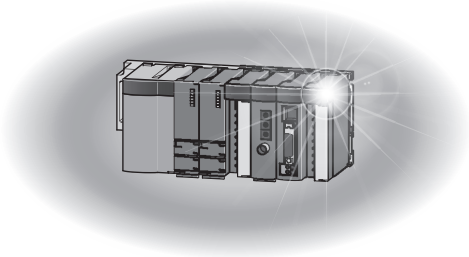
MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC Q series

MELSEC-Q
High Speed Digital-Analog Converter Module
User's Manual

-Q64DAH



●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Analog outputs may remain on due to a failure of the module. Configure an external interlock circuit for output signals that could cause a serious accident.
- Do not write any data to the "system area" and "write-protect area" (R) of the buffer memory in the intelligent function module. Also, do not use any "use prohibited" signals as an output signal from the programmable controller CPU to the intelligent function module. Doing so may cause malfunction of the programmable controller system.

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them.
  Failure to do so may result in malfunction due to noise.
- At power-on, a voltage may occur or a current may flow between output terminals for a moment. In this case, start the control after analog outputs become stable.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place.
  Incorrect mounting may cause malfunction, failure or drop of the module.
  When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
  Tighten the screws within the specified torque range.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in damage to the product.
  A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting the online module change function is used.
  Note that there are restrictions on the modules that can be replaced online, and each module has its predetermined replacement procedure.
  For details, refer to the relevant chapter in this manual.
- Do not directly touch any conductive parts and electronic components of the module.
  Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- After installation and wiring, attach the included terminal cover to the module before turning it on for operation.
  Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG terminal of the programmable controller with a ground resistance of 100Ω or less.
  Failure to do so may result in electric shock or malfunction.
- Tighten the terminal screws within the specified torque range.
  Undertightening can cause short circuit, fire, or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module.
  Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring.
  Do not remove the film during wiring.
  Remove it for heat dissipation before system operation.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on.
  Doing so will cause electric shock or malfunction.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws or module fixing screws.
  Failure to do so may result in electric shock or cause the module to fail or malfunction.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

⚠CAUTION

- Do not disassemble or modify the modules.
  Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
  A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting the online module change function is used. Note that there are restrictions on the modules that can be replaced online, and each module has its predetermined replacement procedure.
  For details, refer to the relevant chapter in this manual.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively.
  Exceeding the limit of 50 times may cause malfunction.
- Before handling the module, touch a grounded metal object to discharge the static electricity from the human body.
  Failure to do so may cause the module to fail or malfunction.

[Disposal Precautions]

⚠ CAUTION
● When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC-Q series programmable controllers.
This manual describes the operating procedure, system configuration, parameter settings, functions, programming, and troubleshooting of the Q64DAH high speed digital-analog converter module (hereafter abbreviated as D/A converter module).

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC-Q series programmable controller to handle the product correctly.
When applying the program examples introduced in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

■Relevant module: Q64DAH

Remark

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y00 to X/Y0F are assigned for a D/A converter module.
  For I/O number assignment, refer to the following manuals.
  QnUCPU User's Manual (Function Explanation, Program Fundamentals)
  Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- Operating procedures are explained using GX Works2. When using GX Developer, refer to the following.
  - When Using GX Developer (Page 237, Appendix 3)

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)
- Safety Guidelines
  (This manual is included with the CPU module or base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures

No additional measures are necessary for the compliance of this product with EMC and Low Voltage Directives.

RELEVANT MANUALS

(1) CPU module user's manual

Manual name <manual number (model code)>	Description
QCPU User's Manual (Hardware Design, Maintenance and Inspection) <SH-080483ENG, 13JR73>	Specifications of the CPU modules, power supply modules, base units, extension cables, memory cards, SD memory cards, extended SRAM cassettes, and batteries, information on how to establish a system, maintenance and inspection, and troubleshooting
QnUCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080807ENG, 13JZ27>	Functions, methods, and devices for programming
Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080808ENG, 13JZ28>	

(2) Programming manual

Manual name <manual number (model code)>	Description
MELSEC-Q/L Programming Manual (Common Instruction) <SH-080809ENG, 13JW10>	Detailed description and usage of instructions used in programs

(3) Operating manual

Manual name <manual number (model code)>	Description
GX Works2 Version 1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations of GX Works2, which are common to Simple projects and Structured projects
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

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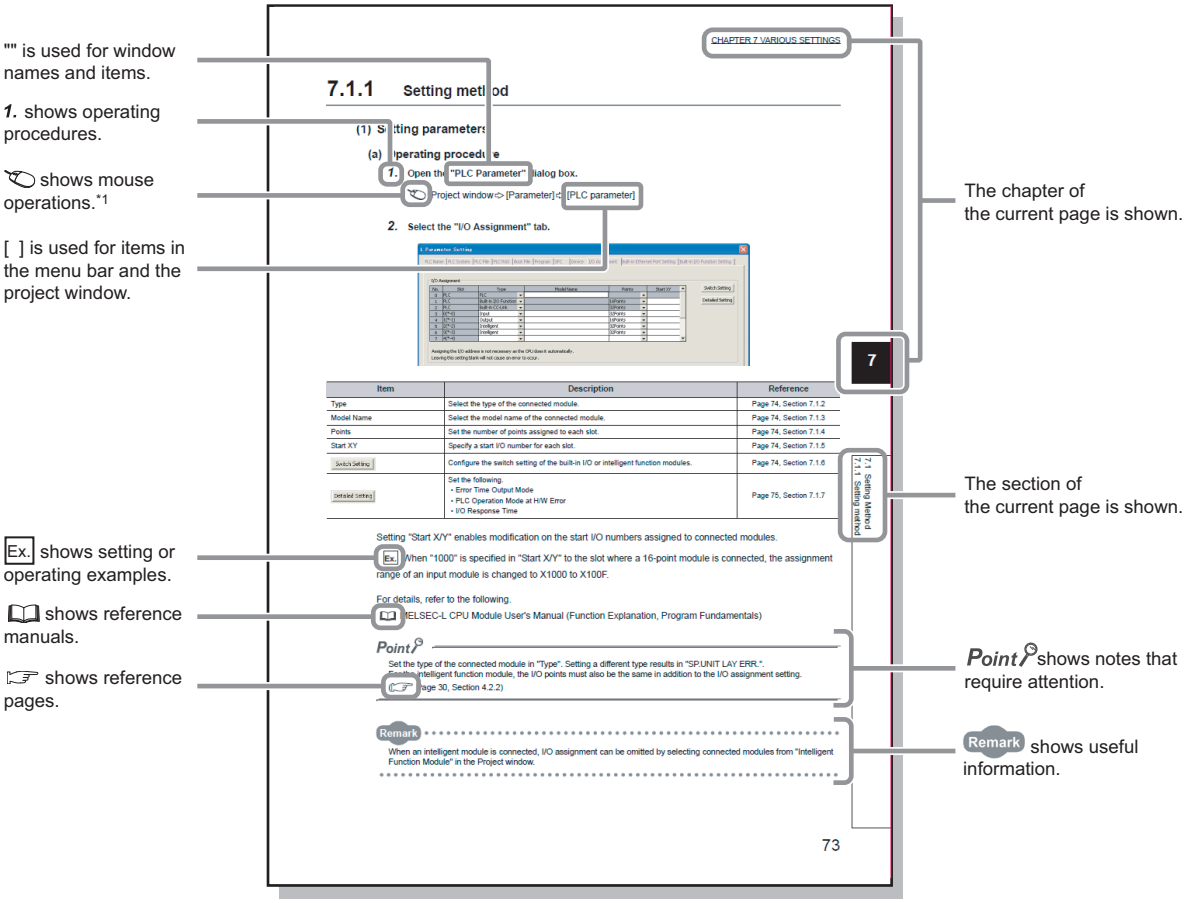
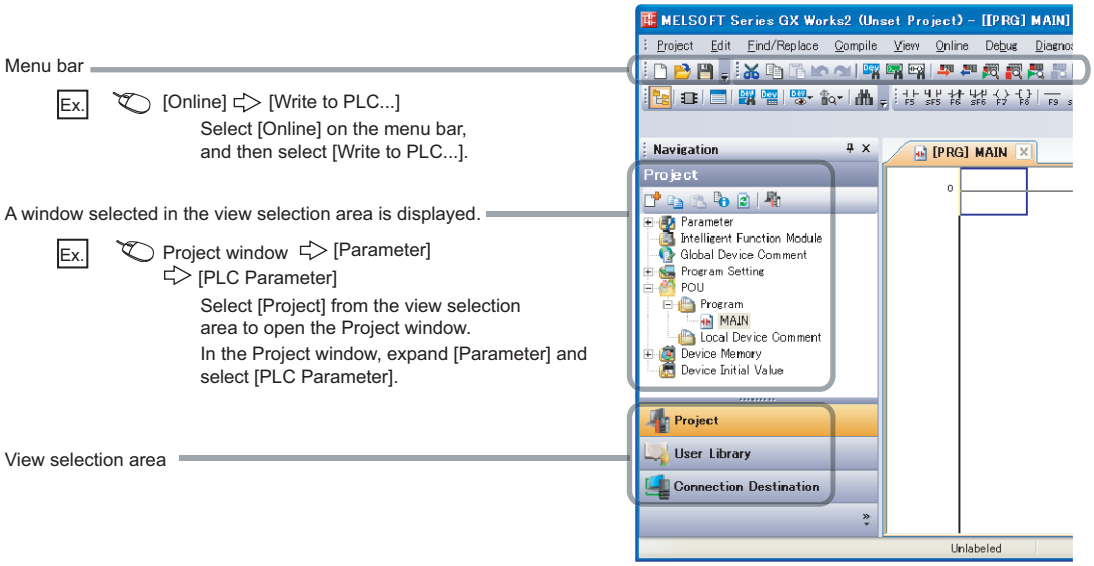
MANUAL PAGE ORGANIZATION

In this manual, pages are organized and the symbols are used as shown below.
The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.

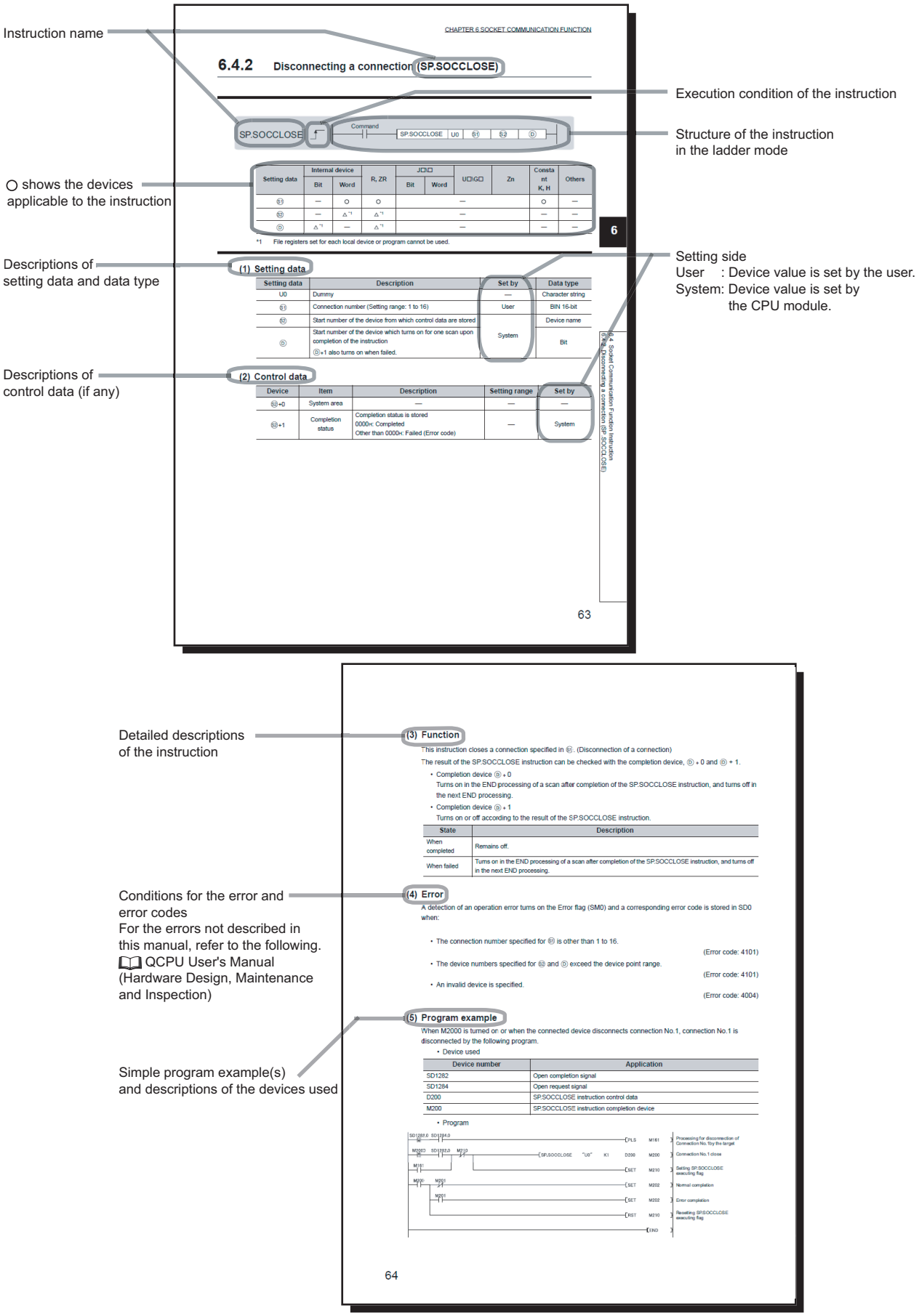


*1 The mouse operation example is provided below.



Pages describing instructions are organized as shown below.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.



• Instructions can be executed under the following conditions.

Execution condition	Any time	During on	On the rising edge	During off	On the falling edge
Symbol	No symbol				

• The following devices can be used.

Setting data	Internal device (system, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Zn	Constant *3	Others *3
	Bit	Word		Bit	Word				
Applicable device*1	X, Y, M, L, SM, F, B, SB, FX, FY *2	T, ST, C, D, W, SD, SW, FD, @□	R, ZR	-		U□\G□	Z	K, H, E, $	P, I, J, U, D, X, DY, N, BL, TR, BL\S, V

*1 For details on each device, refer to the following.

QnUCPU User's Manual (Function Explanation, Program Fundamentals)

Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

*2 FX and FY can be used for bit data only, and FD for word data only.

*3 In the "Constant" and "Others" columns, a device(s) that can be set for each instruction is shown.

• The following data types can be used.

Data type	Description
Bit	Bit data or the start number of bit data
BIN 16-bit	16-bit binary data or the start number of word device
BIN 32-bit	32-bit binary data or the start number of double-word device
BCD 4-digit	Four-digit binary-coded decimal data
BCD 8-digit	Eight-digit binary-coded decimal data
Real number	Floating-point data
Character string	Character string data
Device name	Device name data

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
D/A converter module	The abbreviation for the Q64DAH high speed digital-analog converter module
QCPU	Another term for the MELSEC-Q series CPU module
Process CPU	A generic term for the Q02PHCPU, Q06PHCPU, Q12PHCPU, and Q25PHCPU
Redundant CPU	A generic term for the Q12PRHCPU and Q25PRHCPU
Programming tool	A generic term for GX Works2 and GX Developer
Industrial shipment setting	A generic term for analog output ranges of 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, and 4 to 20mA
User range	An analog output range where any value can be set. Set the user range in the offset/gain setting.
GX Works2	The Product name of the software package for the MELSEC programmable controllers
GX Developer	
Switch setting	A generic term for the window that is displayed by double-clicking "Switch Setting" of the specified module on the project window of GX Works2, and the setting items in that window
Buffer memory	The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module.
Normal mode	"Normal mode" and "Offset-Gain Setting Mode" is the setting values of the drive mode setting in the switch setting. Note that the normal mode is displayed as "Normal (D/A Converter Processing) Mode" on the programming tool.
Offset-Gain Setting Mode	
Watchdog timer error	A D/A converter module monitors its own internal processing by using the watchdog timer. The module generates this error if the internal processing fails.

PACKING LIST

The product package contains the following.

Model	Product	Quantity
Q64DAH	The Q64DAH high speed digital-analog converter module	1
–	Before Using the Product (BCN-P5979)	1

CHAPTER 1 OVERVIEW

1.1 Features

(1) Improved response by high-speed conversion

The high-speed conversion speed of 20μs/channel is achieved.

(2) Detailed control by high resolution

In all analog output ranges, the high resolution of 1/20000 is achieved.

(3) Reliability by high accuracy

The high accuracy is achieved for the maximum value of analog output value: ±0.1% (ambient temperature: 25 ±5°C) and ±0.3% (ambient temperature: 0 to 55°C).

(4) Scale conversion

This function converts a digital value to the ratio value (%) in any width to represent the digital value in a numeric value easy to understand.

(5) Error detection and monitoring

When the digital value exceeds the specified range, the module detects a warning so that the digital value error monitoring and the output control are enabled.

(6) Wave output function

This function outputs any points from 50000 points of the wave data (digital value) in analog by executing the D/A conversion sequentially. The conversion cycle in the wave output function can be set for each channel. A control with the conversion faster than that of a sequence program control is enabled by the registration of the control wave data to the D/A converter module and the analog output from the module. And this method is useful for an analog (torque) control of equipments such as pressing machines and injection molding units. Because the update of the analog output value of the wave output function is not affected by the scan time of the CPU module, a faster and smoother analog control is available.

(7) Easy setting with GX Works2

Sequence programming is reduced because the initial setting or auto refresh setting can be configured on the screen. In addition, setting status and operating status of modules can be checked easily. With the wave output function, wave data can be created easily by using "Create Wave Output Data".

(8) Online module change

This module can be replaced without stopping the system.

Memo

CHAPTER 2 SYSTEM CONFIGURATION

This chapter describes the system configuration of the D/A converter module.

2.1 Applicable Systems

This section describes applicable systems.

(1) Applicable CPU modules and base units, and number of mountable modules

(a) When mounted with a CPU module

For applicable CPU modules and base units, and number of mountable modules, refer to the user's manual for the CPU module used.

When mounting the D/A converter modules with a CPU module, observe the following precautions.

- Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient. Consider the power supply capacity when mounting modules. If the power supply capacity is insufficient, change the combination of the modules.
- Mount modules within the number of I/O points of the CPU module. A module can be mounted on any slot within the number of usable slots.

Remark

To use a C Controller module with the D/A converter module, refer to the C Controller Module User's Manual.

(b) When mounted on MELSECNET/H remote I/O station

For the MELSECNET/H remote I/O station where the D/A converter modules can be mounted, applicable base units, and number of mountable modules, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) For multiple CPU system

When using the D/A converter module in a multiple CPU system, refer to the following.

QCPU User's Manual (Multiple CPU System)

(3) For online module change

The D/A converter module supports online module change. For details on the online module change, refer to the following.

ONLINE MODULE CHANGE (☞Page 170, CHAPTER 10)

(4) Applicable software packages

The following table lists systems that use a D/A converter module and applicable software packages.
A programming tool is required to use a D/A converter module.

Item		Software version	
		GX Developer*1	GX Works2
Q00J/Q00/Q01CPU	Single CPU system	Version 7 or later	Refer to the GX Works2 Version 1 Operating Manual (Common).
	Multiple CPU system	Version 8 or later	
Q02/Q02H/Q06H/Q12H/ Q25HCPU	Single CPU system	Version 4 or later	
	Multiple CPU system	Version 6 or later	
Q02PH/Q06PHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q12PH/Q25PHCPU	Single CPU system	Version 7.10L or later	
	Multiple CPU system		
Q12PRH/Q25PRHCPU	Redundant system	Version 8.45X or later	
Q00UJ/Q00U/Q01UCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q02U/Q03UD/Q04UDH/ Q06UDHCPU	Single CPU system	Version 8.48A or later	
	Multiple CPU system		
Q10UDH/Q20UDHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q13UDH/Q26UDHCPU	Single CPU system	Version 8.62Q or later	
	Multiple CPU system		
Q03UDE/Q04UDEH/Q06UDEH/ Q13UDEH/Q26UDEHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q10UDEH/Q20UDEHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
CPU modules other than the above		N/A	
When mounted on MELSECNET/H remote I/O station		Version 6 or later	

*1 GX Configurator-DA does not support the D/A converter module. When using GX Developer, create a sequence program for initial settings and auto refresh setting.

Point

When using GX Works2, refer to the following.

GX Works2 Version 1 Operating Manual (Common)

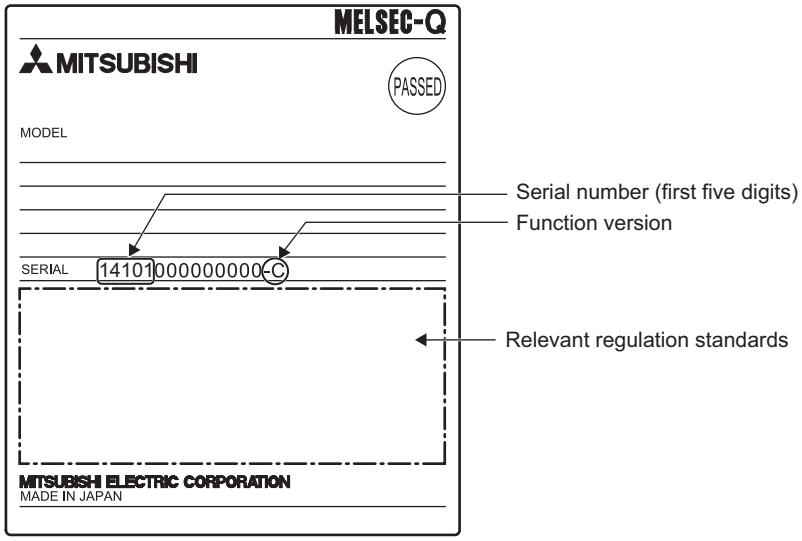
GX Works2 Version 1 Operating Manual (Intelligent Function Module)

2.2 How to Check the Function Version and Serial Number

The function version and serial number of a D/A converter module can be checked on the rating plate, front part of the module, or system monitor of the programming tool.

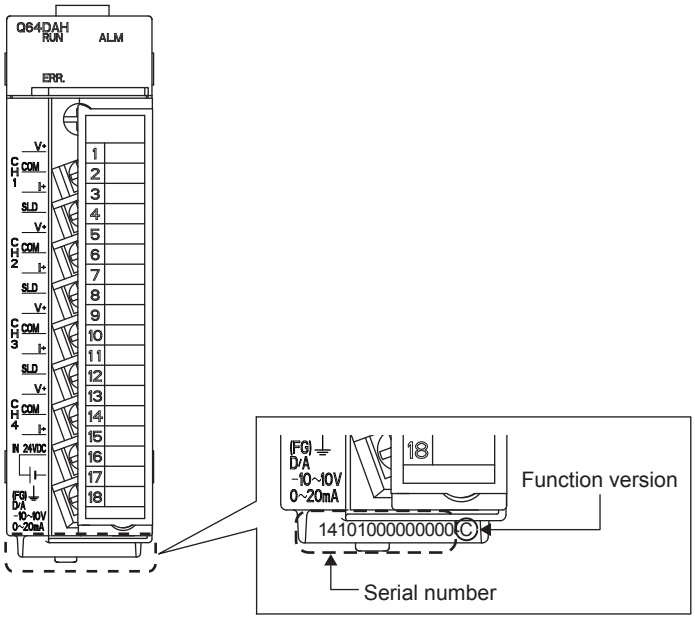
(1) Checking on the rating plate

The rating plate is on the side of the D/A converter module.



(2) Checking on the front part (bottom part) of module

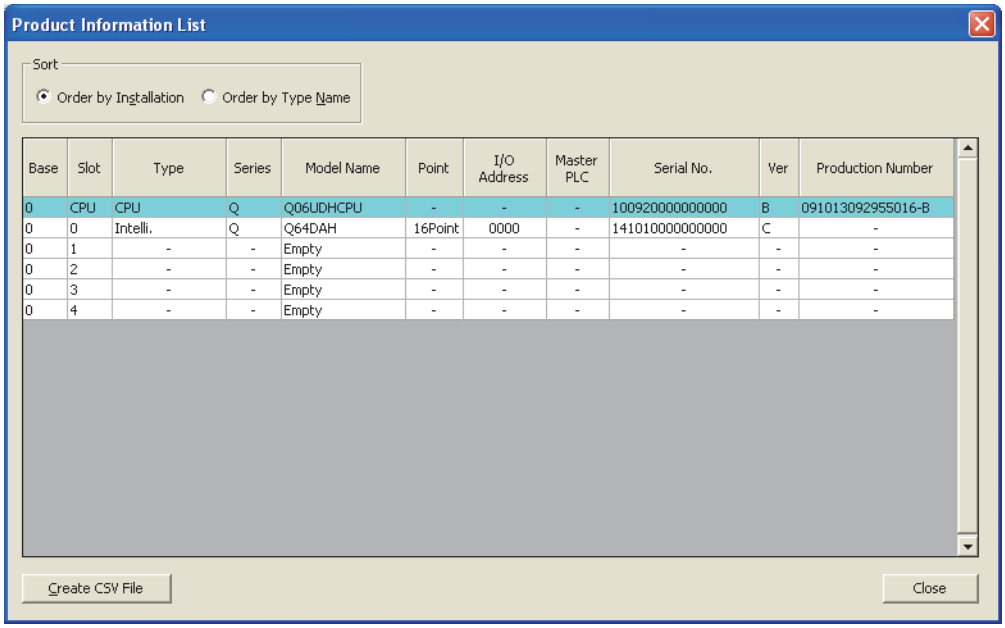
The function version and serial number on the rating plate are also shown on the front part (bottom part) of the module.



