Motoman XRC Controller

ComArc Function Instruction Manual

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SECTION 1
INTRODUCTION

1.1 About this Document

This manual provides instructions for ComArc Function and contains the following sections:

SECTION 1 – INTRODUCTION

General information about this manual, a list of reference documents, and customer service information.

SECTION 2 – SAFETY

Provides information for the safe use and operation of Motoman products.

SECTION 3 – COMARC FUNCTION

Provides detailed instructions to utilize the ComArc Function.

APPENDIX A – COMARC III SUPPLEMENT

Provides set-up parameters and instructions for programming a dual ComArc configuration.

1.2 Reference to Other Documentation

For additional information refer to the following:

- Concurrent I/O Parameters Manual (P/N 142102-1)
- Operator's Manual for General Purpose (P/N 142099-1)
- Operator's Manual for Handling (P/N 142100-1)
- Operator's Manual for Spot Welding (P/N 142101-1)
- Operator's Manual for Arc Welding (P/N 142098-1)
- Motoman UP6, XRC Manipulator Manual (P/N 142104-1)
- Motoman UP20, XRC Manipulator Manual (P/N 144342-1)
- Motoman UP50, XRC Manipulator Manual (P/N 144343-1)
- Motoman UP130, XRC Manipulator Manual (P/N 142107-1)

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (UP6, SK16X, etc.)
- Application Type (welding, handling, etc.)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)

NOTES

SECTION 2
SAFETY

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

- DANGER
- WARNING
- CAUTION
- NOTE

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

DANGER!

Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

WARNING!

Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

CAUTION!

Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

NOTE: Information appearing in a NOTE caption provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

- Any modifications to PART 1 of the MRC controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will **VOID YOUR WARRANTY!**
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. **YOUR WARRANTY WILL BE VOID** if you use these special passwords.
- Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place.
- Check the E-STOP button on the teach pendant for proper operation before programming.
- Carry the teach pendant with you when you enter the workcell.
- Be sure that only the person holding the teach pendant enters the workcell.
- Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Be sure all safeguards are in place.
- Use proper replacement parts.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

YASNAC XRC OPTIONS INSTRUCTIONS

FOR ARC SENSOR COMARC FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN SETUP MANUAL
MOTOMAN-□□□ INSTRUCTIONS
YASNAC XRC INSTRUCTIONS
YASNAC XRC OPERATOR'S MANUAL
YASNAC XRC OPERATOR'S MANUAL for BEGINNERS

The YASNAC XRC operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.

YASKAWA

MANUAL NO. HW9482786 ◇1

MANDATORY

- This manual explains the arc sensor COMARC function of the YASNAC XRC system and general operations. Read this manual carefully and be sure to understand its contents before handling the YASNAC XRC.
- General items related to safety are listed in Section 1: Safety of the Setup Manual. To ensure correct and safe operation, carefully read the Setup Manual before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the YASNAC XRC.

In this manual, the Notes for Safe Operation are classified as “WARNING,” “CAUTION,” “MANDATORY,” or ”PROHIBITED.”

 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.
 MANDATORY	Always be sure to follow explicitly the items listed under this heading.
 PROHIBITED	Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

WARNING

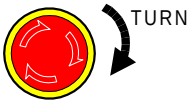
- Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the playback panel or programming pendant are pressed.
  When the servo power is turned off, the SERVO ON READY lamp on the playback panel and the SERVO ON LED on the programming pendant are turned off.

  Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Emergency Stop Button 

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON

  Injury may result from unintentional or unexpected manipulator motion.

Release of Emergency Sto 

- Always set the Teach Lock before entering the robot work envelope to teach a job.

  Operator injury can occur if the Teach Lock is not set and the manipulator is started from the playback panel.

- Observe the following precautions when performing teaching operations within the working envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

  Improper or unintended manipulator operation may result in injury.

- Confirm that no persons are present in the manipulator's work envelope and that you are in a safe location before:
  - Turning on the YASNAC XRC power
  - Moving the manipulator with the programming pendant
  - Running check operations
  - Performing automatic operations

  Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems.The emergency stop button is located on the right side of both the YASNAC XRC playback panel and programming pendant.

WARNING

- Since detected voltage (200V), welding current, and welding voltage are applied to the starting point detecting unit, install the unit securely so that it does not fall.

  Failure to observe this warning may result in an electric shock or damage to the unit.

- Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the XRC and the welder.

  Failure to observe this warning may result in an electric shock.

- Special attention should be paid during starting point detection, since 200 VDC is applied across the wire and the workpiece (welding jig).

  Failure to observe this warning may result in an electric shock.

- Do not place any object directly on the cable of the starting point detecting unit.

  Failure to observe this warning may result in an injury or damage caused by the disconnection of the cable.

- Attach the cable of the starting point detecting unit for the wire feeder with the wire stand, to protect it from robot movement. If interference between the cable and the peripheral devices can not be avoided, cover the cable with a rubber plate or spiral tube, etc.

  Failure to observe this warning may result in an electric shock, aninjury, or damage to the cable.

- Do not lay the cable of the starting point detecting unit directly on the floor, but install them in a pit or duct or attach the cable with a protective cover.

  Failure to observe this warning may result in an injury or damage to the cable.

- Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables can not be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  -Check for problems in manipulator movement.
  -Check for damage to insulation and sheathing of external wires.

- Always return the programming pendant to the hook on the XRC cabinet after use.

  The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Correctly fix the connector at the starting point detecting unit end of the inter-unit cable by fully pushing it into position and tightening the coupling nut.

- The other cables are connected to the terminal stand. Fully tighten the terminal screws to correctly fasten the cables.

  Failure to observe this caution may result in an injury, damage, or an electric shock.

- After connecting the cables, correctly attach the terminal covers on the starting point detecting unit and welder.

  Failure to observe this caution may result in an electric shock.

- Read and understand the Explanation of the Alarm Display in the setup manual before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product.
The manipulator usually consists of the controller, the playback panel, the programming pendant, and supply cables.
The MOTOMAN manipulator is the YASKAWA industrial robot product.
In this manual, the equipment is designated as follows.

Equipment	Manual Designation
YASNAC XRC Controller	XRC
YASNAC XRC Playback Panel	Playback Panel
YASNAC XRC Programming Pendant	Programming Pendant

Descriptions of the programming pendant and playback panel keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page ke  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}
Playback Panel	Buttons	Playback panel buttons are enclosed in brackets. ex. [TEACH] on the playback panel

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed.

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1 Installation

WARNING

- Since detected voltage (200 V), welding current, and welding voltage are applied to the starting point detecting unit, install the unit securely so that it does not fall.

  Failure to observe this warning may result in an electric shock or damage to the unit.

The starting point detecting unit should be installed outside of the manipulator interference area.
For installation methods of a starting point detecting unit and a current detecting unit, refer to the diagrams of each type.

1.1 Floor-mounted Standard Type

The floor-mounted standard type should be installed on the side of the welder.
When installing a floor-mounted standard type on a welder or another device, attach the unit securely with a fixing jig to the 4-M6 tapped mounting holes on the side of unit to prevent the unit from falling.

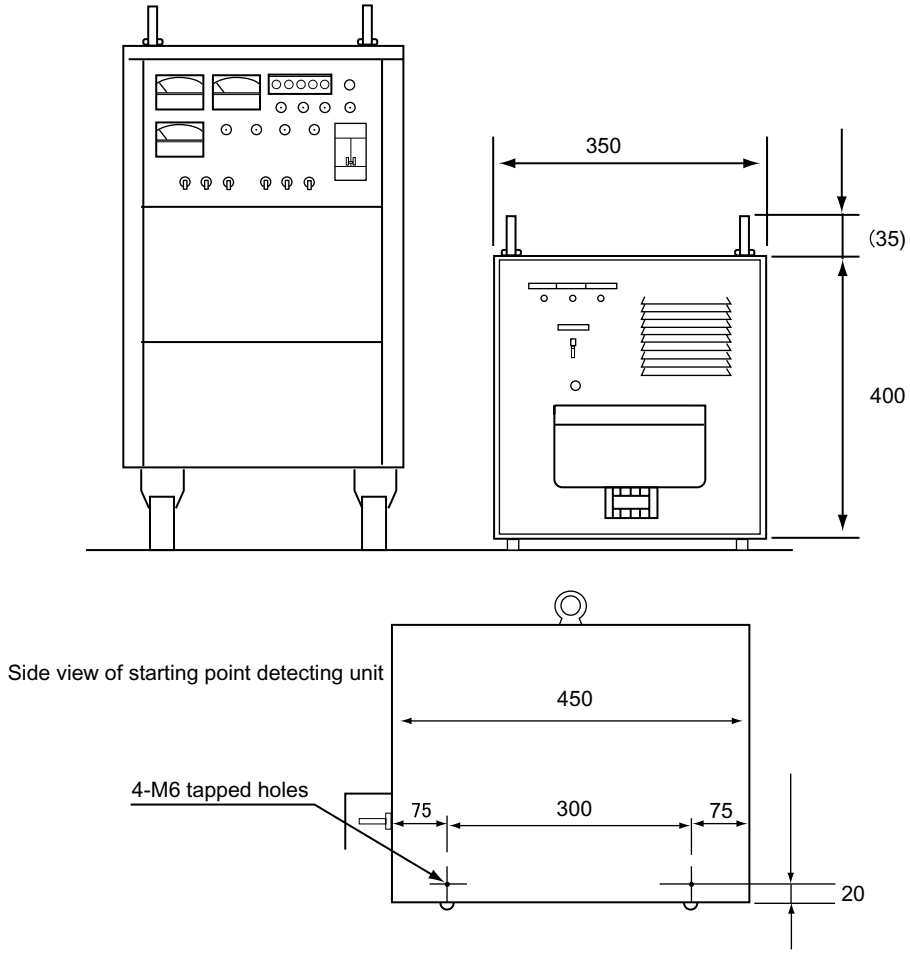


Fig. 1 Floor-mounted Standard Type Installation (Dimensions in mm)

1.2 Floor-mounted Slim Type

To prevent the unit from falling, weld the bracket at the bottom of the starting point detecting unit to the common base, or drill holes on the bracket to attach the unit with anchor bolts.

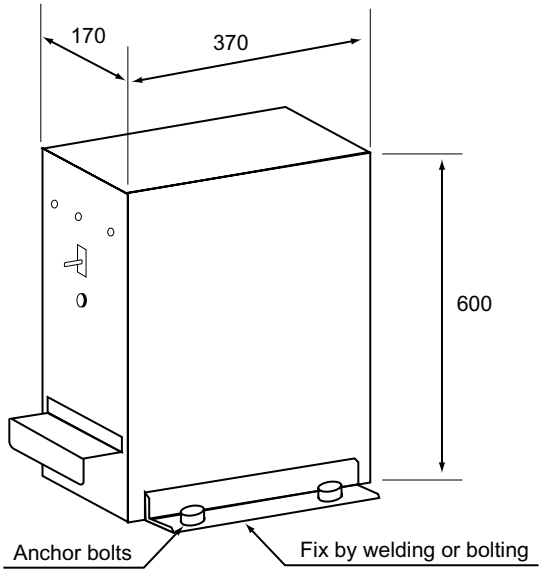


Fig. 2 Floor-mounted Slim Type Installation (Dimensions in mm)

1.3 Side-by-side Type

The starting point detecting unit should be attached to a welder with eyebolts on the top of the welder.

