

- 24-hour Telephone Number: (937) 847-3200
 - Use for urgent or emergency needs for technical support, service and/or replacement parts
 - Routine Technical Inquiries: techsupport@motoman.com
- Allow up to 36 hours for response

YRC1000 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-□□□ INSTRUCTIONS

YRC1000 INSTRUCTIONS

YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)

YRC1000 MAINTENANCE MANUAL

YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The YRC1000 operator's manual above corresponds to specific usage. Be sure to use the appropriate manual.

The YRC1000 operator's manual above consists of "GENERAL" and "SUBJECT SPECIFIC".

The YRC1000 alarm codes above consists of "MAJOR ALARMS" and "MINOR ALARMS".

Have the following information available when contacting the YASKAWA Representative:

- System
- Primary Application
- Software Version (*Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version}*)
- Warranty ID (*Located on Robot Controller*)
- Robot Serial Number (*Located on Manipulator data plate*)
- Robot Sales Order Number (*Located on Robot controller data plate*)



CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- 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.

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC1000.

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



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.



WARNING

Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.



CAUTION

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

NOTICE

NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

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 “DANGER”, “WARNING” and “CAUTION”.



DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
 - Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
 - Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button



- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop



- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
 - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
 - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
 - Turning ON the YRC1000 power
 - Moving the manipulator by using the programming pendant
 - Running the system in the check mode
 - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.



WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
 - Check for a problem in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the YRC1000 cabinet after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows.

Equipment	Manual Designation
YRC1000 controller	YRC1000
YRC1000 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

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

Equipment		Manual Designation
Programming Pendant	Character Keys /Symbol Keys	The keys which have characters or its symbol printed on them are denoted with []. ex. [ENTER]
	Axis Keys /Numeric Keys	[Axis Key] and [Numeric Key] 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}

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 [SELECT] is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

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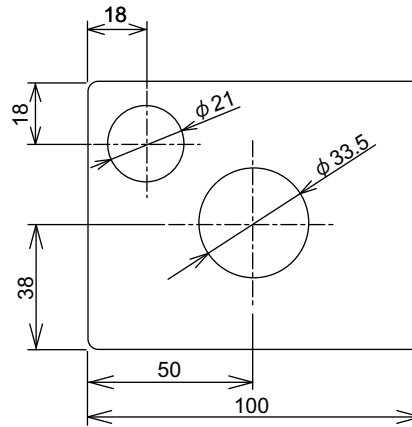
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- 1 Sensor
- 1.1 Current Detecting Unit

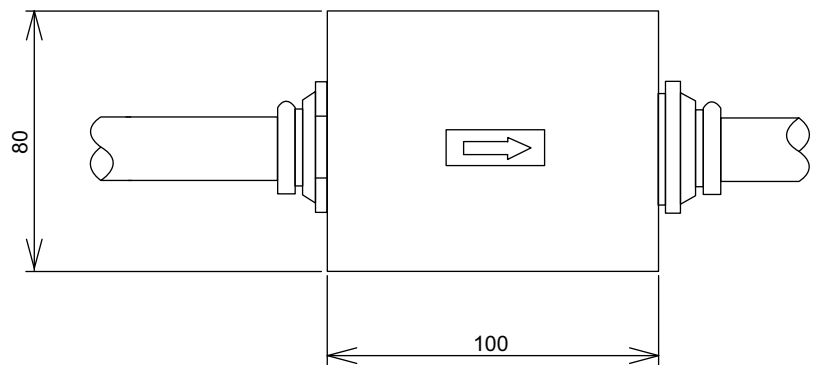
1 Sensor

1.1 Current Detecting Unit

Installation of Current Detecting Unit



Front View



Side View

Units: mm

2 YRC1000 Installation



DANGER

- Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the YRC1000 and the welder. Failure to observe this warning may result in an electric shock.
- Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables cannot be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.



CAUTION

- Fix the welding cable connected to the terminal stand securely by tightening the terminal screws. Failure to observe these cautions may result in an electric shock, an injury, or damage caused by malfunctioning.

2 YRC1000 Installation

2.1 Connection the Current Detecting Unit

2.1 Connection the Current Detecting Unit

Connect the unit in the following manner, referring to *fig. 2-1*
“Configuration Diagram of Current Detecting Unit”

1. Connect the connection cable of current detecting unit to the ACP02 Board(CN121) of YRC1000.
2. Connect the current detecting unit so that the arrow faces the torch side as shown in the figure.
3. 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, winding with attached rubber plate, and tape it with an insulating tape.

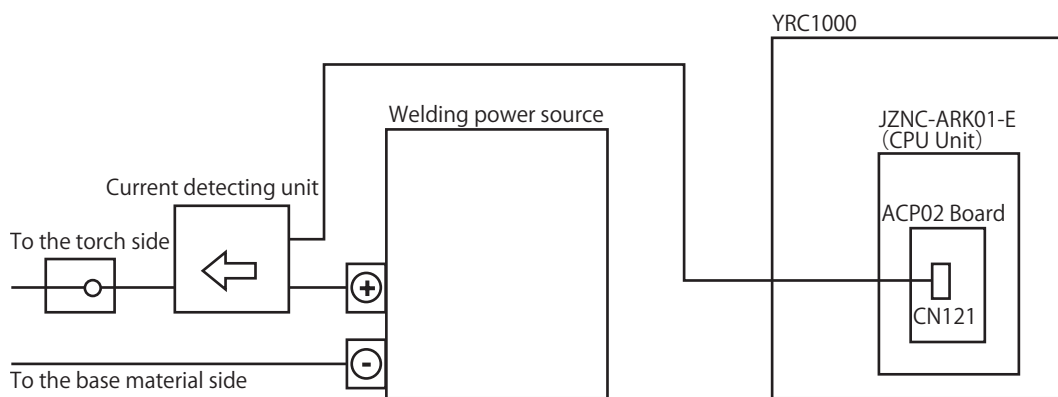


Fig. 2-1: Configuration Diagram of Current Detecting Unit

2 YRC1000 Installation
2.2 Connection Diagnosis



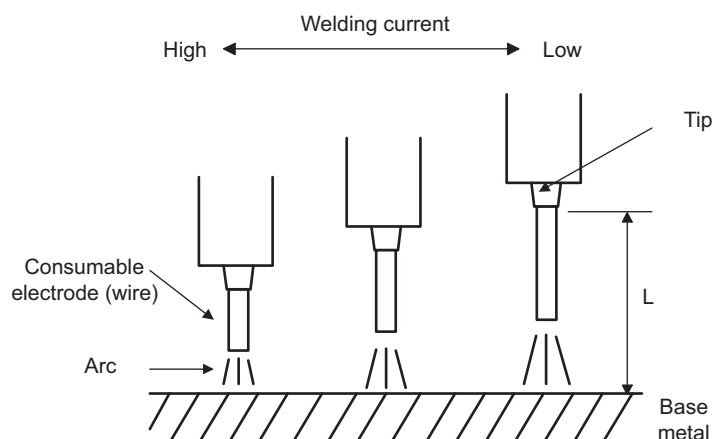
The ACP02 I/O STATUS window can be called only in "MANAGEMENT MODE".

When the icon {ACP02 I/O} does not appear, switch the security mode to "MANAGEMENT MODE".

3 Arc Sensor Function

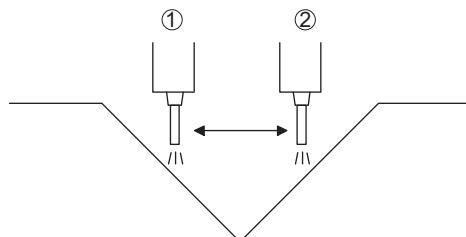
3.1 Basic Understanding of the Arc Sensor

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 Correction

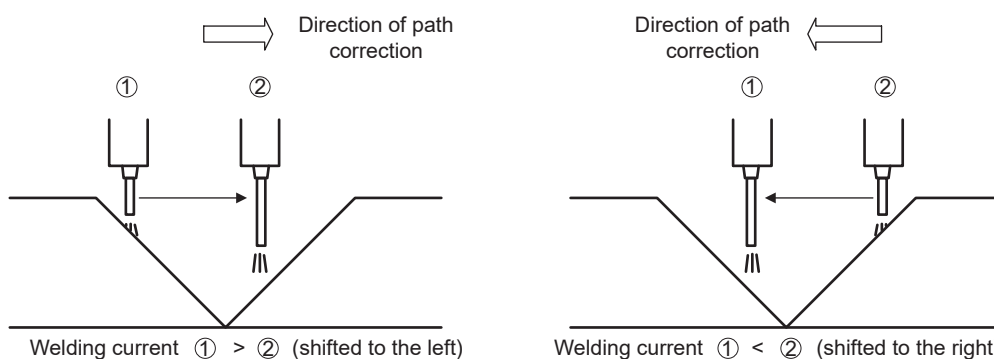
During welding with the torch weaving from side to side, an equal amount welding current flows on points ① and ② if the distance L is the same on both sides (points ① and ②) due to the aforementioned characteristics.