(3) Checking on the system monitor

The function version and serial number can be checked on the "Product Information List" window.

[Diagnostics] ⇨ [System Monitor...] ⇨ Product Information List button



(a) Displaying production number

For the D/A converter module, "-" is displayed since the production number display is not supported.

Point

The serial number displayed on the product information list of a programming tool may differ from that on the rating plate and on the front part of the module.

- The serial number on the rating plate and front part of the module indicates the management information of the product.
- The serial number displayed on the product information list of a programming tool indicates the function information of the product.
  The function information of the product is updated when a new function is added.

CHAPTER 3 SPECIFICATIONS

This chapter describes general specifications, performance specifications, I/O conversion characteristics, accuracy, and functions.

3.1 General Specifications

For the general specifications of the D/A converter module, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

3.2 Performance Specifications

This section describes the performance specifications of the D/A converter module.

3.2.1 Performance specifications list

The following table lists the performance specifications of the D/A converter module.

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="4">Model</th></tr>
<tr><th colspan="4">Q64DAH</th></tr>
<tr><td colspan="3">Number of analog output points</td><td colspan="4">4 points (4 channels)</td></tr>
<tr><td colspan="2" rowspan="2">Digital input</td><td colspan="4">-20480 to 20479</td></tr>
<tr><td>When using the scaling function</td><td colspan="4">-32768 to 32767</td></tr>
<tr><td rowspan="2">Analog output</td><td>Voltage</td><td colspan="4">-10 to 10VDC (external load resistance 1kΩ to 1MΩ)</td></tr>
<tr><td>Current</td><td colspan="4">0 to 20mADC (external load resistance 0Ω to 600Ω)</td></tr>
<tr><td colspan="2" rowspan="9">I/O characteristics, maximum resolution*1</td><td colspan="2">Analog output range</td><td>Digital value</td><td colspan="2">Maximum resolution</td></tr>
<tr><td rowspan="4">Voltage</td><td>0 to 5V</td><td rowspan="2">0 to 20000</td><td colspan="2">250μV</td></tr>
<tr><td>1 to 5V</td><td colspan="2">200μV</td></tr>
<tr><td>-10 to10V</td><td rowspan="2">-20000 to 20000</td><td colspan="2">500μV</td></tr>
<tr><td>User range setting</td><td colspan="2">333μV</td></tr>
<tr><td rowspan="3">Current</td><td>0 to 20mA</td><td rowspan="2">0 to 20000</td><td colspan="2">1000nA</td></tr>
<tr><td>4 to 20mA</td><td colspan="2">800nA</td></tr>
<tr><td>User range setting</td><td>-20000 to 20000</td><td colspan="2">700nA</td></tr>
<tr><td rowspan="2">Accuracy (accuracy for the maximum value of analog output value)*2</td><td>Ambient temperature 25±5°C</td><td colspan="4">Within ±0.1% (voltage: ±10mV, current: ±20μA)</td></tr>
<tr><td>Ambient temperature 0 to 55°C</td><td colspan="4">Within ±0.3% (voltage: ±30mV, current: ±60μA)</td></tr>
<tr><td rowspan="2">Conversion speed</td><td>Normal output mode</td><td colspan="4">20μs/channel</td></tr>
<tr><td>Wave output mode</td><td colspan="4">50μs/channel
80μs/channel</td></tr>
<tr><td colspan="3">Number of offset/gain settings</td><td colspan="4">Up to 50000 counts</td></tr>
<tr><td colspan="3">Output short protection</td><td colspan="4">Protected</td></tr>
<tr><td colspan="3">Insulation method</td><td colspan="4">Between I/O terminals and programmable controller power supply: photocoupler isolation
Between output channels: no isolation
Between external power supply and analog output: transformer isolation</td></tr>
<tr><td colspan="3">Dielectric withstand voltage</td><td colspan="4">Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute
Between external power supply and analog output: 500VACrms for 1 minute</td></tr>
<tr><td colspan="3">Insulation resistance</td><td colspan="4">Between I/O terminals and programmable controller power supply: 500VDC 10MΩ or higher</td></tr>
<tr><td colspan="3">Number of occupied I/O points</td><td colspan="4">16 points (I/O assignment: 16 points for intelligent)</td></tr>
<tr><td colspan="3">Connected terminal</td><td colspan="4">18-point terminal block</td></tr>
<tr><td colspan="3">Applicable wire size</td><td colspan="4">0.3 to 0.75mm^2</td></tr>
<tr><td colspan="3">Applicable solderless terminal</td><td colspan="4">R1.25-3 (solderless terminals with sleeve are not usable)</td></tr>
</table>

Item	Model
	Q64DAH
External power supply	24VDC +20%, -15%
	Ripple, spike 500mV$_{P-P}$ or lower
	Inrush current: 4.7A, 1000μs or shorter
	Current consumption: 0.18A
Internal current consumption (5VDC)	0.12A
Weight	0.19kg

*1 For details on the I/O conversion characteristics, refer to the following.

I/O conversion characteristic of D/A conversion (☞ Page 24, Section 3.2.2)

*2 Except when receiving noise influence. Warm up (power on) the module for 30 minutes to satisfy the accuracy shown in the table.

3.2.2 I/O conversion characteristic of D/A conversion

I/O conversion characteristic of D/A conversion means the slope of the line connected between the offset value and gain value when converting the digital value written from the CPU module to analog output value (voltage or current output).

(1) Offset value

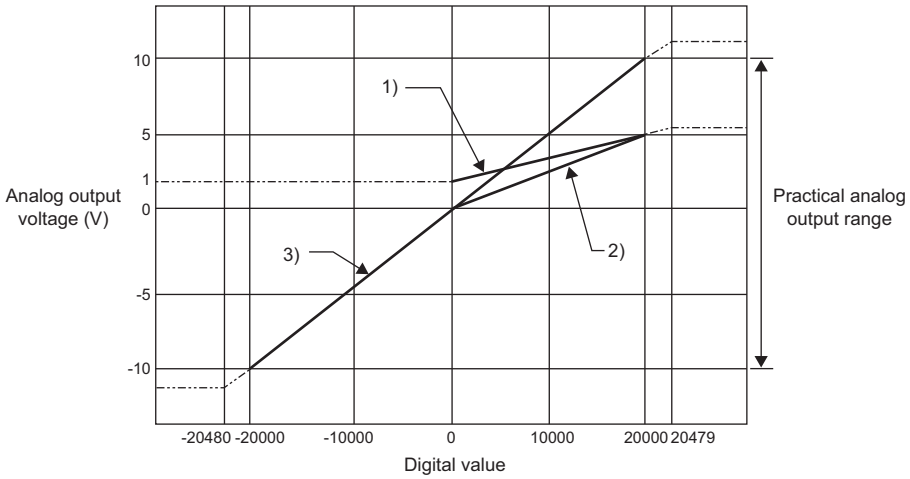
The offset value is the analog output value (voltage or current) when the digital value set from the CPU module is 0.

(2) Gain value

The gain value is the analog output value (voltage or current) when the digital value set from the CPU module is 20000.

(3) Voltage output characteristic

The following graph shows the voltage output characteristic.



No.	Output range setting	Offset value	Gain value	Digital value	Maximum resolution
1)	1 to 5V	1V	5V	0 to 20000	200μV
2)	0 to 5V	0V	5V		250μV
3)	-10 to10V	0V	10V	-20000 to 20000	500μV
-	User range setting	*1	*1		333μV

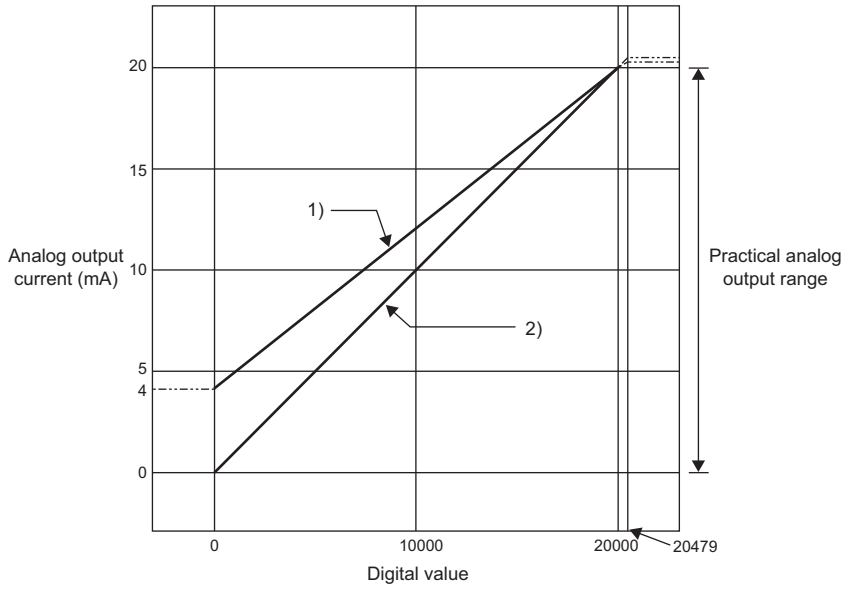
*1 Set the offset value and gain value in the user range setting within the range satisfying the following two conditions.
- Setting range: -10 to 10V
- Gain value - Offset value ≥ 6.6V

Point

Use the value within the practical digital input range and practical analog output range of each output range. If a value is out of the range, the maximum resolution and accuracy may not fall within the range described in performance specifications. (Do not use the value in the dotted line in the graph above.)

(4) Current output characteristic

The following graph shows the current output characteristic.



No.	Output range setting	Offset value	Gain value	Digital value	Maximum resolution
1)	4 to 20mA	4mA	20mA	0 to 20000	800nA
2)	0 to 20mA	0mA	20mA		1000nA
-	User range setting	*1	*1	-20000 to 20000	700nA

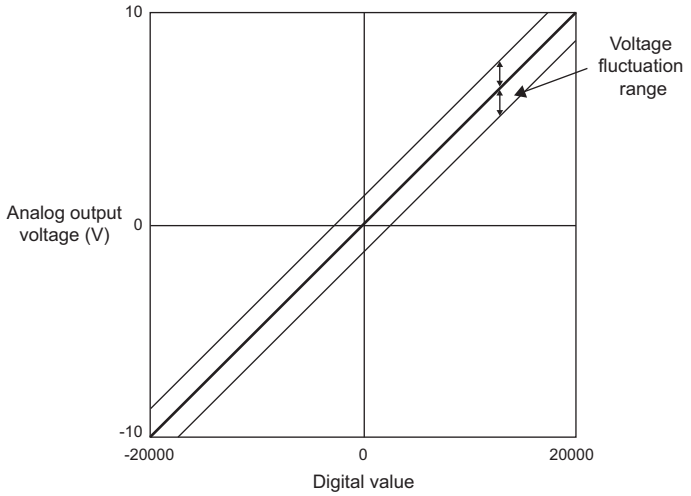
*1 Set the offset value and gain value in the user range setting within the range satisfying the following two conditions.
- Setting range: 0 to 20mA
- Gain value - Offset value ≥ 13.8mA

Point

Use the value within the practical digital input range and practical analog output range of each output range. If a value is out of the range, the maximum resolution and accuracy may not fall within the range described in performance specifications. (Do not use the value in the dotted line in the graph above.)

3.2.3 Accuracy

This accuracy is for the maximum value of analog output value.
Even when the offset/gain setting or output range was changed to change output characteristics, the accuracy remains the same, and is kept within the range described in performance specifications.
The following graph shows the fluctuation range of accuracy when the range of -10 to 10V is selected.
The analog output accuracy is within ±0.1% (±10mV) when the ambient temperature is 25 ±5°C, and within ±0.3% (±30mV) when the ambient temperature is 0 to 55°C (Excluding the case under noise effect).



3.2.4 Number of parameter settings

Set initial settings and auto refresh settings of the D/A converter module so that the number of parameters, including those of other intelligent function modules, does not exceed the number of parameters that can be set in the CPU module.

For the maximum number of parameters that can be set in the CPU module, refer to the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(1) Number of the D/A converter module parameters

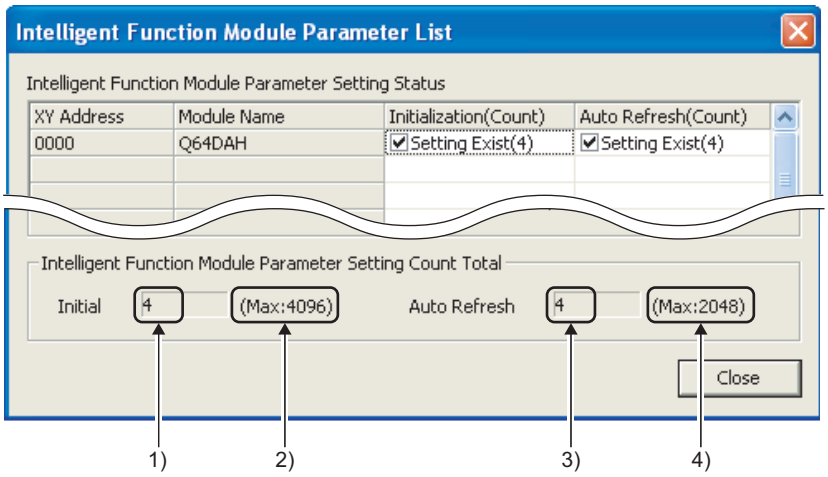
For a D/A converter module, the following number of parameters can be set.

Model	Initial setting	Auto refresh setting
Q64DAH	4	11 (maximum)

(2) Checking method

The maximum number of parameter settings and the number of parameter settings set for the intelligent function module can be checked with the following operation.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [Intelligent Function Module Parameter List...]



No.	Description
1)	The total number of parameters in the initial settings checked on the window
2)	The maximum number of parameter settings in the initial settings
3)	The total number of parameters in the auto refresh setting checked on the window
4)	The maximum number of parameter settings in the auto refresh setting

3.3 Function List

This section lists the functions of the D/A converter module.

Item	Description	Reference
D/A conversion enable/disable function	This function sets whether to enable or disable D/A conversion for each channel. Disabling the D/A conversion for unused channels reduces the conversion cycle.	Page 31, Section 4.2
D/A output enable/disable function	This function sets whether to output the D/A-converted value or the offset value for each channel. The conversion cycle is constant, regardless of the output enable/disable status.	Page 31, Section 4.3
Range switching function	The output range to be used can be selected from the following: • Industrial shipment range (4 to 20mA, 0 to 20mA, 1 to 5V, 0 to 5V, -10 to 10V) • User range setting	Page 139, Section 8.2
Offset/gain setting function	This function compensates for errors in analog output values.	Page 143, Section 8.5
Analog output HOLD/CLEAR function	This function sets whether to hold the output analog value (HOLD) or clear the output analog value (CLEAR) when the CPU module operating status is RUN, STOP, or stop error.	Page 32, Section 4.4
Analog output test when CPU module is in STOP status	When the CPU module is in STOP status, forcibly turning on CH□ Output enable/disable flag (Y1 to Y4) outputs the D/A-converted analog value.	Page 35, Section 4.5
Scaling function	This function scales a digital value into a value within the range of the set scaling lower limit value to scaling upper limit value. The sequence programming for scale conversion can be omitted.	Page 37, Section 4.6
Warning output function	This function outputs a warning when the digital value exceeds the warning output upper limit value or falls below the warning output lower limit value.	Page 42, Section 4.7
Wave output function	This function consecutively outputs data (analog values) every set conversion cycle by registering prepared wave data (digital values) to the D/A converter module. A faster and smoother control than a sequence program is achieved by the automatic output of the control wave data registered in the D/A converter module for the analog (torque) control such as pressing machines and injection molding units. The control can be executed only by registering the wave data to the D/A converter module. Therefore, the program-less control is available for the repeat control such as the line control, and man-hours for programming can be reduced.	Page 44, Section 4.8
Wave output step action function	This function changes addresses and data values to be output to change the analog output flexibly at any timing in the wave output mode. This function is useful for the analog output test in the wave output mode and for debugging the wave output function.	Page 80, Section 4.8.4
External power supply READY flag (X7)	This signal turns on when the external power supply 24VDC is supplied. When the flag is off, 0V/0mA are output to analog output values regardless of other settings.	Page 95, Section 5.2.1 (2)
Error log function	This function stores errors and alarms that occur in the D/A converter module to the buffer memory as history. The total of 16 cases of history for errors and alarms are stored.	Page 89, Section 4.9
Module error collection function	This function collects errors and alarms that occur in the D/A converter module into the CPU module.	Page 92, Section 4.10
Error clear function	When an error occurs, the error can be cleared on the system monitor.	Page 93, Section 4.11
Online module change	This module can be replaced without stopping the system.	Page 170, CHAPTER 10

CHAPTER 4 FUNCTIONS

This chapter describes the details on functions that can be used in the D/A converter module and the setting procedures.
For details on the I/O signals and the buffer memory, refer to the following.

- Details of I/O Signals (☞Page 95, Section 5.2)
- Details of Buffer Memory Addresses (☞Page 111, Section 6.2)

4.1 Mode

The D/A converter module has the normal mode and the offset/gain setting mode. Select the correct mode according to the function to be used.
The following shows descriptions of each mode.

(1) Normal mode

The normal mode includes the normal output mode and wave output mode. In this manual, the description of "normal mode" indicates the normal output mode and wave output mode.

(a) Normal output mode

This output mode is for the standard D/A conversion. The value set in CH□ Digital value (Un\G1 to Un\G4) is output in analog after the D/A conversion. The conversion speed is 20μs/CH.

(b) Wave output mode

This output mode is for the wave output. The value set in Wave data registry area (Un\G5000 to Un\G54999) is output in analog after the D/A conversion. The conversion speed can be selected from 50μs/CH and 80μs/CH.
For details on the wave output function, refer to the following.

- Wave Output Function (☞Page 44, Section 4.8)

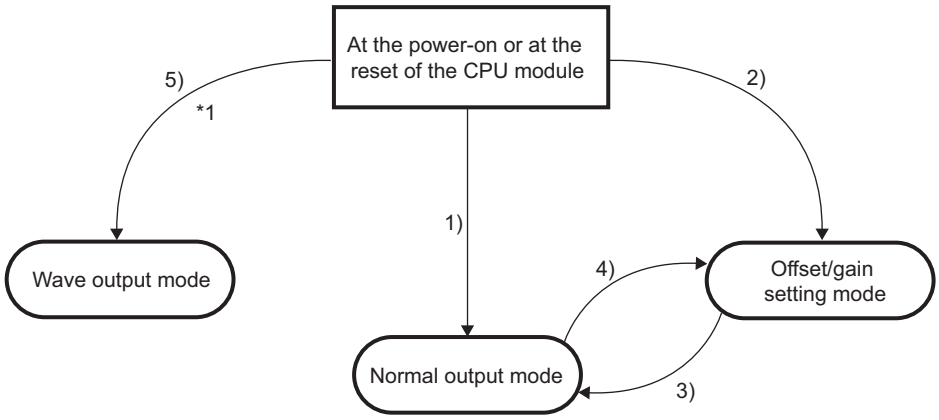
(2) Offset/gain setting mode

This mode is for the offset/gain setting.
For details on the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

(3) Mode transitions

The following shows the transition condition of each mode.



No.	Transition condition	
1)	Set "Drive Mode Setting" to "Normal (D/A Converter Processing) Mode" and set "Output mode setting" to "Normal output mode (conversion speed: 20μs/CH)" in "Switch Setting" of GX Works2.	
2)	Set "Drive Mode Setting" to "Offset-Gain Setting Mode" in "Switch Setting" of GX Works2.	
3)	Shift a mode by either of following methods.	
	Method 1	Execute the G(P).OFFGAN (argument Ⓢ: 0: Switch to the normal output mode).
	Method 2	Set the following values in Mode switching setting (Un\G158, Un\G159) and turn on and off Operating condition setting request (Y9). • Un\G158: 0964_H • Un\G159: 4144_H
4)	Shift a mode by either of following methods.	
	Method 1	Execute the G(P).OFFGAN (argument Ⓢ: 1: Switch to the offset/gain setting mode).
	Method 2	Set the following values in Mode switching setting (Un\G158, Un\G159) and turn on and off Operating condition setting request (Y9). • Un\G158: 4144_H • Un\G159: 0964_H
5)	Set "Drive Mode Setting" to "Normal (D/A Converter Processing) Mode" and set "Output mode setting" to "Wave output mode (conversion speed: 50μs/CH)" or "Wave output mode (conversion speed: 80μs/CH)" in "Switch Setting" of GX Works2.	

*1 The wave output mode is independent from the other modes. After the start in the wave output mode, the transition to another mode is not available. Also, after the start in another mode, the transition to the wave output mode is not available.

(4) Checking method

The current mode of the module can be checked by referring to the following table.

Mode	RUN LED status	Stored value in Output mode (Un\G9)	Offset/gain setting mode flag (XA)
Normal output mode (conversion speed: 20μs/CH)	On	0	OFF*1
Wave output mode (conversion speed: 50μs/CH)	On	1	OFF
Wave output mode (conversion speed: 80μs/CH)	On	2	OFF
Offset/gain setting mode	Flashing	0	OFF*1

*1 When User range writing request (YA) is off

4.2 D/A Conversion Enable/disable Function

This function sets whether to enable or disable D/A conversion for each channel.
Disabling the D/A conversion for unused channels reduces the conversion cycle.

(1) Setting procedure

1. **Set D/A conversion enable/disable setting (Un\G0) to D/A conversion enable (0).**
2. **Turn on and off Operating condition setting request (Y9).**

4.3 D/A Output Enable/disable Function

This function sets whether to output the D/A-converted value or the offset value, for each channel.
The conversion cycle is constant, regardless of the output enable/disable status.

(1) Setting procedure

Configure the setting with CH□ Output enable/disable flag (Y1 to Y4).

CH□ Output enable/disable flag (Y1 to Y4)	Analog output
Enable (ON)	D/A-converted value is output.
Disable (OFF)	Offset value is output.

4.4 Analog Output HOLD/CLEAR Function

This function sets whether to hold the output analog value (HOLD) or clear the output analog value (CLEAR) when the CPU module operating status is RUN, STOP, or stop error.

(1) Combination of analog output status

As shown in (a) and (b), analog output status differs depending on modes (whether the module is set to normal output mode or wave output mode).

(a) Normal output mode

The analog output status changes as shown in the following table, depending on the combination of settings for D/A conversion enable/disable setting (Un\G0) and CH□ Output enable/disable flag (Y1 to Y4).

Execution status	D/A conversion enable/disable setting (Un\G0)	Enable			Disable
	CH□ Output enable/disable flag (Y1 to Y4)	Enable		Disable	Enable or disable
	Analog output HOLD/CLEAR function setting	HOLD	CLEAR	HOLD or CLEAR	HOLD or CLEAR
Analog output status when CPU module is in RUN status		Analog value converted from digital value with D/A conversion is output.		Offset value	0V/0mA
Analog output status when CPU module is in STOP status		Hold	Offset value	Offset value*2	0V/0mA
Analog output status when CPU module is in stop error		Hold	Offset value	Offset value	0V/0mA
Analog output status when a watchdog timer error*1 occurs		0V/0mA	0V/0mA	0V/0mA	0V/0mA

*1 A watchdog timer error refers to the state where Module READY (X0) turns off and the RUN LED on the D/A converter module turns off due to a hardware failure that occurred in the D/A converter module.

*2 The following operation is performed when the CPU module is in STOP status, D/A conversion enable/disable setting (Un\G0) is set to D/A conversion enable (0) for the channel where HOLD is set, and Operating condition setting request (Y9) is turned on and off.

- Output enable/disable flag OFF: 0V/0mA output
- Output enable/disable flag ON: offset value output

(b) Wave output mode

The analog output status changes as shown in the following table, depending on the combination of settings for D/A conversion enable/disable setting (Un\G0), CH☐ Output enable/disable flag (Y1 to Y4), and the wave output status.

