1802, TFDEN-092-005, 001

NACHI

FD CONTROLLER INSTRUCTION MANUAL COMMAND REFERENCE

5th edition

Volume 1
(FN0 ALLCLR – FN356 SLPRSG)

- 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.

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.

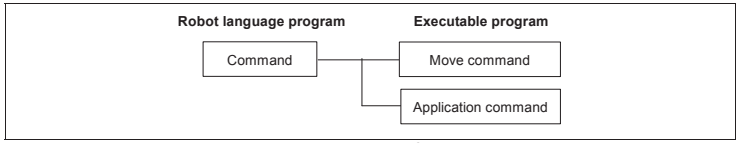


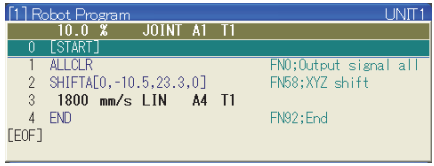
Fig 1.1.1 What is command?

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



Move command (step 3)
Application command (step 1,2 and 4)

- Parameters are surrounded by [ ] after command.
- FN code No. and title is displayed on the right side.

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

```
ALLCLR - - - - - (1)
SHIFTA 0,-10.5,23.3,0 - - - - - (2)
MOVEX A=4,M1X,L,(*,*,*,*,*,*),S=1800,H=1,MS,CONF=0000 - - - (3)
END - - - - - (4)
```

Move command (3)
Application command (1) (2) (4)

- Parameters are displayed after command.
- Respective parameters are separated by comma.

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.).

IMPORTANT

Because this manual covers all the commands without any distinguishments 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***	LET ACOS 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
BELOW	***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(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 usertask 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.
CALLPBCD	***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)
CHGXXGUN	***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 CHGXXGUN: Change Mechanism (FN238). CHGXXGUN (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***	Conveyor counter reset	Reset conveyor 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 moiton by FLEXhand. (Option)
FHCLAMP2	***366***	New FH Clamp	Execute clamp moiton by FLEXhand
FHCLAMPDCT	***368***	FH Clamping Detection	Detect clamp status by FLEXhand
FHUNCLAMP	***363***	FLEXhand Unclamp	Execute unclamp moiton by FLEXhand (Option)
FHUNCLAMP2	***367***	New FH Unclamp	Execute unclamp moiton 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.
JMPPI	***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 V!. 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_APR	***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_GETSFT	***393***	Get palletize shift value	Store palletize shift value to some variables.
PALLET3_OPT	***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_SELGR	***376***	Palletize select grasp position	Select Work grasp position from registered by Palletize pattern.
PALLET3_SELZ	***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_SELZJMP	***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_SELZSFT	***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_SETREG	***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(I-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(I-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.
SLRELOAD	***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 pecified 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.
STOPI	***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.
ZF1	***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 s 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 distinguishments 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.

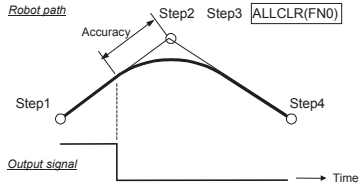
Function commands (FN codes)

Command name	ALLCLR
FN code	0
Title name	All output signals clear
General description	This command is used to set all the general-purpose output signals to OFF.

General description

When this function command is executed, it is possible to set all the general-purpose output signals (O1 to O2048) to OFF.
However, the command cannot set any of the status signals (signals with pre-assigned applications such as the gun signals and starting signal) to 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 OFF altogether.

■ **Example of operation**



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**

None

■ **Example of screen display**

ALLCLR	FN0: All output signals clear

See
SET; Output signal ON (FN32)
RESET; Output signal OFF (FN34)
SETO; Consecutive output signal ON/OFF (FN100)
SETM ; Output signal ON/OFF (FN105)

Function commands (FN codes)

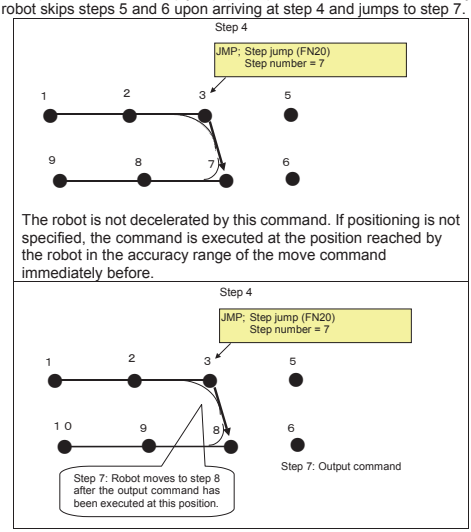
Command name	JMP
FN code	20
Title name	Step jump
General description	The robot jumps to the step specified in the same program.

■ General description

When this function command is executed, the robot is able to jump to the step specified in the same program. It makes no difference whether the jump destination step is a move command or function command.
Bear in mind that if the jump destination step is a function command, the function command at the jump destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record JMP: step jump (FN20), and 7 as the number of the jump destination step. When this is played back, the robot skips steps 5 and 6 upon arriving at step 4 and jumps to step 7.



■ Parameter

Parameter No. 1	Step No.	This specifies the number of the step serving as the robot's jump destination. (1-999)

■ Example of screen display

JMP[35]	FN20; Step jump

See
JMPI: Conditional step jump (FN23)
JMPN; Conditional step jump after specified number of passes (FN26)

Function commands (FN codes)

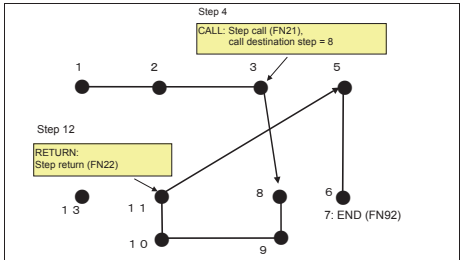
Command name	CALL
FN code	21
Title name	Step Call
General description	This command is used to call the step which has been specified in the same program.

■ General description

When this function command is executed, a step specified in the same program is called. It makes no difference whether the call destination step is a move command or function command.
Bear in mind that if the call destination step is a function command, the function command at the call destination will be executed as soon as the call command has been executed.
When the step return command is subsequently executed, operation returns to the step following the one which executed the call.

■ Example of operation

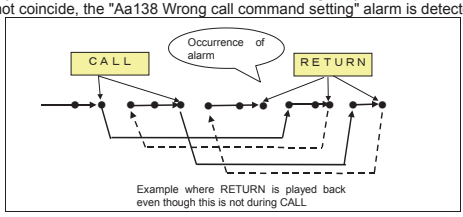
The step call and step return commands are used in tandem.
In step 4, record CALL: step call (FN21), 8 as the number of the call destination step, and in step 12, record RETURN: step return (FN22). When this is played back, the robot skips steps 5 to 7 upon arriving at step 4 and jumps to step 8. Then it advances to steps 9 through 12, and after the RETURN: step return (FN22) command is executed, it returns to the step following the one which executed the call, that is to say, step 5.



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 robot is returned to the step following the one with CALL; step call (FN21) command by the RETURN: step return (FN22) command, the RETI: conditional step return (FN25) command or by the RETN: conditional step return after specified number of passes (FN28) command.

The step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, the "Aa138 Wrong call command setting" alarm is detected during playback, and the robot stops.



■ Parameter

Parameter No. 1	Step No.	This specifies the number of the call destination step. (1-999)

■ **Example of screen display**

See
CALLI: Conditional step call (FN24) command
CALLN: Conditional step call after specified number of passes (FN27) command
RETURN: Step return (FN22)
RETI: Conditional step return (FN25) command
RETN: Conditional step return after specified number of passes (FN28) command

Function commands (FN codes)

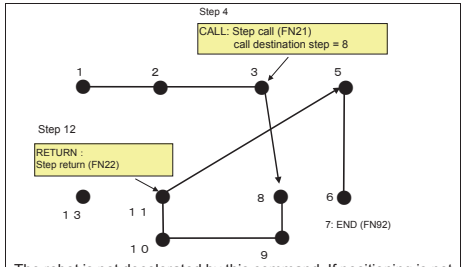
Command name	RETURN
FN code	22
Title name	Step return
General description	This command is used to return the robot to the step following the one which executed the step call command in the same program.

■ General description

When this function command is executed, the robot is returned to the step following the one which executed the step call command in the same program. It makes no difference whether the return destination step is a move command or function command.
Bear in mind that if the return destination step is a function command, the function command at the return destination will be executed as soon as the return command has been executed.

■ Example of operation

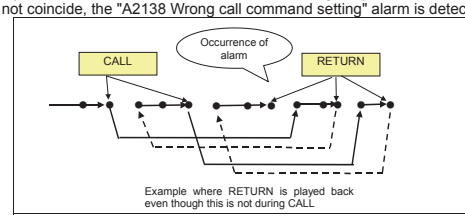
The step call and step return commands are used in tandem.
In step 4, record CALL: step call (FN21), 8 as the number of the call destination step, and in step 12, record RETURN: step return (FN22). When this is played back, the robot skips steps 5 to 7 upon arriving at step 4 and jumps to step 8. Then it advances to steps 9 through 12, and after the RETURN: step return (FN22) command is executed, it returns to the step following the one which executed the call, that is to say, step 5.



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 robot is returned to the step following the one with CALL; step call (FN21) command by the RETURN: step return (FN22) command, the RETI: conditional step return (FN25) command or by the RETN: conditional step return after specified number of passes (FN28) command.

The step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.



■ Parameter

None

■ Example of screen display

RETURN	FN22; Step return

See
CALL; Step call (FN23)
CALLI: Conditional step call (FN24) command
CALLN: Conditional step call after specified number of passes (FN27) command
RETI: Conditional step return (FN25) command
RETN: Conditional step return after specified number of passes (FN28) command

Function commands (FN codes)

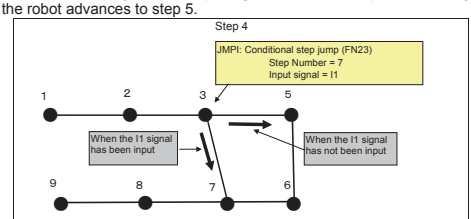
Command name	JMPI
FN code	23
Title name	Conditional step jump
General description	Using an input signal, this command causes the robot to jump to the step specified in the same program.

■ General description

When this function command is executed, the robot is able to jump to the step specified in the same program. It makes no difference whether the jump destination step is a move command or function command.
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.
Bear in mind that if the jump destination step is a function command, the function command at the jump destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record JMPI: step jump (FN23), 7 as the number of the jump destination step and I1 as the input signal.
If, when this is played back, input signal I1 has been input, the robot jumps to step 7, but if the signal has not been input, the robot advances to step 5.

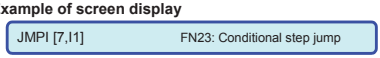


The robot is not decelerated by this command. If no positioning is specified, the input signal is inspected just before the command value reaches the accuracy range of the move command, and if it has been input, an inside arc is drawn. If the input signal has not been input, the command value heads toward the recorded point, and the input signal is inspected when the robot has reached the accuracy range.

■ Parameter

Parameter No. 1	Step No.	This specifies the number of the step serving as the robot's jump destination. （1-999）
Parameter No. 2	Input signal	This records the number of the input signal which is to serve as the condition for executing the jump. When number 5101 or above is specified, multiple input signals can be specified. （1-2048、5101～5196）

■ Example of screen display



See
JMP; Step jump (FN20)
JMPN: Conditional step jump after specified number of passes (FN26)

Function commands (FN codes)

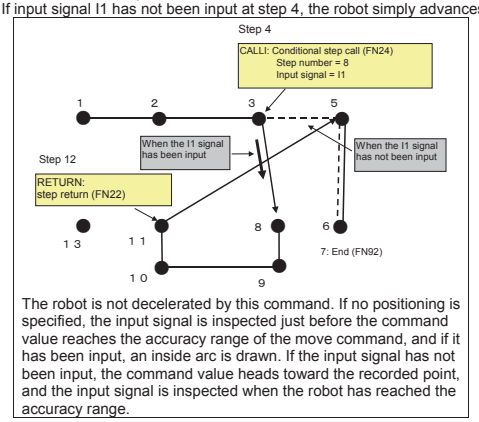
Command name	CALLI
FN code	24
Title name	Conditional step call
General description	Using an input signal, this command is used to call the step which has been specified in the same program.

■ General description

When this function command is executed, a step specified in the same program is called. It makes no difference whether the call destination step is a move command or function command.
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 the call destination step is a function command, the function command at the call destination will be executed as soon as the call command has been executed.
When the step return command is subsequently executed, operation returns to the step following the one which executed the call.

■ Example of operation

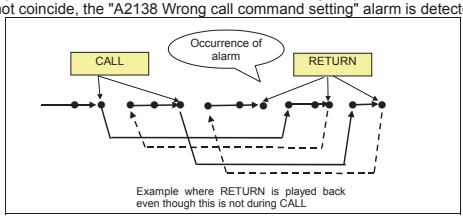
In step 4, record CALLI: conditional step call (FN24), 8 as the number of the call destination step and I1 as the input signal.
If, when this is played back, input signal I1 has been input, the robot jumps to step 8 and advances to steps 9 through 12, and after the RETURN: step return (FN22) command is executed, it returns to the step following the one which executed the call, that is to say, step 5.
If input signal I1 has not been input at step 4, the robot simply advances to step 5.



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 robot is returned to the step following the one with the CALLI: conditional step call (FN24) command by the RETURN: step return (FN22) command, the RETI: conditional step return (FN25) command or by the RETN: conditional step return after specified number of passes (FN28) command.

The step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.



■ **Parameter**

Parameter No. 1	Step No.	This specifies the number of the call destination step.（1-999）
Parameter No. 2	Input signal	This records the number of the input signal which is to serve as the condition for executing the jump. When number 5101 or above is specified, multiple input signals can be specified.（1-2048、5101～5196）

■ **Example of screen display**

CALLI [8,I1]	FN24; Conditional step call

See
CALL; Step call (FN21)
CALLN: Conditional step call after specified number of passes (FN27) command
RETURN: Step return (FN22)
RETI: Conditional step return (FN25) command
RETN: Conditional step return after specified number of passes (FN28) command

Function commands (FN codes)

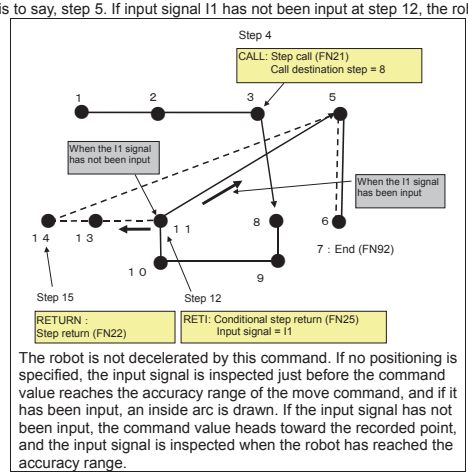
Command name	RETI
FN code	25
Title name	Conditional step return
General description	Using an input signal, this command is used to return the robot to the step following the one which executed the step call command in the same program.

■ General description

When this function command is executed, the robot returns to the step following the one which executed the step call command in the same program when the specified signal has been input. It makes no difference whether the return destination step is a move command or function command.
When the specified input signal has been input, the robot returns; when it has not been input, it does not return but passes the command by.
Bear in mind that if the return destination step is a function command, the function command at the return destination will be executed as soon as the return command has been executed.

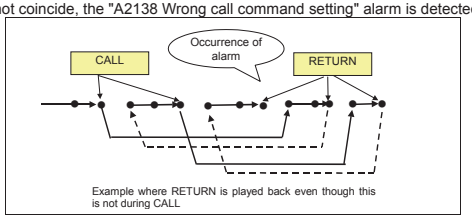
■ Example of operation

In step 4, record CALL: step call (FN21) and in step 11, record RETI: conditional step return (FN25), and I1 as the input signal.
When this is played back, the robot advances to steps 3 through 8 through 12, and if input signal I1 has been input where the RETI: conditional step return command was executed, the robot returns to the step following the call source step, that is to say, step 5. If input signal I1 has not been input at step 12, the robot simply advances to step 13.



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 step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.



Example where RETURN is played back even though this is not during CALL

■ **Parameter**

Parameter No. 1	Input signal	This records the number of the input signal which is to serve as the condition for executing the return. When number 5001 or above is specified, multiple input signals can be specified. （1-2048、5001～5096）

■ **Example of screen display**

RETI [I1]	FN25; Conditional step return

See
CALL; Step call (FN21)
CALLI: Conditional step call (FN24) command
CALLN: Conditional step call after specified number of passes (FN27) command
RETURN: Step return (FN22)
RETN: Conditional step return after specified number of passes (FN28) command

Function commands (FN codes)

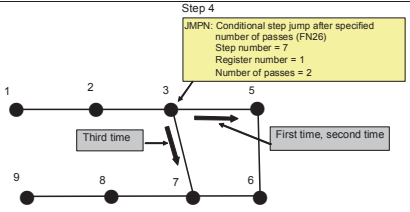
Command name	JMPN
FN code	26
Title name	Conditional step jump after specified number of passes
General description	Using a pass count (number of passes), the robot jumps to the step specified in the same program.

■ General description

When this function command is executed, the robot jumps to the step specified in the same program in accordance with the number of passes. It makes no difference whether the jump destination step is a move command or function command.
The robot passes for the specified number of passes, and on the next time (specified number of passes 1) the jump command is executed. (For instance, if "2" is specified as the number of passes, the robot passes twice, and on the third time the jump command is executed.)
Bear in mind that if the jump destination step is a function command, the function command at the jump destination will be executed as soon as the jump command has been executed.

■ Example of operation

In step 4, record JMPN: conditional step jump after specified number of passes (FN26), 7 as the number of the jump destination step, 1 as the register number, and 2 as the number of passes.
When this is played back, the robot passes on the first and second times, and it advances to step 5; on the third time, however, it jumps to step 7.



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.

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	Step No.	This specifies the number of the step serving as the robot's jump destination. （1-999）
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 jump. The robot passes for the specified number of passes, and on the next time (specified number of passes 1) the jump command is executed. （0-10000）

■ Example of screen display

JMPN [6, V1%, 2] FN26; Conditional step jump after specified number of passes

See
JMP; Step jump (FN20)
JMPI: Conditional step jump (FN23)

Function commands (FN codes)

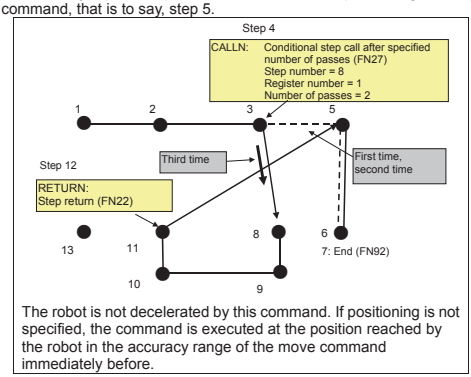
Command name	CALLN
FN code	27
Title name	Conditional step call after specified number of passes
General description	Using a pass count (number of passes), this command is used to call a step specified in the same program.

■ General description

When this function command is executed, the step specified in the same program is called in accordance with the number of passes. It makes no difference whether the call destination step is a move command or function command.
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 the call destination step is a function command, the function command at the call destination will be executed as soon as the call command has been executed.
When the step return command is subsequently executed, operation returns to the step following the one which executed the call.

■ Example of operation

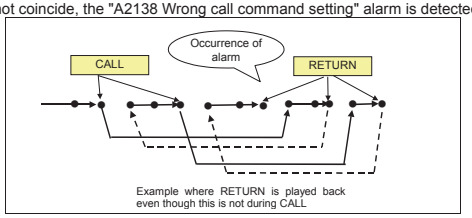
The step call and step return commands are used in tandem.
In step 4, record CALLN: conditional step call after specified number of passes (FN27), 8 as the number of the call destination step, 1 as the register number, and 2 as the number of passes. In step 12, record RETURN: step return (FN22). When this is played back, the robot passes on the first and second times, and it advances to step 5; on the third time, however, it jumps to step 8, and returns to the step following the step which executed the RETURN: step return FN22) command, that is to say, step 5.



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 robot is returned to the step following the one with CALLN: conditional step call after specified number of passes (FN27) command by the RETURN: step return (FN22) command, the RETI: conditional step return (FN25) command or by the RETN: conditional step return after specified number of passes (FN28) command.

The step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, the "A2138 Wrong call command setting" alarm is detected during playback, and the robot stops.



Example where RETURN is played back even though this is not during CALL

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	Step No.	This specifies the number of the call destination step.（1-999）
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）

■ **Example of screen display**

```
CALLN [8, V1%, 2]    FN27; Conditional step call after
                           specified number of passes
```

See
CALL; Step call (FN21)
CALLI: Conditional step call (FN24) command
RETURN: Step return (FN22)
RETI: Conditional step return (FN25) command
RETN: Conditional step return after specified number of passes (FN28) command

Function commands (FN codes)

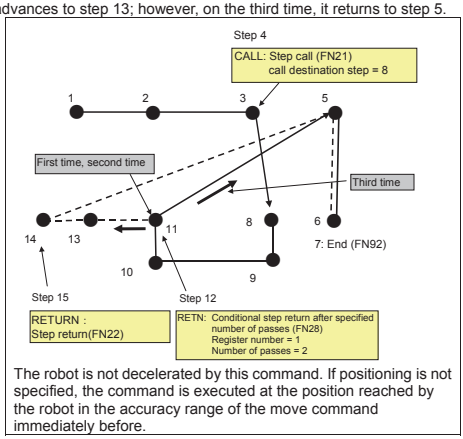
Command name	RETN
FN code	28
Title name	Conditional step return after specified number of passes
General description	Using a pass count (number of passes), this command is used to return the robot to the step following the one which executed the step call command in the same program.

■ General description

When this function command is executed, the robot is returned to the step following the one which executed the step call command in the same program in accordance with the number of passes. It makes no difference whether the return destination step is a move command or function command.
The robot passes for the specified number of passes, and on the next time (specified number of passes 1) the return command is executed. (For instance, if "2" is specified as the number of passes, the robot passes twice, and on the third time the return command is executed.)
Bear in mind that if the return destination step is a function command, the function command at the return destination will be executed as soon as the return command has been executed.

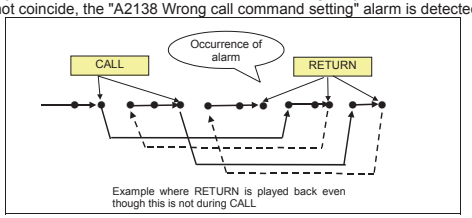
■ Example of operation

In step 4, record CALL: step call (FN21) and in step 11, record RETN: conditional step return after specified number of passes (FN26), 1 as the register number, and 2 as the number of passes.
When this is played back, the robot advances to steps 3 through 8 through 12, and for the first and second times it simply advances to step 13; however, on the third time, it returns to step 5.



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 step call command can be executed again at the call destination (between steps 8 and 11 in the above figure). Up to 8 layers of calls can be executed. If calls exceeding 8 layers are executed or the number of step calls and step returns does not coincide, 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	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. 2	Number of passes	This records the "number of passes" which is to serve as the condition for executing the return. The robot passes for the specified number of passes, and on the next time (specified number of passes 1) the return command is executed. (0-10000)

■ **Example of screen display**

```
RETN [V1%, 2]     FN28; Conditional step return after
                        specified number of passes
```

See
CALL; Step call (FN21)
CALLI: Conditional step call (FN24) command
CALLN: Conditional step call after specified number of passes (FN27) command
RETURN: Step return (FN22)
RETI: Conditional step return (FN25) command

Application command (FN code)

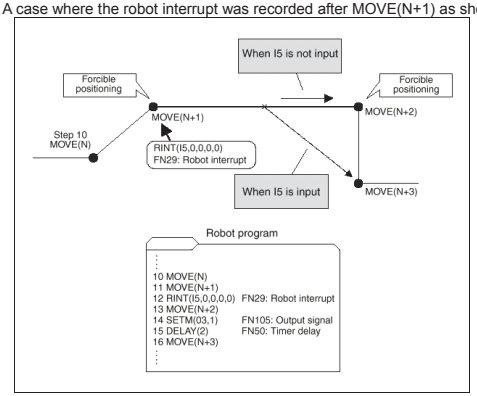
Command name	RINT
FN code	29
Title name	Robot Interrupt (I-condition)
General description	Executing step is interrupted by input signal

■ General description

Normal application commands are executed after the recording position has been reached. For this reason, it is not possible to conduct such operations as changing the movement path or out-putting the output signals until the target step has been reached.
By using this application command, such operations as detecting obstacles and changing the movement path or outputting general-purpose output signals can be conducted while moving between MOVE commands.
The normal procedure to be followed when handling work with a poor positioning accuracy is to use the inputs of the sensors attached to the gripper or other end effecter as the robot interrupt input signals and perform the grip/release operations at the position where contact is made with the work.

■ Example of operation

A case where the robot interrupt was recorded after MOVE(N+1) as shown in the figure is explained as an example.



- The robot interrupt section (range within which the interrupt processing is valid) extends from MOVE(N+1), which is the movement command immediately before the robot interrupt command RINT step, to MOVE(N+2) which is the movement command immediately after this step.
- When the input of the input signal I5 is detected in this section, the process of moving to MOVE(N+2) is exited immediately, and operation transfers to executing the command which has been recorded following MOVE(N+2). Since, in the case of the example provided, the command recorded after the MOVE(N+2) movement command is the SETM application command and the next one is the DELAY application command, these application commands are executed at the position where I5 is detected, and the robot next heads from that position toward the position of the MOVE(N+3) movement command. (Path indicated by the dotted line in the figure)
- The steps at both ends of the robot interrupt section (the MOVE(N+1) and MOVE(N+2) movement commands in the case of the figure) forcibly entail the positioning of the robot irrespective of what has been recorded.
- If the input of the input signal (I5) has not been detected by the time when the position where MOVE(N+2) was recorded is reached, the robot moves as usual up to the position where MOVE(N+2) was recorded, and the next SETM (FN105) command is executed.
- When the input of the input signal (I5) is detected as the robot heads toward MOVE(N+2) and then the robot heads toward the position where MOVE(N+3) was recorded, it moves along the positioning path.
- Record the minimum speed of the Move Command MOVE (N+2). Interrupt detection response may become ineffective if the operations are carried out at a high speed.

■ Parameter

1st parameter	Input Sig.	This is used to specify the number of the input signal serving as the robot interrupt condition. (1 to 2048): General-purpose input signal number (5101 to 5196): Multiple input signal number	
2nd parameter	Search position	Search basis write setting status 0: Not set 1: Already set	These parameters are used by the search function. When a robot interrupt command is used on its own, use the "0" setting for all the parameters. Refer to SEA; Search (FN59) for the search functionality.
3rd parameter	Standard X	X,Y and Z coordinate value when a search basis write has been performed (-3000 to 3000)	
Parameter No.4	Standard Y		
Parameter No.5	Standard Z		

■ **Example of screen display**

```
RINT[34,0,0,0,0]    FN29:Robot Interrupt (I-condition)
```

See
SEA; Search (FN59)

Function Commands (FN Codes)

Command name	COLDET
FN code	31
Title name	Collision detection
General description	Executing step is interrupted by collision detection.

Please refer to the FD-CONTROLLER instruction manual “Collision detection function”.

■ Parameter

1st parameter	ON/OFF(1/0)	Set the ON or OFF of the collision detection. (0-1)
2nd parameter	Condition No.	Set the existent collision detection condition No. (1-8)
3nd parameter	Shelter step	This is used to specify the number of the shelter step when detect the collision interrupt. (0 to 10000) When 10000 is specified as the shelter step number, an alarm (A2362: “Detected the collision interrupt.”) results immediately with no escape operation performed, and the robot can be stopped.

■ Example of screen display

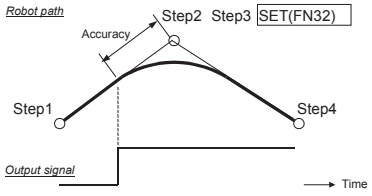
Function commands (FN codes)

Command name	SET
FN code	32
Title name	Output signal ON
General description	This command is used to set one of the general-purpose output signals to ON.

■ General description

When this function command is executed, it is possible to set any one of the general-purpose output signals (O1 to O2048) to ON. 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.
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.

■ Example of operation



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	Output signal number	This specifies the number of the general-purpose output signal which is to be set to ON. (1-2048)

■ Example of screen display

```
SET[O12]          FN32; Output signal ON
```

See
ALLCLR; All output signals clear (FN0)
RESET; Output signal OFF (FN34)
SETO; Consecutive output signal ON/OFF (FN100)
SETM ; Output signal ON/OFF (FN105)

Function commands (FN codes)

Command name	WELDCND
FN code	33
Title name	Spot condition output
General description	Output spot condition signals on manual.

■ General description

This function outputs signals assigned to the "weld condition output." The signals are outputted by the binary of 0-65535.
Notes -- this function is not concerned with a setup of "Check with function " of "Teach/Playback condition", but is performed. However, it does not execute at the time of step back operation.

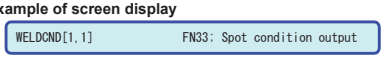
■ Example of operation

Please refer to SETM (FN32) about the timing of outputs.

■ Parameter

Parameter No.1	1～6	Wedler number
Parameter No.2	0～65535	Weld condition data

■ Example of screen display



See
SEAMST Seam weld start (FN245)

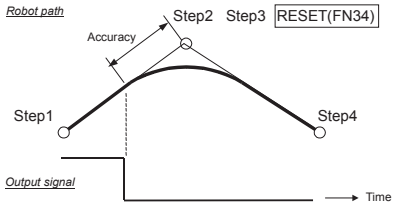
Function commands (FN codes)

Command name	RESET
FN code	34
Title name	Output signal off
General description	This command is used to set one of the general-purpose output signals to OFF.

■ General description

When this function command is executed, it is possible to set any one of the general-purpose output signals (O1 to O2048) to OFF. However, the command cannot set any of the status signals (signals with pre-assigned applications such as the gun signals and starting signal) to 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.

■ Example of operation



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	Output signal number	This specifies the number of the general-purpose output signal which is to be set to OFF.（1-2048）

■ Example of screen display

RESET [O12]　　FN34; Output signal OFF

See
ALLCLR: All output signals clear (FN0)
SET; Output signal OFF (FN32)
SETO: Consecutive output signal ON/OFF (FN100)
SETM: Output signal ON/OFF (FN105)

Function commands (FN codes)

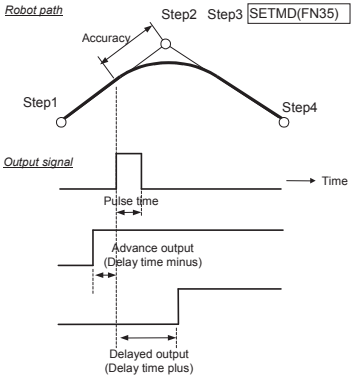
Command name	SETMD
FN code	35
Title name	Output with pulse or delay ON/OFF
General description	This command is used to set one of the general-purpose output signals to come with a pulse or delay and to ON or OFF.

■ **General description**

When this function command is executed, it is possible to set any one of the general-purpose output signals (O1 to O2048) to ON or OFF. Furthermore, the command enables pulse output, advance output or delayed output to be specified.

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**



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.

If an advanced output or delayed output has been specified, the output can cover both the move command immediately before (step 1 in the above figure) and the move command immediately after (step 4 in the above figure).

■ **Parameter**

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

Parameter No. 3	Delay time	If "0.0" is specified as the time, the command is executed at the timing which coincides with the recorded point. If a minus value is specified, the command is output ahead of the original execution timing by the amount equivalent to the delay time setting. Conversely, if a plus value is specified, it is output after the timing by the amount equivalent to the delay time setting. (Increment: seconds) In either case, it can be executed beyond the time lapse to the step before or after. (-10.0 – 10.0)
Parameter No. 4	Pulse time	This is set when the output signal is to be output as a pulse signal. It is used to specify the width of the pulse signal. When "0.0" is specified as the time, a level signal is output. (Increment: seconds) (0.0 – 10.0)

■ **Example of screen display**

```
SETMD [O12, 1, -5, 3]    FN35;      Output with pulse or delay ON/OFF
```

See
ALLCLR: All output signals clear (FN0)
SET: Output signal ON (FN32)
RESET: Output signal OFF (FN34)
SETO: Consecutive output signal ON/OFF (FN100)
SETM: Output signal ON/OFF (FN105)

Function commands (FN codes)

Command name	OnErrGoto
FN code	36
Title name	Error interrupt
General description	Call the step/label, when an error or alarm occurs.

■ General description

After executing this function, the specified step in the same program can be called, when an error or alarm occurs.

RETURNERR: Error interrupt return (FN 37) is executed, it returns to the step that the error occurred, the next step that the error occurred or returns to the specified step.

When an error occurs, servo may be turned off, but the program continues to error interrupt processing. However, you cannot use the move instruction or some functions.

SERVOON: Servo ON (FN 38) will turn on the servo.

The program stops if an error or alarm occurs again during an error interrupt.

■ Example of operation

```
1 OnErrGoto *Label
2 V1% = 1
3 V2% = 0
4 V3% = V1% / V2%
5 END
6 *Label
7 V3% = 0
8 RETURNERR
```

■ Parameters

Parameter 1	Line No./ Label	Used to make setting of line number or label of jump destination. (Setting range: 1 to 9999)

■ Example of screen display

OnErrGoto	FN36; Error interrupt

See

RETURNERR ; Error interrupt return (FN37)

SERVOON ; Servo ON (FN38)

Function commands (FN codes)

Command name	RETURNERR
FN code	37
Title name	Error interrupt return
General description	Return from error interrupt processing.

■ General description

When program number is selected, or step number is reset to 0, the file is automatically closed. If this function is used, return from error interrupt processing.
If the parameter is not set (= NULL), return to the step that the error occurred.
Setting " ＊ " to the parameter returns to the step that the error occurred. Setting the line number or label to the parameter, returns to the line.

■ Example of operation

```
1 OnErrGoto *Label
2 V1% = 1
3 V2% = 0
4 V3% = V1% / V2%
5 END
6 *Label
7 V3% = 0
8 RETURNERR
```

■ Parameters

Parameter 1	Line No./ Label	Used to make setting of line number or label of jump destination. (Setting range: 1 to 9999)

■ Example of screen display

RETURNERR	FN37; Error interrupt return

See
OnErrGoto ; Error interrupt (FN36)
SERVOON ; Servo ON (FN38)

Function commands (FN codes)

Command name	SERVOON
FN code	38
Title name	Servo ON
General description	Turn on the servo.

■ **General description**

When this function is used, the servo is turned on.
It is used in the case that the servo turned off due to an error.

■ **Example of screen display**

```
SERVOON                    FN38; Servo ON
```

See
OnErrGoto ; Error interrupt (FN36)
RETURNERR ; Error interrupt return (FN37)

Function commands (FN codes)

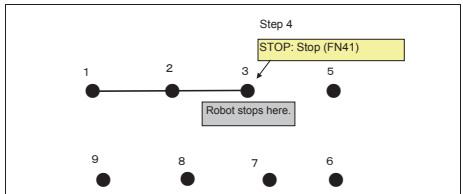
Command name	STOP
FN code	41
Title name	Stop
General description	This command is used to stop the robot.

■ General description

When this function command is executed, the robot is stopped.
The robot will not start unless the start command is input again.

■ Example of operation

In step 4, record STOP: stop (FN41).
When this is played back, the robot stops at step 4. This command does not establish the program end status (status established by executing the END: FN92 command to end the program): this means that the robot will head to step 5 without returning to the first step if it is restarted at the step 4 position. This should be borne in mind.



The robot stops after reaching the recorded point regardless of the accuracy of the move command immediately before.

■ Parameter

None

■ Example of screen display

STOP FN41; Stop

See
STOPI: Conditional stop (FN42)
END: End (FN92)

Function commands (FN codes)

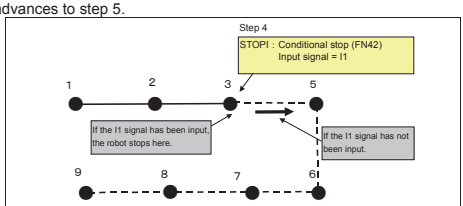
Command name	STOPI
FN code	42
Title name	Conditional stop
General description	Using an input signal, this command is used to stop the robot.