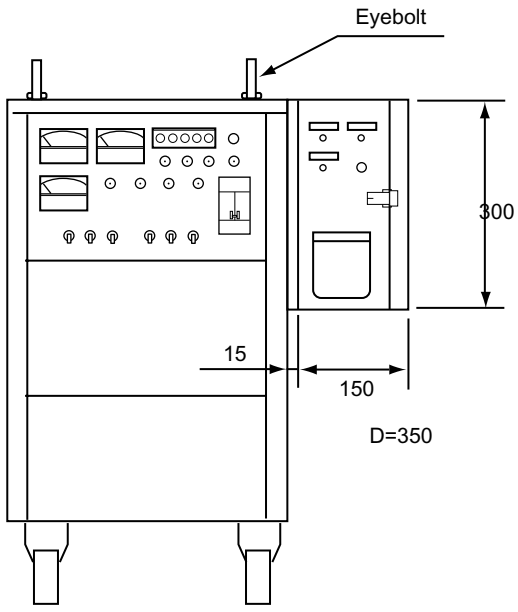
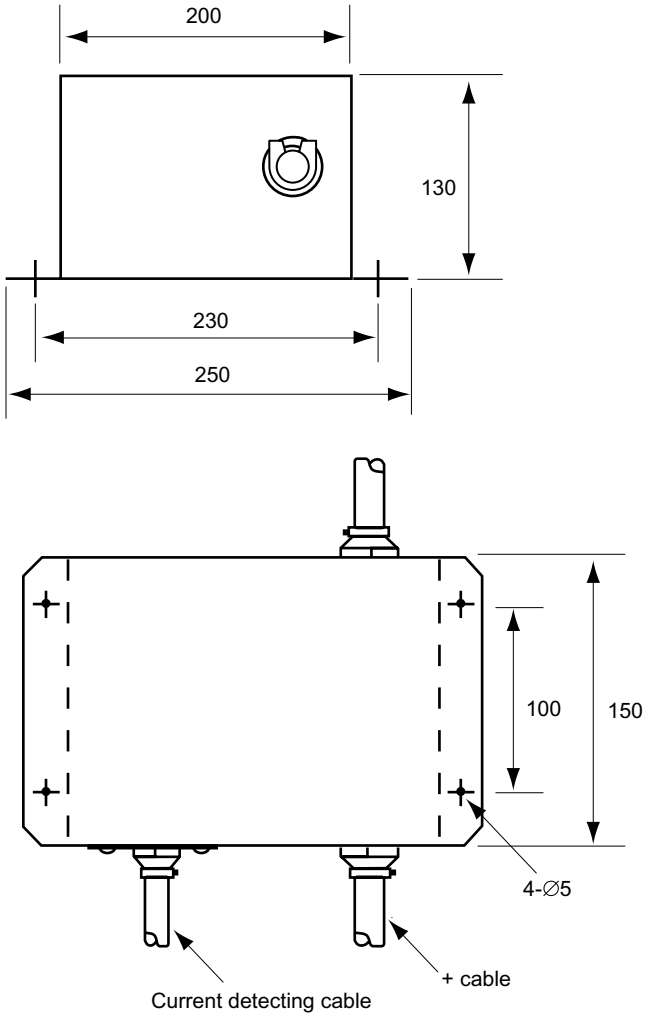


Fig. 3 Side-by-side Type Installation (Dimensions in mm)

1.4 Current Detecting Unit

Attach the unit securely to the mounting holes (4-ϕ5).



2 Wiring

WARNING

- Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the XRC and the welder.

  Failure to observe this warning may result in an electric shock.

- Special attention should be paid during starting point detection, since 200 VDC is applied across the wire and the workpiece (welding jig).

  Failure to observe this warning may result in an electric shock.

- Do not place any object directly on the cable of the starting point detecting unit.

  Failure to observe this warning may result in an injury or damage caused by the disconnection of the cable.

- Attach the cable of the starting point detecting unit for the wire feeder with the wire stand, to protect it from robot movement. If interference between the cable and the peripheral devices can not be avoided, cover the cable with a rubber plate or spiral tube, etc.

  Failure to observe this warning may result in an electric shock, aninjury, or damage to the cable.

- Do not lay the cable of the starting point detecting unit directly on the floor, but install them in a pit or duct or attach the cable with a protective cover.

  Failure to observe this warning may result in an injury or damage to the cable.

- Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables can not be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.

CAUTION

- Insert the inter-unit cable on the starting point detecting unit side, firmly to the connector, and fix it securely by tightening the coupling nut.
- Fix the other cables connected to the terminal stand securely by tightening the terminal screws.

  Failure to observe this caution may result in an electric shock, an injury or damage caused by malfunctioning.
- After connected, be sure to reinstall the terminal covers of starting point detecting unit and welder.

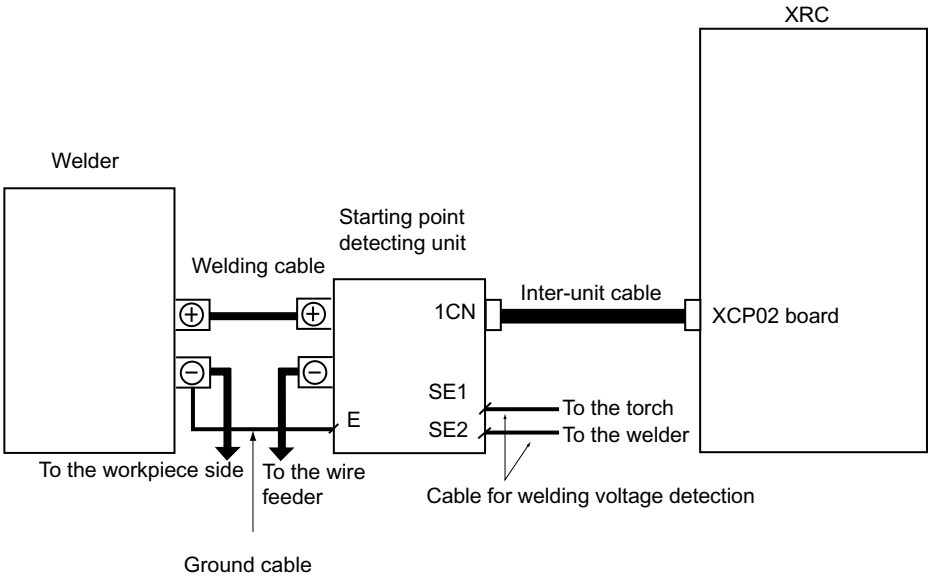
  Failure to observe this caution may result in an electric shock.

Wire the unit in the following manner, referring to Figs. 4 and 5.

Starting Point Detecting Unit

1. Connect the starting point detecting unit to the XRC.
2. Connect the plus terminal of the starting point detecting unit to the plus terminal of the welder.
3. Connect the minus terminal of the starting point detecting unit to the torch power supply unit on the wire feeder.
4. For the floor-mounted standard type and the floor-mounted slim type, connect the front terminal stand of the starting point detecting unit to the welding voltage detecting terminal on the wire feeder.
   For the side-by-side type, connect the front terminal stand of the starting point detecting unit to the terminal stand inside the welder.

• Floor-mounted type (standard and slim types)



• Side-by-side type

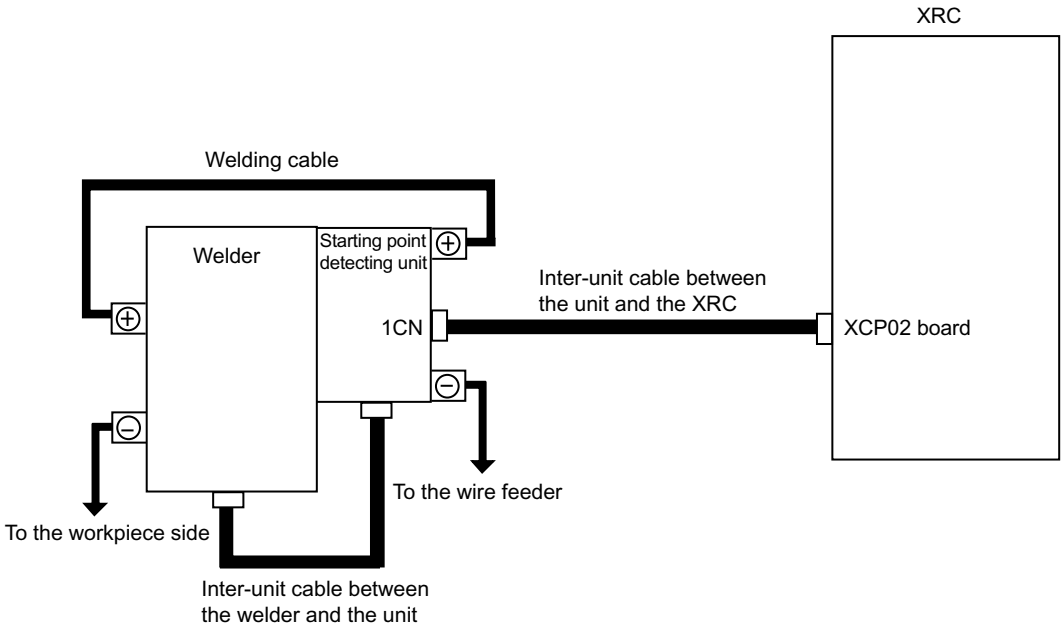


Fig 4 Diagram of Start Point Detecting Unit

SUPPLE -MENT

Side-by-side type start point detecting unit
DAIHEN: CPVY-350
NASTOA: Inverter Ace 350Y
MATSUSHITA: YD-350RFG10, YD-200RFG10

Current Detecting Unit

1. Connect the connection cable of current detecting unit to the XRC.
2. Connect the plus cable of the current detecting unit to the + terminal of the welder. Connect the other cable to the welding cable from the torch power supply unit on the wire feeder.

• Current detecting unit

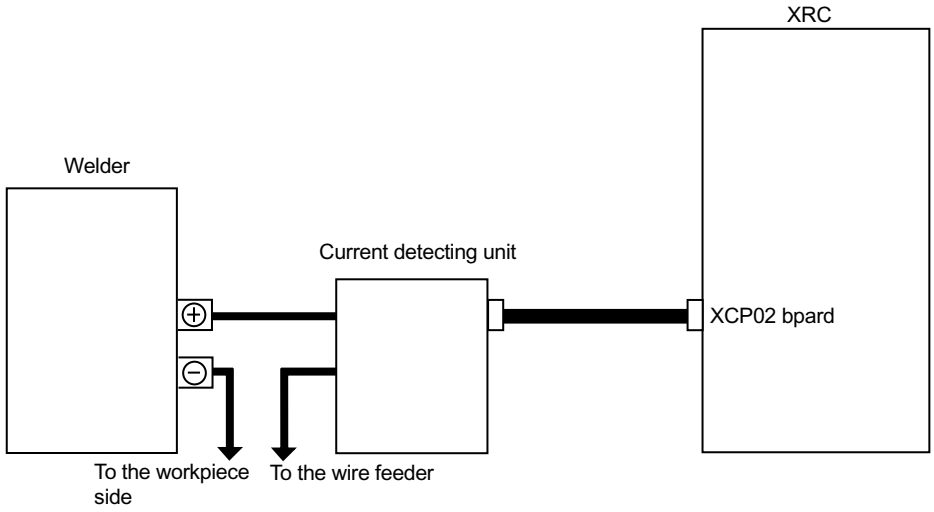


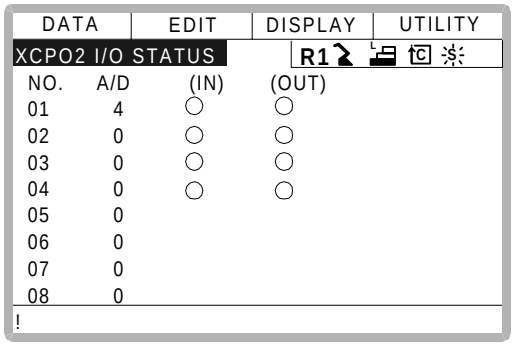
Fig 5 Diagram of Current Detecting Unit

2.1 Connection Diagnosis

To confirm a connection, perform a diagnosis of the input status to the XCP02 board. (The XCP02 board is a board for the COMARC.)
Use the following procedure to call the XCP02 I/O status display.

