

# DX100 OPTIONS INSTRUCTIONS

FOR ANALOG OUTPUT FUNCTION CORRESPONDING TO SPEED

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

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## MOTOMAN INSTRUCTIONS

MOTOMAN--□□□ INSTRUCTIONS

DX100 INSTRUCTIONS

DX100 OPERATOR'S MANUAL

DX100 MAINTENANCE MANUAL

The DX100 Operator's manual above corresponds to specific usage.  
Be sure to use the appropriate manual.

Part Number: 156442-1CD

Revision: 0





## MANDATORY

- This manual explains the analog output function corresponding to speed of the DX100 system. Read this manual carefully and be sure to understand its contents before handling the DX100.
- General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 Instructions before reading this manual.



## CAUTION

- 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.

DX100

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## Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100.

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



### WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



### CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



### MANDATORY

Always be sure to follow explicitly the items listed under this heading.



### PROHIBITED

Must never be performed.

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".



## WARNING

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

*Fig. : Emergency Stop Button*



- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

*Fig. : Release of Emergency Stop*



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the power for the DX100.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.

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**CAUTION**

- 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 cabinet of the DX100 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 DX100 Instructions before operating the manipulator:

## Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.


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

In this manual, the equipment is designated as follows:

<b>Equipment</b>	<b>Manual Designation</b>
DX100 controller	DX100
DX100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

## DX100

Descriptions of the programming pendant, 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 Number Keys	“Axis Keys” and “Number 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, or that the item is directly selected by touching the screen.

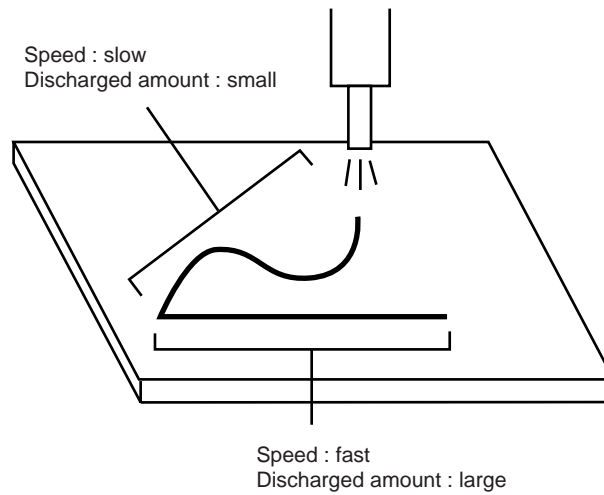
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## 1 Analog Output Function Corresponding to Speed

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.





DX100	2	Instructions
	2.1	Instructions for Analog Output Function Corresponding to 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

①Output 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.

2 Instructions

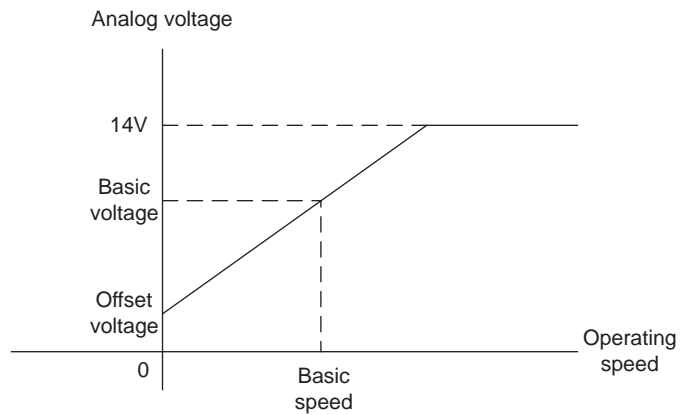
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2.1 Instructions for Analog Output Function Corresponding to Speed

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.

