

PART 2

ANALOG OUTPUT MODULE

Part 2 describes the analog output module.

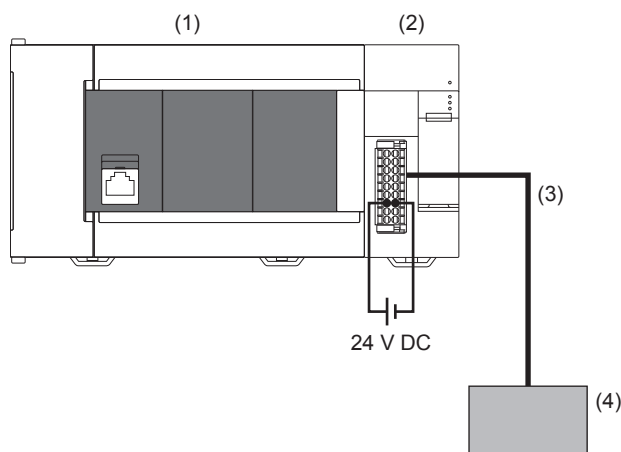
2 FX5-4DA

2 FX5-4DA

2.1 Overview

The FX5-4DA analog output module is an intelligent function module that converts 4 points of digital values into analog output (voltage, current).

It can be added to an FX5 CPU module and can output 4 channels of voltage/current.



- (1) FX5 CPU module
- (2) Analog output module (FX5-4DA)
- (3) Analog device connection cable
- (4) Analog device (e.g. inverter)

2.2 Specifications

This section describes the specifications of FX5-4DA.

General specifications

The general specifications other than below are the same as those for the CPU module to be connected.

For general specifications, refer to the following manuals.

📖 MELSEC iQ-F FX5UJ User's Manual (Hardware)

📖 MELSEC iQ-F FX5U User's Manual (Hardware)

📖 MELSEC iQ-F FX5UC User's Manual (Hardware)

Items		Specifications
Dielectric withstand voltage	500 V AC for 1 minute	Between all terminals and ground terminal
Insulation resistance	10 MΩ or higher by 500 V DC insulation resistance tester	

Power supply specifications

The following table lists the power supply specifications.

Items		Specifications
External power supply	Power supply voltage	24 V DC +20%, -15%
	Allowable momentary power outage time	Operation continues when the instantaneous power failure is shorter than 5 ms.
	Current consumption	150 mA
Internal power supply	Power supply voltage	5 V DC
	Current consumption	100 mA

Performance specifications


The following table lists the performance specifications.

Items		Specifications
Number of output points		4 points (4 channels)
Conversion speed		80 μ s/ch
Isolation method	Between output terminal and PLC	Photocoupler
	Between output terminal channels	Non-isolation
Number of occupied I/O points		8 points
Applicable CPU module		<ul style="list-style-type: none"> FX5UJ CPU module (from the first) FX5U CPU module (Ver.1.050 or later) FX5UC CPU module*1 (Ver.1.050 or later)
Applicable engineering tool		<ul style="list-style-type: none"> FX5UJ CPU module: GX Works3 (Ver.1.060N or later) FX5U/FX5UC CPU module: GX Works3 (Ver.1.040S or later)

*1 FX5-CNV-IFC or FX5-C1PS-5V is necessary to connect FX5-4DA to the FX5UC CPU module.

Output specifications

Items	Specifications			
Analog output voltage	-10 to +10 V DC (external load resistance value 1 kΩ to 1 MΩ)			
Analog output current	0 to 20 mA DC (external load resistance value 0 to 500 Ω)			
Digital input	16-bit signed binary (-32768 to +32767)			
Output characteristics, resolution*1	Analog output range		Digital value	Resolution
	Voltage	0 to 10 V	0 to 32000	312.5 μV
		0 to 5 V	0 to 32000	156.3 μV
		1 to 5 V	0 to 32000	125 μV
		-10 to +10 V	-32000 to +32000	312.5 μV
		User range setting	-32000 to +32000	312.5 μV ^{*2}
	Current	0 to 20 mA	0 to 32000	625 nA
		4 to 20 mA	0 to 32000	500 nA
		User range setting	-32000 to +32000	500 nA ^{*2}
Accuracy (accuracy for the full scale analog output value)	Ambient temperature 25±5°C: Within ±0.1% (voltage ±20 mV, current ±20 μA) Ambient temperature 0 to 55°C: Within ±0.2% (voltage±40 mV, current ±40 μA) Ambient temperature -20 to 0°C: Within ±0.3% (voltage±60 mV, current ±60 μA)			

*1 For details on the output characteristics, refer to  Page 182 Output conversion characteristics.

*2 Maximum resolution in the user range setting.

Output conversion characteristics

The output conversion characteristics of D/A conversion are expressed by the slope of the straight line connected between the offset and gain values both of which are used when a digital value written from CPU module is converted to the voltage or current output value.

Offset value

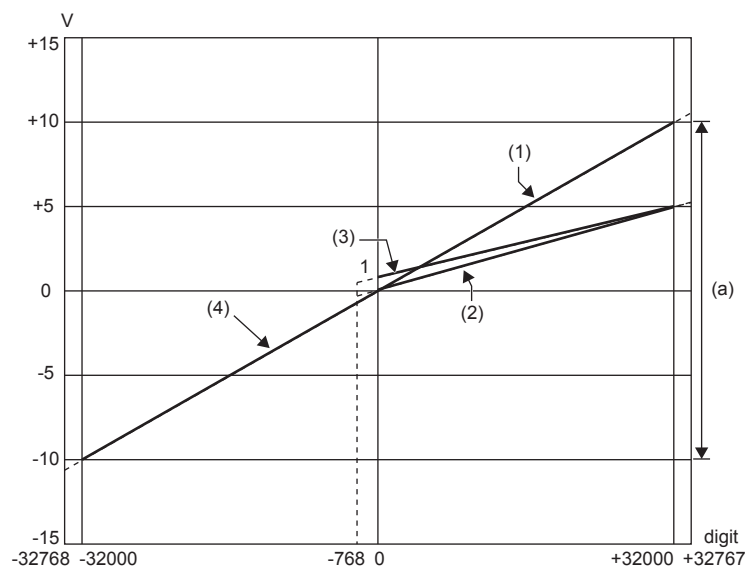
The analog voltage or current value generated when the digital value 0 is set from the CPU module.

Gain value

The analog voltage or current value generated when the digital value 32000 is set from the CPU module.

Voltage output characteristic

The following shows the list of analog output ranges at the voltage output and the graphs of the voltage input characteristics.



digit: Digital value

V: Analog output voltage (V)

(a): Practical analog output range

No.	Analog output range setting	Offset value	Gain value	Digital value	Resolution
(1)	0 to 10 V	0 V	10 V	0 to 32000	312.5 μ V
(2)	0 to 5 V	0 V	5 V		156.3 μ V
(3)	1 to 5 V	1 V	5 V		125.0 μ V
(4)	-10 to +10 V	0 V	10 V	-32000 to +32000	312.5 μ V
—	User range setting (voltage)	*1	*1		312.5 μ V ^{*2}

*1 Set the offset value and gain value in the user range setting within a range satisfying the following conditions. Failure to satisfy the conditions may not result in proper D/A conversion.

- Setting range of the offset value and gain value: -10 to +10 V
- $((\text{Gain value}) - (\text{Offset value})) \geq 2.0 \text{ V}$

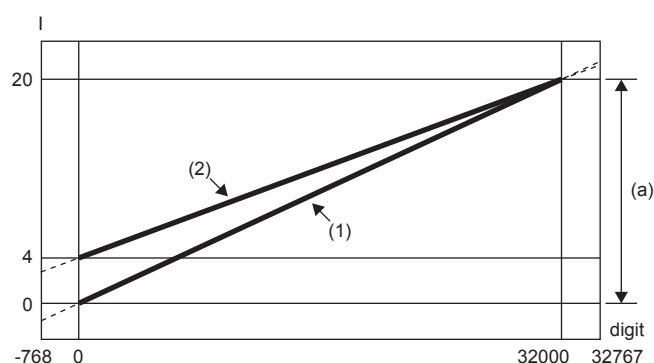
*2 Maximum resolution in the user range setting. The resolution reaches the maximum when (gain value - offset value) = 10 V. Even when (gain value - offset value) < 10 V, the maximum resolution is unchanged.

Point

- Set values within the practical digital input and analog output ranges of each output range. If the range is exceeded, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of voltage output characteristics.)

Current output characteristic

The following shows the list of analog output ranges at the current output and the graphs of the voltage output characteristics.



digit: Digital value

I: Analog output current (mA)

(a): Practical analog output range

No.	Analog output range setting	Offset value	Gain value	Digital value	Resolution
(1)	0 to 20 mA	0 mA	20 mA	0 to 32000	625.0 nA
(2)	4 to 20 mA	4 mA	20 mA		500.0 nA
—	User range setting (current)	*1	*1	-32000 to +32000	500.0 nA ^{*2}

*1 Set the offset value and gain value in the user range setting within a range satisfying the following conditions. Failure to satisfy the conditions may not result in proper D/A conversion.

- Offset value ≥ 0 mA, gain value ≤ 20 mA
- ((Gain value) - (Offset value)) ≥ 6.0 mA

*2 Maximum resolution in the user range setting. The resolution reaches the maximum when (gain value - offset value) = 16 mA. Even when (gain value - offset value) < 16 mA, the maximum resolution is unchanged.

Point

- Set values within the practical digital input and analog output ranges of each output range. If the range is exceeded, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of current output characteristics.)

Accuracy

The accuracy of D/A conversion is the accuracy for the full scale of analog output value.

Any output characteristic change through changes of the offset/gain setting or the output range does not sacrifice the accuracy, which is maintained within the range in the performance specifications.

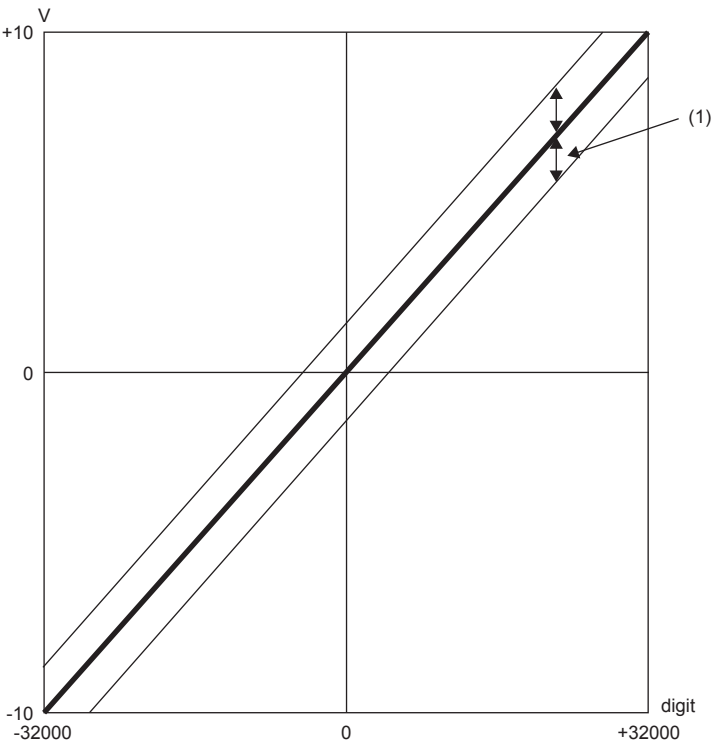
The following graph shows the fluctuation range of accuracy when the range of -10 to +10 V is selected.

The fluctuation range varies as follows depending on the ambient temperature and output range.

Analog output	Ambient temperature		
	25±5℃	0 to 55℃	-20 to 0℃
Voltage	Within ±0.1% (voltage ±20 mV, current ±20 μA)/full scale*1	Within ±0.2% (voltage ±40 mV, current ±40 μA)/full scale*1	Within ±0.3% (voltage ±60 mV, current ±60 μA)/full scale*1
Current			

*1 Full-scale refers to voltage: -10 to +10 V, and current: 0 to 20 mA.
(Except for the conditions under noise influence.)

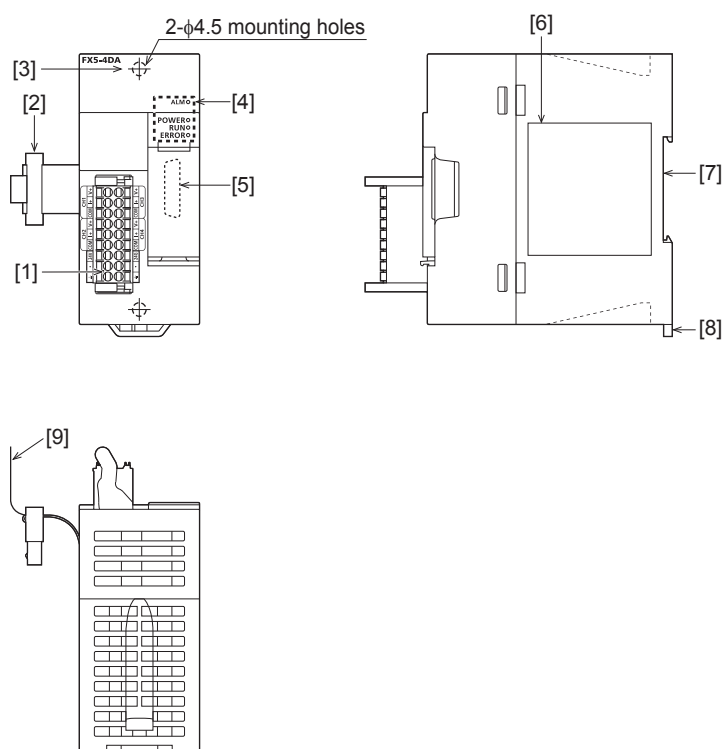
Ex.



digit: Digital value
V: Analog output value (V)
(1): Fluctuation range

Part names

This section describes the part names of the analog output module.



No.	Name	Description
[1]	Terminal block (Spring clamp terminal block)	For the current/voltage output and the input of 24 V external power supply.
[2]	Expansion cable	Cable for connecting the module when adding the analog output module.
[3]	Direct mounting hole	Screw holes (2-φ4.5, mounting screw: M4 screw) for direct installation.
[4]	Operations status display LEDs	Indicates the operating status of the module. (☞ Page 185 LED display)
[5]	Extension connector	Connector for connecting the extension cable of an extension module.
[6]	Name plate	The product model name and manufacturer's serial number are shown.
[7]	DIN rail mounting groove	The module can be installed on DIN46277 rail (35 mm wide).
[8]	DIN rail mounting hook	Hook for mounting the module on a DIN rail of DIN46277 (35 mm wide).
[9]	Pull out tab	They are used when drawing out an extension cable.

LED display

The following table lists the LED display.

LED display	LED color	Description
POWER	Green	Indicates the power supply status. ON: Power ON OFF: Power off or module failure
RUN	Green	Indicates the operating status. Light on: Normal operation Flashing: Offset/gain setting mode Light off: Error occurring
ERROR	Red	Indicates the error status. ON: Minor error Flashing: Moderate error or major error OFF: Normal operation
ALM	Red	Indicates the alarm status. ON: Alarm occurred OFF: Normal operation

2.3 Procedures Before Operation


This section describes the procedures before operation.


1. Check the analog output module specifications


Check the specifications for the analog output module. ( Page 180 Specifications)

2. Install the analog output module

Install the analog output module to the CPU module. For details, refer to the following.

 MELSEC iQ-F FX5UJ User's Manual (Hardware)

 MELSEC iQ-F FX5U User's Manual (Hardware)

 MELSEC iQ-F FX5UC User's Manual (Hardware)

3. Wiring

Perform wiring of external devices to the analog output module.


4. Adding a module

Add an analog output module to the module configuration by using GX Works3.

Point

When adding a new analog output module, if selecting the module whose module model name has "(FX3)" at the end, it can be used as FX3 allocation mode.

- FX5-4DA: Normal mode
- FX5-4DA(FX3): FX3 allocation mode

For details on the FX3 allocation mode function, refer to  Page 242 FX3 allocation mode function

5. Parameter settings

Set parameters of the analog output module by using GX Works3. ( Page 249 Parameter Settings)

6. Offset/gain setting

When setting the user range, perform the offset/gain setting.

7. Programming

Create a program.

2.4 Functions


This section describes the functions of an analog output module and the setting procedures for those functions.

For details on the buffer memory areas, refer to the following.

 Page 289 Buffer Memory Areas

Point

- This section describes buffer memory addresses for CH1. For details on the buffer memory addresses after CH2, refer to the following.

 Page 289 List of buffer memory areas

- Numerical values corresponding to the channel where an error has occurred and the error description fit in the □ and △ of an error code and alarm code described in this section. For details on the numerical values, refer to the following.

 Page 281 List of error codes

 Page 284 List of alarm codes

Function list

This section lists the functions of analog output module.

Item	Description	Reference
Operation mode	Select the operation mode (Normal mode, Offset/gain setting mode) of the analog output module.	Page 187
Range switching function	Switches the analog output range for each channel. This function can change the output conversion characteristic by switching the range.	Page 189
D/A conversion enable/disable function	Controls whether to enable or disable the D/A conversion for each channel. Disabling D/A conversion for unused channels reduces the conversion cycle.	Page 189
D/A output enable/disable function	Specifies whether to output the D/A conversion value or offset value for each channel. The conversion speed is constant regardless of the output enable/disable setting.	Page 190
Analog output HOLD/CLEAR function	Sets whether to clear the current analog output value, or hold the previous value or the setting value when the CPU module operating status is Run, Stop, or Stop Error.	Page 190
Analog output test function when CPU module stops	Conducts an analog output test when CPU module stops.	Page 193
Scaling function	Performs scale conversion on digital values within the range from a scaling upper limit value to a scaling lower limit value, both of which are set at desired values. This function helps reduce the man-hours taken for creating a scale conversion program.	Page 194
Shift function	Adds the set input value shift amount to the digital value.	Page 196
Alert output function	Outputs an alarm when the digital value exceeds the warning output upper limit value or is below the warning output lower limit value.	Page 198
Rate control function	Limits the increase or decrease amount of the analog output value per 80 μ s to prevent sudden change of the analog output value.	Page 200
External power supply disconnection detection function	Detects that the 24 V DC external power supply is not being supplied or the supply stopped.	Page 203
Disconnection detection function	Detects a disconnection by monitoring the analog output value.	Page 204
Interrupt function	Executes a CPU module interrupt program when an interrupt factor such as a disconnection or warning output is detected.	Page 205
Wave output function	Registers the previously prepared wave data (digital input values) in the analog output module and performs consecutive analog output with the set conversion cycle.	Page 208
Error history function	Records up to 16 errors and alarms that occurred in an analog output module to store them in the buffer memory areas.	Page 239
Offset/gain setting	Corrects the D/A conversion value error for each channel.	Page 261
FX3 allocation mode function	This function controls the operation with a layout of the buffer memory addresses equivalent to those in FX3U-4DA. Sequence programs with proven results in FX3U-4DA can be diverted.	Page 242

Operation mode

The analog output module operates in the normal and offset gain setting modes. Change the mode according to the function to be used.

The individual modes are described below.



Each operation mode further allows you to select the FX3 allocation mode function that controls the operation with a layout of the buffer memory addresses equivalent to those in FX3U-4DA.

Normal mode

The normal mode is divided into the normal output and wave output modes. "Normal mode" in this manual refers to both the normal output and wave output modes.

■Normal output mode

Used to perform normal D/A conversion. This mode D/A-converts the value set in 'CH1 Digital value' (Un\G460) and outputs it as an analog output value.

■Wave output mode

Used for wave output. This mode D/A-converts the value set in 'Wave data registration area' (Un\G10000 to Un\G89999) and outputs it as an analog output value.

For details on the wave output function, refer to the following.

📖 Page 208 Wave output function

Offset/gain setting mode

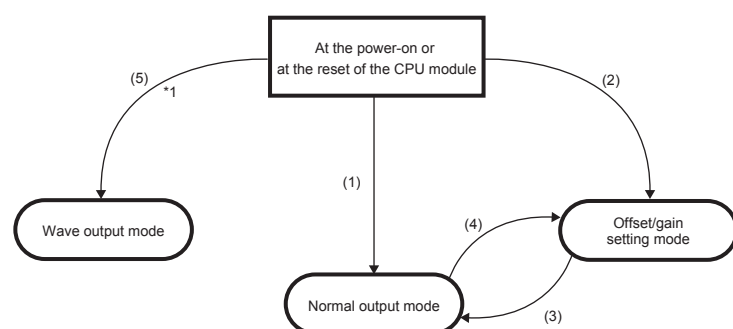
A mode used for the offset/gain setting

For details on the offset/gain settings, refer to the following.

📖 Page 261 Offset/Gain Setting

Mode change

The conditions for changing each mode are described below.



No.	Conditions for change
(1)	In "Basic setting" of GX Works 3, "Operation mode setting" is set to "Normal mode", and "Output mode setting" is set to "Normal output mode".
(2)	In "Basic setting" of GX Works 3, "Operation mode setting" is set to the "Offset/gain setting mode".
(3)	The following values are set in 'Mode switching setting' (Un\G296, Un\G297), and 'Operation condition setting request' (Un\G70, b9) is turned off→on→off. <ul style="list-style-type: none"> • Un\G296: 4658H • Un\G297: 4441H
(4)	The following values are set in 'Mode switching setting' (Un\G296, Un\G297), and 'Operation condition setting request' (Un\G70, b9) is turned off→on→off. <ul style="list-style-type: none"> • Un\G296: 4441H • Un\G297: 4658H
(5)	In "Basic setting" of GX Works 3, "Operation mode setting" is set to "Normal mode", and "Output mode setting" is set to "Wave output mode".

*1 The wave output mode is independent of the others. After the system starts up in the wave output mode, it cannot change to another. After the system starts up in a mode other than wave output, it cannot change to the wave output mode.

Checking

The current mode can be examined by the following.

Mode		RUN LED status	Stored value of "Operation mode monitor" (Un\G60)	Offset/gain setting mode status flag (Un\G69, b10)
Normal mode	Normal output mode	ON	0	OFF
	Wave output mode	ON	2	OFF
Offset/gain setting mode		FLASH	1	ON


Range switching function

Switches the analog output range for each channel.

This function can change the output conversion characteristic by switching the range.

Setting procedure


In the "Output range setting", set the output range to be used.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Basic setting] ⇒ [Range switching function]

Output range setting	Digital input range
4 to 20 mA	0 to 32000
0 to 20 mA	0 to 32000
1 to 5 V	0 to 32000
0 to 5 V	0 to 32000
-10 to +10 V	-32000 to +32000
0 to 10 V	0 to 32000
User range setting (voltage)*1	-32000 to +32000
User range setting (current)*1	-32000 to +32000

*1 When using the user range setting, set the offset/gain.

For offset/gain settings, refer to the following.

 Page 261 Offset/Gain Setting


After the data is written, the range is switched when the programmable controller power supply is turned off→on or when the CPU module is reset.

Point

The range can be switched or the range setting can be monitored using the following buffer memory addresses.

- 'CH1 Range setting' (Un\G598)
- 'CH1 Range setting monitor' (Un\G430)

For details on the buffer memory, refer to the following.

 Page 330 CH1 Range setting

 Page 316 CH1 Range setting monitor


D/A conversion enable/disable function

Controls whether to enable or disable the D/A conversion for each channel.

Disabling D/A conversion for unused channels reduces the conversion cycle.

Setting procedure

Set "D/A conversion enable/disable setting" to "D/A conversion enable" or "D/A conversion disable".

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Basic setting] ⇒ [D/A conversion enable/disable setting function]

D/A output enable/disable function

This function specifies whether to output the D/A conversion value or offset value for each channel.
The conversion speed is constant regardless of the output enable/disable setting.

Setting procedure

Set D/A output enable/disable for each channel by using 'CH1 Output enable/disable flag' (Un\G70, b1).

CH1 Output enable/disable flag (Un\G70, b1)	Analog output
Output enable (ON)*1	Outputs the D/A conversion value.
Output disable (OFF)	Outputs the offset value.

*1 When the CPU module changes from RUN to STOP, or a stop error occurs in the CPU module, the 'Output enable/disable flag' (Un\G70, b1) turns off.

Analog output HOLD/CLEAR function

Sets whether to clear the current analog output value, or hold the previous value or the setting value when the CPU module operating status is Run, Stop, or Stop Error.

When the setting value is set, it becomes the value that was set in 'CH1 HOLD setting value' (Un\G596). The following table lists the setting ranges.

Output range setting	When the scaling function is disabled	When the scaling function is enabled*1
	Setting range (practical range)	Setting range
4 to 20 mA	0 to 32767 (practical range: 0 to 32000)	-32000 to +32000
0 to 20 mA		
1 to 5 V		
0 to 5 V		
0 to 10 V		
-10 to +10 V	-32768 to +32767 (practical range: -32000 to +32000)	
User range setting (voltage)		
User range setting (current)		

*1 The setting and practical ranges applied when the scaling function is enabled depend on the setting of the upper and lower scaling limit values.

The HOLD/CLEAR setting can be checked with 'CH1 HOLD/CLEAR function setting monitor' (Un\G431).

Operation

When the CPU module operation status changes to RUN, STOP, or Stop Error, the following analog output state is entered, depending on the combination of the analog output HOLD/CLEAR setting, 'CH1 D/A conversion enable/disable setting' (Un\G500), and 'CH1 Output enable/disable flag' (Un\G70, b1). If the analog output HOLD/CLEAR function setting is the previous value, the last output value will be held.

■ In the normal output mode

Execution status	CH1 D/A conversion enable/disable setting (Un\G500)	Enable			Disable
	CH1 Output enable/disable flag (Un\G70, b1)	Enable		Disable	Enable/disable
	Analog output HOLD/CLEAR setting	Previous Value	Setting value	CLEAR	Previous Value, setting value, or CLEAR
Analog output status while the CPU module is RUN		Output the value D/A-converted from the digital value			Offset value
Analog output status while the CPU module is STOP		Previous value ^{*2*3}	HOLD setting value ^{*2*3}	Offset value	Offset value
Analog output status while the CPU module is in Stop Error		Previous value ^{*3}	HOLD setting value ^{*3}	Offset value	Offset value
The external power supply READY flag is off.		0 V/0 mA	0 V/0 mA	0 V/0 mA	0 V/0 mA
The disconnection detection flag is on.					
Analog output status when a watchdog timer error ^{*1} occurs					

*1 When a watchdog timer error occurs, 'Module READY' (Un\G69, b0) turns off and the RUN LED of the analog output module turns off.

*2 Also when the CPU module changes from STOP to RUN, the value is output according to the analog output HOLD/CLEAR setting.

*3 When the external supply power shuts off or a disconnection is detected and then it is restored, the output will be the offset value.

Precautions

With 'CH1 Output enable/disable flag' (Un\G70, b1) enabled, any CPU module change from RUN to STOP changes this flag to Disable.

At this time, if the analog output HOLD/CLEAR function setting is the previous value, the analog output will hold the last output value. If the analog output HOLD/CLEAR function setting is the setting value, the analog output will be the HOLD setting value.

When the CPU module is set to RUN again, 'CH1 Output enable/disable flag' (Un\G70, b1) remains disabled. However, the analog output will not be the offset value, and output of the previous value or HOLD setting value will continue.

When 'CH1 Output enable/disable flag' (Un\G70, b1) is enabled, output of the value D/A-converted from the digital value is restarted.

■In the wave output mode

Execution status	CH1 D/A Conversion enable/disable setting (Un\G500)	Enable										Disable
	CH1 Output enable/disable flag (Un\G70, b1)	Enable									Disable	Enable/disable
	Analog output HOLD/CLEAR setting	HOLD						CLEAR			Previous Value, setting value, or CLEAR	Previous Value, setting value, or CLEAR
		Previous Value			Setting value							
	Wave output status	Output	Stop	Pause	Output	Stop	Pause	Output	Stop	Pause		
Analog output status while the CPU module is RUN		Wave data	*3	Previous value	Wave data	*3	HOLD setting value	Wave data	*3	Offset value	Offset value	0 V/0 mA
Analog output status while the CPU module is STOP		Previous value ^{*1*4*5}			HOLD setting value ^{*1*4*5}			Offset value ^{*1}			Offset value	0 V/0 mA
Analog output status while the CPU module is in Stop Error		Previous value ^{*1*5}			HOLD setting value ^{*1*5}			Offset value ^{*1}			Offset value	0 V/0 mA
The external power supply READY flag is off. ^{*1}		0 V/0 mA			0 V/0 mA			0 V/0 mA			0 V/0 mA	0 V/0 mA
The disconnection detection flag is on. ^{*1}												
Analog output status when a watchdog timer error ^{*2} occurs												

*1 When the CPU module changes from RUN to STOP or a disconnection has occurred, the wave output status changes to the wave output stop.

*2 When a watchdog timer error occurs, 'Module READY' (Un\G69, b0) turns off and the RUN LED of the analog output module turns off.

*3 Output as per the setting of 'CH1 Output setting during wave output stop' (Un\G524).

*4 Also when the CPU module changes from STOP to RUN, the value is output according to the analog output HOLD/CLEAR function setting.

*5 When the external supply power shuts off or a disconnection is detected and then it is restored, the output will be as follows.

If the CPU module is RUN: Output that was selected in Wave output stopped selection.

If the analog output HOLD/CLEAR function is being used for output because the CPU module has changed from RUN to STOP: Offset value.

Precautions

With 'CH1 Output enable/disable flag' (Un\G70, b1) enabled, any CPU module change from RUN to STOP changes this flag to Disable. The wave output signal also changes to wave output stop.

At this time, if the analog output HOLD/CLEAR function setting is the previous value, the analog output will hold the last output value. If the analog output HOLD/CLEAR function setting is the setting value, the analog output will be the HOLD setting value.

When the CPU module is set to RUN again, 'CH1 Output enable/disable flag' (Un\G70, b1) remains disabled. However, the analog output will not be the offset value, and output of the previous value or HOLD setting value will continue.

When 'CH1 Output enable/disable flag' (Un\G70, b1) is enabled, the value selected in Wave output stopped selection is output. Wave output does not restart.

Setting procedure




Set "Analog output HOLD/CLEAR setting" to "Previous Value", "Setting value", or "CLEAR".

🔍 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Basic setting] ⇒ [Analog output HOLD/CLEAR function]

Analog output test function when CPU module stops

Conducts an analog output test when CPU module stops.

The following functions are enabled also during the analog output test.

- Scaling function ( Page 194 Scaling function)
- Shift function ( Page 196 Shift function)
- Alert output function ( Page 198 Alert output function)

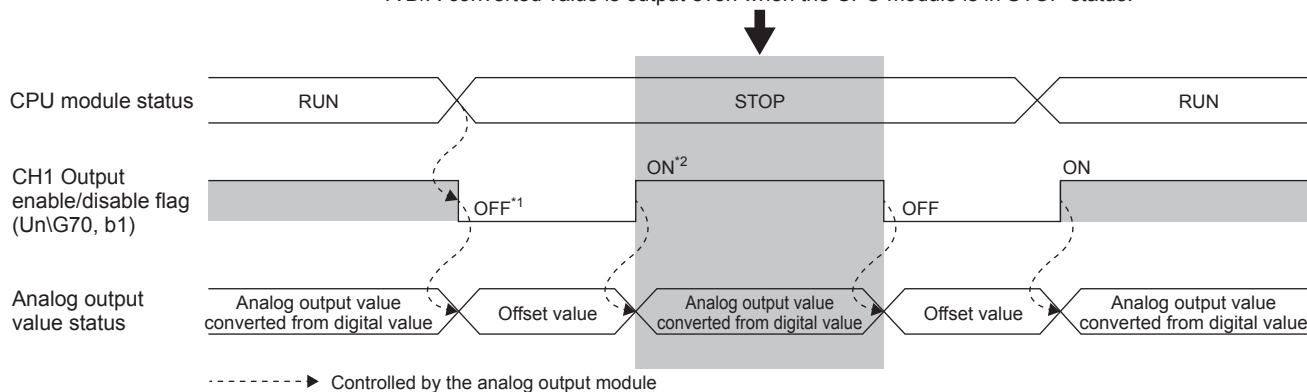
If a digital value out of the setting range is written, a digital value setting range error (error code: 191□H) will occur and the check code will be stored in 'CH1 Set value check code' (Un\G400).

Operation

When the CPU module forcibly turns 'CH1 Output enable/disable flag' (Un\G70, b1) off→on while it is STOP, the analog output value changes from the offset value to the D/A-converted analog output value. After that, when 'CH1 Digital value' (Un\G460) is updated, the analog output is also updated.

When the CPU module is STOP with the analog output HOLD/CLEAR setting set to CLEAR (0), there is the following relationship between 'CH1 Output enable/disable flag' (Un\G70, b1) and the analog output value.

A D/A-converted value is output even when the CPU module is in STOP status.



*1 When the CPU module status changes to STOP, 'CH1 Output enable/disable flag' (Un\G70, b1) turns off.

*2 When the CPU module forcibly turns 'CH1 Output enable/disable flag' (Un\G70, b1) off→on, the analog output value changes from the offset value to the D/A-converted analog output value.

Setting procedure

To execute the analog output test, in the GX Works3 device test, use the following procedure for setting.

1. Set D/A conversion enable (0) in the buffer memory address 'CH1 D/A conversion enable/disable setting' (Un\G500).
2. Turn off→on 'Operating condition setting request' (Un\G70, b9).
3. After checking that 'Operating condition setting completed flag' (Un\G69, b9) turns off, turn on→off 'Operating condition setting request' (Un\G70, b9).
4. In the buffer memory address 'CH1 Digital value' (Un\G460), set the digital value corresponding to the analog value to be output.
5. Turn off→on 'CH1 Output enable/disable flag' (Un\G70, b1).

Scaling function

Performs scale conversion on digital values within the range from a scaling upper limit value to a scaling lower limit value, both of which are set at desired values. This function helps reduce the man-hours taken for creating a scale conversion program.

Operation

The set 'CH1 Digital value' (Un\G460) is scale converted using 'CH1 Scaling upper limit value' (Un\G504) and 'CH1 Scaling lower limit value' (Un\G506). Then, the D/A conversion is executed using the scale converted value. (In conversion, values are rounded off to the nearest whole number.)

If the relation between the values is the scaling lower limit value > the scaling upper limit value, the scale conversion can be performed according to a negative slope.

Concept of scaling setting

The scaling lower and upper limit value settings depend on whether the factory setting or user range setting is used for the analog output range.

■If the factory default is used for the analog output range

- For the scaling upper limit value, set the value corresponding to the upper limit value of the analog output value in the currently set output range.
- For the scaling lower limit value, set the value corresponding to the lower limit value of the analog output value in the currently set output range.

■If the user range is set for the analog output range

- For the scaling upper limit, set the value corresponding to the gain value.
- For the scaling lower limit, set the value corresponding to the offset value.

Calculating the scaling value

For D/A conversion, use the value converted based on the following formula.

■If the factory default is used for the output range

- If voltage: 1 to 5, 0 to 5, or 0 to 10 V
Current: 4 to 20 or 0 to 20 mA

$$\text{Digital value used for D/A conversion} = \frac{32000}{S_H - S_L} \times (D_X - S_L)$$

- If voltage: -10 to 10 V



$$\text{Digital value used for D/A conversion} = \frac{64000}{S_H - S_L} \times (D_X - S_L) - 32000$$

■If the user range setting is used for the output range

$$\text{Digital value used for D/A conversion} = \frac{32000}{S_H - S_L} \times (D_X - S_L)$$

Item	Description
D _X	Digital value
S _H	Scaling upper limit value
S _L	Scaling lower limit value

Setting procedure

1. Set "D/A conversion enable/disable setting" to "D/A conversion enable".
 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Basic setting] ⇒ [D/A conversion enable/disable setting function]
2. Set "Scaling enable/disable setting" to "Enable".
 Navigation window ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Application setting] ⇒ [Scaling function]
3. Set values for "Scaling upper limit value" and "Scaling lower limit value". Set the scaling setting in the following conditions. Scaling upper limit value ≠ Scaling lower limit value

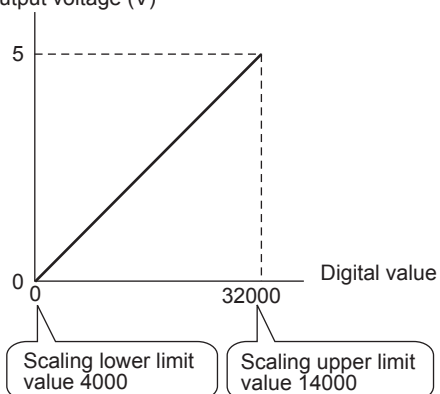
Item	Setting range
Scaling upper limit value	-2147483648 to +2147483647
Scaling lower limit value	(practical range: -32000 to +32000)

Scaling setting example

Ex.

When the scaling upper and lower limit values are set as 14000 and 4000, respectively, for a channel the output range of which is set as 0 to 5 V

Analog output voltage (V)



Digital value	Scaled digital value	Output voltage (V)
4000	0	0
6000	6400	1
8000	12800	2
10000	19200	3
12000	25600	4
14000	32000	5

Precautions

- When the scaling function is used, the unscaled digital value can be set to a value out of the range between the scaling upper and lower limit values (dashed line portion of output characteristics)". However, use it within the analog output practical range (solid line portion of output characteristics). If the analog output practical range is exceeded, the maximum resolution or the accuracy may go out of the specification.
- Depending on the scaling function setting, the default digital value "0" may be inappropriate. Particularly for an example of the output range 0 to 5 V, if 'CH1 Output enable/disable flag' (Un\G70, b1) turns on with the digital value set to "0", a digital value out-of-range error will occur. A digital value setting range error occurs (error code: 191□H) occurs, "Error flag" (Un\G69, b15) turns on, and the ERROR LED turns on. To avoid this, set a proper digital value within the scaling range before turning on 'CH1 Output enable/disable flag' (Un\G70, b1).
- Note that use of the user range results in "scaling lower limit value = offset value".
- If a scaling converted digital value falls outside the digital setting range when the scaling function is enabled, a digital value setting range error (error code: 191□H) occurs and the check code is stored in 'CH1 Set value check code' (Un\G400).
- The scaling function is enabled only for normal output. If the scaling function is enabled while the wave output function is in use, a wave output mode scaling setting error (alarm code: 0B1□H) will occur and 'Warning output signal' (Un\G69, b14) turns on.
- Use the setting range of the scaling upper and lower limit values in the range of -2147483648 to +2147483647 only when only when performing the same operation as the FX3U-4DA offset/gain function. For other than the FX3U-4DA Offset/gain setting function, use it in the range of -32000 to +32000 because the digital value exceeds this range.

Shift function

Adds the set input value shift amount to the digital input value.

A change in input value shift amount is reflected to the analog output value in real time, which facilitates fine adjustment at system start-up.

Operation


During digital value D/A conversion, the value obtained by adding 'CH1 Input value shift' (Un\G480) to 'CH1 Digital value' (Un\G460) is D/A-converted.

If the shift processing produces a calculated digital value exceeding the range of -32768 to +32767, the lower (-32768) and upper (+32767) limit values are fixed.

If the value is written into the 'CH1 Input value shift' (Un\G480), the setting value will be added to the digital input value regardless of whether 'Operating condition setting request' (Un\G70, b9) is on or off.

Setting procedure

In 'Input value shift amount', set the amount by which to shift.

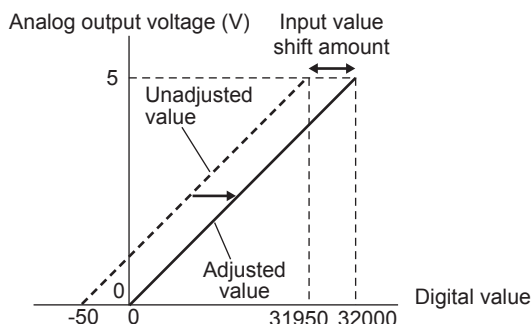
 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Application setting] ⇒ [Shift function]

Item	Setting range
Input value shift amount	-32768 to +32767

Setting example

Ex.

When the output range is set to 0 to 5 V and the input value shift amount is set to +50



Digital value		Analog output voltage (V)
Unadjusted value	Adjusted value	
-50	0	0
31950	32000	5

Precautions

- The warning output, scaling, and rate control functions are executed based on the digital value for which shift-and-add was performed.
- When the value obtained by adding 'CH1 Input value shift' (Un\G480) to 'CH1 Digital value' (Un\G460) is out of the digital setting range, a digital value setting range error (error code: 191□H) occurs and the check code is stored in 'CH1 Set value check code' (Un\G400).
- The shift function is enabled only for normal output. If 'CH1 Input value shift' (Un\G480) is set to a value other than 0 while the wave output function is in use, a Wave output mode Input value shift amount setting error (alarm code: 0B2□H) occurs and 'Warning output signal' (Un\G69, b14) turns on. The wave output continues, but 'CH1 Input value shift' (Un\G480) is not added to the output wave data.
- After a Wave output mode Input value shift amount setting error occurs, 'Warning output signal' (Un\G69, b14) will not be turned off even if 0 is set in 'CH1 Input value shift' (Un\G480). To turn off 'Warning output signal' (Un\G69, b14), turn off→on→off 'Warning output clear request' (Un\G70, b14). This turns off 'Warning output signal' (Un\G69, b14), turns off the ALM LED, and clears the 'Latest alarm code' (Un\G2).

Alert output function

Outputs an alarm when the digital value exceeds the warning output upper limit value or is below the warning output lower limit value.

Operation

■Warning output notification

When 'CH1 Digital value' (Un\G460) exceeds 'CH1 Alert output upper limit' (Un\G510) or falls below 'CH1 Alert output lower limit' (Un\G512), an alarm is output when 'Alarm output upper limit flag' (Un\G36), 'Alarm output lower limit flag'(Un\G37), or 'Warning output signal' (Un\G69, b14) turns on and the ALM LED turns on. When an alarm occurs, alarm code 080□H or 081□H is stored in 'Latest alarm code' (Un\G2).

When an alarm occurs, one of the following is executed depending on 'CH1 Alert output setting' (Un\G508).

- If the setting is Enable (output not limited), the D/A conversion will be executed with the set digital values.
- If the setting is Disable (output limited), the D/A conversion will be executed with the setting values of the warning output upper and lower limit values handled as digital values.

After a warning occurs and 'CH1 Digital value' (Un\G460) becomes less than 'CH1 Alert output upper limit value' (Un\G510) or larger than 'CH1 Alert output lower limit value' (Un\G512), the analog output value returns to the normal value, but 'Alarm output upper limit flag' (Un\G36), 'Alarm output lower limit flag' (Un\G37), and 'Alarm output signal flag' (Un\G69, b14) are not cleared.

Clear the warning

There are the following two methods to clear the warning output.

Set 'CH1 Digital value' (Un\G460) to a value equal to or smaller than 'CH1 Alert output upper limit value' (Un\G510) and equal to or larger than 'CH1 Alert output lower limit value' (Un\G512). Then,


- Turn off→on→off 'Alarm output clear request' (Un\G70, b14).
- Turn off→on→off 'Operating condition setting request' (Un\G70, b9).

The analog output module changes to the following status when the warning output is cleared.

- 'Alarm output upper flag' (Un\G36) and 'Alarm output lower flag' (Un\G37) are cleared.
- 'Alarm output signal' (Un\G69, b14) turns off.
- The ALM LED turns off.
- The alarm code stored in 'Latest alarm code' (Un\G2) is cleared.

Setting procedure

1. Set 'Warning output setting' to 'Enable (output not limited)' or 'Disable (output limited)'.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Application setting] ⇒ [Warning output function]

2. Set values for "Warning output upper limit value" and "Warning output lower limit value".

Set the warning output upper and lower limit values in the following conditions.

- Warning output upper limit value > Warning output lower limit value

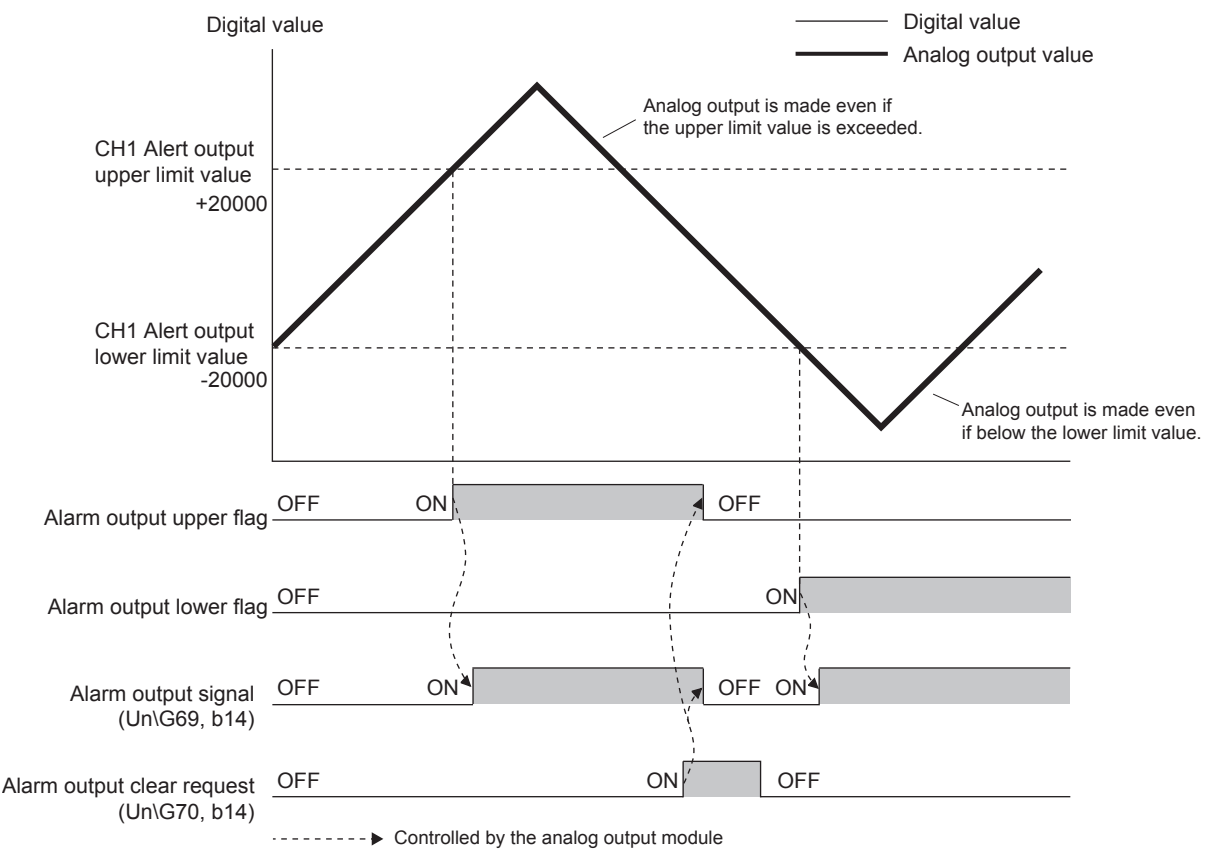
Item	Setting range
Warning output upper limit value	-32768 to +32767
Warning output lower limit value	

Precautions

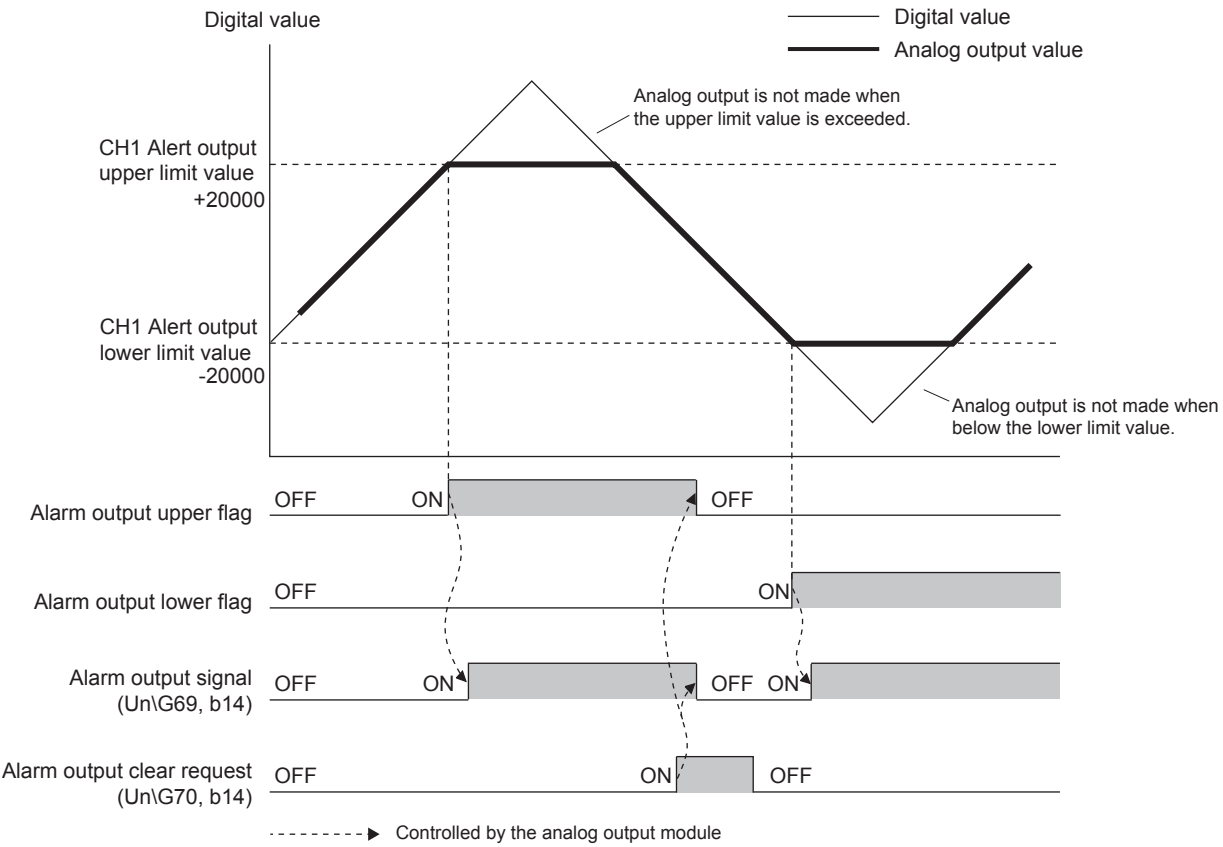
When the shift function is used in the normal mode, the 'CH1 Digital value' (Un\G460) for which shift-and-add was performed will be processed as the target of alarm detection. For the warning output upper and lower limit values, be sure to set the values, taking shift-and-add into consideration.

