



FD CONTROLLER INSTRUCTION MANUAL COMMAND REFERENCE

5th edition

Volume 2
(FN360 GETFORCE – FN597 CNVSETM)

- Before attempting to operate the robot, please read through this operating manual carefully, and comply with all the safety-related items and instructions in the text.
- The installation, operation and maintenance of this robot should be undertaken only by those individuals who have attended one of our robot course.
- When using this robot, observe the low related with industrial robot and with safety issues in each country.
- This operating manual must be given without fail to the individual who will be actually operating the robot.
- Please direct any queries about parts of this operating manual which may not be completely clear or any inquiries concerning the after-sale service of this robot to any of the service centers listed on the back cover.

NACHI-FUJIKOSHI CORP.

Chapter 1 Command Reference

This document is a reference manual for application commands (Functions) and move commands.

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1.1 What is command?

1.1.1 Outline of the command

There are two categories for the commands in a playback program. One is motion command that can be taught using [REC] key and the other is application command that can be taught using [FN] key. However, these are simply treated as "Commands" in the robot language program.

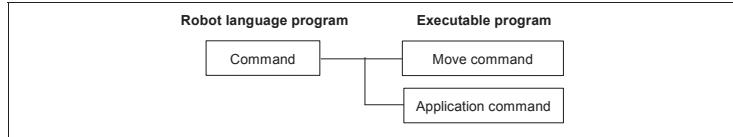


Fig 1.1.1 What is command?

Excepting three motion commands (MOVE, MOVEJ and MOVEX), the all command are called as "Application command (function)".

Application commands (functions) have code No. that starts from "FN". Motion commands do not have FN code No.

There are 100 or more various application commands for some kinds of applications or optional functions. For details, please refer to the respective option manuals.

1.1.2 Format of Move command and application command

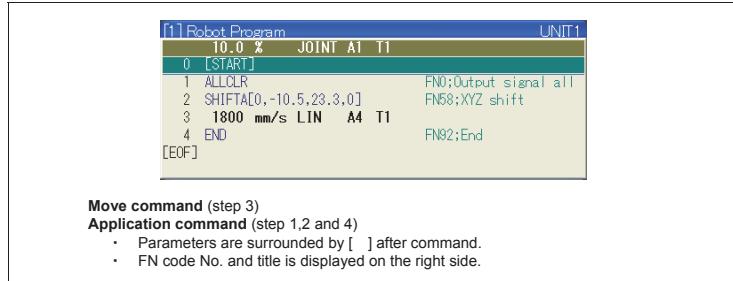


Fig 1.1.2 Format of move command and application command for executable program

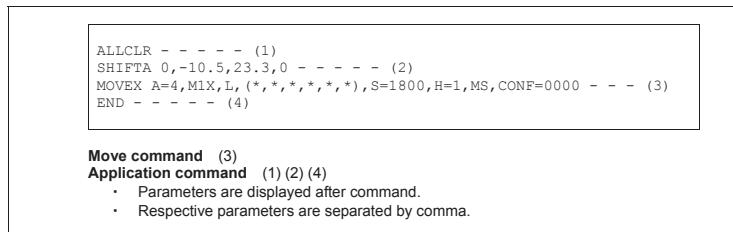


Fig 1.1.3 Format of move command and application command for robot language program

1.2 Command list (order of SLIM command)

The command sorted in an order of SLIM command is described hereinafter.

The respective outlines are described in short. For more details, please refer to 1.3 Detail of each command (order of FN code No.).



Because this manual covers all the commands without any distinctions like standard or option, please be sure that there are some cases where some commands are not available depending on the specification of the controller.

If the command is not displayed on the teach pendant screen, it is a command that is protected by option protect or non-supported command in an old system software version.

SLIM command	FN code	Name	Description
*	601	Label	Label. This is used as a label that can be referred by GOTO command etc.
ABOVE	163	Elbow config.(above)	The above-the-elbow (less than 180-degree angle formed by J2 axis and J3 axis) posture is forcibly selected for calculating the robot postures.
ABS	657	Let ABS function	Calculates the absolute value of real number.
ACOS	649	LETACOS function	Get ACOS variables
ADAPTOFF	365	Adaptive Motion OFF	Ends Adaptive Motion. (Option)
ADAPTON	364	Adaptive Motion ON	Starts Adaptive Motion with the specified condition. (Option)
ADDP	635	Add pose variable	Adds the value of pose variable.
ADDR	69	Add shift value	The specified values in the specified shift register are added up. (Option)
ADDVF	638	Add real variable	Adds the value of real variable.
ADDVI	637	Add integer variable	Adds the value of integer variable.
AE	415	Arc end	Terminates arc welding with the specified conditions. This is available only when connected with a weld power interface.
AEM	419	Multi Pass Welding End	This ends the multi-pass welding under the designated conditions.
AEMV	662	Multi Pass Welding End(Variable)	Multi-pass welding end.
AES	741	Stitch pulse welding end command Cycle pulse welding end command	The arc welding will be terminated at the specified conditions.
AEV	666	ASV Arc end(Variable)	Terminates arc welding with the specified conditions.
AIMBASEPL	725	Aimed angle standard plane selection	This switches between the standard planes of aimed angle.
AIMREFPT	726	Aimed angle standard plane selection	This switches between the standard planes of aimed angle.
ALLCLR	0	Output signal all reset	This command is used to set all the output signals to OFF.
ANG2ENC	820	Set encoder Variable (angle)	Set an angle variable(As angle) to encoder variable(As encoder)
ANG2POS	813	Set position Variable (angle)	Set an angle variable(As angle) to position variable(As position)
ANG2POSE	810	Set Pose Variable (Angle)	Set an Angle variable(As Angle)to Pose variable Pn
AOUT	46	Analog output	The TCP (robot tool center point) linear speed and other data are output as analog voltages. Offset can be designated using distance or time. (OPTION)
APP_CALL	880	Call User application	Start the user application and wait for it to finish.
APP_CEVENT	892	Create event the User application	Create an event in the User application.
APP_FORK	883	Fork User application	Start the user application.
APP_HIDE	891	Hide User application	Hide the user application.
APP_SHOW	890	Show User application	Show me the user application.
APP_WAIT	886	Wait User application	Wait before the end user application.
APP_WEVENT	893	Wait event the User application	Wait for the event from the User application.
AS	414	Arc start	Starts arc welding with the specified conditions. This is available only when connected with a weld power interface.
ASIN	648	LET ASIN function	Get ASIN variables
ASM	418	Multi Pass Welding Start	This starts the multi-pass welding under the designated conditions.
ASMV	661	Multi Pass Welding Start(Variable)	Multi-pass welding start
ASS	740	Stitch pulse welding start command Cycle pulse welding start command	Starts arc welding with the specified conditions.
ASV	665	Arc start (Variable specification)	Starts arc welding with the specified conditions.
ATN	655	Let ATN function	Calculates the ATN value of real number.
ATN2	656	Let ATN2 function	Calculates the ATN2 value of real number.
AUTOZERO	319	Analog input auto zero set	Auto zero the analog input signal is executed. (Option)
BARC	613	Draw the arc	This command is used for the user screen to draw the arc.

SLIM command	FN code	Name	Description
BELLOW	164	Elbow config.(below)	The below-the-elbow (180-degree angle or more formed by J2 axis and J3 axis) posture is forcibly selected for calculating the robot postures.
BGCOLOR	617	Designate back ground color	This can designate the background color used in color graphics command.(CLS, PRINT) Total 16 colors (0 to 15) are available.
BREAK	688	BREAK	End the execution of an innermost instruction that encloses this with the loop or the condition structure. The control shifts to the instruction immediately after the ended instruction.
CALIBROB	702	Calibration Execution	This is to execute deviation revision against the task program as a calibration target.
CALL	21	Step call	This command is used to call the step which has been specified in the same program.
CALLFAR	454	CallFar Program	This command is used to call the program of other unit. (Option)
CALLFARI	455	CallFari Program	Using an input signal, this command is used to call the program of other unit. (Option)
CALLFARIV	694	CallFari Program(Variable)	Call the task program in other unit, if there is a signal input.
CALLFARN	456	CallFarN Program	Using a pass count (number of passes), this command is used to call the program of other unit. (Option)
CALLFARNV	695	CallFarN Program(Program(Variable))	Call the task program in other unit by the passing frequency.
CALLFARV	693	CallFar Program(variable)	Call the task program in other unit.
CALLI	24	Step call(I-condition)	Using an input signal, this command is used to call the step which has been specified in the same program.
CALLMCR	671	Call user task Program	This command is used to call the specified user task program.
CALLN	27	Step call(freq. condition)	Using a pass count (number of passes), this command is used to call a step specified in the same program.
CALLP	80	Program call	This command is used to call the specified program.
CALLPB _D	402	Program call(external BCD prog.)	This command enables to call the program externally designated by the BCD code.
CALLPBIN	403	Program call(external BIN prog.)	The robot calls the program externally designated by the binary code.
CALLPI	81	Program call(I-condition)	Using an input signal, this command is used to call the specified program.
CALLPIV	691	Program call(I-cond...)(Variable)	Call the specified task program.
CALLPN	82	Program call(freq. condition)	Using a pass count (number of passes), this command is used to call the specified program.
CALLPNV	692	Program call(freq...)(Variable)	This command enables to call the specified task program by the passing number.
CALLPR	102	Relative program call	This command is used to call a subprogram and makes the first step position and orientation the same as the current step in the base program and all point positions in the subprogram become relative to that step position.
CALLPRI	103	Conditional relative program call	Using an input signal, this command is used to call the specified program.
CALLPRN	104	Relative program call (freq. condition)	Using a pass count (number of passes), this command is used to call the specified program.
CallProc	806	Call User Procedure	Call User procedure
CALLPV	690	Program call(Variable)	This command enables to call the specified task program.
CALMATRIX	631	Calculation matrix	Calculation matrix
CASE	687	CASE	Two or more conditions are judged.
CHGCOORD	113	Change coord. No.(shift)	This makes it possible to select the number of the user coordinate system used to implement shifts based on the coordinate system. The number of the user coordinate system must be selected without fail before implementing shift-related commands based on the coordinate system.
CHGENDLESS	373	Change endless control	The control of the endless rotation axis to change.
CHGGUN	95	Mount Mechanism2	Connect or disconnect mechanism2(Option) (dedicated to mechanism 2 only)
CHGMEC	301	Mount Mechanism	Connect or disconnect the designated mechanism(Option)
CHGXGUN	238	Change Mechanism2	This is the function command used in mechanism change without electric disconnection, or mechanism change without removing and mounting.

SLIM command	FN code	Name	Description
CHGXXMEC	302	Change Mechanism	As for the change mechanism, refer to the function command CHGXGUN: Change Mechanism (FN238). CHGXGUN (FN238) is a command exclusive for the mechanism 2, meanwhile, CHXXMEC (FN302) allows you to designate an arbitrary mechanism. Except this point, it is the same command as CHGXXGUN (FN238).
CHKMCR	834	Check UserTask	Check the specified user task status from function commands in robot program or user task.
CLRREGWR	699	Clear register of written sts	Clear the written flag of shift register. (Option)
CLS	609	Clear user screen	This is to clear the user screen. (Paint screen with back ground color.)
CNVI	550	Conveyor interlock	Robot waits until conveyor register reaches up to the designated distance, stationarily. (Option)
CNVI2	595	Conveyor Interlock 2	Robot waits until conveyor register reaches up to the designated distance, stationarily
CNVSETM	597	Conveyer sync output signal ON/OFF	This command is used to set any general-purpose output signal to ON or OFF and assign conveyer resister value to global real number variable simultaneously with signal output.
CNVSYNC	55	Conveyer counter reset	Reset conveyer counter (Option)
CNVSYNCCHG	274	Conveyor synchronize select	Used to select a mechanism that is synchronized with the conveyor with the conveyor synchronization function.
CNVSYNCI	562	Conveyor interlock(sync.)	Robot waits until conveyor register reaches up to the designated distance, synchronizing to the conveyor. (Option)
COLDET	31	Collision detection	Executing step is interrupted by collision detection.
COLOR	616	Designate color	This can designate the color used in color graphics command. Total 16 colors (0 to 15) are available. 0: Black 1: Gray 2: Dark Blue 3: Blue 4: Dark Green 5: Green 6: Dark Sky Blue 7: Sky Blue 8: Dark Red 9: Red 10:Purple 11:Pink 12:Dark Yellow 13:Yellow 14:Light Gray 15:White
COLSEL	230	Set interference detection level	The threshold value to be considered as interference can be switched during playback.
COMPOFF	207	Compliance OFF	When this function command is executed, the soft compliance control function becomes disabled. (Option)
COMPON	206	Compliance ON	When this function command is executed, the soft compliance control function becomes enabled, and the robot can be moved according to external force. (Option)
COS	653	Let COS function	Calculates the COS value of real number.
CPRIMCR	703	Change usertask priority	The function changes the usertask priority.
CVTCOORDPOS	821	Coord. Trans (position)	Translate a position variable(As Position) to a designated coordinate.
DELAY	50	Timer delay	This command is used to place the robot in the standby status.
DIM	801	Any variable	You can define some variables as Integer, real and Array, as you like.
DIVVF	644	Divide real variable	Divides the value of real variable.
DIVVI	643	Divide integer variable	Divides the value of integer variable.
DOUT	278	Digital output	The TCP (robot tool center point) linear speed and other data are output using general-purpose output signals.
DPRESETM	280	Advanced output (distance)	This command is used to set one of the general-purpose output signals with advancing distance
DSPALLET	65	Direction select palletize	This limits the shift direction, and it is started by the palletizing work. (Option)
ELSE	678	Condition	Move the control to the following instruction.
ELSEIF	677	Condition	Move the control to the following instruction when the condition consists. Move the control to ELSE and ENDIF for the failure.
ENC2ANG	817	Set angle Variable (encoder)	Set an encoder variable(As encoder) to Angle variable(As Angle)
ENC2POS	814	Set position Variable (encoder)	Set an encoder variable(As encoder) to position variable(As position)
ENCS2POSE	811	Set Pose Variable (encoder)	Set an encoder variable(As Encoder)to Pose variable Pn

SLIM command	FN code	Name	Description
END	92	End	This command is used to end program playback. If the program is a called program, return to the original program.
ENDIF	679	Condition end	End IF-ENDIF.
EndProc	804	End Procedure	Finish and exit Procedure, and back to source procedure
ENDS	689	SWITCH end	It is a terminator of the SWITCH-ENDS structure.
ENDW	664	WHILE end	It is terminator of the WHILE-ENDW structure.
EP	498	Execution Pass Specification	This designates per pass whether the function commands are to be executed or not in the multi-pass section.
EQUALIZE	287	Equalize value	This command is used to the equalizing motion as defined by the servo gun.
EQUALIZECLR	248	Equalize clear	The equalize setting clear.
ET	486	End tracking	This ends the seam tracking. This is used when the arc sensor (AX-AR) is connected.
EXIT	619	User task end	This can terminate the user task.
ExitProc	803	Exit User Procedure	Stop procedure routine and back to source procedure
EXT TRACK	45	External tracking	External tracking
FBUSCON	565	Field bus connect	This function is for a Filedbus master module. After waiting for the connection of the designated node (slave) with time-out condition, continue the program enabling the error detection immediately.
FBUSREL	312	Field bus release	In the field bus master, error detection Enabled/Disabled of the specified node is switched.
FCASEEND	88	Case jump end	This command is used to end the case jump(FCASEI, FCASEN).
FCASEI	87	Case jump(I-condition)	Using an input signal, this command is used to select one of a multiple number of steps and executes it.
FCASEN	86	Case jump(freq. condition)	Using a pass count (number of passes), this command is used to select one of a multiple number of steps and execute it.
FCLOSE	599	File Close	Specify the output file using FN669 PRINTF.
FETCH	528	Fetch Input cond.	Determine judgment the input condition of a following function.
FHCLAMP	362	FLEXhand Clamp	Execute clamp motion by FLEXhand. (Option)
FHCLAMP2	366	New FH Clamp	Execute clamp motion by FLEXhand
FHCLAMPDCT	368	FH Clamping Detection	Detect clamp status by FLEXhand
FHUNCLAMP	363	FLEXhand Unclamp	Execute unclamp motion by FLEXhand (Option)
FHUNCLAMP2	367	New FH Unclamp	Execute unclamp motion by FLEXhand
FLIP	165	Wrist config.(flip)	The wrist-flip posture is forcibly selected for calculating the robot postures.
FOPEN	598	File Open	Close the opened file.
FOR	604	Loop Start	This is loop command. Loop starts here. See also; NEXT(FN605)
FORCECTRL	326	Force control	Start the force control.
FORCEEND	328	Force Control/ Touch End	Ending of the force control and touch shift.
FORCETOUCH	327	Force Touch	Start the touch operation.
FORCEZERO	379	Force Sensor Zero Adjustment	Set the correction value of the force sensor.
FORK	450	Fork Program	This command is used to start the program of other unit. (Option)
FORKI	451	ForkI Program	Using an input signal, this command is used to start the program of other unit. (Option)
FORKMCR	670	Fork Usertask Program	This command is used to start the specified user task program.
FORKMCRDST	673	Fork User Task Program (distance)	This command is used to start the specified user task program with advancing distance.
FORKMCRTM	672	Fork User Task Program (time)	This command is used to start the specified user task program. Furthermore, the command enables advance execution to be specified.
FORKN	452	ForkN Program	Using a pass count (number of the passes), this command is used to start the program of other unit. (Option)
FORKWAIT	453	Wait Fork-Program	This command leads the robot to await the completion of the task program of the other unit which was started up by the FORK, FORKI or FORKN command. (Option)
FORM	370	Form cut	Cutting operation is performed using the specified form data.

SLIM command	FN code	Name	Description
FRANGE	202	Flange axis rot. config.	The rotational direction of the J6 axis is specified for calculating the robot postures
GACTIVE	696	Active user window	Switch the active of the user window.
GARC	623	Display ellipse	This command is used for the user screen to draw the ellipse.
GBOX	612	Draw the box	This command is used for the user screen to draw the box.
GE	413	Gas OFF	Stops the shield gas.
GETANG	823	Set angle variable (pos.data)	Substitute robot position to angle variables
GETANGLE	157	Set real variable (angle)	This command is used to store the current angle value of each axis in a real number variable.
GETBYTE	587	Get buffer (byte)	This command is used to read one byte data from the buffer, and stored the integer variable.
GETENC	824	Set encoder variable (pos.data)	Substitute robot position to encoder variables
GETFIGURE	158	Set real variable (figure)	The robot figure is used to store in real number variables.
GETFORCE	360	Get force/torque	The force/torque data are acquirable to a real variable. (Option)
GETFORCE2	329	Get Force/Torque Data	Acquire the data for force sensor.
GETINT	585	Get buffer (integer)	This command is used to read data from the buffer, and stored the integer variable.
GETOVR	318	Get Override	This command is used to get the speed override value.
GETP	142	Set real variable (coordinate)	This command is used to store the current coordinate values (RPY angle expression) in real number variables.
GETPELR	94	Set real variable(Euler pos)	This command is used to store the current coordinate values (Eulerian angle expressions) in the real number variables
GETPOS	822	Set position variable (pos.data)	Substitute robot position to positional variables
GETPOSE	143	Set real variable (pose)	This stores the pose variable Pn into the real variable V!.
GETREAL	586	Get buffer (real)	This command is used to read data from the buffer, and stored the real variable.
GETSFT	145	Set real variable (shift)	This command replaces the values of the specified shift register with the specified real number variables (7 consecutive variables are used).
GETSTR	584	Get buffer (string)	This command is used to read data from the buffer, and to store data in the string variable.
GETTIPCON	306	Get tip consumption	Used to get tip consumption amount.
GETTIPRATE	371	Get tip consumption rate	Used to get move-tip consumption rate.
GETTOOL	830	Get Tool Parameters	This command is used to get the tool parameter values.
GETUSRCOORD	627	Get user coordinate	Get the existent user coordinates
GFONT	683	Set the font	The font of the user screen is set.
GLINE	611	Display position specification	This command is used for the user screen to draw the straight line.
GMSGBOX	685	Create message box	Create a message box on the user screen.
GOSUB	91	Line call	Execute a sub-routine call by a designated line No. or label.
GOTO	90	Line jump	This is used to jump to a designated line or label.
GPAINT	614	Paint	This command is used to paint out the enclosed area on the user screen.
GS	412	Gas ON	Starts to output the shield gas.
GSEA	167	Servo gun search	This command is used to detect the electrode tip consumption of the servo gun.
GSEA ORDER	229	Servo gun search order	Servo gun search2 is execute before servo gun search1
GSETP	615	Draw the pixel	This command is used for the user screen to draw a pixel.
GSOFTKEY	684	Create soft key	Create a soft key on the user screen.
GUNOPEN	218	Gun Open	This command is used to change stroke of air gun.
ICH	410	Inching	Performs inch the wire with specified time and wire speed
IF	602	Condition	If condition is satisfied then command(jump/call) after "THEN" is executed, else command(jump/call) after "ELSE" is executed.
IF	676	Condition	Move the control to the following instruction when the condition consists. Move the control to ELSEIF, ELSE, and ENDIF for the failure.
INCLUDE	697	Translate table included (file)	The conversion rule is read from "inc file"
INCLUDEIO	698	Translate table included (I/O)	The conversion rule is read from "I/O NAME".
INH	310	Inhibit	This determines to inhibit the fetch control.

SLIM command	FN code	Name	Description
INPUT	271	Strings input	This receives the character string data from the specified communication (serial) port, and holds it in the specified character string variable. (Option)
INT2OSIG	531	Change int to O-signal	Change an integer to O-signal.
JMP	20	Step jump	The robot jumps to the step specified in the same program.
JMPI	23	Step jump(I-condition)	Using an input signal, this command causes the robot to jump to the step specified in the same program.
JMPN	26	Step jump(freq. condition)	Using a pass count (number of passes), the robot jumps to the step specified in the same program.
JMPP	83	Program jump	This command is used to jump to the start of the specified program.
JMPPBCD	400	Program jump(to ext. BCD prog.)	This command enables to externally jump to the program designated by the BCD code.
JMPPBIN	401	Program jump(to ext. BIN prog.)	The robot jumps to the program externally designated by the binary code.
JMPPPI	84	Program jump(I-condition)	Using an input signal, this is used to jump to the start of the specified program.
JMPPIV	681	Program jump (I-cond...)(Variable)	This command enables to jump to the specified task program top.
JMPPNV	682	Program jump(freq...)(Variable)	This command enables to jump to the specified task program top by the passing number.
JMPPN	85	Program jump(freq. condition)	Using a pass count (number of passes), this command is used to jump to the start of the specified program.
JMPPV	680	Program jump(Variable)	This command enables to jump to the specified task program top.
KILLMCR	833	Kill UserTask	Stop the specified user task from function commands in robot program or user task.
LCALLMCR	593	Call User Task Program with Arguments	This command is used to call the specified user task program. At this time, ten real numbers can pass the arguments to the program.
LCALLP	590	Program call with Arguments	This command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.
LCALLPI	591	Conditional program call with Arguments	Using an input signal, this command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.
LCALLPN	592	Conditional program call after specified number of passes with Arguments.	Using a pass count (number of passes), this command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.
LEFTY	161	Arm config.(left/front)	The left-arm system posture is forcibly selected for calculating the robot postures
LET	634	Let variable	Sets the variable of the same type.
LETC	647	Integer variable setting	Used to make setting of values to integer variable registers specified.
LETCOORDP	630	Let pose variable	Stores the pose data recorded by the specified rectangular coordinates value in the pose variables.
LETLF	629	Set local real variable	Sets the value into the specified local real variable register.
LETLI	628	Set local integer variable	Sets the value into the specified local integer variable register.
LETPE	632	Let pose element	Stores the pose element recorded by the specified rectangular coordinates value in the pose variables.
LETPOSE	144	Set pose variable	This stores the real variable V1. into the pose variable.
LETR	68	Set shift value	The shift amount data is set in the specified shift register. (Option)
LETRE	633	Let shift element	Sets the shift element in the specified shift register.
LETVF	76	Set real variable	Substitute a value for a global float variable. Can not substitute for a local variable.
LETVI	75	Set integer variable	Substitute a value for a global integer variable. Can not substitute for a local variable.
LETVS	77	Set strings variable	Substitute a value(string) for a global string variable. Can not substitute for a local variable.
LETX	71	Pose X	Substitute a value for the X component of a pose. LETX, LETY, and LETZ are available only for an already recorded pose. These functions are used in a case where only 1 pose is made and parallel shift is applied for the pose.
LETY	72	Pose Y	Substitute a value for the Y component of a pose.

SLIM command	FN code	Name	Description
LETZ	73	Pose Z	Substitute a value for the Z component of a pose.
LOCATE	610	Locate the display pos	This command is used to specify the position of the character displayed on the user screen.
LOCCVT	53	Coord. trans(shift value)	It is possible to proceed with playback while offsetting each recorded point based on the difference (skew amount) measured beforehand between the recorded position of the three points serving as the reference and the actual position obtained from the visual device, etc. (OPTION)
LOCCVT1	54	Coord. trans(posi. value)	It is possible to proceed with playback while offsetting each recorded point based on the difference (skew amount) measured beforehand between the recorded position of the three points serving as the reference and the actual position obtained from the visual device, etc.
LOCCVT3	275	Base angle shift	The start or end of the shift operation is specified. When shift operation start has been specified, the shift operation is performed on the basis of the shift amount stored in the specified shift register.
MAX	659	Let MAX function	Calculates a larger real number out of two.
MESPOS	700	Taking of a Measuring/Reference point	This is to specify the measurement point.
MESQCP	701	Taking of a Quick check point	Obtain and store the quick check pints.
MIN	658	Let MIN function	Calculates a smaller real number out of two.
MODUSRCOORD	626	Modify User coordinate	Modifies the existent user coordinates using pose variables
MOVE	-	Movement (Cartesian coordinates or pose designation)	Move the robot based on a traditional Cartesian coordinate system of NACHI AW controller.(XYZRPY)
MOVEJ	-	Movement (Axis values)	Move the robot using joint values(angles) in NACHI AW controller format.
MOVEX	645	Movement (Unified format)	Move the robot based on this controller original format. Position data can be given in any of Cartesian coordinates, joint values and encoder data.
MPE	497	Multi Pass Section End	This represents the end position of the section where a series of movements for multi-pass welding is repeated.
MPS	496	Multi Pass Section Start	This represents the start position of the section where a series of movements for multi-pass welding is repeated.
MSRTM	835	Measure Time	Measure processing time from start-point A to end-point B.
MULTIM	264	Multi output signal	This command is used to set the pre-defined multiple output signals to ON or OFF using the binary format.
MULVF	642	Multiply real variable	Multiplies the real variables.
MULVI	641	Multiply integer variable	Multiplies the integer variables.
NEXT	605	Loop End	Please refer to "FOR"(FN604).
NONFLIP	166	Wrist config.(non-flip)	The wrist-non-flip posture is forcibly selected for calculating the robot postures.
NOP	600	NOP	No operation
NRLCRD	171	Select robot language coordinate system	Used to switch functions to a specified user coordinate system.
OFFSET	499	Multi Offset Specification	This sets offset in the movement steps in the multi-pass welding section.
OFFSETV	660	Multi Offset condition specification (Variable)	It gives offset to the movement steps between multi-pass welding section.
OnErrGoto	36	Error interrupt	Call the step/label, when an error or alarm occurs.
ONGOTO	603	ON GOTO Jump	Next command(jump/call) is determined by the value of condition. It's order is 1,2,3... from left.
OPEANG	827	Extraction angle Variable	Substitute or Extract an angle variable to a global real variable (V!) or local real variable (L!).
OPEENC	828	Extraction encoder Variable	Substitute or Extract an encoder variable to a global integer variable (V%) or local integer variable (L%), any integer variable.
OPENMCR	621	Open user task	Start user task program
OPEPOS	826	Extraction position Variable	Substitute or Extract a position variable to a global real variable (V!) or local real variable (L!).
OPEPOSE	825	Extraction pose Variable	Substitute or Extract a pose variable to a global real variable (V!) or local real variable (L!).
OUT	44	Binary output signal	This command is used to set the general-purpose output signals in any group to ON or OFF using the binary format.

SLIM command	FN code	Name	Description
OUTDIS	43	Discrete output signal	This command is used to set the general-purpose output signals in any group to ON or OFF using the discrete format.
PALLET2	47	Palletize start	Start palletizing based on the pre-designed palletizing pattern. (OPTION)
PALLET2_END	48	Palletize end	Finish palletizing based on the pre-designed palletizing pattern. Confirmation signal can be output. (OPTION)
PALLET2_RESET	49	Palletize reset	When a condition signal has been input, the palletize counter is forcibly reset. (palletizing operation is forcibly terminated) (OPTION)
PALLET3	249	Palletize start	Start palletizing based on the pre-designed palletizing pattern.
PALLET3_APPROACH	374	Palletize approach selection	Starts approaching motion.
PALLET3_END	250	Palletize end	Finish palletizing based on the pre-designed palletizing pattern.
PALLET3_GETREG	377	Get palletize register	Store some palletize register to some variables.
PALLET3_GETSHIFT	393	Get palletize shift value	Store palletize shift value to some variables.
PALLET3_OPTIMIZE	375	Palletize optimize path	Optimize Step position based on the locus of previous step and following step
PALLET3_RESET	251	Palletize reset	The palletize counter is forcibly reset. (palletizing operation is forcibly terminated)
PALLET3_SELECT_GRASP	376	Palletize select grasp position	Select Work grasp position from registered by Palletize pattern.
PALLET3_SELECT_HEIGHT_Z	388	Palletize select height(Z)	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.
PALLET3_SELECT_HEIGHT_Z_JUMP	394	Palletize select height (z) step jump	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.
PALLET3_SELECT_HEIGHT_Z_SHIFT	395	Palletize select height (z) step jump	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both. In addition, the shift amount ratio amount specified in the palletizing shift, it will shift operation.
PALLET3_SETREGISTER	378	Set palletize register	Set some variables to some palletize registers.
PAUSE	620	Pause user task	This can make a brief stop of user task.
PAUSEINPUT	252	Pause Input	The robot is pause when the designated [Pause input] signal is turned off.
POS2ANG	816	Set angle Variable (position)	Set a position variable(As position) to Angle variable(As Angle)
POS2ENC	819	Set encoder Variable (position)	Set a position variable(As position) to encoder variable(As encoder)
POS2POSE	809	Set Pose Variable (position)	Set a position variable(As Position)to Pose variable Pn
POSAUTO	160	Disable posture control	Used to disable the posture control for robot posture calculation.
POSE2ANG	815	Set angle Variable (pose)	Set Pose variable Pn to Angle variable(As Angle)
POSE2ENC	818	Set encoder Variable (pose)	Set Pose variable Pn to encoder variable(As encoder)
POSE2POS	812	Set position Variable (pose)	Set a Pose variable Pn to position variable(As position)
POSESAVE	74	Pose file save	Pose variables are stored to the pose file.
PRINT	101	Output strings	The character string data is output to the screen or specified RS232C serial port.
PRINT	606	Print String	Please refer to "PRINT"(FN101).

SLIM command	FN code	Name	Description
PRINTF	669	Print string with format	Draw the string data on the screen with form. Or Output string data with form via RS232C.
PRSD	308	Read press data	This reads a press brake synchronization setting file, in the press brake synchronization function.
PRSI	564	Press interlock	This sets interlock, in the press brake synchronization function.
PRSS	307	Press brake shelter	This executes retreat actions after work process, in the press brake synchronization function.
REGC	224	Shift register copy	Data is copied between shift registers. (Option)
RELMOV	407	Move of External axis	The designated external axis moves the specified distance from the current position.
REM	99	Comment	This command is used to provide comments inside programs.
RESET	34	Output signal reset	This command is used to set one of the general-purpose output signals to OFF.
RETI	25	Step return(l-condition)	Using an input signal, this command is used to return the robot to the step following the one which executed the step call command in the same program.
RETN	28	Step return(freq. condition)	Using a pass count (number of passes), this command is used to return the robot to the step following the one which executed the step call command in the same program.
RetProc	805	Return User Procedure	Set a return value of user procedure
RETURN	22	Step return	This command is used to return the robot to the step following the one which executed the step call command in the same program. The commands that call a sub-routine are CALL, CALLI, CALLN, and GOSUB. Normally, only GOSUB is used in robot language.
RETURNERR	37	Error interrupt return	Return from error interrupt processing.
RIGHTY	162	Arm config.(right/back)	The right-arm system posture is forcibly selected for calculating the robot postures
RINT	29	Robot interrupt(l-condition)	Executing step is interrupted by input signal
ROLHEMCHG	193	Change roller hem condition	Change the roller hem conditions during pressurization.
ROLHEMCTRL	192	Change control of roller hem	Change the control of roller hem during execution of roller hemming.
ROLHEMEND	191	Finish roller hem	Finish the roller hem pressing.
ROLHEMST	190	Start roller hem	Execute roller hem in accordance with pre-defined condition.
RSCLR	111	RS232C buffer clear	The send/receive buffer inside the specified RS232C port is cleared. (Option)
RTC	411	Retract	Performs to retract the wire with specified time and wire speed.
SCANF	589	Scan string with format	Read one line of strings from specified file, and output string to string register.
SEA	59	Search	Detect the work position shift amount, and store those data to the shift register (Option)
SEAMANG	254	Seam angle correction	Seam angle correction is start / end.
SEAMEND	246	Seam weld end	Stop the seam welding.
SEAMOV	313	Seam override	Set the electrode rotation speed override.
SEAMSPD	247	Seam electrode speed	Set the electrode rotation speed while welding.
SEAMST	245	Seam weld start	Start the seam welding.
SEAMTHICK	311	Seam panel thick	Set the thickness of the work.
SERVOON	38	Servo ON	Turn on the servo.
SET	32	Output signal set	This command is used to set one of the general-purpose output signals to ON.
SETBYTE	583	Set buffer (byte)	This command is used to stored byte data at an arbitrary position in the buffer.
SETC	646	Set output signal	Consecutive output signal is output.
SETINT	581	Set buffer (integer)	This command is used to stored integer value at an arbitrary position in the buffer.
SETM	105	Output signal	This command is used to set any general-purpose output signal to ON or OFF
SETMD	35	Output sig(ON/OFF/delay/pulse)	This command is used to set one of the general-purpose output signals to come with a pulse or delay and to ON or OFF.

SLIM command	FN code	Name	Description
SETMSECTION	396	Sectional signal output	This command is used to set any general-purpose output signal to ON or OFF. In selecting the step between ON to OFF, the signal always turns ON.
SETO	100	Consecutive output signal ON/OFF	This command is used to set any number of consecutive general-purpose output signals to ON or OFF altogether.
SETOVR	317	Set Override	This command is used to set the speed override value.
SETREAL	582	Set buffer (real)	This command is used to stored real value at an arbitrary position in the buffer.
SETSTR	580	Set buffer (string)	This command is used to stored string at an arbitrary position in the buffer.
SETTHKERR	392	Set panel thickness abnormal level	This command is setup (+) and (-) of panel thickness abnormal level detection is specified directly.
SETTIPCON	323	Set tip consumption	Used to set tip consumption amount.
SETTIPRATE	372	Set tip consumption rate	Used to set move-tip consumption rate.
SETTOOL	831	Set Tool Parameters	This command is used to set the tool parameter values from real variable register.
SETVELO	309	Set velocity	This command is used to set the speed in an endless axis.
SF0	470	Wire Extension	This detects and corrects the wire extension. This is used when the touch sensor (AX-WD) is connected.(OPTION)
SF1	471	One Direction Search(Touch)	This detects the deviation of a workpiece by a touch sensor. *This is used when the touch sensor (AX-WD) is connected. (Option)
SF2	472	Pattern Search(Touch)	Detect setting deviation of the work object by the touch sensor attached to the welding wire and store the deviation volume/gap volume file in the specified file / gap file.
SF3	473	Deviation call	This receives the stored deviation and execute a compensation. (Option) *This is used when the touch sensor (AX-WD) and the laser search (AX-RD) are connected.
SF4	474	Dev. vector composition	This calculates a new deviation on the basis of stored deviation. This is used when the touch sensor (AX-WD) and the laser search (AX-RD) are connected.
SF5	475	Store of tracking deviation	Store the cumulative volume of the weld line tracking augmenter up to the present will be stored in the deviation file.
SF8	478	Generation of a DEV. file	Exchange the deviation volume between the general purpose register and the deviation file.
SF9	479	Generation of a GAP.file	This stores variable values to a gap file. This is used when the touch sensor (AX-WD) and the laser search (AX-RD) are connected.
SGSPRT	279	Servo gun separation	Servo gun separated status is changed.
SGTIPRST	270	Reset consumption	Reset the tip consumption of designated servo gun
SHIFTA	58	XYZ shift	The playback position is shifted in parallel (Option)
SHIFTR	52	Shift	The start or end of the shift operation is specified. When shift operation start has been specified, the shift operation is performed on the basis of the shift amount stored in the specified shift register.
SIGREQ	723	Shift value get (signal)	Using external signals, the command requests shift amount input, and the shift amount data which is input is stored in the designated shift register.
SIN	652	Let SIN function	Calculates the SIN value of real number.
SLEND	351	Seal end	Stop the dispensing process
SLPRS	355	Seal press ctrl	Start/Stop pressure control in the dispensing process.
SLPRSG	356	Seal press ctrl 2	Start/Stop pressure control in the dispensing process. Control level can be designated.
SLREADY	353	Flow ready	Pressure in the pump is controlled to a specified value.
SLELOAD	352	Reload	Refill the booster pump.
SLSTART	350	Seal start	Start the dispensing.
SOCKBIND	572	Bind the socket	This command is used to assign a socket an port No.
SOCKCLOSE	571	Close the socket	This command is used to close the socket.
SOCKCONNECT	574	Connect to server	This command is used to connect to server.
SOCKCREATE	570	Create Socket	This command is used to create the socket.
SOCKRECV	577	Receive data	This command is used to receive the data.
SOCKSEND	575	Send data	This command is used to transmit the data stored in the specified buffer.

