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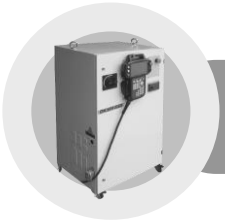
WARNING

THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi5AW120701FMEN2



Hi5 Controller Function Manual

Arc welding (GB2, GZ4 Welder)

HYUNDAI
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Contents

Contents

Figure Contents

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1 Basic information of arc welding

1.1. Introduction

Teach the arc welding work as the following picture.

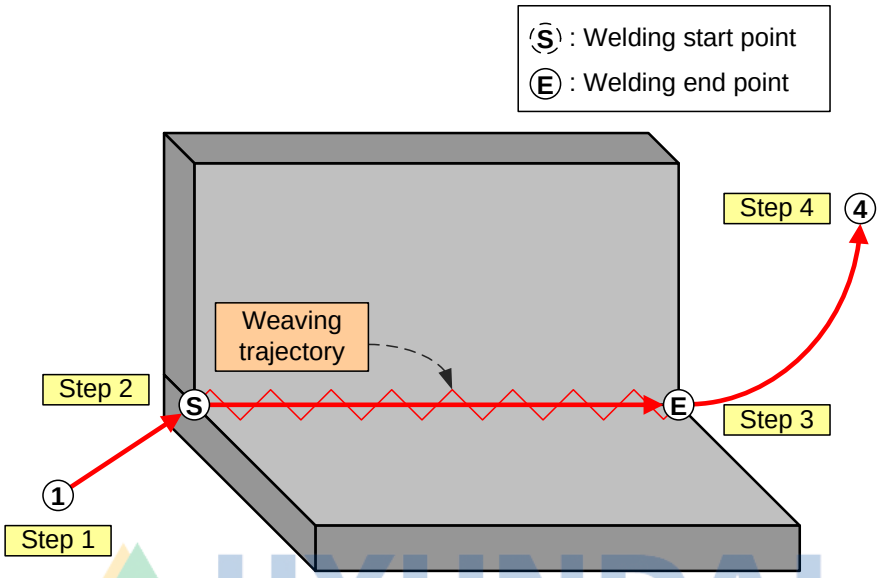

Figure 1.1 Basic arc welding teaching

(1) Connect the power.
Turn on the power switch on the front side of the controller.

(2) Switch to a manual mode.
Select a manual mode from [Mode] switch of teach pendant.

(3) Click [Program] on the teach pendant and enter the program number.

(4) After these processes, the teach pendant screen will be displayed as in Figure 1.2.

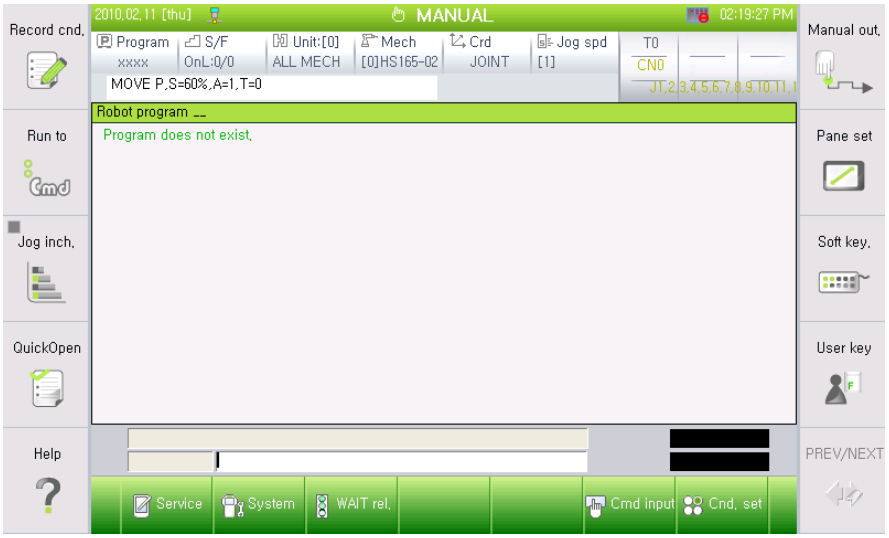

Figure 1.2 New program number selected

(5) Click [Motor On] on the teach pendant to supply power to the robot motor.

(6) Use the axis control button to move the robot torch to Step 1 position.

(7) Click [Record cnd.] key and select the interpolation type, speed, accuracy and the tool number that you want to use.

① Use the direction key for moving around items. Setting will be saved after moving to an appropriate item, setting a value and pressing the [ENTER] key.
② Press [Tool] key and enter the tool number you want for setting the tool number. (Select [Tool] key by pressing [SHIFT]+[Coordinate] key.)

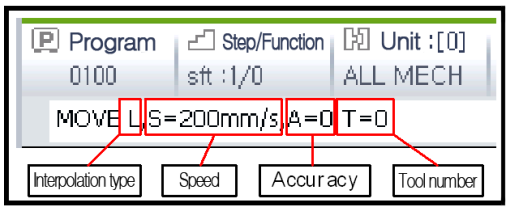

Figure 1.3 Contents of the record condition displayed

(8) Click [Record] to record the steps as in Figure 1.4.

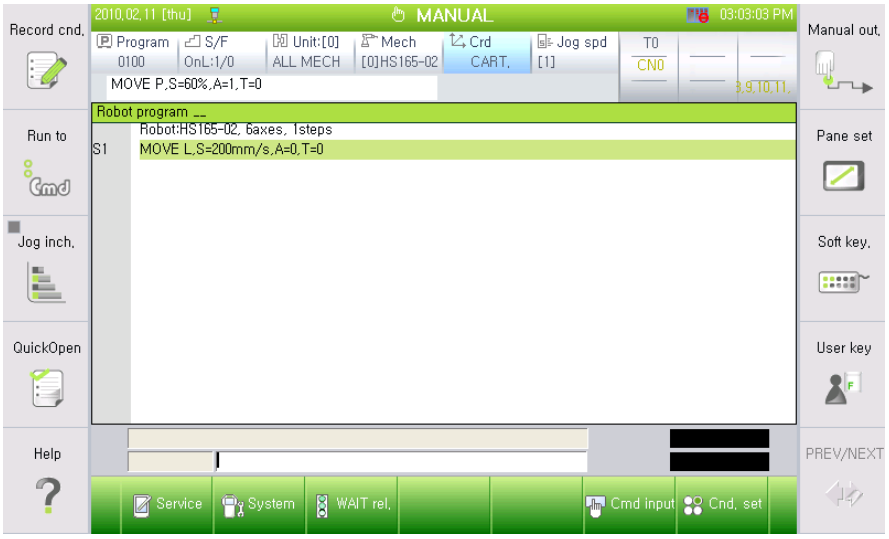

Figure 1.4 Step recording screen (1)

(9) Repeat (5) ~ (7) process for Step 2~4.

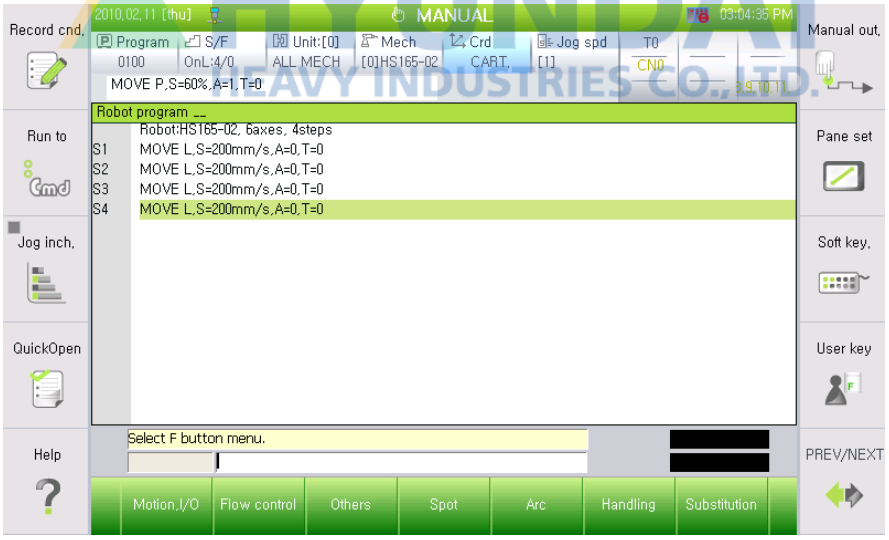

Figure 1.5 Step recording screen (2)

(10) Move the cursor to Step 2 since welding sections are between Step 2 ~ Step 3.

① Click [User key] to display the registered user key at the bottom of the screen.
② Click [WEAVON] key ([F4] by default) when using weaving. Input the pattern number and click [ENTER]. (Refer to ’13.8 Weaving condition’ to learn more about how to set weaving conditions.)
③ Click [ARCON] key in the same way. Enter the pattern number and press the [ENTER] key. (Refer to ’13. Starting Conditions for Arc Welding’ to learn more about how to set arc welding conditions.)

(11) Move the cursor to Step 3 where arc will is ended.

① Click [User key] again to display the registered user key at the bottom of the screen and click [ARCOF] key to enter the command.
② Click [WEAVOF] key in the same way to enter WEAVOF command.

(12) Adjust the speed in Step 3 to the desired welding speed. (Ex. 12mm/s)

(13) Finally, enter the END command that will terminate the program.
Click 『[F6]: Command input』 → 『[F2]: Flow control』 → 『[F7]: End』 to enter the END command.

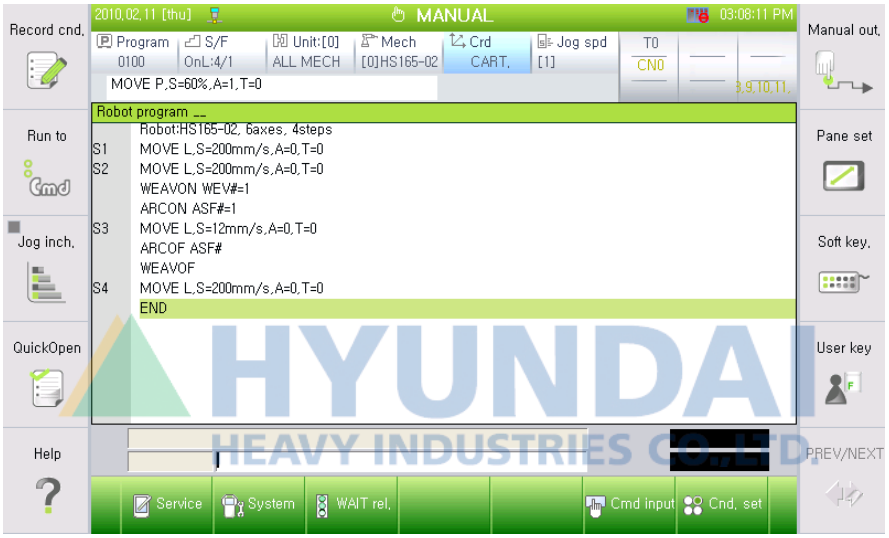

Figure 1.6 Teaching complete

1.2. Arc welding function setting

(1) The arc welding function may not be activated in some robot types. In such cases, set the arc welding function according to the following process. (Seek help from certified engineer for arc welding function setting.)

(2) Clicking 『[F2]: System』 → 『5: Initialize』 → 『3: Set purpose』 under manual setting screen displays the following dialog box for setting the robot purpose, user key, and input/output signal allotment.

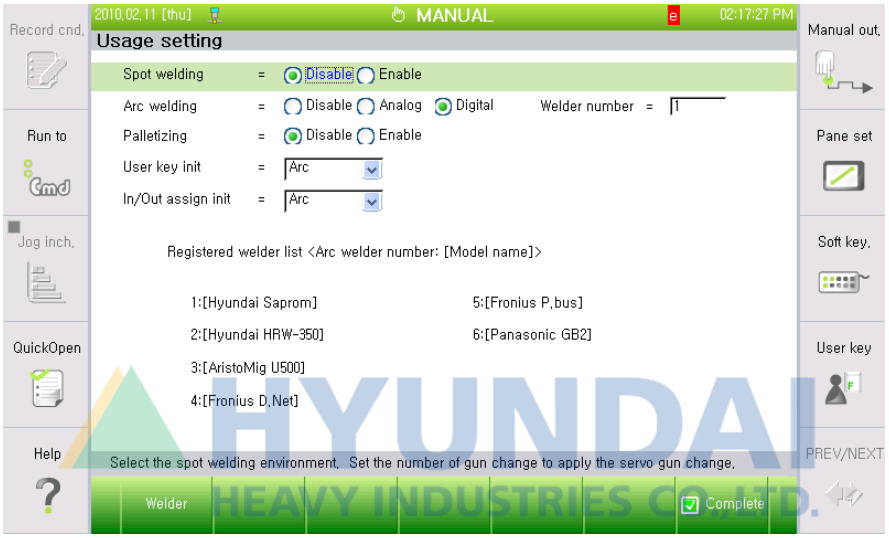

Figure 1.7 Usage setting dialog box

(3) The screen above shows a case which arc welding is set as digital, GB2 welder.
You can enter into the welder condition setting dialog box after pressing 『[F1]: welder』 on this screen.

(4) Refer to [15. Welder characteristics file] for advanced setting of welder condition files.

1.3. Arc welding application condition setting

A screen where various conditions for arc welding application can be set will be displayed as follows by clicking 『[F2]: System』 → 『4: Application parameter』 → 『2: Arc welding』from the manual setting screen.

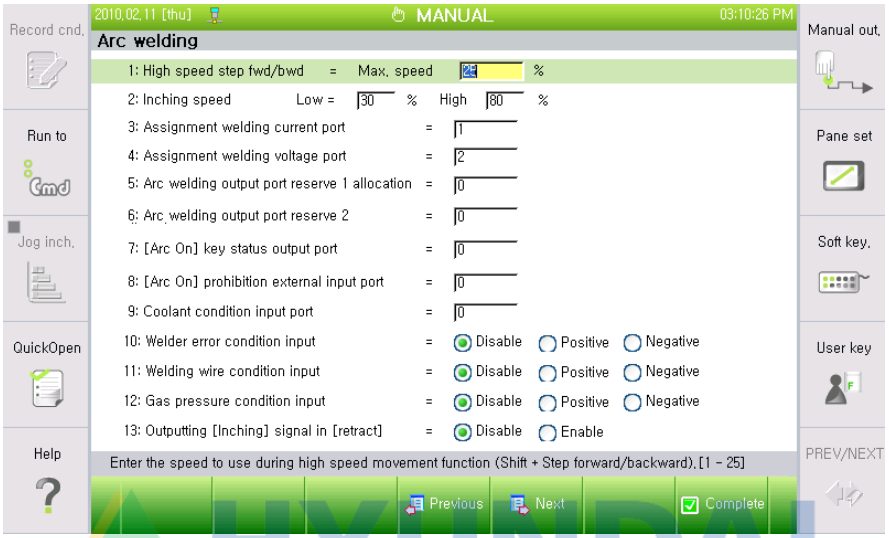

Figure 1.8 Arc welding application condition dialog box

Details for each item are as follows.