Execution status	D/A conversion enable/disable setting (Un\G0)	Enable						Disable	
	CH☐ Output enable/disable flag (Y1 to Y4)	Enable						Disable	Enable or disable
	Analog output HOLD/CLEAR function setting	HOLD			CLEAR			HOLD or CLEAR	HOLD or CLEAR
	Wave output status	Output	Stop	Pause	Output	Stop	Pause	Stop	Stop
Analog output status when CPU module is in RUN status		Wave data	*2	Hold	Wave data	*2	Offset value	Offset value	0V/0mA
Analog output status when CPU module is in STOP status		Hold			Offset value			Offset value	0V/0mA
Analog output status when CPU module is in stop error		Hold			Offset value			Offset value	0V/0mA
Analog output status when a watchdog timer error*1 occurs		0V/0mA			0V/0mA			0V/0mA	0V/0mA

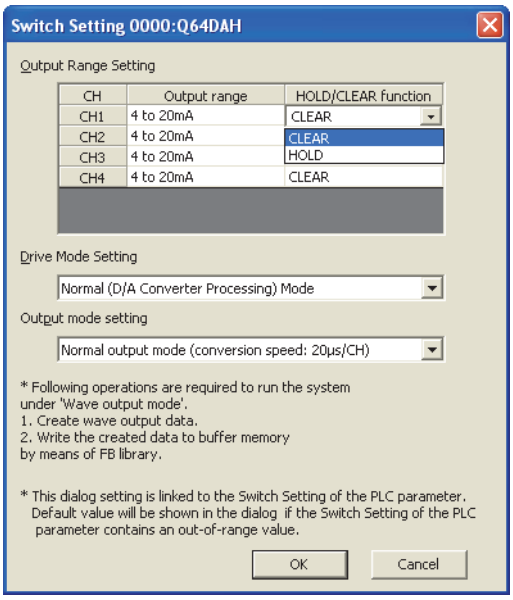
*1 A watchdog timer error refers to the state where Module READY (X0) turns off and the RUN LED on the D/A converter module turns off due to a hardware failure that occurred in the D/A converter module.

*2 The value is output in analog according to the setting in CH☐ Output setting during wave output stop (Un\G1008 to Un\G1011).

(2) Setting procedure

Configure the setting from "HOLD/CLEAR function".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]



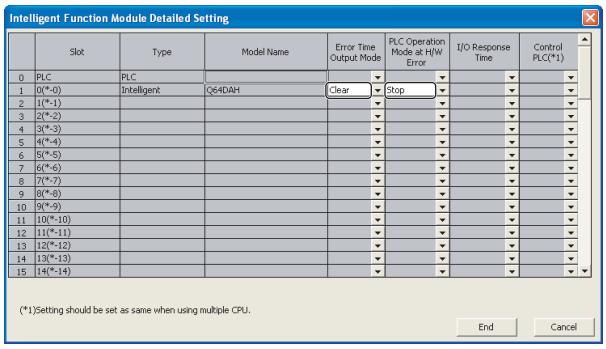
(3) When the module is mounted on MELSECNET/H remote I/O station

The following lists the conditions to use the analog output HOLD/CLEAR function with the D/A converter module mounted on MELSECNET/H remote I/O station.

- Use the master module and remote I/O module of the function version D or later.
- Enable the station-based block data assurance of the cyclic data on the send side.
- To hold the D/A conversion output when a link error occurs, configure the setting from "Error Time Output Mode" of the I/O assignment setting. The setting in "HOLD/CLEAR function" in the "Switch Setting" window is disabled.

The "Error Time Output Mode" can be set for each module, but not set for each channel.
Thus, to match the output status when a CPU module is in a stop error or in STOP status with the output status when a link error occurs, set the "HOLD/CLEAR function" to the same value for all channels.

Project window ⇨ [Parameter] ⇨ [PLC Parameter] ⇨ [I/O Assignment] ⇨ Detailed Setting button



Operating status	Error Time Output Mode	HOLD/CLEAR function (All channels should be the same setting)
Holds the analog output	Hold	HOLD
Clears the analog output (Outputs an offset value)	Clear	CLEAR

For the station-based block data assurance of the cyclic data, refer to the following.

Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

4.5 Analog Output Test When CPU Module Is in STOP Status

Analog output test can be performed when the CPU module is in STOP status.

The following functions are enabled during the analog output test.

- Scaling Function (☞Page 37, Section 4.6)
- Warning Output Function (☞Page 42, Section 4.7)

When a digital value out of the range is written to each channel, an error (error code: 60□) occurs and the check code is stored in CH□ Set value check code (Un\G11 to Un\G14).

This section describes the analog output test in the normal output mode. For the analog output test in the wave output mode, refer to the following.

- Wave output step action function (☞Page 80, Section 4.8.4)

(1) Setting procedure

For analog output test, configure the settings in the following procedure in the device test of GX Works2.

1. **Set D/A conversion enable/disable setting (Un\G0) to enable (0) for the channel where the analog output test is performed.**
2. **Turn on Operating condition setting request (Y9).**
3. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**
4. **Set the digital value equivalent to the analog value to be output to CH□ Digital value (Un\G1 to Un\G4) in the buffer memory.**
5. **Turn on CH□ Output enable/disable flag (Y1 to Y4) for the channel where the analog output test is performed.**

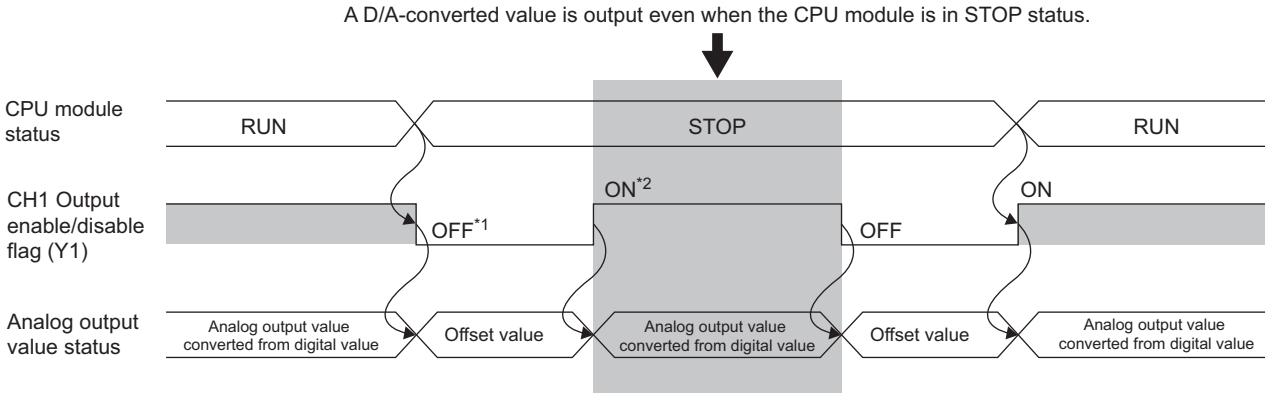
Setting combination	D/A conversion enable/disable setting (Un\G0)	Enable		Disable	
	CH□ Output enable/disable flag (Y1 to Y4)	Enable	Disable	Enable	Disable
Analog output test		Allowed	Not allowed	Not allowed*1	

*1 When performing the analog output test, set D/A conversion enable/disable setting (Un\G0) to enable (0) beforehand.

(2) Operation timing

By forcibly turning on CH□ Output enable/disable flag (Y1 to Y4) when the CPU module is in STOP status, analog output value is changed from offset value to D/A-converted analog value.

The following shows the relation between CH1 Output enable/disable flag (Y1) and analog output value when the CPU module is in STOP status.



*1 CH1 Output enable/disable flag (Y1) turns off with CPU STOP.

*2 By forcibly turning on CH1 Output enable/disable flag (Y1), analog output value is changed from offset value to D/A-converted analog value.

Point

When the D/A converter module is mounted on MELSECNET/H remote I/O station, analog output tests can be performed even though the CPU module on the master station is in a stop error.

4.6 Scaling Function

This function scales a digital value into a value within the range of the set scaling lower limit value to scaling upper limit value. The sequence programming for scale conversion can be omitted.
However, this function cannot be used in the wave output mode.

(1) Concept of scaling setting

The setting for scaling lower and upper limit values differs depending on whether the industrial shipment setting or the user range setting is used for analog output range.

(a) When the industrial shipment setting is used for analog output range

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

(b) When the user range setting is used for analog output range

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

(2) Calculating the scaling value

Values converted using the following formulas are used for D/A conversion.
(Values lower than the decimal point are rounded down in scale conversion.)

(a) When the industrial shipment setting is used for output range

- Voltage: 1 to 5V, 0 to 5V
- Current: 4 to 20mA, 0 to 20mA

$$\text{Digital value used for D/A conversion} = \frac{20000}{S_H - S_L} \times (D_X - S_L)$$

- When the voltage is -10 to 10V

$$\text{Digital value used for D/A conversion} = \frac{40000}{S_H - S_L} \times (D_X - S_L) - 20000$$

(b) When the user range setting is used for output range

$$\text{Digital value used for D/A conversion} = \frac{20000}{S_H - S_L} \times (D_X - S_L)$$

Item	Description
Dx	digital value
S_H	scaling upper limit value
S_L	scaling lower limit value

(3) Setting procedure

1. **Set D/A conversion enable/disable setting (Un\G0) to D/A conversion enable (0).**
2. **Set Scaling enable/disable setting (Un\G53) to Enable (0).**
3. **Set values for CH1 Scaling lower limit value (Un\G54) to CH4 Scaling upper limit value (Un\G61).**

Item	Setting range
CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60)	-32000 to 32000
CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61)	

4. **Turn on and off Operating condition setting request (Y9).**

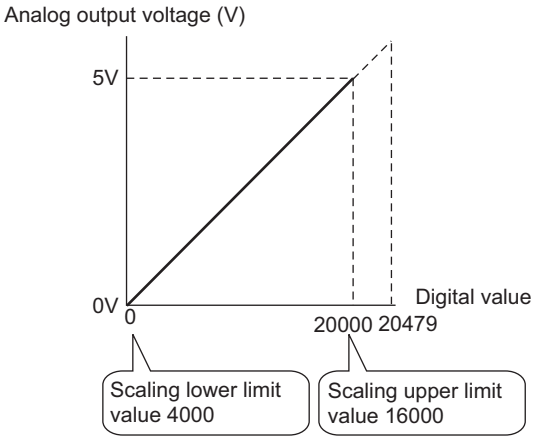
Point

- The scaling settings must meet the following condition:
  Scaling upper limit value > Scaling lower limit value
- In the channel where Scaling enable/disable setting (Un\G53) is set to Enable (0) in the wave output mode, an error occurs. The error code (21☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- Even though the input range of digital value is increased, the resolution does not become higher than the resolution of when the scaling function is not used.

(4) Scaling setting example

Ex. When following are set for a channel with the output range of 0 to 5V
- CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61): 16000
- CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60): 4000

The following shows the digital values before and after scaling.

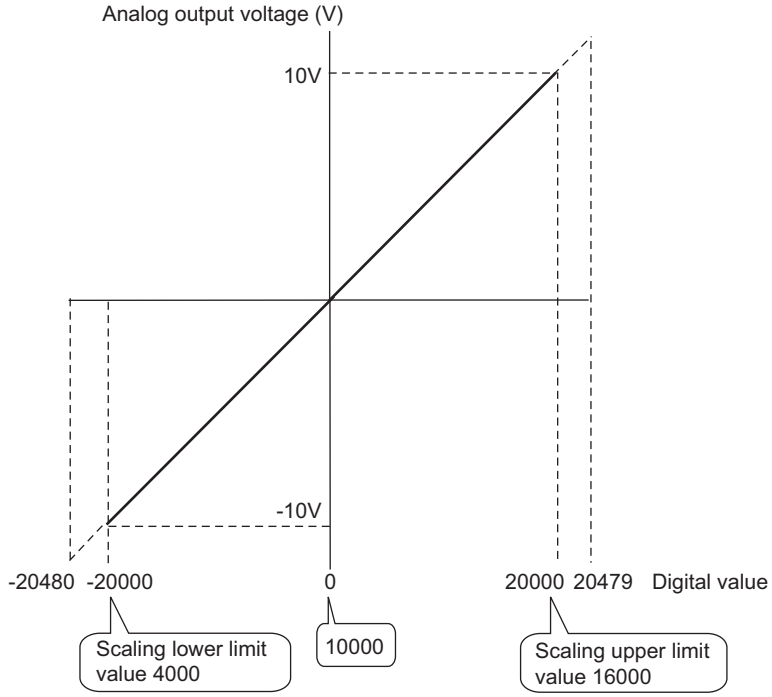


Digital value	Digital value after scaling	Analog output voltage (V)
4000	0	0
6400	4000	1
8800	8000	2
11200	12000	3
13600	16000	4
16000	20000	5

Ex. When following are set for a channel with the output range of -10 to 10V

- CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61): 16000
- CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60): 4000

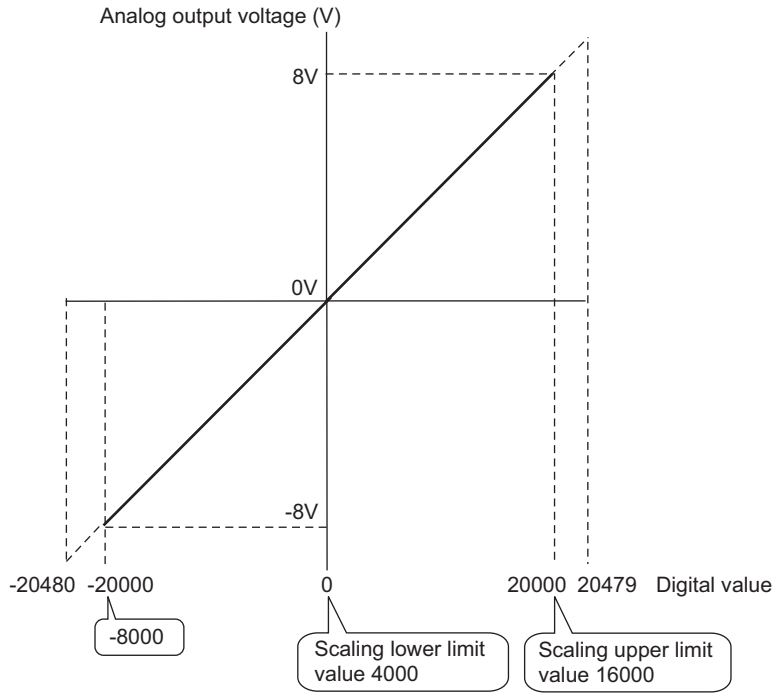
The following shows the digital values before and after scaling.



Digital value	Digital value after scaling	Analog output voltage (V)
4000	-20000	-10
7000	-10000	-5
10000	0	0
13000	10000	5
16000	20000	10

Ex. When following are set for a channel with the user range setting of -8 to 8V
- CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61): 16000
- CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60): 4000

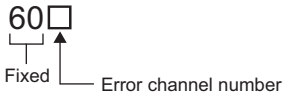
The following shows the digital values before and after scaling.



Digital value	Digital value after scaling	Analog output voltage (V)
-8000	-20000	-8
-2000	-10000	-4
4000	0	0
10000	10000	4
16000	20000	8

Point

- When the scaling function is used, the digital value before scaling can be set to a value out of the range of scaling upper and lower limit values (dotted line area in the I/O characteristics). However, use the scaling function within the range of analog output practical range (solid line area in the I/O characteristics). If the value exceeds the analog output practical range, the maximum resolution and accuracy may not fall within the range of performance specifications.
- The default digital value "0" may not be appropriate, depending on the scaling function setting.
  In particular in the examples for the output range of 0 to 5V and output range of -10 to 10V, when CH☐ Output enable/disable flag (Y1 to Y4) is turned on with the digital value "0", an out-of-range digital value error occurs. The error code (60☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.
  Therefore, set an appropriate digital value within the scaling range before turning on CH☐ Output enable/disable flag (Y1 to Y4).
  The following shows the error codes that occur.

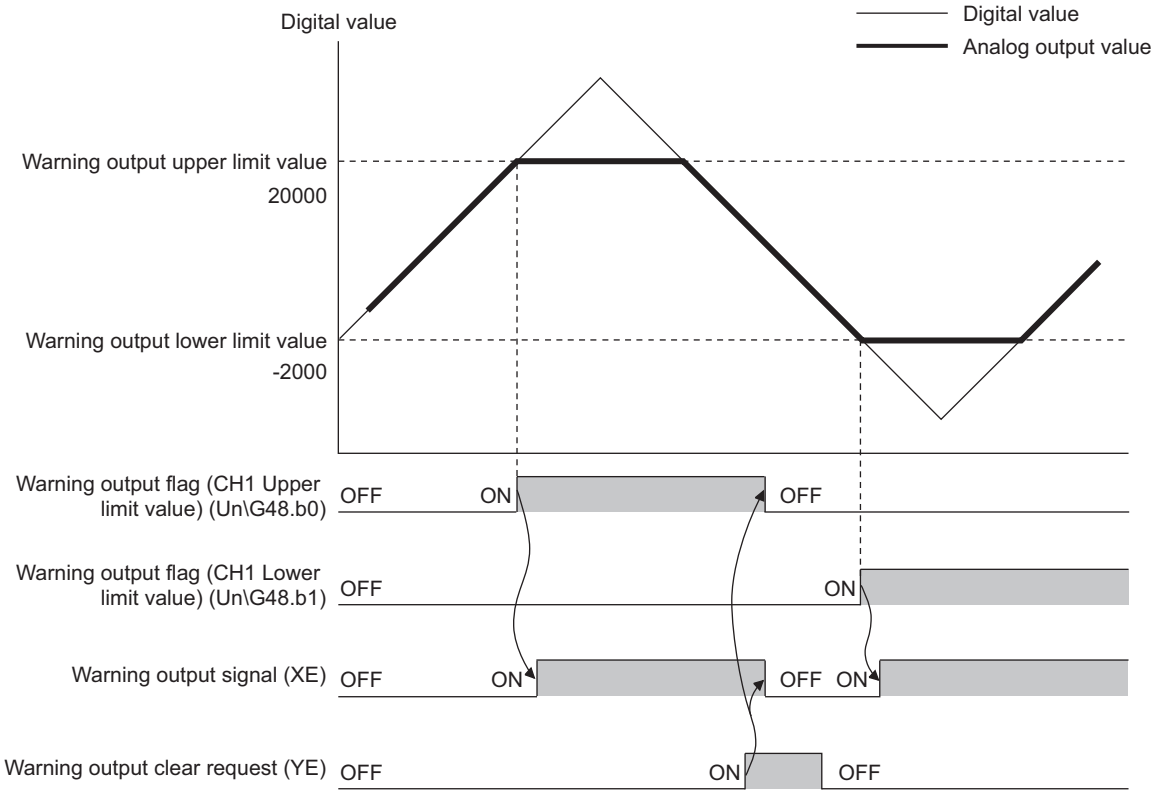


- When using the user range, note that the scaling lower limit value is equal to the offset value.

4.7 Warning Output Function

This function outputs a warning when the digital value exceeds the warning output upper limit value or falls below the warning output lower limit value. The warning target depends on the output mode as shown below.

- In normal output mode: CH☐ Digital value (Un\G1 to Un\G4)
- In wave output mode: Wave data registry area (Un\G5000 to Un\G54999)

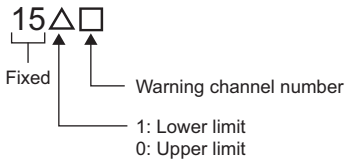


(1) Warning output notification

When the digital value exceeds the warning output upper limit value or falls below the warning output lower limit value, a warning is output by turning on of Warning output flag (Un\G48), Warning output signal (XE), and the ALM LED.

In addition, alarm code: 15△☐ is stored in Latest error code (Un\G19).

The following shows the alarm codes that are stored.



(2) Operation of warning output function

When the digital value exceeds the warning output upper limit value, or becomes less than the warning output lower limit value, a warning is output and the analog output value becomes any of the following.

- When the digital value exceeds the warning output upper limit value: An analog value converted from the digital value of warning output upper limit value is output.
- When the digital value becomes less than the warning output lower limit value: An analog value converted from the digital value of warning output lower limit value is output.

After a warning has occurred, the analog output value returns to the normal value by changing the digital value to a value within the setting range. However, Warning output flag (Un\G48) and Warning output signal (XE) are not cleared. (ALM LED keeps on.)

(3) Clearing of the warning

The warning can be cleared in the following two methods:

- Turning on and off Warning output clear request (YE)
- Turning on and off Operating condition setting request (Y9)

Clearing the warning puts the D/A converter module into the following status.

- Warning output flag (Un\G48) is cleared.
- Warning output signal (XE) turns off.
- ALM LED is turned off.
- Alarm code: 15△☐ stored in Latest error code (Un\G19) is cleared.

(4) If the scaling function is enabled

If Scaling enable/disable setting (Un\G53) is set to Enable (0), the digital value after converted to the scaling range becomes a target for warning detection.

When setting CH1 Warning output upper limit value (Un\G86) to CH4 Warning output lower limit value (Un\G93), consider the scaling range and specify values.

(5) Setting procedure

1. **Set D/A conversion enable/disable setting (Un\G0) to D/A conversion enable (0).**
2. **Set Warning output setting (Un\G47) to Enable (0).**
3. **Set values for CH1 Warning output upper limit value (Un\G86) to CH4 Warning output lower limit value (Un\G93).**

Item	Setting range
CH☐ Warning output upper limit value (Un\G86, Un\G88, Un\G90, Un\G92)	-32768 to 32767
CH☐ Warning output lower limit value (Un\G87, Un\G89, Un\G91, Un\G93)	

4. **Turn on and off Operating condition setting request (Y9).**

Point

The value to be set must satisfy the condition of Warning output upper limit value > Warning output lower limit value. In the channel where a value does not satisfy the condition, an error occurs. The error code (62☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

4.8 Wave Output Function

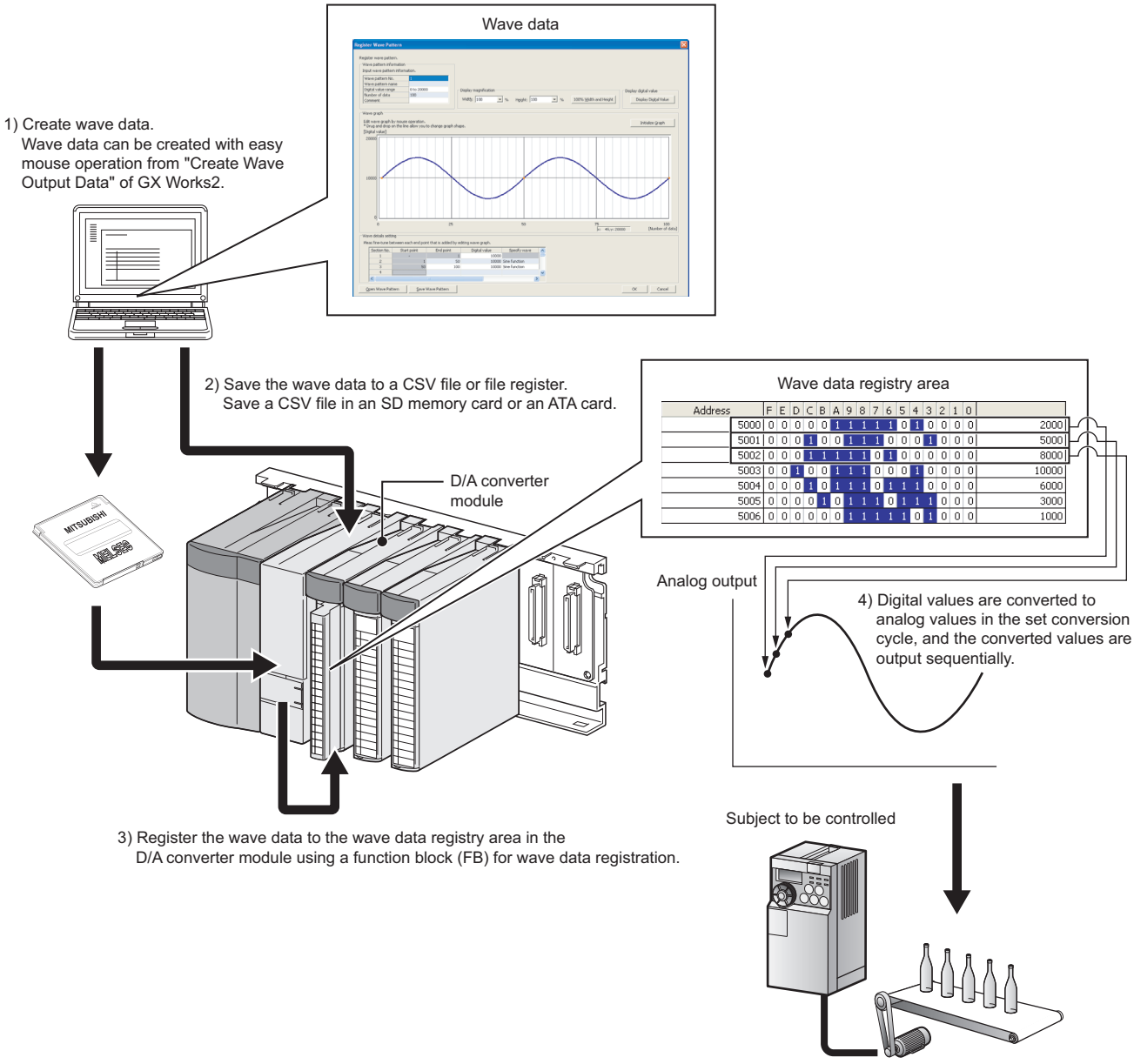
This function consecutively outputs data (analog values) every set conversion cycle by registering prepared wave data (digital values) to the D/A converter module. A faster and smoother control than a sequence program is achieved by the automatic output of the control wave data registered in the D/A converter module for the analog (torque) control such as pressing machines and injection molding units. The control can be executed only by registering the wave data to the D/A converter module. Therefore, the program-less control is available for the repeat control such as the line control, and man-hours for programming can be reduced.

