt (Steel)		Hexagon socket head bolt (stainless)		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.

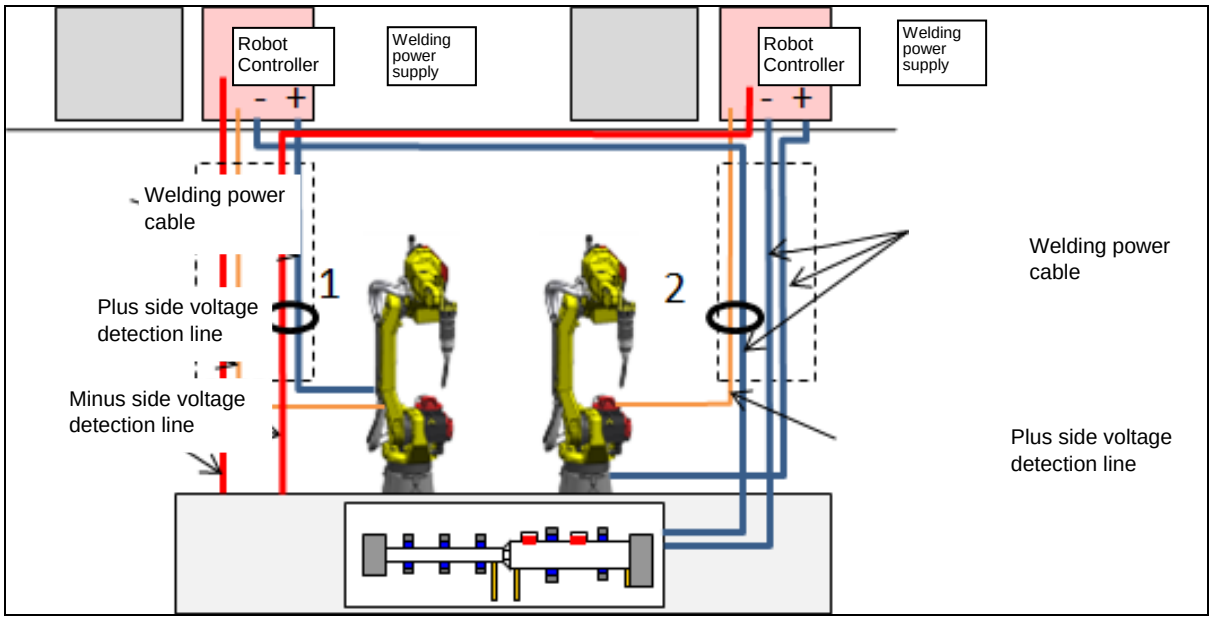


Fig. D (a) Bad wiring example

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.

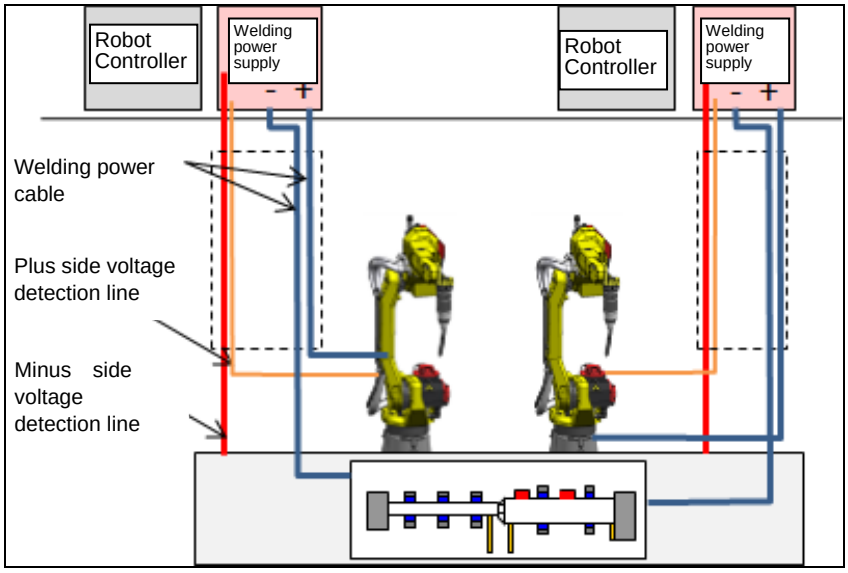


Fig. D (b) Good wiring example

INDEX

<Number>

1-YEAR (3840 HOURS) CHECKS 112
6-MONTH (1920 HOURS) CHECKS 112

<A>

Acquisition of All Backup 130
Acquisition of Image Backup 130
Adjustment of the Flexible Conduit Length 34
Adjustment of Weld Schedule at Weld Start Position 74
Air Cooling Torch 143
ALIGNMENT WORK 41,103
Arc Abnormal Monitor Function (Option) 92
Arc Weld End Instruction 69
Arc Weld Start Instruction 69
Arc Welding Analogue Meter Displaying Function (Option) 93
ARC WELDING FUNCTIONS 73
Auto Recovery of TCP Gap 91
Auto Recovery to Pause Position 81

