TOSHIBA

6F8C0842

Integrated Controller V series

MENU

model 2000

2Axis positioning contoller (MC612) User's Manual

Important Information

Misuse of this equipment can result in property damage or human injury.
Because controlled system applications vary widely, you should satisfy yourself as to the acceptability of this equipment for your intended purpose.
In no event will Toshiba Corporation be responsible or liable for either indirect or consequential damage or injury that may result from the use of this equipment.

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Safety Precautions

This module MC612 is a 2-axis motion control module for Toshiba's Integrated Controller V-series model 2000.
Read this manual thoroughly before using this module. Also, keep this manual and related manuals so that you can read them anytime while this module is in operation.

Safety Symbols

The following safety symbols are used on the product and/or in the related manuals.
Pay attention to the information preceded by the following symbols for safety.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Safety Precautions

⚠ CAUTION

- Turn off power to the controller and to this module (MC612) before removing or mounting this module. Failure to do so can cause electrical shock or damage to this product.
- Read the Safety Precautions described in the controller User's Manual before using this module.
- Follow the instructions described in this manual and in the controller User's Manual when installing and wiring this module.
- This module has been designed for the Integrated Controller V-series model 2000. Use your MC612 only on the V-series model 2000 rack.
- Follow the power up and the power down sequences described below. Failure to do so may cause unexpected behavior of the controlled loads/machines.
  Power up: Controller power ON → MC612 load power ON
  Power down: MC612 load power OFF → Controller power OFF
- This module consumes maximum 770 mA of internal 5 Vdc power. Confirm that the total 5 Vdc consumed current per one power supply module is within the limit.
  If it exceeds the limit, the controller cannot operate properly and this may cause unsafe situation.

About This Manual

This manual describes the specification and the operations of Toshiba's 2-axis motion control module (MC612) for the V-series model 2000.
Read this manual carefully for your correct operation of the MC612.

The following related manuals are available for your reference.

Sequence Controller S2 User's Manual - Basic Hardware (6F8C0836)
Sequence Controller S2 User's Manual - Functions (6F8C0837)
Engineering Tool - Setup (6F8C0873)
Engineering Tool - Introduction (6F8C0874)
Engineering Tool - Basics (6F8C0875)

Note: In this manual, the model 2000 controller is simply called as S2.

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Section 1

Introduction

1. Introduction

1. Introduction

The MC612 is a direct I/O module for the S2 controller.
The MC612 can output pulse train for a servo or stepping motor driver to configure a motion control system. The MC612 has 2-axis control function. The each axis can be controlled independently, or proportionally to achieve a linear interpolation with an X-Y table.

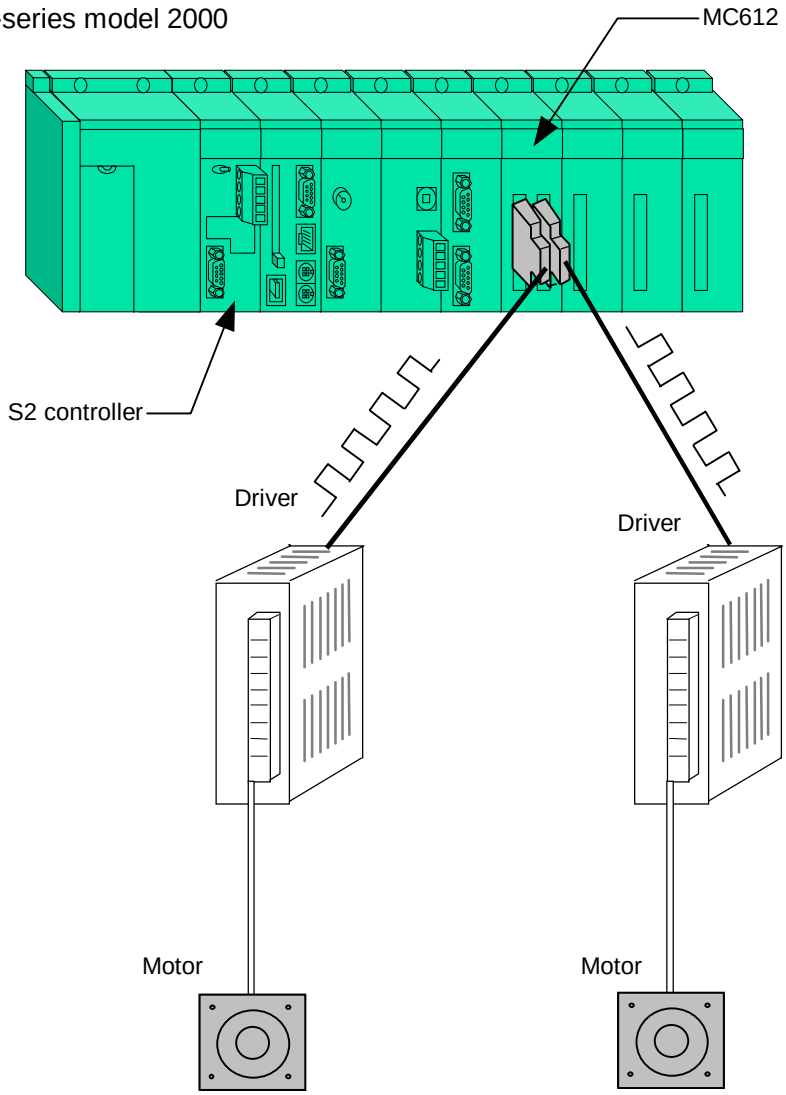
1.1 MC612 main Functions

The MC612 has the following functions.

1) The MC612 outputs pulse train to control the following motors:
   - Stepping motor driver
   - Servo motor driver with pulse train input function
2) The MC612 performs 2-axis independent control or 2-axis linear interpolation control.
3) The MC612 has the electronic gear function. By using this function, any desired command units, such as mm, inch, degree, etc., can be used.
4) The MC612 has built-in EEPROM to memorize the control parameters without need of a battery.
5) The operation speed can be changed during pulse output.
6) The following operation commands are available.
   - Jog operation
   - Zero return operation
   - Fixed feed operation
   - Direct command operation
   - Point number operation
   - Automatic stepping operation
   - Bump-less switch from Jog to positioning
   - Interrupt operation
7) The current position data can be taught as the target position of a specified point. (Teaching function)
8) The MC612 also has a function to receive the feedback pulses. It is only for monitoring purpose.
9) The current position data of output pulse and feedback pulse can be changed independently.
10) The soft-limit can be disabled. Therefore, endless repeated single-direction operation, such as running turntables, belt-conveyors, etc., can be established easily.

1.2 System Configuration

The MC612 outputs pulse train to a servo motor driver or a stepping motor driver.
The following figure shows a typical system configuration.



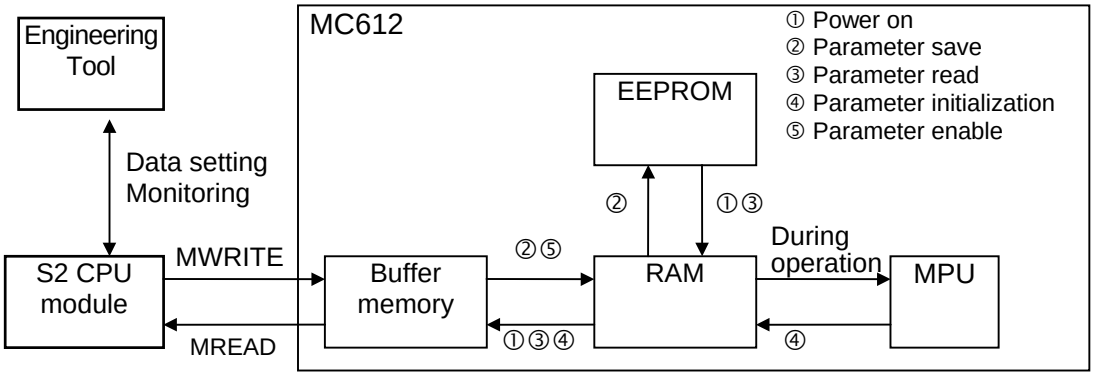
NOTE

- The MC612 cannot be mounted on the slot in which the station bus connector is provided. Therefore, the following base/slot cannot be used for the MC612. Others are usable.
  BU643D ... MC612 cannot be mounted.
  BU648E ... MC612 cannot be mounted on the slot 0 to 4.

1.3 Operation overview

• Control parameters

The MC612 stores the control parameters and position data in its built-in EEPROM and loads them into RAM at power on. Then the MC612 performs positioning operation in response to the commands given by the S2.
The control parameters can be written and monitored by the S2 (by using MWRITE and MREAD instructions).
The maximum number of writing times into EEPROM is 100,000.



• Operation modes

Operation mode	Outline of operation
Jog operation	Moves the machine according to the speed and direction designated.
Zero return operation	Searches the machine zero position.
Fixed feed operation	Outputs a selected number of pulses in the designated direction for positioning. Direction: CW or CCW Output pulses: 1, 10, 100, or 1000
Direct command operation	Moves to the target position given by the S2 at the maximum speed.
Point number operation	Refers the designated point number data (position and speed), and moves the machine according to the data.
Automatic stepping operation	Automatically proceeds the Point number operation started with the designated point number by the S2. For this operation, each point number data can have the parameter called dwell time. The dwell time specifies the time staying before starting the next point positioning. The following dwell time value has the special meaning. • H8000: Operation end • H8001: Continuously move to the next point (without stop) • H8002: Wait until the step command is issued by the S2
Interrupt operation	When the interrupt signal comes ON, immediately moves to the position specified by the point 30.

1.4 Command units

(1) Electronic gear for output pulse

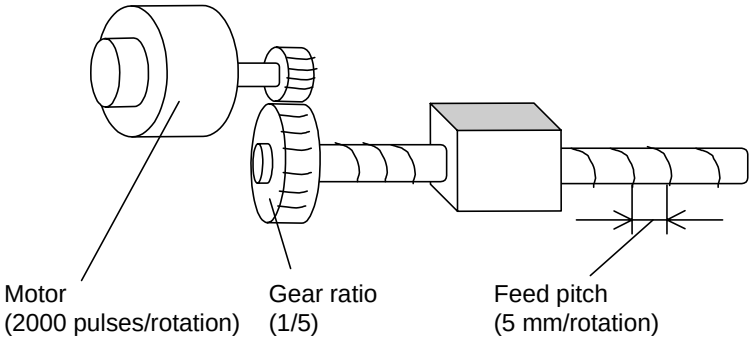
The MC612 has the electronic gear function. By using this function, any desired command units, such as mm, inch, degree, etc., can be used.

The MC612 outputs the pulses as follows.

$$\text{Output pulses} = \text{Command value} \times \frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}}$$

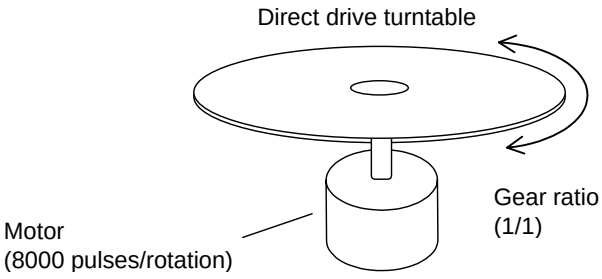
Therefore, decide the electronic gear as follows.
Electronic gear numerator = Pulses per Motor 1 rotation
Electronic gear denominator = Command value per Motor 1 rotation

Example 1)
In the following system, if you want to use the command increment as 0.01 mm, you can decide the electronic gear value as follows. By this setting, if command value is 1, the machine moves 0.01 mm.



Electronic gear numerator = 2000 [pulse/rotation]
Electronic gear denominator = 500 × 1/5 = 100 [0.01mm/rotation]

Example 2)
In the following system, if you want to use the command increment as 0.1 degree, you can decide the electronic gear value as follows. By this setting, if command value is 1, the table rotates 0.1 degree.



Electronic gear numerator = 8000 [pulse/rotation]
Electronic gear denominator = 3600 [0.1degree/rotation]

NOTE

- The least positioning resolution is 1 output pulse. Therefore the command increment must be equal or greater than 1 pulse. That is, the electronic gear must be 1 or more. In other words, the electronic gear numerator must be equal or greater than the denominator.
- When the electronic gear value is not an integer, calculation error (cut down) will occur. Therefore, in this case, positioning accuracy is ±1 pulse. However, the MC612 manages the position by pulses internally. So the calculation error is not summed.

(2) Moving speed and command units

The speed is designated in as a percentage of the maximum feed speed [pps (pulse per second)]. Thus, the moving speed by the command units is expressed as follows.

$$\text{Speed [command units/sec]} = \text{Speed [pps]} \times \frac{\text{Electronic gear denominator}}{\text{Electronic gear numerator}}$$

(3) Electronic gear for feedback pulse

The MC612 allows to input feedback pulses to monitor the current position. Since pulse input also has the electronic gear function, the amount of feedback pulses can be monitored by the command units.

$$\text{Position [command units]} = \text{Feedback pulse [pulse]} \times \frac{\text{Electronic gear denominator}}{\text{Electronic gear numerator}}$$

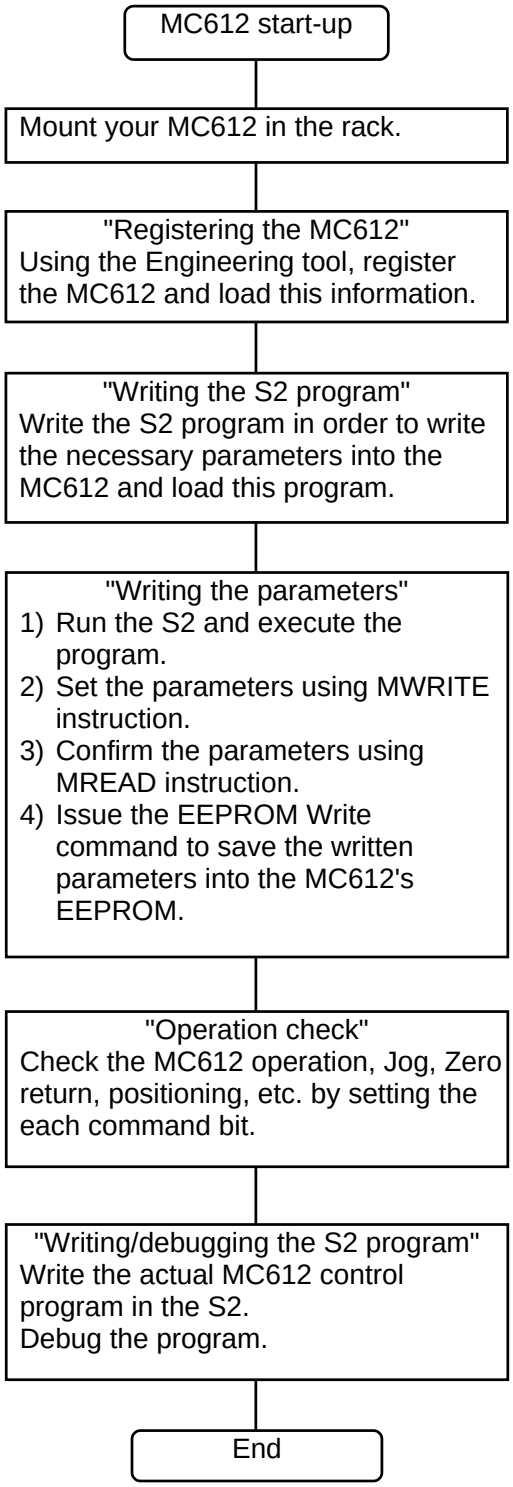
Decide the electronic gear for feedback pulse so that you can monitor the position in desired units.

NOTE

- Set the electronic gear value within the range of 1/127 to 127. If the value is out of this range, parameter mismatch error occurs.
- The electronic gear for output pulses and feedback pulses can be designated independently.
- When the electronic gear setting is changed, write it into MC612's EEPROM and cycle power off/on. Otherwise, positioning deviation will occur.

1.5 Start-up Procedure

The following flowchart shows the procedure to start up your MC612.



⚠ CAUTION

Pay special care for safety in case of the MC612 operation checking.

Section 2

Specification

2. Specifications

2. Specifications

This section describes the MC612 specifications, and explains the functions of the external signals.
The general specification for the MC612 conforms to the specification for the S2 PLC.

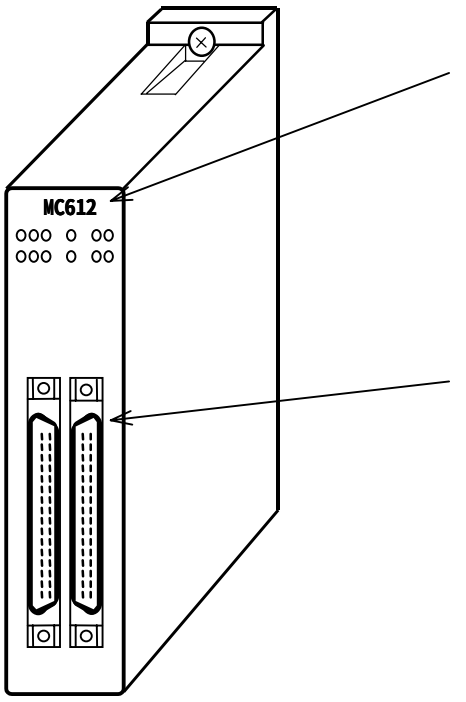
2.1 Functional specifications

Item		Specification
Number of controlled axes		2 axes (X and Y axes independent control, or X and Y axes linear interpolation control)
Command units		Pulse, mm, inch, or others
Command value range		±9,999,999 command units
Command data capacity		30 points for each axis
Maximum pulse output speed		200 kpps
Acceleration/Deceleration system		Automatic trapezoidal/triangular acceleration/deceleration
Acceleration/Deceleration time		0 to 32.76 sec
Backlash compensation		0 to 1000 pulses
Zero offset range		±9,999,999 command units
Dwell time		0 to 100.00 sec
I/O allocation type		X+Y 4 W (4 registers = 64 points occupied)
Parameter data save		EEPROM (life of writing times: approx. 100,000)
Current consumption	Internal 5 Vdc	Typ. 700 mA (maximum 770 mA)
	External 24 Vdc	200 mA or less

2.2 I/O Specifications

Item			Specification	
External input	Limit switch input, etc.	Type of signal	Limit switch input	Servo interface input
		Input voltage	12/24 Vdc	24 Vdc
		Input current	Typ. 10 mA (at 24 Vdc)	
		ON/OFF voltage	ON voltage: 9.6 V minimum OFF voltage: 3.2 V maximum	
		ON/OFF delay	5 ms or less	
	Feedback pulse input/ Z-phase input	Input voltage	5 Vdc	
		Input current	Typ. 16 mA	
		ON/OFF voltage	ON voltage: 4.0 V minimum OFF voltage: 1.2 V maximum	
		ON/OFF delay	1 μs or less	
External output	Pulse output	Output mode	CW/CCW pulses or PLS+DIR (pulse/direction)	
		Output method	Open collector (5 to 24 Vdc, max. 50 mA) or Differential output (RS485 equivalent, max. 30 mA)	
		ON/OFF delay	2 μs or less	
		ON duty	40 to 60% (at 30 kpps)	
	Others	Output system	Open collector (5 to 24 Vdc, max. 50 mA)	
		ON/OFF delay	2 ms or less	

2.3 External features



Status LEDs:

X
R P I Z O E
● ● ● ● ● ● ⟵ For X axis
● ● ● ● ● ● ⟵ For Y axis
R P I Z O E
Y

External I/O connectors:
(40-pin x 2)

Connector type
PCB side: FCN-365P040-AU-2
Cable side: FCN-361J040-AU (connector body)
FCN-360C040-E (connector cover)
Cable side connectors (soldering type) are standard accessories.

Status LEDs

Axis	LED	Color	LED name	Operation status
X-axis	R	Red	X-axis Run	Lit: Normal operation AND Servo ON Blink: Error has occurred
	P	Red	X-axis Pulse output	Lit: Pulses being output
	I	Red	X-axis In-position	Lit: Positioning completed
	Z	Red	X-axis Zero LS	Lit: Zero limit switch ON
	O	Red	X-axis Over-travel LS	Lit: Over-travel limit switch ON
	E	Red	X-axis Emergency stop	Lit: Emergency stop input ON
Y-axis	R	Red	Y-axis Run	Lit: Normal operation AND Servo ON Blink: Error has occurred
	P	Red	Y-axis Pulse output	Lit: Pulses being output
	I	Red	Y-axis In-position	Lit: Positioning completed
	Z	Red	Y-axis Zero LS	Lit: Zero limit switch ON
	O	Red	Y-axis Over-travel LS	Lit: Over-travel limit switch ON
	E	Red	Y-axis Emergency stop	Lit: Emergency stop input ON

Other status
- During resetting … All LEDs unlit
- During initialization … All LEDs lit
- Hardware error has occurred … All LEDs blink

2.4 Functions of external signals

The external signals of the MC612 have the following functions:

• Pulse output

1) CW/PLS output (open collector and differential output)
   Outputs CW direction pulses or feed pulses (PLS).
   The pulse output mode, CW or PLS, can be selected by the parameter.
   The maximum output frequency is 200 kpps.

2) CCW/DIR output (open collector output and differential output)
   Outputs CCW direction pulses or direction (DIR).
   The pulse output mode, CCW or DIR, can be selected by the parameter.
   The maximum output frequency is 200 kpps.
   The direction (DIR) output comes OFF for the CW direction, and ON for the CCW direction.

• Feedback pulse input (monitoring purpose only)

3) CW pulse/phase-A pulse input (5 Vdc)
   Inputs the CW direction pulses or phase-A pulses for monitoring.
   The pulse input mode, CW or phase-A, can be selected by the parameter.
   The maximum input frequency for CW pulses is 200 kpps.
   The maximum input frequency for the phase-A (quadrature pulses) is 100 kpps (400 k count/sec).
   5 Vdc open collector output or differential output can be is connected. When 12 or 24 Vdc open collector output device is connected, connect a resistor externally to adjust the voltage.

4) CCW pulse/phase-B pulse input (5 Vdc)
   Inputs the CCW direction pulses or phase-B pulses for monitoring.
   The pulse input mode, CCW or phase-B, can be selected by the parameter.
   The maximum input frequency for the CCW pulses is 200 kpps.
   The maximum input frequency for the phase-B (quadrature pulses) is 100 kpps (400 k count/sec).
   5 Vdc open collector output or differential output can be is connected. When 12 or 24 Vdc open collector output device is connected, connect a resistor externally to adjust the voltage.

• Phase-Z input (optional)

5) Phase-Z input (5 Vdc)
   Inputs phase-Z signal for Zero return operation.
   5 Vdc open collector output or differential output can be connected. When 12 or 24 Vdc open collector output device is connected, connect a resistor externally to adjust the voltage.

NOTE

If other than 5 Vdc is used for the feedback pulse input or phase-Z input, externally connect a resistor. For selecting the resistor, refer to section 3.5.

• Servo driver interface output (optional)

6) Servo ON (S-ON) signal output (open collector output)
This output can be controlled by S2 program by setting the corresponding bit in the operation parameter. When this output is ON, the LED "R" is lit.
This signal is used to output the "Servo ON" signal to the connected servo driver.

7) Reset (RST) output (open collector output)
This output can be controlled by S2 program by setting the corresponding bit in the operation parameter.
This signal is used to output the "Reset" signal to the connected servo driver.

8) Error counter clear (CLR) pulse output (open collector output)
This signal is used to output the "Error counter clear" signal to the connected servo driver.
This signal is enabled when the phase-Z use is selected, and turns ON for approx. 50 ms at the following cases.
- When Zero return operation is completed (before zero offset movement)
- When the external emergency stop input comes ON
- When the over-travel limit switch input comes ON
- When the emergency stop command is set to ON by S2 program
- When the corresponding bit in the operation parameter is set to ON by S2 program (in this case, this output remains ON until the bit is reset to OFF)

9) CCW feed enable (REV) output (open collector output)
This output can be controlled by S2 program by setting the corresponding bit in the operation parameter.
This signal is used to output the "CCW enable" signal to the connected servo driver.

10) CW feed enable (FWD) output (open collector output)
This output can be controlled by S2 program by setting the corresponding bit in the operation parameter.
This signal is used to output the "CW enable" signal to the connected servo driver.

• Servo driver interface input (monitoring purpose only)

11) Servo ready (RDY) input (24 Vdc)
The servo driver's "Ready" signal is connected here.
The signal status can be monitored by S2 program by reading the corresponding operation parameter.

12) In-position (INP) input (24 Vdc)
The servo driver's "In-position" signal is connected here.
The signal status can be monitored by S2 program by reading the corresponding operation parameter.
This signal status is not always matches with the positioning complete flag managed in MC612 (bit-14 of %IW register).

NOTE

Do not use the servo driver interface signals for other purposes.

- **Machine sensor input**

13) Zero limit switch (Z-LS) input (12/24 Vdc)
The machine zero position signal is connected here. (Normally open)
This signal is used for Zero return operation.

14) CW over-travel limit switch (CW-LS) input (12/24 Vdc)
The CW side over-travel limit signal is connected here. (Normally closed)
When this input is opened while the CW direction pulses are being output, the pulse output is immediately stopped.

15) CCW over-travel limit switch (CCW-LS) input (12/24 Vdc)
The CCW side over-travel limit signal is connected here. (Normally closed)
When this input is opened while the CCW direction pulses are being output, the pulse output is immediately stopped.

16) External emergency stop (EMS) input (12/24 Vdc)
The emergency stop signal is connected here. (Normally closed)
When this input is opened, the pulse output is immediately stopped.

17) Jog to position switch (J/P) input (12/24 Vdc)
When this input comes ON during Jog operation, the MC612 immediately starts positioning without speed bump. The positioning value is specified by the operation parameter in incremental value.

18) Interrupt (INT) input (12/24 Vdc)
When this signal switches ON, the MC612 stops pulse output (deceleration stop) and performs the Point number operation using the parameter of point 30.
In the linear interpolation mode, the interrupt input of Y-axis side is not valid.

Section 3

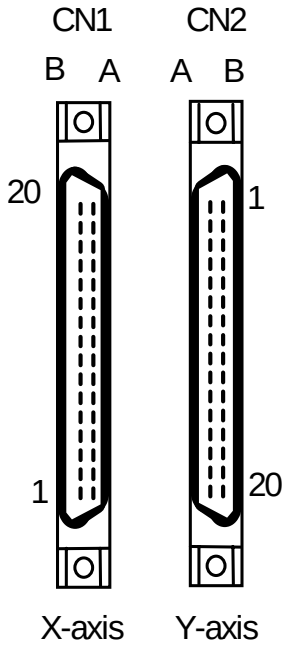
Wiring

3. Wiring

3.1 External signal connectors

The MC612 has two connectors for external signal connections. One is for X-axis and the other is for Y-axis. The pin assignment of the connector is as follows.

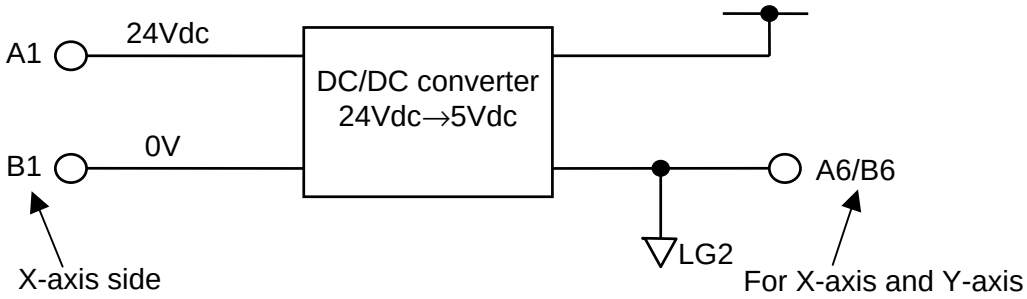
- Connectors



Row A	Pin No.	Row B
CCW over-travel LS input	20	CW over-travel LS input
Zero LS input	19	Emergency stop input
Interrupt input	18	Jog/position switch input
NC	17	Sensor input common (+/-)
NC	16	NC
Servo ready input	15	Servo in-position input
Servo input common (24 Vdc)	14	Servo output common, (0V)
Servo CCW enable output	13	Servo CW enable output
Servo ON signal output	12	Servo reset output
Servo error counter clear output	11	NC
NC	10	NC
Pulse input CW/phase-A (+)	9	Pulse input CW/phase-A (-)
Pulse input CCW/phase-B (+)	8	Pulse input CCW/phase-B (-)
Pulse input phase-Z (+)	7	Pulse input phase-Z (-)
Pulse input/output ground (LG2)	6	Pulse input/output ground (LG2)
Pulse output (Tr.) CW/PLS	5	Pulse output (Tr.) CW/PLS (0V)
Pulse output (Tr.) CCW/DIR	4	Pulse output (Tr.) CCW/DIR (0V)
Pulse output (RS485) CW/PLS (+)	3	Pulse output (RS485) CW/PLS (-)
Pulse output (RS485) CCW/DIR (+)	2	Pulse output (RS485) CCW/DIR (-)
External power input 24Vdc *1	1	External power input 0V *1

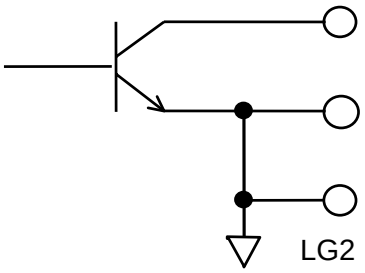
NC: No connection. Do not connect any signal.
*1: A1/B1 pins are X-axis side only. These pins of Y-axis connector are NC.

The pin assignment except A1/B1 is the same between X-axis and Y-axis.