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.

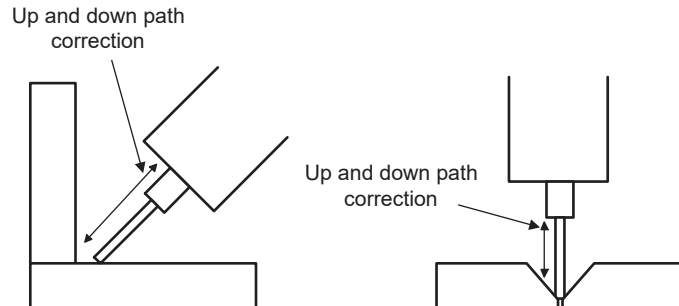


3 Arc Sensor Function

3.1 Basic Understanding of the Arc Sensor

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 tracking performance of the arc sensor is affected by the working environment and welding conditions. If tracking performance is not sufficient, please make the following adjustments.



- Increase the weaving amplitude.
- Increase the weaving frequency.
- Lower the welding speed.
- Lower the welding command voltage.
(Especially in case of spray transfer or pulse transfer, the tracking performance may be improved by lowering the welding command voltage.)
However, please use welding and weaving conditions that allow for stable welding.



- The droplet transfer means that the welded tip of wire (droplet) transfers to the base metal.
- For the status of droplet transfer, there are dip transfer, spray transfer, and etc.

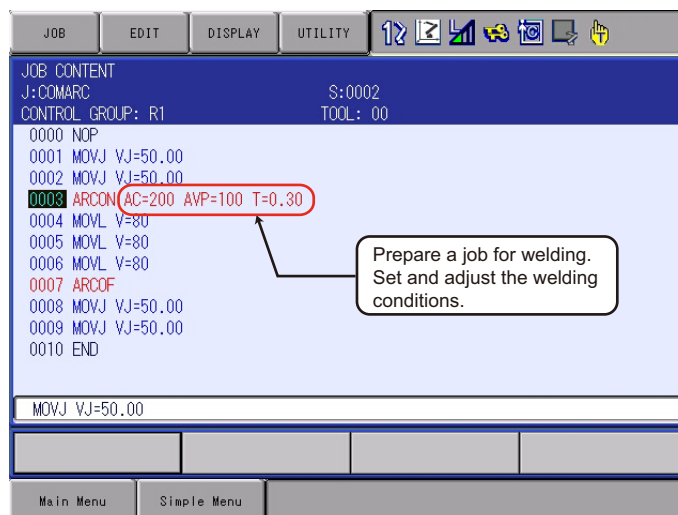
3 Arc Sensor Function

3.2 Main Operations for the Arc Sensor Function

3.2 Main Operations for the Arc Sensor Function

3.2.1 Job Preparation for Welding and Adjustment of Welding Conditions

Prepare a job for welding and adjust the welding conditions.



3.2.1.1 Registration of Arc Sensing Instructions

Register a COMARCON/COMARCOF instructions in the section where arc sensing is to be performed.

Set the UP/DOWN correction condition (U/D) to the same values as the value of the current setting in the ARCON instruction.

Set the LEFT/RIGHT correction condition to "0".

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 chapter 6.4 "Adjustment of Sensing Conditions"



3 Arc Sensor Function

3.2 Main Operations for the Arc Sensor Function

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 chapter 6 “Measurement and Registration of Sensing Conditions” at page 6-1.

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 numeric keys.

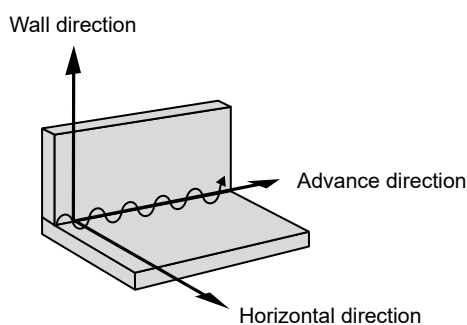
- 3 Arc Sensor Function
- 3.3 Arc Sensor Function and Weaving Condition

3.3 Arc Sensor Function and Weaving Condition

3.3.1 Path Correction Direction and Weaving Basis Coordinate System

As described in chapter 3.1 “Basic Understanding of the Arc Sensor” at page 3-1 , the path correcting direction and weaving action are closely related.

Weaving is performed based on the following coordinate system. This coordinate system is generated automatically when weaving is executed.

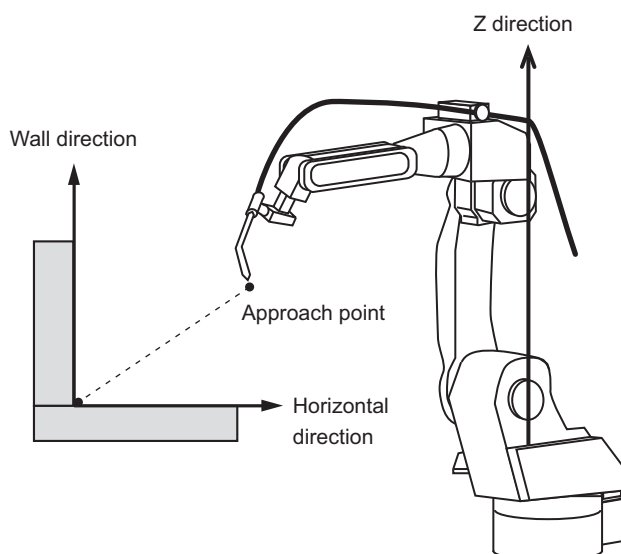


Weaving Basis Coordinate System

- Wall Direction : Z direction of the robot axis
- Horizontal Direction : The direction of approach point from the wall
- Advance Direction : The direction that the torch moves from the weaving start point to the end point



The approach point is a point indicated by a step immediately before the step where weaving starts.



3 Arc Sensor Function

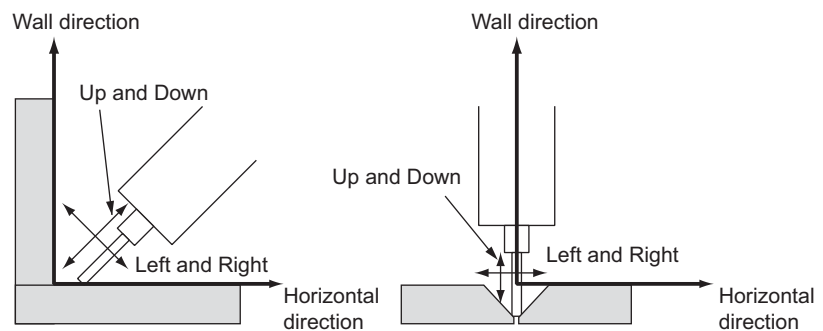
3.3 Arc Sensor Function and Weaving Condition



Depending on the mouthing and shape of the workpiece, a definition of the above coordinate system may not be sufficient to generate a weaving pattern. In that case, register the reference point REFP 1 or REFP 2.

For details, refer to *chapter 3.3 "Arc Sensor Function and Weaving Condition"*

The weaving coordination and the path correcting direction are as follows.

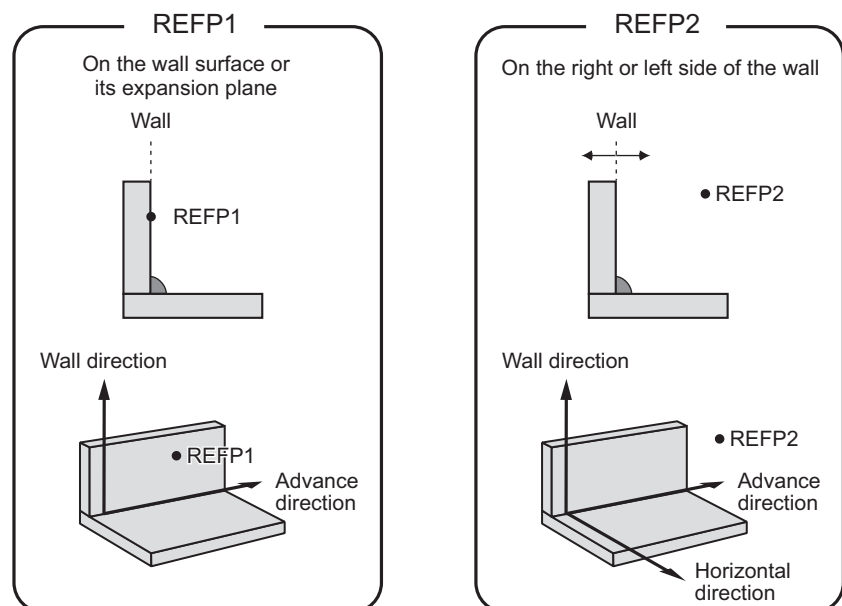


Left and Right path correction is same as the amplitude direction of a weaving, and Up and Down path correction is same as perpendicular direction against the amplitude of a weaving.