Operation

Select {IN/OUT} from the top menu ➡ Select {XCP02 I/O}



In this display, confirm the values read-by the XCP02 board's A/D converter and the general I/O status.
Eight channels are provided for the A/D converter, and four points are provided for general I/O.
Use the XCP02 I/O status display for the following purposes.

1. Check whether the A/D converter is correctly operating
2. Check whether the cables for the current detecting unit are correctly connected.

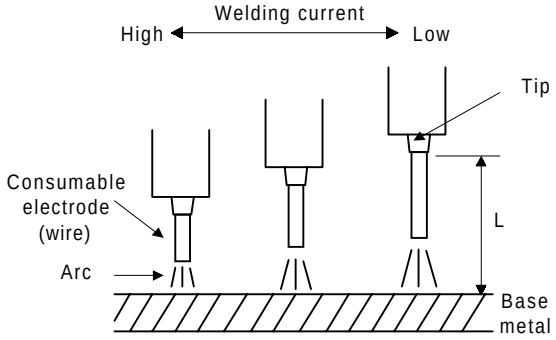
For an incorrect connection:	When welding is performed, the A/D data shows a negative value (- value).
For normal status:	When welding is performed, the A/D data shows a positive value (+ value). (Execute a job without using COMARCON and COMARCOF.)

NOTE The XCP02 I/O status display can be called only in "MANAGEMENT MODE". When the icon {XCP02 I/O} does not appear, switch the security mode to "MANAGEMENT MODE".

3 Arc Sensor Function

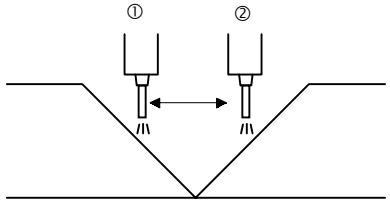
3.1 Basic Understanding of the Arc Sensor

For welding with a power supply that has constant voltage characteristics, the welding current fluctuates as the distance L changes as shown below. Distance L is the distance between the tip and the base metal. The arc sensor function uses these characteristics.



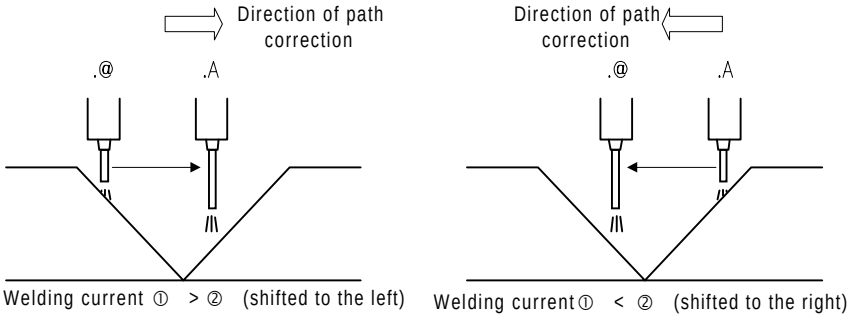
3.1.1 Left and Right Path Correctio

During welding with the torch weaving from side to side, an equal amount welding current flows on points ① and ② if the distance L is the same on both sides (points ① and ②) due to the aforementioned characteristics.



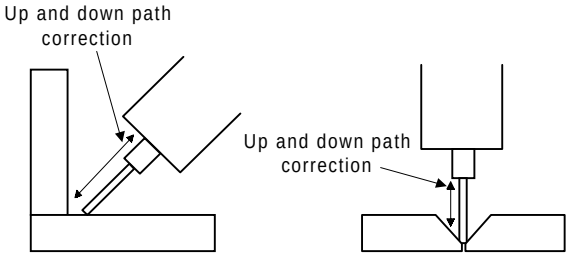
Welding current:① = ② , (When the distance between the tip and the base metal is the same on both sides.)

If the distances L are different at points ① and ②, different currents flow at these two points as shown below. The arc sensor checks the welding currents at points ① and ② and corrects the path to equalize the values.



3.1.2 Up and Down Path Correction

During welding with the torch moving up and down, the arc sensor checks the welding currents at any 2 points, an upper point and a lower point, and corrects the path to equalize the values.



3.1.3 Applicable Range of the Arc Sensor

The applicable metal thickness and joint are as follows.

Metal thickness: 3.2 mm or more
Joint: T joint, Lap joint
Speed: 1 m/min or less

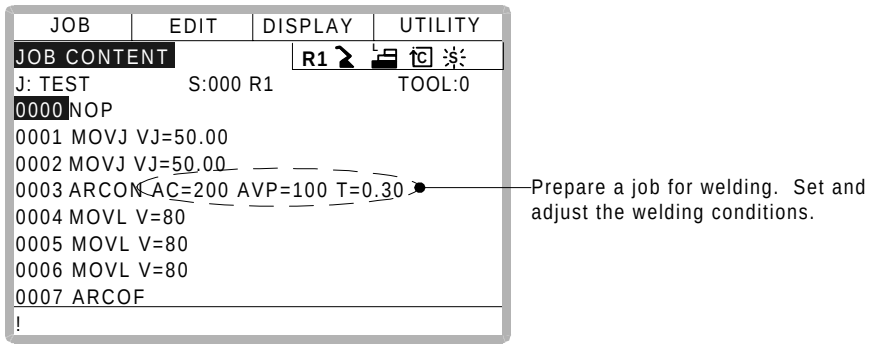
NOTE The arc sensor function can be used except in a spray transfer.

3.2 Main Operations for the Arc Sensor Function

■ Job Preparation for Welding and Adjustment of Welding Conditions

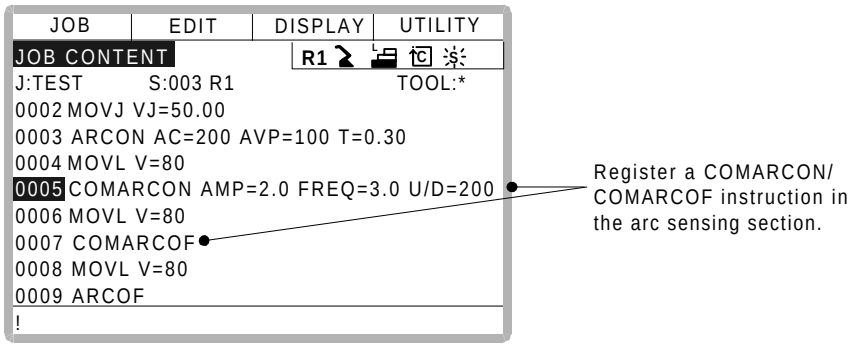
Prepare a job for welding and adjust the welding conditions.

.



■ Registration of Arc Sensing Instructions

Register a COMARCON/COMARCOF instructions in the section where arc sensing is to be performed.
Set the same value as the value of the current setting in the ARCON instruction as the UP/DOWN correction condition (U/D). Set “0” as the LEFT/RIGHT correction conditions (L/R).
When adjustment of the targeted position is required after seeing the results of the welding done with the arc sensor, adjust the UP/DOWN correction conditions (U/D) or the LEFT/RIGHT correction conditions (L/R). For details on how to adjust the UP/DOWN and LEFT/RIGHT correction conditions, refer to “5.4 Adjustment of Sensing Conditions”.



NOTE

- Depending on the welding current range to be used, the current value set with ARCON instruction may differ from the current value actually output from the welder. In this case, measure the sensing conditions when registering the COMARCON instruction.
  For details on how to measure a sensing condition, refer to “5 Measurement and Registration of Sensing Condition”.
  When an actual workpiece cannot be used to measure a sensing condition, use a test piece. Then, for the UP/DOWN and LEFT/RIGHT correction conditions (U/D and L/R) for the COMARCON instruction in the actual work job, enter the values based on those measurements using the number keys.
- When using welders other than the MOTOWELD-S350, measure the phase compensation value. For details on how to measure the phase compensation value, refer to “8 Phase Compensation Value”.

4 Registration of Instructions

4.1 COMARCON (Sensing Start Instruction)

The COMARCON instruction starts the arc sensing and weaving.
There are three types of settings for the COMARCON instruction: weaving conditions, sensor correction conditions (UP/DOWN, RIGH/LEFT), and the COMARC condition file No. specifications.
< > indicates numerical or alphabetical data.

COMARCON	Function	Starts arc sensing and weaving.		
	Instruction items	Settings	Data input range	Unit
		Weaving conditions* 1 AMP = <Weaving amplitude> FREQ = <Weaving frequency> ANGL=<Weaving angle> WEV# (<Weaving file No.>) DIR=<Weaving direction>	 AMP: 0.1 to 99.9 FREQ: 1.0 to 5.0 ANGL: 0.0 to 180.0 1 to 16 0 or 1	 0.1 mm 0.1 Hz 0.1 deg. - -
		Correction conditions U/D = <Correcting the up and down path) L/R = <Correcting the left and right path>	 U/D: 1 to 999 L/R: -255.0 to 255.0	 1 A 0.1 A
		COMARC condition file No. CAF# (<COMARC condition file No.>)	 1 to 16	 -
	Examples	COMARCON AMP=2.0 FREQ=3.0 U/D=200 L/R=0.0 COMARCON WEV#(1) U/D=200 L/R=0.0 COMARCON AMP=2.0 FREQ=3.0 U/D=200 L/R=0.0 CAF#(1) COMARCON WEV#(1) U/D=200 L/R=0.0 CAF#(1)		

1 Two setting methods are available: setting by AMP and FREQ or setting by WEV#. When weaving conditions are set by AMP and FREQ, the weaving mode is “single oscillation.” When ANGL is set to UNUSED, weaving angle is set to 45 deg.
Do not use DIR normally. DIR specifies the weaving direction changing. DIR=0 equals to UNUSED.

NOTE

- Be sure to register the COMARCON instruction after the ARCON instruction.
  Register the COMARCON/COMARCOF instruction and the ARCON/ARCOF instruction in the same job.
- For setting and adjusting sensor correction conditions, refer to “5 Measurement and Registration of Sensing Conditions”.
- When a COMARC condition file is not specified for the COMARCON instruction, perform sensing under the following conditions in the COMARC condition file display.
  - “CORRECTION SELECT” (direction of path correction): U/D & L/R (all directions)
  - “CONDITION” (operation after pass-over): NOT MONITOR

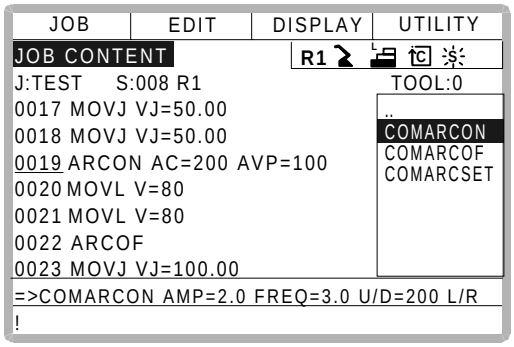
  For details on the COMARC condition file, refer to “6 COMARC Condition File”.

