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Chapter 1

Introduction

1.1 About This Document

This manual provides instructions for the analog output function corresponding to speed and contains the following sections:

SECTION 1 - INTRODUCTION
Provides general information about the structure of this manual, a list of reference documents, and customer service information.

SECTION 2 - SAFETY
This section provides information regarding the safe use and operation of Motoman products.

SECTION 3 - ANALOG OUTPUT INSTRUCTIONS
Provides detailed information about the Analog Output function.

1.2 Reference to Other Documentation

For additional information refer to the following:

• NX100 Controller Manual (P/N 149201-1)
• Concurrent I/O Manual (P/N 149230-1)
• Operator’s Manual for your application
• Vendor manuals for system components not manufactured by Motoman

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

• Product Type (Analog Output)
• Robot Serial Number (located on back side of robot arm)
• Robot Sales Order Number (located on back of controller)
Notes
Chapter 2

Safety

2.1 Introduction

It is the purchaser’s responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06. The address is as follows:

RoboticIndustriesAssociation
900VictorsWay
P.O.Box3724
AnnArbor,Michigan48106
TEL:(734)994-6088
FAX:(734)994-3338

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. The robot must not be operated by personnel who have not been trained!

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.
This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming Safety (Section 2.6)
- Operation Safety (Section 2.7)
- Maintenance Safety (Section 2.8)

### 2.2 Standard Conventions

This manual includes information essential to the safety of personnel and equipment. As you read through this manual, be alert to the four signal words:

**DANGER!**

**WARNING!**

**CAUTION!**

**NOTE:**

Pay particular attention to the information provided under these headings which are defined below (in descending order of severity).

⚠️ **DANGER!**
Information appearing under the DANGER caption concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

⚠️ **WARNING!**
Information appearing under the WARNING caption concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

⚠️ **CAUTION!**
Information appearing under the CAUTION caption concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

>Note: Information appearing in a Note caption provides additional information which is helpful in understanding the item being explained.
2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator’s manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06, section 6.13.4 and 6.13.5, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety measures are available:

- Safety fences and barriers
- Light curtains
- Door interlocks
- Safety mats
- Floor markings
- Warning lights

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Programming tips are as follows:

Any modifications to PART 1 of the NX100 controller PLC can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

Back up all programs and jobs onto a floppy disk whenever program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

The concurrent I/O (Input and Output) function allows the customer to modify the internal ladder inputs and outputs for maximum robot performance. Great care must be taken when making these modifications. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations that may damage the robot or other parts of the system.
Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

Be sure that all safeguards are in place.

Check the E-STOP button on the teach pendant for proper operation before programming.

Carry the teach pendant with you when you enter the workcell.

Be sure that only the person holding the teach pendant enters the workcell.

Test any new or modified program at low speed for at least one full cycle.

2.7 Operation Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Operation tips are as follows:

- Be sure that only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories are permitted to operate this robot system.
- Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Inspect the robot and work envelope to ensure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Ensure that all safeguards are in place.
- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
• All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

2.8 Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. Maintenance tips are as follows:

• Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

• Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

• Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to operate the system.

• Back up all your programs and jobs onto a floppy disk whenever program changes are made. A backup must always be made before any servicing or changes are made to options, accessories, or equipment to avoid loss of information, programs, or jobs.

• Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the cell.

• The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.

• Be sure all safeguards are in place.

• Use proper replacement parts.

• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller, external servo box, and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

• All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot. This includes controller parameters, ladder parts 1 and 2, and I/O (Input and Output) modifications. Check and test all changes at slow speed.

• Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
NX100 OPTIONS
INSTRUCTIONS
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-□□□ 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.
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".

- **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.

**NOTE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.
• Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 and programming pendant are pressed. 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.

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.

Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the working envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - 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 NX100 power
  - 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 the front door of the NX100 and the programming pendant.
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.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX100 Controller</td>
<td>NX100</td>
</tr>
<tr>
<td>NX100 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td></td>
</tr>
<tr>
<td>Character Keys</td>
<td>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td>Symbol Keys</td>
<td>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.</td>
</tr>
<tr>
<td>Axis Keys</td>
<td>“Axis Keys” and “Numeric Keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Numeric Keys</td>
<td></td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. ex. {JOB}</td>
</tr>
</tbody>
</table>

**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.
1  Analog Output Function Corresponding to Speed

2  Instructions
   2.1 Instructions for Analog Output Function Corresponding to Speed
      2.1.1 ARATION ......................................................... 2-1
      2.1.2 ARATIOF ......................................................... 2-2
   2.2 Registration of Instructions ...................................... 2-3
      2.2.1 ARATION ......................................................... 2-3
      2.2.2 ARATIOF ......................................................... 2-6
   2.3 Analog Output Display ............................................ 2-7

3  Examples
   3.1 Examples of Output Characteristics ............................ 3-1
   3.2 Example of Variation of Operating Speed and Analog Output Value ............................................ 3-2

4  Filter Process
   4.1 When Parameter is Set to “0” ................................... 4-1
   4.2 When Parameter is Set to Values Other Than “0” .... 4-1
   4.3 Parameter Setting ................................................. 4-2

5  Precautions
   5.1 When Analog Output Corresponding to Speed is Interrupted ............................................. 5-1
   5.2 When More than One Manipulator is Used .......................... 5-1
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.