Warning output function operation example

■When 'CH1 Alert output setting' (Un\G508) is enabled (output not limited)



■When 'CH1 Alert output setting' (Un\G508) is enabled (output limited)



Rate control function

Limits the increase or decrease amount of the analog output value per 80 μ s to prevent sudden change of the analog output value.

Operation

If the variation amount of 'CH1 Digital value' (Un\G460) is larger than the value set by 'CH1 Increase digital limit value' (Un\G514) and 'CH1 Decrease digital limit value' (Un\G516), 'CH1 Digital value' (Un\G460) is changed by the limit value set for each digital limit value.

For 'CH1 Increase digital limit value' (Un\G514) and 'CH1 Decrease digital limit value' (Un\G516), the increase or decrease value per 80 μ s is set; however, in actuality, the output value of the corresponding channel is updated with a cycle of "80 μ s \times Number of conversion enabled channels".


Therefore, the analog output value is increased or decreased as follows with the update cycle.

- 1st time: D/A conversion value of the Increase/Decrease digital limit value
- 2nd time or later: D/A conversion value of "Increase/Decrease digital limit value \times Number of conversion enabled channels"

If the digital value is changed during rate control, rate control will continue until a new digital value will be output. At this time, if a digital value is set so that the increase/decrease direction is reversed, the initial output after change will be the D/A conversion value of " 'CH1 Increase digital limit value' (Un\G514) \times Number of conversion enabled channels" or " 'CH1 Decrease digital limit value' (Un\G516) \times Number of conversion enabled channels".

Setting procedure

1. Set "Rate control enable/disable setting" to "Enable".

 [Navigation window] \Rightarrow [Parameter] \Rightarrow [Module Information] \Rightarrow Module model name \Rightarrow [Module Parameter] \Rightarrow [Application setting] \Rightarrow [Rate control function]

2. Set values for "Increase digital limit value" and "Decrease digital limit value".

Item	Setting range
Increase digital limit value	0 to 64000
Decrease digital limit value	

2

(Analog output)

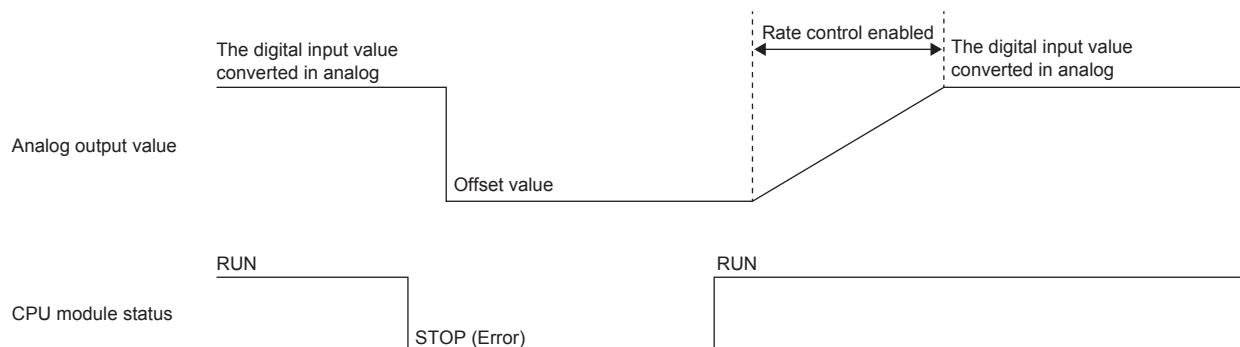


Precautions

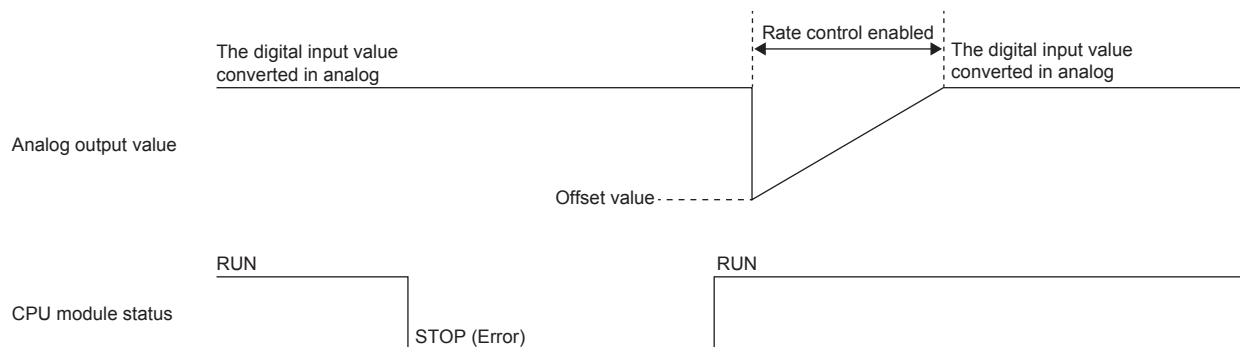
- The shift function setting is enabled also during rate control.
- If the warning output function is enabled, alarm judgment is made for the preset 'CH1 Digital value' (Un\G460). Note that it is not the timing when the upper/lower limit is exceeded by rate control.
- Rate control does not function when the analog output test is in progress in the CPU module STOP state.
- If the analog output HOLD/CLEAR setting is other than the previous value, rate control does not function although the analog output changes in the CPU module STOP state.
- The rate control function will be as follows if the CPU module changes its operation when D/A conversion is enabled, D/A output is enabled, or analog output CLEAR is set.

When the CPU module changes from RUN to STOP (error): Rate control does not function.

When the CPU module changes from STOP (error) to RUN: Rate control functions.



- When D/A conversion is enabled, D/A output is enabled, or the analog output HOLD setting is the previous value or set value if rate control is enabled, the analog output restarts from the offset value when the CPU module changes from STOP (error) to RUN.



- When D/A conversion is enabled or D/A output is disabled, rate control does not function.
- During rate control, if a value out of the settable range is written to 'CH1 Digital value' (Un\G460), rate control is performed with the upper and lower limit values of the setting range. In addition, the check result is stored in 'CH1 Set value check code' (Un\G400).
- If the scaling function is enabled in the following cases, rate control is performed with the upper (-32768) or lower (+32767) limit value.

For the range of -10 to +10 V: (Scaling upper limit value + Scaling lower limit value) / 2 exceeded the range of -32768 to +32767.

For the range of other than -10 to +10 V: The scaling lower limit value exceeded the range of -32768 to +32767.

- If the external power supply turns off during rate control, the analog output changes to 0 V/0 mA with the rate control function stopped. When the external power supply is then restored, rate control restarts from the offset value.
- If a disconnection is detected during rate control, the analog output changes 0 V/0 mA with the rate control function stopped. When the disconnection is then restored and 'Disconnection detection flag' (Un\G38) is cleared, rate control restarts from the offset value.
- The rate control function is enabled only for normal output. If the rate control function is enabled while the wave output function is in use, a wave output mode rate control setting error (alarm code: 0B3□H) will occur and 'Warning output signal' (Un\G69, b14) turns on.

External power supply disconnection detection function

Detects that the 24 V DC external power supply is not being supplied or the supply stopped.

When external power supply off is detected, 'External power supply READY flag' (Un\G69, b7) turns off and the analog output value changes to 0 V/0 mA independently of the other settings.

Operation

If no external power supply is input, the state is judged to be external power supply off, with 'External power supply READY flag' (Un\G69, b7) turned off.

If the input of the external power supply stops, the state is judged to be external power supply off, with 'External power supply READY flag' (Un\G69, b7) turned off.

Precautions

If the external power supply does not satisfy the requirements of the power supply specifications, the state may be determined to be external power supply off.

For the power specifications for the external power supply, refer to  Page 180 Power supply specifications.

Disconnection detection function

Detects a disconnection by monitoring the analog output value. This function is enabled only when the analog output range is 4 to 20 mA, 0 to 20 mA or the user range (current). Disconnections can be detected for each channel.

Operation

Disconnection detection

Disconnections can be when the analog output range is 4 to 20 mA^{*1}, 0 to 20 mA, or the user range (current)^{*1} and 'CH1 D/A conversion enable/disable setting' (Un\G500) is set to D/A conversion enable (0).

^{*1} If the analog output value is 1 mA or less, disconnections cannot be detected.

Operation performed when disconnection is detected

When a disconnection is detected, 'Disconnection detection flag' (Un\G38) and 'Disconnection detection signal' (Un\G69, b13) turn on and the disconnection is notified by turning on the ERROR LED.

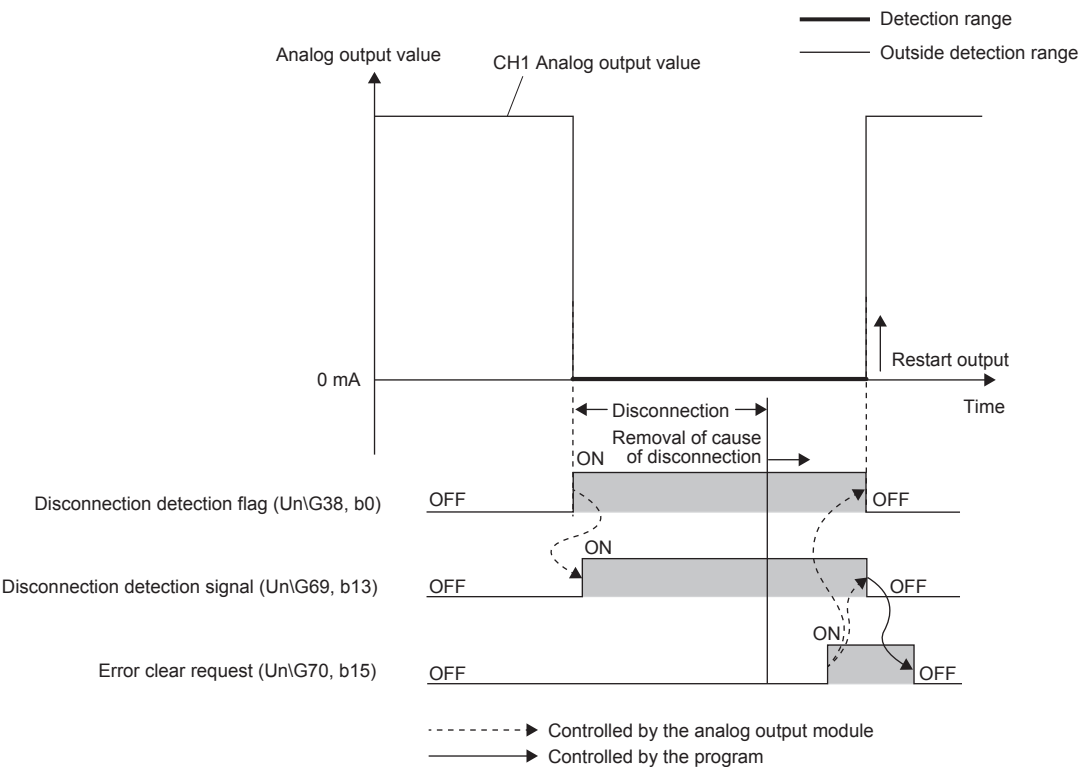
In addition, when a disconnection is detected, error code 1C4□H is stored in 'Latest error code' (Un\G0).

Eliminate the cause of the disconnection from the disconnection state, and perform the following operations depending on the setting of 'Disconnection Detection Automatic Clear Enable/Disable Setting' (Un\G304)^{*1}. The analog output restarts according to 'CH1 Output enable/disable flag' (Un\G70, b1).

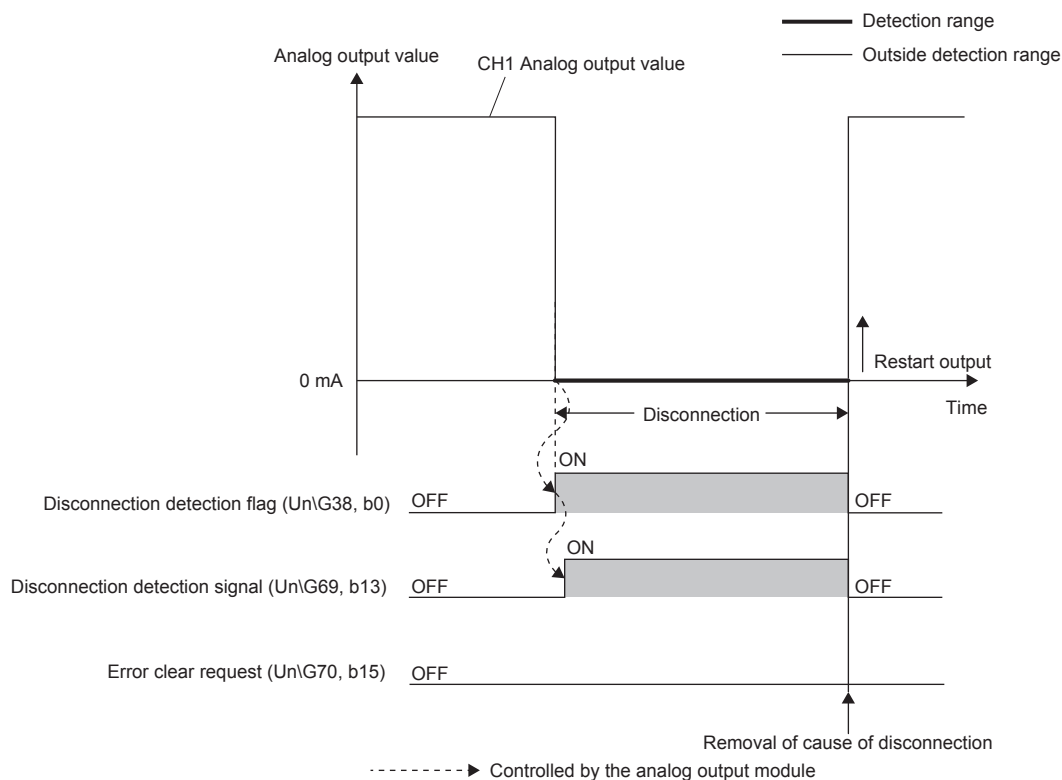
^{*1} Disconnection detection auto-clear enable/disable setting (Un\G304) is enable only in the normal output mode.

Output mode	Disconnection detection automatic clear enable/disable setting (Un\G304)	
	Disable	Enable
Normal output mode	Check the CH1 Digital value (Un\G460), and then turn off→on→off 'Error clear request' (Un\G70, b15).	Once the cause of the disconnection is eliminated, the analog output starts automatically.
Wave output mode	When disconnection is detected, wave output stops. After turning off→on→off 'Error clear request' (Un\G70, b15), set 'CH1 Wave output start/stop request' (Un\G462) as Wave output start request (1).	—

- Operation when 'Disconnection detection automatic clear enable/disable setting' (Un\G304) is Disable



- Operation when 'Disconnection detection automatic clear enable/disable setting' (Un\G304) is Enable



At the same time analog output restarts, the disconnection detection flag (Un\G38) of the corresponding channel is cleared. In addition, when the analog output of all channels restarts, 'Disconnection detection signal' (Un\G69, b13) is cleared.

Interrupt function

Executes a CPU module interrupt program when an interrupt factor such as a disconnection or warning output is detected. The number of available interrupt pointers per analog output module is up to 16.

Operation

■ Detecting an interrupt factor


When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) turns to Interrupt factor (1).

■ How to reset an interrupt factor

When Reset request (1) is set in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the specified interrupt factor is reset and 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).

Setting procedure

To use the interrupt function, set "Condition target setting", "Condition target channel setting", "Interrupt factor transaction setting", and "Interrupt pointer" in GX Works3. After completing the settings, write the project to enable the settings.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Interrupt setting]

The following shows the setting items on the interrupt settings window.

Item	Description
Condition target setting	Select a factor of the target for the interrupt detection.
Condition target channel setting	Select a target channel when the condition target setting for the interrupt detection is channel specification.
Interrupt factor transaction setting	Set an interrupt request for when the same interrupt factor occurs during the interrupt factor detection.
Interrupt pointer	Specify the number of an interrupt pointer that is initiated at the detection of an interrupt factor.

■Condition target setting

Select a factor of the condition target setting for the interrupt detection.

For details on the factors to be detected, refer to the following.

 Page 311 Condition target setting [n]

■Condition target channel setting

Select a target channel when the condition target setting for the interrupt detection is channel specification.

Item	Setting value				
Condition target channel setting	0: All channels	1: CH1	2: CH2	3: CH3	4: CH4

■Interrupt factor transaction setting

Set an interrupt request for when the same interrupt factor occurs during the interrupt factor detection.

- With "Interrupt reissue requests (0)", if the same interrupt factor occurs during the interrupt factor detection, an interrupt request is sent to the CPU module again.
- With "No interrupt reissue request (1)", if the same interrupt factor occurs during the interrupt factor detection, an interrupt request is not sent to the CPU module.


■Interrupt pointer

Specify the number of an interrupt pointer that is initiated at the detection of an interrupt factor. For details on the interrupt pointers, refer to the following.

 MELSEC iQ-F FX5 User's Manual (Application)

Point

- If 'Condition target setting [n]' (Un\G232 to Un\G247) is Disable (0), no interrupt request is sent to the CPU module.
- To reset the interrupt factor, set Reset request (1) until 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).
- Resetting interrupt factors is executed only when 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) changes from No reset request (0) to Reset request (1).
- Multiple interrupt pointers can also share the same setting of 'Condition target setting [n]' (Un\G232 to Un\G247). When interrupts with the same settings occur in 'Condition target setting [n]' (Un\G232 to Un\G247), the interrupt program is executed in order of the priority of the interrupt pointers. For the priority of the interrupt pointers, refer to the following.

 MELSEC iQ-F FX5 User's Manual (Application)

- When All channels (0) is set for 'Condition target channel setting [n]' (Un\G264 to Un\G279) and an interrupt detection target is set for each channel of Warning output flag (2) etc., the interrupt requests that have the same interrupt factor are sent to the CPU module if alarms are issued in multiple channels. In this case, the CPU module executes multiple interrupt programs at a time and thus judges that the program cannot be normally finished due to the scan monitoring function, and a CPU module error may occur. When a CPU module error occurs, review the CPU module parameter setting and the program.

Setting example

Ex.

If the interrupt program (I51) is executed when an error occurs in any channel

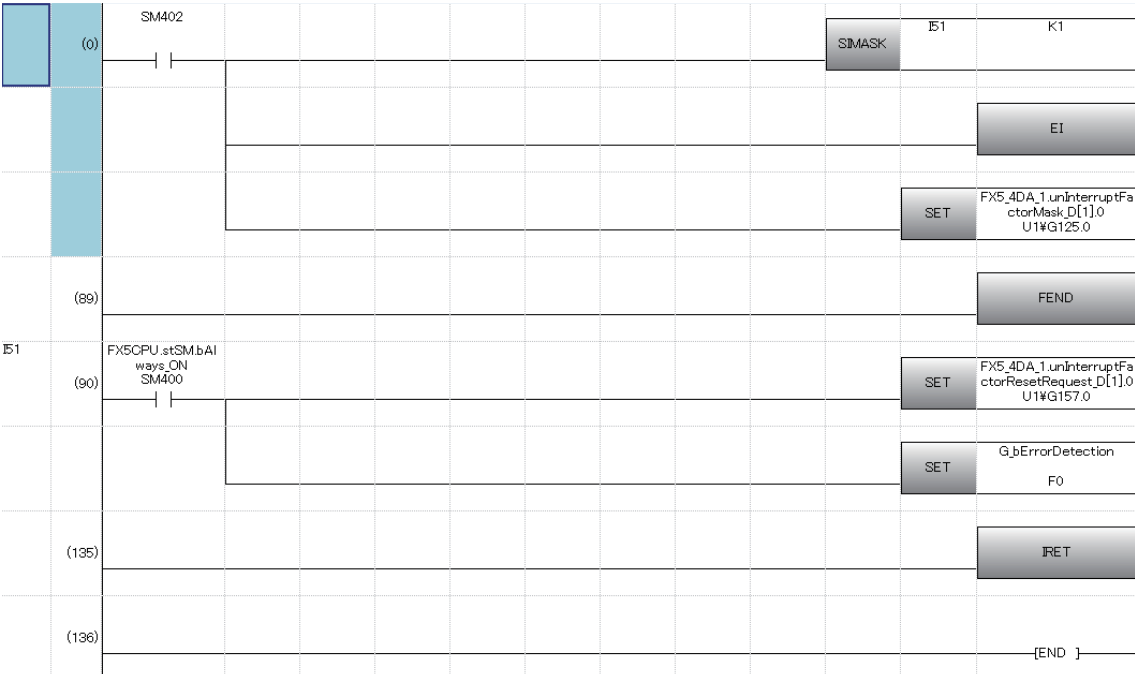
- Parameter settings

Set "Interrupt setting" of [Module Parameter] as follows.

No.	Condition target setting	Condition target channel setting	Interrupt pointer
2	Error flag	All channels	I51

- Label settings



Classification	Device	Description	Device
Module Label	FX5CPU.stSM.bAlways_ON	Always ON	SM400
	FX5_4DA_1.unInterruptFactorMask_D[1]	Interrupt factor mask 2	U1\G125
	FX5_4DA_1.unInterruptFactorResetRequest_D[1]	Interrupt factor reset request 2	U1\G157
Labels to be defined	Define global labels as shown below:		
	Label Name	Data Type	Class
	G_bErrorDetection	Bit	VAR_GLOBAL
			Assign (Device/Label)
			F0

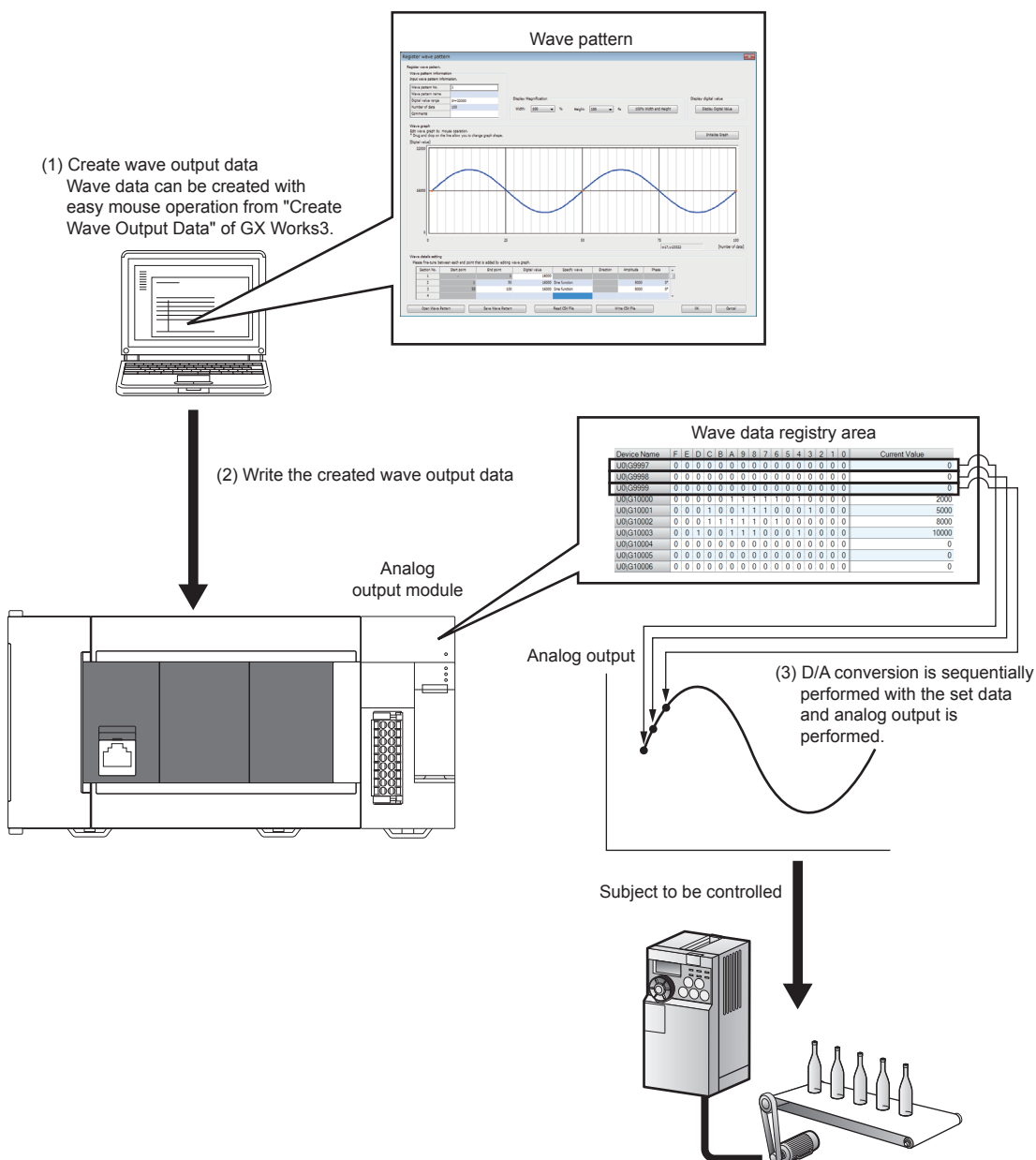


Wave output function

This function registers the previously prepared wave data (digital input values) in the analog output module and performs consecutive analog output with the set conversion cycle. When analog (torque) control is to be performed, for example, for a press machine or injection molding machine, it can achieve faster and smoother control than that by programming, by automatically outputting the control wave registered in the analog output module in advance. In addition, since this control can be achieved only by registering the wave data in the analog output module, it enables control without programming when repetitive control such as line control is to be performed, thus reducing the man-hours for programming.







The wave output function is available only when "Wave output mode" is set in "Output mode setting" of the basic setting. In this section, the following items set in the wave output function are called wave output data. Wave output data can be created by "Wave output data creating tool" of the module expansion parameter.

- Wave pattern ( Page 255 Register the wave pattern)
- Wave output function parameters ( Page 259 Setting the wave output function parameters)



Procedure for using the wave output function

Use the following procedure to use the wave output function.

- 1.** Register the wave pattern
 Page 255 Register the wave pattern
- 2.** Set the wave output function parameters
 Page 259 Setting the wave output function parameters
- 3.** Save the wave pattern
 Page 259 Save the wave pattern
- 4.** Parameter setting of the analog output module
 Page 214 Parameter setting of the analog output module
- 5.** Transfer the wave output data
 Page 217 Transfer the wave output data
- 6.** Start, stop, or pause the wave output
 Page 219 Start, stop, or pause the wave output

Restrictions and precautions on the wave output function

The wave output function has the following restrictions and precautions.

■Output mode setting

To use the wave output function, set the output mode setting to the wave output mode. This makes all channels operate in the wave output mode.

■Output range setting

No user range is available. When executing the wave output function, be sure to use anything other than the user range. For output range setting, refer to the following.

 Page 189 Range switching function

■Unavailable functions

When the wave output function is selected, the scaling, shift, and rate functions are unavailable. Also, the setting description of "Disconnection detection auto-clear enable/disable setting" (Un\G304) will be ignored, and the setting will be disable. When executing the wave output function, be sure to disable them.

■Analog output HOLD/CLEAR function

The analog output HOLD/CLEAR function differs from operation from that for normal output.

For details, refer to the following.


 Page 192 In the wave output mode

Setting the wave output function parameters

To use the wave output function, the parameters of the wave output function needs to be set on the "Create Wave Output Data" window.

Setting item	Reference
Output setting during wave output stop	Page 259
Output value during wave output stop	
Wave pattern start address setting	
Wave pattern data points setting	
Wave pattern output repetition setting	
Constant for wave output conversion cycle	

For details on the buffer memory areas, refer to the following.

 Page 300 Details of buffer memory addresses

Wave data

Wave data is a series of chronologically arranged digital input values to be output as analog data. Up to 80000 points of wave data are available. Wave data is designed to be registered in 'Wave data registry area' (Un\G10000 to Un\G89999).

Wave pattern

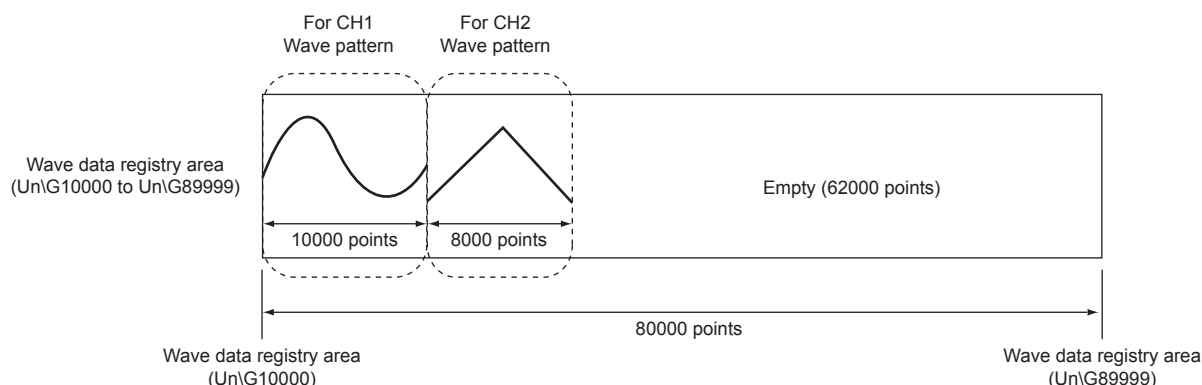
The wave output function allows you to select a desired data points from the registered wave data and set a wave pattern for each channel. Set the wave pattern with the following items.

Setting item	Description
Wave pattern start address setting	Sets the start address of the wave pattern that is output for each channel. D/A conversion is performed sequentially from the digital input values of the set buffer memory address, and they are output as analog data.
Wave pattern data points setting	Sets the data points of the wave pattern that is output for each channel. From the wave pattern start address, the wave data for the set data points is D/A-converted and output as analog data.

An error occurs if the value obtained by subtracting 1 from the sum of the setting values of the wave pattern start address setting and the wave pattern point setting exceeds the last buffer memory address (Un\G89999) of the wave data registration area. Error code 1D9□H is stored in 'Latest error code' (Un\G0), 'Error flag' (Un\G69, b15) turns on, and the ERROR LED turns on.

Ex.

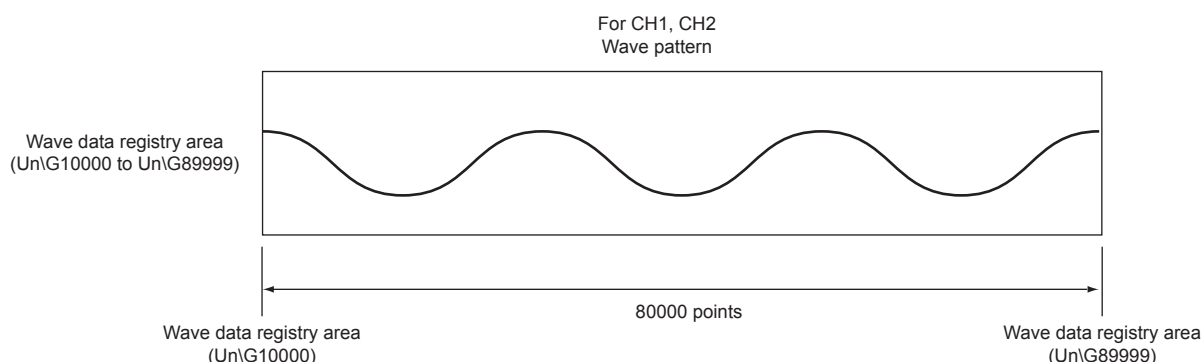
Setting example where different waves are output separately with CH1 and CH2



Setting item	Setting value
CH1 Wave pattern start address setting	10000
CH1 Wave pattern data points setting	10000
CH2 Wave pattern start address setting	20000
CH2 Wave pattern data points setting	8000

Ex.

Setting example where the same wave is output with CH1 and CH2



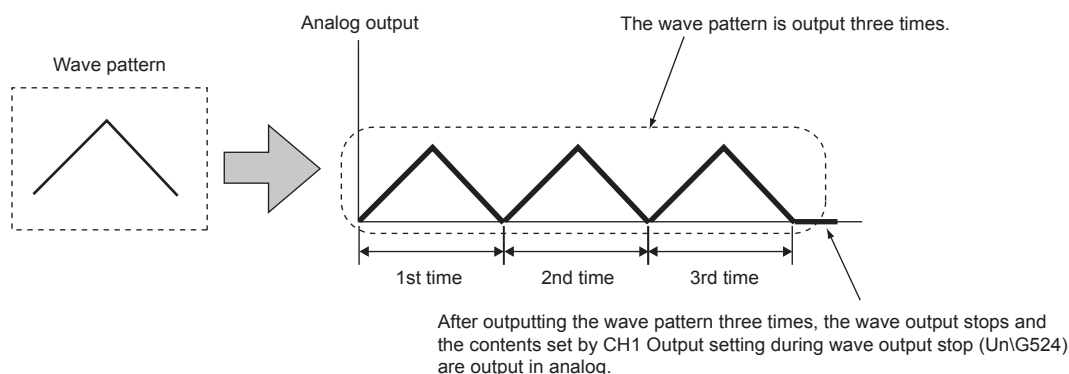
Setting item	Setting value
CH1 Wave pattern start address setting	10000
CH1 Wave pattern data points setting	80000
CH2 Wave pattern start address setting	10000
CH2 Wave pattern data points setting	80000

Wave pattern output count

The wave pattern can be output repeatedly by setting 'CH1 Wave pattern output repetition setting' (Un\G530). A count from 1 to 32767 times can be set. By setting the output count to -1, analog output of the wave pattern can be repeated indefinitely.

Ex.

If the wave pattern output count is set to 3 times



For the analog output module, "repetitive control" that outputs the same wave pattern repeatedly is defined as follows.

■If the start and end point digital input values are identical

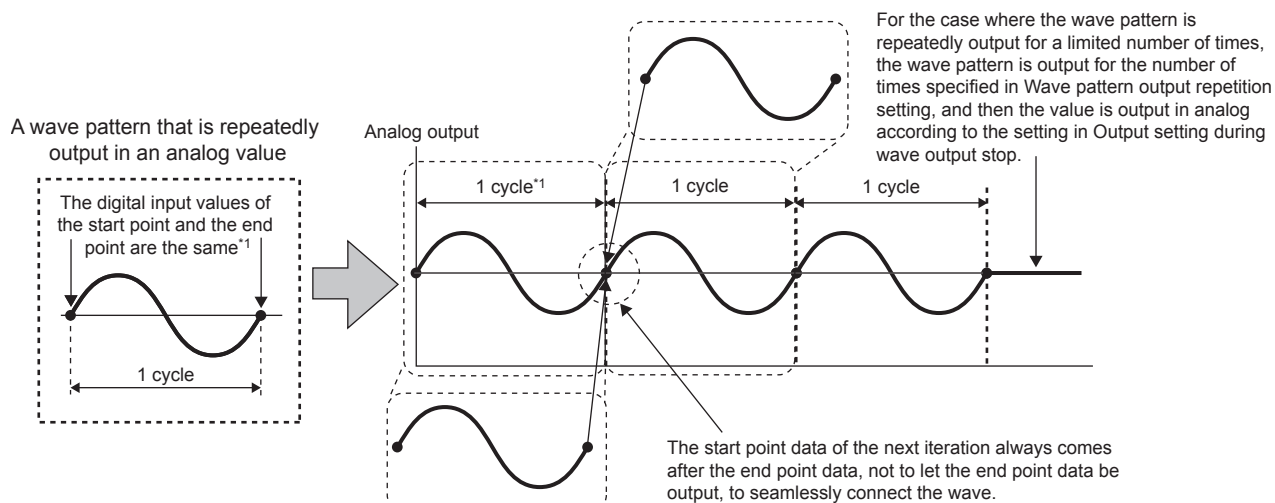
The end point of a wave pattern overlaps with the start point of the succeeding wave pattern by processing of the analog output module; thus, it will not be output as analog data. By setting 'CH1 Wave pattern output repetition setting' (Un\G530), the analog output at the wave pattern end point is as follows.

- For finite repetition

If 'CH1 Wave pattern output repetition setting' (Un\G530) is set to 2 to 32767, the digital input value at the wave pattern end point will not be output as analog data until the last repetition. However, after the end point digital input value is output as analog data at the last repetitive output, analog output is performed as per the setting of 'CH1 Output setting during wave output stop' (Un\G524).

- For indefinite repetition

Any digital input value at the wave pattern end point is not output as analog data.



*1 The wave pattern output cycle is calculated using the following formula.

Wave pattern output cycle = (Wave output conversion cycle) × (Wave pattern data points - 1)

For details on the wave output conversion cycle, refer to the following.

☞ Page 213 Wave output conversion cycle

Ex.

Calculating the wave pattern output cycle

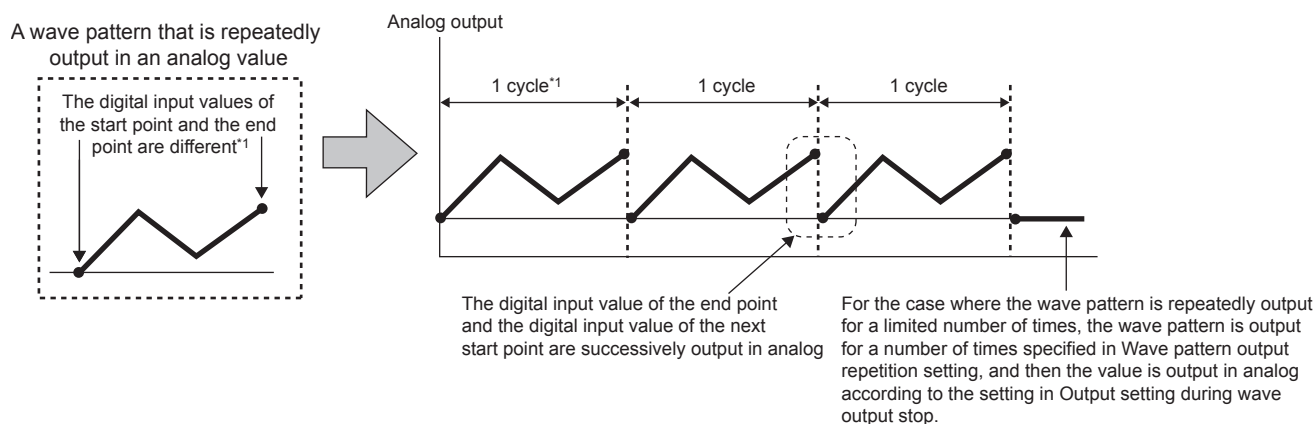
Setting item	Setting value
CH1 D/A conversion enable/disable setting	D/A conversion enable (0)
CH1 Wave pattern data points setting	101
CH1 Wave pattern output repetition setting	3
CH1 Constant for wave output conversion cycle	1

For the above setting, the wave pattern output cycle is as follows (when D/A conversion is enabled only for CH1).

$$\begin{aligned}
 \text{Output cycle of a wave pattern (}\mu\text{s)} &= \text{Conversion speed} \times \text{D/A conversion enabled Number of channels} \times \text{Wave output Conversion cycle constant} \times (\text{Wave pattern data points} - 1) \\
 &= 80 \times 1 \times 1 \times (101 - 1) \\
 &= 8000
 \end{aligned}$$

■ If the start and end point digital input values are different

The wave pattern end point is directly output as analog data. Regardless of the setting in 'CH1 Wave pattern output repetition setting' (Un\G530), the set wave patterns are consecutively output as analog data.



*1 The wave pattern output cycle is calculated using the following formula.

Wave pattern output cycle = (Wave output conversion cycle) × (Wave pattern data points)

For details on the wave output conversion cycle, refer to the following.

☞ Page 213 Wave output conversion cycle

Ex.

Calculating the wave pattern output cycle

Setting item	Setting value
CH1 D/A conversion enable/disable setting	D/A conversion enable (0)
CH1 Wave pattern data points setting	101
CH1 Wave pattern output repetition setting	3
CH1 Constant for wave output conversion cycle	1

For the above setting, the wave pattern output cycle is as follows (when D/A conversion is enabled only for CH1).

$$\begin{aligned}
 \text{Output cycle of a wave pattern (}\mu\text{s)} &= \text{Conversion speed} \times \text{D/A conversion enabled} \times \text{Wave output Conversion cycle constant} \times \text{Wave pattern data points} \\
 &= 80 \times 1 \times 1 \times 101 \\
 &= \underline{8080}
 \end{aligned}$$

Wave output conversion cycle

The wave pattern conversion cycle is calculated using the following formula.

$$\text{Conversion cycle (}\mu\text{s)} = \text{Conversion speed (80 }\mu\text{s)} \times \text{Number of D/A conversion enabled channels} \times \boxed{\text{Wave output conversion cycle constant}}$$

The wave output function allows you to set the conversion cycle by setting 'CH1 Constant for wave output conversion cycle' (Un\G531). The conversion cycle of the current wave output can be examined using 'CH1 Wave output conversion cycle monitor' (Un\G432, 433).

Ex.

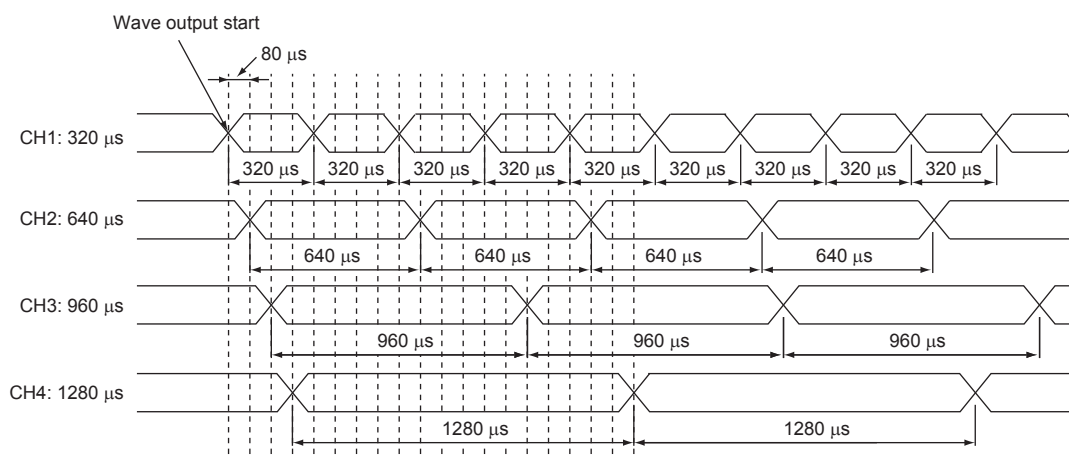
Conversion cycle and operation timing

Setting item	Setting value
D/A conversion enable/disable setting	Enable D/A conversion for CH1 to CH4.
CH1 Constant for wave output conversion cycle	1
CH2 Constant for wave output conversion cycle	2
CH3 Constant for wave output conversion cycle	3
CH4 Constant for wave output conversion cycle	4

For the above setting, the conversion cycles for the channels are as follows.





- CH1: $80 \times 4 \times 1 = 320 \text{ (}\mu\text{s)}$
- CH2: $80 \times 4 \times 2 = 640 \text{ (}\mu\text{s)}$
- CH3: $80 \times 4 \times 3 = 960 \text{ (}\mu\text{s)}$
- CH4: $80 \times 4 \times 4 = 1280 \text{ (}\mu\text{s)}$

With this conversion cycle, D/A conversion is executed and the analog values are output.



Initializing the wave output function

For the wave output function, the following are required to be initialized. Before executing the wave output function, perform the settings described in this section.

- Register the wave pattern ( Page 255 Register the wave pattern)
- Create the wave output function parameters ( Page 259 Setting the wave output function parameters)
- Save the wave pattern ( Page 259 Save the wave pattern)
- Parameter setting of the analog output module ( Page 214 Parameter setting of the analog output module)

■Parameter setting of the analog output module

When the wave output function is to be used, the module parameters need to be set up separately from setting up the wave output function parameters.

The items to be with the module parameters are as follows.

- Output range setting

Same as normal output. Select the output range to be used.

Note that when the wave output function is in use, no user range is available.

- Operation mode setting

Select "Normal mode" for the operation mode setting.

- Output mode setting

Select "Wave output mode" for the output mode setting.

- Analog output HOLD/CLEAR setting

The analog output HOLD/CLEAR function differs from operation from that for normal output. For the differences in operation arising from the HOLD/CLEAR setting, refer to the following.

 Page 190 Analog output HOLD/CLEAR function

- Disconnection detection auto-clear enable/disable setting

"Disconnection detection auto-clear enable/disable setting" cannot be used.

[Warning output setting]

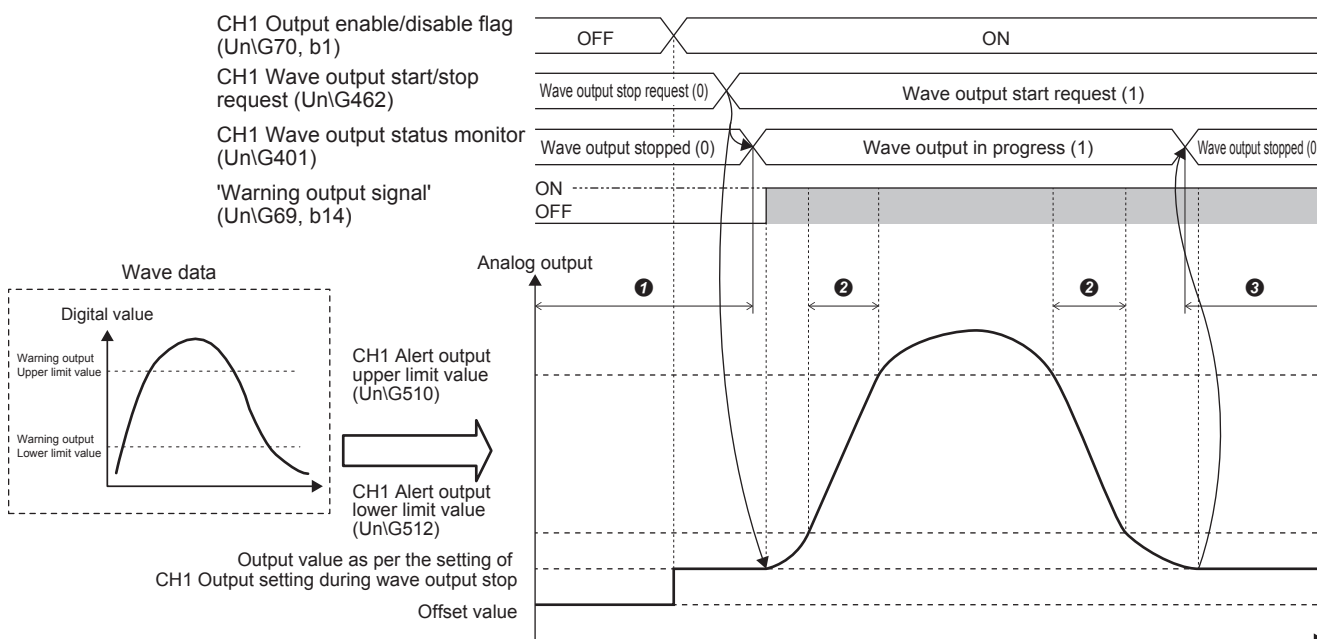
Like normal output, set 'Enable (output not limited)' or 'Disable (output limited)' in 'Warning output setting' for the channel for which to execute D/A conversion.

Whereas for normal output, 'CH1 Digital value' (Un\G460) is the target, for wave output, the set 'wave data registry area' (Un\G10000 to Un\G89999) is the target. The following describes the operation when the warning output function is enabled (output not limited) and the operation when it is enabled (output limited).

- For Enable (output not limited)

If Output setting during wave output stop is Output value during wave output stop (2), this function outputs the value that was set with the Output value during wave output stop while the wave output is at a stop.

By starting the wave output, analog output is performed, but because of "output not limited", the value of wave data is output.

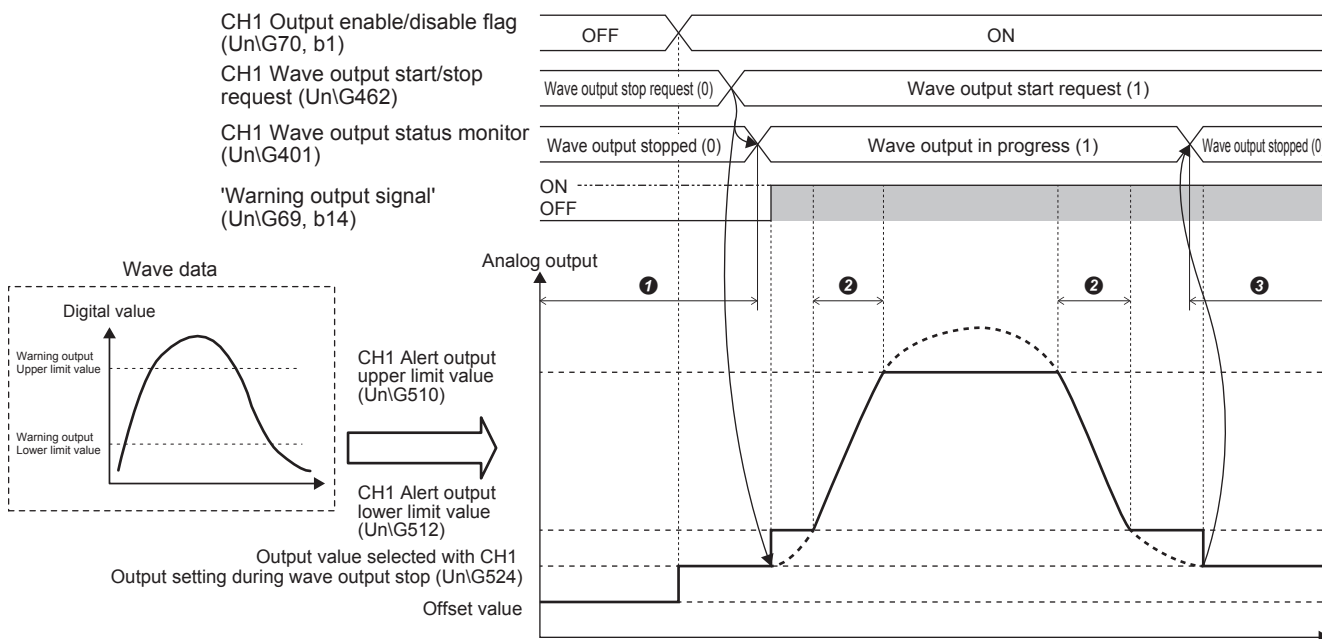


- 1 Since the wave output is at a stop, the alarm turns off. (The warning doesn't turn on.)
- 2 When the output is in the range equal to or larger than "Warning output lower limit value" or equal to or smaller than "Warning output upper limit value", the alarm can be turned off using 'Warning output clear request' (Un\G70, b14).
- 3 Since the wave output is at a stop, the alarm can be turned off using 'Warning output clear request' (Un\G70, b14).