(1) Inching speed: [1 ~ 25]
[1 ~ 50], [10 ~ 100]: Inching speed setting sets the wire feeding speed for wire inching and retracting when using the [Inching], [Retract] keys. Wire speed sets the current value and feeding speed in low/high speeds (movement when pressing key for more than 3 sec.). (Refer to inching and retract function.)

(2) Allotment of welding current reference output port: [1 ~ 32]
Sets the analog output port no. for generating the arc welding current reference voltage.

(3) Allotment of welding voltage reference output port: [1 ~ 32]
Sets the analog output port no. for generating the arc welding voltage reference voltage.

(4) Allotment of arc welding output reserve port 1: [1 ~ 32]
Sets the analog output port no. for generating the reference voltage on the reserve arc welding output port No.1.

(5) Allotment of arc welding output reserve port 2: [1 ~ 32]
Sets the analog output port no. for generating the reference voltage on the reserve arc welding output port No.2.

(6) Allotment of [GUN] key condition output signal: [Allotment of normal output signal]
Sets the output signal for generating the current condition of the [GUN] key.

(7) External input signal for [GUN] key banning: [Allotment of normal input signal]
Sets an input signal that bans the [GUN] key movement to stop the [GUN] key from being accidently pressed. When the robot operates with the LED light off by activating this button, only the movement will continue without actually executing the arc welding.

(8) Allotment of coolant condition input port: [Allotment of normal input signal]
When using a liquid-cooled arc welding torch, set the input signal for determining problems in the coolant circulation. When this signal is input during welding, the robot deems it as an error and stops the movement and welding operation.

(9) Entry of welder error condition: [Null, positive logic, negative logic]
Determines the usage and logic of the input signal for welder error condition.

(10) Entry of welding wire condition: [Null, positive logic, negative logic]
Determines the usage and logic of the input signal for welding wire condition.

(11) Entry of gas pressure condition: [Null, positive logic, negative logic]
Determines the usage and logic of the input signal for gas pressure condition.

(12) [Inching] signal output upon [Retract]: [Null, valid]
When reverse inching the wire, determines whether to also use the function of generating the inching signal. Set this to valid only when using a welder that requires this function.

(13) Digital filter for arc sensing: [0 ~ 200]
Sets the digital filter value to be applied in the arc sensing analog input value. Digital filter is not applied when entering 0 or 1.

(14) Allotment of input port for arc sensing: [-2 ~ 32]
This input port receives the welding current measurement value used in arc sensing. -1 and -2 are set when using arc sensing for welders that support CAN communication. -1 uses the welder input value and -1 uses the digital filter.

(15) Auto-save upon changing I, V: [Null, valid]
Determines whether to auto-save the value when changing the current and voltage in the 'Change arc welding current/voltage' box. Refer to "9: Changing current/voltage during welding" for further details.

(16) Auto-activating monitoring during welding: [Null, valid]
When the arc welding starts, the arc welding monitoring automatically sets the usage of the function displayed on the screen.

(17) Application of filter for high weight arc torch: [Null, valid]
When using a high weight torch, determines whether to apply a high weight arc torch filter. Setting this criterion to valid upon using high weight torches such as liquid-cooled torches has the effect of reducing vibration.

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2 Insert command

2.1. ARCON

<table>
<tr><td>Description</td><td colspan="3">ARCON command starts the arc welding and can be used in 4 forms. But, the 3rd or 4th type commands may not be used for certain welders. The set welder in this manual is the digital welder (GB2/GZ4), which does not support the 4th form of command.</td></tr>
<tr><td>Grammar</td><td colspan="3">• ARCON
• ARCON ASF#=<Arc welding condition no.>
• ARCON C=<Current>,V(VP)=<Voltage>,ASF#=<Arc welding condition no.>
• ARCON ASF#=<Arc welding condition no.>,JOB#=<Welder job no.>
→ Not supported</td></tr>
<tr><td rowspan="4">Parameter</td><td>Arc welding condition no.</td><td>Welding condition no. used for arc welding start and main condition</td><td>Rounded-up. 1~32</td></tr>
<tr><td>Current</td><td>Output current for arc welding</td><td>0~500 A</td></tr>
<tr><td>Voltage(V)
Voltage(VP)</td><td>Actual output voltage upon arc welding
Offset voltage of synergic voltage upon arc welding</td><td>-20 ~ 40 V
-200 ~ 200 V</td></tr>
<tr><td>Welder job no.</td><td>Job no. to use among job no. saved in welder</td><td>1~999</td></tr>
<tr><td>Example of usage</td><td colspan="3">• ARCON: Starts welding based on previous welding conditions or conditions set according to commands such as ARCCUR, ARCVOL
• ARCON ASF#=1: Starts welding based on conditions set on the designated condition file
• ARCON C=200,V=22,ASF#=1: Starts welding by applying input values for current and voltage, and using welding start condition no. for other welding conditions
• ARCON ASF#=1,JOB#=5: Applies the job mode for welding and uses job no. 5. Starts welding based on welding start condition no. for other welding conditions</td></tr>
</table>

Reference

- To use the digital welder, set ‘arc welding’ of 『[F2]: System』 → 『5: Initialize』→ 『3: Set purpose』 as digital.
- When setting 'Arc welding' as digital, it is possible to use only in the form of using a condition number.
- Some welder models have the function of internally saving jobs by presetting various welding settings. In such cases, it is possible to use the 4th criterion.

2.2. ARCOF

ARCOF is a command to end arc welding.

<table>
<tr><td>Description</td><td colspan="3">ARCOF command ends the arc welding and can be used in 4 forms. But, the model used in this manual is the digital welder (GB2/GZ4), which supports only the 1st and 2nd forms of command.</td></tr>
<tr><td>Grammar</td><td colspan="3">• ARCOF
• ARCOF ASF#
• ARCOF AEF#=<Arc end condition number> → Not supported
• ARCOF C=<Current output>,V(VP)=<Voltage output>
,AEF#=<Arc end condition number> → Not supported</td></tr>
<tr><td rowspan="3">Parameter</td><td>Arc end condition number</td><td>Welding condition number which is used on arc welding end</td><td>1~32</td></tr>
<tr><td>Current output</td><td>Output current on arc welding end</td><td>0~999 A</td></tr>
<tr><td>Voltage output (V)

Voltage output (VP)</td><td>Output voltage for individual setting arc welding end.
Output voltage for unified setting arc welding end</td><td>0.0~40.0 V

-20~200 %</td></tr>
<tr><td>Example of usage</td><td colspan="3">• ARCOF: Ends arc welding without special ending process.
• ARCOF ASF#: Ends welding according to details set by ARCON in case of digital setting. Condition setting can be approached only from ARCON.
• ARCOF AEF#=1: Ends welding according to the condition on the condition file.
• ARCOF C=200,V=22, AEF#=1: Ends welding according to input value for current and voltage and the value on the assigned condition file for other welding conditions.</td></tr>
</table>

Reference

- To use the digital welder, set ‘arc welding’ of 『[F2]: System』 → 『5: Initialize』→ 『3: Set purpose』 as digital.

2.3. WEAVON

WEAVON is a command to start the weaving motion.

Description	Starts the weaving motion.		
Grammar	WEAVON WEV#=<Weaving condition number>		
Parameter	Weaving condition number	Condition number in weaving condition file which will be used in weaving motion.	1~32
Example of usage	WEAVON WEV#=1		

2.4. WEAVCmd

WEAVCmd is a command to set weaving condition in each item externally. Various weaving conditions can be set without regard to limitation on the number of weaving condition (32) by using this command.

Description	Sets weaving conditions externally.	
Grammar	WEAVON WEV#=1 WEAVCmd.Freq=5	← Loads weaving condition. ← Sets an item among weaving conditions to be changed.
Example of usage	WEAVON WEV#=1 WEAVCmd.Freq=5 WEAVCmd.FwdAngle=10 MOVE L,S=100cm/min,A=0,T=0	← Loads weaving condition No. 1. ← Change only frequency among weaving conditions to 5Hz. ← Change 10°of proceeding angle among weaving condition ← Move according to changed weaving condition while weaving function is executed.

Reference

- WEAVCmd assignment statement should be placed between WEAVON statement and MOVE statement. WEAVCmd assignment statement which is inserted after MOVE statement is executed will not be applied.

2.5. WEAVOF

WEAVOF is a command to end the weaving motion.

Description	Ends the weaving motion.
Grammar	WEAVOF
Example of usage	WEAVOF

2.6. REFP

REFP is a command to insert the reference point required for weaving motion.

Description	Insert reference points such as weaving wall or approach direction.		
Grammar	REFP <Reference point number>,<Pose (number)> REFP <Reference point number>		
Parameter	Reference point number	The number to set the type of reference point.	1~4
	Pose number	Inserts pose of reference point. Except, it is omitted in case it is inserted as hidden pose.	
Example of usage	REFP 1,P1 REFP 1 REFP 2, (-1073.33, 739.01, 258.30, 0, 76, 23)		
Example of usage	REFP belongs to step as MOVE. It will be the hidden pose type in case REFP is inserted on the teach pendant by using <REFP> key of the user key.		

Reference

- Alike the MOVE grammar, the REFP grammar falls under the step.
- The hidden pose type is adopted when entering the REFP command by using the user key's <REFP> key through the teach pendant.
- It is possible to move to the teaching position by executing the step advance after setting the execute unit as Cmd, Step.

2.7. ARCCUR

The ARCCUR grammar sets a designated value for the welding current output.

Description	Sets the output value of the welding current		
Grammar	ARCCUR C=<Current>		
Parameter	Current	Sets the current output to be used in the main condition of arc welding	0~500 A
Example of usage	ARCCUR C=200		

2.8. ARCVOL

The ARCVOL grammar sets a designated value for the welding voltage output.

Description	Sets the output value of the welding voltage		
Grammar	ARCVOL V(VP)=<Voltage>		
Parameter	Voltage (V) Voltage (VP)	Actual output voltage upon arc welding Offset voltage of synergic voltage upon arc welding	0.0 ~ 40.0 V -200 ~ 200 V
Example of usage	ARCVOL V=20 ARCVOL VP=100		

2.9. ATDC

ATDC is a command to execute the automatic tool data offset function.

Description	Executes automatic tool data offset function.		
Grammar	ATDC T=<Tool number>,OrgP=<Original pose>,NewP=<Current pose>		
Parameter	Tool number	Tool number which will execute automatic tool data compensating function	0~15
	Original pose	Originally saved pose	
	Current pose	Current modified pose	
Example of usage	ATDC T=1,OrgP=P1,NewP=P2		

2.10. CalTVSft

CalTVSft is a command to obtain the shift value which can stand a tool on two pose variables inserted.

Description	Obtains shift value to stand a tool on two pose variables inserted.		
Grammar	CalTVSft <Pose 1>,<Pose 2>,<Shift variable>		
Parameter	Pose 1	Pose 1 obtained by sensing	
	Pose 2	Pose 2 obtained by sensing	
	Shift variable	Shift variable to stand a tool obtained by two pose values straight.	
Example of usage	CalTVSft LP1,LP2,LR1		

Reference

- Commands under the arc command group but not indicated are separate functions or unsupported commands.

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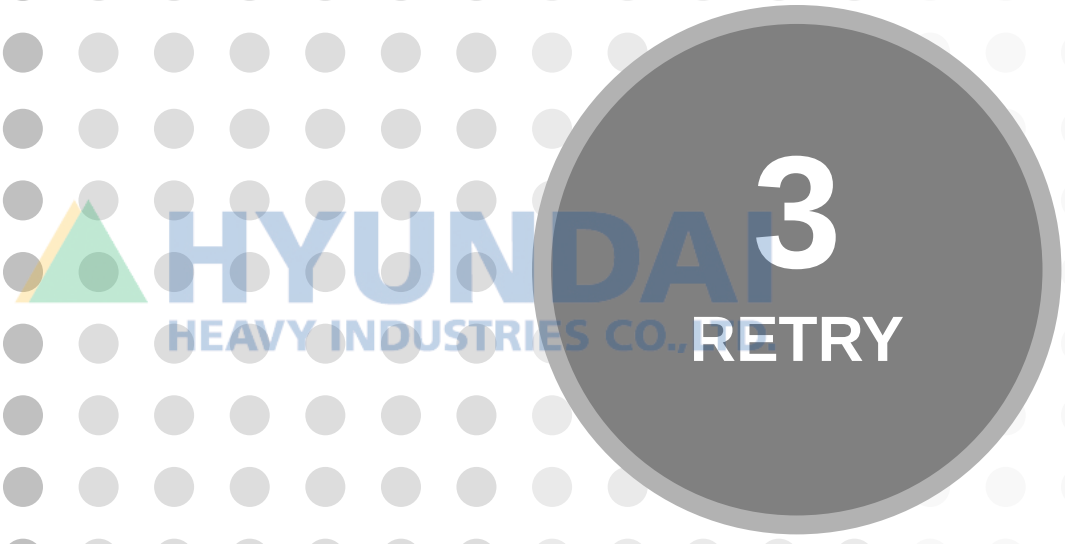

When arc welding commences, the arc ignition may fail due to causes such as foreign substances in the welding start point of the basic material. The retry function enables consecutive operation without having the robot stop by automatically reattempting arc ignition upon failure.
When the arc ignition fails as shown in Figure 3.1, the retry function setting triggers retry attempts, such as reentry, welding line movement, and shift movement. Retry is automatically executed according to the retry condition set under the welding sub-condition.