Operation

Move the cursor to the address area ➡ Press [INFORM LIST] ➡ Select “SENSOR”*1 ➡ Select “COMARCON” ➡ Press [SELECT], and set the conditions in the detail edit display*2 ➡ Press [ENTER] twice *3

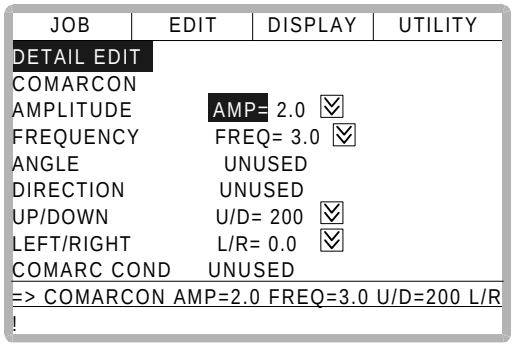
Explanation

1 The instruction appears with the previously registered additional items in the input buffer line.

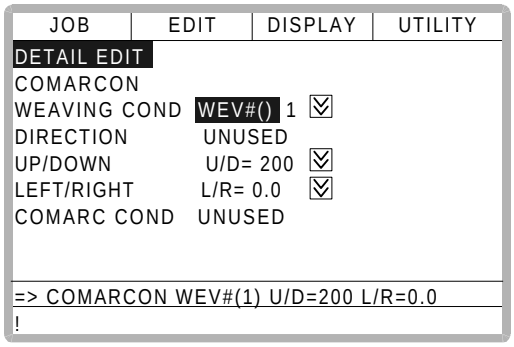


2 Move the cursor to the item to be set, and press [SELECT]. Enter each condition using the number keys, and then press [ENTER].
The following two methods are available to set weaving conditions.

- When a weaving condition is set by additional items



• When a weaving condition is specified by the file



3 Press [ENTER] to display the setting details in the input buffer line. Press [ENTER] again to register the setting details in the job.

4.2 COMARCOF (Sensing End Instruction)

The COMARCOF instruction ends arc sensing and weaving.

COMARCOF	Function	Ends arc sensing and weaving.
	Instruction item	-
	Example	COMARCOF

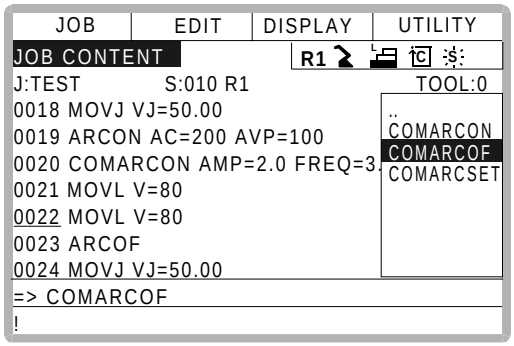
NOTE Be sure to register the COMARCOF instruction before the ARCOF instruction.
Register the COMARCON/COMARCOF instruction and the ARCON/ARCOF instruction in the same job.

Operation

Move the cursor to the address area ➡ Press [INFORM LIST] ➡ Select “SENSOR”*1 ➡ Select “COMARCOF” ➡ Press [ENTER]

Explanation

1 The instruction appears in the input buffer line.



4.3 COMARCSET (Sensing Condition Change)

The COMARCSET instruction changes the arc sensing conditions and the weaving conditions.
There are three types of settings for the COMARCSET instruction: weaving conditions (weaving amplitude, weaving angle), sensor correction conditions (correcting the up and down direction, correcting the left and right direction), and the COMARC condition file No. specifications.

<> indicates numerical or alphabetical data.

COMARCSET*1	Function	Changes the sensing conditions and the weaving condition.		
	Instruction items	Settings	Data input range	Unit
		Weaving conditions AMP = <Weaving amplitude> ANGL=<Weaving angle>	 AMP: 0.1 to 99.9 ANGL: 0.0 to 180.0	 0.1 mm 0.1 deg.
		Correction conditions U/D = <correcting the up and down path> L/R = <correcting the left and right path>	 U/D: 1 to 999 L/R: -255.0 to 255.0	 1 A 0.1 A
		COMARC condition file No. CAF# (<COMARC condition file No.>)	 1 to 16	 -
	Examples	COMARCSET AMP=2.5 U/D=210 L/R=0.0 CAF#(2) COMARCSET AMP=2.5 COMARCSET U/D=210 COMARCSET L/R=1.0 COMARCSET CAF#(2)		

1 For the COMARCSET instruction, only the items to be changed can be set.

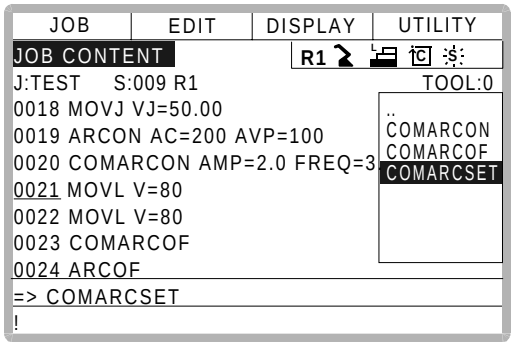
NOTE
- The conditions registered with the COMARCSET instruction are validated when executing the move instruction after the COMARCSET instruction.
- For setting and adjusting sensor correction conditions, refer to “5 Measurement and Registration of Sensing Conditions”.
- For details on the COMARC condition file, refer to “6 COMARC Condition File”.

Operation

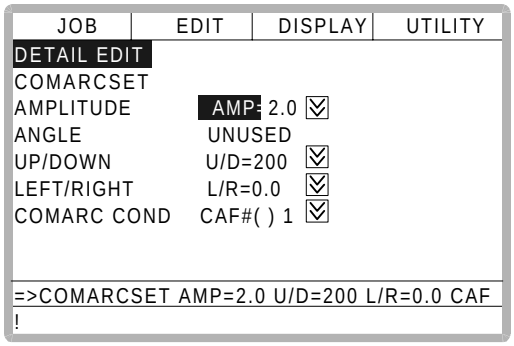
Move the cursor to the address area ➡ Press [INFORM LIST] ➡ Select “SENSOR”*1 ➡ Select “COMARCSET” ➡ Press [SELECT], and set the conditions in the detail edit display*2 ➡ Press [ENTER] twice *3

Explanation

1 The instruction appears with the previously registered additional items in the input buffer line.



2 Move the cursor to the item to be set, and press [SELECT]. Enter each condition by using the number keys, and then press [ENTER].



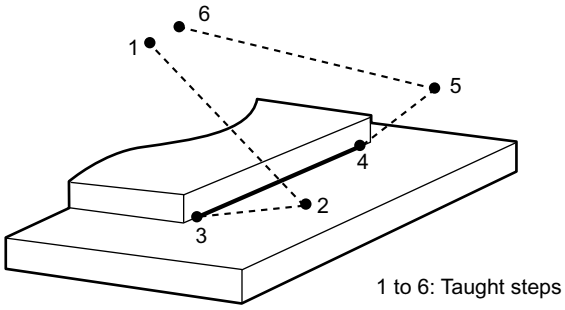
5 Measurement and Registration of Sensing Conditions

5.1 Job for Measuring Sensing Conditions

Play back the measuring job in the sensing condition measurement mode to automatically measure the data of the sensing conditions (correction conditions in the up/ down/left/right directions).
The following shows an example of a measuring job.

<Example>
Job for measuring sensing conditions

0000 NOP	
0001 MOVJ VJ=50.00	Stand-by position
0002 MOVJ VJ=50.00	
0003 MOVJ VJ=30.00	Welding start position
0004 ARCON AC=200 AVP=100	
0005 COMARCON AMP=2.0 FREQ=3.0 U/D=200 L/R=0.0	Sensing starts (measures a condition)
0006 MOVL V=80	Welding end position
0007 COMARCOF	Sensing completed
0008 ARCOF	
0009 MOVJ VJ=30.00	
0010 MOVJ VJ=50.00	Stand-by position
0011 END	



NOTE

Before measuring a condition, make sure that the workpiece is not dislocated. If the workpiece is dislocated, correct the dislocation or correct the taught position for the measurement job.
Measure the sensing conditions in a single section within the same job. Do not set more than one sensing section in the same job.

<Wrong Setting Example>

```
MOVJ  VJ=30.00
ARCON  AC=200  AVP=100
COMARCON  AMP=2.0  FREQ=3.0  U/D=200  L/R=0.0
MOVL  V=80
COMARCOF
COMARCON AMP=2.0  FREQ=3.0  U/D=200  L/R=0.0
MOVL  V=80
COMARCOF
ARCOF
MOVJ  VJ=30.00
```

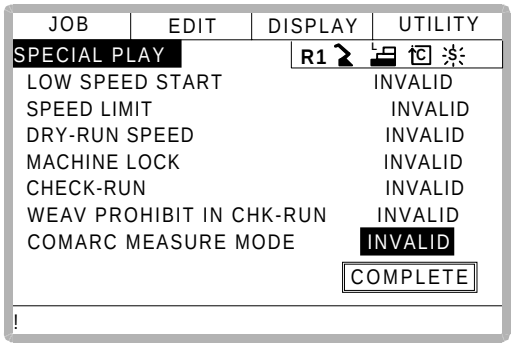
5.2 Measurement of Sensing Conditions

Operation

Select {UTILITY} in the job content display in the play mode ➡ Select {SPECIAL PLAY} from the selection dialog box* 1 ➡ Set "VALID" as the "COMARC MEASURE MODE" * 2 ➡ Execute the job

Explanation

1 The special play display appears.



2 Move the cursor to "COMARC MEASURE MODE", and press [SELECT] to set the mode to "VALID". "COMARC MEASURE MODE " appears in the message line.

NOTE

Be sure to reset "INVALID" as the "COMARC MEASURE MODE" after measuring the sensing conditions.

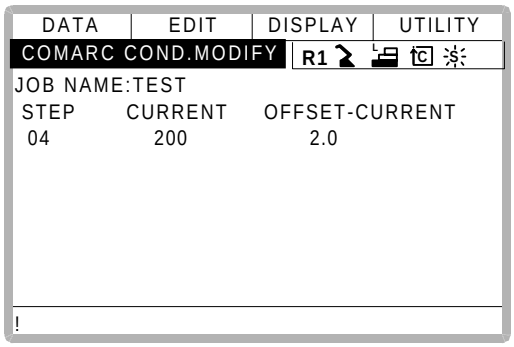
5.3 Registration of Sensing Conditions

Operation

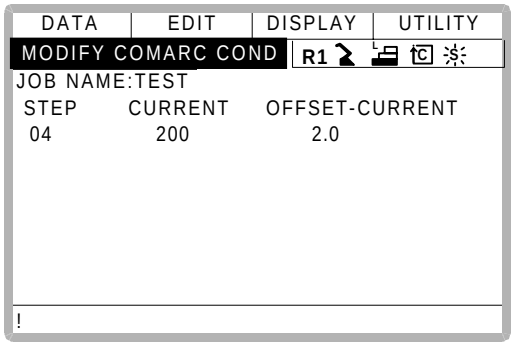
Select {UTILITY} in the job content display in the teach mode ➡ Select {COMARC COND MODIFY *1 ➡ Select “MODIFY COMARC COND” from the {DATA} selection dialog box *2

Explanation

1 The modify COMARC condition modify display appears.



2 The sensing conditions are registered in the job.



When registration is complete, the job content display reappears.