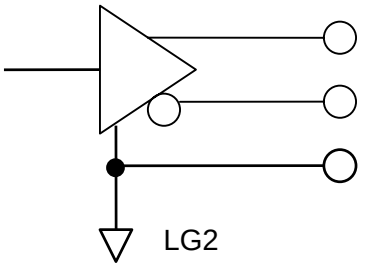


3.2 Output circuits

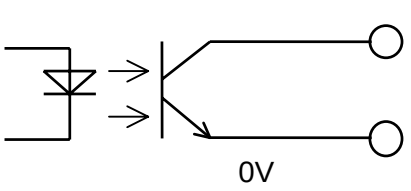
1) Pulse (transistor) output



2) Pulse differential (RS485) output

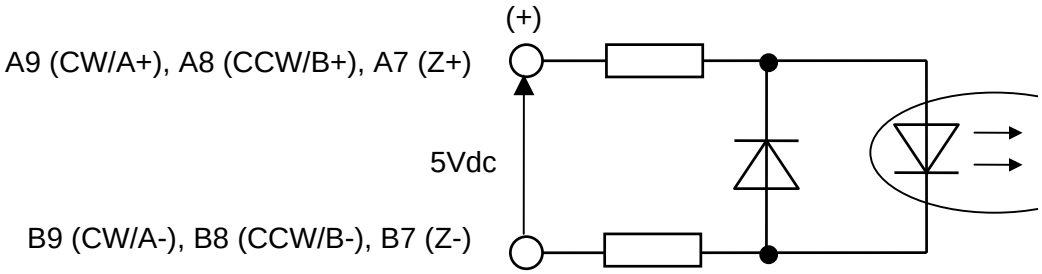


3) Servo interface output

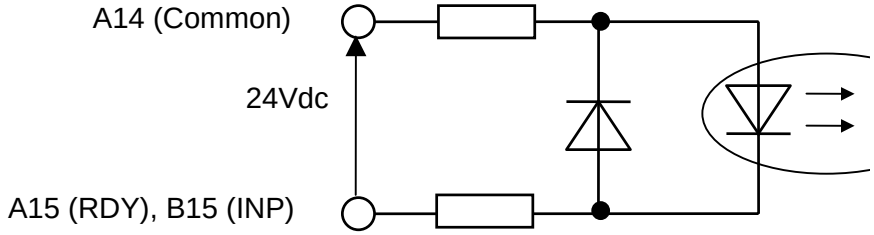


3.3 Input circuits

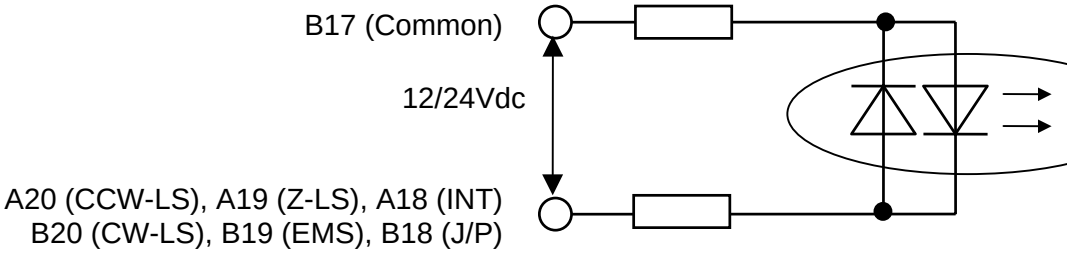
1) Feedback pulse input



2) Servo interface input

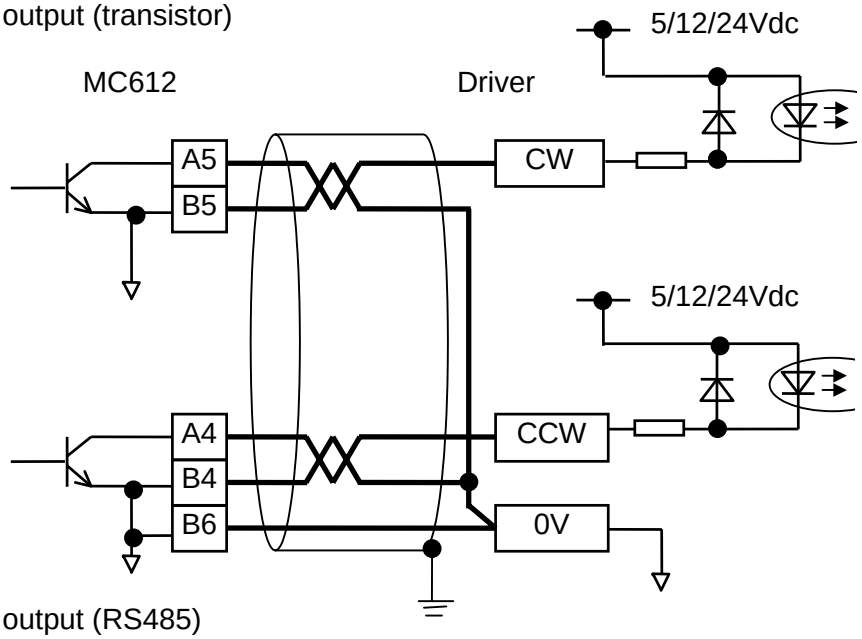


3) Machine sensor input

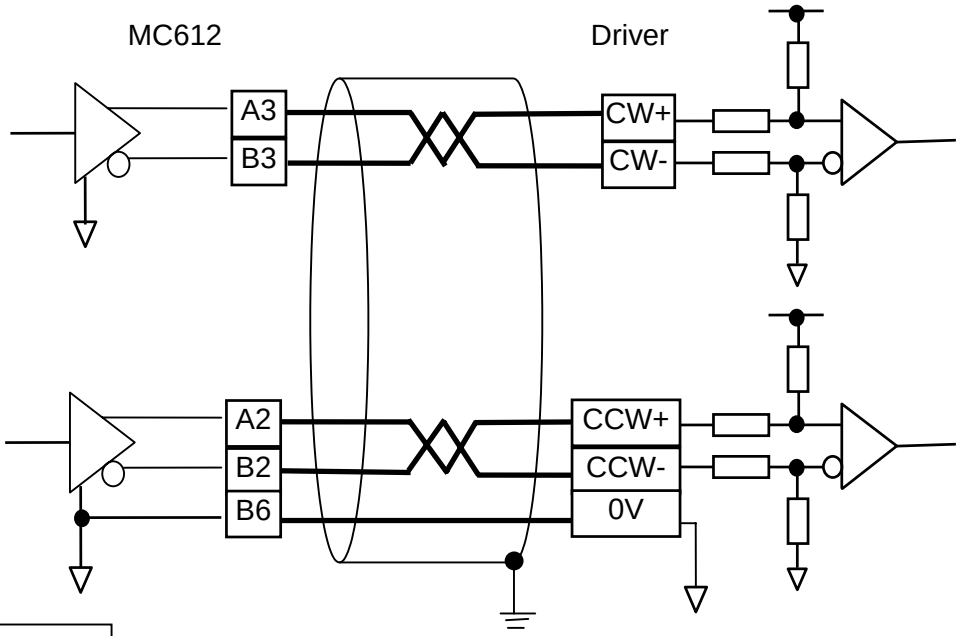


3.4 Pulse output wiring

1) Pulse output (transistor)



2) Pulse output (RS485)

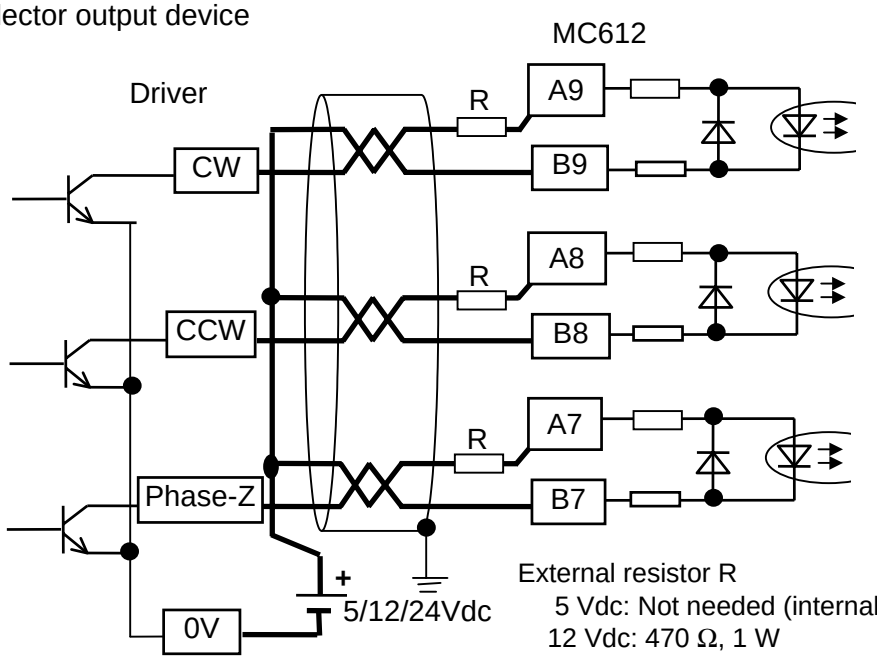


NOTE

- A shielded twisted-pair cable at least 0.2 mm^2 is recommended for pulse output signal.
- The cable length must be 3 m or less and must be separated from other input/output wires and power cables.
- Connect the cable shield to a good grounding point.

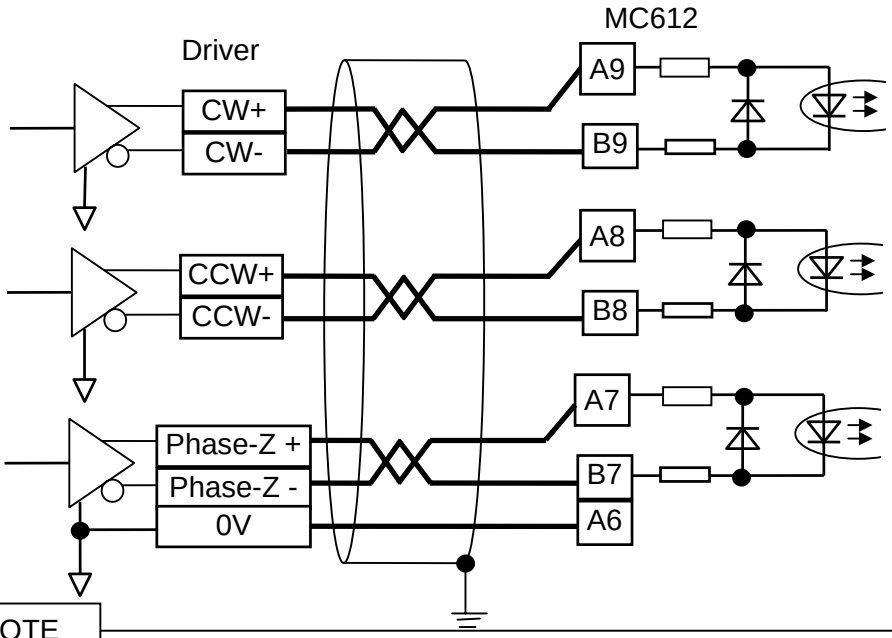
3.5 Feedback pulse Input wiring

1) Open collector output device



External resistor R
5 Vdc: Not needed (internal: 200 Ω)
12 Vdc: 470 Ω, 1 W
24 Vdc: 1.5 kΩ, 1W

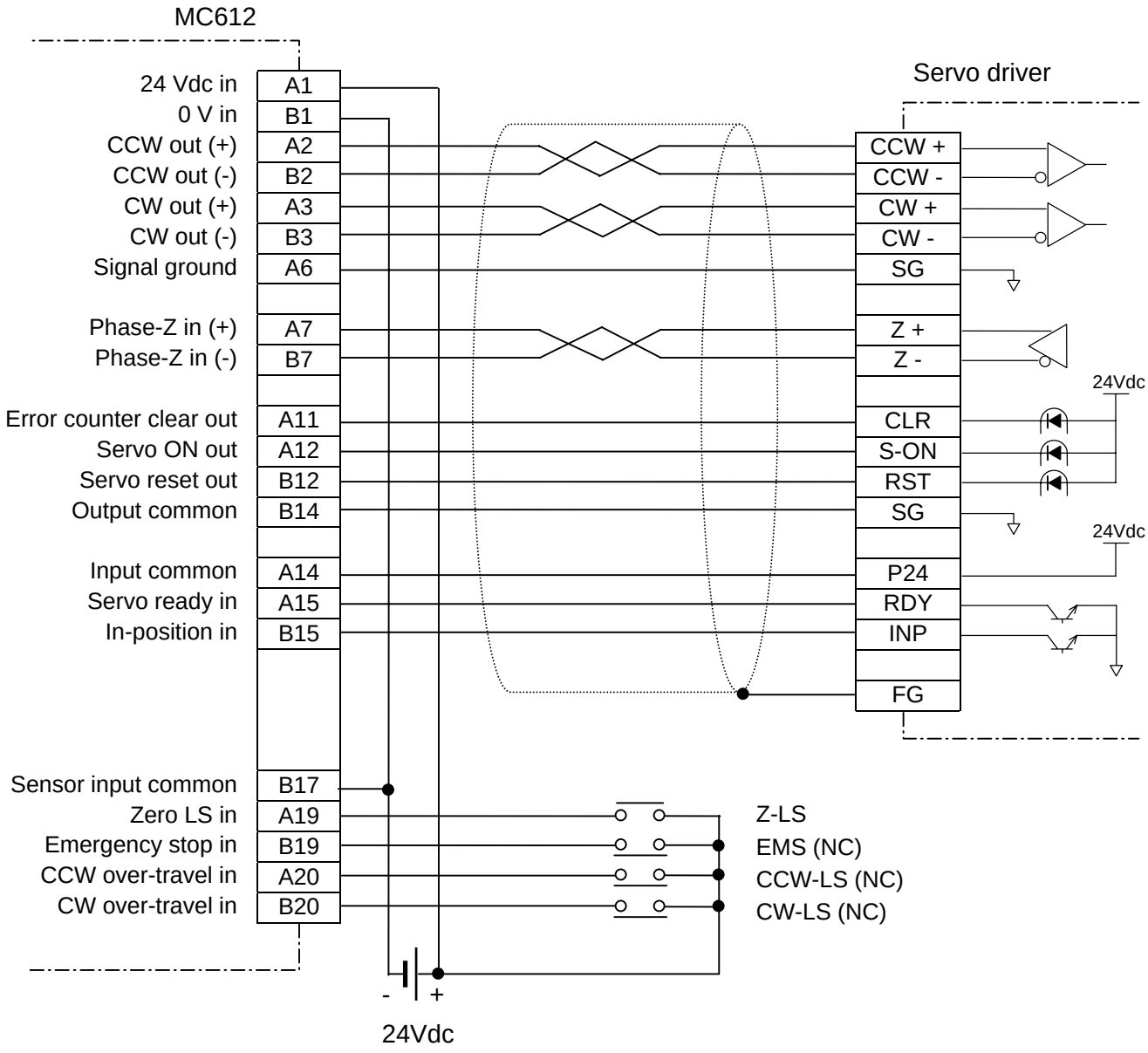
2) Differential output (RS422/RS485) device



NOTE

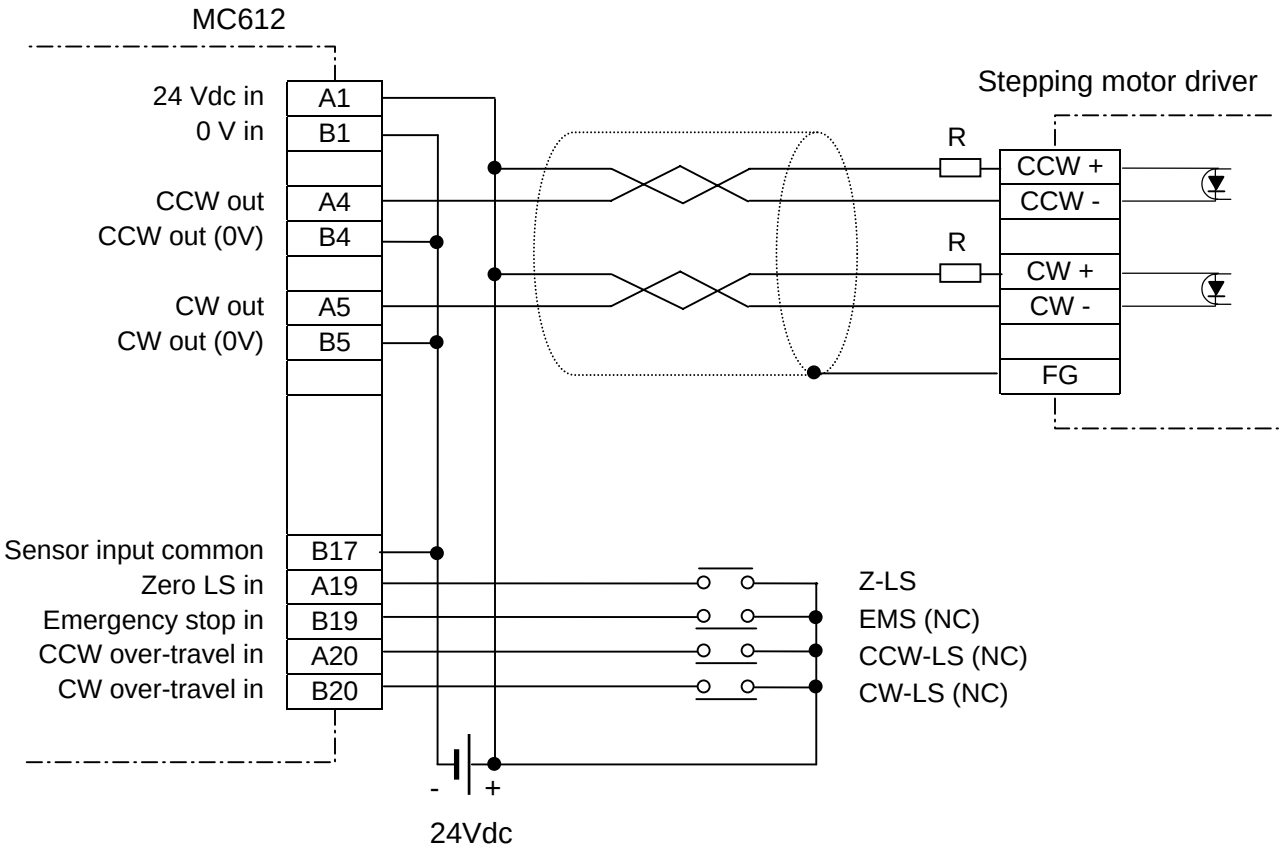
- A shielded twisted-pair cable at least 0.2 mm^2 is recommended for pulse input signal.
- The cable length must be 3 m or less and must be separated from other input/output wires and power cables.
- Connect the cable shield to a good grounding point.

3.6 Typical connection with a servo driver



The above connection is an example. Available signals and the type of interface are different depend on the servo driver used.
The above example uses differential (RS422/RS485) interface for the pulse output and phase-Z input. Feedback pulse input is not used.

3.7 Typical connection with a stepping motor driver

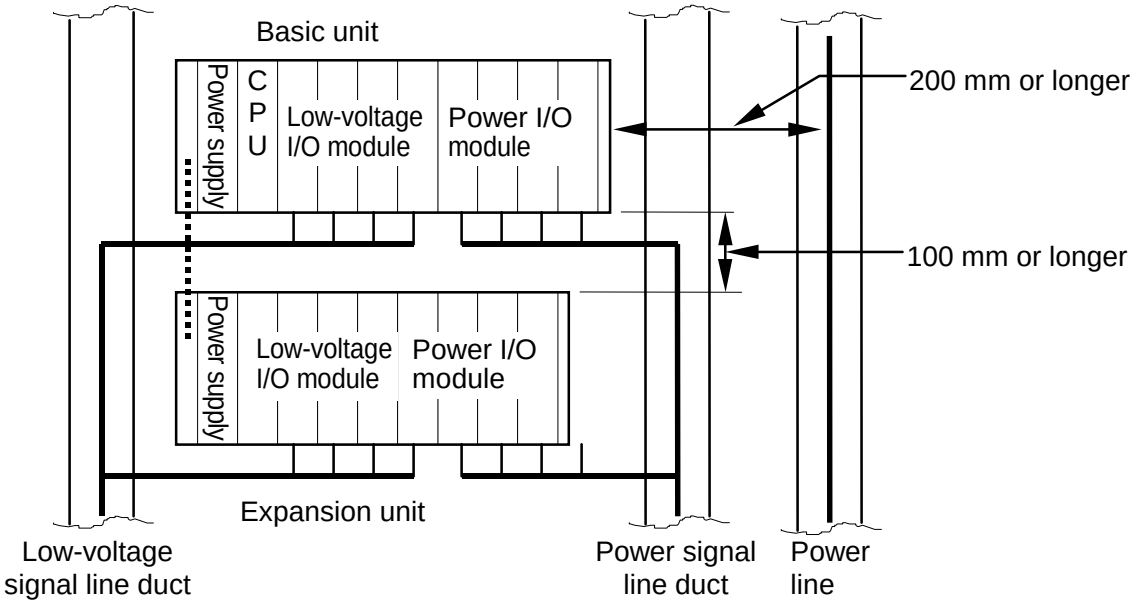


The above connection is an example. Available signals and the type of interface are different depend on the stepping motor driver used.
The external resistor R should be selected according to the driver's input circuit. Consult with the driver maker. Typically 1.5 kΩ - 1W.

3.8 Wiring precautions

Keep the following points in mind when mounting I/O modules in the PLC to wire signal lines.

1) Locate the low-voltage I/O modules (including MC612) at the left side and the power I/O modules at the right side. Also, separate the low-voltage signal lines and the power lines.
2) Keep a distance of 100 mm or more around the each PLC unit for ventilation and maintenance.
3) Separate the PLC unit from power cables and power equipment at least 200 mm. Or shield them with metal plate, etc. The shield metal plate should be connected to the enclosure ground bus.
4) Do not put together low-voltage signal lines and power lines in the same duct.
5) Separate the pulse I/O signal cables from other cables.



Low-voltage I/O modules
DC input module
Analog input module
Analog output module
Pulse input module
Motion control module
Communication module
Network module

Power I/O modules
AC input module
DC output module
AC output module
Relay output module

Section 4

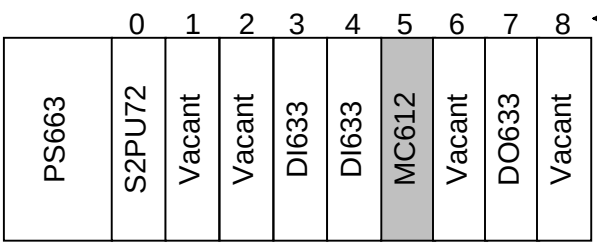
I/O Allocation

4. I/O Allocation

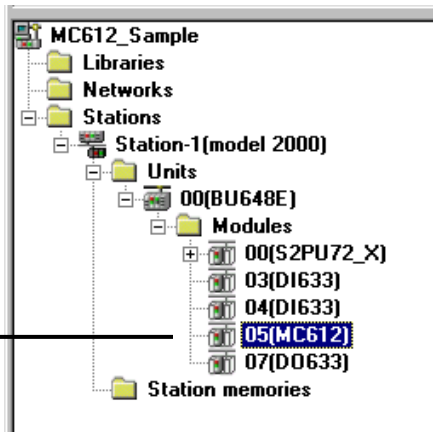
4.1 Allocation to the S2 data memory

The MC612 occupies the four consecutive IQ register of the S2. These are two input registers %IW (lower addresses) and two output registers %QW (higher addresses).
In this manual, these assigned IQ registers are expressed as %IW(n), %IW(n+1), %QW(n+2), and %QW(n+3).
Each bit in the %IW register is designated as %IX(register number).(bit position), and each bit in the %QW register is designated as %QX(register number).(bit position). For example, bit 10 of %IW20 is designated as %IX20.10.

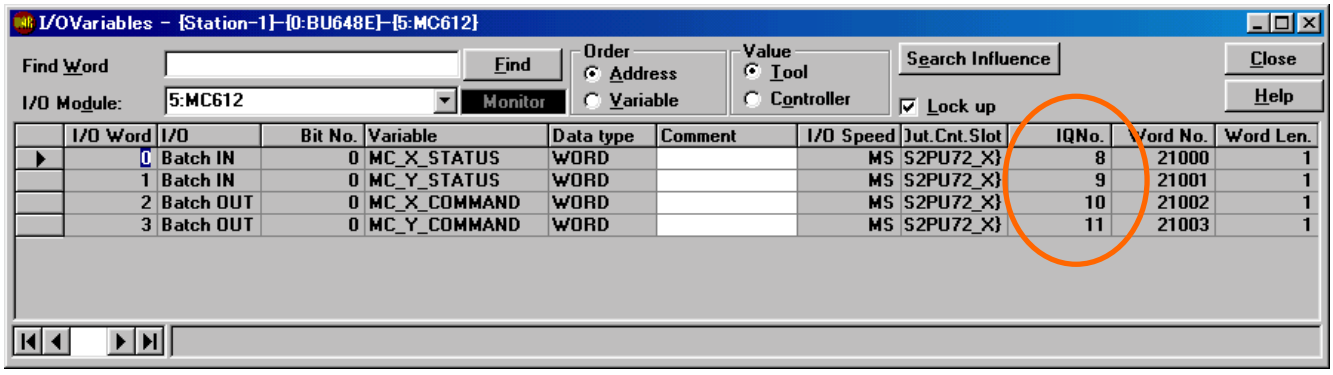
The following figure shows an example of I/O registration screen of the V-series Engineering tool. In this case, the MC612 is mounted in the slot 5 of the base unit BU648E.



Engineering Tool - Product tree screen



I/O Variables screen



In the above example, the MC612 is registered on the unit-0 (BU648E), slot-5.
And four IQ registers, %IW8, %IW9, %QW10, and %QW11 are assigned to the MC612.

4.2 Functions of the assigned data

The functions of the assigned registers are as follows.

%IW(n) ..... Status flags for X-axis
%IW(n+1) .... Status flags for Y-axis
%QW(n+2) .... Command for X-axis
%QW(n+3) .... Command for Y-axis

Each bit in the registers has the following functions.

2-axis independent control mode:

Bit	%IW(n)	%IW(n+1)	%QW(n+2)	%QW(n+3)
	X-axis status	Y-axis status	X-axis command	Y-axis command
15	Command ready	Command ready	Emergency stop	Emergency stop
14	Positioning complete	Positioning complete	Deceleration stop	Deceleration stop
13	Zero return complete	Zero return complete	Jog / Change speed	Jog / Change speed
12	During pulse output	During pulse output	Start	Start
11	Speed reach	Speed reach	Step/Skip command	Step/Skip command
10	Change speed ack	Change speed ack	Operation mode	Operation mode
9	Step/skip acknowledge	Step/skip acknowledge		
8	Error flag	Error flag		
7	Operating point number, Operating mode, or Error code	Operating point number, Operating mode, or Error code	CW/CCW or ABS/INC	CW/CCW or ABS/INC
6			Command auxiliary data	Command auxiliary data
5				
4				
3				
2				
1				
0				

2-axis liner interpolation control mode:

Bit	%IW(n)	%IW(n+1)	%QW(n+2)	%QW(n+3)
	X-axis status	Y-axis status	X-axis command	Y-axis command
15	Command ready	Command ready	Emergency stop	Emergency stop (Jog)
14	Positioning complete	Positioning complete	Deceleration stop	Deceleration stop (Jog)
13	Zero return complete	Zero return complete	Jog / Change speed	Jog
12	During pulse output	During pulse output	Start	Start (Zero, Teaching)
11	Speed reach	Speed reach	Step/Skip command	-
10	Change speed ack	-	Operation mode	Operation mode (Zero return, Teaching)
9	Step/skip acknowledge	-		
8	Error flag	Error flag		
7	Operating point number, Operating mode, or Error code	Operating point number, Operating mode, or Error code	CW/CCW or ABS/INC	CW/CCW (Jog, Fixed fd)
6			Command auxiliary data	Command auxiliary data (For Jog, Fixed feed, Teaching operations)
5				
4				
3				
2				
1				
0				

The status of each bit is shown below.