3.3.2 Cases that Require the Registration of Reference Points

The registration of the reference point REFP1 or REFP2 is not usually required. They are required only with a special workpiece condition, etc.

The REFP1, that defines the wall direction, is a point on the wall surface or its expansion plane. The REFP2, which defines the horizontal direction, is a point on the right or left side of the wall.



3 Arc Sensor Function

3.3 Arc Sensor Function and Weaving Condition

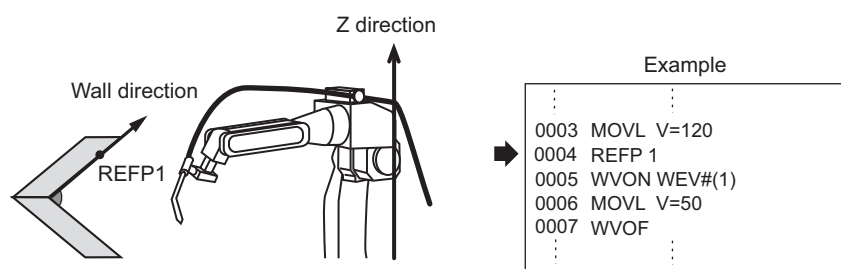


For information on registering REFP, refer to *chapter 4.4*
“REFP (Reference Point Registration)”

< Example 1 >

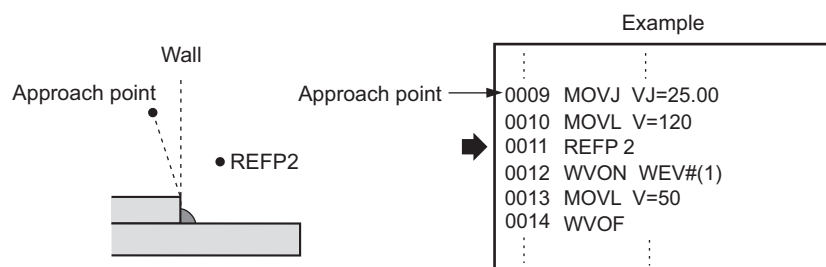
REFP1 is registered because the wall direction is not parallel to the Z direction of the robot axis.

Also, register REFP1 when a robot is hanging from the ceiling. In such case, the Z direction of the robot axis differs from wall direction.



< Example 2 >

REFP2 is registered because the approach point is on another side of the wall.



4 Registration of Instructions
 4.1 COMARCON (Sensing Start Instruction)

4 Registration of Instructions

4.1 COMARCON (Sensing Start Instruction)

The COMARCON instruction starts the arc sensing and weaving.

correction conditions (UP/DOWN correction condition, RIGHT/LEFT correction condition), 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: 0.1 to 5.0 ANGL: 0.0 to 180.0 1 to 255 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 128	-
	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.

4 Registration of Instructions

4.1 COMARCON (Sensing Start Instruction)



- 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 chapter 6 “Measurement and Registration of Sensing Conditions” at page 6-1.
- 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 chapter 7 “COMARC Condition File”

1. Move the cursor to the address area.
2. Press [INFORM LIST].
3. Select "SENSOR".
4. Select "COMARCON".
 - The instruction appears with the previously registered additional items in the input buffer line.



4 Registration of Instructions

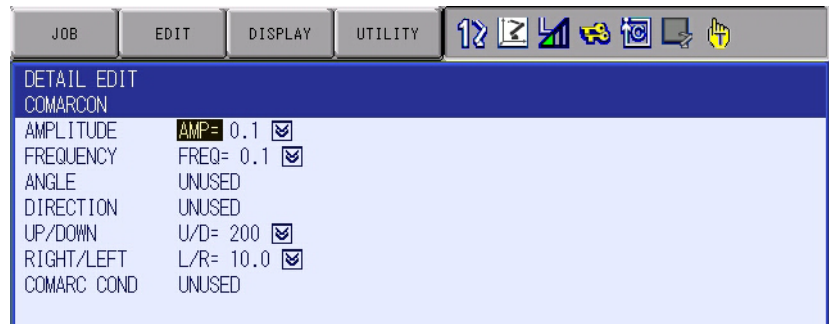
4.1 COMARCON (Sensing Start Instruction)

5. Press [SELECT], and set the conditions in the detail edit window.

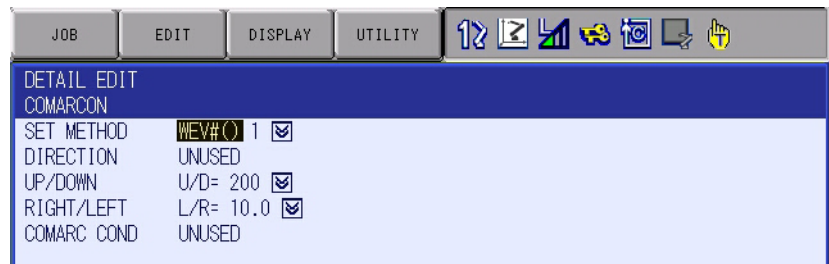
- i) Move the cursor to the item to be set, and press [SELECT].
- ii) Enter each condition using the numeric keys, and then press [ENTER].

– 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



6. Press [ENTER] twice.

- Press [ENTER] in the detail edit window to display the setting details in the input buffer line.
Press [ENTER] again to register the setting details in the job.

- 4 Registration of Instructions
- 4.2 COMARCOF (Sensing End Instruction)

4.2 COMARCOF (Sensing End Instruction)

The COMARCOF instruction ends arc sensing and weaving.

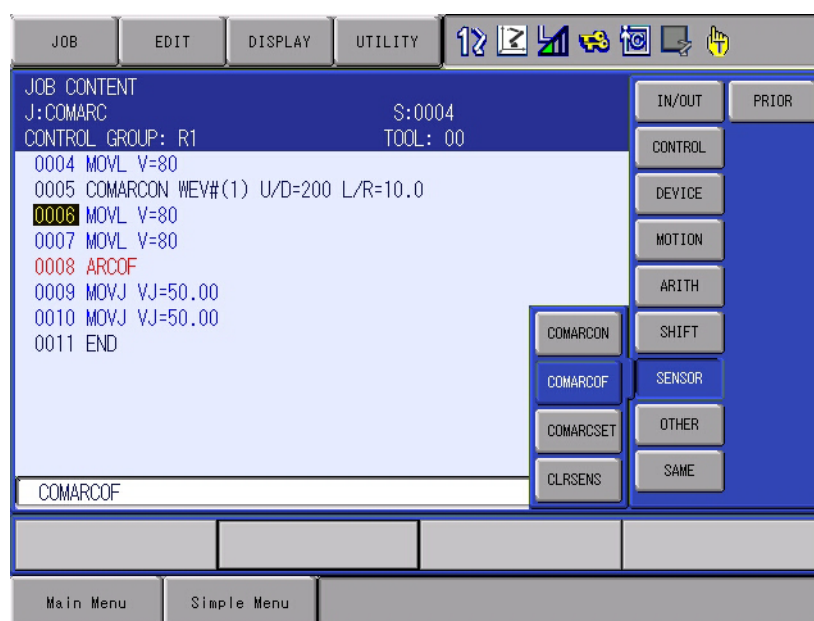
COMARCOF	Function	Ends arc sensing and weaving.
	Instruction item	-
	Example	COMARCOF



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.

1. Move the cursor to the address area.
2. Press [INFORM LIST].
3. Select "SENSOR".
4. Select "COMARCOF".
 - The instruction appears in the input buffer line.



5. Press [ENTER].

4 Registration of Instructions
 4.3 COMARCSET (Sensing Condition Change)

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 (UP/DOWN correction condition, RIGHT/LEFT correction direction), and the COMARC condition file No. specifications.

<> indicates numerical or alphabetical data.

COMARCSET	Function	Changes the sensing conditions and the weaving condition.		
*1)	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 128	-
	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.