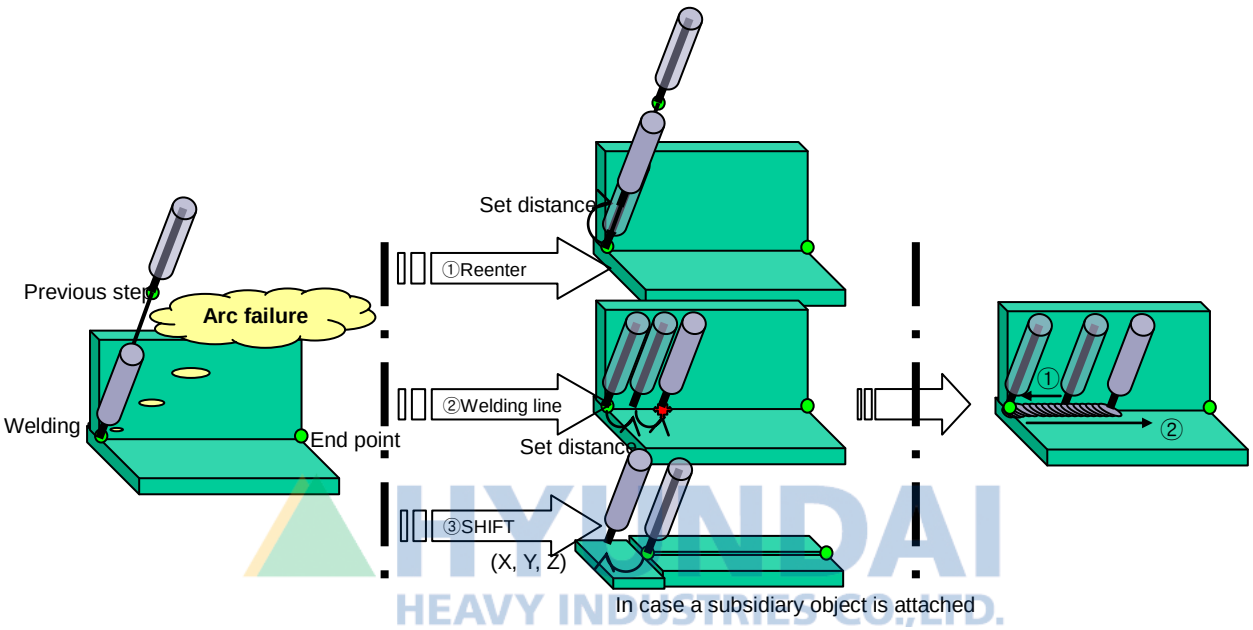

Figure 3.1 Sequence of retry function

(1) Reentry
The robot retreats from the welding start point towards the torch approach direction by the retreat movement amount, and then makes the reentry. The welding condition used is applied with the original welding condition.

(2) Welding line movement
The welding restarts after moving from the welding start point towards the welding proceeding direction by the welding line movement amount. The welding condition applied upon retry is applied with the welding condition of the retry condition number set under the welding sub-condition. Setting the retry condition number to 0 triggers arc ignition attempt under the same condition as the main condition. When the arc ignites normally, the robot returns to the welding start point with the set speed. After returning to the welding start point, the robot starts welding based on the main welding condition.

(3) Shift movement
The welding restarts after moving from the welding start point by the shift movement amount. The welding condition applied upon retry is applied with the welding condition of the retry condition number set under the welding sub-condition. Setting the retry condition number to 0 triggers arc ignition attempt under the same condition as the main condition. When the arc ignites normally, the robot returns to the welding start point with the set speed. After returning to the welding start point, the robot starts welding based on the main welding condition.

The retry function is set under the retry group of the welding sub-condition. Detailed criteria include frequency, retry condition, operating mode, speed, retract time, retract speed, retreat/welding line movement amount, and shift movement amount. To edit the welding sub-condition, click [Quick Open] key under the ARCON command and click [F1: SUB-CONDITION] to enter the welding sub-condition box. Refer to the chapter on quick open of this manual for further details on setting Quick Open.

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4 RESTART

4. Restart

When arc welding is in process, the welding may stop from numerous causes, such as arc shutdown, limit breach, lowering gas pressure, insufficient wire, and coolant error. At this time, restarting the welding from the stopped point may result in areas that are not fully welded. The restart function is intended to complement such insufficiently welded areas.

In the restart condition setting, determine how to operate upon restarting for each cause of the stop, such as arc shutdown. When welding operation is automatically restarted with or without removing the cause of the stop, welding will begin after moving back along the welding line for a certain distance. Consequently, the error point vicinity is covered with a redundant welding overlap. This can prevent any areas being insufficiently welded through a restart.

The restart function is executed according to the setting adjusted in the welding sub-condition box.

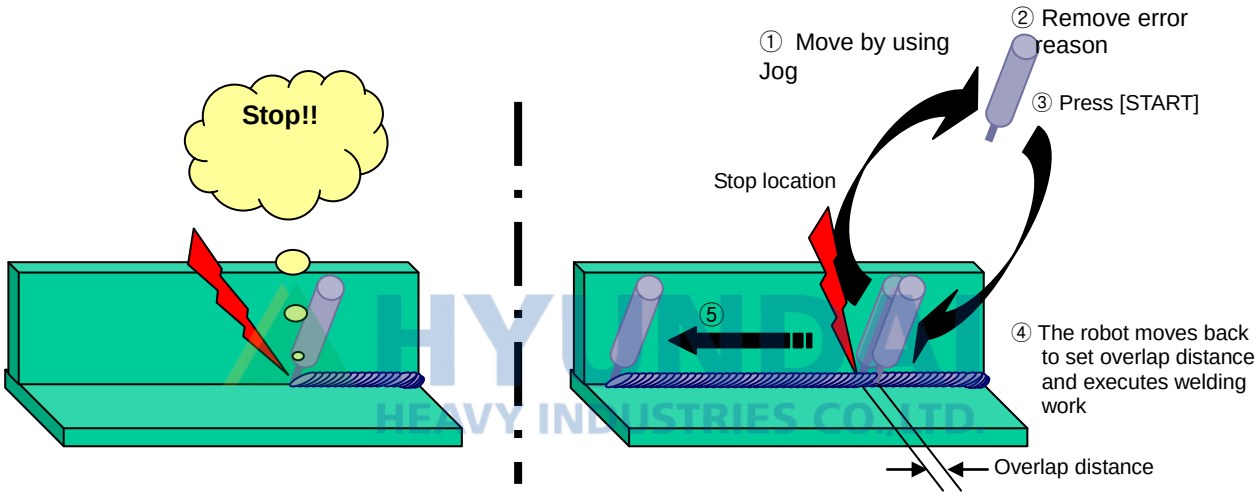

Figure 4.1 Example of restart function (Semi-auto)

When welding stops from numerous causes, such as arc shutdown, limit breach, lowering gas pressure, insufficient wire, and coolant error, the following methods can be used to restart.

- Disable
  When errors such as arc shutdown, limit breach, lowering gas pressure, insufficient wire, and coolant error occur, the welding and robot frame will stop. After removing the cause and clicking [Operate], the robot will recommence welding from its stopping position without overlapping the welding.

- Ignore
  The welding will proceed without stopping. In other words, the robot will ignore and continue welding even if the arc shuts down or the limit is breached. This processing method can be used only during overlapping from arc shutdown or limit breach.

- Semi-auto
  When errors such as arc shutdown, limit breach, lowering gas pressure, insufficient wire, and coolant error occur, the welding and robot frame will stop. After removing the cause and clicking [Operate], the robot will conduct overlap welding according to the method set under the restart criterion of the welding sub-condition before commencing with the main task.

Caution

When pressing the step advance/retreat key during robot transit, the restart info will be cleared and overlapping will not be executed. Always use the jog operation for movement.

- Auto
  When the arc shuts down during welding, the robot will conduct the overlap welding according to the restart criterion of the welding sub-condition without stopping, and then commence with the main task. But, the welding will start immediately at the stopped position when the arc shuts down again during the overlapping section.

Details of each method of dealing with the situation are described in 『Quick Open』.

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5

Auto Stick Recovery

5. Auto stick recovery

Wire might be stuck on the material when arc welding is ended. Stick prevention process to raise the voltage temporarily when welding is ended will be done to the welder to prevent this situation.

After welding prevention the controller will operate the circuit to detect stick and monitor stick. In case wire is stuck to the material continuously at this time, the controller will display an error and the robot will stop its movement. This function is to enable continuous welding working by recovering stick automatically in this case.

When this function is used, stick recovery processing by applying a certain voltage will be executed automatically even if stick is detected. In case stick is not recovered after stick recovery processing is executed for the set number of times, 『Stick』 signal will be outputted and the robot will stop its movement.

The auto stick recovery condition can be set under the 'Auto stick recovery' box. Enter the box through 『Arc welding start condition』 → 『[F2]: End condition』 → 『[F1]: Sub- condition』.

Further details on auto stick recovery are described in 『Quick Open』.

6 Weaving function

The weaving function is used to widen the welding bead in arc welding. Details of the weaving function are determined by the weaving condition file and reference point. The following items can be set in the weaving condition file.

6.1. Type

Set the weaving pattern type as the following pictures.

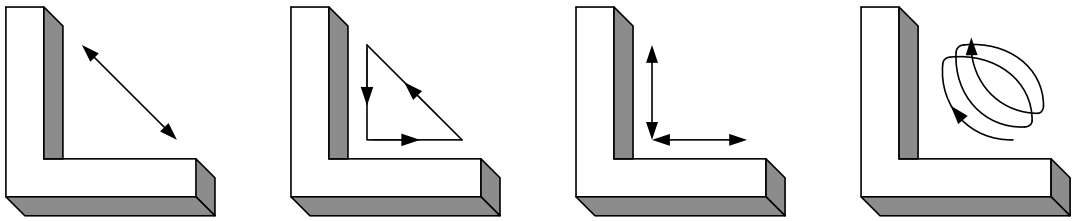


Figure 6.1 Weaving pattern type

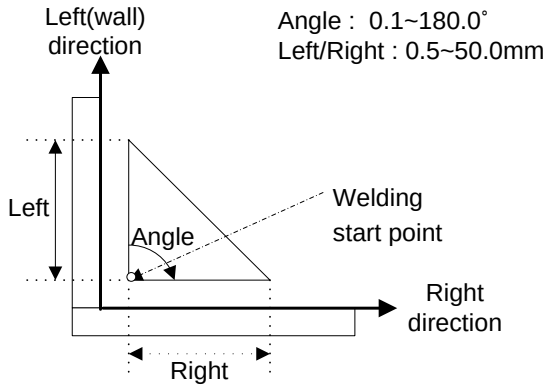
6.2. Frequency

The moving time designation method will be adapted when 「frequency」 is designated to '0'. Set the weaving frequency to any value besides '0'.

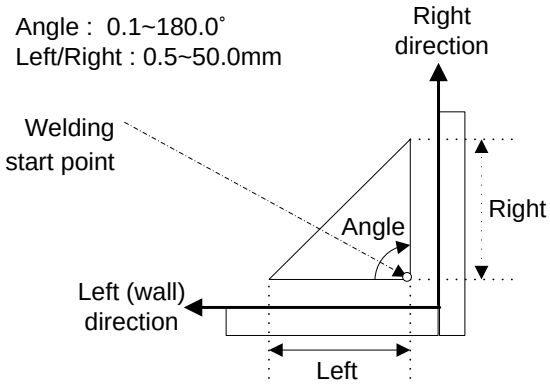
Frequency is related to the horizontal direction distance and the vertical direction distance, so the range size will decrease as the frequency is bigger, and the range size will increase as the frequency is smaller. The addition of the movement time of lateral and longitudinal directions in the movement cycle of each sequence of the triangle wave is equal to the movement time of the diagonal direction.

6.3. Basic pattern

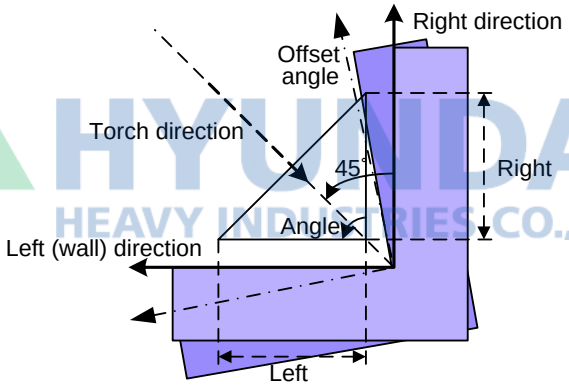
Set each element on the following pictures.



(1) Wall direction: Vertical direction



(2) Wall direction: Horizontal direction



(3) Wall direction: torch position standard

Figure 6.2 Weaving elements according to the wall direction

(1) Left direction distance: Sets the distance of the left (wall) direction.

(2) Right direction distance: Sets the distance of the right direction.

(3) Angle:
Sets the left (wall) direction and right direction angles as shown in Figure 6.2. The angle indicates from the left (wall) direction to the right direction. But, this angle is ignored when using REFP 4.

(4) Wall direction:
Determines whether to use vertical (1), horizontal (2), or torch position standard (3) for the left (wall) direction. Generally, the vertical direction is used as the left (wall) direction, whereas the horizontal direction is used in weavings with a 180° angle on the surface. Torch position standard weavings can respond to all left (wall) directions and can respond to changes in the left (wall) direction while the weaving is proceeding.

(5) Offset angle
When setting the wall direction as the torch position standard, set the rotating angle with the weaving surface based on the proceeding direction of the weaving. When setting 0°, divide the angles of the left(wall)/right directions in half.

6.4. Forward angle

This is the weaving vibration angle to the welding line, the range is -90.0 ~ 90.0 °. When setting 0°, weaving operates perpendicular to the welding line.

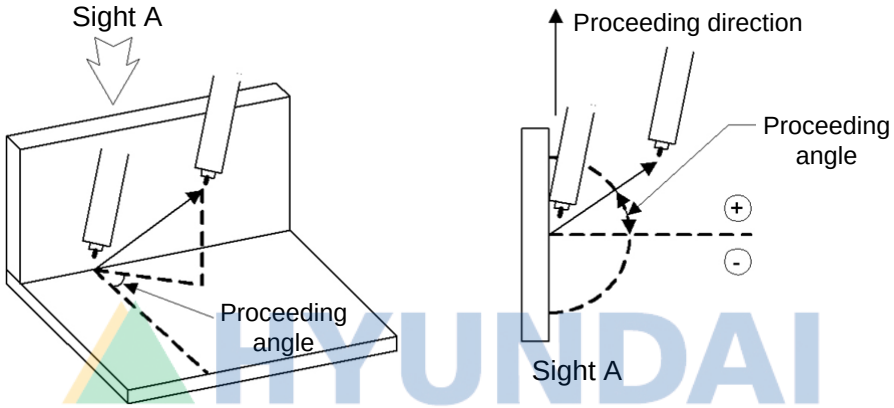
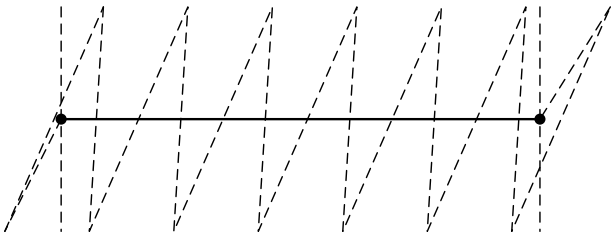


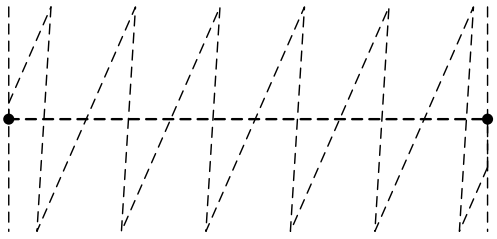
Figure 6.3 Weaving forward angle

6.5. Boundary limit

In case of weaving when the proceeding angle is not 0°, the weaving start/end sections may sometimes pass the boundary limit. In such cases, restrict the boundary limit to set whether to execute the weaving operation with or without a limit.