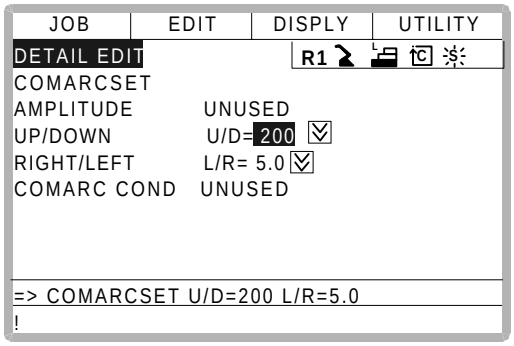
5.4 Adjustment of Sensing Conditions

Operation

Move the cursor to the instruction area of the COMARCON instruction or the COMARCSET instruction ➡ Press [SELECT] twice ➡ Select either “UP/DOWN” or “LEFT/RIGHT” in the detail edit display* 1

Explanation

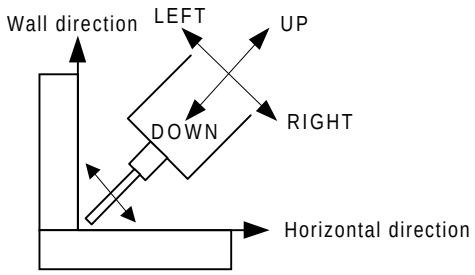
1 Enter a value using the number keys.



NOTE

The following is the relation between the settings of the correction conditions and the correction direction.
To define the direction along the wall and horizontally, refer to “9 Weaving Condition File” of YASNAC XRC OPERATOR’S MANUAL.

- To lengthen a wire extension, decrease the UP/DOWN (U/D) correction condition in units of 10 A.
- To shorten a wire extension, increase the UP/DOWN (U/D) correction condition in units of 10 A.
- To move the targeted position toward the wall, decrease the LEFT/RIGHT (L/R) correction condition in units of 5 A.
- To move the targeted position toward the horizontal direction, increase the LEFT/RIGHT (L/R) correction condition in units of 5 A.



5.5 Results of Arc Sensing

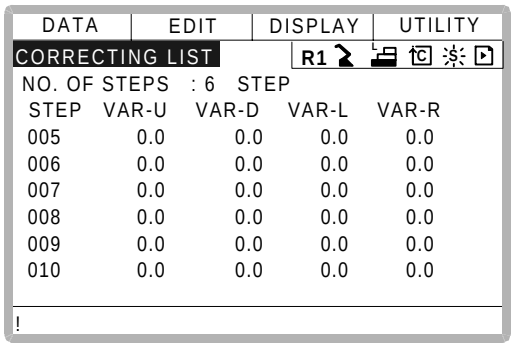
After arc sensing has been performed, the history of the correction amount in each step can be viewed.

Operation

Select {ARC WELDING} from the top menu ➡ Select {COMARC CORRECT}* 1

Explanation

1 The correction amount in each step appears.



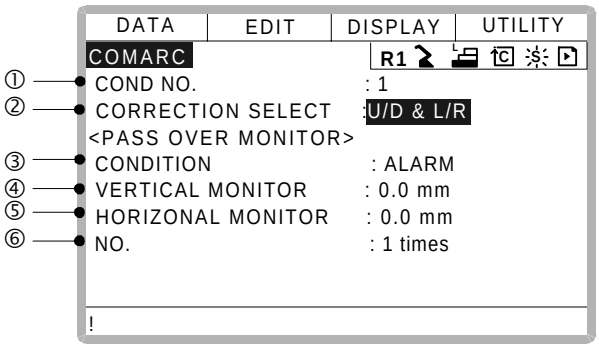
NOTE The correcting list display only appears when sensing has been performed. Therefore, the icon “COMARC CORRECT” does not appear when turning the power ON or before performing sensing.

6 COMARC Condition File

Set the following two items in the COMARC condition files.

- Direction of path correction by sensing
- Pass-over monitoring condition

6.1 COMARC Condition File



①COND NO. (1 to 16)

Displays the file No.

②CORRECTION SELECT (direction of path correction) (U/D & L/R, U/D, L/R, NO CORRECTION)

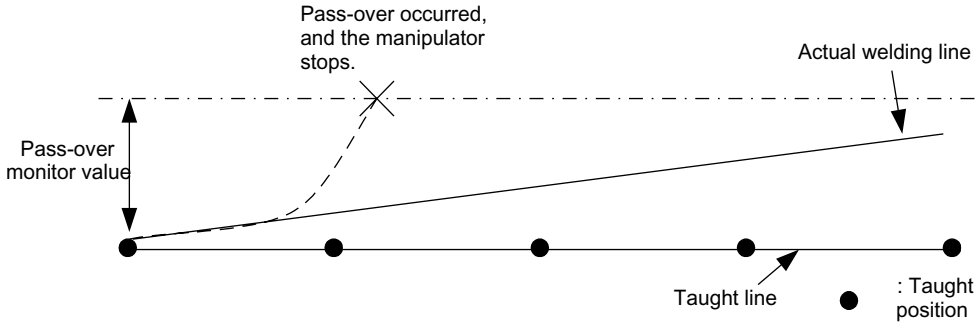
Specifies the direction to be corrected. When “NO CORRECTION” is selected, a correction by sensing is not performed.

U/D & /L/R	Corrects the path in the up, down, left, and right directions.
L/R	Corrects the path in the left and right directions (the up and down directions are not corrected).
U/D	Corrects the path in the up and down directions (the left and right directions are not corrected).

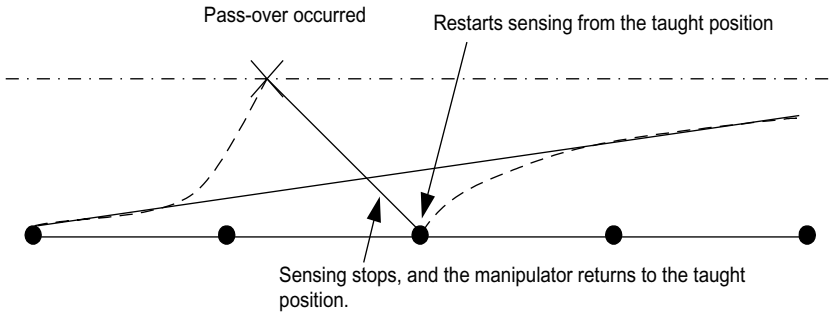
③CONDITION (operation after pass-over) (ALARM, TEACHING POSITION, CORRECTION RETAIN, NOT MONITOR)

Specifies the operation to be done when a pass-over occurs.

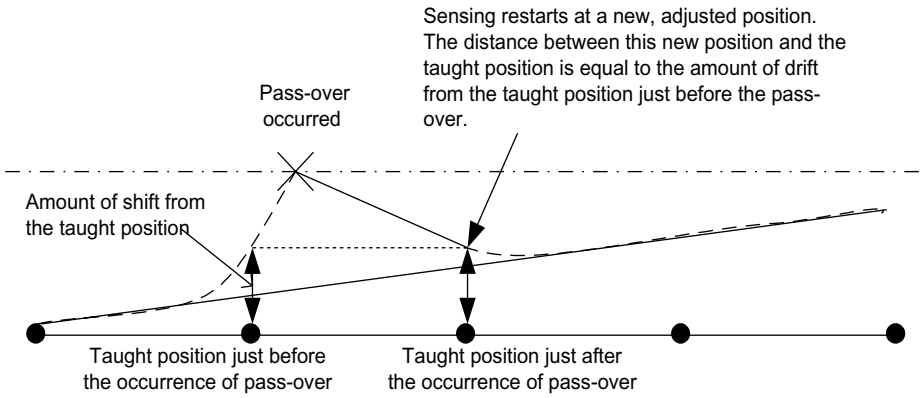
ALARM: An alarm occurs, and the manipulator stops.



TEACHING POSITION: Sensing stops, and the manipulator returns to the taught position and continues welding.



CORRECTION RETAIN: The taught position just after the occurrence of pass-over. The manipulator restarts welding from a position adjusted for the amount of shift from the taught position just before the occurrence of the pass-over.



NOT MONITOR: The pass-over is not monitored.

④VERTICAL MONITOR (the pass-over monitor value in the up and down directions)(0.0 to 25.5 mm)

Sets the pass-over monitor value in the up and down directions. When set to 0.0, the up and down directions are not monitored.

⑤HORIZONTAL MONITOR (the pass-over monitor value in the left and right directions) (0.0 to 25.5 mm)

Sets the pass-over monitor value in the left and right directions. When set to 0.0, the left and right directions are not monitored.

⑥NO. (the number of pass-overs) (1 to 10)
When the number of pass-over exceeds this set value, the manipulator moves as described in ③.

SUPPLE-MENT The pass-over monitor function monitors whether the manipulator is in the rectangular range specified by the vertical monitor value and horizontal monitor value with the taught path as its center line. When the manipulator moves out of the specified range more than the set number of times, the manipulator moves as described in ③.

6.2 File Operation

6.2.1 Display of a File

Operation

Select {ARC WELDING} from the top menu ➡ Select {COMARC COND.} ➡ Display a desired file No.*1

Explanation

1 Press the page key to call the next file No.

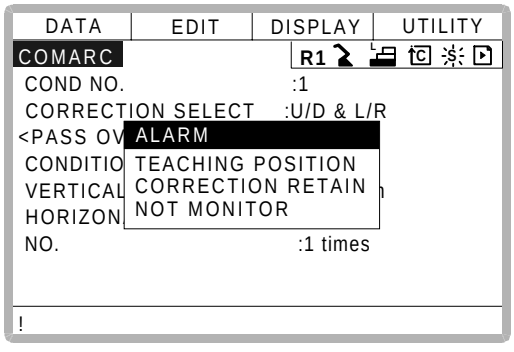
Press [SHIFT] + the page key to call back the previous file No.

6.2.2 Editing of a File

■ Editing of “CORRECTION SELECT” and “CONDITION”

Operation

Select either “CORRECTION SELECT” or “CONDITION” ➡ Select the item to be set fro the selection dialog box



■ Editing of Other Items

Operation

Move the cursor to the item to be set, and then press [SELECT] ➡ Enter a value to be set using the number keys ➡ Press [ENTER]

6.2.3 Initialization of the File

The COMARC condition file can be initialized in the maintenance mode.

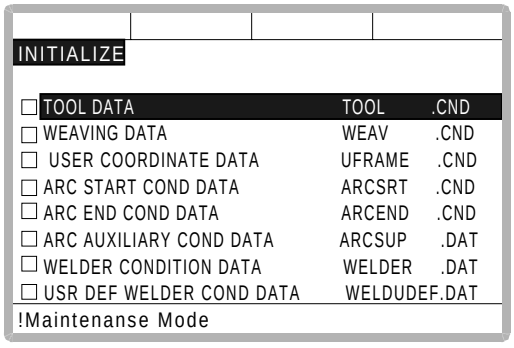
NOTE To initialize the COMARC condition file, change the security mode to "MANAGEMENT MODE".
(When the security mode is set to "OPERATION MODE" or "EDITING MODE", a file cannot be initialized.)