- 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 *chapter 6 "Measurement and Registration of Sensing Conditions"*
- For details on the COMARC condition file, refer to *chapter 7 "COMARC Condition File"*

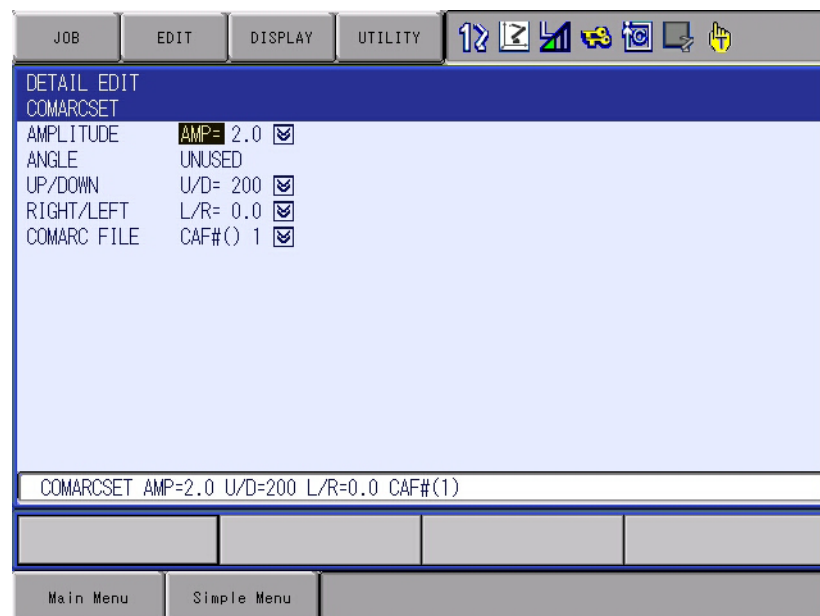
1. Move the cursor to the address area.
2. Press [INFORM LIST].
3. Select "SENSOR".
4. Select "COMARCSET".
 - The instruction appears with the previously registered additional items in the input buffer line.

4 Registration of Instructions

4.3 COMARCSET (Sensing Condition Change)



5. Press [SELECT], and set the conditions in the detail edit window.
 - (1) Move the cursor to the item to be set, and press [SELECT].
 - (2) Enter each condition using the numeric keys, and then press [ENTER].



6. Press [ENTER] twice.

4 Registration of Instructions

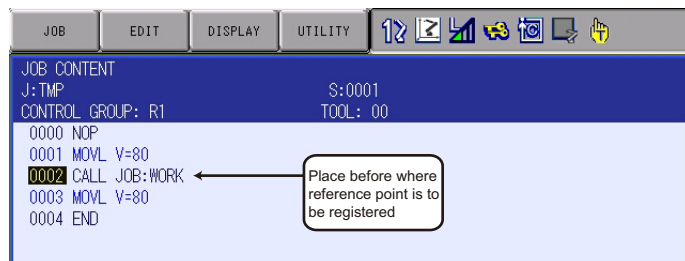
4.4 REFP (Reference Point Registration)

4.4 REFP (Reference Point Registration)

Reference point instructions (REFP) set an auxiliary point such as a wall point for weaving.

Reference points No.1 to 8 are assigned for each application. Follow the procedure below to register reference point instructions.

1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Move the cursor.
 - Move the cursor to the line immediately before the position where the reference point is to be registered.



4. Squeeze the Enable switch.
 - The servo power is turned ON.
5. Press the axis key.
 - Use the axis key to move the manipulator to the position to be registered as a reference point.
6. Press [REFP].
 - The reference point instruction is displayed in the input buffer line.



7. Change the reference point number.
 - Move the cursor to the reference point number, and press [SHIFT] + the cursor key to change the reference point number.



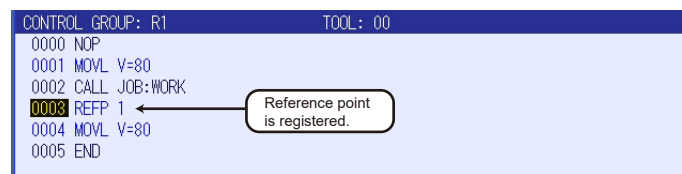
- If you use the numeric keys to input the reference point number, press [SELECT] when the cursor is on the reference point number ("Ref-point_no.=").
- The data input line is displayed. Input number and press [ENTER].



8. Press [INSERT].
 - The [INSERT] key lamp lights.
 - When registering before the END instruction, [INSERT] is not needed.
9. Press [ENTER].
 - The REFP instruction is registered.

4 Registration of Instructions

4.4 REFP (Reference Point Registration)



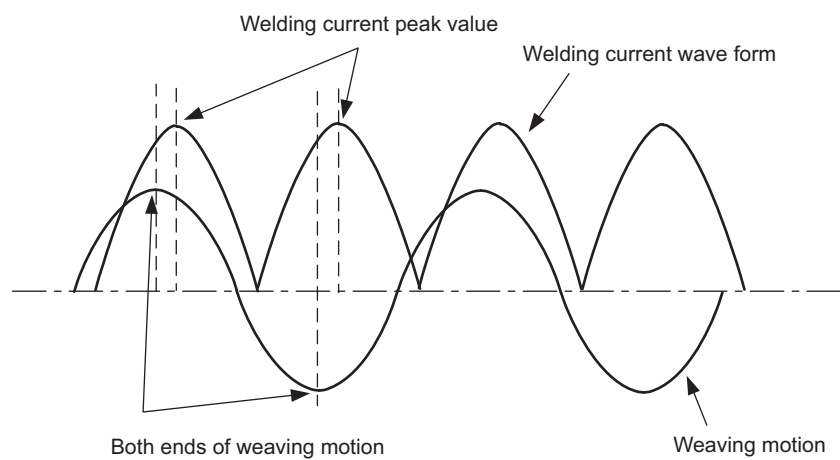
5 Phase Compensation Value

As explained in chapter 3.1 “Basic Understanding of the Arc Sensor” at page 3-1, 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.

5 Phase Compensation Value

5.1 Job Preparation for Measurement of Phase Compensation Value

5.1 Job Preparation for Measurement of Phase Compensation Value

Prepare a job to measure a phase compensation value.

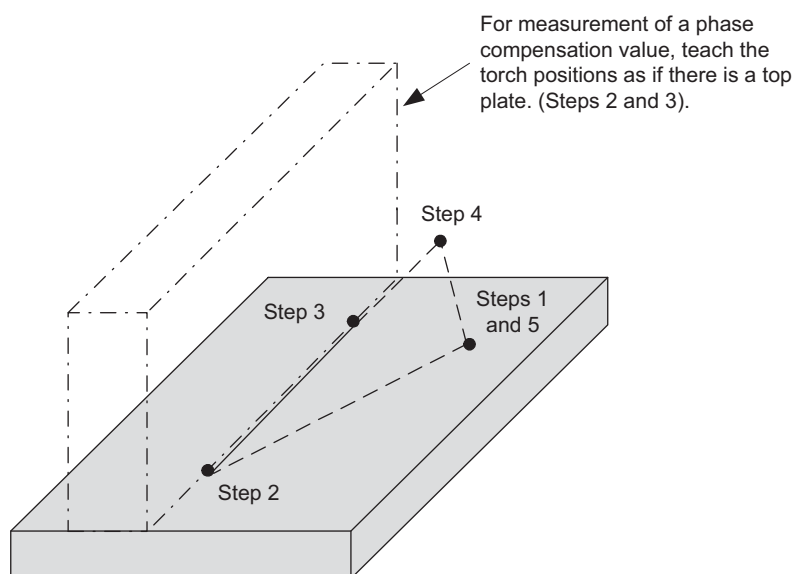
Refer to the following job example to prepare a job for measurement of a phase compensation value.