The wave output function is only available in the wave output mode. Select the suitable wave output mode according to the conversion speed.

- Wave output mode (conversion speed: 50μs/CH)
- Wave output mode (conversion speed: 80μs/CH)

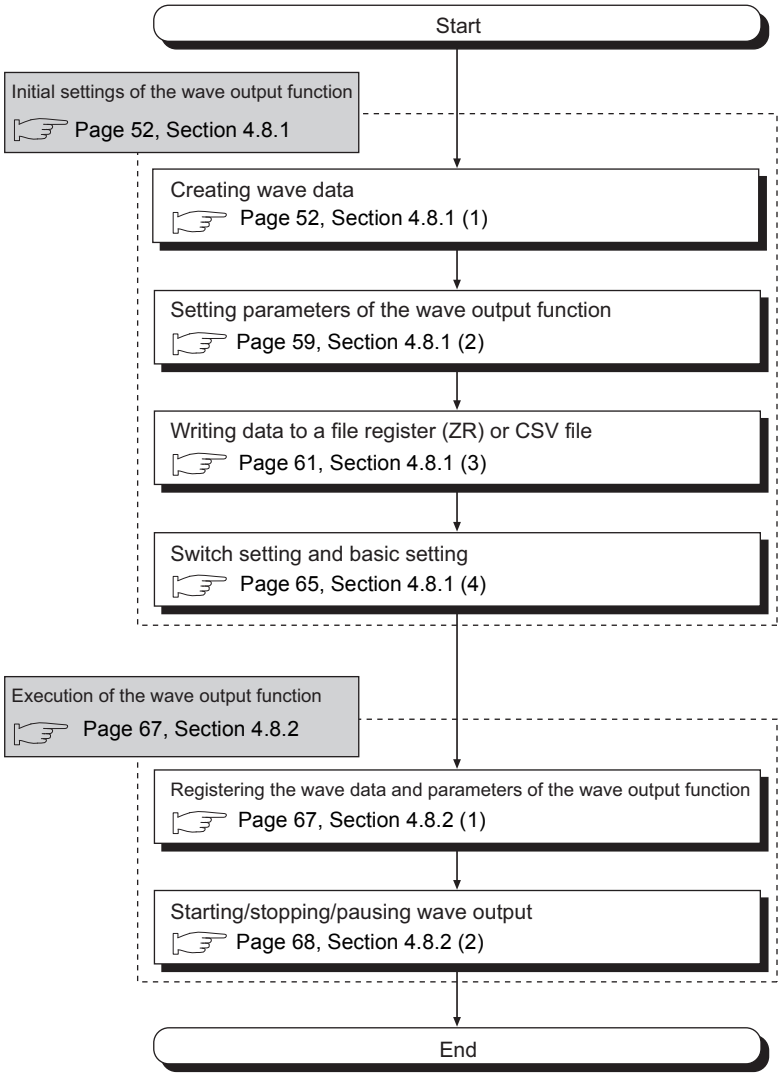
For the setting procedure of the wave output mode, refer to the following.

- Switch setting (☞Page 65, Section 4.8.1 (4) (a))



(1) Wave output function procedure

The following shows how to use the wave output function.



The wave data creation and parameter setting of the wave output function can be executed easily with "Create Wave Output Data" of GX Works2. These setting contents are saved in the file register (ZR) of the CPU module or in a CSV file and registered to the buffer memory of the D/A converter module with the function block (FB) for the wave data registration.

For details on the function block (FB) for the wave data registration and wave output execution, refer to the following manual.

- MELSEC-Q High Speed Digital-Analog Converter Module FB Library Reference Manual (FBM-M087)

(a) Advantage of saving wave data in the file register (ZR) or in a CSV file

- File register (ZR) : The wave data and parameter setting contents remain in the CPU module even after power off or reset of the CPU module.
- CSV file : The wave data and parameter setting can be used for the D/A converter module of other programmable controller systems only by copying the CSV file.

(2) Parameter settings for the wave output function

Set the parameters of the wave output function to the following buffer memory areas to use the wave output function. For details on each buffer memory, refer to the following.

- Details of Buffer Memory Addresses (☞Page 111, Section 6.2)

Setting item	Buffer memory address	Reference
Output setting during wave output stop	Un\G1008 to Un\G1011	Page 119, Section 6.2 (19)
Output value during wave output stop	Un\G1016 to Un\G1019	Page 120, Section 6.2 (20)
Wave pattern start address setting	Un\G1024 to Un\G1031	Page 121, Section 6.2 (21)
Wave pattern data points setting	Un\G1040 to Un\G1047	Page 122, Section 6.2 (22)
Wave pattern output repetition setting	Un\G1056 to Un\G1059	Page 123, Section 6.2 (23)
Constant for wave output conversion cycle	Un\G1064 to Un\G1067	Page 123, Section 6.2 (24)
Wave data registry area	Un\G5000 to Un\G54999	Page 131, Section 6.2 (36)

For details on the parameter setting, refer to the following.

- Setting parameters of the wave output function (☞Page 59, Section 4.8.1 (2))

(3) Restrictions and precautions on the wave output function

The wave output function has the following restrictions and precautions.

(a) Output range setting

The user range cannot be used. When using the wave output function, select the range other than the user range.

For the setting procedure of the output range, refer to the following.

- Switch setting (☞Page 65, Section 4.8.1 (4))

(b) Analog output HOLD/CLEAR function

In the analog output HOLD/CLEAR function, the operation of the D/A converter module in the wave output mode differs from the operation in the normal output mode.

For details, refer to the following.

- Analog output HOLD/CLEAR function (☞Page 33, Section 4.4 (1) (b))

(c) Scaling function

The scaling function cannot be used in the wave output mode. When using the wave output function, disable the scaling function.

(d) CPU module

Some CPU modules cannot use the file register (ZR), SD memory card, or ATA card. Check whether the CPU module in use can use the file register (ZR), SD memory card, or ATA card by referring the following manual.

- 🕮 QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(e) MELSECNET/H remote I/O module

The wave output function cannot be used when the D/A converter module is used on a MELSECNET/H remote I/O station.

(4) Wave data

The wave data indicates the time-series arrangement of the digital value to be output in analog value. Up to 50000 points can be used. The wave data is registered in Wave data registry area (Un\G5000 to Un\G54999).

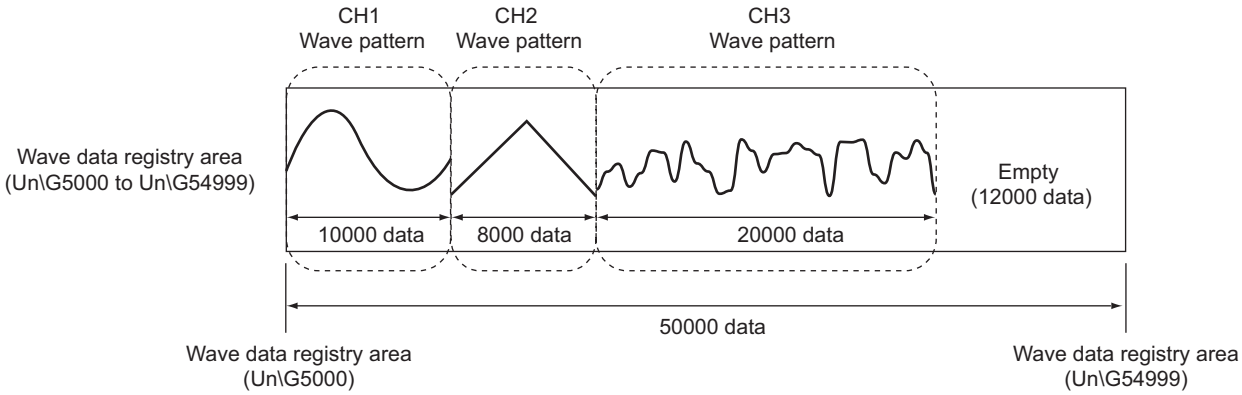
(5) Wave pattern

To use the wave output function, select any points from the registered wave data for each channel and set the wave pattern. The following table lists the setting contents for the wave pattern.

Setting item	Buffer memory address	Description
Wave pattern start address setting	Un\G1024 to Un\G1031	Set the start address of the wave pattern to be output for each channel. The D/A conversion starts from the digital value of the buffer memory address set in this area and the converted values are output sequentially.
Wave pattern data points setting	Un\G1040 to Un\G1047	This area is for setting the points of the wave pattern to be output for each channel. From the start address of the wave pattern, the D/A conversion starts for the points of wave data set in this area and the converted values are output.

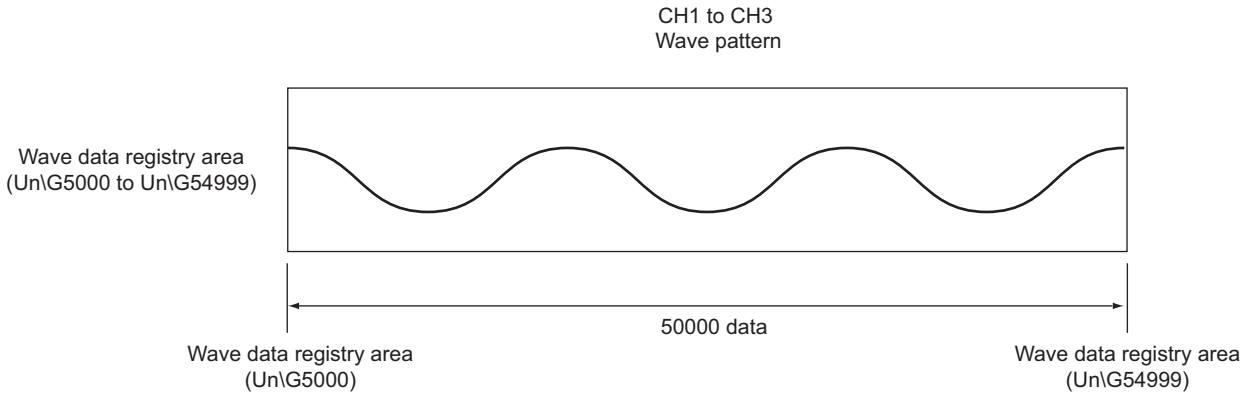
If the address value (total of the set values for Wave pattern start address setting and Wave pattern data points setting - 1) exceeds the last address (Un\G54999) of the wave data registry area, an error occurs. The error code (37☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

Ex. Setting example to output separate waves from CH1 to CH3



Setting item	Buffer memory address	Setting value
CH1 Wave pattern start address setting	Un\G1024, Un\G1025	5000
CH1 Wave pattern data points setting	Un\G1040, Un\G1041	10000
CH2 Wave pattern start address setting	Un\G1026, Un\G1027	15000
CH2 Wave pattern data points setting	Un\G1042, Un\G1043	8000
CH3 Wave pattern start address setting	Un\G1028, Un\G1029	23000
CH3 Wave pattern data points setting	Un\G1044, Un\G1045	20000

Ex. Setting example to output the same wave from CH1 to CH3

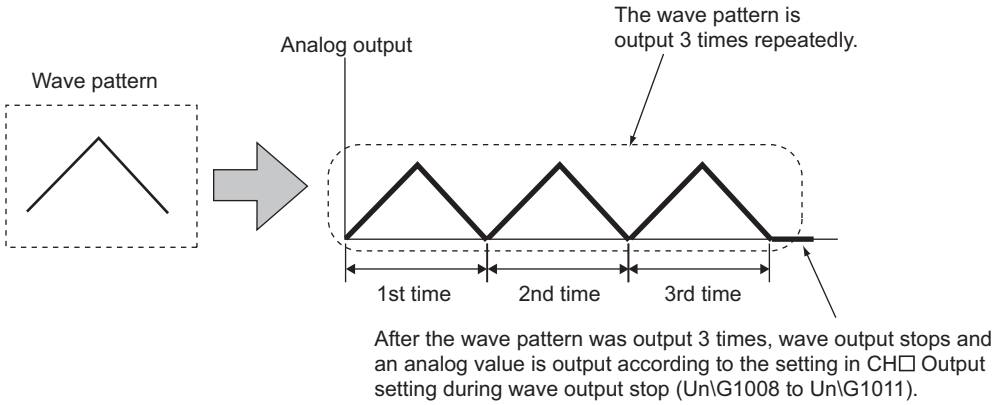


Setting item	Buffer memory address	Setting value
CH1 Wave pattern start address setting	Un\G1024, Un\G1025	5000
CH1 Wave pattern data points setting	Un\G1040, Un\G1041	50000
CH2 Wave pattern start address setting	Un\G1026, Un\G1027	5000
CH2 Wave pattern data points setting	Un\G1042, Un\G1043	50000
CH3 Wave pattern start address setting	Un\G1028, Un\G1029	5000
CH3 Wave pattern data points setting	Un\G1044, Un\G1045	50000

(6) Wave pattern output count

The wave pattern can be output repeatedly according to the setting of CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059). Set the output count within 1 to 32767. The wave pattern also can be output in analog repeatedly and unlimitedly.

Ex. When the wave pattern output count is set to three

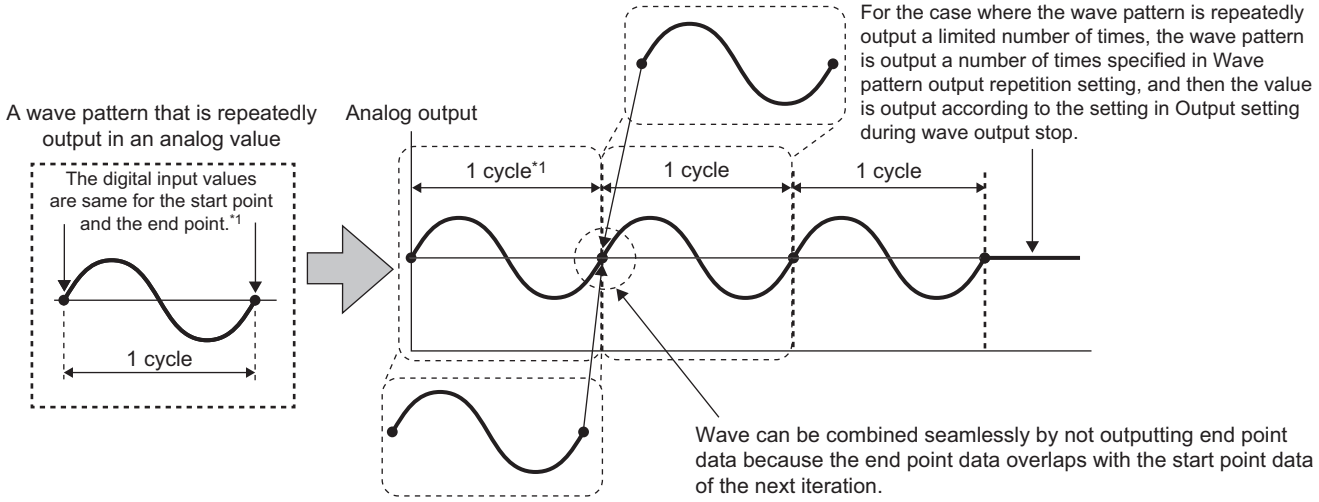


The following section describes "repeat control" in which the same wave pattern is output repeatedly from the D/A converter module.

(a) When the digital values are same for the start point and the end point

An end point of a wave pattern overlaps with the start point of the wave pattern of the next iteration in the D/A converter module's processing; therefore, the end point is not output in analog. The analog output of the wave pattern end point varies as follows depending on the setting of CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059).

- Limited repetition
  When CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059) is set to 2 to 32767, the digital value of the end point is not output in analog till the wave pattern of the final iteration output. After the digital value of the end point is output in analog at the wave pattern of the final iteration output, the value is output according to the setting in CH□ Output setting during wave output stop (Un\G1008 to Un\G1011).
- Unlimited repetition
  The digital value of the wave pattern end point is not output in analog.



*1 The output cycle of a wave pattern is calculated by the following formula.
Output cycle of a wave pattern = (Wave output conversion cycle) × (Wave pattern data points - 1)

For details on the wave output conversion cycle, refer to the following.
Wave output conversion cycle (☞ Page 51, Section 4.8 (7))

Ex. : Calculating the output cycle of a wave pattern

Setting item	Buffer memory address	Setting value
Output mode (switch setting)	–	Wave output mode (conversion speed: 50μs/CH)
D/A conversion enable/disable setting	Un\G0	D/A conversion enable for CH1 only (E_H)
CH1 Wave pattern data points setting	Un\G1040, Un\G1041	101
CH1 Wave pattern output repetition setting	Un\G1056	3
CH1 Constant for wave output conversion cycle	Un\G1064	1

With the above setting, the output cycle of a wave pattern becomes as follows.

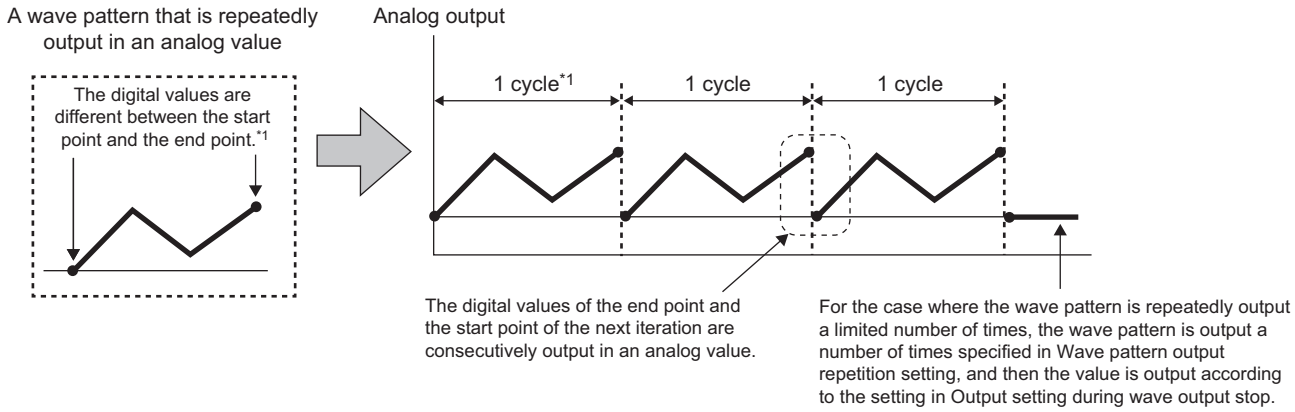
Output cycle of a wave pattern (μs) = Conversion speed × Number of channels where D/A conversion is enabled × Constant for wave output conversion cycle × (Wave pattern data points - 1)

= 50 × 1 × 1 × 100

= 5000

(b) When the digital values are different between the start point and the end point

The wave pattern end point is output in analog as it is. The set wave pattern is consecutively output in analog regardless of the setting in CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059).



*1 The output cycle of a wave pattern is calculated by the following formula.
Output cycle of a wave pattern = (Wave output conversion cycle) × (Wave pattern data points)

For details on the wave output conversion cycle, refer to the following.
Wave output conversion cycle (☞ Page 51, Section 4.8 (7))

Ex. Calculating the output cycle of a wave pattern

Setting item	Buffer memory address	Setting value
Output mode (switch setting)	–	Wave output mode (conversion speed: 50μs/CH)
D/A conversion enable/disable setting	Un\G0	D/A conversion enable for CH1 only (E_H)
CH1 Wave pattern data points setting	Un\G1040, Un\G1041	101
CH1 Wave pattern output repetition setting	Un\G1056	3
CH1 Constant for wave output conversion cycle	Un\G1064	1

With the above setting, the output cycle of a wave pattern becomes as follows.

Output cycle of a wave pattern (μs) = Conversion speed × Number of channels where D/A conversion is enabled × Constant for wave output conversion cycle × Wave pattern data points

= 50 × 1 × 1 × 101

= 5050

(7) Wave output conversion cycle

The conversion cycle of the wave output is calculated by the following formula.

Conversion cycle (μs) = Conversion speed (50μs or 80μs) × Number of channels where D/A conversion is enabled × Constant for wave output conversion cycle

In the wave output function, the conversion cycle can be set for each channel by setting CH□ Constant for wave output conversion cycle (Un\G1064 to Un\G1067). The conversion cycle of the current output wave can be checked in CH1 Wave output conversion cycle monitor (L) (Un\G1108) to CH4 Wave output conversion cycle monitor (H) (Un\G1115).

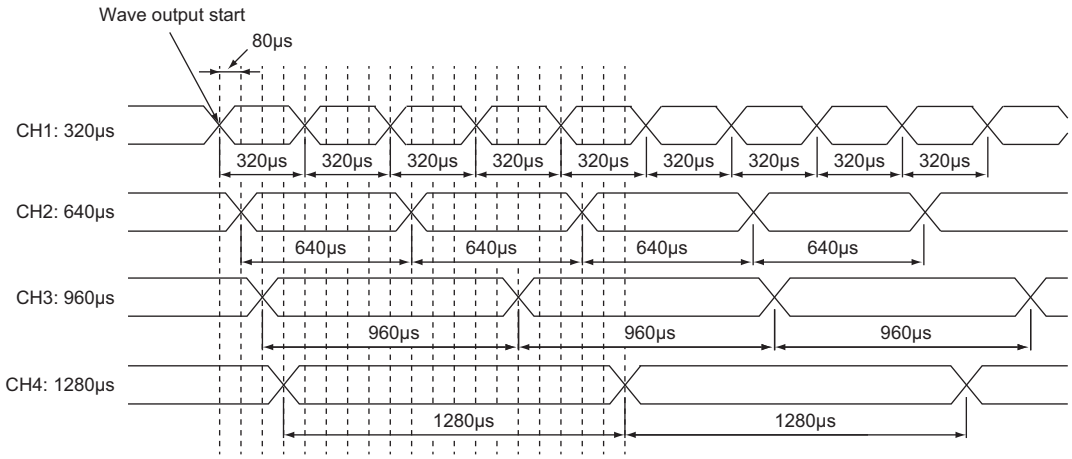
Ex. The conversion cycle and operation timing

Setting item		Setting value
Output mode (switch setting)		Wave output mode (conversion speed: 80μs/CH)
D/A conversion enable/disable setting (Un\G0)		All the channels are set to D/A conversion enable (0).
CH□ Constant for wave output conversion cycle (Un\G1064 to Un\G1067)	CH1	1
	CH2	2
	CH3	3
	CH4	4

The following lists the conversion cycle of each channel with the above settings.

- CH1: 320μs
- CH2: 640μs
- CH3: 960μs
- CH4: 1280μs

The D/A conversion is performed with this conversion cycle and analog values are output.



4.8.1 Initial settings of the wave output function

For the wave output function, set the following items as the initial setting. Before using the wave output function, complete the procedures described in this section.

- Creating wave data (Page 52, Section 4.8.1 (1))
- Setting parameters of the wave output function (Page 59, Section 4.8.1 (2))
- Writing data to a file register (ZR) or CSV file (Page 61, Section 4.8.1 (3))
- Switch setting and basic setting (Page 65, Section 4.8.1 (4))

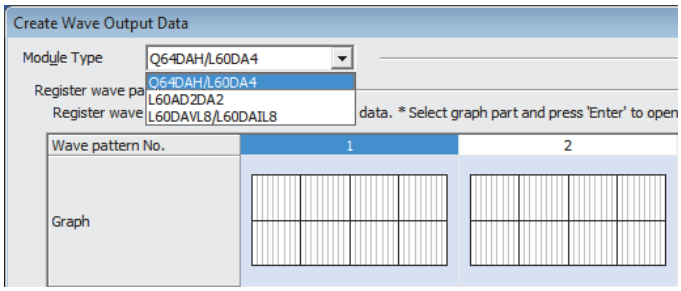
(1) Creating wave data

Create the wave data in "Create Wave Output Data" of GX Works2.