- For Enable (output limited)

If Output setting during wave output stop is Output value during wave output stop (2), this function outputs the value that was set with the Output value during wave output stop while the wave output is at a stop.

By starting the wave output, warning output is performed, and the value set by the warning output upper and limit values is output.



Executing the wave output function

This section describes the procedure for executing the wave output function. After the initial setting of the wave output function, execute the contents of this section.

■Transfer the wave output data

The CPU module power is turned off→on or reset, and the wave output data created with module extension parameter "Wave output data creation tool" is transferred to the analog output module.

If the module extension parameter file has an error, a module extension parameter acquisition error (error code: 1DA0H) occurs without executing D/A conversion on all channels.

■D/A conversion enable/disable setting


D/A conversion enable/disable setting can be set by the module parameter, however, when the wave output data is not set by the module expansion parameter, perform the setting using the program.

At this time, register the wave output function parameter settings and the wave data settings before changing 'D/A conversion enable/disable setting'.


Precautions

'D/A conversion enable/disable setting' can be set also with a module parameter.

1. Set "D/A conversion enable/disable setting" to "D/A conversion enable".

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Module model name ⇒ [Module Parameter] ⇒ [Basic setting] ⇒ [D/A conversion enable/disable setting function]

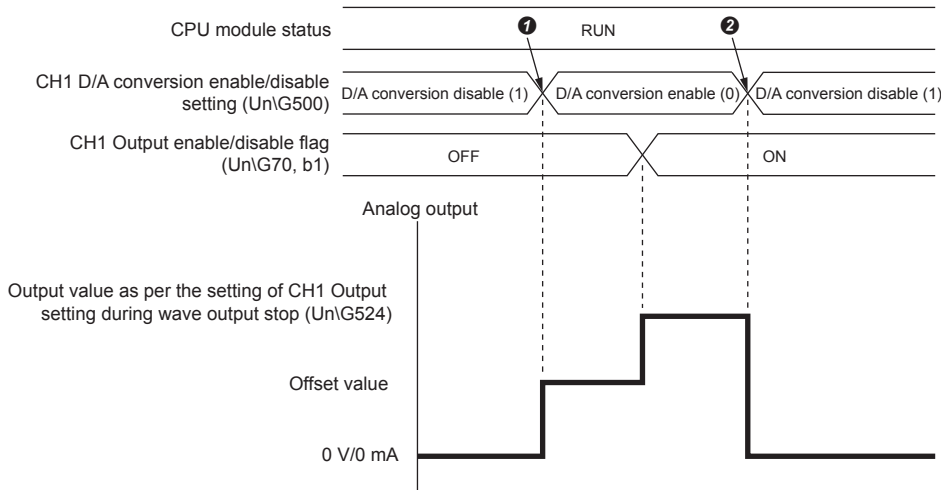
Note the following when wave output data is not yet set by the module extension parameter: If the setting is enabled by resetting the CPU module or turning off→on the power supply, this causes a wave pattern data points setting range error (error code: 1D5□H). This is because the wave pattern data points setting is set to 0 (default value) in the D/A conversion enabled channel.

To clear this error, register the wave output function parameter setting and the wave output data, and then turn off→on→off 'Operation condition setting request' (Un\G70, b9). ( Page 259 Setting the wave output function parameters)

■Changing the module settings

For the wave output function parameter settings written with the program, 'Operating condition setting request' (Un\G70, b9) needs to be turned off→on→off to enable the settings. When the settings are enabled, the CH1 Analog output value set as D/A conversion enable changes to the following depending on the status of the 'CH1 Output enable/disable flag' (Un\G70, b1).

- 'CH1 Output enable/disable flag' (Un\G70, b1) Changes to the offset value.
- 'CH1 Output enable/disable flag' (Un\G70, b1) The setting in 'CH1 Output setting during wave output stop' (Un\G524) is output.



- 1 Set the CH1 D/A conversion enable/disable setting (Un\G500) to D/A conversion enable (0) and turn off→on→off 'Operation condition setting request' (Un\G70, b9).
- 2 Set the CH1 D/A conversion enable/disable setting (Un\G500) to D/A conversion disable (1) and off→on→off 'Operation condition setting request' (Un\G70, b9).

Point

When the wave output function is in use, the parameter setting can be enabled by turning off→on→off 'Operating condition setting request' (Un\G70, b9) only when all channels are at a wave output stop (the CH□ Wave output status monitors for all channels are at a wave output stop (0)).

An alarm will occur if 'Operating condition setting request' (Un\G70, b9) is turned off→on→off when the wave output status is other than the wave output stopped state for even one channel. Alarm code 0B0□H is stored in 'Latest alarm code' (Un\G2). The parameter setting will not be enabled.

■Start, stop, or pause the wave output

[Starting the wave output]

After the wave data is registered, the wave output can be started using the following procedure.

1. Turn on 'CH1 Output enable/disable flag' (Un\G70, b1).

Turning on this flag outputs the 'CH1 Output setting during wave output stop' (Un\G524) setting as analog data.

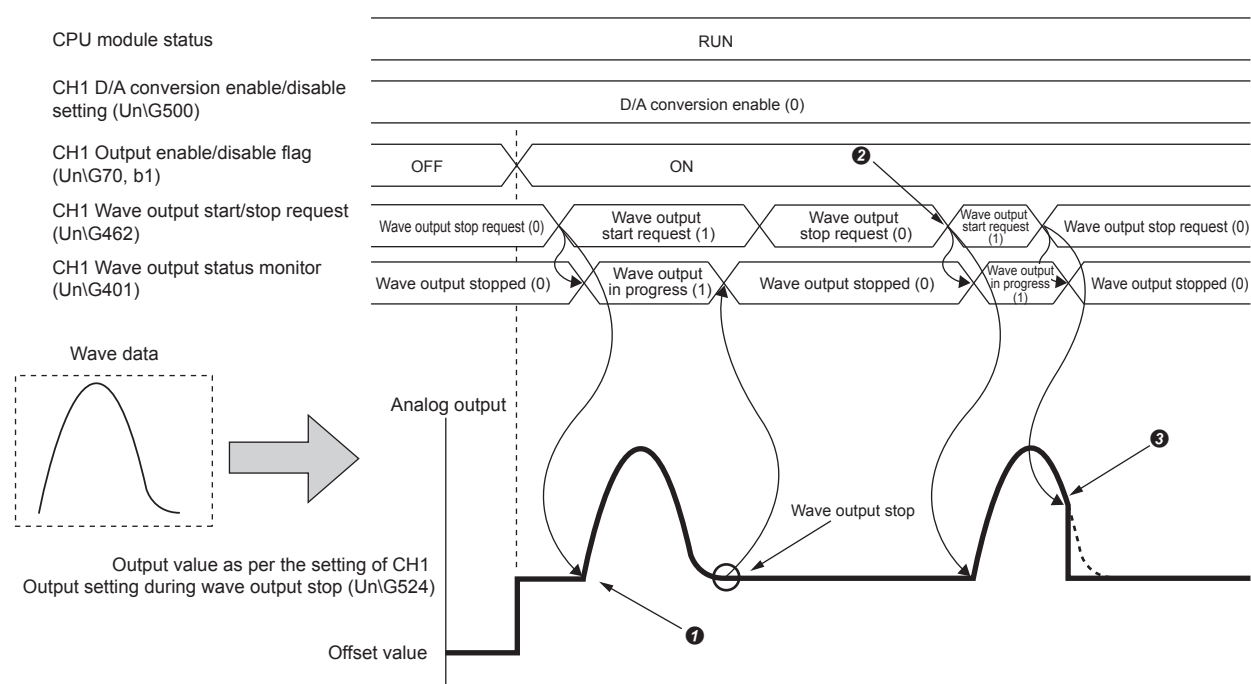
2. Set 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (1).

The wave output starts by changing Wave output stop request (0) or Wave output pause request (2) to Wave output start request (1).

[Stopping the wave output]

To stop the wave output at a desired timing during wave output, set 'CH1 Wave output start/stop request' (Un\G462) to Wave output stop request (0). The wave output fully stops by changing Wave output start request (1) or Wave output pause request (2) to Wave output stop request (0). When wave output stops, Wave output stopped (0) is stored in 'CH1 Wave output status monitor' (Un\G401). The wave output cannot restart from the stopping time point.

The wave output stops also after the wave patterns for the count set with 'CH1 Wave pattern output repetition setting' (Un\G530) have been output.



- 1 The wave output starts by setting 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (1).
- 2 To execute the wave output again, change the 'CH1 Wave output start/stop request' (Un\G462) to Wave output stop request (0) before changing it to Wave output start request (1).
- 3 The wave output stops by setting 'CH1 Wave output start/stop request' (Un\G462) to Wave output stop request (0) during wave output.

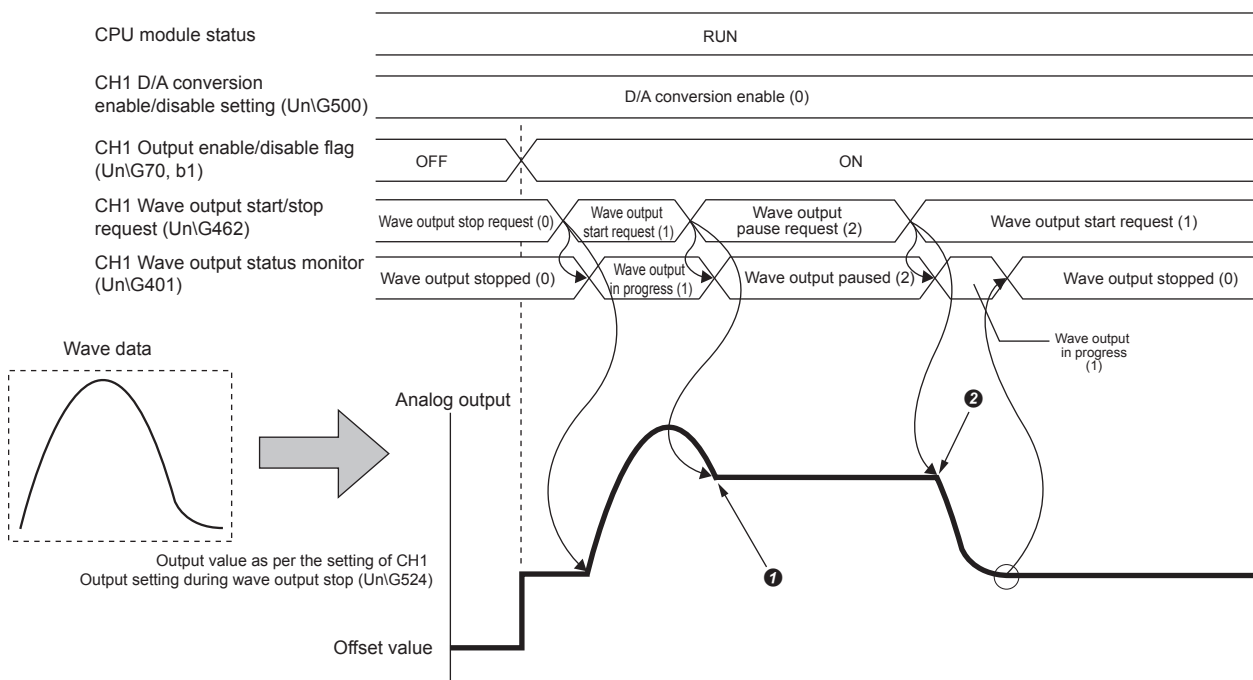
[Pausing the wave output]

- To pause the wave output, set 'CH1 Wave output start/stop request' (Un\G462) to Wave output pause request (2). The wave output pauses by changing from Wave output start request (1) to Wave output pause request (2). In addition, Wave output paused (2) is stored in 'CH1 Wave output status monitor' (Un\G401).
- To restart the wave output, change 'CH1 Wave output start/stop request' (Un\G462) from Wave output pause request (2) to Wave output start request (1). This restarts the wave output from the wave data generated when the pause occurred.
- If 'CH1 Wave output start/stop request' (Un\G462) is set to Wave output temporary stop request (2) while the wave output is at a stop, the following will be output depending on HOLD/CLEAR setting.

Previous Value: Outputs the digital value of the wave pattern start address.

Setting value: Outputs the HOLD setting value.

CLEAR: Outputs the offset value.

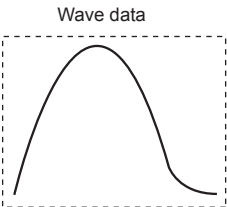


- 1 The wave output stops by setting 'CH1 Wave output start/stop request' (Un\G462) to Wave output pause request (2) during wave output.
- 2 The wave output restarts by setting 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (1).

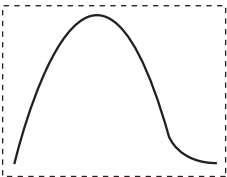
The analog output value obtained during the wave output paused state depends on the setting of the analog output HOLD/CLEAR function. For details, refer to the following.

➡ Page 192 In the wave output mode

- While the wave output is at a pause, the analog output value generated when the pause occurred is held.

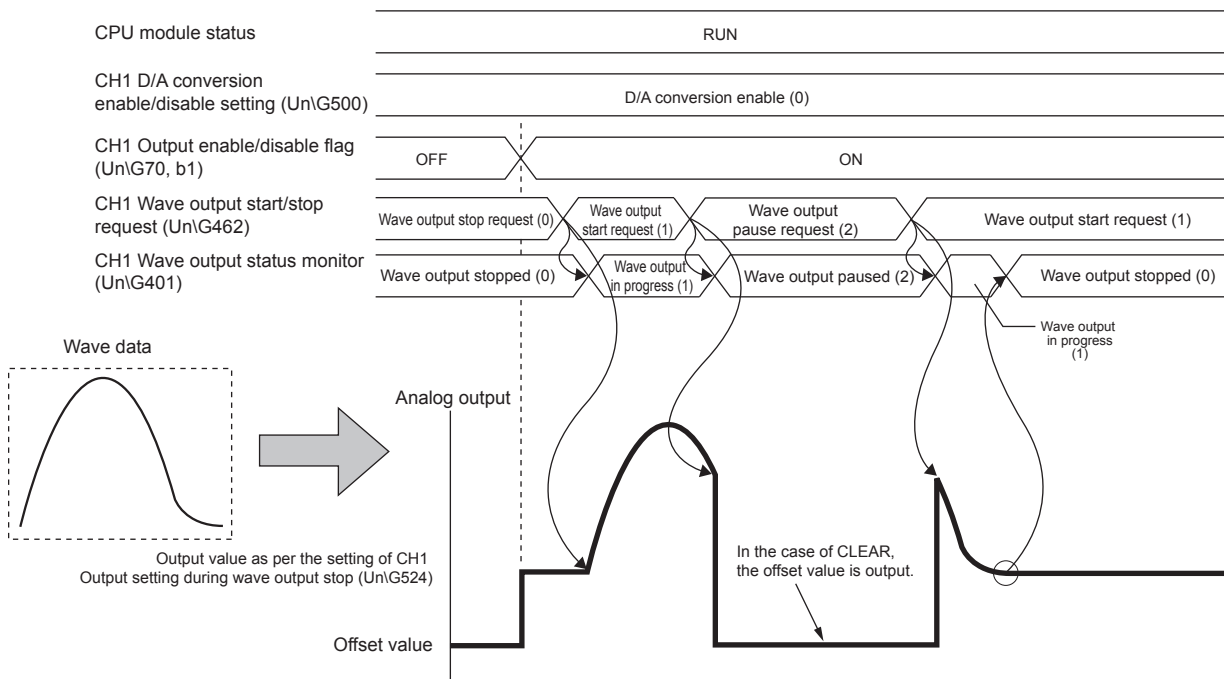


- While the wave output is at a pause, the HOLD setting value is output.



- For CLEAR

While the wave output is at a stop, the offset value is output.



Point

- Wave output start request is accepted only when the CPU module status is RUN. If 'CH1 Wave output start/stop request' (Un\G462) is changed to Wave output start request (1) in CPU module status other than RUN, the wave output will not start.
- Wave output pause request is accepted only when the CPU module status is RUN or STOP.
- Wave output pause request is accepted only when the CPU module status is RUN.
- If 'CH1 Wave output start/stop request' (Un\G462) is set to a value other than 0 to 2, an error will occur. A logging cycle setting disable error (error code: 1D0□H) is stored in 'Latest error code' (Un\G0), 'Error flag' (Un\G69, b15) and the ERROR LED turn on. In this case, the wave output will continue.
- An attempt to output a value out of the digital value range set with the output range causes an error, resulting in occurrence of a digital value setting range error (error code: 191□H).

■Checking the wave output function status

The wave output function status can be checked with the following buffer memory addresses.

Item	Description
Wave output status monitor	An area to store the wave output status.
Wave output conversion cycle monitor	Area in which the conversion cycle of wave output is stored. The unit of the stored value is μ s.
Wave output count monitor	An area to store the number of times the wave pattern was output.
Wave output current address monitor	An area to store the buffer memory address of the currently output wave data.
Wave output current digital value monitor	An area to store the currently output digital input value.
Wave output digital value out-of-range address monitor	When wave data that contains a registered digital input value out of the setting range is output, this area is used to store the registration destination buffer memory address of that wave data. When a digital value outside the setting range is detected with multiple pieces of wave data, this area stores the buffer memory address of only the first detected piece of data.
Wave output alarm occurrence address monitor	An area to store the buffer memory address of the wave data when an alarm occurred. When an alarm occurs due to multiple pieces of wave data, only the buffer memory address of the wave data causing the first alarm is stored.

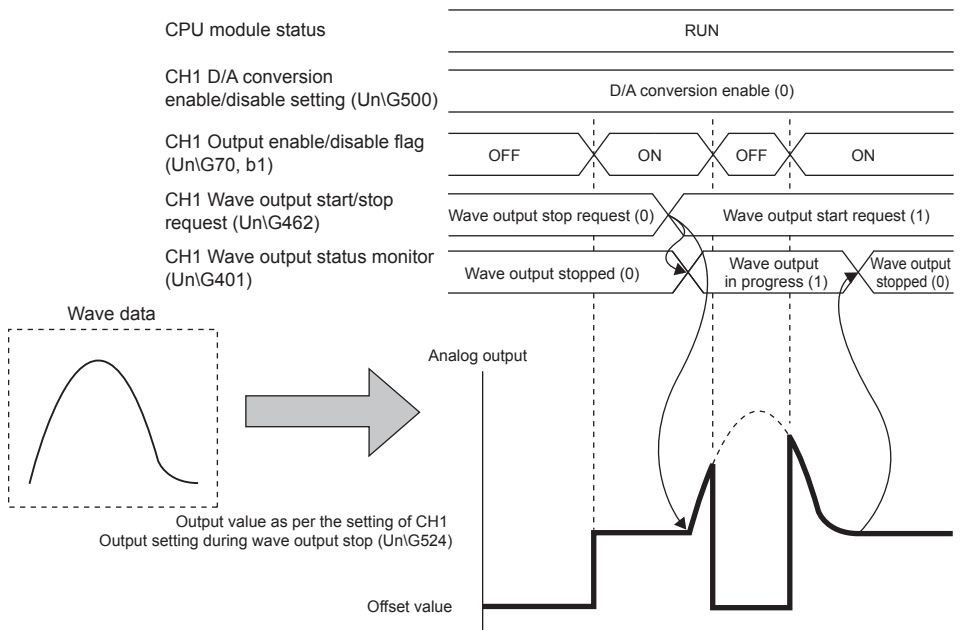
For details on the buffer memory areas, refer to the following.

Page 300 Details of buffer memory addresses

Points on using the wave output function

■ If 'CH1 Output enable/disable flag' (Un\G70, b1) was changed during wave output

When 'CH1 Output enable/disable flag' (Un\G70, b1) is turned on→off during wave output, the wave output does not stop although the analog output value changes to the offset value. The wave output update continues also while 'CH1 Output enable/disable flag' (Un\G70, b1) is off. Turning off→on 'CH1 Output enable/disable flag' (Un\G70, b1) restarts the analog output.



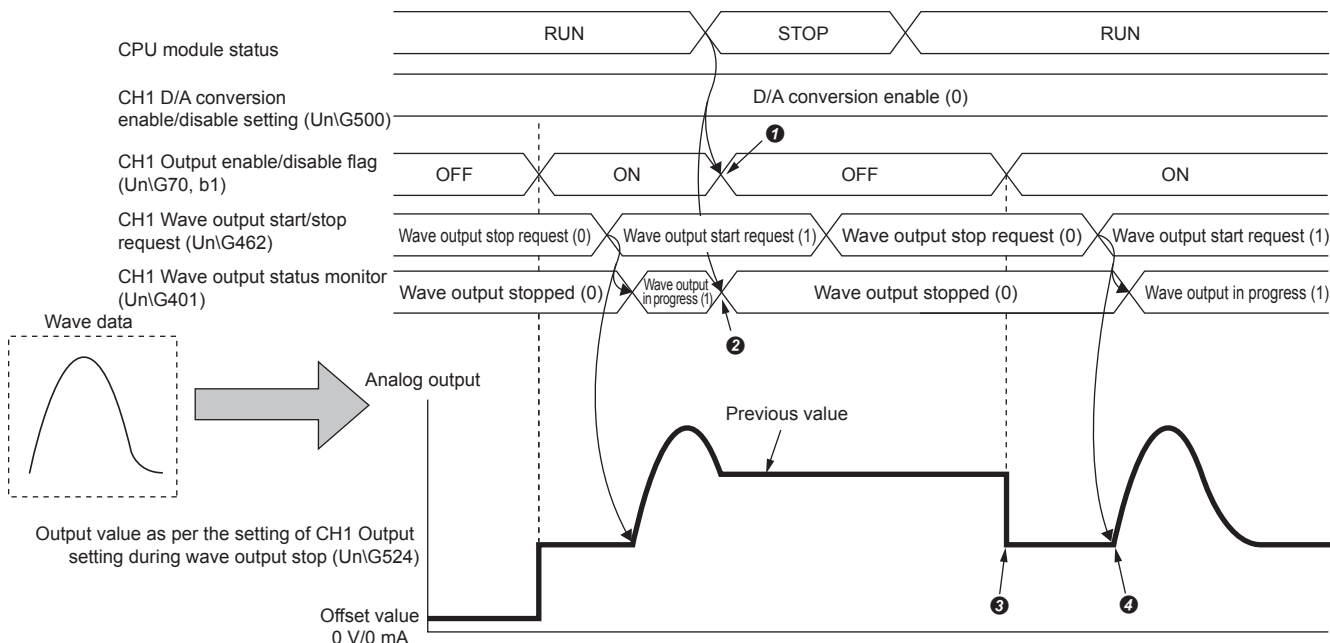
■If the CPU module status was changed during output

When the CPU module status was changed during wave output, after terminating the wave output, it operates as follows depending on the analog output HOLD/CLEAR function setting.

- For the previous value

If the CPU changes from RUN to STOP, the wave output terminates and the value immediately before STOP is held. When 'CH1 Output enable/disable flag' (Un\G70, b1) is turned on with the CPU module changed from STOP to RUN, the output changes as per the setting of 'CH1 Output setting during wave output stop' (Un\G524). Wave output does not restart.

To restart the wave output, change 'CH1 Wave output start/stop request' (Un\G462) from Wave output stop request (0) to Wave output start request (1) again.

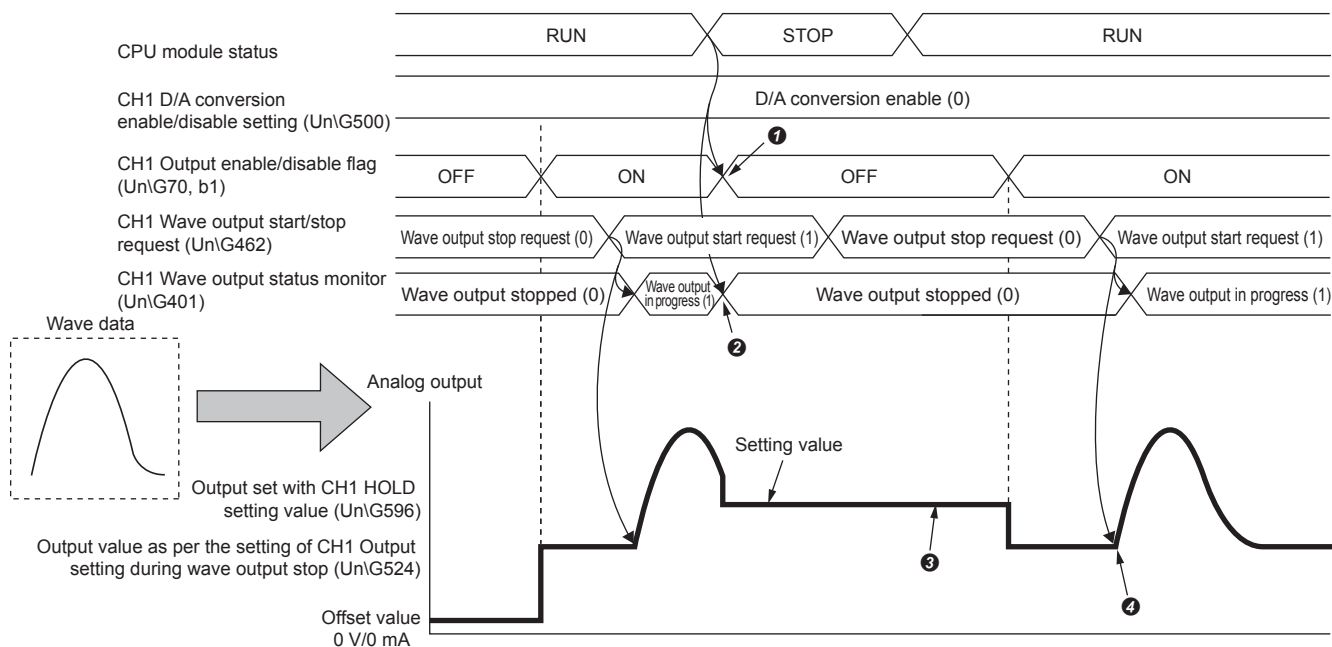


- 1 The output is disabled because the CPU module changes from RUN to STOP.
- 2 Once the HOLD/CLEAR operates, the wave output stops.
- 3 Wave output does not restart.
- 4 To restart the wave output, change the setting to Wave output start request (1).

- For the setting value

If the CPU changes from RUN to STOP, the wave output terminates and its value is held as the 'CH1 HOLD setting value' (Un\G596). When 'CH1 Output enable/disable flag' (Un\G70, b1) is turned on with the CPU module changed from STOP to RUN, the output changes as per the setting of 'CH1 Output setting during wave output stop' (Un\G524). Wave output does not restart.

To perform the wave output, change 'CH1 Wave output start/stop request' (Un\G462) from Wave output request (0) to Wave output start request (1) again.

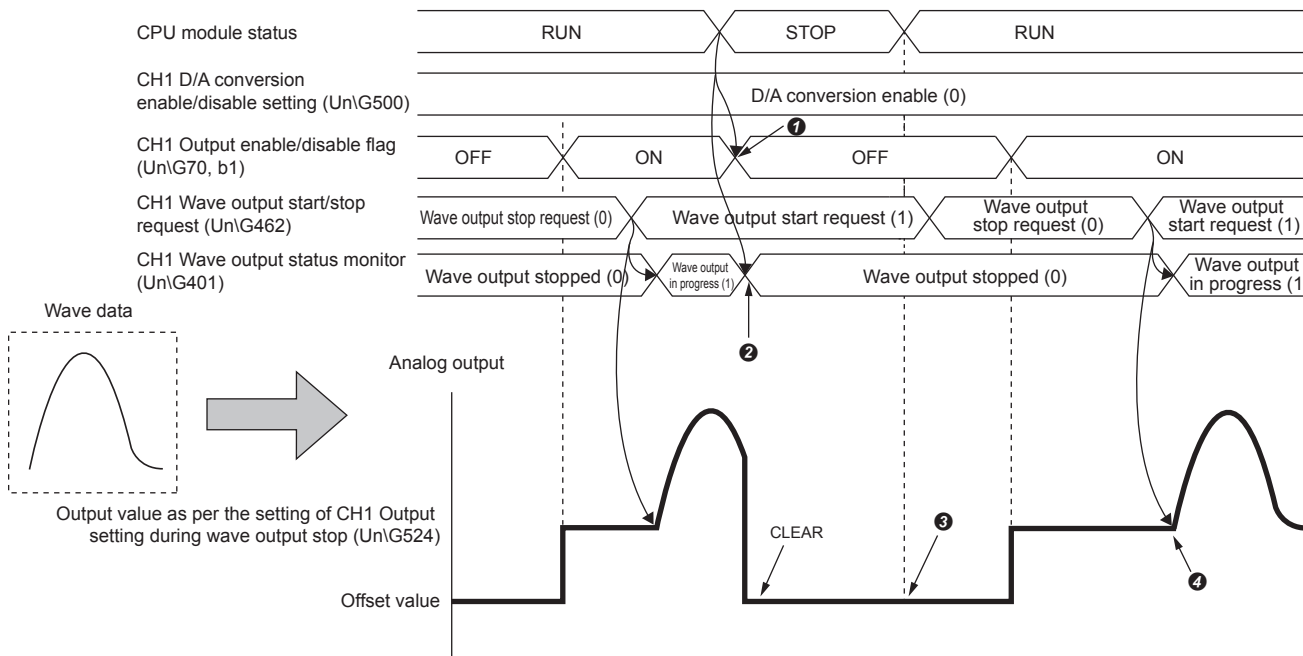


- 1 The output is disabled because the CPU module changes from RUN to STOP.
- 2 Once the HOLD/CLEAR operates, the wave output stops.
- 3 The value set by the HOLD setting value is output.
- 4 To restart the wave output, change the setting to Wave output start request (1).

- For CLEAR

If the CPU changes from RUN to STOP, the wave output terminates and the offset value is output. When 'CH1 Output enable/disable flag' (Un\G70, b1) is turned on with the CPU module changed from STOP to RUN, the output changes as per the setting of 'CH1 Output setting during wave output stop' (Un\G524). Wave output does not restart.

To perform the wave output, change the CPU module from STOP to RUN and then set 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (0). Then, change 'CH1 Wave output start/stop request' (Un\G462) from Wave output stop request (0) to Wave output start request (1).



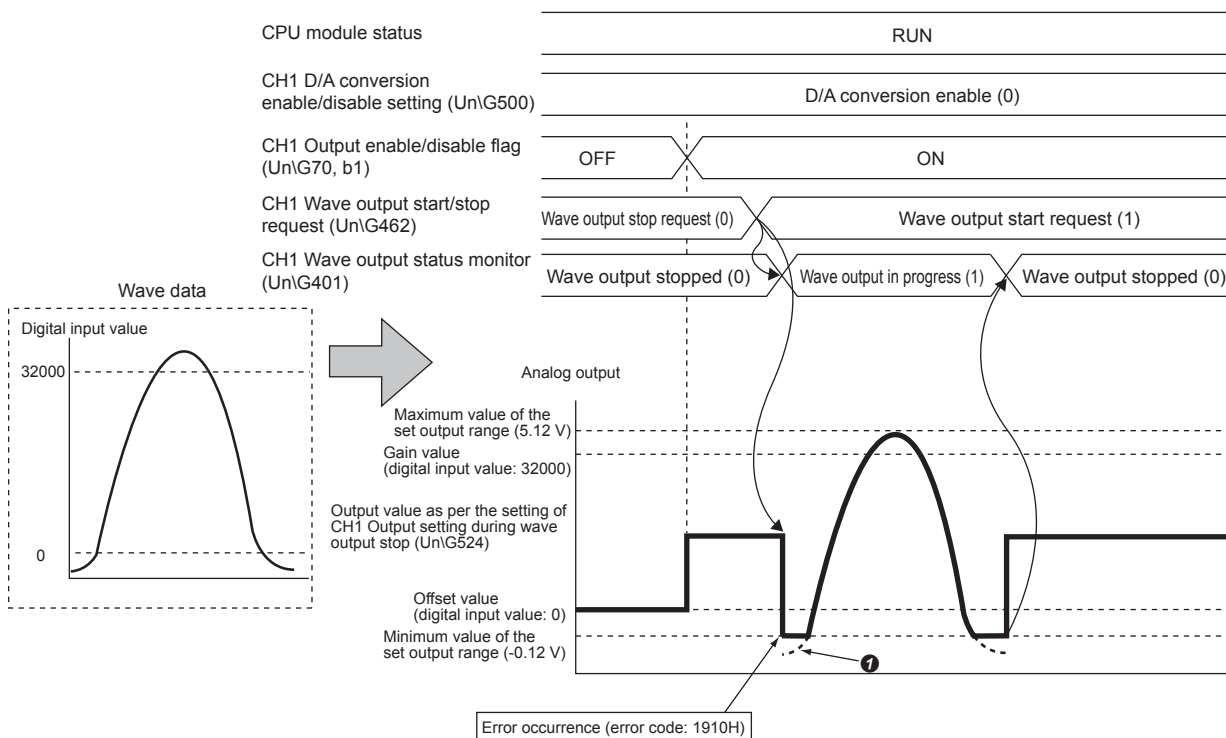
- ❶ The output is disabled because the CPU module changes from RUN to STOP.
- ❷ Once the HOLD/CLEAR operates, the wave output stops.
- ❸ Outputs the offset value.
- ❹ To restart the wave output, change the setting to Wave output start request (1).

■When an error occurs

If a value out of the setting range of the output range is attempted to be output, an error will occur and error code 191□H is stored in 'Latest error code' (Un\G0); 'Error flag' (Un\G69, b15) turns on at this time. If this error (error code: 191□H) occurs during wave output, the analog output value will be as follows.

- If an attempt is made to output a value below the minimum value of the output range, the analog output value will be the minimum value of the output range.

When the output range is set to 0 to 5 V



- ❶ If an attempt is made to output a value below the minimum value of the output range, the analog output value will be the minimum value of the output range.

If an error with error code 191□H occurs due to setting a digital input value outside the range, restore the digital input value to the value within the range before turning off→on→off 'Error clear request' (Un\G70, b15).

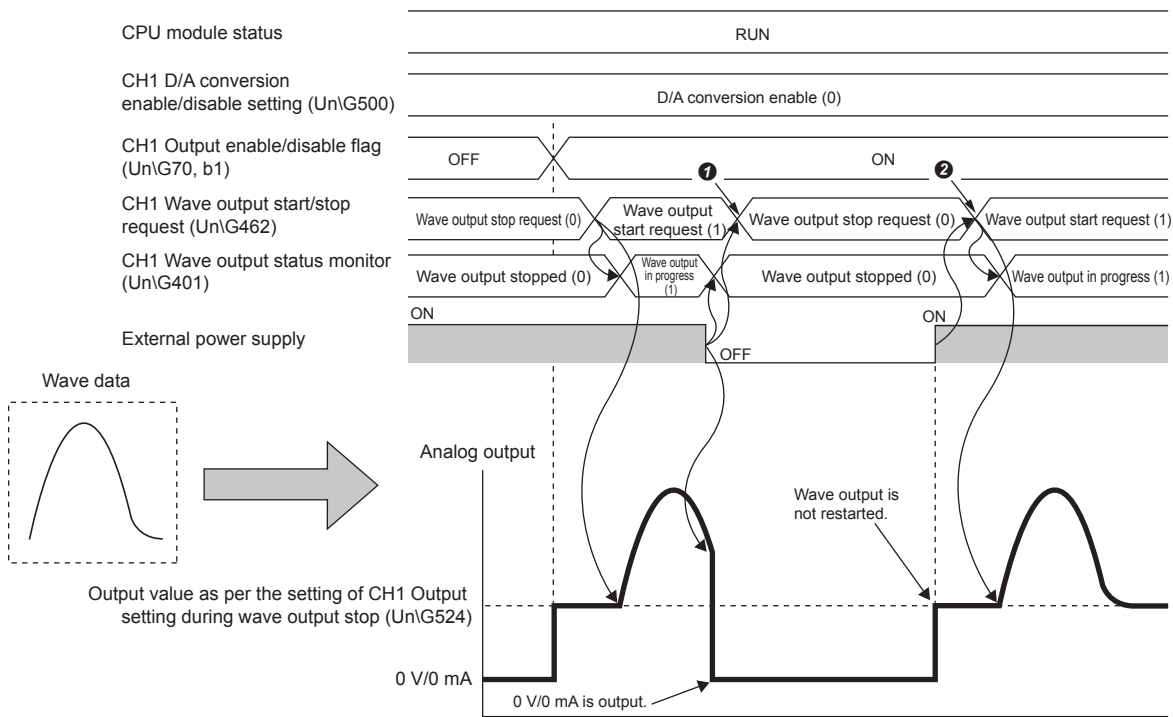
The buffer memory address to register the wave data being out of range can be examined using the wave output digital value out-of-range address monitor.

■When the external power supply turns off during wave output

When the external power supply turns on→off during without, the wave output status of every channel stops and the wave output fully stops. If the external power supply turns off→on at this time, the wave output will not restart.

To restart the wave output, after the external power supply turns off→on, check that the status of the analog output module and the externally connected devices. Then, set 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (1).

While the external power supply is off, no Wave output start/stop request is accepted.



- ❶ Since the external power supply turned on→off and the wave output stopped, change the CH1 Wave output start/stop request (Un\G462) to Wave output stop request (0).
- ❷ To restart the wave output again, change the 'CH1 Wave output start/stop request' (Un\G462) to Wave output stop request (0) before changing it to Wave output start request (1).

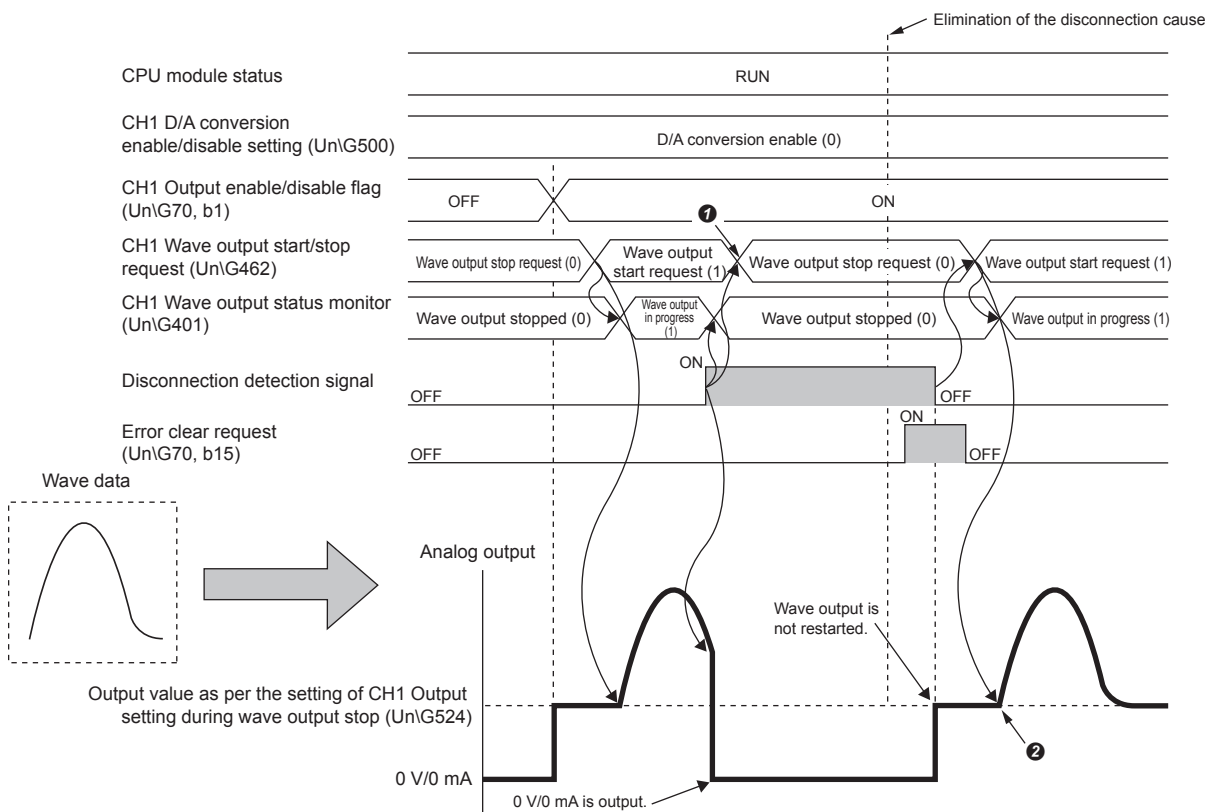
■When the disconnection occurs during wave output

When the disconnection is detected during wave output, the wave output status of the channel in which the disconnection was detected becomes the wave output stopping, and the wave output completely stops. Even if the disconnection cause is eliminated from the disconnection status, the wave output is not restarted.

By turning 'Error clear request' (Un\G70, b15) off→on→off, the output of the value set in 'Output setting during wave output stop' (Un\G524) is restarted.

To restart the wave output, check that the status of the analog output module and the externally connected devices. Then, set 'CH1 Wave output start/stop request' (Un\G462) to Wave output start request (1).

While the disconnection detection signal is on, no Wave output start/stop request is accepted.



- ① Since the disconnection detection signal turned off→on and the wave output stopped, change the CH1 Wave output start/stop request (Un\G462) to Wave output stop request (0).
- ② To restart the wave output again, change the 'CH1 Wave output start/stop request' (Un\G462) to Wave output stop request (0) before changing it to Wave output start request (1).

■Using the wave output function as PWM

The wave output function is available also as PWM with the shortest pulse width of 80 μ s.

In addition, since any number of pulses can be analog output by only creating a one pulse wave pattern, it contributes to reduction of man-hours for program creation.

- Example of creating a wave pattern

Creating a wave pattern with pulse width 80 μ s, amplitude 5 V, and duty ratio 50%

1. Set "Output range setting" to 0 to 5 V.

🔗 [Navigation window] \Rightarrow [Parameter] \Rightarrow [Module Information] \Rightarrow Module model name \Rightarrow [Module Parameter] \Rightarrow [Basic setting] \Rightarrow [Range switching function]

2. In "Create Wave Output Data", create a wave pattern for one pulse.

Setting item	Setting content	
Wave pattern information	Digital value range	0 to 32000
	Number of pieces of data	2
Wave detail setting	Digital value in section No. 1	32000
	Digital value in section No. 2	0
	Specified wave of section No. 2	Line

The wave monitored on GX Works3 differ from the analog output wave.

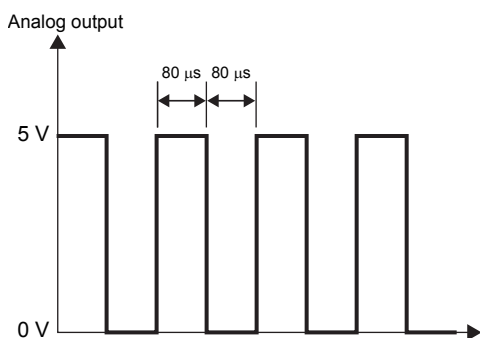
3. Set "Wave output data setting" as follows.

Setting item	Setting content
CH1 Wave pattern No.	Wave pattern created in step 2.
CH1 Wave pattern start address setting	10000 (default value)
CH1 Wave pattern output repetition setting	Set the number of times the wave output is to be repeated.
CH1 Constant for wave output conversion cycle	1 (default value)

4. Register the wave data and wave output function parameter settings in the analog output module. For how to register these, refer to the following.

🔗 Page 217 Transfer the wave output data

5. Set D/A conversion enable (0) in 'CH1 D/A conversion enable/disable setting' (Un\G500).
6. Turn off \rightarrow on \rightarrow off 'Operating condition setting request' (Un\G70, b9).
7. Turn on 'CH1 Output enable/disable flag' (Un\G70, b1).
8. Set 'CH1 Wave output start/stop request' (Un\G462), and start the wave output. After the wave output starts, the following analog output is generated.



Wave output step execution function

When the wave output function is in use, this execution function changes the address and data value to be output and freely changes the analog output at a desired timing.

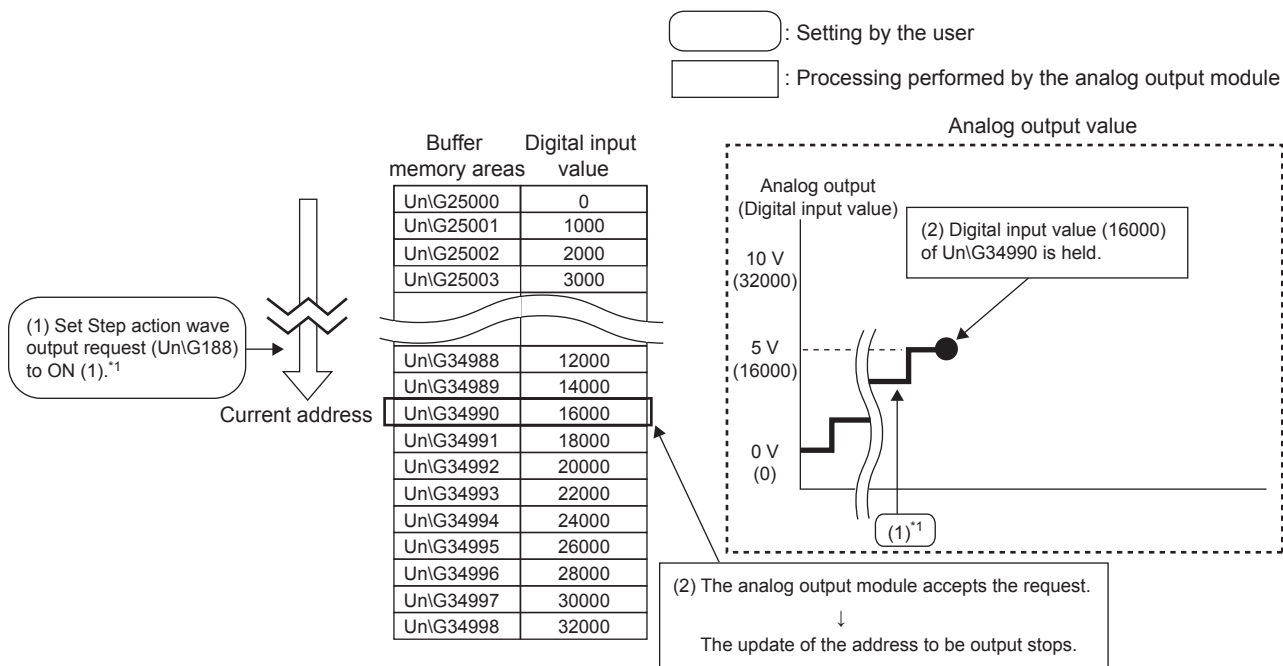
This function is useful for debugging the analog output test or wave output function when the wave output function is used.

Ex.

Wave output step execution in the following conditions

- The output range is set to -10 to +10 V.
- The wave output status is wave output in progress.
- The address when the Step action wave output request is accepted is 34990.

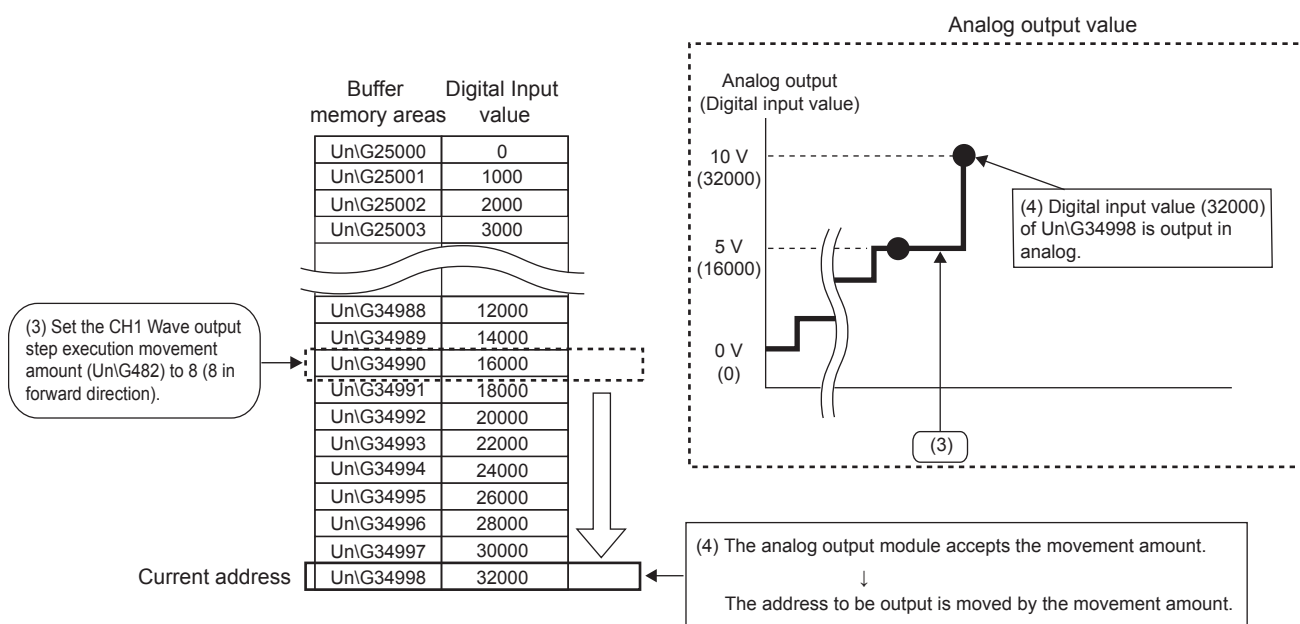
1. During wave output, set Step action wave output request (Un\G188) to ON (1).