Fig. 2-1: Output Characteristics When Analog Output Function Corresponding to Speed is Used



**NOTE** 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.

ARATIOF AO#(1)



①Output port number

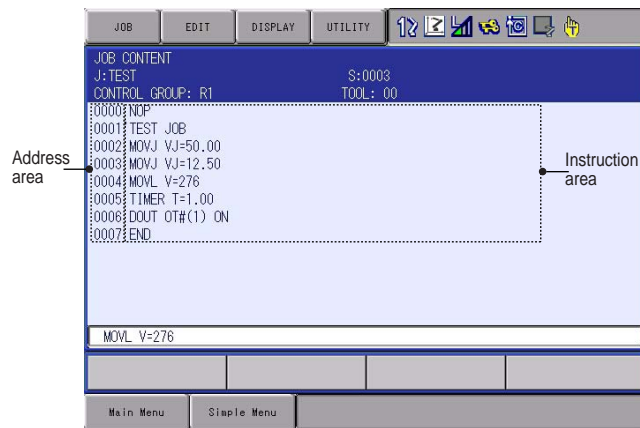
General analog output port to end the analog output corresponding to speed

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.

1. Select {JOB} under the main menu
2. Select {JOB CONTENT}
3. Move the cursor to the address area

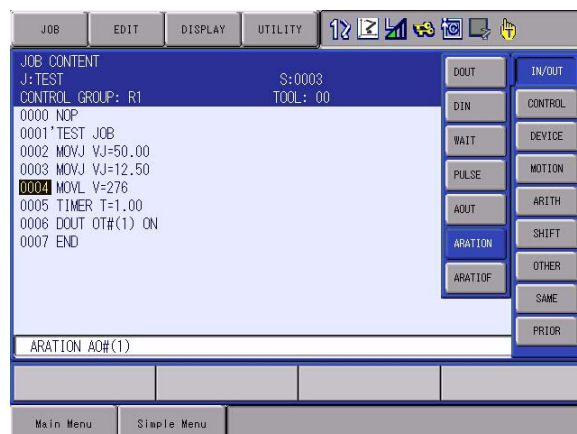


### 2.2.1 ARATION

1. Move the cursor to one line above the place to register the ARATION instruction



2. Press [INFORM LIST]
3. Select [IN/OUT]
  - The instruction list dialog appears.



4. Select "ARATION"
  - The ARATION instruction is indicated in the input buffer line.



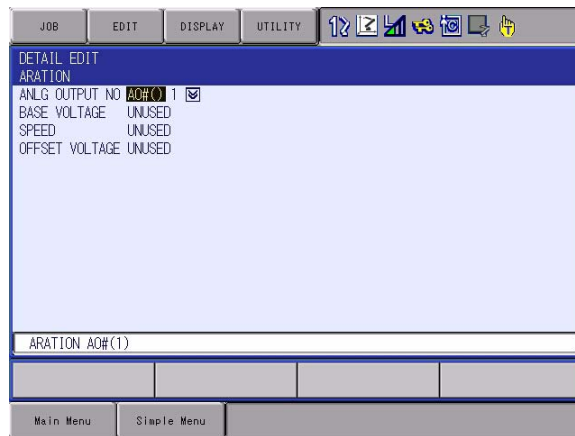
5. Change any additional items and numerical values

- <Register without changes>  
 To register without changes, perform operation of step 5.
- <Register with addition or change of the additional items>
  - 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.



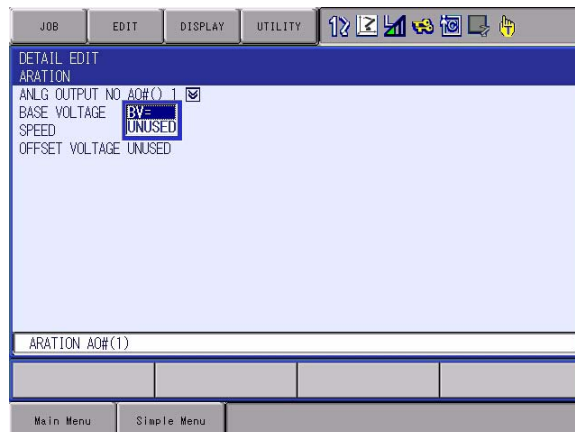
In case of using the number keys, move the cursor to the output port number, and press [SELECT] to display an input buffer line. Enter the number, and then press [ENTER] to change the number displayed.

- 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.



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].