When the boundary limit is invalid



When the boundary limit is valid

6.6. Moving time

This is an item used in case 「Frequency」 is set to '0'. Designate moving speed per each section separately as the following picture. Number of section used will vary according to each waveform type. Therefore, the moving time of unused section (Except, No. 3 and 3 in case of vibration) in set weaving type will be ignored.

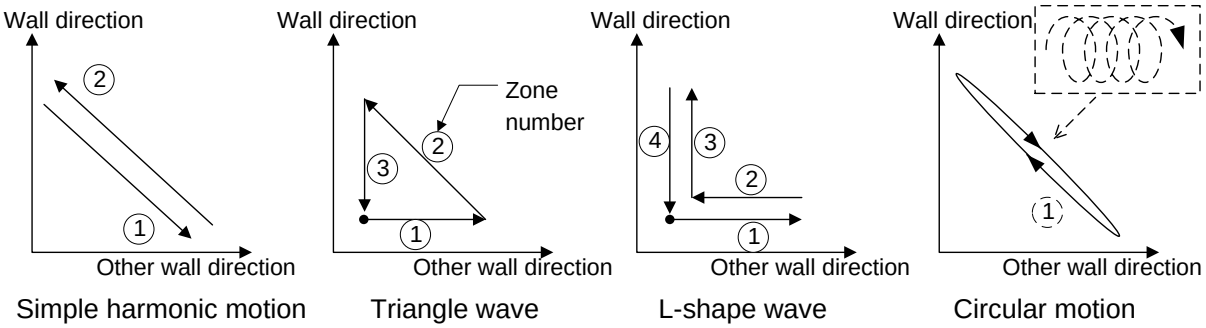


Figure 6.4 Moving section per each weaving pattern

6.7. Timer

This value is valid in case 「Frequency」 is set to '0', and it sets the weaving stop time at the end point of each section as the picture above.

Caution) Movement trace is not stopped at this time. (It is the A form on the picture below)

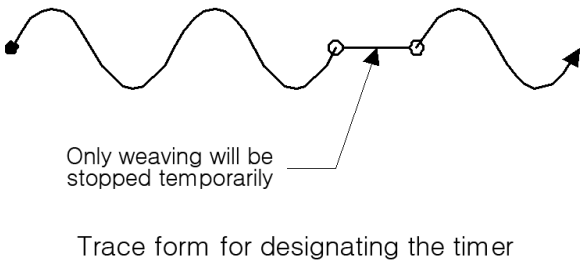


Figure 6.5 Example of trace in case timer is designated

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7

REFP (Reference point)

7. REFP (Reference point)

Factors to decide the shape of weaving are required to weaving function used on extending the width of welding bead in arc welding. Weaving condition file is enough for most of cases.

However, the reference point for deciding weaving plan is required according to the form that parent metal is placed in case vertical plane of weaving doesn't correspond to Z axis of robot coordinate, access point is different from weaving direction, proceeding direction can't be decided or some of these problems are combined. A type of teaching the reference point used at this time is reference point function.

Reference

- When setting the weaving condition as [Basic Pattern] → [Wall Direction] based on the 'torch position standard', REFP commands other than REFP 3 (Reference Point 3) are not used.
- We recommend using the wall direction as the 'torch position standard' when using the weaving function. This makes teaching convenient, since REFP 1, 2, 4 become unnecessary.

7.1. Function

A weaving coordinate system is required to conduct weaving. This is the standard of the detailed condition of weaving pattern and is automatically created upon commencing the weaving. However, the basic coordinate system may not be created according to the form or position of the basic material. In such cases, it is possible to fit the weaving form to the basic material by using the reference point function to create the weaving coordinate system of the desired direction.

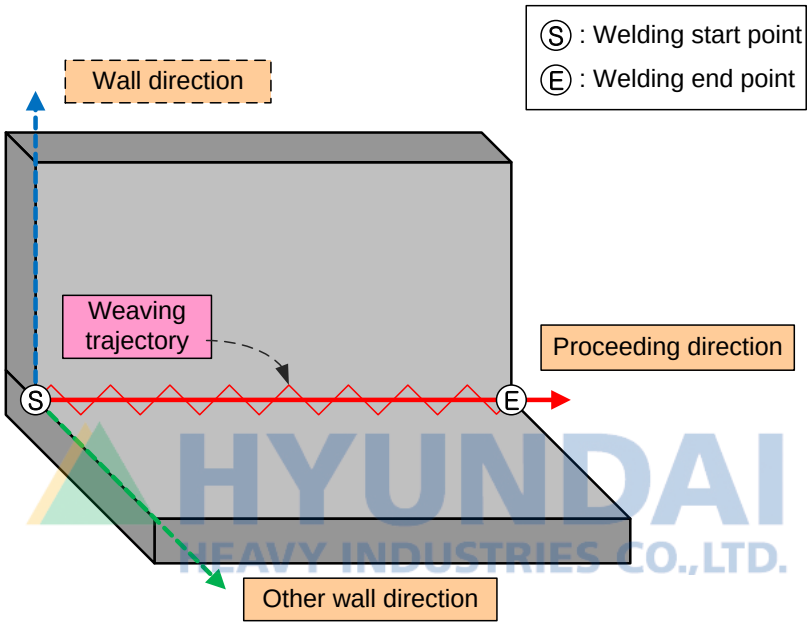

Figure 7.1 Weaving coordinate

(1) REFP 1 (Reference Point 1)
This command designates the wall direction. First, record a point on top of the basic material as REFP 1. Then, it is possible to determine one side using the welding line and REFP 1. Start the weaving by designating this side based on the wall direction. This command is not used when setting the 'wall direction' based on the 'torch position standard'.

(2) REFP 2 (Reference Point 2)
This command determines the other direction by selecting the quadrant conducting the weaving. REFP 2 records a random point on top of the corresponding quadrant. The horizontal direction is generally selected to head towards the approach point. The proceeding direction heads from the weaving start point to the weaving end point. This command is not used when setting the 'wall direction' based on the 'torch position standard'.

(3) REFP 3 (Reference Point 3)
This command designates the proceeding direction of the weaving where the robot is stationary and only the positioner is rotating in stationary weaving.

(4) REFP 4 (Reference Point 4)
This command designates angles towards other directions. Designating the angle by using this command ignores any values set through [Basic Pattern] → [Angle].
This command is not used when setting the 'wall direction' based on the 'torch position standard'.

(5) Standard for determining direction when without REFP

① Wall direction: Z-direction of the robot coordinate system
② Horizontal direction: Direction from wall towards the side of approach point
③ Proceeding direction: Direction from weaving start point towards end point

A basic coordinate system is required for weaving. This is the standard of the detailed condition of weaving pattern and is automatically created upon commencing the weaving.

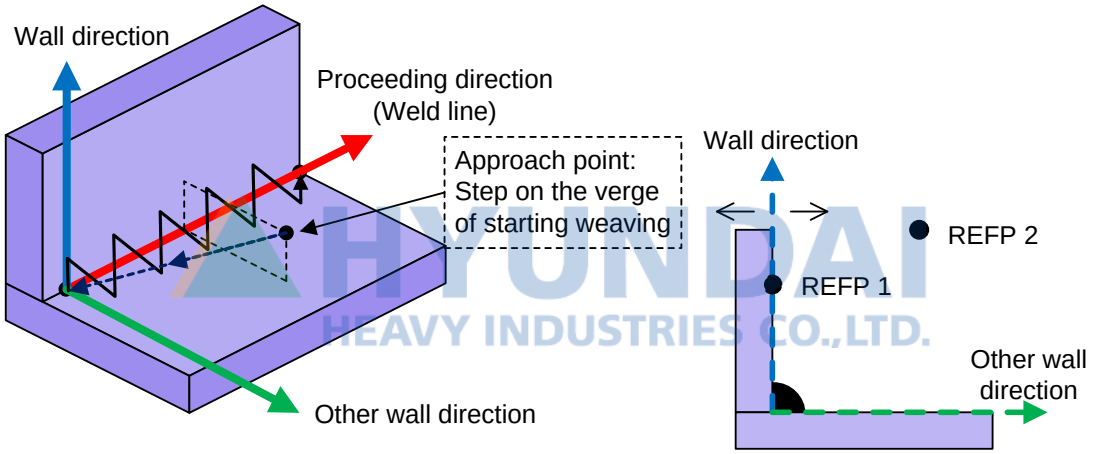

Figure 7.2 Weaving direction and reference point

7.2. Reference point recording

Reference points are recorded in the following order:

- Use the Jog key to move to the position to record as the reference point
- Move the cursor to the position to record as the reference point (normally the step right above the WEAVON command)
- Click [User Key] → [REFP] (use hidden pose) or [Input Command] → [Arc] → [REFP] to record the reference point (input pose variable)

(1) In case reference point record is required

① REFP 1: In case the wall direction is different from Z axis of robot coordinate.
Any location on the plane which decides the wall direction can be used. However, if the distance between this location and weld line is too close, an error might occur on the calculation of the wall direction.

② REFP 2: In case access point is in the opposite direction of weaving
Since this location is used for setting right or left based on the plane which decides wall direction, any location can be used if right and left side can be distinguished. However, if the distance between this location and the plane of the wall direction is too close, an error might occur on the calculation of the horizontal direction.

③ REFP 3: In case there is a difficulty in deciding the proceeding direction as stop weaving
Any location can be used if it is on the line which shows the proceeding direction. However, if the distance between this location and the start point (end point) is too close, an error might occur on the calculation of the proceeding direction.

④ REFP 4: In case there is a difficulty in measuring the weaving pattern angle
Designate the weaving pattern angle directly using REFP.

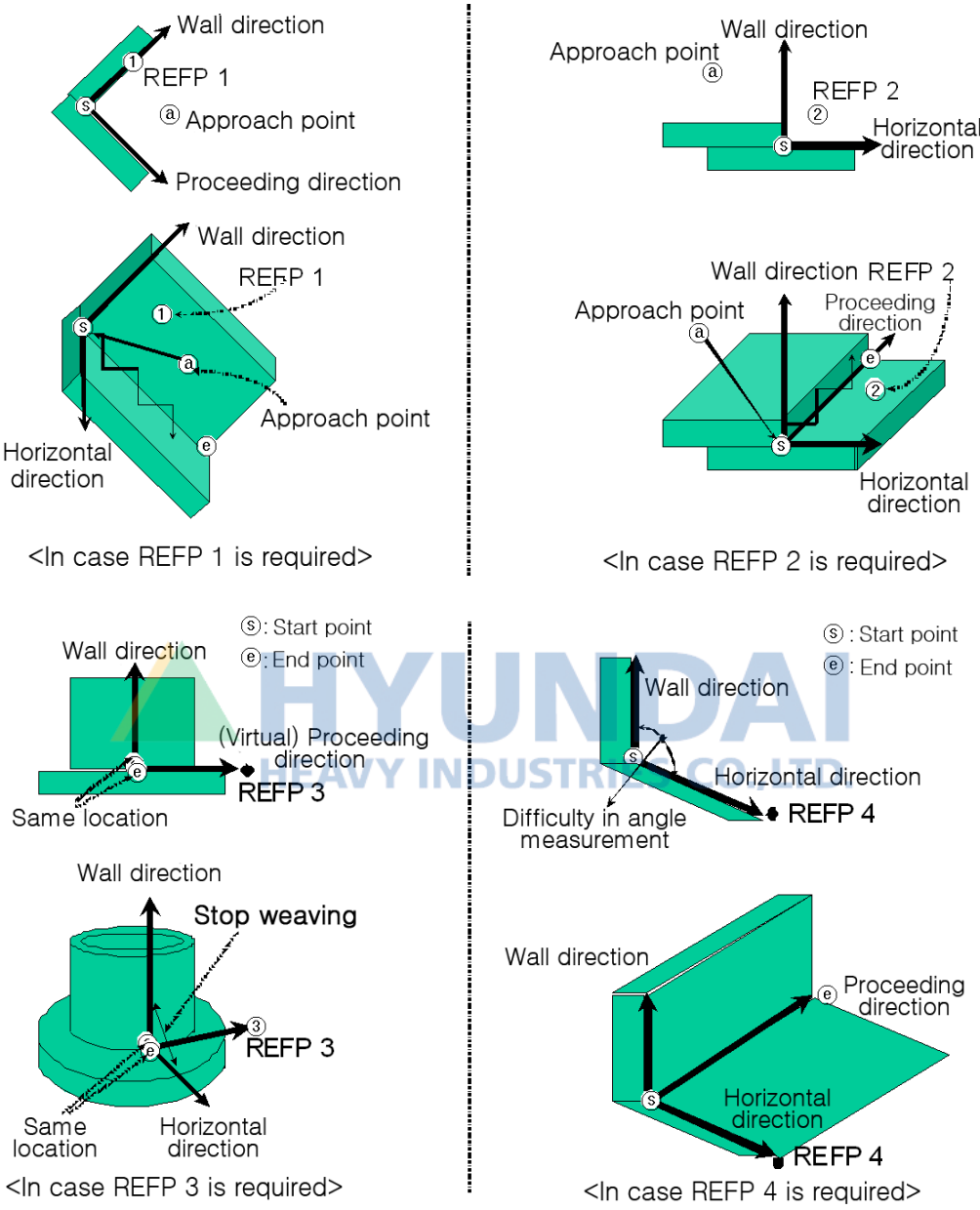

Figure 7.3 Application per each reference point type

Reference

- REFP 1: Set the distance to the welding line to at least 5mm.
- REFP 2: Set the distance to the wall direction to at least 5mm.
- REFP 3: Set the distance to the start point to at least 5mm.
- REFP 4: Designate an angle if it is difficult to measure the weaving pattern angle.

7.3. Reference point editing

(1) Reference point movement

Since the reference point is a location to decide the weaving type, the robot will not move to the reference point for general playback. However, execute the following procedure for confirming and changing the reference point location.

① Place the cursor on the reference point command.
② Move to the reference point after pressing the step forward key. .

※) Set the interpolation type to a straight line at this time and use the condition recorded on weaving start point for moving speed, tool and ACC.

(2) Reference point location edit

① Place the cursor on the reference point command.
② Move to the reference point location to change using Jog key.
③ The reference point location will be changed after pressing [SHIFT] + [POSE.MOD] key.

(3) Reference point command delete

① Place the cursor on the reference point command.
② The reference point command will be deleted after pressing [SHIFT] + [DEL] key.

(4) Reference point number change

① Place the cursor on the reference point command.
② Click [Cmd input] key.
③ Enter new reference point number and press the [ENTER] key.
④ The reference point number will be changed after pressing the [ENTER] key again or pressing [POSE.MOD] key.

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8 Inching and retract

This is the function to control the wire feeder motor which is one of arc welding devices and it pulls out the welding wire longer or rewinds it.

Inching function plays a role of pulling out wire by rotating the wire feeder motor to the forward direction, and retract function plays a role of rewinding wire by rotating the wire feeder motor to the reverse direction.