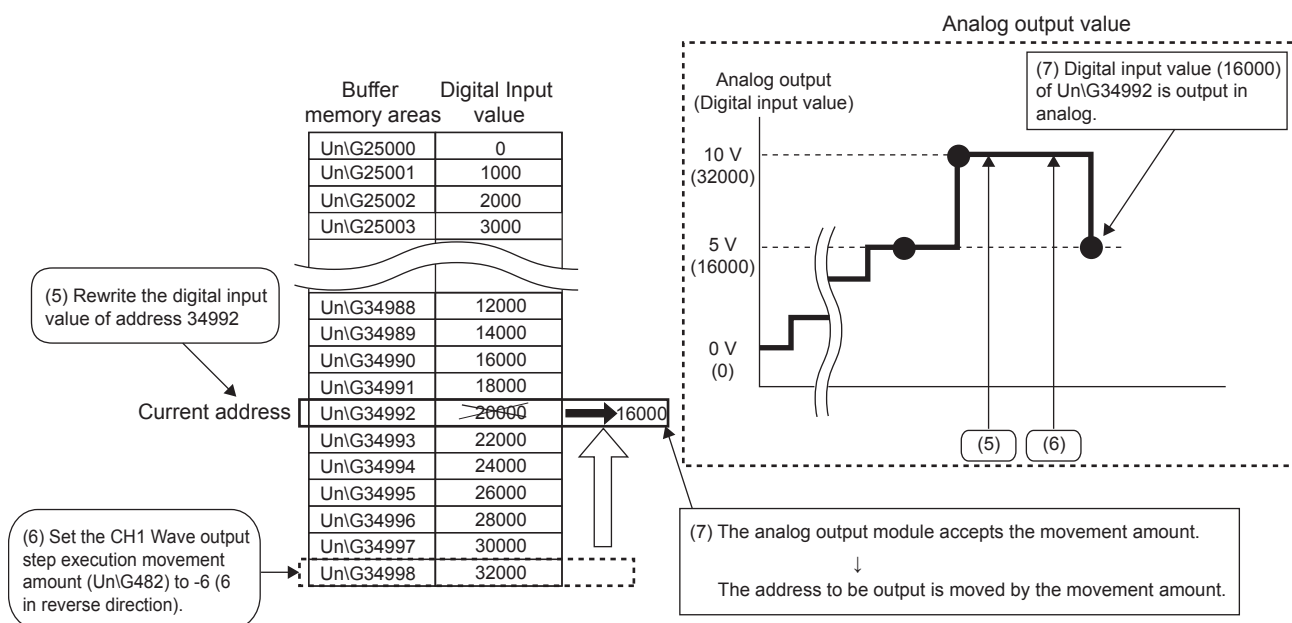
^{*1} The contents described here is the case when the wave output status is the wave output in progress at the timing of (1). If the status is other than the wave output in progress, the following value is output at the timing of (2).

- When wave output is stopped
The digital value that is set as the wave pattern start address is output in an analog value and held.
- When wave output is paused
The data of the address during the wave output pause (wave output current address) is held.

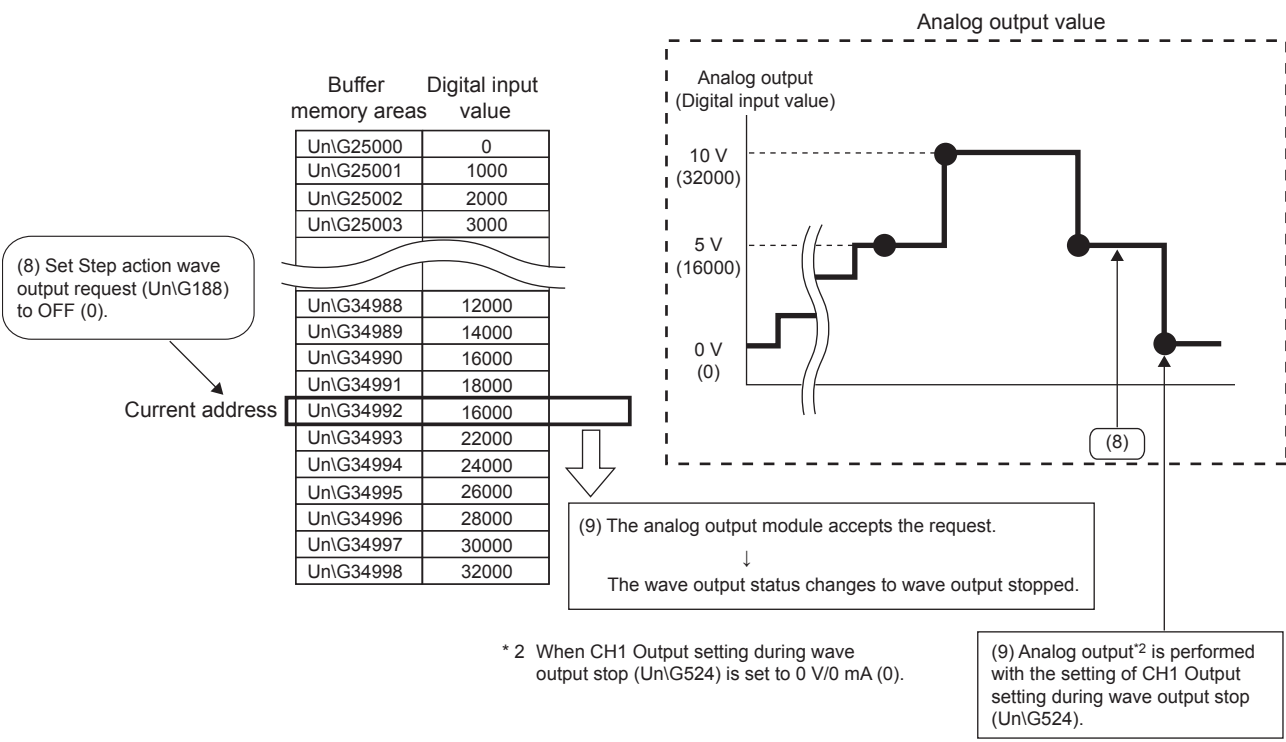
2. Set 'CH1 Wave output step action movement amount' (Un\G482) to 8 (8 in forward direction).



3. Rewrite the digital input value of address 34992 to 16000, and set 'CH1 Wave output step action movement amount' (Un\G482) to -6 (6 in reverse direction).

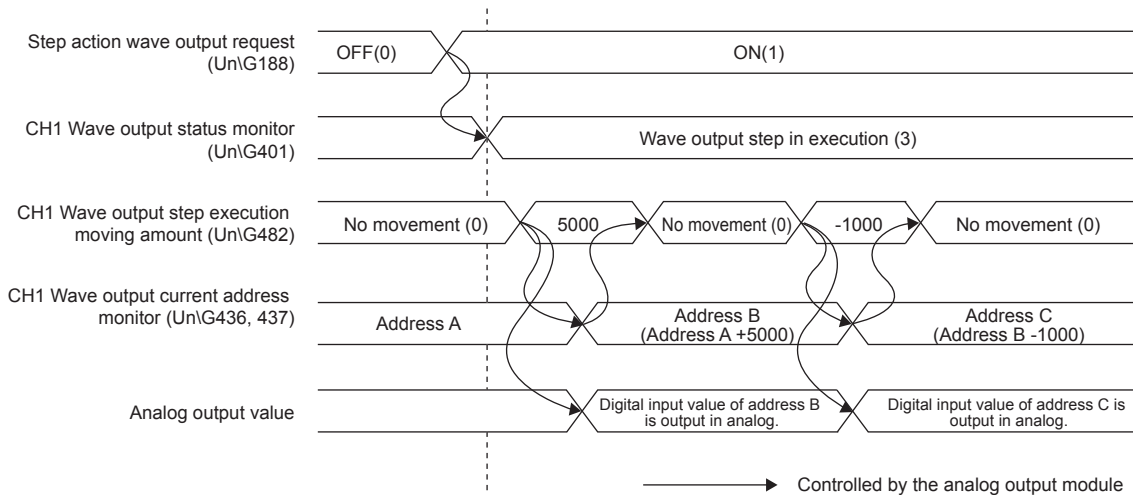


4. Set Step action wave output request (Un\G188) to OFF (0).



■Operation of the wave output step execution function

The wave output step execution function operates as follows.



By turning 'Step action wave output request' (UnG188) OFF (0) → ON (1), change the status to Wave output step execution in progress. By setting the value in 'CH1 Wave output step action movement amount' (UnG482) during wave output step execution, control moves to the address of the wave data to be subjected to the output test. For the value in 'CH1 Wave output step action movement amount' (UnG482), set the amount by which to move it from the address of the current wave data.

After the movement is completed, 'CH1 Wave output step action movement amount' (UnG482) changes to No movement (0) and the destination wave data is output as analog data.

The range where the movement is enabled by 'CH1 Wave output step action movement amount' (UnG482) is determined by both setting values of the wave pattern start address and the wave pattern data points. The movable range is as follows.

$$\left(\begin{array}{c} \text{Wave pattern} \\ \text{Start address} \end{array} \right) \text{ to } \left(\begin{array}{c} \text{Wave pattern} \\ \text{Start address} \end{array} + \text{Wave pattern data points} - 1 \right)$$

If a value equal to or larger than "Wave pattern data points" is set in 'CH1 Wave output step action movement amount' (UnG482), the value of wave pattern data points will be used for processing.

■Execution of the wave output step execution function

To use the wave output step execution function, the wave output function needs to be initialized beforehand. For initializing the wave output function, refer to the following.

☞ Page 214 Initializing the wave output function

[Changing the status to wave output step execution]

Change the wave output status to Wave output step execution in progress by using the following procedure.

1. Turn Step action wave output request (UnG188) OFF (0) → ON (1).
2. Check that the CH□ Wave output status monitor for all channels have changed to Wave output step execution in progress (3).

To perform the wave output step execution, check the 'Latest error code' (UnG0) and the ERROR LED to confirm that no error has occurred. Then, change 'Step action wave output request' (UnG188) (0) from OFF (0) to ON (1). Unless the wave output parameter setting is set within the set range on all D/A conversion enabled channels, the wave output step execution cannot be performed on any channels.

[Wave output step execution]

After making change to the wave output step execution state, perform the wave output step execution using the following procedure. By repeating this procedure, the analog output test and debugging can be performed when the wave output function is performed.

1. Change the wave data of the target subjected to wave output step execution to an arbitrary value.
2. Set the value in 'CH1 Wave output step action movement amount' (Un\G482).

Set the following value depending on the direction in which to move control.

Shift direction	Description	Setting value
No shift	Control does not move to another buffer memory address of the output wave data.	0
Forward movement	Control moves to another output buffer memory address in the increasing direction from the address at which the wave data is currently being output. • If 10000 is set in 'CH1 Wave output step action movement amount' (Un\G482) when the currently output wave data is at buffer memory address Un\G20000, control will move to Un\G30000 as the output buffer memory address.	1 to 30000
Reverse movement	Control moves to another output buffer memory address in the decreasing direction from the address at which the wave data is currently being output. • If -10000 is set in 'CH1 Wave output step action movement amount' (Un\G482) when the currently output wave data is at buffer memory address Un\G40000, control will move to Un\G30000 as the output buffer memory address.	-1 to -30000

3. Check that the value of 'CH1 Wave output step action movement amount' (Un\G482) has changed to No movement (0).
4. Check that 'CH1 Wave output current address monitor' (Un\G436, 437) has changed to the buffer memory addresses at which to output the wave data.
5. Check that the analog output value is proper.



[Terminating the wave output step execution]

Terminate the wave output step execution using the following procedure.

1. Turn 'Step action wave output request' (Un\G188) ON (1) → OFF (0).
2. Check that the CH□ Wave output status monitor for all channels have changed to Wave output stopped (0). In addition, if the CH□ Wave output start/stop request was other than the wave output stop request (0), check that the status has been forcibly changed to Wave output stop request (0) at this timing.

To perform the wave output after the wave output step execution terminates, set CH□ Wave output start/stop request in Wave output start request (1).

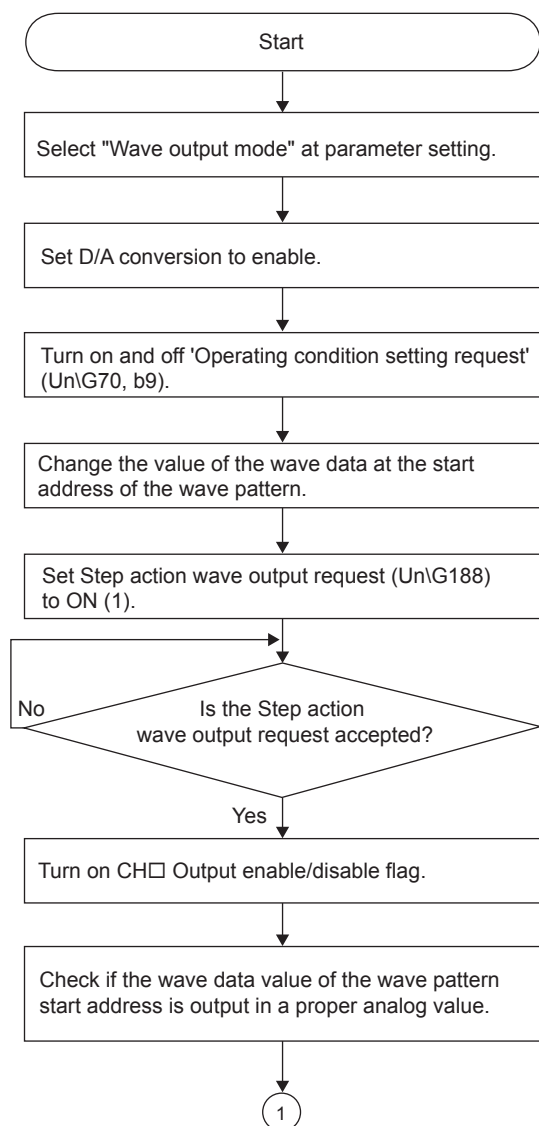
Point

- When the value is set for the CH□ Wave output step execution movement amount, the analog output may suddenly change. It is recommended to use this function in combination with the CH□ Output enable/disable flag to suppress the sudden change. For the combination, refer to the following.
 Page 192 In the wave output mode
- By using this function in combination with the CH□ Output enable/disable flag during wave output step execution, the analog output can be changed at a desired timing. For details, refer to the following.
 Page 236 Analog output test when wave output function is used
- During wave output step execution, setting a value in CH□ Wave output start/stop request does not change the wave output status. The wave output status can be changed by setting 'Step action wave output request' (Un\G188) to OFF (0) so that the status changes to Wave output stopped.

■Analog output test when wave output function is used

The following shows the procedure of an analog output test that uses the wave output step execution function.

An example of executing a CH1 Analog output test is also shown.



Example of executing a CH1 Analog output test

Select "Wave output mode" at "Output mode setting" of parameter setting.

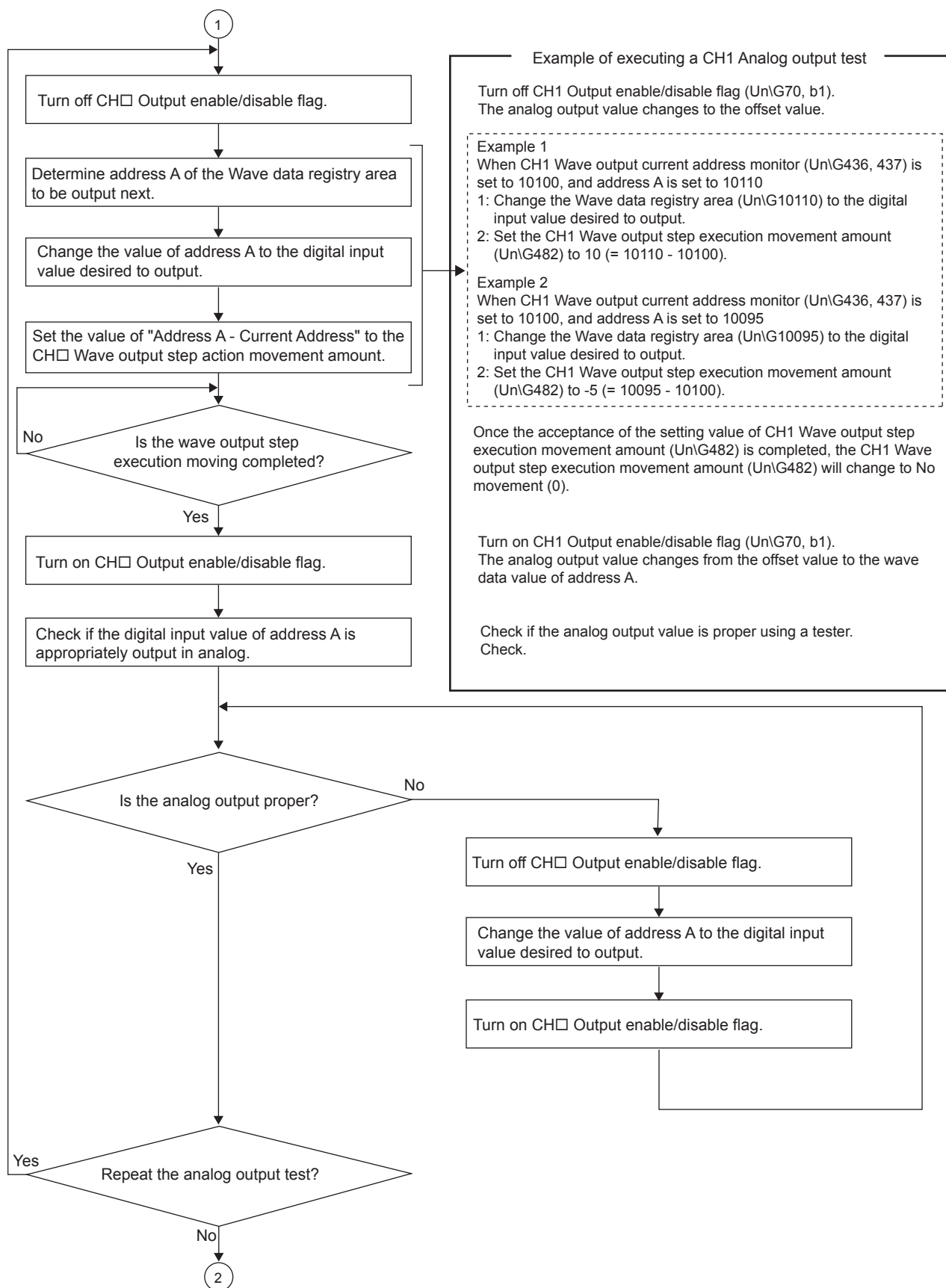
Set D/A conversion enable (0) in CH1 D/A conversion enable/disable setting (Un\G500).

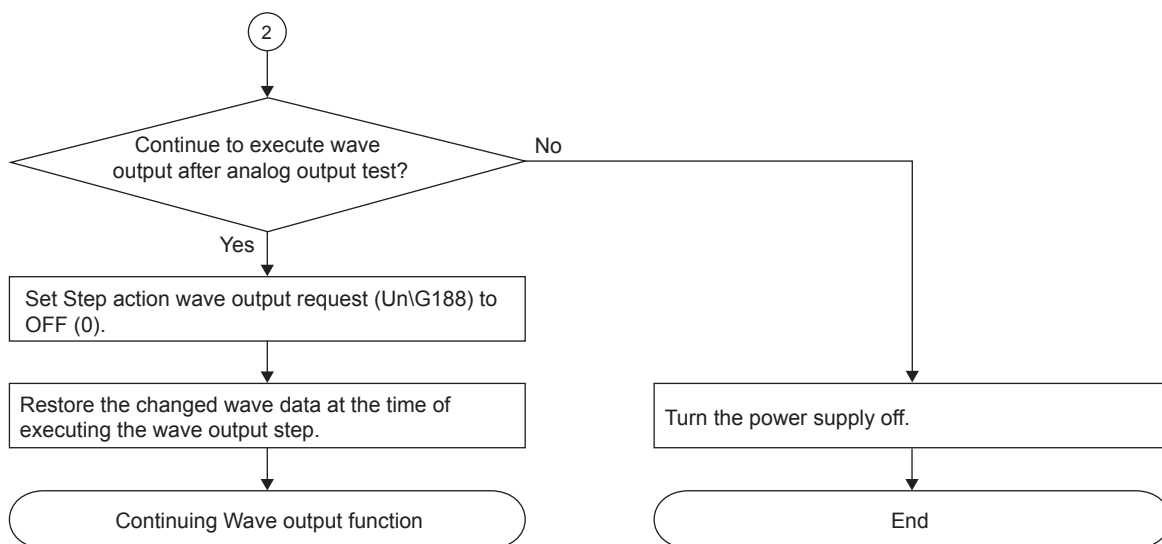
Turn on and off 'Operating condition setting request' (Un\G70, b9). Even if D/A conversion is enabled, since the CH1 Output enable/disable flag (Un\G70, b1) is OFF, the analog output value will be the offset value.

When reception of the set value of the Step action wave output request (Un\G188) is completed, the CH1 Wave output status monitor (Un\G401) becomes wave output step in execution (3).

The analog output value changes from the offset value to the wave data value of the wave pattern start address.

Check if the analog output value is proper using a tester.





Error history function

Records up to 16 errors and alarms that occurred in an analog output module to store them in the buffer memory areas.

Operation

When an error occurs, the error code and error time are stored in order, beginning with Error history No. 1 (Un\G3600 to Un\G3609).

When an alarm occurs, the alarm code and alarm time are stored in order, beginning with Alarm history No. 1 (Un\G3760 to Un\G3769).

- Detail of the error code assignment

	b15	to	b8	b7	to	b0
Un\G3600	Error code					
Un\G3601	First two digits of the year			Last two digits of the year		
Un\G3602	Month			Day		
Un\G3603	Hour			Minute		
Un\G3604	Second			Day of the week		
Un\G3605	Millisecond (upper)			Millisecond (lower)		
Un\G3606	System area					
to						
Un\G3609						

- Detail of the alarm code assignment

	b15	to	b8	b7	to	b0
Un\G3760	Alarm code					
Un\G3761	First two digits of the year			Last two digits of the year		
Un\G3762	Month			Day		
Un\G3763	Hour			Minute		
Un\G3764	Second			Day of the week		
Un\G3765	Millisecond (upper)			Millisecond (lower)		
Un\G3766	System area					
to						
Un\G3769						

Ex.

Example of error history and alarm history storage

Item	Storage contents	Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.	2017H
Month/Day		0130H
Hour/Minute		1035H
Second		40H
Day of the week	One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3, Thursday: 4, Friday: 5, Saturday: 6	1H
Millisecond (upper)	Stored in BCD code.	06H
Millisecond (lower)		28H

*1 These values assume that an error occurs at 10:35 and 40.628 seconds on Monday, January 30th, 2017.

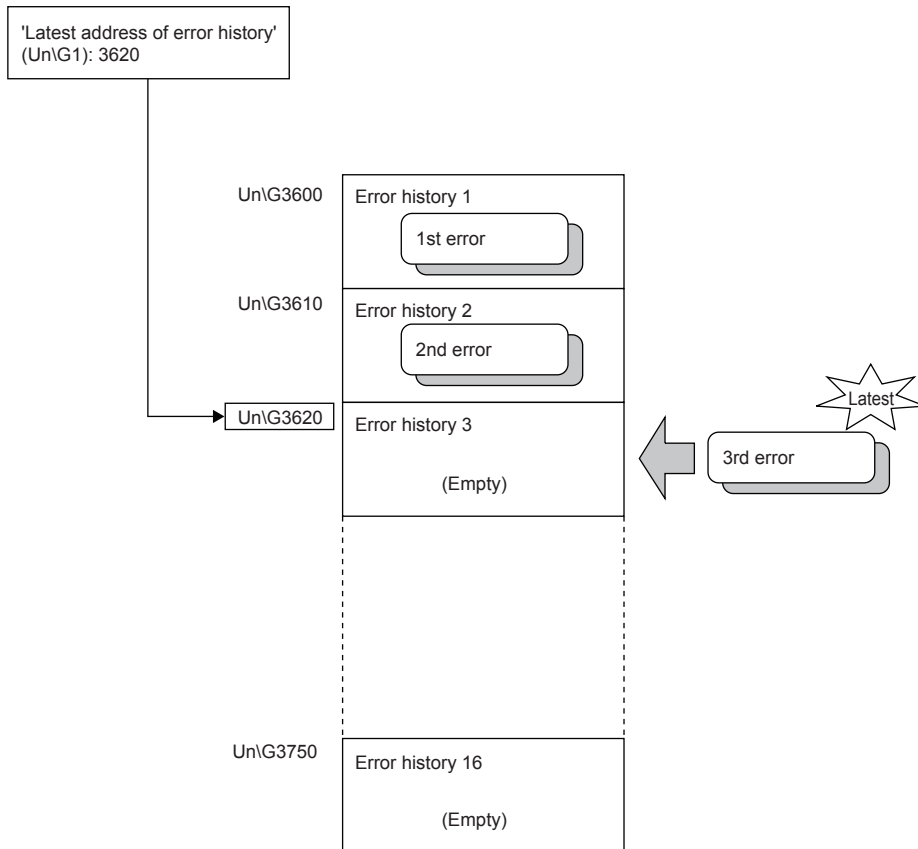
The start address of Error history where the latest error is stored, can be found in 'Latest address of error history' (Un\G1).

The start address of Alarm history where the latest alarm is stored, can be found in 'Latest address of alarm history' (Un\G3).

Ex.

When the third error occurs:

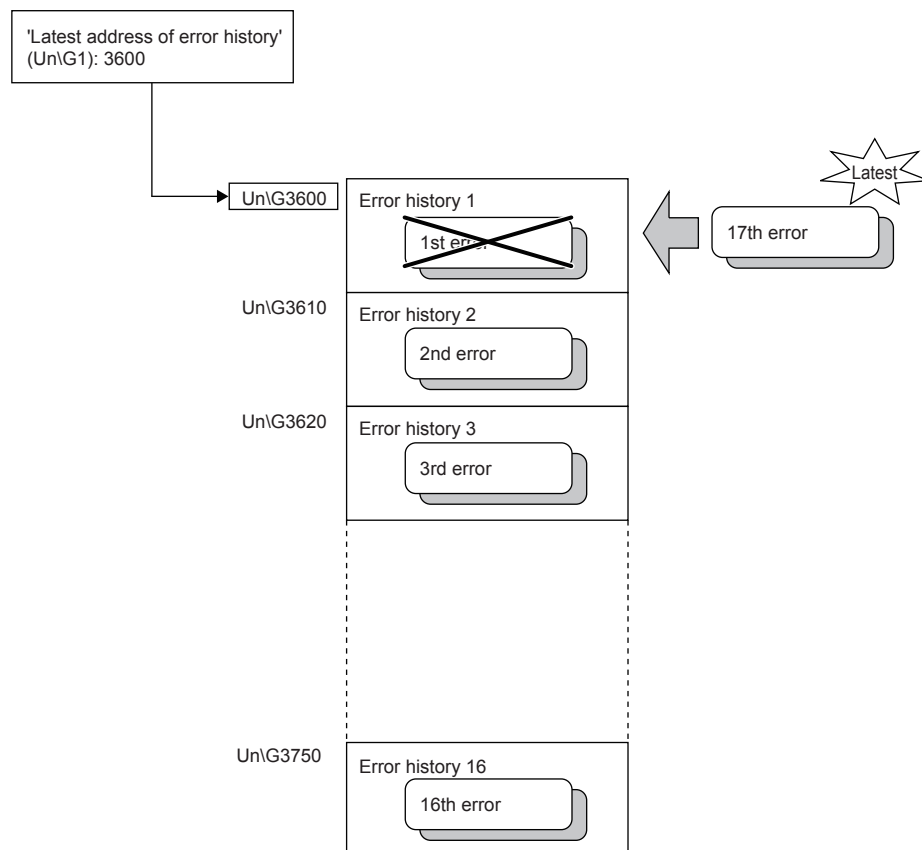
The third error is stored in Error history No. 3, and the value 3620 (start address of Error history No. 3) is stored to Latest address of error history.



Ex.

When the 17th error occurs:

The 17th error is stored in Error history No. 1, and the value 3600 (start address of Error history No. 1) is stored to Latest address of error history.

**Point**

- Once the error history storage area becomes full, the existing data is overwritten in order, starting with 'Error history No. 1' (Un\G3600 to Un\G3609), and error history logging continues. The overwritten history is deleted.
- The same processing is performed for Alarm history when an alarm occurs.
- The stored error history is cleared when an analog output module is powered off or the CPU module is reset.

Offset/gain initialization function

Offset/gain initialization

This function initializes the offset and gain values adjusted by the offset/gain setting to the factory defaults.

User range setting	Offset value	Gain value
User range setting (voltage)	0 V	10 V
User range setting (current)	4 mA	20 mA

1. Set the mode to normal output.
2. Set "D/A conversion not allowed (1)" in 'CH1 D/A conversion enable/disable setting' (Un\G500) to 'CH4 D/A conversion enable/disable setting' (Un\G1100). Then, turn off→on→off 'Operating condition setting request' (Un\G70, b9).
3. Set "E20FH" to 'Offset/gain initialization enabled code' (Un\G305).
4. Turn ON (1) 'Offset/gain initialization request' (Un\G70, b5).

After completion of the offset/gain initialization function, 'Offset/gain initialization enable code' (Un\G305) is initialized to '0000H' and 'Offset/gain initialization completed flag' (Un\G69, b5) turns on (1).

FX3 allocation mode function


This function operates the buffer memory areas of the analog output module with a layout of the buffer memory addresses equivalent to those in FX3U-4DA.

Operation

In FX3 allocation mode, only allocation of buffer memory area is changed. The following buffer memory area is allocated the same as FX3U-4DA.

Buffer Memory Areas	Buffer Memory Area Name
Un\G1 to 4	CH1 to 4 Digital value
Un\G6	Output status
Un\G28	Disconnection detection flag
Un\G30	Module Information
Un\G39	Alarm output flag (upper/lower limit)

For buffer memories with different allocations from FX3U-4DA, it can be used by changing the program. For buffer memory in FX3 allocation mode, refer to the following.

 Page 295 In FX3 allocation function mode

Restriction


When reusing the program used by FX3U-4DA, delete the initial setting process and set the module parameters with GX Works3.

When performing the same operation as FX3U-4DA, it can be executed by the following function.

FX3U-4DA	FX5-4DA	Reference
Output mode specification	Range switching function	Page 189
Output setting upon PLC stop	Analog output HOLD/CLEAR setting	Page 190
Upper lower limit value function	Alert Output Function	Page 198
Table output function	Wave output function	Page 208
Output characteristics adjustment	Offset/gain setting function	Page 261
Initialization function	Offset/gain initialization function	Page 241
Disconnection detection	Disconnection detection function	Page 204
Power supply error	External power supply disconnection detection function	Page 203
Error status data automatic transfer function	Auto refresh	Page 253
Upper/lower limit function status automatic transfer function	Auto refresh	Page 253
Disconnection detection status automatic transfer function	Auto refresh	Page 253

Setting procedure

1. When adding a new module, select the module whose module model name has "(FX3)" at the end.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Right-click ⇒ [Add New Module]

2. Configure the same parameter setting as the one of when the Normal mode is used.

3. After writing the module parameter, turn off→on or reset the CPU module.

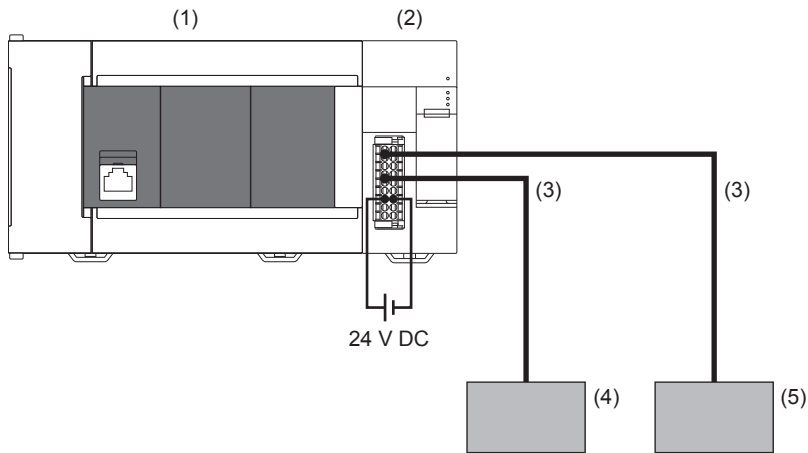
Point

Switching between normal mode and FX3 allocation mode is not possible during operation.

2.5 System Configuration

The following shows a system configuration using the analog output module.

- System configuration example



- (1) FX5 CPU module
- (2) Analog output module (FX5-4DA)
- (3) Analog device connection cable
- (4) Inverter
- (5) DC motor

2.6 Wiring

This section describes the analog output module wiring.

Spring clamp terminal block

Suitable wiring

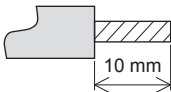
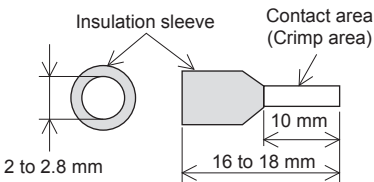
The wires to connect the spring clamp terminal block are described below.

No. of wire per terminal	Wire size	
	Single wire, strand wire	Ferrule with insulation sleeve
Single wiring	AWG24 to 16 (0.2 to 1.5 mm ²)	AWG23 to 19 (0.25 to 0.75 mm ²)

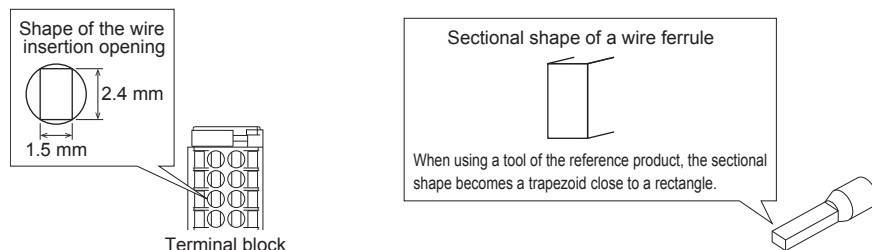
Wire end treatment

When not using a ferrule, strip the cable about 10 mm from the tip and connect it as a strand wire so that the wires do not separate. When using a ferrule, strip the cable about 10 mm from the tip to connect a wire ferrule at the striped area. Failure to do so may result in electric shock or short circuit between adjacent terminals because of the conductive part. If the wire strip length is too short, it may result in the poor contact to the spring clamp terminal part.

Depending on the thickness of the sheath, it may be difficult to insert into the insulation sleeve, so select the wires by referring to the appearance diagram.

Strand wire/single wire	Ferrule with insulation sleeve
	

Check the shape of the wire insertion opening with the following chart, and use the smaller wire ferrule than the described size. Also, insert the wire with care so that the wire ferrule is in proper orientation. Failure to do so may cause the bite of the terminal and the damage of the terminal block.



The following table shows wire ferrules and its associated tools compatible with the terminal block. The shape of the wire ferrule differs depending on the crimp tool to be used, use the reference product. If the product other than referenced products is used, the wire ferrule cannot be removed. Sufficiently confirm that the wire ferrule can be removed before use.

<Reference product>

Manufacturer	Model	Wire size	Crimp tool
PHOENIX-CONTACT GmbH & Co. KG	AI 0.5-10 WH	0.5mm ²	CRIMPFOX 6
	AI 0.75-10 GY	0.75mm ²	
	A 1.0-10	1.0mm ²	
	A 1.5-10	1.5mm ²	

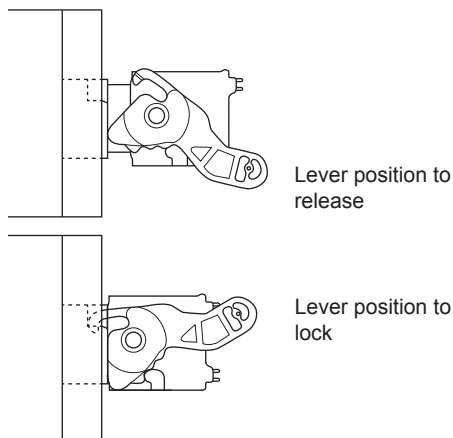
Removing and installing the terminal block

The following shows how to remove and install the terminal block.

■Lever position to lock and release

A 3-step stopper is attached to prevent the lever from rotating, facilitating installation and removal of the terminal block.

When removing or installing the terminal block, move the lever to the corresponding position.



■Lever position to release

The figure left shows the lever position when the terminal block has been completely removed from the module. Rotate the lever from the lock position to the release position, and lift the terminal block from the module.

■Lever position to lock

The figure left shows the lever position when the terminal block is completely engaged with the module. Check that the lever is at the lock position, and pull the terminal block slightly to check that the module and terminal block are completely engaged.

■Removal procedure

Rotate the lever to the release position, and remove the terminal block from the module.

■Installation procedure

Move the lever to the release position, and insert the terminal block. When the terminal block is inserted sufficiently, the lever latch engages with the module and the terminal block is engaged with the module.



After inserting the terminal block, check that the lever is at the lock position.

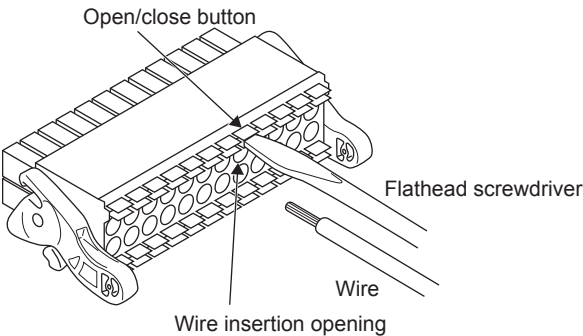
Precautions

When installing the terminal block, check that the lever is in the release position. If installation is performed while the lever is in the lock position, it may cause damage to the lever.

Connection and disconnection of the cable

■Connection of the cable

Fully insert a cable whose end has been properly processed into the wire insertion opening.
If the cable cannot be inserted with this procedure, fully insert the cable while pushing the open/close button with a flathead screwdriver having a tip width of 2.0 to 2.5 mm. After fully inserting the cable, remove the screwdriver.



<Reference>

Manufacturer	Model
PHOENIX-CONTACT GmbH & Co. KG	SZS 0.4 × 2.5 VDE

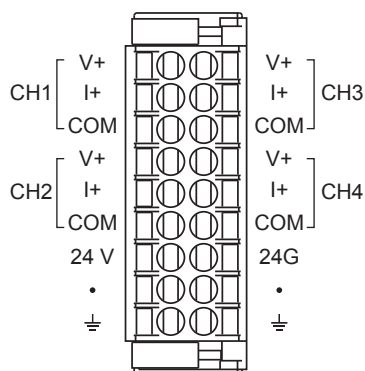
Precautions

Pull the cable or wire ferrule slightly to check that the cable is securely clamped.

■Disconnection of the cable

While pushing the open/close button with a flathead screwdriver having a tip width of 2.0 to 2.5 mm, disconnect the cable.

Terminal arrangement



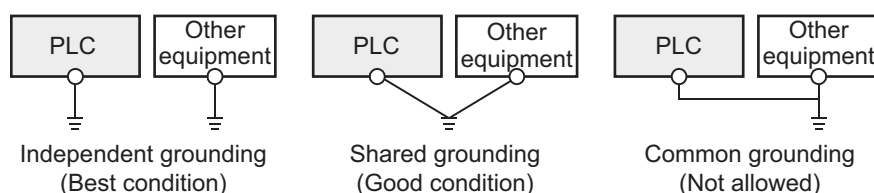
Left side of terminal arrangement		Right side of terminal arrangement	
Display name	Description	Display name	Description
V+	CH1 Voltage output	V+	CH3 Voltage output
I+	CH1 Current output	I+	CH3 Current output
COM	CH1 Voltage/current output common	COM	CH3 Voltage/current output common
V+	CH2 Voltage output	V+	CH4 Voltage output
I+	CH2 Current output	I+	CH4 Current output
COM	CH2 Voltage/current output common	COM	CH4 Voltage/current output common
24V	External 24 V +24 V terminal	24G	External 24 V Ground terminal
.	Unused terminal	.	Unused terminal
⏏	24 V external ground terminal	⏏	24 V external ground terminal

Ground wiring

Grounding

Perform the following.

- Perform class D grounding (Grounding resistance: 100 Ω or less).
- Ground the programmable controller independently when possible.
- If the programmable controller cannot be grounded independently, perform the "Shared grounding" shown below.



- Bring the grounding point close to the PLC as much as possible so that the ground cable can be shortened.

Wiring precautions

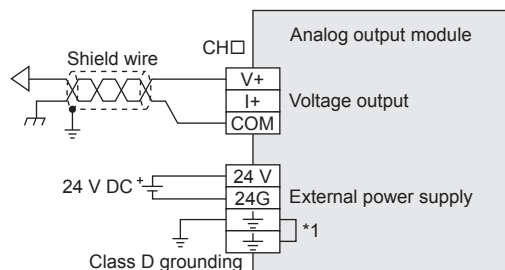
Wiring precautions are indicated below.

- Use separate cables for the external I/O signals of the AC control circuit and the analog output module so that they are not affected by surge or induction on the AC side.
- Do not approach or bundle with the main circuit line, high voltage line, and load line from other than the PLC. Keep it far from circuits including high frequency such as high voltage line and inverter load main circuit. It becomes susceptible to noise, surge, and induction.
- Provide a single-point ground for the shield wire and the shielded cable at the PLC side. However, depending on the external noise situation, it may be better to ground on the external side.

External wiring example

The followings show the examples of external wiring.

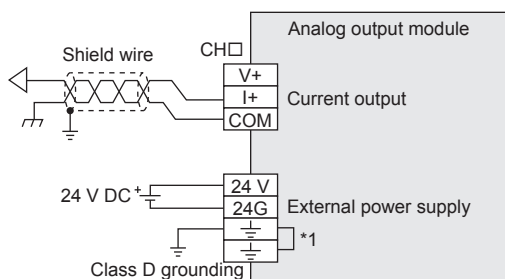
For voltage output



(Grounding resistance: 100 Ω or less).

In □ of CH□, the CH number is entered.

For current output



(Grounding resistance: 100 Ω or less).

In □ of CH□, the CH number is entered.

*1 " " terminals are internally connected. Perform class D grounding by either terminal.

Precautions

Use 2-core shielded twisted pair cable for the analog output lines, and separate the analog output lines from other power lines or inductive lines.

Ground the shielded wire at one point on the signal receiving side.




The external power supply of 24 V DC must be turned on before the system power supply.

2.7 Parameter Settings

Set the parameters of each channel.

Setting parameters here eliminates the need to program them.


Parameter setting procedure

1. Add the analog output module to GX Works3.
 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Right-click ⇒ [Add New Module]
2. There are two parameter setting types: module parameter and module extension parameter settings, both of which can be set after selecting them from the tree on the following window.
 [Navigation window] ⇒ [Parameter] ⇒ [Module information] ⇒ [Target Module]
3. Using GX Works3, write the settings to the CPU module.
 [Online] ⇒ [Write to PLC]
4. The settings are reflected by resetting the CPU module or turning the power supply off→on.

Point

When adding a new analog output module, if selecting the module whose module model name has "(FX3)" at the end, it can be used as FX3 allocation mode.

- FX5-4DA: Normal mode
- FX5-4DA(FX3): FX3 allocation mode

For details on the FX3 allocation mode function, refer to  Page 242 FX3 allocation mode function
This section describes the case in a normal mode.

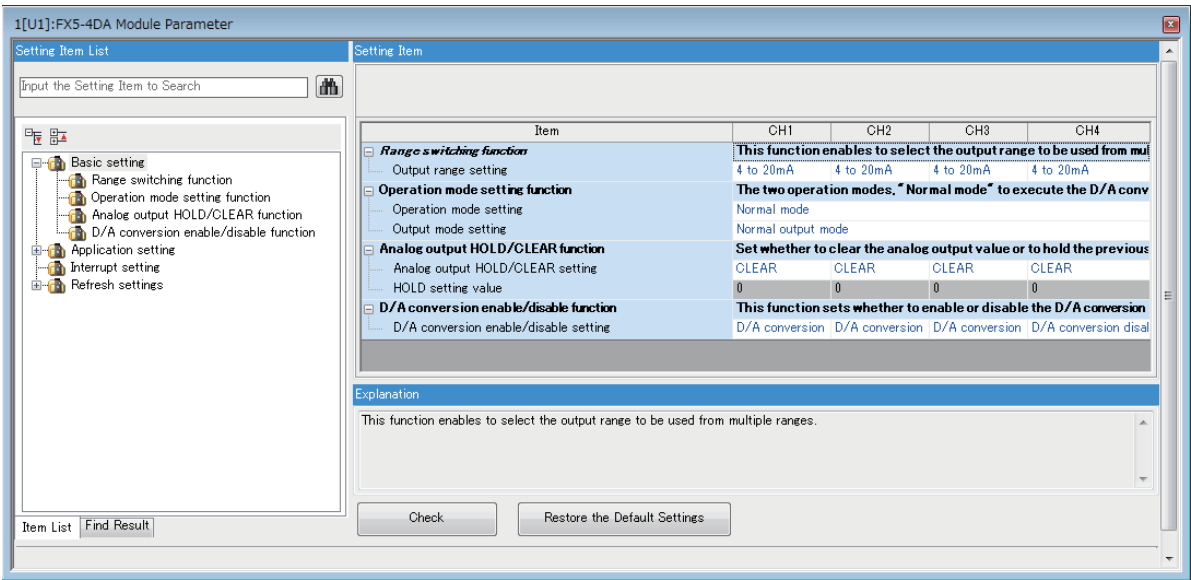
Module parameters

Basic setting

■Setting procedure

1. Open "Basic setting" of GX Works3.

[Navigation window] ⇒ [Parameter] ⇒ [Module information] ⇒ Target module ⇒ [Module Parameter] ⇒ [Basic setting]



2. Double-click the item to be changed to enter the setting value.

- Item where a value is selected from the pull-down

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

- Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

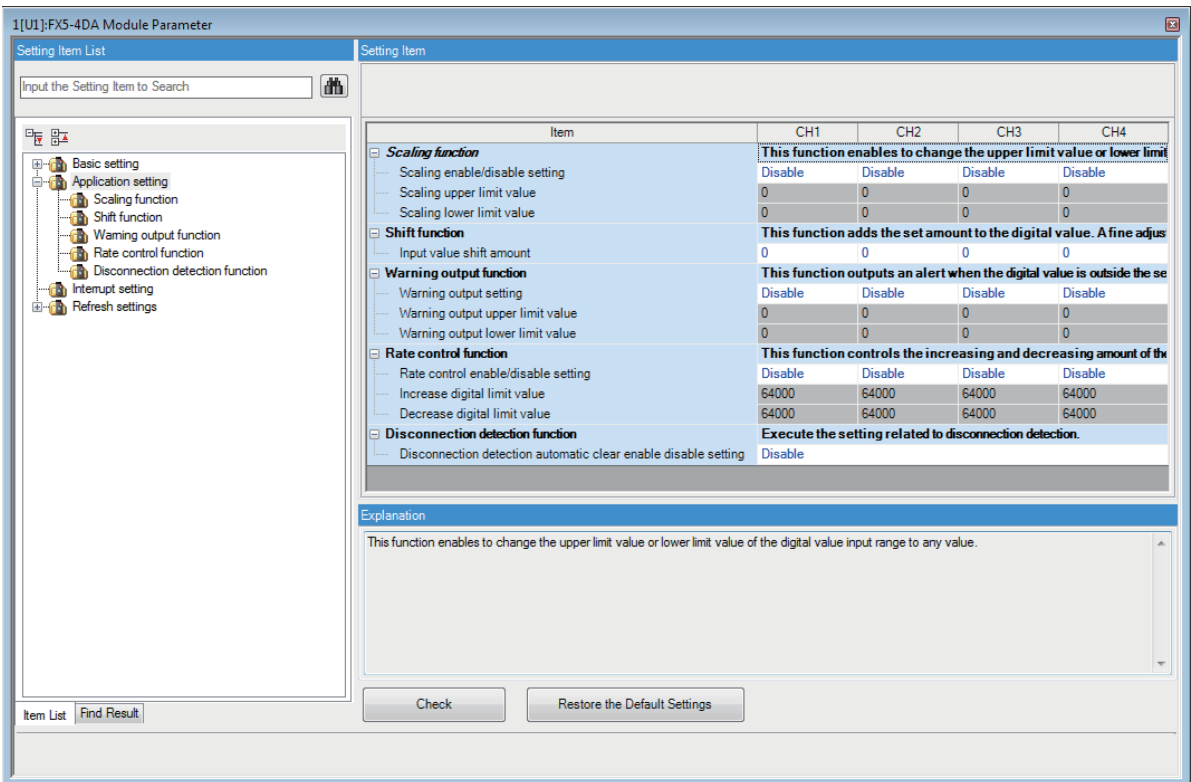
Application setting

■Setting procedure

1. Open "Application setting" of GX Works3.

☞ [Navigation window] ⇒ [Parameter] ⇒ [Module information] ⇒ Target module ⇒ [Module Parameter] ⇒ [Application setting]

2



2. Double-click the item to be changed to enter the setting value.

- Item where a value is selected from the pull-down

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.