■ General description

When this function command is executed, the robot is stopped.
When the specified input signal has been input, the robot stops; when it has not been input, the robot does not stop and passes.
When the robot has stopped, it will not start unless the start command is input again.

■ Example of operation

In step 4, record STOPI: conditional stop (FN41), and I1 as the input signal.
If, when this is played back, input signal I1 has been input, the robot stops at step 4, and if it has not been input, it advances to step 5.



The robot stops after reaching the recorded point regardless of the accuracy of the move command immediately before.

■ Parameter

Parameter No. 1	Input signal	This records the number of the input signal which is to serve as the condition for executing the stop. When number 5101 or above is specified, multiple input signals can be specified. (1-2048、5101～5196)

■ Example of screen display

```
STOPI[I1]                FN42; Conditional stop
```

See
STOP: Stop (FN41)

Function commands (FN codes)

Command name	OUTDIS
FN code	43
Title name	Discrete format output signals
General description	This command is used to set the general-purpose output signals in any group to ON or OFF using the discrete format.

■ General description

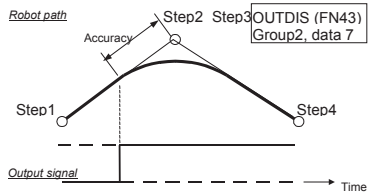
When this function command is executed, it is possible to set the general-purpose output signals (O1 to O2048) in any group to ON or OFF using the discrete format.
The general-purpose output signals are divided up into groups of ten: "group" here refers to such a group. With the discrete format, by specifying a number, any one signal inside a group of ten signals can be set to ON while the other signals are set to OFF.
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.

Group	Output signal
1	1～10
2	11～20
3	21～30
4	31～40
5	41～50
6	51～60
7	61～70
8	71～80
9	81～90
10	91～100

Group	Output signal
11	101～110
12	111～120
13	121～130
14	131～140
15	141～150
16	151～160
17	161～170
18	171～180
19	181～190
20	191～200

Group	Output signal
21	201～210
…	…
30	291～300
…	…
50	491～500
…	…
100	991～1000
…	…
…	…
204	2031～2040

■ Example of operation



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.

When "group 2, data 7" has been specified

Output signal number	11	12	13	14	15	16	17	18	19	20
ON/OFF status	○	○	○	○	○	○	●	○	○	○

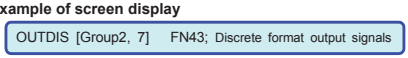
○: ON, ●: OFF

■ Parameter

Parameter No. 1	Group Number	This specifies the number of the group which is to be output. (1–204)

Parameter No. 2	Data	This specifies the data which is to be output. Since ten signals per group are specified using the discrete format, the maximum setting range for the data is 10. (0–10)

■ **Example of screen display**



See
OUT: Binary format output signal (FN44)

Function commands (FN codes)

Command name	OUT
FN code	44
Title name	Binary format output signals
General description	This command is used to set the general-purpose output signals in any group to ON or OFF using the binary format.

■ General description

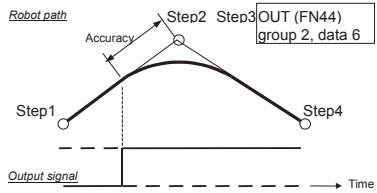
When this function command is executed, it is possible to set the general-purpose output signals (O1 to O2048) in any group to ON or OFF using the binary format.
The general-purpose output signals are divided up into groups of ten: "group" here refers to such a group. With the binary format, a number is specified, this number is then converted into a binary number and used to set the signals inside the corresponding group to ON or OFF.
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.

Group	Output signal
1	1～10
2	11～20
3	21～30
4	31～40
5	41～50
6	51～60
7	61～70
8	71～80
9	81～90
10	91～100

Group	Output signal
11	101～110
12	111～120
13	121～130
14	131～140
15	141～150
16	151～160
17	161～170
18	171～180
19	181～190
20	191～200

Group	Output signal
21	201～210
…	…
30	291～300
…	…
50	491～500
…	…
100	991～1000
…	…
…	…
204	2031～2040

■ Example of operation



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.

When "group 2, data 6" has been specified
As a binary number "6" is 00 0000 0110.

Binary number	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Output signal number	20	19	18	17	16	15	14	13	12	11
ON/OFF status	○	○	○	○	○	○	○	●	●	○

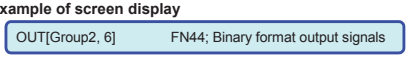
○: OFF, ●: ON

■ Parameter

Parameter No. 1	Group number	This specifies the number of the group which is to be output. (1-204)

Parameter No. 2	Data	This specifies the data which is to be output. Since ten signals per group are specified using the binary format, the maximum setting range for the data is 1023. (0-1023)

■ **Example of screen display**



See
OUTDIS: Discrete format output signals (FN43)

Function Commands (FN Codes)

Command name	EXT_TRACK
FN code	45
Title name	External tracking
General description	External tracking

Please refer to the FD-CONTROLLER instruction manual “External Tracking function”.

■ **Example of screen display**

Function commands (FN codes)

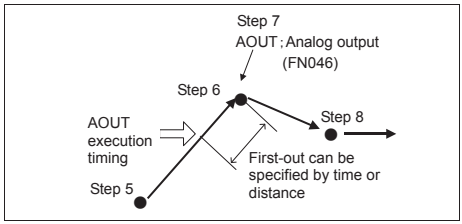
Command name	AOUT
FN code	46
Title name	Analog output
Outline	The TCP (robot tool center point) linear speed and other data are output as analog voltages

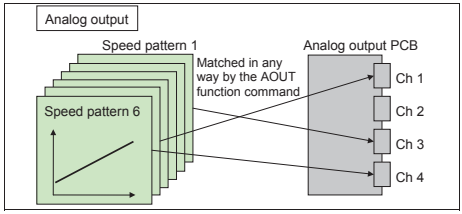
■ General description

By using these function commands, the TCP (robot tool center point) linear speed and other data can be output externally as analog voltages. They are useful for sealing and other applications. The TCP speed, a direct specification or OFF can be selected as the output voltage. If TCP speed has been specified, the TCP speed output data in the constant setting mode must be designed ahead of time. (→ Constants/TCP speed data)

There are 4 channels for the analog output, and the data can be output from any of the ports. The command cannot be used if the analog output PCB (option) has not been installed.

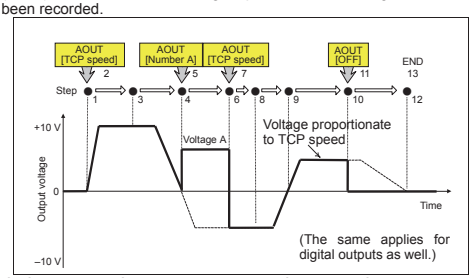
This command can be executed before the recorded point is reached. Specify its amount as a time or distance.





■ Example of operation

Record the AOUT command (FN46) in steps 2, 5, 7 and 11 in the figure shown below.
When these steps are played back, the analog output changes to the specified data each time the AOUT command (FN46) is executed. The analog output remains unchanged at those steps in which the AOUT command (FN46) has not been recorded.



If a first-out time of 0.2 sec. has been specified in the AOUT command of step 7 in this example, the analog voltage changes from numerical data A to the TCP speed 0.2 sec. before the robot reaches step 6 (the previous movement command).

In the teach mode, any analog voltage can be output by performing a manual operation (shortcut R206).
The analog voltage which is output last is held even if the mode is switched between teach and playback.

■ **Parameter**

Parameter No. 1	Channel number	This is used to specify the number of the port from which the analog values will be output. (1 to 4)
Parameter No. 2	Output signal type	This is used to specify the type of data to be output as analog data. (0 to 2) 0: OFF (0 V is output) 1: TCP speed 2: Directly specified
Parameter No. 3	Output data	When output signal type = 0: This recorded data is not used. When output signal type = 1: Specify the number of the pre-designed TCP speed pattern.(0 to 6) When "0" is specified, OFF (0 V) is established. When output signal type = 2: The parameter is used to directly specify the output voltage. (–10 V to 10 V)
Parameter No.4	Pre-out type	This enables the output to be started before the recorded point is reached. Select the specification method. (0 to 1) 0: Specified as a time 1: Specified as a distance
Parameter No. 5	Pre-out data	This is used to initiate pre-out using a negative numerical value. When pre-out type = 0: Specify it as a time. (–1.0 to 0 sec.) When pre-out type = 1: Specify it as a distance. (–500 to 0 mm)

■ **Example of screen display**

```
AOUT[2,1,6,1,-100]      FN46: Analog output
```

See
DOUT: Digital output (FN278)
DPRESETM: Distance specification output preset (FN280)

Function commands (FN codes)

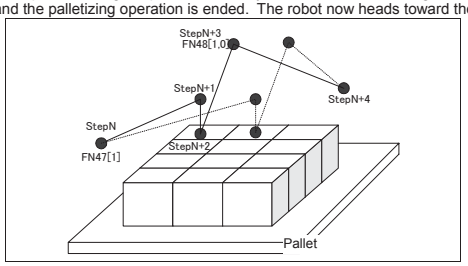
Command name	PALLET2
FN code	47
Title name	Palletize start
Outline	Start palletizing based on the pre-designed palletizing pattern.

■ General description

When this function command is executed, the specified palletizing can be started.
It is executed in tandem with the FN48 "Palletize end" command which is used to end palletizing.

■ Example of operation

As shown in the figure below, record “PALLET2: Palletize start” (FN47) in step N and “PALLET2 END: Palletize end” (FN48) in step N+3.
When the program is played back and the robot reaches step N, the shift amount is calculated from the palletize number specified by FN47 and the palletize counter, and the shift operation is performed. Step N+1 and step N+2 are shifted. (The robot passes along the path indicated by the dotted lines in the figure below.) When it reaches step N+3, FN48 is executed, and the palletizing operation is ended. The robot now heads toward the point where step N+4 is recorded.



■ Parameter

Parameter No. 1	Palletize No.	This specifies the palletizing number to be executed. (1 to 200)

■ Example of screen display

```
PALLET2[999]              FN47: Palletize start
```

See
PALLET2_END: Palletize end (FN48)
PALLET2_RESET: Palletize reset (FN49)
DSPALLET: Direction select palletize (FN65)

Function commands (FN codes)

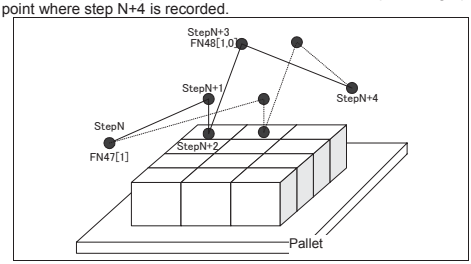
Command name	PALLET2_END
FN code	48
Title name	Palletize end
Outline	Finish palletizing based on the pre-designed palletizing pattern.

■ General description

When this function command is executed, the specified palletizing work can be completed.
It is executed in tandem with the FN47 "Palletize start" command which is used to start palletizing.

■ Example of operation

As shown in the figure below, record “PALLET2: Palletize start” (FN47) in step N and “PALLET2 END: Palletize end” (FN48) in step N+3.
When the program is played back and the robot reaches step N, the shift amount is calculated from the palletize number specified by FN47 and the palletize counter, and the shift operation is performed. Step N+1 and step N+2 are shifted. (The robot passes along the path indicated by the dotted lines in the figure below.)
When it reaches step N+3, FN48 is executed, and the palletizing operation is ended. The robot now heads toward the point where step N+4 is recorded.



■ Parameter

Parameter No. 1	Palletize No.	This specifies the number of the palletizing operation which is to be ended. (1 to 200)
Parameter No. 2	Output signal	This specifies the number of the output signal. When all the palletizing tasks specified have been completed, the general-purpose output signal specified is set to ON. (0 to 2048)

■ Example of screen display

```
PALLET2_END[200, 1]          FN48: Palletize end
```

See
PALLET2: Palletize start (FN47)
PALLET2_RESET: Palletize reset (FN49)
DSPALLET: Direction select palletize (FN65)

Function commands (FN codes)

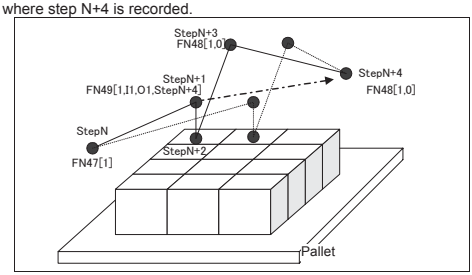
Command name	PALLET2_RESET
FN code	49
Title name	Palletize reset
Outline	When a condition signal has been input, the palletize counter is forcibly reset. (palletizing operation is forcibly terminated)

■ **General description**

If the condition signal (input signal) is at the ON status when the command is executed, the specified palletize counter can be forcibly reset (cleared to zero).
The fact that the counter has been reset can be output to an external source using an output signal. Furthermore, it is possible to jump to a specified step only when the counter has been reset.

■ **Example of operation**

As shown in the figure below, record "PALLET2: Palletize start" (FN47) in step N, "PALLET2_END: Palletize end" (FN48) in step N+3, and "PALLET2_RESET: Palletize reset" (FN49) in step N+2.
When the program is played back and the robot reaches step N, the shift amount file corresponding to the palletize number specified by FN47 is loaded, and the shift operation is performed. Normally, step N+1 and step N+2 are shifted, and when the robot reaches step N+3, the FN49 command is executed to end the palletizing operation.
However, if the reset condition signal (the I1 signal in the example) has been input when the robot reached step N+2, an acknowledge signal (O1 in the example) is output, the palletize counter is reset, and the robot heads toward the point where step N+4 is recorded.



■ **Parameter**

Parameter No. 1	Palletize No.	This is used to specify the palletizing number for which the counter is to be reset. (1 to 200)
Parameter No. 2	Input Signal	This is used to specify the number of the input signal serving as the condition for resetting the palletizing. By specifying numbers from 5101 to 5196, a multiple number of input conditions can be specified. If "0" is recorded, the condition will not be satisfied, and so the reset process will not be executed. (1 to 5196)
Parameter No. 3	Output signal number	This is used to specify the number of the output signal (acknowledge signal) which indicates that the palletizing has been reset. It is not output when 0 has been specified. (1 to 2048) * If <All output> has been selected as the setting for the "Palletize acknowledge signals" under "Handling teach/playback conditions," the output signals which have been specified here are output regardless of whether the reset process is to be executed or not.

Parameter No.4	Step No.	This is used to specify the number of the jump destination step. Operation jumps to the step specified here only when palletizing has been reset. (0 to 9999)

■ **Example of screen display**

```
PALLET2_RESET[200,I1,05,99]  FN49: Palletize reset
```

See
PALLET2: Palletize start (FN47)
PALLET2_END: Palletize end (FN48)
DSPALLET: Direction select palletize (FN65)

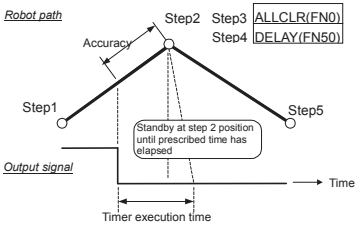
Function commands (FN codes)

Command name	DELAY
FN code	50
Title name	Timer
General description	This command is used to place the robot in the standby status.

■ General description

When this function command is executed, the robot is placed in the standby status. During standby, the robot rests at a recorded point.

■ Example of operation



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.

With the move command immediately before the timer command, the in-position check is not conducted so that the command value passes through the recorded point without fail. This means that even when "0 seconds" has been set for the timer, the cycle time will be longer compared with when no recording is performed.

■ Parameter

Parameter No. 1	Standby time	This specifies the standby time in increments of seconds. (0−60. 0)

In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter.

■ Example of screen display

DELAY [3.0]	FN50; Timer

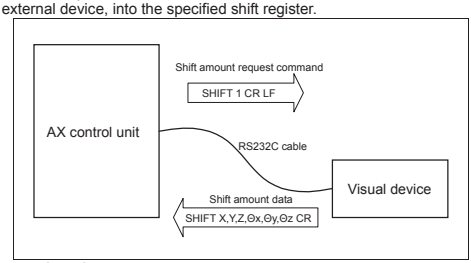
See
WAIT: Input signal wait with timer (FN552)

Function commands (FN codes)

Command name	SREQ
FN code	51
Title name	Shift amount request
Outline	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.

■ General description

This command sends a character string (command) requesting a shift amount to the external device connected to the controller by the RS232C cable, and it sets the shift amount data character string, which is input as the response from the external device, into the specified shift register.



The RS232C cable is an optional accessory.

When this function command is executed, the character string data below is output from the RS232C port, and the shift amount data is thereby requested.

SHIFT *1 CR LF (*1=Register number, CR=0x0d, LF=0x0a)

The robot continues to operate even after the request data has been output.

When the shift amount data is input from the external device in the following format, it is stored in the specified shift register.

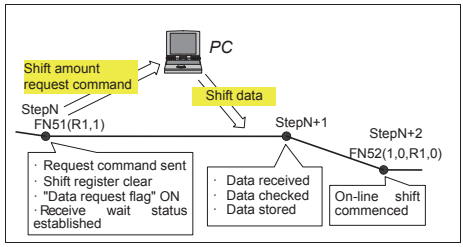
SHIFT X,Y,Z,dX,dY,dZ CR (all values are real numbers)

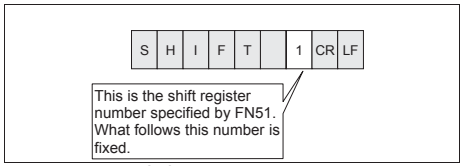
The receive time, wait time and communication conditions are set by selecting "8 Communication" from "Constant Setting" and then "1 Serial port." The data input wait time can be set in "Timeout time," and if this is set to "0," the serial port will remain in the wait status until an input arrives. (The robot continues to operate.)

■ Example of operation

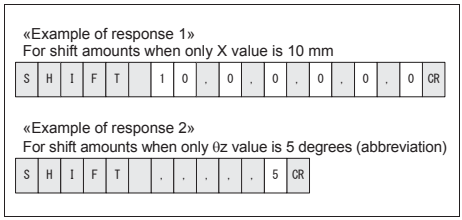
As shown in the figure, when SREQ (FN51) is executed at step N, the shift amount request command is sent to the external device through the serial port, and it is ensured that the data can be received at any time. The robot continues to operate as is and heads toward step N+1. When the shift data is received from the external device at any position, the legitimacy of the data is checked, and the data is stored in the specified shift register only when the data is found to be legitimate.

This shift register value is used for the shift operations by the "SHIFTR: Shift2" (FN52) or such other command which is programmed in step N+2.





Shift amount request command



Response data

If the response data from the external device is sent in any other format, the values will not be set correctly in the shift register.

■ **Parameter**

Parameter No. 1	Shift register number	This is used to specify the number of the shift register in which to store the shift amount received from the external device. (1 to 9)
Parameter No. 2	Port number	This is used to specify the number of the port to be used to transfer the data. At the present time, only port 1 can be used. (1 to 1)

■ **Example of screen display**

```
SREQ[R1, 1]              FN51: Shift amount request
```

See
SHIFTR: Shift2 (FN52)

Function commands (FN codes)

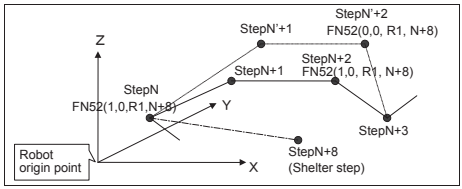
Command name	SHIFTR
FN code	52
Title name	Shift2
Outline	The start or end of the shift operation is specified. When shift operation start has been specified, the shift operation is performed on the basis of the shift amount stored in the specified shift register.

■ **General description**

This function command proceeds with playback while shifting the recorded position in the robot program on the basis of the shift amount data stored in the specified shift register. One of four options — “Machine coordinates (robot coordinates)”, “Tool coordinates,” “User coordinates” or “Absolute coordinates (world coordinates)” — can be selected for the coordinate system to be moved.
If the shift amount data has not been set in the specified shift register, it is possible to jump to the shelter step. Alternatively, the robot can be stopped immediately without escaping.

■ **Example of operation**

As shown in the figure, shift start is recorded at the position (step N) where the shift is to start, and shift end is recorded at the position (step N+2) where shift is to end.
When the program is played back, the robot reads the contents of the shift register specified by FN52 after it has reached step N, and it then moves toward the position (step N'+1) established by shifting the next target position (step N+1). The position established by similarly shifting the recorded position as far as the position (step N+2) where shift end has been recorded serves as the target position. (Path of dotted line in figure below)



If, when FN52 is executed at step N, the shift data has not been set at the time when the specified shift register is read, the robot moves toward the shelter step in the event that an shelter step has been set by the FN52 command. (Path of alternate long and short dash line in figure above)

■ **Parameter**

Parameter No. 1	Start/end	This is used to specify the start or end of the shift operation. 1: Start / 0: End
Parameter No. 2	Coordinate system	This is used to specify the coordinate system to be shifted. 0: Machine coordinates (robot coordinates) 1: Tool coordinates 2: User coordinate 3: Absolute coordinates (world coordinates) If user coordinates are to be specified, they must first be registered in "10 User coordinate system registration" selected on the Service Utilities menu, and then the number of the user coordinates to be used by the shift must be selected using "FN113 shift coordinate system selection" in the application command.
Parameter No. 3	Shift register number	This is used to specify the shift register number. (1 to 9)
Parameter No.4	Shelter step	This is used to specify the number of the shelter step when the shift amount data was not set in the specified shift register. (0 to 10000) When 10000 is specified as the shelter step number, an alarm (A2118: “No data has been input in shift register.”) results immediately with no escape operation performed, and the robot can be stopped.

■ **Example of screen display**

See
SREQ: Shift amount request (FN51)

Function commands (FN codes)

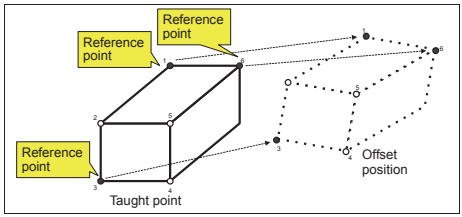
Command name	LOCCVT
FN code	53
Title name	Coordinate transform (Offset amount)
Outline	It is possible to proceed with playback while offsetting each recorded point based on the difference (skew amount) measured beforehand between the recorded position of the three points serving as the reference and the actual position obtained from the visual device, etc.

■ General description

When this function command is used, it is possible to proceed with playback while offsetting the skew based on the skew amount (mm) between the recorded position of the three points serving as the reference and the actual position obtained from the visual device or other external device.
Any already taught three points can be specified as the three points serving as the reference. The skew amounts are stored in shift registers 1, 2 and 3.
Before this application command is executed, the SREQ; shift amount request (FN51) command, etc. must be played back and the skew amount entered.

■ Example of operation

As shown in the figure, the LOCCVT command is recorded with the three points of steps 1, 3 and 6 which were originally taught serving as the reference points. Before the FN53 command is played back, the skew amount corresponding to the offset position (at the right in the figure below) must first be set in shift registers 1, 2 and 3. When FN53 is now played back, a coordinate transform matrix is generated from the three reference points at taught and the three reference points at offset, and the recorded positions are shifted according to this matrix and played back.



When the shift operation end is executed by FN53, the shift playback ends, and the recorded positions are played back.

* As the three reference points, specify the points in such a way that other recorded positions are enclosed.
* Specify the three reference points in such a way that they are not aligned on a single straight line.
* The θx, θy and θz data in the shift registers are not used.

■ Parameter

Parameter No. 1	Start/end	This is used to specify the start or end of the shift operation. 1: Start / 0: End
Parameter No. 2	Reference step 1	This is used to specify the first step to be used as the reference. (1 to 9999)
Parameter No. 3	Reference step 2	This is used to specify the second step to be used as the reference. (1 to 9999)
Parameter No.4	Reference step 3	This is used to specify the third step to be used as the reference. (1 to 9999)

■ Example of screen display

```
LOCCVT[1, 1, 2, 3]  FN53:Coordinate transform (Offset amount)
```

See
LOCCVT1: Coordinate transform (Coordinate values) (FN54)

Function commands (FN codes)

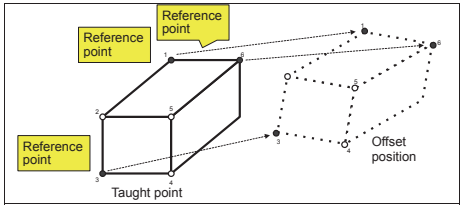
Command name	LOCCVT1
FN code	54
Title name	Coordinate transform (Coordinate values)
Outline	It is possible to proceed with playback while offsetting each recorded point based on the difference (skew amount) measured beforehand between the recorded position of the three points serving as the reference and the actual position obtained from the visual device, etc.

■ General description

When this function command is used, it is possible to obtain the actual coordinates of the three points serving as the reference from the visual device or other external device, and proceed with playback while offsetting the coordinates on the basis of the data obtained.
Any already taught three points can be specified as the three points serving as the reference.
The coordinates are stored in shift registers 1, 2 and 3.
Before this function command is executed, the "SREQ: Shift amount request" (FN51) command, etc. must be played back and the skew amount entered.

■ Example of operation

As shown in the figure, the LOCCVT1 command is recorded with the three points of steps 1, 3 and 6 which were originally taught serving as the reference points. Before the FN54 command is played back, the coordinates of the offset position (at the right in the figure below) must first be set in shift registers 1, 2 and 3. When FN54 is now played back, a coordinate transform matrix is generated from the three reference points at taught and the three reference points at offset, and the recorded positions are shifted according to this matrix and played back.



When the shift operation end is executed by FN54, the shift playback ends, and the recorded positions are played back.

* As the three reference points, specify the points in such a way that other recorded positions are enclosed.
* Specify the three reference points in such a way that they are not aligned on a single straight line.
* The θx, θy and θz data in the shift registers are not used.

■ Parameter

Parameter No. 1	Start/end	This is used to specify the start or end of the shift operation. 1: Start / 0: End
Parameter No. 2	Reference step 1	This is used to specify the first step to be used as the reference. (1 to 9999)
Parameter No. 3	Reference step 2	This is used to specify the second step to be used as the reference. (1 to 9999)
Parameter No.4	Reference step 3	This is used to specify the third step to be used as the reference. (1 to 9999)

■ Example of screen display

```
LOCCVT1[1,1,2,3] FN54:Coordinate transform (Coordinate values)
```

See
LOCCVT: Coordinate transform (Offset amount) (FN53)

Function commands (FN codes)

Command name	CNVSYNC
FN code	55
Title name	Conveyor Counter Reset
General description	Reset conveyor 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.

Please refer to the **"Conveyor Synchronization Manual"** (option) for detail operations.

■ Example of operation

Conveyor Counter is reset where the step CNVCYNC：Conveyor Counter Reset（FN55）is executed.

■ Parameter

Parameter No. 1	Conveyor number	Conveyor number which counter should be reset.(1-*) (* is conveyor quantity defined)

■ Example of screen display

```
CNVSYNC[1]          FN55: Conveyor Counter Reset
```

See
CNVI; Conveyor Interlock (FN550)
CNVYSYNCI; Synchronizing Conveyor Interlock (FN562)

Function commands (FN codes)

Command name	SHIFTA
FN code	58
Title name	XYZ shift
Outline	The playback position is shifted in parallel

■ **General description**

The XYZ shift function shifts the position which has already been taught in a parallel direction for each of the 3 dimensions. During the shift operations, the tool poses are maintained. One of four options — “Machine coordinates (robot coordinates)”, “Tool coordinates,” “User coordinates” or “Absolute coordinates (world coordinates)” — can be selected for the coordinate system to be moved.

The shift amounts are recorded as parameters. In other words, this command is useful when the amounts of the parallel movement by which the robot is to be shifted are already known.

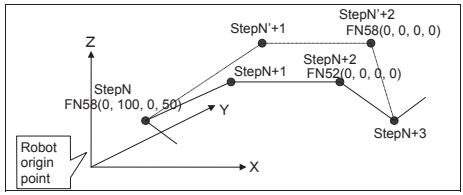
The shift operation is considered to have ended when 0.0 mm is specified for all the shift amounts recorded in FN58.

Use of this shift function will not update the actual recorded positions in the robot program.

■ **Example of operation**

In the example shown in the figure, the XYZ shift (FN58) command with the shift amounts specified is recorded at step N at which the shift operation is to be started, and the XYZ shift command with zero recorded for all the shift amounts is recorded at the shift end step.

When the program is played back, the robot, after it has reached step N, plays back toward the target position, step N'+1, which is obtained by adding the shift amount in the specified coordinate system recorded in FN58 to the next recorded position (step N+1). After the robot has reached step N+2, the shift operation is ended by executing FN58 with 0 mm set for all the shift amounts.



If positions are to be shifted based on the user coordinate system, "User coordinate system registration" must be performed, and the user coordinate numbers must be selected using the "CHGCOORD: Change coord. No. (shift)" (FN113) command beforehand.

If a specified shift amount exceeds the value specified in "Shift Amount Limit" selected from "Machine constants" under "Constant Setting," an error results, and the robot is stopped.

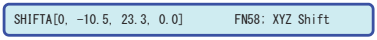
This function can be used together with other shift functions. If shift amounts in the reverse direction from the ones specified by FN58 have been specified by another shift-related command, they will be set to 0.0 mm as a result.

■ **Parameter**

Parameter No. 1	Coordinate system	The parallel movement amounts specified by the parameters No. 2 to 4 serve as the movement amounts in the coordinate system which is specified here. A value from 0 to 3 is specified by this parameter for the coordinates. 0: Machine coordinates (robot coordinates) 1: Tool coordinates 2: User coordinates 3: Absolute coordinates (world coordinates) If user coordinates are to be specified, they must first be registered in "10 User coordinate system registration" selected on the Service Utilities menu, and then the number of the user coordinates to be used by the shift must be selected using "FN113 shift coordinate system selection" in the function command.
Parameter No. 2	Shift value X	This is used to specify the shift amount in the X direction as defined by the coordinate system specified by the parameter No.1. (–3000 mm to 3000 mm)
Parameter No. 3	Shift value Y	This is used to specify the shift amount in the Y direction as defined by the coordinate system specified by the parameter No.1. (–3000 mm to 3000 mm)
Parameter No.4	Shift value Z	This is used to specify the shift amount in the Z direction as defined by the coordinate system specified by the parameter No.1. (–3000 mm to 3000 mm)

In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter.

■ **Example of screen display**



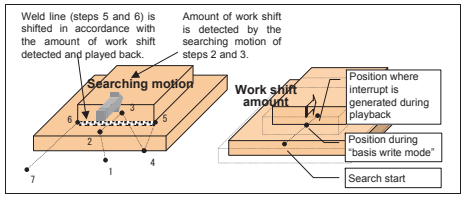
See

Function commands (FN codes)

Command name	SEA
FN code	59
Title name	Search
General description	Detect the work position shift amount, and store those data to the shift register

■ General description

By using this application command, it is possible to detect shift amounts when there are variations in the work positions and store those amounts in the shift register. By using the shift amounts stored in the shift register, any multiple number of steps can be shifted altogether by the shift command. When shift amounts in the work positions are to be detected, the search command must be used together with the robot interrupt signal. This is the case so as to capture the position where contact is made with the work.

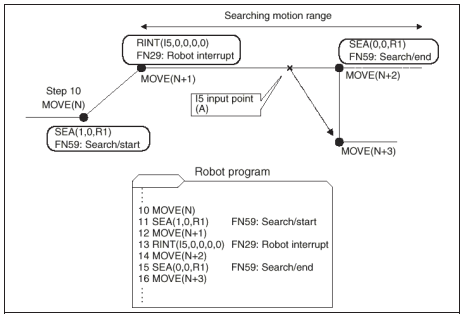


Before calculating the shift amounts, the work position serving as the basis must be obtained. This is called **the basis write mode**. The difference between the basis position obtained in the basis write mode and the actual work positions obtained in the normal mode are stored in the specified shift register as the shift amount. The recording positions are then shifted using the shift amount stored in the shift register.
For details on the robot interrupt application command, refer to 2.1 RINT: Robot interrupt (I-condition) (FN29), and for details on the shift application command, refer to 2.3 SHIFTR: Shift2 (FN52).

Please refer to the **"Application Manual / Material Handling"** for detail operations.

■ Example of operation

1) Teaching	Set the "Search range," and perform the teaching for the searching motion.
↓	
2) Search basis write	Obtain the position to be used the basis in the "Search basis write" mode.
↓	
3) Search execution	The searching motion is executed with normal playback. The shift amounts obtained are stored in the shift register.
↓	
4) Shift execution	Playback is performed in accordance with what is stored in the shift register while the prescribed steps are shifted.



- The teaching of the searching motion must be recorded without fail in the following sequence: **Search start (SEA: FN59) _ Robot interrupt (RINT: FN29) _ Search end (SEA: FN59)**. The search start command declares the processes performed when a recorded robot interrupt has been subsequently implemented to be “search processes.”
- The number of robot interrupts (RINT: FN29) permitted between the search start (SEA: FN59) and search end (SEA: FN59) is limited to one only. If two or more robot interrupts are recorded, the search function will not work correctly.
- The search section (range within which the interrupt processing is valid) is between MOVE(N+1), which is the movement command immediately before the robot interrupt command RINT step, and MOVE(N+2) which is the movement command immediately after this step, and it extends beyond MOVE(N+2) along the straight line which links these two points up to the position specified by “Search range.”
- Movement command MOVE(N+2) is recorded at a low speed using linear interpolation ON. If the speed at which a searching motion is performed is too high, the current position data obtained when the interrupt was detected will vary, resulting in a poor accuracy.
- When an interrupt is detected during a searching motion, it will be interpreted that the robot has reached MOVE(N+2) at that point, and after search end (SEA: FN59) has been executed, the next step, namely, movement command MOVE(N+3) will be executed.

Upon completion of the teaching, perform “search basis write.” “Search basis write” refers to the task that remembers the “basis position.” The remembered basis position serves as the basis for future searching motions, and the difference between this position and the position obtained by a normal searching motion is used as the shift amount.
” Search basis write” selection menu is in Service/22 Handling application/1 Handling teach/playback condition.

■ **Parameter**

Parameter No. 1	Start2/ Start/ End	This is used to specify the start and end of the search. 2 (start2): The machine coordinates at which the shift amounts are not canceled when the position was detected by FN29 (robot interrupt) are obtained. 1 (start): The machine coordinates at which the shift amounts were canceled when the position was detected by FN29 (robot interrupt) are obtained. 0 (end): This is used to end the search.
Parameter No. 2	Coordinate	This is used to specify the coordinate system that serves as the basis for the shift amounts to be set in the shift register. 0 (machine coordinates): The shift amounts are set in the shift register as the shift amounts in the machine coordinate system. 1 (tool): The shift amounts are set in the shift register as the shift amounts in the tool coordinate system.
Parameter No. 3	Register No.	This is used to specify the number of the shift register in which the shift amounts are to be set. (1 to 9)

■ **Example of screen display**

SEA[2,0,9]	FN59: Search

See
RINT; Robot Interrupt (I-condition) (FN29)
SHIFTR; Shift2 (FN52)

Function commands (FN codes)

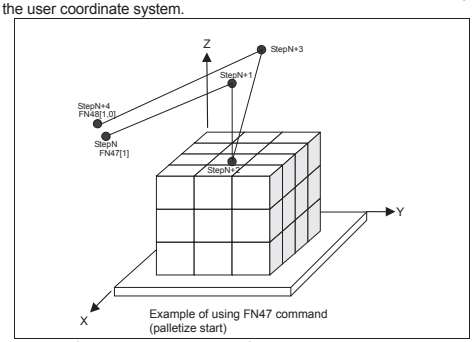
Command name	DSPALLET
FN code	65
Title name	Direction select palletize
Outline	This limits the shift direction, and it is started by the palletizing work.

■ General description

The direction in which the position is to be shifted during the palletizing tasks can be specified using this function command.