Operation

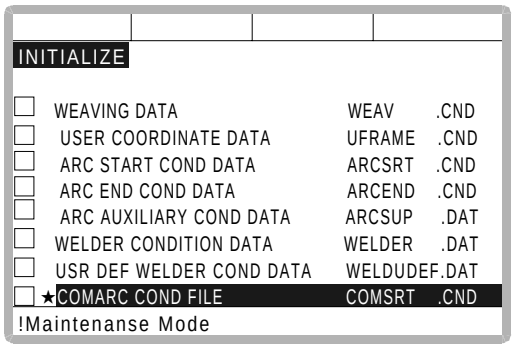
While pressing [TOP MENU], turn ON the power ➡ Change the security mode ("SECURITY") to "MANAGEMENT MODE" ➡ Select {FILE} from the top menu ➡ Select {INITIALIZE} ➡ Select "FILE/GENERAL DATA"*1 ➡ Select "COMARC COND FILE" *2 ➡ Press [ENTER]*3 ➡ Select "YES" *4 ➡ Turn ON the power again

Explanation

1 The condition file/general data selection display appears.

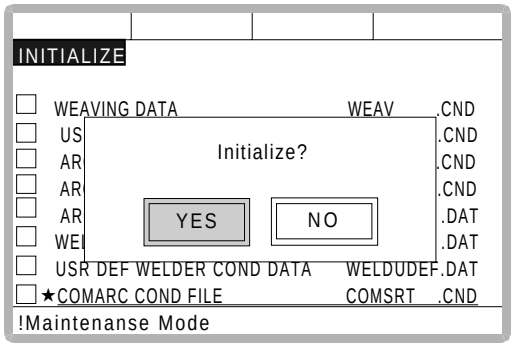


2 A star "★" appears on the left of the "COMARC COND FILE".



The condition files/data marked with " ■ " cannot be selected.

3 The confirmation dialog box appears.



4 The COMARC condition file is initialized.

7 Modification of the Settings in COMARC Function

To validate the COMARC function, mount the JANCD-XCP02 board in the CPU rack (JZNC-XRK01B- □) with the power OFF.
To invalidate the COMARC function, remove the JANCD-XCP02 board from the CPU rack (JZNC-XRK01B- □) with the power OFF.

NOTE The COMARC function has been set before shipment.
Do not change the settings for the COMARC function unless it is required to invalidate the COMARC function.

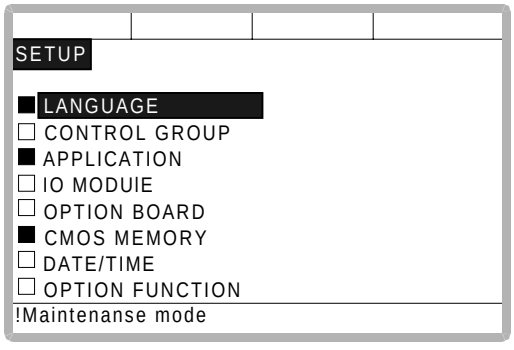
SUPPLE -MENT To validate/invalidate the COMARC function, change the security mode to “MANAGEMENT MODE”.
When the security mode is set to “OPERATION MODE” or “EDITING MODE”, only the setting status can be referenced.

Operation

While pressing [TOP MENU], turn ON the power ➡ Change the security mode (“SECURITY”) to “MANAGEMENT MODE” ➡ Select {SYSTEM} from the top menu ➡ Select {SETUP}*1 ➡ Select {OPTION BOARD} *2 ➡ Press [ENTER] *3 ➡ Select “YES” ➡ Turn ON the power again

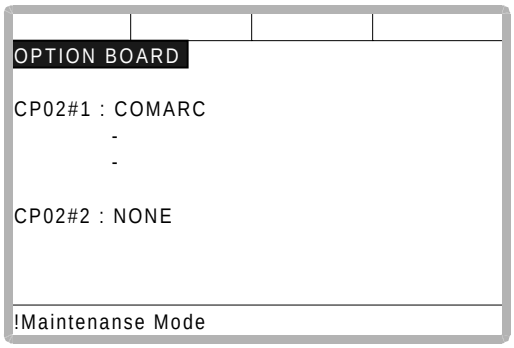
Explanation

1 The setup display appears.



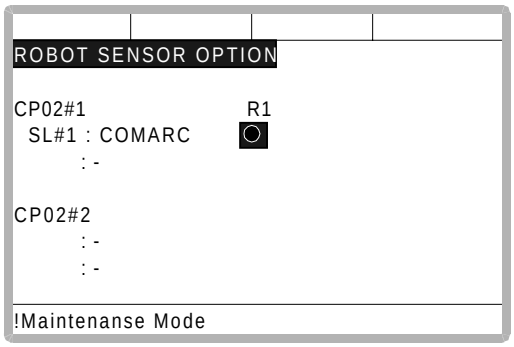
2 The setting status appears.

• When the XCP02 board is mounted, the following display appears.

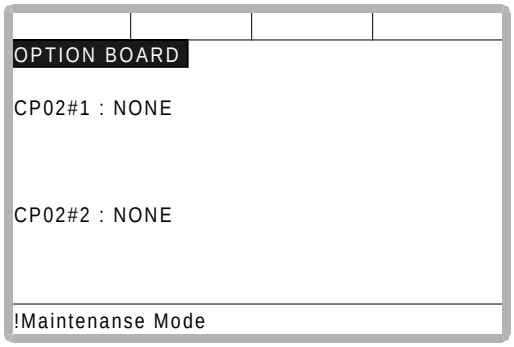


When the XCP02 Board is Mounted

Press [ENTER], and the robot sensor display appears.

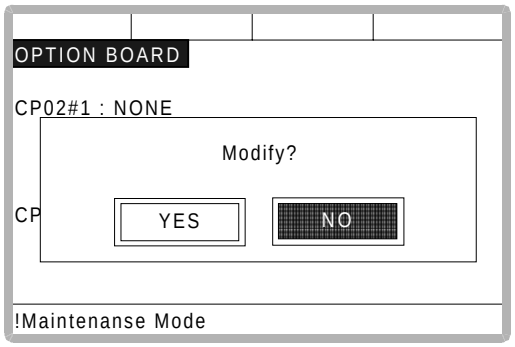


• When the XCP02 board is not mounted, the following display appears.



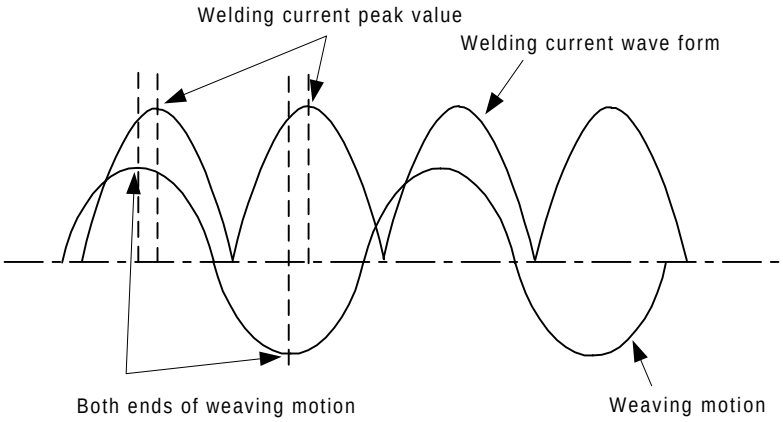
When the XCP02 Board is not Mounted

3 The confirmation dialog box appears.



8 Phase Compensation Value

As explained in “3.1 Basic Understanding of Arc Sensor”, the arc sensing corrects the manipulator path by measuring the welding current values at the peak and bottom of the waves of weaving motion.
However, in the actual welding, a discrepancy between the weaving cycle and the peak value of the current variation cycle is generated as shown in the following figure. The phase compensation value compensates for this discrepancy.
Since the phase compensation value differs depending on the welding circumstances. Measure and register a value for each welder.



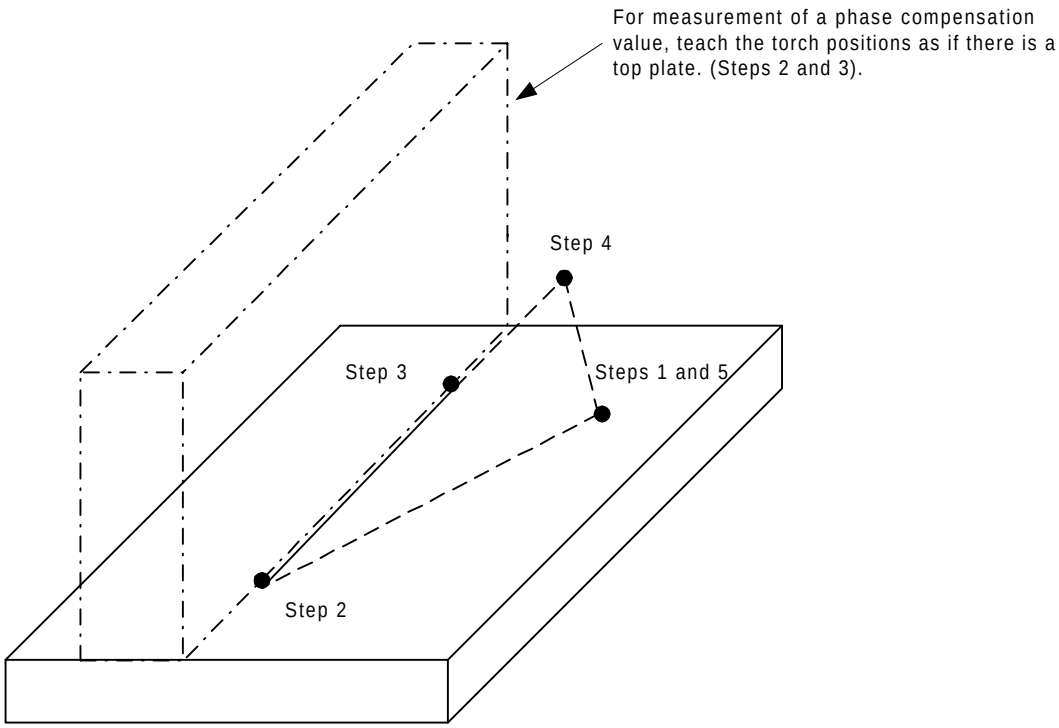
A discrepancy between the weaving motion and the welding current peak value is generated.

8.1 Job Preparation for Measurement of Phase Compensation Value

Prepare a job to measure a phase compensation value.
Refer to the following job example to prepare a job for measurement of a phase compensation value.

Job Example for Measurement of Phase Compensation Value

```
NOP
MOVJ  VJ=50.00
MOVJ  VJ=50.00
ARCON  AC=200  AVP=100
COMARCON  AMP=2.0  FREQ=3.0  U/D=200  L/R=0.0
MOVL  V=80
COMARCOF
ARCOF
MOVL  V=800
MOVJ  VJ=50.00
END
```



NOTE

- Execute a job for measurement of phase compensation value under the same welding condition (current value, voltage value, torch positions) as a job with an actual workpiece.
- For the weaving conditions, measure the phase compensation values for all the weaving frequencies used in the actual welding.