SLIM command	FN code	Name	Description
SOCKSENDSTR	576	Send string	This command is used to transmit the specified string.
SOCKWAIT	573	Wait for connect	This command is waited for until the connection from the client is done to the allocated port.
SPDDOWNA	169	Analog input speed override	The playback speed of the robot is changed in accordance with the input voltage. (Option)
SPDDOWND	277	Digital input speed override	The playback speed of the robot is changed in accordance with digital input signals
SPF	439	Servo OFF	This turns OFF the servo power source in unit of mechanism.
SPN	438	Servo ON	This turns ON the servo power source in unit of mechanism.
SPOT	119	Spot welding	Execute spot welding in accordance with pre-defined sequence.
SPOT2	268	Spot welding	By recording the spot welding function to the welding step, spot welding can be carried out by a designated sequence
SPOTC	314	Spot welding execution	Execute spot welding in accordance with pre-defined sequence.
SPOTIWB1	199	Spot welding	Execute spot welding in accordance with pre-defined sequence. (dedicated to welding I/F= MEDbus only) (Option)
SPRAYOFF	409	Spray End	Turn OFF the start signal of thermal spraying
SPRAYON	408	Spray Start	Turn ON the start signal of thermal spraying
SQR	651	Let SQR function	Calculates the square root of the real number.
SREQ	51	Shift data request	The command requests the shift amount data from the external device using the serial port. Once it has been input from the external device, the shift amount data is stored in the specified shift register.
SREQ2	315	Shift amount request (binary)	The command requests the shift amount data (binary data) from the external device using the serial port. Once it has been input from the external device, the shift amount data is stored in the specified shift register.
ST	485	Start tracking	This starts seam tracking. This is used when the arc sensor (AX-AR) is connected.
STIMER	150	Short timer	Used to wait for a specified period of time.
STOOL	67	Select the stated tool No.	This command is used to select the coordinate system of the stationary tool number from among the user coordinate systems
STOP	41	Robot stop	This command is used to stop the robot.
STOP1	42	Robot stop(I-condition)	Using an input signal, this command is used to stop the robot.
SUBVF	640	Subtract real variable	Subtracts the real variable.
SUBVI	639	Subtract integer variable	Subtracts the value of integer variable.
SWITCH	686	SWITCH	Two or more conditions are judged.
SYNCSPOT	303	Sync spot welding	Enabling to perform synchronous welding with two servo guns.
SYNCSPOTIWB	316	Sync spot welding	Enabling to perform synchronous welding with two servo guns. (dedicated to welding I/F= MEDbus only) (option)
TAN	654	Let TAN function	Calculates the TAN value of real number.
TIMER	650	Let TIMER function	Sets the time value passed since the power-on into the specified real variable register.
TIPDRESS	265	Tip dress	Execute the tip dress of spot welding gun.
TITLE	608	User screen title	This is to draw the title of user screen.
USE	98	Select pose file	This function is used to select a pose file. Pose data is controlled as a file, and poses P1 - P9999 can be recorded into a file. For example, it is useful when to change only the position data of the robot according to the type of work piece, and when to play back a same program.
USRERR	467	User Error Output	Output the user customized error, alarm and information.
UsrProc	802	User Procedure	Define User Procedure
VCHKGRP	336	Vision group check	Check the measurement group of the vision sensor.(Option)
VDATA	334	Vision data	Get the data from the vision sensor.(Option)
VGROUP	335	Vision group change	Change the measurement group of the vision sensor.(Option)

SLIM command	FN code	Name	Description
VLOCCVT	342	Vision location convert	The start or end of the shift operation with the vision sensor are specified. When shift operation start has been specified, the shift operation is performed on the basis of the shift amount stored in the specified shift register. (Option)
VRESET	330	Vision reset	Data of the vision sensor is cleared. (Option)
VSHIFT	333	Vision shift	Get the shift value from the vision sensor. (Option)
VSTART	331	Vision start	Start the measurement of vision sensor. (Option)
VWAIT	343	Vision measure wait	The measurement completion of the vision sensor is waited for. (Option)
VWORK	332	Vision work	Distinguish work with the vision sensor. (Option)
WAIT	552	Wait I-cond with timer	This command is used to wait for any one general-purpose input signal for up to the specified time.
WAITA	553	Wait I-group(AND) with timer	This command is used to wait for any of group general-purpose input signal (AND logic) with designated time.
WAITAD	558	Wait I-group BCD(AND) with timer	This command is used to wait for any of group general-purpose input signal (AND logic) with designated time. The condition is written in BCD format.
WAITE	555	Wait I-group with timer	This command is used to wait for any of group general-purpose input signal with designated time.
WAITED	560	Wait I-group BCD with timer	This command is used to wait for any of group general-purpose input signal with designated time. The condition is written in BCD format.
WAITI	525	Wait Input cond	This command is used to wait for any one general-purpose input signal.
WAITJ	526	Wait not Input cond	This command is used to wait for any one general-purpose input signal using negative logic.
WAITJL	561	Wait not I-cond with timer2	This command is used to wait for any one general-purpose input signal using negative logic for up to the specified time.
WAITMCR	622	Wait user task	Wait for the end of user task program
WAITO	554	Wait I-group(OR) with timer	This command is used to wait for any of group general-purpose input signal (OR logic) with designated time.
WAITOD	559	Wait I-group BCD(OR) with timer	This command is used to wait for any of group general-purpose input signal (OR logic) with designated time. The condition is written in BCD format.
WAITR	127	Wait shift value receive	This initiates a jump to the shelter step when the robot has been waiting for the shift amount data to be input from the external source into the specified shift register and the data has not been input within the specified time. (Option)
WAX	441	Axis Weaving	Starts weaving with the simple harmonic motion of the axes.
WAXV	668	Axis Weaving (variable)	Starts weaving with the simple harmonic motion of the axes.
WE	443	Weaving End	Terminates weaving
WELDCND	33	Spot condition output	This function outputs signals assigned to the "weld condition output."
WELDGRP	282	Weld condition with group	When this function command is executed, the welding machine number to be used by the welding function (FN119) and the welding condition group number are designated.
WFP	440	Fix Pattern Weaving	Starts weaving with the specified waveform, attitude, and frequency.
WFXP	667	Fixed pattern weaving (Variable)	Starts weaving with the specified waveform, attitude, and frequency.
WHILE	663	WHILE loop	Execute the instruction in WHILE-ENDW repeatedly until the condition doesn't consist.
WINDOW	607	User screen open/close	Open user screen, or close user screen.
WRISTSINGULARITY	289	Wrist singularity control	This makes to robot able to pass through the dead zone with condition that flange surface is the horizontal.
WSF	442	Taught Weaving	This carries out weaving in the taught pattern.
ZFL	480	One Direction Search(Laser)	This detects the setting deviation of a workpiece. This is used when the laser search (AX-RD) is connected.
ZG1	483	High-speed groove search	This searches the groove information at high speed. This is used when the laser search (AX-RD) is connected.



1.3 Detail of each command (order of FN code No.)

Detail of each command is described hereinafter, sorted in an order of FN code number.



IMPORTANT

Because this manual covers all the commands without any distinctions like standard or option, please be sure that there are some cases where some commands are not available depending on the specification of the controller.

If the command is not displayed on the teach pendant screen, it is a command that is protected by option protect or non-supported command in an old system software version.

Function commands(FN codes)

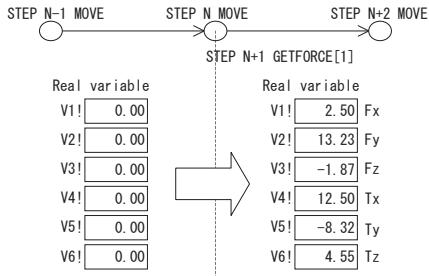
Command name	GETFORCE
FN code	360
Title name	Get force/torque
General description	The force/torque data are acquirable to a real variable.

■ General description

By executing this command, the force / torque data inputted from the force sensor are acquirable to a real variable.

■ Example of operation

The force / torque data are stored in six variables from the specified variable number.



■ Parameter

Parameter No.1	1-195	Variable No.
----------------	-------	--------------

■ Example of screen display

GETFORCE[1] FN360:Get force/torque

Function commands(FN codes)

Command name	FHCLAMP
FN code	362
Title name	FH Unclamp
General description	Execute clamp motion by FLEXhand

■ General description

By this command, the FLEXhand clamps the work.

■ Parameter

Parameter No.1	1-2	FLEXhand Number
Parameter No.2	1-2	Clamping direction 1:close 2:open
Parameter No.3	0-1	Air force mechanism 0:not use 1:use
Parameter No.4	0-50[kN]	Clamping force

■ Example of screen display

FHCLAMP[1, 1, 1, 2] FN362: FLEXhand clamp

Function commands(FN codes)

Command name	FHUNCLAMP
FN code	363
Title name	FH Unclamp
General description	Execute unclamp motion by FLEXhand

■ General description

By this command, the FLEXhand unclamps the work.

■ Parameter

Parameter No.1	1-2	FLEXhand Number
Parameter No.2	0-1	Specifying method of opened finger position 0:absolute 1:relative
Parameter No.3	-1000-1000[mm]	Opened finger position

■ Example of screen display

FHUNCLAMP [1, 1, 10]

FN363: FLEXhand unclamp

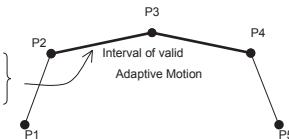
Function commands (FN codes)

Command name	ADAPTON
FN code	364
Title name	Adaptive Motion ON
General description	Starts Adaptive Motion with the specified condition.

■ General description

During recording steps from Adaptive Motion ON function (FN364) to Adaptive Motion OFF function (FN365), Adaptive Motion function becomes valid and robot moves in accordance with external force.

```
1 MOVE (P1)
2 MOVE (P2)
3 ADAPTON (FN364)
4 MOVE (P3)
5 MOVE (P4)
6 ADAPTOFF (FN365)
7 MOVE (P5)
8 END
```



■ Parameter

Parameter No.1	Condition No.	Conditional numbers selected in "Constants-39 Adaptive Motion" shall be set up. (1~10)
Parameter No.2	Command position replacing ON/OFF(1/0)	1: After taking in present position changed by external force, trace calculation to next step is done based on its position. 0: Trace is normally calculated without taking in present position halfway in the step.

■ Example of screen display

ADAPTON[1, 1] FN364: Adaptive Motion ON



You can change the condition number by executing ADAPTON again while Adaptive Motion is running.

See

ADAPTOFF: Adaptive Motion OFF (FN365)

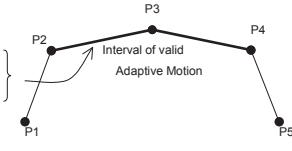
Function commands (FN codes)

Command name	ADAPTOFF
FN code	365
Title name	Adaptive Motion OFF
General description	Ends Adaptive Motion.

■ General description

This command enables to end Adaptive Motion function.

- 1 MOVE (P1)
- 2 MOVE (P2)
- 3 ADAPTON (FN364)
- 4 MOVE (P3)
- 5 MOVE (P4)
- 6 ADAPTOFF (FN365)
- 7 MOVE (P5)
- 8 END



When this function is executed, a trajectory to the next step is created from robot's present position.

■ Parameter

Nil		
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■ Example of screen display

ADAPTOFF FN365: Adaptive Motion OFF

See

ADAPTON: Adaptive Motion ON (FN364)

Function commands(FN codes)

Command name	FHCLAMP2
FN code	366
Title name	New FH Clamp
General description	Execute clamp motion by FLEXhand

■ General description

By this command, the FLEXhand clamps the work.

■ Parameter

Parameter No.1	1-2	FLEXhand Number
Parameter No.2	1-2	Clamping direction 1:close 2:open
Parameter No.3	0-1	Air force mechanism 0:not use 1:use
Parameter No.4	0-50[kN]	Clamping force
Parameter No.5	0-500	Clamping speed
Parameter No.6	0-1	Brake during clamping 0:not use 1:use
Parameter No.7	0-2[s]	Brake delay time

■ Example of screen display

FHCLAMP2[1, 1, 0, 1, 0, 0, 1] FN366: New FLEXhand clamp

Function commands(FN codes)

Command name	FHUNCLAMP 2
FN code	367
Title name	New FH Unclamp
General description	Execute unclamp motion by FLEXhand

■ General description

By this command, the FLEXhand unclamps the work.

■ Parameter

Parameter No.1	1-2	FLEXhand Number
Parameter No.2	0-1	Specifying method of opened finger position 0:absolute 1:relative
Parameter No.3	-1000-1000[mm]	Opened finger position

■ Example of screen display

FHUNCLAMP2 [1, 1, 1, 10] FN367: New FLEXhand unclamp

Function commands(FN codes)

Command name	FHCLAMPDCT
FN code	368
Title name	FH Clamping Detection
General description	Detect clamp status by FLEXhand

■ General description

This command detects that the FLEXhand clamps the work.

■ Parameter

Parameter No.1	1-2	FLEXhand Number
Parameter No.2	0-1000[mm]	Clamping position
Parameter No.3	0-60[sec]	Wait time
Parameter No.4	1-9999	Escape destination step
Parameter No.5	1-200 or 301-500	Real variable number for clamping position value.

■ Example of screen display

FHCLAMPDCT[1, 85, 1, 7, V1!]
FN368:Fhand Clamping Detection

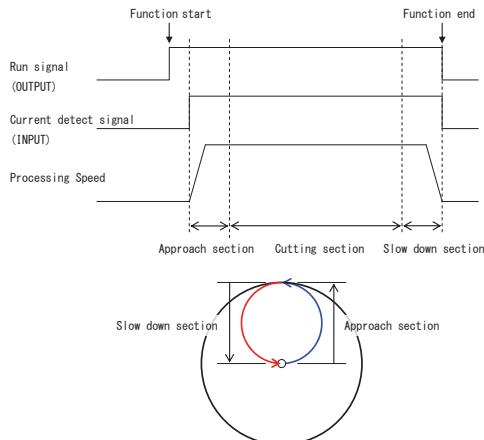
Function commands (FN codes)

Command name	FORM
FN code	370
Title name	Form cut
Outline	Cutting operation is performed using the specified form data.

■ General description

Using the table of the form data registered beforehand, this function command perform cutting operation of specification form.

■ Example of operation



The center position of form is recorded in the last move step.

"Run signal" turns on after this function command start. Then, if "Current detection signal" turns on, specification form will be operated through the approach section.

It returns to the center position through the slow down section, and a command is completed.

Registration of "Run signal" and "Current detection signal" are registered by Tool setting of Form cutting service menu.

■ Parameter

Parameter No. 1	Mechanism	This is used to specify the processing mechanism.
Parameter No. 2	Form	This is used to specify the form data. (1 to 255)
Parameter No. 3	Rotation	This is used to specify the rotation type. 0: Reverse 1: CW 2: CCW
Parameter No.4	Speed	This is used to specify the speed of the cutting tool. (0 to 1000) When 0 is specified as the speed, Tool move by the speed parameter in form data.

■ Example of screen display

FORM[2, 10, 0, 0] FN52:Form cut

Function commands (FN codes)

Command name	GETTIPCON
FN code	371
Title name	Get tip consumption rate
General description	Used to get move-tip consumption rate.

■ General description

Using this command makes it possible to get the move-tip consumption rate.

■ Parameter

Parameters 1	Gun No.	Used to make setting of gun number which you want to detect the move-tip consumption rate. (Setting range: 1 to 31)
Parameters 2	Real variable No.	Used to make setting of variable in which the move-tip consumption rate is saved. (Setting range: 1 to 200, 301 to 500)

■ Example of screen display

GETTIPRATE[1,V1] FN371: Get tip consumption rate

Related commands

GSEA: Servo gun search (FN167)

GETTIPCON: Get tip consumption (FN306)

SETTIPCON: Set tip consumption (FN323)

SETTIPRATE: Set tip consumption rate (FN372)

Function commands (FN codes)

Command name	SETTIPRATE
FN code	372
Title name	Set tip consumption rate
General description	Used to set move-tip consumption rate.

■ General description

Using this command makes it possible to set the move-tip consumption rate.

■ Parameter

Parameters 1	Gun No.	Used to make setting of gun number which you want to detect the move-tip consumption rate. (Setting range: 1 to 31)
Parameters 2	Real variable No.	Used to make setting of variable in which the move-tip consumption rate is saved. (Setting range: 1 to 200, 301 to 500)

■ Example of screen display

SETTIPRATE[1,V1!] FN372: Set tip consumption rate

Related commands

GSEA: Servo gun search (FN167)

GETTIPCON: Get tip consumption (FN306)

SETTIPCON: Set tip consumption (FN323)

GETTIPRATE: Get tip consumption rate (FN371)

Function commands (FN codes)

Command name	CHGENDLESS
FN code	373
Title name	Change endless control
General description	The control of the endless rotation axis to change.

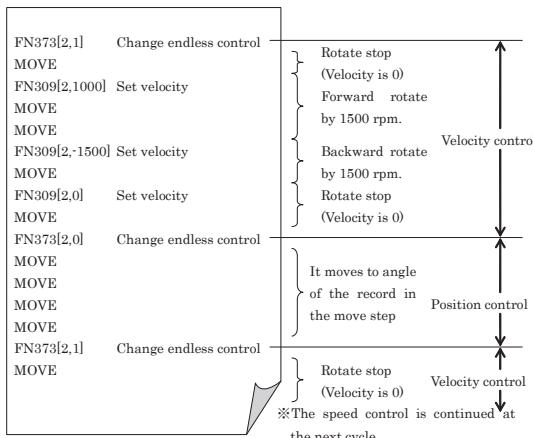
■ General description

It is a function to change the control of the endless rotation axis to the position control or the speed control.
If you use the position control, endless rotation axis moves to recorded position.
if you use the velocity control, endless rotation axis doesn't move to recorded position. The axis rotates by the speed setting of SETVELO; Set velocity (FN309).

Only endless axis set by "Change control" can use the function. Please set the endless rotation axis to "Change" by [Constant setting][Machine constant][Endless Rotation].

This function becomes in position only when the control changes, and robot stops one moment. Robot doesn't stop when the control doesn't change.
Please record the function between the start and the end section.

■ Example of operation



The example is the mechanism 2 as an endless axis.

■ Parameter

Parameter No. 1	Mechanism Number	This specifies the mechanism number of a change type endless axis. (1 - 9)
Parameter No. 2	Control	The changed control is specified. 0:Position control 1:Velocity control

■ Example of screen display

CHGENDLESS[2,0] FN373;Change endless control

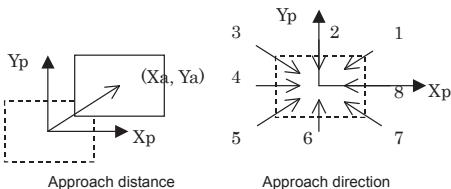
See
SETVELO;Set velocity(FN309)

Function commands (FN codes)

Command name	PALLET3 APR
FN code	374
Title name	Palletize approach selection
General description	Starts approaching motion.

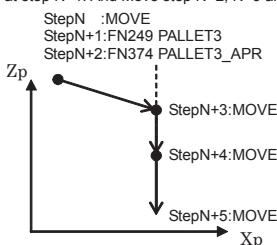
■ General description

'Approaching motion' is for preventing from collision with works already stacked at the time of stacking a new work.
 'Approach distance' is defined in palletize pattern, and 'Approach direction' is designed each works. When this function is executed, robot performs 'Approaching motion' according to the setting from next step.



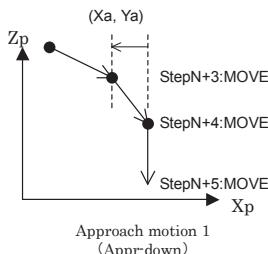
■ Example of operation

Following figure shows FN249 palletize start is recorded at step N+1. And FN374 Palletize approach selection is recorded at step N+1. And Move step N+2, N+3 and N+4 are also recorded.

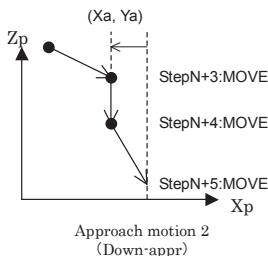


Program sample of approach

Robot starts palletizing based on the palletize pattern of FN249 and the palletize counter. At next step of FN374, Robot moves with palletizing shift and approach shift that includes some value and direction.



Approach motion 1
 (Appr down)



You can select Appr-down or Down-appr by the parameter of function.

■ **Set Approach direction**

Approach direction 1to 8 is set by pallet coordinate. Approach direction doesn't change even if work rotates.

■ **Approach motion**

The next step of Palletize3_AP4 will move with approach shift. In case of Down-appr, robot has some approach shift from next two step of function. Please be careful when you add some steps.

■ **Parameter**

Parameter No.1	Palletize No.	This specifies the palletizing number to be reset. (1 to 100)
Parameter No.2	Route selection	Select Appr-down(0) or Down-appr(1)

■ **Example of screen display**

PALLET3_AP4[1..0] FN374 Palletize approach selection

See

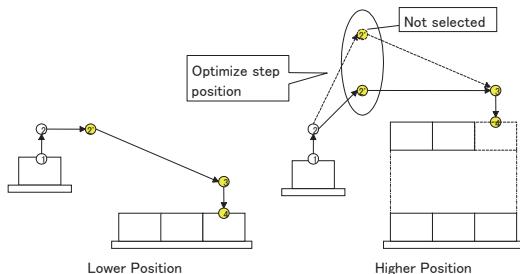
PALLET3: Palletize start (FN249)
 PALLET3_END: Palletize end (FN250)
 PALLET3_RESET: Palletize reset (FN251)
 PALLET3_OPT: Palletize optimize path(FN375)
 PALLET3_SELGR: Palletize select grasp position(FN376)
 PALLET3_GETREG: Get palletize register(FN377)
 PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

Command name	PALLET3_OPT
FN code	375
Title name	Palletize optimize path
General description	Optimize Step position based on the locus of previous step and following step

■ General description

Palletizing motion often has some useless motion when steps are recorded as avoiding the interference in case of big cargo. This function optimizes and adjusts the next position automatically based on the locus of previous step and following step.



■ Example of operation

Concretely a Z axis value of "Next move position" will be replaced with higher Z axis value of two command positions. Regarding two command positions, one is the previous step of the function, another is the reference move step where is set by parameter of the function.

A Z axis value is calculated by the pallet coordinates used as reference Palletize Pattern.

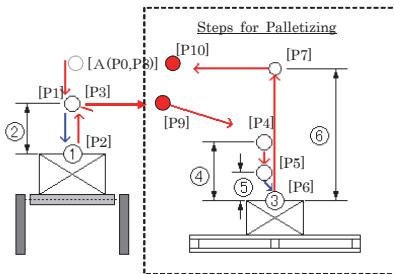
■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Reference step	Reference move step (1 to 9999) Z axis value will be compared.

■ Example of screen display

PALLET3_OPT[1, 20] FN375 Palletize optimize path

■ Example of teaching



Program Name	
1 REM	
2 *TOP	
3 RESET [01]	
4 SET[02]	
5 100% LIN A8 T2	Move to P1
6 WAITI[13]	
7 WAITI[12]	
8 30% LIN A1P T2	Move to P2
9 RESET[02]	
10 SET[01]	
11 WAITI[11]	
12 100% LIN A8 T1	Move to P3 (Compared with ①)
13 PALLET3[1, 0, 10, 020]	Palletizing START
14 PALLET3_APP[1, 1]	Approach function Enabled
15 PALLET3_OPT[1, 17]	Optimized locus (Refer step 17)
16 100% LIN A8 T1	Move to P9
17 100% LIN A8 T1	Move to P4 (Compared with ②)
18 100% LIN A8 T1	Move to P5
19 30% LIN A1P T1	Move to P6
20 RESET[01]	
21 SET[02]	
22 100% LIN A8 T2	Move to P7 (Compared with ①)
23 PALLET3_OPT[1, 26]	Optimized locus (Refer step 26)
24 100% LIN A8 T1	Move to P10
25 PALLETIZE_END[1, 030]	Palletizing END
26 100% LIN A8 T2	Move to P8 (Compared with ②)
27 GOTO *TOP	Go to top of loop
28 END	

See

PALLET3: Palletize start (FN249)
 PALLET3-END: Palletize end (FN250)
 PALLET3_RESET: Palletize reset (FN251)
 PALLET3_APP: Palletize approach selection(FN374)
 PALLET3_SELGR: Palletize select grasp position(FN376)
 PALLET3_GETREG: Get palletize register(FN377)
 PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

Command name	PALLET3_SELGR
FN code	376
Title name	Palletize select grasp position
General description	Select Work grasp position from registered by Palletize pattern.

■ General description

This function selects one Work grasp position from "Work grasp position" which is set by Palletize pattern which has maximum 4 positions.

Suppose that robot grasps some cargo at once. Robot moves toward to cargo position set by Palletize pattern, but robot cannot put a cargo correctly if every cargo has different grasp position.

If you select the grasp position for every cargo correctly, robot target position would be the center of cargo.

If you want to change a work grasp position for cargo (work) number, please use FN377 PALLET_GETREG. This function can get a current work number and store V% variable etc. Then please record SWICH command and FN376 PALLET3_SELGR to move correctly.

■ Default

If this function never runs before, automatically work grasp position is set to one. After changing work grasp position, the position would be kept until the palletize END.

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Work grasp position	Work grasp position (1 to 4) which is set by Palletize pattern.

■ Example of screen display

PALLET3_SELGR[1, 1] FN376 Palletize select grasp position

See

PALLET3: Palletize start (FN249)

PALLET3-END: Palletize end (FN250)

PALLET3_RESET: Palletize reset (FN251)

PALLET3_AP: Palletize approach selection(FN374)

PALLET3_OPT: Palletize optimize path(FN375)

PALLET3_GETREG: Get palletize register(FN377)

PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

Command name	PALLET3_GETREG
FN code	377
Title name	Get palletize register
General description	Store some palletize register to some variables.

■ General description

Palletize register means internal variables that shows some status of palletize.

You don't have to use the function normally because it is for system software. If you want to check some status and use them for changing sequence of robot program, the function offers some useful status to you.

(Example)

Change locus depended on the palletize counter.

Skip palletize counter with intension.

Modify shift values.

This function stores some palletize registers to some variables. If you want to change back some palletize registers from some variables, you use FN378 PALLET3_SETREG.

■ Palletize Registers

No.	Register name	Description	Type	Range
1	Palletize No.	Target palletize No.	Int.	1~100
2	Pallet No.	Target pallet No.	Int.	1~100
3	Running status	Stop or Running	Int.	0/1
4	Type	Palletizing or De-palletizing	Int.	0/1
5	Layer counter	Layer No. in running	Int.	0~50
6	Work counter	Work No. in running	Int.	0~99
7	Total counter	Total work counter in running ()	Int.	0~4950
8	Grasp position sel.	Work grasp position No. in use	Int.	1~4
9	Approach dir.	Approach direction in use	Int.	0~8
10	Layer count signal	LSB Signal No. of Layer count signal	Int.	0~1024
11	Work count signal	LSB Signal No. of work count signal	Int.	0~1024
12	Work complete signal	Work complete signal No.	Int.	0~1024
13	Shift value X	Current shift value of X axis based on the pallet coordinate	Real	—
14	Shift value Y	Current shift value of Y axis based on the pallet coordinate	Real	—
15	Shift value Z	Current shift value of Z axis based on the pallet coordinate	Real	—
16	Shift value Rz	Current shift value of Rz axis based on the pallet coordinate	Real	—

■ Parameter

Parameter No.1	Variable No.	Target variable No. to store value Select from V1, V%, L1 or L%
Parameter No.2	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.3	Register type (Start)	Set number of Palletize Registers(1 - 255)
Parameter No.4	Register type (End)	Set number of Palletize Registers(1 - 255) You can select and get consecutive register values from Start to End

■ Example of screen display

PALLET3_GETREG[V1%, 1, 1, 2] FN377 Get palletize register

See

PALLET3: Palletize start (FN249)
PALLET3_END: Palletize end (FN250)
PALLET3_RESET: Palletize reset (FN251)
PALLET3_APR: Palletize approach selection(FN374)
PALLET3_OPT: Palletize optimize path(FN375)
PALLET3_SELGR: Palletize select grasp position(FN376)
PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

Command name	PALLET3_SETREG
FN code	378
Title name	Set palletize register
General description	Set some variables to some palletize registers.

■ General description

Palletize register means internal variables which shows some status of palletize.

You don't have to use the function normally because it is for system software. If you want to check some status and use them for changing sequence of robot program, the function offers some useful status to you.

(Example)

Change locus depended on the palletize counter.

Skip palletize counter with intension.

Modify shift values.

This function sets some variables to some palletize registers. If you want to change back some variables from some palletize registers, you use FN377 PALLET3_GETREG.

Some registers cannot written. Please refer to table below "Palletize Registers" which register is writable. When the register that cannot be written is specified, it is not changed though alarm doesn't occur.

■ Cautions

Changing registers effect the motion of robot. Do not replace the registers if you don't use them.

■ Palletize Registers

No.	Register name	Description	Type	Range	Write
1	Palletize No.	Target palletize No.	Int.	1~100	
2	Pallet No.	Target pallet No.	Int.	1~100	
3	Running status	Stop or Running	Int.	0/1	
4	Type	Palletizing or De-palletizing	Int.	0/1	<input checked="" type="radio"/>
5	Layer counter	Layer No. in running	Int.	0~50	<input checked="" type="radio"/>
6	Work counter	Work No. in running	Int.	0~99	<input checked="" type="radio"/>
7	Total counter	Total work counter in running	Int.	0~4950	
8	Grasp position sel.	Work grasp position No. in use	Int.	1~4	<input checked="" type="radio"/>
9	Approach dir.	Approach direction in use	Int.	0~8	<input checked="" type="radio"/>
10	Layer count signal	LSB Signal No. of Layer count signal	Int.	0~1024	<input checked="" type="radio"/>
11	Work count signal	LSB Signal No. of work count signal	Int.	0~1024	<input checked="" type="radio"/>
12	Work complete signal	Work complete signal No.	Int.	0~1024	<input checked="" type="radio"/>
13	Shift value X	Current shift value of X axis based on the pallet coordinate	Real	—	<input checked="" type="radio"/>
14	Shift value Y	Current shift value of Y axis based on the pallet coordinate	Real	—	<input checked="" type="radio"/>
15	Shift value Z	Current shift value of Z axis based on the pallet coordinate	Real	—	<input checked="" type="radio"/>
16	Shift value Rz	Current shift value of Rz axis based on the pallet coordinate	Real	—	<input checked="" type="radio"/>

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
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Parameter No.2	Register type (Start)	Set number of Palletize Registers(1 - 255)
Parameter No.3	Register type (End)	Set number of Palletize Registers(1 - 255) You can select and get consecutive register values from Start to End
Parameter No.4	Variable No.	Target variable No. to store value Select from V1, V9%, L1 or L%

■ Example of screen display

PALLET3_SETREG[1, 1, 2, V1%] FN378 Set palletize register

See

PALLET3: Palletize start (FN249)
 PALLET3_END: Palletize end (FN250)
 PALLET3_RESET: Palletize reset (FN251)
 PALLET3_APRI: Palletize approach selection(FN374)
 PALLET3_OPT: Palletize optimize path(FN375)
 PALLET3_SELGR: Palletize select grasp position(FN376)
 PALLET3_GETREG: Get palletize register(FN377)

Function commands (FN codes)

Command name	FORCEZERO
FN code	379
Title name	Force Sensor Zero Adjustment
General description	Set the correction value of the force sensor.

■ General description

Data is obtained from force sensor and compensation value is calculated so as to force/torque becomes 0. By this function, setting values in <Constant Setting> - [34 Force/Torque sensor] – [3 Zero position data] is renewed. If constant file was protected when this function is executed, an alarm is detected.

And if absolute value of obtained data was higher than "Abnormal zero" setting value of <Constant Setting> - [34 Force/Torque sensor] – [5 Abnormal detection], an error is detected and motor power is turned off

■ Example of operation

Please refer to the instruction manual "Force control I/F" for the example of movement.

■ Parameter

Not available.

■ Example of screen display

FORCEZERO	FN379;Force Sensor Zero Adjustment
-----------	------------------------------------

See

FORCECTRL;Force control(FN326)
FORCETOUCH;Touch shift(FN327)
FORCEEND;Force Control/ Touch End(FN328)
GETFORCE2;Get Force/Torque Data(FN329)

Function commands (FN codes)

Command name	PALLET3_SELZ
FN code	388
Title name	Palletize select height (z)
General description	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.

■ General description

Optimize path selection adjusts not only the Z direction (height) shift value but also X and Y direction shift because target step is inside palletize section. This function can be placed the target step at outside of palletize section, and then you can get only Z direction shift.

A target step of Z-axis direction is the next move step of the function.

The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Reference Step	Compared move step. (1 to 9999)

■ Example of screen display

PALLET3_SELZ[1, 12] FN388 Palletize select height(z)

See

PALLET3: Palletize start (FN249)
PALLET3-END: Palletize end (FN250)
PALLET3_RESET: Palletize reset (FN251)
PALLET3_APPR: Palletize approach selection (FN374)
PALLET3_OPT: Palletize optimize path (FN375)
PALLET3_SELGR: Palletize select grasp position (FN376)
PALLET3_GETREG: Get palletize register (FN377)
PALLET3_SETREG: Set palletize register (FN378)

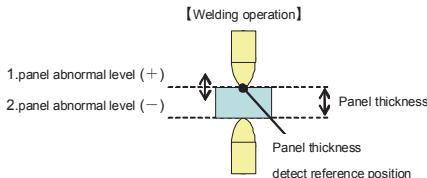
Function commands (FN codes)

Command name	SETTHKERR
FN code	392
Title name	Set panel thickness abnormal level
General description	This command is setup (+) and (-) of panel thickness abnormal level detection is specified directly.

General description

When executing a servo gun welding command and a servo gun grip command, the following items can be specified directly.

1. panel abnormal level (+)
2. panel abnormal level (-)



It is applied to the spot welding command after only one step which recorded this function, and a servo gun grip command (Grip ON).

Welding and grip command to which this function is applied become below.

Function number	Function name	SLIM name
FN119	Spot welding	SPOT
FN199	Spot welding (MEDbus)	SPOTIWB1
FN314	Spot welding (Specified clearance weld function)	SPOTC
FN324	Servo gun grip	SGGRIP

When not using this function, the preset value of the amount of panel abnormal level (+) and panel abnormal level (-) will be set as the common screen of a servo gun usage condition.

The setting level of this function is cleared by executing Step 0, a spot welding command, and a servo gun grip command (Grip ON).

Parameter

Parameter No. 1	Welder No.	This parameter specifies the welder number. Range: 1–6 Initial value: none
Parameter No. 2	panel abnormal level (+)	The panel abnormal level of panel thickness (+) is specified in length. When a preset value is set to 0, the panel abnormal level detection of the direction of plus becomes invalid. Range: 0–99.9 Initial value: The preset value of the amount of Panel abnormal level (+) will be set as the common screen of a servo gun usage condition

Parameter No. 3	panel abnormal level (-)	The panel abnormal level of panel thickness (-) is specified in length. When a preset value is set to 0, the panel abnormal level detection of the direction of minus becomes invalid. Range: 0~99.9 Initial value: The preset value of the amount of Panel abnormal level (-) will be set as the common screen of a servo gun usage condition
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■ Example of screen display

SETTHKERR[1, 0.5, 0.6] FN400: Set panel thick abnormal level

■ Example of record program

```
Program
S01:MOVE
S02:FN392 SETTHKERR[1,0.5,0.6] (1)
S03:MOVE
S04:FN119 SPOT[1,1,1,1] (2)
S05:MOVE
S06:FN119 SPOT[1,1,1,1] (3)
```

- (1) Set the panel abnormal level(+) and (-)
- (2) The amount of panel abnormal level set up by FN392, and check panel thickness.
- (3) The amount of panel abnormal level of a servo gun usage condition, and check panel thickness.

See

SPOT	; Spot welding (FN119)
SPOTIWB1	; Spot welding (FN199 only MEDbus)
SPOTC	; Spot welding (FN314 Specified clearance weld function)
SGGRIPC	; Servo gun grip(FN324)

Function commands (FN codes)

Command name	PALLET3_GETSFT
FN code	393
Title name	Get palletize shift value
General description	Store palletize shift value to some variables.

■ General description

The function can store a palletizing shift value by designated parameter even if the palletizing is running or not.

Use the function with FN377, get palletize shift register.

The parameter of the function can use some variable data by screen edit.

(Example)

Change locus by the palletize shift value.

■ Parameter

Parameter No.1	Variable No.	Target variable No. to store value Select from V!
Parameter No.2	Palletize No.	This specifies the palletizing number to be get. (1 to 100)
Parameter No.3	Palletize type	0:palletize 1:de-palletize
Parameter No.4	Layer count	This specifies the layer count to be executed. (1 to 100)
Parameter No.5	Work count	This specifies the work count to be executed. (1 to 100)

■ Example of screen display

PALLET3_GETSFT[V1%, 1, 0, 1, 2] FN393 Get palletize shift value

See

PALLET3: Palletize start (FN249)

PALLET3_END: Palletize end (FN250)

PALLET3_GETREG: Get palletize shift value(FN377)

Function commands (FN codes)

Command name	PALLET3_SELZJMP
FN code	394
Title name	Palletize select height (z) step jump
General description	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.

■ General description

Height selection adjusts the height of the next step of function. However height select step jump will skip to designated step. Next step of the function is the target of height adjustment.

The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both.

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Reference Step	Compared move step. (1 to 9999)
Parameter No.3	Step No.	This specifies the number of the step serving as the robot's jump destination. (1-999)

■ Example of screen display

PALLET3_SELZJMP[1, 12, 9] FN394 Palletize select height(z) step jump

See

PALLET3: Palletize start (FN249)

PALLET3_END: Palletize end (FN250)

PALLET3_OPT: Palletize optimize path (FN375)

PALLET3_SELZ: Palletize select height(FN388)

Function commands (FN codes)

Command name	PALLET3_SELZSFT
FN code	395
Title name	Palletize select height (z) shift
General description	The function compares the Z-axis value of target step and the Z-axis value of reference step after palletizing shift by using target palletizing number set by the first parameter of the function, and then Z-axis value of target step will be adjust higher value of both. In addition, the shift amount ratio amount specified in the palletizing shift, it will shift operation.

■ General description

Select height (z) function can be placed the target step at outside of palletize section, and then you can get only Z direction shift.

This function can be added the shift amount ratio amount specified in the palletizing shift, it will shift operation.

A target step of Z-axis direction is the next move step of the function.

If specify the shift amount ratio 0 (auto), it calculates the optimal shift amount ratio from operation amounts of the reference step after palletizing shift and the target step after Z direction shift.

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Reference Step	Compared move step. (1 to 9999)
Parameter No.	Shift rate (0:Auto)	The shift amount ratio of palletizing shift. (0: Auto calc. 1-100%)

■ Example of screen display

PALLET3_SELZSFT[1, 12, 0] FN395 Palletize select height(z) shift

See

PALLET3: Palletize start (FN249)

PALLET3_END: Palletize end (FN250)

PALLET3_RESET: Palletize reset (FN251)

PALLET3_SELZ: Palletize select height(FN388)

Function commands (FN codes)

Command name	SETMSECTION
FN code	396
Title name	Sectional signal output
General description	This command is used to set any general-purpose output signal to ON or OFF. In selecting the step between ON to OFF, the signal always turns ON.

■ General description

When this function command is executed, any general-purpose output signal (O1 to O2048) is set to ON or OFF. The difference between SETM, when performing the steps of ON ~ OFF interval SETMSECTION, is to turn ON the specified O signals can also follow what execution path.

- (a) If you jump into the section in step jump.
- (b) If you step set the section using teach pendant.
- (c) If you run by Check-back within the section.

In addition, if the step is to jump from ON ~ OFF section of SETMSECTION outside the section, the signal is turned OFF.

■ Example of operation

```
1 MOVE  
2 SETMSECTION[O1, 1]  
3 MOVE  
4 MOVE  
5 SETMSECTION[O1, 0]  
6 END
```

The signal O1 will change as follows.

Step 1 : OFF
Step 2 ~ 4 : ON
Step 5 ~ 6 : OFF

In any situation, when you select step 2 ~ 4, the signal O1 will be ON.

In any situation, when you select step 1,5 ~ 6, the signal O1 will be OFF.

■ Attention

It will determine the ON or OFF in accordance with the recording order of SETMSECTION.

(1) If you step set by the teach pendant, the signals will be ON / OFF according to the recording order of the program. It is not involved in the actual position of the robot.

(2) Please note that there is a case that does not match the flow of execution.

■ Parameter

Parameter No. 1	Output signal number	This specifies the number of the output signal which is to be turned ON or OFF. (1~2048)
Parameter No. 2	ON/OFF	"1" specified for ON, and "0" for OFF. (0~1)

■ Example of screen display

SETMSECTION[O1, 1] FN396; Sectional signal output

See

SETM: Output signal ON/OFF (FN105)

Application command (FN code)

Command name	JMPPBCD
FN code	400
Title name	Program jump (Selecting ext.BCD prog.)
General description	This command enables to externally jump to the program designated by the BCD code.

■ General description

This command enables to jump to the program externally designated by the BCD code.

However, if the designated input signal has not been entered, it will not jump but only pass. Alternatively, it is also available to wait in the current step until the signal is entered.

For the branch program No., enter it in "Branch Prg.No.(BCD)" in the standard input signal. To use this function command, the signal must be assigned in advance. If not assigned, the program is to be designated to 0 and to jump to the head step of the program No. 0.

Note that, if the function command is stored in the head step of the destination program, the function command in the destination is to be executed in the step where the jump command was executed.

After completing the playback of the destination program, the robot will not return to the original program.

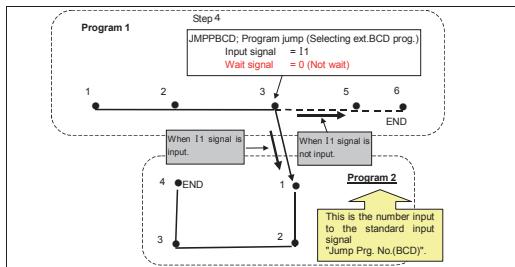


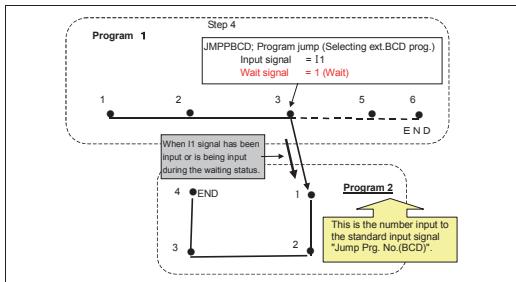
In the multi-unit specifications, the program in the destination is confined to the one within the same unit. (It is not available to jump to the program in the different unit.)

■ Example of operation

● With the wait input signal "OFF"

Store the JMPPBCD command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed to be specified by the external signal (BCD code). By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will proceed to the step 5~6 when not entered.