Fig. 5-1: 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

```



- 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.
- For measurement of a phase compensation value, teach the torch positions as if there is a top plate. (Steps 2 and 3).

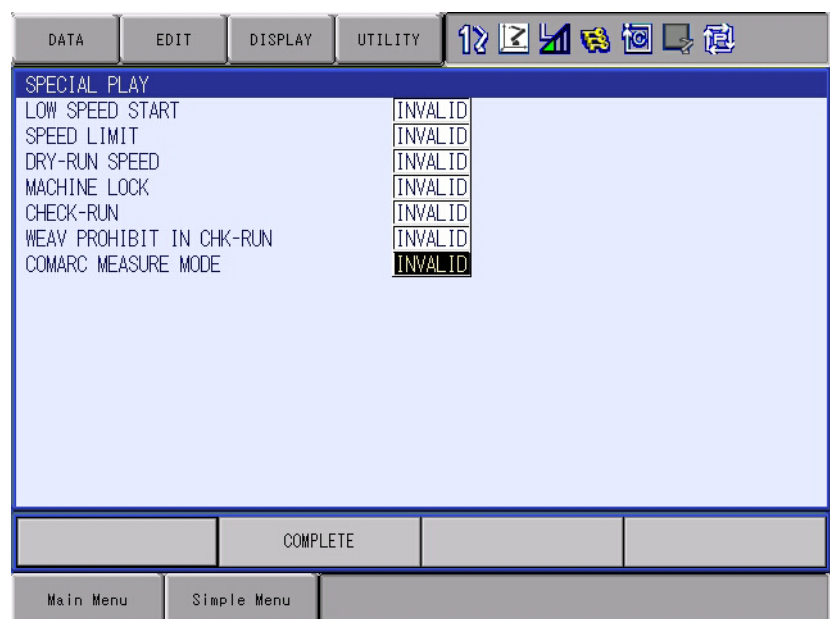
- 5 Phase Compensation Value
- 5.2 Measurement and Registration of a Phase Compensation Value

5.2 Measurement and Registration of a Phase Compensation Value



- 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 the parameter SxE197 to "1" first, then proceed the following operations.
- After the registration of phase compensation value, be sure to reset the parameter SxE197 to "0".

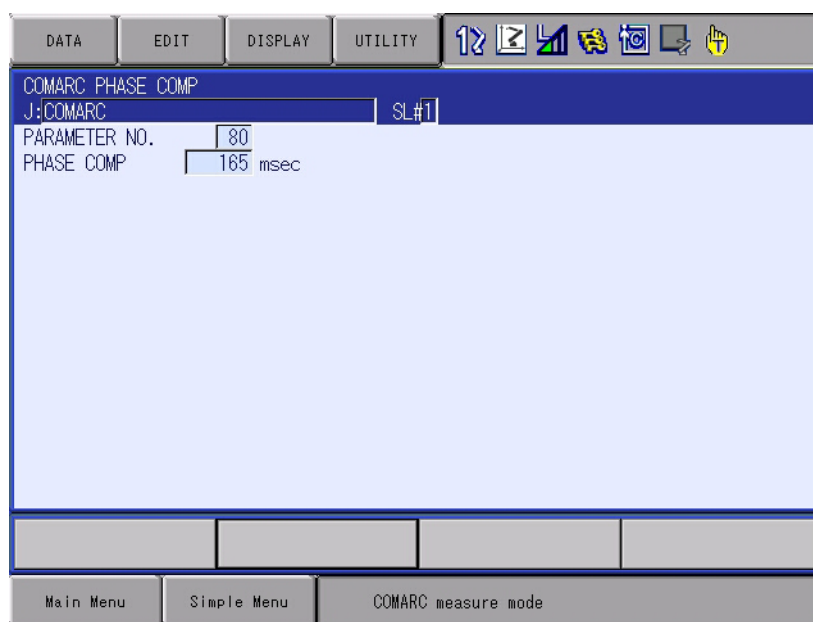
- Select the job for measurement of a phase compensation value.
- Select {UTILITY} in the JOB CONTENT window in play mode.
- Select {SETUP SPECIAL RUN} from the selection dialog box.
 - The SPECIAL PLAY window appears.



- Set the "COMARC MEASURE MODE" to "VALID".
 - Move the cursor to "COMARC MEASURE MODE", and press [SELECT] to set the mode to "VALID".
 - The message "COMARC MEASURE MODE" appears in the message line.
- Execute the job.
- Select {UTILITY} in the teach mode.
- Select {COMARC COND. MODIFY}.
 - The COMARC PHASE COMP window appears.

5 Phase Compensation Value

5.2 Measurement and Registration of a Phase Compensation Value



8. Select {PARAMETER} from the main menu.
9. Select {SxE}.
10. Display the parameter No. to be changed.
11. Register the measured value.
 - Register the phase compensation value confirmed in the COMARC PHASE COMP window appears.



- After measuring the phase compensation value, be sure to reset the "COMARC MEASURE MODE" to "INVALID".
- When the shielding gas is changed, measure and register the phase compensation value. If the type of shielding gas is different, the parameter No. is different.
- 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.

6

Measurement and Registration of Sensing Conditions

6.1

Job for Measuring Sensing Conditions

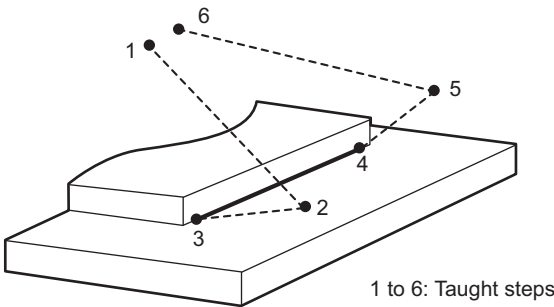
Play back the measuring job in the sensing condition measurement mode to automatically measure the data of the sensing conditions (correction conditions in the up/ down/left/right directions).

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	



6	Measurement and Registration of Sensing Conditions
6.1	Job for Measuring Sensing Conditions

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 measuring 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

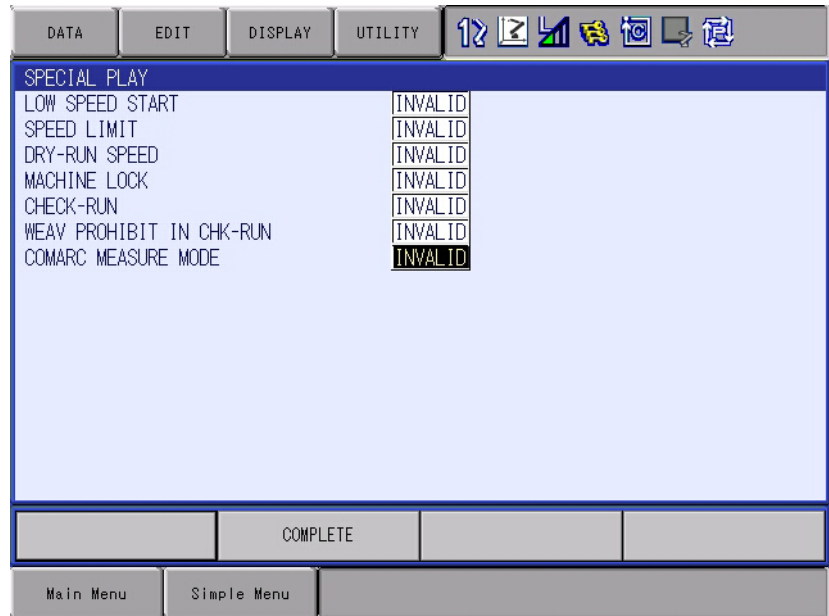
ARCOF

MOVJ VJ=30.00

6 Measurement and Registration of Sensing Conditions
6.2 Measurement of Sensing Conditions

6.2 Measurement of Sensing Conditions

1. Select {UTILITY} in the JOB CONTENT window in the play mode.
2. Select {SPECIAL PLAY} from the selection dialog box.
 - The SPECIAL PLAY window appears.



3. Set "COMARC MEASURE MODE" to "VALID".
 - (1) Move the cursor to "COMARC MEASURE MODE", and press [SELECT] to set the mode to "VALID".