- Item where a value is entered into the text box

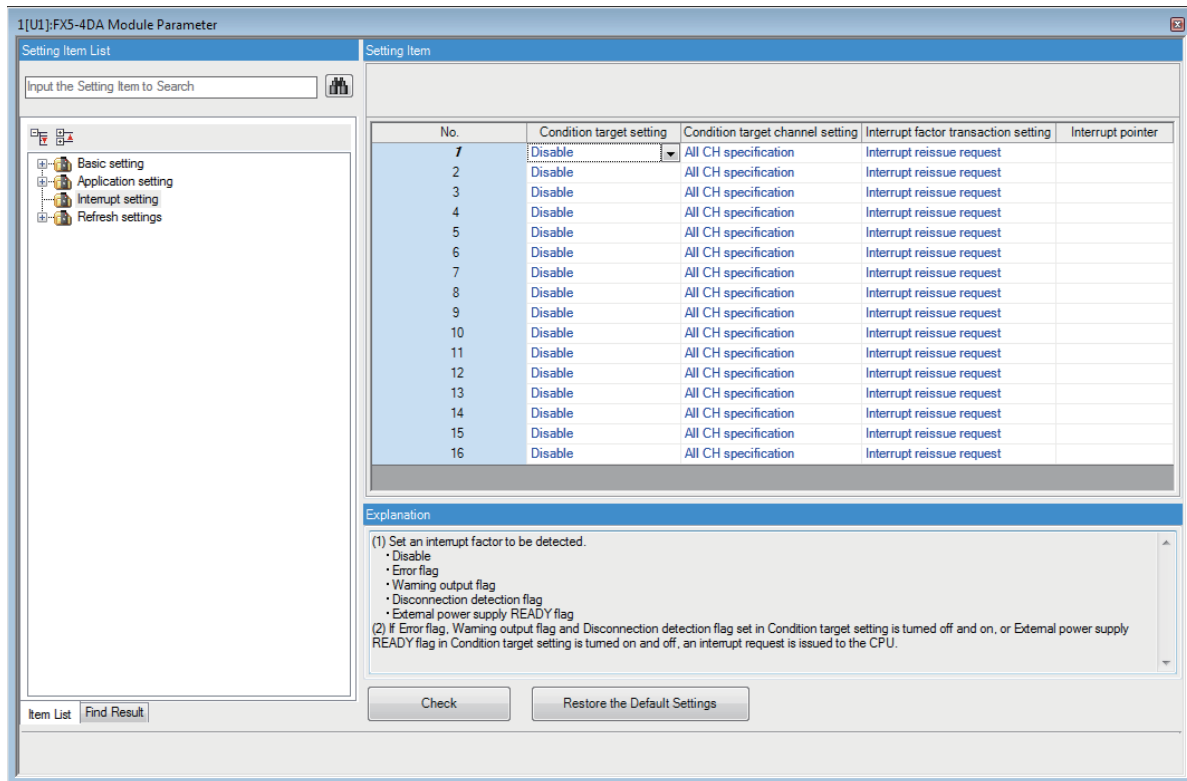
Double-click the item to be set to enter the numeric value.

Interrupt setting

■ Setting procedure

1. Open "Interrupt setting" of GX Works3.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Target module ⇒ [Module Parameter] ⇒ [Interrupt setting]



No.	Condition target setting	Condition target channel setting	Interrupt factor transaction setting	Interrupt pointer
1	Disable	All CH specification	Interrupt reissue request	
2	Disable	All CH specification	Interrupt reissue request	
3	Disable	All CH specification	Interrupt reissue request	
4	Disable	All CH specification	Interrupt reissue request	
5	Disable	All CH specification	Interrupt reissue request	
6	Disable	All CH specification	Interrupt reissue request	
7	Disable	All CH specification	Interrupt reissue request	
8	Disable	All CH specification	Interrupt reissue request	
9	Disable	All CH specification	Interrupt reissue request	
10	Disable	All CH specification	Interrupt reissue request	
11	Disable	All CH specification	Interrupt reissue request	
12	Disable	All CH specification	Interrupt reissue request	
13	Disable	All CH specification	Interrupt reissue request	
14	Disable	All CH specification	Interrupt reissue request	
15	Disable	All CH specification	Interrupt reissue request	
16	Disable	All CH specification	Interrupt reissue request	

Explanation

(1) Set an interrupt factor to be detected.

- Disable
- Error flag
- Warning output flag
- Disconnection detection flag
- External power supply READY flag

(2) If Error flag, Warning output flag and Disconnection detection flag set in Condition target setting is turned off and on, or External power supply READY flag in Condition target setting is turned on and off, an interrupt request is issued to the CPU.

Item List Find Result Check Restore the Default Settings

2. Click the interrupt setting number (No. 1 to 16) to be changed to enter the setting value.

- Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.


- Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

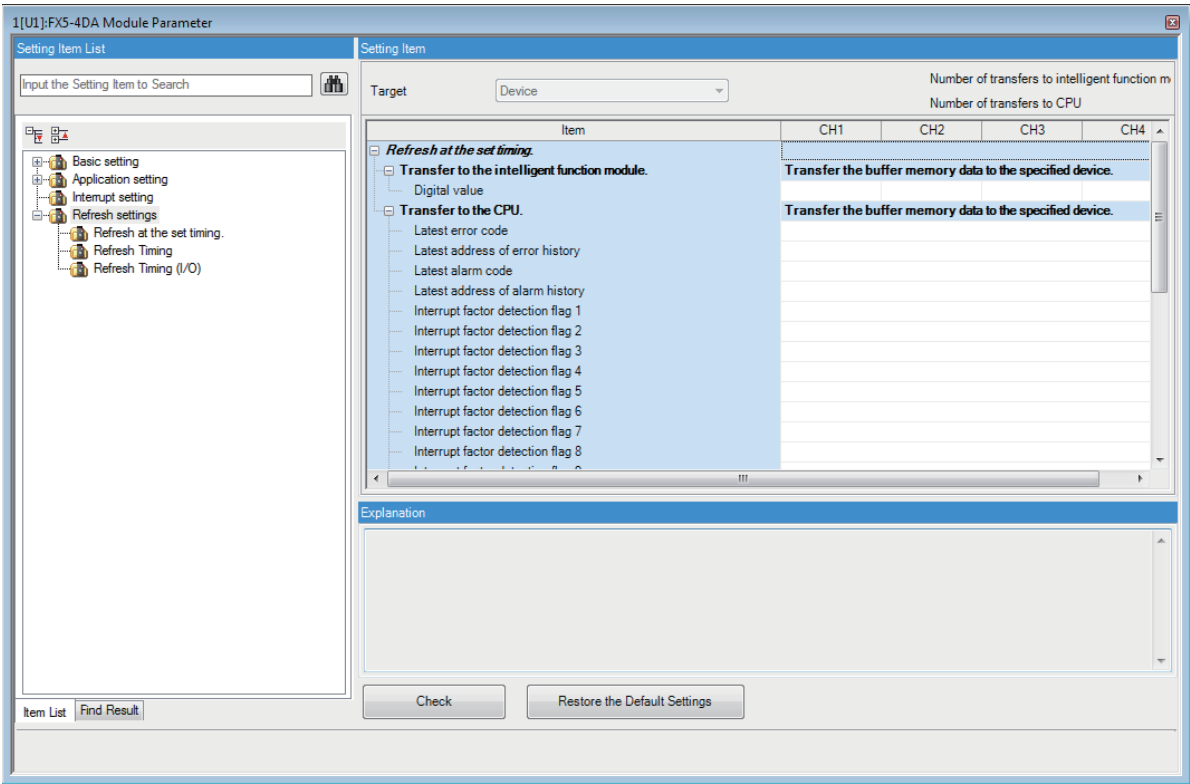
Refresh setting

■Setting procedure

1. Open "Refresh setting" of GX Works3.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Target module ⇒ [Module Parameter] ⇒ [Refresh setting]

2




2. Double-click the item to be set to enter the device of refresh destination.

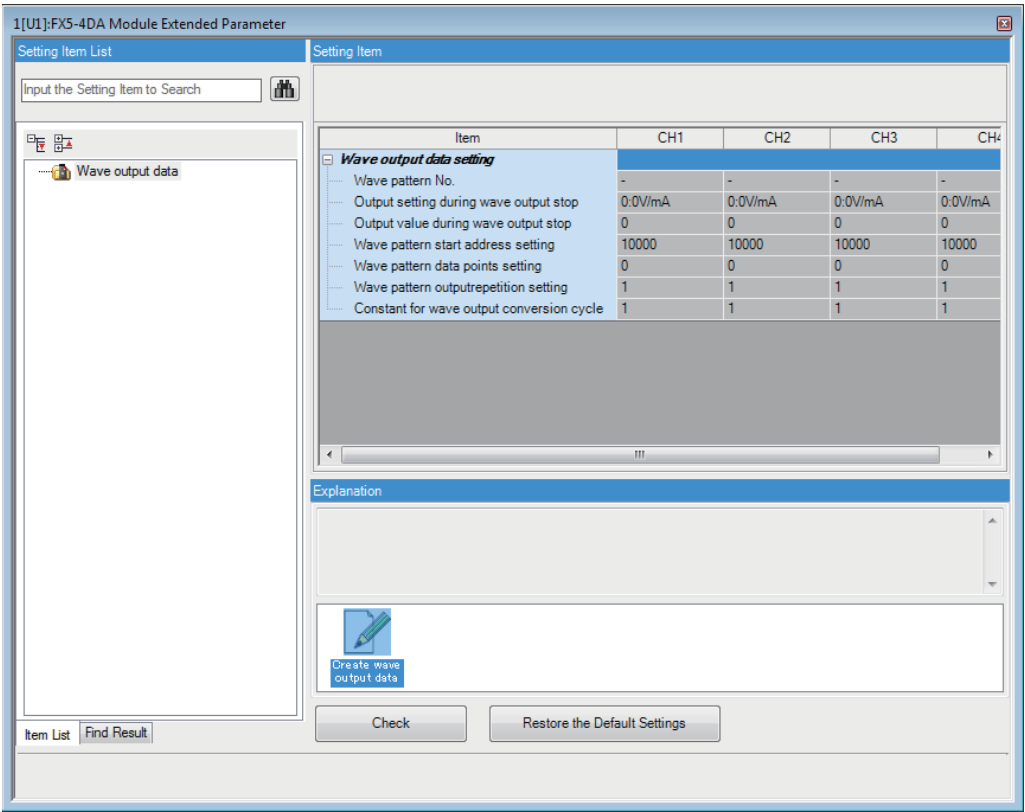
Module extension parameters

Module extension parameters are set to use the wave output function.
To set module extension parameters, use the wave output data creation tool.

Starting up the wave output data creation tool

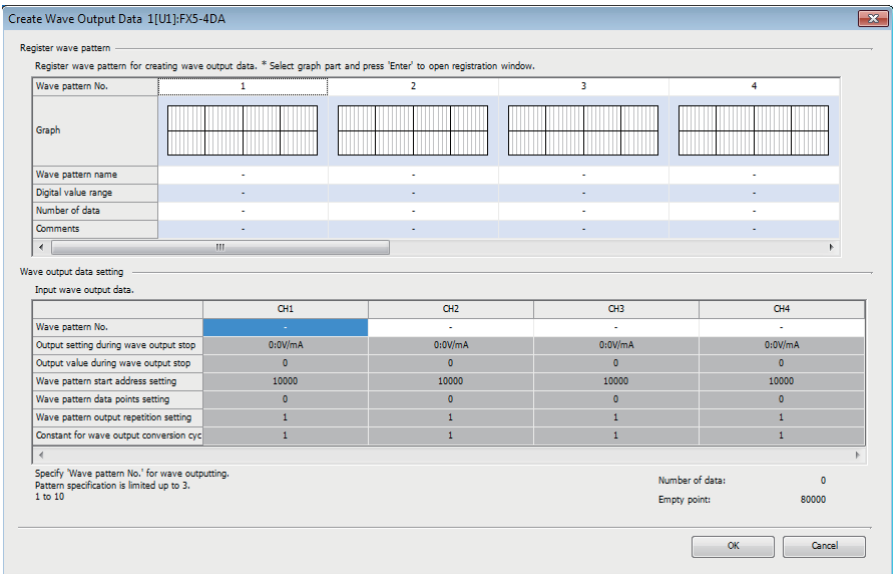
The wave output data creation tool starts up from the Set module extension parameters window.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Target module ⇒ [Module Extension Parameter] ⇒ [Create wave output data]



Creating the wave output data

Using the wave output data creation tool, create the wave pattern and wave output function parameters.



■Register the wave pattern

Using the wave output data creation tool, create and register a wave pattern.

1. Select a graph from "Register wave pattern", and press the Enter key on the keyboard. The "Register wave pattern" window is displayed.

Register wave pattern.

Wave pattern information

Input wave pattern information.

Wave pattern No.	1
Wave pattern name	
Digital value range	0~32000
Number of data	100
Comments	

Display Magnification

Width: 100 % Height: 100 % 100% Width and Height

Display digital value

Display Digital Value

Wave graph

Edit wave graph by mouse operation.
* Drag and drop on the line allow you to change graph shape.

[Digital value]

32000

16000

0

0 25 50 75 100

[Number of data]

Wave details setting

Please fine-tune between each end point that is added by editing wave graph.

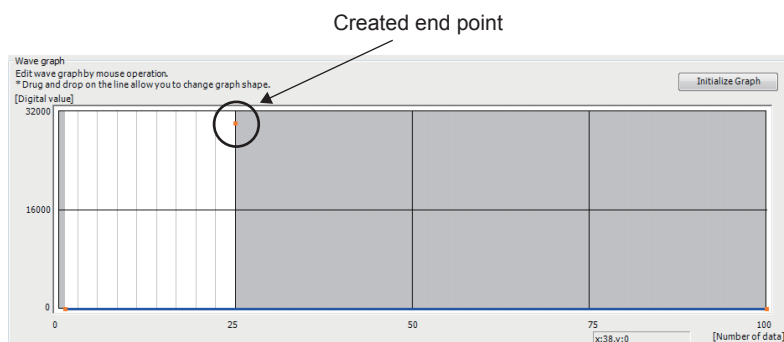
Section No.	Start point	End point	Digital value	Specify wave	Direction	Amplitude	Phase
1	-	1	0				
2	1	100	0 (Do not specify)				
3							
4							

Open Wave Pattern Save Wave Pattern Read CSV File Write CSV File OK Cancel

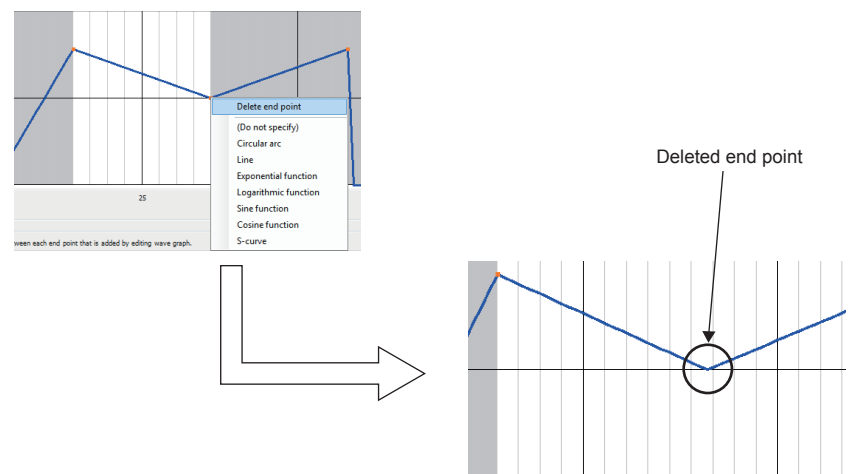
2. Set "Wave pattern information".

Item	Description	Setting range
Wave pattern No.	The wave pattern No. selected on the "Create Wave Data". Up to 10 wave patterns can be created.	—
Wave pattern name	Set "Wave pattern name".	8 two-byte characters (16 one-byte characters)
Digital value range	Select the digital value setting range. Select it according to the output range to be used.	<ul style="list-style-type: none"> • 0 to 32000 (default value) • -32000 to +32000
Number of pieces of data	Set the wave data points of the wave pattern.	1 to 80000 (default value: 100)
Comment	Set a comment on the wave pattern.	32 two-byte characters (64 one-byte characters)

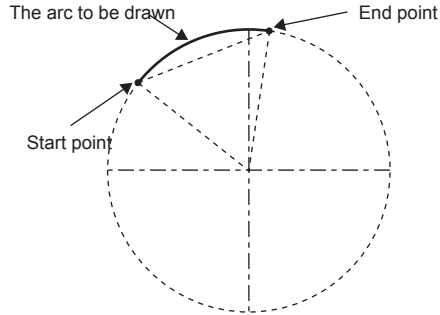
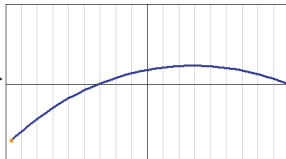
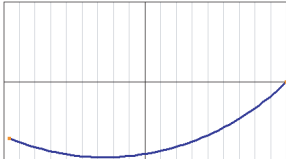
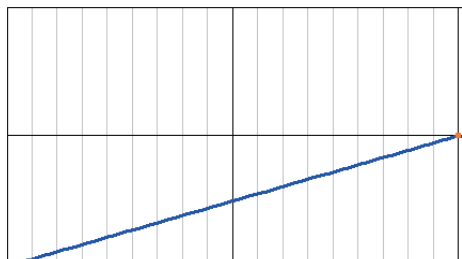
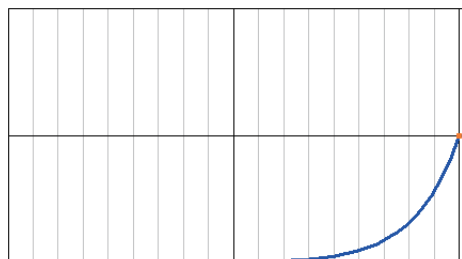
3. Click any position on the wave graph to create the terminal point. Each created terminal points is indicated by ■ .

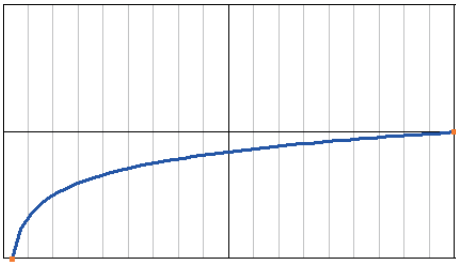
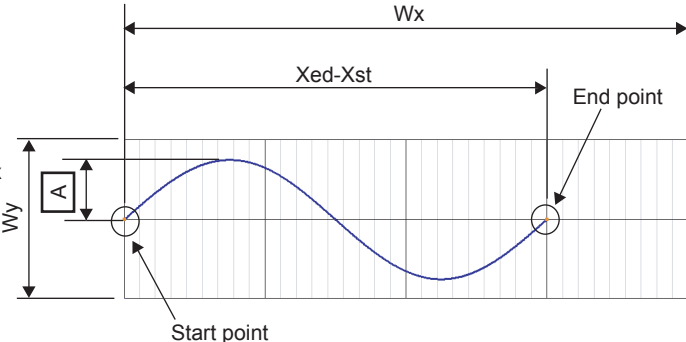
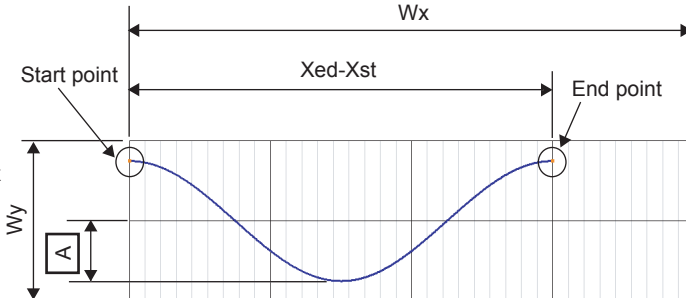
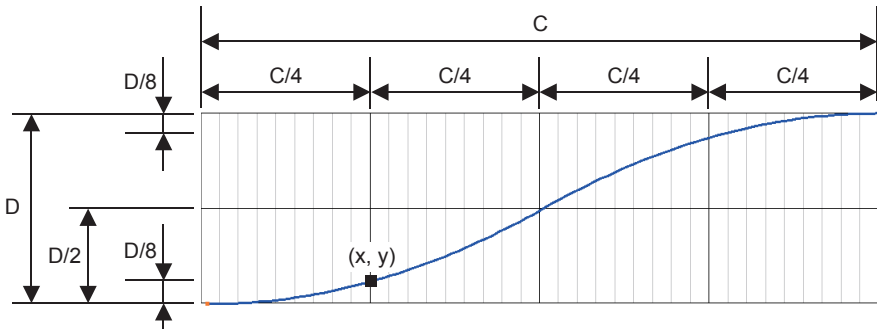


To delete it, move the mouse pointer to the terminal point and select "Delete End Point" from the right-click menu. Once the mouse pointer moves to the terminal point, its displayed shape changes to \oplus .



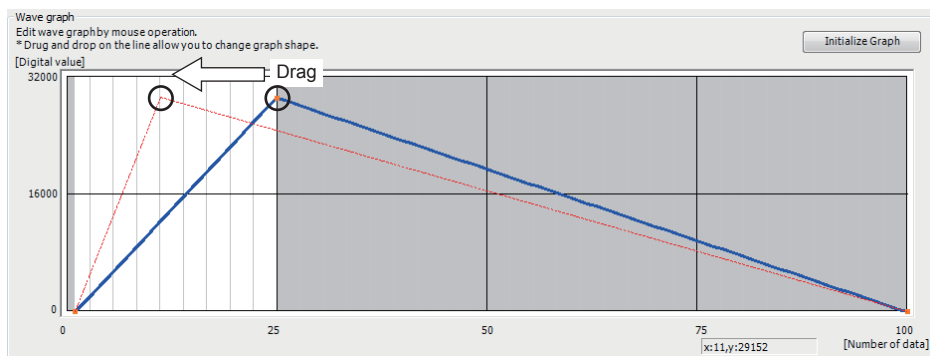
4. Set the wave between terminal points in the right-click menu or "Wave Specification" in "Wave Detail Setting".

Item	Setting result												
Circular arc	<div><div><p>The start and end points are drawn by an arc. When an arc is to be selected, its orientation can be inverted by setting it in "Orientation" The drawn arc is processed according to the following procedure.</p><div><div><p>The arc to be drawn</p><p>End point</p><p>Start point</p></div><div><p>Set "Direction".</p><table><tr><th>Specify wave</th><th>Direction</th><th>Amplitude</th></tr><tr><td>Circular arc</td><td>Upward</td><td></td></tr><tr><td>(Do not specify)</td><td>Upward</td><td></td></tr><tr><td></td><td>Downward</td><td></td></tr></table></div><div><div><p>In an upward direction</p></div><div><p>In a downward direction</p></div></div></div><div><p>1) Construct an equilateral triangle having the start and end points as its vertices.</p><p>2) Construct a circle having the other vertex of the triangle as its center and a side of the triangle as its radius.</p><p>3) Draw the minor arc connecting the start and end points on the wave graph.</p><p>* The steps 1) and 2) are processed inside GX Works3, and not displayed on the wave graph.</p></div></div></div>	Specify wave	Direction	Amplitude	Circular arc	Upward		(Do not specify)	Upward			Downward	
Specify wave	Direction	Amplitude											
Circular arc	Upward												
(Do not specify)	Upward												
	Downward												
Line	<div><p>The start and end points are drawn by a line.</p></div>												
Exponential function	<div><p>The start and end points are drawn by expanding or contracting the graph so that they will be the terminal points of the graph of exponential function $y = e^x$ ($X = 0$ to 10).</p></div>												

Item	Setting result
Logarithmic function	<p>The start and end points are drawn by expanding or contracting the graph so that they will be the terminal points of the graph of logarithmic function $y=\log_e X$ ($X = 1$ to 101).</p> 
Sine function*1	<p>The start and end points are drawn by a sine function. The vertical width, A, of the sine function drawn is the value set by "Amplitude". The star position can be changed by 180° by using "Phase setting".</p>  <p>Number of data in a wave pattern: Wx Digital value range: Wy Data position of the start point: Xst Data position of the end point: Xed</p>
Cosine function*1	<p>The start and end points are drawn by a cosine function. The vertical width, A, of the cosine function drawn is the value set by "Amplitude". The star position can be changed by 180° by using "Phase setting".</p>  <p>Number of data in a wave pattern: Wx Digital value range: Wy Data position of the start point: Xst Data position of the end point: Xed</p>
S-shaped interpolation	<p>The start and end points are drawn by S-shaped interpolation by using the following acceleration.</p> <p>Acceleration $a = (2 \times \text{Output value width } D) \div (\text{Data width } C \times \text{Data width } C)$</p> <p>The digital value y of certain point x is calculated by the following formula.</p> <p>If $x < (c/2)$: $y = ax^2$</p> <p>If $x \geq (c/2)$: $y = -a(x - c)^2 + D$</p>  <p>Width of output value: D Data width: C</p>

*1 When the sine and cosine functions are to be set, set the digital values of the start and end points to the same value.

5. Drag the created end point to adjust its position.




The end point position can be adjusted also by changing the "End point" and "Digital value" values in "Wave detail setting".

Item	Description
Start point	The end point of the previous section is displayed. To change it, change the end point of the previous section.
End point	Set the number of pieces of data of the target terminal point. Since section No.1 represents the first point of the wave pattern, it cannot be changed.
Digital value	Set the digital value of the target terminal point.

6. Repeat steps 3 to 5 to create the wave to be output.

Each digital value of the created wave pattern can be shown using the [Display Digital Value] button. To clear the contents of the created wave pattern, click the [Initialize Graph] button. The graph and the contents of "Wave detail setting" are cleared.

7. To save the wave pattern, click [Save Wave Pattern] or [Write CSV File].

 Page 259 Save the wave pattern

8. Click the [OK] button on the "Register wave pattern" window.

9. Repeat steps 1 to 8 to create another wave pattern.

■Setting the wave output function parameters

Set the wave output function parameters for each channel.

Before setting the parameters, create the wave data.

Item	Description	Setting range	Remarks
Wave pattern No.	Up to three registered wave patterns can be specified at once. To specify two or more wave patterns, set them as follows. <ul style="list-style-type: none"> • When using Nos. 1 and 2: 1, 2 • When using Nos. 1, 5, and 10: 1, 5, 10 • When using Nos. 1 to 3: 1-3 	1 to 10	Use the "Create Wave Output Data" window for setting.
Output setting during wave output stop	Set the analog output that is in the wave output stopped state.	<ul style="list-style-type: none"> • 0: 0 V/0 mA • 1: Offset value (default value) • 2: Output value during wave output stop 	☞ Page 326 CH1 Output setting during wave output stop
Output value during wave output stop	Set the value to be output in wave output stopped state. This value is enabled only when "Output setting during wave output stop" is set in "2: Output value during wave output stop". Set a value within the setting range of the output range to be used.	<ul style="list-style-type: none"> • For 4 to 20 or 0 to 20 mA; or 1 to 5, 0 to 5, or 0 to 10 V 0 to 32767 (practical range: 0 to 32000) • For -10 to +10 V: -32768 to +32767 (practical range: -32000 to +32000) (Default value: 0) 	☞ Page 327 CH1 Output value during wave output stop
Wave pattern start address setting	Set the start address of the wave pattern to be output as analog data.	10000 to 89999 (Default value: 10000)	☞ Page 327 CH1 Wave pattern start address setting
Wave pattern data points setting	Does not need to be set because the number of data points possessed by the wave pattern to be used is automatically stored.	—	☞ Page 328 CH1 Wave pattern data points setting
Wave pattern output repetition setting	When the wave pattern is to be output repeatedly, set the number of repetitions.	<ul style="list-style-type: none"> • -1 (indefinite repetitive output) • 1 to 32767 (default value: 1) 	☞ Page 328 CH1 Wave pattern output repetition setting
Constant for wave output conversion cycle	Set the constant used to determine the conversion cycle (multiple specification of conversion speed). The wave output conversion cycle is determined by the combination of the conversion speed, the number of D/A conversion enabled channels, and this setting. For how to calculate the wave output conversion cycle, refer to the following. ☞ Page 213 Wave output conversion cycle	1 to 5000 (default value: 1)	☞ Page 329 CH1 Constant for wave output conversion cycle

In the wave output data creation tool, click the [OK] button. The wave pattern and wave output function parameters are determined as module extension parameters.

The module extension parameters need to be written to the CPU built-in memory or SD memory card.

For the procedure for writing to the SD memory card, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Application)

■Save the wave pattern

The created wave pattern can be saved in the following format.

- Save the wave pattern

By clicking [Save Wave Pattern], the created wave pattern can be saved. The file is saved in the format of extension ".wdn".

The saved file can be read using the [Open Wave Pattern].

- Saving the wave pattern to a CSV file

By clicking [Write CSV File], the created wave pattern can be saved in a CSV file. The file is saved in the format of extension ".csv".

The saved file can be read using the [Read CSV File].

■About CSV file format

The CSV file format is as below.

[CSV format specifications]

Item name	Description
Separator	Comma (,)
Return code	CRLF (0DH, 0AH)
Character code	ASCII or Shift JIS

[CSV file name]

The number of characters of each CSV file name must be 64 characters or less including extension ".CSV".

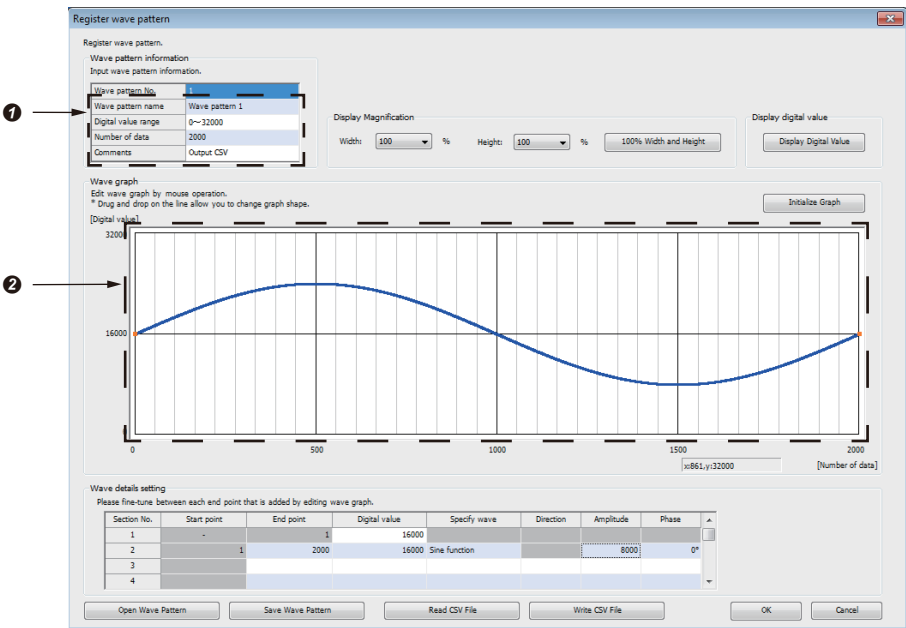
Ex.

FX5-4DA_1.csv, wd000001.csv, wave data.csv

[Contents of CSV file]

The following shows examples of the "Register wave pattern" window and the contents of a CSV file.

- "Register wave pattern" window



- Contents of CSV file

①	["Wave pattern name"],	[Digital value range (1: 0 to 32000/2: -32000 to 32000)],	[Number of pieces of data]	["Comment"]
	"Wave pattern 1",	1,	2000,	"Output CSV"
②	[Data No.],	[Digital value]		
	1,	16000		
	2,	16025		
	3,	16050		
	⋮	⋮		
	1999,	15974		
	2000,	16000		

Point

- Some instruments such as oscilloscopes and pulse generators can output input or output waves to a CSV file. If the waves are to be output with the wave output function by using the saved data in this CSV file, modify the file into the above CSV file format. In addition, modify all decimal values into integers because they are not available with the wave output function.
- If a wave pattern is read from a CSV file, it cannot be edited on the "Register Wave Pattern" window. After editing the CSV file, read the CSV file again.

2.8 Offset/Gain Setting

Using the user range setting requires setting the offset and gain values.
The offset/gain setting can be performed by the following two methods.

- Settings from the module tool of GX Works3
- Setting from the program

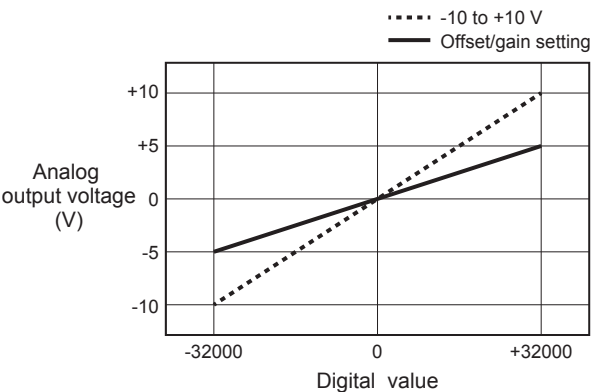
Setting example

An example of offset/gain setting is shown below.

Output conversion characteristics

Ex.

When CH1 digital value is 0, offset is set with 0 V output, and when digital value is 32000, gain is set with 5 V output



User range	Digital value	Resolution	Remarks
-5 to +5 V	-32000 to +32000	321.5 μ V	(Gain value - Offset value) = 5 V As the result of (Gain value - offset value) is < 10 V, the maximum resolution is applied.

Module parameters

The module parameters used for CH1 are as follows. Parameters other than the following are defaults.

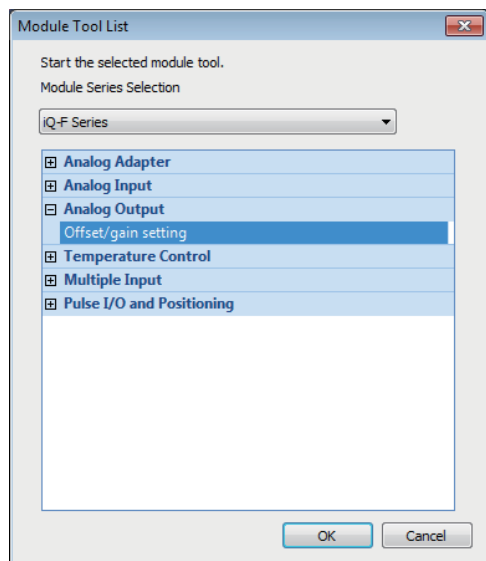
Item	Set conditions
Output range setting	User range setting (voltage)
Operation mode setting	Normal mode
D/A conversion enable/disable setting	D/A conversion enable

Settings from the module tool of GX Works3

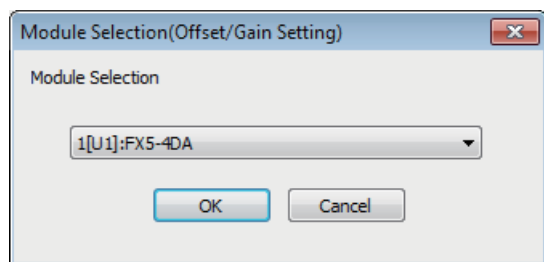
The following shows the procedure for setting the offset and gain from the module tool of GX Works3. (For CH1)

■Setting procedure

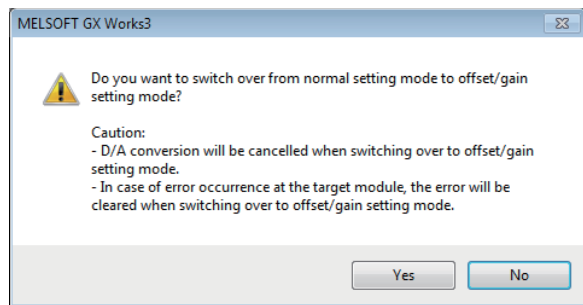
[Tool] ⇒ [Module Tool List]



1. In "Analog Output", select "Offset/gain setting" and click the [OK] button.



2. Select the target module for the offset/gain setting, and click the [OK] button.



3. Click [Yes] button.

Offset/Gain Setting

Set offset/gain settings.

Object Module: I[U1]:FX5-4DA Error Code: --- Detail Display... Error Clear

Offset/Gain Setting

Channel No.: CH1

User Range Setting: User Range Setting (Voltage)

☒ Offset Setting ☐ Gain Setting

Adjustment Value: 1 + -

Range: 1 to 3000
For the adjustment value of 1000 the analog output value with
-voltage at output of about 0.31V and
-current at output of about 0.35mA
can be adjusted.

Channel No.	Offset Status	Gain Status
CH1		
CH2		
CH3		
CH4		

Please select a target channel for the offset/gain setting.
Check Offset setting or Gain setting and input an adjustment value.

Close

4. Specify the channel (CH1) and offset/gain setting used to perform the offset/gain setting.

Offset/Gain Setting

Set offset/gain settings.

Object Module: I[U1]:FX5-4DA Error Code: --- Detail Display... Error Clear

Offset/Gain Setting

Channel No.: CH1

User Range Setting: User Range Setting (Voltage)

☒ Offset Setting ☐ Gain Setting

Adjustment Value: 1 + -

Range: 1 to 3000
For the adjustment value of 1000 the analog output value with
-voltage at output of about 0.31V and
-current at output of about 0.35mA
can be adjusted.

Channel No.	Offset Status	Gain Status
CH1		
CH2		
CH3		
CH4		

Please select a target channel for the offset/gain setting.
Check Offset setting or Gain setting and input an adjustment value.

Close

5. Specify the offset or gain setting using the radio button.
(Perform step 6 and later only when the offset setting is specified in this step.)

Offset/Gain Setting

Set offset/gain settings.

Object Module: I[U1]:FX5-4DA Error Code: --- Detail Display... Error Clear

Offset/Gain Setting

Channel No.: CH1

User Range Setting: User Range Setting (Voltage)

☒ Offset Setting ☐ Gain Setting

Adjustment Value: 1 100 500 1000 2000 3000 + -

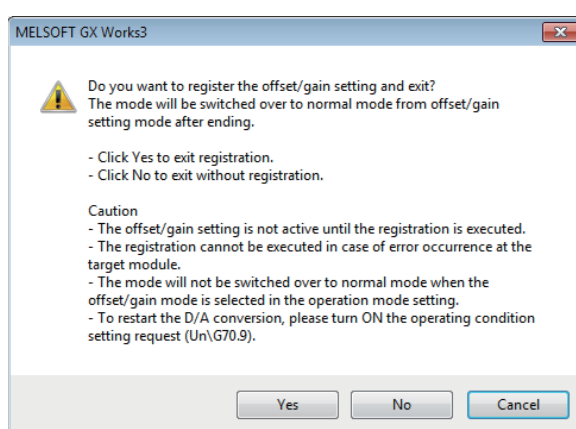
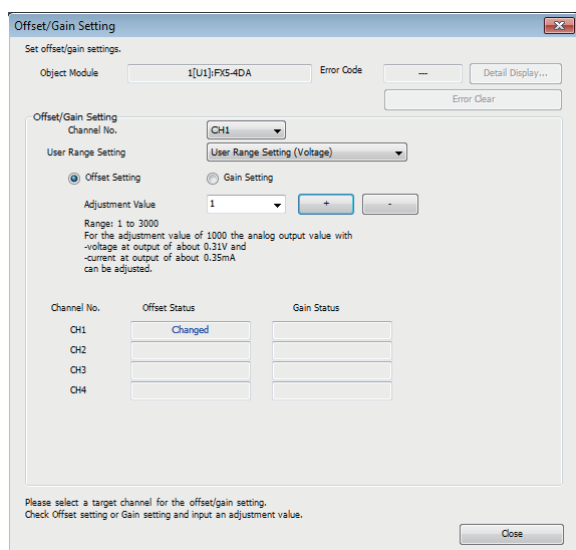
Range: 1 to 3000
For the adjustment value of 1000 the analog output value with
-voltage at output of about 0.31V and
-current at output of about 0.35mA
can be adjusted.

Channel No.	Offset Status	Gain Status
CH1		
CH2		
CH3		
CH4		

Please select a target channel for the offset/gain setting.
Check Offset setting or Gain setting and input an adjustment value.

Close

6. Select the adjustment amount of the offset or gain value from "1", "100", "500", "1000", "2000", and "3000".
Alternatively, the adjustment amount can be set also by entering any numerical value from 1 to 3000.



Point

- All channels must satisfy the offset value < gain value.
- If there is a channel that does not satisfy the offset value < gain value, an offset/gain value inversion error (error code: 1E7□) occurs. Settings are not saved.
- Set the offset value and gain value in the user range setting within a range satisfying the following conditions. Failure to satisfy the conditions may not result in proper D/A conversion.

[Voltage]

Setting range of the offset value and gain value: -10 to +10 V

$$((\text{Gain value}) - (\text{Offset value})) \geq 2.0 \text{ V}$$

[Current]

Offset value ≥ 0 mA, gain value ≤ 20 mA

$$((\text{Gain value}) - (\text{Offset value})) \geq 6.0 \text{ mA}$$

7. Click the [+] or [-] button to fine-tune the analog output voltage value for the set adjustment value.

When setting the offset, adjust so that the analog output voltage becomes the target value (0 V). Adjustment amount: 0 (reference)

When setting the gain, adjust so that the analog output voltage becomes the target value (5 V). Adjustment amount: -16000 (reference)

8. The offset setting state of the specified channel changes to "Changed".

9. If the gain setting is to be performed, repeat the above from step 5.

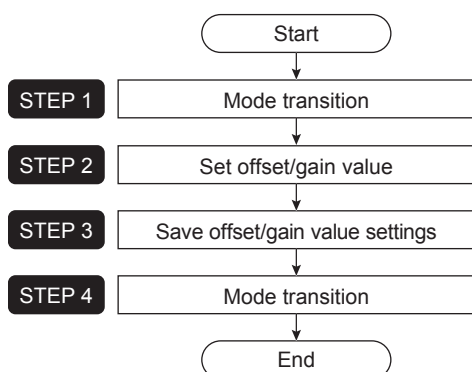
10. After completion of the setting, click [Close] button.

11. Click the [Yes] button.

Setting from the program

The procedure for offset/gain setting from a program is shown below.

■Setting procedure



■STEP 1 Mode transition

Transition from normal mode to offset/gain setting mode.

1. Set "4441H" to 'Mode switching setting' (Un\G296) and "4658H" to 'Mode switching setting' (Un\G297).
2. Turn on 'Operating condition setting request' (Un\G70, b9).
3. Confirm that the 'Operating condition setting completed flag' (Un\G69, b9) is OFF and turn off 'Operating condition setting request' (Un\G70, b9).

When the transition to the offset/gain setting mode is completed, the RUN LED flashes.

■STEP 2 Set offset/gain value

- Selection of voltage or current

1. Set the user range setting (voltage) "000DH" to 'CH1 offset/gain setting mode (range specification)' (Un\G4164).
 - Offset setting
2. Set 'CH1 offset/gain setting mode (offset specification)' (Un\G4132) to set channel (1), and set 'CH1 offset/gain setting mode (gain specification)' (Un\G4133) to invalid (0).
3. Turn on 'Channel change request' (Un\G70, b11).
4. Confirm that 'Channel change completed flag' (Un\G69, b11) is ON, and turn off 'Channel change request' (Un\G70, b11).
5. Set the adjustment amount of the analog output value in 'Offset/gain adjustment value specification' (Un\G4130).
6. Turn on 'Value change request' (Un\G70, b12).
7. Check that the 'Set value change completed flag' (Un\G69, b12) is ON, and turn off the 'Value change request' (Un\G70, b12).
8. Repeat steps 5 to 7 until the analog output voltage reaches the target value "0 V".
 - Gain setting
9. Set 'CH1 offset/gain setting mode (offset specification)' (Un\G4132) to invalid (0), and set 'CH1 offset/gain setting mode (gain specification)' (Un\G4133) to set channel (1).
10. Turn on 'Channel change request' (Un\G70, b11).
11. Confirm that 'Channel change completed flag' (Un\G69, b11) is ON, and turn off 'Channel change request' (Un\G70, b11).
12. Set the adjustment amount of the analog output value in 'Offset/gain adjustment value specification' (Un\G4130).
13. Turn on 'Value change request' (Un\G70, b12).
14. Check that the 'Set value change completed flag' (Un\G69, b12) is ON, and turn off the 'Value change request' (Un\G70, b12).
15. Repeat steps 12 to 14 until the analog output voltage reaches the target value "5 V".
16. Set 'CH1 offset/gain setting mode (offset specification)' (Un\G4132) to invalid (0), and set 'CH1 offset/gain setting mode (gain specification)' (Un\G4133) to invalid (0).

■STEP 3 Save offset/gain value settings

Save the set offset/gain values in the flash memory of the module.

1. Turn on 'User range write request' (Un\G70, b10).
2. Check that 'Offset/gain setting mode status flag' (Un\G69, b10) is off and turn off 'User range write request' (Un\G70, b10).

Point

- All channels must satisfy the offset value < gain value.
- If there is a channel that does not satisfy the offset value < gain value, an offset/gain value inversion error (error code: 1E7□) occurs. Settings are not saved.
- Set the offset value and gain value in the user range setting within a range satisfying the following conditions. Failure to satisfy the conditions may not result in proper D/A conversion.

[Voltage]

Setting range of the offset value and gain value: -10 to +10 V

$((\text{Gain value}) - (\text{Offset value})) \geq 2.0 \text{ V}$

[Current]

Offset value $\geq 0 \text{ mA}$, gain value $\leq 20 \text{ mA}$

$((\text{Gain value}) - (\text{Offset value})) \geq 6.0 \text{ mA}$

■STEP 4 Mode transition

Shift from offset/gain setting mode to normal mode.

1. Set "4658H" to 'Mode switching setting' (Un\G296) and "4441H" to 'Mode switching setting' (Un\G297).
2. Turn on 'Operating condition setting request' (Un\G70, b9).
3. Confirm that the 'Operating condition setting completed flag' (Un\G69, b9) is OFF and turn off 'Operating condition setting request' (Un\G70, b9).

When the transition to the normal mode is completed, the RUN LED lights.

2.9 Programming

This section describes the programming procedure and the basic program of an analog output module.

Programming procedure

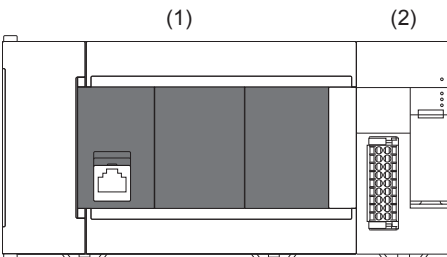
Take the following steps to create a program for running an analog output module:

1. Set parameters.
2. Create a program.

In the normal output mode

■System configuration

The following shows a system configuration example.



(1) CPU module (FX5U CPU module)

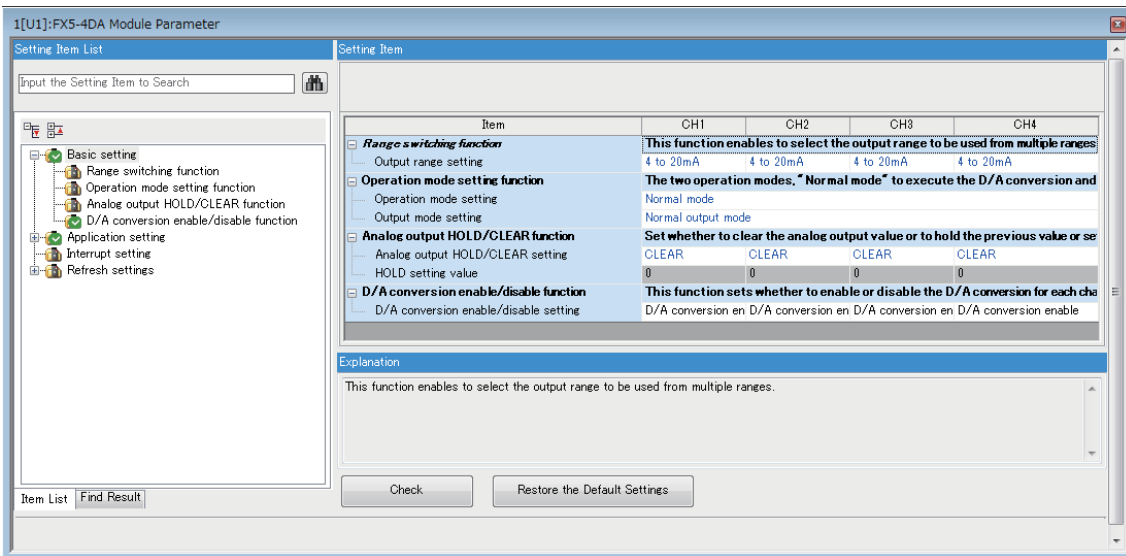
(2) Analog output module (FX5-4DA)

■Parameter settings

Perform an initial setting in the module parameter of GX Works3. The refresh settings do not need to be changed here.

- Module parameters

[Basic setting]



[Application setting]

1[U1]:FX5-4DA Module Parameter

Setting Item List

Input the Setting Item to Search

Basic setting
Application setting
Scaling function
Shift function
Warning output function
Rate control function
Disconnection detection function
Interrupt setting
Refresh settings

Setting Item

Item	CH1	CH2	CH3	CH4
Scaling function	This function enables to change the upper limit value or lower limit value of the digital value input range to any value.			
Scaling enable/disable setting	Disable	Disable	Disable	Disable
Scaling upper limit value	0	0	0	0
Scaling lower limit value	0	0	0	0
Shift function	This function adds the set amount to the digital value. A fine adjustment is possible.			
Input value shift amount	0	0	0	0
Warning output function	This function outputs an alert when the digital value is outside the set range.			
Warning output setting	Enable (no output)	Enable (no output)	Enable (no output)	Enable (no output)
Warning output upper limit value	32000	32000	32000	32000
Warning output lower limit value	0	0	0	0
Rate control function	This function controls the increasing and decreasing amount of the digital value.			
Rate control enable/disable setting	Disable	Disable	Disable	Disable
Increase digital limit value	64000	64000	64000	64000
Decrease digital limit value	64000	64000	64000	64000
Disconnection detection function	Execute the setting related to disconnection detection.			
Disconnection detection automatic clear enable/disable setting	Disable			

Explanation

This function enables to change the upper limit value or lower limit value of the digital value input range to any value.