■ Parameter

1st parameter	Input Sig.	This parameter stores the input signal No. as the jump execution condition. (1 to 2048, 5001 to 5196) Multiple signals can be specified by designating 5001~5196.
2nd parameter	Wait signal	The robot jumps when the designated input signal above has been entered; while it will not jump but only pass when not entered. Alternatively, the robot can even wait in the current step until the signal is entered. 0 : Wait signal "OFF" 1 : Wait signal "ON"

■ Example of screen display

```
JMPPBCD[I1, I1] FN400: Program jump (Selecting ext.BCD prog.)
```

See

CALLPBCD ; Selecting ext.BCD call (FN402)
 JMPPBIN ; Program jump (Selecting ext.BIN prog.) (FN401)
 CALLPBIN ; Program call (Selecting ext.BIN prog.) (FN403)

Application command (FN code)

Command name	JMPPBIN
FN code	401
Title name	Program jump (Selecting ext.BIN prog.)
General description	The robot jumps to the program externally designated by the binary code.

■ General description

This command enables to jump to the program externally designated by the binary code.

However, if the designated input signal has not been entered, it will not jump but only pass. Alternatively, it is also available to wait in the current step until the signal is entered.

For the branch program No., enter it in "Branch Prg.No.(BIN)" in the standard input signal. To use this function command, the signal must be assigned in advance. If not assigned, the program is to be designated to 0 and to jump to the head step of the program No. 0.

Note that, if the function command is stored in the head step of the destination program, the function command in the destination is to be executed in the step where the jump command was executed.

After completing the playback of the destination program, the robot will not return to the original program.



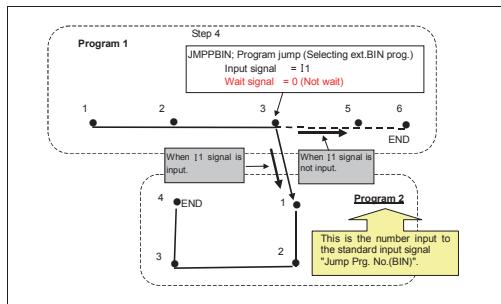
In the multi-unit specifications, the program in the destination is confined to the one within the same unit. (It is not available to jump to the program in the different unit.)

■ Example of operation

● With the wait input signal "OFF"

Store the JMPPBIN command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed be specified by the external signal (Binary code).

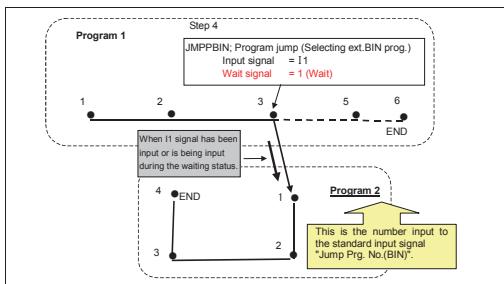
By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will proceed to the step 5-6 when not entered.



● With the wait input signal "ON"

Store the JMPPBIN command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will wait in the step 3 until the signal is entered in the input signal I1 when not entered. If the input signal I1 is entered while waiting, the robot will jump to the head of the program 2.

By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will wait in the step 3 until the signal is entered in the input signal I1 when not entered. If the input signal I1 is entered while waiting, the robot will jump to the head of the program 2.



■ Parameter

1st parameter	Input Sig.	This parameter stores the input signal No. as the jump execution condition. (1 to 2048, 5001 to 5196) Multiple signals can be specified by designating 5001~5196.
2nd parameter	Wait signal	The robot jumps when the designated input signal above has been entered; while it will not jump but only pass when not entered. Alternatively, the robot can even wait in the current step until the signal is entered. 0 : Wait signal "OFF" 1 : Wait signal "ON"

■ Example of screen display

```
JMPPBIN[11, 1] FN401:Program jump (Selecting ext.BIN prog.)
```

See

CALLPBIN ; Program call (Selecting ext.BIN prog.) (FN403)
 JMPPBCD ; Program jump (Selecting ext.BIN prog.) (FN400)
 CALLPBCD ; Program call (Selecting ext.BCD prog.) (FN402)

Application command (FN code)

Command name	CALLPBCD
FN code	402
Title name	Program call (Selecting ext.BCD prog.)
General description	This command enables to call the program externally designated by the BCD code.

■ General description

This command enables to call the program externally designated by the BCD code.

However, if the designated input signal has not been entered, it will not call but only pass. Alternatively, it is also available to wait in the current step until the signal is entered.

For the branch program No., enter it in "Branch Prg.No.(BCD)" in the standard input signal. To use this function command, the signal must be assigned in advance. If not assigned, the program is to be designated to 0 and to jump to the head step of the program No. 0.

Note that, if the function command is stored in the head step of the destination program, the function command in the destination is to be executed in the step where the call command was executed.

After completing the playback of the destination call program, the robot will return to the original program.



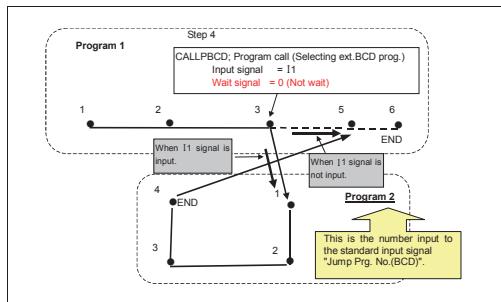
In the multi-unit specifications, the program in the call destination is confined to the one within the same unit. (It is not available to call the program in the different unit.)

■ Example of operation

● With the wait input signal "OFF"

Store the CALLPBCD command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed to be specified by the external signal (BCD code).

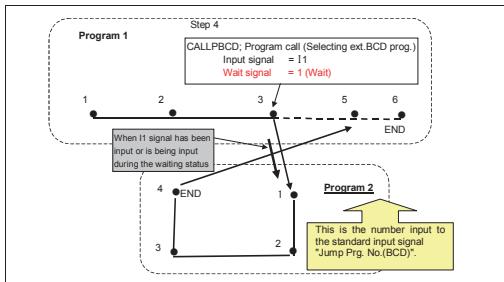
By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will proceed to the step 5~6 when not entered.



● With the wait input signal "ON"

Store the CALLPBCD command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed to be specified by the external signal (BCD code).

By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will wait in the step 3 until the signal is entered in the input signal I1 when not entered. If the input signal I1 is entered while waiting, the robot will jump to the head of the program 2.



■ Parameter

1st parameter	Input Sig.	This parameter stores the input signal No. as the call execution condition. (1 to 2048, 5001 to 5196) Multiple signals can be specified by designating 5001~5196.
2nd parameter	Wait signal	The robot calls when the designated input signal above has been entered; while it will not call but only pass when not entered. Alternatively, the robot can even wait in the current step until the signal is entered. 0 : Wait signal "OFF" 1 : Wait signal "ON"

■ Example of screen display

```
CALLPBCD[11, 1] FN402:Programcall (Selecting ext.BCD prog.)
```

See
JMPPBCD
JMPPBIN
CALLPBIN

; Program jump (Selecting ext.BCD prog.) (FN400)
; Program jump (Selecting ext.BIN prog.) (FN401)
; Program call (Selecting ext.BIN prog.) (FN403)

Application command (FN code)

Command name	CALLPBIN
FN code	403
Title name	Program call (Selecting ext.BIN prog.)
General description	The robot calls the program externally designated by the binary code.

■ General description

This command enables to call the program externally designated by the binary code.

However, if the designated input signal has not been entered, it will not call but only pass. Alternatively, it is also available to wait in the current step until the signal is entered.

For the branch program No., enter it in "Branch Prg.No.(BIN)" in the standard input signal. To use this function command, the signal must be assigned in advance. If not assigned, the program is to be designated to 0 and to jump to the head step of the program No. 0.

Note that, if the function command is stored in the head step of the destination program, the function command in the destination is to be executed in the step where the call command was executed.

After completing the playback of the call destination program, the robot will return to the original program.



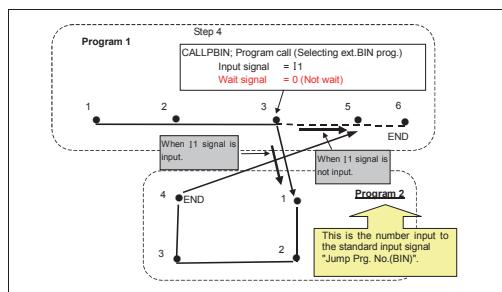
In the multi-unit specifications, the program in the call destination is confined to the one within the same unit. (It is not available to call the program in the different unit.)

■ Example of operation

● With the wait input signal "OFF"

Store the CALLPBIN command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed to be specified by the external signal (Binary code).

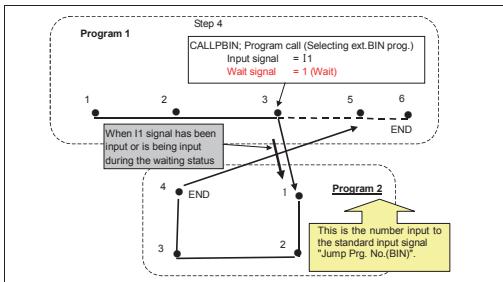
By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will proceed to the step 5~6 when not entered.



● With the wait input signal "ON"

Store the CALLPBIN command, the input signal=1 and the wait signal=0 in the step 4. (0: Input wait "OFF"/ 1: Input wait "ON") And during playback, the program 2 is supposed to be specified by the external signal (Binary code).

By performing playback, the robot will jump to the head step of the program 2 when the input signal I1 has been entered; while it will wait in the step 3 until the signal is entered in the input signal I1 when not entered. If the input signal I1 is entered while waiting, the robot will jump to the head of the program 2.



■ Parameter

1st parameter	Input Sig.	This parameter stores the input signal No. as the call execution condition. (1 to 2048, 5001 to 5196) Multiple signals can be specified by designating 5001~5196.
2nd parameter	Wait signal	The robot calls when the designated input signal above has been entered; while it will not call but only pass when not entered. Alternatively, the robot can even wait in the current step until the signal is entered. 0 : Wait signal "OFF" 1 : Wait signal "ON"

■ Example of screen display

CALLPBIN[I1, 1] FN403:Program call (Selecting ext.BIN prog.)

See

JMPPBIN ; Program jump (Selecting ext.BIN prog.) (FN401)
 JMPPBCD ; Program jump (Selecting ext.BIN prog.) (FN400)
 CALLPBCD ; Program call (Selecting ext.BCD prog.) (FN402)

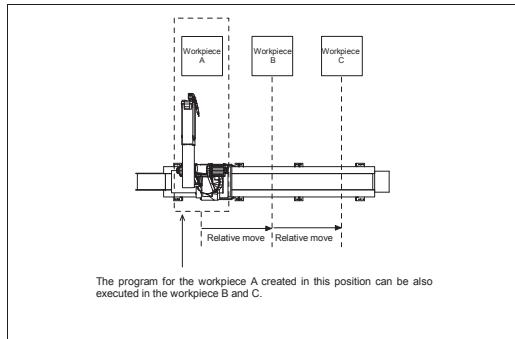
Function Commands (FN Codes)

Command name	RELMOV
FN code	407
Title name	Move of External axis
General description	The designated external axis moves the specified distance from the current position.

■ General description

This command enables an external axis such as a slider, a positioner etc. (auxiliary axis) to move the specified distance or angle from the current position.

This is to be used for repeatedly using the program, created when the external axis was in a particular position, in an arbitrary position on the external axis.



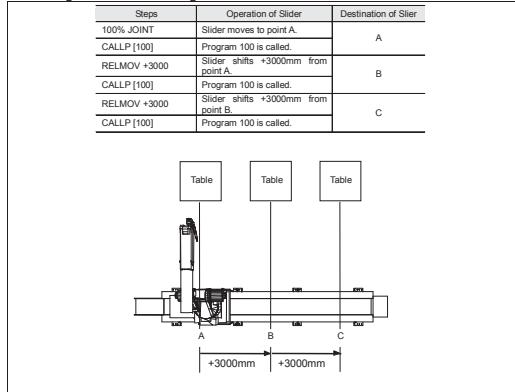
A single RELMOV command can specify a single relative move of the external axis.

The type of interpolation from the current position to the target position is the axis interpolation motion.

■ Example of operation

This function command enables the designated external axis to move the specified distance or angle from the current position.

The simplest way of executing this command is to call the program, created when the external axis was in a particular position, again after executing this RELMOV command.



■ Parameters

Parameter No.1	Mechanism No.	This specifies the mechanism No. defined in the current unit. (1~9)
Parameter No.2	Axis No.	This designates the axis No. for move in the mechanism specified above. For the 1 st axis slider : 1 For the 2 nd axis positioner : 2
Parameter No.3	Rate of Move Speed	This specifies the move speed. (1~100%)
Parameter No.4	Distance/ Angle of Movement	For slider, this specifies the move distance from the current position. (-9999~9999mm) For positioner, this specifies the rotation angle from the current position. (-999.9~999.9deg)

■ Example of screen display

RELMOV[4, 1, 100, 3000] FN407: Move of External axis

Function Commands (FN Codes)

Command name	ICH
FN code	410
Title name	Inching
General description	Performs inch the wire with specified time and wire speed.

■ General description

The robot performs to inch the wire with specified time and wire speed.
Specified time and speed determines the inching value.

The robot does not stop operating while the inching or retract command is executed.
Furthermore, if the arc start command is placed immediately after an inching or retract command in the teaching, welding will be started as soon as the inching or retract operation is completed.



The inching or retract command is not executed in the following situations.

- When welding ON/OFF has been set to OFF
- During a welding section (If TIG filler wire is used by the APDA-301, the retract command can be executed. In the case of other power supplies, neither inching commands nor retract commands can be executed in the welding section.)
- If operation has been temporarily stopped and restarted during inching or retraction

■ Parameters

Conditions	Range	Unit
Time	0.0 ~ 9.9	sec
Wire speed	1 ~ 9999	cm/min

■ Example of screen display

ICH[W1, 2.0s, 6%] FN410:Inching

[] shows the welder number, time, and wire speed from the left.

See

RTC ; Retract (FN411)

Function Commands (FN Codes)

Command name	RTC
FN code	411
Title name	Retract
General description	Performs to retract the wire with specified time and wire speed.

■ General description

The robot performs to retract the wire with specified time and wire speed. Specified time and speed determines the retract value.

The robot does not stop operating while the inching or retract command is executed. Furthermore, if the arc start command is placed immediately after an inching or retract command in the teaching, welding will be started as soon as the inching or retract operation is completed.



The inching or retract command is not executed in the following situations.

- When welding ON/OFF has been set to OFF
- During a welding section (If TIG filler wire is used by the APDA-301, the retract command can be executed. In the case of other power supplies, neither inching commands nor retract commands can be executed in the welding section.)
- If operation has been temporarily stopped and restarted during inching or retraction

■ Parameters

Conditions	Range	Unit
Time	0.0 ~ 9.9	sec
Wire speed	1 ~ 9999	cm/min

■ Example of screen display

RTC [W1, 2.0s. 6%] FN411:Retract

[] shows the welder number, time, and wire speed from the left.

See

ICH ;Inching (FN410)

Function Commands (FN Codes)

Command name	GS
FN code	412
Title name	Gas ON
General description	Starts to output the shield gas.

■ General description

The robot starts to output the shield gas.

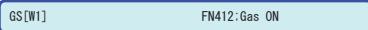
Prior to starting welding, the robot normally performs pre-flow for the duration which was set in the welding constants ("pre-flow time"). However, pre-flow can be started from any position by teaching the following commands.

The robot performs pre-flow from the position of the operation command that was taught immediately before the gas ON command (GS). When automatic operation is temporarily stopped during pre-flow initiated by the gas ON command (GS), pre-flow is suspended but it is then resumed after operation has been restarted.

■ Parameters

Parameter No.1	Welder No.	This specifies the welder number (1 to 12) to be controlled to output the shield gas.
-------------------	------------	---------------------------------------------------------------------------------------

■ Example of screen display



See

GE; Gas OFF(FN413)

Function Commands (FN Codes)

Command name	GE
FN code	413
Title name	Gas OFF
General description	Stops the shield gas.

■ General description

The robot stops the shield gas performed to start with Gas ON command (GS).

■ Parameters

Parameter No.1	Welder No.	This specifies the welder number (1 to 12) to be controlled to stop the shield gas.
----------------	------------	-------------------------------------------------------------------------------------

■ Example of screen display

GE[W1] FN413:Gas OFF

See

GS; [GasON\(FN412\)](#)

Application command (FN code)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS (FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameter

● Arc start control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected to a single controller, select a target welder to start welding. "0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter] → F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Condition file ID	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number.
Retry no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Restart no.	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Welding process	Refer the following table.
Welding conditions	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Move cond. no.	

● Welding conditions

The types of welder are as follows and the conditions to be set vary depending on the type. (Set the type of the welder to be used in the Welding characteristics data in advance).

- Individual adjustment welder... It controls current and voltage separately.

Conditions	Setting range	Unit
Welding current	1 to rated	A
Welding voltage	0.1 to rated	V
Welding speed	1 to 999	cm/min

- Unified adjustment welder...It automatically outputs the appropriate voltage as per the current.

Conditions	Setting range	Unit
Welding current	1 to rated	A
Voltage fine adjustment	-100 to +100	%
Welding speed	1 to 999	cm/min

- TIG welder ... It is a welder used for TIG welding.

Conditions	Setting range	Unit
Welding current	1 to rated	A
Filler feed speed	1 to rated feed speed	cm/min
Welding speed	1 to 999	cm/min



Checkpoints for setting the conditions

Concerning the setting range of the welding speed

The welding speed can be set between the range of 1 to 999cm/sec. though the welding done within this range is not guaranteed. The quality of welding worsens as beads get smaller if the speed is too high. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Voltage fine adjustment

When using in unified adjustment welder, the optimum voltage for the set value of current is adjusted automatically. At this time, there might be some instances where voltage could not be adjusted, depending on the operating environment, therefore, the voltage automatically output by welder can be increased or decreased as "Voltage fine adjustment" on robot.

For example, if set "+10%", it is higher than the voltage to be output. On a contrary, if set "-10%", it is lower. Set the appropriate condition by setting "Voltage fine adjustment".

Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

■ Example of screen display

AS[W1.OFF.0.150A 21.0V. 80cm/m. →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

● Parameters other than welding conditions

Conditions	Range
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AS Cond. file	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Retry cond. no.	Arc retry function is currently under development. Enter "0" and then, the standard Arc retry function will be performed.

● Welding conditions

Conditions	Range	Unit
Current condition	Wire Speed/ Current	-
Welding current (When the Current condition is "Current".)	1 ~ rated.	A
Wire speed (When the Current condition is "Wire Speed".)	1 ~ 9999	cm/min.
Welding voltage (When Individual adjusting)	0.1 ~ rated.	V
Arc length tuning (When Unified adjusting)	-100 ~ +100	
Welding speed	1 ~ 999	cm/min.
Arc characteristic	-100 ~ +100	%
Slow down speed	1 ~ 9999	cm/min.
Start current	1 ~ 600	A
Hot start time	10 ~ 990	msec
Hot start voltage	0.0 ~ 9.9	V

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.

Checkpoints for setting the conditions

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Arc length tuning

When the CPDRA-351/501 is used as a unified adjustment power supply, the optimal voltage for the current setting is output automatically. The "voltage adjustment value" is the value for increasing or reducing the voltage which is output automatically. Setting a "+" value yields a voltage which is on the high side; conversely, setting a "-" value yields a voltage which is on the low side.

Arc characteristic

The arc characteristics value is expressed in the form of a numerical value which enables the arc hardness or softness to be set. When this value is increased gradually in the "+" direction, a concentrated hard arc is obtained; conversely, when it is reduced gradually in the "-" direction, an expansive soft arc is obtained.

A "+" value tends to minimize the arc heat and is thus ideal for upward or sideways welding.

A "--" value tends to minimize spatter.

Bear in mind that setting an excessively high value will cause the welding to become unstable.

Slow down speed/ Start current/ Hot start time/ Hot start voltage

These conditions are supposed to be automatically set to their optimum values based on the input welding current (or wire feed rate). Do not change these default values except inevitability. When obliged to change it by necessity, perform the fine adjustment carefully based on the optimum value. Major change may cause the welding failure, abnormality and the poor quality.

Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constants setting] – [Welding constants] – [Pre-flow time].

■ Example of screen display

AS [W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" on the page 2 and after.

● Arc start control conditions

Conditions	Explanation
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	When designating the welding condition directly by figures : "0" When designating the welding condition by files : File No. (1~999) Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Retry cond. no.	Arc retry function is currently under development. Enter "0" and then, the standard Arc retry function will be performed.
Welding process	This specifies the welding process. The items displayed here are the ones registered as the welding characteristics data.
Current cond.	This gives the alternative of "current" or "wire feed rate" for the welding condition.
Slope cond.	This gives the alternative for the slope control at Arc start of "time designation" (performing at stop) or "distance designation" (performing with move).
Welding control	Normally, this is fixed at "Standard". And, even if the optional software "Synchro MIG" is set, both "Synchro" and "FC" can be selected. To perform the Synchro MIG welding, select "Synchro" and to perform the FC-MIG welding, select "FC2".

● Arc start conditions

Conditions	Range	Unit	DC Pulse	DC Wave Pulse	AC Pulse	AC Wave Pulse
Welding current (When "Current cond." is "Current")	1~200	A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wire speed (When "Current cond." is "Wire speed".)	1 ~ 9999	cm/min	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc length tuning	-100~100	-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Welding speed	1~999	cm/min	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc characteristic	-10~10	-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Wave frequency	0.5~32.0	Hz	—	○	—	○
Penetration adjust.	-150~150	-	—	—	○	○
Slow down speed	1~9999	cm/min	○	○	○	○
Start current	1~600	A	○	○	○	○
Slope time (When "Slope cond." is "Time")	0.0~9.9	sec.				
Slope distance (When "Slope cond." is "Distance")	0~99	mm	○	○	○	○
Initial current (When "Current cond." is "Current")	1~rated	A				
Initial wire speed (When "Current cond." is "Wire speed")	1~9999	cm/min	○	○	○	○
Initial arc length tuning	-100~100	-	○	○	○	○
Base current	20~200	A	○	○	○	○
Standup time	0.4~3.0	m sec	○	○	○	○
Falling time	0.4~3.0	m sec	○	○	○	○
Peak current	20~600	A	○	○	○	○
Peak time	0.4~3.0	m sec	○	○	○	○
EN current	20~300	A	—	—	○	○
EN time	0.0~30.0	m sec	—	—	○	○

○ : Item to be set — : Item not to be set



Checkpoints for setting the conditions

Concerning the welding current and wire speed

The average current (or average feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is initially input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed) which has been input.

Arc length tuning

Since the CPDACA-201 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5V.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

EN current and EN time

The EN current and EN time are parameters for controlling the heat input to the workpiece during AC pulsed welding. "EN" stands for "electrode negative." Outputting EN during AC pulsed welding makes the penetration in the base metal shallower and increases the amount of the wire melted. However, when adjusting the penetration in the base metal, do not change the EN current or EN time but change the penetration adjustment conditions.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "Arc characteristics," "Wave frequency" and "Penetration adjustment".

Pulse conditions "Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to Expert or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc Constant] – [Constant of weld] – [Pulse condition], and set "Recommendation" ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

Arc characteristic

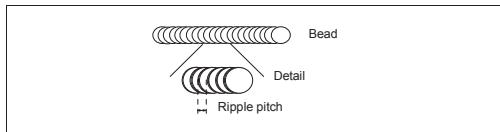
The pulsed arc characteristics are a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

Penetration adjust.

The penetration adjustment is a parameter for adjusting the EN time. Increasing its numerical value makes for a shallower penetration; conversely, reducing it makes for a deeper penetration.

Wave frequency

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency. Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

Slope control

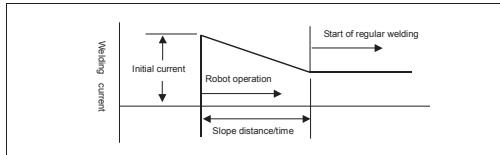
Slope control involves changing the conditions (welding current, welding voltage) in the form of a slope (that is to say, gradually) rather than switching the welding conditions straight away to the specified values. It enables the sputter amount, weld defects, etc. that occur especially when the conditions are switched to be reduced. It can be used when starting the welding, changing the conditions or ending the welding.

Slope control when welding is started

The figure below shows the slope control that is initiated from the initial welding condition settings to the regular welding conditions.

It shows what happens with the welding current although it is the same for the welding voltage.

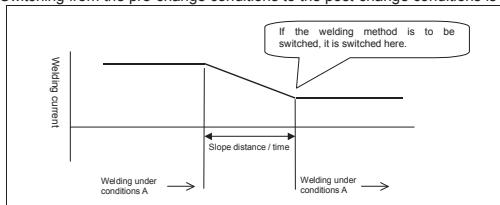
The control can be specified as a distance or time for the slope section.



Slope control when conditions are changed

When conditions are changed, slope control is conducted from the pre-change conditions to the post-change conditions.

The initial current and initial voltage set as the slope conditions are not used when the conditions are changed. (Switching from the pre-change conditions to the post-change conditions is accomplished gradually.)



■ Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and

welding conditions (Current/Voltage/Speed) from the left.

See
AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Explanation
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	When designating the welding condition directly by figures : "0" When designating the welding condition by files : File No. (1~999) Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Retry cond. no.	Arc retry function is currently under development. Enter "0" and then, the standard Arc retry function will be performed.
Welding process	This specifies the welding process. The items displayed here are the ones registered as the welding characteristics data.
Current cond.	This gives the alternative of "current" or "wire feed rate" for the welding condition.
Slope cond.	This gives the alternative for the slope control at Arc start of "time designation" (performing at stop) or "distance designation" (performing with move).
Welding control	Normally, this is fixed at "Standard". And, even if the optional software "Synchro MIG" is set, both "Synchro" and "FC" can be selected. To perform the Synchro MIG welding, select "Synchro" and to perform the FC-MIG welding, select "FC2".

● Arc start conditions

Conditions	Range	Unit	DF	DC Pulse	DC Wave Pulse
Welding current (When "Current cond." is "Current.")	1 ~ rated	A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wire speed (When "Current cond." is "Wire speed".)	1 ~ 9999	cm/min	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Welding voltage (When individual adjustment)	0.1 ~ rated	V	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Arc length tuning (When unified adjustment)	-100 ~ 100	-			
Welding speed	1 ~ 999	cm/min	○	○	○
Arc characteristic	-10 ~ 10	—	—	○	○
Wave frequency	0.5 ~ 32.0	Hz	—	—	○
Slow down speed	1 ~ 9999	cm/min	○	○	○
Start current	1 ~ 600	A	—	○	○
Slope time (When "Slope cond." is "Time".)	0.0~9.9	sec.			
Slope distance (When "Slope cond." is "Distance".)	0~99	mm	○	○	○
Initial current (When "Current cond." is "Current".)	1~rated	A			
Initial wire speed (When "Current cond." is "Wire speed".)	1~9999	cm/min	○	○	○
Initial welding voltage (When individual adjustment)	-100~100	-			
Initial arc length tuning(When unified adjustment)	0.1 ~ rated	V	○	○	○
Base current	20 ~ 200	A	—	○	○
Standup time	0.1 ~ 3.0	m min	—	○	○
Falling time	0.1 ~ 3.0	m min	—	○	○
Peak current	20 ~ 600	A	—	○	○
Peak time	0.1 ~ 3.0	m min	—	○	○

○ : Item to be set — : Item not to be set



Checkpoints for setting the conditions

Concerning the welding current and wire speed

The average current (or average feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is initially input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed) which has been input.

Arc length tuning

Since the CPDPAS-501 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5V.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "Arc characteristics" and "Wave frequency".

Pulse conditions "Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to Expert or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc Constant] – [Constant of weld] – [Pulse condition], and set "Recommendation" ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

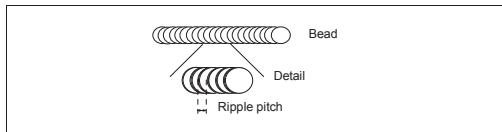
If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

Arc characteristic

The pulsed arc characteristics are a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

Wave frequency

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency. Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

Slope control

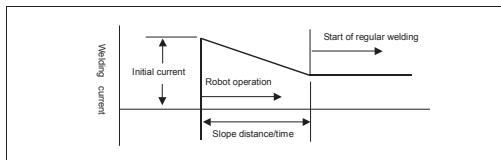
Slope control involves changing the conditions (welding current, welding voltage) in the form of a slope (that is to say, gradually) rather than switching the welding conditions straight away to the specified values. It enables the sputter amount, weld defects, etc. that occur especially when the conditions are switched to be reduced. It can be used when starting the welding, changing the conditions or ending the welding.

Slope control when welding is started

The figure below shows the slope control that is initiated from the initial welding condition settings to the regular welding conditions.

It shows what happens with the welding current although it is the same for the welding voltage.

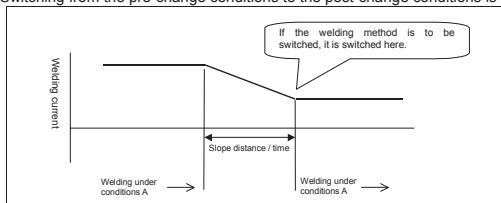
The control can be specified as a distance or time for the slope section.



Slope control when conditions are changed

When conditions are changed, slope control is conducted from the pre-change conditions to the post-change conditions.

The initial current and initial voltage set as the slope conditions are not used when the conditions are changed. (Switching from the pre-change conditions to the post-change conditions is accomplished gradually.)



■ Sample of screen display

AS[#, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Explanation																	
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.																	
AS Cond. file	<p>"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file.</p> <p>Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called.</p> <p>Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.</p>																	
Retry cond. no.	Arc retry function is currently under development. Enter "0" and then, the standard Arc retry function will be performed.																	
Output current	<table border="1"><tr><td>DC</td><td>This is for welding using DC waveforms.</td></tr><tr><td>AC</td><td>This is for welding using AC waveforms.</td></tr><tr><td>DC pulse (*1)</td><td>This is for welding using DC pulsed waveforms.</td></tr><tr><td>AC pulse (*1)</td><td>This is for welding using AC pulsed waveforms.</td></tr><tr><td>AC-DC (*1)</td><td>This is for hybrid welding (a method that switches between AC and DC in the specified cycle).</td></tr><tr><td>DC synchro (*2)</td><td>This is for welding while synchronizing the peak current (DC) with the end point of weaving.</td></tr><tr><td>AC synchro (*2)</td><td>This is for welding while synchronizing the peak current (AC) with the end point of weaving.</td></tr><tr><td>AC-DC synchro (*2)</td><td>This is for TIG welding while synchronizing the AC output or DC output timing with the end point of weaving.</td></tr></table>		DC	This is for welding using DC waveforms.	AC	This is for welding using AC waveforms.	DC pulse (*1)	This is for welding using DC pulsed waveforms.	AC pulse (*1)	This is for welding using AC pulsed waveforms.	AC-DC (*1)	This is for hybrid welding (a method that switches between AC and DC in the specified cycle).	DC synchro (*2)	This is for welding while synchronizing the peak current (DC) with the end point of weaving.	AC synchro (*2)	This is for welding while synchronizing the peak current (AC) with the end point of weaving.	AC-DC synchro (*2)	This is for TIG welding while synchronizing the AC output or DC output timing with the end point of weaving.
DC	This is for welding using DC waveforms.																	
AC	This is for welding using AC waveforms.																	
DC pulse (*1)	This is for welding using DC pulsed waveforms.																	
AC pulse (*1)	This is for welding using AC pulsed waveforms.																	
AC-DC (*1)	This is for hybrid welding (a method that switches between AC and DC in the specified cycle).																	
DC synchro (*2)	This is for welding while synchronizing the peak current (DC) with the end point of weaving.																	
AC synchro (*2)	This is for welding while synchronizing the peak current (AC) with the end point of weaving.																	
AC-DC synchro (*2)	This is for TIG welding while synchronizing the AC output or DC output timing with the end point of weaving.																	
Wire control	<table border="1"><tr><td>OFF</td><td>The filler is not fed. This is selected for TIG fusion welding.</td></tr><tr><td>ON</td><td>This is for feeding the filler at a constant speed.</td></tr><tr><td>Pulse (*3)</td><td>This is for feeding the filler at a pulse rate.</td></tr></table>		OFF	The filler is not fed. This is selected for TIG fusion welding.	ON	This is for feeding the filler at a constant speed.	Pulse (*3)	This is for feeding the filler at a pulse rate.										
OFF	The filler is not fed. This is selected for TIG fusion welding.																	
ON	This is for feeding the filler at a constant speed.																	
Pulse (*3)	This is for feeding the filler at a pulse rate.																	
Starting current	Auto	Specifying the starting current by "strong" or "weak".																

	Manual	Specifying the starting current by figures.
Preheating	ON	Preheating control is performed.
	OFF	Preheating control is not performed.
Slope control	ON	Up-slope control is performed.
	OFF	Up-slope control is not performed.
AC wave	Standard	This enables welding across a wide range from thin sheets to thick sheets.
	Hard	<ul style="list-style-type: none"> This enables concentrated arcs as with DC to be produced. It is useful for thin-sheet fillet welding, etc.
	Soft	<ul style="list-style-type: none"> This enables soft arcs to be produced. It is useful for thin-sheet butt welding, etc.

(*1) These modes require the optional "TIG pulsed welding" software.

(*2) The optional board "RS-422", the connection cable and other items are required.

(*3) An AC servo feeder (L7142 for steel, L7143 for aluminum) is required to feed the pulses. This cannot be selected when AC or DC is selected as the current output.

●Welding start conditions

Classification	Condition	Range	Unit
Welding condition	Welding current	1 ~ 300	A
	Base current	4 ~ 300	A
	Peak current	4 ~ 300	A
	Wire speed	0 ~ rated	cm/min
	Base wire speed	0 ~ rated	cm/min
	Peak wire speed	0 ~ rated	cm/min
	AC wire speed	0 ~ rated	cm/min
	DC wire speed	0 ~ rated	cm/min
	Welding speed	1 ~ 999	cm/min
	AC frequency	50 ~ 200	Hz
Start current	Cleaning width	-10 ~ +10	-
	Pulse control	0.5 ~ 500.0	Hz
	Pulse ratio	1 ~ 99	%
	AC-DC switching	0.5 ~ 30.0	Hz
	AC-DC ratio	1 ~ 99	%
Weaving	Weaving signal	1pulse / 2pulses	-
	Weaving edge	AC/DC	-
	Phase adjust.	0.00 ~ 9.99	sec
Filler timing adjustment	Starting current	Auto setting Manual setting	Weak/Strong A
	Starting current time	Auto setting Manual setting	Set automatically 1 ~ 20
			m min
Pre-heating	Wire timing (Standup)	0.00 ~ 0.99	sec
	Wire timing (Falling)	0.00 ~ 0.99	sec
	Preheating time	0.0 ~ 30.0	m min
Up slope	Preheating current	4 ~ 300	A
	Preheating speed	0 ~ rated	cm/min
	Slope time or Slope distance	0.0 ~ 9.9	sec mm
	Robot stop time	0.0 ~ 9.9	sec
	Wire delay time	0.0 ~ 9.9	sec



Checkpoints for setting the conditions

Preheating

This is a process for stabilizing arc start. A constant preheating current is output while the robot is stopped. (The start current is output for an instant at the very start of this process.) The preheating current does not become a pulsive current even if DC pulsed or AC pulsed is selected as the welding mode.

Start current

This process outputs a constant high current at the beginning in order for preheating to be conducted smoothly. Specify "Strong" or "Weak" at the teaching stage. At the "Strong" setting, the start current is 200 A. (If the current for regular welding is higher than 200 A, this higher value is used.)

Specify "Weak" for thin sheet welding. At the "High" setting, burn-through may occur.

Up-slope

This process is for stabilizing the arc start, and it keeps raising the output current step by step. It performs the 2-step processing described below.

- ① Upon completion of preheating, up-slope is started at the arc start point with the torch stopped.
- ② Next, up-slope is conducted while the torch is being moved.

Wire delay time

This is the time by which the wire feed start timing is delayed from the up-slope start.

The delay time is set using a time shorter than the up-slope time. If the delay time is longer than the up-slope time, wire feed will not start even when up-slope is completed.

Pulse ratio

The pulse ratio is expressed as a percentage of the peak current duration to one period, and it is defined by the following equation.

Cleaning width

The cleaning width can be set in the case of AC welding. Any value from -10 to +10 can be set. The following symptoms raise when the numerical value of the cleaning width is changed.

Symptom	Setting value	
	-10	+10
Cleaning width	Minus direction	Plus direction
Penetration depth	Becomes narrower	Becomes wider
Electrode wear	Becomes deeper	Becomes shallower
	Decreases	Increases

Wire timing

The current output and filler feed timing can be adjusted. This parameter is set in cases where the response of equipment relating to filler feed is to be compensated or filler is to be inserted for an instant within the peak current period, for example. Set the following conditions for the rise and fall of the output waveforms.

AC-DC frequency/ AC-DC ratio

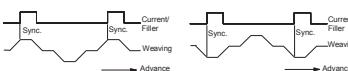
AC/DC hybrid welding involves the output of AC (alternating current) and DC (direct current) alternately. Set the following conditions when AC/DC hybrid has been selected as the welding mode.

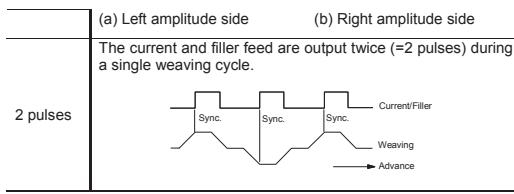
The DC ratio is expressed as a percentage of the AC output duration to one period, and it is defined by the following equation.

When performing Synchro-TIG

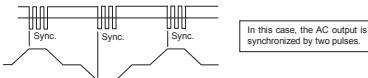
The type of welding in which the weaving period is synchronized with the timing of the current and filler feed output pulses is called synchro TIG welding. The following 3 synchro TIG welding modes are provided.

Either the 1-pulse or 2-pulse method can be selected as the way to synchronize with the weaving.

Synchro-nization method	Details
1 pulse	<p>The current and filler feed are output once (=1 pulse) during a single weaving cycle.</p> <p>The amplitude for peak welding is based on the weaving start phase (oscillation start direction). In other words, when weaving is to start from the left amplitude, the pulses are output at the left amplitude side. Conversely, when weaving is to start from the right amplitude, the pulses are output at the right amplitude side.</p> 



In the case of AC/DC synchro welding, specify whether the above synchronization timing is to be implemented with the AC output or DC output.



■ Example of screen display

AS[W1, OFF, 0, 150A, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Speed) from the left.

See
AE; Arc end (FN415)

Application command (FN code)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameter

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected to a single controller, select a target welder to start welding. "0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file.
Condition file ID	Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No.0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."

Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON".	
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● Welding start conditions

Conditions	Setting range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to 9999	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Welding speed	1 to 999	cm/min
Arc characteristic	-99 to +99	%
Gas Flow Rate	-	L/min.
Slow down speed	100 to 9999	cm/min
Start current	1 to 600	A
Start time	0 to 99	ms
Slope time (when "Time" has been set as the "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 to 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 to rated	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rated	cm/min
Initial voltage (with individual adjustments)	0.1 to rated	V
Ini. arc length (with synergic adjustments)	-100 to +100	-

* Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the setting range of the welding speed

The welding speed can be set between the range of 1 to 999cm/sec. though the welding done within this range is not guaranteed. The quality of welding worsens as beads get smaller if the speed is too high. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Arc length tuning

Since the DM-350/350(S-2)/500 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. When +(plus) value is set, it is higher voltage and when -(minus) value is set, it is lower voltage.

Arc characteristic

The arc characteristics value is expressed in the form of a numerical value which enables the arc hardness or softness to be set. When this value is increased gradually in the "+" direction, a concentrated hard arc is obtained; conversely, when it is reduced gradually in the "-" direction, an expansive soft arc is obtained.

A "+" value tends to minimize the arc heat and is thus ideal for upward or sideways welding.

A "-" value tends to minimize spatter.

Bear in mind that setting an excessively high value will cause the welding to become unstable.

Slow down speed/ Start current

These conditions are supposed to be automatically set to their optimum values based on the input welding current (or wire feed rate). Do not change these default values except inevitability. If changing, adjust the values slightly based on the optimum value. If making a big change, welding cannot be executed and welding error may occur, or welding quality may become worse.

Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

■ Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

[AE; Arc end \(FN415\)](#)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0 : The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999 : The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
Welding control	This is normally fixed at "Standard", but when it is set to the "Synchro MIG" optional software, you will be able to select "Synchro" or "FC". Select "Synchro" to do synchronized MIG welding, and "FC" to do FC-MIG welding.