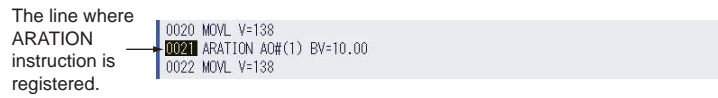
DX100

2 Instructions  
2.2 Registration of Instructions

When the additional item is changed, press [ENTER]. The detail edit window closes, and the job content window appears.

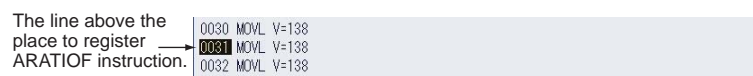
6. Press [INSERT] and [ENTER]

- The instruction indicated in the input buffer line is registered.



2.2.2 ARATIOF

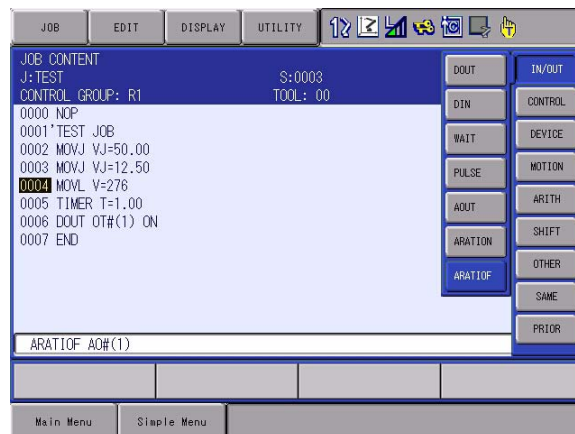
1. Move the cursor to one line above the place to register ARATIOF instruction



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.

	AOUT01	AOUT02	AOUT03	AOUT04
① TERMINAL				
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	1200	1200	1200
⑦ ROBOT	ROBOT1	ROBOT2	ROBOT3	ROBOT4

① Terminal

General analog output port

② OUTPUT (V)

Indicates the voltage which is currently output.

③ BASIC (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.

④ TRAIT

Indicates the current output characteristics of the output port.

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

STATIC : fixed output status

⑤ OFFSET (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.

⑥ BASIC 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.

⑦ ROBOT

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

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 displayed by pressing the page key.



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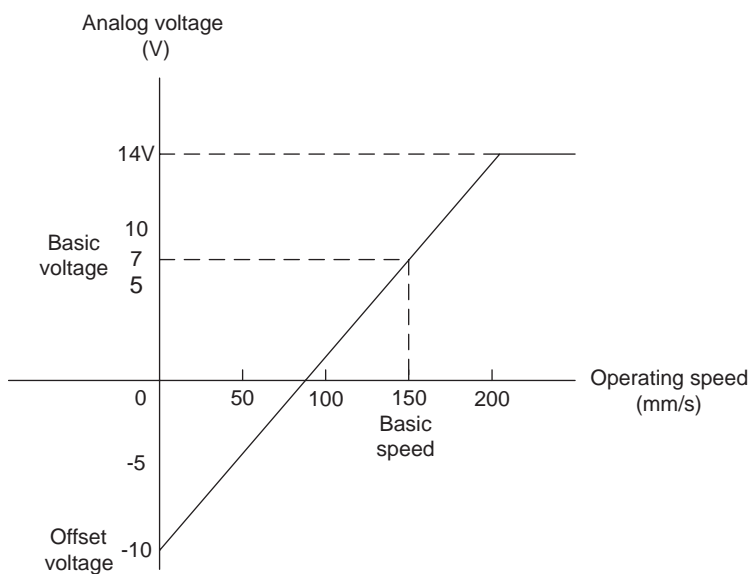
3 Examples  
 3.1 Examples of Output Characteristics

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)