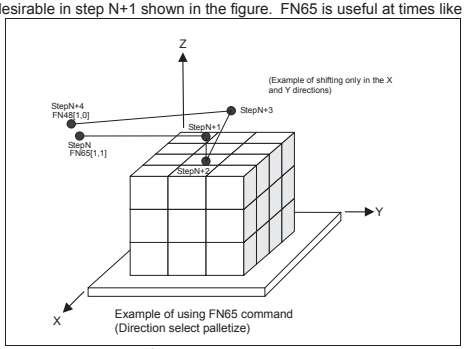
■ Example of operation

When the FN47 "Palletize start" command is used, the shift is normally implemented in all the X, Y and Z axis directions for the user coordinate system.



Example of using FN47 command
(palletize start)

However, if there is an obstruction, for instance, above the Z axis direction, shifting in the Z axis direction would not be desirable in step N+1 shown in the figure. FN65 is useful at times like this.



Example of using FN65 command
(Direction select palletize)

In this example, the shift operation is undertaken only in the X and Y directions of the user coordinate system.

■ Parameter

Parameter No. 1	Palletize No.	This specifies the palletizing number to be executed. (1 to 200)

Parameter No. 2	Shift direction No.	This is used to specify the shift direction. The shift direction numbers are as follows. Here all the X, Y and Z values denote the values used in the user coordinate system. (0 to 6) 0: All directions (Same shift as with FN47) 1: XY plane (Only the X and Y values for the shift amounts are used) 2: YZ plane (Only the Y and Z values for the shift amounts are used.) 3: ZX plane (Only the Z and X values for the shift amounts are used) 4: X direction (Only the X value for the shift amounts is used) 5: Y direction (Only the Y value for the shift amounts is used) 6: Z direction (Only the Z value for the shift amounts is used)

■ **Example of screen display**

See
PALLET2: Palletize start (FN47)
PALLET2_END: Palletize end (FN48)
PALLET2_RESET: Palletize reset (FN49)

Function commands (FN codes)

Command name	STOOL
FN code	67
Title name	Stationary tool number selection
General description	This command is used to select the coordinate system of the stationary tool number from among the user coordinate systems.

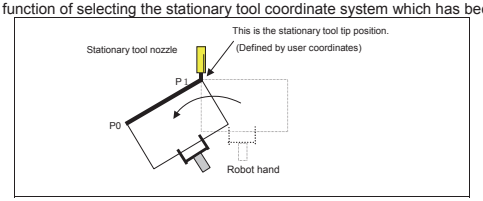
■ General description

A stationary tool is not one of the robot's tools but one which is settled externally. If "stationary tool interpolation" is specified as the interpolation type for the move command, the step concerned will conduct the interpolation playback using the coordinates of the stationary tool.

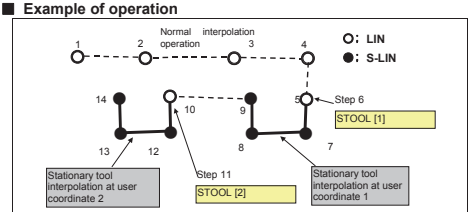
In the case of linear interpolation:

"LIN" for normal interpolation, "S-LIN" for stationary tool interpolation

The coordinate system of the stationary tool is registered as the user coordinate system. The STOOL command has the function of selecting the stationary tool coordinate system which has been registered as the user coordinate system.



■ Example of operation



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.

Once the number of the stationary tool is selected, the interpolation operation is performed by that stationary tool until another stationary tool number is selected.

The normal interpolation tool number remains unaffected by this command.

If the move command for the stationary tool interpolation has been played back without the STOOL command having been recorded, the reference coordinates will be set to zero (= robot coordinates).

■ Parameter

Parameter No. 1	User coordinate No.	This specifies the number of the user coordinate system which is to be used as the stationary tool coordinate system. 0 is a robot coordinate. (0-100)

■ Example of screen display

```
STOOL [1]      FN67;   Stationary tool number selection
```

See
None

Application command (FN code)

Command name	LETR
FN code	68
Title name	Set shift value
General description	The shift amount data is set in the specified shift register

■ **General description**

When this function command is used, the shift amount data can be set in the specified shift register.
Even if the specified shift register is already set as SHIFT R;Shift 2 (FN52) or other command, the new values specified by LETR will be set in the shift register without adversely affecting the operation of the other command being executed. The modified shift value becomes effective when you run SHIFT R;Shift 2 (FN52).

■ **Example of operation**

Shift register values when LETR[R1,100,100,100,10,11,12] has been executed

(1) When the command has been executed while shift register values were already set

	Before LETR is executed	After LETR is executed
Request flag	0	0
Setting flag	1	1
X	110	100
Y	120	100
Z	130	100
θX	5	10
θY	6	11
θZ	7	12

(2) When the command has been executed with the shift registers in the initial status

	Before LETR is executed	After LETR is executed
Request flag	0	0
Setting flag	0	1
X	0	100
Y	0	100
Z	0	100
θX	0	10
θY	0	11
θZ	0	12

After this command has been executed, the request flag of the shift register is always set to "0," and the setting flag is always set to "1." The values specified by the parameters are stored in X through Θz.

■ **Parameter**

1st parameter	Shift register No.	This is used to specify the number of the shift register in which the shift amount data specified by the parameters No.2 to 7 is to be assigned. (1 to 9):
2nd parameter	Shift value X	This is used to specify the value of the shift amount in the X direction. (–3000.0 to 3000.0 mm)
3rd parameter	Shift value Y	This is used to specify the value of the shift amount in the Y direction. (–3000.0 to 3000.0 mm)
Parameter No.4	Shift value Z	This is used to specify the value of the shift amount in the Z direction. (–3000.0 to 3000.0 mm)
Parameter No.5	Angle shift X	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)
Parameter No.6	Angle shift Y	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)

Parameter No.7	Angle shift Z	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)

In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter. However, you can not specify a language format for shift register number parameter.

■ **Example of screen display**

```
LETR[R1,100.0,-100.0,50.0,10.0,0.0,0.0,0.0]  FN68:Set shift value
```

See
SREQ;Shift amount request (FN51)
SHIFTR;Shift 2(FN52)
ADDR;Add Shift value (FN69)

Application command (FN code)

Command name	ADDR
FN code	69
Title name	Add shift value
General description	The specified values in the specified shift register are added up

■ General description

When this function command is used, the specified values in the specified shift register can be added up.
Even if the specified shift register is already set as SHIFT R;Shift 2 (FN52) or other command, the new values specified by ADDR will be set in the shift register without adversely affecting the operation of the other command being executed. The modified shift value becomes effective when you run SHIFT R;Shift 2 (FN52).

■ Example of operation

Shift register values when ADDR[R1,100,100,100,10,11,12] has been executed

(1) When the command has been executed while shift register values were already set

	Before ADDR is executed	After ADDR is executed
Request flag	0	0
Setting flag	1	1
X	110	210
Y	120	220
Z	130	230
θX	5	15
θY	6	17
θZ	7	19

(2) When the command has been executed with the shift registers in the initial status

	Before ADDR is executed	After ADDR is executed
Request flag	0	0
Setting flag	0	1
X	0	100
Y	0	100
Z	0	100
θX	0	10
θY	0	11
θZ	0	12

After this command has been executed, the request flag of the shift register is always set to "0," and the setting flag is always set to "1." The values specified by the parameters are added to the original values and stored in X through Θz.

■ Parameter

1st parameter	Shift register No.	This is used to specify the number of the shift register in which the shift amount data specified by the parameters No.2 to 7 is to be added. (1 to 9)
2nd parameter	Shift value X	This is used to specify the value of the shift amount in the X direction. (–3000.0 to 3000.0 mm)
3rd parameter	Shift value Y	This is used to specify the value of the shift amount in the Y direction. (–3000.0 to 3000.0 mm)
Parameter No.4	Shift value Z	This is used to specify the value of the shift amount in the Z direction. (–3000.0 to 3000.0 mm)
Parameter No.5	Angle shift X	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)
Parameter No.6	Angle shift Y	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)

Parameter No.7	Angle shift Z	This is used to specify the amount of rotation around the X axis. (–360.0 to 360.0 deg)

■ **Example of screen display**

```
ADDR[R1,100.0,-100.0,50.0,10.0,0.0,0.0,0.0]  FN69:Add shift value
```

See
SREQ;Shift amount request (FN51)
SHIFTR;Shift 2(FN52)
LETR;Shift value (FN68)

Application Command (FN Code)

Command name	LETX
FN code	71
Title name	Assign X component of pose
Outline	Used to assign a value to the X component of pose.

■ Outline

Use this command in robot languages.
Executing this command makes it possible to set shift amount to a specified pose variable. The commands LETX (FN71), LETY (FN72), and LETZ (FN73) are only enabled for already-recorded positional data. Use these commands to record only a single point in the pose and move the robot in parallel with the point.

■ Parameters

Parameter 1	Pose variable	Used to make setting of pose variable. (Setting range: 1 to 9999)
Parameter 2	Assigning value	Used to make setting of value of the X component to be assigned to pose variable. (Setting range: −3000.0 to 3000.0 mm)

■ Example of screen display

```
LETX[P1,5]      FN71: Assign X component of pose
```

Related commands
LETY: Assign Y component of pose (FN72)
LETZ: Assign Z component of pose (FN73)

Application Command (FN Code)

Command name	LETY
FN code	72
Title name	Assign Y component of pose
Outline	Used to assign a value to the Y component of pose.

■ Outline

Use this command in robot languages.
Executing this command makes it possible to set shift amount to a specified pose variable. The commands LETX (FN71), LETY (FN72), and LETZ (FN73) are only enabled for already-recorded positional data. Use these commands to record only a single point in the pose and move the robot in parallel with the point.

■ Parameters

Parameter 1	Pose variable	Used to make setting of pose variable. (Setting range: 1 to 9999)
Parameter 2	Assigning value	Used to make setting of value of the Y component to be assigned to pose variable. (Setting range: −3000.0 to 3000.0 mm)

■ Example of screen display

```
LETY[P1,10]     FN72: Assign Y component of pose
```

Related commands
LETY: Assign X component of pose (FN71)
LETZ: Assign Z component of pose (FN73)

Application Command (FN Code)

Command name	LETZ
FN code	73
Title name	Assign Z component of pose
Outline	Used to assign a value to the Z component of pose.

■ Outline

Use this command in robot languages.
Executing this command makes it possible to set shift amount to a specified pose variable. The commands LETX (FN71), LETY (FN72), and LETZ (FN73) are only enabled for already-recorded positional data. Use these commands to record only a single point in the pose and move the robot in parallel with the point.

■ Parameters

Parameter 1	Pose variable	Used to make setting of pose variable. (Setting range: 1 to 9999)
Parameter 2	Assigning value	Used to make setting of value of the Z component to be assigned to pose variable. (Setting range: −3000.0 to 3000.0 mm)

■ Example of screen display

```
LETX[P1,10]     FN73: Assign Z component of pose
```

Related commands
LETX: Assign X component of pose (FN71)
LETY: Assign Y component of pose (FN72)

Application Command (FN Code)

Command name	POSESAVE
FN code	74
Title name	Pose file save
Outline	Pose variables are stored to the pose file.

■ Outline

Pose variables are not saved when the main power is down.
This command can save pose variables to the pose file.

Before this command, pose file must be selected by FN98 USE function.
If pose file is not selected when executing FN74, information “I2151 : The program or the file does not exist.” is detected and robot stops immediately.

■ Parameters

None

■ Example of screen display

POSESAVE FN74: Pose file save

Function commands (FN codes)

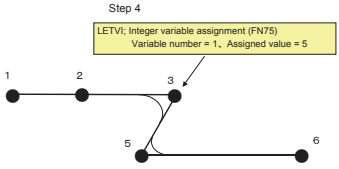
Command name	LETVI
FN code	75
Title name	Integer variable assignment
General description	This command is used to assign a value to the specified integer variable register.

■ General description

When this function command is executed, a value is assigned to the specified (global) integer variable. The (global) integer variables are registers used to count the number of passes by the conditional functions, which are initiated after the specified number of passes, of the flow control system such as the conditional program call after the specified number of passes command. They can be referenced from all the units.
This command is used for initial resetting and for setting the initial values.

■ Example of operation

In step 4, record LETVI: integer variable assignment (FN75), "1" as the variable number, and "5" as the assigned value. When this is played back, "5" is set in the first integer variable. The variables which have been set can be checked on the integer variable register screen of the monitor screen.



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	Integer variable number	This specifies the integer variable number to which the value will be assigned. (1-250,301-500)
Parameter No. 2	Assigned value	This specifies the value which is to be set in the integer variable. (-2147483647～ +2147483647)

201-250 integer variable number is a variable number of the PLC only.
Must be running the PLC when setting 201 to 250.
When executed in the state of PLC “stop” or “disconnect” ,display to "A2368 Connection with Built-in PLC cannot be performed." to stop playback.

■ Example of screen display

LETVI [V1%,5] FN75; Integer variable assignment

See
LETVF: Set real var. (FN76)
LETVS: Set strings variable (FN77)

Application command (FN code)

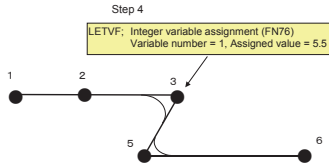
Command name	LETVF
FN code	76
Title name	Real number variable assignment
General description	Assign a value to the specified real number variable register.

■ General description

When this function command is executed, a value is assigned to the specified (global) real number variable. The (global) real number variables are registers used to store values by the robot axis coordinate acquisition commands and timer variable read commands. They can be referenced from all the units.
This command is used for initial resetting and for setting the initial values.

■ Example of operation

In step 4, register LETVF:real number variable assignment (FN76), "1" as the variable number, and "5.5" as the assigned value. If you recover the value, 5.5 will be set to the first real number variable. The variables which have been set can be checked on the real number variable register screen of the monitor screen.



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

1st parameter	Real number variable number	This specifies the number of the real number variable to which the value will be assigned. (1-250,301-500)
2nd parameter	Assigned value	This specifies the value which is to be set in the real number variable. (-1.0E38 to +1.0E38)

201-250 real variable number is a variable number of the PLC only. Must be running the PLC when setting 201 to 250.
When executed in the state of PLC “stop” or “disconnect” ,display to "A2368 Connection with Built-in PLC cannot be performed." to stop playback.

■ Example of screen display

```
LETVF[V1!,5.5]          FN76:Real number variable assignment
```

See
LETVI;Assigning a real number variable (FN75)
LETVS;Assigning string variable (FN77)

Application command (FN code)

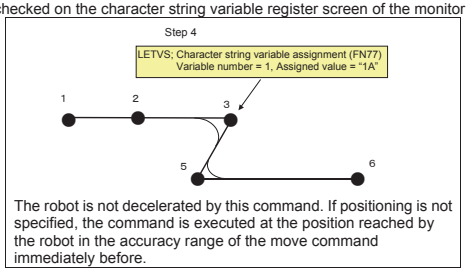
Command name	LETVS
FN code	77
Title name	Character string variable assignment
General description	This assigns the character string to the specified character string variable register.

■ General description

When this function command is executed, a character string is assigned to the specified (global) character string variable. The (global) character string variables are registers used to store the characters displayed on the screen using user macros, and the character string data transmitted from the peripheral devices. They can be referenced from all the units. This command is used for initial resetting and for setting the initial values.

■ Example of operation

In step 4, register LETVF:real number variable assignment (FN76), "1" as the variable number, and "5.5" as the assigned value. When this is played back, "1A" is set in the first character string variable. The variables which have been set can be checked on the character string variable register screen of the monitor screen.



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

1st parameter	Character string variable number	This specifies the number of the character string variable to which the value will be assigned. (1 to 50)
2nd parameter	Assigned value	This specifies the value which is to be assigned to the character string variable using characters with a length of up to 199 characters.

■ Example of screen display

```
LETVS[V1$,"1A"]   FN77: Character string variable assignment
```

See
LETVI;Assigning an integer variable (FN75)
LETVI;Assigning a real number variable (FN75)

Function commands (FN codes)

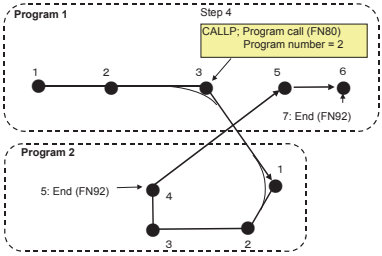
Command name	CALLP
FN code	80
Title name	Program call
General description	This command is used to call the specified program.

■ General description

When this function command is executed, the specified program is called.
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 CALLP: program call (FN80) and "2" as the program number. 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.

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)

■ Example of screen display

See
CALLPI: Conditional program call (FN81)
CALLPN: Conditional program call after specified number of passes (FN82)

Function commands (FN codes)

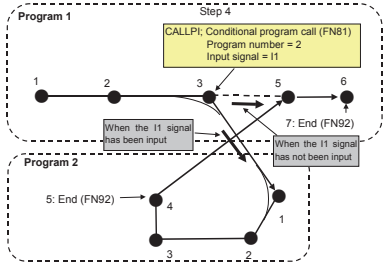
Command name	CALLPI
FN code	81
Title name	Conditional program call
General description	Using an input signal, this command is used to call the specified program.

■ General description

When this function command is executed, the specified program is called. 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 CALLPI: conditional program call (FN81), "2" as the program number, 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.



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)

■ Example of screen display

```
CALLP [2,I1]      FN81; Conditional program call
```

See
CALLP: Program call (FN80)
CALLPN: Conditional program call after specified number of passes (FN82)

Function commands (FN codes)

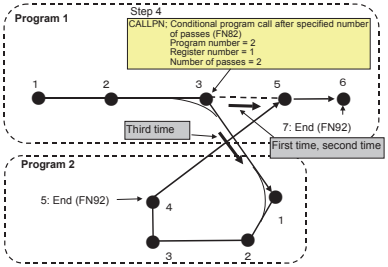
Command name	CALLPN
FN code	82
Title name	Conditional program call after specified number of passes
General description	Using a pass count (number of passes), this command is used to call the specified program.

■ General description

When this function command is executed, the specified program is called. 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 CALLPN: conditional program call after specified number of passes (FN82), "2" as the program number, "1" as the register number, and "2" as the number of passes.
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. 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)

■ **Example of screen display**

```
CALLPN [2, V1%, 2]     FN82; Conditional program call after
                             specified number of passes
```

See
CALLP: Program call (FN80)
CALLPI: Conditional program call (FN81)

Function commands (FN codes)

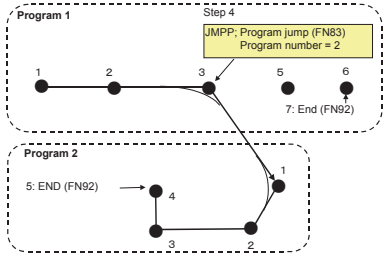
Command name	JMPP
FN code	83
Title name	Program jump
General description	This command is used to jump to the start of the specified program.

■ General description

When this function command is executed, the robot jumps to the specified program.
Bear in mind that if a function command has been recorded in the first step in the jump destination program, the function command at the jump destination will be executed as soon as the jump command has been executed.
The robot does not return to the source program even when the playback of the program at the jump destination is completed.

■ Example of operation

In step 4, record JMPP: program jump (FN83), and "2" as the program number. 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. The robot does not return to the source program even when the playback of the program 2 is completed.

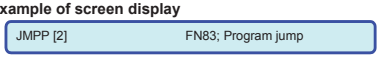


The robot is not decelerated by this command. If positioning is not specified, the command is executed at the position reached by the robot in the accuracy range of the move command immediately before.

■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program which is to serve as the jump destination. (1-9999)

■ Example of screen display



See
JMPPI: Conditional program jump (FN84)
JMPPN: Conditional program jump after specified number of passes (FN85)

Function commands (FN codes)

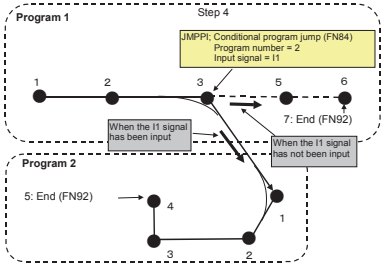
Command name	JMPPI
FN code	84
Title name	Conditional program jump
General description	Using an input signal, this is used to jump to the start of the specified program.

■ General description

When this function command is executed, the specified program is called. 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.
Bear in mind that if a function command has been recorded in the first step in the jump destination program, the function command at the jump destination will be executed as soon as the jump command has been executed.
The robot does not return to the jump source program even when the playback of the program at the jump destination is completed (the END command is executed).

■ Example of operation

In step 4, record JMPPI: conditional program jump (FN84), "2" as the program number, and "1" as the input signal. If, when this is played back, input signal I1 has been input, the robot jumps to the first step in program 2; and if it has not been input, it advances to steps 5 and 6. The robot does not return to the jump source program even when the playback of program 2 is completed (the END command is executed).



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.

Unlike the program call command, the robot can jump any number of times.

■ Parameter

Parameter No. 1	Program No.	This specifies the number of the program which is to serve as the jump 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 jump. When number 5101 or above is specified, multiple input signals can be specified. (1-2048、5101—5196)

■ Example of screen display

JMPPI [2,I1] FN84; Conditional program jump

See
JMPP: Program jump (FN83)
JMPPN: Conditional program jump after specified number of passes (FN85)

Function commands (FN codes)

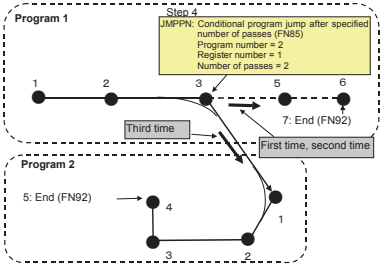
Command name	JMPPN
FN code	85
Title name	Conditional program jump after specified number of passes
General description	Using a pass count (number of passes), this command is used to jump to the start of the specified program.

■ General description

When this function command is executed, the robot jumps to the specified program. The robot passes for the specified number of passes, and on the next time (specified number of passes +1) the jump command is executed. (For instance, if "2" is specified as the number of passes, the robot passes twice, and on the third time the jump command is executed.)
Bear in mind that if a function command has been recorded in the first step in the jump destination program, the function command at the jump destination will be executed as soon as the jump command has been executed.
The robot does not return to the jump source program even when the playback of the program at the jump destination is completed (the END command is executed).

■ Example of operation

In step 4, record JMPPN: conditional program jump after specified number of passes (FN85), "2" as the program number, "1" as the register number, and "2" as the number of passes.
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 robot does not return to the jump source program even when the playback of program 2 is completed (the END command is executed).



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.

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 which is to serve as the jump 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 jump. The robot passes for the specified number of passes, and on the next time (specified number of passes +1) the jump command is executed. (0-10000)

■ Example of screen display

JMPPN [2, V1%, 2] FN85; Conditional program jump after specified number of passes

See
JMPP: Program jump (FN83)
JMPPI: Conditional program jump (FN84)

Function commands (FN codes)

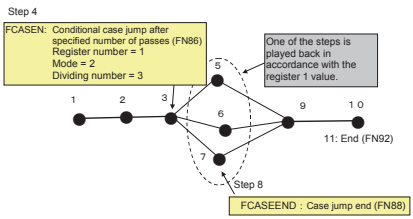
Command name	FCASEN
FN code	86
Title name	Conditional case jump after specified number of passes
General description	Using a pass count (number of passes), this command is used to select one of a multiple number of steps and execute it.

■ General description

When this function command is executed, one of a multiple number of steps is selected and executed. It makes no difference whether the selected step is a move command or function command. As the condition under which the step selection is executed, the "pass count" used by FCASEN is divided by a "dividing number" and, based on its "quotient" or "remainder", just the one step to be executed is decided on.
Bear in mind that if the step selected is a function command, the function command at the jump destination will be executed as soon as the conditional case jump after the specified number of passes command has been executed.

■ Example of operation

The FCASEN: conditional case jump after specified number of passes (FN86) command must always be paired with the FCASEEND: case jump end (FN88) command for use.
In the example presented below, only one step among steps 5, 6 and 7 enclosed between the FCASEN and FCASEEND commands is executed.



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.

Operation proceeds as follows in numerical sequence starting from the step following the step in which FCASEN is recorded: step executed when the quotient (or remainder) is 0 → step executed when the quotient (or remainder) is 1 → step executed when the quotient (or remainder) is 2 and so on.

Step 4: FCASEN: Conditional case jump after specified number of passes (FN86)
Step 5: (Selected when quotient or remainder is 0)
Step 6: (Selected when quotient or remainder is 1)
Step 7: (Selected when quotient or remainder is 2)
Step 8: FCASEEND: Case jump end (FN88)

Mode	Explanation
"Quotient" assignment	The "quotient" of the [pass count divided by the dividing number] serves as the condition of the command. In the example of the table presented below, step 5 is executed when the pass count is 0, 1 or 2, and step 6 is executed when it is 3, 4 or 5.
"Remainder" assignment	The "remainder" of [pass count divided by the dividing number] serves as the condition of the command. In the table below, each time the robot passes, the steps are executed in numerical order as follows: 5 → 6 → 7 → 5 → 6 → 7.

"Quotient" and "remainder" when 3 is the dividing number

Pass count	0	1	2	3	4	5	6	7	8	9	10	11

Quotient	0	0	0	1	1	1	2	2	2	3	3	3
Remainder	0	1	2	0	1	2	0	1	2	0	1	2

Any number of steps between the FCASEN and FCASEEND commands can be recorded provided that this number does not exceed the maximum number of 999 steps allowed per program. Either move commands or function commands can be the steps enclosed. If a step to be executed has not been recorded, an alarm is detected, and the robot stops.

A register (global integer variable) is used to count the number of times the robot passes.
The current number of passes can be referenced using monitor/integer variables.

■ **Parameter**

Parameter No. 1	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. 2	Mode	1: The quotient of the [register value divided by the dividing number] is used as the condition for the command. 2: The remainder of the [register value divided by the dividing number] is used as the condition for the command. (1-2)
Parameter No. 3	Dividing number	This specifies the number that will divide the register value. (1-127)

■ **Example of screen display**

```
FCASEN [V1%, 2, 3]          FN86; Conditional case jump after
                                  specified number of passes
```

See
FCASEEND: Case jump end (FN88)

Function commands (FN codes)

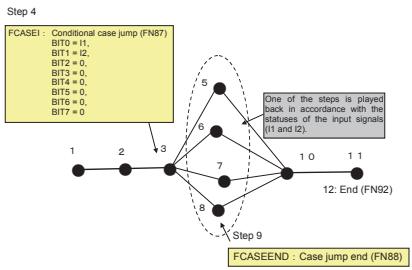
Command name	FCASEI
FN code	87
Title name	Conditional case jump
General description	Using an input signal, this command is used to select one of a multiple number of steps and executes it.

■ General description

When this function command is executed, one of a multiple number of steps is selected and executed. It makes no difference whether the selected step is a move command or function command. The "ON/OFF statuses of up to 8 input signals" are used as the condition under which the step selection is executed. The input signals are converted into an 8-bit binary value and, based on this, just the one step to be executed is decided on.
Bear in mind that if the step selected is a function command, the function command at the jump destination will be executed as soon as the conditional case jump command has been executed.

■ Example of operation

The FCASEI: conditional case jump (FN87) command must always be paired with the FCASEEND: case jump end (FN88) command for use.
In the example presented below, only one step among the four steps (steps 5, 6, 7 and 8) enclosed between the FCASEI and FCASEEND commands is executed.



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.

Operation proceeds as follows in numerical sequence starting from the step following the step in which FCASEI is recorded: step executed when the input signal is 0 → step executed when the input signal is 1 → step executed when the input signal is 2 and so on.

Step 4: FCASEI: Conditional case jump (FN87)
Step 5: (Selected when the input signal is 0)
Step 6: (Selected when the input signal is 1)
Step 7: (Selected when the input signal is 2)
Step 8: (Selected when the input signal is 3)
Step 9: FCASEEND: Case jump end (FN88)

These steps correspond in sequence to BIT 0, BIT 1, BIT 2 and so on from the first parameter of FCASEI. If, for instance, in the example presented in the previous figure, input signals I1 and I2 are both set to ON:

Bit 7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
—	—	—	—	—	—	I2	I1	
0	0	0	0	0	0	1	1	= decimal number "3"

Therefore, step 8 will be selected.

Any number of steps between the FCASEI and FCASEEND commands can be recorded provided that this number does not exceed the maximum number of 999 steps allowed per program. Either move commands or function commands can be the steps enclosed. If a step to be executed has not been recorded, an alarm is detected, and the robot stops.

■ Parameter

Parameter No. 1	Input signal BIT 0	The numbers of the input signals corresponding to bits 0 through 7 are specified in sequence starting from the first parameter. If an input signal is not going to be used, 0 is specified. When number 5101 or above is specified, multiple input signals can be specified. (1–2048, 5101–5196)
Parameter No. 2	Input signal BIT 1	
Parameter No. 3	Input signal BIT 2	
Parameter No. 4	Input signal BIT 3	
Parameter No. 5	Input signal BIT 4	
Parameter No. 6	Input signal BIT 5	
Parameter No. 7	Input signal BIT 6	
Parameter No. 8	Input signal BIT 7	

Pack the input signals in sequence starting from the lower bits. If the registration of any input signal is missing, an alarm results during playback, and the robot stops.

■ **Example of screen display**

```
FCASEI [I1,I2,I3,I0,I0,I0,I0,I0]      FN87; Conditional case jump
```

See
FCASEEND: Case jump end (FN88)

Function commands (FN codes)

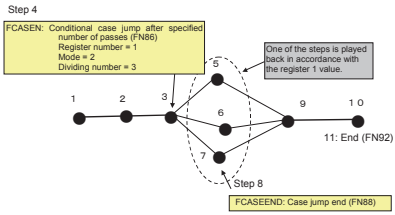
Command name	FCASEEND
FN code	88
Title name	Case jump end
General description	This command is used to end the case jump.

■ General description

This function command is paired with the FCASEN: conditional case jump after specified number of passes (FN86) command or FCASEI: conditional case jump (FN87) command for use. It signals the end of the case jump.

■ Example of operation

Refer to the FCASEN: conditional case jump after specified number of passes (FN86) or FCASEI: conditional case jump (FN87) commands.



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

None

■ Example of screen display

FCASEEND	FN88; Case jump end

See

FCASEN: Conditional case jump after specified number of passes (FN86)
FCASEI: Conditional case jump (FN87)

Application Command (FN Code)

Command name	GOTO
FN code	90
Title name	Line jump
Outline	Used to jump to a specified line or label.

■ **Outline**

Executing this command transfers control to a line specified by line number or label without conditions.

■ **Parameters**

Parameter 1	Line No./ Label	Used to make setting of line number or label of jump destination. (Setting range: 1 to 9999)

■ **Example of screen display**

GOTO[100]	FN90: Line jump
GOTO[∗ABC]	FN90: Line jump

Related commands

∗LABEL: Label (FN601)

Application Command (FN Code)

Command name	GOSUB
FN code	91
Title name	Line call
Outline	Used to subroutine-call a specified line or label.

■ Outline

Use this command in robot languages.
Executing this command makes the program jump to a specified line. Executing any of the commands RETURN: Step return (FN22), RETI: Step return with conditions (FN25), and RETN: Step return with conditions for number of times (FN28) return to a line next to the call in which call was made.

■ Parameters

Parameter 1	Line No./ Label	Used to make setting of line number or label of jump destination. (Setting range: 1 to 9999)

■ Example of screen display

GOSUB[100] FN91: Line call

Related commands
RETURN: Step return (FN22)
RETI: Step return with conditions (FN25)
RETN: Step return with conditions for number of times (FN28)

Function commands (FN codes)

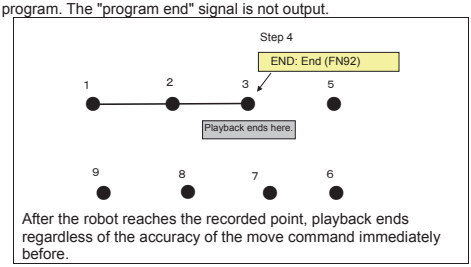
Command name	END
FN code	92
Title name	END
General description	This command is used to end program playback.

■ General description

When this function command is executed, the playback of the program is ended.
In the single cycle mode, operation stops immediately; in the continuous mode, operation returns to the start of the program and continues.
At least one END command is required in a program. This command does not signify the very end of the file so steps can still be recorded after this function. It is also permissible to record a multiple number of END commands in a program.

■ Example of operation

In step 4, record END: End (FN92).
When this is played back in the single cycle mode, the robot stops at step 4. The program end status is established, and the "program end" signal is output. If operation is now started again immediately, the robot returns to the first step.
However, if this program is the call destination program, the robot does not stop after END but returns to the call source program. The "program end" signal is not output.



After the robot reaches the recorded point, playback ends regardless of the accuracy of the move command immediately before.

■ Parameter

None

■ Example of screen display

END	FN92; End

"Program end" basic output signal

See
STOP: Stop (FN41)

Function commands (FN codes)

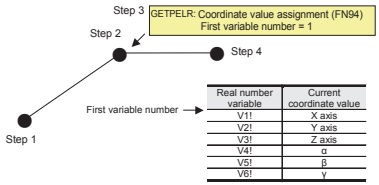
Command name	GETPELR
FN code	94
Title name	Real number variable assignment (coordinate values)
General description	This command is used to store the current coordinate values (Eulerian angle expressions) in the real number variables.

■ General description

When this function command is executed, the current axis coordinate values of the robot expressed as Eulerian angles are stored in the real number variables of the specified numbers.
(The GETP: real number variable assignment (coordinate values) (FN142) command is used when the wrist posture is to be expressed as the R (roll), P (pitch) and Y (yaw) angles.)

■ Example of operation

In the example of the figure presented below, when the robot arrives at the recorded point in step 2 and positioning is completed, the GETPELR command in step 3 is executed, and six real number variables are assigned with the coordinate values in sequence starting from the specified real number variable, as shown below.



Real number variable	Current coordinate value
V1!	X axis
V2!	Y axis
V3!	Z axis
V4!	α
V5!	β
V6!	γ

After the robot reaches the exact recorded point, the GETPELR command is executed regardless of the accuracy of the move command immediately before and regardless of whether positioning is specified.

The assigned values can be referenced by monitor/real number variables.

■ Parameter

Parameter No. 1	Real number variable number	This specifies the first number of the register (real number variable) in which a coordinate value is to be stored. Six variables are then used in succession. (1-195)

■ Example of screen display

```
GETPELR [V1!]          FN94; V! Set real var. (cur.pos)
```

See
GETP: Real number variable assignment (coordinate values) (FN142)
GETANGLE: Real number variable assignment (axis angles) (FN157)

Function commands (FN codes)

Command name	CHGGUN
FN code	95
Title name	Mechanism change
General description	Connect or disconnect mechanism2 (dedicated to mechanism 2 only)

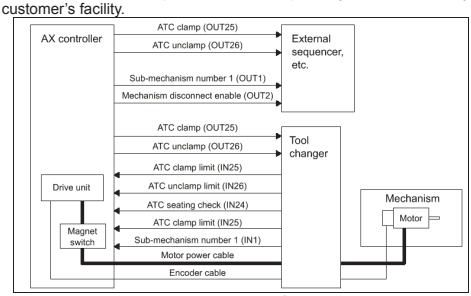
■ General description

There is an application that uses a tool changer to change the spot welding gun, hand grippers or other tools so that one robot can be employed for a multi purpose use. If the tool to be changed is a spot welding gun or hand gripper and it is air-driven, it can be changed by I/I sequences. On the other hand, if it is a servo gun or other servo-driven tool, it is not possible to disconnect it in order to implement the change while still keeping the power supplied to their motors. Therefore, changing servo guns and other such tools requires a function that makes it possible to electrically connect and disconnect the motor. This is called the mechanism change function.
This command can implement this utility. (**dedicated to mechanism 2 only**)

Connecting and disconnecting the tools mechanically must be implemented using I/O sequences.

■ Example of operation

An example is given for tool changing system where the signals have been allocated as shown in the figure below. The method shown here represents an example only, and will actually differs on the environment that depends on the customer's facility.