RS control	This is used to set the operation method for RS control. This condition can be set when the "RS control" optional software is set and the "RS control" welding constant is set to "Enabled".
Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Current cond.	"wire feed speed" or "current"	-
Welding current (When "Current cond." is "Current".)	1 ~ rated	A
Wire speed (When "Current cond." is "Speed".)	1 ~ 9999	cm/min
Welding voltage (When individual adjustment)	0.1 ~ rated	V
Arc length tuning (When unified adjustment)	-100 ~ +100	-
Welding speed	1 ~ 999	cm/min
Arc characteristic	-10 ~ 10	-
Arc character.	-100 ~ 100	-
Wave frequency	0.5 ~ 32.0	Hz
Gas Flow Rate	-	L/min
Slow down speed	1 ~ 9999	cm/min.
Start current	1 ~ 700	A
Hot start time	10 ~ 990	ms
Slope time (when "Time" has been set as the "Slope cond.")	0.0 ~ 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 ~ 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 ~ rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 ~ rating	cm/min.
Initial voltage (with separate adjustments)	0.1 ~ rating	V
Ini. arc length (with synergic adjustments)	-100~100	-
Base current	20 ~ 200	A
Standup time	0.1 ~ 3.0	ms
Falling time	0.1 ~ 3.0	ms

Peak current	20 ~ 600	A
Peak time	0.1 ~ 3.0	ms

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The average current (or average wire feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed).

Concerning the arc characteristic

The arc characteristic is the value that enables to set hard/soft of the arc in the DC welding method. Intensive and hard arcs are generated by increasing this value to the (-) side, while extensive and soft arcs to the (+) side.

Concerning the arc length fine adjustment

The DP-350/400/500 has two modes, synergic adjustments and separate adjustments.

When it is used in the synergic adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

What is the slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "arc characteristic" and "wave frequency".

"Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to **EXPERT** or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc constant] — [Constant of weld] — [Pulse conditions], and set "Recommendation". ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

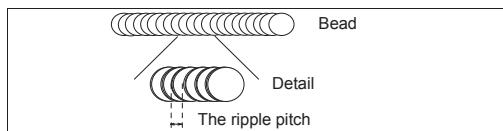
What are the arc characteristic?

The arc characteristic is a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

What is the wave frequency?

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency.

Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] — [Constant of

Weld] – [Pre-flow time].

■ Example of screen display

AS [W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

[AE; Arc end \(FN415\)](#)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0: The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Current output	The kind of the current output corrugate is selected. DC:This is for welding using DC waveforms. AC:This is for welding using AC waveforms. DC pulsed:This is for welding using DC pulsed waveforms. AC pulsed:This is for welding using AC pulsed waveforms. AC-DC:This is for hybrid welding (a method that switches between AC and DC in the specified cycle). Optional software of "TIG pulsed welding" is necessary to use DC Pulsed, AC Pulsed, and AC-DC.
Filler control	Please select the kind of Filler feeder control. None:The filler is not fed. This is selected for TIG fusion welding. Constant speed:This is for feeding the filler at a constant speed. Pulse:This is for feeding the filler at a pulse rate.

AC waveform ※This method is set when AC, AC pulsed or AC/DC has been selected as the "Current output" method.	Standard: This enables welding across a wide range from thin sheets to thick sheets. Hard: <ul style="list-style-type: none">• This enables concentrated arcs as with DC to be produced.• It is useful for thin-sheet fillet welding, etc. Soft: <ul style="list-style-type: none">• This enables soft arcs to be produced.• It is useful for thin-sheet butt welding, etc.
Start current specification	Automatic: Specify the starting current by selecting "Strong" or "Weak". Manual: Select this to specify the starting current numerically.
Preheating control	ON:Preheating control is exercised. OFF:Preheating control is not exercised.
Slope control	ON:Up-slope control is exercised. OFF:Up-slope control is not exercised.
Pulse waveform ※This is set when DC pulse has been selected as the "Current output" method.	Standard: This enables welding across a wide range from thin sheets to thick sheets. Soft: <ul style="list-style-type: none">• This enables soft arcs to be produced.• It is useful for thin-sheet butt welding, etc.
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0".
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range		Unit
Current(Welding current, Base current, Peak current)	4 to rating		A
Filler feed(Filler feed speed, Base filler speed, Peak filler speed, AC filler speed, DC filler speed)	0 to rating		cm/min.
Welding speed	1 to 999		cm/min.
AC frequency	50 to 200		Hz
Gas Flow Rate	-		L/min
Cleaning width	-20 to +20		-
Pulse frequency	0.1 to 500.0		Hz
Pulse width ratio	5 to 95		%
AC/DC switching	0.5 to 30.0		Hz
AC ratio	10 to 90		%
Start current	automatically	High/low	-
	manually	4 to 300	A
Start current time	1 to 20		ms
Filler timing (rise)	-0.99 to 0.99		Sec.
Filler timing (fall)	-0.99 to 0.99		Sec.

Preheating time	0.0 to 30.0		ms
Preheating current	4 to rating		A
Preheat filler wire feed speed	0 to rating		cm/min.
Slope time or slope distance	Time	0.0 to 9.9	Sec.
	Dist.	0 to 99	mm
Robot stop time	0.0 to 9.9		Sec.
Filler feed delay time	0.0 to 9.9		Sec.

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

What is preheating?

This is a process for stabilizing arc start. A constant preheating current is output while the robot is stopped. (The start current is output for an instant at the very start of this process.) The preheating current does not become a pulsive current even if DC pulsed or AC pulsed is selected as the welding mode.

What is the start current?

This process outputs a constant high current at the beginning in order for preheating to be conducted smoothly. Specify "High" or "Low" at the teaching stage. At the "High" setting, the start current is 200 A. (If the current for regular welding is higher than 200 A, this higher value is used.) Specify "Low" for thin sheet welding. At the "High" setting, burn-through may occur.

What is the up-slope?

This process is for stabilizing the arc start, and it keeps raising the output current step by step. It performs the 2-step processing described below.

- (1) Upon completion of preheating, up-slope is started at the arc start point with the torch stopped.
- (2) Next, up-slope is conducted while the torch is being moved.

What is the filler feed delay time?

This is the time by which the wire feed start timing is delayed from the up-slope start.

The delay time is set using a time shorter than the up-slope time. If the delay time is longer than the up-slope time, wire feed will not start even when up-slope is completed.

Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

●Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0:The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999:The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" are constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Welding speed	1 to 999	cm/min
Arc character.	-100 to 100	-
Gas Flow Rate	-	L/min
Slow down speed	1 to 9999	cm/min.
Start current	1 to 700	A
Hot start time	0.1 to 99.0	ms
Start adjust time	-99.0 to 99.0	ms
Slope time (when "Time" has been set as the "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 to 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 to rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.
Initial voltage (with separate adjustments)	0.1 to rating	V
Ini. arc length (with synergic adjustments)	-100to100	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.

Please see each manual in detail.

parameters above may not be displayed



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The average current (or average wire feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed).

Concerning the arc length fine adjustment

The DR-350 has two modes, synergic adjustments and separate adjustments.

When it is used in the synergic adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the arc characteristic

The arc characteristic is the value that enables to set hard/soft of the arc in the DC welding method. Intensive and hard arcs are generated by increasing this value to the (-) side, while extensive and soft arcs to the (+) side.

A “-” value tends to minimize the arc heat and is thus ideal for upward or sideways welding.

A “+” value tends to minimize spatter.

Bear in mind that setting an excessively high value will cause the welding to become unstable.

What is the slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

■ Example of screen display

AS [W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

[AE; Arc end \(FN415\)](#)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0 : The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999 : The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
APCS cond.	This selects the method used to set the APCS (spatter adjustment) parameters. When "AUTO" is specified, the APCS cond. setting parameter is automatically adjusted by the welder. When "TEACH" is specified, the welder exercises spatter suppression control in accordance with the APCS cond. setting parameter among the setting conditions on page 2.

RS control	No setting possible
Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to 9999	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Welding speed	1 to 999	cm/min
Gas Flow Rate	-	L/min
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1	-100 to 100	-
APCS parameter 2	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 to rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.
Initial voltage (with separate adjustments)	0.1 to rating	V
Ini. arc length (with synergic adjustments)	-100 to 100	-
Slowdown speed	1 to 9999	cm/min.
Start current	1 to 600	A
Start adjust time	-50.0 to 999.9	ms
Hot start time	0 to 990	ms
EP start time	100 to 999	ms
EP robot stop time	0 to 999	ms
EP current (when "Current" has been set for "Current cond.")	1 to rating	A

EP wire speed (when "Feed speed" has been set as the "Current cond.")	1 to rating	cm/min.
EP voltage (with separate adjustments)	0.1 to rating	V
EP arc length fine adjustment. (with synergic adjustments)	-100 to 100	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The average current (or average wire feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed).

Concerning the arc length fine adjustment

The DL-350 has two modes, synergic adjustments and separate adjustments.

When it is used in the synergic adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the Arc char.1(Short)

The arc characteristic is expressed in the form of a numerical value which enables the arc hardness or softness to be set.

A "+" figure yields a soft arc with minimized short-circuit current peaks.

A "-" figure yields a hard arc yielded by a high short-circuit current.

Concerning the Arc char.2(Arc)

As with the Arc char.1 setting, the values for this condition enable hard or soft to be set for the arcs.

A "+" figure yields soft arcs with a minimal current rise immediately after arcs are generated.

A "-" figure yields hard arcs where the current rises sharply immediately after arcs are generated.

Concerning the APCS parameter 1

When welding with a wire protruding by 5 mm more than the standard protrusion or when the Arc char.1 setting is extremely low, the spatter reduction effect can be finely adjusted by adjusting APCS parameter 1. Normally, adjust APCS parameter 2.

Concerning the APCS parameter 2

When welding with the standard protrusion length (15 mm), the spatter reduction effect can be finely adjusted by adjusting APCS parameter 2. Depending on the welding conditions, it may not be possible to finely adjust this effect using this parameter. If this is the case, finely adjust the effect using APCS parameter 1 as well.

What is slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

■ Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0 : The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999 : The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
Welding control	Normally, fixed to "Standard". This condition can be set when optional software such as "Synchro MIG" is set.
RS control	This is used to set the operation method for RS control. This condition can be set when the "RS control" optional software is set and the "RS control" welding constant is set to "Enabled".

Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0".
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to 100	-
Welding speed	1 to 999	cm/min
Arc characteristic	-10 to 10	-
EN adjust.	-30 to 30	-
Initial current (when "Current" has been set as the "Current cond.")	1 to rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.
Initial voltage (with separate adjustments)	0.1 to rating	V
Ini. arc length (with synergic adjustments)	-100 to 100	-
Slope time (when "Time" has been set as the "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 to 99	mm
Slow down speed	1 to 9999	cm/min.
Start current	-500 to 300	A
Start Time	-99.9 to 99.9	ms
DC pulse Start Time	0 to 999	ms
Gas Flow Rate	-	L/min
Wave frequency	0.5 to 32.0	Hz
Base current	15 to 200	A
	20 to 300	A
Base time	0.4 to 5.0	ms
Standup time	0.4 to 3.0	ms
Falling time	0.4 to 3.0	ms
Peak current	20 to 600	A
Peak time	0.4 to 3.0	ms
EN time	0.0 to 30.0	ms
EN current	20 to 300	A

- ※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the arc length fine adjustment

DW300+(PLUS) has supported both "Synergetic" and "Individual" adjustment mode only when the wire material is mild steel solid or stainless steel under DC pulsed welding. The other cases of welding mode support only the synergetic adjustment mode.

The optimum voltage value according to the specified current value is automatically output in using under synergetic adjustment mode.

The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

What is the slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

■ Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0 : The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999 : The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Welding control	Please set it to "Standard" usually. Please select "Synchro" when you periodically change welding condition synchronizing with weaving end point.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.

APCS cond.	This selects the method used to set the APCS (spatter adjustment) parameters. When "AUTO" is specified, the APCS cond. setting parameter is automatically adjusted by the welder. When "TEACH" is specified, the welder exercises spatter suppression control in accordance with the APCS cond. setting parameter among the setting conditions on page 2.
RS control	This is used to set the operation method for RS control. This condition can be set when the "RS control" optional software is set and the "RS control" welding constant is set to "Enabled".
Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Welding speed	1 to 999	cm/min
Gas Flow Rate	-	L/min
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1 EP	-100 to 100	-
APCS parameter 2 EP	-100 to 100	-
APCS parameter 1 EN	-100 to 100	-
APCS parameter 2 EN	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 to rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.

Initial voltage (with separate adjustments)	0.1 to rating	V
Ini. arc length (with synergic adjustments)	-100 to 100	-
EN ratio	0 to 100	%
AC frequency	1.0 to 10.0	Hz
Arc length fine adjustment at AC	-100 to 100	-
EP start time	100 to 999	ms
EP robot stop time	0 to 999	ms
EP start current (When "Current" is set to "Current cond.")	1 to rating	A
EP start wire feed speed (When "Feed speed" is set as "Current cond.")	1 to rating	cm/min.
EP start voltage (with separate adjustments)	0.1 to rating	V
EP start arc length fine adjustment (with synergic adjustments)	-100 to 100	-
Slowdown speed	1 to 9999	cm/min.
Start current	1 to 600	A
Start adjust time	-50.0 to 999.9	ms
Hot start time	0 to 990	ms
Start voltage adj.	-15.0 to 15.0	V

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The welding current (or the wire feed speed) inputted as the welding condition is equal to the average current (or the average wire feed speed) in welding. The optimum welding waveform control parameter for the welding current (or wire feed speed) which has been set is automatically calculated based on the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

DL-350 (S-2) has two modes (Synergic adjustments / Separate adjustments).

In the case of using in the synergic adjustment mode, the optimum voltage is automatically output according to the set current value. The "arc length fine adjustment" is an adjustment value to increase or reduce the voltage which is automatically output. For instance, if the adjustment value is set to +5, the output voltage will be raised by about 0.5 V as a theoretical value.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the Arc characteristic 1(SHORT)

The arc characteristic is expressed in the form of a numerical value which enables the arc hardness or softness to be set.

A "+" figure yields a soft arc with minimized short-circuit current peaks.
A "-" figure yields a hard arc yielded by a high short-circuit current.

Concerning the Arc characteristic 2(Arc)

As with the Arc char. 1 setting, the values for this condition enable hard or soft to be set for the arcs.

A "+" figure yields soft arcs with a minimal current rise immediately after arcs are generated.

A "-" figure yields hard arcs where the current rises sharply immediately after arcs are generated.

What is slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

■ Example of screen display

AS[W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	When multiple welders are connected to a single controller, select a target welder to start welding.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0 : The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999 : The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
Welding control	This is normally fixed at "Standard", but when it is set to the "Synchro MIG" optional software, you will be able to select "Synchro" or "FC". Select "Synchro" to do synchronized MIG welding, and "FC" to do FC-MIG welding.

RS control	This is used to set the operation method for RS control. This condition can be set when the "RS control" optional software is set and the "RS control" welding constant is set to "Enabled".
Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 ~ rated	A
Wire speed (When "Current cond." is "Speed".)	1 ~ rated	cm/min
Welding voltage (When individual adjustment)	0.1 ~ rated	V
Arc length tuning (When unified adjustment)	-100 ~ +100	-
Welding speed	1 ~ 999	cm/min
Arc characteristic	-10 ~ 10	-
Arc character.	-100 ~ 100	-
Wave frequency	0.5 ~ 32.0	Hz
Amplitude rate	0 ~ 100	%
Slow down speed	1 ~ 9999	cm/min.
Start current	1 ~ 700	A
Start corrent adj.	-500 ~ 300	A
Start voltage adj.	-20.0 ~ 20.0	V
Start adjust time	-100 ~ 100	ms
Hot start time	10 ~ 990	ms
Gas Flow Rate	-	L/min
Slope time (when "Time" has been set as the "Slope cond.")	0.0 ~ 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 ~ 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 ~ rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 ~ rating	cm/min.
Initial voltage (with separate adjustments)	0.1 ~ rating	V
Ini. arc length (with synergic adjustments)	-100~100	-
Base current	20 ~ 200	A

Standup time	0.1 ~ 3.0	ms
Falling time	0.1 ~ 3.0	ms
Peak current 1	20 ~ 600	A
Peak current 2	20 ~ 600	A
Peak time	0.1 ~ 3.0	ms
Peak time 1	0.1 ~ 3.0	ms
Peak time 2	0.1 ~ 3.0	ms
Switch time	0.1 ~ 3.0	ms
Standup gain	0 ~ 5	-
Falling gain	0 ~ 5	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The average current (or average wire feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is input as the welding condition. The base current, peak current and other pulse conditions during pulsed welding, are automatically calculated based on the welding current (or wire feed speed) that has been input.

Concerning the arc characteristic

The arc characteristic is the value that enables to set hard/soft of the arc in the DC welding method. Intensive and hard arcs are generated by increasing this value to the (-) side, while extensive and soft arcs to the (+) side.

Concerning the arc length fine adjustment

The DP-400R has two modes, synergic adjustments and separate adjustments.

When the DP-400R is used in the synergic adjustment mode, the optimum voltage for the current, which has been set, is automatically output. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

What is the slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "arc characteristic" and "wave frequency"

"Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to **EXPERT** or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc constant] — [Constant of weld] — [Pulse conditions], and set "Recommendation". ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

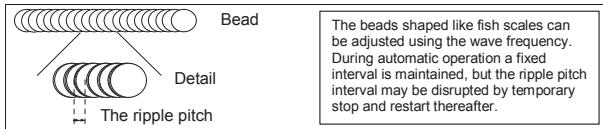
What are the arc characteristic?

The arc characteristic is a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

What is the wave frequency?

For aluminum alloy welding where the beads can be formed in shapes of fish scales, it is possible to adjust the ripple pitches freely, depending on the combinations between the welding speed and wave frequency.

The width of the pitches will become narrow if the wave frequencies are expanded without changing the welding speed. Vice versa, if the frequencies are made smaller with the welding speed unchanged, the pitches will widen.



The beads shaped like fish scales can be adjusted using the wave frequency. During automatic operation a fixed interval is maintained, but the ripple pitch interval may be disrupted by temporary stop and restart thereafter.

Pre-flow time

The pre-flow time cannot be set using the arc start command (AS). Set it by selecting [Arc constant] – [Constant of Weld] – [Pre-flow time].

■ Example of screen display

AS[#, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Function Commands (FN Codes)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS(FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameters

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Description
Welder	This specifies the target welding power supply when a multiple number of welding power supplies are connected. It need not be set if only one welding power supply is being used.
AS Cond. file	This is used to specify the welding condition file number to use in the arc start command. Condition file ID 0:The welding conditions are set directly with the arc start command. A welding condition file is not used. Condition file ID 1 to 999:The welding condition file of the specified number is used.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 0 : A restart operation is not performed. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.
RS control	This is used to set the operation method for RS control. This condition can be set when the "RS control" optional software is set and the "RS control" welding constant is set to "Enabled".

Robot RS control	This is used to set the operation method for robot RS control. This condition can be set when the "Robot RS control" optional software is set and the "Robot RS control" welding constant is set to "Enabled".
Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to '0'.
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON". For details, see the separate instruction manual for option [Gas saver GFC].

●Welding start conditions

Conditions	Range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Welding speed	1 to 999	cm/min
Gas Flow Rate	-	L/min
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1	-100 to 100	-
APCS parameter 2	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Initial current (when "Current" has been set as the "Current cond.")	1 to rating	A
Initial wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.
Initial voltage (with separate adjustments)	0.1 to rating	V
Ini. arc length (with synergic adjustments)	-100 to 100	-
Slowdown speed	1 to 9999	cm/min.
Start current	1 to 600	A
Start adjust time	-50.0 to 999.9	ms
Start voltage adj.	-15.0 to 15.0	V

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.
Please see each manual in detail.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The welding current (or the wire feed speed) inputted as the welding condition is equal to the average current (or the

average wire feed speed) in welding. The optimum welding waveform control parameter for the welding current (or wire feed speed) which has been set is automatically calculated based on the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

The Welbee Inverter M350L has two modes: synergic adjustments and separate adjustments.

In the case of using in the synergic adjustment mode, the optimum voltage is automatically output according to the set current value. The "arc length fine adjustment" is an adjustment value to increase or reduce the voltage which is automatically output. For instance, if the adjustment value is set to +5, the output voltage will be raised by about 0.5 V as a theoretical value.

Concerning the input of the wire feed speed

The wire feed speeds which are actually valid as welding conditions differ according to the welder and welding mode used. If the standard software has been installed in the welder, the minimum speed is approximately 130 cm/min. and the maximum speed is approximately 1800 cm/min. as a general rule. However, depending on the welding mode, the maximum and minimum wire feed speed may be more restricted than the ranges given.

Concerning the setting range of the welding speed

Although any speed from 1 to 999 cm/min. can be set as the welding speed, the maximum speed is actually 600 cm/min. or so. Since this is the maximum operable speed and not a speed which can be used for actual welding, it must be adjusted to ensure optimum welding.

Concerning the Arc characteristic 1(SHORT)

The arc characteristic is expressed in the form of a numerical value which enables the arc hardness or softness to be set.

A "+" figure yields a soft arc with minimized short-circuit current peaks.

A "--" figure yields a hard arc yielded by a high short-circuit current.

Concerning the Arc characteristic 2(Arc)

As with the Arc char.1 setting, the values for this condition enable hard or soft to be set for the arcs.

A "+" figure yields soft arcs with a minimal current rise immediately after arcs are generated.

A "--" figure yields hard arcs where the current rises sharply immediately after arcs are generated.

What is slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

■ Example of screen display

AS [W1, OFF, 0, 150A, 21. OV, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Application command (FN code)

Command name	AS
FN code	414
Title name	Arc start
General description	Starts arc welding with the specified conditions.

■ General description

This command enables to start Arc welding with the specified conditions. If it has been already started, the welding condition is changed to the specified one.

The welding start position is a move command shortly before AS (FN414). To select the command, designate the FN code "414" or press F key <AS>.

■ Parameter

After selecting the Arc start instructions (AS), specify the "Arc start control conditions" first. "Arc start control conditions" are the ones displayed on the page 1. Specify the "Arc start conditions" from on and after the page 2.

● Arc start control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected, specify the welder to be used. This setting is unnecessary when there is only 1 welder.
WFP cond. file	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter] → F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Retry no.	This is used to set the retry operations if an arc is not generated at the start of welding. Retry No. 0 : The standard internal arc retry operation is performed. Retry No. 1 to 99 : The arc retry operation is performed using the retry condition file of the specified number
Restart no.	This is used to set the restart (retry) operation if arc run-out occurs during welding. Restart No. 1 to 99 : The arc restart operation is performed using the retry condition file of the specified number.
Welding process	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc start. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.

Move cond. no.	The robot movement conditions at welding start and in the welding sections are specified by file numbers. Normally, this item is set to "0."
Penetration adjustment *1	This is used to switch ON or OFF the penetration adjustment function of welding power source in the welding section.
Gas Flow Rate Setting	This condition can be set when the "Gas flow control unit" arc constant is set to "ON".

*1: This is displayed only when the "Penetration adjustment" is ON using F5<Constant settings>-"3 constant of weld".

● Welding start conditions

Conditions	Setting range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire feed speed (When "Current cond." is "feed speed")	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to 100	-
Welding speed	1 to 999	cm/min
Gas Flow Rate	-	L/min.
Arc characteristics 1 (short)	-100 to 100	-
Arc characteristics 2 (arc)	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Initial current (when "Current" is set as the "Current cond.")	1 to rated	A
Initial wire speed (when "feed speed" is set as the "Current cond.")	1 to rated	cm/min
Initial voltage (with individual adjustments)	0.1 to rated	V
Ini. arc length (with synergic adjustments)	-100 to 100	-
Slow down speed	1 to 9999	cm/min
Start current	1 to 600	A
Start adjustment time	-50.0 to 999.9	ms
Start voltage adjustment	-15.0 to 15.0	V

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.

For further details, refer to respective operating manual.



Checkpoints for setting the conditions

Welding current or Wire feed speed

The welding current (or wire feed speed) to be input as welding condition becomes the average current at the time of welding (or average wire feed speed). The welding waveform control parameters are calculated automatically appropriate to the set welding current (or wire feed speed) on the basis of the input welding current (or wire feed speed).

Arc length fine adjustment

Welbee Inverter M350L has two modes, Unified adjustment and individual adjustment.

When using in unified adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, if set to +5, the voltage increases to approximately 0.5V in the logical value.

Wire feed speed input

The valid wire feed speed as welding condition varies as per the welder or welding mode to be used. If the standard software is installed on the welder, the standards are minimum of approximately 130cm/sec and maximum of approximately 1800cm/sec. However, the range for minimum and maximum wire feed speed may become narrower on the basis of welding mode.

Concerning the setting range of the welding speed

The welding speed can be set between the range of 1 to 999cm/sec. though the actual maximum speed for it is approximately 600cm/sec. However, even this value cannot be used during actual welding, though it is a maximum value which can be used for an operation. Adjust the value to get appropriate welding done.

Arc characteristics 1 (short)

The arc characteristics value is expressed in the form of a numerical value which enables the arc hardness or softness to be set.

Soft arc with a suppressed peak of short circuit current is on the + side.

Hard arc according to the high short circuit current is on - side.

Arc characteristics 2 (arc)

This arc characteristic is same as arc characteristics 1, and value is expressed in the form of a numerical value which enables the arc hardness or softness to be set.

Soft arc with a suppressed current change during the arc period is on the + side.

Hard arc with large current change during the arc period is on the - side.

Slow down speed

The slow down speed shows the wire feed speed till the arc start at the time of starting welding.

■ Example of screen display

AS [W1, OFF, 0, 150A, 21.0V, 80cm/m, →]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), Arc retry condition No., and welding conditions (Current/Voltage/Speed) from the left.

See

AE; Arc end (FN415)

Application command (FN code)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions.

The welding end position is a move command shortly before AE (FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameter

● Welding end control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected to a single controller, select a target welder to stop welding. "0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter] → F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Condition file ID	
Welding process	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Welding conditions	Refer the following table.

● Welding end conditions

The types of welder are as follows and the conditions to be set vary depending on the type. (Set the type of the welder to be used in the Welding characteristics data in advance).

- Individual adjustment welder... It controls current and voltage separately.

Conditions	Setting range	Unit
Crater current	1 to rated	A
Crater voltage	0.1 to rated	V
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.

- Unified adjustment welder... It automatically outputs the appropriate voltage as per the current.

Conditions	Setting range	Unit
Crater current	1 to rated	A
Voltage fine adjustment	-100 to +100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.

- TIG welder ... It is a welder used for TIG welding.

Conditions	Setting range	Unit
Crater current	1 to rated	A

Wire retract time	0.0 to 9.9	sec.
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for "a certain period of time". The arc applied here is "less than the real welding".

The condition "less than the real welding" is called "crater current/ crater voltage" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "crater time".

Voltage fine adjustment

The optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. When + (plus) value is set, it is higher voltage and when - (minus) value is set, it is lower voltage.

Postflow time

"Postflow time" is to keep supplying the gas for a while to prevent the welded part from oxidized.

■ Example of screen display

AE[W1,OFF,130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

●Parameters other than welding conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AS Cond. file	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.

●Welding end conditions

Conditions	Range	Unit
Current cond.	Speed/ Current	-
Welding current (When the Current condition is "Current".)	1 ~ rated.	A
Wire speed (When the Current condition is "Wire Speed".)	1 ~ 9999	cm/min
Welding voltage (When Individual adjusting)	0.1 ~ rated.	V
Arc length tuning (When Unified adjusting)	-100 ~ +100	-
Crater time	0.0 ~ 9.9	sec
Postflow time	0.0 ~ 9.9	sec
Arc characteristic	-100 ~ +100	%
Burnback time	10 ~ 990	msec

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for "a certain period of time". The arc applied here is "less than the real welding".

The condition "less than the real welding" is called "*crater current/ crater voltage*" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "*crater time*".

Arc length tuning

When the CPDRA-351/501 is used as a unified adjustment power supply, the optimal voltage for the current setting is output automatically. The "voltage adjustment value" is the value for increasing or reducing the voltage which is output automatically. Setting a "+" value yields a voltage which is on the high side; conversely, setting a "-" value yields a voltage

which is on the low side.

Arc characteristic

The arc characteristics value is expressed in the form of a numerical value which enables the arc hardness or softness to be set. When this value is increased gradually in the "+" direction, a concentrated hard arc is obtained; conversely, when it is reduced gradually in the "-" direction, an expansive soft arc is obtained.

A "+" value tends to minimize the arc heat and is thus ideal for upward or sideways welding.

A "—" value tends to minimize spatter.

Bear in mind that setting an excessively high value will cause the welding to become unstable.

Postflow time

"Postflow time" is to keep supplying the gas for a while to prevent the welded part from oxidized.

Burnback time

The optimum values of this parameter are set automatically depending on the specified welding current (or wire feed speed). Do not change this condition, basically. If changing, adjust the values slightly based on the optimum value. If making a big change, welding cannot be executed and welding error may occur, or welding quality may become worse.

■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE).

"Welding end control conditions" are the conditions displayed on Page 1.

"Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AS Cond. file	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered as the welding characteristics data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select whether to exercise slope control at the time of arc end with the robot stopped (in which case it is specified as a time) or while the robot is still advancing (in which case it is specified as a distance).

●Welding end conditions

Conditions	Range	Unit	DC Pulse	DC Wave Pulse	AC Pulse	AC Wave Pulse
Welding current (When "Current cond." is "Current.")	1~200	A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wire speed (When "Current cond." is "Wire speed".)	1 ~ 9999	cm/min	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc length tuning	-100~100		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crater time	0.0~9.9	sec	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Postflow time	0.0~9.9	sec	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc characteristic	-10~10	-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wave frequency	0.5~32.0	Hz	—	<input type="radio"/>	—	<input type="radio"/>
Penetration adjust.	-150~150	-	—	—	<input type="radio"/>	<input type="radio"/>
Burnback time	0~999	m sec	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Burnback voltage	0.1~27.0	V	○	○	○	○
Slope time (When "Slope cond." is "Time".)	0.0~9.9	sec	○	○	○	○
Slope distance (When "Slope cond." is "Distance".)	0~99	mm	○	○	○	○
Base current	20~200	A	○	○	○	○
Standup time	0.4~3.0	m sec	○	○	○	○
Falling time	0.4~3.0	m sec	○	○	○	○
Peak current	20~600	A	○	○	○	○
Peak time	0.4~3.0	m sec	○	○	○	○
EN current	20~300	A	—	—	○	○
EN time	0.0~30.0	m sec	—	—	○	○

○ : Item to be set — : Item not to be set



Checkpoints for setting the conditions Concerning the welding current and wire speed

The average current (or average feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is initially input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed) which has been input.

When welding without a crater process

If performing welding without a crater process, set 0 as the crater time. In this case, note that the setting of welding current or wire feed speed must be the same as that for actual welding. Otherwise, the optimum value of burnback voltage may not be displayed properly when performing teaching.

Arc length tuning

Since the CPDACA-201 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5V.

EN current and EN time

The EN current and EN time are parameters for controlling the heat input to the workpiece during AC pulsed welding. "EN" stands for "electrode negative." Outputting EN during AC pulsed welding makes the penetration in the base metal shallower and increases the amount of the wire melted. However, when adjusting the penetration in the base metal, do not change the EN current or EN time but change the penetration adjustment conditions.

Arc characteristic

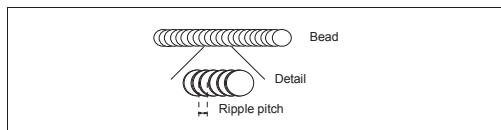
The pulsed arc characteristics are a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

Penetration adjust.

The penetration adjustment is a parameter for adjusting the EN time. Increasing its numerical value makes for a shallower penetration; conversely, reducing it makes for a deeper penetration.

Wave frequency

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency. Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



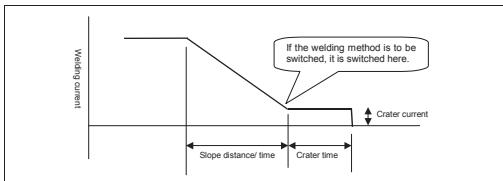
Slope control

Slope control involves changing the conditions (welding current, welding voltage) in the form of a slope (that is to say, gradually) rather than switching the welding conditions straight away to the specified values. It enables the sputter amount, weld defects, etc. that occur especially when the conditions are switched to be reduced. It can be used when starting the welding, changing the conditions or ending the welding.

Slope control when welding is ended

When welding is ended, slope control is conducted as the conditions are changed from the regular welding conditions to the crater conditions.

Even when crater treatment is not performed, the crater conditions (crater current, crater voltage) must be input if slope control is to be conducted.



■ Example of screen display

AE [W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See
AS, Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE).
 "Welding end control conditions" are the conditions displayed on Page 1.
 "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AS Cond. file	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered as the welding characteristics data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select whether to exercise slope control at the time of arc end with the robot stopped (in which case it is specified as a time) or while the robot is still advancing (in which case it is specified as a distance).

● Welding end conditions

Conditions	Range	Unit	DC	DC Pulse	DC Wave Pulse
Welding current (When "Current cond." is "Current.")	1 ~ rated	A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wire speed (When "Current cond." is "Wire speed".)	1 ~ 9999	cm/min	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Welding voltage (When Individual adjusting)	0.1 ~ rated	V	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc length tuning (When Unified adjusting)	-100 ~ 100	-	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crater time	0.0 ~ 9.9	sec	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Postflow time	0.0 ~ 9.9	sec	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arc characteristic	-10 ~ 10	-	—	<input type="radio"/>	<input type="radio"/>

Wave frequency	0.5 ~ 32.0	Hz	—	—	○
Penetration adjust.	0.1 ~ 50.0	V	△	○	○
Burnback time	10 ~ 999	m sec	○	○	○
Slope time (When "Slope cond." is "Time".)	0.0~9.9	秒			
Slope distance (When "Slope cond." is "Distance".)	0~99	mm	○	○	○
Base current	20 ~ 200	A	—	○	○
Standup time	0.1 ~ 3.0	m sec	—	○	○
Falling time	0.1 ~ 3.0	m sec	—	○	○
Peak current	20 ~ 600	A	—	○	○
Peak time	0.1 ~ 3.0	m sec	—	○	○

○ : Item to be set — : Item not to be set

△ : Item to be set only when aluminum is the wire material



Checkpoints for setting the conditions

Concerning the welding current and wire speed

The average current (or average feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is initially input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed) which has been input.

Arc length tuning

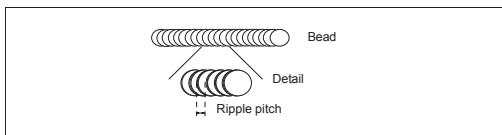
Since the CDPAS-501 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5V.

Arc characteristic

The pulsed arc characteristics are a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

Wave frequency

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency. Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.

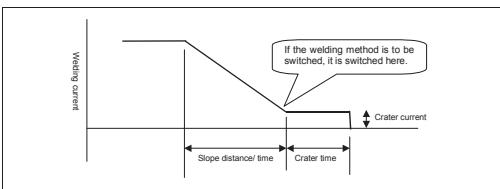


Slope control involves changing the conditions (welding current, welding voltage) in the form of a slope (that is to say, gradually) rather than switching the welding conditions straight away to the specified values. It enables the sputter amount, weld defects, etc. that occur especially when the conditions are switched to be reduced. It can be used when starting the welding, changing the conditions or ending the welding.

Slope control when welding is ended

When welding is ended, slope control is conducted as the conditions are changed from the regular welding conditions to the crater conditions.

Even when crater treatment is not performed, the crater conditions (crater current, crater voltage) must be input if slope control is to be conducted.



■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Explanation	
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.	
AS Cond. file	<p>"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file.</p> <p>Enter the number and press [Enter]→F11<input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called.</p> <p>Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.</p>	
Output current	DC	This is for welding using DC waveforms.
	AC	This is for welding using AC waveforms.
	AC-DC (*1)	This is for hybrid welding (a method that switches between AC and DC in the specified cycle).
Slope control	ON	Down-slope control is performed.
	OFF	Down-slope control is not performed.
AC wave	Standard	This enables welding across a wide range from thin sheets to thick sheets.
	Hard	<ul style="list-style-type: none"> This enables concentrated arcs as with DC to be produced. It is useful for thin-sheet fillet welding, etc.
	Soft	<ul style="list-style-type: none"> This enables soft arcs to be produced. It is useful for thin-sheet butt welding, etc.

(*1) This mode requires the optional "TIG pulsed welding" software.

●Welding end conditions

Classification	Condition		Range	Unit
Welding end condition	Crater	Crater current	4 ~ 300	A
		Crater time	0.0 ~ 9.9	sec
		Postflow time	0.0 ~ 60.0	sec

	Postflow robot operation	Stop/ Move	-
Filler	Retract speed	0 ~ rated	cm/min
	Retract time	0.0 ~ 9.9	sec
	AC frequency	50 ~ 200	Hz
	Cleaning width	-10 ~ +10	-
AC-DC switching	AC-DC frequency	0.5 ~ 30.0	Hz
	AC-DC ratio	1 ~ 99	%
Down slope	Slope time or	0.0 ~ 9.9	sec
	Slope distance	0 ~ 99	mm
	Robot stop time	0.0 ~ 9.9	sec
	Wire precedence time	0.0 ~ 9.9	sec



Checkpoints for setting the conditions

Down slope

This process is for preventing crater cracks from forming at arc end, and it achieves this by lowering the output current step by step. It performs the 2-step processing described below.

- (1) Before the arc end point is reached, down-slope is conducted while the torch is being moved.
- (2) Next, down-slope is conducted at the arc end point with the robot stopped.

Wire precedence time

This is the time by which the wire feed end timing is brought ahead of the down-slope end.

The advance time is set using a time shorter than the down-slope time. If the advance time is longer than the down-slope time, down-slope is not conducted. If down-slope is specified when the crater time is 0 seconds, down-slope to the crater conditions is conducted.

A maximum of 99 mm can be specified for the down-slope distance. However, if the arc end point distance from the teach point immediately before is less than 99 mm, this distance will serve as the maximum down-slope distance instead.

Postflow

"Stop" or "Move" can be selected as the operation performed by the robot during after-

Stop ... The robot is stopped until after-flow or retract ends.

Move ... Upon completion of crater welding, the robot moves to the next sequence while performing post-flow (which also includes retract).

Set to "stop" initially. When a long time is needed to release the gas in order to prevent oxidation of the tungsten electrodes, select "Move." The tact time can be shortened since the gas is released at the same time as the robot is operating.

However, since the gas release is controlled by the robot, the following restrictions apply when "Operate" has been set.

- (1) If a welding command has been executed during post-flow, post-flow is stopped immediately, and the welding command is executed.
- (2) If the work was completed (if the END command was executed) during post-flow, post-flow is stopped.

In regard to restriction (2), the timer command (DELAY) is input before the work is completed (before the END command) to set enough time for after-flow to be completed. By this means, after-flow is conducted as per the time set.

However, since this method may affect the tact time, it is recommended that the step jump command (JMP) be added before the END command and teaching be conducted to ensure that a return is made to the head of the work program if useless robot operations are to be avoided.

■ Example of screen display

AE[W1, OFF, 130A, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Application command (FN code)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions.

The welding end position is a move command shortly before AE (FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameter

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected to a single controller, select a target welder to stop welding.
Condition file ID	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter] → F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Welding process	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc end. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.

● Welding end conditions

Conditions	Setting range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire speed (When "Current cond." is "Speed".)	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to +100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.
Arc characteristic	-99 to +99	%

Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Burnback voltage	0.1 to rated	V

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for "a certain period of time". The arc applied here is "less than the real welding". The condition "less than the real welding" is called "crater current/ crater voltage" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "crater time".

Arc length tuning

Since the DM-350/350(S-2)/500 is a unified adjustment welder, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. When + (plus) value is set, it is higher voltage and when -(minus) value is set, it is lower voltage.

Arc characteristic

The arc characteristics value is expressed in the form of a numerical value which enables the arc hardness or softness to be set. When this value is increased gradually in the "+" direction, a concentrated hard arc is obtained; conversely, when it is reduced gradually in the "-" direction, an expansive soft arc is obtained.

A "+" value tends to minimize the arc heat and is thus ideal for upward or sideways welding.

A "-" value tends to minimize spatter.

Bear in mind that setting an excessively high value will cause the welding to become unstable.

Postflow time

"Postflow time" is to keep supplying the gas for a while to prevent the welded part from oxidized.

Burnback voltage

The optimum values of this parameter are set automatically depending on the specified welding current (or wire feed speed). Do not change this condition, basically. If changing, adjust the values slightly based on the optimum value. If making a big change, welding cannot be executed and welding error may occur, or welding quality may become worse.

■ Example of screen display

AE [W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).

●Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set as the "Current cond.")	1 ~ rating	A
Wire speed (when "Wire speed" has been set as the "Current cond.")	1 ~ rating	cm/min.
Welding voltage (with separate adjustments)	0.1 ~ rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 ~ 100	-
Crater time	0.0 ~ 9.9	sec.
Postflow time	0.0 ~ 9.9	sec.
Arc characteristic	-10 ~ 10	-
Arc character.	-100 ~ 100	-
Wave frequency	0.5 ~ 32.0	Hz

Burnback voltage	0.1 ~ rating	V
Burnback voltage fine adjustment	-9.9 ~ 9.9	-
Slope time (when "Time" has been set as the "Slope cond.")	0.0 ~ 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 ~ 99	mm
Robot stop time	0.0 ~ 9.9	sec.
Base current	20 ~ 200	A
Standup time	0.1 ~ 3.0	ms
Falling time	0.1 ~ 3.0	ms
Peak current	20 ~ 600	A
Peak time	0.1 ~ 3.0	ms

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for "a certain period of time". The arc applied here is "less than the real welding".

The condition "less than the real welding" is called "*crater current/ crater voltage*" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "*crater time*".

Concerning the arc length fine adjustment

The DP-350/400/500 has two modes, synergic adjustments and separate adjustments.

When it is used in the synergic adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "Arc characteristics" and "Wave frequency".

Pulse conditions "Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to **EXPERT** or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc Constant] – [Constant of weld] – [Pulse condition], and set "Recommendation" ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

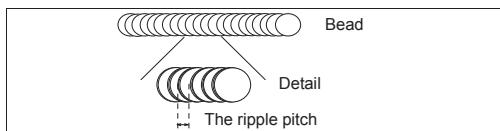
What are the arc characteristic?

The arc characteristic is a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

What is the wave frequency?

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding speed and wave frequency.

Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



When crater is not performed

When crater is not to be performed, set the crater time to "0". However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value.

Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the

teaching stage.

■ Example of screen display

AE [W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

[AS; Arc start \(FN414\)](#)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Current output	The kind of "Current output waveforms" can be selected. DC: This is for welding using DC waveforms. AC: This is for welding using AC waveforms. AC-DC: This is for hybrid welding (a method that switches between AC and DC in the specified cycle). AC-DC mode require the optional software "TIG pulsed welding" software.
AC waveform ※This method is set when AC, AC pulse d or AC/DC has been selected as the "Current output" method.	Standard: This enables welding across a wide range from thin sheets to thick sheets. Hard: <ul style="list-style-type: none">• This enables concentrated arcs as with DC to be produced.• It is useful for thin-sheet fillet welding, etc. Soft: <ul style="list-style-type: none">• This enables soft arcs to be produced.• It is useful for thin-sheet butt welding, etc.
Slope control	ON: Down slope control is executed. OFF: Down slope control is not executed.
Slope control	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).

● Welding end conditions

Conditions	Range	Unit
Crater current	4 to rating	A
Crater time	0.0 to 9.9	sec.
Retract speed	0 to rating	cm/min.
Retract time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.

Robot operation during postflow	Stop/operate	-
AC/DC switching frequency	0.5 to 30.0	Hz
AC ratio	10 to 90	%
Cleaning width	-20 to +20	-
AC frequency	50 to 200	Hz
Slope time (when "Time" has been set as the "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Filler end advance time	0.0 to 9.9	sec.

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for "a certain period of time". The arc applied here is "less than the real welding". The condition "less than the real welding" is called "*crater current/ crater voltage*" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "*crater time*".

What is the downslope?

This process is for preventing crater cracks from forming at arc end, and it achieves this by lowering the output current step by step. It performs the 2-step processing described below.

- (1) Before the arc end point is reached, down-slope is conducted while the torch is being moved.
- (2) Next, down-slope is conducted at the arc end point with the robot stopped.

What is filler end advance time?

This is the time by which the wire feed end timing is brought ahead of the down-slope end.

The advance time is set using a time shorter than the down-slope time. If the advance time is longer than the down-slope time, down-slope is not conducted.

If down-slope is specified when the crater time is 0 seconds, down-slope to the crater conditions is conducted.

■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).

●Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set for "Current cond.")	1 to rating	A
Wire feed speed (when "Wire speed" has been set for "Current cond.")	1 to rating	cm/min.
Welding voltage (with separate adjustments)	0.1 to rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 to 100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.
Arc characteristic	-100 to 100	-
Burnback voltage	0.1 to rating	V
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.

Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions Concerning the arc length fine adjustment

DR-350 has two modes: synergic adjustments and separate adjustments.

When it is used in the unified adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

What is the slowdown speed?

The slowdown speed denotes the speed at which the wire is fed until the arc is started at the arc start point.

When crater treatment is not performed

When crater treatment is not going to be performed, set the crater time to "0." However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value. Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).
APCS cond.	Selecting the setting method for the spatter adjustment parameter. AUTO: "APCS parameter" is automatically adjusted in the welder side. TEACH: The spatter inhibitory control is performed by the welder according to "APCS parameter".

● Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set for a "Current cond.")	1 to rating	A
Wire feed speed (when "Feed speed" has been set for a "Current cond.")	1 to rating	cm/min.
Welding voltage (with separate adjustments)	0.1 to rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 to 100	-
Crater time	0.0 to 9.9	sec.

Postflow time	0.0 to 9.9	sec.
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1	-100 to 100	-
APCS parameter 2	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Burnback V.	0.1 to rating	V
Burnback adjust T.	0 to 999	ms
Burnback pulse control	ON/OFF	-
Burnback pulse control value	-10 to 10	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The welding current (or wire feed speed) which is input as a welding condition becomes the average current (or average wire feed speed) during welding. The welding waveform control parameter optimally suited for the welding current (or wire feed speed) which has been set is calculated automatically on the basis of the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

The DL-350 has two modes, synergic adjustments and separate adjustments.

When it is used in the synergic adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

When crater treatment is not performed

When crater treatment is not going to be performed, set the crater time to "0." However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value. Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE [W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).

●Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set as the "Current cond.")	1 to rating	A
Wire speed (when "Wire speed" has been set as the "Current cond.")	1 to rating	cm/min.
Welding voltage (with separate adjustments)	0.1 to rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 to 100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.
Arc characteristic	-10 to 10	-
Wave frequency	0.5 to 32.0	Hz
EN adjust.	-30 to 30	-
Slope time (when "Time" has been set as the "Slope")	0.0 to 9.9	sec.

cond.")		
Slope distance (when "Distance" has been set as the "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Base current	15 to 200	A
Standup time	0.4 to 3.0	ms
Falling time	0.4 to 3.0	ms
Peak current	20 to 600	A
Peak time	0.4 to 3.0	ms
EN time	0.0 to 30.0	ms
EN current	20 to 300	A
DC pulse end output	Disabled / Enabled	-
DC pulse end adj. Curr (When "Current" has been set as the "Current cond.")	-(rating - 1) to (rating current – welding current)	A
DC pulse end adj. wire speed (When "Wire speed" has been set as the "Current cond.")	-(rating wire speed - 1) to (rating wire speed – wire speed)	cm/min.
DC pulse end time	0 to 999	ms
End pls curr.	-500 to 500	A
End pls time	-9.9 to 9.9	ms
Adjust. Burnback V.	-9.9 to 9.9	-
Burnback adj. T.	-500 to 500	ms
Burnback delay T.	-99 to 99	ms

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The average current (or average feed speed) during pulsed welding serves as the welding current (or wire feed speed) which is initially input as the welding condition. The base current, peak current and other pulse conditions for pulsed welding are automatically calculated on the basis of the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

DW300+(PLUS) has supported both "Synergic" and "Individual" adjustment mode only when the wire material is mild steel solid or stainless steel under DC pulsed welding. The other cases of welding mode support only the synergic adjustment mode.

The optimum voltage value according to the specified current value is automatically output in using under synergic adjustment mode.

The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

When crater treatment is not performed

When crater treatment is not going to be performed, set the crater time to "0." However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value. Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS: Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).
APCS cond.	Selecting the setting method for the spatter adjustment parameter. AUTO: "APCS parameter" is automatically adjusted in the welder side. TEACH: The spatter inhibitory control is performed by the welder according to "APCS parameter".

● Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set for a "Current cond.")	1 to rating	A
Wire feed speed (when "Feed speed" has been set for a "Current cond.")	1 to rating	cm/min.
Welding voltage (with separate adjustments)	0.1 to rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 to 100	-
Crater time	0.0 to 9.9	sec.

Postflow time	0.0 to 9.9	sec.
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1 EP	-100 to 100	-
APCS parameter 2 EP	-100 to 100	-
APCS parameter 1 EN	-100 to 100	-
APCS parameter 2 EN	-100 to 100	-
EN ratio	0 to 100	%
AC frequency	1.0 to 10.0	Hz
Arc length fine adjustment at AC	-100 to 100	-
Slope time (When "Time" is set to "Slope cond.")	0.0 to 9.9	sec.
Slope distance (When "Distance" is set to "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Burnback V.	0.1 to rating	V
Burnback adjust T.	0 to 999	ms
Burnback pulse control	ON/OFF	-
Burnback pulse control value	-10 to 10	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The welding current (or wire feed speed) which is input as a welding condition becomes the average current (or average wire feed speed) during welding. The welding waveform control parameter optimally suited for the welding current (or wire feed speed) which has been set is calculated automatically on the basis of the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

DL-350 (S-2) has two modes (Synergistic adjustments / Separate adjustments).

In the case of using in the synergistic adjustment mode, the optimum voltage is automatically output according to the set current value. The "arc length fine adjustment" is an adjustment value to increase or reduce the voltage which is automatically output. For instance, if the adjustment value is set to +5, the output voltage will be raised by about 0.5 V as a theoretical value.

When crater treatment is not performed

When crater treatment is not going to be performed, set the crater time to "0." However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value. Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE [W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0: The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to select the method for setting the slope control which is to be exercised at arc end. Specification by time (time specification) or by distance (distance specification) is selected for the range where slope control is to be exercised.

● Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set for "Current cond.")	1 ~ rating	A
Wire feed speed (when "Wire speed" has been set for "Current cond.")	1 ~ rating	cm/min.
Welding voltage (with separate adjustments)	0.1 ~ rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 ~ 100	-
Crater time	0.0 ~ 9.9	sec.
Postflow time	0.0 ~ 9.9	sec.
Arc characteristic	-10 ~ 10	-
Arc character.	-100 ~ 100	-
Wave frequency	0.5 ~ 32.0	Hz
Amplitude rate	0 ~ 100	%

Burnback voltage	0.1 ~ rating	V
Adjust. Burnback V.	-9.9 ~ 9.9	-
Burnback adj. T.	-500 ~ 500	ms
Burnback delay T.	-99 ~ 99	ms
Retract adj. T.	-990 ~ 990	ms
End pls curr.	-500 ~ 500	A
End pls time	-9.9 ~ 9.9	ms
Slope time (when "Time" has been set as the "Slope cond.")	0.0 ~ 9.9	sec.
Slope distance (when "Distance" has been set as the "Slope cond.")	0 ~ 99	mm
Robot stop time	0.0 ~ 9.9	sec.
Base current	20 ~ 200	A
Standup time	0.1 ~ 3.0	ms
Falling time	0.1 ~ 3.0	ms
Peak current 1	20 ~ 600	A
Peak current 2	20 ~ 600	A
Peak time	0.1 ~ 3.0	ms
Peak time 1	0.1 ~ 3.0	ms
Peak time 2	0.1 ~ 3.0	ms
Switch time	0.1 ~ 3.0	ms
Standup gain	0 ~ 5	-
Falling gain	0 ~ 5	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Crater conditions

Crater condition denotes the process to reform the bead shape after welding performance by applying the arc for a certain period of time". The arc applied here is "less than the real welding".

The condition "less than the real welding" is called "crater current/ crater voltage" (arc length fine adjustment) and likewise, "a certain period of time" to apply the arc, "crater time".

Concerning the arc length fine adjustment

The DP-400R has two modes, synergic adjustments and separate adjustments.

When the DP-400R is used in the synergic adjustment mode, the optimum voltage for the current, which has been set, is automatically output. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, when it is set to +5, the output voltage is increased by approximately 0.5 V.

Concerning the pulse conditions

To adjust the pulse conditions, proceed by changing "Arc characteristics" and "Wave frequency".

Pulse conditions "Base current", "Standup time", "Falling time", "Peak current", and "Peak time" can be set provided that the operator qualifications level is set to **EXPERT** or above. However, the welding quality may deteriorate if they are set carelessly. In principle, therefore, do not change these conditions.

To prevent the conditions from being changed in error, select [Arc Constant] – [Constant of weld] – [Pulse condition], and set "Recommendation" ("Teaching" or "Recommendation" can be set, and "Teaching" is set initially.)

If "Recommendation" is set, these values will always be used when welding is executed even if the pulse conditions are changed in error, thus safeguarding the welding quality from deterioration.

What are the arc characteristic?

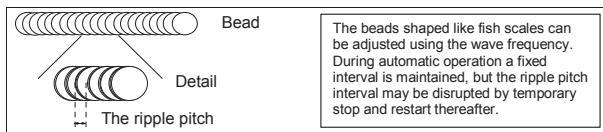
The arc characteristic is a parameter used for adjusting the pulse rise time and pulse fall time internally. When its value is increased, an expansive soft arc is obtained; conversely, when it is reduced, a concentrated hard arc is obtained.

What is the wave frequency?

The wave frequency is a parameter used for adjusting the ripple pitch of beads which are shaped like fish scales and which occur in the DC wave pulsed method. The ripple pitch can be adjusted as desired by a combination of the welding

speed and wave frequency.

Increasing the wave frequency while keeping the welding speed fixed reduces the pitch width; conversely, reducing it increases the pitch width.



The beads shaped like fish scales can be adjusted using the wave frequency. During automatic operation a fixed interval is maintained, but the ripple pitch interval may be disrupted by temporary stop and restart thereafter.

When crater is not performed

When crater is not to be performed, set the crater time to "0". However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value.

Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function Commands (FN Codes)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE(FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameters

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

●Welding end control conditions

Conditions	Details
Welder	This specifies the target welder when a multiple number of welders are connected. It need not be set if only one welder is being used.
AE Cond. file	This is used to specify the welding condition file number to use in the arc end command. Condition file ID 0 : The welding conditions are set directly with the arc end command. A welding condition file is not used. Condition file ID 1 to 999: The welding condition file of the specified number is used.
Welding process	This is used to set the welding method to be used for the welding. The items displayed here are the welding methods which have been registered in the welding characteristic data.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This selects the method used to set the slope control which is to be exercised at arc end. It selects whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification).

●Welding end conditions

Conditions	Range	Unit
Welding current (when "Current" has been set for a "Current cond.")	1 to rating	A
Wire feed speed (when "Feed speed" has been set for "Current cond.")	1 to rating	cm/min.
Welding voltage (with separate adjustments)	0.1 to rating	V
Arc length fine adjustment. (with synergic adjustments)	-100 to 100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.
Arc char.1(Short)	-100 to 100	-
Arc char.2(Arc)	-100 to 100	-
APCS cond.	AUTO/TEACH	-
APCS parameter 1	-100 to 100	-

APCS parameter 2	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (When "Distance" has been set for "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Burnback V.	0.1 to rating	V
Burnback adjust T.	-500 to 500	ms
Retract adj. T.	-990 to 990	ms
Burnback pulse control	ON / OFF	-
Burnback pulse control value	-10 to 10	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.



Checkpoints for setting the conditions

Concerning the welding current and wire feed speed

The welding current (or wire feed speed) which is input as a welding condition becomes the average current (or average wire feed speed) during welding. The welding waveform control parameter optimally suited for the welding current (or wire feed speed) which has been set is calculated automatically on the basis of the welding current (or wire feed speed) which has been input.

Concerning the arc length fine adjustment

The Welbee Inverter M350L has two modes: synergic adjustments and separate adjustments.

When it is used in the unified adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For instance, if a setting of +5 is used, the output voltage will be raised by about 0.5 V as a theoretical value.

When crater treatment is not performed

When crater treatment is not going to be performed, set the crater time to "0." However, in this case, set the same conditions as for regular welding as the crater current or wire feed speed setting value. Unless the same conditions are set, the appropriate burnback voltage level may not be displayed properly at the teaching stage.

■ Example of screen display

AE[#,OFF,130A, 18.0V, 0.1s,0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Application command (FN code)

Command name	AE
FN code	415
Title name	Arc end
General description	Terminates arc welding with the specified conditions.

■ General description

This command enables to end Arc welding, performing the crater process with the specified conditions. The welding end position is a move command shortly before AE (FN415). To select the command, designate the FN code "415" or press F key <AE>.

■ Parameter

Set "Welding end control conditions" first, after selecting this command (AE). "Welding end control conditions" are the conditions displayed on Page 1. "Welding end conditions" are displayed on Page 2 and after.

● Welding end control conditions

Conditions	Setting range
Welder No.	When multiple welders are connected, specify the welder to be used. This setting is unnecessary when there is only 1 welder.
Condition file ID	"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file. Enter the number and press [Enter] → F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.
Welding process	This is used to select the welding method to use. The welding methods registered as welding characteristic data are displayed as selection choices.
Current cond.	This is used to select whether to specify the welding conditions by current or by wire feed speed.
Slope cond.	This is used to specify the method for setting the slope control which is to be exercised at arc end. Whether the range in which the slope control is to be exercised will be specified as a time (time specification) or distance (distance specification) is selected.

● Welding end conditions

Conditions	Setting range	Unit
Welding current (When "Current cond." is "Current".)	1 to rated	A
Wire feed speed (When "Current cond." is "feed speed")	1 to rated	cm/min
Welding voltage (When individual adjustment)	0.1 to rated	V
Arc length tuning (When unified adjustment)	-100 to 100	-
Crater time	0.0 to 9.9	sec.
Postflow time	0.0 to 9.9	sec.

Arc characteristics 1 (short)	-100 to 100	-
Arc characteristics 2 (arc)	-100 to 100	-
Slope time (when "Time" has been set for "Slope cond.")	0.0 to 9.9	sec.
Slope distance (when "Distance" has been set for "Slope cond.")	0 to 99	mm
Robot stop time	0.0 to 9.9	sec.
Burnback voltage	0.1 to rated	V
Anti-sticking adjustment time	-500 to 500	ms
Retract adjustment time	-990 to 990	ms
Anti-sticking pulse output	Not exist/ Exist	-
Anti-sticking pulse output adjustment value	-10 to 10	-

※ Since incorrect settings may cause the poor welding quality, some of the parameters above may not be displayed depending on the operator qualification.

For further details, refer to respective operating manual.



Checkpoints for setting the conditions

Welding current or Wire feed speed

The welding current (or wire feed speed) to be input as welding condition becomes the average current at the time of welding (or average wire feed speed). The welding waveform control parameters are calculated automatically appropriate to the set welding current (or wire feed speed) on the basis of the input welding current (or wire feed speed).

Arc length fine adjustment

Welbee Inverter M350L has two modes, Unified adjustment and individual adjustment.

When using in unified adjustment mode, the optimum voltage for the current which has been set is output automatically. The "arc length fine adjustment" is an adjustment value for increasing or reducing the voltage which is output automatically. For example, if set to +5, the voltage increases to approximately 0.5V in the logical value.

If crater process is not conducted

If crater process is not conducted, set the crater time as 0. However, in such cases, set the condition for crater current or wire feed speed set value similar to conditions set at the time of actual welding. If the conditions are not same, optimum value of anti-sticking voltage may not display correctly at the time of teaching.

Example of screen display

AE[W1, OFF, 130A, 18.0V, 0.1s, 0.1s]

[] shows Welder No., Condition file No. (OFF indicates no number is specified), and arc end conditions (Current/ Voltage/ Crater time/ Postflow time) from the left.

See

AS; Arc start (FN414)

Function commands (FN codes)

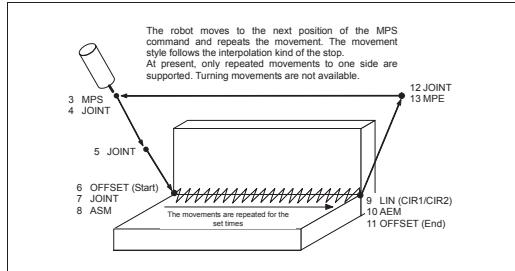
Command name	ASM
FN code	418
Title name	Multi Pass Welding Start
General description	This starts the multi-pass welding under the designated conditions.

■ General description

This starts the multi-pass welding under the designated conditions. For teach and playback, the optional software "Multi-pass Welding function" is required.

As for details, refer to the instruction manual for multi-pass welding function (optional).

■ Example of operation



Step	Command
1	100% JOINT
2	100% JOINT
3	MPS [3 times]
4	100% JOINT
5	100% JOINT
6	OFFSET [Start]
7	100% JOINT
8	ASM [1]
9	SUPERIOR LINE
10	AEM [1]
11	OFFSET [End]
12	100% JOINT
13	MPE
14	100% JOINT
15	END

Multi-pass welding start condition file (ASM*ARCW.001)		
Pass	Multi-pass welding start condition file number	Weaving condition file number
First pass	1 (AS**ARCW.001)	1 (WFP001)
Second pass	2 (AS**ARCW.002)	2 (WFP002)
Third pass	3 (AS**ARCW.003)	3 (WFP003)
Fourth pass	4 (AS**ARCW.004)	4 (WFP004)
Fifth pass	5 (AS**ARCW.005)	5 (WFP005)
.	.	.

■ Parameter

Parameter No. 1	AS Cond. file	This designates the multi-pass welding start condition file number. (1 - 999) This file is to be created in advance by <Arc Condition> - [6 Arc start in multipass welding].
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■ Example of screen display

ASM[W1,001, ->] FN418;MultiPass Welding Start

See

AEM; Multi Pass Welding End (FN419)

MPS; Multi Pass Section Start (FN496)

MPE; Multi Pass Section End (FN497)

EP; Execution Pass Specification (FN498)

OFFSET; Multi Offset Specification (FN499)

Function commands (FN codes)

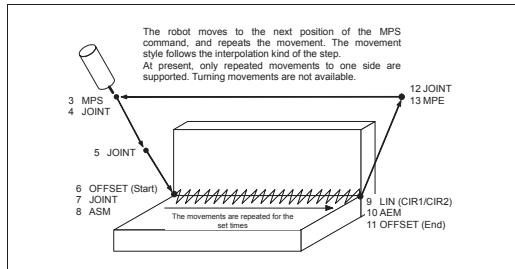
Command name	AEM
FN code	419
Title name	Multi Pass Welding End
General description	This ends the multi-pass welding under the designated conditions.

■ General description

This ends the multi-pass welding under the designated conditions. For teach and playback, the optional software "Multi-pass Welding function" is required.

As for details, refer to the instruction manual for multi-pass welding function (optional).

■ Example of operation



Step	Command
1	100% JOINT
2	100% JOINT
3	MPS [3 times]
4	100% JOINT
5	100% JOINT
6	OFFSET [Start]
7	100% JOINT
8	ASM [1]
9	300cm/m LINE
10	AEM [1]
11	OFFSET [End]
12	100% JOINT
13	MPE
14	100% JOINT
15	END

Multi-pass welding end condition file (AEM*ARCW.001)	
Pass	Multi-pass welding end condition file number
First pass	1 (AE*ARCW.001)
Second pass	2 (AE**ARCW.002)
Third Pass	3 (AE**ARCW.003)
Fourth pass	4 (AE**ARCW.004)
Fifth pass	5 (AE**ARCW.005)
.	.

■ Parameter

Parameter No. 1	AS Cond. file	This designates the multi-pass welding end condition file number. (1 - 999) This file is to be created in advance by <Arc Condition> - [7 Arc end in multipass welding].
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■ Example of screen display

AEM[W1,001, ->] FN419;Multi Pass Welding End

See

ASM; Multi Pass Welding Start (FN418)

MPS; Multi Pass Section Start (FN496)

MPE; Multi Pass Section End (FN497)

EP; Execution Pass Specification (FN498)

OFFSET; Multi Offset Specification (FN499)

Function commands (FN codes)

Command name	SPN
FN code	438
Title name	Servo ON
General description	This turns ON the servo power source in unit of mechanism.

■ General description

This turns ON the servo power source in unit of designated mechanism. For teach and playback, the optional software "Mechanism-by-Mechanism Servo ON/OFF function" is required.

- At check go operation (when <Service Utilities> - [1 Teach / Playback Condition] - [9 Check with function] is set to "Enabled")
- At automatic operation (at playback)

To turn OFF the servo power source, use SPF (FN439).

■ Parameter

Parameter No. 1	Mechanism No.	This designates the mechanism number to turn ON the servo power source. (1 - 9) When a mechanism that does not exist, or a mechanism that does not belong to the unit of teach objective is designated, though there is no error at teaching, it is detected as an alarm "A4911" at check go operation, and an error "E4911" at automatic operation.
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■ Example of screen display

SPN[1] FN438;Servo ON

See
SPF; Servo OFF (FN439)

Function commands (FN codes)

Command name	SPF
FN code	439
Title name	Servo OFF
General description	This turns OFF the servo power source in unit of mechanism.

■ General description

This turns OFF the servo power source in unit of designated mechanism. For teach and playback, the optional software "Mechanism-by-Mechanism Servo ON/OFF function" is required.

- At check go operation (when <Service Utilities> - [1 Teach / Playback Condition] - [9 Check with function] is set to "Enabled")
- At automatic operation (at playback)

To turn ON the servo power source, use SPN (FN438).

■ Parameter

Parameter No. 1	Mechanism No.	This designates the mechanism number to turn OFF the servo power source. (1 - 9) When a mechanism that does not exist, or a mechanism that does not belong to the unit of teach objective is designated, though there is no error at teaching, it is detected as an alarm "A4911" at check go operation, and an error "E4911" at automatic operation.
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■ Example of screen display

SPF[1] FN439;Servo OFF

See

SPN; Servo ON (FN438)

Application command (FN code)

Command name	WFP
FN code	440
Title name	Fixed pattern weaving
General description	Starts weaving with the specified waveform, attitude, and frequency.

■ General description

This command enables to start weaving with the specified waveform, attitude, and frequency.

The robot starts weaving from a position of the movement command taught immediately before this command (WFP).

■ Parameter

AND condition	Setting range
Condition file ID	0 to 999
Frequency	0.0 to 20.0 [Hz]
Function Type	Linear func./ Sine wave / Circle
Amplitude (right amplitude, left amplitude) ※When the linear or sine wave function has been set as the operation pattern	0.0 to 50.0 [mm]
Radius (right radius, left radius) ※When the arc has been set as the operation pattern	0.0 to 50.0 [mm]
Stopping time (center, 1/4 period, 3/4 period)	0.0 to 9.9 [sec.]
Move at Stop Time	Not exist/ Exist
Keep weaving time	Not keep / Keep
Weave start direction	Right/ Left
Weav Angle (right angle of inclination, left angle of inclination)	-180 to 180 [deg.]
Torch Angle (right angle of inclination, left angle of inclination)	-180 to 180 [deg.]
Push Angle (right crosswise angle, left crosswise angle) ※When the linear or sine wave function has been set as the operation pattern	-180 to 180 [deg.]
Circle center ratios (front circle center ratio, back circle center ratio) ※When the arc has been set as the operation pattern	1 to 100 [%]

Condition file ID

"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file.

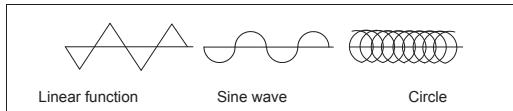
Enter the number and press [Enter]→F11<Input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.

Frequency

This is the weaving frequency (number of waveforms per second).

Function Type

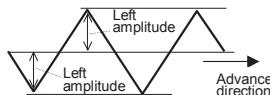
One of the following can be selected as the weaving operation pattern (waveform).



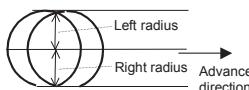
Amplitude

This condition is for setting the weaving amplitude when the linear function or trigonometric function has been set as the operation pattern. Both the left and right amplitudes relative to the advance direction can be set.

The radius from the center of the circle is set when the arc has been set as the operation pattern. Both the left and right radii relative to the advance direction can be set.



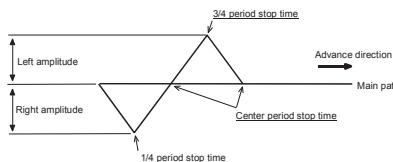
When Linear function or Sine wave is set



When Circle is set

Stopping time

The center stop time, 1/4 period stop time and 3/4 period stop time are set. Deeper penetration can be obtained by setting the stopping time.



Move at Stop Time

This condition is for selecting whether the robot is to move forward in the advance direction or stop during the weaving stop time when weaving stop time has been set. The initial setting is "Not Exist".



Move at stop time : "No"



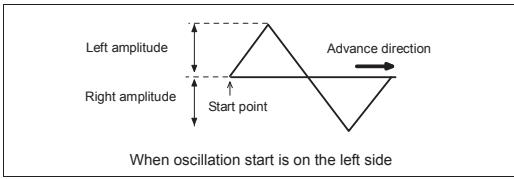
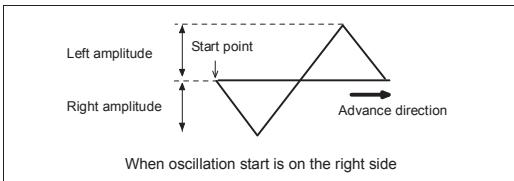
Move at stop time : "Yes"

Keep weaving time

The condition is for setting whether the actual welding time is to be maintained even when the weaving stop time has been set. If the weaving stop time is not set, the condition will be devoid of meaning.

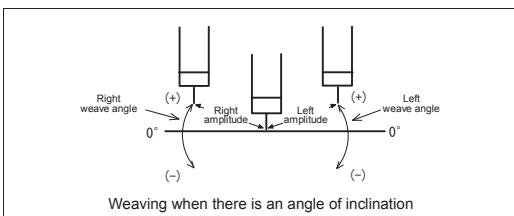
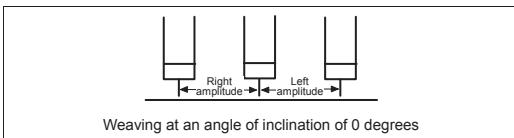
Weave start direction

This condition is for setting whether the weaving is to start on the right or left relative to the advance direction. Right is the initial setting, and weaving starts from the right side relative to the advance direction.



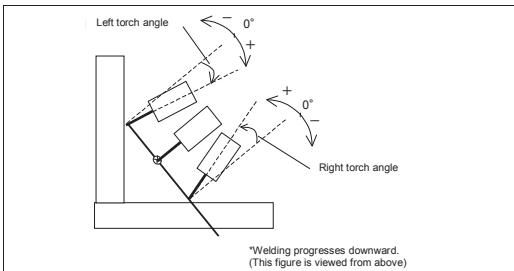
Weave angle

This condition is for setting angle of the weaving from the main path. It can be set both for the left and right amplitude. The initial value is 0 degrees, and the weaving plane is perpendicular to the torch.



Torch angle

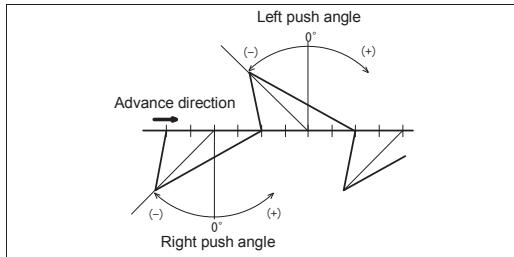
When the angle of inclination of the torch is set, this condition makes it possible to determine the welding posture in respect of the work piece surface at the weaving end point.



Push angle

When the crosswise angle is set, this enables a change into a waveform such as the one shown in the figure below.

However, when the crosswise angle is set, the amplitude is tilted in the advance direction and is thus shortened. If, for instance, the angle is set to -45 degrees, the amplitude will be about 70% of what it would be if the angle were 0 degrees.



Circle rate

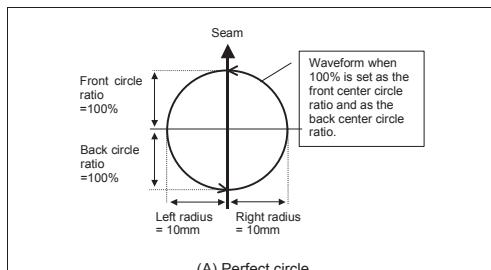
The circle center ratio is set when the arc has been set as the operation pattern. This ratio is for determining the percentage of the advance direction component to be reflected in the arc radius (for determining to what extent the arc is to be distorted).

For instance, if it is assumed that the circle in Fig. (A),

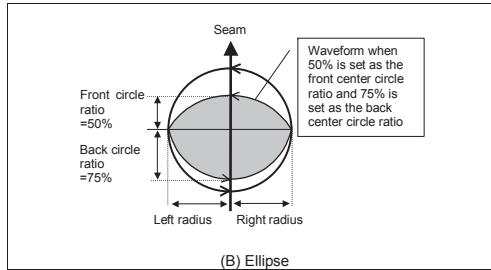
- A left radius and right radius of the same length
- A front circle center ratio and back circle center ratio of 100%

Then the circle will have a perfectly round shape. (Perfect circles are formed in cases where weaving is performed immediately. Normally, they are not formed since the speed component of the advance direction is added.)

The center circle ratio is what determines the extent to which the arcs are to be distorted in the advance direction. The circle shown in Fig.(B) is formed if 50% is set as the front center circle ratio and 75% is set as the back center circle ratio.



(A) Perfect circle



(B) Ellipse

■ Example of screen display

WFP[OFF, 5Hz →] FN440: Fixed pattern weaving

[] shows Condition file number, and Frequency from the left.

See

WAX;Axis weaving (FN441)

WE;Weaving End (FN443)

Application command (FN code)

Command name	WAX
FN code	441
Title name	Axis Weaving
General description	Starts weaving with the simple harmonic motion of the axes.

■ General description

This command enables to start weaving with the simple harmonic motion of the axes.

The robot starts weaving from a position of the movement command taught immediately before this command (WAX).

■ Parameter

AND condition	Setting range
Condition file ID	0 to 999
Frequency	0.0 to 20.0 [Hz]
Stopping time (center, 1/4 period, 3/4 period)	0.0 to 9.9 [sec.]
Move at Stop Time	Not exist/ Exist
Keep weaving time	Not keep / Keep
Axis number	1 to 6
Amplitude (right amplitude, left amplitude)	0.0 to 50.0 [mm]

Condition file ID

"0" is selected if the welding conditions are to be specified directly using numbers; a file number (1 to 999) is selected if they are to be specified by a file.

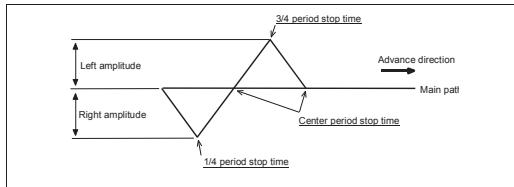
Enter the number and press [Enter]—F11<input value> key. Then, the conditions stored in the previously created condition files are to be called. If you entered the file number not created yet, the initial conditions are to be called. Also, called conditions can be modified. If writing after modification, the modified details are reflected in the files. If newly creating the files, they will be stored in the internal memory.

Frequency

This is the weaving frequency (number of waveforms per second).

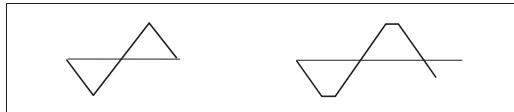
Stopping time

The center stop time, 1/4 period stop time and 3/4 period stop time are set. Deeper penetration can be obtained by setting the stopping time.



Move at Stop Time

This condition is for selecting whether the robot is to move forward in the advance direction or stop during the weaving stop time when weaving stop time has been set. The initial setting is "Not Exist"



Move at stop time : "No"

Move at stop time : "Yes"

Keep weaving time

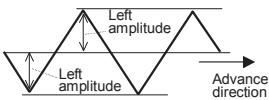
The condition is for setting whether the actual welding time is to be maintained even when the weaving stop time has been set. If the weaving stop time is not set, the condition will be devoid of meaning.

Axis number

This condition specifies the number of the axis which will be used to conduct the weaving.

Amplitude

This condition is for setting the weaving amplitude. Both the left and right amplitudes relative to the advance direction can be set.



■ Example of screen display

WAX[OFF, 5Hz →] FN441:Axis Weaving

[] shows Condition file number, and Frequency from the left.

See

WFP; Fixed Pattern weaving (FN441)

WE; Weaving End (FN443)

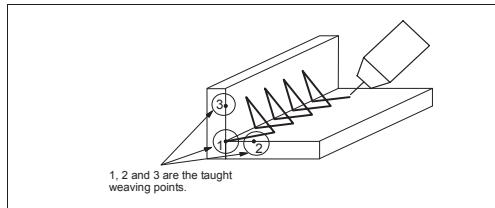
Application command (FN code)

Command name	WSF
FN code	442
Title name	Taught Weaving
General description	This carries out weaving in the taught pattern.

■ General description

Taught weaving (optional) is the weaving operation where points for weaving can be taught according to the groove shape.

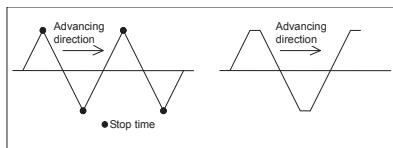
A weaving pattern as shown in the figure below can be created arbitrarily.



As for details of taught weaving, refer to the instruction manual for taught weaving. This help explains its outline.

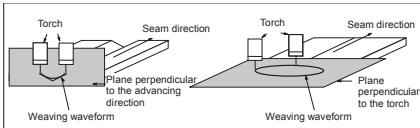
■ Parameter

Condition	Description	Setting range
Weaving condition		
Control of Weaving speed	This sets whether the weaving speed is designated by the frequency or by the speed between points.	Frequency / Point speed
Frequency	This sets the weaving frequency in the case when "Control of Weaving speed" is set to "Frequency".	0.1 to 10.0 [Hz]
Point speed	This sets the speed in the case when "Control of Weaving speed" is set to "Point speed".	1 to 999 [cm/min]
Motion type	This sets whether to loop or repeat between taught points.	Loop / Repeat
Move at Stop Time	This sets whether or not to move the robot in the main track direction during stop time, in the case when stop time is set in teaching point.	Not exist / Exist



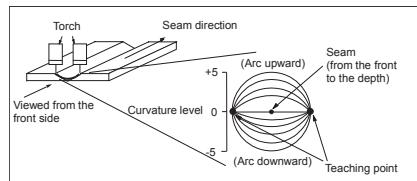
Keep weaving time	This sets whether or not to maintain the actual welding time even in the case where stop time is set in teaching point.	Not keep / Keep
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Condition	Description	Setting range
Weaving plane	<p>This sets "User" when the number of teaching points is 3 points or more. This sets "Advance" or "Torch" when the number of teaching points is 2 points.</p> <p>Advance: The plane perpendicular to the advancing direction is the weaving plane.</p> <p>Torch: The plane perpendicular to the torch direction is the weaving plane.</p>	User / Advance / Torch

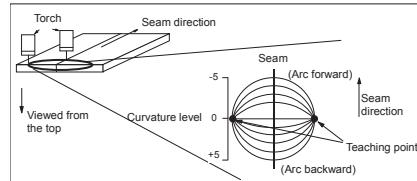


Comment	By [ENABLE] and [EDIT], a comment may be added.	Arbitrary character string
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Parameter at teaching points		
Stopping time	This sets the stop time at each point.	0.0 to 9.9 [sec]
Curvature	<p>Curvature level becomes valid only when the number of teaching points is 2 points, and this sets what a curvature should be drawn. (When the curvature level is 0, a straight line results.)</p> <p>When the number of teaching points is 3 points or more, the torch moves in a straight line between points, so even if this is set, setting is ignored. (Normally, leave it "0".)</p>	-5 to 5



Curvature level when the weaving plane is set to "Advance"



Curvature level when the weaving plane is set to "Torch"

Positional data	This sets the point position and posture with the seam coordinate system as reference.	
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■ Example of screen display

WSF [001, 60cm/min →] Taught Weaving

See

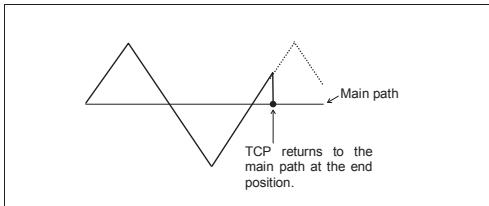
WE, Weaving End (FN443)

Function Commands (FN Codes)

Command name	WE
FN code	443
Title name	Weaving End
General description	Terminates weaving

■ General description

This command is used to end the weaving while it is being executed.
TCP returns to the main path if it is midway through a weaving waveform.