Status register:

Register	Bit	Status	
%IW(n) and %IW(n+1) Status MC→S2	15	Command ready	1 = Command acceptable 0 = During command processing or during initialization
	14	Positioning complete	1 = Positioning completed 0 = Positioning not completed (including emergency stop or deceleration stop command)
	13	Zero return complete	1 = Zero return normal complete status 0 = Other than above
	12	During pulse output	1 = During pulse output 0 = No pulse output
	11	Speed reach	1 = During operation at designated speed 0 = Other than above
	10	Change speed acknowledge	1 = Change speed request has been accepted 0 = Other than above
	9	Step/Skip acknowledge	1 = Step/Skip request has been accepted 0 = Other than above
	8	Error flag	1 = Error mode 0 = Normal
	7 : 0	During Point number operation	Operating point number (1 to 30)
		During Automatic stepping operation	Operating point number (1 to 30)
		During other operations	H80: Jog operation H81: Zero return operation H82: Fixed feed operation H83: Direct command operation H84: Interrupt operation H85: Jog/Position switch operation
		In case of error occurred	Error code

Command register:

Register	Bit	Status	
%QW(n+2) and %QW(n+3) Command S2→MC	15	Emergency stop	1 = Emergency stop request 0 = Normal
	14	Deceleration stop	1 = Deceleration stop request 0 = Normal
	13	Jog / Change speed	1 = Jog feed 1 = Change speed command (during positioning operation)
	12	Start	1 = Positioning operation start
	11	Step/Skip command (valid in automatic stepping operation)	1 = Step command (at positioning complete = 1) 1 = Skip command (during pulse output = 1)
	10 : 8	Operation mode	0 = Auxiliary command (error clear, parameter save, etc.) 1 = Zero return 2 = Fixed feed operation 3 = Direct command operation 4 = Point number operation 5 = Automatic stepping operation 6 = Teaching 7 = Current position changing
	7	For Jog operation (for bit-D)	1 = CCW 0 = CW
		For Fixed feed operation (for bit-C)	1 = CCW 0 = CW
		For other positioning operation (for bit-C)	1 = Incremental (INC) command 0 = Absolute (ABS) command
	6 : 0	Command auxiliary data	Auxiliary command ..... Type of command (0 to 5) Jog / Change speed ..... Speed (0 to 127) Fixed feed operation ..... Feed pulse amount (0 to 3) Point number operation ..... Point number (0 to 30) Automatic stepping operation ..... Point number (0 to 30) Teaching function ..... Point number (0 to 30) Position data preset ..... Preset object (1, 2, or 3)

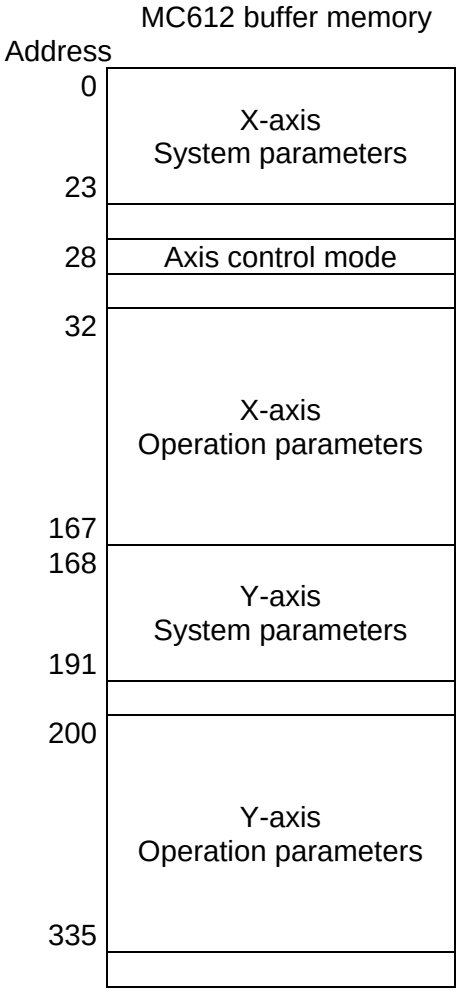
Note) For details of the bit control for each operation, refer to section 6 and the following sections.

Section 5

Parameters

5. Parameters

The MC612 has the control parameters in its memory. The S2 can access these parameters through the MC612's buffer memory by using MREAD and MWRITE instructions.
The figure below shows the overall memory map of the MC612 buffer memory.



Axis control mode:
Selection either independent control mode or liner interpolation control mode.

System parameters:
Control parameters that are used commonly for each operation mode, such as pulse output mode, electronic gear, acceleration/deceleration rate, etc.

Operation parameters:
Current position for monitoring, point number data (position, speed, dwell time), external input status, external output, etc.

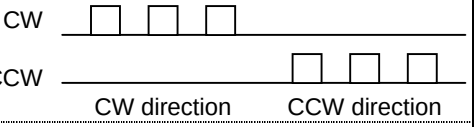
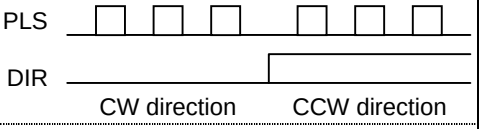
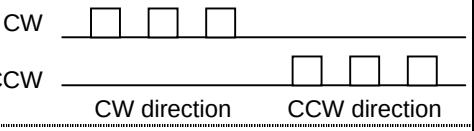
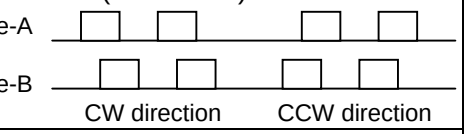
5.1 System parameters

Listed below are the system parameters (including the axis control mode) and the buffer memory addresses of the MC612.

<Axis control mode>

Parameter	Address	Setting range	Description
Axis control mode	28	0: Independent 1: Linear interpolation	Selects the control mode either 2-axis independent or 2-axis linear interpolation control mode.

<System parameters>

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
Pulse output mode	0	168	Bit-0: Output pulse	0 = CW/CCW mode  1 = PLS/DIR (Pulse + Direction) mode 
			Bit-1: Feedback input pulse	0 = CW/CCW mode  1 = Quadrature (Phase-A/B) mode 
Backlash compensation	1	169	0 to 1000 (pulse)	Sets the number of pulses for compensating the mechanical gear backlash.
Zero return operation mode	2	170	Bit-0: Zero LS	0 = Zero LS is used 1 = Over-travel LS is used (no zero LS)
			Bit-1: Phase-Z pulse	0 = Phase-Z is used 1 = Phase-Z is not used
			Bit-2: Error counter clear output	0 = Normal mode (50 ms) 1 = Toei servo mode
Zero return operation direction	3	171	Bit-0: Search direction (Zero LS ON direction)	0 = CW 1 = CCW
			Bit-1: Creep direction (Zero LS OFF direction)	0 = CW 1 = CCW

5. Parameters

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
Electronic gear numerator (for output pulse)	4	172	1 to 10000 (pulse/rotation)	Sets the number of pulses per one motor rotation.
Electronic gear denominator (for output pulse)	5	173	1 to 10000 (command units/ rotation)	Sets an amount of movement (command units) per one motor rotation.
Electronic gear numerator (for feedback pulse)	6	174	1 to 10000 (pulse/rotation)	Sets the number of pulses per one motor rotation.
Electronic gear denominator (for feedback pulse)	7	175	1 to 10000 (command units/ rotation)	Sets an amount of movement (command units) per one motor rotation.
Acceleration rate	8	176	0 to 32767 (ms)	Sets the time needed to accelerate from the minimum speed to the maximum speed.
Deceleration rate	9	177	0 to 32767 (ms)	Sets the time needed to decelerate from the maximum speed to the minimum speed.
Maximum speed	10 11	178 179	20 to 200,000(pps)	Designates the maximum operating speed, which must be larger than any other speed parameters. This is the reference value for speed commands.
Minimum speed	12 13	180 181	20 to 200,000(pps)	Designates the minimum operating speed. This speed is also used for creep speed for the zero return operation.
Zero return speed	14 15	182 183	20 to 200,000(pps)	Designates the speed to search the zero LS for the zero return operation. This speed is also used for zero offset movement.
Coordinate origin value	16 17	184 185	-9999999 to 9999999 (command units)	Sets the origin position (coordinate) of the zero return completion position.
Zero offset	18 19	186 187	-9999999 to 9999999 (command units)	Distance of movement to shift from the machine zero to the coordinate origin.
CW Soft Limit (Plus)	20 21	188 189	-9999999 to 9999999 (command units)	Designates the position of the movement limit on CW (plus) side.
			HFFFFFFFF (-1)	Soft limit function is disabled if CCW soft-limit is also -1.
CCW Soft Limit (Minus)	22 23	190 191	-9999999 to 9999999 (command units)	Designates the position of the movement limit on CCW (minus) side.
			HFFFFFFFF (-1)	Soft limit function is disabled if CW soft-limit is also -1.

NOTE

(1) For the parameters of double-length (32-bit) data, the lower address stores the lower 16-bit, and the higher address stores the higher 16-bit data.
For example, if the X-axis maximum speed is 200,000 (H00030D40), it is stored as follows.

Address	11				10			
Data (HEX)	0	0	0	3	0	D	4	0

(2) The current position data based on the output pulse is increased when outputting CW pulse, and decreased when outputting CCW pulse. The maximum pulse output rate is 200 kpps.

(3) The current position data based on the feedback pulse input is increased when inputting CW pulse, and decreased when inputting CCW pulse.
When CW/CCW pulse mode is selected, the maximum input pulse rate is 200 kpps.
When quadrature bi-pulse mode (phase-A/B) is selected, the maximum input pulse rate is 100 kpps. However in this case, both rising and falling edges of phase-A and B pulses are counted. As the result, the maximum counting speed is 400 k count/sec.

(4) The axis control mode parameter written in the buffer memory is enabled at each time the command in issued.
All other system parameters written in the buffer memory become valid when the parameter enable command is issued.

(5) When the pulse mode and/or electronic gear parameters are changed, positioning deviation or erroneous current position data changing may occur, due to the internal calculation.
Therefore, when you change these parameters, write the parameters into the EEPROM and reset the power, or execute the zero return operation, or execute the current position data preset before starting the positioning operation.

(6) When the backlash compensation parameter is set (other than 0), the specified number of pulses is output before starting the positioning in the case of operating direction is changed. The pulse rate of the backlash compensation is the specified maximum speed with the specified acceleration/deceleration.
Right after power on (for the first time operation), the MC612 executes backlash compensation in the CCW direction but not in the CW direction.

<For the first time operation>

CW direction: No backlash compensation
CCW direction: Backlash compensation

5. Parameters

5.2 Operation parameters

Listed below are the operation parameters and the buffer memory addresses of the MC612.

<Operation parameters>

Name	Address X-axis	Address Y-axis	Setting range (unit)	Description
Current position (pulse output)	32 33	200 201	-9999999 to 9999999 (command units)	Current position based on the output pulse. (for monitoring)
Current position (feedback pulse)	34 35	202 203	-9999999 to 9999999 (command units)	Current position based on the feedback pulse input. (for monitoring)
Operating point number (for monitoring)	36	204	1 to 30	Operating point number (for point number operation and automatic stepping operation)
			H0080	Jog operation
			H0081	Zero return operation
			H0082	Fixed feed operation
			H0083	Direct command operation
			H0084	Interrupt operation
			H0085	Jog/position switch operation
Error code (for monitoring)	37	205	0	No error
			1 to 255	Error code (refer to appendix A.2)
External input status (monitor)	38	206	Monitors ON/OFF status of the external inputs.	bit-0: Servo ready input bit-1: Servo in-position input bit-4: Jog/position switch input bit-5: Interrupt input bit-8: Zero LS input bit-12: CW over-travel LS input bit-13: CCW overt-ravel LS input bit-15: External emergency stop input
External output setting	39	207	Sets ON/OFF status of external outputs.	bit-0: Servo ON output bit-2: Servo CW feed enabled output bit-3: Servo CCW feed enabled output bit-14: Servo error counter clear pulse output bit-15: Servo reset output
Current position preset data (for pulse output)	40 41	208 209	-9999999 to 9999999 (command units)	Sets the preset value for current position. This is for position based on pulse output.
Current position preset data (for feedback pulse)	42 43	210 211	-9999999 to 9999999 (command units)	Sets the preset value for current position. This is for position based on feedback pulse input.
Direct command position	44 45	212 213	-9999999 to 9999999 (command units)	Designates the target position for the direct command operation.
Jog/position switch command value	46 47	214 215	0 to 9999999 (command units)	Incremental position value for jog/position switch operation.

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
Point 1 Position	48 49	216 217	-9999999 to 9999999 (command units)	Point 1 target position
Point 1 Speed	50	218	0 to 32767 (0.1 %)	Point 1 target speed
Point 1 Dwell time	51	219	0 to 10000 (0.01 s)	Point 1 dwell time
			H8000	Block end
			H8001	Non-stop
			H8002	Stop until step command
Point 2 Position	52 53	220 221	-9999999 to 9999999 (command units)	Point 2 target position
Point 2 Speed	54	222	0 to 32767 (0.1 %)	Point 2 target speed
Point 2 Dwell time	55	223	0 to 10000 (0.01 s)	Point 2 dwell time
			H8000	Block end
			H8001	Non-stop
			H8002	Stop until step command
Point 3 Position	56 57	224 225	-9999999 to 9999999 (command units)	Point 3 target position
Point 3 Speed	58	226	0 to 32767 (0.1 %)	Point 3 target speed
Point 3 Dwell time	59	227	0 to 10000 (0.01 s)	Point 3 dwell time
			H8000	Block end
			H8001	Non-stop
			H8002	Stop until step command
:	:	:	:	:
Point 29 Position	160 161	328 329	-9999999 to 9999999 (command units)	Point 29 target position
Point 29 Speed	162	330	0 to 32767 (0.1 %)	Point 29 target speed
Point 29 Dwell time	163	331	0 to 10000 (0.01 s)	Point 29 dwell time
			H8000	Block end
			H8001	Non-stop
			H8002	Stop until step command
Point 30 Position	164 165	332 333	-9999999 to 9999999 (command units)	Point 30 target position
Point 30 Speed	166	334	0 to 32767 (0.1 %)	Point 30 target speed
Point 30 Dwell time	167	335	0 to 10000 (0.01 s)	Point 30 dwell time
			H8000	Block end
			H8001	Non-stop
			H8002	Stop until step command

NOTE

(1) For the parameters of double-length (32-bit) data, the lower address stores the lower 16-bit, and the higher address stores the higher 16-bit data.
For example, if the X-axis current position is 200,000 (H00030D40), it is stored as follows.

Address	33				32			
Data (HEX)	0	0	0	3	0	D	4	0

(2) The following operation parameters are automatically updated at a fixed cycle.
- Current position data (pulse output/feedback pulse input)
- Operating point number
- Error code
- External input status

(3) The following operation parameter is automatically output at a fixed cycle.
- External output setting

(4) The following operation parameters become valid at relevant command reception.
- Current position preset data (pulse output/feedback pulse input)
- Direct command value
- Jog/position switch command position

(5) Other operation parameters become valid when the parameter enable command is issued.

5.3 Sample programs for parameter setting

This section describes how to write the parameters into the MC612.
The MC612's parameters can be accessed by the S2's user program (MREAD or MWRITE instruction).

To write the parameters, write them from the S2 to the MC612's buffer memory using MWRITE instruction. Then execute the parameter enable command. Refer to section 17.6 for the parameter enable command.

To read the parameters, read them from the MC612's buffer memory and store into the S2's memory using MREAD instruction.

The parameters can also be stored in the MC612's EEPROM. The EEPROM contents are restored at power on. Therefore, once necessary parameters are stored in the EEPROM, there is no need to write parameters at every time the S2 is started. Refer to section 17.3 for the EEPROM write operation.

NOTE

Any operation to the MC612, including the parameter reading/writing, must be executed after the MC612 initialization is finished. When the initialization is finished, the command ready flag (bit-15 of %IW(n) and %IW(n+1)) comes ON.

The followings are the program examples to read/write the parameters. In these examples, it is assumed that the MC612 is mounted on the main unit (0) slot number 5, and it is allocated to %IW0 to %QW3.

• Writing X-axis system parameters

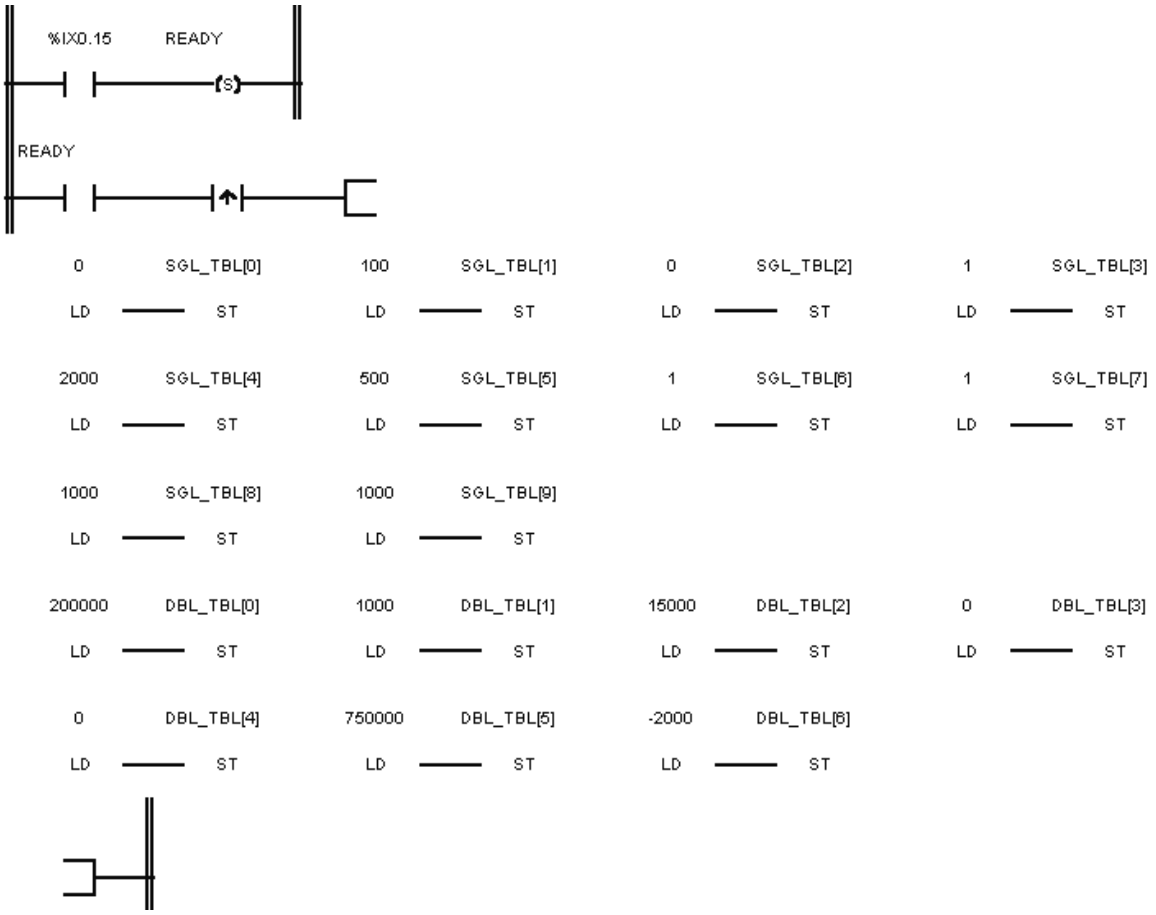
The data used in this example are as follows.

Array table	Data	
SGL_TBL[0]	0	Pulse output mode: CW/CCW
SGL_TBL[1]	100	Backlash compensation: 100 pulses
SGL_TBL[2]	0	Zero return operation mode: Zero LS and Phase-Z used
SGL_TBL[3]	1	Zero return operation direction: Search=CCW, Creep=CW
SGL_TBL[4]	2000	Electric gear numerator (for output pulse)
SGL_TBL[5]	500	Electric gear denominator (for output pulse)
SGL_TBL[6]	1	Electric gear numerator (for feedback pulse)
SGL_TBL[7]	1	Electric gear denominator (for feedback pulse)
SGL_TBL[8]	1000	Acceleration rate: 1 second
SGL_TBL[9]	1000	Deceleration rate: 1 second
DBL_TBL[0]	200000	Maximum speed: 200 kpps
DBL_TBL[1]	1000	Minimum speed: 1 kpps
DBL_TBL[2]	15000	Zero return speed: 15 kpps
DBL_TBL[3]	0	Coordinate origin value
DBL_TBL[4]	0	Zero offset
DBL_TBL[5]	750000	CW soft-limit
DBL_TBL[6]	-2000	CCW soft-limit

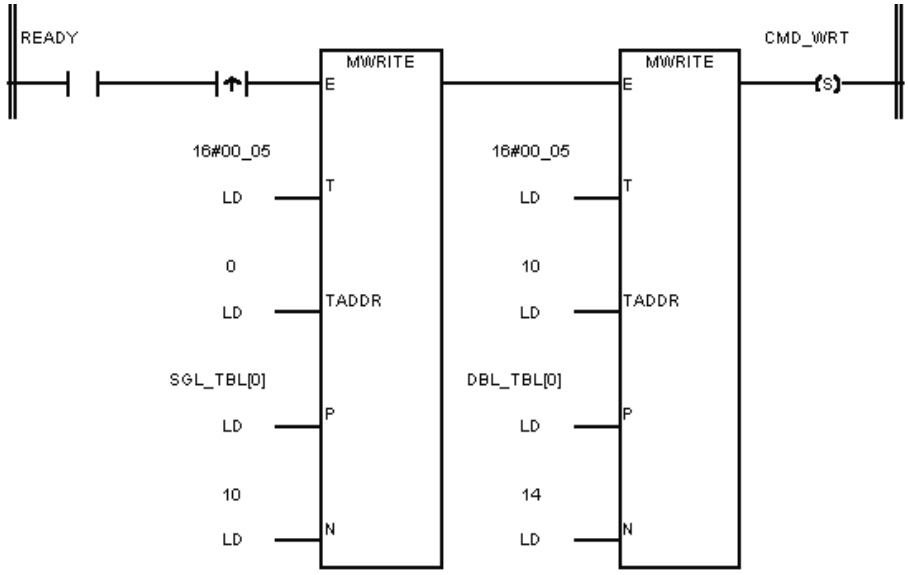
5. Parameters

Variables declaration:

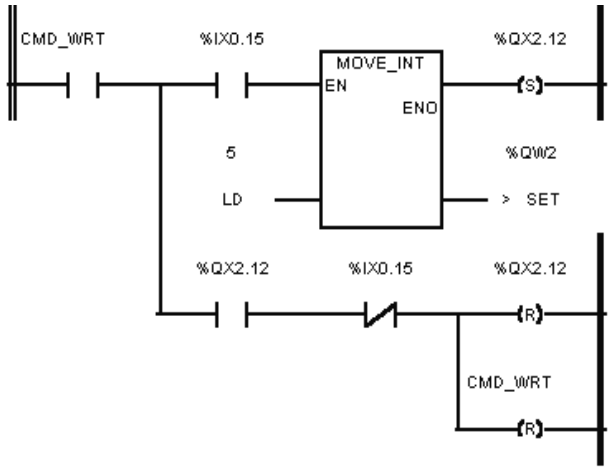
```
VAR
        SGL_TBL   :ARRAY[0..99] OF INT     (* for single-word parameters *)
        DBL_TBL   :ARRAY[0..99] OF DINT    (* for double-word parameters *)
        READY     :BOOL                    (* comes on when MC612 is ready *)
        CMD_WRT   :BOOL                    (* used to issue command to MC612 *)
END_VAR
```



This part is to prepare the MC612 parameters to be written.
When the MC612 initialization is finished (%IX0.15 changes ON), READY is set to ON.
When READY changes to ON, the parameters described in the previous page is set to the data table SGL_TBL[0] to [9] for the single-word parameters and DBL_TBL[0] to [6] for the double-word parameters.



This part is to write the parameters into the MC612's buffer memory.
When READY changes to ON, the 10 words data prepared in SGL_TBL[0] to [9] are written into the buffer memory address 0 and after, and 24 words data prepared in DBL_TBL[0] to [6] are written into the buffer memory address 10 and after. Then CMD_WRT is set to ON.
Note that the data 16#00_05 indicates the MC612 by unit-slot number which is mounted on unit 0 - slot 5.



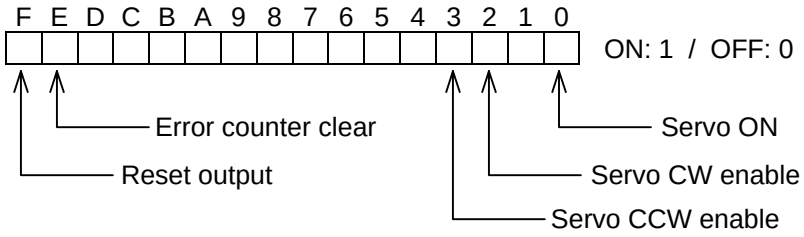
This part is for executing the parameter enable command.
When CMD_WRT comes ON, the parameter enable command (command number 5) is executed.
When the command is accepted (%IX0.15 changes OFF), %QX2.12 and CMD_RWT are reset to OFF.

• Writing X-axis external output setting

The MC612's external output (servo interface output signals) can be controlled by writing the data into the buffer memory. (Address 39 for X-axis and 207 for Y-axis)

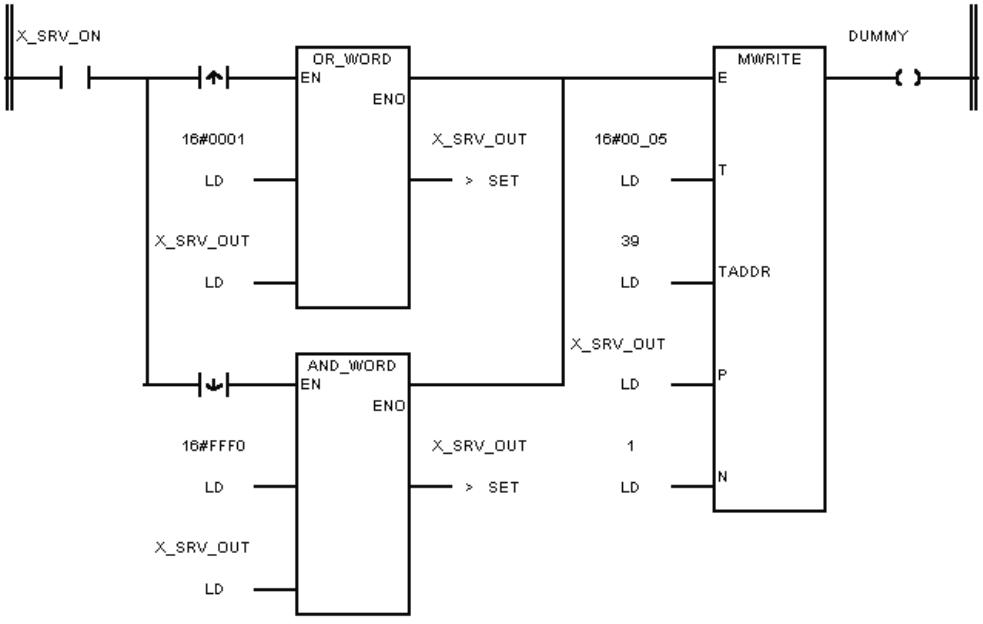
The following example is to control the servo ON signal. In this example, RW010 is used to control the servo interface output signals.

The servo interface output:



Variables declaration:

```
VAR
        X_SRV_ON    :BOOL       (* X-axis servo ON condition *)
        X_SRV_OUT   :WORD       (* X-axis servo interface output *)
        DUMMY       :BOOL
END_VAR
```

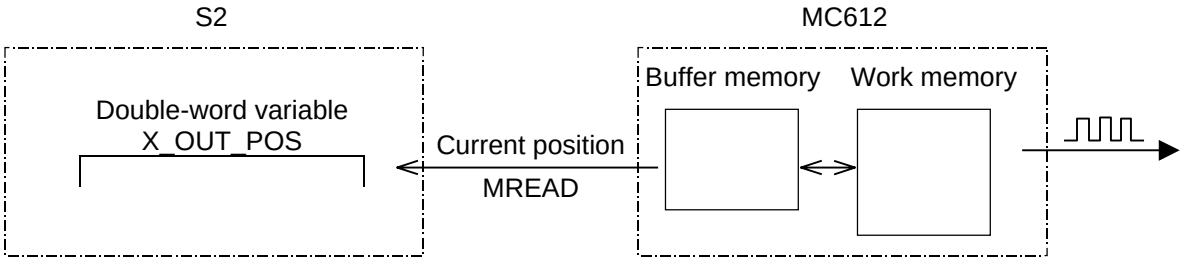


When the servo ON condition X_SRV_ON is changed, the bit-0 of X_SRV_OUT is set/reset fulfilled, R0100 is set to ON. And the X_SRV_OUT data is written into the MC612's buffer memory address 39.

• Reading the current position

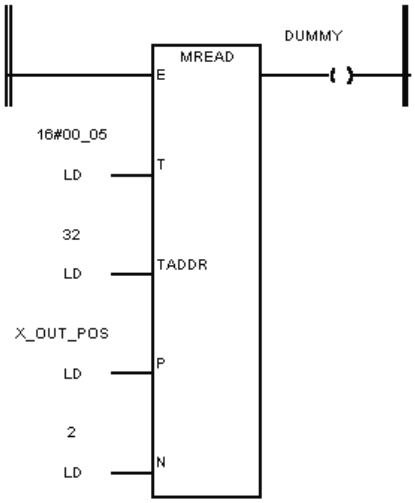
The MC612's current position data can be read from the buffer memory by using the MREAD instruction. The buffer memory address for the current position (for pulse output) is 33·32 for X-axis and 201·200 for Y-axis.

The program below is an example to read the X-axis current position (for pulse output) and store it to a double-word variable named X_OUT_POS.



Variables declaration:

```
VAR
        X_OUT_POS   :DINT       (* X-axis current position *)
        DUMMY       :BOOL
END_VAR
```



Reads the current position data from the MC612 buffer memory address 32 and 33, and stores it into a double-word (DINT) variable X_OUT_POS.

Section 6

Operation Summary

6. Operation Summary

6.1 Operation summary

The command to the MC612 is performed by combination of the relevant operation parameters and the command bit control of the output registers (command registers) assigned to the MC612.

The followings are the summary of the MC612 operation modes.
In the following explanation, bit-N means the bit position N in the command register (%QW) assigned to the MC612.

Jog operation:
During bit-13 is ON, the MC612 outputs pulses at the speed specified by bit-6 to bit-0. The speed is given as percentage (1% increments) against the maximum speed (system parameter). The direction (CW or CCW) can be controlled by bit-7 of the command register.
The speed can be changed during the jog operation.