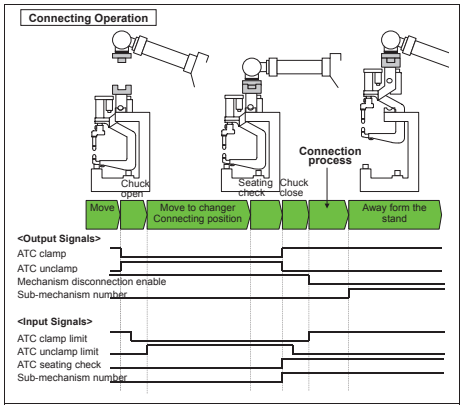


Connection with tool changer (sample)

Connecting operation

STEP N	**500mm/s LIN A1 T31**		
STEP N+1	**RESET[025]**	FN34: Output OFF	Unclamp
STEP N+2	**SET[026]**	FN32: Output ON	
STEP N+3	**WAITI[126]**	FN525: Wait input (positive)	Waiting for unclamp finish
STEP N+4	**100mm/s LIN A1 T31**		Move to the connect/disconnect position
STEP N+5	**DELAY[0.5]**	FN50: Delay	
STEP N+6	**WAIT[124]**	FN525: Wait input (positive)	Waiting for seating
STEP N+7	**RESET[026]**	FN34: Output OFF	Clamp
STEP N+8	**SET[025]**	FN32: Output ON	
STEP N+9	**WAITI[125]**	FN525: Wait input (positive)	Waiting for clamp finish
STEP N+10	**CHGGUN[1]**	FN95: Mechanism change	Electrical connection
STEP N+11	**100mm/s LIN A1 T1**		Move away

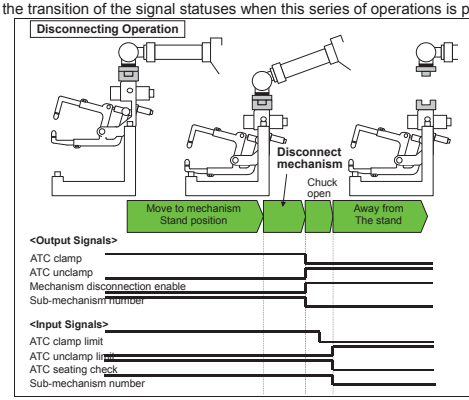
At step N, the mechanism is moved by the following linear movement to the position where the changer can be connected. At this position, the changer is set to the unclamp status by the way or precaution.
At step N+4, the mechanism is moved to the position where the changer is connected. At first its seating is checked and the changer is clamped. After it has been clamped, the mechanism change function is executed.
At step N+11, the mechanism is disengaged from the stand.
Shown below is the transition of signal statuses when this series of operations is performed.



Disconnecting Operation

STEP N	**500mm/s LIN A1 T1**		
STEP N+1	**100mm/s LIN A1 T1**		Move to the connect/disconnect position
STEP N+2	**CHGGUN[0]**	FN95: Mechanism change	Electrical disconnection
STEP N+3	**RESET[025]**	FN34: Output OFF	Unclamp
STEP N+4	**SET[026]**	FN32: Output ON	
STEP N+5	**WAIT[I26]**	FN525: Wait input (positive)	Waiting for unclamp finish
STEP N+6	**100mm/s LIN A1 T31**		

At step N, the mechanism is moved by the following movement to the position where it can be brought to the stand. At step N+1, the mechanism is moved to the changer disconnect position. At this position, the mechanism function is executed, and the mechanism is electrically disconnected. Next, the changer is set to the unclamp status.
After the unclamp status has been checked, the mechanism is electrically disconnected at the step N+6. Shown below is the transition of the signal statuses when this series of operations is performed.



■ **Parameter**

Parameter No. 1	Connect / Disconnect	This is used to specify whether the mechanism is to be connected or disconnected O; Connect 1; Disconnect

■ **Example of screen display**

See
CHGMEC; Mechanism Change（mechanism can be designated）(FN301)

Application Command (FN Code)

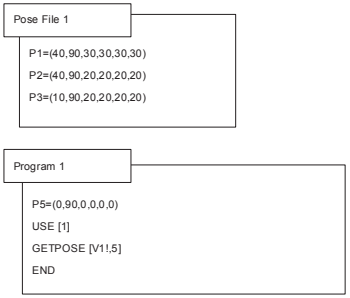
Command name	USE
FN code	98
Title name	Pose file select
Outline	Used to select pose file.

■ Outline

Pose data are controlled as files and one file can record poses P1 to P999. For example, this command is useful in playing back the same program by changing only the data on robot positions according to the types of workpieces.

This application command applies the pose data included in the selected file to the pose variable.

Note that when this application command is executed, the pose variable is first cleared.
When pose data P1 to 3 are saved in pose file 1.
When the following program 1 is executed, error message “I2151 Program or file does not exist.” is displayed when GETPOSE is executed, and playback is stopped.



■ Parameters

Parameter 1	Pose file number	Used to make setting of pose file number. (Setting range: 1 to 9999)

■ Example of screen display

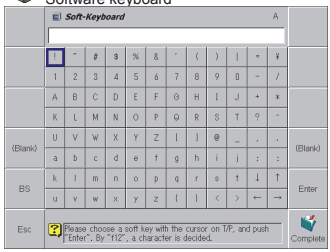
Function commands (FN codes)

Command name	REM
FN code	99
Title name	Comment
General description	This command is used to provide comments inside programs.

■ General description

This command is used to provide comments inside programs.
Using the software keyboard, alphanumerics and symbols can be input.
A comment provided in step 0 is handled specially as the "program name," and it appears on the program directory by the R17 short-cut and on the status window at the top of the screen.

Software keyboard



Entire text of comment entered using 

■ Example of operation

The robot is not decelerated by this command.
More than one comment may be recorded in a program.

■ Parameter

Parameter No. 1	Comment	Comments consisting of up to 230 characters can be recorded.

■ Example of screen display

```
REM ["Test program"]        FN99; Comment
```

See
None

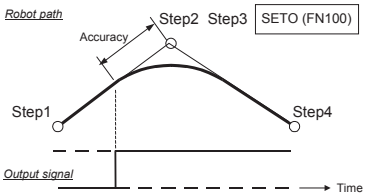
Function commands (FN codes)

Command name	SETO
FN code	100
Title name	Consecutive output signal ON/OFF
General description	This command is used to set any number of consecutive general-purpose output signals to ON or OFF altogether.

■ General description

When this function command is executed, any number of consecutive general-purpose output signals (O1 to O2048) are set to ON or OFF altogether. It makes no difference how many consecutive signals are involved.
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



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	Output signal number	This specifies the number of the first consecutive output signals which are to be turned ON or OFF. (1–2048)
Parameter No. 2	Output signal number	This specifies the number of the last consecutive output signals which are to be turned ON or OFF. (1–2048)
Parameter No. 3	ON/OFF	"1" specified for ON, and "0" for OFF. (0–1)

■ Example of screen display

SETO [O1, O512, 1] FN100; Consecutive output signal ON/OFF

See
SETM: Output signal ON/OFF (FN105)

Function commands (FN codes)

Command name	PRINT
FN code	101
Title name	Strings output
Outline	The character string data is output to the screen or specified RS232C serial port

■ General description

When this function command is used, character string data can be displayed on the TP screen or output to the specified serial port. (RS232Cis option)
Device number can designate to where output data. #0 is screen, #1 is RS232C. If device number is omitted, #0 is selected. If character is omitted, line feed code is only sent. Plural characters can be combined by ";" or ",". If last character was ";", line feed code is not sent.
FN606 is same as this function.

■ Example of operation

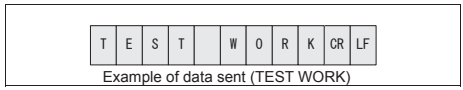
When the robot reaches the step in which the PRINT command is recorded, the character string is sent.
The robot continues moving while the data is being sent.

■ Parameter

Parameter No. 1	Port number	This is used to specify the number of the port from which the character string is to be output. 0; screen 1; RS232C
Parameter No. 2	Output character string	This is used to specify the character string to be output. Press [Enable]+[Edit] to open software keyboard to input characters. (Up to 199 single-byte alphanumeric)

■ Example of screen display

```
PRINT[#1,TEST WORK]          FN101:Strings Out
```



Example of data sent (TEST WORK)

See
SREQ: Shift amount request (FN51)
RSCLR: RS232C Buffer clear (FN111)

Function commands (FN codes)

Command name	CALLPR
FN code	102
Title name	Relative program call
General description	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.

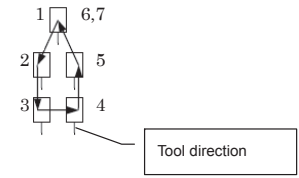
■ **General description**

[Relative Program Call] calls 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. （Refer to the illustration below）

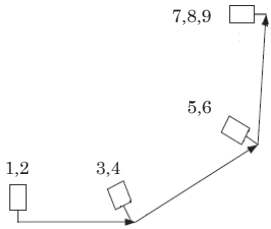
This is a very convenient function for spot welding, weld gun sticking, grinding, cutting and other frequently repeated simple task actions.

■ **Example of operation**

When you make the program to operate as follows

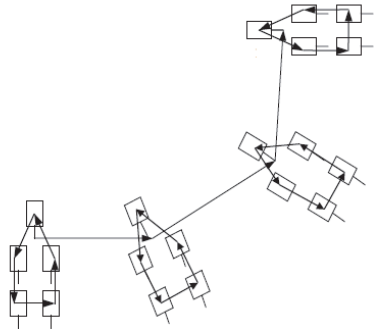


Program 1
(subprogram to be called)
1 MOVE
2 MOVE
3 MOVE
4 MOVE
5 MOVE
6 MOVE
7 END



Program 2
(Main(Base) program)
1 MOVE
2 CALLPR 1
3 MOVE
4 CALLPR 1
5 MOVE
6 CALLPR 1
7 MOVE
8 CALLPR 1
9 END

Below shows a task(program 1) to be repeated numerous times.



When CALLPR is recorded in program 2 as above the robot will operate as shown here. CALLPR function cannot be executed again while executing CALLPR function. After other shifts are applied, the shift by CALLPR is done.
The CALLPR outputs abnormality when move command has never been executed before CALLPR is executed. Please note immediately after having turned on the power supply of controller and immediately after selecting program.
This function cannot be used with two manipulators or more included in a unit. There is a possibility of doing the operation that the robot doesn't anticipate.

■ **Parameter**

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (0-9999)

■ **Example of screen display**

CALLPR [2]	FN102; Relative program call

See
CALLPRI: Conditional relative program call (FN103)
CALLPRN: Relative program call (freq. condition) (FN104)

Function commands (FN codes)

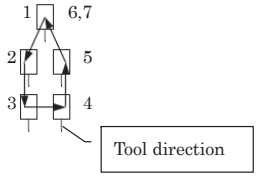
Command name	CALLPRI
FN code	103
Title name	Conditional relative program call
General description	Using an input signal, this command is used to call the specified program.

■ General description

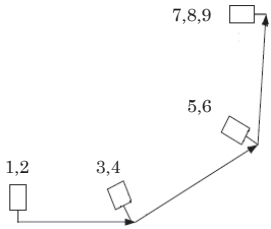
If the designated input signal is being input, [Relative Program Call] calls a subprogram and makes the first step position and orientation the same as the current step in the base program. Then all point positions in the subprogram become relative to that step position. (Refer to the illustration below)
If the input signal is not being input the main program simply continues on. This is a very convenient function for spot welding, weld gun sticking, grinding, cutting and other frequently repeated simple task actions.

■ Example of operation

When you make the program to operate as follows

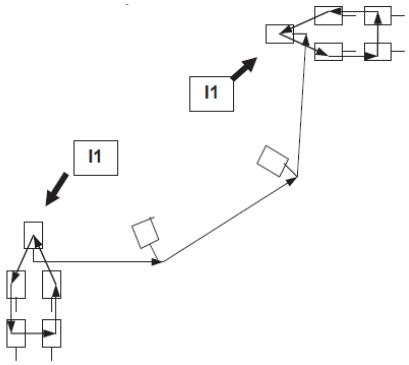


Program 1
1 MOVE
2 MOVE
3 MOVE
4 MOVE
5 MOVE
6 MOVE
7 END



Program 2
1 MOVE
2 CALLPRI 1,I1 ← I1 ON
3 MOVE
4 CALLPRI 1,I1 ← I1 OFF
5 MOVE
6 CALLPRI 1,I1 ← I1 OFF
7 MOVE
8 CALLPRI 1,I1 ← I1 ON
9 END

Below shows a task(program 1) to be repeated numerous times.



When CALLPRI function is executed and the designated I signal is being input program 2 is played and robot will operate as shown here. CALLPRI function cannot be executed again while executing CALLPRI function. After other shifts are applied, the shift by CALLPRI is done.
The CALLPRI outputs abnormality when move command has never been executed before CALLPRUI s executed. Please note immediately after having turned on the power supply of controller and immediately after selecting program.
This function cannot be used with two manipulators or more included in a unit. There is a possibility of doing the operation that the robot doesn't anticipate.

■ **Parameter**

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (0-9999)
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)

■ **Example of screen display**

```
CALLPRI [2,I1]      FN103; Conditional relative program call
```

See
CALLPR : Relative program call (FN102)
CALLPRN: Relative program call (freq. condition) (FN104)

Function commands (FN codes)

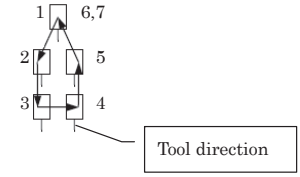
Command name	CALLPRN
FN code	104
Title name	Relative program call (freq. condition)
General description	Using a pass count (number of passes), this command is used to call the specified program.

■ General description

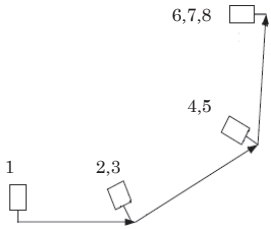
Depending on the number of times CALLPRN function has been passed, [Relative Program Call] calls a subprogram and makes the first step position and orientation the same as the current step in the base program. Then all point positions in the subprogram become relative to that step position. （Refer to the illustration below） This is a very convenient function for spot welding, weld gun sticking, grinding, cutting and other frequently repeated simple task actions.
When the cycle (frequency. + 1) is reached, [Relative Program Call] calls a subprogram, if the cycle is not (frequency + 1) the main program will simply continue on.

■ Example of operation

When you make the program to operate as follows

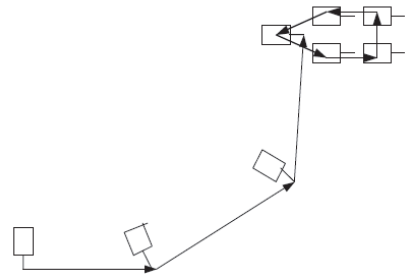


Program 1
1 MOVE
2 MOVE
3 MOVE
4 MOVE
5 MOVE
6 MOVE
7 END



Program 2
1 MOVE
2 MOVE
3 CALLPRN 1,V1%,2
4 MOVE
5 CALLPRN 1,V1%,2
6 MOVE
7 CALLPRN 1,V1%,2
8 END

Below shows a task(program 1) to be repeated numerous times.



When CALLPRN function is being passed on the 3rd (Freq. + 1) cycle program 2 will operate, as shown here. CALLPRN function cannot be executed again while executing CALLPRN function. After other shifts are applied, the shift by CALLPRN is done.

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.

The CALLPRN outputs abnormality when move command has never been executed before CALLPRN is executed. Please note immediately after having turned on the power supply of controller and immediately after selecting program. This function cannot be used with two manipulators or more included in a unit. There is a possibility of doing the operation that the robot doesn't anticipate.

■ **Parameter**

Parameter No. 1	Program No.	This specifies the number of the program serving as the call destination. (0-9999)
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, 301-500)
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)

■ **Example of screen display**

```
CALLPN  [2,  V1%,  2]      FN104; Relative program call
                                  (freq. condition)
```

See
CALLPR: Relative program call (FN102)
CALLPRI: Conditional relative program call (FN103)

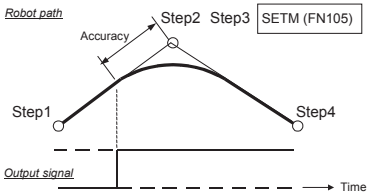
Function commands (FN codes)

Command name	SETM
FN code	105
Title name	Output signal ON/OFF
General description	This command is used to set any general-purpose output signal to ON or OFF.

■ General description

When this function command is executed, any general-purpose output signal (O1 to O2048) is set to ON or OFF.
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.
Single-action recording is possible using the [OUT] key on the teach pendant.

■ Example of operation



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	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

SETM [O17, 1]	FN105; Output signal ON/OFF

See
SETO: Consecutive output signal ON/OFF (FN100)

Function commands (FN codes)

Command name	RSCLR
FN code	111
Title name	RS232C Buffer clear
Outline	The send/receive buffer inside the specified RS232C port is cleared

■ General description

When this function command is used, the send/receive buffer inside the specified RS232C port can be cleared.
At the present time, only port 1 can be used as the RS232C port.

■ Example of operation

When the robot reaches the step in which the RSCLR (FN111) command is recorded, the send/receive buffer inside the specified RS232C port is cleared. The robot continues moving while the buffer is being cleared.

■ Parameter

Parameter No. 1	Port number	This is used to specify the number of the serial port whose send/receive buffer is to be cleared. (1 to 1) At the present time, only port 1 can be specified.

■ Example of screen display

```
RSCLR[#1]              FN111: RS232C Buffer clear
```

See
SREQ: Shift amount request (FN51)
PRINT: Strings output (FN101)

Function commands (FN codes)

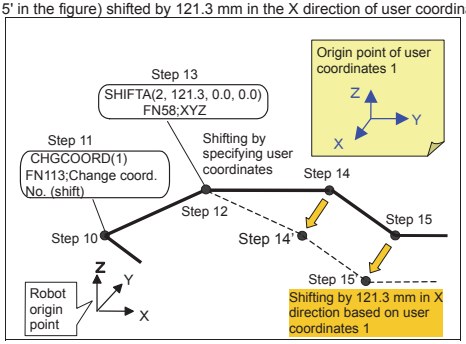
Command name	CHGCOORD
FN code	113
Title name	Change coord. No. (shift)
Outline	This makes it possible to select the number of the user coordinate system used to implement shifts based on the coordinate system. The number of the user coordinate system must be selected without fail before implementing shift-related commands based on the coordinate system.

■ General description

The user coordinate system can be selected as the coordinate system to serve as the reference for shifting when a command such as the "SHIFTR: Shift 2 (FN52)" or "SHIFTA: XYZ shift (FN58)" is used to implement shift operations. The CHGCOORD command specifies the number of the user coordinate system to be used at this time.
When a shift operation has been executed using a user coordinate system with no user coordinate system number selected by this function command, an alarm results, and the robot is stopped.
The user coordinate system must be registered ahead of time using Service Utilities/User coordinates. Up to a hundred coordinate systems can be registered.

■ Example of operation

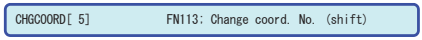
In the figure below, the function command “SHIFTA: XYZ shift” (FN58) has been recorded in step 13, and a user coordinate system has been selected as the coordinate system to be used for this. Therefore, the command “CHGCOORD: Change coord. No. (shift)” (FN113) is recorded in step 11 which comes before, and user coordinate system No.1 has been specified.
The move commands executed in step 14 and the subsequent steps operate with the positions (positions of steps 14' and 15' in the figure) shifted by 121.3 mm in the X direction of user coordinate system No.1 serving as the movement target.



■ **Parameter**

Parameter No. 1	User coordinate number	This is used to specify the user coordinate number to be used by the shift-related function commands. (0 to 100) When "0" is specified, the user coordinates are not selected.

■ **Example of screen display**



See
SHIFTR: Shift2 (FN52)
SHIFTA: XYZ shift (FN58)

Function commands (FN codes)

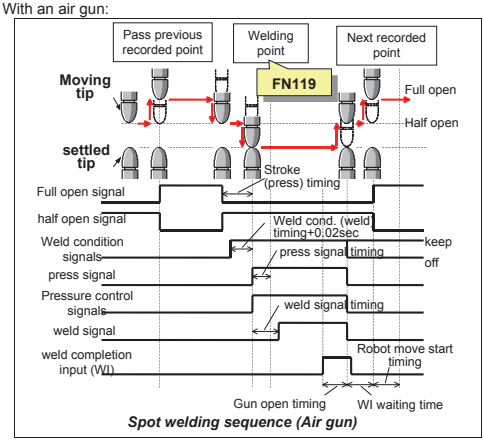
Command name	SPOT
FN code	119
Title name	Spot welding execution
General description	Execute spot welding in accordance with pre-defined sequence.

■ General description

Spot welding can be performed in the specified step by recording the spot welding function in the welding step. By using this function, the output timings of the pressurizing signal, power-on signal, stroke signal and other welding control signals can be programmed by the controller without having to use an external sequencer. A higher level of welding control tailored to each weld point can be exercised by setting a multiple number of welding conditions and welding sequences.
This function is used with either an air gun or servo gun.

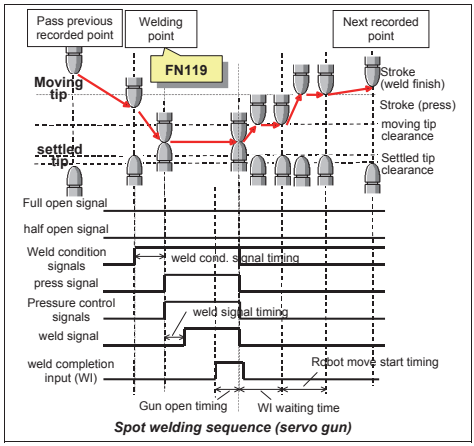
■ Example of operation

With an air gun:



Spot welding sequence (Air gun)

With a servo gun:



Spot welding sequence (servo gun)

■ Parameter

Parameter No. 1	Welder number	This parameter specifies the number of the first welder for which the welding control signal is output. (1–6)
Parameter No. 2	Condition#	This specifies the number of the welding condition. It establishes the welding force and welding condition signal. (1–255)
Parameter No. 3	Welding sequence number	This specifies the number of the welding sequence. It establishes the output timing of the pressurizing signal, power-on signal and stroke signal. (1－64)
Parameter No. 4	Welding point number	This specifies the number of the weld point. Use this parameter when controlling the welding points. If welding trouble has occurred, this weld point number is output. In the case of automatic recording, the step number is recorded. (0–16000)

■ Example of screen display

SPOT [1, 1, 2, 3]　　FN119; Spot welding

See
GSEA: Servo gun search (FN167)

Function commands (FN codes)

Command name	WAITR
FN code	127
Title name	Wait shift reg. receive
Outline	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.

■ General description

When this function command is used, the robot operation is stopped and the wait status is established until the shift amount data is input into the specified shift register or until the specified time arrives. As soon as the input of the shift amount data has been detected within the specified time, the next step is executed. The input is judged to have been detected by the setting of "input completed" data in the specified shift register to "1."

When the input of the shift amount data has not been detected within the specified time, operation jumps to the shelter step.

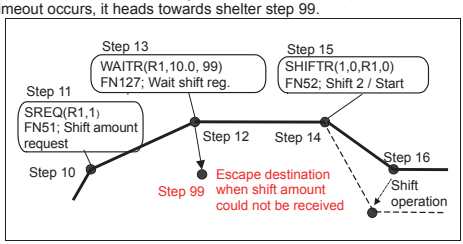
The input of the shift amount data can be confirmed even more definitely by having this function command before the shift-related command that use the shift registers.

If the robot is stopped during shift amount receive wait and then restarted, the remaining time in the specified time serves as the wait time.

■ Example of operation

In the figure, the "WAITR: Wait shift reg. receive" (FN127) command is recorded in step 13.

When the program is played back, the robot, after reaching step 13, is set to the wait status until the shift amount data is input in the specified shift register. When the data input is confirmed, the robot heads toward the next step, and when a timeout occurs, it heads towards shelter step 99.



■ **Parameter**

Parameter No. 1	Shift register number	This is used to specify the number of the shift register into which the input of the shift amount data is awaited. (1 to 9)
Parameter No. 2	Wait time	This is used to specify the wait time. (0.0 to 60.0 sec.) When 0.0 sec. is specified, the wait status is established until the shift amount data is input.
Parameter No. 3	Shelter step number	This is used to specify the step to which the robot is to escape in the event that the data was not input during the specified time. (0 to 10000) When 10000 is specified as the shelter step number, an alarm (A2118: “No data has been input in shift register.”) results immediately with no escape operation performed, and the robot can be stopped.

■ **Example of screen display**

```
WAITR[R1, 10.5, 15]                FN127: Wait shift reg. receive
```

See
SREQ: Shift amount request (FN51)
SHIFTR: Shift2 (FN52)

Function commands (FN codes)

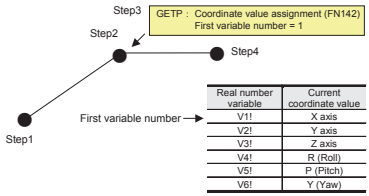
Command name	GETP
FN code	142
Title name	Real number variable assignment (coordinate values)
General description	This command is used to store the current coordinate values (RPY angle expression) in real number variables.

■ General description

When this function command is executed, the current coordinate value expressed as RPY (roll, pitch and yaw) angle of each of the robot's axes is stored in the real number variables with the specified numbers.
(If a wrist posture is to be expressed as Eulerian angles, use the GETPELR: real number variable assignment (coordinate values) (FN94) instead.)

■ Example of operation

In the example of the figure presented below, when the robot arrives at the recorded point in step 2 and positioning is completed, the GETP command in step 3 is executed, and six real number variables are assigned with the coordinate values in sequence starting from the specified real number variable, as shown below.



Real number variable	Current coordinate value
V1!	X axis
V2!	Y axis
V3!	Z axis
V4!	R (Roll)
V5!	P (Pitch)
V6!	Y (Yaw)

The robot reaches the exact recorded point, the GETP command is executed regardless of the accuracy of the move command immediately before and regardless of whether positioning is specified.

The assigned values can be referenced by monitor/real number variables.

■ Parameter

Parameter No. 1	Real number variable number	This specifies the first number of the register (real number variable) in which a coordinate value is to be stored. Six variables are then used in succession. (1–195)

■ Example of screen display

```
GETP [V1!]          FN142; V! Set real var. (cur.pos)
```

See
GETPELR: Real number variable assignment (Eulerian angle coordinate value) (FN94)
GETANGLE: Real number variable assignment (axis angles) (FN157)

Application Command (FN Code)

Command name	GETPOSE
FN code	143
Title name	Assign real variable (pose variable)
Outline	Used to save pose variable Pn in the real variable V!.

■ Outline

This command is used to save pose variable Pn in the real variable V!.

■ Parameters

Parameter 1	Leading variable number	Used to make setting of leading numbers of real variables in which the current robot coordinate values (X, Y, Z, r, p, y) and also pose file numbers. (Setting range: 1 to 195) The coordinate values are saved in six real variables in the order in which the variables were specified. V! [Leading variable number] = X V! [Leading variable number + 1] = Y V! [Leading variable number + 2] = Z V! [Leading variable number + 3] = r V! [Leading variable number + 4] = p V! [Leading variable number + 5] = y
Parameter 2	Pose variable number	Used to make setting of robot posture (pose). (Setting range: 1 to 9999)

■ Example of screen display

GETPOSE[V1!, 2] FN143: Assign real variable (pose variable)

Application Command (FN Code)

Command name	LETPOSE
FN code	144
Title name	Assign pose variable
Outline	Used to assign real variable V! to pose variable.

■ Outline

This command is used to assign the real variable V! to pose variable.

■ Parameters

Parameter 1	Pose variable number	Used to make setting of pose variable number to be assigned. (Setting range: 1 to 9999)
Parameter 2	Leading variable number	Used to make setting of leading numbers of real variables. (Setting range: 1 to 195) Taking the values of specified real variables as coordinate values, assign these values to the pose coordinate values in order. X = V! [Leading variable number] Y = V! [Leading variable number + 1] Z = V! [Leading variable number + 2] r = V! [Leading variable number + 3] p = V! [Leading variable number + 4] y = V! [Leading variable number + 5]

■ Example of screen display

```
LETPOSE[2, V1!]      FN144: Assign pose variable
```

Function commands (FN codes)

Command name	GETSFT
FN code	145
Title name	Real number variable assign (shift)
Outline	This command replaces the values of the specified shift register with the specified real number variables (7 consecutive variables are used).

■ General description

When this function command is used, the values (X, Y, Z, θx, θy, θz) recorded in the specified shift register can be assigned in sequence from the number of the specified real number variable. Furthermore, the numerical value (1) indicating that the values have been assigned is set in the number of the next specified real number variable.

The numerical values at the time concerned are assigned regardless of whether or not the data has been set in the specified shift register.

■ Example of operation

When the robot reaches the step where the "GETSTF: Set real var. (shift)" (FN145) command is recorded, the contents of the shift register are immediately read, copied into the real number variables, and set. The robot does not stop.

The numerical values are set (written over the existing data) in 7 consecutive real number variables regardless of their usage status up to this point.

■ Parameter

Parameter No. 1	Real number variable number	This is used to specify the starting number of the real number variables which will store the numerical values inside the shift register. The numerical values are set (overwritten) in 7 consecutive real number variables whose number starts with this. (1 to 94)
Parameter No. 2	Shift register number	This is used to specify the shift register number. (1 to 9)

■ Example of screen display

```
GETSFT[ V1!, R1]          FN145: Set real var.(shift)
```

See
SREQ: Shift amount request (FN51)
SHIFTR: Shift2 (FN52)

Application Command (FN Code)

Command name	STIMER
FN code	150
Title name	Short timer
Outline	Used to wait for a specified period of time.

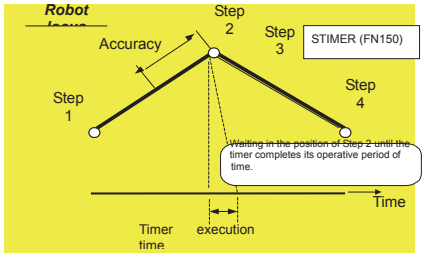
■ Outline

Using this command makes it possible to put the robot into a waiting state. While in the waiting state, the robot comes to rest at a position recorded.

Compared to the command DELAY (FN50), this command has the following limiting conditions for its use.

- This command cannot be used while in synchronized operation with conveyor.
- If this command is used in combination with the signal first-out/last-out command, signal output timing will become different.
- There are cases where the locus of movement command does not become an inward-turning locus.
- This command has a different setting range.
- If you record the functions like Signal ON, FN150, Signal OFF, signal sometime does not turn OFF. Please record the position step before Signal OFF.

■ Example of motion



■ Parameters

Parameter 1	Waiting time	Used to make setting of waiting time in seconds. (Setting range: 0.1 to 0.5)

■ Example of screen display

STIMER[0.5]	FN150: Short timer

Related commands
DELAY: Timer (FN50)
WAIT: Wait for input signal with timer (FN552)

Function commands (FN codes)

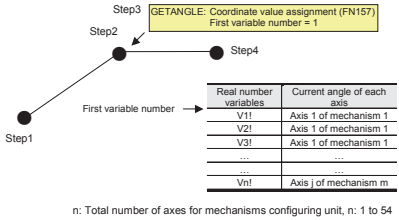
Command name	GETANGLE
FN code	157
Title name	Real number variable assignment (axis angles)
General description	This command is used to store the current angle value of each axis in a real number variable.

■ General description

When this function command is executed, the current angle value (in degrees) for each axis of all the mechanisms in the unit is stored in a real number variable with the specified number.

■ Example of operation

In the example of the figure presented below, when the robot arrives at the recorded point in step 2 and positioning is completed, the GETANGLE command in step 3 is executed, and the number of real number variables corresponding to the number of axes starting from the specified real number variable are assigned in sequence to the axis angle values (in degrees), as shown below.



n: Total number of axes for mechanisms configuring unit, n: 1 to 54

The robot reaches the exact recorded point, the GETANGLE command is executed regardless of the accuracy of the move command immediately before and regardless of whether positioning is specified.

The assigned values can be referenced by monitor/real number variables.

■ Parameter

Parameter No. 1	Real number variable number	This specifies the first number of the register (real number variable) in which a coordinate value is to be stored. Following this, the number of variables that corresponds to the "total number of axes of the mechanisms configuring the unit" are used in succession. (1–195)

Since the total number of axes is high, the number of variables may exceed 200, in which case the angles for the axes above the 200 mark will not be assigned.

■ Example of screen display

```
GETANGLE [V1!]      FN157; V! Set real var. (cur.ang)
```

See
GETPELR: Real number variable assignment (Eulerian angle coordinate value) (FN94)
GETP: Real number variable assignment (RPY angle coordinate value) (FN142)

Function commands (FN codes)

Command name	GETFIGURE
FN code	158
Title name	Set real variable(figure)
General description	The robot figure is used to store in real number variables.

■ **General description**

When this function command is executed, the position of the mechanism is stored in the V! variable.
You can choice the kind and type of the position of the mechanism as follow.

Kind

Angle	The current angle of each of the mechanism's axes is stored in the V! variable. Unit [deg] or [mm]
TCP Coordinate (RPY)	The current TCP coordinate of each of the mechanism is stored in six chosen V! variables in （X,Y,Z, R,P,Y）order. Output is in user coordinate if you use “FN171 NRLCRD” or else is in the mechanism coordinate Unit [mm]/[deg]
TCP Coordinate (EULER)	The current TCP coordinate of each of the mechanism is stored in six chosen V! variables in （X,Y,Z, α , β , γ ） order. Output is in user coordinate if you use “FN171 NRLCRD” or else is in the mechanism coordinate Unit [mm]/[deg]

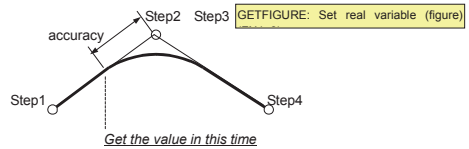
Type

Com	Get the command value in the time.
Current	Get the current value in the time.
Object	Get the object value in the time. This is not depend on accuracy of the move command. The value reflects “shift” if you use “shift” and so on.

This function is carried out while passing. Was that, if the step that an accuracy of the move command is large, gotten value in the time when enter accuracy extent.

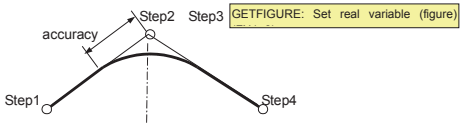
■ **Example of operation**

case Type =com or cur



Gotten value in the time when enter accuracy extent.
Gotten the value after positioning If you command it.

case Type =obj



Get the value in this time

This is not depend on accuracy of the move command.
The value reflects “shift” if you use “shift” and so on.

■ **Parameter**

Parameter No. 1	Top Variable (figure)	Select a register used to store in result. （1-195）
Parameter No. 2	Mechanism No.	Select the Mechanism No. (1-9)
Parameter No. 3	Kind	0：ang 1：TCP（RPY） 2：TCP（EULER）
Parameter No. 4	Type	0：Com 1：Cur 2：Obj

If valables is over 200, make an error in the time starting.

■ **Example of screen display**

GETFIGURE[V1!, 1, 1, 2]　FN158; Set real variable(figure)

See
GETPELR: Real number variable assignment (Eulerian angle coordinate value) (FN94)
GETP；Set real variable（Set real variable(pos)（FN142）
GETANGLE: Real number variable assignment (axis angles) (FN157)
NRLCRD；Change coord. for R-Lang(FN171)

Application Command (FN Code)

Command name	POSAUTO
FN code	160
Title name	Disable posture control
Outline	Used to disable the posture control for robot posture calculation.

■ Outline

In order to perform a robot posture calculation, this command disables setting used to find the calculation result in a posture that is forcedly set.