■ Parameters

None

■ Example of screen display

WE [1] FN443:Weaving End

See

WFP; Fixed Pattern weaving (FN440)

WAX; Axis weaving (FN441)

Function commands (FN codes)

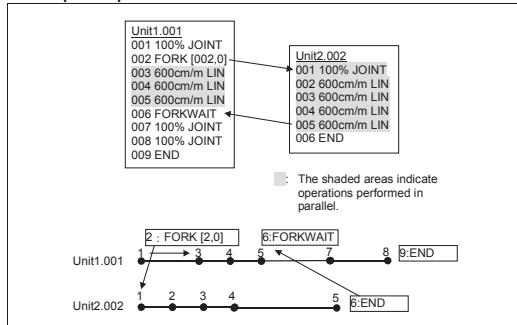
Command name	FORK
FN code	450
Title name	Fork Program
General description	This command is used to start the program of other unit.

■ General description

The specified task program is started up alongside the task program now being played back.

When the FORK command has been taught, teach the FORKWAIT command, which is for awaiting the completion of the FORK command, at the appropriate position whenever this is possible. The FORK and FORKWAIT commands do not always need to be taught as a pair, but it is safer to do so in order to avoid contention for resources and duplicated execution of the FORK command.

■ Example of operation



■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1~9999)
Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (∞ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.

■ Example of screen display

FORK[1,-1] FN450;Fork Program

See

FORKI; Fork Program (FN451)
FORKN; ForkN Program (FN452)
FORKWAIT; Wait Fork-Program (FN453)

Function commands (FN codes)

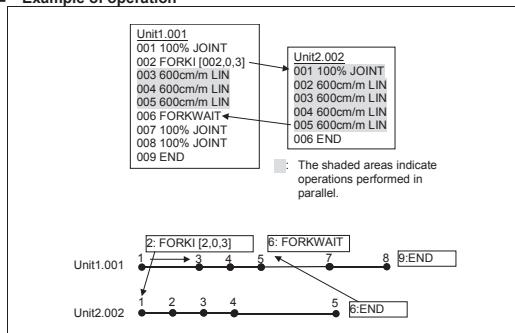
Command name	FORKI
FN code	451
Title name	Forkl Program
General description	Using an input signal, this command is used to start the program of other unit.

■ General description

The specified task program is started up alongside the task program now being played back. This command enables a task program of another unit to be started up when its signal is input. If its signal is not input, the task program is not started up.

When the FORKI command has been taught, teach the FORKWAIT command, which is for awaiting the completion of the FORKI command, at the appropriate position whenever this is possible. The FORKI and FORKWAIT commands do not always need to be taught as a pair, but it is safer to do so in order to avoid contention for resources and duplicated execution of the FORKI command.

■ Example of operation



■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1-9999)
Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (≈ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.
Parameter No.3	Input signal	This is used to specify the number of the input signal which decides whether the program is to be started up. (1~2048, 5001~5064)

■ Example of screen display

FORK[1,-1,I1] FN451; Forkl Program

See

FORK; Fork Program (FN450)
FORKN; ForkN Program (FN452)

FORKWAIT; Wait Fork-Program (FN453)

Function commands (FN codes)

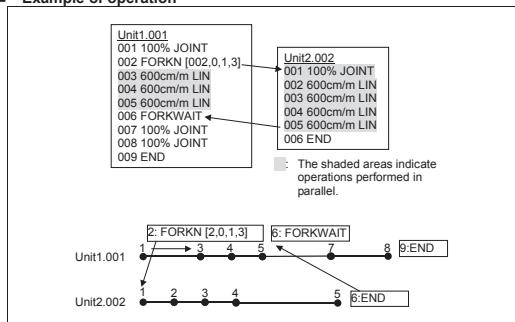
Command name	FORKN
FN code	452
Title name	ForkN Program
General description	Using a pass count (number of the passes), this command is used to start the program of other unit.

■ General description

The specified task program is started up alongside the task program now being played back. This command enables a task program of other unit to be started up when the counter exceeds the specified value. If the counter shows a figure below the specified value, the task program is not started up.

When the FORKI command has been taught, teach the FORKWAIT command, which is for awaiting the completion of the FORKI command, at the appropriate position whenever this is possible. The FORKI and FORKWAIT commands do not always need to be taught as a pair, but it is safer to do so in order to avoid contention for resources and duplicated execution of the FORKI command.

■ Example of operation



■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1-9999)
Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (∞ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.
Parameter No.3	Register number	This is used to specify the number of the count register. (1-200)
Parameter No.4	Count	This is used to specify the number of times (count) for comparing the specified value with the counter value. (0-10000)

■ Example of screen display

FORKN[1,-,V1%,5] FN452; ForkN Program

See

FORK; Fork Program (FN450)
FORKI; Forkl Program (FN451)
FORKWAIT; Wait Fork-Program (FN453)

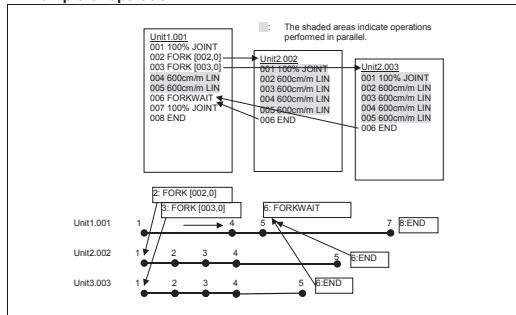
Function commands (FN codes)

Command name	FORKWAIT
FN code	453
Title name	Wait Fork-Program
General description	This command leads the robot to await the completion of the task program of the other unit which was started up by the FORK, FORKI or FORKN command.

■ General description

When the task program specified by the FORK, FORKI or FORKN command has started up, the completion of all the programs being started is awaited.

■ Example of operation



■ Parameter

None

■ Example of screen display

FORKWAIT FN453; Wait Fork-Program

See

FORK; Fork Program (FN450)

FORKI; ForkI Program (FN451)

FORKN; ForkN Program (FN452)

Function commands (FN codes)

Command name	CALLFAR
FN code	454
Title name	CallFar Program
General description	This command is used to call the program of other unit.

■ General description

This command calls a task program of other unit.

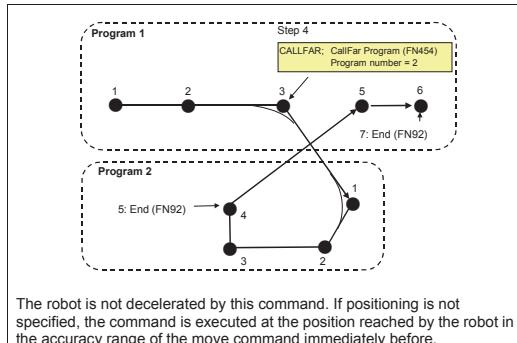
When it is called, the execution of the existing program is suspended, and it is not resumed until the execution of the called program is completed.

The other unit external call cannot be executed by the call destination program. However, programs can be called inside the unit using the CALLP or other such commands in the call destination program (up to 8 levels).

Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the call destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record CALLFAR: Call Far program (FN454) and "2" as the program number. of other unit. When this is played back, the robot skips steps 5 and 6 upon arriving at step 4 and jumps to the first step in program 2. When the playback of program 2 is completed (in the status established by executing the END command), the robot returns to step 5 following the step with the call command of call source program 1.



The robot is not decelerated by this command. If positioning is not specified, the command is executed at the position reached by the robot in the accuracy range of the move command immediately before.

■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1-9999)
Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (∞ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.

■ Example of screen display

CALLFAR[1,-1] FN454; CallFar Program

See

CALLFARI; CallFari Program (FN455)
CALLFARN; CallFarN Program (FN456)

Function commands (FN codes)

Command name	CALLFARI
FN code	455
Title name	CallFari Program
General description	Using an signal, this command is used to call the program of other unit.

■ General description

This command calls a task program of other unit when its signal is input.

When the specified input signal has been input, the robot jumps; when it has not been input, it does not jump and the command is passed by.

When it is called, the execution of the existing program is suspended, and it is not resumed until the execution of the called program is completed.

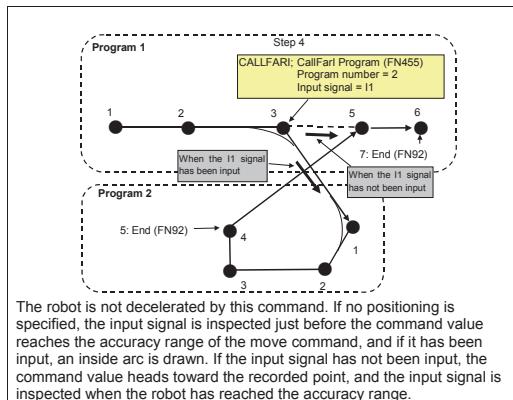
The other unit external call cannot be executed by the call destination program. However, programs can be called inside the unit using the CALLP or other such commands in the call destination program (up to 8 levels).

Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the call destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record CALLFARI: CallFari Program (FN455), "2" as the program number of other unit, and I1 as the input signal.

When this is played back, the robot arrives at step 4, and if input signal I1 has been input, it jumps to the first step in program 2, and when the playback of program 2 is completed (the END command is executed), the robot returns to step 5 following the step with the call command of call source program 1. If the signal has not been input, the robot does not jump to program 2.



■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1-9999)
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Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (∞ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.
Parameter No.3	Input signal	This is used to specify the number of the input signal which decides whether the program is to be started up. (1~2048, 5001~5064)

■ Example of screen display

CALLFARI[1,-1,I1] FN455, CallFari Program

See

CALLFAR; CallFar Program (FN454)

CALLFARN; CallFarN Program (FN456)

Function commands (FN codes)

Command name	CALLFARN
FN code	456
Title name	CallFarN Program
General description	Using a pass count (number of passes), this command is used to call the program of other unit.

■ General description

This command calls a task program of other unit when the counter shows a figure above the specified value. If the counter shows a figure below the specified value, the task program is not started up.

The robot passes for the specified number of passes, and on the next time (specified number of passes +1) the call command is executed. (For instance, if "2" is specified as the number of passes, the robot passes twice, and on the third time the call command is executed.)

When it is called, the execution of the existing program is suspended, and it is not resumed until the execution of the called program is completed.

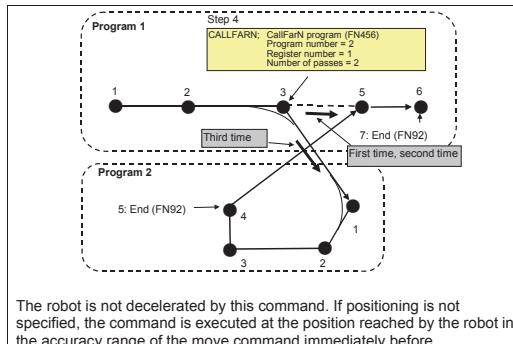
The other unit external call cannot be executed by the call destination program. However, programs can be called inside the unit using the CALLP or other such commands in the call destination program (up to 8 levels).

Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the call destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record CALLFARN: CallFarN program (FN456), "2" as the program number of other unit, "1" as the register number, and "2" as the number of passes.

When this is played back, the robot passes for the first and second times, and then advances to steps 5; however, on the third time, it jumps to the first step in program 2. When the playback of program 2 is completed (the END command is executed), the robot returns to step 5 following the step with the call command of call source program 1.



The robot is not decelerated by this command. If positioning is not specified, the command is executed at the position reached by the robot in the accuracy range of the move command immediately before.

■ Parameter

Parameter No.1	Number of Program	This is used to specify the number of the program to be started. (1-9999)
Parameter No.2	Resource contention wait time	In a case where the mechanism used inside the program to be started may be played back by the other unit, this parameter is used to specify in seconds how long to wait for that mechanism to be released. (∞ (-1), 0~100) If the mechanism is released within the specified time, the specified program is called. If it is not released, an error results.

Parameter No.3	Register number	This is used to specify the number of the count register. (1-200)
Parameter No.4	Count	This is used to specify the number of times (count) for comparing the specified value with the counter value. (0-10000)

■ Example of screen display

CALLFARN[1,-1,V1%,5] FN456; CallFarN Program

See

CALLFAR: CallFar Program (FN454)

CALLFARI: CallFarI Program (FN455)

Function commands (FN codes)

Command name	USRERR
FN code	467
Title name	User Error Output
General description	Output the user customized error

■ General description

When this function is played, this can output the user error (or alarm or information) that is defined in Service / 25.Root Diagnosis / 6.User error definition. Total 997 errors (or alarm or information) can be defined.

Error	Playback aborted, and motor power OFF.
Alarm	Playback aborted, but motor power is still ON.
Information	Playback continued.

■ Example of operation

When this function is played, this can output the user error (or alarm or information). If designated error is not defined, default error is detected.

■ Parameter

Parameter No. 1	Error code	This specifies the error number to be happened in recorded step. (7003-7999)
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■ Example of screen display

USRERR[7003] FN467: User error
USRERR[7004] FN467: User alarm
USRERR[7005] FN467: User information

User error definition screen

User Error	
Failure code	7003
Input Signal	0
Failure type	<input checked="" type="radio"/> Error <input type="radio"/> Alarm <input type="radio"/> Information
Failure message	User failure.
Failure content	User failure.
Measures	Please carry out "failure-reset".

Please input the edited failure code. [7001 – 7099]

Refer Copy Paste Up Down Delete Complete

Application command (FN code)

Command name	SF0
FN code	470
Title name	Wire Extension
General description	This detects and corrects the wire extension. ※This is used when the touch sensor is connected.

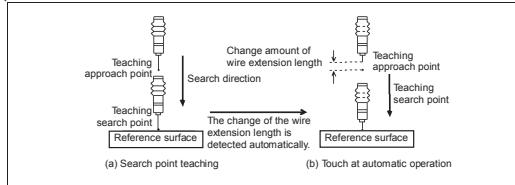
■ General description

SF0 is the command to detect the wire extension so that the search motions and deviation detection of SF1 and SF2 should be carried out correctly. By this command, for example, even if the wire extension length changes, it is possible to limit mistake in detection or deviation caused by that to minimum.

As for details on the respective functions, teach examples and so forth of the touch sensor, refer to the instruction manual for the touch sensor. This help explains its outline.

■ Example of operation

When SF0 is executed, deviation between the search point at teaching and the touch point detected during automatic operation is detected.

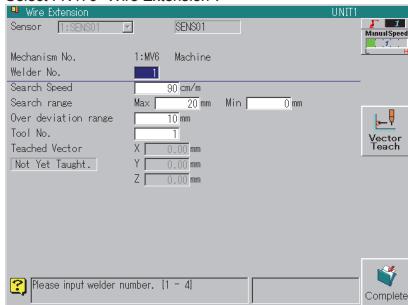


In SF1 and SF2 after SF0, the wire top positions are corrected so as to be always constant.

As for the correction of SF0, until welding is executed, the search command and the motion command just before it is corrected automatically.

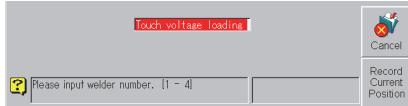
■ SF0 Teaching Method

- (1) Select FN470 "Wire Extension".



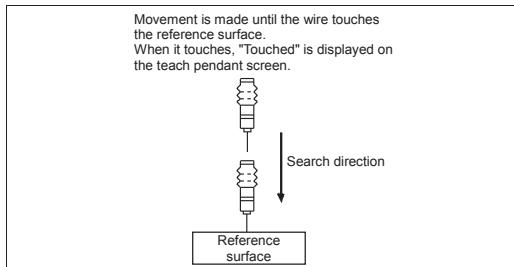
- (2) Set the required parameters (described in the following).

- (3) Select f9 <Vector Teach>.



 Warning	During teaching of search vectors, voltage of DC50V is impressed. Do not touch the wire or electricity conductive portions, otherwise electric shock may result.
--------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(4) By manual operation, movements are made until the wire touches the reference surface.



(5) When the wire touches, select f12 <Record Current Position>, and record the reference position.

(6) Press f12 <Complete> and record SF0.

■ Parameter

Parameter name	Details	Range
Sensor	This selects the sensor to become a teach objective in the case where plural sensors are connected.	
Mechanism No.	The mechanism number to use the sensor is displayed. This cannot be edited.	—
Welder No.	This sets the welding machine number.	1 to 4
Search Speed	This is the speed of search motions at playback. When the search speed is increased, the tact time is shortened, but the detection precision decreases, and coasting amount after touching increases. (The wire may be bent.) Set around 60cm/min (10mm/sec) as a standard amount. Set an appropriate search speed according to your purpose.	6 to 360 [cm/min]
Search range (Max.)	This sets the maximum searching distance so as to detect the search idle run at execution of SF0. When after start of search, touch is not detected in motions on set distance from the reference position, a failure is detected.	0.0 to 999.9 [mm]
Search range (Min.)	This sets the minimum searching distance so as to detect that the wire has already touched at execution of SF0. When after start of search, touch is detected in motions on set distance, a failure is detected.	0.0 to 999.9 [mm]
Over deviation range	This sets the allowable range of wire extension deviation detected by SF0. When the wire extension deviation after touch detection is larger than the set value, a failure is detected.	0.0 to 999.9 [mm]
Tool No.	This sets the tool number.	1 to 32
Taught Vector	When search vectors are taught, the value is set. The value cannot be edited.	—

■ Example of screen display

SFO [150cm/m, M1]

FN470:Wire Extension

Application command (FN code)

Command name	SF1
FN code	471
Title name	One Direction Search (Touch)
General description	This detects the setting deviation of a workpiece. ※This is used when the touch sensor (AX-WD) is connected.

■ General description

SF1 is the command that detects the deviation of a workpiece from the positional difference between the search point at teaching and the touch point at automatic operation, and records it to the deviation correction file.

- The deviation of a workpiece to be detected by SF1 is in one direction. When a workpiece displaces in 3 dimensional manners, carry out SF1 in 3 directions.
- Only by executing SF1, the deviation of a workpiece cannot be corrected. To correct the deviation, teaching of SF3 (receiving deviation amount) is necessary.
- In SF1, there are the following 2 methods.
 - Search motion to move the torch attached to manipulator
 - Search motion to rotate or slide the external axis, while keeping the torch standstill.

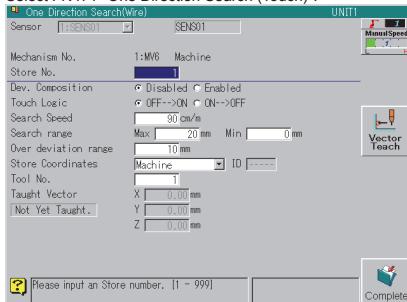
The latter method is specially called "external axis search".

The external axis search is available whether the external axis is a slider or a positioner. (However, it is not available in other case than the robot's external axis.) And it is available in both the control methods (coordinate control and simultaneous control).

As for details on the respective functions, teaching examples and so forth of the touch sensor (AX-WD), refer to the instruction manual for the touch sensor. This help explains its outline.

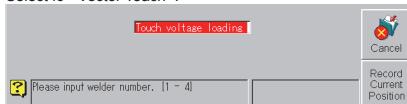
■ SF1 Teach Method

- Select the mechanism for search motions as the manual operation mechanism.
- Select FN471 "One Direction Search (Touch)".



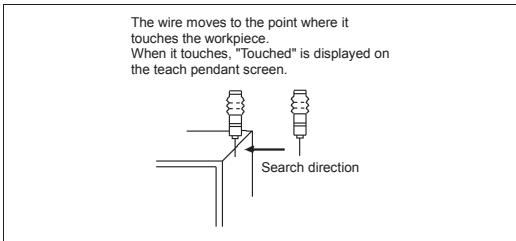
- Set the required parameters (described in the following).

- Select f9 <Vector Teach>.



During teaching of search vectors, voltage of DC50V is impressed. Do not touch the wire or electricity conductive portions, otherwise electric shock may result.

(5) By manual operation, movements are made until the wire touches the reference surface.



(6) When the wire touches, select f12 <Record Current Position>, and record the reference position.

(7) Press f12 <Complete> and record SF1.

■ Parameter

Parameter name	Details	Range
Sensor	This selects the sensor to become a teach objective in the case where plural sensors are connected.	—
Mechanism No.	The manual operation mechanism at the moment when a command is selected is selected as the mechanism to carry out search motions, and is displayed here. When the manipulator is selected, it becomes the one direction search, and when the external axis is selected, it becomes the external axis search. Editing is not available, so if a wrong mechanism is displayed, exit teaching by reset once, and newly select the correct mechanism and select the command once again.	—
Store No.	This sets the number of deviation length detected by SF1. Detected deviation is stored per number. Stored deviation can be received by SF3 command.	1 to 999
Dev. composition	When deviation has been already stored by the same store number, when the deviation composition is set to "ON", the detected deviation and the already stored deviation can be composed. When the deviation composition is set to "OFF", the detected deviation is overwritten.	Disabled/ Enabled
Touch Logic	This designates the logic of touch detection. This judges the touch detection from changes from the wire off status to the wire touch status by "OFF → ON", while from the wire touch status to the wire off status by "ON → OFF".	OFF → ON/ ON → OFF
Search Speed	This is the speed of search motions at playback. When the search speed is increased, the tact time is shortened, but the detection precision decreases, and coasting amount after touching increases. (The wire may be bent.) Set around 60cm/min (10mm/sec) as a standard amount. Set an appropriate search speed according to your purpose.	Manipulator: 6 to 360 [cm/min]
Search range (Max.)	This sets the maximum searching distance so as to detect the search idle run at execution of SF1.	External axis: 1-100[%] Manipulator: 0.0 to 999.9 [mm]

	When after start of search, touch is not detected in motions on set distance from the reference position, a failure is detected.	Slider: 0.0 to 9999.9 [mm] Positioner: 0.0 to 90.0 [deg]
Search range (Min.)	This sets the minimum searching distance so as to detect that the wire has already touched at execution of SF1. When after start of search, touch is detected in motions on set distance, a failure is detected.	Manipulator: 0.0 to 999.9 [mm] Slider: 0.0 to 9999.9 [mm] Positioner: 0.0 to 90.0 [deg]
Over deviation range	This sets the allowable range of wire extension deviation detected by SF1. When the wire extension deviation after touch detection is larger than the set value, a failure is detected.	Manipulator: 0.0 to 999.9 [mm] Slider: 0.0 to 9999.9 [mm] Positioner: 0.0 to 90.0 [deg]
Store Coordinates	This designates the coordinate system to store the deviation. In the list box, coordinate systems that can be selected are displayed, so select one. At the external axis search, it is fixed to each axis coordinate system.	Manipulator: Machine/ Tool/ Other External axis: Axis
Tool No.	This sets the tool number.	1 to 32
Taught Vector	When search vectors are taught, the value is set. The value cannot be edited.	—

■ Example of screen display

SF1[150cm/m, No.1, M1] FN471:One Direction Search (Touch)

Parameters displayed on the screen shows "Search Speed", "Store No.", and "Mechanism No." from the left.

See

SF3; Deviation call (FN473)

SF4; Dev. vector composition (FN474)

Application command (FN code)

Command name	SF3
FN code	473
Title name	Deviation call
General description	<p>Specifies the Start/End of the deviation call. When specifying the deviation call start, the playback position can be shifted by the shift amount stored in the designated deviation correction file.</p> <p>Also, it enables to directly specify the shift amount instead of the deviation correction file (shift function by numeric input).</p>

■ General description

When the target workpieces are installed in deviated positions, it is not possible to obtain the expected result of welding performance even if playing back the recorded position of robot program.

Use of this function command enables to perform playback with shifting the position based on the deviation amount stored in the deviation correction file when playing back the MOVE command.

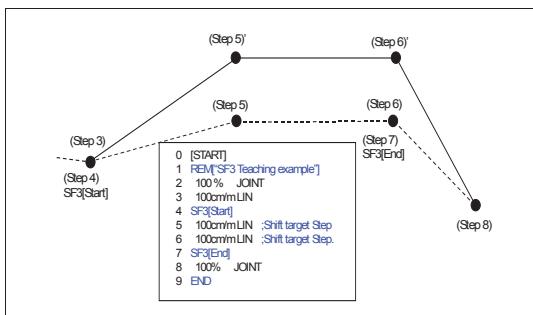
Before using this command, it is necessary to store the positional deviation of installed workpiece in the "Deviation correction file" with SF1<FN471>"One direction search" and so on.

If the shift amount of robot has been clear, it is not necessary to create the deviation correction file. It is available to directly specify the shift amount to the parameter for this command (shift function by numeric input).

■ Example of operation

SF3 is a section command. Record the SF3[Start] right before the position to start shifting as shown in the figure (Step5), and SF3[End] right after the position to end shifting (Step6).

Playing back, the robot reads into the shift amount specified by SF3[Start] (deviation correction file or numeric input value) and moves to the shifted target position (Step5') in the next step (Step5). Afterwards, it continues the shifting status to the step right before SF3[End] (Step6'), and heads for the target position of no-shifting (Step8) in the next step of SF3[End]. (Shifted to the full-line trajectory in the following figure.)



i SF3 enables to correct the MOVE command (LIN/CIR/JPOINT) and sensor command to perform searching motion (SF1/SF2/ZF1/ZF2/ZG1/ZF/ZJ/ZT/ZJLETP).

i The deviation store command (SF1/SF2/ZF1/ZF2/ZG1/ZF/ZJ/ZT) stores the positional deviation in the deviation correction file but not the postural deviation. Therefore, only the position is corrected when calling the deviation correction file by SF3; the torch posture remains the same.

i Deviation call is available only between the same type of mechanism. For instance, it is not possible for the manipulator to call the deviation stored by positioner.

i Each mechanism can specify the deviation call section. Be sure the range of reflection for each deviation before use.

Be sure that the deviation is called in the coordinates where it is stored by. Especially as for deviation correction files, those stored in a variety of mechanisms have been mixed. For example, if calling a wrong deviation number, it may happen to receive the deviation stored by the neighboring manipulator.

If calling a deviation in the deviation correction file created by another unit, the coordinates where it is stored may not be existing. In that case, note that the deviation call may not be carried out (moving toward the teaching point).

In one section, the amount of deviation to call per mechanism is one. If simultaneously reflecting (calling) two or more searching results, compose them into one in advance with SF4 command.

In check GO operation, shifting may not be executed even if in the SF3 section depending on the setting conditions of sensor constants. (If the setting in <Constant Setting> - [19 Sensor Application] - [3 Constant of sensor] - [1 Common] - [1 Common to all sensors] - "Dev call on check go operation" is "OFF", no shifting is executed.)

In check BACK operation, no shifting is executed even if during SF3 section.

When F key<Sensor Trial> is ON, no shifting is executed even if during SF3 section.

Shift function by numeric input is available only when the manipulator is selected in the target mechanism.

Do not use the shift function by numeric input for the sensor command (SF1/ SF2/ SF5/ ZF1/ ZF2/ ZG1/ ET/ ZF/ ZT/ ZE/ ZJ) that stores the deviation amount.

■ Parameter

Parameter name	Details	Range
Mechanism No.	Specifies the mechanism No. where there are two or more mechanisms in a unit.	1 to 9
SF3 Section	Selects "Start" or "End" of the SF3 section. Also it is possible to batch end the "Start" of all mechanisms by selecting "All End".	Start/ End/ All End
Shift method ※ At the time of Section start	Selects the method of specifying the shift amount. For manipulator, it is possible to directly specify it (by numeric input/ manual operation).	Dev.file/ Numerical/ Manual
Call No. ※ When specifying DEV file	Specifies the file number in designating the shift amount by DEV file (deviation correction file).	1 to 999
Posture calling	Selects whether to call the postural deviation. i Select "Disabled" when the "Shift method" is set Dev. file. i Select "Disabled" if also teaching the deviation store command in the SF3 section.	Disabled/ Enabled
Base coordinate system ※ When specifying numerical input	Selects a type of base coordinates for the parallel shift amount of manipulator.	Machine/ Tool/ World/ Work/ User

Direction offset/ Shift distance	X	By DEV file This is used when adding the offset value further to the deviation in DEV file. By Numerical input This is used to set the parallel shift amount of manipulator. By Manual operation	Manipulator: [-99.9 to 99.9mm] Slider: [-9999.9 to 9999.9mm] Positioner: [-90.0 to 90.0deg]
Direction offset/ Shift distance	Y	The parallel shift amount can be automatically input by manual operation of the manipulator.	
Direction offset/ Shift distance	Z		
Rotation shift distance ※When posture calling is enabled by specifying numerical input	r	Specifies the rotation shift amount around the Z axis of the manipulator on tool coordinates.	-99.9 to 99.9deg

■ Example of screen display

(1) Section Start of "DEV.file" specification

SF3[No. 1. Start, M1 →] FN473:Deviation call

The parameter displayed on the screen shows "Store No.", "Section Start/End", and "Shift target mechanism No." from the left.

(2) Section Start of "Numerical" specification

SF3[M1. Machine, X=-99.9, Y=-88.8, Z=-77.7, r=-66.6 →]

The parameter shows "Shift target mechanism No.", "Base coordinates", and "Shift amount" from the left.

(3) Section End, All End

SF3[End, M1 →] FN473:Deviation call

SF3[A11 End →] FN473:Deviation call

See

Deviation Store:

SF1;One Direction Search(Touch)	FN471
SF2;Pattern Search(Touch)	FN472
SF5;Store of tracking deviation	FN475
ZF1;One Direction Search(Laser)	FN480
ZF2;Pattern Search(Laser)	FN481
ZG1;High-speed groove search	FN483
ET;End tracking	FN485
ZF;Start Point Detection	FN489
ZT;Start Laser Sensor Tracking	FN490
ZE;End Laser Sensor Tracking	FN492
ZJ;Groove Point Detection	FN495

Others:

SF4; Dev. vector composition	FN474
SF8;Generation of a DEV.file	FN478
ZJLETP;Groove Point Detection pose variable output	FN727

Function commands (FN codes)

Command name	SF4
FN code	474
Title name	Dev. vector composition
General description	This calculates a new deviation on the basis of stored deviation. * This is used when the touch sensor (AX-WD) and the laser search (AX-RD) are connected.

■ General description

In SF4, a new deviation is calculated on the basis of stored deviation. And at the same time, by receiving this deviation, positions may be corrected.

As for details on the respective functions, teach examples and so forth of the touch sensor (AX-WD), and the laser search (AX-RD), refer to the respective instruction manuals. This help explains its outline.

■ Parameter

Parameter name	Description	Range
DEV file 1 No.	This designates the number of the DEV file 1 to calculate the deviation.	1 ~ 999
DEV file 1 Rate	This designates the composition ratio of the DEV file 1 to calculate the deviation.	-100 ~ 100 [%]
DEV file 2 No.	This designates the number of the DEV file 2 to calculate the deviation.	1 ~ 999
DEV file 2 Rate	This designates the composition ratio of the DEV file 2 to calculate the deviation.	-100 ~ 100 [%]
DEV file 3 No.	This designates the number of the DEV file 3 to calculate the deviation.	1 ~ 999
DEV file 3 Rate	This designates the composition ratio of the DEV file 3 to calculate the deviation.	-100 ~ 100 [%]
Dev. storage No.	This select start / end / all end of SF3 section.	1 ~ 999

SF4 is calculated on the basis of the above parameters by the following equation.

Deviation to be calculated (stored)

$$= (\text{DEV file 1} \times \text{Rate 1}) + (\text{DEV file 2} \times \text{Rate 2}) + (\text{DEV file 3} \times \text{Rate 3})$$

■ Example of screen display

SF4[001,002,003,No.004] FN474:Dev.vector composition

Parameters displayed on the screen show "DEV file 1 No.", "DEV file 2 No.", "DEV file 3 No.", and "Store No." from the left.

See

When using the touch sensor:

SF1; One Direction Search (Touch) (FN471)
SF3; Deviation call (FN473)

When using the laser search:

ZF1; One Direction Search (Laser) (FN480)
SF3; Deviation call (FN473)

Application command (FN code)

Command name	SF9
FN code	479
Title name	Generation of a GAP file
General description	This stores variable values to a gap file. ※This is used when the touch sensor (AX-WD) and the laser search (AX-RD) are connected.

■ General description

By use of this function command, the values of designated actual variables (global actual numbers, local actual numbers) can be stored into a gap file (GAP***) as gap values. In the case when there is not a gap file, one is newly created and gap values are stored into it.

And gap values designated from gap file to variables can be obtained.

Thereby, in the case where there is restriction in available "gap file" or 3 gap values or more are to be composed, gap values can be saved to variables (and can be composed by calculation by register), accordingly more gap values can be handled.

As for details on the respective functions, teach examples and so forth of the touch sensor (AX-WD), and the laser search (AX-RD), refer to the respective instruction manuals. This help explains its outline.

■ Parameter

Parameter name	Details	Range
Storing direction	This designates the method (storage direction) to handle generated gap value.	Register→File/ File→Register
Register Kind	This designates the kind of actual variable to store gap value.	Local variable/ Global variable
Register No.	This designates the number of actual variable to store gap value.	1 to 200
GAP file No.	This designates the number of a gap file to store gap value.	1 to 999
Data kind	This designates the kind of data to be obtained.	Root Gap/ Gap Depth/ Gap Angle 1/ Gap Angle 2

■ Example of screen display

SF9[R->F,G001,GAP001] FN479:Generation of a GAP file

See

SF1; One Direction Search (Touch) (FN471)

SF3; Deviation call (FN473)

Application command (FN code)

Command name	ZF1
FN code	480
Title name	One Direction Search (Laser)
General description	This detects the setting deviation of a workpiece. ※This is used when the laser search (AX-RD) is connected.

■ General description

ZF1 is the command that detects the deviation of a workpiece from the positional difference between the search point at teaching and the touch point at automatic operation, and records it to the deviation correction file.

- The deviation of a workpiece to be detected by ZF1 is in one direction. When a workpiece displaces in 3 dimensional manners, carry out ZF1 in 3 directions.
- Only by executing ZF1, the deviation of a workpiece cannot be corrected. To correct the deviation, teaching of SF3 (receiving deviation amount) is necessary.
- In ZF1, there are the following 2 methods.
 - Search motion to move the manipulator
 - Search motion to rotate or slide the external axis, while keeping the manipulator standstill.

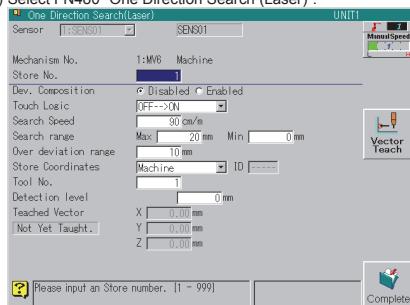
The latter method is specially called "external axis search".

The external axis search is available whether the external axis is a slider or a positioner. (However, it is not available in other case than the robot's external axis.) And it is available in both the control methods (coordinate control and simultaneous control).

As for details on the respective functions, teach examples and so forth of the laser search, refer to the instruction manual for the laser search. This help explains its outline.

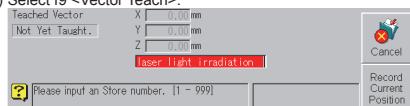
■ ZF1 Teach Method

- Select the mechanism for search motions as the manual operation mechanism.
- Select FN480 "One Direction Search (Laser)".

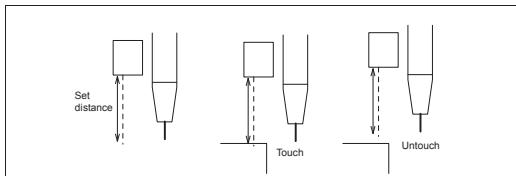


- (3) Set the required parameters (described in the following).

- (4) Select f9 <Vector Teach>.



- (5) By manual operation, movements are made until the wire touches the reference surface.



- (6) When the wire touches, select f12 <Record Current Position>, and record the reference position.
 (7) Press f12 <Complete> and record ZF1.

■ Parameter

Parameter name	Details	Range
Sensor	This selects the sensor to become a teach objective in the case where plural sensors are connected.	—
Mechanism No.	The manual operation mechanism at the moment when a command is selected is selected as the mechanism to carry out search motions, and is displayed here. When the manipulator is selected, it becomes the one direction search, and when the external axis is selected, it becomes the external axis search. Editing is not available, so if a wrong mechanism is displayed, exit teaching by reset once, and newly select the correct mechanism and select the command once again.	—
Store No.	This sets the number of deviation length detected by ZF1. Detected deviation is stored per number. Stored deviation can be received by SF3 command.	1 to 999
Dev. composition	When deviation has been already stored by the same store number, when the deviation composition is set to "ON", the detected deviation and the already stored deviation can be composed. When the deviation composition is set to "OFF", the detected deviation is overwritten.	Disabled/ Enabled
Touch Logic	This designates the logic of touch detection. This judges the touch detection from changes from the wire off status to the wire touch status by "OFF → ON", while from the wire touch status to the wire off status by "ON → OFF".	OFF→ON/ ON→OFF
Search Speed	When the search speed is increased, the tact time is shortened, but the detection precision declines. Set an appropriate search speed according to your purpose.	Manipulator: 6 to 360 [cm/min] External axis: 1-100[%]
Search range (Max.)	This sets the maximum searching distance so as to detect the search idle run at execution of ZF1. When after start of search, touch is not detected in motions on set distance from the reference position, a failure is detected.	Manipulator: 0 to 999 [mm] Slider: 0 to 9999 [mm] Positioner: 0 to 360 [deg]

Search range (Min.)	This sets the minimum searching distance so as to detect laser touch is already made at execution of ZF1. When after start of search, touch is detected in motions on set distance, a failure is detected.	Manipulator: 0 to 999 [mm] Slider: 0 to 9999 [mm] Positioner: 0 to 360 [deg]
Over deviation range	This sets the allowable range of wire extension deviation detected by ZF1. When the wire extension deviation after touch detection is larger than the set value, a failure is detected.	Manipulator: 0 to 999 [mm] Slider: 0 to 9999 [mm] Positioner: 0 to 360 [deg]
Store Coordinates	This designates the coordinate system to store the deviation. In the list box, coordinate systems that can be selected are displayed, so select one. At the external axis search, it is fixed to each axis coordinate system.	Manipulator: Machine/ Tool/ Other External axis: Axis
Tool No.	This sets the tool number.	1 to 32
Detecting level	This sets the reference distance for touch detection. From the sensor nozzle 176mm → reference distance 0mm 276mm → reference distance 100mm. Normally, the height of the tool top becomes same as that of the reference distance 0mm.	0 to 99
Taught Vector	When search vectors are taught, the value is set. The value cannot be edited.	—

■ Example of screen display

ZF1[90cm/m, No. 1, M1] FN471: One Direction Search (Laser)

Parameters displayed on the screen shows "Search Speed", "Store No.", and "Mechanism No." from the left.

See

SF3; Deviation call (FN473)

SF4; Dev. vector composition (FN474)

Application command (FN code)

Command name	ZG1
FN code	483
Title name	High-speed groove search
General description	This searches the groove information at high speed. ※This is used when the laser search (AX-RD) is connected.

■ General description

This carries out a search motion crossing the groove (seam) once, and obtains the groove (seam) shape, and searches the welding position by simple image processing method, and detects deviation from teaching of the welding portion.

As for details on the respective functions, teach examples and so forth of the laser search (AX-RD), refer to the instruction manual for the laser search. This help explains its outline.