Zero return operation:
The zero return is the operation to detect the Machine zero position and set the Coordinate origin (electrical origin). When bit-12 is set to ON while bit-8 is ON, the zero return operation is started. The zero return operation proceeds as follows.
(1) Moves to the search direction at the zero return speed until the zero LS turns ON.
(2) Stops then moves to the creep direction at the minimum speed until the zero LS turns OFF.
(3) Stops at the zero LS turns OFF if phase-Z is not used,
or stops at the first phase-Z comes ON after the zero LS turns OFF if phase-Z is used.
(4) Moves by the zero offset amount (if any) at the zero return speed, then sets the coordinate origin value to the current position.
The operation speed and the moving direction are specified by the system parameters.

Direct command operation:
This operation is used to specify the target position (absolute or incremental) by the S2 program each time.
To start this operation, write the target position in the operation parameter, and set bit-12, bit-9, and bit-8 to ON. Then the positioning operation is started at the maximum speed. The target position data handling (absolute or incremental) is determined by bit-7.

Point number operation:
This operation is used for positioning based on the pre-stored point data (target position and speed) in the operation parameters.
To start this operation, set bit-12 and bit-10 to ON with setting the point number in bit-6 to bit-0. The target position data handling (absolute or incremental) is determined by bit-7.

Automatic stepping operation:
This is a variation of the point number operation. The positioning proceeds automatically based on the pre-stored two or more consecutive point data. The time interval until starting the next point operation is determined by the dwell time stored in the point data (operation parameter). If the dwell time value s H8000, it is determined as the final point.
To start this operation, set bit-12, bit-10 and bit-8 to ON with setting the starting point number in bit-6 to bit-0. The target position data handling (absolute or incremental) is determined by bit-7.
In the automatic stepping operation, the skip command and the step command are available.

Switching from jog to positioning:
When the external jog/position switch input comes ON during the jog operation, the MC612 outputs specified amount of pulses (jog/position switch command value in the operation parameter) and stops. This function is used for positioning originated by an external sensor signal.

Interrupt operation:
When the external interrupt input signal comes ON, the MC612 forcibly starts positioning based on the point number 30. If the signal comes ON during moving, the operation is interrupted (deceleration stop) then moves to the point number 30. If the signal comes ON while stopping, moving to the point number 30 is started immediately.

Fixed feed operation:
This operation is used to output the fixed amount of pulses. The feed amount can be selected from 1, 10, 100, and 1000 (command units).
To start this operation, set bit-12 and bit-9 to ON with setting the feed amount in bit-6 to bit-0. (Feed amount designation: 0 = 1, 1 = 10, 2 = 100, 3 = 1000)
The direction (CW or CCW) can be controlled by bit-7.

In addition to the above operation, the following functions are available.

Current position preset function:
This function is used to change the current position data to desired value. Either one or both the current position data, the pulse output position and the feedback pulse input position, can be changed.
To perform this function, write the preset position value in the operation parameter (current position preset data), and set bit-12, bit-10, bit-9 and bit-8 to ON with setting the changing object in bit-7 to bit-0. (Changing object designation: 1 = pulse output position, 2 = feedback pulse input position, 3 = both)

Change speed during positioning function:
The operating speed during positioning can be changed by this function.
To perform this function, set bit-13 to ON with setting the speed designation in bit-6 to bit-0. The speed designation is given as percentage (1% increments) against the maximum speed (system parameter).

Teaching function:
By using this function, the current position is recorded as the target position of the specified point data.
To perform this function, set bit-12, bit-10 and bit-9 to ON with setting the point number in bit-6 to bit-0. The teaching does not change the speed and the dwell time values of the point number data.

The MC612 also has the following auxiliary commands.

Error reset (command 0):
When the MC612 detects an abnormality (including over-travel LS, emergency stop signal, etc.), it stops pulse output immediately and sets the error flag.
This error reset command is used to recover from the error state.
To execute this command, set bit-12 to ON with setting the command number (0) in bit-7 to bit-0.

Parameter save (EEPROM write) (command 1):
This command is used to save the system and operation parameters into the MC612's EEPROM. (Both X- and Y-axis at a time)
To execute this command, set bit-12 to ON with setting the command number (1) in bit-7 to bit-0.

Parameter read (EEPROM read) (command 2):
This command is used to read the system and operation parameters from the MC612's EEPROM and set them in the buffer memory. (X- and Y-axis independent)
To execute this command, set bit-12 to ON with setting the command number (2) in bit-7 to bit-0.

Parameter initialize (command 3):
This command is used to initialize the system and operation parameters. The parameters are returned to the default value. (EEPROM write is not executed by this command)
To execute this command, set bit-12 to ON with setting the command number (3) in bit-7 to bit-0.

Parameter enable (command 5):
Just writing the parameters in the MC612's buffer memory, they are not valid for the MC612 operation. By executing this command, they become valid.
To execute this command, set bit-12 to ON with setting the command number (5) in bit-7 to bit-0.

6.2 Command bit control summary

The MC612 is operated by the command from the S2. The S2's output registers (%QW) assigned to the MC612 is used to issue a command. Some command requires parameter data written in the MC612 buffer memory.

To issue commands, the following conditions are required.
(1) The MC612 is ready to receive commands (excluding change speed, skip, and step commands).
(2) No error is occurring (excluding error reset command).
(3) Parameters stored in the MC612 are consistent.

The bit combinations for the each command are as follows.

2-axis independent control mode:

	%QW(n+2) for X-axis / %QW(n+3) for Y-axis															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Emergency stop	1	-	-	-	-	-	-	-	-							
Deceleration stop	0	1	-	-	-	-	-	-	-							
Jog operation, CW	0	0	1	0	0	-	-	-	0	Speed (0 to 127)						
Jog operation, CCW	0	0	1	0	0	-	-	-	1	Speed (0 to 127)						
Error reset	0	0	0	1	0	0	0	0	Command number (0)							
Parameter save (EEPROM write)	0	0	0	1	0	0	0	0	Command number (1)							
Parameter read (EEPROM read)	0	0	0	1	0	0	0	0	Command number (2)							
Parameter initialize	0	0	0	1	0	0	0	0	Command number (3)							
Parameter enable	0	0	0	1	0	0	0	0	Command number (5)							
Zero return	0	0	0	1	0	0	0	1	-							
Fixed feed, CW	0	0	0	1	0	0	1	0	0	Feed amount (0,1,2,3)						
Fixed feed, CCW	0	0	0	1	0	0	1	0	1	Feed amount (0,1,2,3)						
Direct command, ABS	0	0	0	1	0	0	1	1	0	-						
Direct command, INC	0	0	0	1	0	0	1	1	1	-						
Point number operation, ABS	0	0	0	1	0	1	0	0	0	Point number (1 to 30)						
Point number operation, INC	0	0	0	1	0	1	0	0	1	Point number (1 to 30)						
Automatic stepping, ABS	0	0	0	1	0	1	0	1	0	Point number (1 to 30)						
Automatic stepping, INC	0	0	0	1	0	1	0	1	1	Point number (1 to 30)						
Teaching	0	0	0	1	0	1	1	0	-	Point number (1 to 30)						
Current position change	0	0	0	1	0	1	1	1	Changing object (1, 2, 3)							
Change speed	0	0	1	0	0	-	-	-	-	Speed (0 to 127)						
Skip activation	0	0	-	-	1	-	-	-	-							
Step activation	0	0	-	-	1	-	-	-	-							
Jog to positioning switch	0	0	1	0	-	-	-	-	-							
Interrupt operation	0	0	-	-	-	-	-	-	-							

- EEPROM write and Parameter initialize requires both X- and Y-axis are ready.
- Skip/Step activation is valid during automatic stepping operation.
- ABS stands for absolute position, INC stands for incremental position.

2-axis liner interpolation control mode:

When the liner interpolation control mode is selected, the following operation works as 2-axis liner interpolation control.

- Direct command operation
- Point number operation
- Automatic stepping operation
- Fixed feed operation

For these operations, commands (bit controls) are given to the register corresponding to the X-axis.

	%QW(n+2)															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Emergency stop	1	-	-	-	-	-	-	-	-							
Deceleration stop	0	1	-	-	-	-	-	-	-							
Error reset	0	0	0	1	0	0	0	0	Command number (0)							
Parameter save (EEPROM write)	0	0	0	1	0	0	0	0	Command number (1)							
Parameter read (EEPROM read)	0	0	0	1	0	0	0	0	Command number (2)							
Parameter initialize	0	0	0	1	0	0	0	0	Command number (3)							
Parameter enable	0	0	0	1	0	0	0	0	Command number (5)							
Fixed feed, CW	0	0	0	1	0	0	1	0	0	Feed amount (0,1,2,3)						
Fixed feed, CCW	0	0	0	1	0	0	1	0	1	Feed amount (0,1,2,3)						
Direct command, ABS	0	0	0	1	0	0	1	1	0	-						
Direct command, INC	0	0	0	1	0	0	1	1	1	-						
Point number operation, ABS	0	0	0	1	0	1	0	0	0	Point number (1 to 30)						
Point number operation, INC	0	0	0	1	0	1	0	0	1	Point number (1 to 30)						
Automatic stepping, ABS	0	0	0	1	0	1	0	1	0	Point number (1 to 30)						
Automatic stepping, INC	0	0	0	1	0	1	0	1	1	Point number (1 to 30)						
Current position change	0	0	0	1	0	1	1	1	Changing object (1, 2, 3)							
Change speed	0	0	1	0	0	-	-	-	-	Speed (0 to 127)						
Skip activation	0	0	-	-	1	-	-	-	-							
Step activation	0	0	-	-	1	-	-	-	-							
Interrupt operation	0	0	-	-	-	-	-	-	-							

- EEPROM write/read, parameter initialize, and parameter enable commands requires both X- and Y-axis are ready.
- Zero return, jog, switching from jog to positioning, and teaching operations are 2-axis independent command even if the interpolation control mode is selected.
- For the fixed feed operation, the feed direction and the feed amount for Y-axis are given by %QW(n+3) register. (Start command is given by %QW(n+2) register)
- Error reset command is available for X- and Y-axis independently.

NOTE

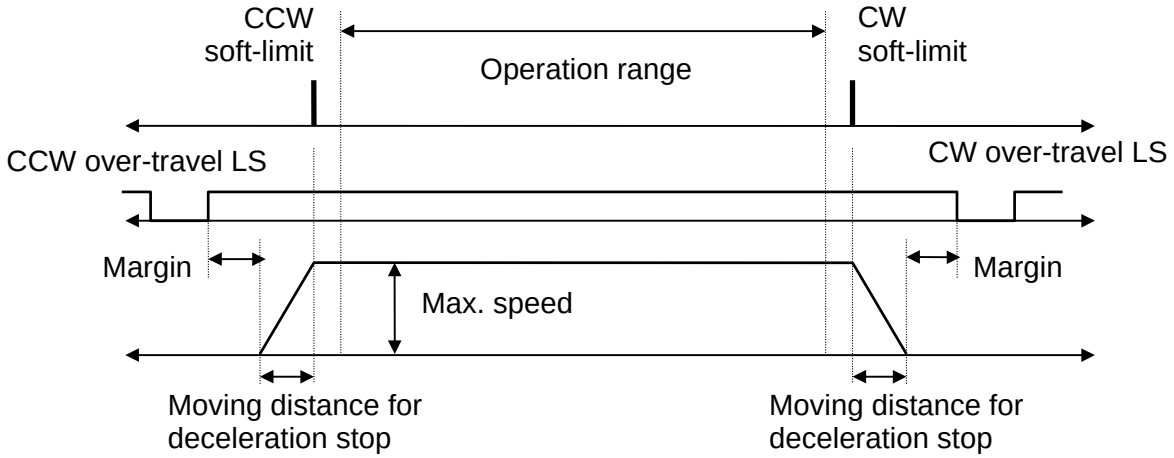
Do not set illegal bit combinations. Otherwise, error code registration may be abnormal.

6.3 Operation range

The MC612 has a soft-limit function, besides external over-travel limit switch input.
When the current value exceeds the soft-limit specified in the system parameter during operation, the movement will decelerate and stop.
For the positioning operation that the target position will exceeds the soft-limit, the operation start is not accepted.
Normally, the soft-limit (CW and CCW) are specified inside the external over-travel limits.
The buffer memory addresses of the soft-limit are as follows:

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
CW Soft Limit (Plus)	20 21	188 189	-9999999 to 9999999 (command units)	Designates the position of the movement limit on CW (plus) side.
			HFFFFFFFF (-1)	Soft limit function is disabled if CCW soft-limit is also -1.
CCW Soft Limit (Minus)	22 23	190 191	-9999999 to 9999999 (command units)	Designates the position of the movement limit on CCW (minus) side.
			HFFFFFFFF (-1)	Soft limit function is disabled if CW soft-limit is also -1.

Normal operation range



Decide the position of soft-limit (CW and CCW) so that the movement will not reach the external over-travel limit even if operating at maximum speed as the figure above.

NOTE

- The soft-limit function is effective for the operations other than zero return, regardless of zero return completion.
- For the zero return operation, the soft-limit function is not effective.
- When the movement exceeds the soft-limit (CW/CCW) and stops, the MC612 enters error mode. To recover from this state, execute the error reset command, then return the position within the operating range using the jog operation.

Disable the soft-limit

The soft-limit function can be disabled by setting the data HFFFFFFFF (-1) for both soft-limit (CW and CCW).
By using this setting, the MC612 can be applied for an endless repeated single-direction operation, such as running turntables, belt-conveyors, etc.

NOTE

- Both CW and CCW soft-limit parameters must be HFFFFFFFF (-1) to be disabled the soft-limit. If only one soft-limit is set to HFFFFFFFF (-1), the soft-limit works as -1.
- When the soft-limit is disabled, the position data will be changed as follows.

CW direction:	99,999,999	→	-100,000,000	→	-99,999,999
CCW direction:	-99,999,999	→	-100,000,000	→	99,999,999

Section 7

Zero Return Operation

7. Zero Return Operation

7.1 Overview

The zero return is the operation to detect the Machine zero position and set the Coordinate origin (electrical origin).
The zero return operation generally proceeds as follows.

(1) Moves to the search direction at the zero return speed until the zero LS turns ON.
(2) Stops then moves to the creep direction at the minimum speed until the zero LS turns OFF.
(3) Stops at the zero LS turns OFF if phase-Z is not used, or stops at the first phase-Z comes ON after the zero LS turns OFF if phase-Z is used.
(4) Moves by the zero offset amount (if any) at the zero return speed, then sets the coordinate origin value to the current position.

When zero return operation is completed, the zero return complete flag in the status register (%IW) switches ON (1). Depending on the zero return complete status, available operations are determined as below.

Zero return complete flag	0	1
Jog operation	Yes	Yes
Change speed	Yes	Yes
Auxiliary command	Yes	Yes
Zero return	Yes	Yes
Fixed feed operation	Yes	Yes
Direct command, Absolute	No	Yes
Direct command, Incremental	Yes	Yes
Point number, Absolute	No	Yes
Point number, Incremental	Yes	Yes

Zero return complete flag	0	1
Automatic stepping, Absolute	No	Yes
Automatic stepping, Incremental	Yes	Yes
Teaching	No	Yes
Current position change	Yes	Yes
Soft-limit function	Yes	Yes
Endless repeated positioning	Yes	Yes
Jog to positioning switch	Yes	Yes
Interrupt operation	No	Yes

Zero return complete flag: 0 = Zero return is not completed
1 = Zero return is completed

When zero return is not completed, the operation of designating the absolute position is invalid because the MC612 operates with the temporal position data. However, the soft-limit function is valid with the temporal position data. (Excluding zero return operation)

7.2 Related parameters

To perform the zero return operation, the following parameters must be set before starting the zero return operation.

Name	Address X-axis	Address Y-axis	Setting range (unit)	Description
Zero return operation mode	2	170	Bit-0: Zero LS	0 = Zero LS is used 1 = Over-travel LS is used (no zero LS)
			Bit-1: Phase-Z pulse	0 = Phase-Z is used 1 = Phase-Z is not used
			Bit-2: Error counter clear output	0 = Normal mode (50 ms) 1 = Toei servo mode
Zero return operation direction	3	171	Bit-0: Search direction (Zero LS ON direction)	0 = CW 1 = CCW
			Bit-1: Creep direction (Zero LS OFF direction)	0 = CW 1 = CCW
Zero return speed	14 15	182 183	20 to 200,000(pps)	Designates the speed to search the zero LS for the zero return operation. This speed is also used for zero offset movement.
Coordinate origin value	16 17	184 185	-9999999 to 9999999 (command units)	Sets the origin position (coordinate) of the zero return completion position.
Zero offset	18 19	186 187	-9999999 to 9999999 (command units)	Distance of movement to shift from the machine zero to the coordinate origin.

7.2.1 Zero return operation mode (Address: X = 2, Y = 170)

(1) Bit-0: Zero return movement mode selection

Selects either zero LS or over-travel LS as the machine zero position limit switch for the zero return operation.
Using the over-travel LS instead of the zero LS will allow the zero return operation at over-travel LS position. Refer to section 7.2.2 for the operation.

Parameter setting
"0" : Zero LS used
"1" : Over-travel LS used

NOTE

When the over-travel LS is selected for zero return operation, the search direction (LS ON direction) and the creep direction (LS OFF direction) must be opposite. Otherwise parameter mismatch error will occur.

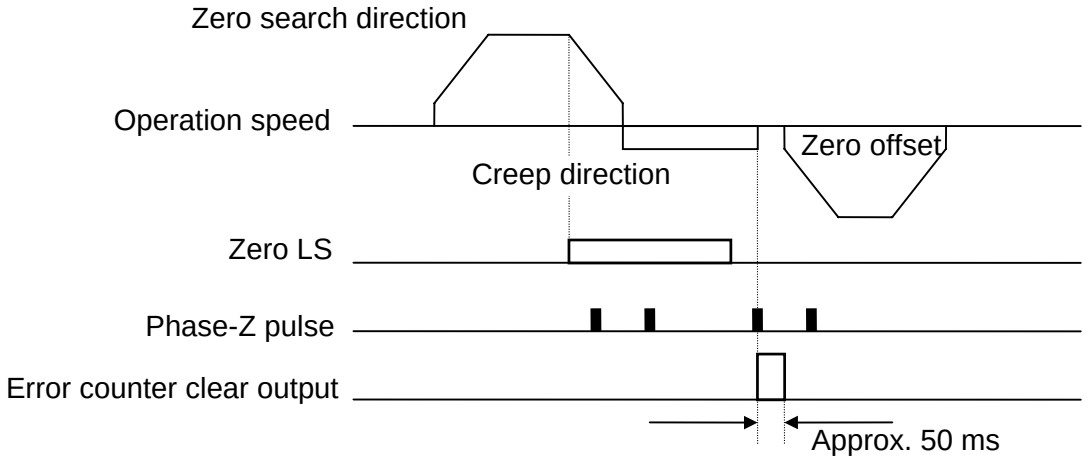
(2) Bit-1: Phase-Z pulse use selection

Selects either use or non-use of the phase-Z pulse in the zero return operation.
When the phase-Z is not used, the machine zero is determined at the point where the zero LS turns OFF.
When the phase-Z is used, the machine zero is determined at the point where the phase-Z comes ON after the zero LS turns OFF. Also, at the time, the MC612 outputs the error counter clear signal.

Parameter setting	"0" :	Phase-Z used	Error counter clear output
	"1" :	Phase-Z unused	No error counter clear output

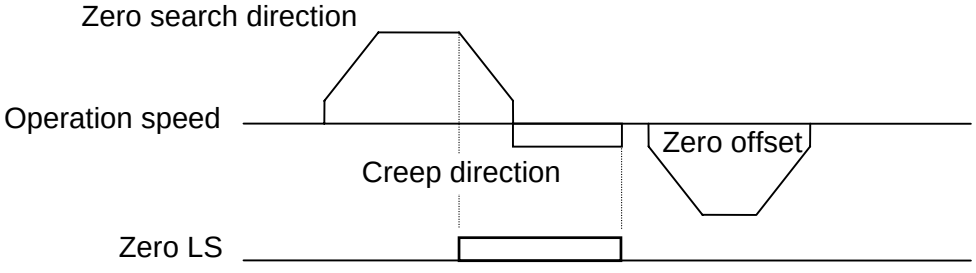
• When phase-Z is used:

When the phase-Z pulse is used, it stops at the first phase-Z ON after the zero LS goes OFF, and determines the machine zero. At the same time, the MC612 outputs the error counter clear output for approx. 50 ms.
This mode is selected when a servo motor is used.



• Phase-Z pulse is not used:

When the phase-Z pulse is not used, it stops at the zero LS coming OFF, and determines the machine zero. The error counter clear output is not functioning.
This mode is selected when a stepping motor is used.

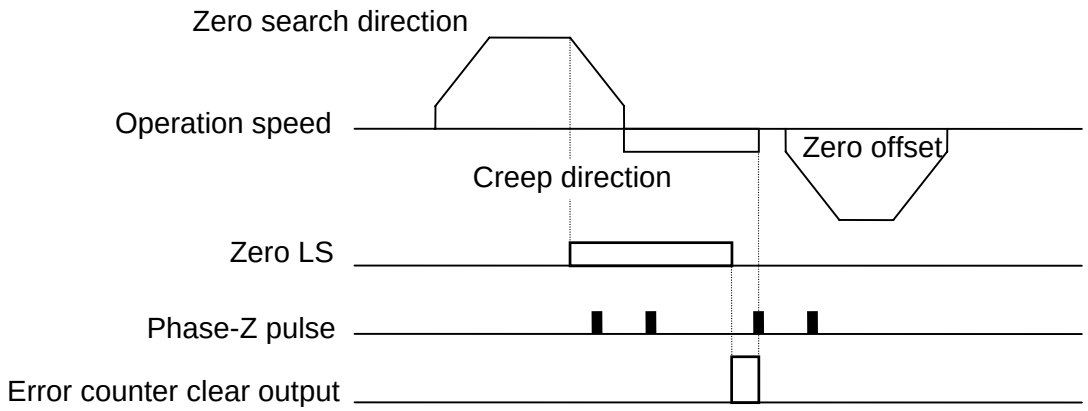


(3) Bit-2: Error counter clear output

Specifies the output mode of the error counter clear signal.
The Toei servo mode is selected when Toei's servo motor is used. When this mode is selected, phase-Z use must be selected.

Parameter setting	"0" :	Normal mode
	"1" :	Toei servo mode

Error counter clear output of the Toei servo mode:



For the normal mode operation, see the previous page.

NOTE

- The length of the zero LS ON must be longer than the distance needed for deceleration from the zero return speed. If this condition is not satisfied, positioning accuracy is not guaranteed. (see below)
- When the length of the zero LS ON is shorter than the distance needed for deceleration from the zero return speed, the machine zero position is determined as follows.

Creep direction	Machine zero
Same as the zero search direction	Position where decelerated and stopped in moving in the zero search direction
Opposite to the zero search direction	Position where the zero LS is switched ON → OFF again in moving in the creep direction

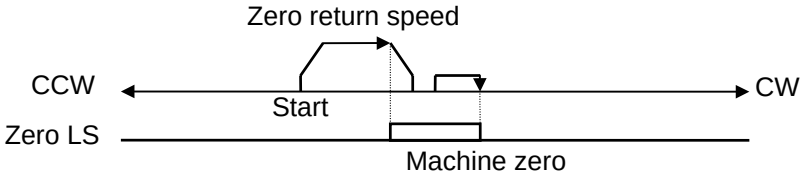
7.2.2 Zero return operation direction (Address: X = 3, Y = 171)

Selects the search direction (zero LS ON direction) and the creep direction (zero LS OFF direction) for the zero return operation.
The search direction is specified by bit-0 and the creep direction is specified by bit-1. See table below. (all other bits must be "0").

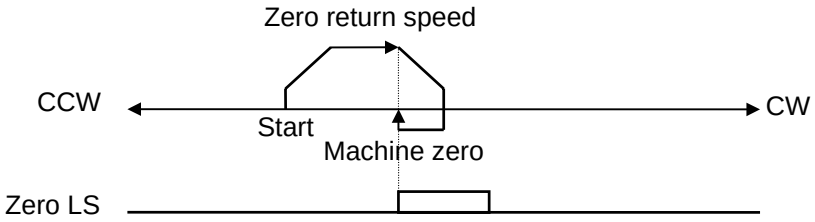
Setting		Direction		Remarks (over-travel LS use)
Bit-0	Bit-1	Search	Creep	
“0”	“0”	CW	CW	Over-travel LS cannot be used
“0”	“1”	CW	CCW	Over-travel LS can be used (CW side over-travel LS)
“1”	“0”	CCW	CW	Over-travel LS can be used (CCW side over-travel LS)
“1”	“1”	CCW	CCW	Over-travel LS cannot be used

The zero return operation in each setting is shown below. In the following diagram, the zero offset and the phase-Z pulse are omitted for ease of explanation.

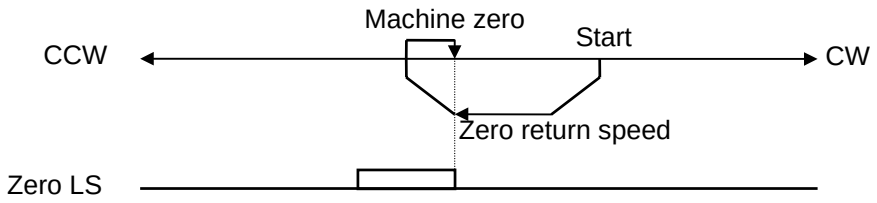
(1) Zero LS used
Search direction: CW
Creep direction: CW



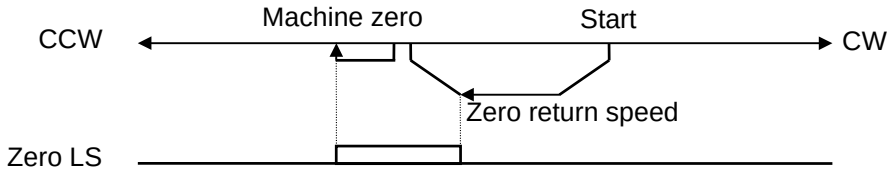
(2) Zero LS used
Search direction: CW
Creep direction: CCW



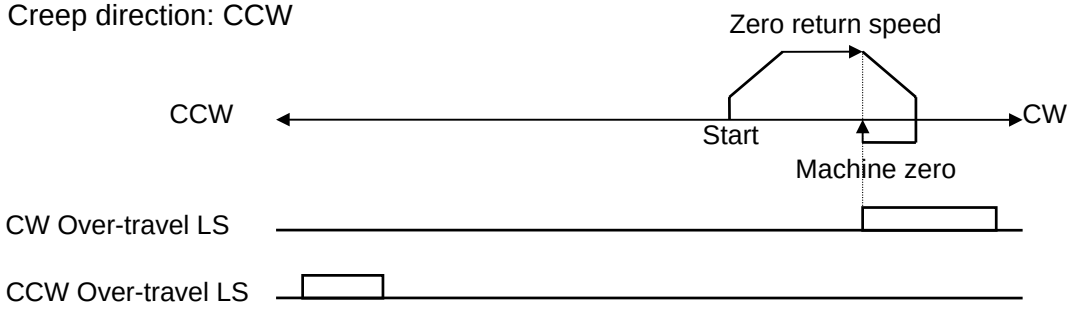
(3) Zero LS used
Search direction: CCW
Creep direction: CW



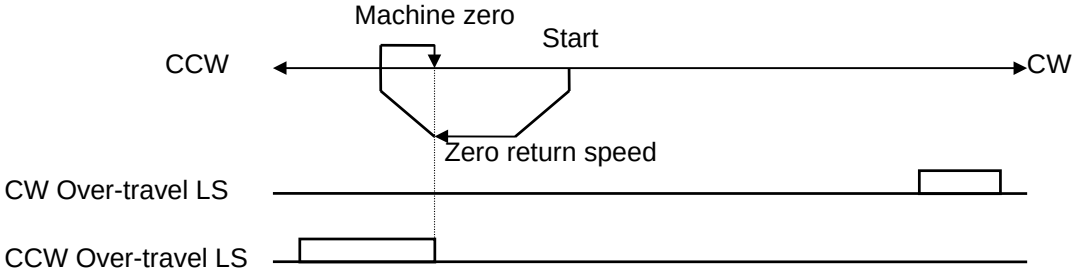
(4) Zero LS used
Search direction: CCW
Creep direction: CCW



(5) Over-travel LS used
Search direction: CW
Creep direction: CCW

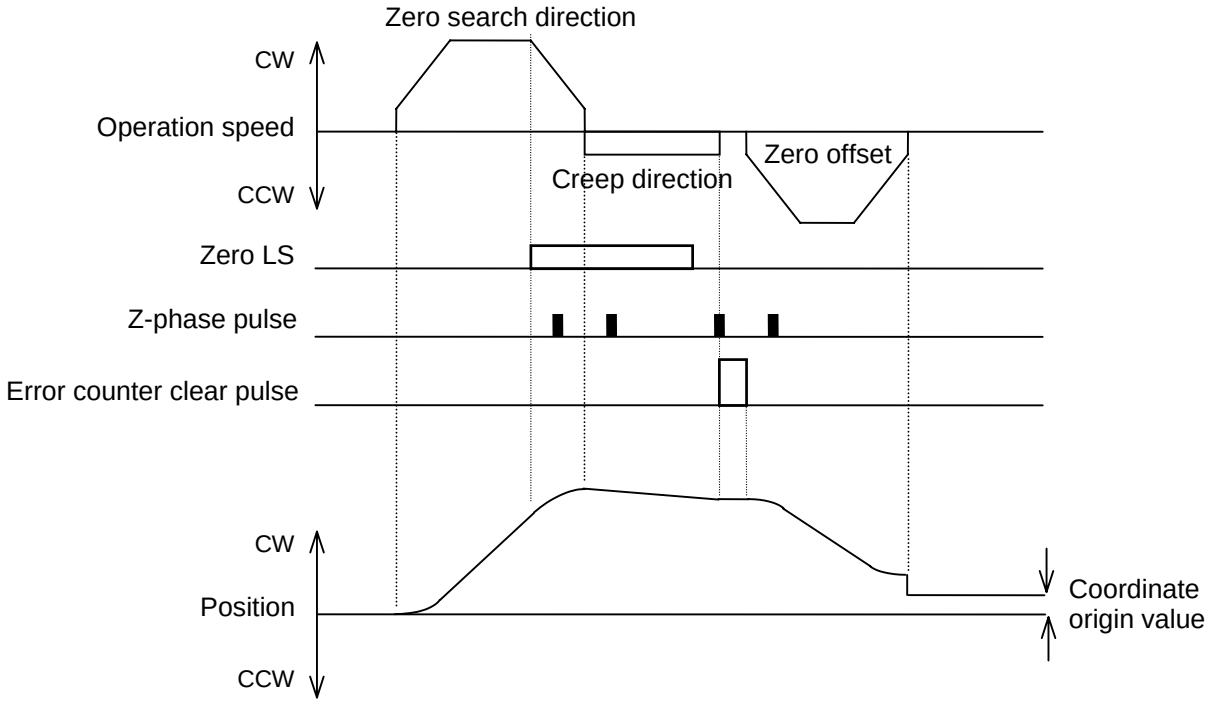


(6) Over-travel LS used
Search direction: CCW
Creep direction: CW



7.2.3 Zero offset (Address: X = 19·18, Y = 187·186)

When the machine zero is determined, the MC612 outputs the pulses of the zero offset (incremental value) which is specified in the system parameter at the zero return speed. Then the coordinate origin value specified in the system parameter is preset to the current position.