8.2 Measurement and Registration of a Phase Compensation Value

NOTE

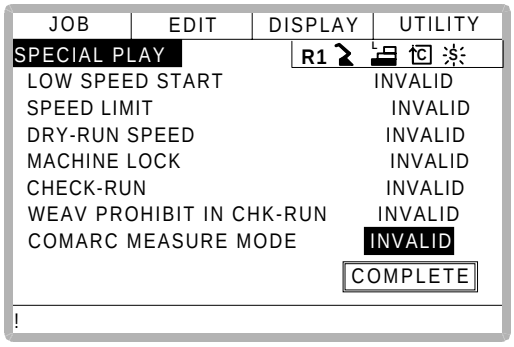
- Measuring and registering a phase compensation value is only possible in “MANAGEMENT MODE”. Change the security mode to “MANAGEMENT MODE”.
- The phase compensation value is registered in the parameter SxE. To measure and register phase compensation value, set “1” as the parameter SxE197 first, then proceed the following operations.
- After the completion of the registration of phase compensation value, be sure to reset “0” as the parameter SxE197.

Operation

Select the job for measurement of a phase compensation value ➡ Select {UTILITY} in the job content display in play mode ➡ Select {SETUP SPECIAL RUN} from the selection dialog box*1 ➡ Set “VALID” as the “COMARC MEASURE MODE” *2 ➡ Execute the job ➡ Select {UTILITY} in the teach mode ➡ Select {COMARC COND MODITY}*3 ➡ Select {PARAMETER} from the top menu ➡ Select {SxE} ➡ Display the parameter No. to be changed ➡ Register the measured value*4

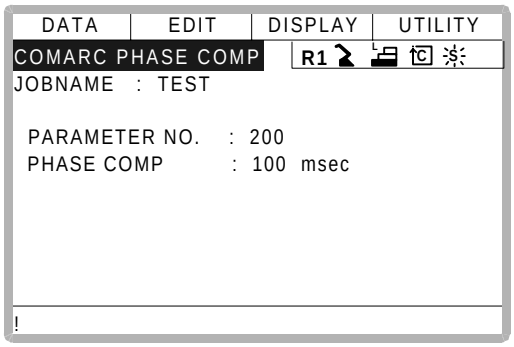
Explanation

1 The special play display appears.



2 Move the cursor to “COMARC MEASURE MODE”, and press [SELECT] to set “VALID” as the mode. The message “COMARC MEASURE MODE” appears in the message line.

3 The COMARC phase compensation display appears.



4 Register the phase compensation value confirmed in the COMARC phase compensation display as the parameter SxE.

NOTE

- After measuring the phase compensation value, be sure to reset “INVALID” as the “COMARC MEASURE MODE”.
- When the shielding gas is changed, measure and register the phase compensation value.
- Measure and register phase compensation values for all the frequencies used in the actual welding.

Depending on the frequency for which a phase compensation value is measured, the values may be registered in same parameter No. In this case, register the average value of several measured phase compensation values.
<Example>
The phase compensation values for the weaving frequencies 4.0 Hz and 5.0 Hz are registered in SxE060.
In this case, the average value of the phase compensation values for the weaving frequencies 4.0 Hz and 5.0 Hz is registered in SxE060.

9 Instruction List

< > indicates numerical or alphabetical data.

COMARCON	Function	Starts arc sensing and weaving.		
	Instruc-tion item	Settings	Data input range	Unit
		Weaving conditions* 1 AMP = <Weaving amplitude> FREQ = <Weaving frequency> ANGL=<Weaving angle> WEV# (<Weaving file No.>) DIR=<Weaving direction>	 AMP: 0.1 to 99.9 FREQ: 1.0 to 5.0 ANGLE: 0.0 to 180.0 1 to 16 0 or 1	 0.1mm 0.1Hz 0.1deg. - -
		Correction conditions U/D = <Correcting the up and down path) L/R = <Correcting the left and right path>	 U/D: 1 to 999 L/R: -255.0 to 255.0	 1A 0.1A
		COMARC condition file No. CAF# (<COMARC condition file No.>)	 1 to 16	 -
	Exam-ples	COMARCON AMP=2.0 FREQ=3.0 U/D=200 L/R=0.0 COMARCON WEV#(1) U/D=200 L/R=0.0 COMARCON AMP=2.0 FREQ=3.0 U/D=200 L/R=0.0 CAF#(1) COMARCON WEV#(1) U/D=200 L/R=0.0 CAF#(1)		
COMARCOF	Function	Ends arc sensing and weaving.		
	Instruct-tion item	-		
	Example	COMARCOF		

COMARCSET* 2	Function	Changes sensing condition and weaving condition.		
	Instruction item	Settings	Data input range	Unit
		Weaving condition AMP = <Weaving amplitude> ANGL=<Weaving angle>	 AMP: 0.1 to 99.9 ANGL: 0.0 to 180.0	 0.1mm 0.1deg
		Correction condition U/D = <Correcting the up and down path> L/R = <Correcting the left and right path>	 U/D: 1 to 999 L/R: -255.0 to 255.0	 1A 0.1A
		COMARC condition file No. CAF# (<COMARC condition file No.>)	 1 to 16	 -
	Examples	COMARCSET AMP=2.5 U/D=210 L/R=5.0 CAF#(2) COMARCSET AMP=2.5 COMARCSET U/D=210 COMARCSET L/R=5.0 COMARCSET CAF#(2)		

1 Two setting methods are available: setting by AMP and FREQ, or setting by WEV#. When weaving conditions are set by AMP and FREQ, the weaving mode is “single oscillation.” When ANGLE is set to UNUSED, weaving angle is set to 45 deg.
Do not use DIR normally. DIR specifies the weaving direction changing. DIR=0 equals to UNUSED.

2 For the COMARCSET instruction, only the items to be changed can be set.

NOTE

The data in < > can be set by using constants or user variables.
To use user variables, pay attention to the unit of set data.
<Example>
COMARCSET AMP=B000

The unit for the weaving amplitude settings is “0.1 mm”. To set 2.5 mm as the amplitude, set “25” as the B000.

10 Parameter List

SxE Parameters

Parameter No.	Contents	Unit	Initial Value	Setting Range
0	Application designation	-	-	-
20	Analog signal input channel	-	SL1: 1 SL2: 2 SL3: 1	1 to 8
21	Compensation value for conversion of an AD value to a current value	[%]	100	0 to 100
22	Number of times that correction was prohibited at COMARCON	-	4	0 to 10000
24	Correction prohibited minimum current	[0.1A]	500	0 to 10000
25	Correction prohibited maximum current	[0.1A]	10000	0 to 10000
27	Dead zone U/D	[0.1A]	50	0 to 10000
28	Dead zone L/R	[0.1A]	50	0 to 10000
30	Correction amount Y+ (Weaving frequency less than 2.0 [Hz])	[µm]	150	0 to 10000
31	Correction amount Y- (Weaving frequency less than 2.0 [Hz])	[µm]	150	0 to 10000
32	Correction amount Z+ (Weaving frequency less than 2.0 [Hz])	[µm]	150	0 to 10000
33	Correction amount Z- (Weaving frequency less than 2.0 [Hz])	[µm]	150	0 to 10000
34	Correction amount Y+ (Weaving frequency 2.0 [Hz] or more, less than 3.0 [Hz])	[µm]	150	0 to 10000
35	Correction amount Y- (Weaving frequency 2.0 [Hz] or more, less than 3.0 [Hz])	[µm]	150	0 to 10000
36	Correction amount Z+ (Weaving frequency 2.0 [Hz] or more, less than 3.0 [Hz])	[µm]	150	0 to 10000

SxE Parameters

Parameter No.	Contents	Unit	Initial Value	Setting Range
37	Correction amount Z- (Weaving frequency 2.0 [Hz] or more, less than 3.0 [Hz])	[μm]	150	0 to 10000
38	Correction amount Y+ (Weaving frequency 3.0 [Hz] or more, less than 4.0 [Hz])	[μm]	100	0 to 10000
39	Correction amount Y- (Weaving frequency 3.0 [Hz] or more, less than 4.0 [Hz])	[μm]	100	0 to 10000
40	Correction amount Z+ (Weaving frequency 3.0 [Hz] or more, less than 4.0 [Hz])	[μm]	100	0 to 10000
41	Correction amount Z- (Weaving frequency 3.0 [Hz] or more, less than 4.0 [Hz])	[μm]	100	0 to 10000
42	Correction amount Y+ (Weaving frequency 4.0 [Hz] or more)	[μm]	100	0 to 10000
43	Correction amount Y- (Weaving frequency 4.0 [Hz] or more)	[μm]	100	0 to 10000
44	Correction amount Z+ (Weaving frequency 4.0 [Hz] or more)	[μm]	100	0 to 10000
45	Correction amount Z- (Weaving frequency 4.0 [Hz] or more)	[μm]	100	0 to 10000
50	Sampling interval	[msec]	2	1 to 10

11 Alarm Message List

Alarm Number	Message	Cause	Remedy
4410	TWO STEPS SAME POSITION (WEAV)	The weaving base point was the same as the wall point.	Reset the alarm. Reteach the 3 different points.
4486	PASS OVER [Decimal data]	The path went outside the designated pass-over monitoring area.	Remove the cause of the pass-over Set the pass-over radius inside the permitted range.
4494	DEFECTIVE TAUGHT POINT (WEAV)	1: Weaving start point and end point were the same. If not using hover weaving, the weaving start point and end point will be the same point, or the weaving start point and the reference point will be the same point. If using hover weaving, the weaving start point and the reference point will be the same point. 2: Weaving targeted point outer product error	Check the start point, the end point, and the reference point. Teach again.
1003	ROM ERROR (XCP02)	Checksum error in the ROM (memory) of the sensor program.	Replace the XCP02 board.
5010	ANALOG INPUT ERROR (XCP02) [Decimal data]	The analog input value of XCP02 board can not be read properly. The decimal data indicates the channel where an input fault occurs.	Check the cable connection. Replace the XCP02 board.
5011	TRANSMISSION ERROR (XCP02) [Decimal data]	An error occurs in serial transmission on the XCP02 board. The decimal data indicates the contents of error. 0: Receiving FIFO error 1: Framing error 2: Parity error 3: Overrun error 4: Checksum error 5: NAK receiving error 6: Sending time over 7: Receiving time over	Check the parameters for the sending and receiving side. Check the transmission cable.
5012	SYSTEM ERROR (COMARC) [Decimal data]	An error occurs in the system of the sensor in the COMARC function. The decimal data indicates the contents of error.	Needs investigation. Contact your Yaskawa representative. State any observations, the alarm No. and data displayed.

Alarm Number	Message	Cause	Remedy
5013	COMARC ERROR [Decimal data]	An error occurs when processing the sensor in the COMARC function. The decimal data indicates the contents of error.	Needs investigation. Contact your Yaskawa representative. State any observations, the alarm No. and data displayed.

YASNAC XRC OPTIONS
INSTRUCTIONS

FOR ARC SENSOR COMARC FUNCTION

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YASKAWA ELECTRIC CORPORATION

YASKAWA

MANUAL NO. HW9482786 ①

APPENDIX A
COMARC III SUPPLEMENT

A.1 Overview

ComArc III Seam Tracking is based on the concept that on a constant voltage welding machine (CV), the current will vary depending on the distance of the contact tip from the work piece, or contact tip to work distance (CTWD). Weaving is required so that a variation in welding current can be observed, and then reproduced, by the XRC controller. For a fillet weld, the current is a function of the distance from the contact tip to the walls of the fillet joint. As the robot moves through the weld joint, it monitors the welding current and corrects the path as it travels by moving into or away from the joint, depending on the current feedback that it receives.

If ComArc III Seam Tracking is purchased, hardware must be installed, including additional boards, chips, and the actual ComArc box, and software must also be installed and/or enabled. Normally these installations are completed at MOTOMAN by MOTOMAN technicians, but field retrofits are possible.