The length of welding wire can be adjusted by using inching and retract function.

8.1. Operation

(1) Inching function: [Shift]+[2] key
- Private key: [Inching] key among the user key
- Feeding speed: pressing the key, low speed for 3 sec. and high speed afterwards

(2) Retract function: [Shift]+[3] key
- Private key: [Retract] key among the user key
- Feeding speed: After pressing the key, low speed for 3 sec. and high speed afterwards

(3) Inching speed setting
- Select 『[F2]: System』 → 『4: Application parameter』 → 『2: Arc welding』 from the manual setting.
- Under the arc welding setting menu, set the 『1: Inching Speed: Low Speed=[???]%, High Speed=[???]%』 value to the desired low/high speed. The speed is indicated in percentage (%) regarding the maximum feeding speed.
- Inching speed change might not be applied depending on the welder model.

9

Welding current/voltage change function

9. Welding current/voltage change function

This is a function to increase/decrease current or voltage used during arc welding.

(1) Welding current/voltage setting check
Current/voltage setting recorded in the file can be checked by pressing '[User key] → [change I, V]' key during welding.

(2) Welding current/voltage adjustment unit
- Welding current adjustment unit: Increase/decrease 1[A](or 5A) by pressing once.
- Welding voltage adjustment unit: Increase/decrease 0.1[V](or 0.5V) by pressing once.

(3) Save or cancel the changed value
The changed value of welding current/voltage can be saved on the file or cancelled.
- Save: Press the [F7: Record] key.
- Cancel: Press the [ESC] key.

9.1. Operation

Press [change I, V] among the user key in the manual mode.

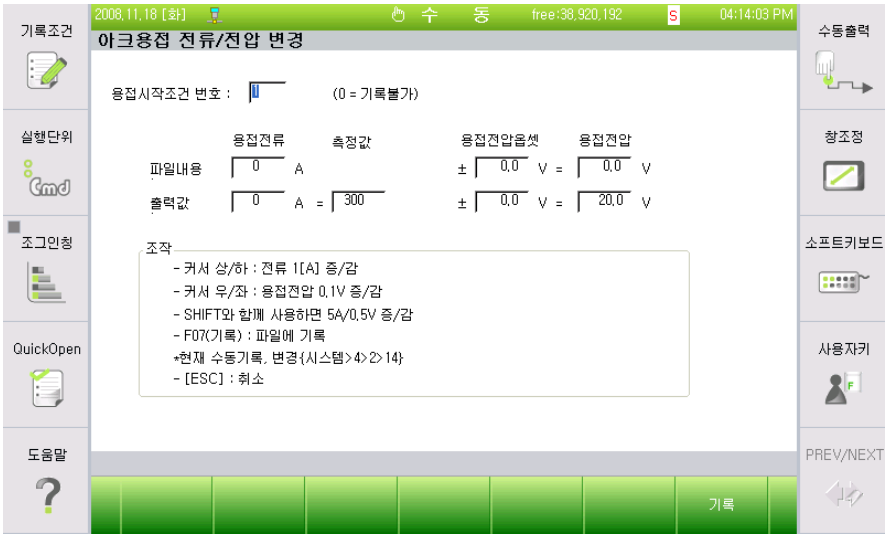

Figure 9.1 Arc welding current/voltage change dialog box

(1) Description
- File content: Shows settings recorded on the file.
- Output value: Displays the current output value.

(2) Operation
- Output change: Current or voltage can be changed using [⇦][⇨][⇧][⇩] keys.
- Record on the file:
  The output value will be saved on the file and the previous screen will be displayed after pressing the [F7: Record] key.
- Cancel:
  The output value will not be saved and the previous screen will be displayed after pressing the [ESC] key.

Current/voltage change is applied to the welding start condition but it is not applied to the end condition. And, in case current/voltage are designated directly without using the welding condition file, current/voltage change and confirm are possible, but the value can't not be recorded on the file.

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10

High speed movement function

The moving speed on the welding section is very slow in the arc welding application, so high speed movement function faster than the teaching speed is required at the time of test operation for the confirmation of the location.
The robot will move in maximum speed rather than the teaching speed after pressing a specific key and operating step forward/backward at the time of test operation for the confirmation of the location.

(1) The operation of this function is limited to step forward/backward in general manual mode.

(2) 『Step fwd/bwd max. speed』of condition setting will not be applied for step forward/backward in case the high speed movement function is executed.

(3) The robot will stop its movement and restart in the new setting in case high speed movement condition is changed during the movement.

10.1. Operation

(1) Teaching speed will be ignored and step forward/backward will be done in the maximum robot movement speed after pressing [SHIFT] key and then pressing [Forward] / [Backward] key.
『Step fwd/bwd max. speed』limit of the condition setting will be ignored at this time.

(2) In case [SHIFT] key is changed during step forward/backward operation, the robot will stop immediately and move again in the changed condition.

For example, When releasing [SHIFT] key while operating high speed step forward/backward by pressing [Forward] / [Backward] key in condition [SHIFT] key is pressed, the robot will stop its movement.

(3) When the robot is completely stopped, step forward/backward will executed not in high speed.

(4) High speed step forward/backward speed setting
Select 『[F2]: System』 → 『4: Application parameter』 → 『2: Arc welding』in the manual setting screen.

11 Welding data monitoring

Current settings of current and voltage and actual output current and voltage might need to be confirmed during arc welding operation. At this time, welding data can be confirmed in real time using this function during arc welding operation.

11.1. Function

This function displays the following data.

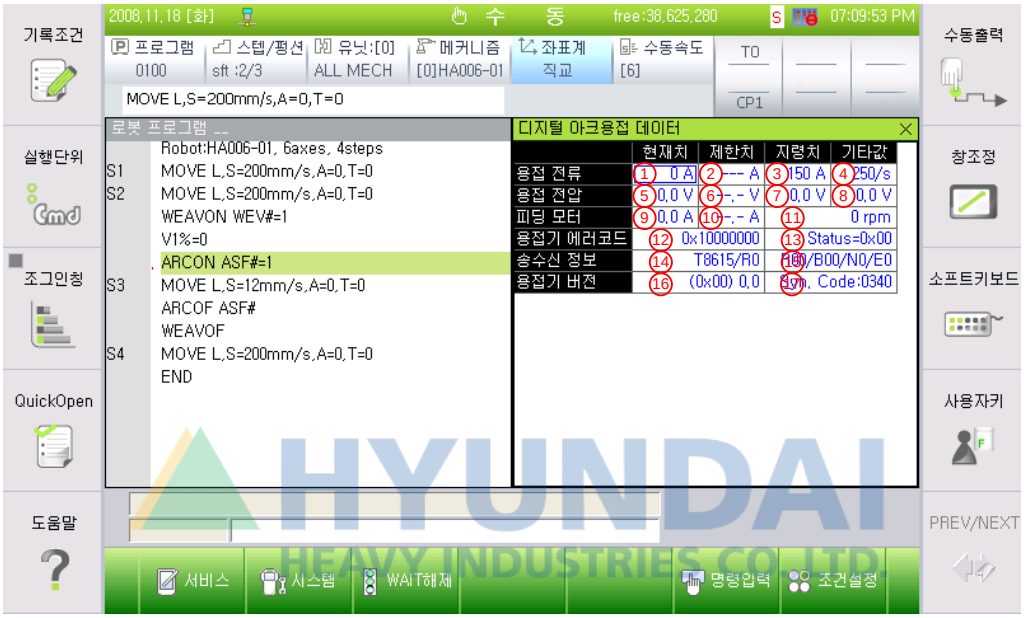

Figure 11.1 Arc welding data monitoring

(1) Actual welding current outputted in the welder (A).
(2) Welding current limit. Indicate as '---' in case arc limit monitoring function is not used.
(3) Command welding current outputted from the robot to the welder (A).
(4) Arc short circuiting frequency for 1 sec.
(5) Actual welding voltage (V) generated from current welder.
(6) Welding voltage limit. Indicate as '---' when not using the arc limit monitor function.
(7) Reference welding voltage offset value (V) generated from the robot to the welder.
(8) Offset value + synergic voltage. In other words, target output voltage (V).
(9) Current value (A) that drives the actual feeding motor.
(10) Feeding motor current limit (A).
(11) Feeding motor rotation speed (rpm).
(12) Welder error code.
(13) Indication of welder condition.
(14) T: Command send frequency, R: command receive frequency.
(15) R: retry frequency, B: busy detection frequency, N: NG frequency, E: error frequency.
(16) Welder version.
(17) Synergic code delivered via welder.

11.2. Operation

(1) Welding data monitoring screen can be selected from 『[F1]: Service』 → 『1: Monitoring』 → 『12: Arc welding data』.

(2) This screen can be also selected from 『[F1]: Content select』 → 『12: Arc welding data』 after splitting the screen using [Pane set] key.

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12

Cooperation control arc function

This is the function to execute arc welding simultaneously in case more than 2 robots are in the cooperation condition using HiNet. In order to use cooperation control arc function, positioner group setting and common coordinate setting between more than 2 robots should be done first. Refer to 'Cooperation control function manual' for details of relevant cooperation control setting. Only cooperation control arc function method in the condition that cooperation control setting such as positioner and common coordinate will be explained in this manual.

12.1. Function

This function executes two settings as follows.

(1) Cooperation arc welding HiNet GE port setting

- Set GE port to receive and send required signals during arc welding in cooperation control. 1 port for signal output and 3 ports for signal input can be set.
- In case the port is set as No. 0, input and output port will not be used.
- Available port number varies according to each robot number. For example, in case the robot number (1~4) is 1, GE number can be set from 1~4 and input number will be 5~16 at this time. In case the robot number is 3, GE number can be set from 9~12, and GE 1~8, 13~16 can be set as the input port.

※ Content per set GE bit

- Bit 0(ArcOn): Display torch on status after ARCON is executed.
- Bit 2(WCR): Display set robot WCR input status.
- Bit 3(Retry): Display robot operation status with retry function
- Bit 4(Overlap): Display the status until overlap is completed with restart function.
- Bit 5(DryRun): Display arc simulation of robot operation without actual welding.
- Bit 6(ArcSt): Display the status before main movement process after Arc on. Retry status is included.

(2) Remote WCR wait setting

Set whether to ignore only Remote WCR signal sent by another robot among cooperation control arc function. This setting is used in case another robot is executing DryRun (Play in non-welding operation).

12.2. Operation

Arc welding function should be executed together in case two robots in one positioner execute arc welding simultaneously as the picture below. If welding works on both sides are not executed simultaneously at this time, error will be occurred in the welding work.

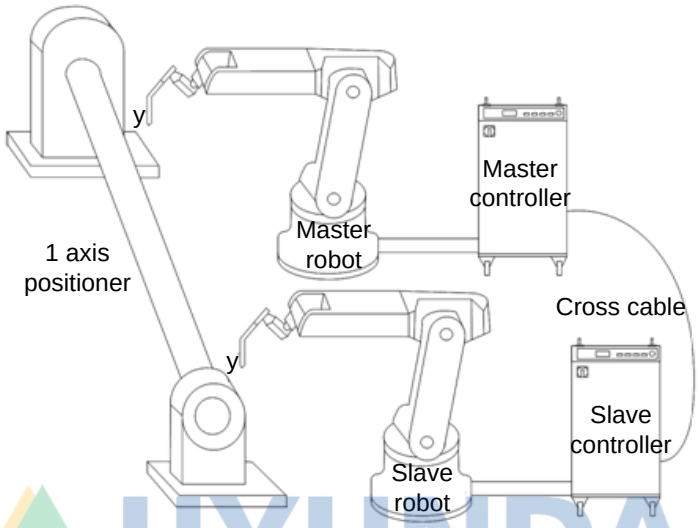

Figure 12.1 Cooperation control arc function key map

The following menu will be displayed additionally on the setting screen in case cooperation control is set after entering to 『Welding start condition file』 setting screen by pressing [Quick Open] key in “ARCON ASF#=??”. In case GB2 welder is supported, cooperation control setting will be placed on the third page.

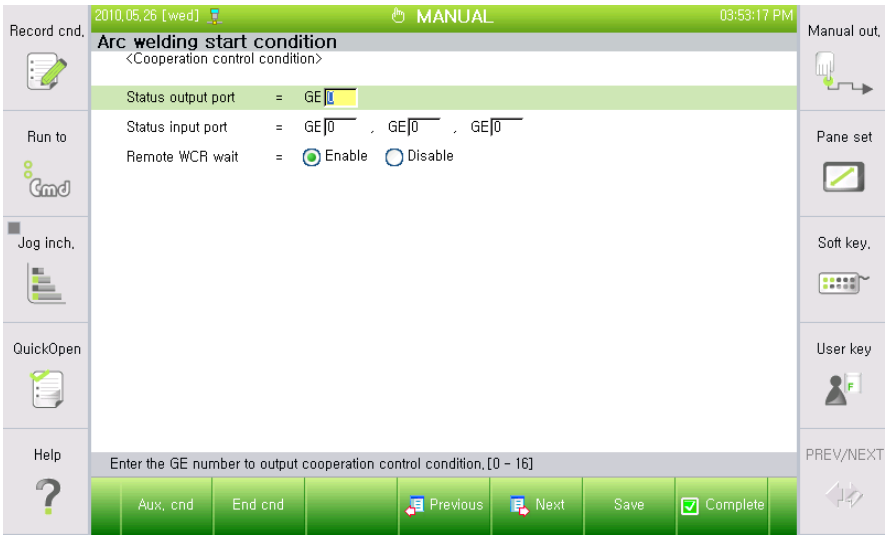

Figure 12.2 Welding start condition dialog box for cooperation control setting

Setting and operation per each item are as described below.

(1) In case the master robot number is 1 and the slave robot number is 2, the master side controller setting can be done as follows.
- State output port: GE4 (Select one among 1~4)
- State input port: GE8 (Match with slave size state output port)

(2) Slave side controller setting can be done as follows.
- State output port: GE8 (Select one among 5~8)
- State input port: GE4 (Match with master side state output port)

(3) Use cooperation control to execute ARCON simultaneously by two robots. Refer to 'Cooperation control' manual for details.

(4) When two robots succeed the arc ignition simultaneously, two robots will move and execute arc welding simultaneously.

(5) If one robot fails the arc ignition, the other robot will stop arc and both robots will execute the retry function simultaneously. When two robots succeed the arc ignition simultaneously, two robots will move normally.

(6) If the arc welding on one side is stopped during welding movement due to stoppage or error, the arc welding on the other side will be stopped. When arc welding is restarted after removing error, two robots execute overlap function and execute the main welding work simultaneously.

(7) When only arc welding work on one side is finished normally during welding work by ARCOF, arc welding work on the other side will not be influenced by this.