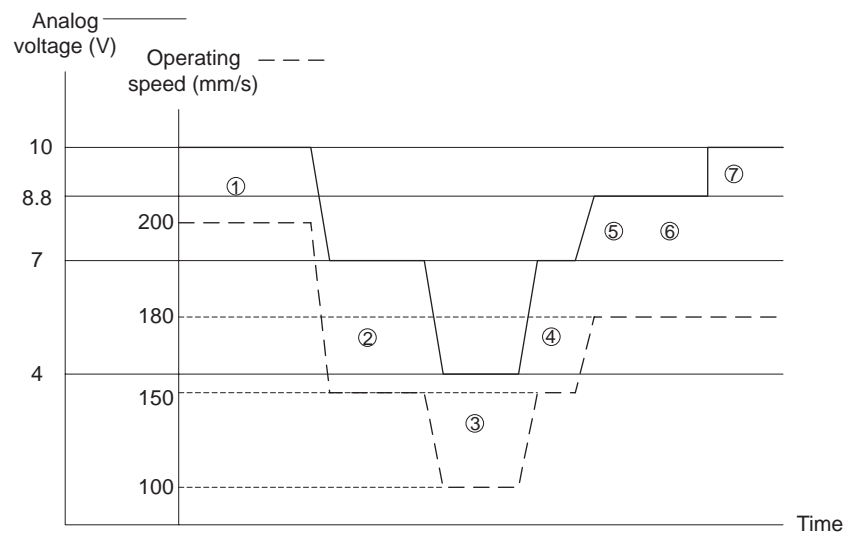
MOVC V=150.0⋯④

MOVL V=180.0⋯⑤

MOVL⋯⑥ (When the tool center point speed is 180 mm/s)

AOUT AO#(1) 10.00⋯⑦

Fig. 3-2: 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.

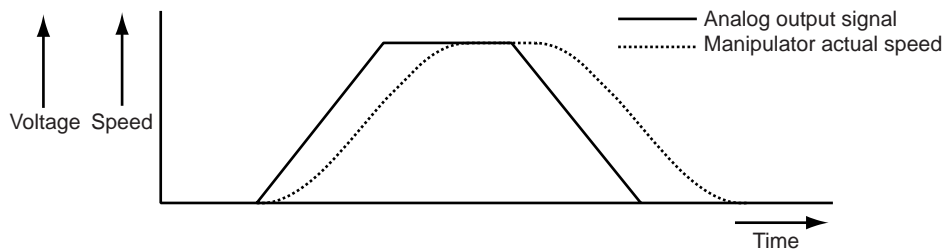


## 4 Filter Process

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

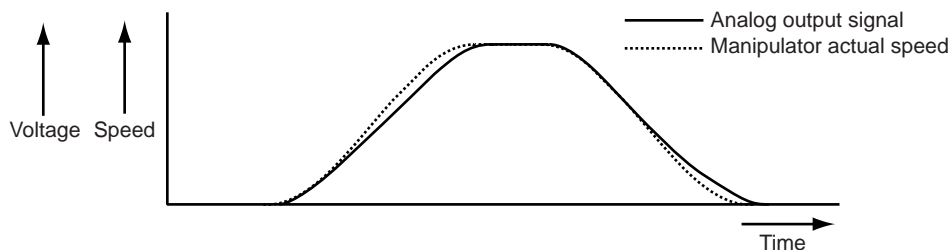
### 4.1 When Parameter is Set to "0"

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
S3C1111 S3C1112	Analog output No.1 Analog output No.1	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1113 S3C1114	Analog output No.2 Analog output No.2	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1115 S3C1116	Analog output No.3 Analog output No.3	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1117 S3C1118	Analog output No.4 Analog output No.4	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1119 S3C1120	Analog output No.5 Analog output No.5	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1121 S3C1122	Analog output No.6 Analog output No.6	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1123 S3C1124	Analog output No.7 Analog output No.7	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1125 S3C1126	Analog output No.8 Analog output No.8	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1127 S3C1128	Analog output No.9 Analog output No.9	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1129 S3C1130	Analog output No.10 Analog output No.10	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1131 S3C1132	Analog output No.11 Analog output No.11	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1133 S3C1134	Analog output No.12 Analog output No.12	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1135 S3C1136	Analog output No.13 Analog output No.13	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1137 S3C1138	Analog output No.14 Analog output No.14	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1139 S3C1140	Analog output No.15 Analog output No.15	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1141 S3C1142	Analog output No.16 Analog output No.16	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1143 S3C1144	Analog output No.17 Analog output No.17	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1145 S3C1146	Analog output No.18 Analog output No.18	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1147 S3C1148	Analog output No.19 Analog output No.19	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1149 S3C1150	Analog output No.20 Analog output No.20	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1151 S3C1152	Analog output No.21 Analog output No.21	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1153 S3C1154	Analog output No.22 Analog output No.22	Primary filter constant Secondary filter constant	[msec] [msec]