1. Start "Create Wave Output Data".

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Analog Module] ⇨ [Create Wave Output Data]

2. Select "Q64DAH/L60DA4" for "Module Type".

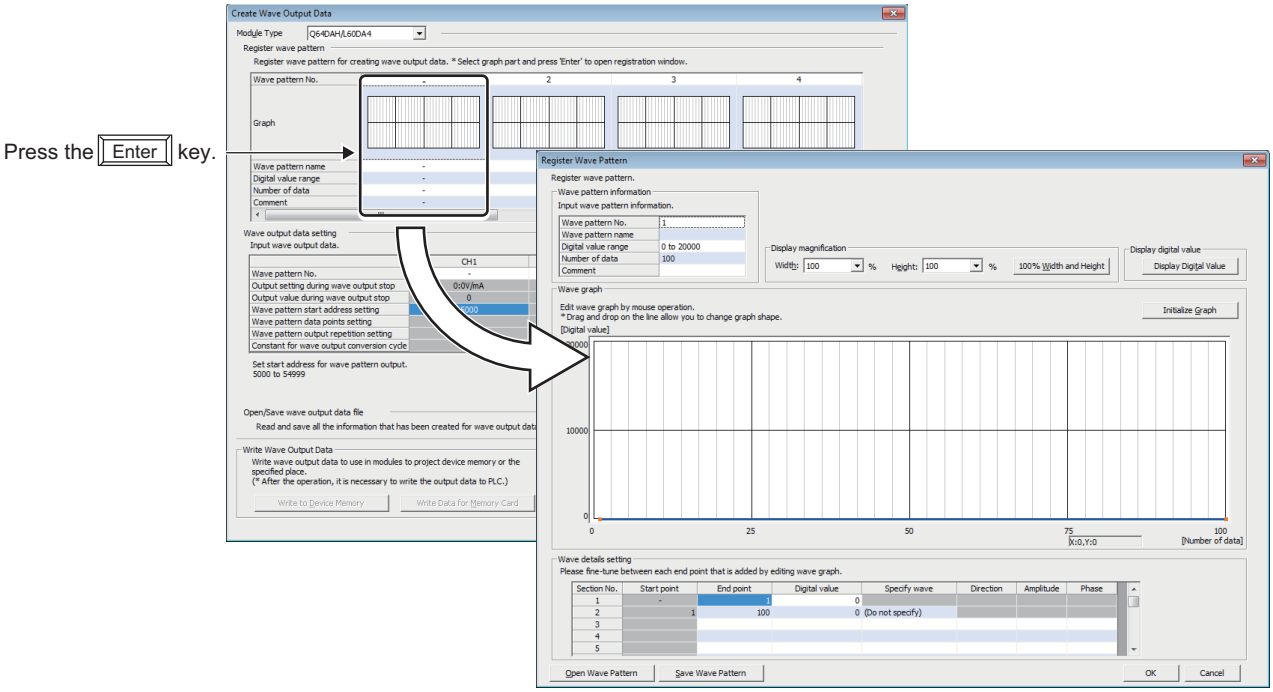


Point

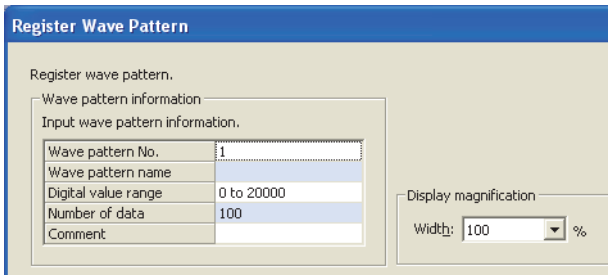
- Perform Step 3 and later after selecting the "Module Type". With this procedure, the wave pattern and the wave output data can be set properly.
- If the "Module Type" is changed after operation of Step 3 or later is completed, all data of the wave pattern and the wave output are deleted.

3. Select the graph displayed in "Register wave pattern" and press the Enter key.

The "Register Wave Pattern" window is displayed.



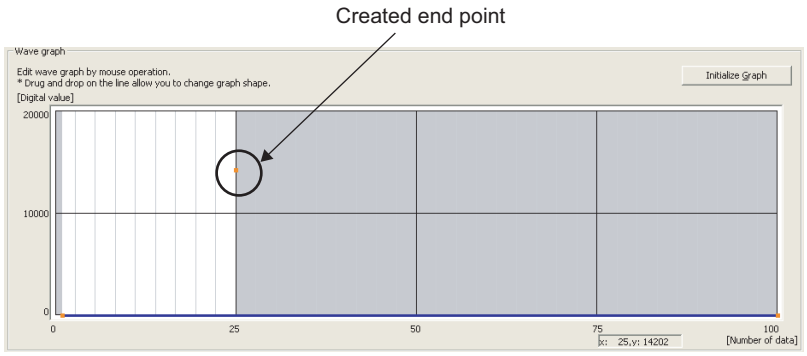
4. **Set "Wave pattern information".**



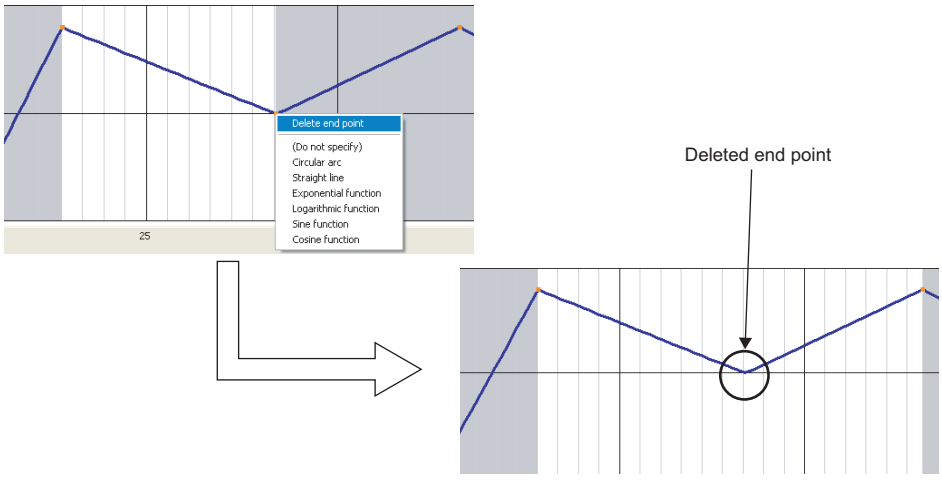
Item	Description	Setting range
Wave pattern No.	The wave pattern number selected in the "Create Wave Output Data" window is displayed. Up to 10 wave patterns can be created.	–
Wave pattern name	Set the name of the wave pattern.	16 characters
Digital value range	Select the setting range of the digital value according to the output range to be used.	• 0 to 20000 (default value) • -20000 to 20000
Number of data	Set the number of the digital values of the wave pattern.	1 to 50000 (default value: 100)
Comment	Set the comment of the wave pattern.	64 characters

5. **Click any position on the wave graph to create an end point.**

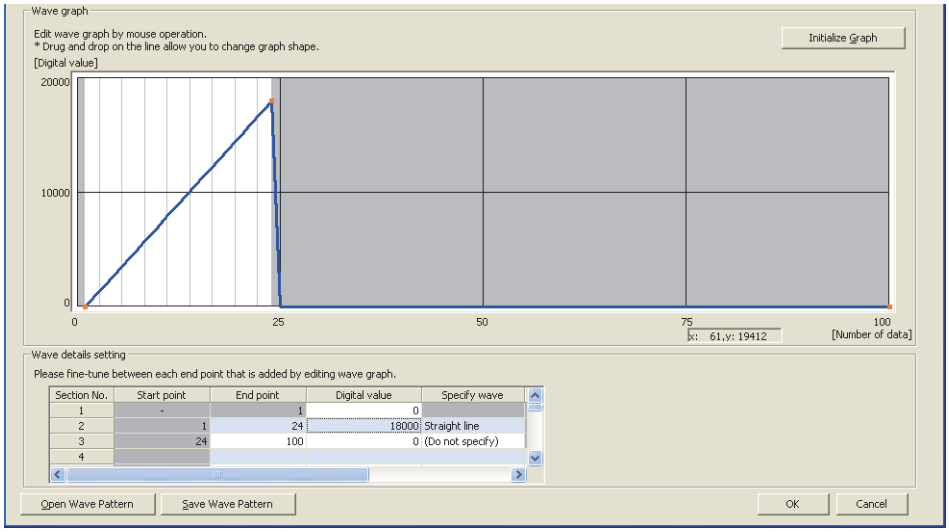
The created end point is displayed with ■ .



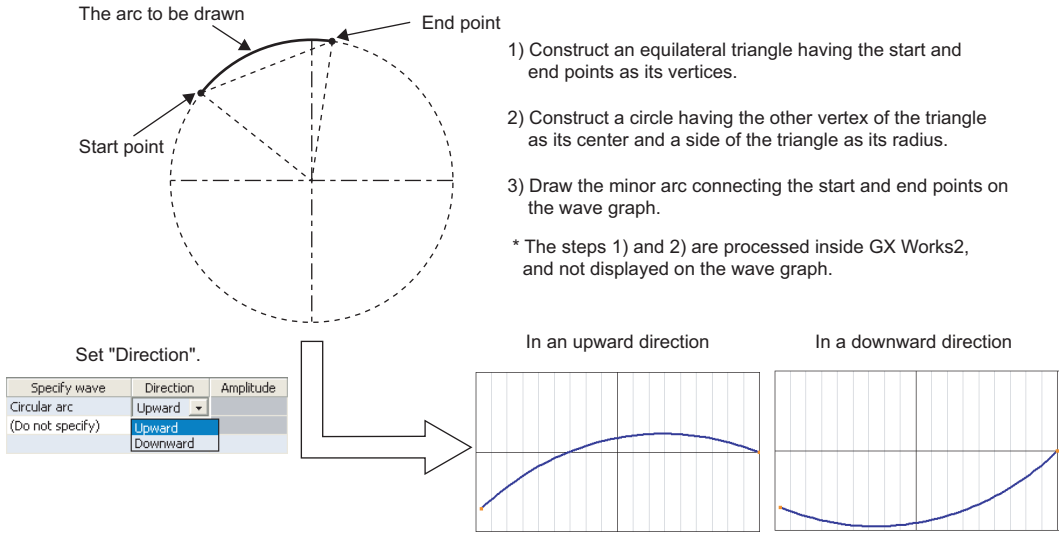
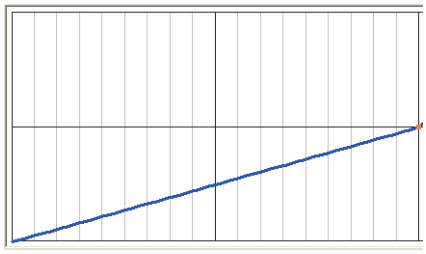
To delete the end point, move the mouse pointer to the point. Then select "Delete end point" from the right-click menu. When the mouse pointer is on the end point, the display of the mouse pointer is changed to ┼ .

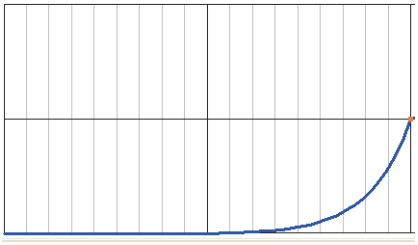
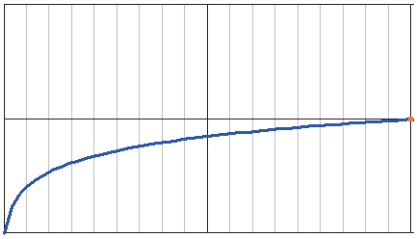
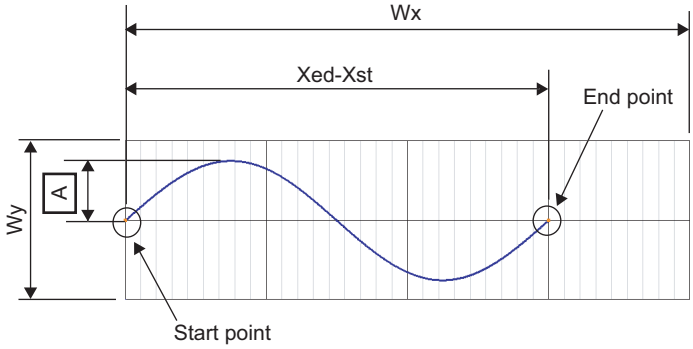
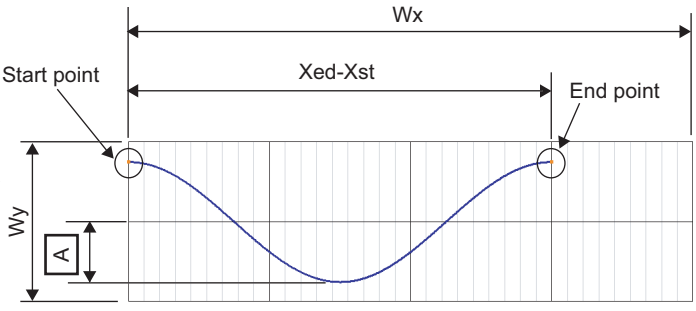


6. **Set the wave between end points from the right-click menu or in "Specify wave" of "Wave details setting".**



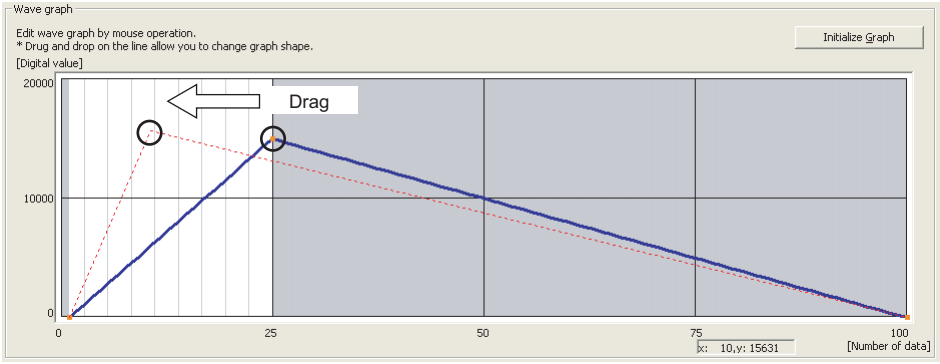
This setting enables the wave change in the specified interval as follows.

Item	Setting result
Circular arc	The interval of the start point and end point is drawn in an arc. When the circular arc is selected, the arc direction can be set in "Direction"; it can be inverted. The arc is drawn in the procedure below. 
Straight line	The interval of the start point and end point is drawn in a straight line. 

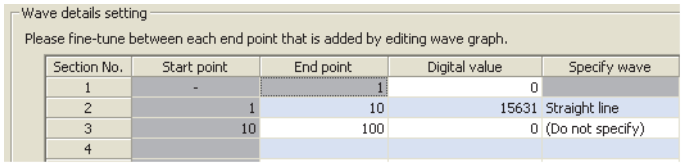
Item	Setting result
Exponential function	The graph is drawn with an adjustment so that the start point and end point are on the edge points of the exponential function of $y = e^x$ (x = 0 to 10). 
Logarithmic function	The graph is drawn with an adjustment so that the start point and end point are on the edge points of the logarithmic function of $y = \log_e X$ (x = 1 to 101). 
Sine function*1	The interval between the start point and end point is drawn in a sine function wave. The amplitude A of the sine function to be drawn is the value set in "Amplitude". The start position can be changed by 180° by setting "Phase". 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 
Cosine function*1	The interval between the start point and end point is drawn in a cosine function wave. The amplitude A of the cosine function to be drawn is the value set in "Amplitude". The start position can be changed by 180° by setting "Phase". 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 

*1 When using the sine function and cosine function, set the same digital value for the start point and end point.

7. **Drag the created end point to adjust the position.**



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

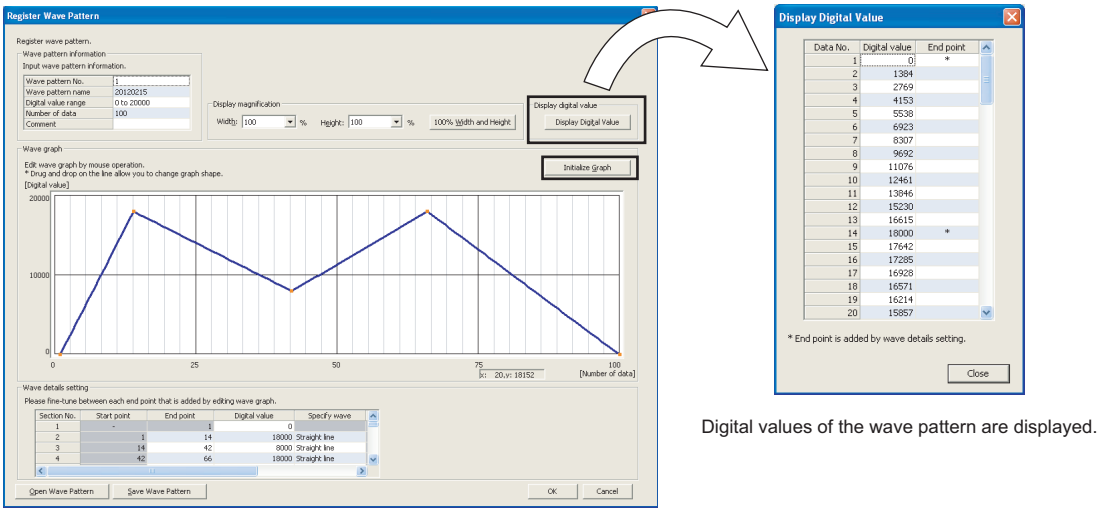


Item	Description
Start point	The end point of the previous interval is displayed. To change the start point, change the end point of the previous interval.
End point	Set the number of data (position) for the destination end point. Note that the section No.1 cannot be changed because it is the first point of the wave pattern.
Digital value	Set the digital value for the destination end point.

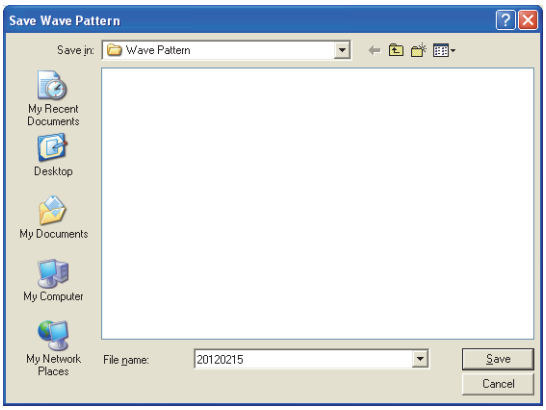
8. **Repeat Steps 5 to 7 to create the wave to be output.**

Each digital value of the created wave pattern can be checked by clicking the Display Digital Value button.

Click the Initialize Graph button to clear the created wave pattern contents. The graph and the contents of "Wave details setting" are cleared.



9. **Click the** [Save Wave Pattern] **button.**



The saved wave pattern can be opened by clicking the [Open Wave Pattern] button.

10. **Set the save destination and the file name, then click the** [Save] **button.**

11. **Click the** [OK] **button.**

12. **Click the** [OK] **button in "Register Wave Pattern" to register the created wave pattern.**

13. **Repeat Steps 3 to 12 to create other wave patterns.**

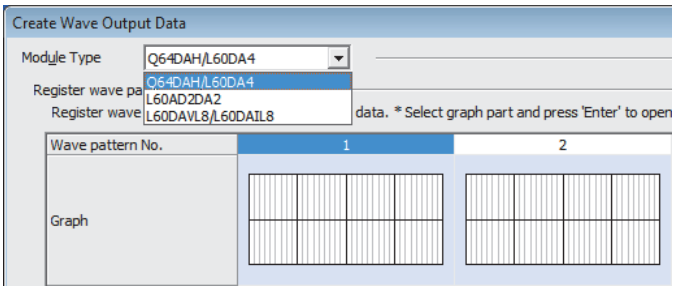
(2) Setting parameters of the wave output function

Set the parameters of the wave output function in "Create Wave Output Data" of GX Works2. Before the parameter setting, create the wave data.

1. Start "Create Wave Output Data".

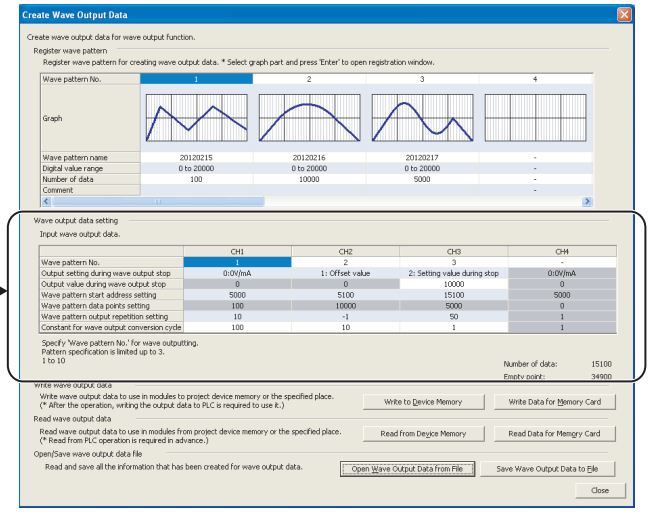
[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Analog Module] ⇨ [Create Wave Output Data]

2. Select "Q64DAH/L60DA4" for "Module Type".



3. Set the parameters of the wave output function in "Wave output data setting".

Set parameters of the wave output function.

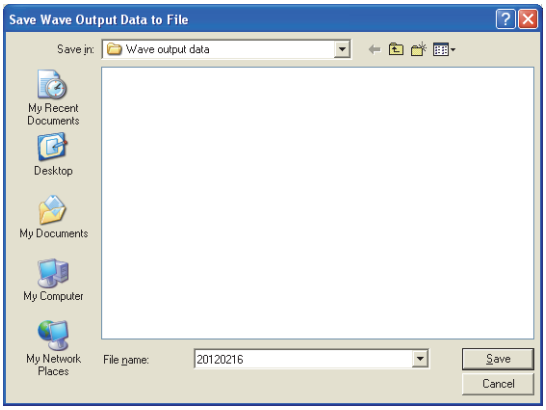


Item	Description	Setting range
Wave pattern No.	Up to three patterns can be specified at a time from registered wave patterns. When specifying multiple wave patterns, set the pattern No. as follows. • When No. 1 and No. 2 are used: 1, 2 • When No. 1, No. 5, and No. 10 are used: 1, 5, 10 • When No. 1 to No. 3 are used: 1-3	1 to 10
Output setting during wave output stop	Set the analog output during the wave output stop.	• 0: 0V/mA (default value) • 1: Offset value • 2: Setting value during stop
Output value during wave output stop	Set the value to be output while the wave output is stopped. This setting is enabled only when "Output setting during wave output stop" is set to "2: Setting value during stop". Set the value within the output range to be used.	• For 4 to 20mA, 0 to 20mA, 1 to 5V, 0 to 5V: 0 to 20479 (practical range: 0 to 20000) • For -10 to 10V: -20480 to 20479 (practical range: -20000 to 20000)

Item	Description	Setting range
Wave pattern start address setting	Set the start address of the wave pattern to be output.	5000 to 54999 (default value: 5000)
Wave pattern data points setting	This setting is not required because the data points of the wave pattern to be used are stored automatically.	–
Wave pattern output repetition setting	Set the repeat count to output the wave pattern repeatedly.	• -1 (Unlimitedly repeat output) • 1 to 32767 (default value: 1)
Constant for wave output conversion cycle	Set a constant to determine the conversion cycle (specifying a multiple of the conversion speed). The conversion cycle of the wave output is determined from the combination of the conversion speed, number of channels for which D/A conversion is enabled, and this setting. For the calculation method of the wave output conversion cycle, refer to the following. • Wave output conversion cycle (☞ Page 51, Section 4.8 (7))	1 to 5000 (default value: 1)

4. **Click the [Save Wave Output Data to File] button.**

The created wave pattern and the parameter setting of the wave output function are saved.



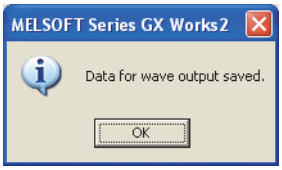
The saved wave pattern and the parameter setting of the wave output function can be read out by clicking the [Open Wave Output Data from File] button.