13

Quick Open function

13.1. Function summary

When teaching the arc welding work program, welding conditions such as voltage and current as well as detail setting of arc private function such as weaving, retry/restart and welder characteristics are required. And also, generally step or supplementary point location might need to be confirmed.

Arc welding conditions are managed in the file type inside of the controller, and a fast and easy function to edit these files is required.

For the case above, a function to confirm or change setting or location in one key control without complicated control is Quick Open function.

For example such as welding start condition, when pressing [Quick Open] key while the cursor is on ARCON which executes Arc On function, the condition number among the welding start condition used from the current command will be displayed. Details of welding start condition can be confirmed or edited in this screen, and in case there is another condition file related to current condition file, you can move to that file directly.

As mentioned above, this function is easy and fast function to confirm and edit detail contents related to a specific command such as the condition file or the step location.

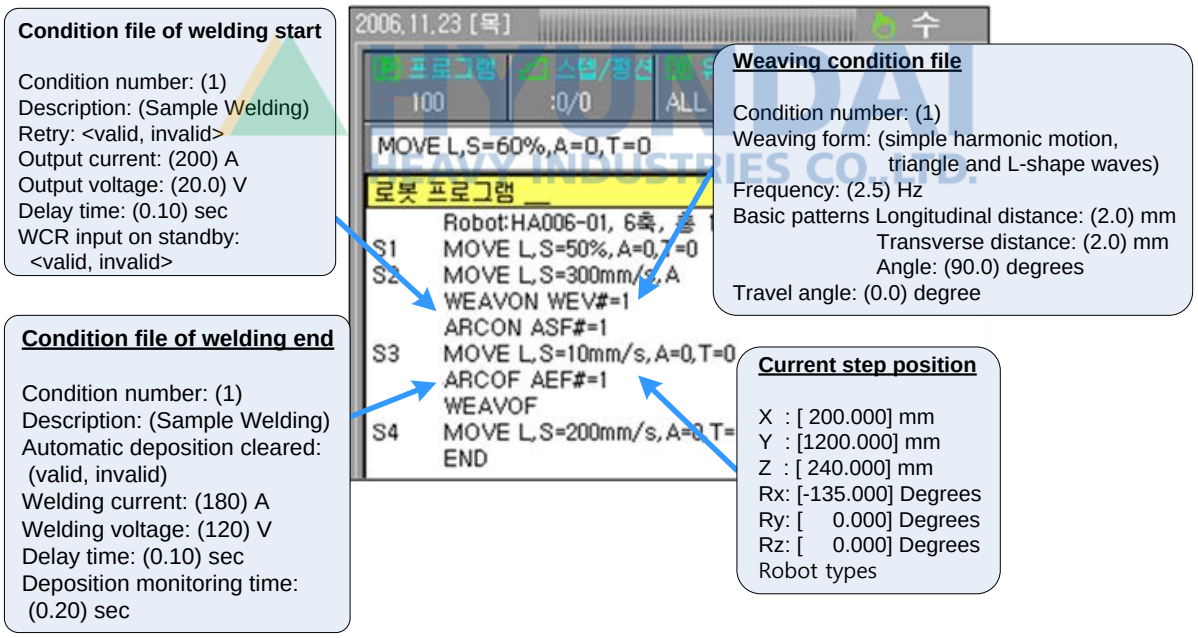

Figure 13.1 Quick open in the robot program

Clicking the [Quick Open] key in certain commands displays relevant files or details on the screen. Click <Complete> to end after saving, and <Cancel> to end without saving.

The content displayed when pressing [Quick Open] in each command is as follows.

Command	File, content	Details	Note
MOVE	Location	Current location and command. X Y Z(mm) Rx Ry Rz(。) robot Configuration	The command can be modified
CALL	Program to be called	Command display	
JMPP			
Assignment statement	Confirm and change variable	Relevant variable can be monitored and modified according to the variable type of assignment statement. V%, V!, V$, P, R, LV%, LV!, LV$, LP, LR, system variable, and etc	
ARCON ASF#=	Welding start condition file Welding auxiliary condition file Welder characteristics file	welding start condition condition number, description, voltage check, RETRY execution, operating mode, current, voltage, WCR input wait execution, wait (delay) time Welding auxiliary condition -RETRY: number of times, RETRACT time, retracting /welding line distance, shift distance, speed, current, voltage -RESTART: number of times, the overlapped amount, speed, current, voltage, overlap condition setting Welder characteristics Welder number, name, description. setting, wire diameter, Stick out length, stick detection time, arc off detection time -Current characteristics: polarity, command (V), measurement (A), offset -Voltage characteristics: polarity, command (V), measurement (V,%), offset	
ARCOF AEF#=	Welding end condition file Welding auxiliary condition file Welder characteristics file	Welding end condition file condition number, voltage check, description,, auto stick recovery, current, voltage, crater time, gas time Welding auxiliary condition file Auto stick recovery: number of times, current, voltage, delay time	
WEAVON WEV#=	Weaving condition	weaving condition file condition number, weaving type, frequency, basic pattern, proceeding angle, moving time, timer	
REFP	Reference point	Current location and command. X Y Z(mm) Rx Ry Rz(。)	The command can be modified Same as the “Location” screen

13.2. Arc welding time chart

This is the digital arc welding time chart. Refer to the dialog box description per each command for each condition setting.

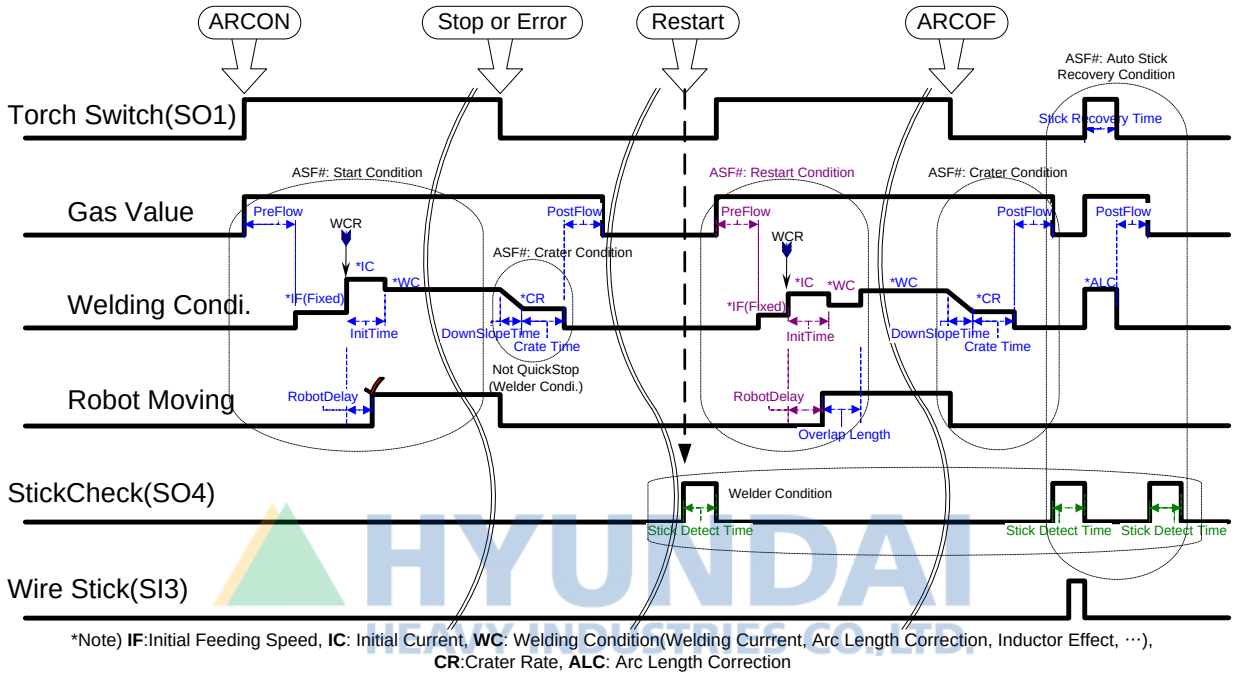

Figure 13.2 Digital arc welding time chart

13.3. MOVE - step location

(1) Click [Quick Open] key in MOVE command.

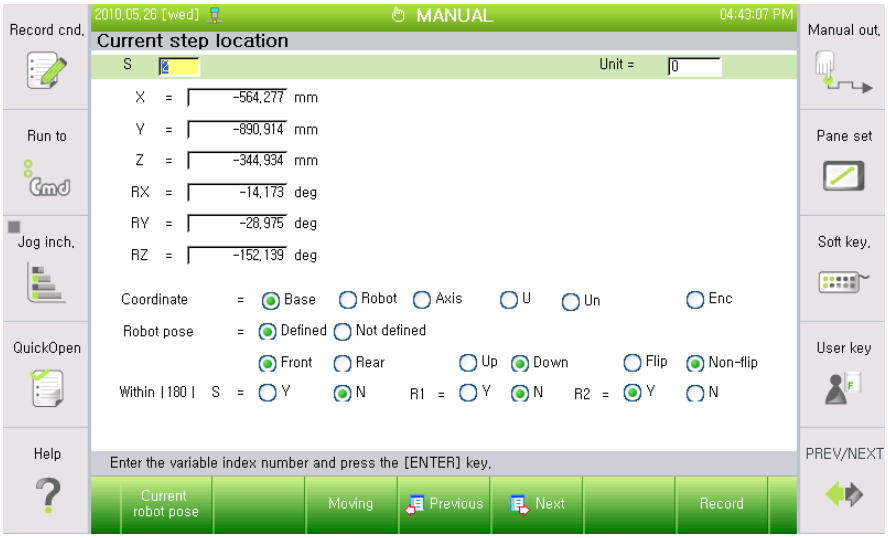

Figure 13.3 Quick Open of MOVE

(2) Display the relevant step location (pose).

- Move using the cursor key to change the pose. Press [ENTER] key to change. The content Inputted will be recorded after entering the number and pressing [ENTER] key.

- More than one solution exists in the robot type in terms of robot mechanism characteristics for describing the robot position. Therefore, the designation of robot type is required for describing the type uniquely. Use [SHIFT] + [←] [→] when designating the robot type by selecting one of < > item.

- The setting should be completed by pressing 『[F7]: Record』 key in order to apply the setting to the program. The setting will not be applied to the program when completing the setting by pressing 『ESC』.

13.4. Welding start condition – executed in ASF#=x

(1) When pressing [Quick Open] key while arc welding is set to digital GB2 welder and the cursor is in ARCON ASF#= command line, the edit screen will be displayed as follows.

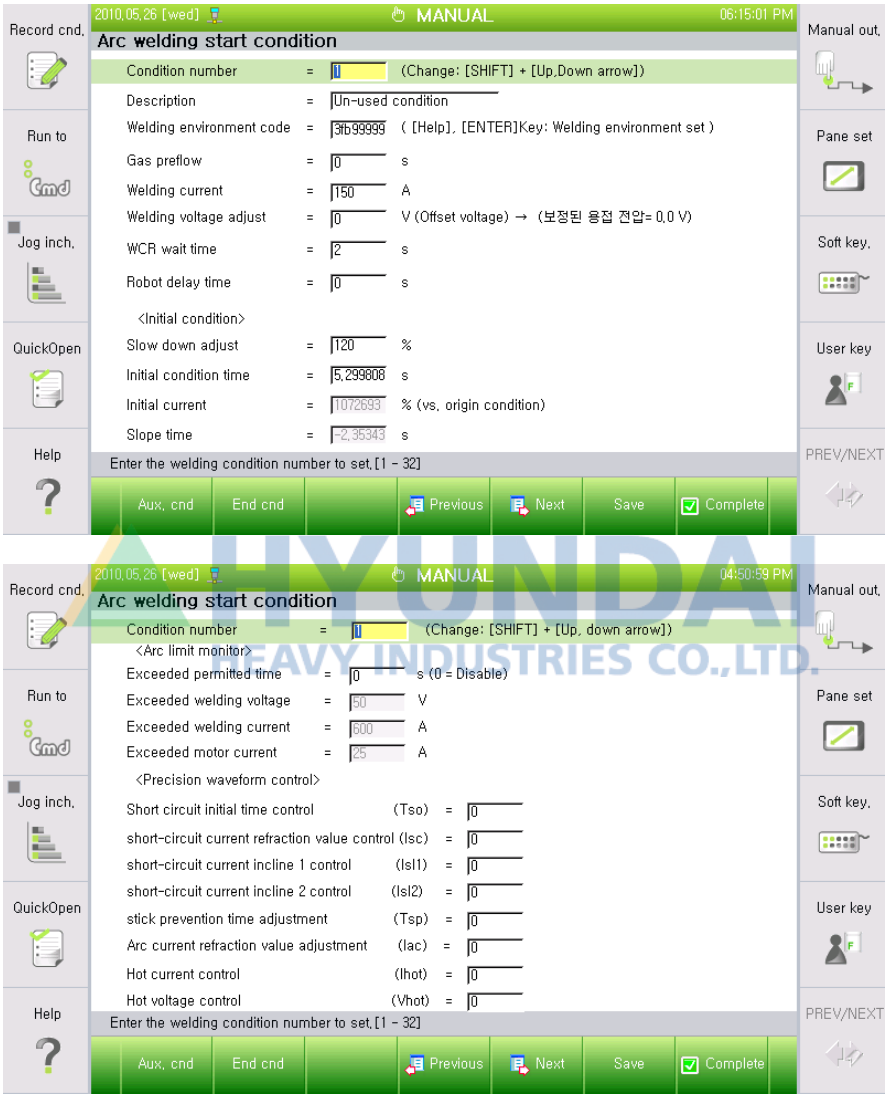

Figure 13.4 Welding start condition dialog box (digital)

(2) The dialog box will be completed without saving the setting when pressing [ESC] key and the dialog box will be completed after saving the setting when pressing [F7: Complete] key.

(3) The content per each time is as follows.

- Condition number: [1] (Range: 1 ~ 32)
  Designate the welding start condition number (32 conditions can be designated and used.)

- Description: [Un-used condition]
  Record the description of the relevant welding start condition

- Welding environment code: [0000]
  Display the synergic code to be transmitted to the welder. Code setting will be done in a separate synergic selection dialog box.
  Synergic selection dialog box can be entered pressing [HELP] key or [ENTER] key when the cursor is located in the welding environment code.

- Gas preflow (In case the gas signal is controlled): [1] sec (Range: 0.0 ~ 10.0)
  Set preflow time of shield gas to isolate the weld part from the air before arc start.

- Welding current: [150] A (Range: 30 ~ 350)
  Input welding current value to be outputted in the welder power supply.

- Welding voltage adjust: [0] V (Range: -10.0 ~ 10.0)
  Set appropriate welding voltage for synergic data according to set welding current in digital welding. Set voltage offset to be changed additionally to this welding voltage.

- WCR wait time: [2] sec (Range: 0.0 ~ 10.0)
  Display WCR input wait time. Retry will be executed if WCR signal is not received within this time. Except, in case number of retry is set to 0, error will be displayed and the robot will be stopped.