NOTE

1. Zero offset movement starts in 50 ms after detecting the machine zero.
2. The Coordinate origin value is set to the current position data (both pulse output and feedback pulse input) in 200 ms after completing zero offset movement.

7.3 Operation procedure

The zero return operation is started by setting bit-12 and bit-8 of the command register (%QW) to ON while the command ready flag (bit-15 of %IW register) is ON.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	0	0	1	-	-	-	-	-	-	-	-

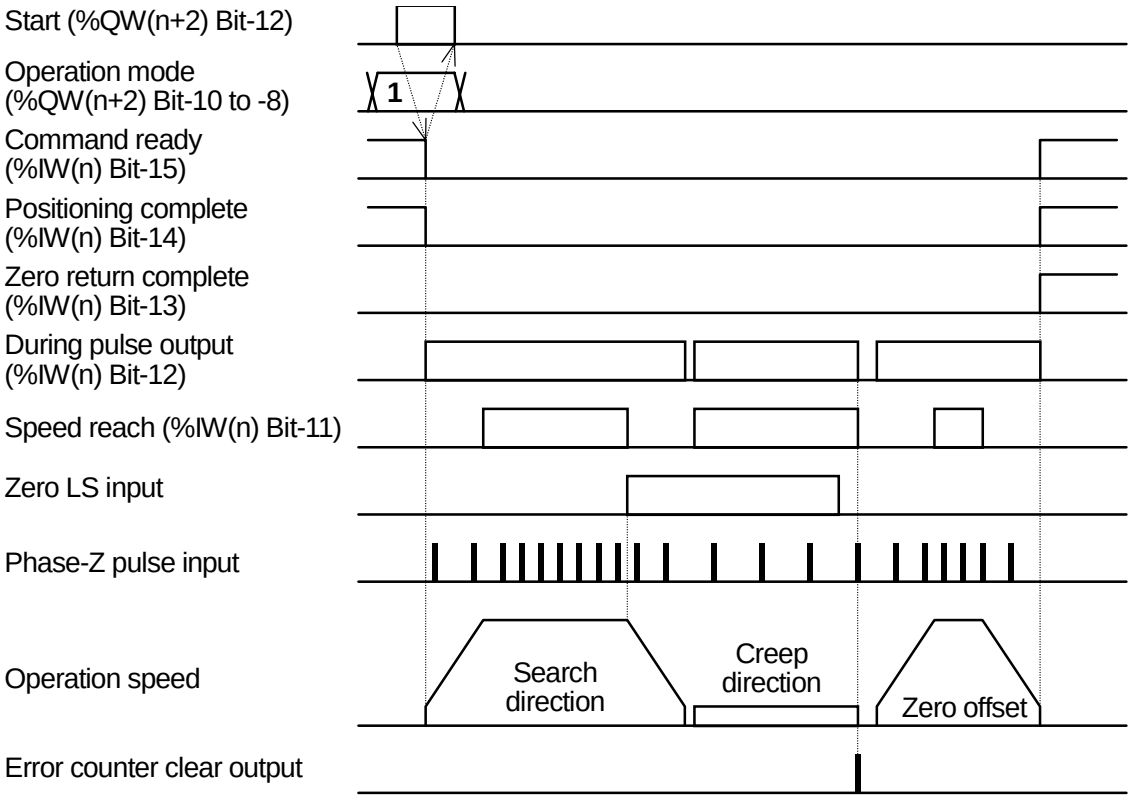
- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	0	0	1	-	-	-	-	-	-	-	-

Zero return operation time chart

The following diagram shows the time chart for X-axis zero return operation. (When using the zero LS and normal phase-Z pulse)



NOTE

When the zero return operation is activated while the zero return complete flag is ON, the operation is executed normally. However the zero return complete flag is remained ON during the operation. Therefore you should judge the operation complete by the command ready flag.

7.4 Zero return completion status at power on

When the power is turned ON, the zero return complete flag is 0. Therefore, the absolute positioning commands are not allowed until the zero return operation is completed.

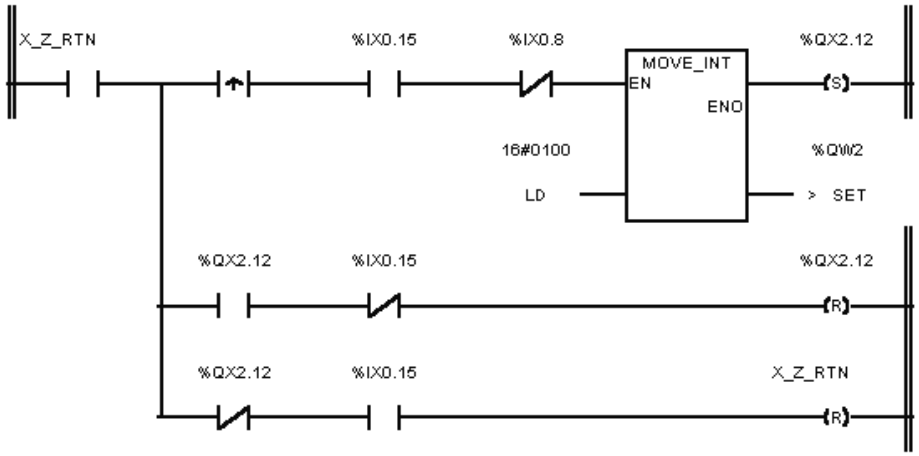
However, by executing the following special operation, the zero return complete flag can be set to 1 forcibly.

(1) Turn on power.
(2) Before executing any other command, execute the current position preset for pulse output. If the changed value is the same as the original position value (saved in the EEPROM), the zero return complete flag will set to 1.

For details of this procedure, refer to section 14.3.

7.5 Sample program

A sample program to execute the zero return operation is shown below.
In this program, X-axis zero return is started when X_Z_RTN is set to ON.
When the zero return operation is completed, X_Z_RTN is reset to OFF automatically.



When X_Z_RTN is set to ON, the value 1 is set in bit-10 to bit-8 of %QW2 then %QX2.12 is set to ON. When %IX0.15 (command ready) is turned OFF (command accepted), %QX2.12 is reset to OFF. Then, when %IX0.15 is turned ON again (operation complete), X_Z_RTN is reset to OFF.

NOTE

(1) To start the operation, the start command bit (bit-12 of %QW register) must be kept ON until the command ready flag (bit-15 of %IW register) is turned OFF.
(2) The operation complete should be judged by the command ready flag (bit-15 of %IW register).

Section 8

Jog Operation

8. Jog Operation

8.1 Overview

The jog operation performs the jog feed for the specified direction (CW or CCW) at the specified speed. The speed is given by the percentage (1% increments) against the maximum speed (system parameter). The speed can be changed during the operation.

The allowable speed setting range is 0 to 127%. However, even if it is more than 100%, the speed is limited by the maximum speed parameter value. In this case, speed setting alarm is occurred. (Jog operation is continued)

8.2 Operation procedure

When bit-13 is set to ON with the speed designation in bit-6 to bit-0, the jog feed is started. And when bit-13 is reset to OFF, it is stopped.
Bit-7 is used to specify the feed direction. (0 = CW, 1 = CCW)

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	1	0	0	-	-	-	1/0	Speed (0 to 127)						

- : Do not care

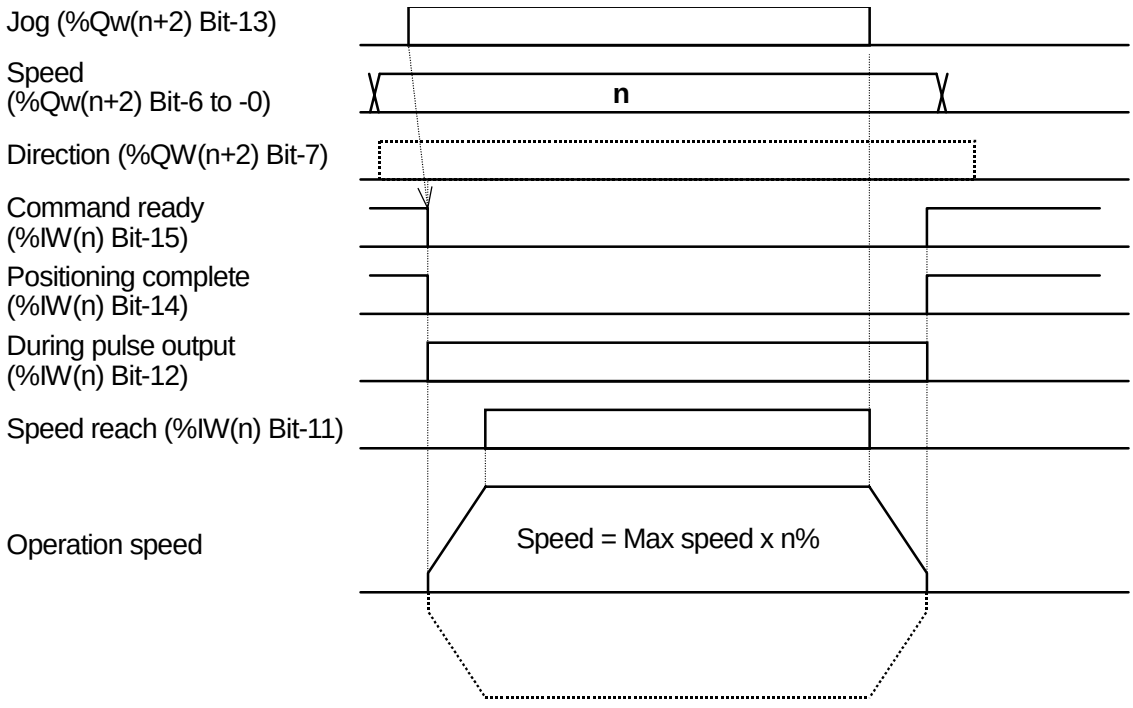
Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	1	0	0	-	-	-	1/0	Speed (0 to 127)						

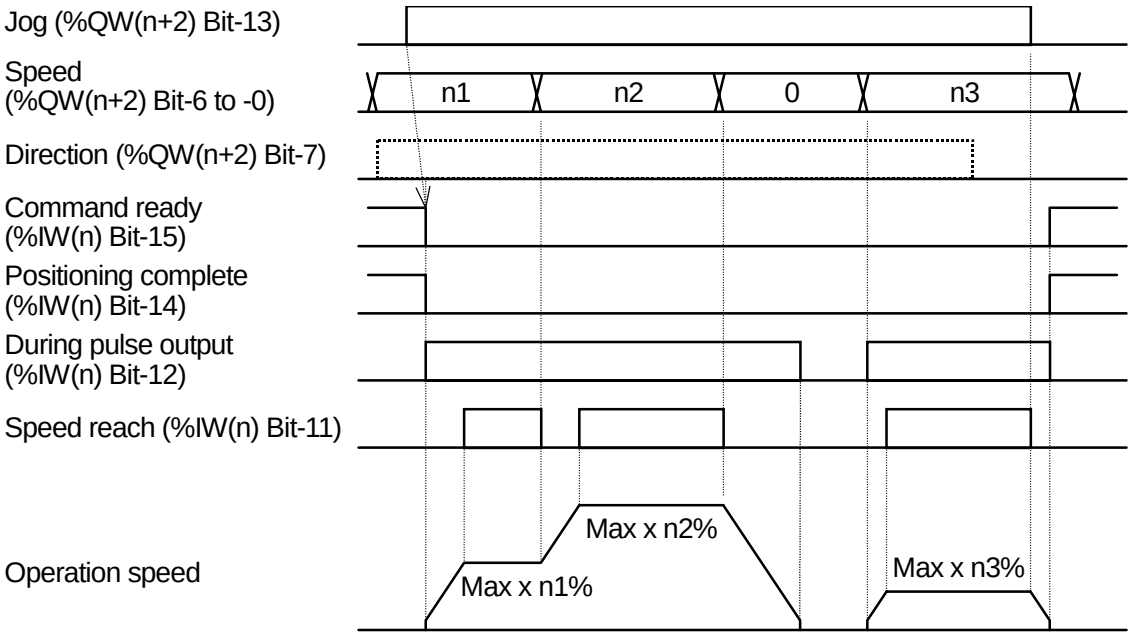
Jog operation time chart

The following diagram shows the time chart for X-axis jog operation.

(1) Constant speed start/stop

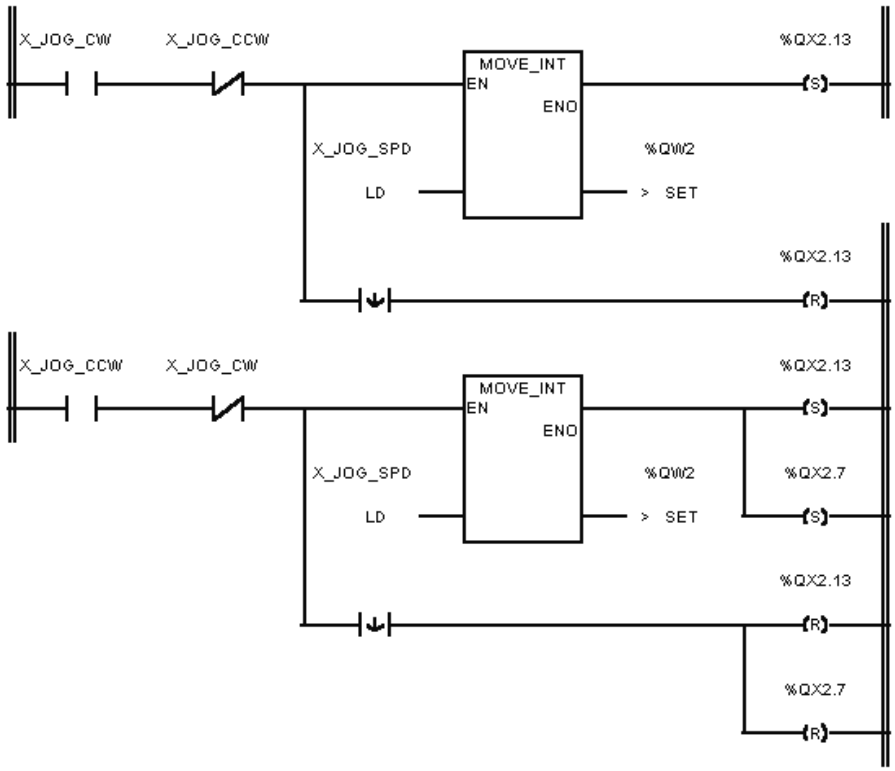


(2) Speed change during jog



8.3 Sample program

A sample program for jog operation (X-axis) is shown below.
In this program, when X_JOG_CW is ON, CW direction jog feed is executed. And when X_JOG_CCW is ON, CCW jog feed is executed. The feed speed is designated by X_JOG_SPD.



When X_JOG_CW is ON, the speed data in X_JOG_SPD is transferred to %QW2, and %QX2.13 is set to ON.
And when X_JOG_CW is changed to OFF, %QX2.13 is reset to OFF.
When X_JOG_CCW is ON, the speed data in X_JOG_SPD is transferred to %QW2, and %QW2.7 and %QW2.13 are set to ON. And when X_JOG_CCW is changed to OFF, %QW2.7 and %QW2.13 are reset to OFF.

Section 9

Direct Command Operation

9. Direct Command Operation

9.1 Overview

In the direct command operation, the target position is given by the S2 program at each time the positioning is started. The operation speed is fixed to the maximum speed.
It is possible to select the absolute positioning or the incremental positioning at the command activation. The absolute positioning requires the zero return completion before starting this operation.

9.2 Related parameters

The direct command position is the target position data located in the operation parameter.
To execute the direct command operation, write the target position into this parameter and issue the command by the command register (%QW register).

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
Direct command position	44 45	212 213	-9999999 to 9999999 (command units)	Designates the target position for the direct command operation.

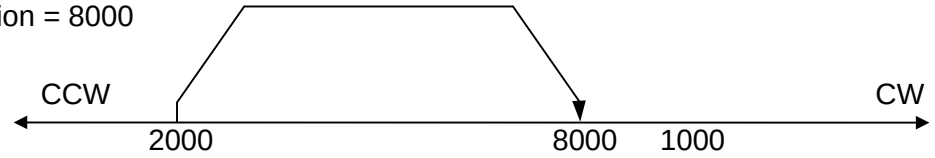
9.3 Absolute and incremental positioning

In the direct command operation, the selection either absolute positioning or incremental positioning is possible. The absolute positioning requires the zero return completion before starting this operation.

(1) Absolute positioning

When the absolute positioning is selected, the target position data is treated as absolute position based on the coordinate origin.
For example, if the current position is 2000 and the target position is 8000, the positioning operation is as follows. (feed amount is 6000)

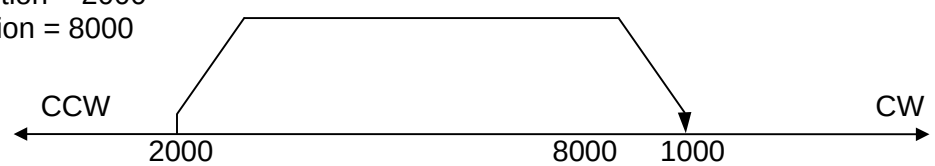
Current position = 2000
Target position = 8000



(2) Incremental positioning

When the incremental positioning is selected, the target position data is treated as relative position from the current position.
For example, if the current position is 2000 and the target position is 8000, the positioning operation is as follows. (feed amount is 8000)

Current position = 2000
Target position = 8000



9.4 Operation procedure

The direct command operation is started by setting bit-12, bit-9 and bit-8 of the command register (%QW) to ON while the command ready flag (bit-15 of %IW register) is ON.
Bit-7 is used to select absolute or incremental positioning. (0 = Absolute, 1 = Incremental)

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	0	1	1	1/0	-	-	-	-	-	-	-

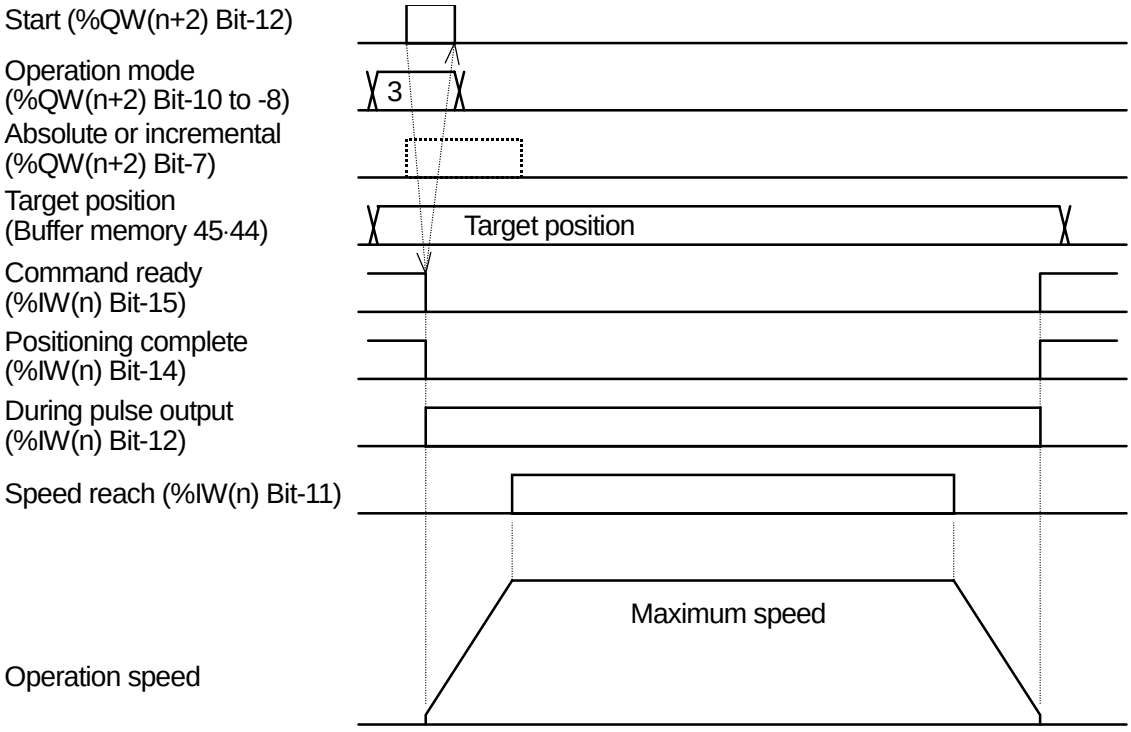
- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	0	1	1	1/0	-	-	-	-	-	-	-

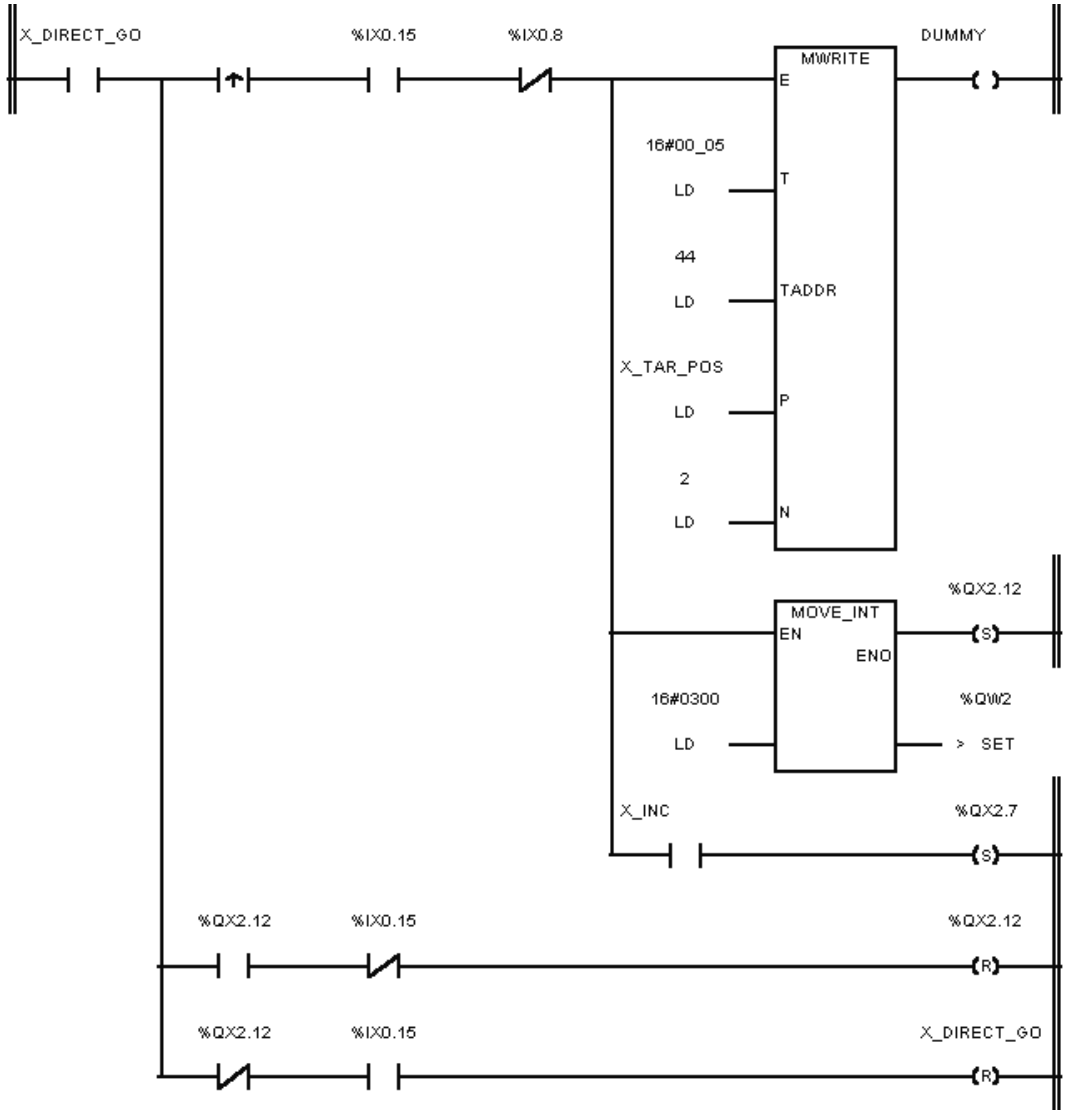
Direct command operation time chart

The following diagram shows the time chart for X-axis direct command operation.



9.5 Sample program

A sample program for the direct command operation (X-axis) is shown below.
To activate this program, set the target position in double-word variable X_TAR_POS, select absolute or incremental by X_INC (OFF = Absolute, ON = Incremental), then set X_DIRECT_GO to ON.
When the positioning is completed, X_DIRECT_GO is reset to OFF automatically.



When X_DIRECT_GO is set to ON while the command ready flag (X000F) is ON, the target position data in X_TAR_POS is written into the buffer memory address 45·44 (X-axis direct command position). Then the value 3 is set in bit-10 to bit-8 of %QW2, %QX2.7 is set to ON if X_INC is ON, and %QX2.12 is set to ON.
When %IX0.15 (command ready) is turned OFF (command accepted), %QX2.12 is reset to OFF. Then, when %IX0.15 is turned ON again (operation complete), X_DIRECT_GO is reset to OFF.

Section 10

Point Number Operation

10. Point Number Operation

10.1 Overview

In the point number operation, the S2 program specifies the point number in which the positioning data (target position and speed) is pre-stored. The point number data is a part of the operation parameters. Different from the direct command operation, the point number operation can control the operation speed.
It is possible to select the absolute positioning or the incremental positioning at the command activation. The absolute positioning requires the zero return completion before starting this operation.

10.2 Related parameters

The point number operation executes the positioning based on the point number data stored in the operation parameter.

MC612 buffer memory (Operation parameters)

Address	X-axis
49·48	Point 1 Target position
50	Point 1 Speed (0.1%)
51	Point 1 Dwell time (0.01s)
53·52	Point 2 Target position
54	Point 2 Speed (0.1%)
55	Point 2 Dwell time (0.01s)
:	:
165·164	Point 30 Target position
166	Point 30 Speed (0.1%)
167	Point 30 Dwell time (0.01s)

Address	Y-axis
217·216	Point 1 Target position
218	Point 1 Speed (0.1%)
219	Point 1 Dwell time (0.01s)
221·220	Point 2 Target position
222	Point 2 Speed (0.1%)
223	Point 2 Dwell time (0.01s)
:	:
333·332	Point 30 Target position
334	Point 30 Speed (0.1%)
335	Point 30 Dwell time (0.01s)

These point number data must be stored in the MC612 before starting the point number operation.
If you change the point number data, the parameter enable command is necessary after writing the point number data in the buffer memory. For the parameter enable command, refer to section 17.6.

NOTE

1. The speed designation in the point number data is 0.1% increments against the maximum speed setting.
2. In the point number operation, the dwell time does not have any function.
3. The starting address of point N data can be calculated as follows.
   X-axis: (N - 1) x 4 + 48
   Y-axis: (N - 1) x 4 + 216

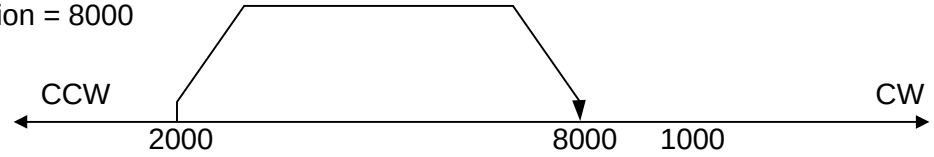
10.3 Absolute and incremental positioning

In the point number operation, the selection either absolute positioning or incremental positioning is possible. The absolute positioning requires the zero return completion before starting this operation.