Point

Note that if data created under the module type other than "Q64DAH/L60DA4" is read out, its "Module Type" is changed to the type that was selected when the data was created, even though the current setting of "Module Type" is "Q64DAH/L60DA4".

5. **Set the save destination and the file name, then click the [Save] button.**

6. **Click the [OK] button.**



(3) Writing data to a file register (ZR) or CSV file

Write the wave data and the parameter setting of the wave output function to the file register (ZR) or the CSV file.

Point

Data not necessary for control such as "Wave pattern name", "Comment", and "Wave details setting" are not written to the file register (ZR) or CSV file.
Therefore, it is recommended to save the wave data and the parameter setting of the wave output function with the [Save Wave Output Data to File] button before writing the data to the file register (ZR) or the CSV file.

(a) Writing data to a file register (ZR)

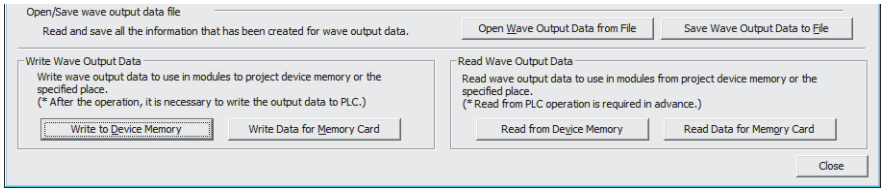
When writing the data to the file register (ZR), set the capacity of the file register (ZR) for the number of required data points. The following are the setting precautions.

- Set the target memory to the standard RAM. Do not set it to a memory card.
- Check that the file register (ZR) can be used with the CPU module in use.

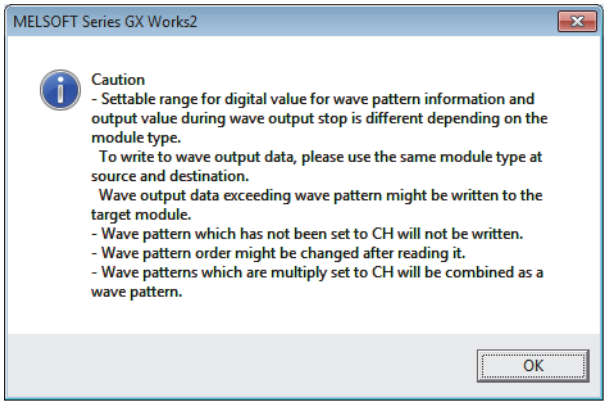
For the setting procedure and the availability of a file register (ZR), refer to the following.

- QnUCPU User's Manual (Function Explanation, Program Fundamentals)
- Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

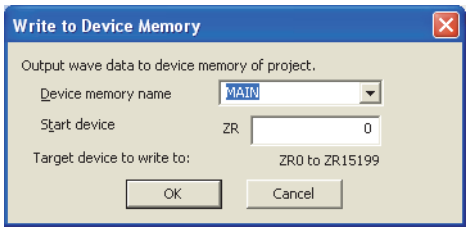
1. Click the [Write to Device Memory] button of the "Create Wave Output Data" window.



2. Click the [OK] button.

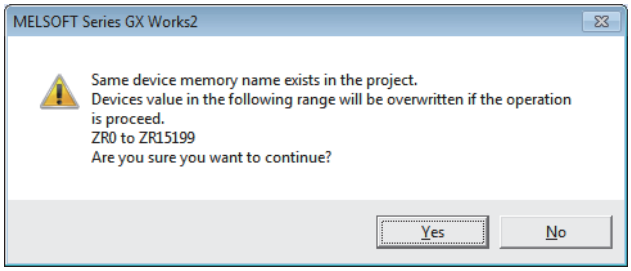


3. **Set "Device memory name" and "Start device", then click the [OK] button.**

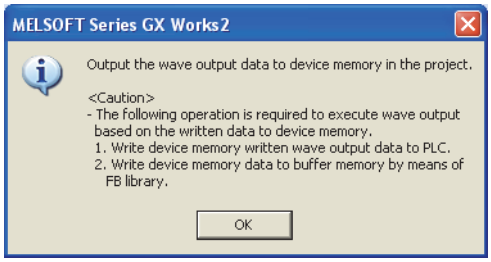


Item	Description
Device memory name	Set the device memory to be written to the file register (ZR). Select the device memory to be written from the pull-down menu or enter the device memory name to be created.
Start device	Set the start address for the output of the device memory.
Target device to write to	The file register (ZR) range to write to is displayed.

4. **Click the [Yes] button.**



5. **Click the [OK] button.**



6. **Click the [Close] button in "Create Wave Output Data" to finish the window.**

7. **Write the device memory to the CPU module from "Write to PLC...".**

[Online] ⇨ [Write to PLC...]

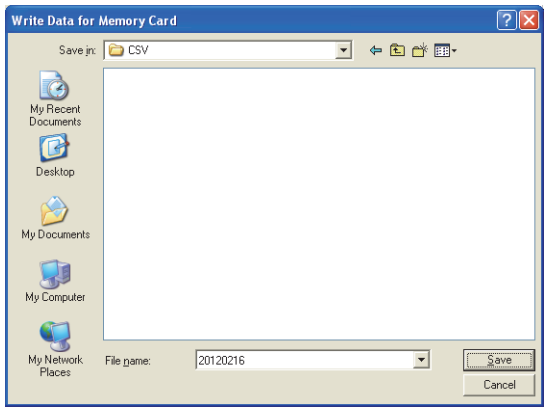
(b) Writing data to a CSV file

When writing the data to the CSV file, store the CSV file to an SD memory card or ATA card. When the CSV file is stored to an SRAM card or a Flash card, the wave data and the parameter setting of the wave output function cannot be registered to the D/A converter module.

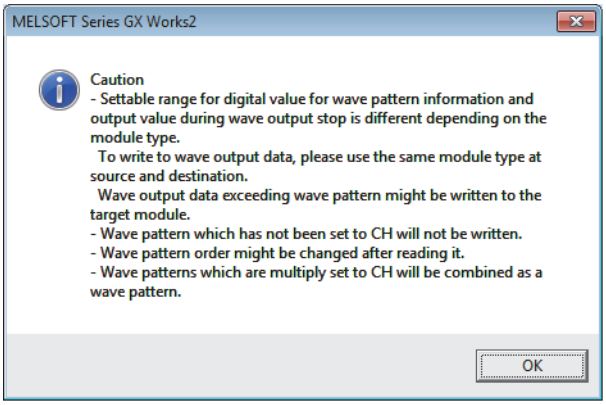
For the CPU module which can use an SD memory card or ATA card, refer to the following.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)

1. **Click the [Write Data for Memory Card] button of the "Create Wave Output Data" window.**

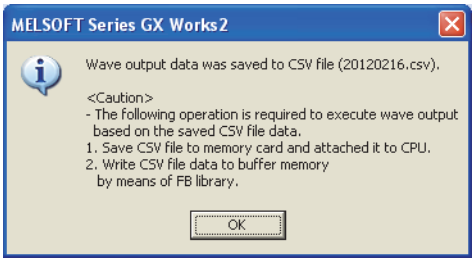


2. **Click the [OK] button.**



3. **Set the save destination and the file name, then click the [Save] button.**

4. **Click the [OK] button.**



5. **Click the [Close] button in "Create Wave Output Data" to finish the window.**

6. **Insert an SD memory card or ATA card into the CPU module, and store the CSV file to the SD memory card or ATA card with GX Works2.**

Point

Some oscilloscopes or pulse generators can output the input wave or output wave to the CSV file. To output the wave with the wave output function by using the CSV file data, convert the data format into the one described in the following manual. In addition, convert the fractional value into the integer because the fractional value is unavailable in the wave output function.

- MELSEC-Q High Speed Digital-Analog Converter Module FB Library Reference Manual (FBM-M087)

(4) Switch setting and basic setting

To use the wave output function, the switch setting and basic setting are required in addition to the parameter setting of the wave output function.

Item		Reference
Switch setting	Output range	Page 65, Section 4.8.1 (4) (a)
	Output mode setting	
Basic setting	D/A conversion enable/disable setting	Page 66, Section 4.8.1 (4) (b)

For the parameter settings for the wave output function, refer to the following.

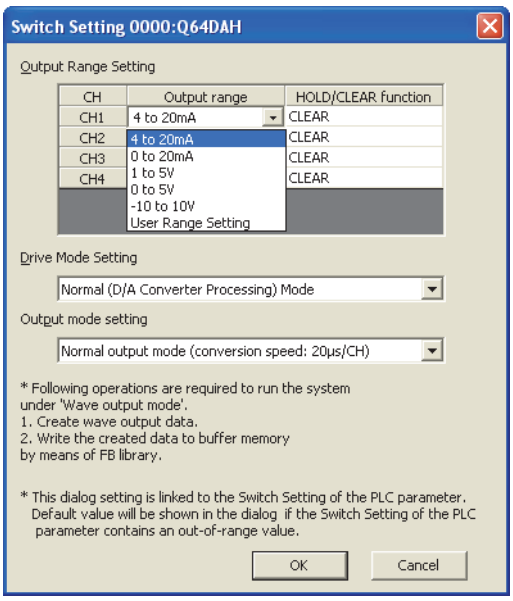
- Setting parameters of the wave output function (☞ Page 59, Section 4.8.1 (2))

(a) Switch setting

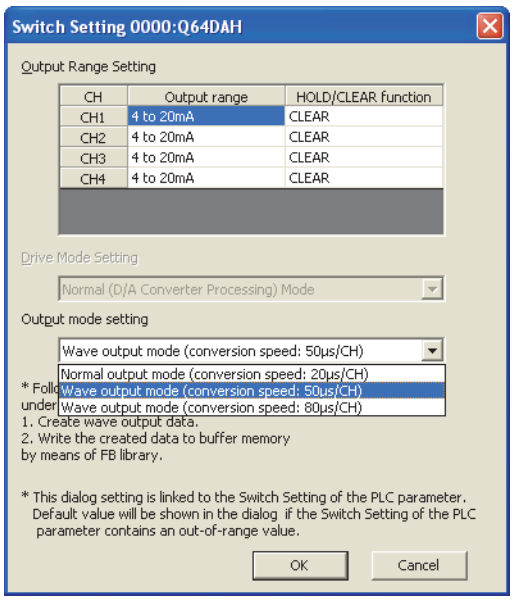
1. Start "Switch Setting".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]

2. Set "Output range" to the value other than "User Range Setting".



3. **Set "Output mode setting" to "Wave output mode (conversion speed: 50μs/CH)" or "Wave output mode (conversion speed: 80μs/CH)".**



(b) Basic setting

Change D/A conversion enable/disable setting (Un\G0) using a sequence program or function block (FB). Register the wave data and parameters for the wave output function first, then change D/A conversion enable/disable setting (Un\G0).

For registration of the wave data and parameters for the wave output function, refer to the following.

- Registering the wave data and parameters of the wave output function (☞Page 67, Section 4.8.2 (1))

Enable D/A conversion only for the channel to be used because the conversion cycle of the wave output varies depending on the number of channels where D/A conversion are enabled.

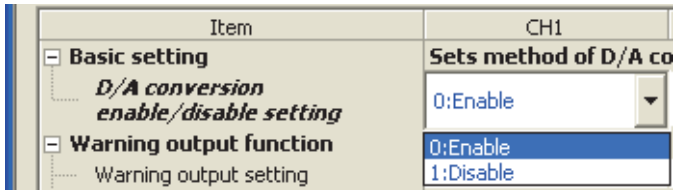
[Precaution]

The setting also can be configured through "D/A conversion enable/disable setting" in "Parameter" of GX Works2.

1. **Start "Parameter".**

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]

2. **Set "D/A conversion enable/disable setting" to "0: Enable".**



When the setting is configured by the above procedure, an error occurs if the setting content is activated by resetting the CPU module or by turning off and on the power. The error code (33☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

This error occurs because the wave pattern data points setting is set to 0 (default value) for the channel where D/A conversion enable is set. To clear this error, register wave data and parameters for the wave output function, then turn on and off Operating condition setting request (Y9) as in the procedure described in Page 67, Section 4.8.2 (1).

4.8.2 Execution of the wave output function

This section describes the execution procedures for the wave output function. Execute the contents in this section after the initial setting of the wave output function.

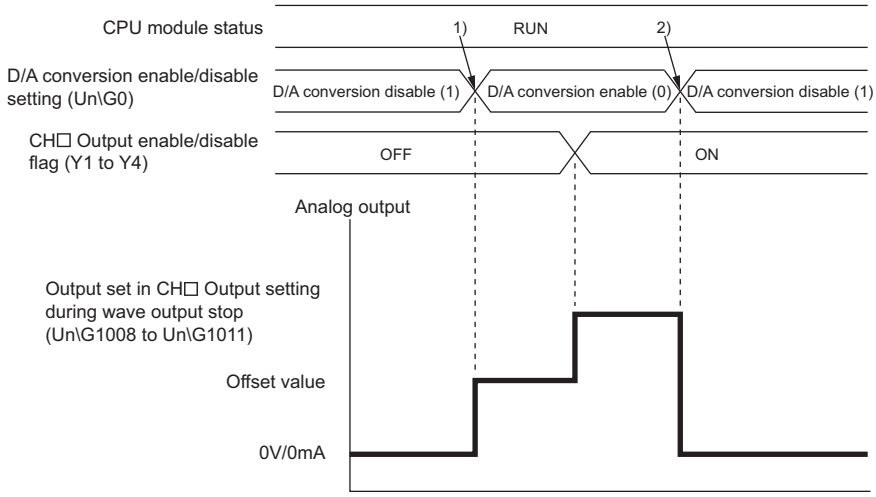
(1) Registering the wave data and parameters of the wave output function

After creating the wave data and parameter settings of the wave output function in "Create Wave Output Data" of GX Works2, register the created data to the D/A converter module. Use the function block (FB) for the wave data registration. For how to use the function block (FB) for the wave data registration, refer to the following.

- MELSEC-Q High Speed Digital-Analog Converter Module FB Library Reference Manual (FBM-M087)

The contents registered by the function block (FB) for the wave data registration need to be enabled by turning on and off Operating condition setting request (Y9). When the setting is enabled, the analog output value of the channel where the D/A conversion is enabled varies depending on the CH☐ Output enable/disable flag (Y1 to Y4) status as shown below.

- CH☐ Output enable/disable flag (Y1 to Y4) is OFF: The offset value is output.
- CH☐ Output enable/disable flag (Y1 to Y4) is ON: The contents set in CH☐ Output setting during wave output stop (Un\G1008 to Un\G1011) are output.



1): Set D/A conversion enable/disable (Un\G0) to D/A conversion enable (0), and turn on then off Operating condition setting request (Y9).

2): Set D/A conversion enable/disable (Un\G0) to D/A conversion disable (1), and turn on then off Operating condition setting request (Y9).

Point

In the wave output mode, only when the wave output is stopped in all the channels (CH☐ Wave output status monitor (Un\G1100 to Un\G1103) is set to Wave output stop (0) in all the channels), the parameter setting can be enabled by turning on and off Operating condition setting request (Y9). When Operating condition setting request (Y9) is turned on and off with a channel set to other than the Wave output stop, an error occurs. The error code (20☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. In this case, the parameter setting does not become enabled.

(2) Starting/stopping/pausing wave output

(a) Starting the wave output

The wave output can be started by the following procedures after the wave data registration.

1. **Turn on CH□ Output enable/disable flag (Y1 to Y4).**

The value is output in analog according to the setting in "Output setting during wave output stop".

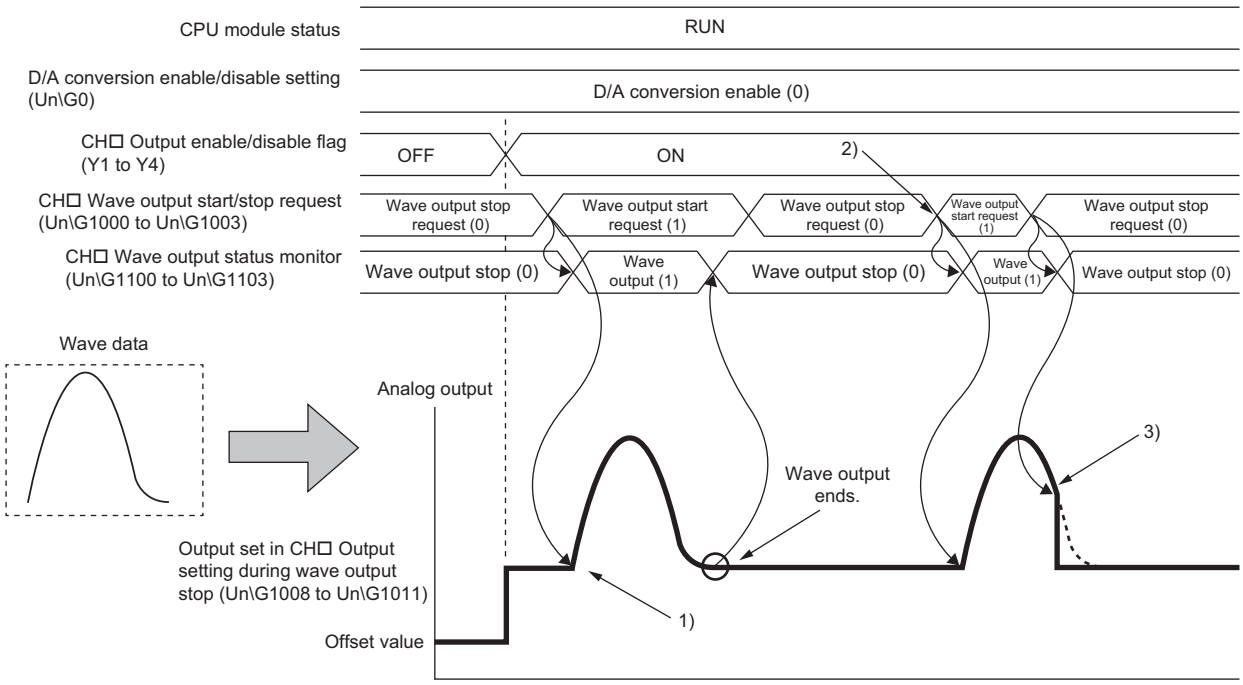
2. **Set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output start request (1).**

When Wave output stop request (0) or Wave output pause request (2) is changed to Wave output start request (1), the wave output is started.

(b) Stopping the wave output

To stop the wave output during the wave output, set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output stop request (0). When Wave output start request (1) or Wave output pause request (2) is changed to Wave output stop request (0), the wave output is completely stopped. When the wave output is stopped, Wave output stop (0) is stored to CH□ Wave output status monitor (Un\G1100 to Un\G1103). The wave output cannot be resumed at the stop point.

When the wave pattern outputs for the count set in CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059) are finished, the wave output is also stopped.



1): Wave output starts when CH□ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output start request (1).

2): To execute wave output again, change CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output stop request (0), then to Wave output start request (1).

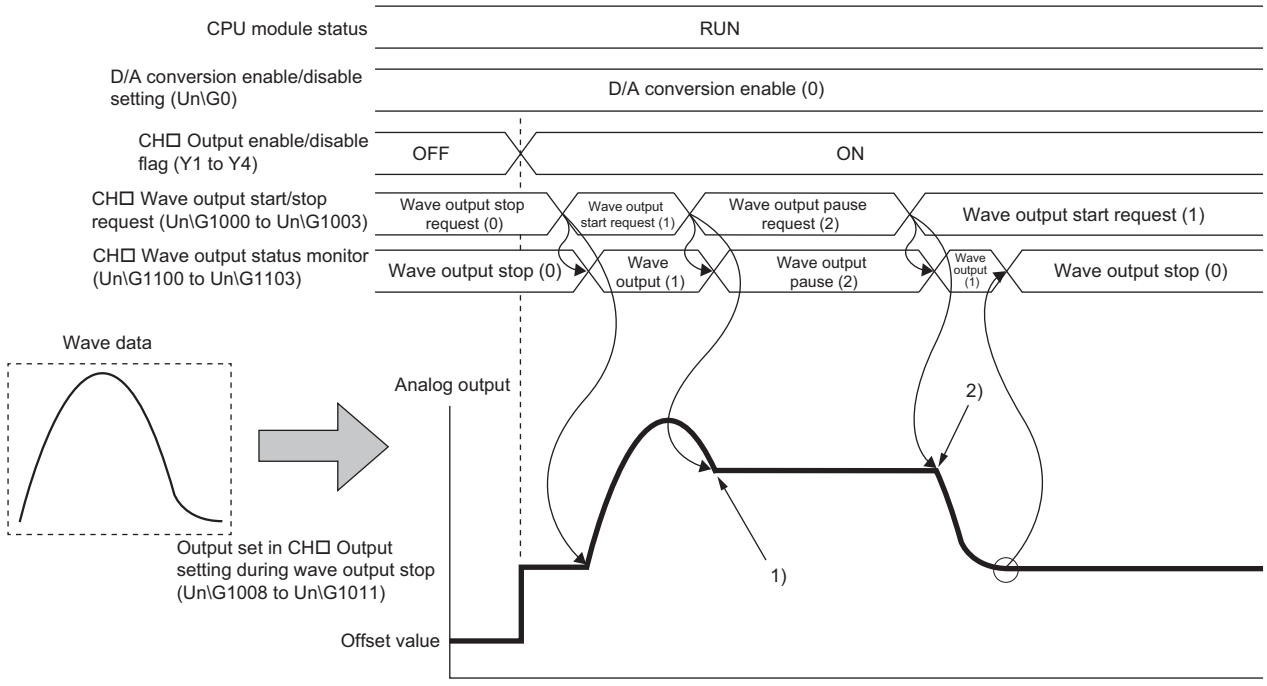
3): Wave output stops when CH□ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output stop request (0) during the wave output.

(c) Pausing the wave output

- To pause the wave output, set CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output pause request (2). When Wave output start request (1) is changed to Wave output pause request (2), the wave output is paused. Wave output pause (2) is stored to CH☐ Wave output status monitor (Un\G1100 to Un\G1103).

- To resume the wave output, change CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) from Wave output pause request (2) to Wave output start request (1). The wave output is resumed from the paused point.

- When CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output pause request (2) during the wave output stop, the digital value of the wave pattern start address is output in analog after the D/A conversion.



1): Wave output pauses when CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output pause request (2) during the wave output.

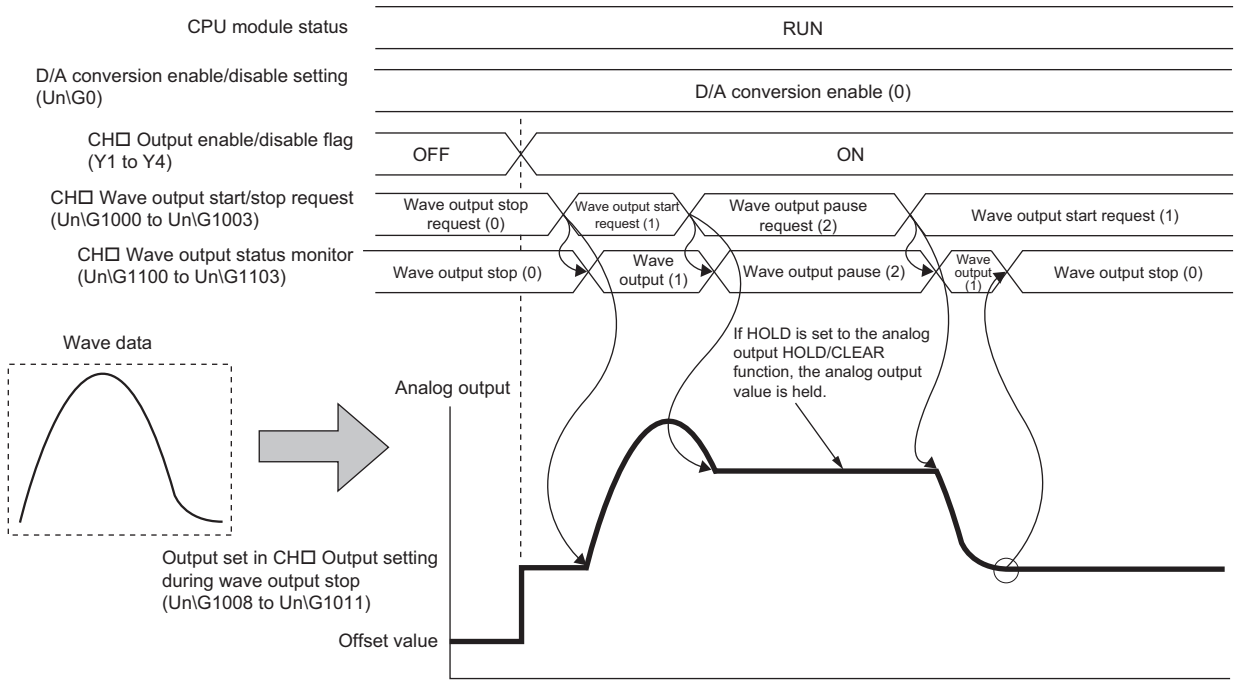
2): Wave output resumes when CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output start request (1) during the wave output pause.

