Motoman XRC Controller

Anticipation Output Function Manual

Part Number 143764-1

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SECTION 1

INTRODUCTION

The Anticipation Output function is used to modify the execution of the output signal before or after the step command. Output signal timing can be modified using 4 separate settings for general output signals, and 2 for general output groups. The Anticipation Output function can be used to adjust the operating time delay between the robot and peripheral device movements.

A negative (-) execution timing value processes the output signal before the step command. This is used to adjust peripheral device movement timing.

STEP	COMMAND
n-1	MOVL V=100
n	MOVL NWAIT
	ANTOUT AT#(1) ON
N+1	MOVL V=100
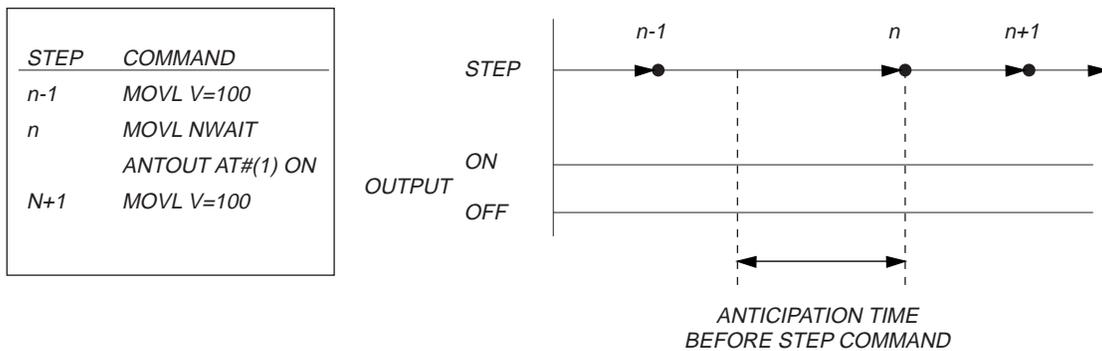
Figure 1-1   Output Processing Before Step Command

A positive (+) execution timing value processes the output signal after the step command. This is used to adjust robot movement timing.

STEP	COMMAND
n-1	MOVL V=100
n	MOVL NWAIT
	ANTOUT AT#(2) ON
N+1	MOVL V=100
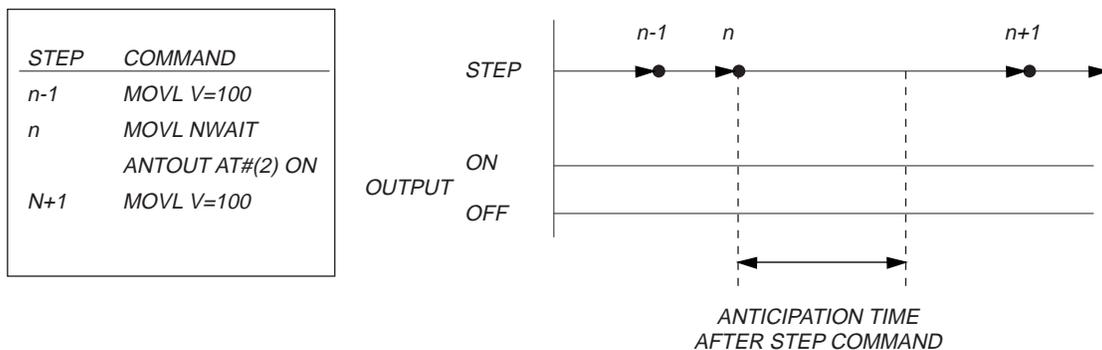
Figure 1-2   Output Processing After Step Command

1.1   *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:

- Robot Type (UP6 or SK16X)
- Application Type (welding, material handling, etc.)
- Software Version (5.101A)
- Robot Serial Number (located on the back side of the robot arm)
- Robot Sales Order Number (located on back side of XRC controller)

NOTES

SECTION 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:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
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 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).

SECTION 3
OPERATION

This section provides operating instructions for the Anticipation Output function, including; file setup and command registration in job structure. The operation of this system is programming dependent. The following operating instructions are based on one possible configuration of this system. Your system configuration and job structure may differ slightly from that presented here, however basic operation will be the same.