■ Parameters

Parameter 1	Select posture control	Used to select posture control to be disabled. (Selection range: 0 to 4) 0: All / 1: Right and left arm system / 2: System above/below elbow / 3: Wrist posture system / 4: Flange shaft

■ Example of screen display

```
POSAUTO[0]          FN160: Disable posture control
```

Related commands
LEFTY: Left arm system (FN161)
RIGHTY: Right arm system (FN162)
ABOVE: System above elbow (FN163)
BELOW: System below elbow (FN164)

Function commands (FN codes)

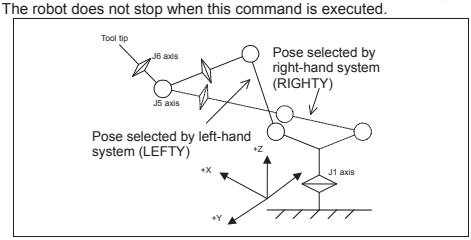
Command name	LEFTY
FN code	161
Title name	Arm config. (left/front)
Outline	The left-arm system posture is forcibly selected for calculating the robot postures

■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-related operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose. When this function command is used, the poses of the left-arm system are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "LEFTY: Arm config. (left/front)" (FN161) command is played back, the poses of the left-arm system are forcibly selected when shift-related operations are executed in the subsequent steps.
The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
LEFTY              FN161: Arm config. (left/front)
```

See
RIGHTY: Arm config. (right/back) (FN162)
ABOVE: Elbow config. (above) (FN163)
BELOW: Elbow config. (below) (FN164)

Function commands (FN codes)

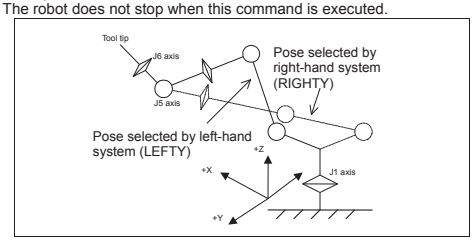
Command name	RIGHTY
FN code	162
Title name	Arm config. (right/back)
Outline	The right-arm system posture is forcibly selected for calculating the robot postures

■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-type operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose. When this function command is used, the poses of the right-arm system are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "RIGHTY: Arm config. (right/back)" (FN162) command is played back, the poses of the right-arm system are forcibly selected when shift-related operations are executed in the subsequent steps.
The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
RIGHTY              FN162: Arm config.(right/back)
```

See
LEFTY: Arm config. (left/front) (FN161)
ABOVE: Elbow config. (above) (FN163)
BELOW: Elbow config. (below) (FN164)

Function commands (FN codes)

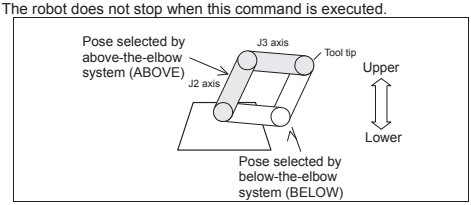
Command name	ABOVE
FN code	163
Title name	Elbow config. (above)
Outline	The above-the-elbow (less than 180-degree angle formed by J2 axis and J3 axis) posture is forcibly selected for calculating the robot postures

■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-related operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose. When this function command is used, the poses of the above-the-elbow system (less than 180-degree angle formed by J2 axis and J3 axis) are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "ABOVE: Elbow config. (above)" (FN163) command is played back, the poses of the above-the-elbow system (less than 180-degree angle formed by J2 axis and J3 axis) are forcibly selected when shift-related operations are executed in the subsequent steps.
The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
ABOVE              FN163: Elbow config. (above)
```

See
LEFTY: Arm config. (left/front) (FN161)
RIGHTY: Arm config. (right/back) (FN162)
BELOW: Elbow config. (below) (FN164)

Function commands (FN codes)

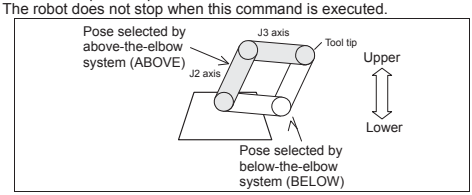
Command name	BELOW
FN code	164
Title name	Elbow config. (below)
Outline	The below-the-elbow (180-degree angle or more formed by J2 axis and J3 axis) posture is forcibly selected for calculating the robot postures

■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-related operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose. When this function command is used, the postures of the below-the-elbow system (180-degree angle or more formed by J2 axis and J3 axis) are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "BELOW: Elbow config. (below)" (FN164) command is played back, the poses of the below-the-elbow system (180-degree angle or more formed by J2 axis and J3 axis) are forcibly selected when shift-related operations are executed in the subsequent steps.
The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
BELOW              FN164: Elbow config.(below)
```

See
LEFTY: Arm config. (left/front) (FN161)
RIGHTY: Arm config. (right/back) (FN162)
ABOVE: Elbow config. (above) (FN163)

Function commands (FN codes)

Command name	FLIP
FN code	165
Title name	Wrist config. (flip)
Outline	The poses of the wrist-flip system (where the J5 axis angle is positive) is forcibly selected for calculating the robot postures

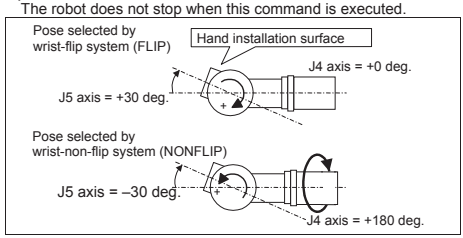
■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-related operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose. When this application command is used, the poses at which the angle of the J5 axis is positive are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "FLIP: Wrist config. (flip)" (FN165) command is played back, the poses at which the angle of the J5 axis is positive are forcibly selected when shift-related operations are executed in the subsequent steps.

The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
FLIP            FN165: Wrist config.(flip)
```

See
LEFTY: Arm config. (left/front) (FN161)
RIGHTY: Arm config. (right/back) (FN162)
ABOVE: Elbow config. (above) (FN163)
BELOW: Elbow config. (below) (FN164)
NONFLIP: Wrist config. (nonflip) (FN166)

Function commands (FN codes)

Command name	NONFLIP
FN code	166
Title name	Wrist config. (nonflip)
Outline	The poses of the wrist-non-flip system (where the J5 axis angle is negative) is forcibly selected for calculating the robot postures

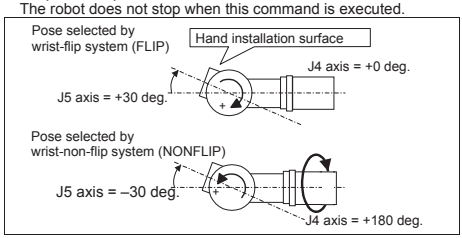
■ General description

This command obtains the angles of the robot axes by calculating them from the head coordinates when shift-related operations are executed. The angles of two patterns capable of expressing the same position are obtained by the calculation. Which angle is to be selected is normally determined automatically and sometimes the robot is not set to the desired pose.
When this function command is used, the poses at which the angle of the J5 axis is negative are forcibly selected from among the calculation results in the subsequent steps.

■ Example of operation

When the "NONFLIP: Wrist config. (nonflip)" (FN166) command is played back, the poses at which the angle of the J5 axis is negative are forcibly selected when shift-related operations are executed in the subsequent steps.

The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

None.

■ Example of screen display

```
NONFLIP              FN166: Wrist config.(nonflip)
```

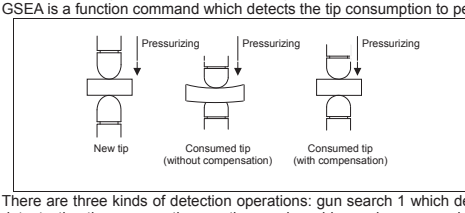
See
LEFTY: Arm config. (left/front) (FN161)
RIGHTY: Arm config. (right/back) (FN162)
ABOVE: Elbow config. (above) (FN163)
BELOW: Elbow config. (below) (FN164)
FLIP: Wrist config. (flip) (FN165)

Function commands (FN codes)

Command name	GSEA
FN code	167
Title name	Servo gun search
General description	This command is used to detect the electrode tip consumption of the servo gun.

■ General description

As welding is performed over and over again, the electrodes gradually start to wear down, and their length shortens. If welding is performed after the electrode lengths have changed, the settled side electrode can no longer be pressed against the work piece: as a result, the work piece is subjected to extra stress, the welding force at the settled side becomes inadequate, etc. The tip consumption must be compensated in order to eliminate these discrepancies.
GSEA is a function command which detects the tip consumption to perform this compensation.



There are three kinds of detection operations: gun search 1 which detects the total tip consumption, gun search 2 which detects the tip consumption on the moving side, and gun search 3 which adds simplified compensation to the tip consumption obtained by gun searches 1 and 2.

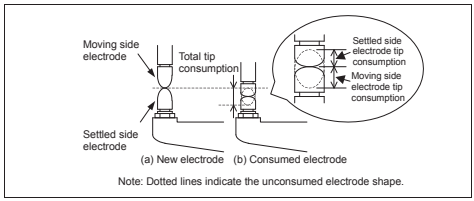
Search system	Description of features
Gun Search 1	**Total tip consumption detection** The total tip consumption is measured and subdivided into the settled side tip consumption and moving side tip consumption according to a constant ratio. When gun search 1 is used independently, there is no need for a reference stand, and the tip consumption can be measured in a short period of time. On the other hand, the measurement accuracy is not as good as when both gun search 1 and gun search 2 are performed.
Gun Search2	**Moving side tip consumption detection** This is used together with gun search 1. The moving side tip consumption is measured. The settled side tip consumption is calculated by subtracting the moving side tip consumption from the total tip consumption obtained by gun search 1. This has the highest measurement accuracy. It is necessary to provide a reference stand.
Gun Search 3	**Simplified tip consumption detection** This is used together with gun search 1 and gun search 2. It measures the overall tip consumption. With gun search 3, the tip consumption can be compensated in a simplified way for the tip consumption after gun search 1 and gun search 2 have been executed. The measurement accuracy is not as good as when gun search 3 is performed together with gun search 1 and gun search 2. However, its advantage is that the search operation is completed in one go except when the tips have been replaced. Reference write is not required.

In accordance with the trouble detection level set by constants/spot welding application/servo gun tip consumption detection, an error or information is output, and the corresponding alarm signal is output for the tip consumption obtained.

■ Example of operation

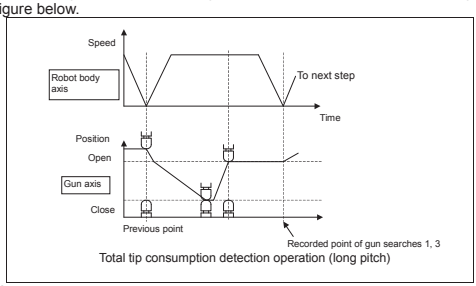
Total tip consumption detection

The total tip consumption is measured and subdivided into the settled side tip consumption and moving side tip consumption according to a constant ratio.



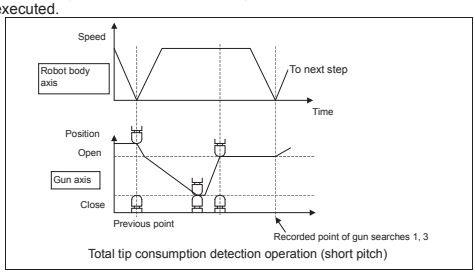
As soon as the robot starts heading toward the point where gun searches 1 and 3 have been recorded, the gun axis heads toward the recorded point at the maximum speed. Upon arriving at the recorded point, the pressurizing operation by the welding force which has been set as the parameter of the function is commenced. The search speed set in constants/spot welding parameters/servo gun tip consumption detection (or the pressurizing speed among the servo gun characteristics if "0" has been set) serves as the pressurizing speed at this time.

In this way, the gun operation and robot operation are not synchronized during movement toward the point where gun searches 1 and 3 have been recorded. Consequently, if the robot operation is a long one, the gun tip consumption detection operation will be completed before the robot reaches the tip consumption detection point, as is shown in the figure below.



Total tip consumption detection operation (long pitch)

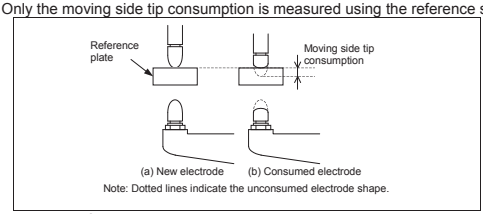
If the robot operation is a short one, the robot may conceivably reach the recorded point before the gun has performed the tip consumption detection operation. In a case like this, the robot stops at the recorded point, but the tip consumption detection operation continues. This operation is then concluded, and after the gun release is completed, the next step is executed.



Total tip consumption detection operation (short pitch)

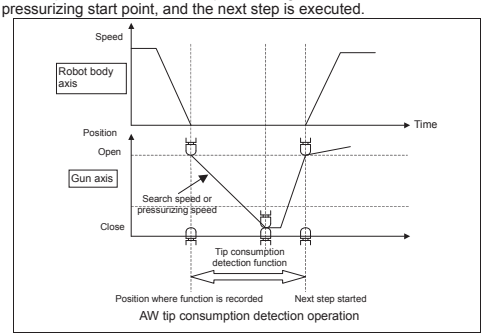
Moving side tip consumption detection

Only the moving side tip consumption is measured using the reference stand.



In the case of gun search 2 which detects the moving side tip consumption, the pressurizing operation is performed for the target which is secured to the ground but whose location is not known. For this reason, the robot is stopped once before

this pressurizing operation is performed. After this, the pressurizing operation is started, and the moving side tip consumption is detected after pressurizing is directed toward the reference stand. The gun is released as far as the pressurizing start point, and the next step is executed.



AW tip consumption detection operation

■ **Parameter**

Parameter No. 1	Welder number	This specifies the number of the welder to which the servo gun whose electrode tip consumption are to be detected is connected. (1–6)
Parameter No. 2	Gun search number	This specifies the type of gun search to be executed. (1–3) 1: Gun search 1 = Total tip consumption detection 2: Gun search 2 = Moving side tip consumption detection 3: Gun search 3 = Total tip consumption detection (simplified tip consumption detection)
Parameter No. 3	Pressure	This specifies the welding force when detecting the tip consumption. (1.0 – 100.0) [kN]

■ **Example of screen display**

GSEA [1,1,1.5] FN167; Servo gun search

See
SPOT: Spot welding execution (FN119)

Function commands (FN codes)

Command name	SPDDOWNA
FN code	169
Title name	Analog input speed override
Outline	The playback speed of the robot is changed in accordance with the input voltage

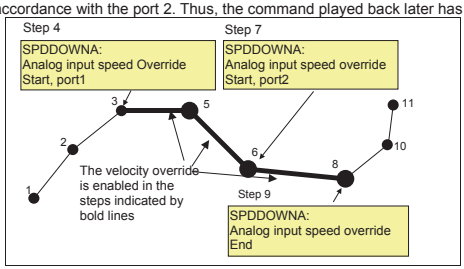
■ General description

With this function command, the playback speed of the robot can be changed in accordance with the analog input voltage. It is necessary to set a velocity override pattern beforehand in the "Constant Setting" mode. (→ Constant Setting / Signals / Velocity override depend on input)
Four analog input channels are provided, any of which can be specified.

This function, however, cannot be used when an analog input board (option) is not installed.

■ Example of operation

In the following diagram, record "SPDDOWNA (FN169) / Start" in steps 4 and 7, and "SPDDOWNA (FN169) / End" in step 9. When this is played back, the velocity override is performed by analog input signals in the sections indicated by the bold lines in the diagram. As far as step 6 the operation is performed in accordance with the port 1, and as far as step 8 in accordance with the port 2. Thus, the command played back later has priority.



If the rate of velocity override by F keys and R codes is set to 50% and that by input signals set to 50%, the actual rate of velocity override is 25% (50% x 50%).
The velocity override by digital input (FN277) is also available, yet this cannot be used together with the SPDDOWNA command.

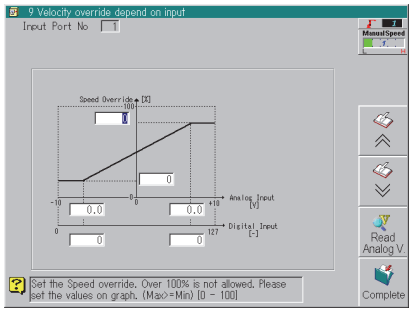
■ Parameter

Parameter No. 1	Start/end	Specify whether to start or end the velocity override by input signals. (1: Start, 0: End)
Parameter No. 2	Input port No.	Select the analog input port to refer to from the four ports. It is ignored when "0: End" is selected as the setting of the first parameter. (1 to 4)

■ Example of screen display

```
SPDDOWNA[1,4]      FN169: Analog input speed override
```

The correspondence between input voltage and speed override must be designed beforehand using "Constant Setting → Signals → Velocity override depend on input". The velocity override by input signal cannot be set over 100%.



If no pattern is defined (all the parameters on the screen are set to 0), the velocity override function is disabled.

See
SPDDOWND: Digital input speed override (FN277)

Application Command (FN Code)

Command name	NRLCRD
FN code	171
Title name	Select robot language coordinate system
Outline	Used to switch functions to a specified user coordinate system.

■ Outline

Using this command makes it possible to switch the following functions to a specified user coordinate system.
- LETX (FN71): Assign X component of pose
- LETY (FN72): Assign Y component of pose
- LETZ (FN73): Assign Z component of pose
- GETP (FN142): Assign real variable (coordinate value)
- GETPOSE (FN143): Assign real variable (pose variable)
- LETPOSE (FN144): Assign pose variable

Example of use

This section explains how to shift using a specified user coordinate system.

```
NRLCRD [1]          // Specifies user coordinate system 1
GETPOSE[V1!, 1]     // Obtains pose of pose No. 1 with user coordinate system 1
V1!=V1!+500         // Shifts +500mm in X direction of user coordinate system 1
V2!=V2!+600         // Shifts +600mm in Y direction of user coordinate system 1
V3!=V3!+700         // Shifts +700mm in Z direction of user coordinate system 1
LETPOSE[2, V1!]     // Stores shift results in pose No. 2
```

When the program above is executed, a pose is stored in pose No. 2 for which the pose of pose No. 1 is shifted by +500mm in the X direction of the user coordinate system, +600mm in the Y direction, and +700mm in the Z direction.

■ Parameters

Parameter 1	User coordinate system number	Used to make setting of user coordinate system number. (Setting range: 0 to 100)

***When "0" is set to this parameter, the robot will run in the machine coordinate system, but not in the user coordinate system.**

■ Example of screen display

Related commands

LETX: Assign X component of pose (FN71)
LETY: Assign Y component of pose (FN72)
LETZ: Assign Z component of pose (FN73)
GETP: Assign real variable (coordinate value) (FN142)
GETPOSE: Assign real variable (pose variable) (FN143)
LETPOSE: Assign pose variable (FN144)

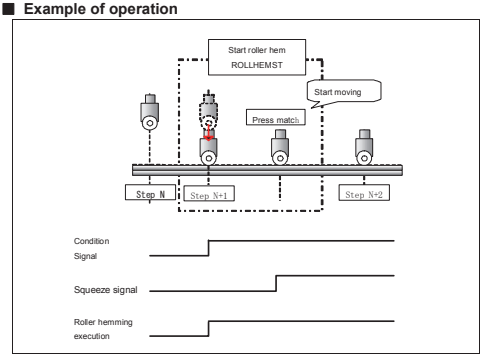
Function commands (FN codes)

Command name	ROLHEMST
FN code	190
Title name	Start roller hem
General description	Execute roller hem in accordance with pre-defined condition.

■ General description

Roller hem can be performed in the specified step by recording the roller hem function.

■ Example of operation



■ Parameter

Parameter No. 1	Roller hem number	This parameter specifies the number of the roller hem.
Parameter No. 2	Condition number	This specifies the number of the condition.

■ Example of screen display

```
ROLHEMST [1, 1]          FN190; Start roller hem
```

See
ROLHEMEND: Finish roller hem(FN191)
ROLHEMCTRL: Change control of roller hem(FN192)
ROLHEMCHG: Change roller hem condition(FN193)

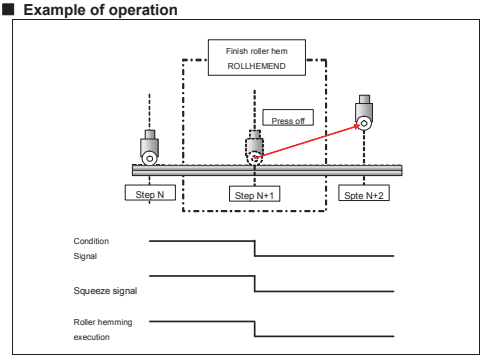
Function commands (FN codes)

Command name	ROLHEMEND
FN code	191
Title name	Finish roller hem
General description	Finish the roller hem pressing.

■ General description

Roller hem can be finished in the specified step by recording the roller hem function in the finished pressurizing step.

■ Example of operation



■ Parameter

Parameter No. 1	Roller hem number	This parameter specifies the number of the roller hem.

■ Example of screen display

ROLHEMEND [1] FN191; Finish roller hem

See
ROLHEMST: Start roller hem(FN190)
ROLHEMCTRL: Change control of roller hem(FN192)
ROLHEMCHG: Change roller hem condition(FN193)

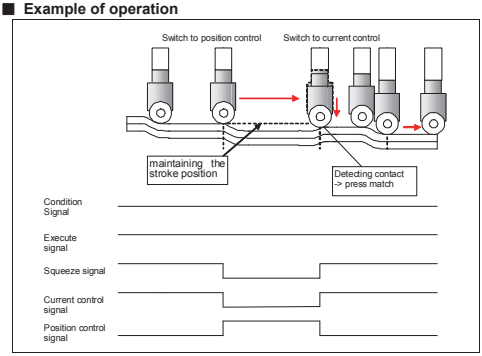
Function commands (FN codes)

Command name	ROLHEMCTRL
FN code	192
Title name	Change control of roller hem
General description	Change the control of roller hem during execution of roller hemming.

■ General description

Switch the current control / position control during the execution of the pressurizing. If you switch from the current control to position control, so they operate while maintaining the stroke position at the present time to turn off the pressure. If you switch from position control to the current control, operates in the direction push from the stroke at the present time, do the pressure after workpiece contact.

■ Example of operation



■ Parameter

Parameter No. 1	Roller hem number	This parameter specifies the number of the roller hem.
Parameter No. 2	Control	This specifies the control of the condition. 0 : Current control 1 : Position control

■ Example of screen display

```
ROLHEMCTRL [1, 1]    FN192; Change control of roller
```

See
ROLHEMST: Start roller hem(FN190)
ROLHEMEND: Finish roller hem(FN191)
ROLHEMCHG: Change roller hem condition(FN193)

Function commands (FN codes)

Command name	ROLHEMCHG
FN code	193
Title name	Change roller hem condition
General description	Change the roller hem conditions during pressurization.

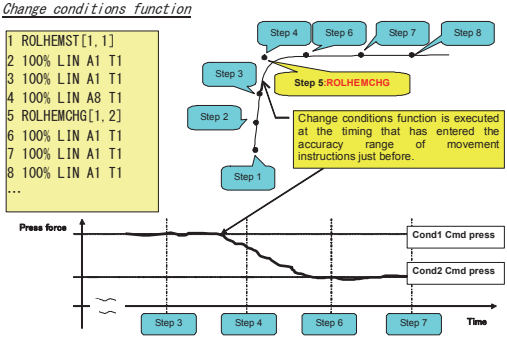
■ General description

Roller hem condition can be changed in the specified step by recording the change condition function.
If the command pressure is changed, it will work without waiting for the pressure match.

■ Example of operation

Change conditions function

```
1 ROLHEMST[1, 1]
2 100% LIN A1 T1
3 100% LIN A1 T1
4 100% LIN A8 T1
5 ROLHEMCHG[1, 2]
6 100% LIN A1 T1
7 100% LIN A1 T1
8 100% LIN A1 T1
...
```



Change conditions function is executed at the timing that has entered the accuracy range of movement instructions just before.
If the command pressure has been changed by the conditions change, the command pressure will gradually change from execution timing.
Because after conditions change to work without waiting for the pressure match, it does not necessarily has reached the pressure after the change at the time of move instructions pass after conditions change.

■ Parameter

Parameter No. 1	Roller hem number	This parameter specifies the number of the roller hem.
Parameter No. 2	Condition number	This specifies the number of the condition.

■ Example of screen display

ROLHEMCHG[1, 1] FN193; Change roller hem condition

See
ROLHEMST: Start roller hem(FN190)
ROLHEMEND: Finish roller hem(FN191)
ROLHEMCTRL: Change control of roller hem(FN192)

Function commands (FN codes)

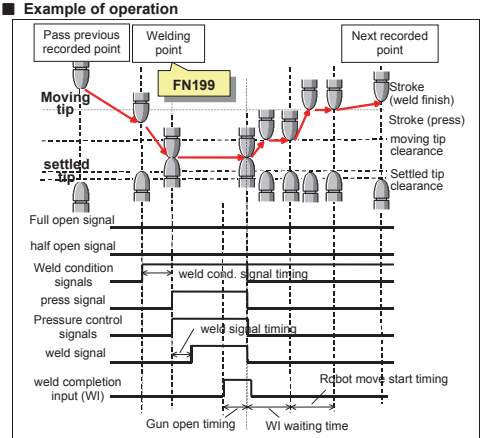
Command name	SPOTIWB1
FN code	199
Title name	Spot welding
General description	Execute spot welding in accordance with pre-defined sequence. （dedicated to welding I/F＝MEDbus only）

■ General description

This function is dedicated to the MEDAR spot welder (IWB timer controller) interface application only. **(welding I/F＝MEDbus)**

Spot welding can be performed in the specified step by recording the spot welding function in the welding step. By using this function, the output timings of the pressurizing signal, power-on signal, stroke signal and other welding control signals can be programmed by the controller without having to use an external sequencer. A higher level of welding control tailored to each weld point can be exercised by setting a multiple number of welding conditions and welding sequences.

■ Example of operation



Spot welding sequence (servo gun)

■ Parameter

Parameter No. 1	Welder number	This parameter specifies the number of the first welder for which the welding control signal is output. (1–1)
Parameter No. 2	Welding sequence number	This specifies the number of the welding sequence. It establishes the output timing of the pressurizing signal, power-on signal and stroke signal. (1-64)
Parameter No. 3	Welding point number	This specifies the number of the weld point. Use this parameter when controlling the welding points. If welding trouble has occurred, this weld point number is output. In the case of automatic recording, the step number is recorded. (0–16000)

■ Example of screen display

```
SPOTIWB1[1,2,3]        FN199: Spot welding
```

See

GSEA; Servo gun search (FN167)

Function commands (FN codes)

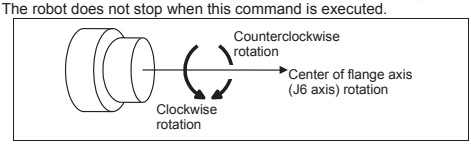
Command name	FRANGE
FN code	202
Title name	Flange axis rot. config.
Outline	The rotational direction of the J6 axis is specified for calculating the robot postures

■ General description

Restrictions stemming from the wiring that accompanies the tools and the installation conditions of the robot sometimes make it preferable for the rotational direction of the tools to be fixed. During palletizing operations and rotational shifts based on the robot language, etc., the poses that minimize the rotational amount are often selected automatically. This sometimes results in operations which differ from the desired rotational direction.
When this finction command is used, the rotational direction of the J6 axis can be forcibly specified.

■ Example of operation

When the "FRANGE: Flange axis rot. config." (FN202) command is played back, the poses are forcibly selected with the rotational direction of the J6 axis specified when shift-related operations are executed in the subsequent steps.
The robot does not stop when this command is executed.



As soon as the first step (step 0) in the program is played back, the forced selection status is released, and the process of automatically determining which angle to select is restored. However, the forced selection status continues at step 0 of a program which has been called.

■ Parameter

Parameter No. 1	ON/OFF	This is used to specify whether to specify the rotational direction or release the specification. (1: ON/2: OFF)
Parameter No. 2	Rotational direction	This is used to specify the rotational direction of the J6 axis. (1: Clockwise rotation/ –1: counterclockwise rotation)

■ **Example of screen display**

```
FRANGE[1,1]      FN202: Flange axis rot. config.
```

See
LEFTY: Arm config. (left/front) (FN161)
RIGHTY: Arm config. (right/back) (FN162)
ABOVE: Elbow config. (above) (FN163)
BELOW: Elbow config. (below) (FN164)
FLIP: Wrist config.(flip) (FN165)
NONFLIP: Wrist config. (nonflip) (FN166)

Application Command (FN Code)

Command name	COMPON
FN code	206
Title name	Software compliance ON
Outline	Used to enable the software compliance control function.

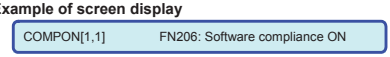
■ Outline

Using this command enables the software compliance control function, thus making it possible to run the robot according to external force.

■ Parameters

Parameter 1	Condition number	Used to make setting of condition number that is selected within the software compliance data. (Setting range: 1 to 10)
Parameter 2	Command position replace	Used to select whether or not to retrieve the current position and take it as a command position. (1: ON / 2: OFF) 1: Used to retrieve the current position that made a change due to external force in a step in progress and perform a calculation of locus to the subsequent step according to this position. 0: Used to perform a normal locus calculation in a step in progress without retrieving the current position.

■ Example of screen display



Related commands

COMPOFF: Software compliance OFF (FN207)

Application Command (FN Code)

Command name	COMPOFF
FN code	207
Title name	Software compliance OFF
Outline	Used to disable the software compliance control function.

■ Outline
Using this command disables the software compliance control function.

■ Parameters
None

■ Example of screen display

```
COMPOFF          FN207: Software compliance OFF
```

Related commands
COMPON: Software compliance ON (FN206)

Function commands (FN codes)

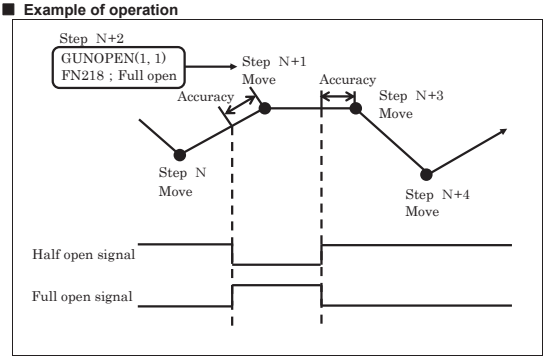
Command name	GUNOPEN
FN code	218
Title name	Gun Open
General description	This command is used to change stroke of air gun.

■ General description

This function changes a stroke of air gun to half open or full open.
If you select half open, half open signal is on and full open signal off.
If you select half open, half open signal is on and full open signal off.

If you use this function, you must set “Full/half gun open function” of [Constant Setting][13 Spot welding application][1 Spot welder setting] is enabled.

■ Example of operation



■ Parameter

Parameter No. 1	Welder number	The number of Welder number. (1–6)
Parameter No. 2	Half open / Full open	"1" means full open stroke, and "0" means half open stroke. (0–1)

■ Example of screen display

```
GUNOPEN [1, 1]    FN218; Gun Open
```

Function commands (FN codes)

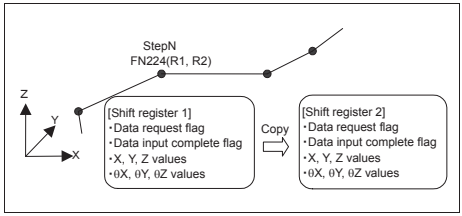
Command name	REGC
FN code	224
Title name	Shift register copy
Outline	Data is copied between shift registers

■ General description

When this function command is used, data can be copied between shift registers.

■ Example of operation

The "REGC: Shift register copy" (FN224) command is recorded in step N.
When the program is played back, the robot, after reaching step N, copies the contents of the copy source shift register into the copy destination shift register. The "data input completed flag" of the copy destination shift register is always set to "1."



■ Parameter

Parameter No. 1	Copy source shift register number	This is used to specify the number of the copy source shift register. (1 to 9)
Parameter No. 2	Copy destination shift register number	This is used to specify the number of the copy destination shift register. (1 to 9)

■ Example of screen display

```
REGC[ R1, R4]          FN224: Shift register copy
```

See
SREQ: Shift data request (FN51)
SHIFTR: Shift2 (FN52)

Function commands (FN codes)

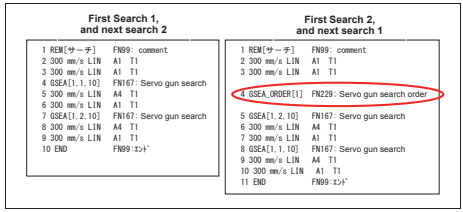
Command name	GSEA_ORDER
FN code	229
Title name	Servo gun search order
General description	Servo gun search2 is execute before servo gun search1

■ General description

When gun search 1 and gun search 2 are to be used together, their execution sequence can be specified. The execution sequence is specified using a function command. Under normal circumstances, set so that gun search 1 is executed first followed by gun search 2. In this case, there is no need to register the function command. Use this sequence when, due to the system configuration or other
factors, it is better to execute gun search 2 first.

Please refer to GSEA: Servo gun search (FN167) for the detail of Servo gun search.

■ Example of operation



If what has been specified in the search sequence and the gun search sequence differ, an alarm is detected during playback, and the robot stops.

■ Parameter

Parameter No. 1	Execution sequence	This parameter specifies the execution sequence of gun search 1 and gun search 2. (0–1) 0; Gun search 1 is executed first followed by gun search 2. 1; Gun search 2 is executed first followed by gun search 1.

■ Example of screen display