## 4 Filter Process

### 4.3 Parameter Setting

Parameter Number	Analog Output	Content	Unit
S3C1155 S3C1156	Analog output No.23 Analog output No.23	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1157 S3C1158	Analog output No.24 Analog output No.24	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1159 S3C1160	Analog output No.25 Analog output No.25	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1161 S3C1162	Analog output No.26 Analog output No.26	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1163 S3C1164	Analog output No.27 Analog output No.27	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1165 S3C1166	Analog output No.28 Analog output No.28	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1167 S3C1168	Analog output No.29 Analog output No.29	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1169 S3C1170	Analog output No.30 Analog output No.30	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1171 S3C1172	Analog output No.31 Analog output No.31	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1173 S3C1174	Analog output No.32 Analog output No.32	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1175 S3C1176	Analog output No.33 Analog output No.33	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1177 S3C1178	Analog output No.34 Analog output No.34	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1179 S3C1180	Analog output No.35 Analog output No.35	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1181 S3C1182	Analog output No.36 Analog output No.36	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1183 S3C1184	Analog output No.37 Analog output No.37	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1185 S3C1186	Analog output No.38 Analog output No.38	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1187 S3C1188	Analog output No.39 Analog output No.39	Primary filter constant Secondary filter constant	[msec] [msec]
S3C1189 S3C1190	Analog output No.40 Analog output No.40	Primary filter constant Secondary filter constant	[msec] [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.

# DX100 OPTIONS INSTRUCTIONS

FOR ANALOG OUTPUT FUNCTION CORRESPONDING TO SPEED

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## HEAD OFFICE

2-1 Kurosaki-Shiroishi, Yahatanishi-ku, Kitakyusyu-shi, 806-0004, Japan  
Phone +81-93-645-7745 Fax +81-93-645-7746

## MOTOMAN INC. HEADQUARTERS

805 Liberty Lane, West Carrollton, OH 45449, U.S.A.  
Phone +1-937-847-6200 Fax +1-937-847-6277

## MOTOMAN ROBOTICS EUROPE AB

Franska Vagen 10, Box 4004, SE-390 04 Kalmar, Sweden  
Phone +46-480-417800 Fax +46-480-417999

## MOTOMAN ROBOTEC GmbH

Kammerfeld strasse 1, 85391 Allershausen, Germany  
Phone +49-8166-90-100 Fax +49-8166-90-103

## YASKAWA ELECTRIC KOREA CORPORATION

1F, Samyang Bldg. 89-1, Shinchun-dong, Donk-Ku, Daegu, Korea  
Phone +82-53-382-7844 Fax +82-53-382-7845

## YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.

151 Lorong Chuan, #04-01, New Tech Park, Singapore 556741  
Phone +65-6282-3003 Fax +65-6289-3003

## YASKAWA ELECTRIC (MALAYSIA) SDN. BHD.

Unit 47-1 and 2, Jalan PJU 5/9, Dataran Sunway, Kota Damansara, 47810, Petaling Jaya Selangor, Malaysia  
Phone +60-3614-08919 Fax +60-3614-08929

## YASKAWA ELECTRIC (THAILAND) CO., LTD.

252/246, 4th Floor, Muang Thai-Phatra office Tower II Rechadapisek Road, Huaykwang Bangkok 10320, Thailand  
Phone +66-2-693-2200 Fax +66-2-693-4200

## SHOUGANG MOTOMAN ROBOT CO., LTD.

No.7, Yongchang-North Road, Beijing Economic and Technological and Development Area, Beijing 100076, China  
Phone +86-10-6788-0541 Fax +86-10-6788-0542

## MOTOMAN MOTHERSON ROBOTICS LTD.

Plot Number 195-196, First Floor, Imt Manesar -Sector 4, Gurgaon (Haryana), Pin-122050, India  
Phone +91-124-475-8500 Fax +91-124-475-8542



YASKAWA ELECTRIC CORPORATION

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