Item List Find Result

Check Restore the Default Settings

■Program example

Classification	Device	Description	Device
Module label	FX5_4DA_1.bCH1OutputEnableDisableFlag_D	CH1 Output enable/disable flag	U1\G70.1
	FX5_4DA_1.bCH2OutputEnableDisableFlag_D	CH2 Output enable/disable flag	U1\G70.2
	FX5_4DA_1.bCH3OutputEnableDisableFlag_D	CH3 Output enable/disable flag	U1\G70.3
	FX5_4DA_1.bCH4OutputEnableDisableFlag_D	CH4 Output enable/disable flag	U1\G70.4
	FX5_4DA_1.bDisconnectionDetectionSignal_D	Disconnection detection signal	U1\G69.D
	FX5_4DA_1.bErrorFlag_D	Error flag	U1\G69.F
	FX5_4DA_1.bExternalPowerSupplyREADY_Flag_D	External power supply READY flag	U1\G69.7
	FX5_4DA_1.bModuleREADY_D	Module READY	U1\G69.0
	FX5_4DA_1.bWarningOutputClearRequest_D	Warning output clear request	U1\G70.E
	FX5_4DA_1.bWarningOutputSignal_D	Alert output signal	U1\G69.E
	FX5_4DA_1.stnControl_D[0].wDigitalValue_D	CH1 Digital value	U1\G460
	FX5_4DA_1.stnControl_D[1].wDigitalValue_D	CH2 Digital value	U1\G660
	FX5_4DA_1.stnControl_D[2].wDigitalValue_D	CH3 Digital value	U1\G860
	FX5_4DA_1.stnControl_D[3].wDigitalValue_D	CH4 Digital value	U1\G1060
	FX5_4DA_1.uDisconnectionDetectionFlag_D.3	Disconnection detection flag	U1\G38.3
	FX5_4DA_1.uWarningOutputLowerFlag_D.1	Warning output lower flag	U1\G37.1
	FX5_4DA_1.uWarningOutputUpperFlag_D.1	Warning output upper flag	U1\G36.1
Labels to be defined	Define global labels as shown below:		
	Label Name	Data Type	Class
	CH1_DigInVal	Word [Signed]	VAR_GLOBAL
	CH2_DigInVal	Word [Signed]	VAR_GLOBAL
	CH3_DigInVal	Word [Signed]	VAR_GLOBAL
	CH4_DigInVal	Word [Signed]	VAR_GLOBAL
	CH2_AlmUpLimit	Bit	VAR_GLOBAL
	CH2_AlmLowLimit	Bit	VAR_GLOBAL
	CH4_DisconnectDetect	Bit	VAR_GLOBAL
	DigitWriteSig	Bit	VAR_GLOBAL
	DAOutputSig	Bit	VAR_GLOBAL
	WarningOutClrSig	Bit	VAR_GLOBAL
	ErrResetSig	Bit	VAR_GLOBAL
	ErrOperationEN	Bit	VAR_GLOBAL
	ErrOperationENO	Bit	VAR_GLOBAL
	ErrOperationOK	Bit	VAR_GLOBAL
	UnitErFlg	Bit	VAR_GLOBAL
	UnitErCode	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL

- D/A conversion value setting and D/A output start processing

This program example sets digital values for D/A conversion of CH1 to CH4 in the analog output module and then starts the D/A conversion by enabling the analog output.

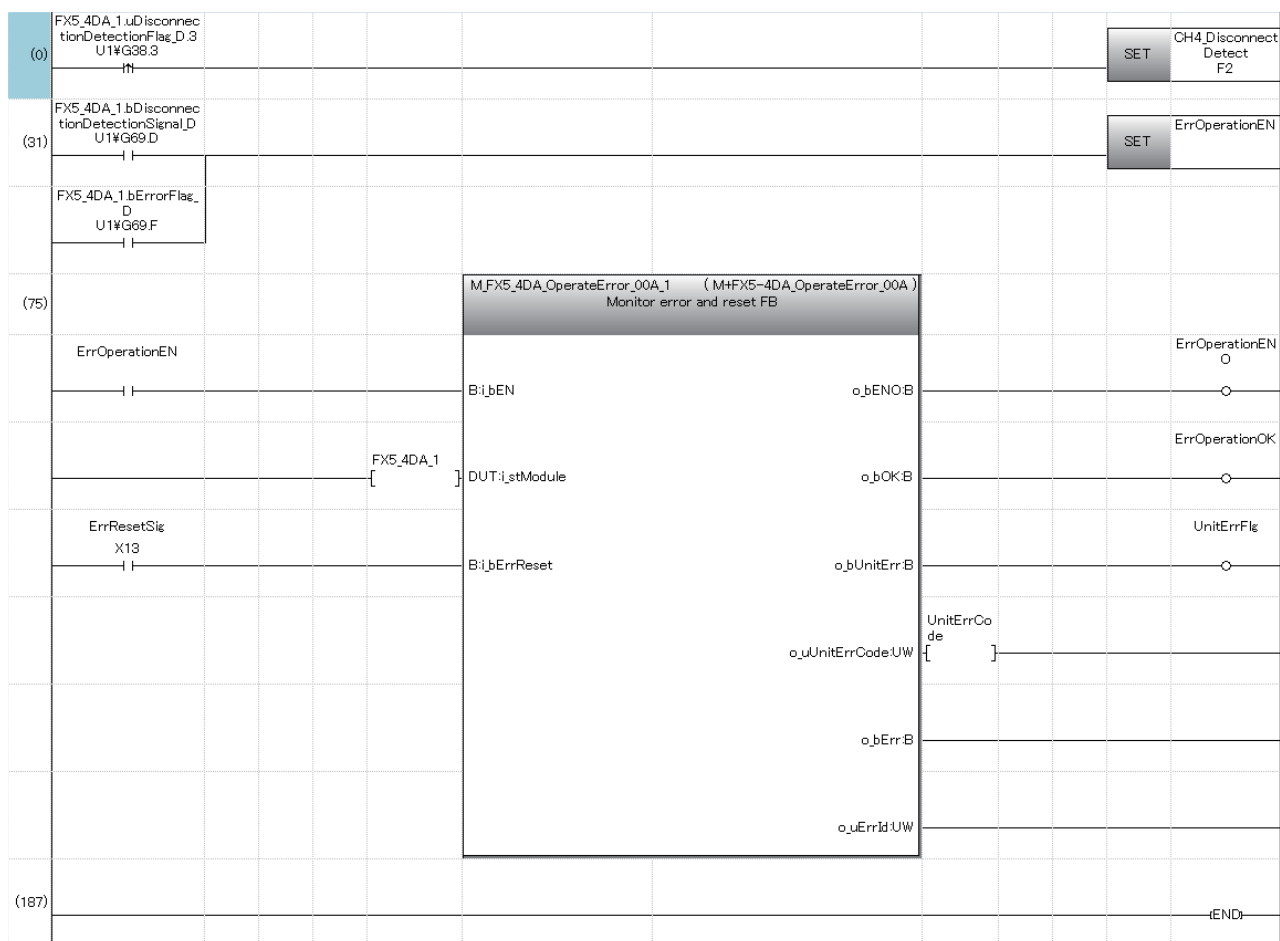
(0)	DigitWriteSig X10	FX5_4DA_1.bModuleREADY_D U1#G69.0	FX5_4DA_1.bExternalPowerSupplyREADY_Flag_D U1#G69.7					MOV	CH1_DigInVal D11	FX5_4DA_1.stnControl_D[0].wDigitalValue_D U1#G460
								MOV	CH2_DigInVal D12	FX5_4DA_1.stnControl_D[1].wDigitalValue_D U1#G660
								MOV	CH3_DigInVal D13	FX5_4DA_1.stnControl_D[2].wDigitalValue_D U1#G860
								MOV	CH4_DigInVal D14	FX5_4DA_1.stnControl_D[3].wDigitalValue_D U1#G1060
(114)	DAOutputSig X11	FX5_4DA_1.bModuleREADY_D U1#G69.0	FX5_4DA_1.bExternalPowerSupplyREADY_Flag_D U1#G69.7							FX5_4DA_1.bCH1OutputEnableDisableFlag_D U1#G70.1 ○
										FX5_4DA_1.bCH2OutputEnableDisableFlag_D U1#G70.2 ○
										FX5_4DA_1.bCH3OutputEnableDisableFlag_D U1#G70.3 ○
										FX5_4DA_1.bCH4OutputEnableDisableFlag_D U1#G70.4 ○
(202)										—END—

- Warning output-time processing

This program example clears the CH2 Warning output-time processing and warning output in the analog output module.

(0)	FX5_4DA_1.uWarningOutputUpperFlag_D.1 U1#G36.1							SET	CH2_AlmUpLimit F0
(37)	FX5_4DA_1.uWarningOutputLowerFlag_D.1 U1#G37.1							SET	CH2_AlmLowLimit F1
(61)	WarningOutClrSig X12	FX5_4DA_1.bWarningOutputSignal_D U1#G69.E						SET	FX5_4DA_1.bWarningOutputClearRequest_D U1#G70.E
(89)	FX5_4DA_1.bWarningOutputSignal_D U1#G69.E	FX5_4DA_1.bWarningOutputClearRequest_D U1#G70.E						RST	FX5_4DA_1.bWarningOutputClearRequest_D U1#G70.E
(118)									—END—

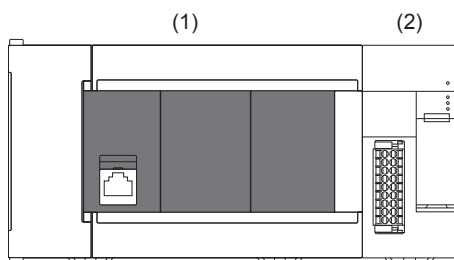
- When a CH4 disconnection is detected or an error occurs in the analog output module, the latest error code appears. After this, the program clears the disconnection detection flag, error flag, and stored error code.



In the wave output mode

■System configuration

The following shows a system configuration example.



(1) CPU module (FX5U CPU module)

(2) Analog output module (FX5-4DA)

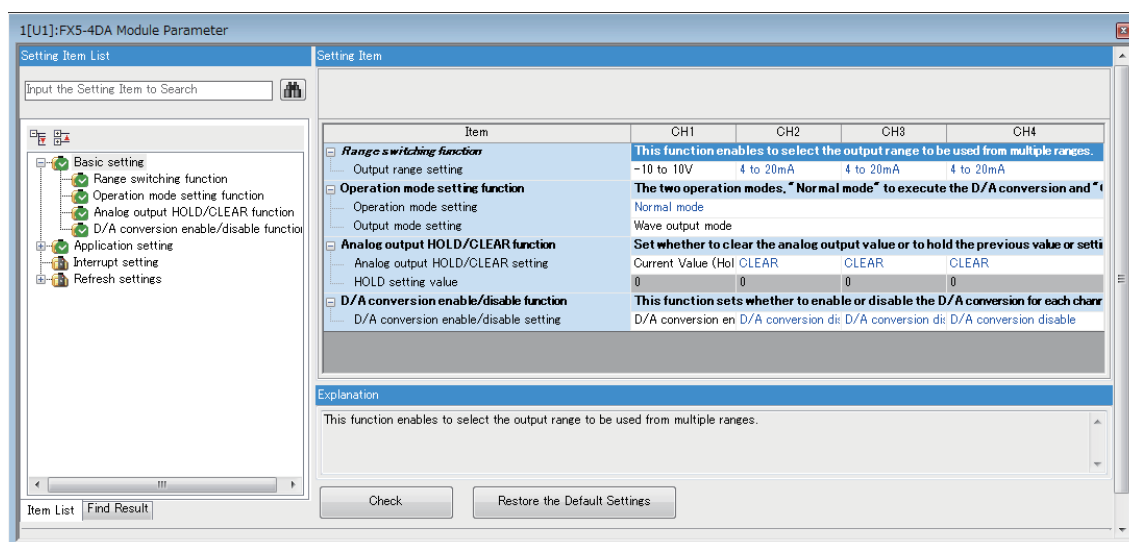
■Parameter settings

Perform the initial setting using the module and module extension parameters of GX Works3. The refresh settings do not need to be changed here.

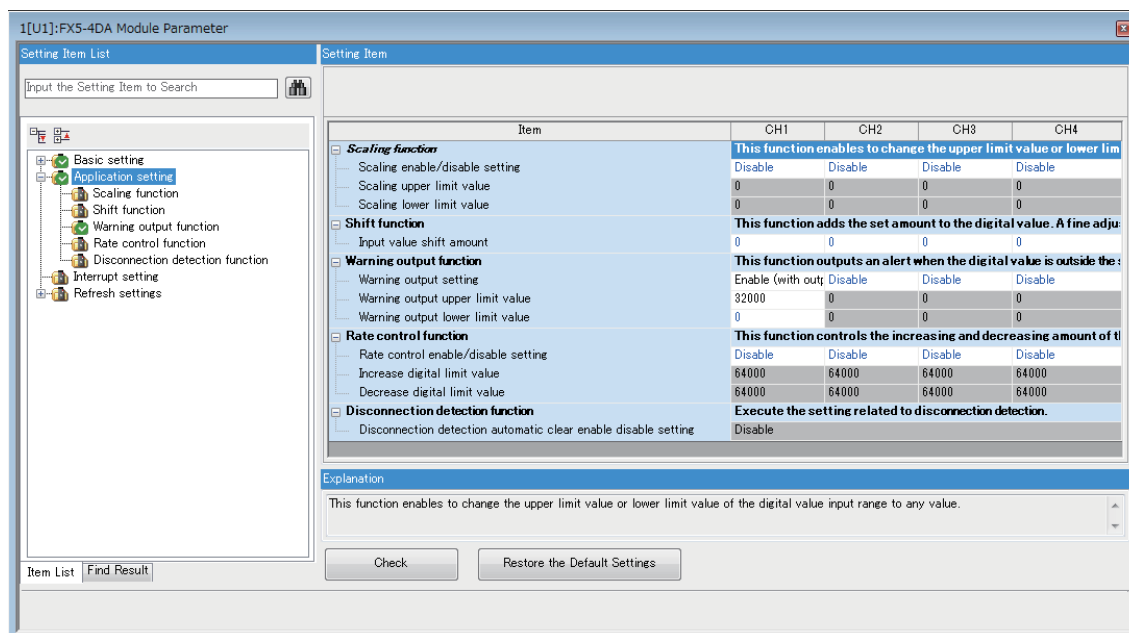
- Module parameters

Set the module parameters as follows.

[Basic setting]



[Application setting]



- Module Extension Parameters

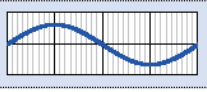
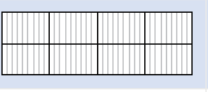
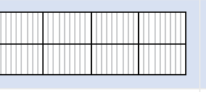

To create the wave output data and register the wave pattern of the module extension parameter, set the setting as follows.

[Create Wave Output Data]

Create Wave Output Data 1[U1]:FX5-4DA

Register wave pattern

Register wave pattern for creating wave output data. * Select graph part and press 'Enter' to open registration window.

Wave pattern No.	1	2	3	4
Graph				
Wave pattern name		-	-	-
Digital value range	0~32000	-	-	-
Number of data	360	-	-	-
Comments		-	-	-

Wave output data setting

Input wave output data.

	CH1	CH2	CH3	CH4
Wave pattern No.	1	-	-	-
Output setting during wave output stop	0:0V/mA	0:0V/mA	0:0V/mA	0:0V/mA
Output value during wave output stop	0	0	0	0
Wave pattern start address setting	10000	10000	10000	10000
Wave pattern data points setting	360	0	0	0
Wave pattern output repetition setting	100	1	1	1
Constant for wave output conversion cyc	100	1	1	1

Specify 'Wave pattern No.' for wave outputting.
Pattern specification is limited up to 3.
1 to 10

Number of data: 360
Empty point: 79640

OK Cancel

[Register wave pattern]

Register wave pattern

Register wave pattern.

Wave pattern information

Input wave pattern information.

Wave pattern No.	1
Wave pattern name	
Digital value range	0~32000
Number of data	360
Comments	

Display Magnification

Width: 100 % Height: 100 % 100% Width and Height

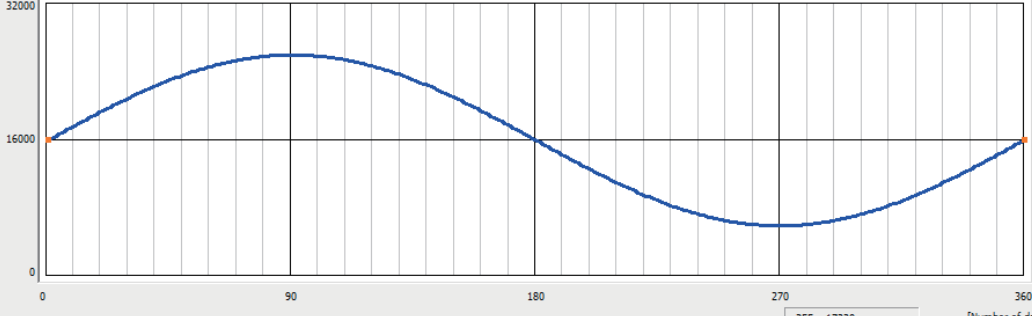
Display digital value

Display Digital Value

Wave graph

Edit wave graph by mouse operation.
* Drag and drop on the line allow you to change graph shape.

[Digital value]



Initialize Graph

Wave details setting

Please fine-tune between each end point that is added by editing wave graph.

Section No.	Start point	End point	Digital value	Specify wave	Direction	Amplitude	Phase
1	-	1	16000				
2	1	360	16000	Sine function		10000	0°
3							
4							

Open Wave Pattern Save Wave Pattern Read CSV File Write CSV File OK Cancel

The created wave output data need to be written, as module extension parameters, to the CPU module or SD memory card.

Program example

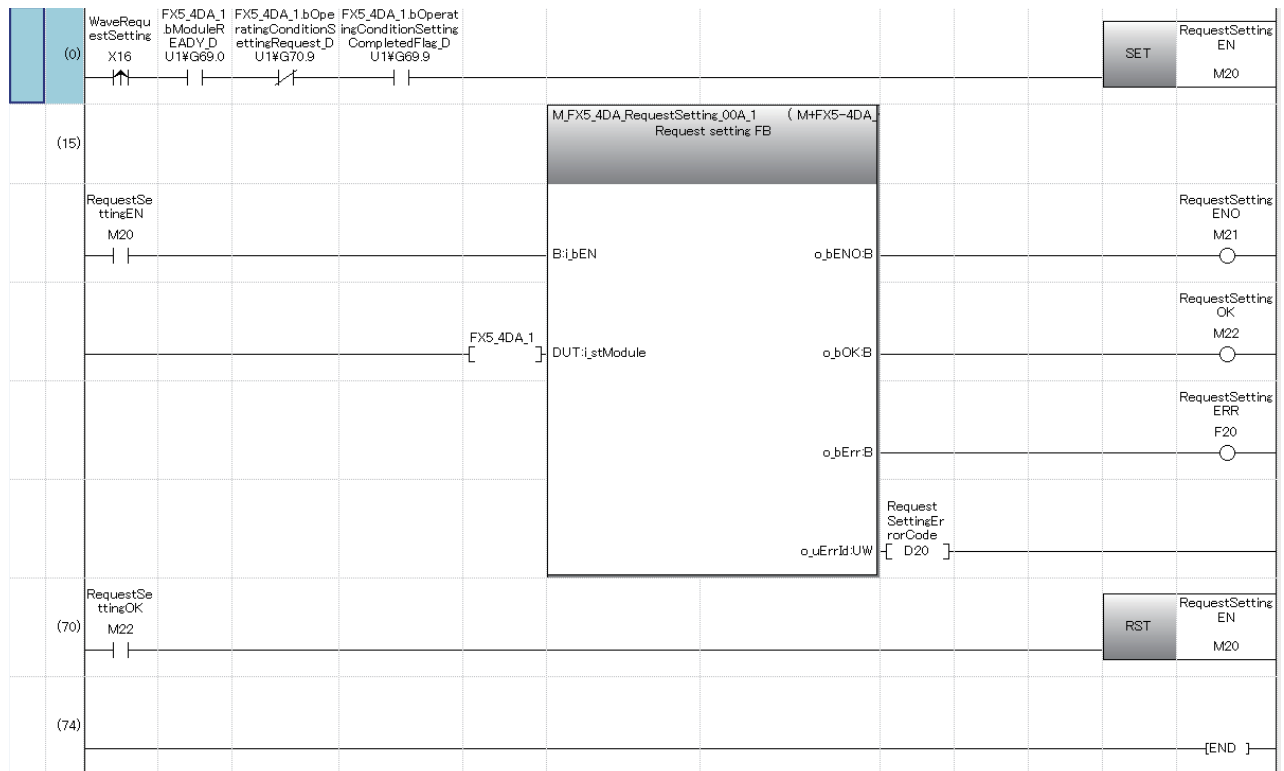
Classification	Device	Description	Device
Module label	FX5_4DA_1.bCH1OutputEnableDisableFlag_D	CH1 Output enable/disable flag	U1\G70.1
	FX5_4DA_1.bExternalPowerSupplyREADY_Flag_D	External power supply READY flag	U1\G69.7
	FX5_4DA_1.bModuleREADY_D	Module READY	U1\G69.0
	FX5_4DA_1.bOperatingConditionSettingCompletedFlag_D	Operating condition setting completed flag	U1\G69.9
	FX5_4DA_1.bOperatingConditionSettingRequest_D	Operating condition setting request	U1\G70.9
	FX5_4DA_1.stnControl_D[0].uWaveOutputStartStopRequest_D	CH1 Wave output start/stop request	U1\G462
Labels to be defined	Define global labels as shown below:		
		Label Name	Data Type
	1	WaveOutputSettingEN	Bit
	2	WaveOutputSettingENO	Bit
	3	WaveOutputSettingOK	Bit
	4	WaveOutputSettingERR	Bit
	5	WaveOutputSettingOutputSelect	Word [Unsigned]/Bit String [16-bit]
	6	WaveOutputSettingOutputValue	Word [Signed]
	7	WaveOutputSettingStartingAddr	Double Word [Unsigned]/Bit String [32-bit]
	8	WaveOutputSettingPointsSetting	Double Word [Unsigned]/Bit String [32-bit]
	9	WaveOutputSettingFrequency	Word [Signed]
	10	WaveOutputSettingConvSpeed	Word [Unsigned]/Bit String [16-bit]
	11	WaveOutputSettingErrorCode	Word [Unsigned]/Bit String [16-bit]
	12	RequestSettingEN	Bit
	13	RequestSettingENO	Bit
	14	RequestSettingOK	Bit
	15	RequestSettingERR	Bit
	16	RequestSettingErrorCode	Word [Unsigned]/Bit String [16-bit]
	17	WaveOutputReqSettingEN	Bit
	18	WaveOutputReqSettingENO	Bit
	19	WaveOutputReqSettingOK	Bit
	20	WaveOutputReqSettingERR	Bit
	21	WaveStartStop	Word [Unsigned]/Bit String [16-bit]
	22	WaveStatusCH1	Word [Unsigned]/Bit String [16-bit]
	23	WaveStatusCH2	Word [Unsigned]/Bit String [16-bit]
	24	WaveStatusCH3	Word [Unsigned]/Bit String [16-bit]
	25	WaveStatusCH4	Word [Unsigned]/Bit String [16-bit]
	26	WaveOutputReqSettingErrorCode	Word [Unsigned]/Bit String [16-bit]
	27	WaveDataStoreReq	Bit
	28	WaveOutputSetting	Bit
	29	WaveRequestSetting	Bit
	30	OutputReq	Bit
	31	WaveStartStopReq	Bit

This program example is used to change part of the wave output parameter settings that were set from the "Create Wave Output Data" window. If this change is not to be made, this program is unnecessary.

Step	Condition	Action	Comment
(0)	WaveOutputSettingEN X15 FX5_4DA_1bModuleReadyD U1%G69.0 FX5_4DA_1bOperatingConditionsRequestD U1%G70.9 FX5_4DA_1bOperatingConditionsCompletedFlagD U1%G69.9	MOV K0 WaveOutputSettingEN M10	
(37)	WaveOutputSettingEN M10	<div> <div>M.FX5_4DA_WaveOutputSetting_00A.1 (M+FX5_4DA_Wave output setting FB)</div> <div> <div>Bi: bEN</div> <div>o: bENOB</div> </div> <div> <div>FX5_4DA_1</div> <div>DUT: i: stModule</div> <div>o: bOKB</div> </div> <div> <div>K1</div> <div>UW: i: uCH</div> <div>o: bErrB</div> </div> <div> <div>WaveOutputSettingOutputSelect D10</div> <div>UW: i: uOutputSelect</div> <div>o: uErrIdUW</div> </div> <div> <div>WaveOutputSettingOutputValue D11</div> <div>W: i: wOutputValue</div> </div> <div> <div>WaveOutputSettingStartingAddr D12</div> <div>UD: i: udStartingAddr</div> </div> <div> <div>WaveOutputSettingPointsSetting D14</div> <div>UD: i: udPointsSetting</div> </div> <div> <div>WaveOutputSettingFrequency D16</div> <div>W: i: wFrequency</div> </div> <div> <div>WaveOutputSettingConvSpeed D17</div> <div>UW: i: uConvSpeed</div> </div> <div> <div>K0</div> <div>UW: i: uUnitType</div> </div> </div>	<div>WaveOutputSettingENO M11</div> <div>WaveOutputSettingOK M12</div> <div>WaveOutputSettingERR F10</div> <div>WaveOutputSettingErrorCode D18</div>
(346)	WaveOutputSettingOK M12	RST WaveOutputSettingEN M10	
(350)			[END]

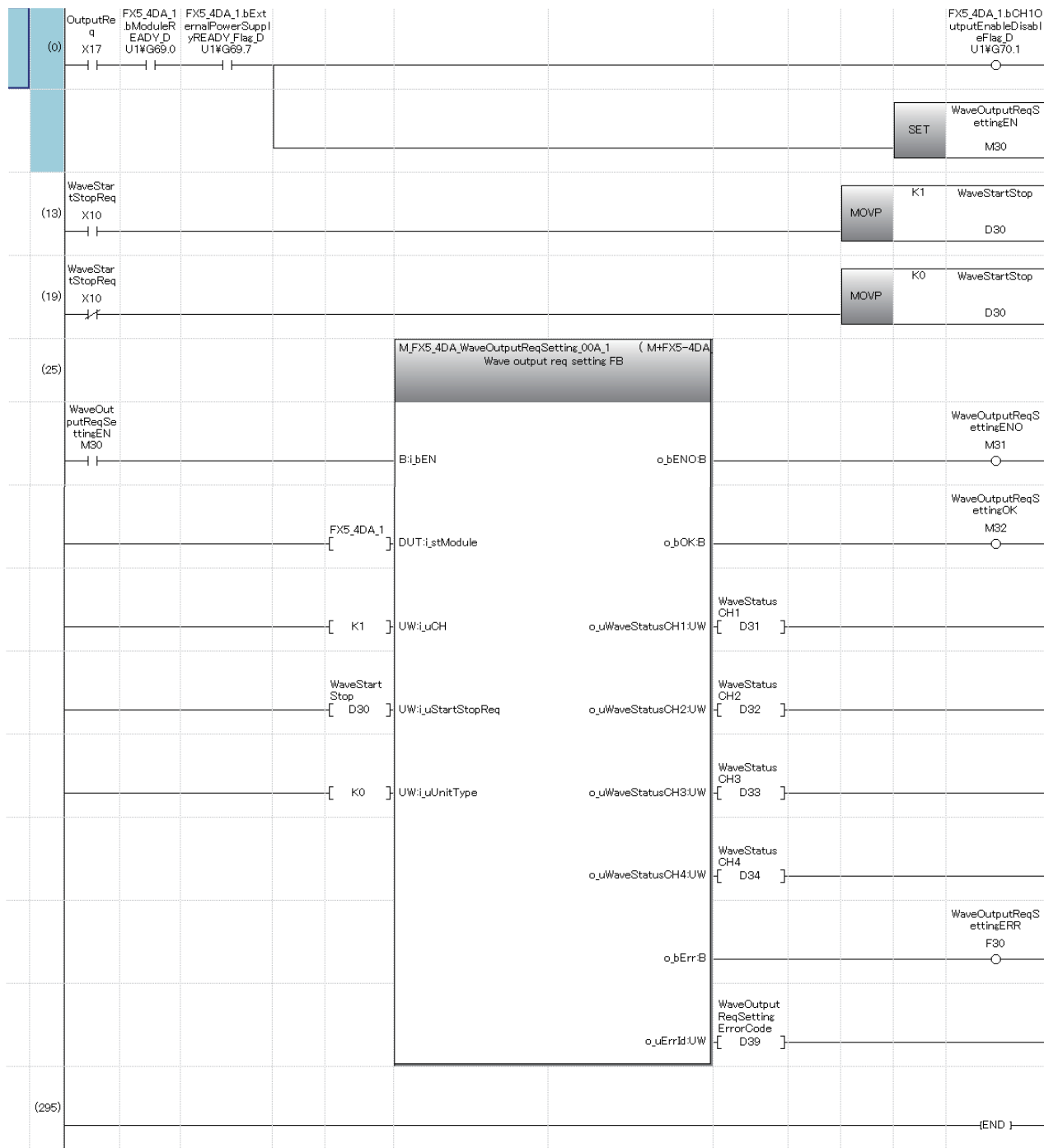
- Example of operating condition setting request processing program

When the registered contents or settings of wave output parameters are changed, enable the settings using this program.



- Example of wave output start processing program

This program example starts the CH1 wave output.



2.10 Troubleshooting

This section describes errors that may occur during use of an analog output module and troubleshooting for these.

Troubleshooting with the LEDs

Check the state of the LEDs to narrow down the possible causes of the trouble. This step is the first diagnostics before using GX Works3.

The analog output module state can be checked with the POWER, RUN, ERROR, and ALM LEDs. The following table shows the correspondence between the LEDs and the analog output module state.

Name	Description
POWER LED	Indicates the power supply status. ON: Power ON OFF: Power off or module failure
RUN LED	Indicates the operating status. Light on: Normal operation Flashing: Offset/gain setting mode Light off: Error occurring
ERROR LED	Indicates the error status.*1 ON: Minor error Flashing: Moderate error or major error OFF: Normal operation
ALM LED	Indicates the alarm status.*2 ON: Alarm occurred OFF: Normal operation

*1 For details, refer to the following.

📖 Page 281 List of error codes

*2 For details, refer to the following.

📖 Page 284 List of alarm codes

Troubleshooting by symptom

When the POWER LED turns off

Check item	Corrective action
Check whether the power is supplied.	Check that power is supplied to the CPU and extension power supply modules.
Check whether the capacities of the CPU module extension power supply modules are enough.	Calculate the current consumption of the I/O modules, and intelligent function modules to check that the power supply capacity for the CPU module and extension power supply module is enough.
Check whether the module is mounted properly.	Check that the extension cable is inserted correctly.

When the RUN LED flashes or turns off

■When flashing


Check item	Cause	Corrective action
Check whether the module is in offset/gain setting mode.	In the GX Works3 module parameter setting, the CPU module was powered off→on or reset when the operation mode setting was the offset/gain setting mode.	In the GX Works3 module parameter setting, set the operation mode setting to normal and power off→on or reset the CPU module.
	The value in the mode switching setting has been changed and the mode has been switched to offset/gain setting mode.	Review the program that uses the mode switching setting to check whether the mode has been switched erroneously.

■When turning off


Check item	Corrective action
Check whether the power is supplied.	Check that power is supplied to the CPU and extension power supply modules.
Check whether the capacities of the CPU module extension power supply modules are enough.	Calculate the current consumption of the I/O modules, and intelligent function modules to check that the power supply capacity for the CPU module and extension power supply module is enough.
Check whether the module is mounted properly.	Check that the extension cable is inserted correctly.
Other than the above	Reset the CPU module, and check if the RUN LED turns on. If the RUN LED still remains off, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.

When the ERROR LED flashes or turns on

■When flashing


Check item	Action
Check whether the 24 V DC external power supply is supplied.	Confirm if FX5-4DA is connected properly to the external power supply of 24 V DC. Also, confirm if the supply of the voltage from the external power supply of 24 V DC to FX5-4DA is started before the system power supply turns on.
Check whether a moderate error has occurred.	Check Latest error code and take actions described in the list of error codes. ( Page 281 List of error codes)

■When turning on

Check item	Action
Check whether any error has occurred.	Check Latest error code and take actions described in the list of error codes. ( Page 281 List of error codes)

The ALM LED turns on

■When turning on

Check item	Action
Check whether any alert has been issued.	Check the latest alarm code and take action as described in the list of alarm codes. ( Page 284 List of alarm codes)

No analog output

■No analog output when the normal output mode is selected

Check item	Action
Check whether the 24 V DC external power supply is supplied.	Check 'External power supply READY flag' (Un\G69, b7). If it is off, supply 24 V DC to the external power supply terminal.
Check whether there is any problem with the wiring, such as looseness or disconnection of analog signal lines.	Identify the faulty area of signal lines by a visual check and continuity check.
Check whether the CPU module is in the STOP state.	Change the state of the CPU module to RUN.
Check whether the offset/gain setting in the user range setting is correct.	Check that the offset/gain setting is correct. If a user range setting is in use, change it to another default output range and check that the D/A conversion is performed normally. If the D/A conversion is correct, retry the offset/gain setting.
Check whether the output range setting is correct.	Check the CH□ Input range setting monitor with the GX Works3 monitor. If the output range setting is incorrect, retry to set the GX Works3 output range setting or CH□ Range setting.
For the desired channel for output, check whether the CH□ D/A conversion enable/disable is set to D/A conversion disable.	Check CH□ D/A conversion enable/disable setting and set it to D/A conversion enable using a sequence program or the GX Works3.
For the desired channel for output, check whether 'CH□ Output enable/disable flag' (Un\G70, b1 to b4) is set to OFF.	Check the ON/OFF setting of 'CH□ Output enable/disable flag' (Un\G70, b1 to b4). If 'CH□ Output enable/disable flag' (Un\G70, b1 to b4) is off, review the sequence program. In addition, check whether the CPU module is in the STOP state.
Check whether the digital value writing program has an error.	Check the CH□ Digital value using the GX Works 3 monitor (buffer memory batch monitor). If the value as specified for the digital value has not been stored, review the writing program.
Check whether 'Operating condition setting request' (Un\G70, b9) has been executed.	By turning off→on→off 'Operating condition setting request' (Un\G70, b9), check whether the normal analog output is generated. If it is normal, review the sequence program.

■No analog output when the wave output mode is selected

Check item	Action
Check the connection method	Check whether the 24 V DC external power supply is supplied.
Checking the module parameter settings of GX Works3	Check that Offset/gain setting mode flag (Un\G69, b10) is off, and the operation mode setting is normal mode. If the normal mode is not set, retry to set the operation mode to the normal mode with the module parameter setting of GX Works 3.
	Check whether the output module setting is correct.
	Check whether the user range setting was selected. When the wave output mode is selected with the output mode setting, the user range setting (current) or (voltage) cannot be selected as the output range. If the user range setting (current) or (voltage) was selected as the output range, retry to select a range other than the user ranges.

Check item		Action
Checking the program	For the desired channel for wave output, check whether the CH□ D/A conversion enable/disable is set to D/A conversion disable.	Check CH□ D/A conversion enable/disable setting to set to D/A conversion enable.
	Check whether 'Operating condition setting request' (Un\G70, b9) has been executed.	By turning off→on→off 'Operating condition setting request' (Un\G70, b9), enable the wave output function parameter setting.
	Check whether the value is written in the wave data registry area of the desired channel for wave output.	Check the value of the wave data registry area used for the desired channel for wave output. By pausing the wave output, each monitor of the wave output function can be checked. Set the analog output HOLD/CLEAR setting to the previous value, set the CH□ Wave output start/stop request to the wave output pause request (2) to pause the analog output state, and check each monitor.
	Check whether the CH□ Wave output start/stop request of the desired channel for wave output is set to Wave output stop request (0).	Check the CH□ Wave output status monitor of the desired channel for wave output. When the CH□ Wave output status monitor is Wave output stopped (0), retry to set CH□ Wave output start/stop request in Wave output start request (1).
	For the desired channel for wave output, check whether 'CH□ Output enable/disable flag' (Un\G70, b1 to b4) is set to OFF.	Check the status of the ON/OFF setting of 'CH□ Output enable/disable flag' (Un\G70, b1 to b4). If 'CH□ Output enable/disable flag' (Un\G70, b1 to b4) is off, review the program.

The analog output value is not identical with the previous value/setting value

Check item	Corrective action
Check whether the operation status of the CPU module is STOP or Stop Error.	Check the CPU module operating status. The analog output HOLD/CLEAR function is enabled when the CPU module operating status is STOP or Stop Error.
Check whether the analog output HOLD/CLEAR function is correct.	Check the CH□ HOLD/CLEAR function setting monitor. If the setting is incorrect, retry to set the analog output HOLD/CLEAR setting to the previous value/setting value by setting GX Works3 module parameters.
Check whether the CH□ HOLD setting value is correct.	If the setting value is selected with the analog output HOLD/CLEAR function setting function, check the value the CH□ HOLD setting value.

'External power supply READY flag' (Un\G69, b7) does not turn on

Use the following procedure for checking.

Check item	Corrective action
Check whether the 24 V DC external power supply is supplied. (1) Wiring is proper. (2) External power supply 24 V DC is supplied within the specified range.	(1) Make wiring by reference to the external wiring. (☞ Page 244) (2) Supply 24 V DC within the performance specifications. (☞ Page 181)
Other than the above	The analog output module may be in failure. Please consult your local Mitsubishi representative.



If the external power supply does not operate normally after the above actions are taken, the analog output module may be in failure. Please consult your local Mitsubishi representative.

List of error codes

If an error occurs during operation, an analog output module stores the error code into 'Latest error code' (Un\G0) of the buffer memory. In addition, 'Error flag' (Un\G69, b15) turns on. When disconnection is detected, not the 'Error flag' (Un\G69, b15) but the 'Disconnection detection signal' (Un\G69, b13) turns ON. The error code of 'Latest error code' (Un\G0) is cleared by turning on 'Error clear request' (Un\G70, b15), and the 'Error flag' (Un\G69, b15) and 'Disconnect detection signal' (Un\G69, b13) are turned off.

Error codes of an analog output module are classified into minor and moderate errors.

- Minor error: This error is caused by the setting failure of programs and parameters, and after eliminating the error cause, each function normally executes. (1000H to 1FFFH)
- Moderate error: An error such as hardware failure. The D/A conversion does not continue. (3000H to 3FFFH)

The following table lists the error codes that may be stored.

□: Indicates the number of the channel where an error has occurred. It represents one of numerical values 0 to 3, which correspond to CH1 to CH4.

(CH1: 0, CH2: 1, CH3: 2, CH4: 3)

△ in error code: Indicates the interrupt setting corresponding to the error (0: setting 1 to F: setting 16).

Error code	Error name	Description and cause	Corrective action
0000H	—	There is no error.	—
1080H	Number of writes to offset/gain settings reach limit error	The number of the offset/gain settings has exceeded the guaranteed maximum number.	Though any further setting of offset/gain values is performed, the setting value will not be guaranteed.
180△H	Interrupt factor transaction setting range error	A value other than 0 or 1 was set in 'Interrupt factor transaction setting' (Un\G200 to 215).	Retry to set 0 or 1 in 'Interrupt factor transaction setting' (Un\G200 to 215).
181△H	Condition target setting range error	A value other than 0 to 4 was set in 'Condition target setting' (Un\G232 to 247).	Retry to set a value of 0 to 4 in 'Condition target setting' (Un\G232 to 247).
182△H	Condition target channel setting range error	A value other than 0 to 4 was set in 'Condition target channel setting' (Un\G264 to 279).	Retry to set a value of 0 to 4 in 'Condition target channel setting' (Un\G264 to 279).
1861H	Offset/gain setting continuous write occurrence error	The setting value has been continuously written to the flash memory 26 times or more in the offset/gain setting.	For the offset/gain setting, write the setting value only once per setting.
190□H	Range setting range error	A value out of the range is set in CH□ Range setting.	Set CH□ Range setting to the value within the range again.
191□H	Digital value setting range error	• For normal output A value out of the range is set for the CH□ Digital value.	Retry to set a proper value for the CH□ Digital value.
		• For wave output A value out of the setting range was set for part of 'wave data registry area' (Un\G10000 to Un\G89999) used for the channel of wave-output-in-progress.	Correct the corresponding data in 'wave data registry area' (Un\G10000 to Un\G89999) being used for the channel where the error occurred, to a value within the setting range.
192□H	HOLD setting value range error	A value out of the range is set in CH□ HOLD setting.	Retry to set a proper value for the CH□ HOLD digital value.
1A0□H	Scaling enable/disable setting range error	A value other than 0 and 1 is set in CH□ Scaling enable/disable setting.	Set CH□ Scaling enable/disable setting to 0 or 1.
1A2□H	Scaling upper/lower limit value setting error	CH□ Scaling upper limit value and CH□ Scaling lower limit value are set as the scaling upper limit value = the scaling lower limit value.	Set CH□ Scaling upper limit value and CH□ Scaling lower limit value as the scaling upper limit value ≠ the scaling lower limit value.
1B0□H	Warning output setting range error	A value other than 0 to 2 was set in CH□ Warning output setting.	Retry to set CH□ Warning output setting to 0 to 2.
1B1□H	Warning output upper/limit reversal error	A value not meeting the following condition was set for the CH□ Warning output upper limit value or CH□ Warning output lower limit value. Upper limit value > Lower limit value	Retry to set the CH□ Warning output upper limit value and CH□ Warning output lower limit value so that the condition "upper limit value > lower limit value".
1B8□H	Rate control enable/disable setting range error	A value other than 0 or 1 was set in CH□ Rate control enable/disable setting.	Retry to set CH□ Rate control enable/disable setting to 0 or 1.
1B9□H	Digital limit value range error	A value other than 0 to 64000 was set for the CH□ Increase digital limit value or CH□ Decrease digital limit value.	Retry to set a value of 0 to 64000 for the CH□ Increase digital limit value or CH□ Decrease digital limit value.

Error code	Error name	Description and cause	Corrective action
1C4□H	Disconnection detection error	A disconnection was detected on CH□.	Eliminate the cause of the disconnection from the channel. If the disconnection detection automatic clear enable/disable setting is disabled, remove the cause of the disconnection and then turn off→on→off 'Error Clear Request' (Un\G70, b15)'.
1D0□H	Wave output start/stop setting range error	A value out of the range was set in 'CH□ Wave output start/stop request'.	Retry to set 'CH□ Wave output start/stop request' to one of the following. <ul style="list-style-type: none"> • Wave output stop request (0) • Wave output start request (1) • Wave output pause request (2)
1D1□H	Wave output mode user range specification error	In the output mode setting, the wave output mode was selected, and the user range setting was selected with the output range setting.	<ul style="list-style-type: none"> • If the wave output function is to be used, retry to set the output range to a range other than the user range by using the output range setting. • If the user range setting is to be used, retry to set the output mode setting to the normal output mode by using the module parameter setting.
1D2□H	Output setting during wave output stop setting range error	'CH□ Output setting during wave output stop' is set to a value other than 0 to 2.	Retry to set 'CH□ Output setting during wave output stop' to one of the following. <ul style="list-style-type: none"> • 0 V/0 mA (0) • Offset value (1) • Output value during wave output stop (2)
1D3□H	Output value during wave output stop range error	'CH□ Output value during wave output stop' is set to a value out of the range.	Correct 'CH□ Output value during wave output stop' to a value within the setting range. The setting range depends on the output range setting. -10 to +10 V: -32768 to +32767 4 to 20 mA, 0 to 20 mA, 1 to 5 V, 0 to 5 V, or 0 to 10 V: 0 to 32767
1D4□H	Wave pattern start address setting range error	'CH□ Wave pattern start address setting' is set to a value out of the setting range.	Retry to set 'CH□ Wave pattern start address setting' to a value of 10000 to 89999.
1D5□H	Wave pattern number-of-points setting range error	'CH□ Wave pattern data points setting' is set to a value other than 1 to 80000.	Retry to set 'CH□ Wave pattern data points setting' to a value of 1 to 80000.
1D6□H	Wave pattern output repetition setting range error	'CH□ Wave pattern output repetition setting' is set to a value out of the range.	Retry to set 'CH□ Wave pattern output repetition setting' to one of the following. <ul style="list-style-type: none"> • Indefinite repetitive output (-1) • Specified-count output (1 to 32767)
1D7□H	Wave output conversion cycle setting range error	'CH□ Constant for wave output conversion cycle' is set to a value other than 1 to 5000.	Retry to set 'CH□ Constant for wave output conversion cycle' to a value of 1 to 7.
1D80H	Step action wave output request range error	'Step action wave output request' is set to a value other than 0 or 1.	Retry to set 0 or 1 'Step action wave output request'.
1D9□H	Wave data registry area range error	The value obtained by subtracting 1 from the sum of 'CH□ Wave pattern start address setting' and 'CH□ Wave pattern data points setting' is set to a value exceeding 89999 (final buffer memory address of wave data registry area).	Retry to set 'CH□ Wave pattern start address setting' and 'CH□ Wave pattern number-of-points setting' to values meeting the following conditions. "Wave pattern start address setting" + "Wave pattern data points setting" - 1 ≤ 89999
1DA0H	Module extension parameter acquisition error	No module extension parameter can be acquired.	Write to the CPU module, the module extension parameter by which the wave output data was registered. Then, power off→on or reset the CPU module.
1E50H	Offset/gain setting channel specification error	<ul style="list-style-type: none"> • Multiple channels are set simultaneously while during offset/gain setting. • In the offset/gain setting, "1: Setting channel" is set for both CH□ Offset/gain setting mode (offset specification) and CH□ Offset/gain setting mode (gain specification), or "0: Disable" is set. 	Correctly set CH□ Offset/gain setting mode (offset specification) and CH□ Offset/gain setting mode (gain specification).
1E51H	User range data invalid (CH specification disable)	An invalid value is set in the offset/gain setting. The number of the channel in which this error occurs cannot be identified.	Perform the offset/gain setting again for all channels where the user range is set. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
1E52H	Analog adjustment output out-of-range error	A value other than -3000 to +3000 is set for the offset/gain adjustment value specification.	Retry to set the offset/gain adjustment value specification to a value of -3000 to +3000.

Error code	Error name	Description and cause	Corrective action
1E6□H	User range data invalid (CH specification enable)	An invalid value is set in CH□ Offset/gain setting.	Perform the offset/gain setting again for the channels where the error has occurred. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
1E7□H	Offset/gain value inversion error	The offset value and gain value to be saved in the flash memory are as follows: Offset value \geq Gain value	Perform the offset/gain setting again so that the following condition is satisfied: Offset value < Gain value
1E8□H	Offset/gain setting channel range error	A value other than 0 and 1 is set in CH□ Offset/gain setting mode (offset specification) and CH□ Offset/gain setting mode (gain specification).	Set CH□ Offset/gain setting mode (offset specification) and CH□ Offset/gain setting mode (gain specification) to 0 or 1.
1E9□H	Offset/gain setting range error	When the offset and gain are set, values other than D or E were set in 'CH□ Offset/gain setting mode' (range specification).	Retry to set the 'CH□ Offset/gain setting mode' (range specification) to D or E.
1F08H	Module power supply error	The 24 V DC power supply is not normally supplied to the module.	Check the wiring of the cable or the supplied voltage. After the check, turn off→on→off Error clear request (Un\G70, b15) to eliminate this error and resume the conversion. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3001H	Hardware failure	A hardware failure in the module.	Power off→on the module. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3030H	Flash memory error	The data in the flash memory is abnormal.	Check the analog output values. If the values are abnormal, please consult your local Mitsubishi representative.

List of alarm codes

If an alarm occurs during operation, the analog output module stores the alarm code into 'Latest alarm code' (Un\G2) of the buffer memory. Turning on 'Alert output clear request'(Un\G70, b14) or 'Operating condition setting request'(Un\G70, b9) clears the alarm code in 'Latest alarm code' (Un\G2).

The following table lists the alarm codes that may be stored.

□: Indicates the number of the channel where the alarm has occurred. It represents one of numerical values 0 to 3, which correspond to CH1 to CH4.

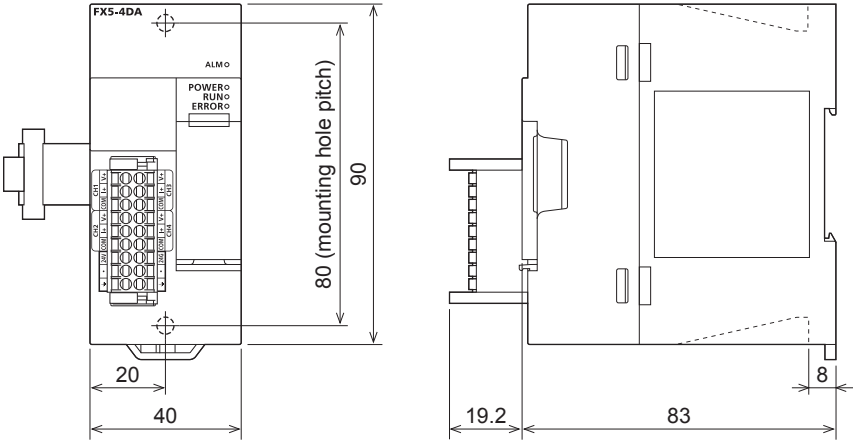
(CH1: 0, CH2: 1, CH3: 2, CH4: 3)

Alarm code	Alarm name	Description and cause	Corrective action
080□H	Warning output alarm flag (upper limit)	A warning output alarm (upper limit) has occurred in CH□.	After the CH□ Digital value returns to within the setting range, turn off→on→off 'Warning output clear request' (Un\G70, b14). Both the bit corresponding to the warning output upper or lower flag and 'Warning output signal' (Un\G69, b14) turn off.
081□H	Warning output alarm flag (lower limit)	A warning output alarm (lower limit) has occurred in CH□.	
0B0□H	Setting error of conditions for operation other than Wave output stopped	In wave output status other than Wave output stopped, 'Operating condition setting request' (Un\G70, b9) was turned off→on→off.	Wait until the wave output of all channels stop. Then, turn off→on→off 'Operating condition setting request' (Un\G70, b9).
0B1□H	Wave output mode scaling setting error	The scaling function is enabled when the wave output function is in use.	If the wave output function is in use, retry to set 'CH□ Scaling enable/disable setting' to Disable (1).
0B2□H	Wave output mode input value shift amount setting error	When the wave output function is in use, the input value shift amount is set to a value other than 0.	If the wave output function is in use, retry to set 'CH□ Input value shift' to 0.
0B3□H	Wave output mode rate control setting error	The rate function is enabled when the wave output function is in use.	If the wave output function is in use, retry to set 'CH□ Rate control enable/disable setting to Disable (1).
0C0□H	CH□ Output-in-progress range change enable alarm	In CH□, range switching was executed during analog output.	When range switching is to be performed, turn off 'Output enable/disable flag' (Un\G70, b1 to b4) for the channel the range of which is to be switched and turn off→on→off 'Operating condition setting request' (Un\G70, b9).