```
GSEA_ORDER[1,1]    FN229: Servo gun search order
```

See
SPOT: Spot welding (FN119)
GSEA: Servo gun search (FN167)
SGTIPRST: Reset servo gun tip consumption (FN270)

Application Command (FN Code)

Command name	COLSEL
FN code	230
Title name	Select interference detection level
Outline	Used to select a detection level.

■ Outline

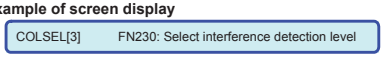
Using this command makes it possible to select a threshold used to determine interference.
For example, use this command to reduce interference detection sensitivity or prevent detection errors in cases where you want to put a robot tip in narrow places, have a close look at interference, keep threshold levels low, increase detection sensitivity, and make the robot conduct contact work.

■ Parameters

Parameter 1	Level number	Used to make setting of detection level number. (Setting range: 1 to 3) 0: Normal sensitivity 1: High sensitivity 2: Low sensitivity 3: Disabled

∗ The operator class ***Expert*** or greater is required.

■ Example of screen display



Application Command (FN Code)

Command name	CHGXXGUN
FN code	238
Title name	Mechanism change
Outline	Used to select a mechanism to be operated manually. (Command dedicated to Mechanism 2 / Mechanism change type “Unlock”)

■ Outline

This application command is used for mechanism changes without electrical disconnection or unlocked mechanism changes (e.g. to control two gun arms with a single motor for servo gun application).
Use this application command to make mechanism changes.
(Command dedicated to Mechanism 2 / Mechanism change type “Unlock”)

■ Example of motion

When the mechanism change type is set to “Unlock”, teaching will be conducted as shown below.

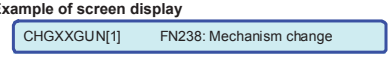
STEP N	**500mm/s LIN A1 T2**		
STEP N+1	**100mm/s LIN A1 T2**		
STEP N+2	**CHGXXGUN[1]**	FN238: Mechanism change	Change to sub-mechanism 1
STEP N+3	**100mm/s LIN A1 T1**		Move to weld point
STEP N+4	**SPOT[1,1,1,1,]**	FN119: Spot welding	
STEP N+5	**100mm/s LIN A1 T1**		
STEP N+6	**100mm/s LIN A1 T1**		
STEP N+7	**CHGXXGUN[2]**	FN238: Mechanism change	Change to sub-mechanism 2
STEP N+8	**100mm/s LIN A1 T2**		Move to weld point
STEP N+9	**SPOT[1,1,1,1,]**	FN119: Spot welding	
STEP N+10	**100mm/s LIN A1 T2**		

For steps in which mechanism changes are made, teach positions in which both guns can move. If one gun is located outside the motion range even though the other gun is located within the motion range (software limit), “software stroke over” error may be detected when executing the mechanism change function.
Set a correct tool number to the spot welding function execution step. Not doing so will disable proper equalizing operation.
If the “Tool number check” parameter on the Servo Gun usage condition screen is set to “Enabled”, the tool number recorded and that set with the “Spot welding gun setting” parameter will be verified. If different, an error will be detected to stop playback of mechanism change.

■ Parameters

Parameter 1	Sub-mechanism number	Used to make setting of sub-mechanism number. (Setting range: 1 to 31)

■ Example of screen display



Function commands(FN codes)

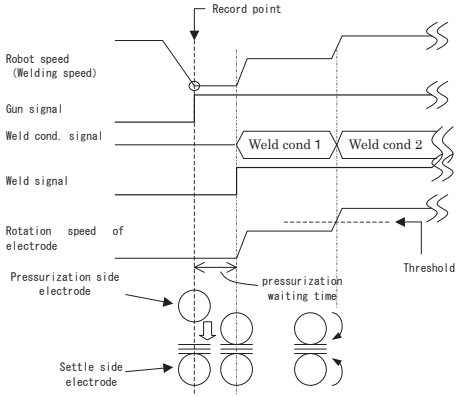
Command name	SEAMST
FN code	245
Title name	Seam weld start
General description	Start the seam welding.

■ General description

Execution of this command starts seam welding.
First, pressurization operation of the electrode by the side of pressurization is carried out, and a work is put. Next, after applying delay by pressurization waiting time, the weld signal and a welding condition signal are outputted. Furthermore, rotation of electrodes which synchronized with a robot's speed is started. The rotation direction is specified by a parameter.
By this command, welding conditions can be automatically changed according to welding speed. It can have a maximum of 5 sets of correspondences of the welding speed and a welding condition number. This correspondence data is recorded as a parameter of a function. Moreover, the welding condition output signals can be outputted by the WELDCND function(FN33) to use this automatic welding condition change function. In this case, the parameter 1 of a function is set as 0.
Furthermore, when the parameter 1 of a function is set as 2, electrodes are rotated at the speed specified with the parameters, without carrying out pressurization. Pressurization side electrode rotates at the speed set as the parameter 3, and settle side electrode rotates at the speed set as the parameter 5.
This is used in dressing of electrodes.

■ Example of operation

The robot shall move to a specified position according to specified motion command and start seam welding as follow time chart.



■ Parameter

Parameter No.1	0-2	Welding condition (0:Manu/1:Auto)	
Parameter No.2	0-1	Rotation direction (0:Normal/1:Reverse)	
Parameter No.3	0.0-10.0	Press wait time(sec)	
Parameter No.4	0-65535	Weld condition 1	(Auto)
Parameter No.5	0-1000	Weld speed 1	(Auto)
	0-1000	Speed of electrode	(Dress)
Parameter No.6	0-65535	Weld condition 2	(Auto)
Parameter No.7	0-1000	Weld speed 2	(Auto)
	0-1000	Speed of electrode	(Dress)
Parameter No.8	0-65535	Weld condition 3	(Auto)
Parameter No.9	0-1000	Weld speed 3	(Auto)
Parameter No.10	0-65535	Weld condition 4	(Auto)

Parameter No.11	0-1000	Weld speed 4	(Auto)
Parameter No.12	0-65535	Weld condition 5	(Auto)
Parameter No.13	0-1	Seam gun type (0:Both type/1:One type)	
Parameter No.14	0-30	Press value(mm)	(One type)
Parameter No.15	0-1	Weld operation (0:Continue/1:Pitch/2:Dress)	
Parameter No.16	0-5000	Welding distance(mm)	(Pitch)
Parameter No.17	0-5000	Idle distance(mm)	(Pitch)

The Unit of Parameter No.5, No.7 and No.9 are changed by the parameter,“unit of velocity” in [Constant menu] [Spot Welding Application] [Seam Welding] monitor. Details is explained by the manual of Seam Welding.

Example of screen display

See
SEAMEND: Seam weld end (FN246)
SEAMSPDD: Seam electrode speed (FN247)
SEAMANG: Seam angle correction(FN254)
WELDCND: Spot condition output (FN33)
SEAMOV: Seam override (FN313)

Function commands(FN codes)

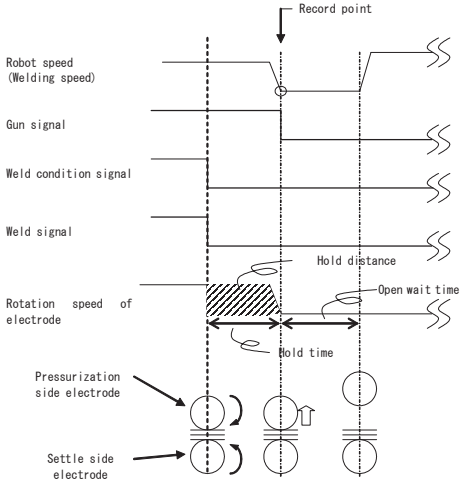
Command name	SEAMEND
FN code	246
Title name	Seam weld end
General description	Stop the seam welding.

■ General description

Execution of this command ends seam welding started by the seam welding start function SEAMST.
From position attainment of the move command on which the function was recorded, weld signal turns off previously only the order to time or order to distance specified with the parameter, and it ends welding. Then, rotations of electrodes are stopped at the same time a robot is positioned by hold time progress. Next, gun signals are made to turn off and between electrodes are opened wide. Furthermore, the following step is performed after the open waiting time progress specified with the parameter.

■ Example of operation

The robot shall move to a specified position according to specified motion command and end seam welding.



■ Parameter

Parameter No.1	0-10.0	Time (sec)
	0-5000.0	Distance (mm)
Parameter No.2	0-10	Open wait time (sec)
Parameter No.3	0-1	Pre-out timing of electric off 0:Order to time / 1:Order to distance

■ Example of screen display

```
SEAMEND[1,1,0]              FN246:Seam weld end
```

See
SEAMST: Seam weld start (FN245)
SEAMSPD: Seam electrode speed (FN247)
SEAMANG: Seam angle correction(FN254)
WELDCND: Spot condition output (FN33)

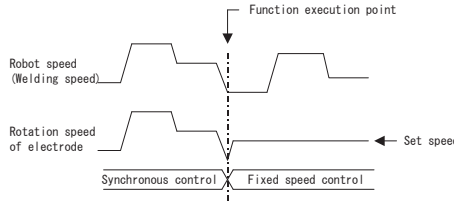
Function commands(FN codes)

Command name	SEAMSPD
FN code	247
Title name	Seam electrode speed
General description	Set the electrode rotation speed while welding.

■ General description

Fundamentally, the rotation speed of electrodes are automatically controlled after seam welding start function execution to become the speed corresponding to a robot's speed. However, the speed of electrodes can be specified by this command to tune speed only for a specific part finely.

■ Example of operation



■ Parameter

Parameter No.1	0-1000	Speed 1 Welding speed of move-side electrode.
Parameter No.2	0-1000	Speed 2 Welding speed of settle-side electrode.

The Unit of Parameter No.1 and No.2 are changed by the parameter, “unit of velocity” in [Constant menu] [Spot Welding Application] [Seam Welding] monitor. Details is explained by the manual of Seam Welding.

■ Example of screen display

```
SEAMSPD[30,30]              FN247:Seam electrode speed
```

See
SEAMST: Seam weld start (FN245)
SEAMEND: Seam weld end (FN246)

Function commands (FN codes)

Command name	EQUALIZECLR
FN code	248
Title name	Equalize clear
General description	The equalize setting clear.

■ General description

The equalize setting set by the EQUALIZE; Equalize value (FN287) function is cleared.

■ Parameter

Parameter No. 1	Welder No.	This parameter specifies the welder number. (1–6)

■ Example of screen display

```
EQUALIZECLR[1]                          FN248 ; Equalize clear
```

See
SPOT ; Spot welding (FN119)
TIPDRESS ; Tip dress (FN265)
EQUALIZE ; Equalize value(FN287)

Function commands (FN codes)

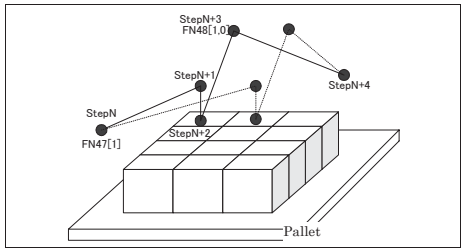
Command name	PALLET3
FN code	249
Title name	Palletize start
General description	Start palletizing based on the pre-designed palletizing pattern.

■ General description

When this function command is executed, the specified palletizing can be started.
It is executed in tandem with the FN250 "Palletize end" command which is used to end palletizing.

■ Example of operation

As shown in the figure below, record “PALLET3: Palletize start” (FN249) in step N and “PALLET3 END: Palletize end” (FN250) in step N+3.
When the program is played back and the robot reaches step N, the shift amount is calculated from the palletize number specified by FN249 and the palletize counter, and the shift operation is performed. Step N+1 and step N+2 are shifted. (The robot passes along the path indicated by the dotted lines in the figure below.) When it reaches step N+3, FN250 is executed, and the palletizing operation is ended. The robot now heads toward the point where step N+4 is recorded.



● Counter signal output

Signal numbers can be specified for outputting the layer counter value and work counter value as parameters. When the palletize start command is executed, these signals are updated.

● Simultaneous palletizing

Up to 32 multiple palletizing operations can be executed simultaneously.

● Multiplex palletizing

While palletize start is in progress, up to 8 other palletize numbers can be executed as different layers.

■ Parameter

Parameter No.1	Palletize No.	This specifies the palletizing number to be executed. (1 to 100)
Parameter No.2	Palletize type	0:palletize 1:de-palletize
Parameter No.3	Layer count signal	O-signal No. for layer counter. (1 to 1024) The counter is outputted by binary data. This number shows the last bit.
Parameter No.4	Work count signal	O-signal No. for work counter. (1 to 1024) The counter is outputted by binary data. This number shows the last bit.

■ Example of screen display

```
PALLET3[1, 0, 01, 011]          FN249 Palletize start
```

See
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_GETREG: Get palletize register(FN377)
PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

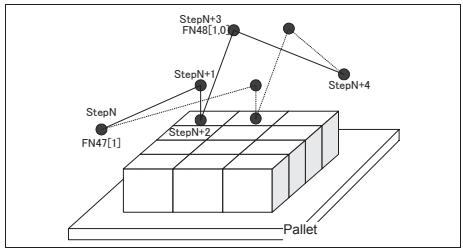
Command name	PALLET3_END
FN code	250
Title name	Palletize end
General description	Finish palletizing based on the pre-designed palletizing pattern.

■ General description

When this function command is executed, the specified palletizing work can be completed.
It is executed in tandem with the FN249 "Palletize start" command which is used to start palletizing.

■ Example of operation

As shown in the figure below, record “PALLET3: Palletize start” (FN249) in step N and “PALLET3 END: Palletize end” (FN250) in step N+3.
When the program is played back and the robot reaches step N, the shift amount is calculated from the palletize number specified by FN249 and the palletize counter, and the shift operation is performed. Step N+1 and step N+2 are shifted. (The robot passes along the path indicated by the dotted lines in the figure below.) When it reaches step N+3, FN250 is executed, and the palletizing operation is ended. The robot now heads toward the point where step N+4 is recorded.
Refer to the picture of FN249 PALLET3’s Help screen.



When palletizing ends, +1 is added to the work counter.
If the number of workpieces for the corresponding layer is exceeded, +1 is added to the layer counter and the work counter is returned to 1.
If the number of layers for the corresponding palletizing is exceeded, the layer counter is returned to 1 and the work completion signal is turned ON.

(During de-palletizing, the counter is reduced in steps of 1 from the work maximum value.)

■ Parameter

Parameter No.1	Palletize No.	This specifies the number of the palletizing operation which is to be ended. (1 to 100)
Parameter No.2	Completion signal	When the palletizing finishes all works, this O-signal is outputted. (1 to 1024)

■ Example of screen display

```
PALLET3_END[1, 011]          FN250 Palletize end
```

See
PALLET3: Palletize start (FN249)
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_GETREG: Get palletize register(FN377)
PALLET3_SETREG: Set palletize register(FN378)

Function commands (FN codes)

Command name	PALLET3_RESET
FN code	251
Title name	Palletize reset
General description	The palletize counter is forcibly reset. (palletizing operation is forcibly terminated)

■ **General description**

The specified palletize counter can be forcibly reset (cleared to zero).
When palletizing is reset, work is started from the 1st workpiece the next time that palletizing is started.

Resetting can be performed even while palletize start is in progress or after palletizing has ended. If resetting is performed while palletize start is in progress, it changes to palletize end.

● Counter signal output

If the corresponding palletizing has been started, even only once, the layer counter and work counter signals of the corresponding palletizing is turned OFF when resetting.

● Acknowledge signal

When resetting, the “Palletize reset ACK” signal (dedicated signal) is turned ON.

■ **Parameter**

Parameter No.1	Palletize No.	This specifies the palletizing number to be reset. (1 to 100)

■ **Example of screen display**

See

PALLET3: Palletize start (FN249)
PALLET3_END: Palletize end (FN250)
PALLET3_APR: 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	PAUSEINPUT
FN code	252
Title name	Pause Input
General description	The robot is pause when the designated [Pause input] signal is turned off.

■ General description

The robot enters the state of the standby if the designated input signal is turned off when this function is effective. Moreover, when the designated input signal is turned on, the robot restarts operation.

■ Parameter

Parameter No. 1	1～4	Signal No.
Parameter No. 2	0～1	enabled/disabled(1/0)

■ Example of screen display

```
PAUSEINPUT[4,1]          FN252;Pause Input
```

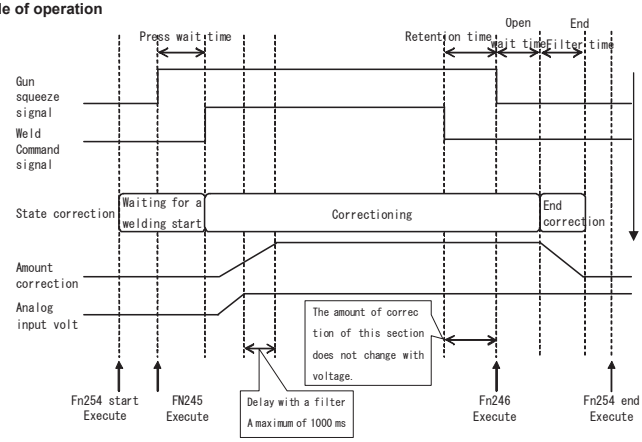
Function commands(FN codes)

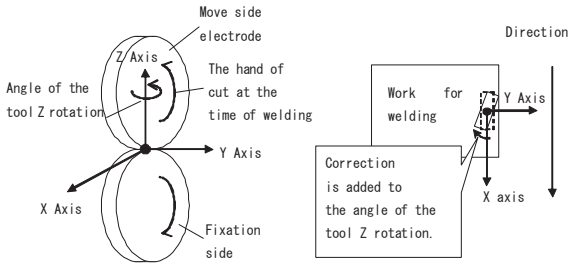
Command name	SEAMANG
FN code	254
Title name	Seam angle correction
General description	Seam angle correction is start / end.

■ General description

This function will perform to correct the angle of Tool rotation Z according to analog voltage from external equipment after seam welding start. The start condition of the function should be done before seam start function.
The end condition of the function should be done after seam end function, then the angle of tool rotation Z will be back to original posture.

■ Example of operation





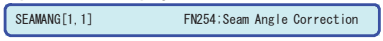
- **Operation of a correction start**
  The angle after correction will reach after the set period of "Run Filter Time" of [Constant Setting][13 Spot welding application][11 Seam Welding Application][2 Seam Angle Correction] screen.
- **Operation of a correction end**
  The angle will return the angle of step recorded after the set period of "End Filter Time" of [Constant Setting][13 Spot welding application][11 Seam Welding Application][2 Seam Angle Correction] screen.

■ Parameter

Parameter No.1	0 or 1	Seam angle correction start/end start:1 / end:0

Parameter No.2	1-16	The setting table number used for correction

■ **Example of screen display**



■ **Example of program**

```
1.MOVE
2.Fn254(1,1)        Correction start
3.Fn245(····)       Seam weld start
4.MOVE
5.Fn246(····)       Seam weld end
6.Fn254(0,1)        Correction end
7.MOVE
8.END
```

See
SEAMST: Seam weld start (FN245)
SEAMEND: Seam weld end (FN246)

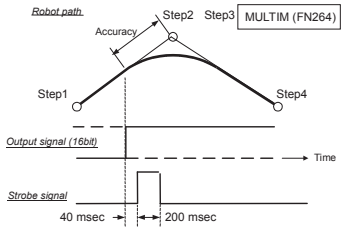
Function commands (FN codes)

Command name	MULTIM
FN code	264
Title name	Multi Output signal
General description	This command is used to set the pre-defined multiple output signals to ON or OFF using the binary format.

■ General description

When this function command is executed, it is possible to set any general-purpose output signals (O1 to O2048) to ON or OFF using the binary format.
Up to 16 general-purpose output signals (O1 to O2048) are combined in any way, and by defining them as a group (multiple output signals) and specifying a number, these multiple output signals are set to ON or OFF using the binary format. This command differs from the OUT: binary format output signal (FN44) command in that up to 16 general-purpose output signals forming a group can be combined in any way.
The group must have already been defined in the constants mode.
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

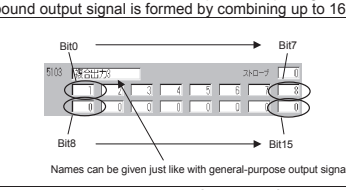


The robot is not decelerated by this command. If positioning is not specified, the command is executed at the position reached by the robot in the accuracy range of the move command immediately before.

As soon as the accuracy is matched, a 16-bit signal is output, and 40 ms later the strobe signal is output by a 200 ms pulse.
If the output data setting has exceeded the number of defined bits of the general-purpose output signals, the data is output within the range of the number of bits defined. (Error stop does not occur.)

Definition of multiple output signals (constants mode)

The multiple output signals are defined ahead of time by input/output signals/output signal assignment/compound output signals in the constants mode. Compound output signals can be defined in 96 different ways from 5101 to 5196, and one compound output signal is formed by combining up to 16 general-purpose output signals.



The output data (0 to 65535) specified by the function command (FN264) is converted into a 16-bit binary value, and the general-purpose output signals concerned are set to ON or OFF. In order to provide the read timing of the output signals, one strobe signal can be defined in addition to the 16 general-purpose output signals. (If this signal is not going to be used, its number is zero.) It is not possible to specify other multiple output signals as signals which configure multiple output signals.

■ **Parameter**

Parameter No. 1	Output signal number	This specifies the numbers of the multiple output signals to be output. It is defined in advance in the constants mode. (5101 – 5196)
Parameter No. 2	Output data	This specifies the data to be output in the binary format by the multiple output signals. (0 – 65535)

■ **Example of screen display**

MULTIM [05102, 65535] FN264; Multiple output signals

See
OUTDIS: Discrete format output signals (FN43)
OUT: Binary format output signal (FN44)

Function commands (FN codes)

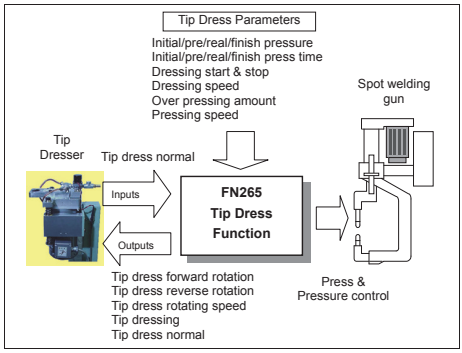
Command name	TIPDRESS
FN code	265
Title name	Tip dress
General description	Execute the tip dress of spot welding gun

■ General description

During the course of welding, the tips of the electrodes eventually wear down and their shapes change. Since the shape of the electrode tips determines the current density of the current-carrying path, proper welding cannot be performed if the electrodes have worn down.
Therefore, before the wear amounts become significant and the welding quality is impaired, the electrodes must be ground and reshaped. This work is known as “tip dressing”. A machine called a “tip dresser” is used to dress the tips. It has a rotary blade matching the shape of the electrodes.

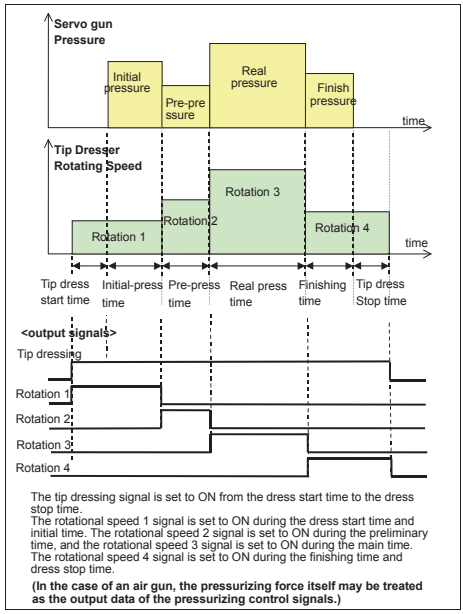
The electrodes are ground by rotating the rotary blade while pressure remains applied to the blade by the spot welding gun.
Normally, tip dressing is taught so that it is performed when the prescribed number of welding times or cycles have been executed.
The tips are generally dressed by executing welding operations in the welding OFF status. For the rotational direction and speed of the dresser and the time to be controlled, an interface using I/O signals between the robot controller and tip dresser is required.

This function, which utilizes the characteristics inherent to a servo gun, divides the tip dressing cycle into six periods, two of which are the tip dressing start time and the initial pressurizing time. By specifying the servo gun welding force and rotational speed of the tip dresser for each of these periods, the function achieves high-quality tip dressing without using an external sequencer.



■ Example of operation

Proceed with the same teaching as for the spot welding function (FN119). Record the positions where contact has been made on the tip dresser at both the moving and fixed sides, and record the tip dressing function TIPDRESS (FN265) in the step concerned.
When TIPDRESS(FN265) is executed, pressure and rotating speed of tip dresser is controller under the condition that is defined in Service / 20 Spot welding application / 3 Tip dress.



Input & output signals should be assigned in Constant setting / 3 Input & output / 2 Input signal assignment or 3 Output signal assignment.

■ **Parameter**

Parameter No. 1	Welder number	This is used to specify the number of the tip dressing welder. (1-6)
Parameter No. 2	Tip dressing sequence number	is used to specify the sequence number to be used for tip dressing.(1-8)

■ **Example of screen display**

```
TIPDRESS[1,3]          FN265: Tip dress
```

See
SPOT; Spot welding (FN119)

Application Command (FN Code)

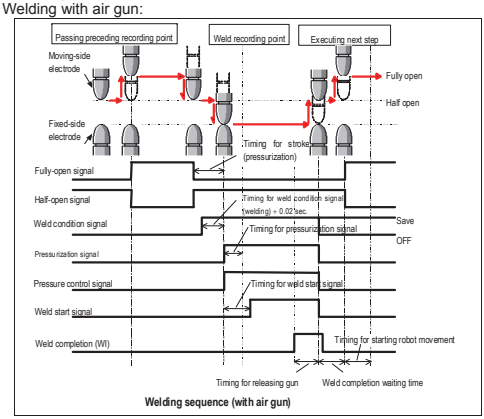
Command name	SPOT2
FN code	268
Title name	Spot welding
Outline	Used to output welding signals according to the set sequence.

■ Outline

By recording the spot welding function in steps in which welding is carried out, spot welding can be carried out in the steps specified. Using this function enables the controller to program timing for outputting welding control signals such as pressurization signal, weld start signal, and stroke signal without using any external programmable logic controller. In addition, making setting of multiple welding conditions and welding sequence enables detailed welding control by welding point.
This function is used for both air guns and servo guns.

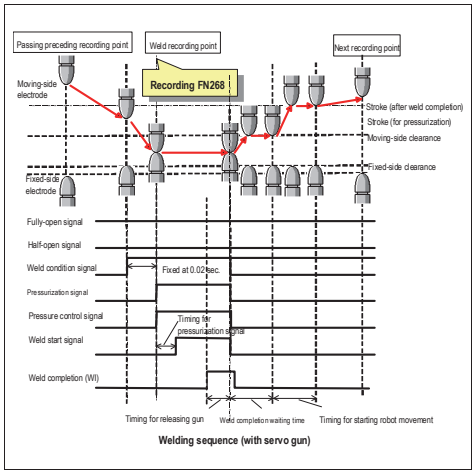
■ Examples of motions

Welding with air gun:



Welding sequence (with air gun)

Welding with servo guns:



■ Parameters

Parameter 1	Weld condition output data	Used to make setting of welding condition output data. (Setting range: 0 to 65535)
Parameter 2	Weld sequence No.	Used to make setting of welding sequence number and also determine timing for outputting pressurization signal, weld start signal, and stroke signal. (Setting range: 1 to 64)
Parameter 3	Pressure	Used to make setting of gun pressure for pressurization. This parameter is ignored for welding with air gun. (Setting range: 0.5 to 10.0 [kN], or 50 to 1,020 [kgf] depending on the selection of unit)
Parameter 4	Thickness	Used to make setting of thickness of plate to be welded. (Setting range: 0 to 20.00 [mm])

■ Example of screen display

SPOT2[1, 2, 1.5, 0.7]　　FN268: Spot welding

Related commands
GSEA: Servo gun weld point search (FN167)

Function commands (FN codes)

Command name	SGTIPRST
FN code	270
Title name	Reset servo gun tip consumption
General description	Reset the tip consumption of designated servo gun

■ General description

The tip consumption amounts can be cleared to zero using a function command. (They cannot be preset to the desired values.) When the electrodes are to be replaced automatically, record this function command in the electrode replacement program.

Please refer to GSEA: Servo gun search (FN167) for the detail of Servo gun search.

■ Example of operation

When SGTIPRST (FN270) is executed, the moving tip or settled tip or both tip consumption of designated servo gun is reset.

Also, the tip consumption amounts can be cleared to 0 by the following method.

- R code (R339)
- Manual operation
- Input signal

■ Parameter

Parameter No. 1	Gun number	This parameter specifies the number of the gun whose tip consumption amounts are to be reset. (1–32)
Parameter No. 2	Tip selection	This parameter specifies the tip whose amounts is to be reset. (0–2) 0: The consumption amount of only the moving side electrode is reset. 1: The consumption amount of only the settled side electrode is reset. 2: The consumption amounts of both the moving side and settled side electrode are reset.

■ Example of screen display

```
SGTIPRST[1,0]  FN270: Reset servo gun tip consumption
```

See

SPOT: Spot welding (FN119)
GSEA: Servo gun search (FN167)
GSER_ORDER: Servo gun search order (FN229)

Function commands (FN codes)

Command name	INPUT
FN code	271
Title name	Strings input
Outline	This receives the character string data from the specified communication (serial) port, and holds it in the specified character string variable.

■ General description

When this function command is used, a character string which is input from the specified serial port can be read and then stored in the specified character string variable. Only character strings consisting of up to 100 single-byte alphanumerics per string can be read.
The robot stops until the input process of the character string is completed. If the process of inputting the character string could not be completed even after the timeout time has elapsed, it is aborted, and execution is transferred to the next step.

■ Example of operation

When the step where the "INPUT: Strings input" (FN271) command is recorded is played back, the robot checks the positioning and then waits for the data input from the specified serial port.
When any data is received during the specified timeout time, the received data is stored in the specified character string variable. The standby status is released, and the robot moves to the next step.
If no data is input even after the timeout time has elapsed, the robot simply moves to execute the next step.

■ Parameter

Parameter No. 1	Port number	This is used to specify the number of the input destination port. At the present time, only port 1 can be used. (1 to 1)
Parameter No. 2	Character string variable number	This is used to specify the number of the character string variable in which the received character string is to be stored. (1 to 100)
Parameter No. 3	Connection time out	This is used to specify the timeout time. (1.0 to 60.0 sec.)

■ Example of screen display

See
PRINT: Strings output (FN101)
RSCLR: RS232C Buffer clear (FN111)

Application Command (FN Code)

Command name	CNVYSYNCCHG
FN code	274
Title name	Conveyor synchronize select
Outline	Used to select a mechanism that is synchronized with the conveyor with the conveyor synchronization function.

■ Outline

Using this application command makes it possible to specify a mechanism that follows the conveyor with the conveyor synchronization function.
If this application command is not used, such mechanism will be determined in the order of slider and manipulator included in the targeted unit. The mechanism is automatically selected in such a manner that the slider moves to the motion range in synchronization with the conveyor, and then the manipulator is synchronized with it.

■ Example of motion

Enter a mechanism number that you want to synchronize with the conveyor.

■ Parameters

Parameter 1	Mechanism No.	Used to make setting of mechanism that is synchronized with the conveyor. (Setting range: 0 to 9)

Setting “0” to the mechanism number that you want to synchronize will return the system to the default state: Default: The mechanism is automatically selected in such a manner that the slider moves to the motion range in synchronization with the conveyor, and then the manipulator is synchronized with it.

■ Example of screen display

Function commands (FN codes)

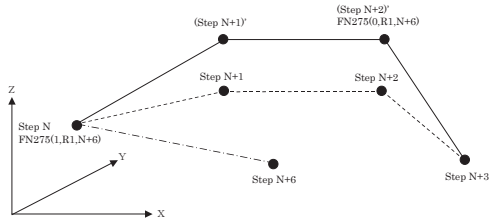
Command name	LOCCVT3
FN code	275
Title name	Base angle shift
Outline	The start or end of the shift operation is specified.When shift operation start has been specified, the shift operation is performed on the basis of the shift amount stored in the specified shift register.

■ **General description**

This function command proceeds with playback while shifting the recorded position in the robot program on the basis of the shift amount data stored in the specified shift register. If the shift amount data has not been set in the specified shift register, it is possible to jump to the shelter step.Alternatively, the robot can be stopped immediately without escaping.
It is similar to FN52 (shift 2) excluding the thing that the shift processing method and the shift are always done in the machine coordinate system.

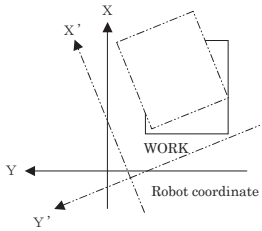
■ **Operation example**

The shift beginning is recorded at position Step N where the shift wants to begin as shown in the figure below and the shift end is recorded in position (Step N+2) 'which wants to end shifting. The robot reads the content of the shift register specified with FN275 after it reaches step N, and faces position (Step N+1) 'by which the following target position Step N+1 is shifted when reproducing. The robot works as a target position, position where the record position was similarly shifted to position (Step N+2) 'where the shift end is recorded.(solid line tracks of figure below)
The shift is done in the machine coordinate system regardless of the coordinate system selection.



When FN275 is executed in step N, if the shift data is not set when the specified shift register is read, the robot faces the shelter step (Step N+6) which is set with FN275.

■ **About the shift operation**



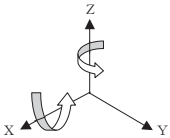
The work when teaching and the position of the robot are shown by the solid line. (Hereafter, explain by two dimensions for the simplification of the explanation)
Two point chain line shows the thing which shifts more than the position of work teaches, and also shows the appearance by which robot coordinate system (X'-Y') is described to become as the work when the shifting work is taught is the same as the relative position between robots.

In the base angle shift,

1. It is assumed the one to show the amount of conversion of the robot coordinate system from robot coordinate system (X-Y) shown by the solid line from which showed in 2 point chain line in amount (X,Y,Z,θx,θy,θz) of the shift. X, Y, and Z correspond to the position of "Starting point of robot coordinate system (X'-Y')" in robot coordinate

system (X-Y).

2. θx, θy, and θz are the amounts of the rotation in X axis, Y axis, and Z axis circumference respectively. The plus of ± of the rotation is a direction to each coordinates axis as shown in the figure below where a right screw proceeds.



3. Robot coordinate system (X-Y) sequentially
   (1) θx rotation X axially of robot coordinate system (X-Y)
   (2) θy rotation Y axially of robot coordinate system (X-Y)
   (3) θz rotation Z axially of robot coordinate system (X-Y)
   (4) X, Y, and Z translation in robot coordinate system (X-Y).

   It becomes robot coordinate system (X'-Y') in robot coordinate system

■ **Parameters**

Parameter No. 1	Start/End	This is used to specify the start or end of the shift operation. 1: Start / 0: End
Parameter No. 2	Shift register number	This is used to specify the shift register number. (1 to 9)
Parameter No. 3	Shelter step	This is used to specify the number of the shelter step when the shift amount data was not set in the specified shift register. (0 to 10000) When 10000 is specified as the shelter step number, an alarm (A2118: “No data has been input in shift register.”) results immediately with no escape operation performed, and the robot can be stopped.

■ **Example of screen display**

```
LOCCVT3 [1,R1,100]              FN275: Base angle shift
```

See

This function begins processing before the record point reaches. Therefore, it is necessary to have been set before the shift amount data processing.

When shift amount data is set by using SREQ: Shift amount request (FN51) or SREQ2: Shift amount request 2(FN315), it is better to record WAITR: Wait shift value receive(FN127) before this function, to confirm the shift amount data is surely input.

Function commands (FN codes)

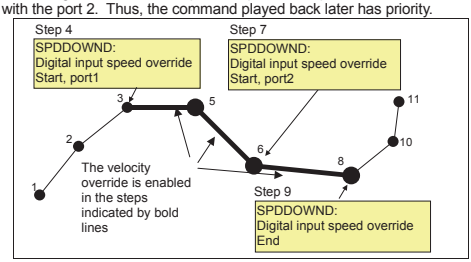
Command name	SPDDOWND
FN code	277
Title name	Digital input speed override
Outline	The playback speed of the robot is changed in accordance with digital input signals

■ General description

With this function command, the playback speed of the robot can be changed in accordance with digital input signals. It is necessary to design the velocity override patterns (Constant Setting / Signals / Velocity override depend on input) and allocate input signals beforehand in the "Constant Setting" mode.
Four digital input ports are provided, any of which can be specified.

■ Example of operation

In the following diagram, record "SPDDOWND (FN277) / Start" in steps 4 and 7, and "SPDDOWND (FN277) / End" in step 9. When this is played back, the velocity override is performed by digital input signals in the sections indicated by the bold lines in the diagram. As far as step 6 the operation is performed in accordance with the port 1, and as far as step 8 in accordance with the port 2. Thus, the command played back later has priority.



If the rate of velocity override by f keys and R codes is set to 50% and that by input signals set to 50%, the actual rate of velocity override is 25% (50% x 50%).
The velocity override by analog input (FN169) is also available, yet this cannot be used together with the SPDDOWND command.

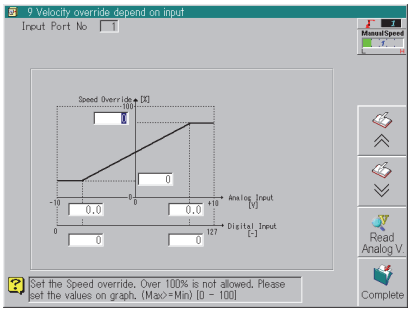
■ Parameter

Parameter No. 1	Start/end	Specify whether to start or end the velocity override by input signals. (1: Start, 0: End)
Parameter No. 2	Input port No.	Select the digital input port to refer to from the four ports. It is ignored when "0: End" is selected as the setting of the parameter No.1. (1 to 4)

■ Example of screen display