 - (2) "COMARC MEASURE MODE" appears in the message line.
4. Execute the job.

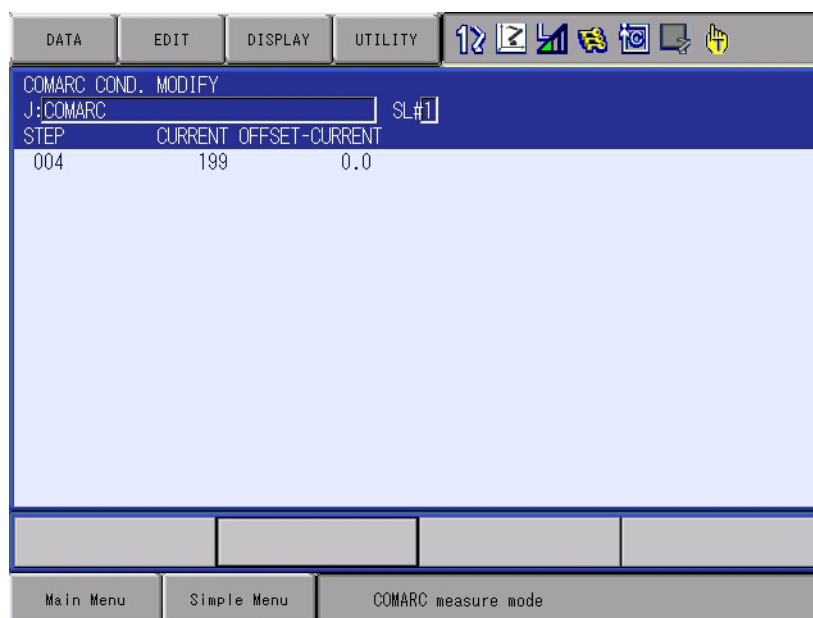


Be sure to reset the "COMARC MEASURE MODE" to "INVALID" after measuring the sensing conditions.

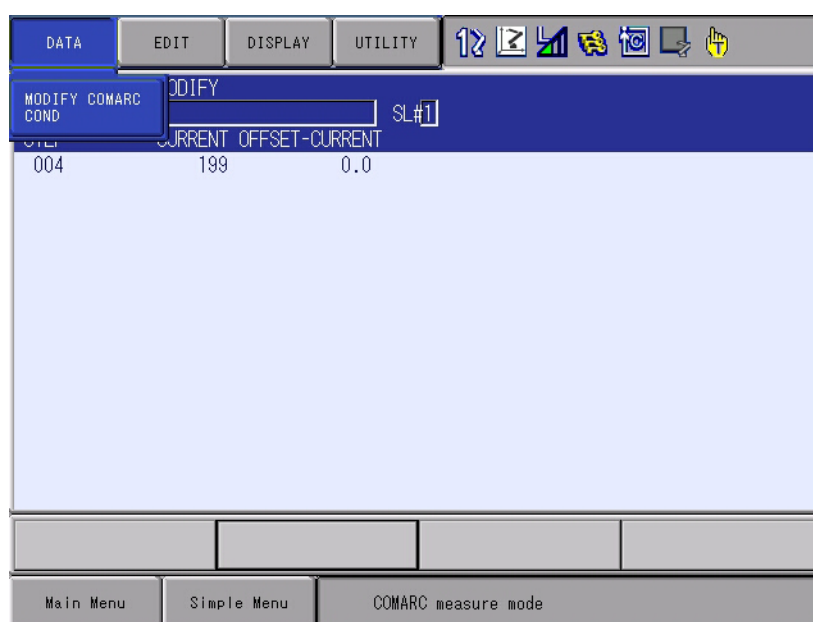
6 Measurement and Registration of Sensing Conditions
 6.3 Registration of Sensing Conditions

6.3 Registration of Sensing Conditions

1. Select {UTILITY} in the JOB CONTENT window in the teach mode.
2. Select {COMARC COND. MODIFY}.
 - The COMARC COND. MODIFY window appears.



3. Select "MODIFY COMARC COND" from the {DATA} selection box.
 - The sensing conditions are registered in the job.



- When registration is complete, the JOB CONTENT window reappears.

6 Measurement and Registration of Sensing Conditions

6.4 Adjustment of Sensing Conditions

6.4 Adjustment of Sensing Conditions

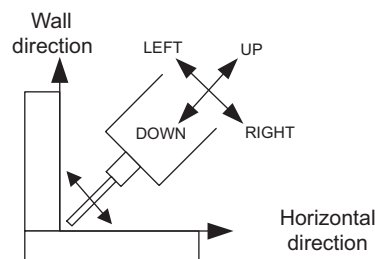
1. Move the cursor to the instruction area of the COMARCON instruction or the COMARCSET instruction.
2. Press [SELECT] twice.
3. Select either "UP/DOWN" or "LEFT/RIGHT" in the DETAIL EDIT window.
 - Enter a value using the numeric keys.



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 chapter 3.3 "Arc Sensor Function and Weaving Condition" at page 3-5.

- 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.



6 Measurement and Registration of Sensing Conditions

6.5 Results of Arc Sensing

6.5 Results of Arc Sensing

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

1. Select {ARC WELDING} from the main menu.
2. Select {COMARC CORRECT}.
 - The correction amount in each step appears.

CORRECTING LIST				
NO. OF STEPS	STEP	VAR-U	VAR-D	SENSOR SL#1
0005	0.0	2.7	0.0	2.7
0006	0.0	3.0	0.0	3.0
0007	0.0	3.0	0.0	3.0
0008	0.0	3.0	0.0	3.0
0009	0.0	3.0	0.0	3.0
0010	0.0	3.0	0.0	3.0



The CORRECTING LIST window only appears when sensing has been performed.

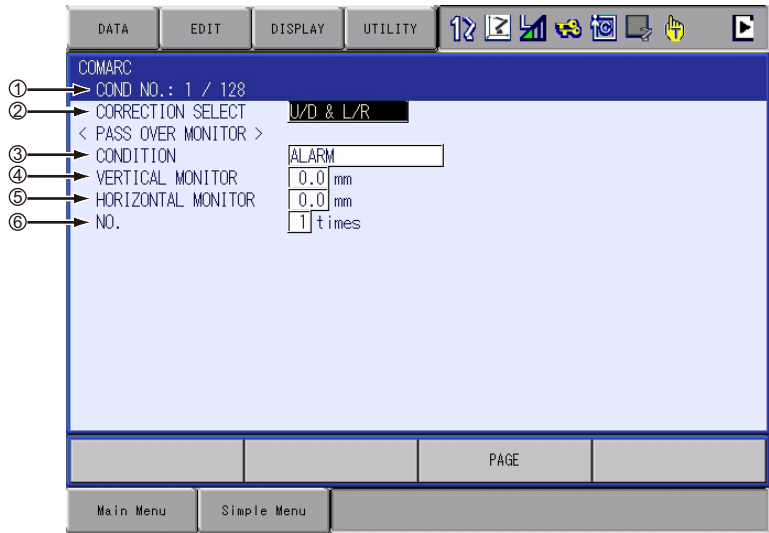
Therefore, the icon "COMARC CORRECT" does not appear when turning the power ON or before performing sensing.

7 COMARC Condition File

Set the following two items in the COMARC condition files.

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

7.1 COMARC Condition File



① COND NO. (1 to 128)

Displays the file No.

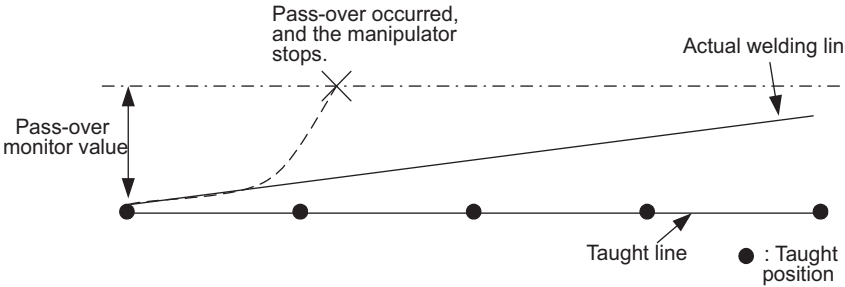
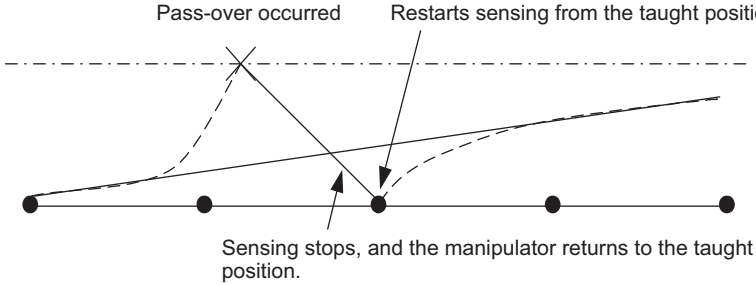
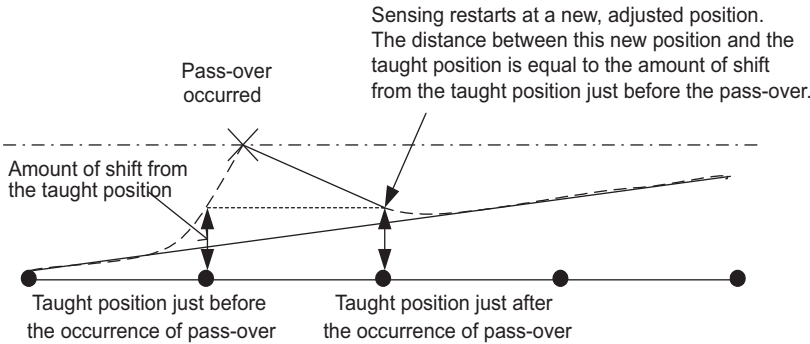
② CORRECTION SELECT (direction of path correction) (U/D & L/R, U/D, L/R, NO CORRECTION)

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).

③ CONDITION (operation after pass-over) (ALARM, TEACHING POSITION, CORRECTION RETAIN, NOT MONITOR)
Specifies the operation to be done when a pass-over occurs.

7 COMARC Condition File
7.1 COMARC Condition File

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.

④ VERTICAL 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.

⑤ HORIZONTAL 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.

7 COMARC Condition File
7.1 COMARC Condition File

⑥ NO. (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



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

