NX100 OPTIONS

FOR ANALOG OUTPUT FUNCTION CORRESPONDING TO SPEED

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

MOTOMAN INSTRUCTIONS

MOTOMAN-DDD INSTRUCTIONS NX100 INSTRUCTIONS NX100 OPERATOR'S MANUAL NX100 MAINTENANCE MANUAL

The NX100 operator's manuals above correspond to specific usage. Be sure to use the appropriate manual.

Do not submit this electronic data to the customer.

THIS MATERIAL IS FOR STUDY PURPOSE ONLY. YOU MUST READ THE MANUAL WHICH ENCLOSED WITH A ROBOT.





MANDATORY

- This manual explains the analog output function corresponding to speed of the NX100 system and general operations. Read this manual carefully and be sure to understand its contents before handling the NX100.
- General items related to safety are listed in Section 1: Safety of the NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 Instructions before reading this manual.



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

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the NX100.

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



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



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





• Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.

-Check for problems in manipulator movement. -Check for damage to insulation and sheathing of external wires.

• Always return the programming pendant to the hook on the NX100 cabinet after use.

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

• Read and understand the Explanation of Warning Labels in the NX100 Instructions before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows.

Equipment	Manual Designation
NX100 Controller	NX100
NX100 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator Cable

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

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

Description of the Operation Procedure

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

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1 Analog Output Function Corresponding to Speed

The analog output function corresponding to speed changes the analog output value automatically, according to the manipulator operating speed. This function does not need resetting of the analog output value according to the operating speed, so that the time required for job teaching can be reduced.

For example, when the thickness of sealing or painting should be constant, the discharged amount of seals or paints can be controlled by the manipulator operating speed.



2 Instructions

2.1 Instructions for Analog Output Function Corresponding to Speed

The instructions, ARATION and ARATIOF, are used for the analog output function corresponding to speed.

2.1.1 ARATION

The analog output function corresponding to speed is performed after executing ARATION instruction. This instruction is valid during circular interpolation, linear interpolation or spline interpolation. It is executed only at playback or FWD key operation; it is not executed during axis operation.

This instruction is also used when each set value for the analog output function corresponding to speed is to be changed.

ARATION AO#(1) BV=10.00 V=200.0 OFV=2.00

1	2	3	4

Output port number

General analog output port to execute the analog output corresponding to speed Setting range : 1 to 40

②Basic voltage

Voltage to be output at the speed set with the basic speed.

3Basic speed

Operating speed which becomes the basis for when the set voltage is output.

④Offset voltage

Analog voltage when the operating speed is 0.

According to the set value of the ARATION instruction, the output characteristics for the relation between the operating speed and the analog voltage are calculated. The analog output function corresponding to speed is executed depending on these output characteristics. The following graph shows the output characteristics.



Output Characteristics When Analog Output Function Corresponding to Speed is Used

When the analog output value exceeds \pm 14.00 V because of the operating speed, the value is limited within \pm 14.00 V.

2.1.2 ARATIOF

When the ARATIOF instruction is executed, the analog output corresponding to speed is completed, and the set offset voltage becomes the fixed output.



Output port number

General analog output port to end the analog output corresponding to speed Setting range : 1 to 40

2.2 Registration of Instructions

The instructions can be registered when the cursor is in the address area on the job content display in teach mode. Perform the following operations before registering an instruction.

	Operation	Explanation	
1	Select {JOB} under the main menu		
2	Select {JOB CONTENT}		
3	Move the cursor to the address area	JOB EDIT DISPLAY UTILITY Image: Constraint of the second s	Instruction area

2.2.1 ARATION

	Operation	Explanation
1	Move the cursor to one line above the place to register the ARATION instruction	The line above the place to register ARATION instruction. 0020 MOVL V=138 0022 MOVL V=138
2	Press [INFORM LIST]	
3	Select [IN/OUT]	The instruction list dialog appears.