Any changes made to your system configuration and/or job structure will alter the operation of this cell. Motoman recommends you do not modify the original jobs and system configuration that came with your system. If modifications need to be made, they should be made to copies of these jobs and not to the originals. Modifications should only be performed by personnel who have received operator training from Motoman, and who are familiar with the operation of this Motoman system. If you have questions concerning the configuration of your system please contact the 24 hour Service Hotline, at (937) 847-3200 (see Section 1.1).

3.1 Anticipation Output File

The Anticipation Output file contains the command variables for each of the general output and general output group numbers. Output numbers, ON anticipation time values, and OFF anticipation values are set in this file. When the ANTOUT command is used in a job, the command references this file for the variable settings for that particular AT number.

3.1.1 Anticipation Output File Setup

To set up values for Anticipation Output file AT number, proceed as follows:

1. Press TEACH mode button on XRC playback panel.
2. Press TOP MENU key on programming pendant.
3. Select [INPUT/OUTPUT] from top menu screen.
4. Select [ANT. OUTPUT]. Anticipation Output screen appears.

DATA	EDIT	DISPLAY	UTILITY
ANTICIPATION OUTPUT		R1	

<SINGLE>

AT NO.	OT OUTPUT	ON TIME	OFF TIME
1	---	0.00	0.00
2	---	0.00	0.00
3	---	0.00	0.00
4	---	0.00	0.00

<GROUP>

AG NO.	OG OUTPUT	TIME
1	---	0.00
2	---	0.00

Figure 3-1   Anticipation Output Screen

5. Set values for each variable.
    a) Cursor to variable and press Select key on programming pendant.
    b) Enter value using numeric keypad and press Enter.

Table 3-1   Anticipation Output Variables

Variable	Range	Description
OT OUTPUT	1 ~ 192	General output numbers
ON TIME	-327.68 ~ 327.67 sec.	Execute time (output ON)
OFF TIME	-327.68 ~ 327.67 sec.	Execute time (output OFF)
OG OUTPUT	1 ~ 24	General output group number
TIME	-327.68 ~ 327.67 sec.	Group output execute time

3.2 Anticipation Output Function Command

3.2.1 ANTOUT Command

The ANTOUT command is placed in the job content to initiate the anticipation output function. The Anticipation Output number or group number, execution time and output pattern are all defined in Anticipation Output command line.

Below are the command variables for the ANTOUT command as they appear on the input buffer line.
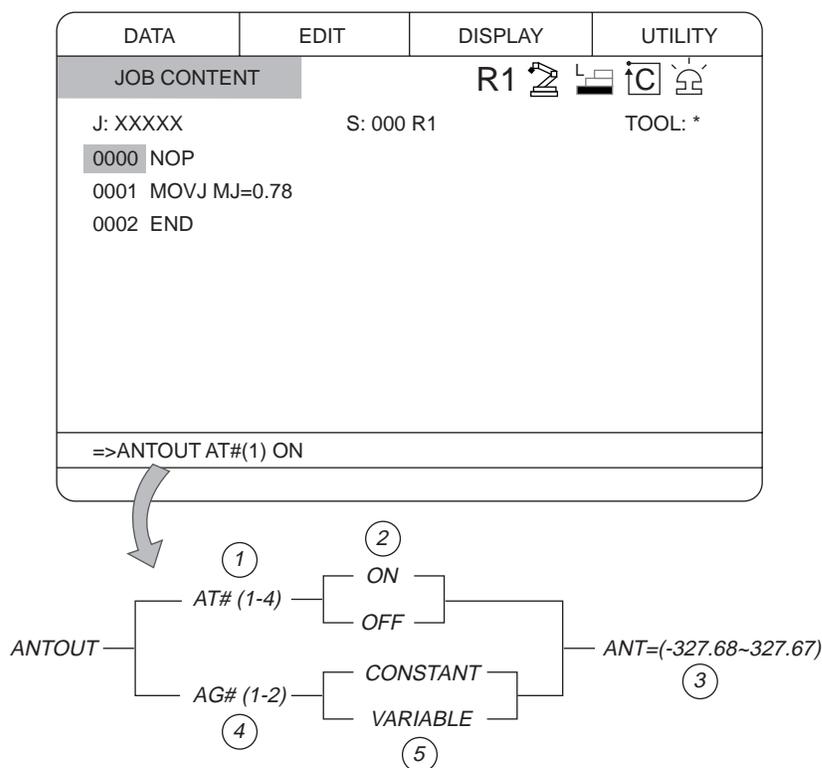
Figure 3-2   ANTOUT Command Screen

① __AT#0 (1~4)__

Selects Anticipation Output file number to be used.