(1) Absolute positioning

When the absolute positioning is selected, the target position data is treated as absolute position based on the coordinate origin.
For example, if the current position is 2000 and the target position is 8000, the positioning operation is as follows. (feed amount is 6000)

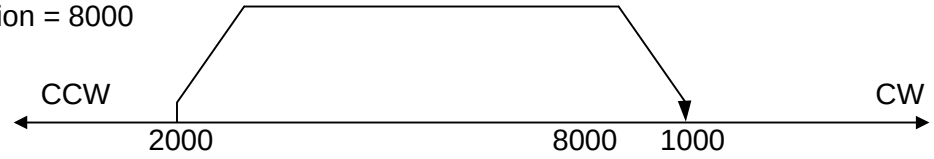
Current position = 2000
Target position = 8000



(2) Incremental positioning

When the incremental positioning is selected, the target position data is treated as relative position from the current position.
For example, if the current position is 2000 and the target position is 8000, the positioning operation is as follows. (feed amount is 8000)

Current position = 2000
Target position = 8000



10.4 Operation procedure

The point number operation is started by setting bit-12 and bit-10 to ON with specifying the point number in bit-6 to bit-0 of the command register (%QW) while the command ready flag (bit-15 of %IW register) is ON.
Bit-7 is used to select absolute or incremental positioning. (0 = Absolute, 1 = Incremental)

X-axis

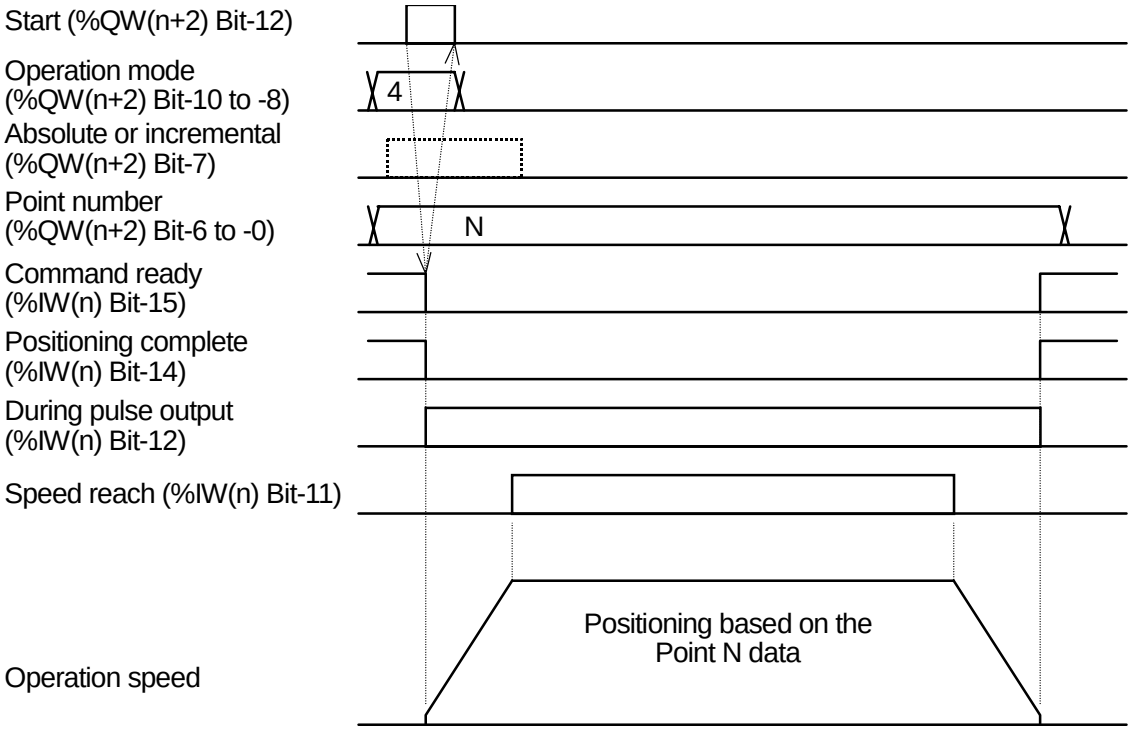
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	1	0	0	1/0	Point number (1 to 30)						

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	1	0	0	1/0	Point number (1 to 30)						

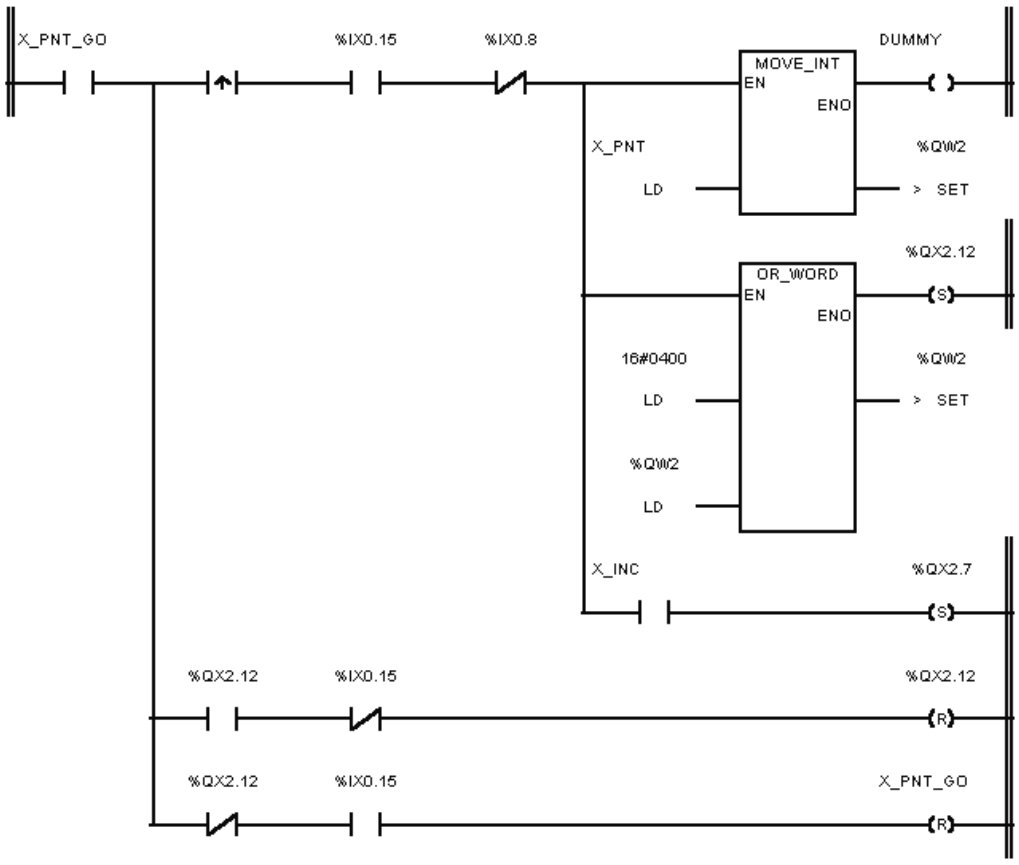
Point number operation time chart

The following diagram shows the time chart for X-axis point number operation.



10.5 Sample program

A sample program for the point number operation (X-axis) is shown below.
To activate this program, set the target point number in X_PNT, select absolute or incremental by X_INC (OFF = Absolute, ON = Incremental), then set X_PNT_GO to ON.
When the positioning is completed, X_PNT_GO is reset to OFF automatically.



When X_PNT_GO is set to ON while the command ready flag (%IX0.15) is ON, the target point number (1 to 30) stored in X_PNT is set in the %QW2. The value 4 is set in bit-10 to bit-8 of %QW2. If X_INC is ON, %QX2.7 is set to ON. Then %QX2.12 is set to ON.
When %IX0.15 (command ready) is turned OFF (command accepted), %QX2.12 is reset to OFF. Then, when %IX0.15 is turned ON again (operation complete), X_PNT_GO is reset to OFF.

Section 11

Automatic Stepping Operation

11. Automatic Stepping Operation

11.1 Overview

The automatic stepping operation is a variation of the point number operation. In the automatic stepping operation, the positioning proceeds automatically based on the two or more consecutive point number data stored in the MC612 operation parameter. The time interval until starting the next point operation is determined by the dwell time stored in the point number data. If the dwell time value is H8000, it is determined as the final point.

In the automatic stepping operation, the S2 program specifies the starting point number.

It is possible to select the absolute positioning or the incremental positioning at the command activation. The absolute positioning requires the zero return completion before starting this operation. For the absolute and incremental positioning, refer to section 10.3.

11.2 Related parameters

As same as the point number operation, the automatic stepping operation executes the positioning based on the point number data stored in the operation parameter.

MC612 buffer memory (Operation parameters)

Address	X-axis
49·48	Point 1 Target position
50	Point 1 Speed (0.1%)
51	Point 1 Dwell time (0.01s)
53·52	Point 2 Target position
54	Point 2 Speed (0.1%)
55	Point 2 Dwell time (0.01s)
:	:
165·164	Point 30 Target position
166	Point 30 Speed (0.1%)
167	Point 30 Dwell time (0.01s)

Address	Y-axis
217·216	Point 1 Target position
218	Point 1 Speed (0.1%)
219	Point 1 Dwell time (0.01s)
221·220	Point 2 Target position
222	Point 2 Speed (0.1%)
223	Point 2 Dwell time (0.01s)
:	:
333·332	Point 30 Target position
334	Point 30 Speed (0.1%)
335	Point 30 Dwell time (0.01s)

These point number data must be stored in the MC612 before starting the point number operation.
If you change the point number data, the parameter enable command is necessary after writing the point number data in the buffer memory. For the parameter enable command, refer to section 17.6.

NOTE

1. The speed designation in the point number data is 0.1% increments against the maximum speed setting.
2. The starting address of point N data can be calculated as follows.
   X-axis: (N - 1) x 4 + 48
   Y-axis: (N - 1) x 4 + 216

The point N dwell time value basically specifies the time interval from the completion of point N positioning to the starting of point N+1 operation. (0.01s increments)

However the dwell time value also has the special functions as listed below.

Dwell time value	Meaning	Condition to start the next point operation	Step command
0 to 100000	Dwell time (0.01s units)	Specified dwell time is elapsed, or the step command is issued	Available
H8000	Block end	N/A	N/A
H8001	Non-stop	No condition (continue)	N/A
H8002	Wait until Step command	The step command is issued	Available

NOTE

1. When this automatic stepping operation is used, at least one point data must have the block end designation (H8000) in the following points. Otherwise "No block end" error will occur.
2. For the step command, refer to section 11.5.
3. When the non-stop designation (H8001) is used, the operation will continue without stopping. However in the following cases, the operation will be stopped before starting the next positioning.
   - When the operation direction is changed.
   - In the 2-axis liner contouring control mode.

11.3 Operation procedure

The automatic stepping operation is started by setting bit-12, bit-10 and bit-8 to ON with specifying the starting point number in bit-6 to bit-0 of the command register (%QW) while the command ready flag (bit-15 of %IW register) is ON.
Bit-7 is used to select absolute or incremental positioning. (0 = Absolute, 1 = Incremental)

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	1	0	1	1/0	Point number (1 to 30)						

Y-axis

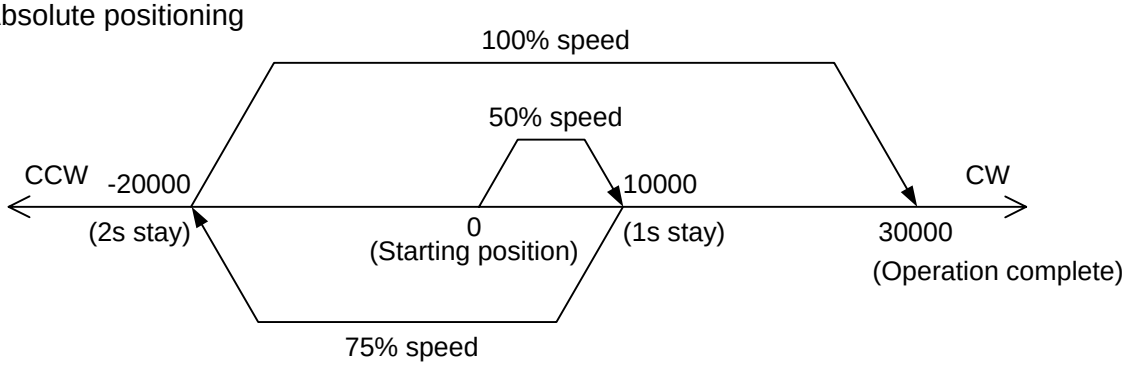
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	1	0	1	1/0	Point number (1 to 30)						

Operation example

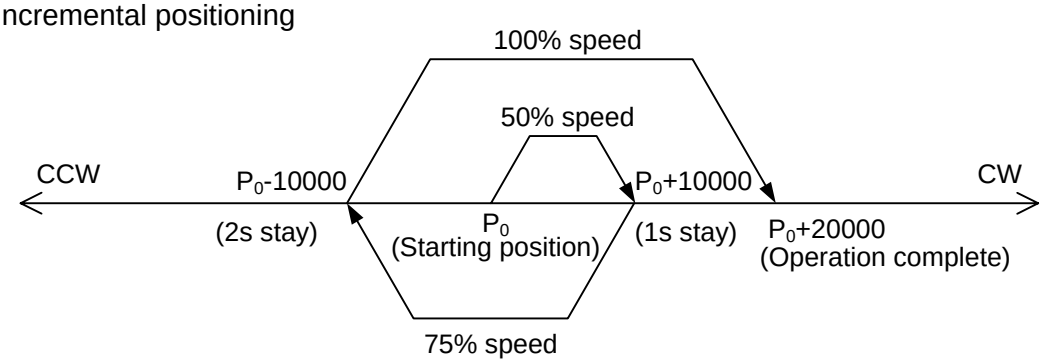
The following diagram shows an operation example when the following point data is registered and the point 10 is specified as the starting point.

Point	Target position	Speed	Dwell time
10	10000	500	100
11	-20000	750	200
12	30000	1000	H8000

(1) Absolute positioning

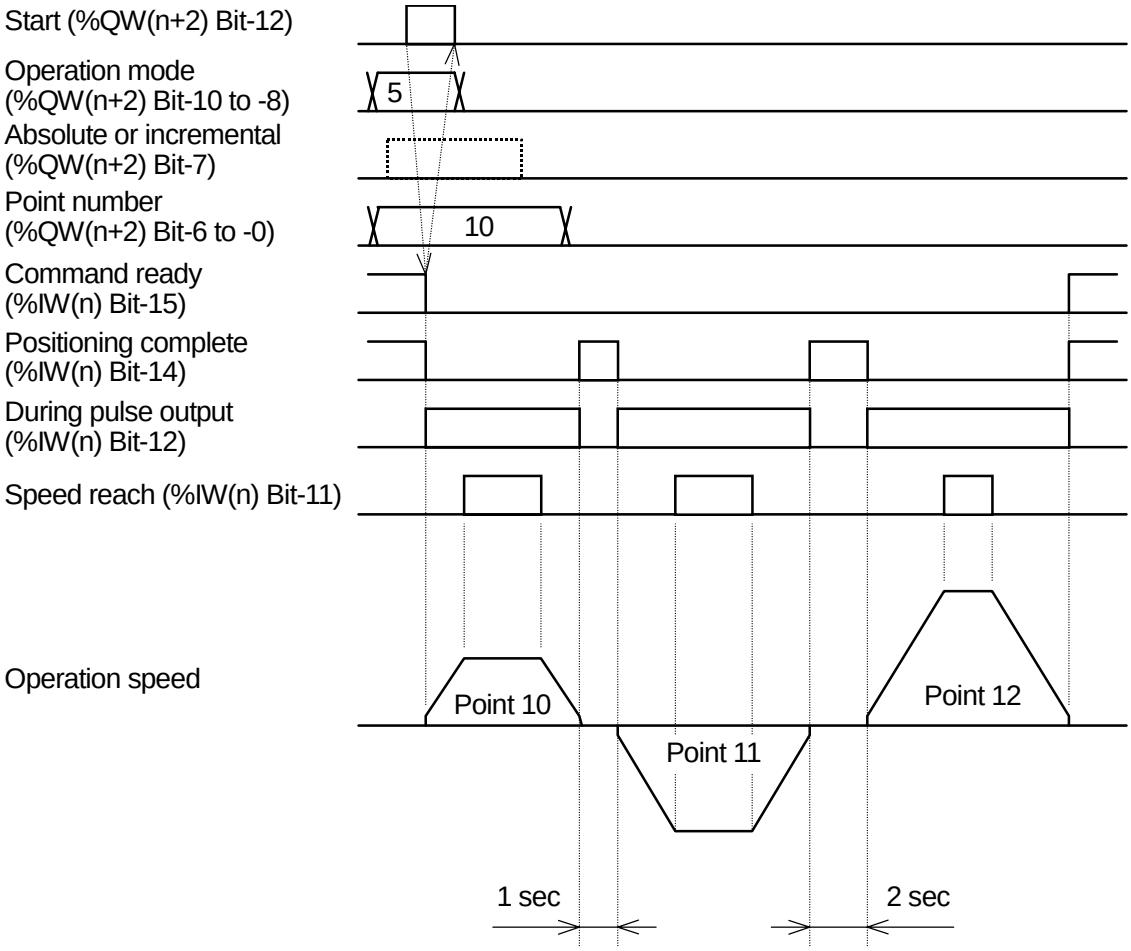


(2) Incremental positioning



Automatic stepping operation time chart

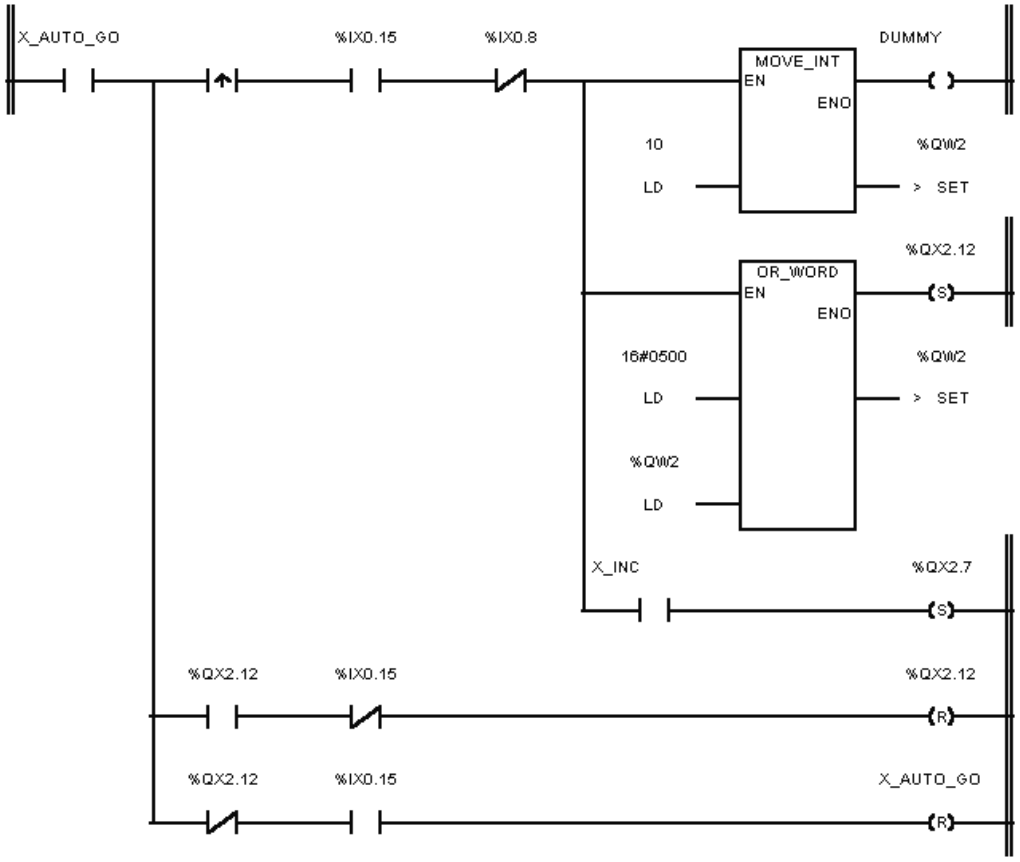
The following diagram shows the time chart for X-axis automatic stepping operation.



11.4 Sample program

A sample program for the automatic stepping operation (X-axis) is shown below.
This program designates the point 10 as the starting point.
It is assumed that the point 10 to 12 data (point 12 is block end) has been written into the MC612 before activating this sample program.

To activate this program, select absolute or incremental by X_INC (OFF = Absolute, ON = Incremental), then set X_AUTO_GO to ON.
When the consecutive positioning operation (point 10 to point 12) is completed, X_AUTO_GO is reset to OFF automatically.



When X_AUTO_GO is set to ON while the command ready flag (%IX0.15) is ON, the starting point number (10 in this sample) is set in the %QW2. The value 5 is set in bit-10 to bit-8 of %QW2. If X_INC is ON, %QX2.7 is set to ON. Then %QX2.12 is set to ON.
When %IX0.15 (command ready) is turned OFF (command accepted), %QX2.12 is reset to OFF. Then, when %IX0.15 is turned ON again (operation complete), X_AUTO_GO is reset to OFF.

11.5 Step command

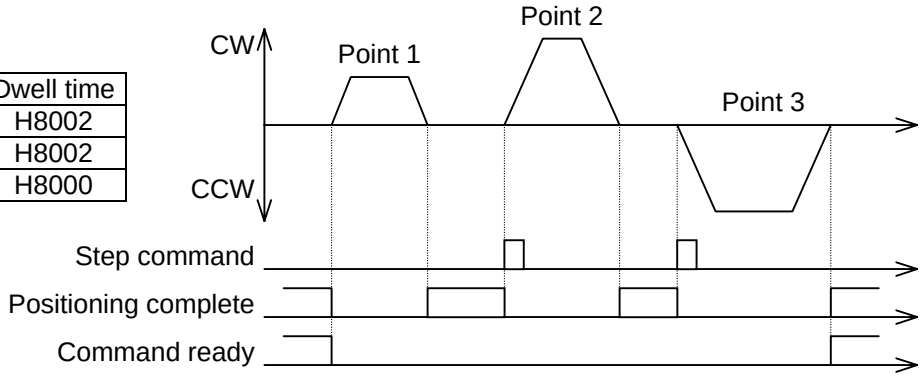
In the automatic stepping operation, if the dwell time value is H8002, the next point operation will not be started until the step command is issued. This function is used to give the step timing from the S2, instead of the pre-specified dwell time.

The step command is also available during the dwell time counting.

The followings are the operation example of the step command.

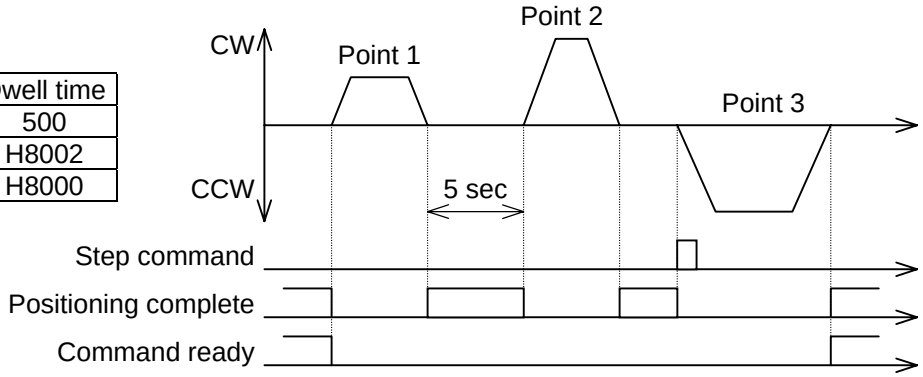
Case 1

Point	Position	Dwell time
1	5000	H8002
2	10000	H8002
3	-3000	H8000



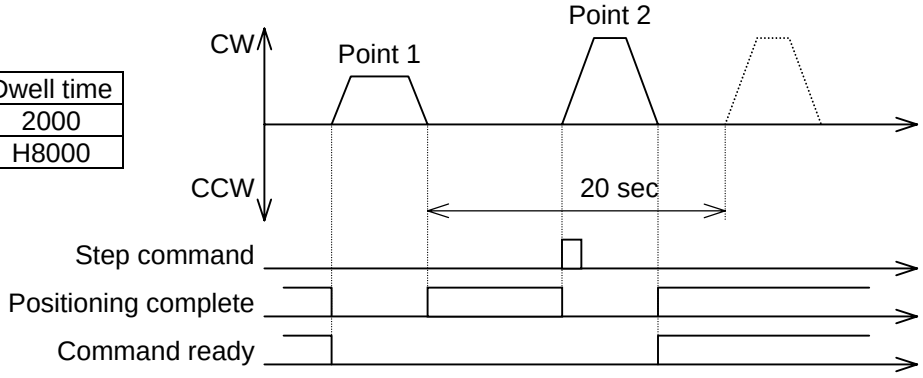
Case 2

Point	Position	Dwell time
1	5000	500
2	10000	H8002
3	-3000	H8000



Case 3

Point	Position	Dwell time
1	5000	2000
2	10000	H8000



Step command

The step command is issued by setting bit-11 of the command register (%QW) to ON while the positioning complete flag (bit-14 of %IW register) is ON.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	-	-	1	-	-	-	-	-	-	-	-	-	-	-

- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Step command acknowledge

When the step command is accepted, the step/skip acknowledge flag (bit-9) of the status register (%IW) comes ON.

Therefore, to execute the step command, follow the procedure below.

(1) Confirm the positioning complete flag (bit-14 of %IW register) is ON.

(2) Set the step command (bit-11 of %QW register) to ON.

(3) When the step/skip acknowledge flag (bit-9 of %IW register) comes ON, reset the step command (bit-11 of %QW register) to OFF.

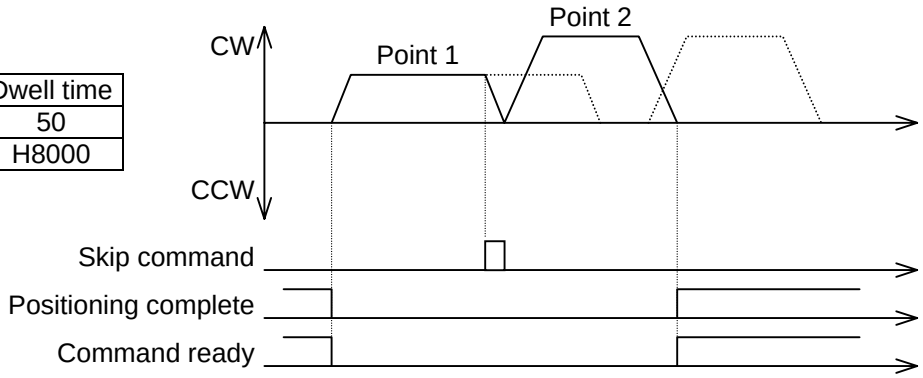
11.6 Skip command

In the automatic stepping operation, it is possible to skip the current point operation. This function is called skip command.
When the skip command is issued during a point operation, the MC612 immediately start the next point operation.

The followings are the operation example of the skip command.

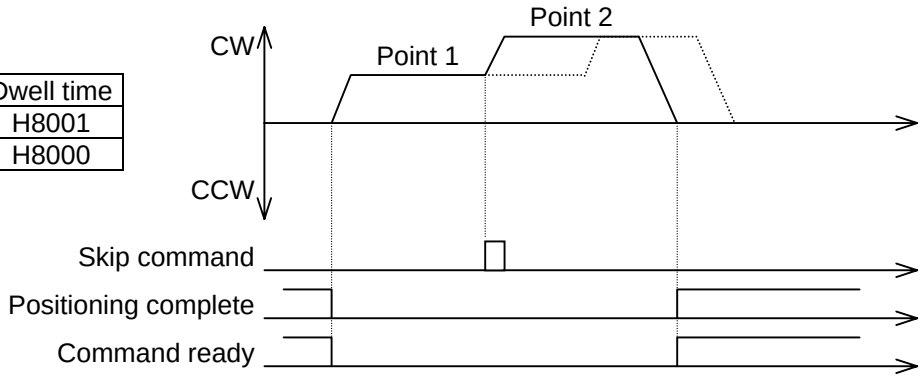
Case 1

Point	Position	Dwell time
1	5000	50
2	10000	H8000



Case 2

Point	Position	Dwell time
1	5000	H8001
2	10000	H8000



NOTE

1. The skip command is not valid for the final point (block end).
2. When you issue a skip command, do not issue the next skip command repeatedly until the operating point number (%IW register) is changed to the next point. Otherwise the second skip command will not accepted normally.
3. If the skip command is issued during incremental positioning mode, the original target position is kept.
   For example if the skip command is issued during point 1 operation under the condition that point 1 = 1000, point 2 = 2000, and the position before starting point 1 is P_0, the position after completing point 2 operation is P_0+1000+2000.

Skip command

The skip command is issued by setting bit-11 of the command register (%QW) to ON while the positioning operation is executing (positioning complete flag bit-14 of %IW register is OFF).

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	-	-	1	-	-	-	-	-	-	-	-	-	-	-

- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	-	-	1	-	-	-	-	-	-	-	-	-	-	-

Skip command acknowledge

When the skip command is accepted, the step/skip acknowledge flag (bit-9) of the status register (%IW) comes ON.

Therefore, to execute the skip command, follow the procedure below.

(1) Confirm the positioning complete flag (bit-14 of %IW register) is OFF.

(2) Set the skip command (bit-11 of %QW register) to ON.

(3) When the step/skip acknowledge flag (bit-9 of %IW register) comes ON, reset the skip command (bit-11 of %QW register) to OFF.

NOTE

The operation procedure for the step command and the skip command are the same.
If it is issued during the positioning operation, it is accepted as skip command. And if it is issued after completing positioning and waiting for dwell time, it is accepted as step command.
The functions of these two commands are the same. That is, immediately start the next point operation.