7 COMARC Condition File
7.2 File Operation

7.2 File Operation

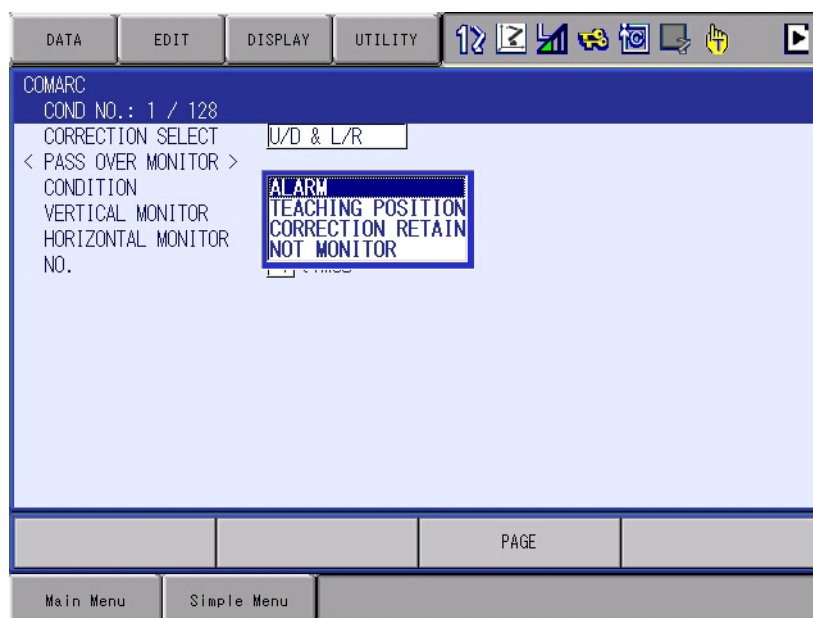
7.2.1 Display of a File

1. Select {ARC WELDING} from the main menu.
2. Select {COMARC COND}.
3. Display a desired file No.
 - Press the [PAGE] to call the next file No.
 - Press [SHIFT] + [PAGE] to call back the previous file No.

7.2.2 Editing of a File

7.2.2.1 Editing of "CORRECTION SELECT" and "CONDITION"

1. Move the cursor to "CORRECTION SELECT" or "CONDITION", and press [SELECT].
2. Select the item to be set from the selection dialog box.



7.2.2.2 Editing of Other Items

1. Move the cursor to the item to be set, and press [SELECT].
2. Enter a value to be set using the numerical keys.
3. Press [ENTER].

7 COMARC Condition File

7.2 File Operation

7.2.3 Initialization of the File

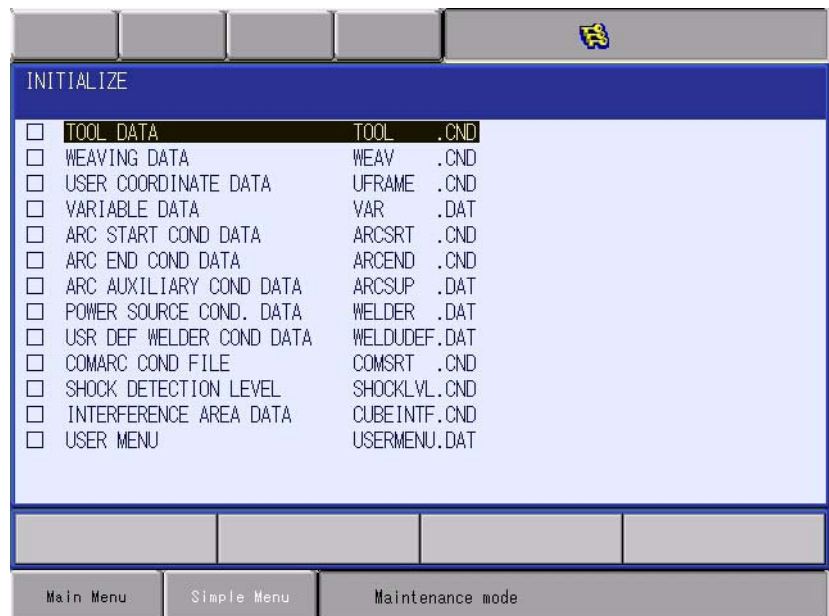
The COMARC condition file can be initialized in the maintenance mode.



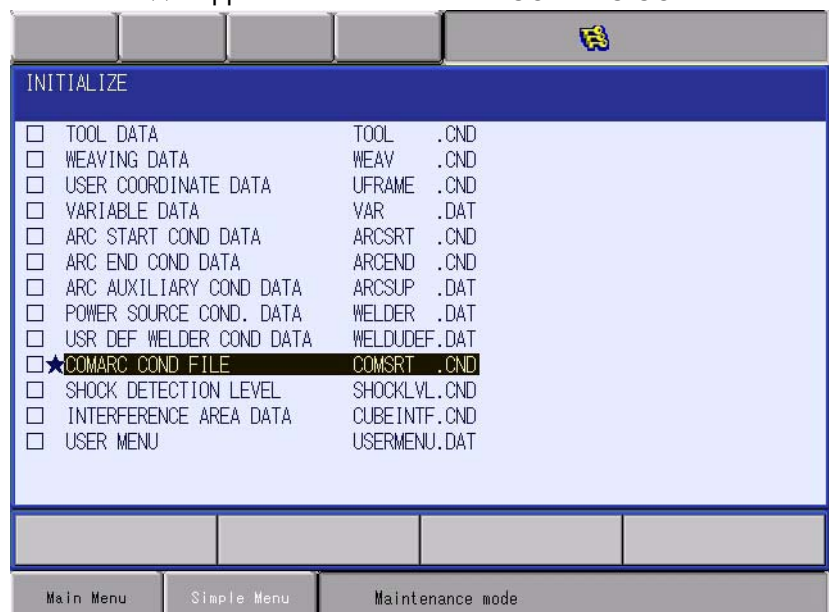
To initialize the COMARC condition file, set the security mode to "MANAGEMENT MODE".

(When the security mode is set to "OPERATION MODE" or "EDITING MODE", a file cannot be initialized.)

1. While pressing [MAIN MENU], turn ON the power.
2. Change the security mode ("SECURITY") to "MANAGEMENT MODE".
3. Select {FILE} from the main menu.
4. Select {INITIALIZE}.
5. Select "FILE/GENERAL DATA".
 - The selection window of condition file/general data appears.



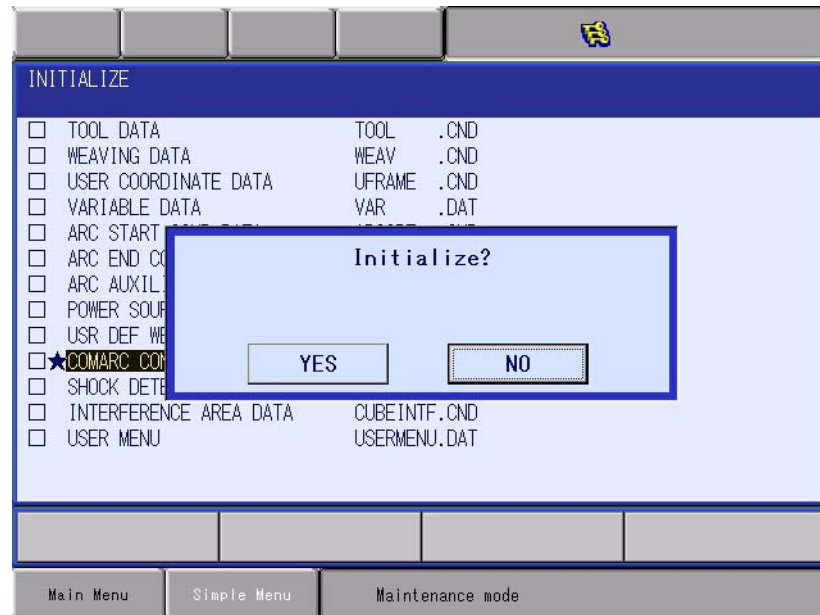
6. Select "COMARC COND FILE".
 - A star "★" appears on the left of the "COMARC COND FILE".



7 COMARC Condition File

7.2 File Operation

7. Press [ENTER].
 - The confirmation dialog box appears.
8. Select "YES".
 - The COMARC condition file is initialized.



9. Turn ON the power again.

8 Modification of the Settings in COMARC Function

To validate the COMARC function, mount the JANCD-ACP02-E board in the CPU rack (JZNC-ARK01-E) with the power OFF.

To invalidate the COMARC function, remove the JANCD-ACP02 board from the CPU rack (JZNC-ARK01-E) with the power OFF.



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.



- 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", the setting status can be only referenced.

1. While pressing [MAIN MENU], turn ON the power.
2. Change the security mode ("SECURITY") to "MANAGEMENT MODE".
3. Select {SYSTEM} from the main menu.
4. Select {SETUP}.
 - The SETUP window appears.



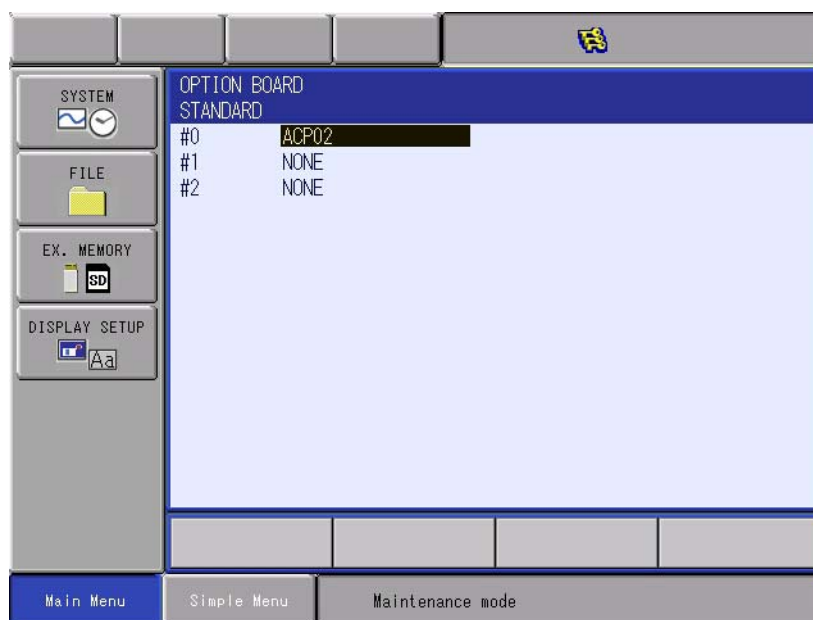
8 Modification of the Settings in COMARC Function

5. Select {OPTION BOARD}.

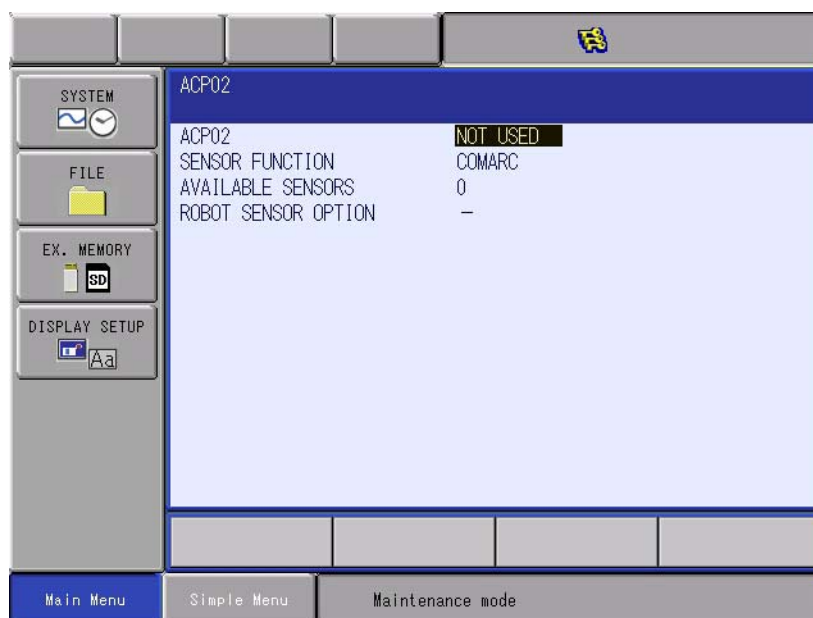
(1) The setting status appears.

– When the ACP02 board is mounted, the following window appears.

Fig. 8-1: When the ACP02 board is Mounted



(2) Press [SELECT], and the ACP02 window appears.



(3) Set the “ACP02” to “USED”.



(4) To change the ROBOT SENSOR OPTION, Select “DETAIL” of “ROBOT SENSOR OPTION”.



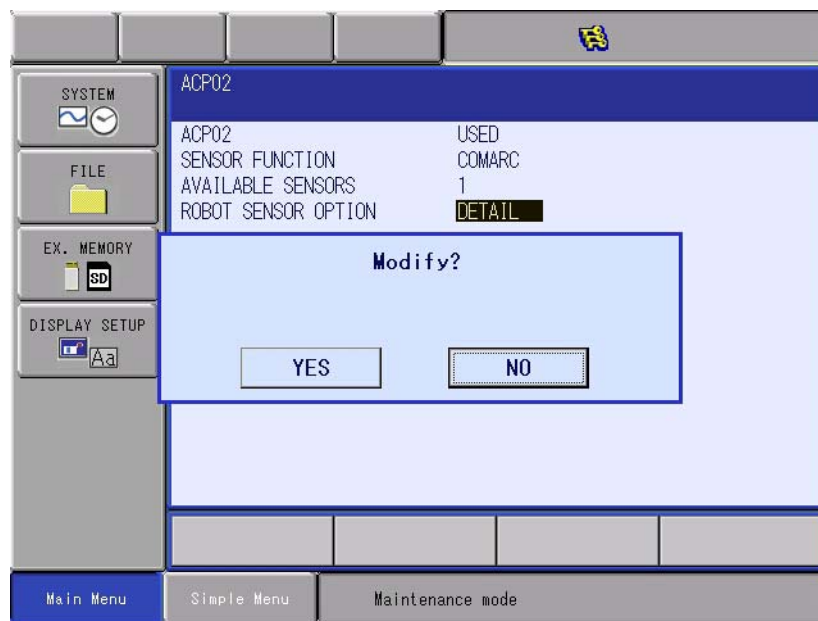
– When the ACP02 board is not mounted, the following window appears.

Fig. 8-2: When the ACP02 board is not Mounted