■ Parameter

Parameter name	Details	Range
Sensor	This selects the sensor to become a teach objective in the case where plural sensors are connected.	—
Mechanism No.	The manual operation mechanism at the moment when a command is selected is selected as the mechanism to carry out search motions, and is displayed here. When the manipulator is selected, it becomes the one direction search, and when the external axis is selected, it becomes the external axis search. Editing is not available, so if a wrong mechanism is displayed, exit teaching by reset once, and newly select the correct mechanism and select the command once again.	—
File Number DEV	This sets the number of deviation detected by ZG1. Detected deviation is stored per number. Stored deviation can be received by SF3 command.	1 to 999
File Number GAP	This sets the number of the gap value detected by ZG1.	1 to 999
File Number GFF	This sets the number of the GFF file (image processing parameter file) to be used.	1 to 999
Search Speed	When the search speed is increased, the tact time is shortened, but the detection precision declines. Set an appropriate search speed according to your purpose.	Manipulator: 6 to 360 [cm/min] External axis: 1-100[%]
Store Coordinates	This designates the coordinate system to store the deviation. In the list box, coordinate systems that can be selected are displayed, so select one. At the external axis search, it is fixed to each axis coordinate system.	Manipulator: Machine/ Tool/ Other External axis: Axis
Tool No.	This sets the tool number.	1 to 32

Dev. composition	When deviation has been already stored by the same store number, when the deviation composition is set to "ON", the detected deviation and the already stored deviation can be composed. When the deviation composition is set to "OFF", the detected deviation is overwritten.	Disabled/ Enabled															
Auto modify	<p>In the trial operation of the soft key, if the trial operation is selected to ON, trial operation mode gets in. However, in the section where this parameter is set to OFF, acquisition of the reference position is not carried out (trial operation is not carried out), and normal deviation detection mode gets in.</p> <p>Speaking reversely, only the section where this parameter is set to ON become the objective for reference position acquisition.</p> <p>The above contents are summarized as shown below.</p> <table border="1"> <thead> <tr> <th>Automatic correction setting</th> <th>Trial operation setting</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>OFF (Not designated)</td> <td>OFF</td> <td>Deviation detection motion (normal motion)</td> </tr> <tr> <td>OFF (Not designated)</td> <td>ON</td> <td>Deviation detection motion (without deviation detection)</td> </tr> <tr> <td>ON (Designated)</td> <td>OFF</td> <td>Deviation detection motion (normal motion)</td> </tr> <tr> <td>ON (Designated)</td> <td>ON</td> <td>Reference position acquisition motion (without deviation detection)</td> </tr> </tbody> </table>	Automatic correction setting	Trial operation setting	Result	OFF (Not designated)	OFF	Deviation detection motion (normal motion)	OFF (Not designated)	ON	Deviation detection motion (without deviation detection)	ON (Designated)	OFF	Deviation detection motion (normal motion)	ON (Designated)	ON	Reference position acquisition motion (without deviation detection)	ON/OFF
Automatic correction setting	Trial operation setting	Result															
OFF (Not designated)	OFF	Deviation detection motion (normal motion)															
OFF (Not designated)	ON	Deviation detection motion (without deviation detection)															
ON (Designated)	OFF	Deviation detection motion (normal motion)															
ON (Designated)	ON	Reference position acquisition motion (without deviation detection)															
Stable waiting time	This sets the stability waiting time at distance measurement.	0.3 to 9.9 [sec]															
Vertical Distance Base Horizontal Distance Base	<p>This is the position to be the reference of deviation store. Coordinates of the reference position are displayed, which can be confirmed easily.</p> <ul style="list-style-type: none"> The reference position cannot be registered by teaching. Be sure to execute trial operation to register it. When correction is erroneous, by checking the reference position, it may be easy to specify the problem. 																
Over deviation range	This sets the allowable range of wire extension deviation detected by ZG1. When the wire extension deviation after touch detection is larger than the set value, a failure is detected.	<table border="1"> <tr> <td>Manipulator: 0 to 999 [mm]</td> </tr> <tr> <td>Slider: 0 to 9999 [mm]</td> </tr> <tr> <td>Positioner: 0 to 360 [deg]</td> </tr> </table>	Manipulator: 0 to 999 [mm]	Slider: 0 to 9999 [mm]	Positioner: 0 to 360 [deg]												
Manipulator: 0 to 999 [mm]																	
Slider: 0 to 9999 [mm]																	
Positioner: 0 to 360 [deg]																	
Max. Gap value	This parameter is the one to be used in the image processing portion. This sets the maximum expected gap value. Designate the maximum value and the minimum value of the gap value obtained as the result of image processing by the parameter "gap watch value".	0.0 to 99.9 [mm]															
Min. Depth value	This sets the minimum depth value to be used in the process of image processing. As same as the above "maximum gap value", this may be used or not according	0.0 to 99.9 [mm]															

	to applicable shapes.	
Gap watch range (Max.)	When the gap value detected in the image processing exceeds the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-999 to 999 [mm]
Gap watch range (Min.)	When the gap value detected in the image processing is below the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-999 to 999 [mm]
Groove depth range (Max.)	When the groove depth detected in the image processing exceeds the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-999 to 999 [mm]
Groove depth range (Min.)	When the groove depth detected in the image processing is below the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-999 to 999 [mm]
Groove angle 1 range (Max.)	When the groove angle 1 detected in the image processing exceeds the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-360 to 360 [deg]
Groove angle 1 range (Min.)	When the groove angle 1 detected in the image processing is below the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-360 to 360 [deg]
Groove angle 2 range (Max.)	When the groove angle 2 detected in the image processing exceeds the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-360 to 360 [deg]
Groove angle 2 range (Min.)	When the groove angle 2 detected in the image processing is below the value of this parameter, it is judged as a failure. As for the troubleshooting, designation can be made by sensor constant.	-360 to 360 [deg]
Allowable arc dev	This parameter is the one to designate the allowable deviation at circular detection, to be used in the process of image processing. As same as the above "maximum gap value", this may be used or not according to applicable shapes.	0 to 100 [%]

■ Example of screen display

ZGI [DEV001, GAP002, 90cm/n] FN483: High-speed groove search

Parameters displayed on the screen show "DEV file No.", "GAP file No.", and "Search speed" from the left.

See

SF3; Deviation call (FN473)

SF4; Dev. vector composition (FN474)

Function commands (FN codes)

Command name	ST
FN code	485
Title name	Start Tracking
General description	This starts seam tracking. *This is used when arc sensor (AX-AR/AX-AR2) or TIG arc sensor (AX-TR/AX-TR2) is connected.

■ General description

ST is the start command of seam tracking.

In tracking section, it detects the workpiece deviation while welding, and corrects taught seam.

- Teach the move command in tracking section by linear interpolation (LIN) or circular interpolation (CIR).
- Teach ST in the following section.
Arc Sensor: Welding section and weaving section.
TIG Arc Sensor: Welding section
- Deviation stored by ET, SF4, and SF5 is data of the designated coordinate system. In the case to shift a task program including motion commands of different coordinate systems, shift may not be available by the coordinate system to be the reference or shift may be made in unexpected direction, which please note.

■ Parameter

Parameter name	Description	Range
Sample data No.	This is the parameter necessary for the arc sensor, and the basic data to set the values to be used in common according to mainly joint kinds and so forth.	1 ~ 50
Chasing sensitivity (Horizontal)	<p><Arc Sensor> This sets the speed to correct the detected deviation. 1 (slow) → 5 (fast)</p> <p>When 0 is set here, correction is not carried out.</p> <p>When the chasing speed is fast, position is corrected fast to deviation occurrence, but when it is too fast, bead snakes by seam tracking becomes conspicuous. On the contrary, when the chasing speed is slow, bead snaking decreases and becomes near taught track, but large deviation may not be corrected. In the arc sensor, current deviation is detected, and reflected to positions after that, so in the case of a workpiece with a large rotation deviation, tool center may see offset. To make the status as small as possible, it is necessary to set the left and right chasing speed large.</p> <p><TIG Arc Sensor> Set 0 here.</p>	0 ~ 5
Chasing sensitivity (Vertical)	<p>This sets the speed to correct the detected deviation. 1 (slow) → 5 (fast)</p> <p>When 0 is set here, correction is not carried out.</p> <p>When the chasing speed is fast, position is corrected fast to deviation occurrence, but when it is too fast, changes of extension by seam tracking becomes conspicuous.</p> <p>On the contrary, when the chasing speed is slow, extension changes from the desired value (changes of extension cannot be corrected).</p>	0 ~ 5

Offset (Horizontal)	<Arc Sensor> This sets the offset amount to the detected deviation. <TIG Arc Sensor> Set 0 here.	-9.999 ~ 9.999 [mm]
Offset (Vertical)	This sets the offset amount to the detected deviation.	-9.999 ~ 9.999 [mm]
Chasing coordinates	This sets the chasing method of manipulator.	torch / work
Tracking deviation range	This sets the maximum value of correction in tracking function. Erroneous deviation of a set workpiece, and tracking deviation by some problem can be detected. Set about +5 ~ -10mm to the expected maximum deviation of workpiece. When the total of the deviation corrected by tracking function (total of vertical direction and horizontal direction) exceeds this value, "processing at correction amount monitor value over" is executed.	1.0 ~ 99.9 [mm]
Undetecting range	Not in use at present	
Arc stable surveillance value	Not in use at present	
Wire speed stable surveillance value	Not in use at present	
Arc Standard Voltage	<TIG Arc sensor only> Input the actual arc voltage. Set the value to realize the desired stand-off. Normally, the value should be between 5V and 15V (10V in average). TIG arc sensor controls the distance between the tip point of electrode and workpiece according to the arc reference value.	0.1 ~ 99.9[V]

● Sample Data (for Arc Sensor)

Item	Arc Sensor AX-AR	Arc Sensor AX-AR2
Sensing Algorithm	Use this with "spray".	
Smooth Chasing Time	Use this at "100ms".	
Horizontal Detection Parameter α	0	5
Horizontal Detection Parameter β	0	1
Horizontal Detection Parameter Rx	0	
Horizontal Detection Parameter Rt	999	
Horizontal Detection Parameter A	<ul style="list-style-type: none"> • Inputting the value of 0 is equivalent to that of 300. • If tracking swerves, reduce the horizontal tracking sensitivity of the ST parameter. To improve further, set this parameter to 300 or lower (as a guideline, approximately 50 to 100). • If the tracking goes off course (tries to operate as taught), raise the horizontal tracking sensitivity of the ST parameter. To improve further, set this parameter to 300 or higher. 	

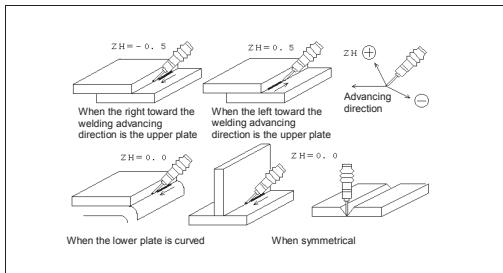
Horizontal Detection Parameter B	<ul style="list-style-type: none"> Inputting the value of 0 is equivalent to that of 100. Normally, set it at 0. If the wire extension length changes a lot, first adjust the vertical tracking sensitivity of the ST parameter. To improve further, try adjusting this parameter around a reference value of 100.
Horizontal Detection Parameter C	0
Horizontal Detection Parameter D	0
Horizontal Detection Parameter θ	0

● **Sample Data (for TIG Arc Sensor)**

Item	TIG Arc Sensor AX-TR	TIG Arc Sensor AX-TR2
Sensing Algorithm	Use this with "spray".	
Smooth Chasing Time	Use this at "100ms".	
Horizontal Detection Parameter α	0	5
Horizontal Detection Parameter β	0	2
Horizontal Detection Parameter Rx	0	
Horizontal Detection Parameter Rt	999	
Horizontal Detection Parameter A	0	
Horizontal Detection Parameter B	<ul style="list-style-type: none"> Inputting the value of 0 is equivalent to that of 400. Normally, set it at 0. If the stand-off changes a lot, first adjust the vertical tracking sensitivity of the ST parameter. To improve further, try adjusting this parameter around a reference value of 400. 	
Horizontal Detection Parameter C	0	
Horizontal Detection Parameter D	0	
Horizontal Detection Parameter θ	0	

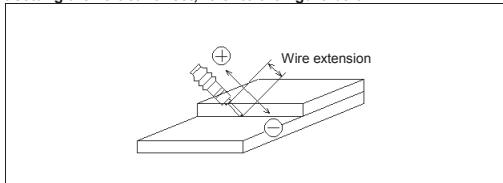
● **Offset (Horizontal)**

At setting the horizontal offset, refer to the figure below.



● Offset (Vertical)

At setting the vertical offset, refer to the figure below.



● Chasing coordinates

At setting the chasing method, refer to the figure below.

	Torch reference	Workpiece reference
Correction motion example	Point C Point B (1) Correction value at point B (2) Correction value at point C	Point C Point B (1) Correction value at point B (2) Correction value at point C
Correction motion image	Scale	Horizontal movement
Applicable workpiece	<ul style="list-style-type: none"> Straight line Modular curve Circle or arc with diameter over 100mm 	<ul style="list-style-type: none"> Straight line including corner Circle or arc with diameter below 100mm

■ Example of screen display

ST[S1, No.1] FN485,Start Tracking

See

SF3; Deviation call (FN473)

SF4; Dev. vector composition (FN474)

SF5; Dev. vector composition (FN475)

ET : End Tracing (FN486)

Application command (FN code)

Command name	ET
FN code	486
Title name	Tracking end
General description	This ends the seam tracking. ※This is used when the arc sensor (AX-AR) is connected.

■ General description

ET is the command to end the seam tracking.

In ET, deviation (touch sensor deviation + arc sensor deviation, or arc sensor deviation) in the designated coordinate system in the execution of ET is stored into the deviation correction file of the designated store number.

- Teach ET in the tracking section and the welding section and the weaving section.
- Teach the move command in the tracking section by linear interpolation (LIN) or circular interpolation (CIR).
- When the stored number is further stored, a new deviation is overwritten.
- When to carry out corner winding process or so in the section by use of the deviation stored by ET, designate receiving by SF3 after ET.

■ Parameter

Parameter name	Details	Range
Store No.	This sets the number of deviation to be stored. Contents of store may be selected by "Basement of Store". Detected deviation is stored per number. Stored deviation can be received by SF3 command.	1 to 999
Endpoint detection	This sets the end point detection whether disabled or enabled. Be sure to set this to "Disabled".	Not exist/ Exist
Endpoint detection offset	Not in use at present	0 to 999 [mm]
Endpoint detection range	Not in use at present	0 to 999 [mm]
Store Coordinates	This selects an store coordinate system. Coordinate systems for selection are displayed, so select the one you want.	—
Basement of Store	This designates the contents to be stored. Tracking only : Only the amount corrected by the arc sensor is stored as deviation. In the receiving section of SF3, received amount becomes subtracted amount. Teaching Point : The deviation of the present torch position to the teaching point is stored. In the receiving section of SF3, its amount is also included. It is convenient for carrying out corner winding process or so.	Tracking only/ Teaching Point
Keep compensation	This designates whether to keep the tracking correction amount at the moment of ET, or to move as taught toward the next teaching point. Correction is kept until arc end command.	Not exist/ Exist

● "Keep compensation"

As for "Keep compensation" parameter movements, refer to the table below.

Keep compensation	SF3 receiving	Movement
None	None	It moves toward the next teaching point. (Without correction)

	In section	Only correction in SF3 is continued. (It moves to the point corrected by only SF3.)
	Receiving changed to just after ET	Only correction amount newly designated is continued. At this moment, do not designate the store number by ET. (It may go to an unexpected position.)
Enabled	None	It is continuously corrected by the deviation corrected by the arc sensor.
	In section	The deviation corrected by the arc sensor and the deviation designated in SF3 are continued simultaneously.
	Receiving changed to just after ET	The newly designated correction amount and the deviation corrected by the arc sensor are continued simultaneously. At this moment, do not designate the store number by ET. (It may go to an unexpected position.)

■ Example of screen display

ET[S1, Store No.1] FN486:Tracking end

See

SF3; Deviation call (FN473)

SF4; Dev. vector composition (FN474)

ST ; Start Tracing (FN485)

Function commands (FN codes)

Command name	MPS
FN code	496
Title name	Multi Pass Section Start
General description	This represents the start position of the section where a series of movements for multi-pass welding is repeated.

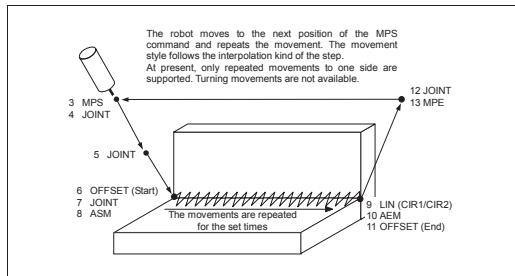
■ General description

This is the command to represent the start of multi-pass section. For teach and playback, the optional software "Multi-pass Welding function" is required.

The multi-pass section means the section where taught movements including not only welding but also approach movements to workpiece and retreat movements are carried out repeatedly.

As for details, refer to the multi-pass welding function instruction manual (optional).

■ Example of operation



- (1) Joint interpolation movements are carried out from the position of step 2 to the teach position of step 4. In the conventional DAIHEN multi-pass welding function, since MPS had position data, the robot moved to the teach position of MPS. While, in this controller, MPS does not have position data, the robot moves to the next step of MPS.
- (2) The robot moves to the arc start point of step 7, and starts welding under the multi-pass welding condition taught by ASM.
- (3) After completion of welding, the robot moves to the position of step 12.
- (4) If the number of repetitions in the multi-pass section is smaller than the number of repetitions set by MPS (3 times), the step execution shifts to MPS. The robot moves to the position of step 4.
- (5) The robot carries out the steps 5 ~ 12 once again.
- (6) After execution of MPE of step 13, if repetition movements are completed by the set number, the robot moves to the position of step 14, and completes its movements.

■ Parameter

Parameter No. 1	Variable No.	The number of the integer variable to count the number of passes is designated here. (1 - 200) As for the integer variable to be designated here, designate a number different from the integer variable to be used for other applications. The pass number now under execution may be confirmed on the integer variable monitor.
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Parameter No. 2	Number of the pass	"How many times to be repeated" is designated as the number of passes. (1 - 100)
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■ Example of screen display

MPS[V1%,1,0] FN496;Multi Pass Section Start

See

MPE; Multi Pass Section End (FN497)

Function commands (FN codes)

Command name	MPE
FN code	497
Title name	Multi Pass Section End
General description	This represents the end position of the section where a series of movements for multi-pass welding is repeated.

■ General description

This is the command to represent the end of multi-pass section. For teach and playback, the optional software "Multi-pass Welding function" is required.

As for details, refer to the multi-pass welding function instruction manual (optional).

■ Example of operation

Refer to the multi-pass welding start MPS (FN496).

■ Parameter

None

■ Example of screen display

MPE FN497;Multi Pass Section End

See

MPS; Multi Pass Section Start (FN496)

Function commands (FN codes)

Command name	EP
FN code	498
Title name	Execution Pass Specification
General description	This designates per pass whether the function commands are to be executed or not in the multi-pass section.

■ General description

This is the command to designate per pass whether the function commands are to be executed or not in the multi-pass section. In the case when this command is not taught, the function commands in the multi-pass area are executed at every execution of each pass.

For teach and playback, the optional software "Multi-pass Welding function" is required.

As for details, refer to the multi-pass welding function instruction manual (optional).

■ Example of operation

By teaching EP <FN498>, the following movements are available. The designated parameter is shown in [].

Step	Command	Contents
:	:	
3	MPS [10 times]	
4	EP [==, 5]	
5	CALLP [100]	At the stage when the number of passes becomes 5, the waiting program for checking the forming condition is called.
6	EP [==, 10]	At the stage when the number of passes becomes 10 (final pass), signal is output to the outside.
7	SET [200]	
8	100% JOINT	
9	100% JOINT	
10	OFFSET [Start]	
11	100% JOINT	
12	ASM	
13	300cm/m LINE	
14	AEM	
15	OFFSET [End]	
16	100% JOINT	
17	MPE	
:	:	

■ Parameter

Parameter No. 1	Condition	One of the following conditions for executing the function commands taught in the next step is selected here. • == (execution only at the designated number of pass) • <= (execution at one over the designated number of pass) • >= (execution at one below the designated number of pass) • Forward (not supported at present) • Return (not supported at present) (0: == / 1: <= / 2: >= / 3: Forward / 4: Return)
Parameter No. 2	Number of the pass	The number of pass for comparison with the first parameter is designated here. (1 - 100)

■ Example of screen display

EP[1,0] FN498; Execution Pass Specification

See

MPS; Multi Pass Section Start (FN496)

MPE; Multi Pass Section End (FN497)

Function commands (FN codes)

Command name	OFFSET
FN code	499
Title name	Multi Offset Specification
General description	This sets offset in the movement steps in the multi-pass welding section.

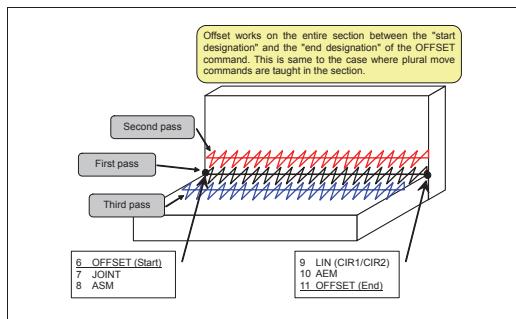
■ General description

This is the command to set the offset in the movement steps in the multi-pass welding section. This is used when to weld the second pass and passes after that with shift from the first pass.
For teach and playback, the optional software "Multi-pass Welding function" is required.

As for details, refer to the multi-pass welding function instruction manual (optional).

■ Example of operation

As shown below, by teaching the OFFSET command to the step just before the arc start point, and further the OFFSET command again to the step just after the arc end point, the entire multi-pass welding section is shifted by the designated offset amount.



■ Parameter

Parameter No. 1	Multi Offset No.	The number of the multi offset condition file is designated here. (1 - 999) This file is to be created in advance in <Arc condition> - [9 Multi offset condition].
Parameter No. 2	Mechanism No.	The mechanism number to which offset is set designated here. (1 - 9) Normally, since the manipulator having the welding torch is set as mechanism 1, designate "1".
Parameter No. 3	Section Kind	Since the offset becomes valid over the entire multi-pass welding section, whether to "start" or "end" the offset is designated here. (1 : start, 0 : end) Designate "start" for the start position of the multi-pass welding section, while designate "end" for the end position.

■ Example of screen display

OFFSET[1,1]
FN499; Multi Offset Specification

See

MPS; Multi Pass Section Start (FN496)

MPE; Multi Pass Section End (FN497)

Function commands (FN codes)

Command name	WAITI
FN code	525
Title name	Input signal wait (positive logic)
General description	This command is used to wait for any one general-purpose input signal.

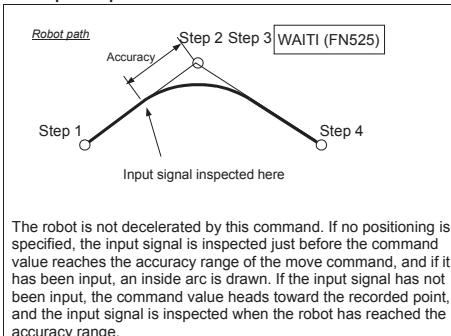
■ General description

When this function command is executed, the robot is made to stand by until the specified general-purpose input signal is input.

It can be recorded in a single action using the [IN] dedicated key on the teach pendant.

It is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

■ Example of operation 1

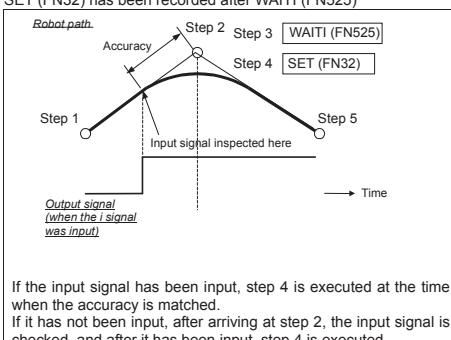


The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command value reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the command value heads toward the recorded point, and the input signal is inspected when the robot has reached the accuracy range.

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Example of operation 2

If SET (FN32) has been recorded after WAITI (FN525)

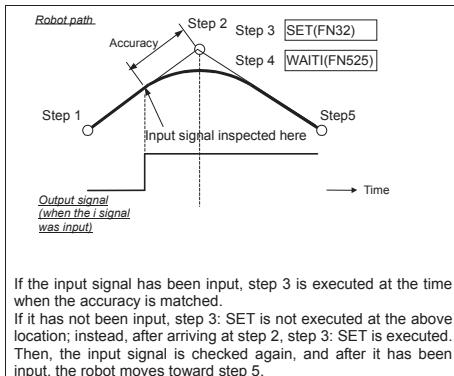


If the input signal has been input, step 4 is executed at the time when the accuracy is matched.

If it has not been input, after arriving at step 2, the input signal is checked, and after it has been input, step 4 is executed.

■ Example of operation 3

If SET (FN32) has been recorded before WAITI (FN525)



■ Parameter

Parameter No. 1	Input signal number	This specifies the number of input signal to be awaited. When number 5101 or above is specified, multiple input signals can be awaited. (1-2048, 5101-5196)
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■ Example of screen display

WAITI [I7] FN525; Input signal wait (positive logic)

See

WAITJ: Input signal wait (negative logic) (FN526)
 WAIT: Input signal wait with timer (FN552)

Function commands (FN codes)

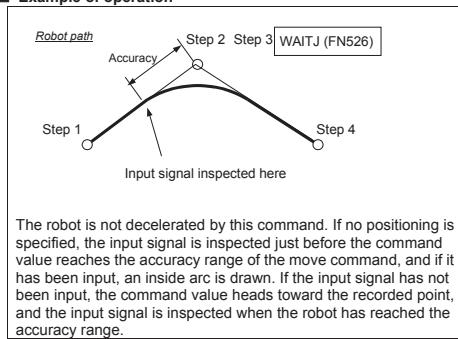
Command name	WAITJ
FN code	526
Title name	Input signal wait (negative logic)
General description	This command is used to wait for any one general-purpose input signal using negative logic.

■ General description

When this function command is executed, the robot is made to stand by until the one specified general-purpose input signal is set to OFF.

If it is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

■ Example of operation



The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command value reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the command value heads toward the recorded point, and the input signal is inspected when the robot has reached the accuracy range.

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Parameter

Parameter No. 1	Input signal number	This specifies the number of input signal to be awaited. When number 5101 or above is specified, multiple input signals can be awaited. (1 – 2048, 5101 – 5196)
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■ Example of screen display

WAITJ [I7] FN526; Input signal wait (negative logic)

See

WAITI: Input signal wait (positive logic) (FN525)

WAIT: Input signal wait with timer (FN552)

Function commands (FN codes)

Command name	FETCH
FN code	528
Title name	Fetch Input cond.
General description	Determine judgment the input condition of a following function.

■ General description

This has a parameter I-signal No., it decides judgment the input condition of a following function. Input condition function (ex. WAITI, JMPI, etc.) might cause robot deceleration, because pathway might not be decided immediately before. 'FN258 FETCH' function decides judgment the input condition in any timing, it also prevents from deceleration.

■ Target functions of FETCH function

It is effective for the functions with parameter I signal No.

■ Out of target functions of FETCH function

Follows function is off the subject.

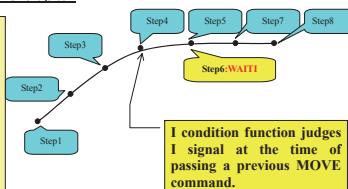
- FN29 RINT Robot interrupt (I-condition)

■ Example of operation

Functions with I-cond. in short pitch

```
1 100% LIN A1 T1
2 100% LIN A8 T1
3 100% LIN A8 T1
4 100% LIN A8 T1
5 100% LIN A8 T1
6 WAITI[[1]]
7 100% LIN A8 T1
8 100% LIN A8 T1
...

```

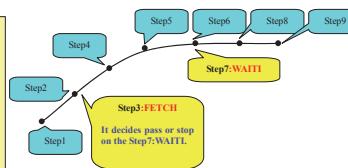


I condition function judges I signal when robot passes a previous move command. Therefore, when the movement section is short the migration pathway might not be decided immediately before, and the robot decelerate.

Using 'FETCH' function

```
1 100% LIN A1 T1
2 100% LIN A8 T1
3 100% LIN A8 T1
3 FETCH[[1]]
4 100% LIN A8 T1
5 100% LIN A8 T1
6 100% LIN A8 T1
7 WAITI[[1]]
8 100% LIN A8 T1
9 100% LIN A8 T1
...

```



I-condition is decided at the time of executing 'FETCH' function. It prevents from robot deceleration because the pathway is decided.

■ Parameter

Parameter No. 1	Input signal	I signal No. to fetch.(1-5196)
-----------------	--------------	--------------------------------

■ Example of screen display

FETCH[I1]

FN528; Fetch Input cond.

■ Effective span of FETCH function

The result of 'FETCH' function keeps until execution a function with fetched I-signal condition. However, when follows occur the effect of FETCH is lost.

- (1) Stopping playback. (include Motor-OFF and power-OFF)
- (2) Executing 'END'.
- (3) Program No. is changed by executing program jump, call, return, and so on.
- (4) Executing step jump.

■ Plural execution of FETCH function (1)

When some 'FETCH' functions with same I-signal are executed, the judgment of I-signal is revised whenever it executes.

For example, in case of execution `FETCH[I1] -> FETCH[I1] -> WAIT[I1]`, the second FETCH is effective for WAITI.

■ Plural execution of FETCH function (2)

Some pairs of FETCH and I-cond. function can be recorded. These works independently.

```
FETCH[I1]
FETCH[I2]
MOVE
WAIT[I1]
MOVE
WAIT[I2]
```

■ Settings

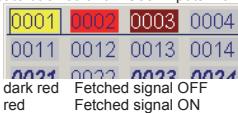
Some error is supported.

Refer to 'Constants: 6 Signals: 1 Signal Condition'

Setting	function
Detect fetch error	Error occurs when a fetched signal status by function <code>FETCH(Fn528)</code> is changed before the intended function working. Choice: Disabled / Enabled
Effective span of a fetched signal	Detect an error when a fetched signal by a function <code>FETCH(Fn528)</code> spends the designated number of move steps. Range: 0~9999 (0: disabled)

■ Monitor

Fetched signals indicate back color on 'User Inputs monitor'.



The monitor shows state of current unit.

■ Others

'FETCH' function does not work while operating 'Check back'.

'FETCH' function is managed separately each units. Executing 'FETCH' in one unit does not affect other unit.

Function commands (FN codes)

Command name	INT2OSIG
FN code	531
Title name	Change int to O-signal
General description	Change an integer to O-signal.

■ General description

This function changes an integer to output to signals.
The range of numbers is changed, according to the BIT length.

BIT length	Range
1	0~1
2	0~3
3	0~7
4	0~15
5	0~31
6	0~63
.	.
.	.
.	.
31	0~2147483647
32	-2147483648~2147483647

■ Parameter

1 st parameter	Top signal No.	First signal number to be output
2 nd parameter	Bit length	Number of bits to use. The range of numbers is changed, according to the BIT length.
3 rd parameter	Integer	An integer to be changed.

■ Example of screen display

INT2OSIG [O101,32,-1] FN36; Error interrupt

Function commands (FN codes)

Command name	CNVI
FN code	550
Title name	Conveyor Interlock
General description	Robot waits until conveyor register reaches up to the designated distance, stationarily

■ General description

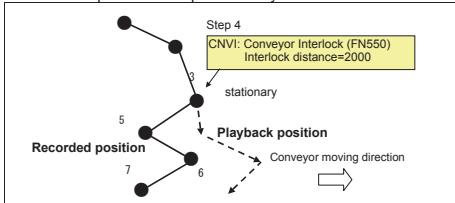
This function is used in conveyor synchronizing application.

Robot waits until conveyor register reaches up to the designated distance (= interlock distance). While waiting, robot is stationary. When conveyor register reaches, robot proceeds to the next step. If conveyor register had already reached to the interlock distance before the start of waiting, robot immediately proceeds to the next step.

Please refer to the "Conveyor Synchronization Manual" (option) for detail operations.

■ Example of operation

In case of CNVI : Conveyor Interlock (FN550) is recorded at step4, robot will wait until conveyor register reaches up to 2000mm in the position of step4 stationary.



■ Parameter

Parameter No. 1	Interlock distance	Input the conveyor interlock distance. Linear conveyor; (0-30,000) mm Circular conveyor; (0-180) degree
-----------------	--------------------	---------------------------------------------------------------------------------------------------------------

■ Example of screen display

CNVI [3000] FN550: Conveyor Interlock

See

CNVSYNC; Conveyor Counter Reset (FN55)
CNVSYNCI; Synchronizing Conveyor Interlock (FN562)

Function commands (FN codes)

Command name	WAIT
FN code	552
Title name	Input signal wait with timer
General description	This command is used to wait for any one general-purpose input signal for up to the specified time.

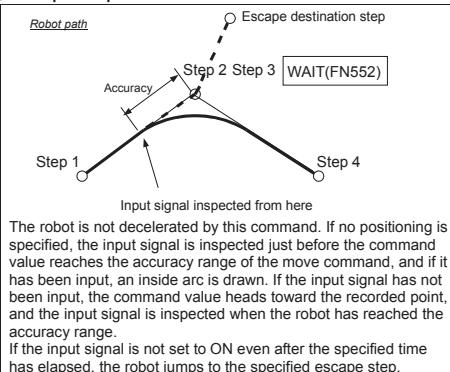
■ General description

When this function command is executed, the robot is made to stand by until the specified general-purpose input signal is input. If the input signal is not input even after the specified time has elapsed, the robot jumps to the specified escape step.

The escape step can be designated with a move command or a function command. Bear in mind that when a function command has been designated, the command will be executed straight away.

It is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

■ Example of operation



In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Parameter

Parameter No. 1	Input signal number	This specifies the number of input signal to be awaited. When number 5101 or above is specified, multiple input signals can be awaited. (1 – 2048, 5101 – 5196)
Parameter No. 2	Wait time	This specifies the wait unit in seconds. (0.0 – 60.0)
Parameter No. 3	Escape step number	This specifies the number of the step to which the robot is to jump if the input signal is not input even though the wait time has elapsed. Any step in the same program can be designated. (1 – 9999)

■ Example of screen display

WAIT [17, 3.0, 7] FN552; Timer input signal

See

WAITI: Input signal wait (positive logic) (FN525)

WAITJ: Input signal wait (negative logic) (FN526)

Application command (FN code)

Command name	WAITA
FN code	553
Title name	Wait group input (AND) with timer
General description	This command is used to wait for any of group general-purpose input signal (AND logic) with designated time

■ General description

When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is all designated bit (I signal) should be ON. If the condition is not satisfied even after the specified time has elapsed, the robot jumps to the specified escape step.

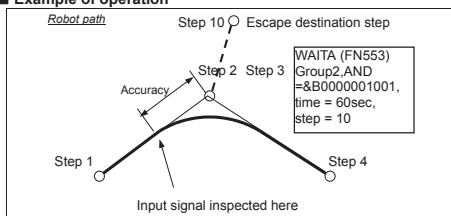
One "group" is constructed by 10 general-purpose input signals (I1~I2048) as shown below.

Move command or Function command can be specified as Escape step. Note that, if Function command is specified, then that command is executed.

It is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

Group	Input Sig.	Group	Input Sig.	Group	Input Sig.
1	1 to 10	11	101 to 110	21	201 to 210
2	11 to 20	12	111 to 120
3	21 to 30	13	121 to 130	30	291 to 300
4	31 to 40	14	131 to 140
5	41 to 50	15	141 to 150	50	491 to 500
6	51 to 60	16	151 to 160
7	61 to 70	17	161 to 170	100	991 to 1000
8	71 to 80	18	171 to 180
9	81 to 90	19	181 to 190
10	91 to 100	20	191 to 200	204	2031 to 2040

■ Example of operation



The robot is not decelerated by this command. If the condition of input signal is satisfied, the robot does not inspect the subsequent input signal and draws an inside arc as shown in the above figure.

And if the input signal condition is not satisfied, robot moves to recorded position in step 2 in the above figure. Robot stops and waits at step 2 until the input signal condition is satisfied. Robot certainly continues Step 2 even if the input signal condition is satisfied during the movement from accuracy point to recorded position.

If the condition is not satisfied even after the specified time has elapsed, the robot jumps to the specified escape step. Following are the conditions to be satisfied in the above figure. Signals described "ON" should be "ON", and signals described "Any" can be either ON or OFF.

In case of "GROUP2, AND=&B0000001001"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Any	Any	Any	Any	Any	Any	ON	Any	Any	ON

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Parameter

1st parameter	Group number	This specifies the group number. (1 to 204)
2nd parameter	AND condition	This specifies the condition of 10 input signals. At least one "1" signal should be ON, and "0" does not matter ON/OFF. (0000000000 to 1111111111)
3rd parameter	Timer	This specifies the wait unit in seconds. (0.0 to 60.0)
Parameter No.4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 to 9999)

■ Example of screen display

WAITA[Group2, &800000101, 60.0, 10] FN553:Wait group input (AND) with timer

See

WAITO; Wait group input (OR) with timer (FN554)

WAITE; Wait group input with timer (FN555)

Application command (FN code)

Command name	WAITO
FN code	554
Title name	Wait group input (OR) with timer
General description	This command is used to wait for any of group general-purpose input signal (OR logic) with designated time

■ General description

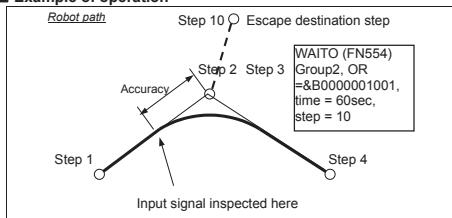
When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is at least one designated bit (I signal) should be ON. If the condition is not satisfied even after the specified time has elapsed, the robot jumps to the specified escape step. One "group" is constructed by 10 general-purpose input signals (I1~I2048) as shown below.

Move command or Function command can be specified as Escape step. Note that, if Function command is specified, then that command is executed.

It is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

Group	Input Sig.	Group	Input Sig.	Group	Input Sig.
1	1 to 10	11	101 to 110	21	201 to 210
2	11 to 20	12	111 to 120
3	21 to 30	13	121 to 130	30	291 to 300
4	31 to 40	14	131 to 140
5	41 to 50	15	141 to 150	50	491 to 500
6	51 to 60	16	151 to 160
7	61 to 70	17	161 to 170	100	991 to 1000
8	71 to 80	18	171 to 180
9	81 to 90	19	181 to 190
10	91 to 100	20	191 to 200	204	2031 to 2040

■ Example of operation



The robot is not decelerated by this command. If the condition of input signal is satisfied, the robot does not inspect the subsequent input signal and draws an inside arc as shown in the above figure.

And if the input signal condition is not satisfied, robot moves to recorded position in step 2 in the above figure. Robot stops and waits at step 2 until the input signal condition is satisfied. Robot certainly continues Step 2 even if the input signal condition is satisfied during the movement from accuracy point to recorded position.

If the condition is not satisfied even after the specified time has elapsed, the robot jumps to the specified escape step. Following are the conditions to be satisfied in the above figure. At least one signal described "ON" should be "ON", and signals described "Any" can be either ON or OFF.

In case of "GROUP2, OR=&B0000001001"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Any	Any	Any	Any	Any	Any	ON	Any	Any	ON

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Parameter

1st parameter	Group number	This specifies the group number. (1 to 204)
2nd parameter	OR condition	This specifies the condition of 10 input signals. At least one "1" signal should be ON, and "0" does not matter ON/OFF. (0000000000 to 1111111111)
3rd parameter	Timer	This specifies the wait unit in seconds. (0.0 to 60.0)
Parameter No.4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 to 9999)

■ Example of screen display

```
WAITO[Group2, &B00000101, 60.0, 10] FN554:Wait group input (OR) with timer
```

See

WAITA; Wait group input (AND) with timer (FN553)

WAITE; Wait group input with timer (FN555)

Function commands (FN codes)

Command name	WAITE
FN code	555
Title name	Wait group input with timer
General description	This command is used to wait for any of group general-purpose input signal with designated time

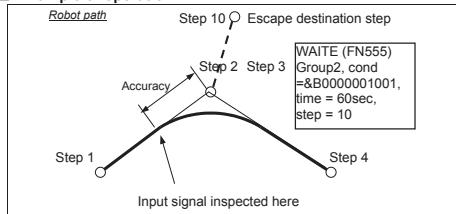
General description

When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is all bit (I signal) ON/FF should coincident. One "group" is constructed by 10 general-purpose input signals (I1~I2048) as shown below.

It is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

Group	Input Sig.	Group	Input Sig.	Group	Input Sig.
1	1~10	11	101~110	21	201~210
2	11~20	12	111~120
3	21~30	13	121~130	30	291~300
4	31~40	14	131~140
5	41~50	15	141~150	50	491~500
6	51~60	16	151~160
7	61~70	17	161~170	100	991~1000
8	71~80	18	171~180
9	81~90	19	181~190
10	91~100	20	191~200	204	2031~2040

Example of operation



The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command position reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the robot toward the recorded point and the condition is inspected when the robot has reached.

If the condition is not satisfied even after the specified time has elapsed, the robot jumps to the specified escape step. On this sample as followed table, all signals described "ON" should be "ON", and all signals described "OFF" should be "OFF".

In case of "GROUP2, cond.=&B0000001001"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Off	Off	Off	Off	Off	Off	ON	Off	Off	ON

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

Parameter

Parameter No. 1	Group number	This specifies the group number. (1-204)
Parameter No. 2	condition	This specifies the condition of 10 input signals. "1" signal should be ON, and "0" signal should be OFF. (0000000000 - 1111111111)
Parameter No. 3	Wait time	This specifies the wait unit in seconds. (0.0 – 60.0)

Parameter No. 4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 – 9999)
-----------------	-------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

■ Example of screen display

```
WAITE[Group2, &B00000101, 60.0, 10] FN555:Wait group input with timer
```

See

WAITA; Wait group input (AND) with timer (FN553)

WAITO; Wait group input (OR) with timer (FN554)

Application command (FN code)

Command name	WAITAD
FN code	558
Title name	Wait group input BCD (AND) with timer
General description	This command is used to wait for any of group general-purpose input signal (AND logic) with designated time

■ General description

When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is all designated bit (1 signal) should be ON.
The only one difference from WAITA (FN553) is how to designate condition that is here BCD (Binary Coded Decimal).