Section 12

Fixed Feed Operation

12. Fixed Feed Operation

12.1 Overview

The fixed feed operation performs the fixed amount of feed positioning. The feed amount can be selected from 1, 10, 100, and 1000 (command units).
The maximum speed specified in the system parameter is used as the operation speed.
The feed direction (CW or CCW) can be selected.
This operation mode is used for inching function.

12.2 Operation procedure

The fixed feed operation is started by setting bit-12 and bit-9 to ON with specifying the feed amount in bit-6 to bit-0 of the command register (%QW) while the command ready flag (bit-15 of %IW register) is ON.
Bit-7 is used to select absolute or incremental positioning. (0 = Absolute, 1 = Incremental)

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	0	1	0	1/0	Feed amount (0 to 3)						

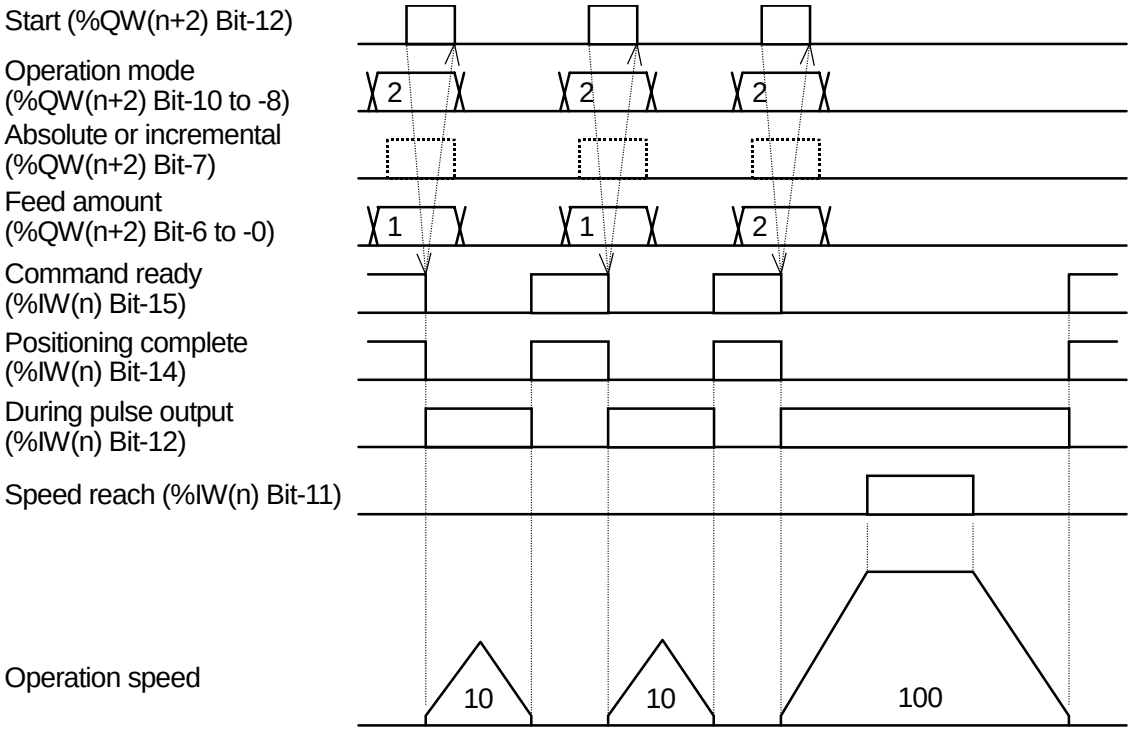
Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	0	1	0	1/0	Feed amount (0 to 3)						

Feed amount (bit-6 to bit-0):
- 0: 1
- 1: 10
- 2: 100
- 3: 1000 (command units)

Fixed feed operation time chart

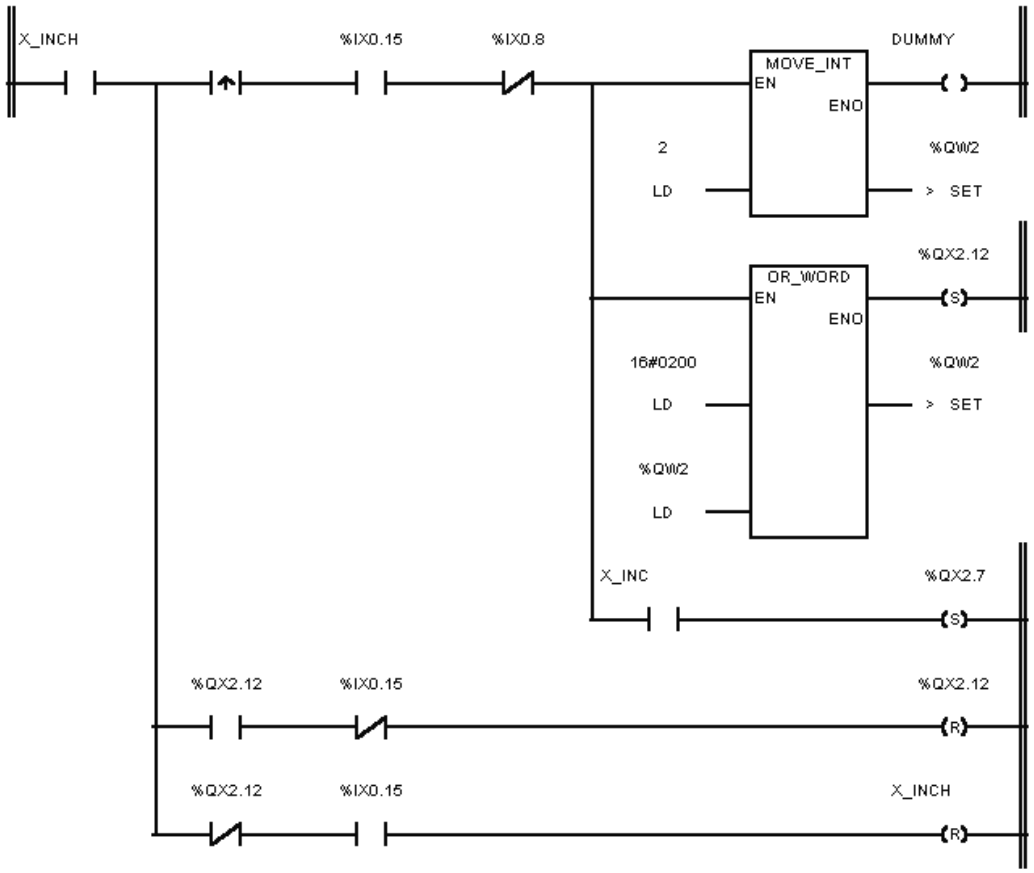
The following diagram shows the time chart for X-axis fixed feed operation.



12.3 Sample program

A sample program for the fixed feed operation (X-axis) is shown below.

In this sample program, the MC612 outputs pulses corresponding to 100 units at the each time of X_INCH changes to ON. The direction is controlled by X_INC (OFF = CW, ON = CCW).



When X_INCH is turned ON while the command ready flag (%IX0.15) is ON, the feed amount type (type 2 = 100 units in this sample) is set in the %QW2. The value 2 is set in bit-10 to bit-8 of %QW2. If X_INC is ON, %QX2.7 is set to ON. Then %QX2.12 is set to ON.

When %IX0.15 (command ready) is turned OFF (command accepted), %QX2.12 is reset to OFF.

Section 13

Special Operations

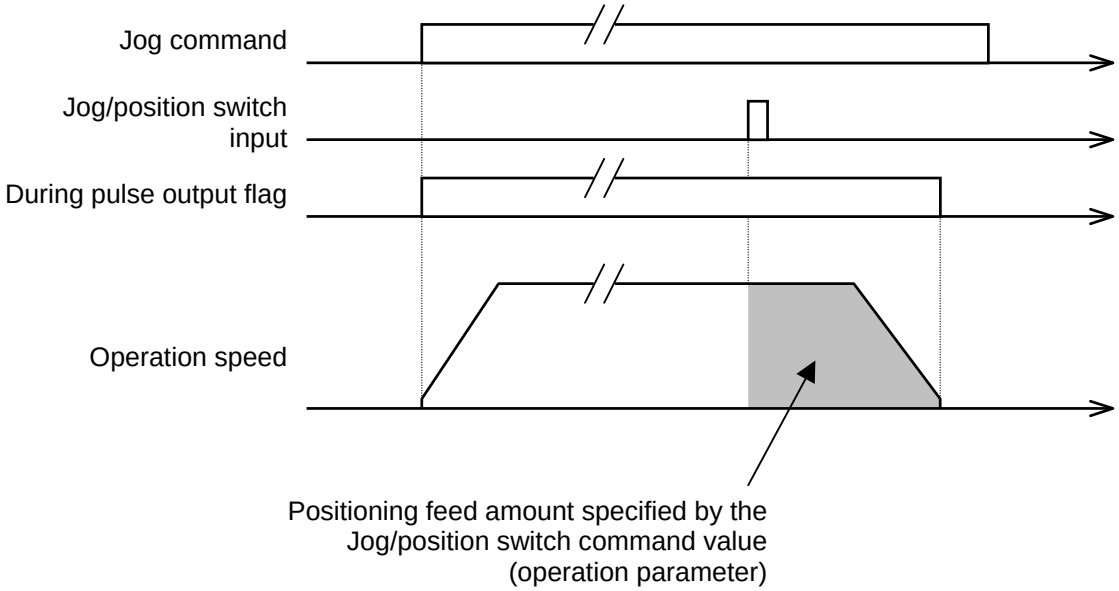
13. Special Operations

13.1 Bump-less switching from jog to positioning

During the jog operation, when the jog/position switch input comes ON, the MC612 immediately switches from jog to positioning control with keeping the current speed and direction.
The positioning feed amount (from the timing of the jog/position switch input comes ON) is specified by the operation parameter (jog/position switch command value).

For the jog/position switch input, refer to section 3.1.
For the jog/position switch command value, refer to section 5.2.

This function is useful for the application in which the positioning start timing is given by an external sensor signal during jog (speed control) operation.



NOTE

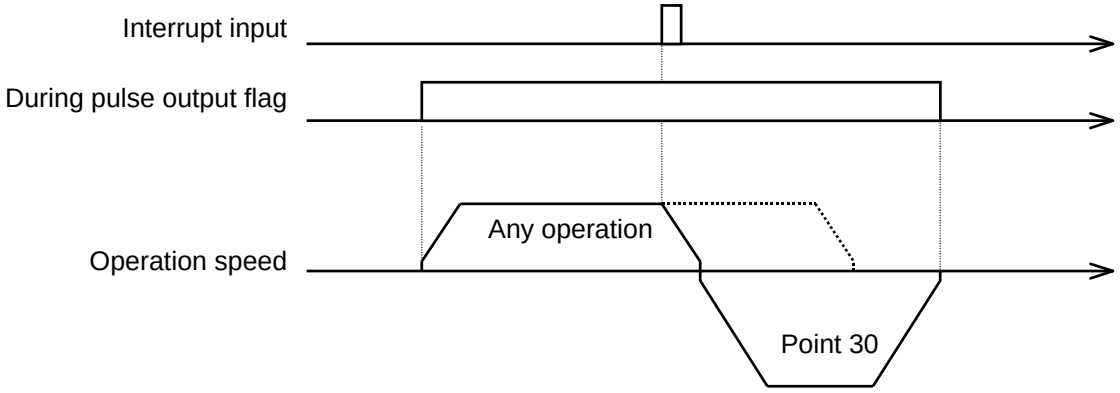
1. The jog/position switch input signal must be ON for more than 10 ms.
2. After the positioning complete, the command ready flag and the positioning complete flag will return to ON under the following condition.
   - Jog command bit is OFF
   - Jog/position switch input is OFF
3. If the jog/position switch command value is too small against the operation speed and the specified deceleration rate, the error (code 153) will occur.
4. If the jog/position switch input comes ON after the jog command bit has been OFF (during deceleration), the error (code 155) will occur.

13.2 Interrupt operation

When the interrupt input comes ON, the MC612 immediately start the positioning operation based on the point 30 data (target position and speed).
If the interrupt input comes ON during other operation, the MC612 stops the pulse output (deceleration stop), and starts the point 30 operation.

For the interrupt input, refer to section 3.1.
For the point 30 data, refer to section 5.2.

In this operation, the point 30 target position is treated as absolute position. Therefore, the zero return must be completed before using this operation. Otherwise, error (code 154) will occur.



NOTE

1. The interrupt input signal must be ON for more than 10 ms.
2. After the point 30 positioning complete, the command ready flag and the positioning complete flag will return to ON under the following condition.
   - Jog command bit or positioning start bit is OFF
   - Interrupt input signal is OFF
3. The dwell time parameter of the point 30 does not have any function for the interrupt operation.

Section 14

Other Functions

14. Other Functions

14.1 Speed changing during positioning

During the positioning operation, the operation speed can be changed by this function.
The allowable speed setting range is 0 to 127% against the maximum speed parameter value. However, even if it is more than 100%, the speed is limited by the maximum speed parameter value. In this case, speed setting alarm is occurred. (Operation is continued)

Operation procedure

This function uses the status register (%IW) and the command register (%QW) assigned to the MC612.

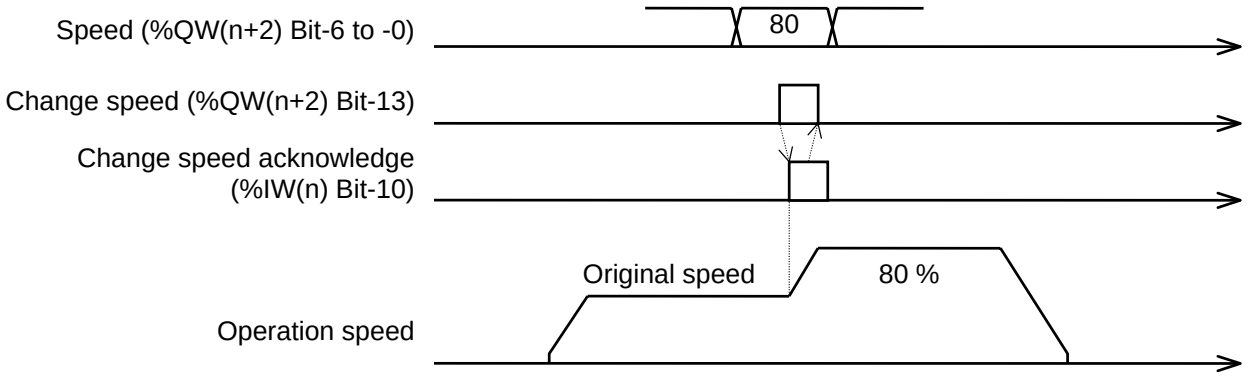
The speed changing procedure is as follows.

(1) During a positioning operation, set the required speed (%) in bit-6 to bit-0 of the command register, and set bit-13 (jog/change speed bit) to ON.

(2) When the request is accepted by the MC612, bit-10 (change speed acknowledge) of the status register comes ON.

(3) Then reset bit-13 (jog/change speed bit) of the command register to OFF.

The following diagram shows an example of X-axis.



NOTE

1. This speed changing is valid only for the current positioning operation.
2. Other than the normal positioning operations, speed changing is also possible for the following operations by the same procedure. In the following cases, the speed changing percentage is against the zero return speed value.
   - Zero return (zero LS search)
   - Zero offset

   Creep speed in the zero return operation can not be changed by this function.

14.2 Teaching

Teaching is the function to register the current position data into the designated point number's target position data.
The teaching function does not change the speed and the dwell time in the point data.

To execute the teaching function, the zero return must be completed beforehand.

The teaching function registers the current position data into the buffer memory and the main RAM in the MC612. However it is not saved into the EEPROM. Therefore, the EEPROM write command is necessary after teaching to save into EEPROM.

Operation procedure

This function uses the status register (%IW) and the command register (%QW) assigned to the MC612.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	1	1	0	-	Point number (1 to 30)						

- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	1	1	0	-	Point number (1 to 30)						

The teaching procedure is as follows.

(1) Use the jog or other operations to move to the position to be registered.

(2) Set the required point number (1 to 30) in bit-6 to bit-0 of the command register, set value 6 in bit-10 to bit-8, and set bit-12 to ON.

(3) When the request is accepted by the MC612, bit-15 (command ready) of the status register comes OFF.

(4) Then reset bit-12 of the command register to OFF.

NOTE

The teaching function registers the position data as command units. On the other hand, in the jog feed, the least increment is pulse. Therefore initial position error (round error) may occur within the command increment.

14.3 Current position preset

This function is used to change the current position data to the desired value.
In the MC612, there are two types of current position data. One is for output pulse and the other is for feedback pulse input. The current position preset function can select either or both as the changing target.

Operation procedure

The operation procedure to change the current position data is as follows.

(1) Write the position data into the current position preset data of the operation parameters. (see below)

Name	Address		Setting range (unit)	Description
	X-axis	Y-axis		
Current position preset data (for pulse output)	40 41	208 209	-9999999 to 9999999 (command units)	Sets the preset value for current position. This is for position based on pulse output.
Current position preset data (for feedback pulse)	42 43	210 211	-9999999 to 9999999 (command units)	Sets the preset value for current position. This is for position based on feedback pulse input.

(2) Set the preset target (1 to 3) in bit-7 to bit-0 of the command register, set value 7 in bit-10 to bit-8, and set bit-12 to ON.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	1	1	1	Preset target (1 to 3)							

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	1	1	1	Preset target (1 to 3)							

Preset target: 1 = Current position for output pulse only
2 = Current position for feedback pulse input only
3 = Both

(3) When the request is accepted by the MC612, bit-15 (command ready) of the status register comes OFF.

(4) Then reset bit-12 of the command register to OFF.

Special procedure to set the zero return complete flag forcibly (Soft zero return)

When the power is turned ON, the zero return complete flag is 0. (Zero return incomplete)
However, by executing the following special operation, the zero return complete flag can be set to 1 forcibly.
By this special operation, absolute positioning becomes possible without executing the zero return.

Preparation:

(1) Preset the current position for output pulse to the desired value (e.g. 100).

(2) Execute parameter save (EEPROM write) command.
(The current position data is also saved in the EEPROM. But it cannot be seen.)

At the normal operation:

(1) Turn on power to the S2.

(2) Before executing any other command, preset the current position for output pulse by the value that is saved in the EEPROM (e.g. 100).
If the changed value is the same as the position data saved in the EEPROM, the zero return complete flag will be set to 1.

Section 15

Stop

15. Stop

15.1 Deceleration stop command

When the MC612 is in positioning operation (including zero return), the S2 can forcibly stop the operation by the deceleration stop command.

The deceleration stop command is executed by setting bit-14 of the command register (%QW) to ON.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

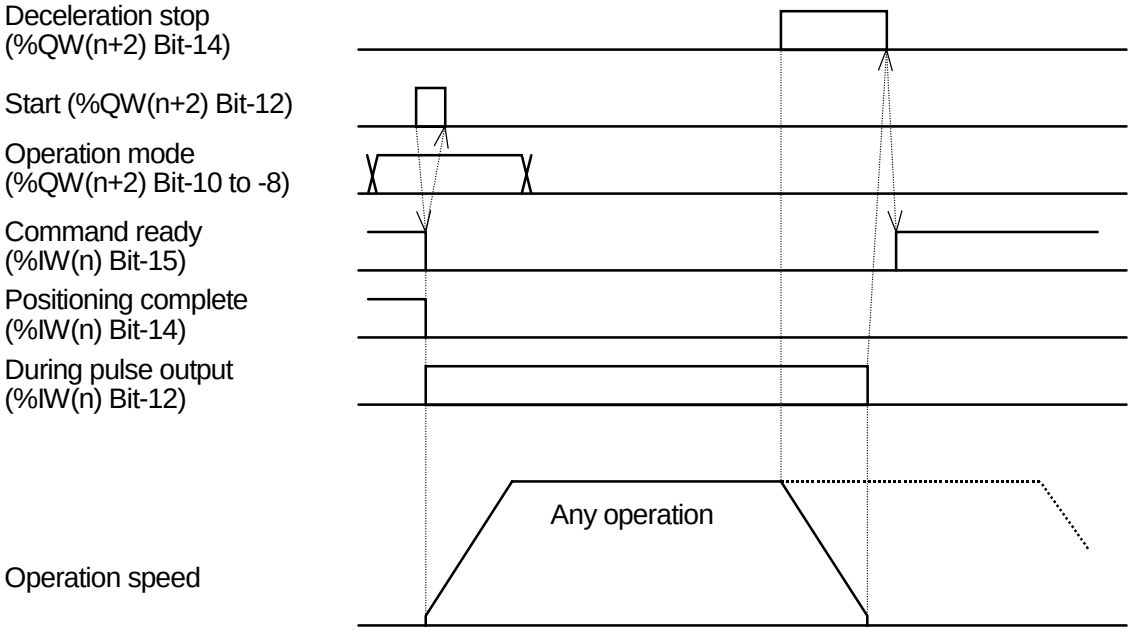
- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

When the deceleration stop command is executed during operation, the MC612 decelerates and stops the pulse output. The zero return completion status is not changed.

The following diagram shows the time chart for X-axis deceleration stop command.

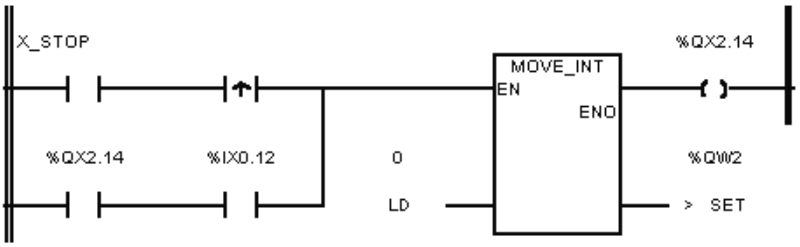


NOTE

When the deceleration stop command is executed, the positioning complete flag will not return to ON even when the operation is stopped. This flag will come ON when the next operation is completed normally.

Deceleration stop command sample program

A sample program for the deceleration stop (X-axis) is shown below.



When X_STOP is turned ON, %QW2 (command register) is reset to 0 and %QX2.14 (deceleration stop command) is set to ON.
%QX2.14 is kept ON until %IX0.12 (during pulse output flag) comes OFF.

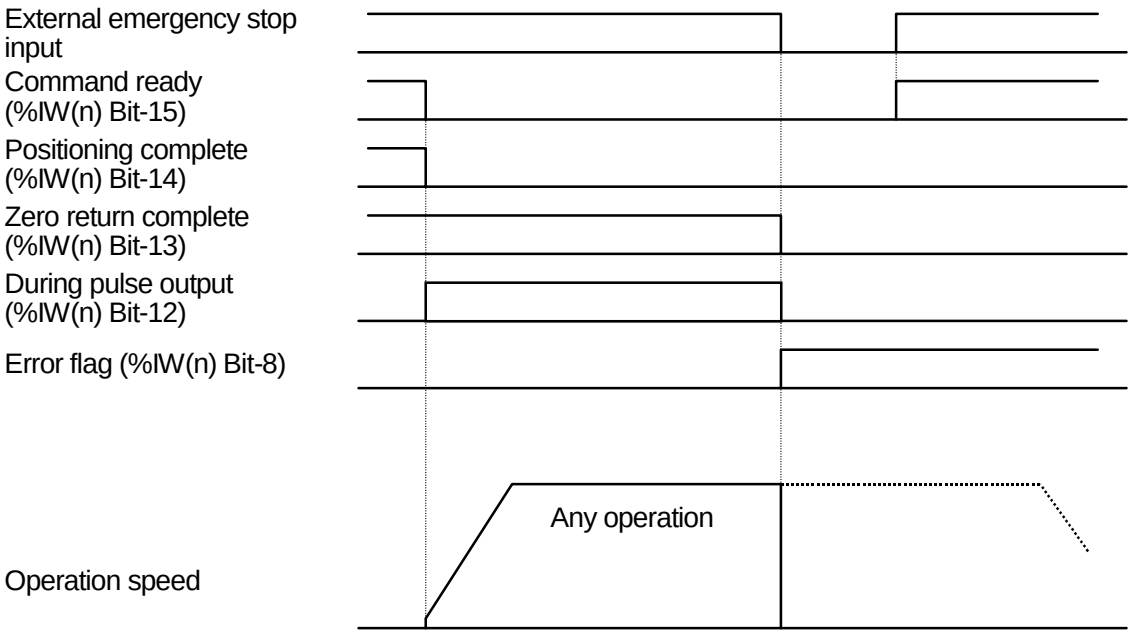
NOTE

As above sample program, keep the deceleration stop command (%QX2.14) ON until the during pulse output flag (%IX0.12) comes OFF. Then reset the deceleration stop command (%QX2.14) to OFF.

15.2 Emergency stop signal

The MC612 has the emergency stop input. Refer to sections 2.4 and 3.1.
When the emergency stop input is activated (opened), the MC612 immediately stops the pulse output and goes into the error state (code 144).
At the same time, the zero return completion status is reset (the zero return complete flag changes to OFF), and the error counter clear output turns ON for 50 ms if phase-Z signal is used. (Refer to section 7.2.1)

The following diagram shows the time chart for X-axis emergency stop input.



To recover from the error state, reset the command bit (jog, etc.) to OFF, reset the emergency stop input to normal condition, then execute the error reset command. For the error reset command, refer to section 17.2.

NOTE

If the selected error counter clear mode is Toei servo mode (refer to section 7.2.1), the error counter clear output will not come ON when the emergency stop input is activated.

15.3 Emergency stop command

As well as the external emergency stop input, the S2 can also issue the emergency stop command. The behavior at the emergency stop command is the same as the external emergency stop input.

The emergency stop command is executed by setting bit-15 of the command register (%QW) to ON.

X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- : Do not care

Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

When the emergency stop command (bit-15) turns ON, the MC612 immediately stops the pulse output and goes into the error state (code 145).
At the same time, the zero return completion status is reset (the zero return complete flag changes to OFF), and the error counter clear output turns ON for 50 ms if phase-Z signal is used. (Refer to section 7.2.1)

To recover from the error state, reset the command bit (jog, etc.) to OFF, reset the emergency stop command (bit-F of the command register) to OFF, then execute the error reset command. For the error reset command, refer to section 17.2.

NOTE

If the selected error counter clear mode is Toei servo mode (refer to section 7.2.1), the error counter clear output will not come ON when the emergency stop command is executed.

15.4 Over-travel limit switch

The MC612 has the CW over-travel limit input and the CCW over-travel limit input. Refer to sections 2.4 and 3.1.
When the CW over-travel limit input comes active (opened) during CW direction operation, the MC612 immediately stops the pulse output and goes into the error state (code 146).
On the other hand, when the CCW over-travel limit input comes active (opened) during CCW direction operation, the MC612 immediately stops the pulse output and goes into the error state (code 147).

When the CW or CCW over-travel limit input comes active, the zero return completion status is reset (the zero return complete flag changes to OFF), and the error counter clear output turns ON for 50 ms if phase-Z signal is used. (Refer to section 7.2.1)

To recover from the error state, execute the error reset command (refer to section 17.2), then operate for the opposite direction to escape from the over-travel limit switch.

NOTE

1. When wiring the CW and CCW over-travel limit switches, make sure the CW and CCW side. If they are reversed, the over-travel limit switches will not function correctly.
2. If the selected error counter clear mode is Toei servo mode (refer to section 7.2.1), the error counter clear output will not come ON when the over-travel limit is activated.

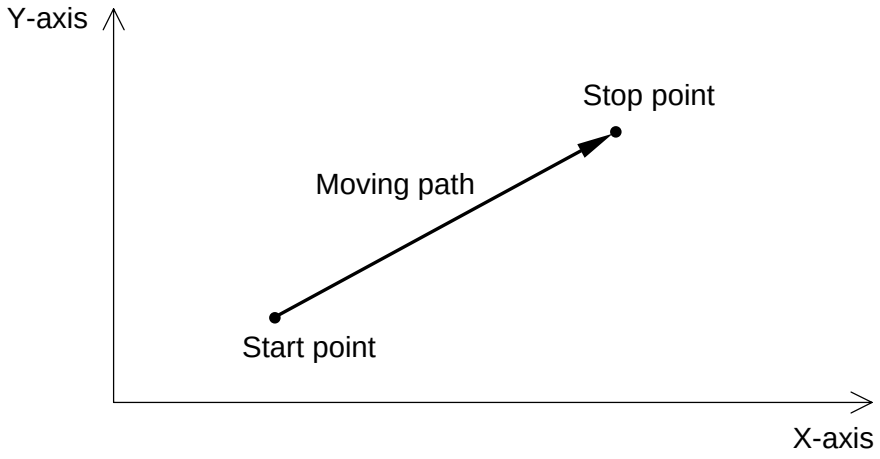
Section 16

2-axis Linear Interpolation Control Mode

16. 2-axis Linear Interpolation Control Mode

16.1 Overview

The MC612 has two axis control mode. One is the 2-axis independent control mode, and the other is the 2-axis linear interpolation control mode. In the linear interpolation mode, the 2 axes are controlled proportionally. As the result, when an X-Y table is used with the each axis, the moving path during the positioning is controlled to be a straight line.



The linear interpolation mode is effective for the following operations.

- Direct command operation
- Point number operation
- Automatic stepping operation
- Fixed feed operation

Even if the linear interpolation mode is selected, other operations (Zero return, Jog, etc.) work as the independent control mode.

NOTE

1. The accuracy of the linearity is ±3 pulses when the feed amount of X and Y axes are same.
2. In the linear interpolation mode, speed related parameters are applied for the synthesis movement.
3. The backlash compensation is effective in the linear interpolation mode.