APPENDIX

Appendix 5 External Dimensions

The following figure shows the external dimensions of an analog output module.



(Unit: mm)

Appendix 6 Standards

Certification of UL, cUL standards

The FX5-4DA supports UL (UL, cUL) standards.

For models that support UL standards, refer to the following.

UL, cUL file number: E95239

Compliance with EC directive (CE marking)

This note does not guarantee that an entire machine produced in accordance with the contents of this note will comply with the following standards.

Compliance to EMC directive and LVD directive of the entire mechanical module should be checked by the user/manufacturer. For more details please contact to the local Mitsubishi Electric sales site.

Requirement for compliance with EMC directive

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (2014/30/EU) when used as directed by the appropriate documentation.

Attention

This product is designed for use in industrial applications.

Product compatibility

Type: Programmable controller (open type equipment)

Models: FX5 manufactured

from November 1st, 2017	FX5-4DA
Electromagnetic compatibility (EMC) directive	Remarks
EN61131-2:2007 Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. EMI • Radiated emission • Conducted emission EMS • Radiated electromagnetic field • Fast transient burst • Electrostatic discharge • High-energy surge • Voltage drops and interruptions • Conducted RF • Power frequency magnetic field

Caution for compliance with EC directive

Caution for when the FX5-4DA is used

When the FX5-4DA is used, attach a ferrite core to the power supply of the CPU module.

Make 2 turns around the ferrite core and attach within approximately 200 mm from the terminal block and connectors of the power cable. Also, attach a ferrite core to the input/output cable pulled out to the outside of the control panel. Attach the ferrite core before the cable is pulled out to the outside of the control panel. (Ferrite core used in Mitsubishi Electric's test: E04SR401938 manufactured by SEIWA ELECTRIC MFG. CO., LTD.)

Appendix 7 Module Label

The functions of the analog output module can be set by using module labels.

Module labels of I/O signals

The module label name of an I/O signal is defined with the following structure:

"Module name"_"Module number".b"Label name"_D

Ex.

FX5_4DA_1.bModuleREADY_D

■Module name

The character string of a module model name is given.

■Module number

A number starting from 1 is added to identify modules that have the same module name.

■Label name

The label identifier unique to a module is given.

■_D

This string indicates that the module label is for the direct access.

Module labels of buffer memory areas

The module label name of a buffer memory area is defined with the following structure:

"Module name"_"Module number"."Data type"_D["(Channel)"]. "Data format" "Label name"_D

Ex.

FX5_4DA_1.stnMonitor_D[0].uSetValueCheckCode_D

■Module name

The character string of a module model name is given.

■Module number

A number starting from 1 is added to identify modules that have the same module name.

■Data type

The data type to sort a buffer memory area is given. Each data type is as follows:

Data type	Description
stnMonitor	Monitor
stnControl	Control
stnSetting	Setting

■Channel

The channel number corresponding to a module label is given. A numerical value of 0 to 3 is used to correspond to CH1 to 4. (CH1: 0, CH2: 1, CH3: 2, CH4: 3)

■Data format

The string that represents the data size of a buffer memory area is given. Each data type is as follows:

Data format	Description
u	Word [Unsigned]/Bit string [16-bit]
w	Word [Signed]
ud	Double word [Unsigned]/Bit string [32-bit]
d	Double word [Signed]

■Label name

The label identifier unique to a module is given.

■_D

This string indicates that the module label is for the direct access. Values that are read from or written to the module label is reflected in the analog output module instantly.

Appendix 8 Buffer Memory Areas

List of buffer memory areas

This section lists the buffer memory areas of the analog output module. For details on the buffer memory, refer to the following.

Page 300 Details of buffer memory addresses

The buffer memory areas of the analog output module are classified into the data types described below.

Data type	Description	
Setting data	Description	The data to be customized to suit the connected devices and the purpose of the system.
	Read and write attributes	Read and write is possible.
	Setting procedure	Use GX Works3 or a program to set the data.
	Setting timing	After a change of value, turning off→on→off 'Operating condition setting request' (Un\G70, b9) allows the setting value to take effect.
Control data	Description	The data used for controlling the analog output module.
	Read and write attributes	Read and write is possible.
	Setting procedure	Use GX Works3 or a program to set the data.
	Setting timing	As soon as the values are changed, the set values become enabled.
Monitor data	Description	The data used for checking the status of the analog output module.
	Read and write attributes	Only read is possible and write is not possible.
	Setting procedure	—
	Setting timing	—



Do not write data to the system areas and areas whose data types are monitor in the buffer memory. Writing data into these areas can cause the malfunction of the module.

A

In the normal mode

○: With refresh setting, ×: Without refresh setting

■Un\G0 to Un\G399

Address (decimal)	Address (hexadecimal)	Name	Default value	Data type	Auto refresh
0	0H	Latest error code	0	Monitor	○
1	1H	Latest address of error history	0	Monitor	○
2	2H	Latest alarm code	0	Monitor	○
3	3H	Latest address of alarm history	0	Monitor	○
4 to 19	4H to 13H	Interrupt factor detection flag [n] ^{*1}	0	Monitor	○
20 to 29	14H to 1DH	System area	—	—	—
30	1EH	Module Information	6160H	Monitor	×
31	1FH	Firmware version	*2	Monitor	×
32 to 35	20H to 23H	System area	—	—	—
36	24H	Alarm output upper limit flag	0000H	Monitor	○
37	25H	Alarm output lower limit flag	0000H	Monitor	○
38	26H	Disconnection detection flag	0000H	Monitor	○
39 to 59	27H to 3BH	System area	—	—	—
60	3CH	Operation mode monitor	0000H	Monitor	×
61 to 68	3DH to 44H	System area	—	—	—
69	45H	Input signals	0	Monitor	×
70	46H	Output signals	0	Control	×
71 to 123	47H to 7BH	System area	—	—	—

Address (decimal)	Address (hexadecimal)	Name	Default value	Data type	Auto refresh
124 to 139	7CH to 8BH	Interrupt factor mask [n] ^{*1}	0	Control	×
140 to 155	8CH to 9BH	System area	—	—	—
156 to 171	9CH to ABH	Interrupt factor reset request [n] ^{*1}	0	Control	×
172 to 187	ACH to BBH	System area	—	—	—
188	BCH	Step action wave output request	0	Control	×
189 to 199	BDH to C7H	System area	—	—	—
200 to 215	C8H to D7H	Interrupt factor generation setting [n] ^{*1}	0	Setting	×
216 to 231	D8H to E7H	System area	—	—	—
232 to 247	E8H to F7H	Condition target setting [n] ^{*1}	0	Setting	×
248 to 263	F8H to 107H	System area	—	—	—
264 to 279	108H to 117H	Condition target channel setting [n] ^{*1}	0	Setting	×
280 to 295	118H to 127H	System area	—	—	—
296, 297	128H, 129H	Mode switching setting	0	Setting	×
298 to 303	12AH to 12FH	System area	—	—	—
304	130H	Disconnection detection automatic clear enable/disable setting	1	Setting	×
305	131H	Offset/gain initialization enable code	0	Setting	×
306 to 399	132H to 18FH	System area	—	—	—

*1 [n] in the table indicates an interrupt setting number. (n = 1 to 16)

*2 The firmware version of the analog output module is stored. For Ver. 1.000, 1000 is stored.

■Un\G400 to Un\G3599

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
400 (190H)	600 (258H)	800 (320H)	1000 (3E8H)	CH□ Setting value check code	0	Monitor	○
401 (191H)	601 (259H)	801 (321H)	1001 (3E9H)	CH□ Wave output status monitor	0	Monitor	○
402 to 428 (192H to 1ACH)	602 to 628 (25AH to 274H)	802 to 828 (322H to 33CH)	1002 to 1028 (3EAH to 404H)	System area	—	—	—
429 (1ADH)	629 (275H)	829 (33DH)	1029 (405H)	CH□ Output status	0	Monitor	×
430 (1AEH)	630 (276H)	830 (33EH)	1030 (406H)	CH□ Range setting monitor	3	Monitor	×
431 (1AFH)	631 (277H)	831 (33FH)	1031 (407H)	CH□ HOLD/CLEAR function setting monitor	0	Monitor	×
432 (1B0H)	632 (278H)	832 (340H)	1032 (408H)	CH□ Wave output conversion cycle monitor (L)	0	Monitor	×
433 (1B1H)	633 (279H)	833 (341H)	1033 (409H)	CH□ Wave output conversion cycle monitor (H)		Monitor	×
434 (1B2H)	634 (27AH)	834 (342H)	1034 (40AH)	CH□ Wave pattern output count monitor	0	Monitor	×
435 (1B3H)	635 (27BH)	835 (343H)	1035 (40BH)	System area	—	—	—
436 (1B4H)	636 (27CH)	836 (344H)	1036 (40CH)	CH□ Wave output current address monitor (L)	0	Monitor	×
437 (1B5H)	637 (27DH)	837 (345H)	1037 (40DH)	CH□ Wave output current address monitor (H)		Monitor	×
438 (1B6H)	638 (27EH)	838 (346H)	1038 (40EH)	CH□ Wave output current digital value monitor	0	Monitor	×
439 (1B7H)	639 (27FH)	839 (347H)	1039 (40FH)	System area	—	—	—
440 (1B8H)	640 (280H)	840 (348H)	1040 (410H)	CH□ Wave output digital value out-of-range address monitor (L)	0	Monitor	×
441 (1B9H)	641 (281H)	841 (349H)	1041 (411H)	CH□ Wave output digital value out-of-range address monitor (H)		Monitor	×

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
442 (1BAH)	642 (282H)	842 (34AH)	1042 (412H)	CH□ Wave output warning address monitor (L)	0	Monitor	×
443 (1BBH)	643 (283H)	843 (34BH)	1043 (413H)	CH□ Wave output warning address monitor (H)		Monitor	×
444 to 459 (1BCH to 1CBH)	644 to 659 (284H to 293H)	844 to 859 (34CH to 35BH)	1044 to 1059 (414H to 423H)	System area	—	—	—
460 (1CCH)	660 (294H)	860 (35CH)	1060 (424H)	CH□ Digital value	0	Control	○
461 (1CDH)	661 (295H)	861 (35DH)	1061 (425H)	System area	—	—	—
462 (1CEH)	662 (296H)	862 (35EH)	1062 (426H)	CH□ Wave output start/stop request	0	Control	×
463 to 479 (1CFH to 1DFH)	663 to 679 (297H to 2A7H)	863 to 879 (35FH to 36FH)	1063 to 1079 (427H to 437H)	System area	—	—	—
480 (1E0H)	680 (2A8H)	880 (370H)	1080 (438H)	CH□ Input value shift amount	0	Control	×
481 (1E1H)	681 (2A9H)	881 (371H)	1081 (439H)	System area	—	—	—
482 (1E2H)	682 (2AAH)	882 (372H)	1082 (43AH)	CH□ Wave output step action movement amount	0	Control	×
483 to 499 (1E3H to 1F3H)	683 to 699 (2ABH to 2BBH)	883 to 899 (373H to 383H)	1083 to 1099 (43BH to 44BH)	System area	—	—	—
500 (1F4H)	700 (2BCH)	900 (384H)	1100 (44CH)	CH□ D/A conversion enable/disable setting	1	Setting	×
501 (1F5H)	701 (2BDH)	901 (385H)	1101 (44DH)	System area	—	—	—
502 (1F6H)	702 (2BEH)	902 (386H)	1102 (44EH)	CH□ Scaling enable/disable setting	1	Setting	×
503 (1F7H)	703 (2BFH)	903 (387H)	1103 (44FH)	System area	—	—	—
504 (1F8H)	704 (2C0H)	904 (388H)	1104 (450H)	CH□ Scaling upper limit value (L)	0	Setting	×
505 (1F9H)	705 (2C1H)	905 (389H)	1105 (451H)	CH□ Scaling upper limit value (H)		Setting	×
506 (1FAH)	706 (2C2H)	906 (38AH)	1106 (452H)	CH□ Scaling lower limit value (L)	0	Setting	×
507 (1FBH)	707 (2C3H)	907 (38BH)	1107 (453H)	CH□ Scaling lower limit value (H)		Setting	×
508 (1FCH)	708 (2C4H)	908 (38CH)	1108 (454H)	CH□ Alert output setting	0	Setting	×
509 (1FDH)	709 (2C5H)	909 (38DH)	1109 (455H)	CH□ Rate control enable/disable setting	1	Setting	×
510 (1FEH)	710 (2C6H)	910 (38EH)	1110 (456H)	CH□ Alert output upper limit value	0	Setting	×
511 (1FFH)	711 (2C7H)	911 (38FH)	1111 (457H)	System area	—	—	—
512 (200H)	712 (2C8H)	912 (390H)	1112 (458H)	CH□ Alert output lower limit value	0	Setting	×
513 (201H)	713 (2C9H)	913 (391H)	1113 (459H)	System area	—	—	—
514 (202H)	714 (2CAH)	914 (392H)	1114 (45AH)	CH□ Increase digital limit value	64000	Setting	×
515 (203H)	715 (2CBH)	915 (393H)	1115 (45BH)	System area	—	—	—
516 (204H)	716 (2CCH)	916 (394H)	1116 (45CH)	CH□ Decrease digital limit value	64000	Setting	×
517 to 523 (205H to 20BH)	717 to 723 (2CDH to 2D3H)	917 to 923 (395H to 39BH)	1117 to 1123 (45DH to 463H)	System area	—	—	—

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
524 (20CH)	724 (2D4H)	924 (39CH)	1124 (464H)	CH□ Output setting during wave output stop	1	Setting	×
525 (20DH)	725 (2D5H)	925 (39DH)	1125 (465H)	CH□ Output value during wave output stop	0	Setting	×
526 (20EH)	726 (2D6H)	926 (39EH)	1126 (466H)	CH□ Wave pattern start address setting (L)	10000	Setting	×
527 (20FH)	727 (2D7H)	927 (39FH)	1127 (467H)	CH□ Wave pattern start address setting (H)		Setting	×
528 (210H)	728 (2D8H)	928 (3A0H)	1128 (468H)	CH□ Wave pattern data points setting (L)	0	Setting	×
529 (211H)	729 (2D9H)	929 (3A1H)	1129 (469H)	CH□ Wave pattern data points setting (H)		Setting	×
530 (212H)	730 (2DAH)	930 (3A2H)	1130 (46AH)	CH□ Wave pattern output repetition setting	1	Setting	×
531 (213H)	731 (2DBH)	931 (3A3H)	1131 (46BH)	CH□ Constant for wave output conversion cycle	1	Setting	×
532 to 595 (214H to 253H)	732 to 795 (2DCH to 31BH)	932 to 995 (3A4H to 3E3H)	1132 to 1195 (46CH to 4ABH)	System area	—	—	—
596 (254H)	796 (31CH)	996 (3E4H)	1196 (4ACH)	CH□ HOLD setting value	0	Setting	×
597 (255H)	797 (31DH)	997 (3E5H)	1197 (4ADH)	System area	—	—	—
598 (256H)	798 (31EH)	998 (3E6H)	1198 (4AEH)	CH□ Range setting	3	Setting	×
599 (257H)	799 (31FH)	999 (3E7H)	1199 (4AFH)	System area	—	—	—
1200 to 3599 (4B0H to E0FH)				System area	—	—	—

■Error history (Un\G3600 to Un\G3759)

Address (decimal)	Address (hexadecimal)	Name				Default value	Data type	Auto refresh
3600	E10H	Error history No.1	Error code			0	Monitor	×
3601	E11H		Error time	First two digits of the year	Last two digits of the year			
3602	E12H							
3603	E13H							
3604	E14H							
3605	E15H							
3606 to 3609	E16H to E19H	System area				—	—	—
3610 to 3615	E1AH to E1FH	Error history No.2	Same as error history No.1			0	Monitor	×
3616 to 3619	E20H to E23H	System area				—	—	—
3620 to 3625	E24H to E29H	Error history No.3	Same as error history No.1			0	Monitor	×
3626 to 3629	E2AH to E2DH	System area				—	—	—
3630 to 3635	E2EH to E33H	Error history No.4	Same as error history No.1			0	Monitor	×
3636 to 3639	E34H to E37H	System area				—	—	—
3640 to 3645	E38H to E3DH	Error history No.5	Same as error history No.1			0	Monitor	×
3646 to 3649	E3EH to E41H	System area				—	—	—
3650 to 3655	E42H to E47H	Error history No.6	Same as error history No.1			0	Monitor	×
3656 to 3659	E48H to E4BH	System area				—	—	—
3660 to 3665	E4CH to E51H	Error history No.7	Same as error history No.1			0	Monitor	×
3666 to 3669	E52H to E55H	System area				—	—	—
3670 to 3675	E56H to E5BH	Error history No.8	Same as error history No.1			0	Monitor	×
3676 to 3679	E5CH to E5FH	System area				—	—	—
3680 to 3685	E60H to E65H	Error history No.9	Same as error history No.1			0	Monitor	×
3686 to 3689	E66H to E69H	System area				—	—	—
3690 to 3695	E6AH to E6FH	Error history No.10	Same as error history No.1			0	Monitor	×
3696 to 3699	E70H to E73H	System area				—	—	—
3700 to 3705	E74H to E79H	Error history No.11	Same as error history No.1			0	Monitor	×
3706 to 3709	E7AH to E7DH	System area				—	—	—
3710 to 3715	E7EH to E83H	Error history No.12	Same as error history No.1			0	Monitor	×
3716 to 3719	E84H to E87H	System area				—	—	—
3720 to 3725	E88H to E8DH	Error history No.13	Same as error history No.1			0	Monitor	×
3726 to 3729	E8EH to E91H	System area				—	—	—
3730 to 3735	E92H to E97H	Error history No.14	Same as error history No.1			0	Monitor	×
3736 to 3739	E98H to E9BH	System area				—	—	—
3740 to 3745	E9CH to EA1H	Error history No.15	Same as error history No.1			0	Monitor	×
3746 to 3749	EA2H to EA5H	System area				—	—	—
3750 to 3755	EA6H to EABH	Error history No.16	Same as error history No.1			0	Monitor	×
3756 to 3759	EACH to EAFH	System area				—	—	—

■Alarm history (Un\G3760 to Un\G3999)

Address (decimal)	Address (hexadecimal)	Name				Default value	Data type	Auto refresh	
3760	EB0H	Alarm history No.1	Alarm code			0	Monitor	×	
3761	EB1H		Alarm time	First two digits of the year	Last two digits of the year				
3762	EB2H								
3763	EB3H								
3764	EB4H								
3765	EB5H								
3766 to 3769		EB6H to EB9H		System area		—	—	—	
3770 to 3775		EBAH to EBFH		Alarm history No.2	Same as alarm history No.1		0	Monitor	×
3776 to 3779		EC0H to EC3H		System area		—	—	—	
3780 to 3785		EC4H to EC9H		Alarm history No.3	Same as alarm history No.1		0	Monitor	×
3786 to 3789		ECAH to ECDH		System area		—	—	—	
3790 to 3795		ECEH to ED3H		Alarm history No.4	Same as alarm history No.1		0	Monitor	×
3796 to 3799		ED4H to ED7H		System area		—	—	—	
3800 to 3805		ED8H to EDDH		Alarm history No.5	Same as alarm history No.1		0	Monitor	×
3806 to 3809		EDEH to EE1H		System area		—	—	—	
3810 to 3815		EE2H to EE7H		Alarm history No.6	Same as alarm history No.1		0	Monitor	×
3816 to 3819		EE8H to EEBH		System area		—	—	—	
3820 to 3825		EECH to EF1H		Alarm history No.7	Same as alarm history No.1		0	Monitor	×
3826 to 3829		EF2H to EF5H		System area		—	—	—	
3830 to 3835		EF6H to EFBH		Alarm history No.8	Same as alarm history No.1		0	Monitor	×
3836 to 3839		EFCH to EFFH		System area		—	—	—	
3840 to 3845		F00H to F05H		Alarm history No.9	Same as alarm history No.1		0	Monitor	×
3846 to 3849		F06H to F09H		System area		—	—	—	
3850 to 3855		F0AH to F0FH		Alarm history No.10	Same as alarm history No.1		0	Monitor	×
3856 to 3859		F10H to F13H		System area		—	—	—	
3860 to 3865		F14H to F19H		Alarm history No.11	Same as alarm history No.1		0	Monitor	×
3866 to 3869		F1AH to F1DH		System area		—	—	—	
3870 to 3875		F1EH to F23H		Alarm history No.12	Same as alarm history No.1		0	Monitor	×
3876 to 3879		F24H to F27H		System area		—	—	—	
3880 to 3885		F28H to F2DH		Alarm history No.13	Same as alarm history No.1		0	Monitor	×
3886 to 3889		F2EH to F31H		System area		—	—	—	
3890 to 3895		F32H to F37H		Alarm history No.14	Same as alarm history No.1		0	Monitor	×
3896 to 3899		F38H to F3BH		System area		—	—	—	
3900 to 3905		F3CH to F41H		Alarm history No.15	Same as alarm history No.1		0	Monitor	×
3906 to 3909		F42H to F45H		System area		—	—	—	
3910 to 3915		F46H to F4BH		Alarm history No.16	Same as alarm history No.1		0	Monitor	×
3916 to 3919		F4CH to F4FH		System area		—	—	—	
3920 to 3999		F50H to F9FH		System area		—	—	—	

■Offset/gain setting (Un\G4000 to Un\G9999)

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
4000 to 4131 (FA0H to 1023H)				System area	—	—	—
4130 (1022H)				Offset/gain adjustment value specification	0	Control	×
4131 (1023H)				System area	—	—	—
4132 (1024H)	4134 (1026H)	4136 (1028H)	4138 (102AH)	CH□ Offset/gain setting mode (offset specification)	0	Setting	×
4133 (1025H)	4135 (1027H)	4137 (1029H)	4139 (102BH)	CH□ Offset/gain setting mode (gain specification)	0	Setting	×
4140 to 4163 (102CH to 1043H)				System area	—	—	—
4164 (1044H)	4165 (1045H)	4166 (1046H)	4167 (1047H)	CH□ Offset/gain setting mode (range specification)	0	Setting	×
4168 to 9999 (1048H to 270FH)				System area	—	—	—

■Wave data registration (Un\G10000 to Un\G89999)

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
10000 to 89999 (2710H to 15F8FH)				Wave data registration area	0	Setting	×

In FX3 allocation function mode

○: With refresh setting, ×: Without refresh setting

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
0 (0H)				Range setting	0000H	Setting	×
1 (1H)	2 (2H)	3 (3H)	4 (4H)	CH□ Digital value	0000H	Control	○
5 (5H)				System area	—	—	—
6 (6H)				Output status	0000H	Monitor	×
7 to 27 (7H to 1BH)				System area	—	—	—
28 (1CH)				Disconnection detection flag	0000H	Monitor	○
29 (1DH)				Latest error code	0	Monitor	○
30 (1EH)				Module Information	6164H	Monitor	×
31 (1FH)				System area	—	—	—
32 (20H)	33 (21H)	34 (22H)	35 (23H)	CH□ HOLD setting value	0	Setting	×
36, 37 (24H, 25H)				System area	—	—	—
38 (26H)				Alert output setting	0000H	Setting	×
39 (27H)				Alert output flag (upper/lower limit)	0	Monitor	○
40 (28H)				System area	—	—	—
41 (29H)	42 (2AH)	43 (2BH)	44 (2CH)	CH□ Alert output lower limit value	0	Setting	×
45 (2DH)	46 (2EH)	47 (2FH)	48 (30H)	CH□ Alert output upper limit value	0	Setting	×
49 to 68 (31H to 44H)				System area	—	—	—
69 (45H)				Input signals	0	Monitor	×
70 (46H)				Output signals	0	Control	×
71 to 3100 (47H to C1CH)				System area	—	—	—
3101 (C1DH)				Latest address of error history	0	Monitor	○
3102 (C1EH)				Latest alarm code	0	Monitor	○

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
3103 (C1FH)				Latest address of alarm history	0	Monitor	○
3104 to 3130 (C20H to C3AH)				System area	—	—	—
3131 (C3BH)				Firmware version	—*1	Monitor	×
3132 to 3159 (C3CH to C57H)				System area	—	—	—
3160 (C58H)				Operation mode monitor	0	Monitor	×
3161 to 3169 (C59H to C61H)				System area	—	—	—
3170 (C62H)				Disconnection detection automatic clear enable/disable setting	0	Setting	×
3171 to 3200 (C63H to C80H)				System area	—	—	—
3201 (C81H)	3202 (C82H)	3203 (C83H)	3204 (C84H)	CH□ Setting value check code	0	Monitor	○
3205 to 3210 (C85H to C8AH)				System area	—	—	—
3211 (C8BH)	3212 (C8CH)	3213 (C8DH)	3214 (C8EH)	CH□ Range setting monitor	0	Monitor	×
3215 to 3220 (C8FH to C94H)				System area	—	—	—
3221 (C95H)	3222 (C96H)	3223 (C97H)	3224 (C98H)	CH□ HOLD/CLEAR function setting monitor	1	Monitor	×
3225 to 3249 (C99H to CB1H)				System area	—	—	—
3250 (CB2H)	3252 (CB4H)	3254 (CB6H)	3256 (CB8H)	CH□ Input value shift amount	0	Setting	×
3251 (CB3H)	3253 (CB5H)	3255 (CB7H)	3257 (CB9H)	System area	—	—	—
3258 to 3270 (CBAH to CC6H)				System area	—	—	—
3271 (CC7H)	3272 (CC8H)	3273 (CC9H)	3274 (CCA H)	CH□ D/A conversion enable/disable setting	0	Setting	×
3275 to 3280 (CCBH to CD0H)				System area	—	—	—
3281 (CD1H)	3282 (CD2H)	3283 (CD3H)	3284 (CD4H)	CH□ Scaling enable/disable setting	1	Setting	×
3285 to 3289 (CD5H to CD9H)				System area	—	—	—
3290 (CDAH)	3292 (CDCH)	3294 (CDEH)	3296 (CE0H)	CH□ Scaling upper limit value (L)	0	Setting	×
3291 (CDBH)	3293 (CDDH)	3295 (CDFH)	3297 (CE1H)	CH□ Scaling upper limit value (H)		Setting	×
3298 to 3309 (CE2H to CEDH)				System area	—	—	—
3310 (CEEH)	3312 (CF0H)	3314 (CF2H)	3316 (CF4H)	CH□ Scaling lower limit value (L)	0	Setting	×
3311 (CEFH)	3313 (CF1H)	3315 (CF3H)	3317 (CF5H)	CH□ Scaling lower limit value (H)		Setting	×
3318 to 3330 (CF6H to D02H)				System area	—	—	—
3331 (D03H)	3332 (D04H)	3333 (D05H)	3334 (D06H)	CH□ Rate control enable/disable setting	1	Setting	×
3335 to 3339 (D07H to D0BH)				System area	—	—	—
3340 (D0CH)	3342 (D0EH)	3344 (D10H)	3346 (D12H)	CH□ Increase digital limit value	64000	Setting	×
3341 (D0DH)	3343 (D0FH)	3345 (D11H)	3347 (D13H)	System area	—	—	—
3348 to 3359 (D14H to D1FH)				System area	—	—	—
3360 (D20H)	3362 (D22H)	3364 (D24H)	3366 (D26H)	CH□ Decrease digital limit value	64000	Setting	×
3361 (D21H)	3363 (D23H)	3365 (D25H)	3367 (D27H)	System area	—	—	—
3368 to 4000 (D28H to FA0H)				System area	—	—	—
4001 to 4016 (FA1H to FB0H)				Interrupt factor detection flag [n] ^{*2}	0	Monitor	○
4017 to 4020 (FB1H to FB4H)				System area	—	—	—
4021 to 4036 (FB5H to FC4H)				Interrupt factor mask [n] ^{*2}	0	Control	×
4037 to 4040 (FC5H to FC8H)				System area	—	—	—
4041 to 4056 (FC9H to FD8H)				Interrupt factor reset request [n] ^{*2}	0	Control	×
4057 to 4060 (FD9H to FDCH)				System area	—	—	—
4061 to 4076 (FDDH to FECH)				Interrupt factor generation setting [n] ^{*2}	0	Setting	×
4077 to 4080 (FEDH to FF0H)				System area	—	—	—
4081 to 4096 (FF1H to 1000H)				Condition target setting [n] ^{*2}	0	Setting	×
4097 to 4100 (1001H to 1004H)				System area	—	—	—
4101 to 4116 (1005H to 1014H)				Condition target channel setting [n] ^{*2}	0	Setting	×
4117 to 4119 (1015H to 1017H)				System area	—	—	—

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
4120, 4121 (1018H, 1019H)				Mode switching setting	0	Setting	×
4122 to 4129 (101AH to 1021H)				System area	—	—	—
4130 (1022H)				Offset/gain adjustment value specification	0	Control	×
4131 (1023H)	4132 (1024H)	4133 (1025H)	4134 (1026H)	CH□ Offset/gain setting mode (offset specification)	0	Setting	×
4135 to 4140 (1027H to 102CH)				System area	—	—	—
4141 (102DH)	4142 (102EH)	4143 (102FH)	4144 (1030H)	CH□ Offset/gain setting mode (gain specification)	0	Setting	×
4145 to 4150 (1031H to 1036H)				System area	—	—	—
4151 (1037H)	4152 (1038H)	4153 (1039H)	4154 (103AH)	CH□ Offset/gain setting mode (range specification)	0	Setting	×
4155 to 4159 (103BH to 103FH)				System area	—	—	—
4160 (1040H)				Offset/gain initialization enable code	0	Setting	×
4161 to 8599 (1041H to 2197H)				System area	—	—	—
8600 to 8609 (2198H to 21A1H)				Error history No.1	0	Monitor	×
8610 to 8619 (21A2H to 21ABH)				Error history No.2	0	Monitor	×
8620 to 8629 (21ACH to 21B5H)				Error history No.3	0	Monitor	×
8630 to 8639 (21B6H to 21BFH)				Error history No.4	0	Monitor	×
8640 to 8649 (21C0H to 21C9H)				Error history No.5	0	Monitor	×
8650 to 8659 (21CAH to 21D3H)				Error history No.6	0	Monitor	×
8660 to 8669 (21D4H to 21DDH)				Error history No.7	0	Monitor	×
8670 to 8679 (21DEH to 21E7H)				Error history No.8	0	Monitor	×
8680 to 8689 (21E8H to 21F1H)				Error history No.9	0	Monitor	×
8690 to 8699 (21F2H to 21FBH)				Error history No.10	0	Monitor	×
8700 to 8709 (21FCH to 2205H)				Error history No.11	0	Monitor	×
8710 to 8719 (2206H to 220FH)				Error history No.12	0	Monitor	×
8720 to 8729 (2210H to 2219H)				Error history No.13	0	Monitor	×
8730 to 8739 (221AH to 2223H)				Error history No.14	0	Monitor	×
8740 to 8749 (2224H to 222DH)				Error history No.15	0	Monitor	×
8750 to 8759 (222EH to 2237H)				Error history No.16	0	Monitor	×
8760 to 8769 (2238H to 2241H)				Alarm history No.1	0	Monitor	×
8770 to 8779 (2242H to 224BH)				Alarm history No.2	0	Monitor	×
8780 to 8789 (224CH to 2255H)				Alarm history No.3	0	Monitor	×
8790 to 8799 (2256H to 225FH)				Alarm history No.4	0	Monitor	×
8800 to 8809 (2260H to 2269H)				Alarm history No.5	0	Monitor	×
8810 to 8819 (226AH to 2273H)				Alarm history No.6	0	Monitor	×
8820 to 8829 (2274H to 227DH)				Alarm history No.7	0	Monitor	×
8830 to 8839 (227EH to 2287H)				Alarm history No.8	0	Monitor	×
8840 to 8849 (2288H to 2291H)				Alarm history No.9	0	Monitor	×
8850 to 8859 (2292H to 229BH)				Alarm history No.10	0	Monitor	×
8860 to 8869 (229CH to 22A5H)				Alarm history No.11	0	Monitor	×
8870 to 8879 (22A6H to 22AFH)				Alarm history No.12	0	Monitor	×
8880 to 8889 (22B0H to 22B9H)				Alarm history No.13	0	Monitor	×
8890 to 8899 (22BAH to 22C3H)				Alarm history No.14	0	Monitor	×
8900 to 8909 (22C4H to 22CDH)				Alarm history No.15	0	Monitor	×
8910 to 8919 (22CEH to 22D7H)				Alarm history No.16	0	Monitor	×
8920 to 8999 (22D8H to 2327H)				System area	—	—	—
9000 (2328H)				Step action wave output request	0	Control	×
9001 (2329H)	9002 (232AH)	9002 (232BH)	9004 (232CH)	CH□ Wave output status monitor	0	Monitor	○
9005 to 9009 (232DH to 2331H)				System area	—	—	—

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
9010 (2332H)	9012 (2334H)	9014 (2336H)	9016 (2338H)	CH□ Wave output conversion cycle monitor (L)	0	Monitor	×
9011 (2333H)	9013 (2335H)	9015 (2337H)	9017 (2339H)	CH□ Wave output conversion cycle monitor (H)		Monitor	×
9018 to 9029 (233AH to 2345H)				System area	—	—	—
9030 (2346H)	9032 (2348H)	9034 (234AH)	9036 (234CH)	CH□ Wave pattern output count monitor	0	Monitor	×
9031 (2347H)	9033 (2349H)	9035 (234BH)	9037 (234DH)	System area	—	—	—
9038 to 9049 (234EH to 2359H)				System area	—	—	—
9050 (235AH)	9052 (235CH)	9054 (235EH)	9056 (2360H)	CH□ Wave output current address monitor (L)	0	Monitor	×
9051 (235BH)	9053 (235DH)	9055 (235FH)	9057 (2361H)	CH□ Wave output current address monitor (H)		Monitor	×
9058 to 9069 (2362H to 236DH)				System area	—	—	—
9070 (236EH)	9072 (2370H)	9074 (2372H)	9076 (2374H)	CH□ Wave output current digital value monitor	0	Monitor	×
9071 (236FH)	9073 (2371H)	9075 (2373H)	9077 (2375H)	System area	—	—	—
9078 to 9089 (2376H to 2381H)				System area	—	—	—
9090 (2382H)	9092 (2384H)	9094 (2386H)	9096 (2388H)	CH□ Wave output digital value outside the range Address monitor (L)	0	Monitor	×
9091 (2383H)	9093 (2385H)	9095 (2387H)	9097 (2389H)	CH□ Wave output digital value outside the range Address monitor (H)		Monitor	×
9098 to 9109 (238AH to 2395H)				System area	—	—	—
9110 (2396H)	9112 (2398H)	9114 (239AH)	9116 (239CH)	CH□ Wave output warning Address monitor (L)	0	Monitor	×
9111 (2397H)	9113 (2399H)	9115 (239BH)	9117 (239DH)	CH□ Wave output warning Address monitor (H)		Monitor	×
9118 to 9130 (239EH to 23AAH)				System area	—	—	—
9131 (23ABH)	9132 (23ACH)	9133 (23ADH)	9134 (23AEH)	CH□ Wave output start/stop request	0	Control	×
9135 to 9139 (23AFH to 23B3H)				System area	—	—	—
9140 (23B4H)	9142 (23B6H)	9144 (23B8H)	9146 (23BAH)	CH□ Wave output step action movement amount	0	Control	×
9141 (23B5H)	9143 (23B7H)	9145 (23B9H)	9147 (23BBH)	System area	—	—	—
9148 to 9160 (23BCH to 23C8H)				System area	—	—	—
9161 (23C9H)	9162 (23CAH)	9163 (23CBH)	9164 (23CCH)	CH□ Output setting during wave output stop	1	Setting	×
9165 to 9170 (23CDH to 23D2H)				System area	—	—	—
9171 (23D3H)	9172 (23D4H)	9173 (23D5H)	9174 (23D6H)	CH□ Output value during wave output stop	0	Setting	×
9175 to 9179 (23D7H to 23DBH)				System area	—	—	—
9180 (23DCH)	9182 (23DEH)	9184 (23E0H)	9186 (23E2H)	CH□ Wave pattern start address setting (L)	10000	Setting	×
9181 (23DDH)	9183 (23DFH)	9185 (23E1H)	9187 (23E3H)	CH□ Wave pattern start address setting (H)		Setting	×
9188 to 9199 (23E4H to 23EFH)				System area	—	—	—
9200 (23F0H)	9202 (23F2H)	9204 (23F4H)	9206 (23F6H)	CH□ Wave pattern data points setting (L)	0	Setting	×
9201 (23F1H)	9203 (23F3H)	9205 (23F5H)	9207 (23F7H)	CH□ Wave pattern data points setting (H)		Setting	×
9208 to 9220 (23F8H to 2404H)				System area	—	—	—
9221 (2405H)	9222 (2406H)	9223 (2407H)	9224 (2408H)	CH□ Wave pattern output repetition setting	1	Setting	×
9225 to 9230 (2409H to 240EH)				System area	—	—	—

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
9231 (240FH)	9232 (2410H)	9233 (2411H)	9234 (2412H)	CH□ Constant for wave output conversion cycle	1	Setting	×
9235 to 9999 (2413H to 270FH)				System area	—	—	—
10000 to 89999 (2710H to 15F8FH)				Wave data registry area	0	Setting	×

*1 The firmware version of the analog output module is stored. For Ver. 1.000, 1000 is stored.

*2 [n] in the table indicates an interrupt setting number. (n = 1 to 16)

Details of buffer memory addresses

This section details the buffer memory areas of the analog output module.



This section describes buffer memory addresses for CH1.

Latest error code

The latest error code detected in the analog output module is stored. For details, refer to the following.

Page 281 List of error codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest error code	0			
Latest error code (in FX3 allocation mode function)	29			

■Clearing an error

Turn on and off 'Error clear request' (Un\G70, b15).

Latest address of error history

Among 'Error history No.□' (Un\G3600 to Un\G3759), a buffer memory address which stores the latest error code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest address of error history	1			
Latest address of error history (in FX3 allocation mode function)	3101			

Latest alarm code

The latest alarm code detected in the analog output module is stored. For details, refer to the following.

Page 284 List of alarm codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest alarm code	2			
Latest alarm code (in FX3 allocation mode function)	3102			

■Clearing an alarm

Turn on and off 'Error clear request' (Un\G70, b15).

Latest address of alarm history

Among 'Alarm history No.□' (Un\G3760 to Un\G3999), a buffer memory address which stores the latest alarm code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest address of alarm history	3			
Latest address of alarm history (in FX3 allocation mode function)	3103			

Interrupt factor detection flag [n]

The detection status of the interrupt factor is stored.

Monitor value	Description
0	No interrupt factor
1	Interrupt factor

When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor detection flag [n]	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Interrupt factor detection flag [n] (in FX3 allocation mode)	4001	4002	4003	4004	4005	4006	4007	4008	4009	4010	4011	4012	4013	4014	4015	4016

Module information

Module information of FX5-4DA is stored. For module information, 6160H (fixed hexadecimal value) is stored.

- In the normal mode: 6160H
- In the FX3 allocation mode: 6164H

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Module Information	30			
Module information (in FX3 allocation mode function)	30			

Firmware version

Firmware version is stored. Firmware version is stored in 4 digit decimal number.

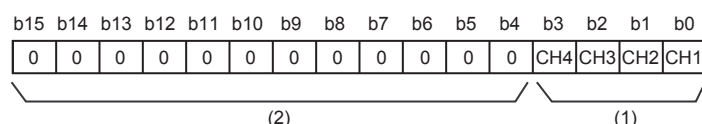
■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Firmware version	31			
Firmware version (in FX3 allocation mode function)	3131			

Alarm output upper limit flag

The upper limit alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Alarm output upper limit flag	36			

■Alarm output upper limit flag status

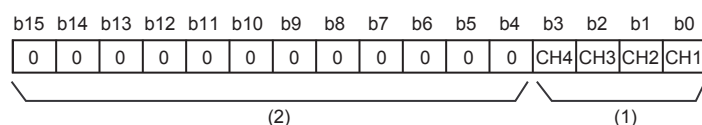
- When the value is out of the range specified in the alert output upper limit value, Alert alarm ON (1) is stored in 'Alarm output upper limit flag' (Un\G36) corresponding to each channel.
- When an alert is detected in any channel where the D/A conversion and the alert output setting are enabled, 'Alarm output signal' (Un\G69, b14) also turns on.

■Clearing Alarm output upper limit flag

Turn on and off 'Operating condition setting request' (Un\G70, b9) or 'Alarm output clear request' (Un\G70, b14).

Alarm output lower limit flag

The lower limit alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Alarm output lower limit flag	37			

■Alarm output lower limit flag status

- When the value is out of the range specified in the alert output lower limit value, Alert alarm ON (1) is stored in 'Alarm output lower limit flag' (Un\G37) corresponding to each channel.
- When an alert is detected in any channel where the D/A conversion and the alert output setting are enabled, 'Alarm output signal' (Un\G69, b14) also turns on.

■Clearing Alarm output lower limit flag

Turn on and off 'Operating condition setting request' (Un\G70, b9) or 'Alarm output clear request' (Un\G70, b14).

Alarm output flag (upper/lower limit)

When the FX3 allocation mode function is used, the upper/lower limit alarm can be checked.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH4 Upper limit value	CH4 Lower limit value	CH3 Upper limit value	CH3 Lower limit value	CH2 Upper limit value	CH2 Lower limit value	CH1 Upper limit value	CH1 Lower limit value
(2)								(1)							

(1) 0: Normal, 1: Alarm ON

(2) b8 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Alarm output flag (upper/lower limit) (in FX3 allocation mode function)	39			

■Alarm output flag status

- When the value is out of the range specified in the alert output upper limit value or alert output lower limit value, Alert alarm ON (1) is stored in 'Alarm output flag' (Un\G48) corresponding to each channel.
- When an alert is detected in any channel where the D/A conversion and the alert output setting are enabled, 'Alarm output signal' (Un\G69, b14) also turns on.

■Clearing Alarm output flag

Turn on and off 'Operating condition setting request' (Un\G70, b9) or 'Alarm output clear request' (Un\G70, b14).

Disconnection detection flag

By setting 4 to 20 mA, 0 to 20 mA, or user range (current) for the analog output range and enabling the D/A conversion, a disconnection can be detected for each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1
(2)												(1)			

(1) 0: Normal, 1: Disconnection detection

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Disconnection detection flag	38			
Disconnection detection flag (in FX3 allocation mode function)	28			

■Status of Disconnection detection flag

- When a disconnection is detected, Disconnection detection (1) is stored in 'Disconnection detection flag' (Un\G38) corresponding to each channel.
- When a disconnection is detected in any channel, 'Disconnection detection signal' (Un\G69, b13) turns on.

■Clearing disconnection detection flag

Even if the disconnection cause is eliminated from the disconnected state when the disconnection detection auto-clear enable/disable setting is disabled, analog output does not restart automatically to prevent an incorrect output.

To restart analog output, perform the following. Analog output restarts according to the state of CH□ Output enable/disable flag (Un\G70, b1 to 4).

- In the normal output mode

Check the CH□ Digital value, and then turn on and off 'Error clear request' (Un\G70, b15).

- In the wave output mode

Turn on and off 'Error clear request' (Un\G70, b15) , and set CH□ Wave output start/stop request to Wave output start request (1).

If disconnection detection auto-clear enable/disable setting is enable, perform the following. Analog output restarts according to the state of CH□ Output enable/disable flag (Un\G70, b1-4).

- In the normal output mode

When the cause of the disconnection is eliminated from the disconnected state, analog output restarts.



At the same time analog output restarts, the disconnection detection flag of the corresponding channel is cleared.

Operation mode monitor

The current normal mode can be checked.

Monitor value	Description
0H	Normal output mode
1H	Offset/gain setting mode
2H	Wave output mode

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Operation mode monitor	60			
Operation mode monitor (In FX3 allocation mode function)	3160			

Input signals

A state of an analog output module can be checked in the buffer memory area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Input signals	69			
Input signals (In FX3 allocation mode function)	69			

■List of input signals

Buffer memory	Description
b0	Module READY
b1 to 4	Use not allowed
b5	Offset/gain initialization completed flag
b6	Use not allowed
b7	External power supply READY flag
b8	Use not allowed
b9	Operating condition setting completed flag
b10	Offset/gain setting mode status flag
b11	Channel change completed flag
b12	Set value change completed flag
b13	Disconnection detection signal
b14	Alert output signal
b15	Error flag

■Module READY (b0)

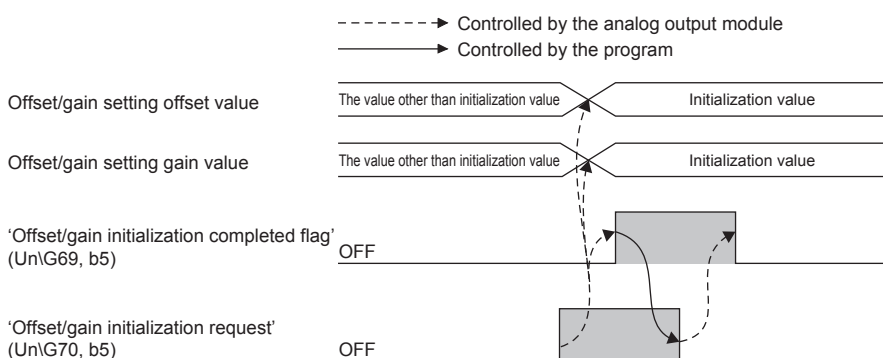
'Module READY' (Un\G69, b0) turns on to indicate the preparation for the D/A conversion is completed after the power-on or the reset operation of the CPU module.

In the following cases, 'Module READY' turns off.

- In the offset/gain setting mode (In this case, the D/A conversion is performed.)
- When a watchdog timer error occurs in the analog output module (In this case, the D/A conversion is not performed.)

■Offset/gain initialization completed flag (b5)

- Use as an interlock condition to turn on and off 'Offset/gain initialization request' (Un\G70, b5).
- After the offset/gain initialization is executed, the offset/gain initialization completed flag turns on from off.
- Offset/gain initialization is not be performed unless 'Offset/gain initialization enabled code' (Un\G305) is set to E20FH.
- It is possible to perform offset/gain initialization in normal output mode only.
- When 'Offset/gain initialization request' (Un\G70, b5) is off, 'Offset/gain initialization complete flag' (Un\G69, b5) turns off.



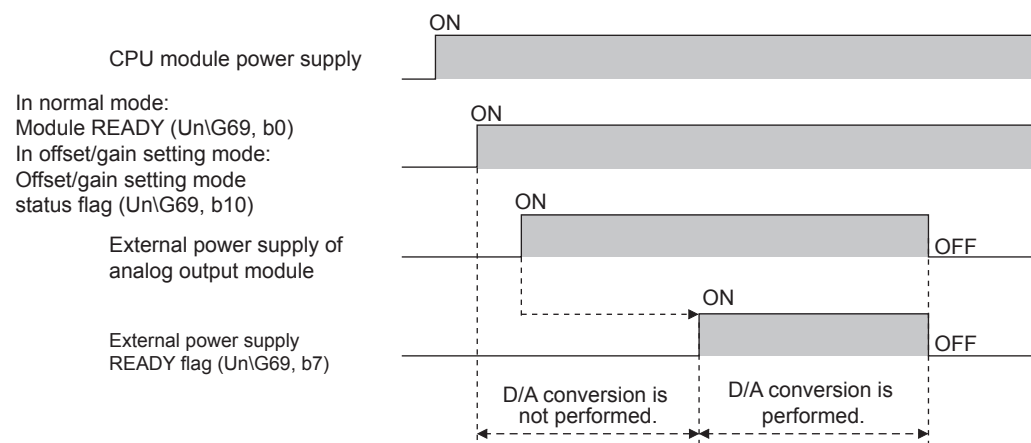
■External power supply READY flag (b7)

- When the external power supply is off

'External power supply READY flag' (Un\G69, b7) remains off and D/A conversion processing is not performed. In this case, the analog output value is 0 V/0 mA.

- When the external power supply is turned off and on

When the external power supply turns on, 'External power supply READY flag' (Un\G69, b7) turns on. The D/A conversion is started on the channels where the D/A conversion is enabled.



- When the external power supply is turned on and off

'External power supply READY flag' (Un\G69, b7) turns off and the D/A conversion stops. In this case, the analog output value is 0 V/0 mA. When the external power supply is turned off and on again, 'External power supply READY flag' (Un\G69, b7) turns on after 200ms as described above and the D/A conversion is restarted.

A

Precautions

Use the external power supply that satisfies the specifications defined in the "Power Supply Specifications" section.

Otherwise, 'External power supply READY flag' (Un\G69, b7) does not turn on. For the power supply specifications, refer to

Page 180 Power supply specifications.

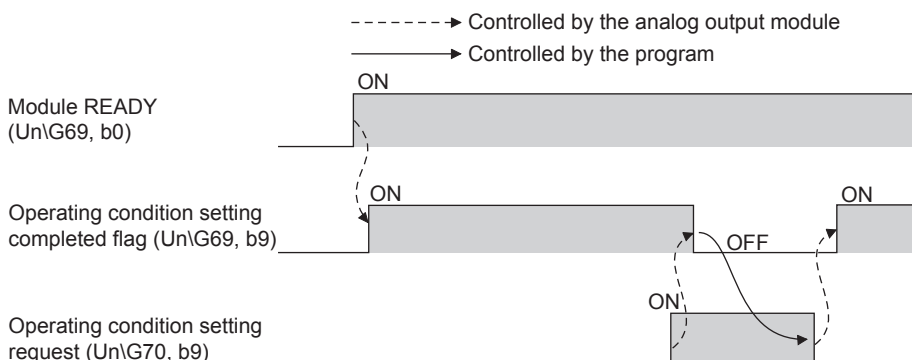
■Operating condition setting completed flag (b9)

When changing values of the buffer memory, use 'Operating condition setting completed flag' (Un\G69, b9) as an interlock condition to turn on and off 'Operating condition setting request' (Un\G70, b9).

For the buffer memory addresses which require turning on and off of 'Operating condition setting request' (Un\G70, b9) to enable the changed values, refer to the following.