<B>

Backup 106
BASIC OPERATION 56
BASIC OPERATION (QUICK REFERENCE) 25
BASIC OPERATION FOR TS/TPS WELDER 56

<C>

Cable 110
CABLE FORMING ROUT FOR USING MULTI WELDING POWER SUPPLY 173
Check and Reset of Wire Stick 79
Checking Gas Flow Rate 111
CHECKS AND MAINTENANCE 108
Communication Cable Specifications 20
Communication error with welding power supply 127
Confirmation of the Alarm History 130
CONNECTION 26
Connection of Controller and Welding Power Supply 29
Connection of Input Power Supply of the Welding Power Supply 36
Connection of Input Power Supply to Controller 27
Connection of Robot and Controller 26
Connection of Welding Power Supply and Robot 31
Coolant 115
Correcting a Position 63
COUNTERMEASURE TO WELDING DEFECTS 168
CREATING MOTION PROGRAM 42

<E>

Edit by Using Program Edit Instructions 66
Editing of Motion Instruction 61
EDITING OPERATION OF PROGRAM 60
Examination for the Number of Using I/O 155
EXECUTION OF WELD PROGRAM 54

<F>

FLOW FOR WELDING 25
FUNCTION OF ARC WELDING END TIMING 79
FUNCTION OF ARC WELDING START TIMING 73

<G>

Gas 114
Gas Control at Weld End Timing 80
Gas Control by External Devices 83
Gas Control Just before Weld Start 73

<I>

INFLUENCE BY ADJUSTMENT OF WELDING CONDITION 167
INITIAL SETTING 155
INTRODUCITON 155

<L>

Liner 115
LIST OF PROGRAM NUMBER OF TS/TPS WELDER 152

<M>

MAINTENANCE PARTS 149
Malfunction at The Switching Characteristic Line 125
MANUAL OPERATION FOR WELDING 50
Mechanical Unit Specification 2
Monitoring Functions 85
MOVING THE ROBOT MANUALLY (JOGGING) 38

<N>

Note while Teaching Arc Weld Instruction 70
Nozzle 115

<O>

Occurrence of error-E30 127
Operating Mode 56
OPERATION FOR TS/TPS WELDING MACHINE 96
Operation Method of Fronius Xplorer 100
OPTION CONSTITUTION 20
OTHER FUNCTION RELATED TO ARC WELDING 81
OVERVIEW 1

<P>

Parameter Correction of Gas Preflow/Post Flow 106
Parameter Correction of the Special 2-step 105
PARAMETER OF WELD SCHEDULE 59
PERIODIC MAINTENANCE TABLE 170
PREFACE p-1
Preparation 96
PREPARATION FOR TS/TPS WELDER 155
Preparation of DeviceNet Communication 157
Preparation of EtherNet Communication 157
Pressurization Power Adjustment of the Roller 35
PROCESS MODE 152

PROGRAM BACK-UP....116

<R>

REMEDY FOR TROUBLES....129
REPALCING THE WATER COOLING UNIT 148
REPLACING CONSUMABLES....113
REPLACING HOSE PACK (TORCH CABLE CHANGING) 133
REPLACING PARTS OF ROBACTA DRIVE AND ROBOT SIDE....147
REPLACING PARTS OF ROBACTA DRIVE AND TORCH SIDE....146
REPLACING PARTS OF THE WIRE FEEDER 147
REPLACING THE FEED ROLLER AND THE FOLLOW ROLLER....142
REPLACING THE FEEDER ROLLS 141
REPLACING THE GUIDE NOZZLE....146
REPLACING THE LINER....138
REPLACING THE NOZZLE HOLDER (IN CASE OF AIR COOLING TORCH) 145
REPLACING THE TORCH NECK 143
REPLACING THE WELDING POWER SUPPLY....132
REPLACING THE WIRE FEEDER....147
REPLACING UNITS....132
Retry after Weld Start Failed 76
Robot Controller 7
ROUTINE INSPECTION 108

<S>

SAFETY PRECAUTIONS s-1
Selecting and Editing of Program 60
SETTING AFTER SETTING OF WELDER MANUFACTURER....160
Setting of Ethernet IP Scanner 162
Setting of Multi-Process Function....156
Setting of Robot Ethernet IP Address 160
Setting of Weld Procedure 57
SETTING OF WELDER MANUFACTURER....158
SPECIFY ARC WELD SCHEDULE....46
STANDARD CONFIGURATION....1
STRENGTH OF BOLT AND BOLT TORQUE LIST 172

<T>

TAST Tracking (Fronius Welder)....95
TEACHING AND EDITING OF ARC WELD INSTRUCTION 69
Teaching of Arc Direct Instruction 71
Teaching of Arc Indirect Instruction....70
TEST OPERATION....51
Tip....115
Torch Guard Function....90
Touch Sensing (Option) 94
TROUBLE SHOOTING....117
TROUBLE SHOOTING ABOUT ALARM 117
TROUBLE SHOOTING AGAINST SITUATIONS....122
TURNING ON THE POWER....37

<W>

Water Cooling Torch 144
Water cooling unit....111
WELD CONDITION ADJUSTMENT 167
Weld External Output Function 89
Welding Output does not be Obtained According to The Welding Command....124
Welding Power Supply 14,108
Welding Torch 18,109
Welding Wire....111
Wire 113
Wire Buffer....18
Wire Feed Control by External Devices 84
Wire Feeder....17,109
WIRE INCHING / RETRACT 41

REVISION RECORD

Edition	Date	Contents
02	May., 2018	・Addition of R-30*i*B Mate Plus Controller ・Addition of NOTE, part replacing procedure and maintenance parts ・Correction of errors
01	Mar., 2017	

B-83614EN-3/02