	Operation	Explanation
4	Select "ARATION"	The ARATION instruction is indicated in the input buffer line.
5	Change any additional items and numerical values	<register changes="" without=""> To register without changes, perform operation of step 5. <register addition="" additional="" change="" items="" of="" or="" the="" with=""> • To change the output port number In case of using [SHIFT] and the cursor key, move the cursor to the output port number, and then press [SHIFT] and the cursor key simultaneously, to change the output port number. Image: the cursor is a constrained by the cursor is the output port number, and then press [SHIFT] and the cursor to the output port number, and press [SELECT] to display an input buffer line. Enter the number, and then press [ENTER] to change the number displayed. • To change the basic voltage, the speed, and the offset voltage Move the cursor to the instruction in the input buffer line, and then press [SELECT]. The detail edit display is shown. Image: Constrained by the output is constrained by the cursor is the instruction in the input buffer line, and then press [SELECT]. The detail edit display is shown. Image: Constrained by the output is constrained by the cursor is constrained by th</register></register>

	Operation	Explanation
5	(Cont'd) Change any addi- tional items and numerical values	Move the cursor to "UNUSED" of the additional item to be changed, and then press [SELECT]. The selection dialog is displayed. Move the cursor to the additional item to be changed, and press [SELECT]. JOB EDT DISPLAY UTLITY IN EN IN THE PETAL EDIT ARATION ANLG OUTPUT NO AO#(%) 1 M BASE VOLTAGE INVISED OFFSET VOLTAGE UNUSED When the additional item is changed, press [ENTER]. The detail edit window closes, and the job content window appears.
6	Press [INSERT] and [ENTER]	The instruction indicated in the input buffer line is registered. The line where ARATION instruction is registered. 0020 MOVL V=138 0021 ARATION AO#(1) BV=10.00 MOVL V=138

2.2.2 ARATIOF

	Operation	Explanation
1	Move the cursor to one line above the place to register ARATIOF instruction	The line above the place to register ARATIOF instruction. MOVL V=138
2	Press [INFORM LIST]	
3	Select [IN/OUT]	The instruction list dialog appears.
4	Select "ARATIOF"	The ARATIOF instruction is indicated in the input buffer line.
5	Press [INSERT] and [ENTER]	The ARATIOF instruction is registered.

2.3 Analog Output Display

The current settings can be confirmed on the analog output window.

	DATA	EDIT	PLAY U	ΓΙLITY [2 🖻 🕅	1 😪 🔯	
	ANALOG OU	TPUT					
1)	TERMINAL	AOUT1	AOUT2	AOUT3	AOUT4		
2—	OUTPUT (V) -14.00	-14.00	-10.00	-14.00		
3 —	BASIC (V)	0.00	0.00	0.00	0.00		
4 —	TRAIT	SP RAT	SP RAT	STATIC	SP RAT		
5	OFFSET (V)	0.00	0.00	0.00	0.00		
6 —	BASIC SPD	1200.0	1200.0	1200.0	1200.0		
7—	ROBOT	R1	R2	R3	R4		
				PAG	=		
				TAO	-		
	Main Menu	Short Cut					

①Terminal

General analog output port

OUTPUT (V)

Indicates the voltage which is currently output.

3BASIC (V)

Indicates the basic voltage used for the analog output corresponding to speed. This value is used until a new value is set by ARATION instruction.

4TRAIT

Indicates the current output characteristics of the output port.

SP RAT : during execution of the analog output corresponding to speed

STATIC : fixed output status

SOFFSET (V)

Indicates the offset voltage used for the analog output corresponding to speed. This value is used until a new value is set by ARATION instruction.

6BASIC SPD

Indicates the basic speed used for the analog output corresponding to speed. This value is used until a new value is set by ARATION instruction.

OROBOT

Indicates the manipulator number for the analog output corresponding to speed.

	Operation	Explanation
1	Select {IN/OUT} from the main menu	
2	Select {ANALOG OUTPUT}	The analog output window appears. The output terminal numbers which follow the AOUT4 can be switched and dis- played by pressing the page key.

3 Examples

3.1 Examples of Output Characteristics

The graph below shows the change in the output characteristics when the following job is done.