- Robot delay time: [0] sec (Range: 0.0 ~ 10.0)
  Set the time of robot waits at the start point before moving along welding line after arc is started normally. It is irrelevant to the initial condition, and the robot can move while processing the initial condition.

- Slow down adjust: [0] % (Range: -10 ~ 10)
  Set basic speed offset of wire to be sent before arc is generated.

- Initial condition time: [1] sec (Range: 0.0 ~ 10.0)
  Set Initial current maintain time when arc welding is started.

- Initial current: [120] % (Range: 100 ~ 150)
  Set welding current during Initial current maintain time when arc welding is started.

- Slope time: [0.1] sec (Range: 0.0 ~ 25.0)
  Set the slope process time between the initial condition and the main condition.

- Exceeded permitted time: [0] sec (Range: 0.0 ~ 10.0)
  Set exceeded permitted time of welding current/voltage and feed motor current limit. In case this time is set to 0 second, the arc limit monitor function will not be used.

- Exceeded welding voltage: [50] V (Range: 0.0 ~ 100.0)
  Set the reference criteria of the voltage during welding.

- Exceeded welding current: [600] A (Range: 0 ~ 1000)
  Set the reference criteria of the current during welding.

- Exceeded motor current: [25] A (Range: 0.0 ~ 50.0)
  Set the reference criteria of the motor current during welding.

- Short-circuit initial time control (Tso): [0] (Range: -3 ~ 3)
  Set a value for suppressing current increase after wire making contact with a welding pole.
  As this value is smaller, the spatter will increase and the arc retention will be deteriorated.
  As this value is larger, the impact will be bigger but the arc retention will be improved.

- Short-circuit current refraction value adjustment (Isc): [0] (Range: -3 ~ 3)
  Set current adjustment which connects slope 1 and 2.
  The spatter will decrease but the arc retention will be deteriorated and the sound will become softer as this value is smaller (-).
  The arc retention will be improved and the spatter will increase as this value is bigger (+).

- Short-circuit current incline 1 control (Isl1): [0] (Range: -7 ~ 7)
  Arc will be generated softly and the spatter will decrease as this value is smaller (-)..
  The arc retention will be improved in the high speed welding but clumped spatter will be created according to the time passage as time goes on passed as this value is bigger (+).

- Short -circuit current incline 2 control (Isl2): [0] (Range: -7 ~ 7)
  The spatter will decrease but impact from contact between tip and molten pool will increase as this value is smaller (-).
  The arc retention will be improved in the high speed welding but more spatter will be created as this value is bigger (+).

- Stick prevention refraction value adjustment (Tsp): [0] (Range: -3 ~ 3)
  Set a collision prevention time (stick prevention time) adjustment value.

- Arc current refraction value adjustment (Iac): [0] (Range: -3 ~ 3)
  Set current refraction value adjustment in arc generation. Spatter will be suppressed and the arc length will be decided at the time of arc generation through this value.

- Hot current control (Ihot): [0] (Range: -3 ~ 3)
  Control high current used in welding start.

- Hot voltage control (Vhot) : [0] (Range: -10 ~ 10)
  Control high voltage used in welding start.
  Decide the arc length.

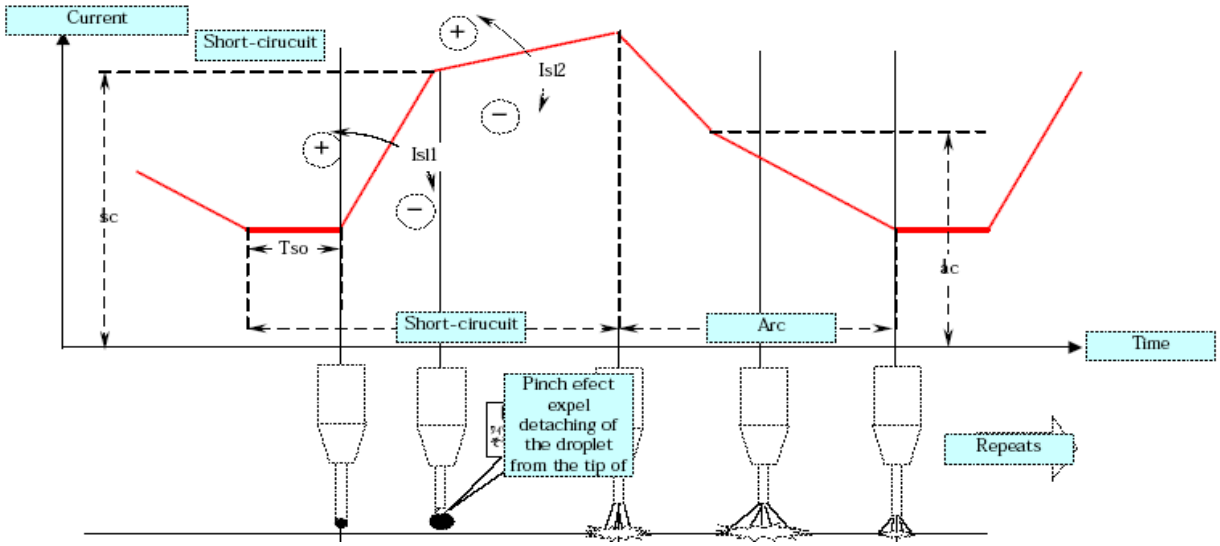

Figure 13.5 Precision waveform control parameter

13.5. Welding end condition – entering from welding start condition

(1) The following edit screen will be displayed when pressing [F2: End condition] in the welding start condition dialog box wile arc welding is set to digital.

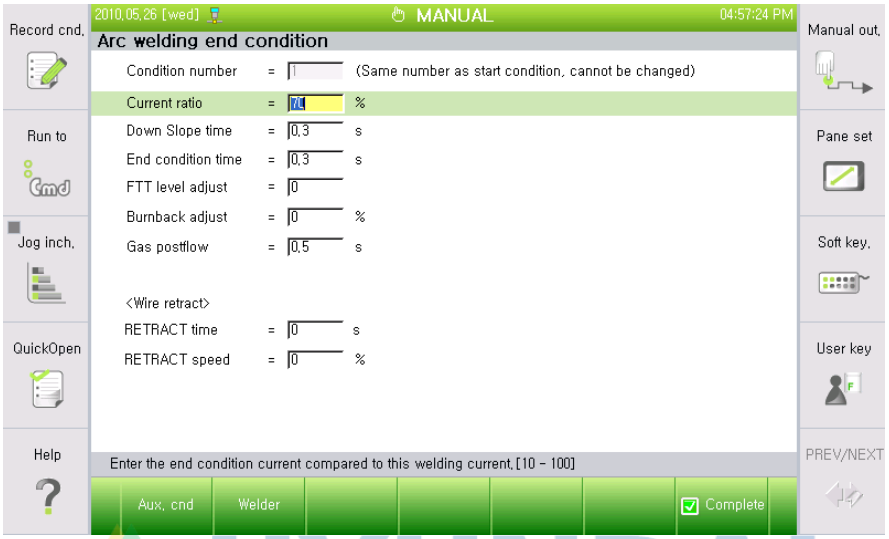

Figure 13.6 welding end condition dialog box (digital)

(2) The welding start condition dialog box will be displayed without saving the setting when pressing [ESC] key. The welding start condition dialog box will be displayed after saving the setting when pressing [F7: Complete] key.

(3) The content per each item is as follows.

- Condition number: [1] (Range: cannot change)
  Display the welding start condition number. The end condition number and the start condition number are same in the digital arc welding function. Therefore, this item can be confirmed only and cannot be changed.

- Current ratio: [70] % (Range: 10 ~ 100)
  Set output current in crater processing. Set current value in % compared to the main condition.

- Down Slope time (Crate Time): [0.10] sec (Range : 0.0 ~ 10.0)
  It is the time to maintain current and voltage of the welding end condition.

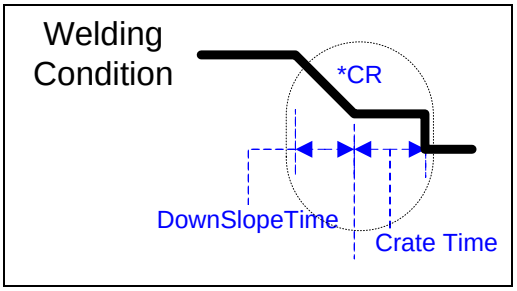

Figure 13.7 Down Slope time and crate time chart

- End condition time: [1] sec (Range : 0.1 ~ 10.0)
  Set the time to maintain output value designated to Current rate set in the welding end condition.

- FTT level adjust: [0] (Range : -50 ~ 50)
  Set fine tip treatment adjustment. Wire clump on the end of wire after welding can be controlled through this value.

- Burnback adjust: [0] % (Range : -20 ~ 20)
  Set the time to execute burnback processing.

- Gas postflow: [0.10] sec (Range : 0.3 ~ 10.0)
  It is the time to output shield gas continuously after arc off.

13.6. Welding auxiliary condition - retry, restart

(1) The following edit screen will be displayed when pressing [F1: Aux. cnd] in the welding start condition dialog box wile arc welding is set to digital.

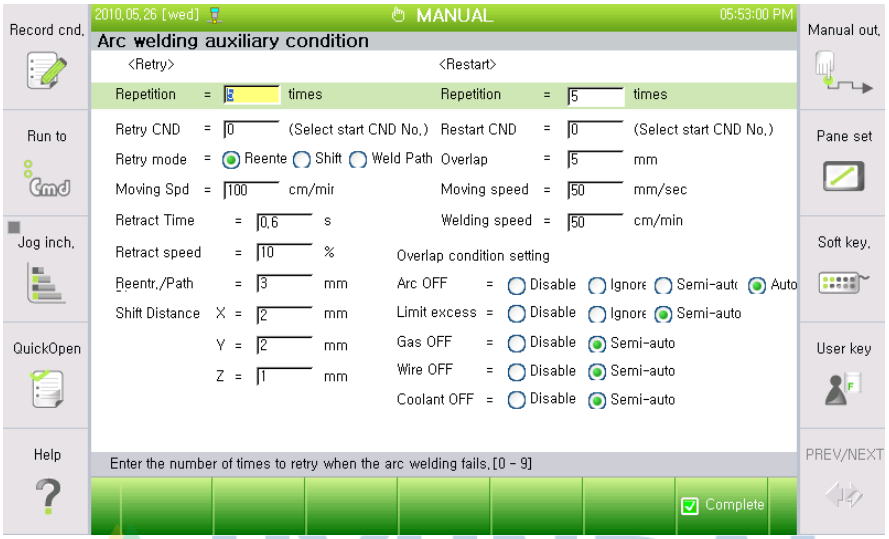

Figure 13.8 Welding auxiliary condition dialog box (digital)

(2) The items on the left side show the retry condition among the Welding auxiliary condition. The content per each item of the retry condition is as follows.

- Repetition: [1] time (Range: 0 ~ 9)
  Designate the number of try in arc ignition failure. If retry of arc ignition is failed within the designated number of retry, the machine will return to the original point (the point of initial arc ignition tried, welding start point) and stop.

- Retry condition: [0] (Range: 0 ~ 32)
  Enter the welding condition number to use during arc ignition retrial. Welding retry will be executed according to the main condition (current, voltage and etc) of inputted welding start condition. Except, in case the condition number inputted is “0”, welding retry will be executed according to the main condition of current welding start condition.

- Retry mode: <Reenter, Shift, Weld Path>
  It is the direction to move the torch for retrying.

  ① Reenter
  Retry arc generation after moving back to the previous step in case arc generation is failed. Enter the moving distance to the distance during retracting/moving welding line during the retrial mode. Set the moving distance to 'retracting /welding line movement' distance in the Welding auxiliary condition retry setting menu. Follow the welding start condition for voltage and current condition since the robot will step forward again after stepping back a certain distance.

  ② Shift
  The robot will move set shift distance in retry condition of Welding auxiliary condition and return to the arc generation step. Arc generation will be retried in the welding start condition of condition number set in retry condition.

  ③ Weld Path
  The robot will move the moving distance set in 'retracting /welding line movement' distance among retry condition of the Welding auxiliary condition along the welding line and retry arc generation based on the welding start condition of condition number set in retry condition. When the arc generation is succeeded, the robot will move to the welding start point and execute the welding work while arc is maintained.

- Moving Speed: [100]cm/min (Range : 1 ~ 999)
  It is the speed of torch to move to the retry point or to return to the welding start point.

- RETRACT time: [0.6] sec (Range : 0.00 ~ 10.00)
  It is the wire retracting time for retrying. Arc on will be done after retracting the wire, moving the torch and inching the wire.

- RETRACT speed : [10] % (Range : 0 ~ 100)
  It is the wire retracting speed for retrying. This speed might not be applied depending on the welder. (Ex. Saprom welder)

- Reenter/Path Dist.: [3] mm (Range : 0.00 ~ 99.99)
  It is the moving distance of torch for retrying in case the operating mode is set to reenter or welding line. Designate the operating mode setting in the start condition.

- Shift distance: X=[2], Y=[2], Z=[1] mm (Range : -99.9 ~ 99.9)
  It is the moving distance of torch for retrying in case the operating mode is set to shift.

(3) The items on the right side show the restart condition among the Welding auxiliary condition. The content per each item of the restart condition is as follows.

- Restart count: [5] time (Range : 0 ~ 9)
  Designate the maximum number of times re-operating within same welding period. When this number is exceeded, “E1274 Number of times re-operating within same welding period exceeded” error will occur.

- Restart condition: [0] (Range : 0 ~ 32)
  Input welding condition number to be used for restart. Welding will be executed within overlap section based on the main condition (current, voltage and etc) of inputted welding start condition. Except, in case the condition number inputted is “0”, welding restart will be executed according to the main condition of current welding start condition.

- Overlap: [5] mm (Range : 0.0 ~ 99.9)
  It is the welding overlap distance (Overlap distance) for restarting welding. The robot will move back the overlap distance and start welding work again.

- Moving Speed: [50] mm (Range : 1~999)
  It is the bead overlap speed after moving to the overlap location. In case an error is occurred, the robot will move the overlap distance in 3 times the speed designated, and this speed will be applied for welding the overlap section. After welding the overlap section, welding work will be executed in the normal speed. (Refer to Figure 15-11)

  In case error is occurred during welding is processed from welding start point(①) to welding end point (④), the robot will move the overlap distance in 3 times the speed designated (③). The robot will execute welding work to ② based on current, voltage and speed set in the re-operation and execute the normal welding work from ② to ④ based on the condition set in the start condition. Except, in case error is occurred during welding on the overlap section (from ③ to ②), the welding work will be started from that location without overlapping.

- Overlap condition setting
  Items on the bottom of the right side set overlap execution in case arc off, gas off, wire off and coolant off during arc welding.