■ Example of operation

In case of AND condition = 63, all the signals described "ON" should be "ON", and signals described "Any" can be either ON or OFF.

In case of "GROUP2, AND=63"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Any	Any	Any	ON	ON	Any	Any	Any	ON	ON
BCD	0			6			3			

■ Parameter

1st parameter	Group number	This specifies the group number. (1 to 204)
2nd parameter	AND condition	This specifies the condition of 10 input signals. "1" should be ON and "0" should be "OFF", then describe it by BCD, (0 to 399)
3rd parameter	Timer	This specifies the wait unit in seconds. (0.0 to 60.0)
Parameter No.4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 to 9999)

■ Example of screen display

WAITAD[Group2, 63, 60.0, 10] FN558:Wait group input BCD (AND) with timer

See

WAITA; Wait group input (AND) with timer (FN553)

Application command (FN code)

Command name	WAITOD
FN code	559
Title name	Wait group input BCD (OR) with timer
General description	This command is used to wait for any of group general-purpose input signal (OR logic) with designated time

■ General description

When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is at least one designated bit (I signal) should be ON. The only one difference from WAITO (FN554) is how to designate condition that is here BCD (Binary Coded Decimal).

■ Example of operation

In case of OR condition = 63, at least one signal described "ON" should be "ON", and signals described "Any" can be either ON or OFF.

In case of "GROUP2, OR=63"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Any	Any	Any	ON	ON	Any	Any	Any	ON	ON
BCD	0			6			3			

■ Parameter

1st parameter	Group number	This specifies the group number. (1 to 204)
2nd parameter	AND condition	This specifies the condition of 10 input signals. "1" should be ON and "0" should be "OFF", then describe it by BCD, (0 to 399)
3rd parameter	Timer	This specifies the wait unit in seconds. (0.0 to 60.0)
Parameter No.4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 to 9999)

■ Example of screen display

WAITOD [Group2, 63, 60.0, 10] FN559.Wait group input BCD (OR) with timer

See

WAITO; Wait group input (OR) with timer (FN554)

Application command (FN code)

Command name	WAITED
FN code	560
Title name	Wait group input BCD with timer
General description	This command is used to wait for any of group general-purpose input signal with designated time

■ General description

When this function command is executed, the robot is stand by until the specified group input satisfies the condition that is all bit (I signal) should be coincident.
The only one difference from WAITE (FN555) is how to designate condition that is here BCD (Binary Coded Decimal).

■ Example of operation

In case of "condition = 63", signals described "ON" should be "ON", and signals described "OFF" should be "OFF".

In case of "GROUP2, cond.=63"

Output signals	20	19	18	17	16	15	14	13	12	11
ON/OFF status	Off	Off	Off	ON	ON	Off	Off	Off	ON	ON
BCD	0			6					3	

■ Parameter

1st parameter	Group number	This specifies the group number. (1 to 204)
2nd parameter	AND condition	This specifies the condition of 10 input signals. "1" should be ON and "0" should be "OFF", then describe it by BCD, (0 to 399)
3rd parameter	Timer	This specifies the wait unit in seconds. (0.0 to 60.0)
Parameter No.4	Escape destination step	This specifies the number of the step to which the robot is to jump if condition is not satisfied even though the wait time has elapsed. Any step in the same program can be designated. (1 to 9999)

■ Example of screen display

WAITED[Group2, 63, 60.0, 10] FN558:Wait group input BCD with timer

See

WAITE; Wait group input with timer (FN555)

Function commands (FN codes)

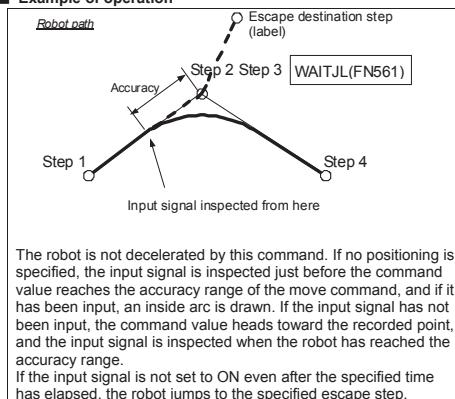
Command name	WAITJL
FN code	561
Title name	Wait not I-cond with timer2
General description	This command is used to wait for any one general-purpose input signal using negative logic for up to the specified time.

■ General description

When this function command is executed, the robot is made to stand by until the specified general-purpose input signal is OFF. If the input signal is ON even after the specified time has elapsed, the robot jumps to the specified escape step. The escape step is designated with a label. Bear in mind that when a function command has been designated, the command will be executed straight away.

If it is not possible to wait for a status signal (a signal such as the welding finish signal and start signal whose application has already been assigned). Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be awaited.

■ Example of operation



The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command value reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the command value heads toward the recorded point, and the input signal is inspected when the robot has reached the accuracy range.

If the input signal is not set to ON even after the specified time has elapsed, the robot jumps to the specified escape step.

In the case of an interlock signal requiring a stringent accuracy, either reduce the accuracy level in step 2 or record positioning "P" in step 2 in the figure above.

■ Parameter

Parameter No. 1	Input signal number	This specifies the number of input signal to be awaited. When number 5101 or above is specified, multiple input signals can be awaited. (1 – 2048, 5101 – 5196)
Parameter No. 2	Wait time	This specifies the wait unit in seconds. (0.0 – 60.0)
Parameter No. 3	Escape step label	This specifies the label to which the robot is to jump if the input signal is not OFF even though the wait time has elapsed. Top of label must be **.

■ Example of screen display

WAITJL[7, 3.0, *NOWORK] FN561; Wait not I-cond with timer2

See

WAITI: Input signal wait (positive logic) (FN525)

WAITJ: Input signal wait (negative logic) (FN526)

Function commands (FN codes)

Command name	CNVYSYNCI
FN code	562
Title name	Synchronizing conveyor Interlock
General description	Robot waits until conveyor register reaches up to the designated distance, synchronizing to the conveyor

■ General description

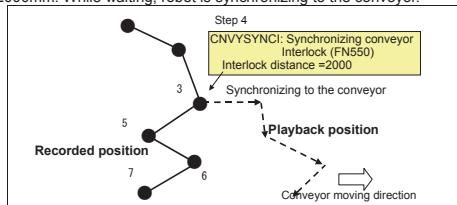
This function is used in conveyor synchronizing application.

Robot waits until conveyor register reaches up to the designated distance (= interlock distance). While waiting, robot is synchronizing to the conveyor. When conveyor register reaches, robot proceeds to the next step. If conveyor register had already reached to the interlock distance before the start of waiting, robot immediately proceeds to the next step.

Please refer to the “Conveyor Synchronization Manual” (option) for detail operations.

■ Example of operation

In case of CNVI : Conveyor Interlock (FN550) is recorded at step4, robot will wait until conveyor register reaches up to 2000mm. While waiting, robot is synchronizing to the conveyor.



■ Parameter

Parameter No. 1	Interlock distance	Input the conveyor interlock distance. Linear conveyor; (0-30,000) mm Circular conveyor; (0-180) degree
-----------------	--------------------	---------------------------------------------------------------------------------------------------------------

■ Example of screen display

CNVYSYNCI [3000] FN562: Synchronizing conveyor Interlock

See

CNVSYNC; Conveyor Counter Reset (FN55)
VNCI; Conveyor Interlock (FN550)

Function commands (FN codes)

Command name	PRSI
FN code	564
Title name	Press interlock
Outline	This sets interlock, in the press brake synchronization function.

■ Outline

When the parameter 1 (downward) is designated, "synchronization start position" of the press brake setting data is used, and when the conveyor register becomes larger than the value, the interlock is released. At waiting for interlock, the robot stops and waits.

When the parameter 0 (upward) is designated, "retreat start position" is used, and when the conveyor register becomes smaller than the value, the interlock is released. At waiting for interlock, the robot waits in synchronization.

■ Parameters

Parameter No.1	Conveyor number	This designates a conveyor number registered as press brake. (1-2)
Parameter No.2	Upward/ Downward	This designates punch upward/downward. (Upward: 0 / Downward: 1)

■ Screen display example

PRSI[1,0] FN564; Press interlock

Function commands (FN codes)

Command name	FBUSCON
FN code	565
Title name	Field bus connect
General description	

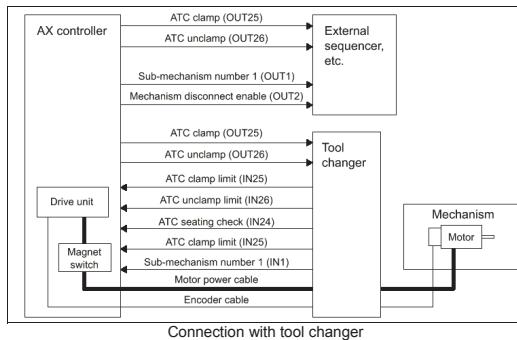
■ General description

This function waits for a connection to the slave with a time-out.

If the FD is a field bus master, it will detect the error for each slave to be connected. By FBUSREL function, you can disable the error detection for a particular slave device. Depending on the slave device, there is a case that takes a long time to than usual to connect. In such cases, you should use the FBUSCON function. After the slave device is connected, this function will immediately enable the error detection, will continue the program.

■ Example of operation

The following example uses the tool changer is a system for changing the mechanism. In this system, as shown in the following figure, it is allocated signal. This is just one example. This is different from the actual customer's system environment.



STEP N	500mm/s LIN A1 T31		
STEP N+1	100mm/s LIN A1 T1		Move to the connect/disconnect position
STEP N+2	FBUSREL[1, 1, 0]	FN312: Fieldbus release	Error detection Disabled.
STEP N+3	CHGGUN[0]	FN95: Mechanism change	Electrical disconnection
STEP N+4	RESET[025]	FN34: Output OFF	Unclamp
STEP N+5	SET[026]	FN32: Output ON	
STEP N+6	WAIT[I26]	FN525: Wait input (positive)	Waiting for unclamp finish
STEP N+7	100mm/s LIN A1 T31		Move to the connect/disconnect position
STEP N+8	DELAY[0.5]	FN50: Delay	
STEP N+9	WAIT[I24]	FN525: Wait input (positive)	Waiting for seating
STEP N+10	RESET[026]	FN34: Output OFF	Clamp
STEP N+11	SET[025]	FN32: Output ON	
STEP N+12	WAITI[I25]	FN525: Wait input (positive)	Waiting for clamp finish
STEP N+13	CHGGUN[1]	FN95: Mechanism change	Electrical connection
STEP N+14	FBUSCON[1, 1, 10]	FN565: Fieldbus connect	Waiting for connection with slave device
STEP N+15	100mm/s LIN A1 T1		Move away

Disconnect the field bus before disconnecting the mechanism in "Step N + 2". Then, error detection is disabled. Also specified slave node is physically disconnected, the error does not occur. After you physically connect the mechanism in "Step N + 13", wait for the connection of the slave node in the "STEP N + 14". After the connection to the slave, or the specified time-out period has elapsed, and then restart the error detection for the field bus. At the time of the time-out, an error will occur if not connected to the slave.

■ Parameter

Parameter No. 1	Channel No.	Channel number which the field bus master is using is specified.(1-4)
Parameter No. 2	Slave Node No.	The slave node number of the object of the error detection is specified. (0-127)
Parameter No. 3	Wait time	Time-out period(sec)(0-60)

■ Example of screen display

FBUSCON[1, 3, 10] FN565: Fieldbus connect

Function commands (FN codes)

Command name	SOCKCREATE
FN code	570
Title name	Create Socket
General description	This command is used to create the socket.

■ General description

The socket is made. It is necessary to execute this function before other socket functions are executed when communicating with a socket.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number that has already been made is specified, it becomes an error. (1 – 16)
Parameter No.2	TCP/UDP	Whether the specified socket is used with TCP or it uses it with UDP is specified. 0 if TCP and 1 is specified, it becomes UDP if is specified. (0 – 1)

■ Example of screen display

SOCKCREATE[1,0] FN570; Create the socket

See

SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKCLOSE
FN code	571
Title name	Close the socket
General description	This command is used to close the socket.

■ General description

The socket made with SOCKCREATE is cleared, and it puts it into the state that can be used again. When the user task program ends, it is closed automatically.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
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■ Example of screen display

SOCKCLOSE[1] FN571; Close the socket

See

SOCKCREATE ; Open the socket (FN570)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKBIND
FN code	572
Title name	Bind the socket
General description	This command is used to assign a socket an port No.

■ General description

When AX Controller is used as a server, the port where the connection from the client is waited is specified for the socket.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	Port No.	The waiting port when operating as a server is specified. When the port number used is specified, it becomes an error. (1 – 65535)

■ Example of screen display

SOCKBIND[1,48952]

FN572; Bind the socket

See

SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKWAIT
FN code	573
Title name	Wait for connect
General description	This command is waited for until the connection from the client is done to the allocated port.

■ General description

SOCKWAIT is waited for until the connection from the outside is done to the allocated port. Meanwhile, the program stops. When the time-out is done, the reproduction of the program is restarted. SOCKWAIT is used only in the case of TCP.

■ Parameter

Parameter No. 1	Waiting Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	Communication Port No.	The socket to connect it with the client that has been connected is specified. When the client has connected it, the socket is made by the specified socket. Therefore, after the communication ends, it is necessary to close by using the SOCKCLOSE function. (1 – 16)
Parameter No. 3	Timeout	The time of connected waiting time-out is set every second. It keeps waiting for the connection without doing the time-out when 0 is set. (0 – 20)

■ Example of screen display

SOCKWAIT[1,2,5] FN573; Wait for connect

See

SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKCONNECT
FN code	574
Title name	Connect to server
General description	This command is used to connect to server.

■ General description

This command is connected with the server for TCP. It is necessary to set IP address with SOCKCONNECT though this command doesn't connect with the server for UDP.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	IP Address	The least significant byte of IP address of the server is specified. Other values use the same one as the setting of TCP/IP of the AX Controller. (1 – 254)
Parameter No. 3	Port No.	The port number of the server is specified. (1 – 65535)
Parameter No. 4	Timeout	The time of connected waiting time-out is set every second. (1 – 20)

■ Example of screen display

SOCKCONNECT[1,2,48952,5] FN574; Connect to server

See

SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKSEND
FN code	575
Title name	Send data
General description	This command is used to transmit the data stored in the specified buffer.

■ General description

This command transmits the data stored in the specified buffer. When it doesn't connect or the other party closes, it becomes an error. When SOCKSEND is done because the other party's cutting cannot be recognized at once, it is likely not to become an error when the other party doesn't do the close processing and it cuts it. When the data of length that exceeds the size of the buffer is transmitted, it is necessary to transmit ,divided into two portions.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	Buffer No.	The buffer number is specified. (1 – 16)
Parameter No. 3	Data Length	The size of the transmitted data is set. (1 – 1024)
Parameter No. 4	Timeout	The time of connected waiting time-out is set every second. (1 – 20)
Parameter No. 5	Integer Variable	The variable in which the transmitted data size (unit of the byte) is written is specified.

■ Example of screen display

SOCKSEND[1,1,10,5,V1%] FN575; Send Data

See

SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSENDSTR ; Send string data (FN576)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKSENDSTR
FN code	576
Title name	Send string
General description	This command is used to transmit the specified string.

■ General description

This command transmits the specified string. At that time, the terminal character that shows the end of the string can be added.

When it doesn't connect or the other party closes, it becomes an error. When SOCKSENDSTR is done because the other party's cutting cannot be recognized at once, it is likely not to become an error when the other party doesn't do the close processing and it cuts it. When the data of length that exceeds the size of the buffer is transmitted, it is necessary to transmit, divided into two portions.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	String	The transmitted string data is specified. String data can be specified by the string variable and the string constant.
Parameter No. 3	Data Length	The size of the transmitted data is set. (1 – 1024)
Parameter No. 4	Timeout	The time of connected waiting time-out is set every second. (1 – 20)
Parameter No. 5	Integer Variable	The variable in which the transmitted data size (unit of the byte) is written is specified.
Parameter No. 6	Termination character	The termination character is specified. When the terminal character is specified, the Data Length becomes long only as for the length of the terminal character. (0 – 3) 0 : The terminal character is not added. 1 : It transmits applying "¥r" as a terminal character. 2 : It transmits applying "¥n" as a terminal character. 3 : It transmits applying "¥r¥n" as a terminal character.

■ Example of screen display

SOCKSENDSTR[1,"ABC",3,5,V1%3] FN576; Send String Data

See

SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKRECV ; Receive data (FN577)

Function commands (FN codes)

Command name	SOCKRECV
FN code	577
Title name	Receive data
General description	This command is used to receive the data.

■ General description

This command is used to receive the data. Operation changes into this command with TCP in UDP.

In the following cases, the step is completed for TCP.

1. The size of the data actually received becomes more than the receive data length.
2. Other party's telecommunications equipment closed the socket.
3. The timeout was done.

The reception of data is waited for when the received data size is smaller than the set receive data size. This command is completed, when receive data reaches the set data size.

In the following cases, the step is completed for UDP.

1. Data was received.
2. The timeout was done.

UDP stores the data that was able to be received in the buffer when data is received, and completes the function. Therefore, the data length actually received might be smaller than the specified receive data length. The excess data is cut short, when the data length actually received is larger than the specified receive data length, and the error is returned. Moreover, it is possible to reply to the other party of the communication by doing SOCKSEND after it receives the data. It is necessary to set the destination again by using SOCKCONNECT to transmit data to other parties of the communication.

■ Parameter

Parameter No. 1	Socket No.	The socket number used is specified. When the socket number not made is specified, it becomes an error. (1 – 16)
Parameter No. 2	Buffer No.	The number of the buffer where the received data is stored is specified. (1 – 16)
Parameter No. 3	Data Length	The size of the receive data is set. (1 – 1024)
Parameter No. 4	Timeout	The time of connected waiting time-out is set every second. (1 – 20)
Parameter No. 5	Integer Variable	The variable in which the received data size (unit of the byte) is written is specified. The data size actually received might be smaller than the value specified by the receive data length.

■ Example of screen display

SOCKRECV[1,1,3,5,V1%] FN577; Receive data

See

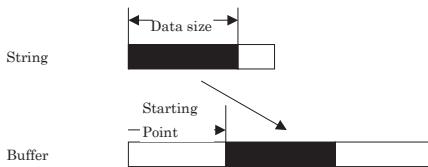
SOCKCREATE ; Open the socket (FN570)
SOCKCLOSE ; Close the socket (FN571)
SOCKBIND ; Bind the socket (FN572)
SOCKWAIT ; Wait for connect (FN573)
SOCKCONNECT ; Connect to server (FN574)
SOCKSEND ; Send data (FN575)
SOCKSENDSTR ; Send string data (FN576)

Function commands (FN codes)

Command name	SETSTR
FN code	580
Title name	Set buffer (string)
General description	This command is used to stored string at an arbitrary position in the buffer

■ General description

This command is used to stored string at an arbitrary position in the buffer. When the writing string overflows of the buffer (When starting position + data size exceeds the size of the buffer), the AX Controller outputs "E2250 step data is abnormal".



■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to store data is specified. (1 – 16)
Parameter No. 2	String	The string stored in the buffer is specified. The string data can be specified by the string variable and the string constant.
Parameter No. 3	Starting point	The stored position of the buffer is specified. (0 – 1023)
Parameter No. 4	Data size	The data size of the data stored in the buffer is specified. (1 – 199)

■ Example of screen display

SETSTR[1,"ABC",0,3] FN580; Set buffer (string)

See

SETINT ; Set buffer(integer) (FN581)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETINT ; Get buffer(integer) (FN585)
GETREAL ; Get buffer(real) (FN586)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	SETINT
FN code	581
Title name	Set buffer (integer)
General description	This command is used to stored integer value at an arbitrary position in the buffer

■ General description

This command is used to stored integer value at an arbitrary position in the buffer. The integral value with the sign is stored by four bytes in the big endian in this command.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to store data is specified. (1 – 16)
Parameter No. 2	Integer value	The integer value stored in the buffer is specified. The integer value can be specified by the integer variable and the integer constant.
Parameter No. 3	Starting point	The stored position of the buffer is specified. (0 – 1020)

■ Example of screen display

SETINT[1,53,0] FN581; Set buffer (integer)

See

SETSTR ; Set buffer(string) (FN580)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETINT ; Get buffer(integer) (FN585)
GETREAL ; Get buffer(real) (FN586)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	SETREAL
FN code	582
Title name	Set buffer (real)
General description	This command is used to stored real value at an arbitrary position in the buffer

■ General description

This command is used to stored real value at an arbitrary position in the buffer.

The real number value is expressed in the form of the single precision floating point number defined by IEEE754. The data is stored in the buffer by the big endian by four bytes.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to store data is specified. (1 – 16)
Parameter No. 2	Real value	The real value stored in the buffer is specified. The real value can be specified by the real variable and the real constant.
Parameter No. 3	Starting point	The stored position of the buffer is specified. (0 – 1020)

■ Example of screen display

SETREAL[1,53.2,0] FN582; Set buffer (real)

See

SETSTR ; Set buffer(string) (FN580)
SETINT ; Set buffer(integer) (FN581)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETINT ; Get buffer(integer) (FN585)
GETREAL ; Get buffer(real) (FN586)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	SETBYTE
FN code	583
Title name	Set buffer (byte)
General description	This command is used to stored byte data at an arbitrary position in the buffer.

■ General description

This command is used to stored byte data at an arbitrary position in the buffer. This command is userd, when the data that cannot correspond with SETSTR, SETINT, and SETREAL is stored in the buffer.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to store data is specified. (1 – 16)
Parameter No. 2	Integer value	The value stored in the buffer is specified. The value can be specified by the variable and the constant.
Parameter No. 3	Starting point	The stored position of the buffer is specified. (0 – 1020)

■ Example of screen display

SETBYTE[1,53,0] FN583; Set buffer (byte)

See

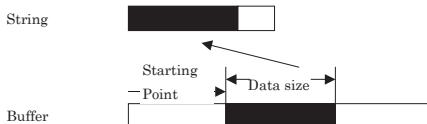
SETSTR : Set buffer(string) (FN580)
SETINT : Set buffer(integer) (FN581)
SETREAL : Set buffer(real) (FN582)
GETSTR : Get buffer(string) (FN584)
GETINT : Get buffer(integer) (FN585)
GETREAL : Get buffer(real) (FN586)
GETBYTE : Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	GETSTR
FN code	584
Title name	Get buffer (string)
General description	This command is used to read data from the buffer, and to store data in the string variable.

■ General description

This command is used to read data from specified position of the buffer, and to store data in the specified string variable. When the reading string overflows of the buffer (When starting position + data size exceeds the size of the buffer), it becomes it , saying that "E2250 step data is abnormal".



■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to read data is specified. (1 – 16)
Parameter No. 2	String variable	The string variable to store the read data is specified.
Parameter No. 3	Starting point	The read position of the buffer is specified. (0 – 1023)
Parameter No. 4	Data size	The data size of the data read in the buffer is specified. (1 – 199)

■ Example of screen display

GETSTR[1,V1\$0,3] FN584; Get buffer (string)

See

SETSTR ; Set buffer(string) (FN580)
SETINT ; Set buffer(integer) (FN581)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETINT ; Get buffer(integer) (FN585)
GETREAL ; Get buffer(real) (FN586)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	GETINT
FN code	585
Title name	Get buffer (integer)
General description	This command is used to read data from the buffer, and stored the integer variable.

■ General description

This command is used to read four bytes data from the specified position of the buffer, and stored the integer variable. When this command is used, it is necessary to confirm the big endian the data stored in the buffer, and the integer value with the sign in four bytes. It is necessary to use the GETBYTE function for other integral values.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to read data is specified. (1 – 16)
Parameter No. 2	Integer variable	The integer variable to store the read data from the buffer is specified.
Parameter No. 3	Starting point	The read position of the buffer is specified. (0 – 1020)

■ Example of screen display

GETINT[1,V1%,0] FN585; Get buffer (integer)

See

SETSTR ; Set buffer(string) (FN580)
SETINT ; Set buffer(integer) (FN581)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETREAL ; Get buffer(real) (FN586)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	GETREAL
FN code	586
Title name	Get buffer (real)
General description	This command is used to read data from the buffer, and stored the real variable.

■ General description

This command is used to read four bytes data from the specified position of the buffer, and stored the real variable. When this command is used, it is necessary to confirm the big endian the data stored in the buffer, and the floating point number provided for by IEEE754 in four bytes.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to read data is specified. (1 – 16)
Parameter No. 2	Real variable	The real variable to store the read data from the buffer is specified.
Parameter No. 3	Starting point	The read position of the buffer is specified. (0 – 1020)

■ Example of screen display

GETREAL[1,V1!,0] FN586; Get buffer (real)

See

SETSTR ; Set buffer(string) (FN580)
SETINT ; Set buffer(integer) (FN581)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETINT ; Get buffer(integer) (FN585)
GETBYTE ; Get buffer(byte) (FN587)

Function commands (FN codes)

Command name	GETBYTE
FN code	587
Title name	Get buffer (byte)
General description	This command is used to read one byte data from the buffer, and stored the integer variable.

■ General description

This command is used to read one byte data from the buffer, and stored the integer variable.

■ Parameter

Parameter No. 1	Buffer No.	The number of the buffer to read data is specified. (1 – 16)
Parameter No. 2	Integer variable	The integer variable to store the read data from the buffer is specified.
Parameter No. 3	Starting point	The read position of the buffer is specified. (0 – 1023)

■ Example of screen display

GETBYTE[1,V2%,0] FN587; Get buffer (byte)

See

SETSTR ; Set buffer(string) (FN580)
SETINT ; Set buffer(integer) (FN581)
SETREAL ; Set buffer(real) (FN582)
SETBYTE ; Set buffer(byte) (FN583)
GETSTR ; Get buffer(string) (FN584)
GETINT ; Get buffer(integer) (FN585)
GETREAL ; Get buffer(real) (FN586)

Function commands (FN codes)

Command name	SCANF
FN code	589
Title name	Scan string with format
General description	Read one line of strings from specified file, and output string to string register.

■ General description

Read one line of strings from specified file, and output string to string register.

■ Example of operation

- 1 Fopen #5,"Test.log",0,1
- 2 Scanf #5,2,"%s",V1\$
- 3 Fclose #5

■ Parameter

1 st parameter	Device No.	Device No. specifying with FOPEN. 5 – 36 : At the same time you can open up to 32 kinds of files.
2 nd parameter	Line number	Specify the line number which you'd like to read in the file.
3 rd parameter	String with format	Only "%s", cannot edit.
4 th parameter	String Register Number	Set the string register number which you'd like to output string.

■ Example of screen display

SCANF[#5,1,"%s",V1\$]	FN589; Scan string with format
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See

PRINTF ; Print string with format(FN669)
FOPEN ; Files Open(FN598)
FCLOSE ; Files Close(FN599)

Function commands (FN codes)

Command name	LCALLP
FN code	590
Title name	Program call with Arguments
General description	This command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.

■ General description

When this function command is executed, the specified program is called and passed the arguments.

Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the jump destination will be executed as soon as the call command has been executed.

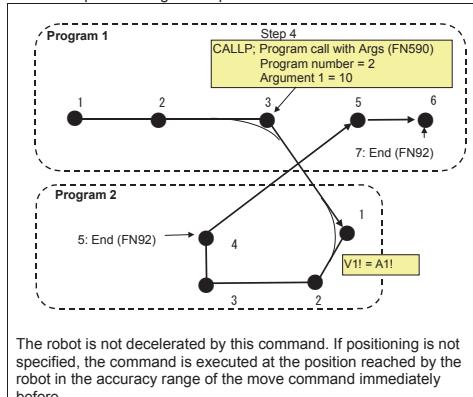
When the playback of the program at the call destination is completed (in the status established by executing the END command), the robot returns to the step following the step with the call command of the call source program.

■ Example of operation

In step 4, record LCALLP: program call with Arguments (FN590) and "2" as the program number, and "10" as an argument.

When this is played back, the robot calls the Program 2 upon arriving at step 4. The program2 can get the value "10" passed an argument1 in LCALLP command by using variable of argument "A1!".

When the playback of program 2 is completed (in the status established by executing the END command), the robot returns to step 5 following the step with the call command of call source program 1.



The program call can be executed again at the call destination (during program 2 in the above figure.) Up to 8 layers of

calls can be executed. If calls exceeding 8 layers are executed, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.

■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (1-9999)
Parameter No.2-No.11	Argument 1-10	This specifies the value of an argument passed to the program serving as the call destination. (-1E38 – 1E38)

■ Example of screen display

LCALLP [2,10,0,0,0,0,0,0,0] FN590; Program call with Arguments

See

LCALLPI: Conditional program call with Arguments (FN591)

LCALLPN: Conditional program call after specified number of passes with Arguments (FN592)

Function commands (FN codes)

Command name	LCALLPI
FN code	591
Title name	Conditional program call with Arguments
General description	Using an input signal, this command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.

■ General description

When this function command is executed, the specified program is called and passed the arguments. When the specified input signal has been input, the step is called; when it has not been input, the step is not called and the robot passes the command by.

Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the jump destination will be executed as soon as the call command has been executed.

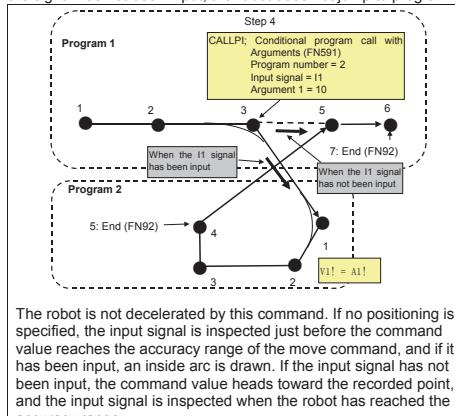
When the playback of the program at the call destination is completed (in the status established by executing the END command), the robot returns to the step following the step with the call command of the call source program.

■ Example of operation

In step 4, record LCALLPI: conditional program call with Arguments (FN591), "2" as the program number, and I1 as the input signal, and "10" as an argument.

When this is played back, the robot arrives at step 4, and if input signal I1 has been input, it jumps to the first step in program 2. The program2 can get the value "10" passed an argument1 in LCALLP command by using variable of argument "A1!". When the playback of program 2 is completed (the END command is executed), the robot returns to step 5 following the step with the call command of call source program 1.

If the signal has not been input, the robot does not jump to program 2.



The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command value reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the command value heads toward the recorded point, and the input signal is inspected when the robot has reached the accuracy range.

The program call can be executed again at the call destination (during program 2 in the above figure.) Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.

■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (1-9999)
Parameter No. 2	Input signal	This records the number of the input signal which is to serve as the condition for executing the call. When number 5101 or above is specified, multiple input signals can be specified. (1-2048, 5101—5196)

Parameter No.3-No.12	Argument 1-10	This specifies the value of an argument passed to the program serving as the call destination. (-1E38 – 1E38)
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■ **Example of screen display**

LCALLP [2,I1,10,0,0,0,0,0,0,0,0] FN81; Conditional program call with Args

See

LCALLP: Program call with Arguments (FN590)

LCALLPN: Conditional program call after specified number of passes with Arguments (FN592)

Function commands (FN codes)

Command name	LCALLPN
FN code	592
Title name	Conditional program call after specified number of passes with Arguments.
General description	Using a pass count (number of passes), this command is used to call the specified program. At this time, ten real numbers can pass the arguments to the program.

■ General description

When this function command is executed, the specified program is called and passed the arguments. The robot passes for the specified number of passes, and on the next time (specified number of passes +1) the call command is executed. (For instance, if "2" is specified as the number of passes, the robot passes twice, and on the third time the call command is executed.)

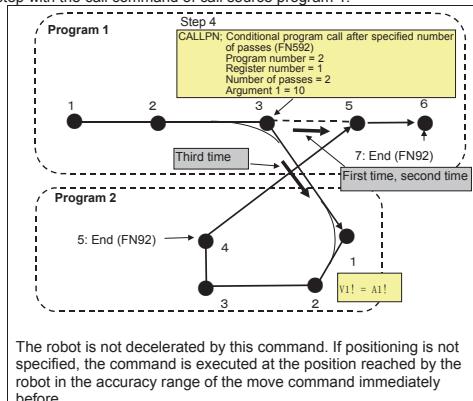
Bear in mind that if a function command has been recorded in the first step in the call destination program, the function command at the jump destination will be executed as soon as the call command has been executed.

When the playback of the program at the call destination is completed (in the status established by executing the END command), the robot returns to the step following the step with the call command of the call source program.

■ Example of operation

In step 4, record LCALLPN: conditional program call after specified number of passes with Args (FN592), "2" as the program number, "1" as the register number, "2" as the number of passes, and "10" as the argument 1. When this is played back, the robot passes by for the first and second times, and then advances to steps 5; however, on the third time, it jumps to the first step in program 2. The program2 can get the value "10" passed an argument1 in LCALLP command by using variable of argument "A1!".

When the playback of program 2 is completed (the END command is executed), the robot returns to step 5 following the step with the call command of call source program 1.



The robot is not decelerated by this command. If positioning is not specified, the command is executed at the position reached by the robot in the accuracy range of the move command immediately before.

The program call can be executed again at the call destination (during program 2 in the above figure.) Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.

A global integer variable common to all units is used for the number of passes.
The current number of passes can be referenced using monitor/integer variables.

■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (1-9999)
-----------------	-------------	------------------------------------------------------------------------------------

Parameter No. 2	Register number	A "register" refers to the memory used for counting. Since an integer variable (1 to 200) is used, this parameter specifies its number. (1-200)
Parameter No. 3	Number of passes	This records the number of passes which is to serve as the condition for executing the call. The robot passes for the specified number of passes, and on the next time (specified number of passes +1) the call command is executed. (0-10000)
Parameter No.4-No.13	Argument 1-10	This specifies the value of an argument passed to the program serving as the call destination. (-1E38 – 1E38)

■ Example of screen display

LCALLPN[2,V1%,2,10,0,0,0,0,0,0,0,0]	FN82; Conditional program call after specified number of passes with Arguments
-------------------------------------	--------------------------------------------------------------------------------

See

LCALLP: Program call with Arguments (FN590)

LCALLPI: Conditional program call with Arguments (FN591)

Function commands (FN codes)

Command name	LCALLMCR
FN code	593
Title name	Call User Task Program with Arguments
General description	This command is used to call the specified user task program. At this time, ten real numbers can pass the arguments to the program.

■ General description

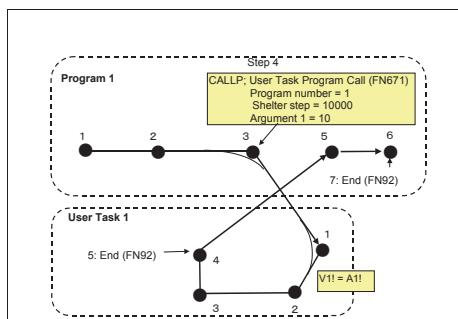
When this function command is executed, the specified user task program is called and passed the arguments. When program call user task program, program stop one's playback and start specified user task program.
When the playback of the user task program at the call destination is completed (in the status established by executing the END command), the program returns to the step following the step with the call command of the call source program.

■ Example of operation

In step 4, record LCALLMCR: User Task Program Call with Arguments (FN593) and "1" as the program number, "10000" as the shelter step, and "10" as an argument.

When this is played back, the program1 call the user task program 1 upon arriving at step 4. The program2 can get the value "10" passed an argument1 in LCALLP command by using variable of argument "A1!". When the start of User Task 1 fails, the program1 jumps shelter step.

When the playback of user task program 1 is completed (in the status established by executing the END command), the robot returns to step 5 following the step with the call command of call source program 1.



■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (1-999)
Parameter No. 2	Shelter step	This is used to specify the number of the shelter step when the specified user task program was not starting. (1 to 10000) When 10000 is specified as the shelter step number, an alarm results immediately with no escape operation performed, and the robot can be stopped.
Parameter No.3-No.12	Argument 1-10	This specifies the value of an argument passed to the program serving as the call destination. (-1E38 – 1E38)

■ Example of screen display

LCALLMCR [1,10000,10,0,0,0,0,0,0,0,0] FN593; Call User Task Program with Arguments

Function commands (FN codes)

Command name	CNV12
FN code	595
Title name	Conveyor Interlock 2
General description	Robot waits until conveyor register reaches up to the designated distance, stationarily

■ General description

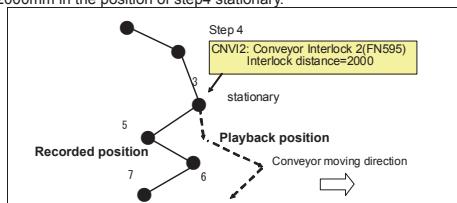
This function is used in conveyor synchronizing application.

Robot waits until conveyor register reaches up to the designated distance (= interlock distance). While waiting, robot is stationary. When conveyor register reaches, robot proceeds to the next step. If conveyor register had already reached to the interlock distance before the start of waiting, robot immediately proceeds to the next step.

Please refer to the “Conveyor Synchronization Manual” (option) for detail operations.

■ Example of operation

In case of CNV12 : Conveyor Interlock 2 (FN595) is recorded at step4, robot will wait until conveyor register reaches up to 2000mm in the position of step4 stationary.



■ Parameter

Parameter No. 1	Conveyor number	Conveyor number which conveyor should be interlocked.(1~*) (* is conveyor quantity defined)
Parameter No. 2	Interlock distance	Input the conveyor interlock distance. Linear conveyor: (0-30,000) mm Circular conveyor: (0-180) degree

■ Example of screen display

CNV12[1, 3000] FN595: Conveyor Interlock 2

See

CNV1; Conveyor Interlock(FN550)

CNVSYNC; Conveyor Counter Reset (FN55)

CNVYSNCI; Synchronizing Conveyor Interlock (FN562)

Function commands (FN codes)

Command name	CNVSFTSYNC
FN code	596
Title name	Conveyor Register Reset
General description	Reset conveyor register and counter

■ General description

This function is used in conveyor synchronizing application.

Conveyor counter (read value of conveyor pulse) is reset at step0 forcibly, but this function allows to clear conveyor counter in any step. In addition, to begin the automatic re-count up this function after execution.

Please refer to the “Conveyor Synchronization Manual” (option) for detail operations.

■ Example of operation

Conveyor Counter is reset where the step CNVSFTCYNC : Conveyor Register Reset (FN596) is executed.

■ Parameter

Parameter No. 1	Conveyor number	Conveyor number which counter should be reset.(1-*) (* is conveyor quantity defined)
Parameter No. 2	Reset threshold value	It will specify a number to make the decision to reset the conveyor counter. If conveyor register is greater than the specified value, and reset the counter. (1-8000000)

■ Example of screen display

CNVSFTSYNC[1,2000] FN596: Conveyor Register Reset

See

CNVSYNC; Conveyor Counter Reset (FN55)

CNVI; Conveyor Interlock (FN550)

CNVYSYNCI; Synchronizing Conveyor Interlock (FN562)

Function commands (FN codes)

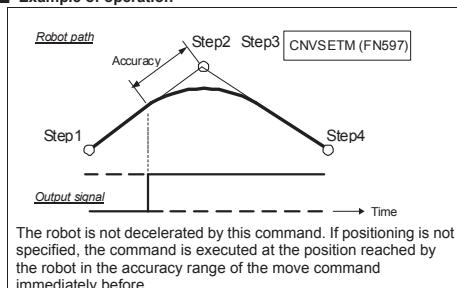
Command name	CNVSETM
FN code	597
Title name	Conveyer sync output signal ON/OFF
General description	This command is used to set any general-purpose output signal to ON or OFF and assign conveyer resister value to global real number variable simultaneously with signal output.

■ General description

When this function command is executed, any general-purpose output signal (O1 to O2048) is set to ON or OFF and assign conveyer resister value to global real number variable simultaneously with signal output.

However, the command cannot set any of the status signals (signals with pre-assigned applications such as the gun signals and starting signal) to ON or OFF. Which signals have been assigned as status signals can be identified on the monitor screen. Signals whose numbers are displayed in the bold italics are status signals so any of the other signals can be set to ON or OFF.

■ Example of operation



■ Parameter

Parameter No. 1	Conveyer number	Conveyor number which conveyor should be assigned.(1-*) (* is conveyor quantity defined)
Parameter No. 2	Output signal number	This specifies the number of the output signal which is to be turned ON or OFF. (1-2048)
Parameter No. 3	ON/OFF	"1" specified for ON, and "0" for OFF. (0-1)
Parameter No. 4	Real number variable number	This specifies the number of the register (real number variable) in which a conveyer register value is to be stored. (1-200,301-500)

■ Example of screen display

CNVSETM [1, O17, 1, V150]
FN597; Conveyer sync output

See

SETM: Output signal ON/OFF (FN105)

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