The analog output value while the wave output is paused differs depending on the setting of the analog output HOLD/CLEAR function. For details, refer to the following.

- Analog output HOLD/CLEAR function (☞Page 33, Section 4.4 (1) (b))

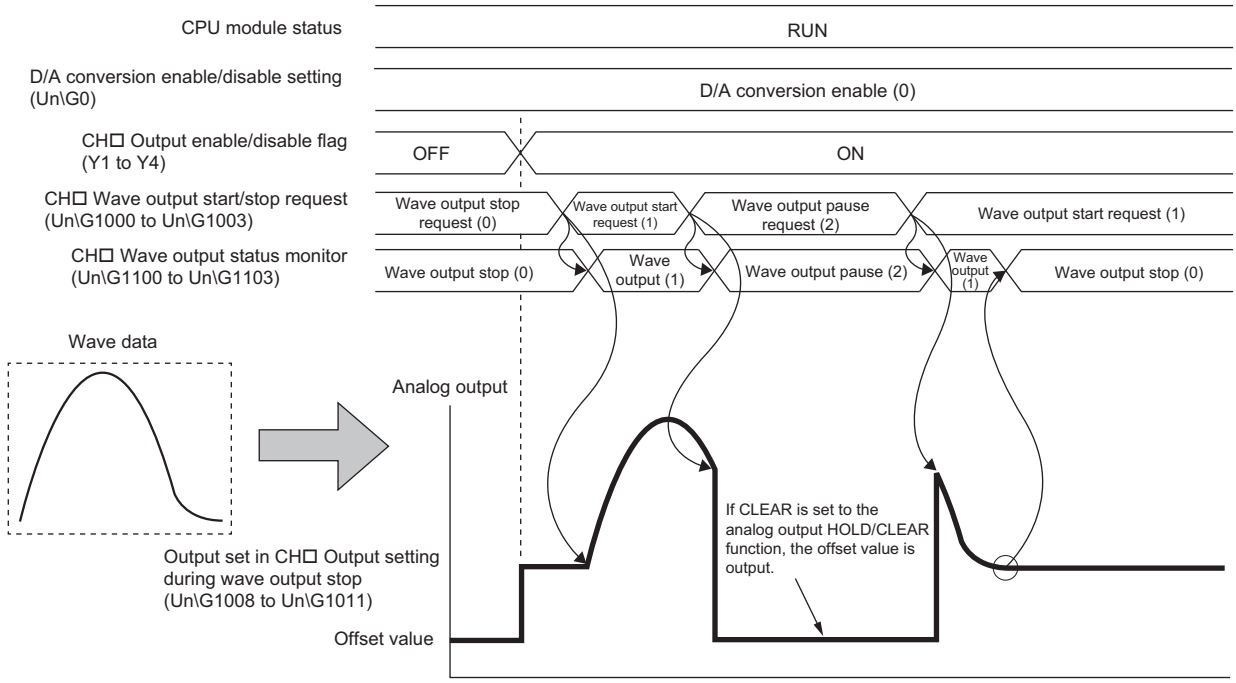
• For HOLD setting

While the wave output is paused, analog output value during the pause is held.



• For CLEAR setting

While the wave output is paused, the offset value is output.



Point

- Wave output start request is accepted only when the CPU module is in the RUN status. When CH□ Wave output start/stop request (Un\G1000 to Un\G1003) is changed to Wave output start request (1) with the CPU module status other than in the RUN status, the wave output is not started.
- Wave output stop request is accepted when the CPU module is in the RUN or STOP status.
- Wave output pause request is accepted only when the CPU module is in the RUN status.
- When a value other than 0 to 2 is set to CH□ Wave output start/stop request (Un\G1000 to Un\G1003), an error occurs. The error code (23□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. However, the process will continue.

(3) Checking the setting for the wave output function

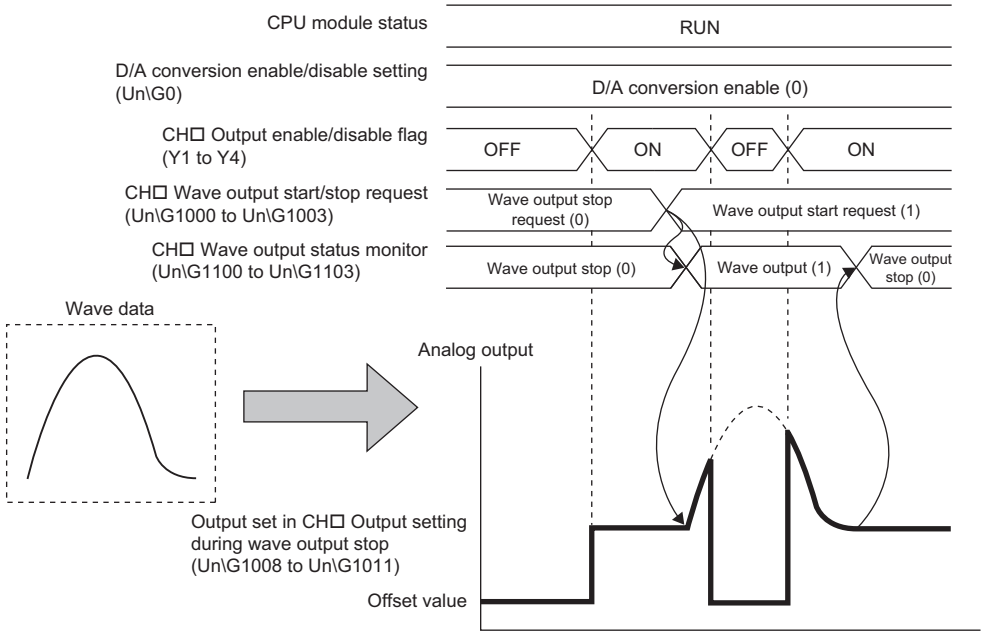
The setting for the wave output function can be checked in the following buffer memory areas.

Item	Buffer memory address	Description	Reference
Wave output status monitor	Un\G1100 to Un\G1103	The wave output status is stored in this area.	Page 126, Section 6.2 (27)
Wave output conversion cycle monitor	Un\G1108 to Un\G1115	The conversion cycle of the wave output is stored in 32-bit signed binary in units of μs in this area.	Page 126, Section 6.2 (28)
Wave pattern output count monitor	Un\G1124 to Un\G1127	The output count of the wave pattern is stored in this area.	Page 126, Section 6.2 (29)
Wave output current address monitor	Un\G1132 to Un\G1139	The buffer memory address of the currently output wave data is stored in 32-bit signed binary in this area.	Page 127, Section 6.2 (30)
Wave output current digital value monitor	Un\G1148 to Un\G1151	The digital value which is currently output is stored in this area.	Page 128, Section 6.2 (31)
Wave output digital value outside the range Address monitor	Un\G1156 to Un\G1163	The buffer memory address of the wave data with the digital value out of the setting range is stored in 32-bit signed binary in this area. When the multiple wave data with the digital value out of the setting range are detected, only the buffer memory address of the wave data detected first is stored.	Page 129, Section 6.2 (32)
Wave output warning Address monitor	Un\G1172 to Un\G1179	The buffer memory address of the wave data where a warning has occurred is stored in 32-bit signed binary in this area. 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.	Page 130, Section 6.2 (33)

4.8.3 Points for the wave output function

(1) When turning on or off CH□ Output enable/disable flag (Y1 to Y4) during the wave output

When CH□ Output enable/disable flag (Y1 to Y4) is turned off during the wave output, the analog output value becomes the offset value though the wave output is continued. The wave output continues to be updated while CH□ Output enable/disable flag (Y1 to Y4) is off. When CH□ Output enable/disable flag (Y1 to Y4) is turned on, the analog output is resumed.

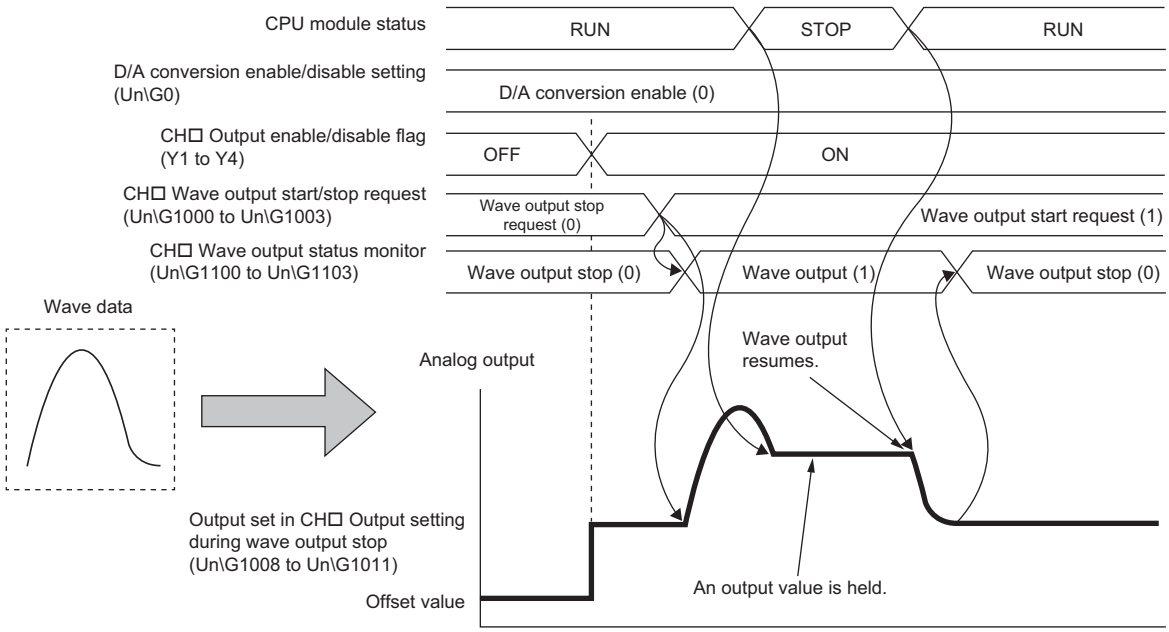


(2) When changing the CPU module status during the wave output

When the CPU module status is changed during the wave output, the operation of the module varies depending on the setting of the analog output HOLD/CLEAR function as shown below.

(a) For HOLD setting

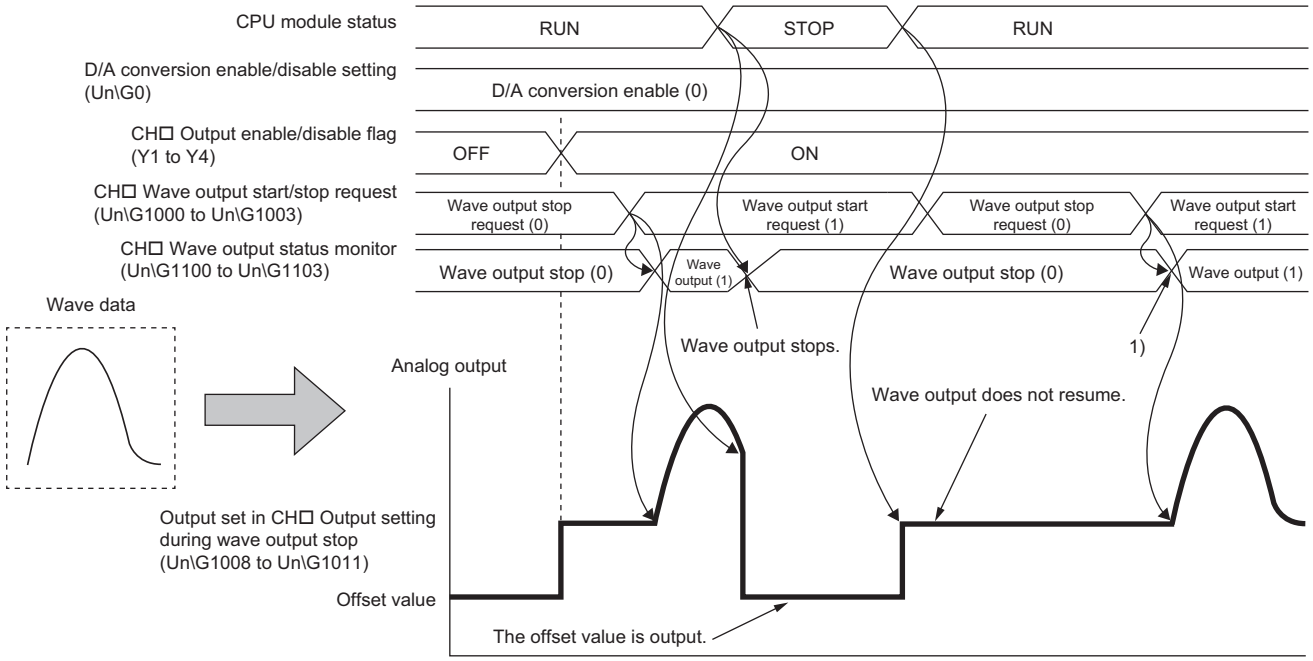
When the CPU module status is changed to STOP from RUN, the analog output value at the change is held and the wave output status pauses. When the CPU module status is changed to RUN from STOP, the wave output resumes. To prevent the wave output resuming, set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output stop request (0) after changing the CPU module status to STOP from RUN.



(b) For CLEAR setting

When the CPU module status is changed to STOP from RUN, the wave output is finished and the offset value is output. When the CPU module status is changed to RUN from STOP, the value is output according to the setting in CH□ Output setting during wave output stop (Un\G1008 to Un\G1011). The wave output does not resume.

To execute the wave output again, set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output stop request (0) after changing the CPU module status to RUN from STOP. Then, set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output start request (1) from Wave output stop request (0).



1): Wave output starts when the value set in CH□ Wave output start/stop request (Un\G1000 to Un\G1003) is changed from Wave output stop request (0) to Wave output start request (1).

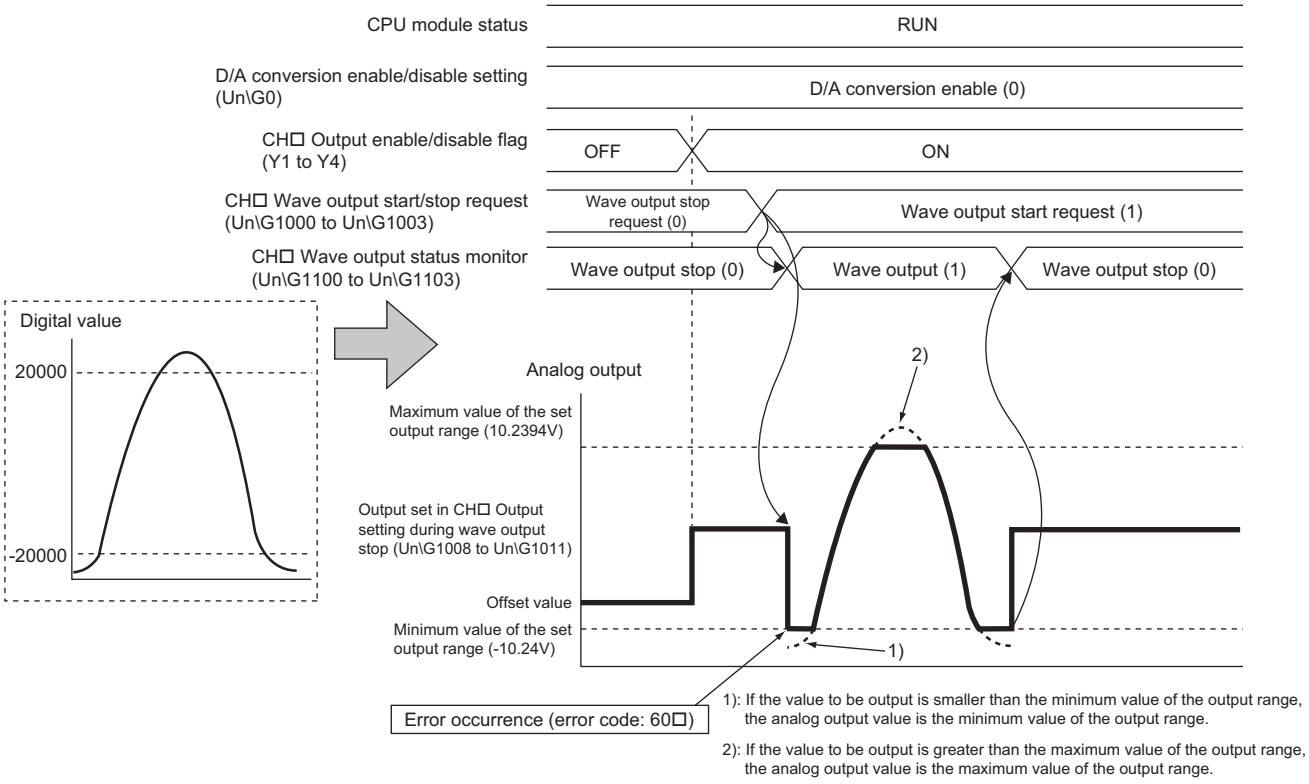
(3) When the error (error code: 60☐) has occurred

When the value to be output is out of the output range, an error occurs. The error code (60☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. When the error (error code: 60☐) occurs during the wave output, the analog output value becomes as follows.

- If the value to be output is greater than the maximum value of the output range, the maximum value of the output range is output in analog.
- If the value to be output is smaller than the minimum value of the output range, the minimum value of the output range is output in analog.

When the error (error code: 60☐) has occurred, correct the digital value of the wave data so that the value is within the output range. Then, turn on and off Error clear request (YF).

When -10 to 10V is set to the output range



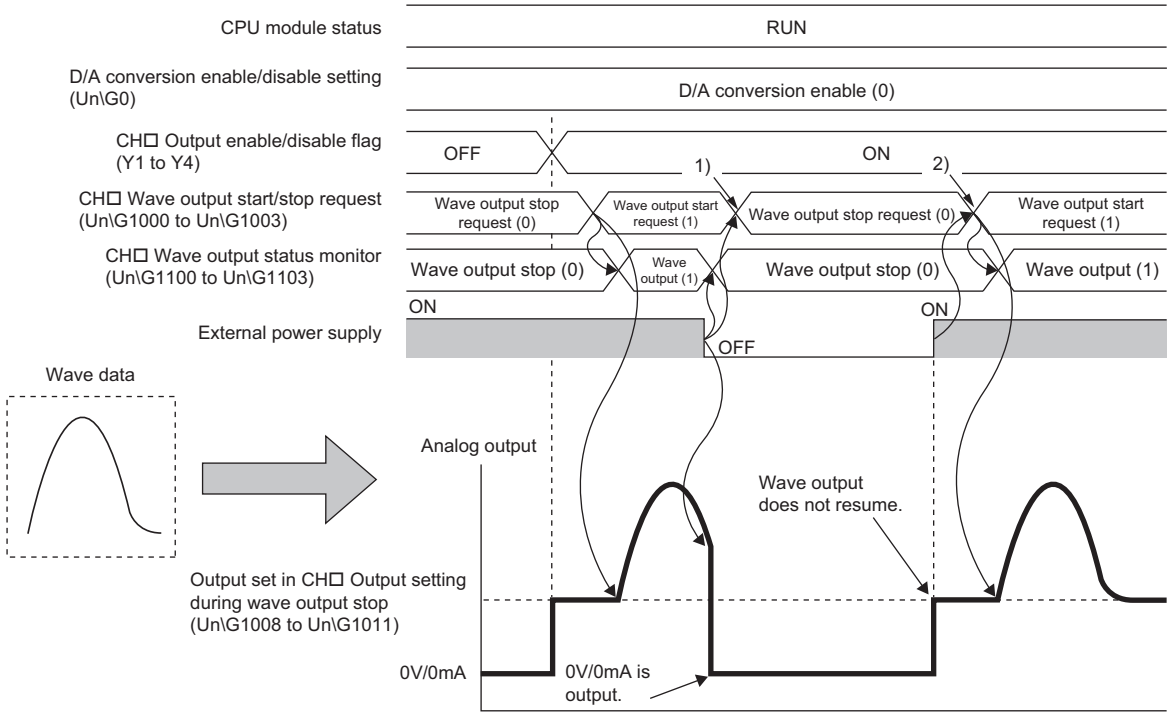
In addition, when the digital value out of the range is set and the error (error code: 60☐) has occurred, correct the value to the one within the range and turn on and off Error clear request (YF).
A buffer memory address of the wave data with the digital value out of the range can be checked in CH1 Wave output digital value outside the range Address monitor (L) (Un\G1156) to CH4 Wave output digital value outside the range Address monitor (H) (Un\G1163).

(4) When the external power supply is turned off during the wave output

When the external power supply is turned off during the wave output, the wave output status of all the channels becomes the wave output stop (the wave output stops). The wave output does not resume even when the external power supply is turned on.

To resume the wave output, check the D/A converter module and external devices after turning on the external power supply, and set CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output start request (1).

Wave output start/stop request cannot be accepted when the external power supply is off.



1): Because the external power supply was turned off and wave output stopped, change the value set in CH□ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output stop request (0).

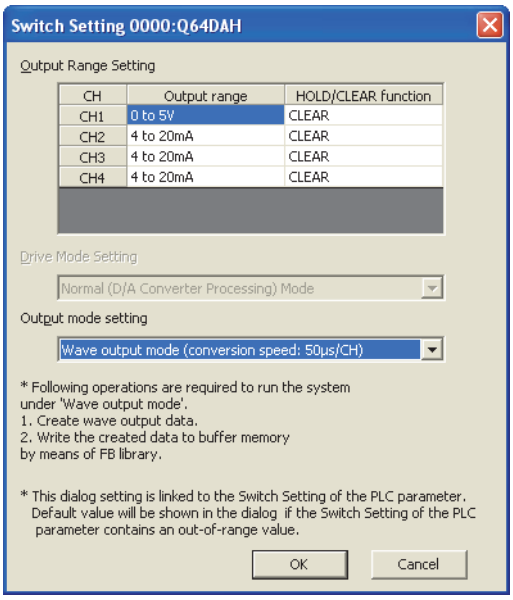
2): To resume wave output, change the value set in CH□ Wave output start/stop request (Un\G1000 to Un\G1003) from Wave output stop request (0) to Wave output start request (1).

(5) When using the wave output function as PWM

The wave output function can also be used as PWM with the minimum pulse width of 50μs.
Also the man-hours for programming can be reduced because necessary numbers of pulses can be output in analog by creating a wave pattern only for one pulse.