13.7. Welding auxiliary condition – Automatic stick recovery

(1) The following edit screen will be displayed when pressing [F1: Supplementary condition] key in 『[Welding start condition] → [F2: welding end condition]』 dialog box while arc welding is set to digital.

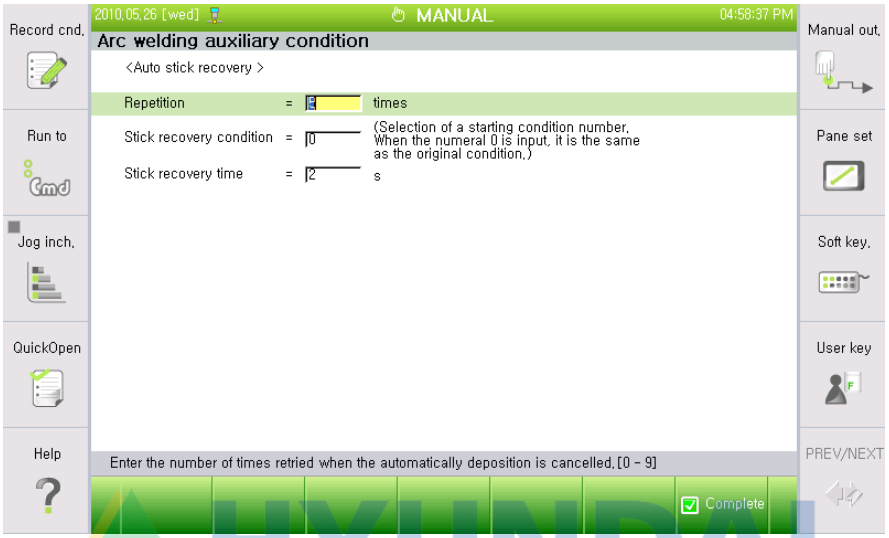

Figure 13.9 Automatic stick recovery dialog box

(2) The content per each item of the automatic stick recovery condition is as follows.

- Repetition: [5] time (Range : 0 ~ 9 times)
  It is the maximum number of times to repeat stick recovery processing. In case this is set to 0, stick recovery will not be tried and the stick error (“E1262 Wire stick detecting”) will be generated immediately.

- Stick recovery condition: [0] (Range : 0 ~ 32)
  It is the welding start condition number to be used for stick recovery processing. Stick recovery will be tried based on this condition of the relevant condition. Except, in case the condition number inputted is “0”, Stick recovery will be tried based on the main condition of current welding start condition.

- Stick recovery time: [2] sec (Range: 0.00 ~ 9.99)
  It is the time to output stick recovery condition. In case this time is too short, stick recovery will not be executed.

13.8. Weaving condition

(1) The following edit screen will be displayed when pressing [Quick Open] key while the cursor is in WEAVON WEA#= command line.

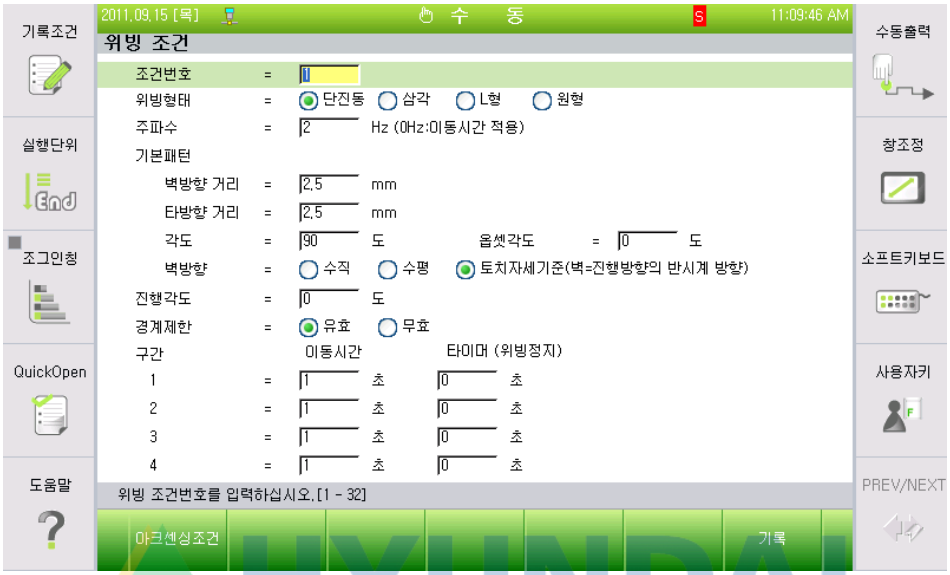

Figure 13.10 Weaving condition dialog box

(2) The content per each item of weaving condition is as follows.

- Condition number: [0] (Range : 0 ~ 32)
  It is the condition number set in weaving operation. You can enter the number or move to the previous number or the next number using [SHIFT]+[↑],[↓].

- Weaving type: <Simple harmonic motion, triangle, L type >
  Designate the weaving operation type.

- Frequency: [2] Hz (Range : 0.0 ~ 10.0)
  Set the weaving frequency. The range of frequency is 0.0 ~ 10.0Hz. In case the frequency is set to '0', the moving time will be applied.

- Basic pattern
  Set the weaving operation pattern.
  Vertical direction distance: [2.5] (Range: 1.0 ~ 25.0mm)
  Horizontal direction distance: [2.5] (Range 1.0 ~ 25.0mm)
  Angle: [90] (Range: 0.1 ~ 180.0°)
  Wall direction: <vertical direction, horizontal direction, torch position standard>

- Forward angle : [0] (Range: -90.0 ~ 90.0°)
  It displays the weaving angle direction to the processing direction. In case this is set to 0°, proceeding direction and weaving direction will be at right angles to each other.

- Boundary limit: <Enable, Disable>
  Set whether to limit weaving trace by boundary of welding start section and end section.
  In case this function is set to valid, weaving trace will be limited to the welding section.

- Moving time: [1] (Range: 0.04 ~ 9.99 sec), Timer: [0] (Range: 0.00 ~ 2.00)
  In case the weaving frequency is set to '0', weaving will be executed in the moving time.
  Set the moving time per each section and the weaving stop time between sections.

13.9. Arc sensing condition

(1) The arc sensing condition will be displayed on the next screen of the weaving file as follows. This is the section for setting arc sensing which can be used during weaving.

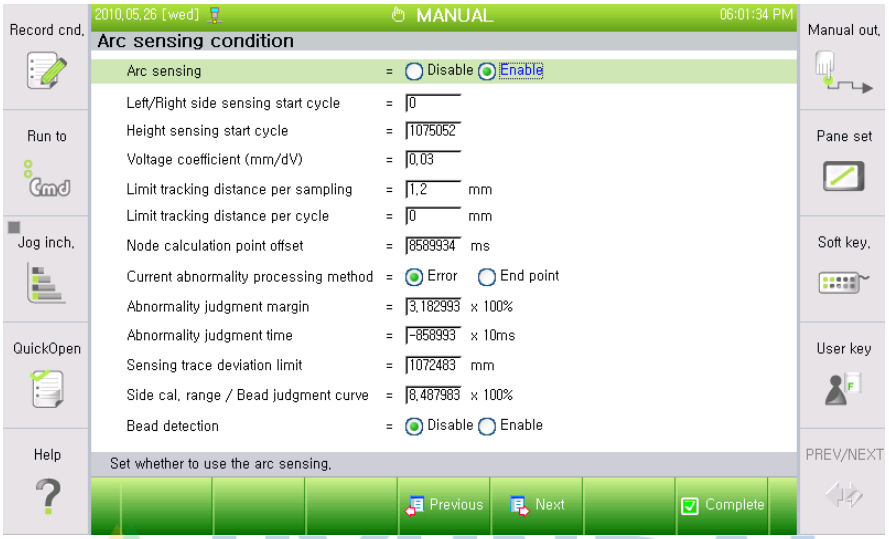

Figure 13.11 Arc sensing\ dialog box

(2) Refer to 'Arc Sensing Function Manual' for further details on this function.

14

Welder characteristics file edit

14.1. Welder characteristics file edit

(1) Select welder type through 'Welder no.' under 『[F2]: System』 → 『5: Initialize』 → 『3: Set purpose』. Select 『[F1]: Welder』 to display the setting screen for 'Panasonic GB2 welder condition'.

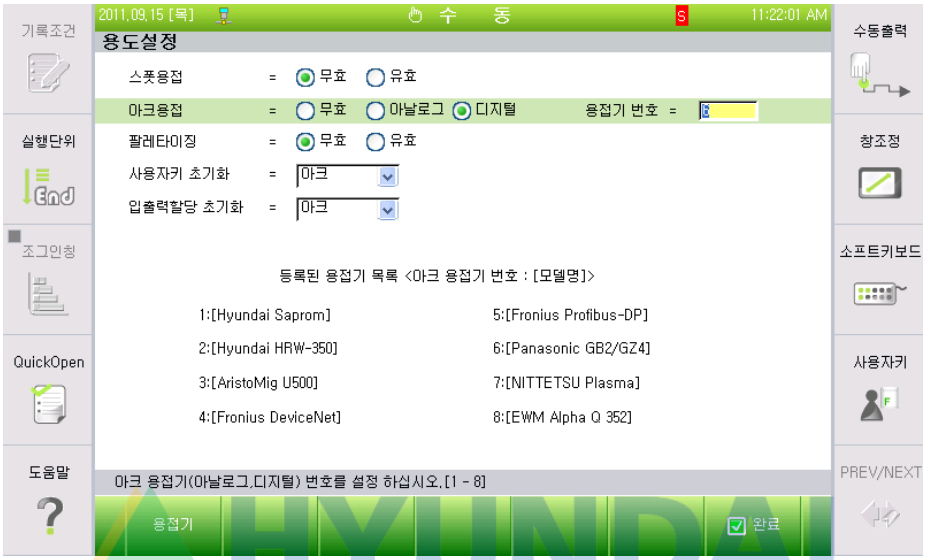

Figure 14.1 Usage setting dialog box

(2) When the cursor highlights the 'ARCON ASF#=' command line, it is possible to edit the welder characteristic file under the 'Welding starting condition' setting by clicking [Quick Open] key. Clicking 『[F2]: End condition』 key while in this screen displays the 'Arc End Condition Setting' screen. Then, clicking 『[F2]: Welder』 key on the bottom of the screen displays the 'Panasonic GB2 Welder Condition Setting' screen.

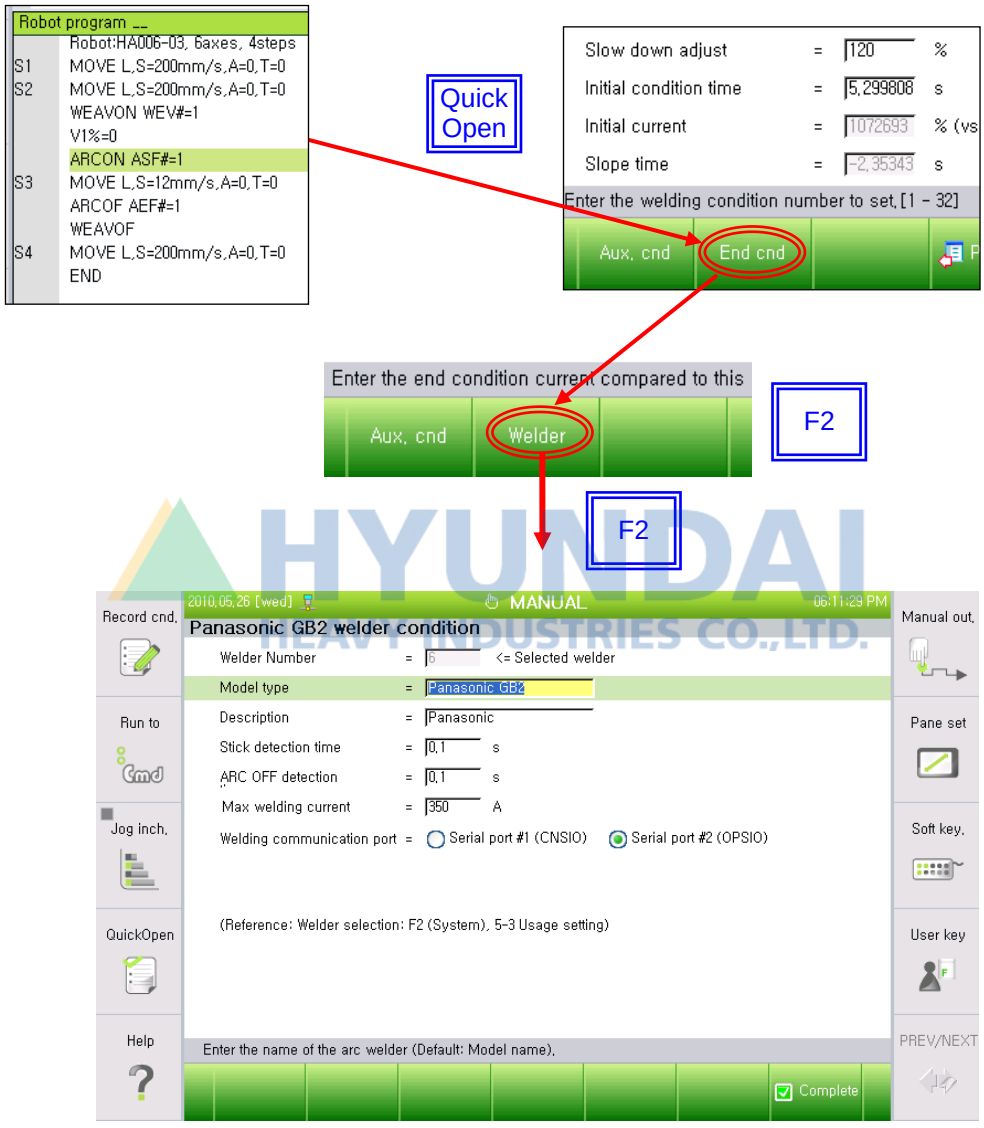

Figure 14.2 How to enter welder setting dialog box (Digital)

(3) The content per each item is as follows.

- Welder Number: [1]
  Display current setting welding number. Currently selected welder number can be confirmed and it can be changed only in 'Usage setting' screen.

- Model type : [Panasonic GB2]
  Record the model name of welder. Basically, the model name of welder supported by our company is written.

- Description: [Panasonic]
  Record the welder description. Basically, the name of welder maker is written.

- Stick detection time: [0.1] sec (Range: 0.1 ~ 10.0)
  Set the time to check wire stick after arc completed.

- ARC OFF detection time: [0.6] sec (Range: 0.0 ~ 10.0)
  Set the time to check arc off in arc welding. In case this value is too small, arc failure might occur often. On the other hand, in case this value is too big, robot distance and wire retracting will increase at the time of arc ignition failure.

- Maximum welding current: [350] A (Range : 0 ~ 999)
  Set the maximum available current to output in the welder.

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