16.2 Mode setting

The linear interpolation mode can be selected by setting the MC612's system parameter. Write value 1 into the buffer memory address 28 to select the liner interpolation mode.

<Axis control mode>

Parameter	Address	Setting range	Description
Axis control mode	28	0: Independent 1: Linear interpolation	Selects the control mode either 2-axis independent or 2-axis linear interpolation control mode.

Refer to section 5.1 for how to write the parameters.

NOTE

1. Even if the axis control mode is set to the linear interpolation mode, the following operations work as the independent control mode.
   - Zero return operation
   - Jog operation
   - Teaching

   Therefore, for these operations, the emergency stop signal is required for each axis.

16.3 Related commands and parameters

In the linear interpolation mode, the following commands, parameters, and external signals are used for each operation.

Operation	Command	Parameter	External signal
Direct command operation	X-axis command %QW(n+2) is used.	Both X-axis and Y-axis parameters designate target position. X-axis speed parameters are used for the synthesis speed.	X-axis signals are used. As for the over-travel, Y-axis signal is also used.
Point number operation	X-axis command %QW(n+2) is used.	Both X-axis and Y-axis parameters designate target position. X-axis speed parameters are used for the synthesis speed.	X-axis signals are used. As for the over-travel, Y-axis signal is also used.
Automatic stepping operation	X-axis command %QW(n+2) is used.	Both X-axis and Y-axis parameters designate target position. X-axis speed parameters are used for the synthesis speed. X-axis dwell time setting is used.	X-axis signals are used. As for the over-travel, Y-axis signal is also used.
Fixed feed operation	X-axis command %QW(n+2) is used. For the feed amount and the direction, Y-axis command %QW(n+3) is also used.	X-axis speed parameters are used for the synthesis speed.	X-axis signals are used. As for the over-travel, Y-axis signal is also used.
Interrupt operation	N/A	Both X-axis and Y-axis parameters designate target position. (Point 30) X-axis speed parameters are used for the synthesis speed.	The interrupt signal of X-axis is used.
Speed changing during positioning	X-axis command %QW(n+2) is used.	X-axis speed parameter is used as reference for the synthesis speed.	N/A
Current position preset	X-axis command %QW(n+2) is used.	Both X-axis and Y-axis parameters designate the preset position.	N/A

NOTE

1. The speed parameters (including acceleration/deceleration rate) are applied for the synthesis movement. Therefore, depending on the moving path, operation speed of X-axis or Y-axis may be slower than the minimum speed setting.
2. The synthesis speed is designated by the X-axis parameter. Therefore, more than 100% value can be designated. However each axis cannot exceed the maximum speed setting.
   In this case, the axis speed is limited by the maximum speed, and the other axis speed is kept the proportion.

Section 17

Auxiliary Commands

17. Auxiliary Commands

17.1 Overview

The MC612 has the following auxiliary commands.

- Command number 0 = Error reset
- Command number 1 = Parameter save (EEPRPM write)
- Command number 2 = Parameter read (EEPROM read)
- Command number 3 = Parameter initialize
- Command number 5 = Parameter enable

How to execute the auxiliary command

To execute the auxiliary command, the status register (%IW) and the command register (%QW) assigned to the MC612 are used.

For X-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+2)	0	0	0	1	0	0	0	0	Command number (0 to 5)							

For Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
%QW(n+3)	0	0	0	1	0	0	0	0	Command number (0 to 5)							

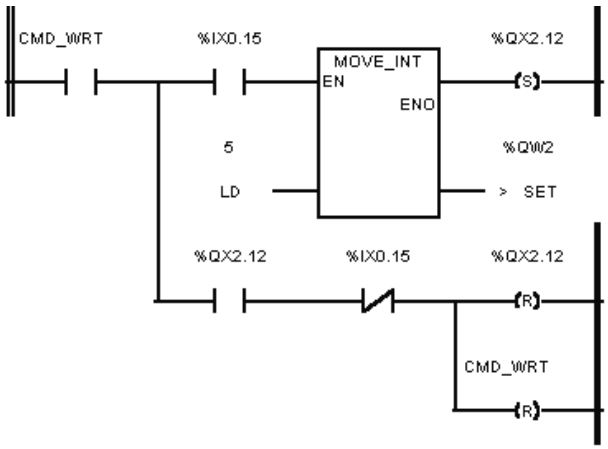
The procedure is as follows.

(1) Set the required command number (0 to 5) in bit-7 to bit-0 of the command register, and set bit-12 to ON.

(2) When the command is accepted by the MC612, bit-15 (command ready) of the status register comes OFF.

(3) Then reset bit-12 of the command register to OFF.

A program example is shown below.



This example is for executing the X-axis parameter enable command.
When CMD_WRT comes ON, the command number 5 is written in %QW2 and %QX2.12 is set to ON. When the command is accepted (%IX0.15 changes OFF), %QX2.12 and CMD_WRT are reset to OFF.

17.2 Error reset

When the MC612 detects an abnormality (parameter error, emergency stop, over-travel, etc.), the MC612 stops pulse outputs then enters the Error mode.
To recover from the Error mode, the Error reset command is necessary.

The command number is 0 for this Error reset command.
Refer to section 17.1 for how to execute this command.

In the independent control mode, this command is effective for the each axis independently.
On the other hand, in the linear interpolation mode, X-axis command is effective.

NOTE

1. When an error has occurred, the corresponding error code is stored in the status register (%IW) and in the buffer memory (address 37 for X-axis and address 205 for Y-axis). Confirm the error code before executing the error reset. Then after resetting the error, take the corrective action. (Refer to appendix A.1 for the error code)

17.3 Parameter save (EEPROM write)

As described in section 1.3, the MC612 contain three types of memory. These are main RAM, buffer memory, and non-volatile EEPROM.

When power is turned on to the MC612, the control parameters stored in the EEPROM are transferred to the main RAM and the buffer memory.

To write the parameters into the EEPROM:

(1) Write the parameters into the MC612's buffer memory.

(2) Execute the Parameter save (EEPROM write) command. Then the parameters are written into the main RAM and the EEPROM.

From the next time power-on, the parameters stored in the EEPROM are automatically retrieved to the main RAM and the buffer memory.

The command number is 1 for this Parameter save (EEPROM write) command.
Refer to section 17.1 for how to execute this command.

In the independent control mode, this command for any axis functions entire parameter save.
In the linear interpolation mode, X-axis command is effective.

NOTE

1. The EEPROM has the life limit for the writing. It is 100,000 times. When it exceeds, the error code 138 is registered.
2. It is also possible to operate the MC612 without using the EEPROM. In this case, every time the S2 starts the operation, write the parameters into the buffer memory and execute the Parameter enable command.

17.4 Parameter read (EEPROM read)

As described in section 1.3, the MC612 contain three types of memory. These are main RAM, buffer memory, and non-volatile EEPROM.

When the Parameter read (EEPROM read) command is executed, the control parameters stored in the EEPROM are transferred to the main RAM and the buffer memory.

The command number is 2 for this Parameter read (EEPROM read) command.
Refer to section 17.1 for how to execute this command.

In the independent control mode, this command is effective for the each axis independently. On the other hand, in the linear interpolation mode, X-axis command is effective for entire parameter read.

17.5 Parameter initialize

When the Parameter initialize command is executed, the parameters stored in the main RAM and the buffer memory are initialized to the default value. Refer to appendix A.2 for the default value.

The command number is 3 for this Parameter initialize command.
Refer to section 17.1 for how to execute this command.

In the independent control mode, this command for any axis functions entire initialization.
In the linear interpolation mode, X-axis command is effective.

17.6 Parameter enable command

As described in section 1.3, the MC612 contain three types of memory. These are main RAM, buffer memory, and non-volatile EEPROM.

When the parameters are written into the buffer memory, these parameters are become effective after executing the Parameter enable command. (Buffer memory contents are transferred to the main RAM.)

The command number is 5 for this Parameter enable command.
Refer to section 17.1 for how to execute this command.

In the independent control mode, this command is effective for the each axis independently. On the other hand, in the linear interpolation mode, X-axis command is effective for entire parameter.

Appendices

A.1 List of Error codes

When an error has occurred in the MC612, the error status is indicated as follows.
- Error bit of the corresponding axis (bit-8 of %IW(n) or bit-8 of %IW(n+1)) turns ON
- Error code is stored in the lower 8-bit of the status register (%IW(n) or %IW(n+1))
- Error code is stored in the buffer memory (address 37 for X-axis or address 205 for Y-axis)

The following list shows the error codes.

The errors are divided into two levels, alarm (error code 1 to 31) and error (error code 32 or more). Depending on the error levels, error recovery method is different.
Alarm: by removing the error cause
Error: by executing the Error reset command

Basic operation error

Code	Error name	Error contents (cause)	Remedy
0	No error	-	-
1	Speed limit	The specified operation speed is out of the allowable speed range. (1) More than 100% speed is set in the independent mode. (2) The synthesis speed exceeds the maximum speed in the linear interpolation mode. (3) The specified speed to be changed is out of the range.	(1) Change the speed parameter to 100% or less. (2) Change the speed parameter for the synthesis speed not to exceed the maximum speed. (3) Change the speed specified between the maximum and the minimum speed.
2	Stop command	The stop command bit of %QW is set to ON.	Reset the stop command bit to OFF.
8	Zero return incomplete	The command that requires zero return complete was given before zero return.	Execute zero return before the command.
9	Soft zero return failed	The soft zero return was failed because the condition was not satisfied.	Execute zero return and set the zero return complete flag.

Command data error

Code	Error name	Error contents (cause)	Remedy
16	Command number error	The auxiliary command number is invalid.	Check the command number. It must be 0,1,2,3,or 5.
18	Fixed feed amount error	The feed amount for the fixed feed operation is invalid.	Check the data for feed amount. It must be 0 to 3.
20	Point number error (Point number operation)	The point number specified is invalid in the point number operation.	Check the point number. It must be 1 to 30.
21	Point number error (automatic stepping operation)	The point number specified is invalid in the automatic stepping operation.	Check the point number. It must be 1 to 30.
22	Point number error (teaching)	The point number specified is invalid in the teaching operation.	Check the point number. It must be 1 to 30.
23	Current position preset target error	The changing target for the current position preset is invalid.	Check the data for target. It must be 1, 2 or 3.

Command timing error

Code	Error name	Error contents (cause)	Remedy
24	Command duplicate error	Both of positioning operation command and JOG command are set to ON at the same time.	Reset to OFF the both commands, and set either intended command to ON.
25	Parameter related command not ready	(1) Either axis is not ready to execute parameter save or parameter initialize command. (2) The corresponding axis is not ready to execute parameter read or parameter enable command.	Confirm the command ready status.
26	Operation command not ready	(1) A command was given when the command ready flag is OFF. (2) in the linear interpolation mode, an interpolation command was given during Y-axis independent operation. (3) A command other than error reset was given in error state.	(1) Give a command after checking that the command ready flag is ON. (2) Before giving an interpolation command, check that the command ready flag of Y-axis is also ON. (3) Execute error reset command in error state.
27	Skip command invalid	A skip command was given when the last point number in automatic stepping operation is being operated.	Do not give the skip command during the last point operation.

Parameter error (No.1)

Code	Error name	Error contents (cause)	Remedy
32	Pulse output mode setting error	The pulse output mode setting is illegal.	Check the setting value.
33	Backlash compensation setting error	The backlash compensation setting value was out of range.	Check the setting value. Allowable range is 0 to 1000.
34	Zero return operation mode setting error	The zero return operation mode setting is illegal.	Check the setting value.
35	Zero return direction setting error	The zero return operation direction setting is illegal.	Check the setting value.
36	Electronic gear numerator setting error (output)	The electronic gear numerator setting for output pulse is out of range.	Check the setting value. Allowable range is 1 to 10000.
37	Electronic gear denominator setting error (output)	The electronic gear denominator setting for output pulse is out of range.	Check the setting value. Allowable range is 1 to 10000.
38	Electronic gear numerator setting error (feedback)	The electronic gear numerator setting for feedback pulse is out of range.	Check the setting value. Allowable range is 1 to 10000.
39	Electronic gear denominator setting error (feedback)	The electronic gear denominator setting for feedback pulse is out of range.	Check the setting value. Allowable range is 1 to 10000.
40	Acceleration rate setting error	The acceleration rate setting is out of range.	Check the setting value. Allowable range is 1 to 32767.
41	Deceleration rate setting error	The deceleration rate setting is out of range.	Check the setting value. Allowable range is 1 to 32767.
42	Maximum speed setting error	The maximum speed setting is out of range.	Check the setting value. Allowable range is 20 to 200000.
43	Minimum speed setting error	The minimum speed setting is out of range.	Check the setting value. Allowable range is 20 to 200000.
44	Zero return speed setting error	The zero return speed setting is out of range.	Check the setting value. Allowable range is 20 to 200000.
45	Coordinate origin setting error	The coordinate origin value setting is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
46	Zero offset setting error	The zero offset setting is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.

Parameter error (No.2)

Code	Error name	Error contents (cause)	Remedy
48	CW soft limit setting error	The CW side soft limit setting is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
49	CCW soft limit setting error	The CCW side soft limit setting is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
50	Current position preset data error (output)	The current position preset data setting for output pulse is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
51	Current position preset data error (feedback)	The current position preset data setting for feedback pulse is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
52	Direct command target position error	The target position data of the direct command operation is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
53	Jog to positioning target position error	The target position (incremental value) of the jog to positioning operation is out of range.	Check the setting value. Allowable range is 0 to 9999999.
54	Target position setting error (point data)	The target position of the point number data is out of range.	Check the setting value. Allowable range is -9999999 to 9999999.
55	Speed setting error (point data)	The speed setting of the point number data is out of range.	Check the setting value. Allowable range is 1 to 32767.
56	Dwell time setting error (point data)	The dwell time setting of the point number data is out of range.	Check the setting value. Allowable range is 0 to 10000, H8000, H8001, or H8002.

Parameter mismatch

Code	Error name	Error contents (cause)	Remedy
64	Soft limit inconsistent	CW and CCW soft limits relation is not correct. (1) CW soft limit ≤ CCW soft limit (2) Soft limit disable condition is mismatched.	Correct the settings. (1) CW soft limit > CCW soft limit (2) Both CW and CCW soft limits must be -1 to disable.
65	Maximum speed inconsistent	The maximum speed setting is smaller than the minimum speed setting.	Review the maximum speed and minimum speed settings for correction.
66	Zero return speed inconsistent	The zero return speed setting is smaller than the minimum speed or greater than the maximum speed.	Review the zero return speed, minimum speed, and maximum speed settings for correction.
67	Operation speed error	The operation speed (% setting) is smaller than the minimum speed.	Review the operation speed or minimum speed settings for correction.
68	Soft limit (positioning)	The positioning command that will cause the soft limit over is given.	(1) Correct the target position within the soft limit range. (2) Review the soft limit value.
69	Internal calculation overflow	MC612 internal calculation overflow has occurred.	Execute error reset. If this error occurs repeatedly, replace the MC612.
70	Zero return parameter inconsistent	Search and Creep directions are the same at over-travel LS use selection.	Set the Search and Creep directions to be opposed when over-travel LS is used.
72	Electronic gear data error (output)	The electronic gear value for the output pulse is out of the allowable range, 1/127 to 127.	Correct the electric gear value.
73	Electronic gear data error (feedback)	The electronic gear value for the feedback pulse is out of the allowable range, 1/127 to 127.	Correct the electric gear value.

Hardware error

Code	Error name	Error contents (cause)	Remedy
128	During reset process	The MC612 is being reset. (No error)	When reset process is completed, the error code is automatically cleared. Do not give any command during reset process.
129 130 131 132	Hardware error	A hardware error in the MC612 has been detected.	Cycle power off/on. When this error occurs repeatedly, replace the MC612.
136	EEPROM data error	BCC error has been detected in the EEPROM data.	Execute error reset. Save the parameters into the EEPROM again. When this error occurs repeatedly, replace the MC612.
137	EEPROM write incomplete	Writing into the EEPROM has not been completed normally.	Execute error reset. Save the parameters into the EEPROM again. When this error occurs repeatedly, replace the MC612.
138	EEPROM write times over	The number of EEPROM writes times exceeded the limit (100,000 times).	It is recommended to replace the MC612 because the EEPROM data is unreliable.

Stop

Code	Error name	Error contents (cause)	Remedy
144	External emergency stop	The external emergency stop signal comes active. Resulting immediate stop.	Check the safety and reset the emergency stop signal. Then execute error reset.
145	Emergency stop command	The emergency stop command bit of the %QW register comes ON. Resulting immediate stop.	Check the safety and reset the emergency stop command bit. Then execute error reset.
146	CW over-travel limit switch	The CW side over-travel limit switch input comes active.	After executing error reset, moves to the CCW direction. (use Jog)
147	CCW over-travel limit switch	The CCW side over-travel limit switch input comes active.	After executing error reset, moves to the CW direction. (use Jog)
148	CW soft limit	The current position exceeds the CW soft limit.	Move to the CCW direction by Jog operation.
149	CCW soft limit	The current position exceeds the CCW soft limit.	Move to the CW direction by Jog operation.
151	PLC mode error	During operation, the PLC changes the mode other than RUN mode. Resulting immediate stop.	Check the PLC operation.

Operation error

Code	Error name	Error contents (cause)	Remedy
152	No block end	No end point (H8000) was found in the automatic stepping operation. Operation proceeds up to point 30.	Check the point number parameters.
153	Jog/position switch command value insufficient	The jog/position switch input was turned ON and the operation was stopped. However the incremental command value was not enough to keep the specified deceleration rate.	Review the parameters and the Jog speed.
154	Interrupt operation invalid	The interrupt input signal is switched ON when zero return has not been completed. (No operation)	Execute zero return before using the interrupt operation.
155	Jog/position switch operation invalid	The Jog/position switch input signal is switched ON when the Jog command is OFF. (No operation)	The Jog/position switch input is effective during the Jog command is ON.

A.2 List of parameter default value

The list below shows the default value (initial value) of the each parameter.

Address	Data length	Axis	Name	Data range	Default value
0	1W	X	Pulse output mode	Bit-0: Output pulse (0 or 1) Bit-1: Feedback pulse (0 or 1)	H0000
1	1W	X	Backlash compensation	0 to 1000 (pulse)	0
2	1W	X	Zero return operation mode	Bit-0: Zero LS (0 or 1) Bit-1: Phase-Z pulse (0 or 1) Bit-2: Error counter clear (0 or 1)	H0000
3	1W	X	Zero return operation direction	Bit-0: Search direction (0 or 1) Bit-1: Creep direction (0 or 1)	H0001
4	1W	X	Electronic gear numerator (output pulse)	1 to 10000 (pulse/rotation)	1000
5	1W	X	Electronic gear denominator (output pulse)	1 to 10000 (command units/rotation)	1000
6	1W	X	Electronic gear numerator (feedback pulse)	1 to 10000 (pulse/rotation)	1000
7	1W	X	Electronic gear denominator (feedback pulse)	1 to 10000 (command units/rotation)	1000
8	1W	X	Acceleration rate	0 to 32767 (ms)	10000
9	1W	X	Deceleration rate	0 to 32767 (ms)	10000
10 11	2W	X	Maximum speed	20 to 200000 (pps)	3000
12 13	2W	X	Minimum speed	20 to 200000 (pps)	100
14 15	2W	X	Zero return speed	20 to 200000 (pps)	3000
16 17	2W	X	Coordinate origin value	-9999999 to 9999999 (command unit)	0
18 19	2W	X	Zero offset	-9999999 to 9999999 (command unit)	0
20 21	2W	X	CW Soft limit	-9999999 to 9999999 (command unit)	+9999999
22 23	2W	X	CCW Soft limit	-9999999 to 9999999 (command unit)	-9999999
24 25 26 27			No use		
28	1W	-	Axis control mode	0 = 2-axis independent 1 = 2-axis linear interpolation	0
29 30 31			No use		

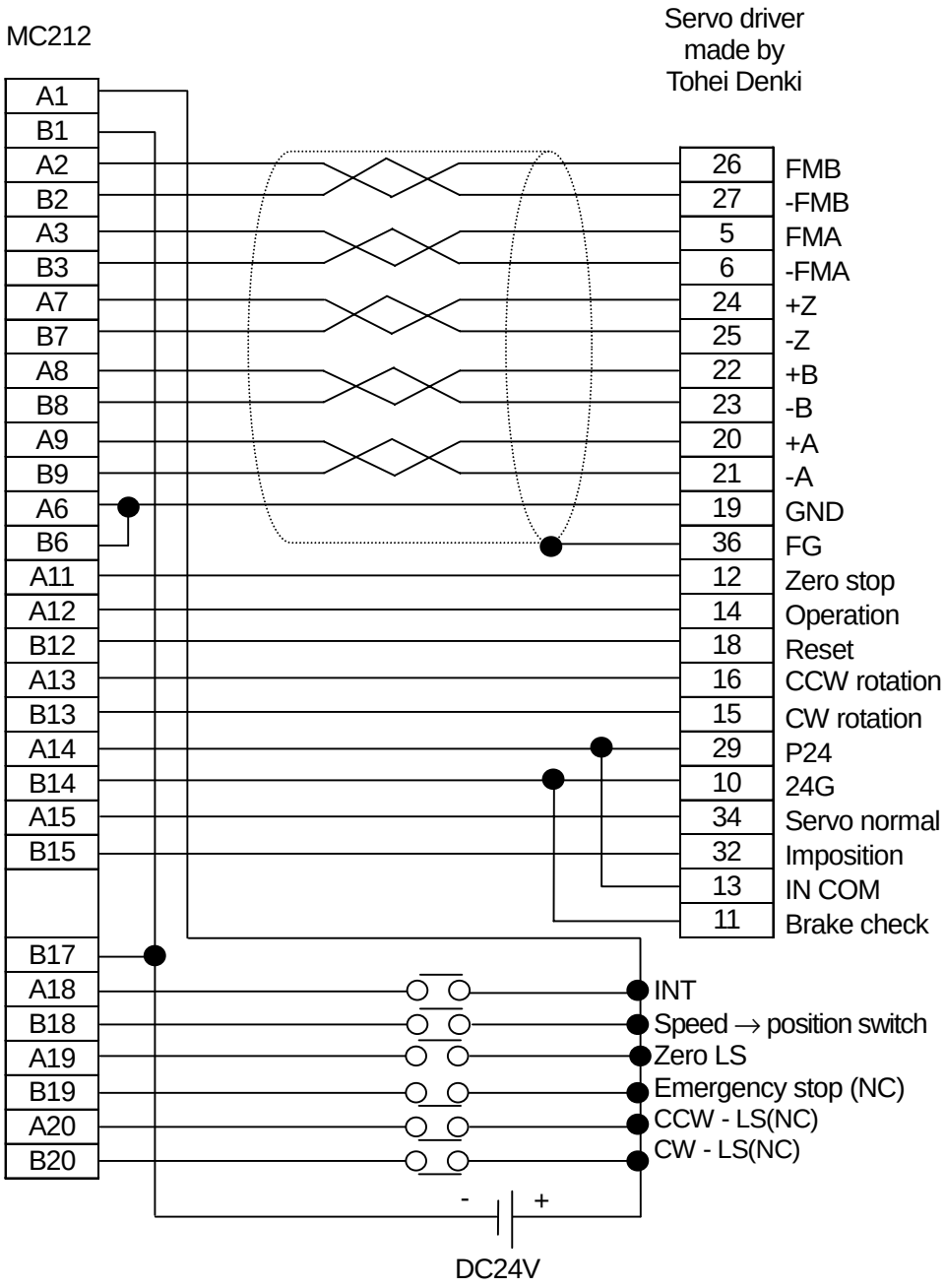
Address	Data length	Axis	Name	Data range	Default value
32 33	2W	X	Current position (pulse output)	-9999999 to 9999999 (command unit)	0
34 35	2W	X	Current position (feedback pulse)	-9999999 to 9999999 (command unit)	0
36	1W	X	Operating point number (monitor)	0,1 to 30 H0080 to H0085	0
37	1W	X	Error code (monitor)	0,1 to 255	0
38	1W	X	External input status (monitor)	-	-
39	1W	X	External output setting	-	H0000
40 41	2W	X	Current position preset data (output pulse)	-9999999 to 9999999 (command unit)	0
42 43	2W	X	Current position preset data (feedback pulse)	-9999999 to 9999999 (command unit)	0
44 45	2W	X	Direct command position	-9999999 to 9999999 (command unit)	0
46 47	2W	X	Jog/position switch command value	0 to 9999999 (command unit)	0
48 49	2W	X	Point 1 position	-9999999 to 9999999 (command unit)	0
50	1W	X	Point 1 speed	1 to 32767 (0.1% unit)	1000
51	1W	X	Point 1 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
52 53	2W	X	Point 2 position	-9999999 to 9999999 (command unit)	0
54	1W	X	Point 2 speed	1 to 32767 (0.1% unit)	1000
55	1W	X	Point 2 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
56 57	2W	X	Point 3 position	-9999999 to 9999999 (command unit)	0
58	1W	X	Point 3 speed	1 to 32767 (0.1% unit)	1000
59	1W	X	Point 3 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
:			Point 4 to Point 28 (same as above)		
160 161	2W	X	Point 29 position	-9999999 to 9999999 (command unit)	0
162	1W	X	Point 29 speed	1 to 32767 (0.1% unit)	1000
163	1W	X	Point 29 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
164 165	2W	X	Point 30 position	-9999999 to 9999999 (command unit)	0
166	1W	X	Point 30 speed	1 to 32767 (0.1% unit)	1000
167	1W	X	Point 30 dwell time	0 to 10000 (0.01 s unit) H8000 to H8002	H8000

Address	Data length	Axis	Name	Data range	Default value
168	1W	Y	Pulse output mode	Bit-0: Output pulse (0 or 1) Bit-1: Feedback pulse (0 or 1)	H0000
169	1W	Y	Backlash compensation	0 to 1000 (pulse)	0
170	1W	Y	Zero return operation mode	Bit-0: Zero LS (0 or 1) Bit-1: Phase-Z pulse (0 or 1) Bit-2: Error counter clear (0 or 1)	H0000
171	1W	Y	Zero return operation direction	Bit-0: Search direction (0 or 1) Bit-1: Creep direction (0 or 1)	H0001
172	1W	Y	Electronic gear numerator (output pulse)	1 to 10000 (pulse/rotation)	1000
173	1W	Y	Electronic gear denominator (output pulse)	1 to 10000 (command units/rotation)	1000
174	1W	Y	Electronic gear numerator (feedback pulse)	1 to 10000 (pulse/rotation)	1000
175	1W	Y	Electronic gear denominator (feedback pulse)	1 to 10000 (command units/rotation)	1000
176	1W	Y	Acceleration rate	0 to 32767 (ms)	10000
177	1W	Y	Deceleration rate	0 to 32767 (ms)	10000
178 179	2W	Y	Maximum speed	20 to 200000 (pps)	3000
180 181	2W	Y	Minimum speed	20 to 200000 (pps)	100
182 183	2W	Y	Zero return speed	20 to 200000 (pps)	3000
184 185	2W	Y	Coordinate origin value	-9999999 to 9999999 (command unit)	0
186 187	2W	Y	Zero offset	-9999999 to 9999999 (command unit)	0
188 189	2W	Y	CW Soft limit	-9999999 to 9999999 (command unit)	+9999999
190 191	2W	Y	CCW Soft limit	-9999999 to 9999999 (command unit)	-9999999
192 193 194 195 196 197 198 199			No use		

Address	Data length	Axis	Name	Data range	Default value
200 201	2W	Y	Current position (pulse output)	-9999999 to 9999999 (command unit)	0
202 203	2W	Y	Current position (feedback pulse)	-9999999 to 9999999 (command unit)	0
204	1W	Y	Operating point number (monitor)	0,1 to 30 H0080 to H0085	0
205	1W	Y	Error code (monitor)	0,1 to 255	0
206	1W	Y	External input status (monitor)	-	-
207	1W	Y	External output setting	-	H0000
208 209	2W	Y	Current position preset data (output pulse)	-9999999 to 9999999 (command unit)	0
210 211	2W	Y	Current position preset data (feedback pulse)	-9999999 to 9999999 (command unit)	0
212 213	2W	Y	Direct command position	-9999999 to 9999999 (command unit)	0
214 215	2W	Y	Jog/position switch command value	0 to 9999999 (command unit)	0
216 217	2W	Y	Point 1 position	-9999999 to 9999999 (command unit)	0
218	1W	Y	Point 1 speed	1 to 32767 (0.1% unit)	1000
219	1W	Y	Point 1 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
220 221	2W	Y	Point 2 position	-9999999 to 9999999 (command unit)	0
222	1W	Y	Point 2 speed	1 to 32767 (0.1% unit)	1000
223	1W	Y	Point 2 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
224 225	2W	Y	Point 3 position	-9999999 to 9999999 (command unit)	0
226	1W	Y	Point 3 speed	1 to 32767 (0.1% unit)	1000
227	1W	Y	Point 3 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
:			Point 4 to Point 28 (same as above)		
328 329	2W	Y	Point 29 position	-9999999 to 9999999 (command unit)	0
330	1W	Y	Point 29 speed	1 to 32767 (0.1% unit)	1000
331	1W	Y	Point 29 dwell time	0 to 10000 (0.01s unit) H8000 to H8002	H8000
332 333	2W	Y	Point 30 position	-9999999 to 9999999 (command unit)	0
334	1W	Y	Point 30 speed	1 to 32767 (0.1% unit)	1000
335	1W	Y	Point 30 dwell time	0 to 10000 (0.01 s unit) H8000 to H8002	H8000

A.3 Connection example with Toei Electric's AC servo driver

The figure below shows an example of the wire connection between the MC612 and Toei Electric's AC servo driver.



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Integrated Controller V series