	Output Voltage (V)
MOVJ VJ=50.00	
ARATION AO#(1) BV=7.00 V=150.0 OFV=- 10.00	7.00
MOVL V=50.0	-4.33
MOVC V=100.0	1.33
MOVC V=100.0	1.33
MOVC V=100.0	1.33
MOVL V=200.0	12.67



3.2 Example of Variation of Operating Speed and Analog Output Value

The following graph shows the change of the analog output according to the speed variation.

MOVL V=200.0·····① ARATION AO#(1) BV=10.00 V=200.0 OFV=-2.00 MOVC V=150.0·····② MOVC VR=20.0····③(When the tool center point speed is 100 mm/s) MOVC V=150.0·····④ MOVL V=180.0·····⑤ MOVL V=180.0·····⑤ MOVL·····⑥ (When the tool center point speed is 180 mm/s) AOUT AO#(1) 10.00·····⑦



Analog Voltage according to Speed



• Since the analog output corresponding to speed is made for the calculated speed, there may be little difference from the actual operating speed of the manipulator.

• When a posture speed is specified, the analog output corresponding to speed is made for the operating speed at the tool center point with the posture speed.

4 Filter Process

In the analog output function corresponding to speed, the output analog signal can be filtered by setting a filter constant at the parameters.

4.1 When Parameter is Set to "0"

The analog signal according to the speed reference (the speed determined by a path operation) is output.



4.2 When Parameter is Set to Values Other Than "0"

The analog signal according to the speed of filtered speed reference is output. By the filter process, the output signal can be close to the manipulator's actual speed.



4.3 Parameter Setting

Adjust the settings of parameters during actual operations.

Parameter Number	Analog Output	Content	Unit
S3C819	Analog output No.1	Primary filter constant	[msec]
S3C820	Analog output No.1	Secondary filter constant	[msec]
S3C821	Analog output No.2	Primary filter constant	[msec]
S3C822	Analog output No.2	Secondary filter constant	[msec]
S3C823	Analog output No.3	Primary filter constant	[msec]
S3C824	Analog output No.3	Secondary filter constant	[msec]
S3C825	Analog output No.4	Primary filter constant	[msec]
S3C826	Analog output No.4	Secondary filter constant	[msec]
S3C827	Analog output No.5	Primary filter constant	[msec]
S3C828	Analog output No.5	Secondary filter constant	[msec]
S3C829	Analog output No.6	Primary filter constant	[msec]
S3C830	Analog output No.6	Secondary filter constant	[msec]
S3C831	Analog output No.7	Primary filter constant	[msec]
S3C832	Analog output No.7	Secondary filter constant	[msec]
S3C833	Analog output No.8	Primary filter constant	[msec]
S3C834	Analog output No.8	Secondary filter constant	[msec]
S3C835	Analog output No.9	Primary filter constant	[msec]
S3C836	Analog output No.9	Secondary filter constant	[msec]
S3C837	Analog output No.10	Primary filter constant	[msec]
S3C838	Analog output No.10	Secondary filter constant	[msec]
S3C839	Analog output No.11	Primary filter constant	[msec]
S3C840	Analog output No.11	Secondary filter constant	[msec]
S3C841	Analog output No.12	Primary filter constant	[msec]
S3C842	Analog output No.12	Secondary filter constant	[msec]
S3C843	Analog output No.13	Primary filter constant	[msec]
S3C844	Analog output No.13	Secondary filter constant	[msec]
S3C845	Analog output No.14	Primary filter constant	[msec]
S3C846	Analog output No.14	Secondary filter constant	[msec]
S3C847	Analog output No.15	Primary filter constant	[msec]
S3C848	Analog output No.15	Secondary filter constant	[msec]
S3C849	Analog output No.16	Primary filter constant	[msec]
S3C850	Analog output No.16	Secondary filter constant	[msec]
S3C851	Analog output No.17	Primary filter constant	[msec]
S3C852	Analog output No.17	Secondary filter constant	[msec]