![Diagram of analog output function corresponding to speed]

- Speed: slow
  - Discharged amount: small

- Speed: fast
  - Discharged amount: large
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. **Output port number**
   General analog output port to execute the analog output corresponding to speed
   Setting range: 1 to 40

2. **Basic voltage**
   Voltage to be output at the speed set with the basic speed.

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

4. **Offset 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](image)

**NOTE**
When the analog output value exceeds ±14.00 V because of the operating speed, the value is limited within ±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)

- **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.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select {JOB} under the main menu</td>
</tr>
<tr>
<td>2</td>
<td>Select {JOB CONTENT}</td>
</tr>
<tr>
<td>3</td>
<td>Move the cursor to the address area</td>
</tr>
</tbody>
</table>

### 2.2.1 ARATION

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Move the cursor to one line above the place to register the ARATION instruction</td>
</tr>
<tr>
<td>2</td>
<td>Press [INFORM LIST]</td>
</tr>
<tr>
<td>3</td>
<td>Select [IN/OUT]</td>
</tr>
</tbody>
</table>

The instruction list dialog appears.
### Operation Explanation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong></td>
<td>Select “ARATION”&lt;br&gt;The ARATION instruction is indicated in the input buffer line.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Change any additional items and numerical values&lt;br&gt;&lt;Register without changes&gt;&lt;br&gt;To register without changes, perform operation of step 5.&lt;br&gt;&lt;Register with addition or change of the additional items&gt;&lt;br&gt;• To change the output port number&lt;br&gt;  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.</td>
</tr>
</tbody>
</table>

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<br>  Move the cursor to the instruction in the input buffer line, and then press [SELECT]. The detail edit display is shown. |
### 2.2 Registration of Instructions

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (Cont’d)</td>
<td>Change any additional items and numerical values</td>
</tr>
</tbody>
</table>

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].

![Selection Dialog](image.png)

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

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Press [INSERT] and [ENTER]</td>
<td>The instruction indicated in the input buffer line is registered.</td>
</tr>
</tbody>
</table>

The line where ARATION instruction is registered.

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0020</td>
<td>MOV L=138</td>
</tr>
<tr>
<td>0021</td>
<td>ARATION AO#(1) BV=10.00</td>
</tr>
<tr>
<td>0022</td>
<td>MOV L=138</td>
</tr>
</tbody>
</table>
# 2.2 Registration of Instructions

## 2.2.2 ARATIOF

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 1 Move the cursor to one line above the place to register ARATIOF instruction. | The line above the place to register ARATIOF instruction. 0030 MOV L V=138  
0031 MOV L 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. 0030 MOV L V=138  
0031 ARATIOF AO#(1)  
0032 MOV L V=138 |
2.3 Analog Output Display

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

<table>
<thead>
<tr>
<th>Operation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select (IN/OUT) from the main menu</td>
</tr>
<tr>
<td>2</td>
<td>Select (ANALOG OUTPUT)</td>
</tr>
<tr>
<td></td>
<td>The analog output window appears.</td>
</tr>
<tr>
<td></td>
<td>The output terminal numbers which follow the AOUT4 can be switched and displayed by pressing the page key.</td>
</tr>
</tbody>
</table>
3 Examples

3.1 Examples of Output Characteristics

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

MOVJ VJ=50.00
ARATION AO#(1) BV=7.00 V=150.0 OFV=-10.00 7.00
MOV L V=50.0 -4.33
MO VC V=100.0 1.33
MO VC V=100.0 1.33
MO VC V=100.0 1.33
MOV L V=200.0 12.67

Output Voltage (V)

Analog voltage (V)

Operating speed (mm/s)

Basic speed

Basic voltage

Offset voltage

0 50 100 150 200

14V

10

7

5

-5

-10
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

Note:
- 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.

![Diagram 1](image1.jpg)

### 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.

![Diagram 2](image2.jpg)
Adjust the settings of parameters during actual operations.

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Analog Output</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3C819</td>
<td>Analog output No.1</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C820</td>
<td>Analog output No.1</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C821</td>
<td>Analog output No.2</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C822</td>
<td>Analog output No.2</td>
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4.3 Parameter Setting
4.3 Parameter Setting

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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

INSTRUCTIONS

ANALOG OUTPUT FUNCTION CORRESPONDING TO SPEED

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