② __ON/OFF__

Sets the Anticipation Output function ON/OFF.

③ __ANT= (-327.68~327.67 seconds)__

Sets the Anticipation Output executing time.

NOTE: *This setting will default to the value set in the Anticipation Output File, if not modified in the input buffer line.*

④ __AG#0 (1~2)__

Setting for Anticipation Output Group Number.

⑤ __Constant/variable__

Setting for Output pattern.

3.2.2   *Registration of the ANTOUT Command*

The ANTOUT command is inserted in the job while in Teach Mode. The cursor should be on address area not the command area. To insert the ANTOUT command into a job, proceed as follows:

1. Press TEACH mode button on XRC playback panel.
2. Press TOP MENU on programming pendant.
3. Select JOB from top menu screen.
4. Select [Job Content].
5. Move cursor to address area.
6. Move cursor to a line before desired insertion point.
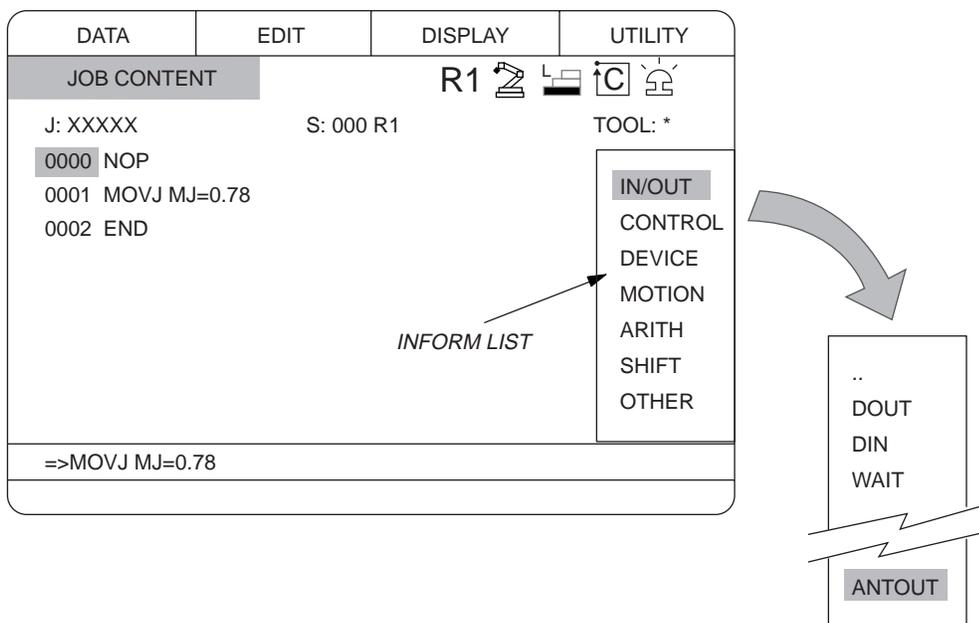7. Press INFORM LIST key. The Inform List window appears.

Figure 3-3   Inform List

8. Select [IN/OUT]. The IN/OUT command list appears.

9. Scroll down list and select [ANTOUT] command. ANTOUT command appears on input buffer line.

10. Modify optional items and numerical data on input buffer line as needed.

   To change numerical data:

   a) Move cursor on numerical data.
   b) Press Shift and cursor at the same time. Data will be increased.

   To change numerical data with numerical keypad:

   c) Move cursor on numerical data.
   d) Press Select.
   e) Input numerical value using numeric keypad on programming pendant.
   f) Press Enter key.