6. Press [ENTER].
– The confirmation dialog box appears.

8 Modification of the Settings in COMARC Function



7. Select "YES".
8. Turn ON the power again.

9 Instruction List

< > indicates numerical or alphabetical data.

COMARCON	Function	Starts arc sensing and weaving.		
	Instruction 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: 0.1 to 5.0 ANGLE: 0.0 to 180.0 1 to 255 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 128	-
	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)		
COMARCOF	Function	Ends arc sensing and weaving.		
	Instruction item	-		
	Examples	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 128	-
	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 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; the weaving directions are identical.

9 Instruction List

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



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 the B000 to "25".

10 Parameter List

SxE Parameters

Parameter No.	Contents	Unit	Initial Value	Setting Range
0	Application designation	-	-	-
1 to 19	Not used	-	-	-
20	Analog signal input channel	-	SL1: 1 SL2: 2 SL3: 3 SL4: 4 SL5: 5 SL6: 6 SL7: 7 SL8: 8	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
23	Number of times that correction was prohibited at MIN: correction prohibited current	-	0	-
24	Correction prohibited minimum current	[0.1A]	500	0 to 10000
25	Correction prohibited maximum current	[0.1A]	10000	0 to 10000
26	Not used	-	-	-
27	Dead zone U/D	[0.1A]	50	0 to 10000
28	Dead zone L/R	[0.1A]	50	0 to 10000
29	Not used	-	-	-
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
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

10 Parameter List

SxE Parameters

Parameter No.	Contents	Unit	Initial Value	Setting Range
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
46 to 49	Not used	-	-	-
50	Sampling interval	[msec]	2	1 to 10
51 to 59	Not used	-	-	-
60 to 179	Phase compensation value	[msec]	-	-
180 to 196	Not used	-	-	-
197	Measurement mode (1: Phase compensation value measurement)	-	0	0,1
198,199	Not used	-	-	-

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)[Decimal data]	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(ACP02)	Checksum error in the ROM (memory) of the sensor program.	Replace the ACP02 board.
5010	ANALOG INPUT ERROR (ACP02) [Decimal data]	The analog input value of ACP02 board cannot be read properly. The decimal data indicates the channel where an input fault occurs.	Check the cable connection. Replace the ACP02 board.
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.
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.

YRC1000 OPTIONS INSTRUCTIONS

FOR ARC SENSOR COMARC FUNCTION

For inquiries or after-sales service on this product, contact your local YASKAWA representative as shown below.

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Specifications are subject to change without notice
for ongoing product modifications and improvements.

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