```
SPDDOWND[1,4]  FN277: Digital input speed override
```

The correspondence between digital input signals and speed override must be designed beforehand using "Constant Setting → Signals → Velocity override depend on input". The velocity override by input signal cannot be set over 100%.



In addition, 7 bits per port must be allocated to the digital input signals (Constant Setting → Signals). The speed override is executed by reading out this signal in the binary format and referencing the above table.
If not even one digital input signal has been allocated, the speed override will not function.

See
SPDDOWNA: Analog input speed override (FN169)

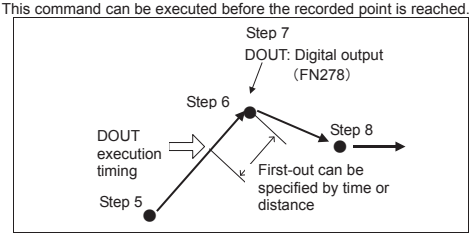
Application command (FN code)

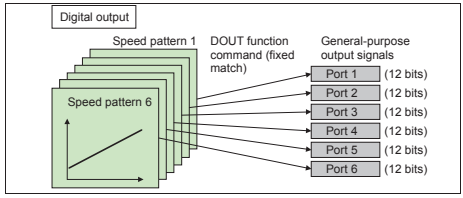
Command name	DOUT
FN code	278
Title name	Digital output
General description	The TCP (robot tool center point) linear speed and other data are output using general-purpose output signals.

■ General description

When this function command is used, the TCP (robot tool center point) linear speed and other data can be output to an external device as 12-bit digital values (0 to 4095) using general-purpose output signals. It is useful in applications such as sealing.
The TCP speed, a direct specification or OFF can be selected as the output data.
The output signals must be allocated in advance ({SYMBOL} Constant Setting/Signals). When the TCP speed has been specified, the TCP speed output data must be designed ahead of time ({SYMBOL} Constants/TCP speed data).
One output port is provided for each TCP speed output pattern. (6 ports)

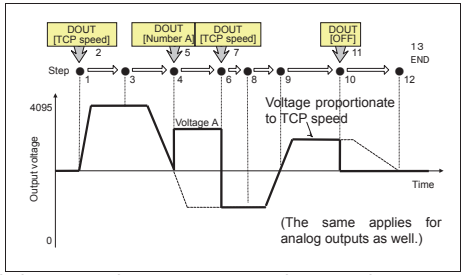
This command can be executed before the recorded point is reached. Specify its amount as a time or distance.





■ Example of operation

Record the DOUT command (FN278) in steps 2, 5, 7 and 11 in the figure shown below.
When the program is played back, the output changes to the specified data each time the DOUT command (FN278) is executed. The output value remains unchanged at those steps in which the DOUT command (FN278) has not been recorded.



If a first-out time of 0.2 sec. has been specified in the DOUT command of step 7 in this example, the output changes from numerical data A to the TCP speed 0.2 sec. before the robot reaches step 6 (the previous movement command).

In the teach mode, any data can be output by performing a manual operation (shortcut R278).

The data which is output last is held even if the mode is switched between teach and playback mode.

■ **Parameter**

1st parameter	Port number	This is used to specify the number of the output signal port from which data will be digitally output. (1 to 6)
2nd parameter	Output signal type	This is used to specify the type of data to be output digitally. (0 to 2) 0: OFF (O is output) 1: TCP speed 2: Directly specified
3rd parameter	Output data	When output signal type = 0: This recorded data is not used. When output signal type = 1: This recorded data is not used. (With digital outputs, the speed pattern numbers and output signal port numbers correspond on a 1:1 basis.) When output signal type = 2: Directly specify the output data. (0 to 4095)
Parameter No.4	Pre-out type	This enables the output to be started before the recorded point is reached. Select the specification method. (0 to 1) 0: Time specified 1: Distance specified
Parameter No.5	Pre-out data	This is used to initiate pre-out using a negative numerical value. When pre-out type = 0: specify the time. (-1.0 to 0 seconds) When pre-out type = 1: specify the distance. (–500 to 0 mm)

■ **Example of screen display**

See
AOUT;Analog output(FN046)
DPRESETM;Distance specification output preset(FN280)

Function commands (FN codes)

Command name	SGSPRT
FN code	279
Title name	Servo gun separation
General description	Servo gun separated status is changed.

■ General description

Separate the servo gun from the robot.

During servo gun separating, because the servo gun axis is separated from the robot, at the external signal it becomes possible to operate.

At external play stop and emergency stop, it stops also the servo gun axis.

External operation）

Ext. squeeze, Wide open, Small open, Ext. gun search1～3

⚠ CAUTION	During servo gun separating, because the servo gun axis does not operate to record position of the program, step set and program set etc. please keep noting sufficiently.

■ Parameter

Parameter No. 1	1～6	Welder No.
Parameter No. 2	0～1	Separation/Release(1/0)

■ Example of screen display

SGSPRT[1,1] FN279;Servo gun separation

■ Status display

During servo gun separating, 

icon is indicated.

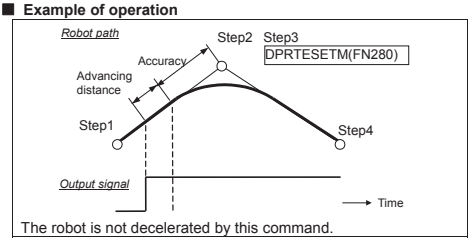
Function commands (FN codes)

Command name	DPRESETM
FN code	280
Title name	Advanced output (distance)
General description	This command is used to set one of the general-purpose output signals with advancing distance

■ General description

When this function command is executed, it is possible to set any one of the general-purpose output signals (O1 to O2048) to ON or OFF. And this enables advanced output designated by distance from the recorded point.
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



The robot is not decelerated by this command.

In advanced output, the output can cover plural MOVE steps. Advancing distance is calculated linear length from recorded point, so if MOVE step is recorded by JOINT output point differs from the real moving length of robot TCP.

■ Parameter

Parameter No. 1	Output signal number	This specifies the number of the general-purpose output signal which is to be set to ON or OFF. (1-2048)
Parameter No. 2	ON/OFF	"1" is specified for ON, and "0" for OFF. (0-1)
Parameter No. 3	Output timing	This specifies the output advancing timing that is designated by the linear length from the recorded point. (−2000 − 0) [mm]

■ Example of screen display

```
DPRESETM[2048,1,-100]  FN280: Advanced output (distance)
```

See
ALLCLR; All output signals clear (FN0)
SET; Output signal ON (FN32)
RESET; Output signal OFF (FN34)
SETO; Consecutive output signal ON/OFF (FN100)
SETM; Output signal ON/OFF (FN105)
SETMD; Output with pulse or delay ON/OFF (FN35)

Function commands (FN codes)

Command name	WELDGRP
FN code	282
Title name	Weld condition with group
General description	Used to designate the welding condition group number for the welding function (FN119).

■ General description

When this function command is executed, the weld controller number to be used by the welding function (FN119) and the welding condition group number are designated.

■ Example of operation

```
1  REM[TEST]     FN99: Comment
2  WELDGRP[1,2] FN282: Weld condition w
3  100 %    LIN   A1  T1
4  SPOT[1,1,1,0]  FN119: Spot welding
5  100 %    LIN   A4  T1
6  100 %    LIN   A4  T1
7  WELDGRP[1,3] FN282: Weld condition w
8  100 %    LIN   A4  T1
9  SPOT[1,1,1,0]  FN119: Spot welding
10 100 %    LIN   A1  T1
11 END           FN99: End
```

Group No.2 designated in step 2 is enabled until step 6.
Group No.3 is enabled from step 7 to step 11.

Caution of check back
Beware that weld group No. may be different from that of normal playback.
- In case of check-go from step 0
  FN119 of step 4 is executed on the group No.2.
- In case of check back from step 11
  FN119 of step 4 is executed on the group No.3.

Utilize the shortcut R371 that can change group No. manually.

If spot welding command is executed without designating spot weld condition group number,
Alarm “A2063: Weld condition group number is not set.” is detected and robot stops. FN282 must be recorded before FN119.

■ Parameter

Parameter No. 1	Welder number	This specifies the weld controller number. Its maximum number is according to the registered data.
Parameter No. 2	Group number	This specifies the weld condition group number. (1 to 16)

■ Example of screen display

```
WELDGRP[1,1]      FN282: Weld condition w/group
```

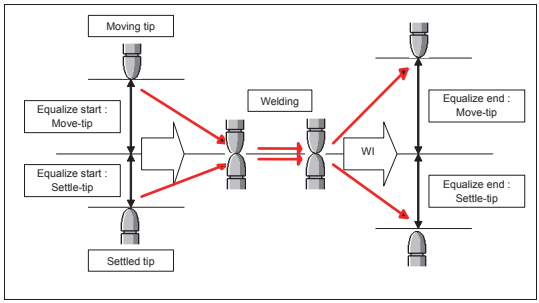
See

Function commands (FN codes)

Command name	EQUALIZE
FN code	287
Title name	Equalize value
General description	This command is used to the equalizing motion as defined by the servo gun.

■ General description

This command is used to the equalizing motion as defined by the servo gun.
1. The equalize start is order position to before the pressing motion.
2. The equalize end is order the open position to after the pressing motion.



Spot welding command and tip dress command is referring to after this command.

A Step zero, EQUALIZECLR; Equalize clear (FN248) is executed to the release of this command.

And, you can confirm current equalize setting by Servo gun data monitor and Equalize confirmation / clear (R376).

■ **Parameter**

Parameter No. 1	Welder No.	This parameter specifies the welder number. (1–6)
Parameter No. 2	Equalize Start : Move-tip	This is used to specify the equalizing motion as defined by the pressing start position by moving tip. Range: Clearance Limit : move-tip – Large opening end(#1) Initial value: Clearance : move-tip
Parameter No. 3	Equalize Start : Settle-tip	This is used to specify the equalizing motion as defined by the pressing start position by settled tip. Range: Clearance Limit : settle-tip – Large opening end(#1) Initial value: Clearance : settle-tip
Parameter No. 4	Equalize End : Move-tip	This is used to specify the equalizing motion as defined by the open position by moving tip. Range: Clearance Limit : Move-tip – Large opening end(#2) Initial value: Clearance : move-tip
Parameter No. 5	Equalize End : Settle-tip	This is used to specify the equalizing motion as defined by the open position by settled tip. Range: Clearance Limit : settle-tip – Large opening end(#2) Initial value: Clearance : settle-tip

#1［Equalize Start: Move-tip + Equalize Start: Move-tip］value is limited the Large opening end value.
#2［Equalize End: Move-tip + Equalize End: Move-tip］value is limited the Large opening end value.

■ **Example of screen display**

```
EQUALIZE[1,5,5,20,20]                    FN287 ; Equalize value
```

See
SPOT ; Spot welding (FN119)
TIPDRESS ; Tip dress (FN265)
EQUALIZECLR ; Equalize clear(FN248)

Function commands (FN codes)

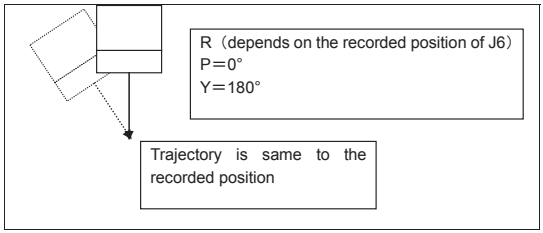
Command name	WRISTSINGULARITY
FN code	289
Title name	Wrist singularity control
General description	This makes to robot able to pass through the dead zone with condition that flange surface is the horizontal.

■ General description

6-axis articulated robot can not be passed through the J5 axis dead zone while maintaining the wrist posture.
Because palletizing working space is often large, the robots sometimes pass through the J5 axis dead zone. However, when the wrist posture can not be maintained, the robot may not be able to approach the straight pallet, problems such as interference will occur in the work around.
This makes to robot able to pass through the dead zone with condition that flange surface is the horizontal.

■ Example of operation

```
1 MOVE
2 WRISTSINGULARITY[1] FN289
3 MOVE
4 MOVE
5 WRISTSINGULARITY[0] FN289
6 MOVE
7 END
```



It starts the control to avoid the wrist singularity in Step 2.
The move command of step 3 or later, flange surface becomes a horizontal to ground forcedly.
During the function is enabled, Trajectory is same to the recorded position.
The J6 axis angle depends on the recorded position.
Control of the wrist singularity returns to the normal control from Step 5.

■ Parameter

Parameter No. 1	1:eliminate / 0:normal	1:eliminate / 0:normal

■ Example of screen display

WRISTSINGULARITY[1]	FN289; Wrist singularity control

Function commands (FN codes)

Command name	CHGCTRLGUN
FN code	290
Title name	Change gun control
General description	Set "Gun No." and "Gun open value" to be used for "One Welder Multi Gun Control" function.

■ General description

This function is used to set the " Servo gun number to be controlled " to be used in "One Welder multi gun control" function and "Gun open check" for "Open value".
The setting value of this function is applied only when "FN 119 spot welding" at check go / back and playback is executed.
<Constant Setting> <Spot Welding Application> <Spot welding gun setting> <Setting> When "One Welder Multi Gun Control" setting is set to "Enabled", it can be executed.
Parameters set in this function are applied to each unit.
Parameters set in this function are cleared in step 0.

Control servo gun number:
This is the gun number of the target servo gun controlled by "One Welder Multi Gun Control" function.
This gun number mechanism works when executing Fn119 spot welding.

Gun open check:
For all servo guns that are not subject to control, check how much gun is opened.
If there is even one gun whose gun open value is equal to or less than the function setting value, an error occurs and the robot operation stops.

For the details of “One Welder Multi Gun Control” function, see the application manual: “FD CONTROLLER INSTRUCTION MANUAL SPOT WELDING” for “8.Special Servo gun Functions”.

■ Example of operation

```
1  MOVE
2  CHGCTRLGUN[2,20.0] FN290   Change gun control
3  MOVE
4  SPOT[1,1,1,0] FN119   Spot welding
5  MOVE
6  END
```

"Servo gun number to be controlled" and "Check gun opening amount not to be controlled" are set in Step 2.
Step 4 Perform "gun open check" on the gun that is not subject to control with the previous movement instruction. If a gun that is not subject to control is opened beyond this function setting value, an error is generated and the robot operation is stopped.

■ Attention point 1

This function can not be executed in the following cases.

- When "Welding I / F" of the welding machine allocated to the servo gun to be used is set to other than "standard"
- When "mechanism change" setting is enabled
- When "FN 290 Change gun control" is recorded and executed immediately before "FN 119 Spot welding" without sandwiching MOVE command

■ Attention point 2

This function can not be used together with functions other than below.

Combined use permission function	
Function number	Function name
119	Spot welding
167	Gun search
265	Tip dress

■ Attention point 3

This function and the following functions can not be used together.

- Mechanisum change

■ **Attention point 4**

This function can not be used in a configuration that uses the same welding machine in multiple units.

Example :

M1:Robot
M2:Gun 1(Welder 1)
M3:Gun 2(Welder 1)
M4:Gun 3(Welder 1)
M5:Gun 4(Welder 1)

U1:M1,M2,M3
U2:M1,M4,M5

■ **Parameter**

	Name	Contents
Parameter No.1	Gun No.	Set the gun number of the servo gun to be controlled by "One Welder Multi Gun Control" function. Please select the gun number assigned to "welder" specified in "Fn119 spot welding". (1 to 31)
Parameter No.2	Gun open value	Set the gun open value. For all servo guns other than the gun specified by the "Gun No." parameter, the gun open is checked using this parameter. (0.0 to 2000.0)

■ **Example of screen display**

SPOT ; Spot Welding(FN119)

Function commands (FN codes)

Command name	CHGMEC
FN code	301
Title name	Mechanism change
General description	Connect or disconnect the designated mechanism

■ General description

About mechanism change itself, please refer to description of function CHGGUN; mechanism change (FN95).
CHGGUN (FN95) is dedicated to mechanism 2 only, but on the other hand mechanism can be designated on CHGMEC (FN301).
This point is only difference between CHGGUN (FN95) and CHGMEC (FN301).

■ Example of operation

Please refer to CHGGUN; mechanism change (FN95).

■ Parameter

Parameter No. 1	Mechanism number	Specify the mechanism number to be connected or disconnected. (1-9)
Parameter No. 2	Connect / Disconnect	This is used to specify whether the mechanism is to be connected or disconnected. O; Connect 1; Disconnect

■ Example of screen display

See
CHGGUN; Mechanism Change（designated to mechanism 2 only）(FN95)

Application Command (FN Code)

Command name	CHGXXMEC
FN code	302
Title name	Mechanism change
Outline	Used to select a mechanism to be operated manually.

■ Outline

For mechanism change, refer to information on the Application Command CHGXXGUN: Mechanism change (FN238).
While the CHGXXGUN (FN238) is a command dedicated to Mechanism 2, the CHXXMEC (FN302) can specify arbitrary mechanisms.
Except for that point, this command is the same as the CHGXXGUN (FN238).

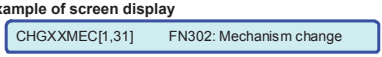
■ Example of motion

For detail, refer to information on the Application Command CHGXXGUN: Mechanism change (FN238).
Setting the Parameter 1 to Mechanism 2 will provide exactly the same motion as that provided by the CHGXXGUN (FN238).

■ Parameters

Parameter 1	Mechanism No.	Used to make setting of mechanism number to perform change operation. (Setting range: 1 to 9)
Parameter 2	Sub-mechanism No.	Used to make setting of sub-mechanism number. (Setting range: 1 to 31)

■ Example of screen display



Related commands
CHGXXGUN: Mechanism change (dedicated to Mechanism 2) (FN238)

Function commands (FN codes)

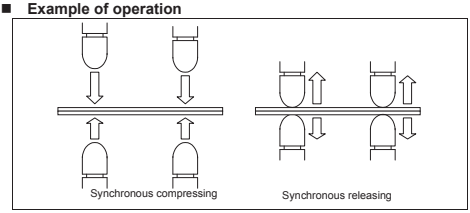
Command name	SYNCSPOT
FN code	303
Title name	Sync spot welding
General description	Enabling to perform synchronous welding with two servo guns

■ General description

The Function commands are the commands to control the special servo guns, which enables to perform synchronous welding using two servo guns as a type of the multi-gun system.
Using this function, the cycle time is greatly reduced since spot welding is synchronously performed at two points.
Note that there are some restrictions on workpiece shape.

For the details of Multi-gun synchronous welding, see the application manual : Spot Welding "Multi-gun Synchronous Welding".

■ Example of operation



■ Parameter

Parameter No.1	Welder number	Specifies the welder number to perform welding. The gun set at this parameter is to be the master gun in the Synchronous welding. (0-6)
Parameter No.2	Weld condition number	Specifies the weld condition number to determine the welding pressure of the gun set at the parameter No.1, the weld condition signal etc. (1-255)
Parameter No.3	Weld sequence number	Specifies the weld sequence number to determine the welding pressure of the gun set at the parameter No.1, the current-conducting signal, the output timing of stroke signal etc. (1-64)
Parameter No.4	Welder number	Specifies the welder number to perform welding. (0-6)
Parameter No.5	Weld condition number	Specifies the weld condition number to determine the welding pressure of the gun set at the parameter No.4, the welding condition signal etc. (1-255)
Parameter No.6	Weld sequence number	Specifies the weld sequence number to determine the pressure signal of the gun set at the parameter No.4 , the current-conducting signal, the output timing of stroke signal etc. (1- 64)
Parameter No.7 - 18	Welder number, Weld sequence number, Weld condition number	Specifies the welder number, the weld condition number and the weld sequence number of the 3rd welder and after to perform synchronous welding in the same way as the 1st and 2nd welder.
Parameter No.19	Weld point No.	Use this parameter to manage the weld point. The weld point No. is output when the welding abnormality occurs, therefore the spot can be identified. If not using this, set it at 0. (0-16000)

■ **Example of screen display**

```
SYNCSPOT [1,1,1,2,1,1 ->]      FN303; Sync spot welding
```

See SPOT; Spot welding (FN119)

Function commands (FN codes)

Command name	GETTIPCON
FN code	306
Title name	Get tip consumption
General description	Used to get tip consumption amount.

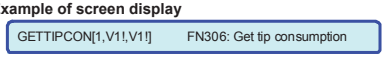
■ General description

Using this command makes it possible to get the consumption amounts of the moving- and fixed-side gun tips.

■ Parameter

Parameters 1	Gun No.	Used to make setting of gun number which you want to detect the tip consumption amount. (Setting range: 1 to 31)
Parameters 2	Moving-side save variable No.	Used to make setting of variable in which the consumption amount of the moving-side tip is saved. (Setting range: 1 to 200)
Parameters 3	Fixed-side save variable No.	Used to make setting of variable in which the consumption amount of the fixed-side tip is saved. (Setting range: 1 to 200)

■ Example of screen display



Related commands

Short-cut (R code)

R code	307
Title name	Press brake shelter
Outline	This executes retreat actions after work process, in the press brake synchronization function.

■ **Outline**

When this function is used, the tool tip coordinates of the first manipulator registered in the unit are taken into real variables. The robot moves to the position with addition of the "retreat distance" of the press brake data to the coordinates.

At movement, it retreats at the speed designated by the "retreat distance" of the press brake data.

■ **Action example**

Parameter No.1	Conveyor number	This designates a conveyor number registered as press brake. (1-2)
Parameter No.2	Real variable number	This designates the start number of the real variables to store the current robot position values (X, Y, Z, R, P, Y). (1-195) The position values are stored to 6 real variables sequentially from the designated real variables. V![Start variable number] = X V![Start variable number+1] = Y V![Start variable number+2] = Z V![Start variable number+3] = R V![Start variable number+4] = P V![Start variable number+5] = Y

■ **Screen display example**

```
PRSS[1,V1!]                    FN307; Press brake shelter
```

Reference

PRSD; Read press data (FN308)

Function commands (FN codes)

Command name	PRSD
FN code	308
Title name	Read press data
Outline	This reads a press brake synchronization setting file, in the press brake synchronization function.

■ **Outline**

When this function command is executed, the synchronization data registered in PRESS.CON file is read.

■ **Action example**

Parameter No.1	Conveyor number	This designates a conveyor number registered as press brake. (1-2)
Parameter No.2	Press data number	This designates a press condition number to be read. (1-10)

■ **Screen display example**

PRSD[1,10] FN308; Read press data

Reference

PRSS; Press brake shelter (FN307)

Function commands (FN codes)

Command name	SETVELO
FN code	309
Title name	Set velocity
General description	This command is used to set the speed in an endless axis.

■ General description

Only one-axis mechanism can use the function. And it must be set an endless axis. Allowed endless type is an speed control type or change control type.
The rotation speed of an endless axis can be freely changed between arbitrary record points.
When this function is used for a change control type endless axis, it is necessary to change the velocity control by the CHGENDLESS; Change endless control (FN373).

■ Parameter

First parameter	Explanation
Mechanism No.	This specifies the mechanism number of an endless axis. (1-9)

Second parameter	Explanation
Velocity	This specifies the number of rotations of deceleration machine output sides. Maximum speed is different depending on the specification of the axis.

■ Example of screen display

SETVELO [2,500] FN309; Set velocity

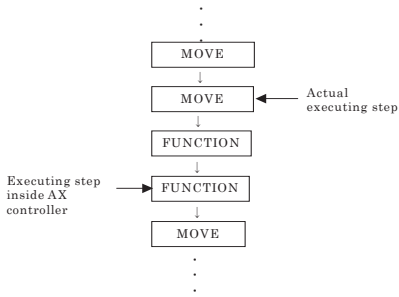
See
CHGENDLESS; Change endless control(FN373)

Function commands (FN codes)

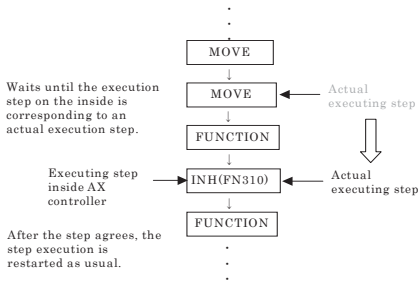
Command name	INH
FN code	310
Title name	INHIBIT
General description	Execution is controlled ahead.

■ General description

This function code is used combine with the input functions such as INP, INPB, GETSIG, and GETSIGB, of the robot language and the signal acquisition timing may be matched to actual step execution.
In the AX controller, the step execution processing is done in AX to make the robot work smoothly, and the robot works follows to it.
Therefore, a part of application instruction is executed earlier than the displays executing. (execution step ahead)



When this function is executed waits until execution is controlled the step ahead, and the execution step in AX is corresponding to an actual execution step.
Afterwards, the step execution is restarted as usual.



■ Parameter

None

■ Example of screen display

```
INH                FN310: Inhibit
```

Function commands(FN codes)

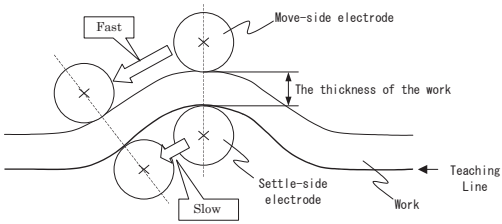
Command name	SEAMTHICK
FN code	311
Title name	Seam panel thick
General description	Set the thickness of the work.

■ **General description**

When performing seam welding on 3-dimensional space, a difference appears in the welding speed of move-side electrode and settle-side electrode by the thickness of a work. According to this speed difference, the rotation speed of electrode can be adjusted automatically, and welding by the optimal electrode rotation can be performed. In this command, the thickness of the work used as the basement of the amount of compensation is specified.

■ **Example of operation**

When welding the work of 3-dimensional form as shown in the following figure by setting work board thickness by this command, according to board thickness, the rotation speed of electrode can be changed automatically, and it can weld at the electrode rotation speed optimal at a work contact surface.



■ **Parameter**

Parameter No.1	-100.0 - 100.0	Panel thickness[mm] Set the thickness of the work.

■ **Example of screen display**

```
SEAMTHICK[0.5]                FN311: Seam panel thick
```

See

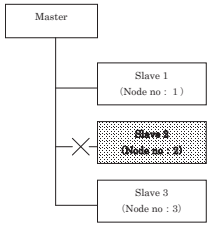
SEAMST Seam weld start (FN245)

Function commands (FN codes)

Command name	FBUSREL
FN code	312
Title name	Field bus release
General description	In the field bus master, error detection Enabled/Disabled of the specified node is switched.

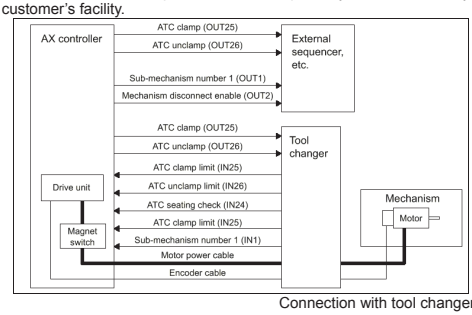
■ General description

In the field bus function, when AX is used as master, the error detection is done in each slave connected with it. This function is used to invalidate the error detection of a specific slave temporarily because of the mechanism change etc.
Enabled/Disabled of the error detection is switched specifying the slave node of each field bus master by using this function.
In the example of the figure below, the example of invalidating the error detection of slave 2 which leads to mastering is shown by using this application instruction. When slave 1 occurs the error, mastering detects the error in the figure below. However, even if slave 2 occurs the error, mastering does not detect the error.



■ Example of operation

An example is given for tool changing system where the signals have been allocated as shown in the figure below. The method shown here represents an example only, and will actually differs on the environment that depends on the customer's facility.



Connection with tool changer (sample)

```
STEP N      500mm/s LIN A1 T31
STEP N+1    100mm/s LIN A1 T1                          Move to the
                                                       connect/disco
                                                       nnect position
STEP N+2    FBUSREL[1,1,0]      FN312:Fieldbus         Error
                                release                detection
                                                       Disabled.
STEP N+3    CHGGUN[0]           FN95: Mechanism        Electrical
                                change                 disconnection
STEP N+4    RESET[025]          FN34: Output OFF       Unclamp
STEP N+5    SET[026]            FN32: Output ON
STEP N+6    WAIT[126]           FN525: Wait input      Waiting for
                                (positive)             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[124]**	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[125]**	FN525: Wait input (positive)	Waiting for clamp finish
STEP N+13	**CHGGUN[1]**	FN95: Mechanism change	Electrical connection
STEP N+14	**100mm/s LIN A1 T1**		Move away
STEP N+15	**FBUSREL[1,1,1]**	FN312:Fieldbus release	Error detection enabled

The error does not occur even if it is a field bus disengaging (error detection invalidity) and the specified slave node is physically cut off in step N+2 before the disengaging of the mechanism.
It is a field bus disengaging (effective the error detection) in STEP N+15 after enough time passes until the mechanism is connected in step N+13 and the link of the field buses establishes, and the error detection of the field bus is restarted.

< Note >
It is necessary to see enough time until the link establishes before executing the field bus disengaging (effective the error detection) after reconnecting the field bus. Error "E0960 A part or all I/O links are stopping." is generated when becoming the error detection effective before the field bus link is established.
Time until the link establishes after reconnecting the field bus is different according to the system environment etc. which the customer uses.

When field bus master is connected with the field bus slave by one-to-one, one example of the average time until the link establishes is shown as follows.

Protocol type	Average time until the link establishes
Device net	8-10[sec]
Device net (Quick Connect Enable)	2[sec]
CC-Link	2[sec]
JEMANET	1[sec]
PROFIBUS	2[sec]

■ **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	Error detection Enabled/Disabled	Enabled/Disabled of the error detection is specified. (0=Disabled/1=Enabled)

■ **Example of screen display**

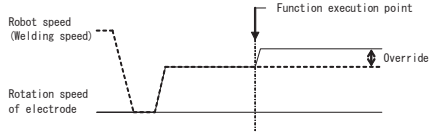
Function commands(FN codes)

Command name	SEAMOV
FN code	313
Title name	Seam override
General description	Set the electrode rotation speed override.

■ General description

This function overrides the rotational speed of the electrode to the welding speed according to the correction rates specified by the parameter.
The override values are cleared when step 0 of the unit that contains the electrode mechanism executions.
Note)
The rotational speed is not corrected in the welding off.

■ Example of operation



If this function is executed before welding, the override values which are specified by this function are applied at time when the welding is begun.
When this function is executed again during welding at the override speed, the rotational speed of the electrodes is changed at the override speed newly specified.

■ Parameter

Parameter No.1	-20-20	Override (Move) [%]
Parameter No.2	-20-20	Override (Settle) [%]

■ Example of screen display

```
SEAMOV[6,6]                FN313:Seam override
```

See
SEAMST: Seam weld start (FN245)
SEAMEND: Seam weld end (FN246)

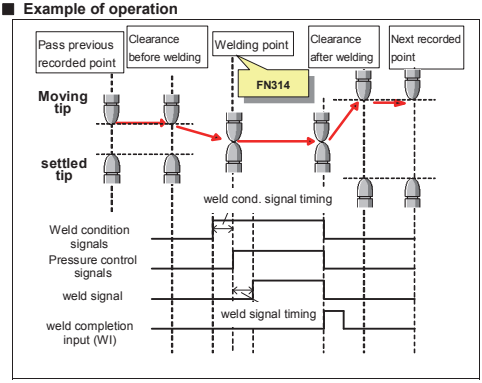
Function commands (FN codes)

Command name	SPOTC
FN code	314
Title name	Spot welding execution
General description	Execute spot welding in accordance with pre-defined sequence.

■ General description

Spot welding can be performed in the specified step by recording the spot welding function in the welding step. By using this function, the output timings of the pressurizing signal, power-on signal, stroke signal and other welding control signals can be programmed by the controller without having to use an external sequencer. A higher level of welding control tailored to each weld point can be exercised by setting a multiple number of pressurizing conditions and welding sequences, clearance table.

■ Example of operation



■ Parameter

Parameter No. 1	Welder number	This parameter specifies the number of the first welder for which the welding control signal is output. (1 - 6)
Parameter No. 2	Pressurizing condition No.	This specifies the number of the pressurizing condition. It establishes the welding force. (1 - 255)
Parameter No. 3	Welding sequence No.	This specifies the number of the welding sequence. It establishes the output timing of the pressurizing signal, power-on signal. (1 - 64)
Parameter No. 4	Weld condition	This specifies the values which are output to the welder as the welding conditions. (0 - 65535)
Parameter No. 5	Clearance condition No. before welding	This specifies the number of the clearance before welding. (0 - 99)
Parameter No. 6	Clearance condition No. after welding	This specifies the number of the clearance after welding. (0 - 99)

Parameter No. 7	Welding point number	This specifies the number of the weld point. Use this parameter when controlling the welding points. If welding trouble has occurred, this weld point number is output. In the case of automatic recording, the step number is recorded. (0-99999)

■ **Example of screen display**

SPOTC [1, 1, 1, 1, 1, 1, 0] FN314; Spot welding

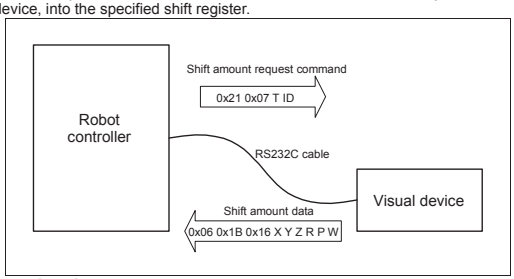
See
GSEA: Servo gun search (FN167)

Function commands (FN codes)

Command name	SREQ2
FN code	315
Title name	Shift amount request (binary)
Outline	The command requests the shift amount data (binary) 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.

■ General description

This command sends binary code data (command) requesting a shift amount to the external device connected to the controller by the RS232C cable, and it sets the shift amount binary data, which is input as the response from the external device, into the specified shift register.



The RS232C cable is an optional accessory.

When this function command is executed, following binary data is output from the RS232C port, and the shift amount data is thereby requested.

0x21 0x07 T ID

Here, T and ID is as followed.

T = time out (4 bytes integer [msec])
Designated time value is transmitted from lower byte to upper byte.
ID = ID of virtual frame (1 byte integer)

The robot continues to operate even after the request data has been output.
When the shift amount data is input from the external device in the following format, it is stored in the specified shift register.

0x06 0x1B 0x16 X Y Z R P W

Here, from X to W is following binary data received from lower byte to upper byte. XYZ direction is right hand coordinate system.

X = X direction shift amount (4 byte floating real value [mm])
Y = Y direction shift amount (4 byte floating real value [mm])
Z = Z direction shift amount (4 byte floating real value [mm])
R = Rotating amount on Z axis (4 byte floating real value [degree])
P = Rotating amount on Y axis (4 byte floating real value [degree])
W = Rotating amount on X axis (4 byte floating real value [degree])

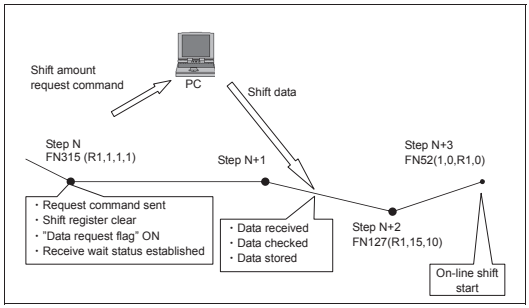
CAUTION	**Shift request command, time out shift data must be manages by little-endian control (sending from lower byte to upper byte). When treating these data in personal computer, beware to follow the little-endian control.**

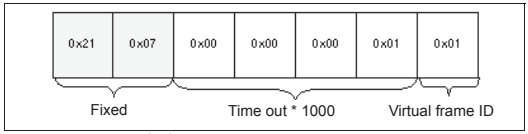
The receive time, wait time and communication conditions are set by selecting "8 Communication" from "Constant Setting" and then "1 Serial port." The data input wait time can be set in "Timeout time," and if this is set to "0," the serial port will remain in the wait status until an input arrives. (The robot continues to operate.) If this function is again executed while waiting for the previous receive, next request command is not sent until receiving is completed. But time out is set to “0” and FN111(RSCLR) is executed, waiting status is abort.

■ Example of operation

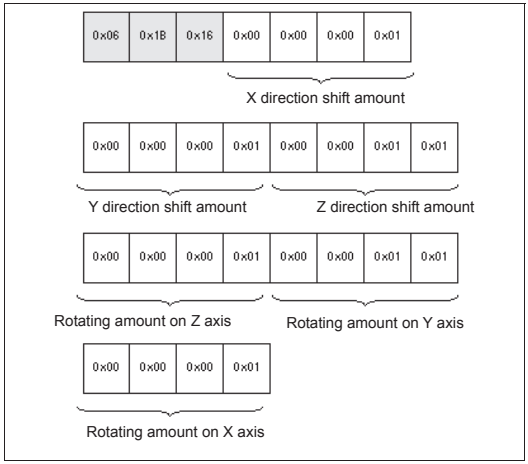
As shown in the figure, when SREQ2 (FN315) is executed, the shift amount request command is sent to the external device through the serial port, and it is ensured that the data can be received at any time. The robot continues to operate as is and heads toward step N+1. When the shift data is received from the external device at any position, the legitimacy of the data is checked, and the data is stored in the specified shift register only when the data is found to be legitimate.