Parameter Number	Analog Output	Content	Unit
S3C853	Analog output No.18	Primary filter constant	[msec]
S3C854	Analog output No.18	Secondary filter constant	[msec]
S3C855	Analog output No.19	Primary filter constant	[msec]
S3C856	Analog output No.19	Secondary filter constant	[msec]
S3C857	Analog output No.20	Primary filter constant	[msec]
S3C858	Analog output No.20	Secondary filter constant	[msec]
S3C859	Analog output No.21	Primary filter constant	[msec]
S3C860	Analog output No.21	Secondary filter constant	[msec]
S3C861	Analog output No.22	Primary filter constant	[msec]
S3C862	Analog output No.22	Secondary filter constant	[msec]
S3C863	Analog output No.23	Primary filter constant	[msec]
S3C864	Analog output No.23	Secondary filter constant	[msec]
S3C865	Analog output No.24	Primary filter constant	[msec]
S3C866	Analog output No.24	Secondary filter constant	[msec]
S3C867	Analog output No.25	Primary filter constant	[msec]
S3C868	Analog output No.25	Secondary filter constant	[msec]
S3C869	Analog output No.26	Primary filter constant	[msec]
S3C870	Analog output No.26	Secondary filter constant	[msec]
S3C871	Analog output No.27	Primary filter constant	[msec]
S3C872	Analog output No.27	Secondary filter constant	[msec]
S3C873	Analog output No.28	Primary filter constant	[msec]
S3C874	Analog output No.28	Secondary filter constant	[msec]
S3C875	Analog output No.29	Primary filter constant	[msec]
S3C876	Analog output No.29	Secondary filter constant	[msec]
S3C877	Analog output No.30	Primary filter constant	[msec]
S3C878	Analog output No.30	Secondary filter constant	[msec]
S3C879	Analog output No.31	Primary filter constant	[msec]
S3C880	Analog output No.31	Secondary filter constant	[msec]
S3C881	Analog output No.32	Primary filter constant	[msec]
S3C882	Analog output No.32	Secondary filter constant	[msec]
S3C883	Analog output No.33	Primary filter constant	[msec]
S3C884	Analog output No.33	Secondary filter constant	[msec]
S3C885	Analog output No.34	Primary filter constant	[msec]
S3C886	Analog output No.34	Secondary filter constant	[msec]
S3C887	Analog output No.35	Primary filter constant	[msec]
S3C888	Analog output No.35	Secondary filter constant	[msec]
S3C889	Analog output No.36	Primary filter constant	[msec]
S3C890	Analog output No.36	Secondary filter constant	[msec]

4.3 Parameter Setting

Parameter Number	Analog Output	Content	Unit
S3C891	Analog output No.37	Primary filter constant	[msec]
S3C892	Analog output No.37	Secondary filter constant	[msec]
S3C893	Analog output No.38	Primary filter constant	[msec]
S3C894	Analog output No.38	Secondary filter constant	[msec]
S3C895	Analog output No.39	Primary filter constant	[msec]
S3C896	Analog output No.39	Secondary filter constant	[msec]
S3C897	Analog output No.40	Primary filter constant	[msec]
S3C898	Analog output No.40	Secondary filter constant	[msec]

The standard parameter settings are as follows.

- For small capacity robot with a payload 6 kg and 16 kg Primary filter constant : 50 msec Secondary filter constant : 50 msec
- For large capacity robot with a payload 60 kg and 130 kg Primary filter constant : 100 msec Secondary filter constant : 100 msec

5 Precautions

5.1 When Analog Output Corresponding to Speed is Interrupted

If the manipulator is stopped for some reason and the editing operation is performed, the analog output corresponding to speed is interrupted. This interruption is performed in all output terminals, and the analog voltage fixed immediately before the interruption is output to each output terminal.

The analog output corresponding to speed is not interrupted in any other cases.

5.2 When More than One Manipulator is Used

The attribute of the job where the instruction is executed determines the manipulator where the analog output corresponding to speed is performed.

For a coordinated job, the analog output corresponding to speed is performed at the operating speed of the manipulator at the slave side.

NX100 OPTIONS

ANALOG OUTPUT FUNCTION CORRESPONDING TO SPEED

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