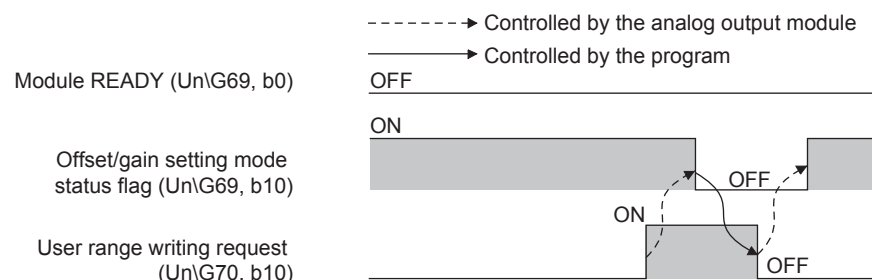
☞ Page 289 Buffer Memory Areas

When 'Operating condition setting request' (Un\G70, b9) is on, 'Operating condition setting completed flag' (Un\G69, b9) turns off.



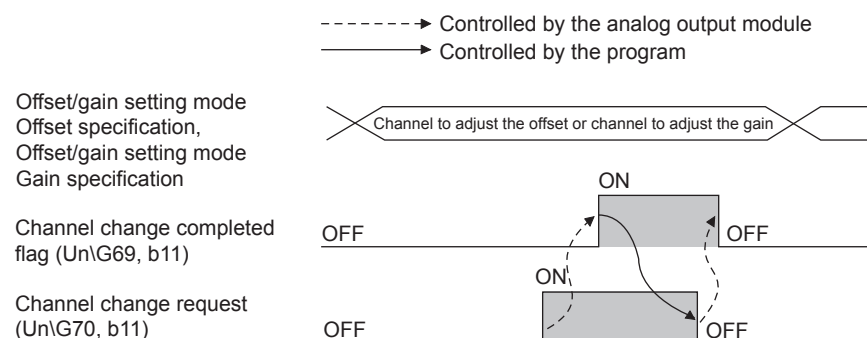
■Offset/gain setting mode status flag (b10)

When registering the value, which has been adjusted with the offset/gain setting, use 'Offset/gain setting mode status flag' (Un\G69, b10) as an interlock condition to turn on and off 'User range write request' (Un\G70, b10).



■Channel change completed flag (b11)

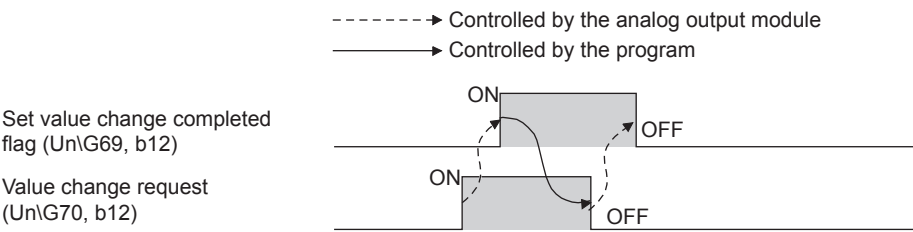
When changing a channel to perform the offset/gain setting, use 'Channel change completed flag' (Un\G69, b11) as an interlock condition to turn on and off 'Channel change request' (Un\G70, b11).



■Set value change completed flag (b12)

When adjusting the offset gain setting, use 'Set value change completed flag' (Un\G69, b12) as an interlock condition to turn on and off 'Value change request Un\G70, b12).

When the external power supply is off, the 'Set value change completed flag' (Un\G69, b12) does not turn on. After turning on the external power supply, turn on and off again 'Value change request' (Un\G70, b12).

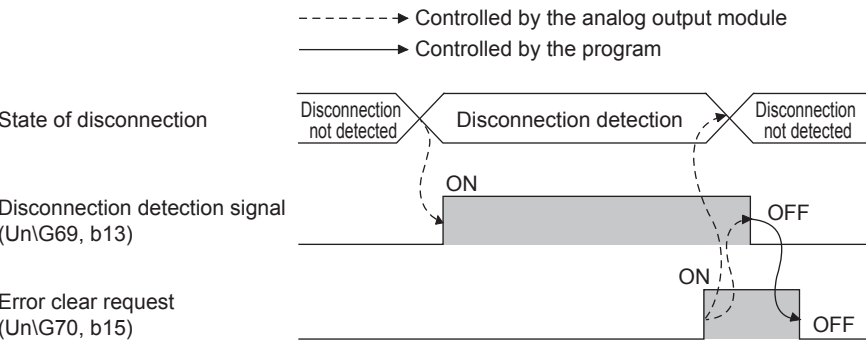


■Disconnection detection signal (b13)

'Disconnection detection signal' (Un\G69, b13) turns on when a disconnection is detected in a channel while the current of 4 to 20 mA, 0 to 20 mA, or user range is in use.

If disconnection detection auto-clear enable/disable setting is disable, 'Disconnection detection signal' (Un\G69, b13) turns off by turning on and off 'Error clear request' (Un\G70, b15) or 'Operating condition setting request' (Un\G70, b9) after the cause of the disconnection is eliminated.

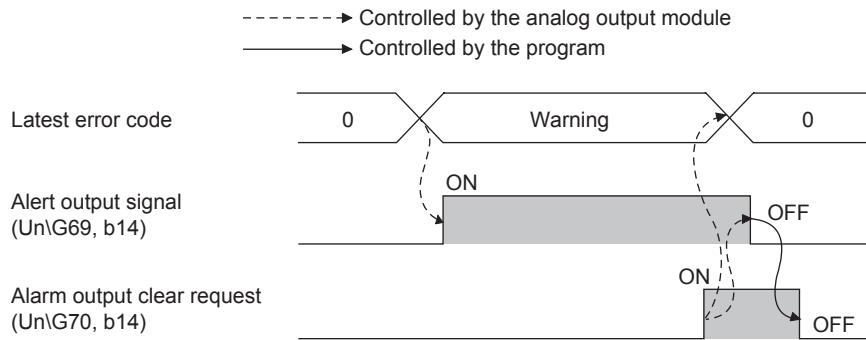
When the cause of disconnection is eliminated if disconnection detection auto-clear enable/disable setting is enable, the disconnection detection signal automatically turns off.



■Alarm output signal (b14)

If the D/A conversion is enabled, this signal turns on when the 'CH1 Digital value' (Un\G460) exceeds 'CH1 Alarm output upper limit value' (Un\G510) or falls below 'CH1 Alarm output lower limit value' (Un\G512).

By turning on and off 'Alert output clear request' (Un\G70, b14) or turning off and on 'Operating condition setting request' (Un\G70, b9) after the cause of the warning is eliminated, 'Alert output signal' (Un\G69, b14) turns off and 'Latest alarm code' (Un\G2) is cleared.

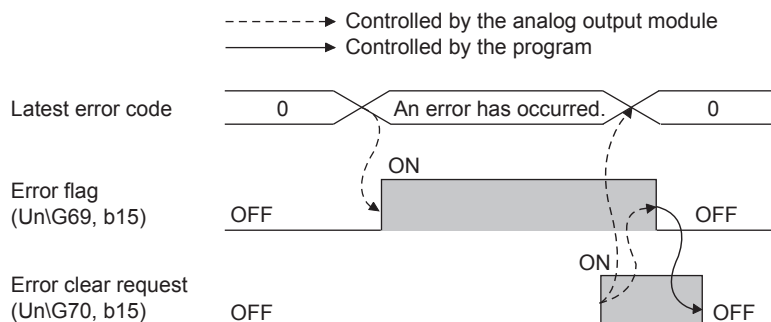


A

■Error flag (b15)

'Error flag' (Un\G69, b15) turns on when an error occurs.

By turning on and off 'Error clear request' (Un\G70, b15) after the cause of the error is eliminated, 'Error flag' (Un\G69, b15) turns off and 'Latest error code' (Un\G0) is cleared.



Output signals

A state of FX5-4DA can be checked in the buffer memory area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Output signals	70			
Output signals (In FX3 allocation mode function)	70			

■List of output signals

Buffer memory	Description
b0	Use not allowed
b1	CH1 Output enable/disable flag
b2	CH2 Output enable/disable flag
b3	CH3 Output enable/disable flag
b4	CH4 Output enable/disable flag
b5	Offset/gain initialization request
b6 to 8	Use not allowed
b9	Operating condition setting request
b10	User range write request
b11	Channel change request
b12	Value change request
b13	Use not allowed
b14	Alert output clear request
b15	Error clear request

■CH1-4 Output enable/disable flag (b1-4)

Set whether to output the D/A conversion value or offset value.

ON: D/A conversion value

OFF: Offset value

■Offset/gain initialization request (b5)

Turn on and off to enable the settings of buffer memory areas.

Offset/gain initialization is not to be performed unless offset/gain initialization enabled code is set to E20FH.

It is possible to perform offset/gain initialization in normal mode only.

When 'Offset/gain initialization request' (Un\G70, b5) is off, 'Offset/gain initialization complete flag' (Un\G69, b5) turns off.

■Operating condition setting request (b9)

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting of the buffer memory address.

For the timing of turning the signal on and off, refer to the following.

☞ Page 306 Operating condition setting completed flag (b9)

■User range write request (b10)

In the offset/gain setting mode, turn on and off 'User range write request' (Un\G70, b10) to register the values adjusted with offset/gain setting in an analog output module. The data is written to the flash memory when this signal is turned off and on.

For the timing of turning the signal on and off, refer to the following.

☞ Page 306 Offset/gain setting mode status flag (b10)

■Channel change request (b11)

Turn on and off 'Channel change request' (Un\G70, b11) to change a channel to perform the offset/gain setting.

For the timing of turning the signal on and off, refer to the following.

☞ Page 306 Channel change completed flag (b11)

■Value change request (b12)

Turn on and off 'Value change request' (Un\G70, b12) to change the analog output value to adjust the offset/gain setting.

The analog output value increases or decreases depending on the value set for the offset/gain adjustment value specification.

For the timing of turning the signal on and off, refer to the following.

☞ Page 307 Set value change completed flag (b12)

■Alarm output clear request (b14)

When clearing the alarm output, turn on and off this signal.

For the timing of turning the signal on and off, refer to the following.

☞ Page 307 Alarm output signal (b14)

■Error clear request (b15)

Turn on and off 'Error clear request' (Un\G70, b15) to clear 'Error flag' (Un\G69, b15), 'Latest error code' Un\G0, and 'Latest alarm code' (Un\G2).

For the timing of turning the signal on and off, refer to the following.

☞ Page 308 Error flag (b15)

Interrupt factor mask [n]

Set Interrupt factor mask to be used.

Setting value	Setting content
0	Mask (Interrupt unused)
1	Mask clear (Interrupt used)

When 'Interrupt factor mask [n]' (Un\G124 to G139) is set to Mask clear (Interrupt used) (1) and an interrupt factor occurs, an interrupt request is sent to the CPU module. When the set value is two or larger, the setting is regarded as Mask clear (Interrupt used) (1).

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor mask [n]	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
Interrupt factor mask [n] (in FX3 allocation mode function)	4021	4022	4023	4024	4025	4026	4027	4028	4029	4030	4031	4032	4033	4034	4035	4036

■Default value

The default value is Mask (Interrupt unused) (0) for buffer memory areas.

Interrupt factor reset request [n]

An interrupt factor reset request is sent.

Setting value	Setting content
0	No reset request
1	Reset request

When Reset request (1) is set to 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the interrupt factor corresponding to the specified interrupt is reset. After that, 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) turns to 'No interrupt factor' (0). When the set value is two or larger, the setting is regarded as Reset request (1). Interrupt factors can also be reset by turning on and off 'Operating condition setting request' (Un\G70, b9).

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor reset request [n]	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171
Interrupt factor reset request [n] (in FX3 allocation mode function)	4041	4042	4043	4044	4045	4046	4047	4048	4049	4050	4051	4052	4053	4054	4055	4056

■Default value

The default value is No reset request (0) for buffer memory areas.

Step action wave output request

Set whether to execute the step action wave output for all the analog output channels in a batch.

Step action wave output request	Setting value
OFF	0
ON	1

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored. When the setting value is changed from OFF (0) to ON (1), the wave output status in all the channels, where the D/A conversion is enabled, is changed to During wave output step action and the wave output step action function is enabled. When the setting value is changed from ON (1) to OFF (0), the wave output status is changed to During wave output stop and the wave output step action ends.

When a value out of the setting range is set, a step action wave output request range error (error code: 1D80H) occurs and the wave output status is not changed.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Step action wave output request	188			
Step action wave output request (in FX3 allocation mode function)	9000			

■Default value

The default value is OFF (0).

Interrupt factor generation setting [n]

Set an interrupt request for when the same interrupt factor occurs during the interrupt factor detection.

Setting value	Setting content
0	Interrupt resend request
1	No interrupt resend request

- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is Interrupt resend request (0) and the same interrupt factor occurs during the interrupt factor detection, an interrupt request is sent to the CPU module again.
- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is No interrupt resend request (1) and the same interrupt factor occurs during the interrupt factor detection, an interrupt request is not sent to the CPU module.

If a value other than the above is set, an interrupt factor generation setting range error (error code: 180△H) occurs.

"n" and △ indicate an interrupt setting number. (n = 1 to 16, △ = 0 to F)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor generation setting [n]	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
Interrupt factor generation setting [n] (in FX3 allocation mode)	4061	4062	4063	4064	4065	4066	4067	4068	4069	4070	4071	4072	4073	4074	4075	4076

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Interrupt resend request (0) for all buffer memory areas.

Condition target setting [n]

Set an interrupt factor to be detected.

Setting value	Setting content
0	Disable
1	Error flag (Un\G69, b15)
2	Alert output flag
3	Disconnection detection flag
4	External power supply READY flag (Un\G69, b7)

If a value other than the above is set, a condition target setting range error (error code: 181△H) occurs.

Turning off and on 'Error flag', 'Alarm output flag' and 'Disconnection detection flag' set in 'Condition target setting [n]' (Un\G232 to Un\G247) or turning on and off 'External power supply READY flag' set in 'Condition target setting [n]' (Un\G232 to Un\G247) send an interrupt request for the CPU module.

"n" and △ indicate an interrupt setting number. (n = 1 to 16, △ = 0 to F)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target setting [n]	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247
Condition target setting [n] (in FX3 allocation mode function)	4081	4082	4083	4084	4085	4086	4087	4088	4089	4090	4091	4092	4093	4094	4095	4096

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Disable (0) for all buffer memory areas.

Condition target channel setting [n]

Set a channel where an interrupt is detected.

Setting value	Setting content
0	All specification
1	CH1
2	CH2
3	CH3
4	CH4

When a factor for the channel specification is set to 'Condition target setting [n]' (Un\G232 to Un\G247), an interrupt factor in the channel set by this area is monitored. If a value other than the above is set, a condition target setting range error (error code: 182△H) occurs.

"n" and △ indicates an interrupt setting number. (n = 1 to 16, △ = 0 to F)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target channel setting [n]	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279
Condition target channel setting [n] (in FX3 allocation mode function)	4160	4161	4162	4163	4164	4165	4166	4167	4168	4169	4170	4171	4172	4173	4174	4175

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is All CH specification (0) for all buffer memory areas.

Mode switching setting

Set a setting value for the mode to be switched.

Destination mode	Buffer memory address	Setting value
Normal output mode	296	4658H
	297	4441H
Offset/gain setting mode	296	4441H
	297	4658H

When a value other than the above is set, the mode switching is not executed and only the operating condition is changed. In this case, this area is cleared to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Mode switching setting	296, 297			
Mode switching setting (in FX3 allocation mode function)	4121, 4122			

■Enabling the setting

Turn on 'Operating condition setting request' (Un\G70, b9).

■After the mode is switched

When the mode is switched, this area is cleared to 0 and 'Operating condition setting completed flag' (Un\G69, b9) turns off. After checking that 'Operating condition setting completed flag' (Un\G69, b9) is off, turn off 'Operating condition setting request' (Un\G70, b9).

■Default value

The default value is 0.

Disconnection detection automatic clear enable/disable setting

Set whether to enable or disable an automatic clear of disconnection detection of the disconnection detection function. The setting is enable only in the normal output mode.

Setting value	Description
0	Enable
1	Disable

Setting a value other than in the table above results in operation with Disable (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
Disconnection detection automatic clear enable/disable setting	304			
Disconnection detection auto-clear enable/disable setting (in FX3 allocation mode function)	3170			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

- In the normal mode: The default value is Disable (1) for all the channels.
- In the FX3 allocation mode: The default value is Enable (0) for all the channels.

Offset/gain initialization enable code

When the 'offset/gain initialization request' (Un\G70, b5) turns on from off by setting the enable code "E20FH" in this area at the time of initialization of offset/gain, the offset value and the gain value in the flash memory of the analog output module are initialized.

When setting anything other than "E20FH" in this area, initialization is not executed.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
Offset/gain initialization enable code	305			
Offset/gain initialization enable code (In FX3 allocation mode function)	4160			

■Default value

The default value is 0.

CH1 Setting value check code

The check result of whether the set digital value is within the setting range can be checked.

The target values are 'CH1 Digital value' (Un\G460) in the normal output mode and the wave data to be output in the wave output mode.

When a digital value out of the setting range is written, one of the following check codes is stored.

Check code	Description
000FH	A digital value exceeding the upper limit of the setting range has been written.
00F0H	A digital value below the lower limit of the setting range has been written.
00FFH	A digital value falling short of the setting range and a digital value exceeding the upper limit setting range have been written. This check code may be stored when a check code is not reset.

Once the check code is stored, the code is not reset even when the digital value falls within the setting range.

To reset the check code, rewrite the digital value to a value within the setting range and turn on and off 'Error clear request' (Un\G70, b15).

Point

When the scaling function is used, the value of 'CH1 Digital value' (Un\G460) which has undergone a scale conversion is checked. Note that some errors may be observed in the target digital value for a check code to be stored due to the calculation error of scale conversion when a scale-converted value exceeds the setting range.

When a check code is stored in the wave output, the address of the wave data which is out of the setting range can be checked with 'CH1 Wave output digital value outside the range Address monitor' (Un\G440 to Un\G441).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Setting value check code	400	600	800	1000
CH□ Setting value check code (in FX3 allocation mode function)	3201	3202	3203	3204

CH1 Wave output status monitor

The wave output status can be checked.

Monitor value	Description
0H	During wave output stop
1H	During wave output
2H	Wave output pause
3H	During wave output step action

Only when the wave output function is used and the operation mode is normal mode, a value is stored in the area. Otherwise, 0 is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output status monitor	401	601	801	1001
CH□ Wave output status monitor (in FX3 allocation mode function)	9001	9002	9003	9004

CH1 Output status

The output status information can be checked.

Monitor value	Setting content
0	Output update inactive
1	Output update in progress

This area stores a value only in the normal output mode.

When outputting the D/A conversion value, output update in progress (1) is stored in the output status.

When the CPU module is put in STOP state, "Output update inactive" (0) is written automatically. If the CH□ Output enable/disable flag is turned on while the CPU module is in STOP state, the output status information is updated.

When 'Operating condition setting request' (Un\G70, b9) is turned on and off, the status returns to "Output update inactive" (0); when the D/A conversion value is output, the status changes to "Output update in progress" (1).

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ Output status	429	629	829	1029

Output status [FX3 allocation mode]

While the FX3 allocation mode function is in use, the output status can be checked.

The setting contents in FX3 allocation mode are as follows.

	b15	...	b12	b11	...	b8	b7	...	b4	b3	...	b0	
Output status (Un\G6)	CH4				CH3				CH2				CH1

The following values are stored in the bits corresponding to each CH.

Monitor value	Setting content
0000	Output update inactive
0001	Output update in progress

This area stores a value only in the normal output mode.

When outputting the D/A conversion value, output update in progress (1) is stored in the output status.

When the CPU module is put in STOP state, "Output update inactive" (0) is written automatically. If the CH□ Output enable/disable flag is turned on while the CPU module is in STOP state, the output status information is updated.

When 'Operating condition setting request' (Un\G70, b9) is turned on and off, the status returns to "Output update inactive" (0); when the D/A conversion value is output, the status changes to "Output update in progress" (1).

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
Output status (in FX3 allocation mode function)	6			

A

CH1 Range setting monitor

The value of the output range set by 'CH1 range setting' (Un\G598) can be checked.

Monitor value	Description
0003H	4 to 20 mA
0002H	0 to 20 mA
0005H	1 to 5 V
0006H	0 to 5 V
0000H	-10 to +10 V
0007H	0 to 10 V
000DH	User range setting (voltage)
000EH	User range setting (current)

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ Range setting monitor	430	630	830	1030
CH□ Range setting monitor (in FX3 allocation mode function)	3211	3212	3213	3214

CH1 HOLD/CLEAR function setting monitor

The setting status of the HOLD/CLEAR function can be checked.

Monitor value	Description
0	CLEAR
1	Previous Value
2	Setting value

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ HOLD/CLEAR function setting monitor	431	631	831	1031
CH□ HOLD/CLEAR function setting monitor (in FX3 allocation mode function)	3221	3222	3223	3224

CH1 Wave output conversion cycle monitor

The wave output conversion cycle can be checked.

Only when the wave output function is used and the operation mode is normal mode, a value is stored in the area. Otherwise, 0 is stored.

The unit of the stored value is μs .

When 'Operating condition setting request' (Un\G70, b9) is turned on and off, the monitored value is updated.

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ Wave output conversion cycle monitor	432, 433	632, 633	832, 833	1032, 1033
CH□ Wave output conversion cycle monitor (in FX3 allocation mode function)	9010, 9011	9012, 9013	9014, 9015	9016, 9017

CH1 Wave pattern output count monitor

The output count of the wave pattern can be checked.

Only when the wave output function is used and the operation mode is normal mode, a value is stored in the area. Otherwise, 0 is stored.

The stored value increases by one every time one cycle of a wave pattern is output. The measuring range is from 0 to 32767. When the wave pattern output repetition setting is set to Unlimitedly repeat output, the count returns to 0 and starts again from 1 after the 32767th count. (...32766→32767→0→1→2...)

In the following cases, the stored value is reset.

- When 'Operating condition setting request' (Un\G70, b9) is turned on and off
- When the wave output status transitions from During wave output stop to another wave output status

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave pattern output count monitor	434	634	834	1034
CH□ Wave pattern output count monitor (in FX3 allocation mode function)	9030	9032	9034	9036

CH1 Wave output current address monitor

In the wave output mode, which data in the wave data registry area is D/A-converted and output can be checked.

Only in the wave output mode, the buffer memory address of the wave output data is stored in this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output current address monitor	436, 437	636, 637	836, 837	1036, 1037
CH□ Wave output current address monitor (in FX3 allocation mode function)	9050, 9051	9052, 9053	9054, 9055	9056, 9057

CH1 Wave output current digital value monitor

The digital value of the current output wave can be checked.

Only in the wave output mode, a value is stored in this area. The stored value differs depending on the wave output status. Otherwise, 0 is stored.

When 'Operating condition setting request' (Un\G70, b9) is turned on and off, the stored value is reset.

The stored value of when the D/A conversion and D/A output are enabled is shown. For the analog output in other statuses, refer to the following.

☞ Page 192 In the wave output mode

The following shows the correspondence relation between the wave output status and the stored value.

- During wave output stop

Output digital value selected in 'CH1 Output setting during wave output stop' (Un\G524)

Setting value of Output setting during wave output stop	Stored value
0 V/0 mA (0)	0
Offset value (1)	
Setting value during stop (2)	Setting value of 'CH1 Output value during wave output stop' (Un\G525)

- During wave output

Digital value stored in the buffer memory address indicated by 'CH1 Wave output current address monitor' (Un\G436 to Un\G437)

- Wave output pause

The value differs depending on the analog output HOLD/CLEAR setting.

Setting of analog output HOLD/CLEAR function	Stored value
Previous Value	Digital value stored in the buffer memory address indicated by 'CH1 waveform output current address monitor' (Un\G436 to Un\G437)
Setting value	Setting value for 'CH1 HOLD setting value' (Un\G596)
CLEAR	0

- During wave output step action

Digital value stored in the buffer memory address indicated with 'CH1 Wave output current address monitor' (Un\G436 to Un\G437)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output current digital value monitor	438	638	838	1038
CH□ Wave output current digital value monitor (in FX3 allocation mode function)	9070	9072	9074	9076

CH1 Wave output digital value out-of-range address monitor

When the digital value of the output wave data is out of the range, the buffer memory address of the wave data with a value out of the range can be checked.

Only in the wave output mode, a value is stored in this area. Otherwise, 0 is stored.

When the multiple wave data with a digital input value out of the setting range are detected, only the buffer memory address of the wave data detected first is stored.

When the first detection of a digital value out of the range occurs in a wave output status other than During wave output stop, the stored value is updated.

To reset this area, correct the wave data to a value within the available setting range. After that, turn on and off 'Error clear request' (Un\G70, b15) or 'Operating condition setting request' (Un\G70, b9) to reset this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output digital value out-of-range address monitor	440, 441	640, 641	840, 841	1040, 1041
CH□ Wave output digital value out-of-range address monitor (in FX3 allocation mode function)	9090, 9091	9092, 9093	9094, 9095	9096, 9097

CH1 Wave output warning address monitor

The buffer memory address of the wave data where a warning has occurred can be checked.

Only in the wave output mode, a value is stored in this area. Otherwise, 0 is stored.

When a warning has occurred in the multiple wave data, only the buffer memory address of the wave data where the warning occurred first is stored.

When the first warning occurs in a wave output status other than During wave output stop, the stored value is updated.

To reset this area, correct the wave data to a value within the setting range. After that, turn on and off 'Alert output clear request' (Un\G70, b14) or 'Operating condition setting request' (Un\G70, b9) to reset this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output warning address monitor	442, 443	642, 643	842, 843	1042, 1043
CH□ Wave output warning address monitor (in FX3 allocation mode function)	9110, 9111	9112, 9113	9114, 9115	9116, 9117

CH1 Digital value

Set the digital input value in 16-bit signed binary for the D/A conversion from the CPU module.

Output range setting	When the scaling function is disabled	When the scaling function is enabled*1
	Setting range (practical range)	Setting range
3: 4 to 20 mA	-768 to +32767 (practical range: 0 to 32000)	-32000 to +32000
2: 0 to 20 mA		
5: 1 to 5 V		
6: 0 to 5 V		
7: 0 to 10 V		
0: -10 to +10 V	-32768 to +32767 (practical range: -32000 to +32000)	
D: User range setting (voltage)		
E: User range setting (current)		

*1 The available setting range and practical range of when the scaling function is enabled differ depending on the setting of the scaling upper limit value and scaling lower limit value.

When a value out of the available setting range is written, the D/A conversion is performed with the upper or lower limit value of the available setting range.

A check code is stored in 'CH1 Setting value check code' (Un\G400) and a digital value setting range error (error code: 191□H) is stored in 'Latest error code' (Un\G0).

When the wave output function is selected, this area is disabled because registered wave data is output.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Digital value	460	660	860	1060
CH□ Digital value (in FX3 allocation mode function)	1	2	3	4

CH1 Wave output start/stop request

This area is for requesting start or stop of wave output to the analog output module when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

Request	Setting value
Wave output stop request	0
Wave output start request	1
Wave output pause request	2

While 'Step action wave output request' (Un\G188) is set to ON (1), changing the setting value is ignored.

When 'Step action wave output request' (Un\G188) is changed from ON (1) to OFF (0), the wave output status changes to

During wave output stop and Wave output stop request (0) is set for this area.

In the channel where a value out of the setting range is set, a wave output start/stop setting range error (error code: 1D1□H) occurs and 'Error flag' (Un\G69, b15) turns on. The operation of the wave output before the change continues.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output start/stop request	462	662	862	1062
CH□ Wave output start/stop request (in FX3 allocation mode function)	9131	9132	9133	9134

■Default value

The default value is Wave output stop request (0) for all channels.

CH1 Input value shift amount

The set value is added to the digital input value regardless of the on/off status of 'Operating condition setting request' (Un\G70, b9).

For the shift function, refer to the following.

☞ Page 196 Shift function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Input value shift amount	480	680	880	1080
CH□ Input value shift amount (in FX3 allocation mode function)	3250	3252	3254	3256

■Setting range

The setting range is from -32768 to +32767.

■Default value

The default value is 0 for all channels.

CH1 Wave output step action movement amount

This area is for setting the wave output step action movement amount and for checking if the target has been obtained.

The value set in this area is subtracted from or added to the buffer memory address that has been storing the value and so the buffer memory address of Wave data registry area that has been storing the target digital value is specified. When a value is set in this area, the target address starts to be specified and when specifying the address is complete, No movement (0) is stored.

The setting for this area is enabled only when the following conditions are satisfied.

- In the wave output mode
- When During wave output step action (3) is stored in 'CH1 Wave output status monitor' (Un\G401).

Movement direction	Setting value
No movement	0
Forward movement (movement in the direction to increase the address)	1 to 30000
Reverse movement (movement in the direction to decrease the address)	-30000 to -1

The setting range is from -30000 to +30000. Even if a set value is out of the setting range, no error occurs. When a value smaller than -30000 is set, the value is processed as -30000. When a value greater than 30000 is set, the value is processed as 30000.

The following shows the available range for movement.

- "Wave pattern start address" to "Wave pattern start address" + "Wave pattern data points setting" - 1

If a value equal to or more than the wave pattern data points is set, only the data for the wave pattern data points is processed.

Set a value for the wave output step action movement amount. When specifying the address is complete, No movement (0) is stored in this area.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave output step action movement amount	482	682	882	1082
CH□ Wave output step action movement amount (in FX3 allocation mode function)	9140	9142	9144	9146

■Default value

The default value is No movement (0) for all channels.

CH1 D/A conversion enable/disable setting

Set whether to enable or disable the D/A conversion.

For details on the D/A conversion enable/disable setting function, refer to the following.

 Page 189 D/A conversion enable/disable function

Setting value	Description
0	D/A conversion enabled
1	D/A conversion disabled

When a value other than the above is set, the value is processed as D/A conversion disable (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ D/A conversion enable/disable setting	500	700	900	1100
CH□ D/A conversion enable/disable setting (in F3 allocation mode function)	3271	3272	3273	3274

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.


■Default value

- In the normal mode: The default value is D/A conversion disable (1) for all the channels.
- In the FX3 allocation mode: The default value is D/A conversion enable (0) for all the channels.

CH1 Scaling enable/disable setting

Set whether to enable or disable the scaling.

For the scaling function, refer to the following.

 Page 194 Scaling function

Setting value	Description
0	Enable
1	Disable

If a value other than the above is set, a scaling enable/disable setting range error (error code: 1A0□H) occurs.

The scaling function cannot be used when the wave output function is used. In the channel for which Enable (0) is set while the wave output function is being used, a scaling setting error in wave output mode (alarm code: 0B0□H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Scaling enable/disable setting	502	702	902	1102
CH□ Scaling enable/disable setting (In FX3 allocation mode function)	3281	3282	3283	3284

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Disable (1) for all the channels.

CH1 Scaling upper limit value

Set the range of scale conversion.

For the scaling function, refer to the following.

 Page 194 Scaling function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Scaling upper limit value	504, 505	704, 705	904, 905	1104, 1105
CH□ Scaling upper limit value (In FX3 allocation mode function)	3290, 3291	3292, 3293	3294, 3295	3296, 3297

■Setting range

The setting range is from -2147483648 to +2147483647. In the channel where a set value does not satisfy the condition "scaling upper limit value \neq scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2□H) occurs.

When 'CH1 Scaling enable/disable setting' (Un\G502) is set to Disable (1), the setting for 'CH1 Scaling upper limit value' (Un\G504, 505) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.


■Default value

The default value is 0 for all channels.

CH1 Scaling lower limit value

Set the range of scale conversion.

For the scaling function, refer to the following.

 Page 194 Scaling function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Scaling lower limit value	506, 507	706, 707	906, 907	1106, 1107
CH□ Scaling lower limit value (In FX3 allocation mode function)	3310, 3311	3312, 3313	3314, 3315	3316, 3317

■Setting range

The setting range is from -2147483648 to +2147483647. In the channel where a set value does not satisfy the condition "scaling upper limit value \neq scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2□H) occurs.

When 'CH1 Scaling enable/disable setting' (Un\G502) is set to Disable (1), the setting for 'CH1 Scaling lower limit value' (Un\G506, 507) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

CH1 Alarm output setting

Set whether to enable or disable the alarm output.

For the alarm output function, refer to the following.

 Page 198 Alert output function

Setting value	Description
0	Disable
1	Enabled (no output limit)
2	Enable (with output limit)

Setting a value other than the above causes an alarm output setting range error (error code: 1B0□H).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Alarm output setting	508	708	908	1108

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Disable (0) for all the channels.

Alarm output setting [FX3 allocation mode]

Set whether to enable or disable disconnection detection or alarm output while the FX3 allocation mode function is in use.

The setting contents in FX3 allocation mode are as follows.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH4				CH3				CH2				CH1			

Set the following setting values for the bits corresponding to each CH.

Setting value	Description
0000	Disable
0001	Enabled (no output limit)
0010	Enable (with output limit)

Setting a value other than the above causes an alarm output setting range error (error code: 1B0□H).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Alarm output setting [in FX3 allocation mode function]	38			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Disable (0) for all the channels.

CH1 Rate control enable/disable setting

Set whether to enable or disable rate control.

For the rate control function, refer to the following.

 Page 200 Rate control function

Setting value	Description
0	Enable
1	Disable

If a value other than the above is set, a rate control enable/disable setting range error (error code: 1B8□H) occurs.

The rate control function cannot be used when the wave output function is used. In the channel for which Enable (0) is set while the wave output function is being used, a rate control setting error in wave output mode (alarm code: 0B3□H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Rate control enable/disable setting	509	709	909	1109
CH□ Rate control enable/disable setting (in FX3 allocation mode function)	3331	3332	3333	3334

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is Disable (1) for all channels.

CH1 Alarm output upper limit value

Set the range of a digital value used for alarm output.

For the alarm output function, refer to the following.

 Page 198 Alert output function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Alarm output upper limit value	510	710	910	1110
CH□ Alarm output upper limit value (in FX3 allocation mode function)	45	46	47	48

■Setting range

The setting range is from -32768 to +32767. In the channel where a set value does not satisfy the condition "alert output upper limit value > alert output lower limit value", an alert output upper/lower limit value inversion error (error code: 1B1□H) occurs. When 'CH1 Alert output setting' (Un\G508) is set to Disable (1), the setting of 'CH1 Alert output upper limit value' (Un\G510) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

■Precautions

When the shift function is used, always set a value in consideration of 'CH1 Input value shift amount' (Un\G480).

CH1 Alarm output lower limit value

Set the range of a digital value used for alarm output.

For the alarm output function, refer to the following.

☞ Page 198 Alert output function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Alarm output lower limit value	512	712	912	1112
CH□ Alarm output lower limit value (in FX3 allocation mode function)	41	42	43	44

■Setting range

The possible setting range is from -32768 to +32767. A channel for which any value not meeting the condition of "alarm output upper limit value > alarm output lower limit value" causes an alarm output upper/lower limit value reverse error (error code: 1B1□H).

If 'CH1 alarm output setting' (Un\G508) is set to Disable (1), the setting for 'CH1 alarm output lower limit value' (Un\G512) will be ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

■Precautions

When the shift function is used, always set a value in consideration of 'CH1 Input value shift amount' (Un\G480).

CH1 Increase digital limit value

Set the increment value per conversion cycle (80 μ s) when using the rate control function.

For the rate control function, refer to the following.

☞ Page 200 Rate control function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Increase digital limit value	514	714	914	1114
CH□ Increase digital limit value (in FX3 allocation mode function)	3340	3342	3344	3346

■Setting range

The setting range is from 0 to 64000 (FA00H). If a value out of the setting range is set for a channel where the conversion and rate control are enabled, a digital limit value range error (error code: 1B9□H) occurs.

When the scaling setting is enabled, the increase digital limit value of the input digital value converted within the scaling range is applied.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 64000 for all channels.

■Precautions

When a value exceeding 32767 is set in 'CH1 Increase digital limit value' (Un\G514) with the program, the value must be input in hexadecimal.

CH1 Decrease digital limit value

Set the decrement value per conversion cycle (80 μ s) when using the rate control function.

For the rate control function, refer to the following.

 Page 200 Rate control function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Decrease digital limit value	516	716	916	1116
CH□ Decrease digital limit value (in FX3 allocation mode function)	3360	3362	3364	3366

■Setting range

The setting range is from 0 to 64000 (FA00H). If a value out of the setting range is set for a channel where the conversion and rate control are enabled, a digital limit value range error (error code: 1B9□H) occurs.

When the scaling setting is enabled, the decrease digital limit value of the input digital value converted within the scaling range is applied.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 64000 for all channels.

■Precautions

When a value exceeding 32767 is set in 'CH1 Decrease digital limit value' (Un\G516) with the program, the value must be input in hexadecimal.

CH1 Output setting during wave output stop

Select the output during wave output stop when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

Analog output	Setting value
0 V/0 mA	0
Offset value	1
Output value during wave output stop ^{*1}	2

^{*1} Set value of 'CH1 Output value during wave output stop' (Un\G525)

In the channel where a value out of the setting range is set, an output setting during wave output stop setting range error (error code: 1D2□H) occurs and 'Error flag' (Un\G69, b15) turns on. The operation of the wave output before the change continues.

When Output value during wave output stop (2) is set for this area, set a value in 'CH1 Output value during wave output stop' (Un\G525).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Output setting during wave output stop	524	724	924	1124
CH□ Output setting during wave output stop (in FX3 allocation mode function)	9161	9162	9163	9164

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is the offset value (1) for all the channels.

CH1 Output value during wave output stop

This area is for setting the value to be output when Output value during wave output stop (2) is set in 'CH1 Output setting during wave output stop' (Un\G524).

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored. The setting range depends on the set output range. Configure the setting in the following range.

Output range	Setting range
6: 0 to 5V	0 to 32767 (practical range: 0 to 32000)
5: 1 to 5V	
2: 0 to 20mA	
3: 4 to 20mA	
7: 0 to 10 V	
0: -10 to +10V	-32768 to +32767 (practical range: -32000 to +32000)

In the channel where a value out of the setting range is set, an output value during wave output stop setting range error (error code: 1D3□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

However, when a value other than Output value during wave output stop (2) is set in 'CH1 Output setting during wave output stop' (Un\G524), the above error does not occur.

Since the default value is 0, change the setting value if 'CH1 Output setting during wave output stop' (Un\G524) is set to Output value during wave output stop (2).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Output value during wave output stop	525	725	925	1125
CH□ Output value during wave output stop (in FX3 allocation mode function)	9171	9172	9173	9174

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

CH1 Wave pattern start address setting

This area is for setting the start address of the wave pattern to be output when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

In the channel where the set values in this area and in 'CH1 Wave pattern data points setting' (Un\G528, Un\G529) satisfy the following conditions, a wave data registry area range error (error code: 1D9□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

(Wave pattern start address setting + Wave pattern data points setting - 1) > 89999 (the last buffer memory address of the wave data registry area)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave pattern start address setting	526, 527	726, 727	926, 927	1126, 1127
CH□ Wave pattern start address setting (in FX3 allocation mode function)	9180, 9181	9182, 9183	9184, 9185	9186, 9187

■Setting range

The possible setting range is from 10000 to 89999. (10000 to 89999 of buffer memory)

In the channel where a value out of the setting range is set, a wave pattern start address setting range error (error code: 1D4□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 10000 for all channels.

CH1 Wave pattern data points setting

This area is for setting the data points of the wave pattern to be output when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

In the channel where the set values in this area and in 'CH1 Wave pattern data points setting' (Un\G528, Un\G529) satisfy the following conditions, a wave data registry area range error (error code: 1D9□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

(Wave pattern start address setting + Wave pattern data points setting - 1) > 89999 (the last buffer memory address of the wave data registry area)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave pattern data points setting	528, 529	728, 729	928, 929	1128, 1129
CH□ Wave pattern data points setting (in FX3 allocation mode function)	9200, 9201	9202, 9203	9204, 9205	9206, 9207

■Setting range

The setting range is from 1 to 80000 (the number of data points of the wave data registry area).

In the channel where a value out of the setting range is set, a wave pattern data points setting range error (error code: 1D5□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

However, when the value of 'CH1 Wave pattern start address setting' (Un\G526, Un\G527) is out of the setting range, the above error does not occur.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

CH1 Wave pattern output repetition setting

This area is for setting the number of wave pattern outputs when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

Setting value	Description
-1	The wave pattern is output in analog unlimitedly.
1 to 32767	The wave pattern is output in analog for the set number.

In the channel where a value out of the setting range is set, a wave pattern output repetition setting range error (error code: 1D6□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Wave pattern output repetition setting	530	730	930	1130
CH□ Wave pattern output repetition setting (in FX3 allocation mode function)	9221	9222	9223	9224

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 1 (once) for all channels.

CH1 Constant for wave output conversion cycle

This area is for setting the constant to determine the conversion cycle (specifying a multiple of the conversion speed) for each channel when the wave output function is used.

The setting for this area is enabled only in the wave output mode. In other modes, changing the setting value is ignored.

The conversion cycle of each channel is determined from the combination of the reference conversion speed (80 μ s), number of channels where D/A conversion is enabled, and the constant for wave output conversion cycle.

- "Conversion cycle" = "Reference conversion speed (80 μ s) \times "Number of channels where D/A conversion is enabled" \times "Constant for wave output conversion cycle"

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Constant for wave output conversion cycle	531	731	931	1131
CH□ Constant for wave output conversion cycle (in FX3 allocation mode function)	9231	9232	9233	9234

■Setting range

The possible setting range is from 1 to 5000.

In the channel where a value out of the setting range is set, a wave output conversion cycle setting range error (error code: 1D7□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output does not start.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 1 for all channels.

CH1 HOLD setting value

When the setting value (2) is set for the analog output HOLD/CLEAR function setting, this area is used to set the output value.

Output range setting	When the scaling function is disabled	When the scaling function is enabled ^{*1}
	Setting range (practical range)	Setting range
4 to 20 mA	0 to 32767 (practical range: 0 to 32000)	-32000 to +32000
0 to 20 mA		
1 to 5 V		
0 to 5 V		
0 to 10 V		
-10 to +10 V	-32768 to +32767 (practical range: -32000 to +32000)	
User range setting (voltage)		
User range setting (current)		

*1 The setting and practical ranges applied when the scaling function is enabled depend on the setting of the upper and lower scaling limit values.

Any channel for which a value out of the range is set causes a HOLD setting value range error (error code: 192□H). However, the error will not occur unless the HOLD/CLEAR function setting is the setting value (2).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ HOLD setting value	596	796	996	1196
CH□ HOLD Trigger setting value (In FX3 allocation mode function)	32	33	34	35

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

■Default value

The default value is 0 for all channels.

CH1 Range setting

This area is for setting the output range.

Setting value	Output range
0003H	4 to 20 mA
0002H	0 to 20 mA
0005H	1 to 5 V
0006H	0 to 5 V
0000H	-10 to +10 V
0007H	0 to 10 V
000DH	User range setting (voltage)
000EH	User range setting (current)

If a value other than the above is set, a range setting range error (error code: 190□H) occurs.

If the range switching is attempted with the D/A conversion and D/A output enabled for the purpose of preventing a sudden change in the analog output, CH□ Under-output range change denial alarm (alarm code: 0C0□H) occurs and the range switching is not executed. To execute the range switching, turn off 'CH1 Output enable/disable flag' (Un\G70, b1).

The user range cannot be used when the wave output function is used. Even within the setting range in the above table, when the user range is set while the wave output function is used, a user range specification error in wave output mode (error code: 1D1□H) occurs and the wave output does not start.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Range setting	598	798	998	1198

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

Range setting [FX3 allocation mode]

When the FX3 allocation mode function is used, this area is for setting the output range.

The setting contents in FX3 allocation mode are as follows.

b15	...	b12 b11	...	b8 b7	...	b4 b3	...	b0
CH4		CH3		CH2		CH1		

Set the following setting values for the bits corresponding to each CH.

Setting value	Output range
0000	-10 to +10 V
0001	-10 to +10 V
0010	0 to 20 mA
0011	4 to 20 mA
0100	0 to 20 mA
0101	1 to 5 V
0110	0 to 5 V
0111	0 to 10 V
1101	User range setting (voltage)
1110	User range setting (current)

If a value other than the above is set, a range setting range error (error code: 190□H) occurs.

If the range switching is attempted with the D/A conversion and D/A output enabled for the purpose of preventing a sudden change in the analog output, CH. Under-output range change denial alarm (alarm code: 0C0□H) occurs and the range switching is not executed. To execute the range switching, turn off 'CH1 Output enable/disable flag' (Un\G70, b1).

The user range cannot be used when the wave output function is used. Even within the setting range in the above table, when the user range is set while the wave output function is used, a user range specification error in wave output mode (error code: 1D1□H) occurs and the wave output does not start.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Range setting	0			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Un\G70, b9) to enable the setting.

Error history

Up to 16 errors that occurred in the analog output module are logged.

	b15	to	b8 b7	to	b0
Un\G3600	Error code				
Un\G3601	First two digits of the year		Last two digits of the year		
Un\G3602	Month		Day		
Un\G3603	Hour		Minute		
Un\G3604	Second		Day of the week		
Un\G3605	Millisecond (upper)		Millisecond (lower)		
Un\G3606	System area				
to					
Un\G3609					

Item	Storage contents	Storage example *1
First two digits of the year/Last two digits of the year	Stored in BCD code.	2017H
Month/Day		0130H
Hour/Minute		1035H
Second		40H
Day of the week	One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3, Thursday: 4, Friday: 5, Saturday: 6	1H
Millisecond (upper)	Stored in BCD code.	6H
Millisecond (lower)		28H

*1 These values assume that an error occurs at 10:35 and 40.628 seconds on Monday, January 30th, 2017.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory area name	No.1 to No.16
Error history	3600 to 3759
Error history (In FX3 allocation mode function)	8600 to 8759

Alarm history

Up to 16 alarms that occurred in the analog output module are logged.

	b15	to	b8 b7	to	b0
Un\G3760	Alarm code				
Un\G3761	First two digits of the year		Last two digits of the year		
Un\G3762	Month		Day		
Un\G3763	Hour		Minute		
Un\G3764	Second		Day of the week		
Un\G3765	Millisecond (upper)		Millisecond (lower)		
Un\G3766	System area				
to					
Un\G3769					

Item	Storage contents	Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.	2017H
Month/Day		0130H
Hour/Minute		1035H
Second		40H
Day of the week	One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3, Thursday: 4, Friday: 5, Saturday: 6	1H
Millisecond (upper)	Stored in BCD code.	06H
Millisecond (lower)		28H

*1 These values assume that an alarm occurs at 10:35 and 40.628 seconds on Monday, January 30th, 2017.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory area name	No.1 to No.16
Alarm history	3760 to 3919
Alarm history (in FX3 allocation mode function)	8760 to 8919

Offset/gain adjustment value specification

This area is used to set the adjustment amount of analog output value during the offset/gain setting mode.

Adjust it to make it equal to the target output value.

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
Offset/gain adjustment value specification	4130			
Offset/gain adjustment value specification (In FX3 allocation mode function)	4130			

■Setting range

The possible setting range is from -3000 to +3000.

Ex.

If the setting value is 1000

During voltage output: Approx. 0.31 V, During current output: The analog output value rises by approx. 0.35 mA.

If the setting value is -1000

During voltage output: Approx. 0.31 V, During current output: The analog output value drops by approx. 0.35 mA.

CH1 Offset/gain setting mode

Specify the channel where the offset/gain setting is adjusted.

- Offset/gain setting mode (offset specification): Channel to adjust the offset
- Offset/gain setting mode (gain specification): Channel to adjust the gain

Setting value	Description
0	Disable
1	Setting channel

Multiple channels cannot be set at the same time. Set to Offset/gain setting mode (offset specification) or Offset/gain setting mode (gain specification) to Disable (0).

Setting a value other than the above causes an offset/gain setting value range error (error code: 1E8□H).

In the following cases, an offset/gain setting channel specification error (error code: 1E50H) occurs.

- Both the offset/gain setting mode (offset specification) and the offset/gain setting mode (gain specification) of the same channel are set for the setting channel (1) at the same time.
- All channels are set to Disable (0).
- Multiple channels are set at the same time.

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ Offset/gain setting mode (offset specification)	4132	4134	4136	4138
CH□ Offset/gain setting mode (gain specification)	4133	4135	4137	4139
CH□ Offset/gain setting mode (offset specification) (in FX3 allocation mode function)	4131	4132	4133	4134
CH□ Offset/gain setting mode (gain specification) (in FX3 allocation mode function)	4141	4142	4143	4144

■Enabling the setting

From off, Turn on 'Channel change request' (Un\G70, b11).

■Default value

The default value is Disable (0) for all the channels.

CH1 Offset/gain setting mode (range specification)

The output range can be changed during offset/gain setting.

The output range is changed to the set one by using 'Channel change request' (Un\G70, b11).

Setting value	Description
000DH	User range setting (voltage)
000EH	User range setting (current)

Setting a value other than the above causes an offset/gain setting range range error (error code: 1E9□H).

■Buffer memory address

The following shows the buffer memory addresses of this area.

Buffer memory area name	CH1	CH2	CH3	CH4
CH□ Offset/gain setting mode (range specification)	4164	4165	4166	4167
CH□ Offset/gain setting mode (range specification) (in FX3 allocation mode function)	4151	4152	4153	4154

Wave data registry area

This area is for registering wave data for analog output in the wave output mode.

The setting range depends on the set output range. The setting range is shown below.

Output range	Setting range
4 to 20 mA	0 to 32767 (practical range: 0 to 32000)
0 to 20 mA	
1 to 5 V	
0 to 5 V	
0 to 10 V	-32768 to +32767 (practical range: -32000 to +32000)
-10 to +10 V	

In the channel where the wave data with a value out of the above setting range set is output, a digital value setting range error (error code: 191□H) occurs and 'Error flag' (Un\G69, b15) turns on. The wave output operations continue to be performed. However, the analog output value corresponding to a digital input value out of the setting range is fixed to the maximum or minimum value of the output range.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Wave data registry area	10000 to 89999			
Wave data registry area (in FX3 allocation mode function)	10000 to 89999			