   To change or add an optional item:

   g) Move cursor to ANTOUT command on input buffer line.
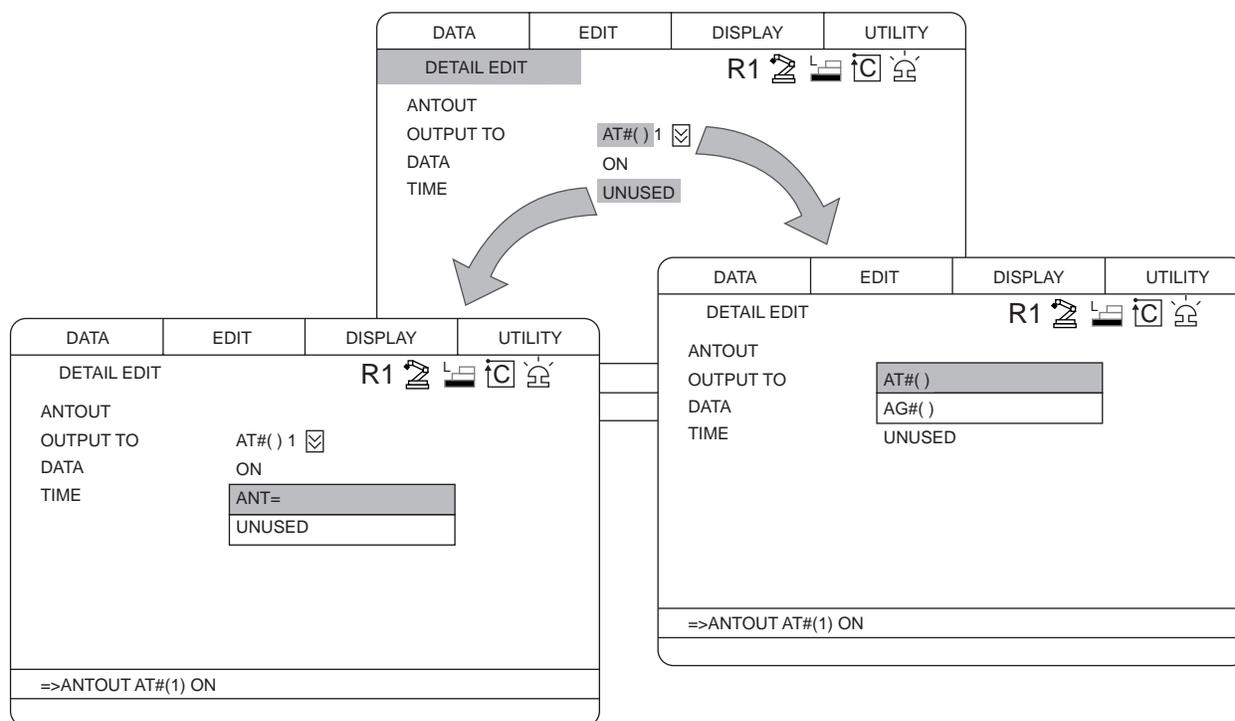   h) Press Select. Detail Edit screen appears.

Figure 3-4   Detail Edit Screen

   To change [To Output] to [AG#()]:

   a) Move cursor to [AT#()].
   b) Press Select key. The list appears on screen.
   c) Select [AG#()].

   To add anticipation execution time:

   a) Select [Unused] of [Time].
   b) Select [ANT=] from list.
   c) Press Enter key after changes have been made to return to Job Content screen.