Once ComArc III is installed, it is necessary to collect data to verify the correct operation of the seam tracking system. There are a couple steps that must be followed to gather the correct information.

A.2 Setting Up ComArc

Phase Compensation or "PC" data allows the user to "synchronize" the power source with the ComArc system. The PC data is used to define the time lag between the position of the robot in its weave and the welding current. This data varies with different robot types, welding power sources, shielding gases, electrode diameters, weave frequencies, and welding cable lengths. Large changes in welding current may require re-measurement of PC data. For example, if you measure PC data with a weld current of 200 amps, then need to do other welds at 350 amps, you will need to collect new data to use on those other welds.

To properly collect the PC data, use the weld path defined in the steps below with the weld parameters properly set for the joint you wish to track. Develop a good, stable arc and an acceptable weld bead. Use about a 45° work angle and a push-travel angle of around 10-20°. Sound welding conditions should provide weave conditions such that the arc is on the leading edge of the weld pool, with no undercutting.

1. Set up the following job structure for good weaving and welding conditions:

   MOVJ

   MOVJ

   ARCON ASF#(4)

   WVON WEV#(2)

   MOVL V=90

   WVOF

   ARCOF AEF#(3)

   MOVJ

2. Replace the WVON command in the job with the COMARCON command (specify the weave file the COMARCON command should reference).

NOTE: These instructions can be found in the Inform List under SENSOR.

3. Replace the WVOF command with the COMARCOF command.

Next, measure current and offset current as follows:

1. Set up a complete fillet joint, with upper and lower leg.
2. In PLAY mode, select UTILITY ‡ SETUP SPECIAL RUN ‡ COMARC MEASUREMENT MODE = VALID.
3. START (commence welding).
4. Once welding is completed, select TEACH mode.
5. Select UTILITY ‡ COMARC CONDITION MODIFY. This will give you the correct U/D and L/R data to be inserted into the COMARCON instruction. Selecting DATA - COMARC CONDITION MODIFY will insert the U/D and L/R data into the last COMARCON instruction that was executed during job playback.
6. From job display, select UTILITY ‡ SETUP SPECIAL RUN ‡ COMARC MEASURE MODE = INVALID.
7. The job structure for normal ComArc operation is now set up:

   MOVJ

   MOVJ

   ARCON ASF#(4)

   COMARCON WEV#(2) U/D=225 L/R=4.5 CAF#(5)

If ComArc does not track the joint, will need to record phase compensation (PC) data as outlined below.

1. Set parameter S1E197 (S3E197 for R2) to 1. This makes phase compensation (PC data) measurement mode possible.
2. Set up a weld plate with no upper leg.
3. Select PLAY mode.
4. From the job display screen, select: UTILITY ‡ SETUP SPECIAL RUN ‡ COMARC MEASURE MODE = VALID.
5. START (commence welding) on the plate.

NOTE: *Observe the current range while making this weld. The highest current will be when the weave is toward the bottom or horizontal leg. The average current will be when the weave is passing through what was the center of the joint when both legs were intact. The lowest current will be seen when the weave is at the position that would normally be the upper or vertical leg of the leg. In this joint, which is missing the upper leg, the electrical stick out is the longest, which produces a lower current. This is a constant voltage welding power source, so the voltage should remain relatively constant.*

6. Phase compensation data is now recorded.
7. Once welding is complete, select TEACH mode.
8. UTILITY ‡ COMARC CONDITION MODIFY ‡ Set the given parameter number for S1E(S3E for R2) parameter shown to the given value (example: 245 msec.)
9. Set parameter S1E197 (S3E197 for R2) to 0.
10. Arrange a fillet weld joint with an upper and lower leg.
11. Select PLAY mode.
12. START (commence welding).
13. Once welding is complete, select TEACH mode.
14. Select UTILITY ‡ COMARC CONDITION MODIFY ‡ DATA ‡ COMARC CONDITION MODIFY.
15. From the job display screen, select: UTILITY ‡ SETUP SPECIAL RUN ‡ COMARC MEASURE MODE = INVALID.

A.3 ComArc Files and Pass Over Monitor

A.3.1 ComArc Condition File

A ComArc File (CAF#(x)) can be referenced in the COMARCON command. This specifies correction directions and Pass Over Monitor. Because direct opening the COMARCON instruction produces the Weave File screen, the only way to access the ComArc file is from TOP MENU ‡ ARC WELDING ‡ COMARC COND.

The correction direction has four options for adjusting the robot path. These are:

U/D and L/R

U/D only

L/R only

No Correction

A.3.2 Pass Over Monitor

The ComArc file also specifies Pass Over Monitor. First, create a window that describes a maximum vertical and maximum horizontal distance the robot path can be altered. Pass Over Monitor allows the user to define the number of times the manipulator can go out of the specified zone. If this zone is exceeded as many as or more times than specified, the user can set a condition, which determines what occurs. Possible actions once the robot path moves outside the PASS OVER envelope the specified number of times are:

ALARM – Stop welding, halt robot motion, and send a Pass Over Alarm

TAUGHT POSITION – revert to taught path

CORRECTION RETAIN – maintain corrected amount, but do not deviate further

NOT MONITOR

A.3.3 ComArc Correction Screen

The ComArc Correction screen is only visible if seam tracking has taken place. It is accessed from TOP MENU ‡ ARC WELDING ‡ COMARC CORRECT. This displays the magnitude of correction (in millimeters) for each step that ComArc tracked. The correction amounts are described by UP, DOWN, LEFT and RIGHT directions.

A.4 Additional Parameters

A.4.1 Dead Zone

The Dead Zone, like the COMARCON / COMARCSET commands, refers to UP/DOWN and LEFT/RIGHT directions. If minor current fluctuations occur (i.e. a tack weld) in the axial direction of the torch, a set amperage value can be registered for UP/DOWN sensitivity. Variations within this range will be ignored. If the variations are likely to occur in the weave plane, the measured value would be registered for LEFT/RIGHT. As the robot welds over tacks, the raised area of the tack weld causes a shorter CTWD, which raises the current. If seam tracking this joint, the robot would correct away from the tack, then once past it, track back into the joint. This often causes small nuisance voids in the welds. With the use of Dead Zones, these minor variations would be ignored and no corrections would take place. Adjustment of the Dead Zone is found in the S1E(S3E) parameter list.

A.4.2 Correction Amount

Other parameters that can be found in the parameter list are Correction Data, Correction Prohibition Current, and Sampling Interval. Correction data are parameters which control the amount of correction (step size, in millimeters) the robot will make. For small variations in the programmed path use small values (100 to 150) while large variations in part fit-up may require large steps to track the part. Listed below are the default values, which are based on the weaving frequency range.

Table A-1 ComArc Parameter Listing (S1E, S3E)

S1E/S3E	Item	Range	Units	Default
20	Analog Signal Input Channel	SL1/SL3=1, SL2=2		1
21	A-->D Current Conversion Compensation	0 to 100	%	100
22	Correction Prohibition Count (Pass Over)	0 to 10000		4
24	Min. Correction Prohibition Current	0 to 10000	0.1 A	500
25	Max. Correction Prohibition Current (Pass Over)	0 to 10000	0.1 A	10000
27	Dead Zone: U/D	0 to 10000	0.1 A	50
28	Dead Zone: L/R	0 to 10000	0.1 A	50
30		0 to 10000	0.001mm	150
31	Correction Data	0 to 10000	0.001mm	150
32	(weaving frequency < 2 Hz)	0 to 10000	0.001mm	150
33		0 to 10000	0.001mm	150
34		0 to 10000	0.001mm	150
35	Correction Data	0 to 10000	0.001mm	150
36	(2 Hz <= weaving frequency < 3 Hz)	0 to 10000	0.001mm	150
37		0 to 10000	0.001mm	150
38		0 to 10000	0.001mm	100
39	Correction Data	0 to 10000	0.001mm	100
40	(3 Hz <= weaving frequency < 4 Hz)	0 to 10000	0.001mm	100
41		0 to 10000	0.001mm	100
42		0 to 10000	0.001mm	100
43	Correction Data	0 to 10000	0.001mm	100
44	(weaving frequency >= 4 Hz)	0 to 10000	0.001mm	100
45		0 to 10000	0.001mm	100
50	Sampling Interval	1 to 10	msec	2

NOTE: The correction prohibit current parameters listed above are used when a ComArc file (CAF) is not referenced by the COMARCON instruction. Also, the S1E parameters are used for a single robot system. For a dual robot system (R1 and R2) the S3E parameters are used for R2.

A.5 Coordinated Motion with ComArc

In order to interface ComArc with Master Tool Frame (the Cartesian, X-Y-Z reference frame used to describe the position of R1 relative to S1) the use of specific instructions in necessary. Substitute the following instructions when using coordinated motion:

MOVL/C/S	SMOVL/C/S
REF	SREF
WVON	SWVON
COMARCON	SCOMARCON
COMARCSET	SCOMARCSET
WFOF	SWVOF
COMARCOF	SCOMARCOF

A.6 Sample Jobs

Single Robot ComArc:

NOP	
MOVJ C00001 VJ=25.00	Approach point
MOVL C00002 V=23.0	Starting Point
ARCON ASF#(1)	Arc Start using ArcStart file #1
COMARCON WEV#(1) U/D=200 L/R=10.0	ComArc Start instruction using Weaving condition file #1 and Up/Down of 200 mm max with Left/Right correction of10mm max
MOVL C00003 V=11.0	Ending point
COMARCOF	Disabling ComArc Function
ARCOF	Disabling Welding Arc
MOVL C00004 V=46.0	Retraction point
END	

Single Robot with Single Coordinated Axis ComArc:

NOP	
MOVJ C00001 VJ=25.00 +MOVJ EC00001 VJ=25.00	Approach point
SMOVC C00002 V=83.3 +MOVJ EC00002	Synchronized Starting Point
ARCON ASF#(1)	Arc Start using ArcStart file #1
SCOMARCON WEV#(1) U/D=234 L/R=10.0	Synchronized ComArc Start instruction using Weaving condition file #1 and Up/Down of 200 mm max with Left/Right correction of 10mm max
SMOVC C00003 V=10.0 +MOVJ EC00003	Synchronized Ending point
SCOMARCOF	Disabling Synchronized ComArc Function
ARCOF	Disabling Welding Arc
SMOVC C00004 V=10.0 +MOVJ EC00004	Retraction point
END	

Dual Robot with Single Coordinated Axis ComArc:

NOP	
MOVJ C00002 VJ=12.50 +MOVJ EC00002 VJ=25.00	Approach point
SMOVC C00004 V=11.0 +MOVJ EC00004	1st Synchronized point (Arc Starting point)
TSYNC 2	
ARCON ASF#(1)	Arc Start using ArcStart file #1
SCOMARCON WEV#(4) U/D=200 L/R=10.0	Synchronized ComArc Start instruction using Weaving condition file #4 and Up/Down of 200 mm max with Left/Right correction of 10mm max
SMOVC C00005 V=11.0 +MOVJ EC00005	2nd Synchronized point
SCOMARCST U/D=237 L/R=12.5	Resetting ComArc Correction amounts "on the fly"
SMOVC C00006 V=11.0 +MOVJ EC00006	3rd Synchronized point
SCOMARCST U/D=238 L/R=22.1	Resetting ComArc Correction amounts "on the fly"
SMOVC C00007 V=11.0 +MOVJ EC00007	4th Synchronized point (Arc Ending point)
SCOMARCOF	Disabling Synchronized ComArc Function
ARCOF	Disabling Welding Arc
TSYNC 3	
END	