But received shift data is committed after executing the function “WAITR: Wait shift value receive” (FN127) which is programmed at step N+2.
This shift register value is used for the shift operations by the "SHIFTR: Shift2" (FN52) or such other command.





Shift amount request command



Response data

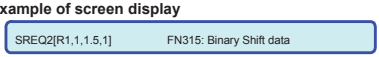
If the response data from the external device is sent in any other format, the values will not be set correctly in the shift register.

■ **Parameter**

Parameter No. 1	Shift register number	This is used to specify the number of the shift register in which to store the shift amount received from the external device. (1 to 9)

Parameter No. 2	Port number	This is used to specify the number of the port to be used to transfer the data. At the present time, only port 1 can be used. (1 to 1)
Parameter No. 3	Time out	This is used to specify the waiting time. (0.0 to 3600.0 sec) This is sent as the time out data of sending command to the vision sensor.
Parameter No. 4	Virtual frame ID	This is used to specify the virtual frame ID of the vision sensor. (0 to 255)

■ **Example of screen display**



See
SHIFTR: Shift2 (FN52)
RSCLR: Buffer clear (FN111)
WAITR: Wait shift value receive (FN127)
CLRREGWR: Clear register of written sts (FN699)

Application Command (FN Code)

Command name	SYNCSPOTIWB
FN code	316
Title name	Spot sync welding
Outline	Used to weld with two servo guns at a time. （dedicated to welding I/F＝MEDbus only）

■ Outline

This function is dedicated to the MEDAR spot welder (IWB timer controller) interface application only. **(welding I/F＝MEDbus)**

This is a command to control special servo gun that enables welding at two weld points at a time as one of multi gun system patterns. Since this command enables spot welding at two points at a time, cycle time can be significantly reduced.

There are limits to workpiece shapes that can be welded.

For detail of multi-gun synchronous welding, refer to information in the “Multi-gun synchronous welding” section in the “SPOT WELDING” of the FD CONTROLLER OPERATING MANUAL – APPLICATION VERSION.

■ Parameters

Parameter 1	Welder No.	Used to makes setting of welder number used for welding. A gun set with this parameter serves as the master for synchronous welding. (Setting range: 0 to 6)
Parameter 2	Weld sequence No.	Used to make setting of welding sequence number with the Parameter 1. (Setting range: 1 to 255)
Parameter 3	Welder No.	Used to makes setting of welder number used for welding. (Setting range: 0 to 6)
Parameter 4	Weld sequence No.	Used to make setting of welding sequence number with the Parameter 3. (Setting range: 1 to 255)
Parameters 5 to 12	Welder No. Weld sequence No.	Used to make settings of welder number and welding sequence number for the third and later welders following the setting procedure for the first and second welders.
Parameter 13	Weld point No.	Used to control weld points. If a weld fault occurs, the relevant weld point number will be output, thus making it possible to identify the weld point. To disable this function, set this parameter to “0”. (Setting range: 0 to 16000)

■ Example of screen display

```
SYNCSPOTIWB[1,1,2,1      →]  FN316: Spot sync welding
```

Related commands

SPOTIWB1: Spot welding (FN199)

Function commands (FN codes)

Command name	SETOVR
FN code	317
Title name	Set Override
General description	This command is used to set the speed override value.

■ General description

Using this command makes it possible to set the speed override value of the unit which executed the command.
This function is carried out for only Playback mode.

■ Parameter

Parameter No. 1	Speed Override(%)	This specifies the speed override value. 1- maximum (150 or 100)

■ Example of screen display

```
SETOVR [V1%]                FN317;  Set override
```

See
GETOVR: Get override (FN318)

Function commands (FN codes)

Command name	GETOVR
FN code	318
Title name	Get Override
General description	This command is used to get the speed override value.

■ General description

Using this command makes it possible to get the speed override value of the unit which executed the command. This value is saved into specified (global) integer variable.

■ Parameter

Parameter No. 1	Integer variable number	This specifies the integer variable number to which the speed override value will be saved. (1-200)

■ Example of screen display

```
GETOVR [V1%]                FN318;  Get override
```

See
SETOVR: Set override (FN317)

Function commands (FN codes)

Command name	AUTOZERO
FN code	319
Title name	Analog input auto zero set
Outline	Auto zero the analog input signal is executed.

■ General description

The analog signal input is prepared two channels for the servo amplifier. The analog input signal has the unavoidable offset value when it is 0V. The measurement accuracy of the analog input signal decreases if the influence of the offset is not removed.
This function executes the autozero of the analog input, and removes the influence of the offset.

■ Example of operation

This function is used as follows.

```
SETM   O4,1     Digital output port 4 resets the analog signal
DELAY 0.5       wait until analog input becomes 0.
SETM   O4,0
AUTOZERO        Execute auto zero
```

We recommend that this function is executed at the beginning of the program when the analog input signal is used.

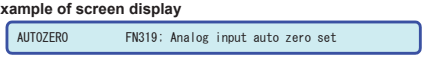
For the convenience, the above-mentioned functions is used as the user macro.

Please execute this function when the analog input signal is always 0V. The measurement accuracy of the analog input signal decreases when executing it, except when the analog input signal is 0V.

■ Parameter

None.

■ Example of screen display



Function commands (FN codes)

Command name	SETTIPCON
FN code	323
Title name	Set tip consumption
General description	Used to set tip consumption amount.

■ General description

Using this command makes it possible to set the consumption amounts of the moving- and fixed-side gun tips.
When the consumption amounts to set up is over the Max. tip consumption, the alarm of A2781 or A2782 is outputted, without setting consumption. Consumption error output signals are not outputted at this time.Using this command makes it possible to set the speed override value of the unit which executed the command.

■ Parameter

Parameters 1	Gun No.	Used to make setting of gun number which you want to detect the tip consumption amount. (Setting range: 1 to 31)
Parameters 2	Moving-side save variable No.	Used to make setting of variable in which the consumption amount of the moving-side tip is saved. (Setting range: 1 to 200)
Parameters 3	Fixed-side save variable No.	Used to make setting of variable in which the consumption amount of the fixed-side tip is saved. (Setting range: 1 to 200)

■ Example of screen display

```
SETTIPCON[1,V1!,V2!]        FN323: Set tip consumption
```

Related commands
GSEA: Servo gun search (FN167)
GETTIPCON: Get tip consumption (FN306)

Function commands (FN codes)

Command name	FORCECTRL
FN code	326
Title name	Force control
General description	Start the force control.

■ General description

This is the function to start the force control that is used force sensor.
In principle this function is not “in position check” type. But only at the first time execution, this function is “in position check” type. If one FN326 is executed and another FN326 is executed, force control condition is change without “in position check”.
To finish the force control, use FN328 (Force Control/ Touch End Function).

■ Example of operation

Please refer to the instruction manual “Force control” for the example of movement.

■ Parameter

1st parameter	Mechanism	This is to designate the mechanism number to execute force control. Only manipulator mechanism can execute force control. (1 to 9)
2nd parameter	Condition No.	This is to designate the condition number which is selected in <Constant Setting> - [41 Force Control] - [1 Force control condition]. (1 to 100)

■ Example of screen display

```
FORCECTRL[1,1]                FN326 ; Force control
```

See
FORCETOUCH;Touch shift(FN327)
FORCEEND;Force Control/ Touch End(FN328)
GETFORCE2;Get Force/Torque Data(FN329)
FORCEZERO;Force Sensor Zero Adjustment (FN379)

Function commands (FN codes)

Command name	FORCETOUCH
FN code	327
Title name	Force Touch
General description	Start the touch operation.

■ General description

Start the touch operation using force sensor by this function.
After executing this function, touch shift amount is summarized and robot base trajectory is shifted.
In order to finish force control, please use FN328 (Force Control/ Touch End Function).

■ Example of operation

Please refer to the instruction manual “Force control” for the example of movement.

■ Parameter

1st parameter	Mechanism	This is to designate the mechanism number to execute touch motion. Only manipulator mechanism can execute touch motion. (1 to 9)
2nd parameter	Condition No.	This is to designate the condition number which is selected in <Constant Setting> - [41 Force Control] - [2 Touch condition]. (1 to 100)

■ Example of screen display

FORCETOUCH[1,1]	FN327;Force Touch

See
FORCECTRL;Force control(FN326)
FORCEEND;Force Control/ Touch End(FN328)
GETFORCE2;Get Force/Torque Data(FN329)
FORCEZERO;Force Sensor Zero Adjustment(FN379)

Function commands (FN codes)

Command name	FORCEEND
FN code	328
Title name	Force Control/ Touch End
General description	Ending of the force control and touch shift.

■ General description
Both of force control and touch shift is ended by this function.
If they are not executed, nothing happen.

■ Example of operation
Please refer to the instruction manual “Force control” for the example of movement.

■ Parameter
Not available.

■ Example of screen display

FORCEEND	FN328;Force Control/ Touch End

See
FORCECTRL;Force control(FN326)
FORCETOUCH;Touch shift(FN327)
GETFORCE2;Get Force/Torque Data(FN329)
FORCEZERO:Force Sensor Zero Adjustment(FN379)

Function commands (FN codes)

Command name	GETFORCE2
FN code	329
Title name	Get Force/Torque Data
General description	Acquire the data for force sensor.

■ General description

Force sensor data (force/torque) based on the designated coordinate system can be obtained by this function.
“Obtaining start” or “obtaining end” is designated here. “Obtaining start” initiates to obtain data for force sensor and to store them to the designated real variable registers. Obtained data is kept renewing until “obtaining end”. Its renewing cycle is fixed.

■ Example of operation

Please refer to the instruction manual “Force control” for the example of movement.

■ Parameter

1st parameter	Obtaining start/ End	This is to designate of obtaining start or end. (1: Start / 0: End)
2nd parameter	Coordinate	This is to designate the coordinate system of obtained data. 0: Sensor coordinate (Same result as FN360:GETFORCE command) 1: Robot coordinate 2: Tool coordinate 3: User coordinate 4: World coordinate 5: Current coordinate of force control In case of user coordinate, before utilizing this command, user coordinate system must be registered in <Service Utilities> - [10 User coordinate] and current user coordinate number for shift calculation must be fixed by FN113 (Change coord. No. (shift)) command.
3rd parameter	Register No.	This is to designate the real variable register number to store obtained data. Obtained data is stored to continuous 6 real variable registers. First register number is recorded here. (1 to 195 and 301 to 495)

■ Example of screen display

GETFORCE2	FN329;Get Force/Torque Data

See
FORCECTRL;Force control(FN326)
FORCETOUCH;Touch shift(FN327)
FORCEEND;Force Control/ Touch End(FN328)
FORCEZERO:Force Sensor Zero Adjustment(FN379)

Function commands (FN codes)

Command name	VRESET
FN code	330
Title name	Vision reset
General description	Data of the vision sensor is cleared.

■ General description

This instruction used to clear data of the vision sensor built into AX controller.
In general, it is necessary to execute this instruction before measuring.

Operations and parameters are different from which vision sensor uses.

[Vision sensor type1]

■ Example of operation

This instruction can clear the measurement data of the vision sensor.
If it is not possible to communicate with the vision sensor, the error is detected.

■ Parameter

None

■ Example of screen display

```
VRESET            FN330:Vision reset
```

[Vision sensor type2]

■ Example of operation

You can clear the measure result of vision. This function will be done at before actual function execution timing (pre-execution).

■ Parameter

Parameter No.1	0～999	Measure condition No.

If you set 0, all measure results are cleared.
In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter.

■ Example of screen display

```
VRESET[1]         FN330: FN330:Vision reset
```

See
VSTART: Vision start (FN331)
VWORK: Vision discrimination (FN332)
VSHIFT: Vision shift (FN333)
VDATA: Vision data (FN334)
VLOCCVT: Vision location convert (FN342)
VWAIT: Vision wait (FN343)

Function commands (FN codes)

Command name	VSTART
FN code	331
Title name	Vision start
General description	Start the measurement of vision sensor.

■ General description

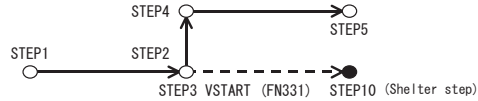
[High-speed synchro vision is unavailable]
When this instruction is executed, the AX controller request to start the measurement of the vision sensor.
The next step is not executed until the measurement is completed.
Jumps to the shelter step specified by the parameter the vision sensor notifies abnormality.

[High-speed synchro vision is available]
When this instruction is executed, the AX controller request to start the measurement of the vision sensor.
The next step is executed without waiting to complete the measurement.
VWAIT(FN343) is used to wait to complete the measurement

Operations and parameters are different from which vision sensor uses.

[Vision sensor type1]

■ Example of operation



[High-speed synchro vision is unavailable]
After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done when abnormality occurs when measuring with the vision sensor, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

[High-speed synchro vision is available]
This function is executed without checking position.The shelter step specified by the parameter is ignored. Please use VWAIT(FN343) when you want to jump to the shelter step when failure occurs when vision measuring.

■ Parameter

Parameter No.1	1-256	Measurement No.
Parameter No.2	1-9999	Shelter step No.

In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter. However, you can not specify a language format for the shelter step number parameter.

■ Example of screen display

```
VSTART[1,10]    FN331:Vision start
```

[Vision sensor type2]

■ Example of operation

Case: Disabled hardware trigger
The function will be done after robot position will be at the step.
Next target step will be judged after receiving the completion note from vision sensor.
Robot moves to the next step if the note from vision sensor is complete.
Robot moves to the shelter step if note from vision sensor is abnormal, for example, vision couldn't measure for some reason.
You should check what kind of error happened by the logging data of vision monitor.

Case: Enabled hardware trigger

This function is optional of the vision sensor. Set appropriate signal number to the 3rd parameter(Trigger No.) when measuring with the robot moving. Please wait the measurement completion with VWAIT(FN343) when you use the trigger signal. The shelter step specified by the parameter in this function is disregarded, and the shelter step of VWAIT(FN343) is used.

■ Parameter

Parameter No.1	1～999	Measure condition No.
Parameter No.2	0～16	Image Proc. No. / Measure point No.
Parameter No.3	0～3	Trigger No.
Parameter No.4	1～10000	Shelter step No.

Robot will stop with recognition error if you set [10000] for shelter step.
In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter. However, you can not specify a language format for the shelter step number parameter.

■ Example of screen display

```
VSTART[1,10,0,10000]      FN331: Vision start
```

See
VRESET: Vision reset (FN330)
VWORK: Vision discrimination (FN332)
VSHIFT: Vision shift (FN333)
VDATA: Vision data (FN334)
VLOCCVT: Vision location convert (FN342)
VWAIT: Vision wait (FN343)

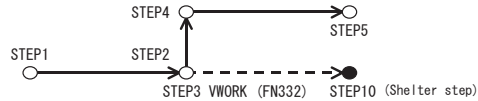
Function commands (FN codes)

Command name	VWORK
FN code	332
Title name	Vision work
General description	Distinguish work with the vision sensor

■ General description

When this instruction is executed, the AX controller request to start the distinction of the work with the vision sensor.
The next step is not executed until the distinction is completed.
Jumps to the shelter step specified by the parameter the vision sensor notifies abnormality.

■ Example of operation



After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done when abnormality occurs when measuring with the vision sensor, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ Parameter

Parameter No.1	1-256	Start Measure No.
Parameter No.2	1-256	End Measure No.
Parameter No.3	1-9999	Shelter step No.

■ Example of screen display

```
VWORK[1,5,10]      FN332:Vision work
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VSHIFT: Vision shift (FN333)
VDATA: Vision data (FN334)

Function commands (FN codes)

Command name	VSHIFT
FN code	333
Title name	Vision shift
General description	Get the shift value from the vision sensor

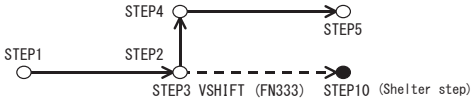
■ General description

The shift values are acquired from the last measurement result of the vision sensor when this function is executed, and stores the shift values in the shift register specified by the parameter.
The next step is not executed until the function is completed.
Jumps to the shelter step specified by the parameter the vision sensor notifies abnormality.

Operations and parameters are different from which vision sensor uses.

[Vision sensor type1]

■ Example of operation



[High-speed synchro vision is unavailable]
After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done when abnormality occurs when measuring with the vision sensor, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

[High-speed synchro vision is available]
This function is executed without checking position. The following STEP4 is executed when the calculation of the shift amount succeeds, but it jumps to the shelter step when failure occurs.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ Parameter

Parameter No.1	1-9	Shift register No.
Parameter No.2	1-9999	Shelter step No.

In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter. However, you can not specify a language format for shift register number and the shelter step number parameter.

■ Example of screen display

```
VSHIFT[1,10]     FN333:Vision shift
```

[Vision sensor type2]

■ Example of operation

Robot moves to the next step if the note from vision sensor is complete.
Robot moves to the shelter step if note from vision sensor is abnormal, for example, vision couldn't measure for some reason.
You should check what kind of error happened by the logging data of vision monitor.

■ Parameter

Parameter No.1	1～999	Measure Condition No.
Parameter No.2	0～16	Detect No.
Parameter No.3	1～9	Shift register No.
Parameter No.4	1～3	Base coordinate
Parameter No.5	1～10000	Shelter step No.

Robot will stop with recognition error if you set [10000] for shelter step.
In the screen editing, it is able to specify the robot language format (Vn%, Vn!, Ln!, etc) in the parameter. However, you can not specify a language format for shift register number and the shelter step number parameter.

■ **Example of screen display**

```
VSHIFT[1,1,1,1,10000]          FN333: Vision shift
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VWORK: Vision discrimination (FN332)
VDATA: Vision data (FN334)
VLOCCVT: Vision location convert (FN342)
VWAIT: Vision wait (FN343)

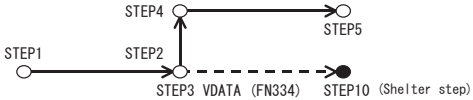
Function commands (FN codes)

Command name	VDATA
FN code	334
Title name	Vision data
General description	Get the data from the vision sensor

■ **General description**

The kind of data specified that this function is executed from the last measurement result of the vision sensor by the parameter is acquired, and stores data in the real variable register. Thirteen kinds of data can be selected.
The next step is not executed until the function is completed.
Jumps to the shelter step specified by the parameter the vision sensor notifies abnormality.
This function is available after FN331 VSTART. When VSTART has been executed, the measurement results are stored in the data, it will be able to get.

■ **Example of operation**



After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done when abnormality occurs when measuring with the vision sensor, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ **Parameter**

Parameter No.1	1～999	Measurement No.
Parameter No.2	0～16	Detect No.
Parameter No.3	1～1000	Data No. 1:Detect Num. 2:Scale (X, Y) 3:Score 4:Angle 5:Detect Pos.(Image Coord.) 6:Detect Pos.(World Coord.) 7:Detect Pos.(Flange Coord.) 8:Detect Pos.(Vision sensor Coord.) 9:Image treatment number 10:Blob Property 11:Base Pos.(World Coord.) 12:Base Pos.(Flange Coord.) 13:Base Pos.(Vision sensor Coord.) 14～1000:Reserved (do not set.) ※To use the data number 11-13, please set the image treatment number in the parameter No.2.
Parameter No.4	-32767 ～32767	Subparametar. (It is unused. Please set to 0.)
Parameter No.5	1～200, 301～500	Real variable No.
Parameter No.6	1-10000	Shelter step No.

■ **Example of screen display**

```
VDATA[1,1,10]       FN334:Vision data
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VWORK: Vision discrimination (FN332)
VSHIFT: Vision shift (FN333)

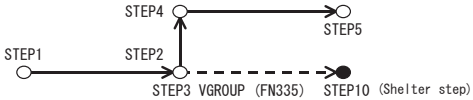
Function commands (FN codes)

Command name	VGROUP
FN code	335
Title name	Vision group change
General description	Change the measurement group of the vision sensor

■ General description

This function change the measurement group of the vision sensor.
The group number after this processing is stored in the specified integer variable. The next step is not executed until processing is completed.
Jumps to the shelter step specified by the parameter when the measurement group is not correctly changed, or when the vision sensor notifies abnormality.

■ Example of operation



After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ Parameter

Parameter No.1	1-20	Measurement group No.
Parameter No.2	1-200	Integer variable No.
Parameter No.3	1-9999	Shelter step No.

■ Example of screen display

```
VGROUP[2,1,10]      FN335:Vision group change
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VWORK: Vision discrimination (FN332)
VSHIFT: Vision shift (FN333)
VDATA: Vision data (FN334)

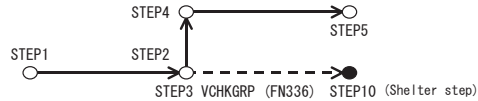
Function commands (FN codes)

Command name	VCHKGRP
FN code	336
Title name	Vision group check
General description	Check the measurement group of the vision sensor

■ General description

This function acquires the measurement group of the vision sensor in the integer variable specified by the parameter.
The next step is not executed until processing is completed.
Step jumps to the shelter step specified by the parameter when the vision sensor notifies abnormality. Moreover, Step jumps to the shelter step when this value and the acquired measurement number are different when the values other than 0 are set in the measurement group number of the parameter.

■ Example of operation



After checking position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ Parameter

Parameter No.1	0-20	Measurement group No.
Parameter No.2	1-200	Integer variable No.
Parameter No.3	1-9999	Shelter step No.

■ Example of screen display

```
VCHKGRP[2,1,10]      FN336:Vision group check
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VWORK: Vision discrimination (FN332)
VSHIFT: Vision shift (FN333)
VDATA: Vision data (FN334)

Function commands (FN codes)

Command name	VLOCCVT
FN code	342
Title name	Vision location convert
Outline	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.

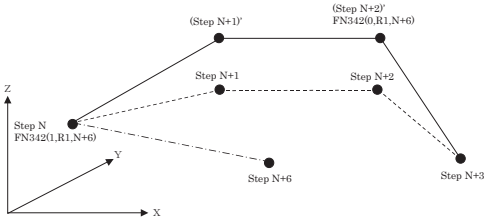
■ General description

This function command proceeds with playback while shifting the recorded position in the robot program on the basis of the shift amount data stored in the specified shift register. If the shift amount data has not been set in the specified shift register, it is possible to jump to the shelter step.

parameters are different from which vision sensor uses.

■ Operation example

The shift beginning is recorded at position Step N where the shift wants to begin as shown in the figure below and the shift end is recorded in position (Step N+2) 'which wants to end shifting. The robot reads the content of the shift register specified with FN342 after it reaches step N, and faces position (Step N+1) 'by which the following target position Step N+1 is shifted when reproducing. The robot works as a target position, position where the record position was similarly shifted to position (Step N+2) 'where the shift end is recorded.(solid line tracks of figure below)
The shift is done in the machine coordinate system regardless of the coordinate system selection.



When FN342 is executed in step N, if the shift data is not set when the specified shift register is read, the robot faces the shelter step (Step N+6) which is set with FN342.

[Vision sensor type1]

■ Parameters

Parameter No. 1	Start/End	This is used to specify the start or end of the shift operation. 1: Start / 0: End
Parameter No. 2	Shift register number	This is used to specify the shift register number. (1 to 9)
Parameter No. 3	Shelter step	This is used to specify the number of the shelter step when the shift amount data was not set in the specified shift register. (0 to 9999)

■ Example of screen display

```
VLOCCVT[1,R1,100]                FN342: Vision location
```

[Vision sensor type2]

■ Parameters

Parameter No. 1	Start/End	This is used to specify the start or end of the shift operation. 1: Start / 0: End

Parameter No. 2	Shift register number	This is used to specify the shift register number. (1 to 9)
Parameter No. 3	Base coordinate	Set a base coordinate for calculation of correction. 0:World 1:Flange
Parameter No. 4	Shelter step	This is used to specify the number of the shelter step when the shift amount data was not set in the specified shift register. (0 to 10000)

Robot will stop with recognition error if you set [10000] for shelter step.

■ **Example of screen display**

```
VLOCCVT[1,R1,0,100]                FN342: Vision location
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VSHIFT: Vision shift (FN333)
VWAIT: Vision wait (FN343)

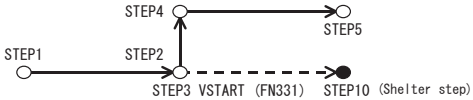
Function commands (FN codes)

Command name	VWAIT
FN code	343
Title name	Vision measure wait
General description	The measurement completion of the vision sensor is waited for.

■ General description

It waits until the measurement of the vision sensor is completed when this function is executed.
The next step is not executed until the measurement is completed.
It jumps to the shelter step when failure occurs when measuring by the vision sensor.

■ Example of operation



When passing over the position, this function is executed.
The step executed based as follows on the completion notification received from the vision sensor is decided. When it is normal completion, the following STEP4 is executed. When it is abnormal completion of being not able the measurement etc., jumps to the shelter step
Because the operation moved to the shelter step is done when abnormality occurs when measuring with the vision sensor, Robot error is not detected.
Please turn on the output signal by the routine in the shelter step when it is necessary to detect error on the outside. It is necessary to confirm an error content on the display of the vision sensor.

■ Parameter

Parameter No.1	1-256	Measurement No.
Parameter No.2	1-9999	Shelter step No.

The maximum value of the shelter step is 10000 for vision sensor type 2. Robot will stop with recognition error if you set [10000] for shelter step.

■ Example of screen display

```
VWAIT[1,10]      FN343:Vision measure wait
```

See
VRESET: Vision reset (FN330)
VSTART: Vision start (FN331)
VSHIFT: Vision shift (FN333)
VLOCCVT: Vision location convert (FN342)

Function commands(FN codes)

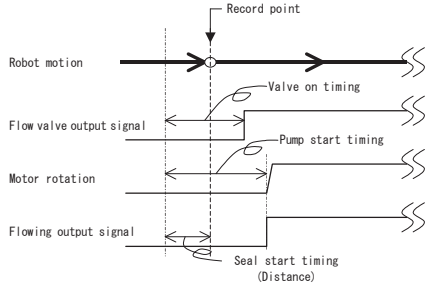
Command name	SLSTART
FN code	350
Title name	Seal start
General description	Start the dispensing.

■ General description

This instruction used to actuate the dispense applicator and start the dispensing.
Flow rate and execution timing parameters are set in “Sealing Schedule.”
This instruction contains a schedule number used as an input parameter.

■ Example of operation

The robot shall move to a specified position according to specified motion command and start dispensing according to the parameters specified in the sealing schedule.



■ Parameter

Parameter No.1	1-6	Gun No.
Parameter No.2	1-255	Seal Schedule No.

■ Example of screen display

```
SLSTART[1,1]              FN350:Seal start
```

See
SLEND: Seal end (FN351)
SLRELOAD: Reload (FN352)
SLREADY : Flow ready (FN353)
SLPRS : Seal press ctrl (FN355)

Function commands(FN codes)

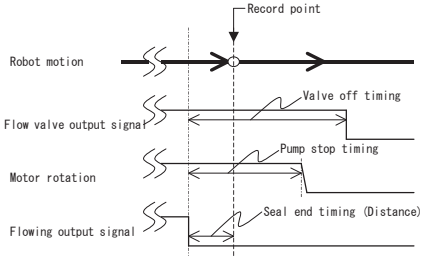
Command name	SLEND
FN code	351
Title name	Seal end
General description	Stop the dispensing process

■ General description

This instruction used to stop the dispensing process.
This instruction is executed according to the timing described to the seal schedule specified by the last executed seal start function.
The pressure correction is turned off.

■ Example of operation

The robot shall move to a specified position according to specified motion command and start dispensing according to the parameters specified in the sealing schedule.



■ Parameter

Parameter No.1	1-6	Gun No.

■ Example of screen display

```
SLEND[1]              FN351:Seal end
```

See
SLSTART: Seal start (FN350)
SLRELOAD: Reload (FN352)
SLREADY : Flow ready (FN353)
SLPRS : Seal press ctrl (FN355)

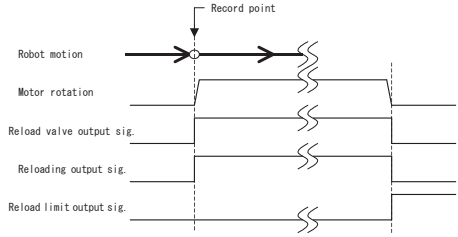
Function commands(FN codes)

Command name	SLRELOAD
FN code	352
Title name	Reload
General description	Refill the booster pump.

■ **General description**

This instruction used to refill the booster pump. The reload operation ends automatically when reaching the reload limit. The robot can move while reloading.

■ **Example of operation**



■ **Parameter**

Parameter No.1	1-6	Gun No.

■ **Example of screen display**

```
SLRELOAD[1]                FN352:Reload
```

See
SLSTART: Seal start (FN350)
SLEND: Seal end (FN351)
SLREADY : Flow ready (FN353)
SLPRS : Seal press ctrl (FN355)

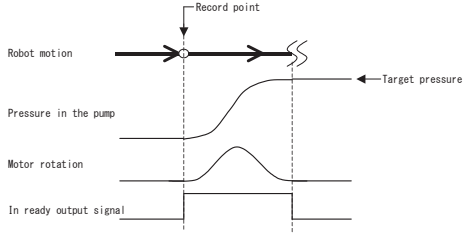
Function commands(FN codes)

Command name	SLREADY
FN code	353
Title name	Flow ready
General description	Pressure in the pump is controlled to a specified value.

■ **概要**

The motor which controls the pump is moved when this instruction is executed, and controls to the value for which pressure in the pump is specified by the parameter of the function.
The change of the bead shape when beginning to dispense in controlling pressure in the pump can be controlled.
The robot can move in the flow ready control.

■ **動作例**



■ **Parameter**

Parameter No.1	1-6	Gun number
Parameter No.2	0-50.0	Pre-pressure[MPa]

■ **Example of screen display**

```
SLREADY[1,1,2]                FN353: Flow ready
```

See
SLSTART Seal start (FN350)
SLEND: Seal end (FN351)
SLRELOAD: Reload (FN352)
SLPRS: Seal press ctrl (FN355)

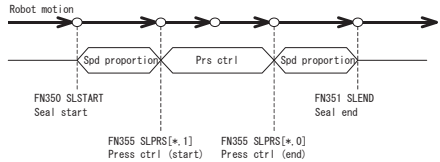
Function commands(FN codes)

Command name	SLPRS
FN code	355
Title name	Seal press ctrl
General description	Start/Stop pressure control in the dispensing process

■ General description

This instruction declares start/end of pressure control as flow control.
When this instruction for which start(ON) is specified by the parameter is executed, the dispensing will be executed by the pressure control. When this instruction is executed specifying end (OFF), the pressure control is canceled. Even if the pressure control end is not executed, the pressure control is canceled by the seal end function.

■ Example of operation



■ Parameter

Parameter No.1	1-6	Gun number
Parameter No.2	0-1	ON/OFF(1/0)

■ Example of screen display

```
SLPRS[1,1]                FN355: Seal press ctrl
```

See
SLSTART Seal start (FN350)
SLEND: Seal end (FN351)
SLRELOAD: Reload (FN352)
SLREADY : Flow ready (FN353)

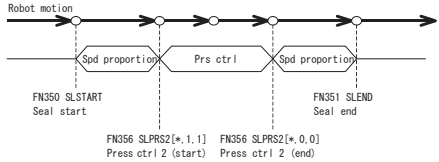
Function commands(FN codes)

Command name	SLPRSG
FN code	356
Title name	Seal press ctrl 2
General description	Start/Stop pressure control in the dispensing process

■ **General description**

This instruction declares start/end of pressure control as flow control.
When this instruction for which start (ON) is specified by the parameter is executed, the dispensing will be executed by the pressure control.
During pressure control, the control level is corrected by the value specified by the parameter.
It is happen the pulsation or the oscillation though the response improves if a big value is set.
When this instruction is executed specifying end (OFF), the pressure control is canceled. Even if the pressure control end is not executed, the pressure control is canceled by the seal end function. It is possible to end with FN355.

■ **Example of operation**



■ **Parameter**

Parameter No.1	1-6	Gun number
Parameter No.2	0-1	ON/OFF(1/0)
Parameter No.3	0.0-10.0	Rate

■ **Example of screen display**

```
SLPRSG[1,1,1.2]                FN356: Seal press ctrl 2
```

See
SLSTART Seal start (FN350)
SLEND: Seal end (FN351)
SLRELOAD: Reload (FN352)
SLREADY : Flow ready (FN353)
SLPRS : Seal press ctrl (FN355)

NACHI NACHI-FUJIKOSHI CORP.			*http://www.nachi-fujikoshi.co.jp/*
Japan Main Office	Phone: +81-3-5568-5245	Fax: +81-3-5568-5236	Shiodome Sumitomo Bldg. 17F, 1-9-2 Higashi-Shinbashi Minato-ku, TOKYO, 105-0021 JAPAN
Nachi Robotic Systems Inc. (NRS)			*http://www.nachirobotics.com/*
North America Headquarters	Phone: 248-305-6545	Fax: 248-305-6542	42775 W. 9 Mile Rd. Novi, Michigan 48375, U.S.A
Indiana Service Center	Phone: 248-305-6545	Fax: 248-305-6542	Greenwood, Indiana
Ohio Service Center	Phone: 248-305-6545	Fax: 248-305-6542	Cincinnati, Ohio
South Carolina Service Center	Phone: 248-305-6545	Fax: 248-305-6542	Greenville, South Carolina
Canada Branch Office	Phone: 905-760-9542	Fax: 905-760-9477	89 Courtland Ave., Unit No.2, Concord, Ontario, L4K 3T4, CANADA
Mexico Branch Office	Phone :+52-555312-6556	Fax:+52-55-5312-7248	Urbina No.54, Parque Industrial Naucalpan, Naucalpan de Juarez, Estado de Mexico C.P. 53489, MEXICO
NACHI EUROPE GmbH			*http://www.nachi.de/*
Central Office Germany	Phone: +49-2151-65046-0	Fax: +49-2151-65046-90	Bischofstrasse 99, 47809, Krefeld, GERMANY
U.K. branch	Phone: +44-0121-423-5000	Fax: +44-0121-421-7520	Unit 3, 92, Kettles Wood Drive, Woodgate Business Park, Birmingham B32 3DB, U.K.
Czech branch	Phone: + 420-255-734-000	Fax: +420-255-734-001	Obchodni 132, 251 01 Cestlice, PRAGUE-EAST CZECH REPUBLIC
Turkey branch	Phone: + 90-(0)216-688-4457	Fax: +90-(0)216-688-4458	Ataturk Mah. Mustafa Kemal Cad. No:10/1A 34758 Atasehir / Istanbul - TURKEY
NACHI AUSTRALIA PTY. LTD.			*http://www.nachi.com.au/*
Robotic Division & Victoria office	Phone: +61-(0)3-9796-4144	Fax: +61-(0)3-9796-3899	38, Melverton Drive, Hallam, Victoria 3803, , AUSTRALIA
Sydney office	Phone: +61-(0)2-9898-1511	Fax: +61-(0)2-9898-1678	Unit 1, 23-29 South Street, Rydalmere, N.S.W, 2116, AUSTRALIA
Brisbane office	Phone: +61-(0)7-3272-4714	Fax: +61-(0)7-3272-5324	7/96 Gardens Dr,Willawong,QLD 4110, , AUSTRALIA
NACHI SHANGHAI CO., LTD.			*http://www.nachi.com.cn/*
Shanghai office	Phone: +86-(0)21-6915-2200	Fax: +86-(0)21-6915-2200	11F Royal Wealth Centre, No.7 Lane 98 Danba Road Putuo District, Shanghai 200062, China
NACHI KOREA			*http://www.nachi-korea.co.kr/*
Seoul office	Phone: +82-(0)2-469-2254	Fax: +82-(0)2-469-2264	2F Dongsan Bldg. 276-4, Sungsu 2GA-3DONG, Sungdong-ku, Seoul 133-123, KOREA

Robot Division
1-1-1, FUJIKOSHIHONMACHI, TOYAMA CITY, JAPAN 930-8511
Phone +81-76-423-5137
Fax +81-76-493-5252

Original manual is written in Japanese.