11. Press ADD.

12. Press Enter key. All commands on input buffer line are now registered.

Table 3-2   ANTOUT Command Setting Examples

Command	Explanation
ANTOUT AT#(1) ON	Anticipation Output signal is ON using variables defined in AT1 Anticipation Output File.
ANTOUT AT#(2) ON	Anticipation Output signal is ON using variables defined in AT2 Anticipation Output File.
ANTOUT AT#(3) ON	Anticipation Output signal is ON using variables defined in AT3 Anticipation Output File.
ANTOUT AT#(4) ON	Anticipation Output signal is ON using variables defined in AT4 Anticipation Output File.
ANTOUT AT#(1) OFF	Anticipation Output signal is OFF using variables defined in AT1 Anticipation Output File.
ANTOUT AT#(2) OFF	Anticipation Output signal is OFF using variables defined in AT2 Anticipation Output File.
ANTOUT AT#(3) OFF	Anticipation Output signal is OFF using variables defined in AT3 Anticipation Output File.
ANTOUT AT#(4) OFF	Anticipation Output signal is OFF using variables defined in AT4 Anticipation Output File.
ANTOUT AG#(1) Constant	Execute pattern output with the general output group # in AG1, execute time, and constant on the command register.
ANTOUT AG#(2) Constant	Execute pattern output with the general output group # in AG2, execute time, and constant on the command register.
ANTOUT AG#(1) Variable	Execute pattern output with the general output group # in AG1, execute time, and variable on the command register.
ANTOUT AG#(2) Variable	Execute pattern output with the general output group # in AG2, execute time, and variable on the command register.
ANTOUT AT#(1) ON ANT=0.50	Anticipation Output signal is ON, executing time in [ANT=] and using variables defined in AT1 Anticipation Output File.

NOTE:
- [NWAIT] (ANTOUT Command) must be set at Step Movement Command to process before the step command.

- [NWAIT] command does not need to be used when processing after step command (positive execution time value).

- [NWAIT] will be canceled by insertion of CALL Command and JUMP Command before ANTOUT Command. [ANT=] will be ignored and the signal will be ON when the cursor is on ANTOUT command. It won't affect process after the step command.

3.2.3   *Examples of Anticipation Output Function*

The operational process of the Anticipation Output File is shown below.

STEP	COMMAND
n-1	MOVL V=100
n	MOVL NWAIT
	ANTOUT AT#(1) ON
N+1	MOVL V=100

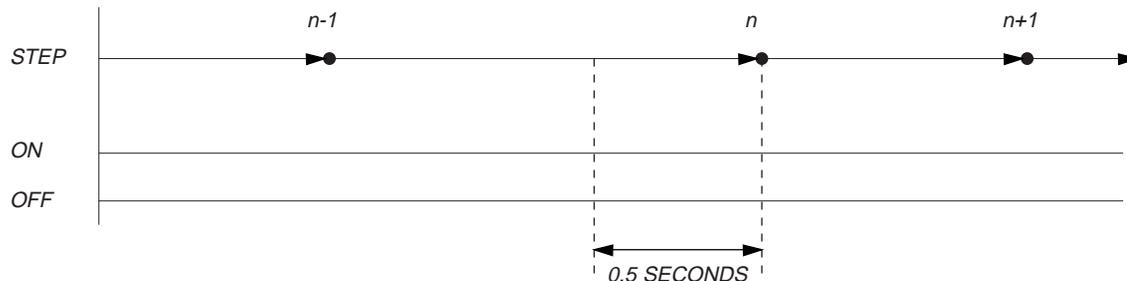***Figure 3-5   Process Before the Step Command***

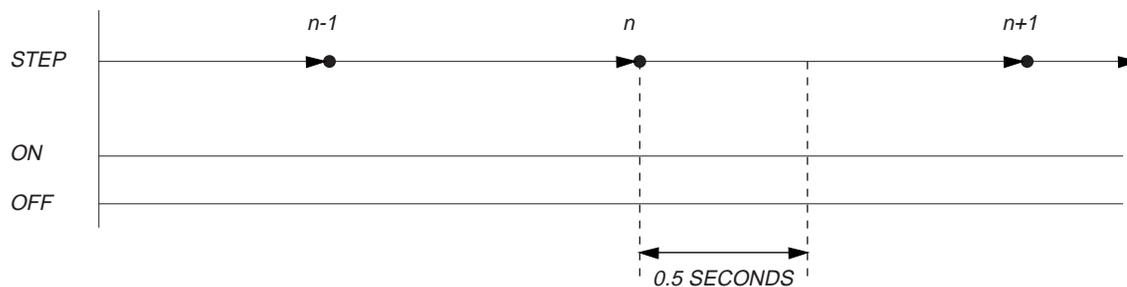| STEP	COMMAND
n-1	MOVL V=100
n	MOVL NWAIT
	ANTOUT AT#(2) ON
N+1	MOVL V=100

Figure 3-6   Process After the Step Command

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