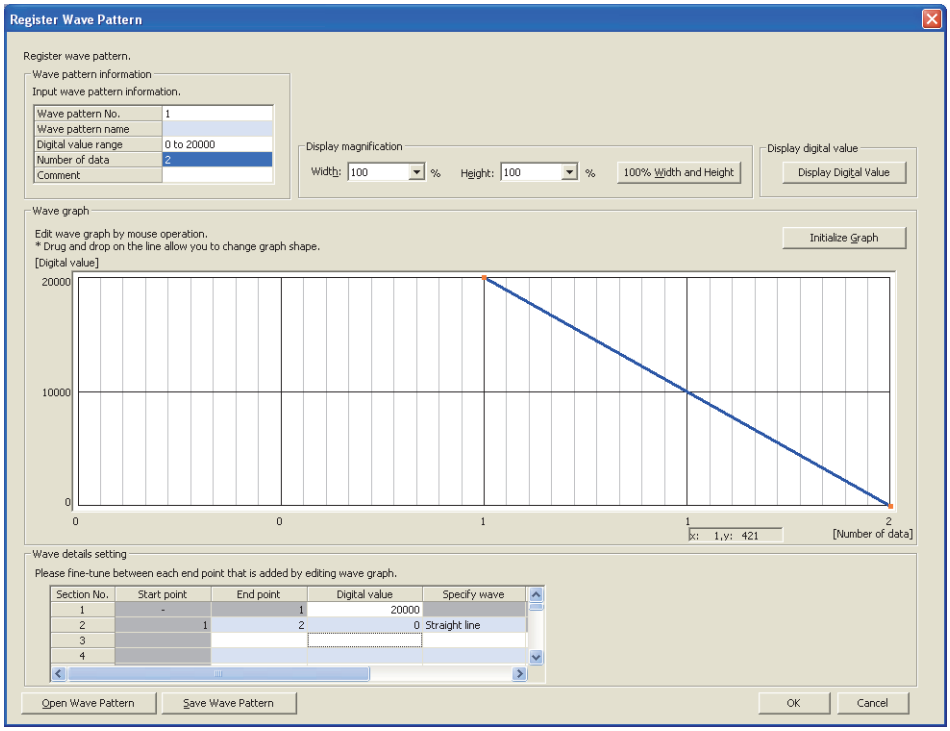
Ex. : When creating a wave pattern with pulse width of 50μs, amplitude of 5V, and duty ratio of 50%

1. **Configure the "Switch Setting" as shown below.**



Setting item	Setting content
Output range for CH1	0 to 5V
Output mode setting	Wave output mode (conversion speed: 50μs/CH)

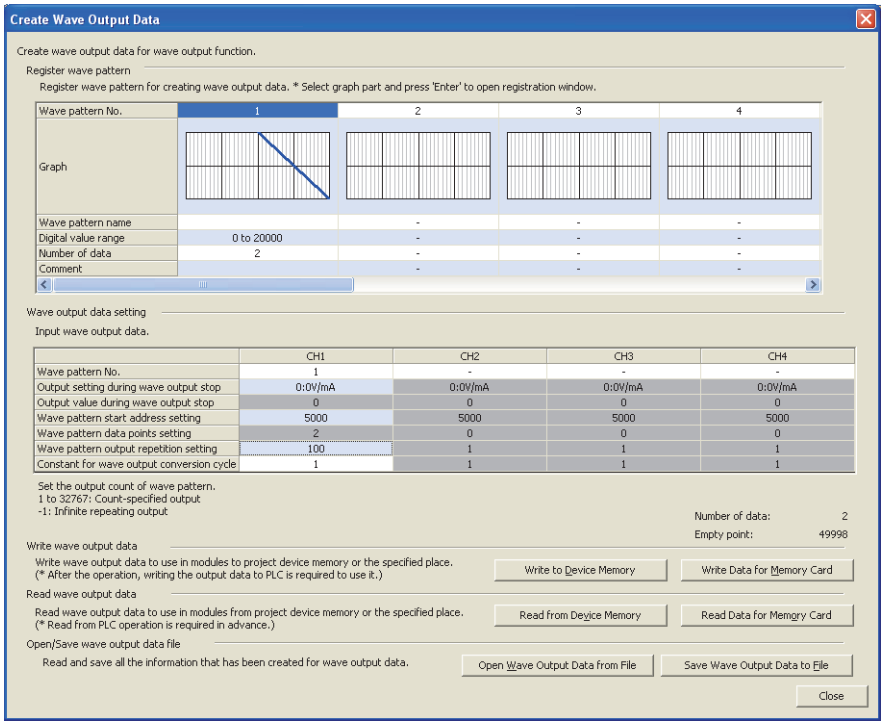
2. Create a wave pattern for one pulse [*1] in "Create Wave Output Data".



Setting item		Setting content
Wave pattern information	Digital value range	0 to 20000
	Number of data	2
Wave details setting	Digital value for Section No.1	20000
	Digital value for Section No.2	0
	Specify wave for Section No.2	Straight line

*1 The wave pattern to be output in analog differs from the one to be monitored on GX Works2.

3. Configure the "Wave output data setting" as shown below.



Setting item	Setting content
Wave pattern No. for CH1	Wave pattern created in step 2
Wave pattern start address setting for CH1	5000 (default value)
Wave pattern output repetition setting for CH1	Set the number of repetitions.
Constant for wave output conversion cycle for CH1	1 (default value)

4. Register the wave data and parameters of the wave output function to the D/A converter module. For how to register the wave data and parameters, refer to the following.

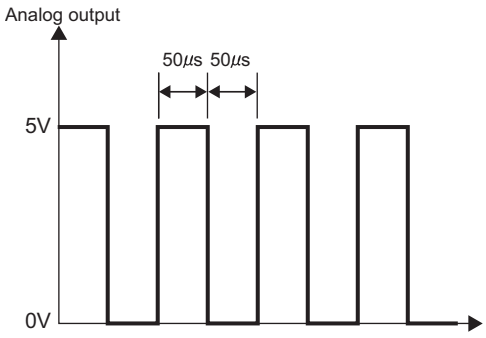
• Registering the wave data and parameters of the wave output function (Page 67, Section 4.8.2 (1))

5. Set D/A conversion enable/disable setting (Un\G0) to D/A conversion enable for CH1 only (E_H).

6. Turn on and off Operating condition setting request (Y9).

7. Turn on CH1 Output enable/disable flag (Y1).

8. Start wave output by setting CH1 Wave output start/stop request (Un\G1000) to Wave output start request (1). Then the values are output in analog as shown below.



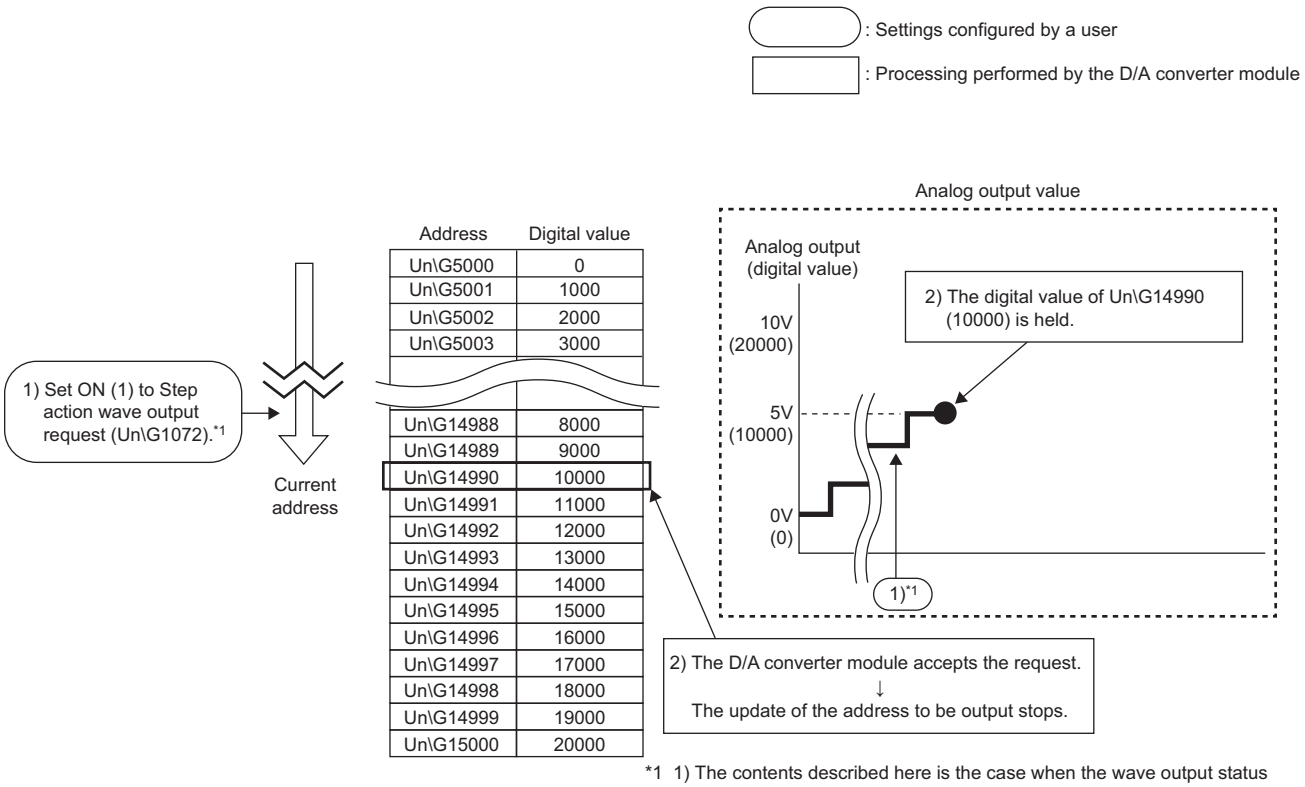
4.8.4 Wave output step action function

This function changes addresses and data values to be output to change the analog output flexibly at any timing in the wave output mode.
This function is useful for the analog output test in the wave output mode and for debugging the wave output function.

Ex. : Wave output step action on the following conditions

- The output range is set to "-10 to 10V".
- The wave output status is the wave output.
  The address of when the step action wave output request is accepted is 14990.

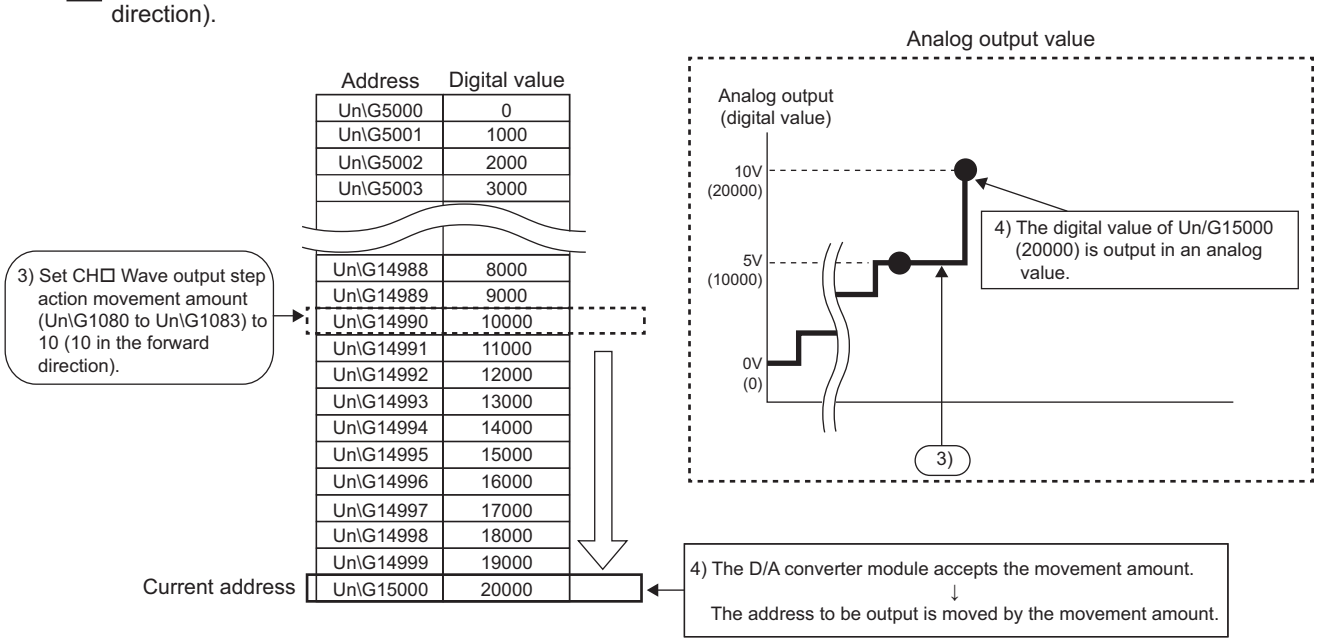
1 Set ON (1) to Step action wave output request (Un\G1072) during the wave output.



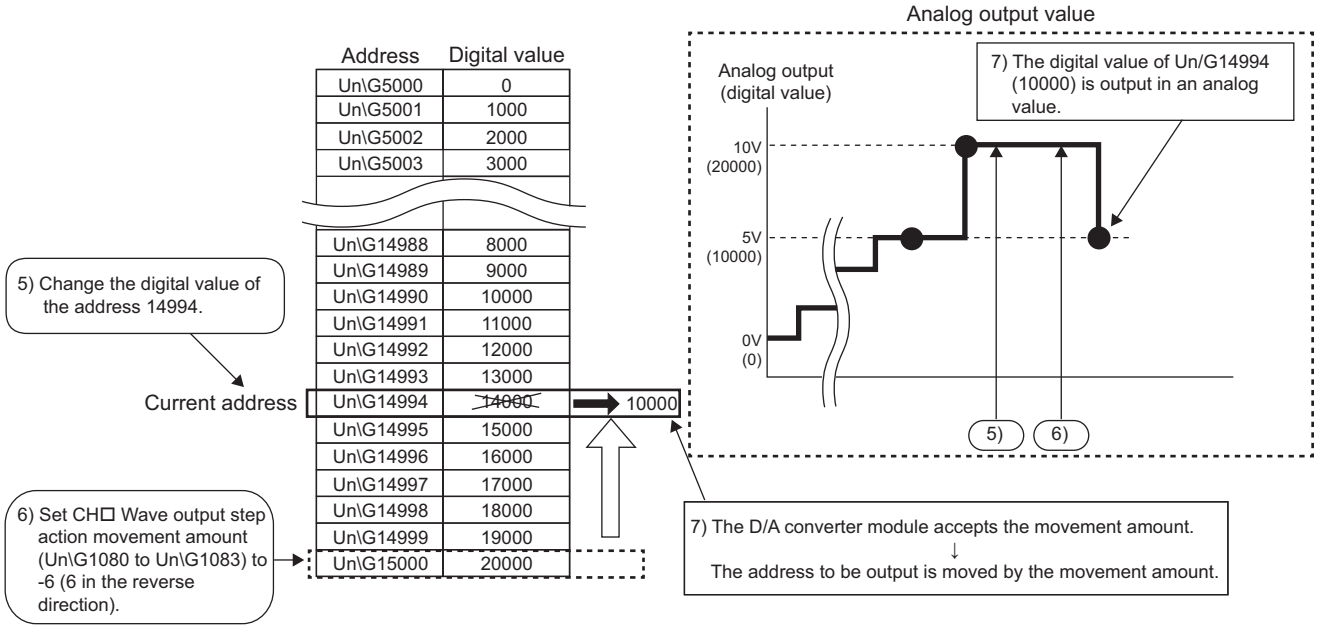
*1 1) The contents described here is the case when the wave output status is the wave output at the timing of 1). If the wave output status is other than the wave output, following operations are performed at the timing of 2).

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

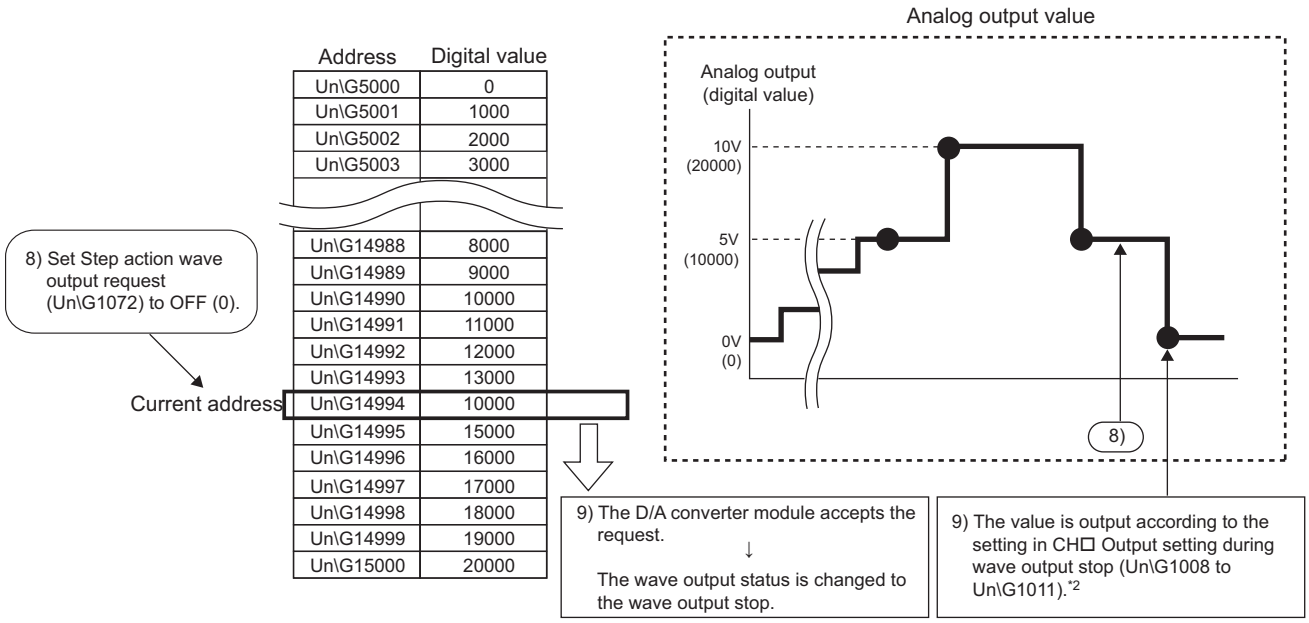
2 Set CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) to 10 (10 in the forward direction).



3 Change the digital value (in the address 14994) to 10000, and set CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) to -6 (reverse run direction).



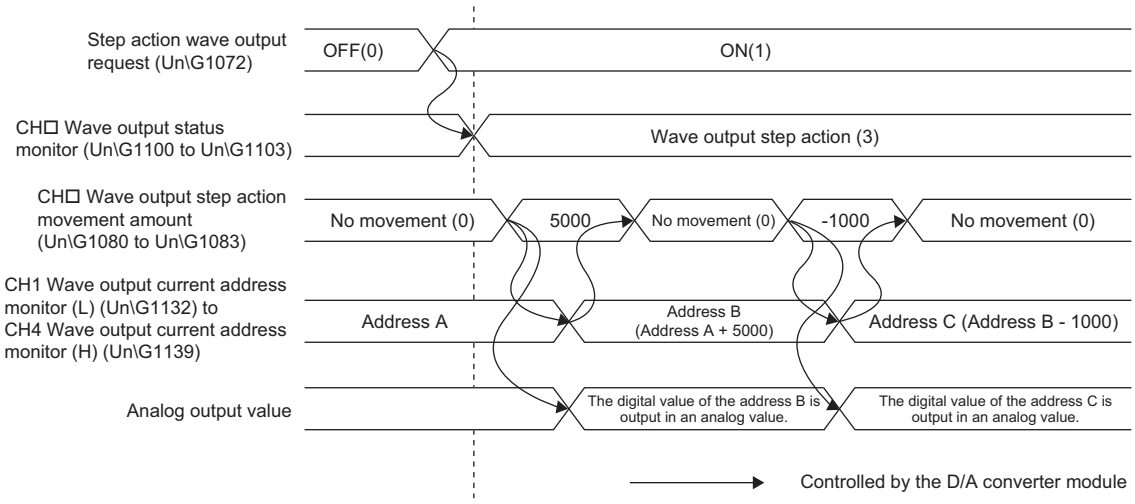
4 Set Step action wave output request (Un\G1072) to OFF (0).



*2 This graph shows the value when CHo Output setting during wave output stop (Un\G1008 to Un\G1011) is set to 0V/0mA (0).

(1) Operation of the wave output step action function

The wave output step action function is executed as follows.



Set Step action wave output request (Un\G1072) to ON (1) to set the wave output status to the wave output step action.

By setting a value in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) during the wave output step action, the address moves to the address of the target wave data for the output test. Set the amount for movement from the current wave data address in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083).

After the movement, CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) is set to No movement (0) and the wave data of the target address is output in analog.

The available range for movement by using CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) depends on the setting values of the wave pattern start address and wave pattern data points. The following shows the available range for movement.

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

Ex. Setting 5000 for CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031)

Setting 10000 for CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047)

→ The available range for movement is Un\G5000 to Un\G14999.

If a value out of the setting range of the wave pattern data points is set for CH□ Wave output step action movement amount (Un\G1080 to Un\G1083), the data is processed with the value within the setting range.

(2) Execution of the wave output step action function

To use the wave output step action function, the initial setting for the wave output function must be set in advance. For details on the initial setting for the wave output function, refer to the following.

- Initial settings of the wave output function (☞Page 52, Section 4.8.1)
- Registering the wave data and parameters of the wave output function (☞Page 67, Section 4.8.2 (1))

(a) Switch to the wave output step action status

Switch the wave output status to the wave output step action in the following procedure.

1. **Set Step action wave output request (Un\G1072) to ON (1).**

2. **Check that CH□ Wave output status monitor (Un\G1100 to Un\G1103) is set to Wave output step action (3) in all the channels where the D/A conversion is enabled.**

(b) Execution of the wave output step action

After switching the status to the wave output step action status, execute the wave output step action in the following procedure. An analog output test can be performed in the wave output mode or the wave output function can be debugged by repeating this procedure.

1. **Change the value of the target wave data for the wave output step action to any value.**

2. **Set a value for CH□ Wave output step action movement amount (Un\G1080 to Un\G1083).**
Set the following value according to the direction to move.

Movement direction	Description	Setting value
No movement	The buffer memory address of the wave data to be output is not moved.	0
Forward movement	The buffer memory address of the wave data to be output is moved in the address increasing direction from the buffer memory address of the currently output wave data. Example): When 10000 is set in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) with the buffer memory address of the currently output wave data being Un\G30000 → The buffer memory address of the wave data to be output is changed to Un\G40000.	1 to 30000
Reverse movement	The buffer memory address of the wave data to be output is moved in the address decreasing direction from the buffer memory address of the currently output wave data. Example): When -10000 is set in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) with the buffer memory address of the currently output wave data being Un\G30000 → The buffer memory address of the wave data to be output is changed to Un\G20000.	-1 to -30000

3. **Check that the value stored in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) is No movement (0).**

4. **Check that CH1 Wave output current address monitor (L) (Un\G1132) to CH4 Wave output current address monitor (H) (Un\G1139) are the buffer memory addresses of the wave data to be output. At this time, the value of the target wave data is output in analog.**

5. **Check that proper analog values are output.**

(c) End of the wave output step action

End the wave output step action in the following procedure.

1. **Set Step action wave output request (Un\G1072) to OFF (0).**
2. **Check that CH☐ Wave output status monitor (Un\G1100 to Un\G1103) is set to Wave output stop (0) in all the channels. If CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) has been set to the value other than Wave output stop request (0), the value is changed to Wave output stop request (0) forcibly at this timing. Check also the value of this buffer memory area.**

To execute the wave output after the wave output step action, set Wave output start request (1) for CH☐ Wave output start/stop request (Un\G1000 to Un\G1003).

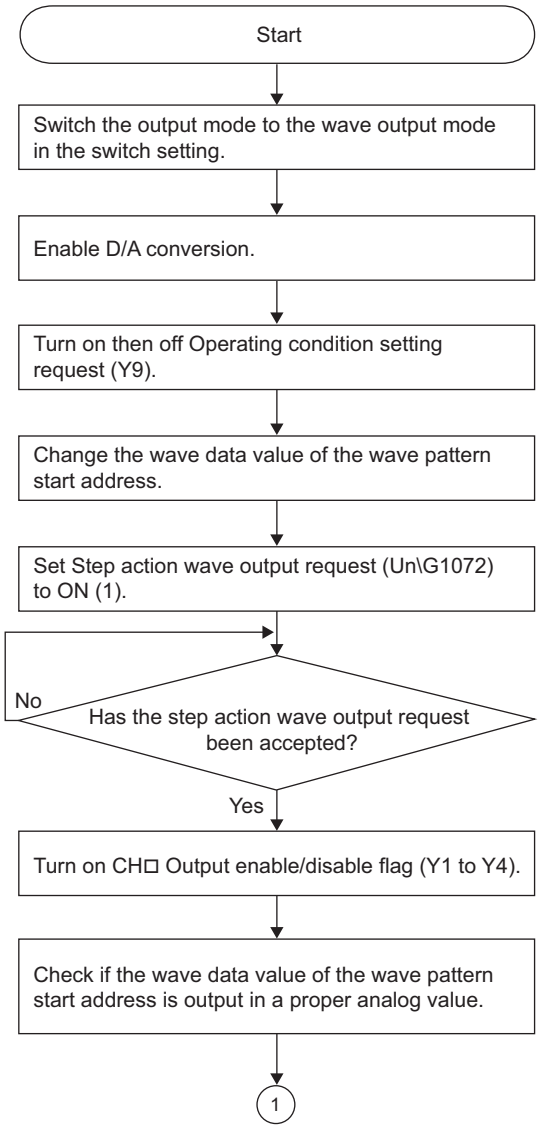
Point

- Analog output may be changed suddenly when a value is set for CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083). To prevent a sudden change, use of CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) in combination with CH☐ Output enable/disable flag (Y1 to Y4) is recommended. For the combination, refer to the following.
  - Analog Output HOLD/CLEAR Function (☞ Page 32, Section 4.4)

  In addition, analog output can be changed at any timing by using CH☐ Output enable/disable flag (Y1 to Y4) in combination with other factors during the wave output step action. For details, refer to the following.
  - (☞ Page 86, Section 4.8.4 (3))
- During the wave output step action, the wave output status is not changed even when a value is set for CH☐ Wave output start/stop request (Un\G1000 to Un\G1003). To change the wave output status, set Step action wave output request (Un\G1072) to OFF (0) (set the status to the wave output stop).

(3) Analog output test in the wave output mode

The following shows the procedure of the analog output test using the wave output step action function.
The example of testing analog output in CH1 is described as well.



Example of testing analog output in CH1

Set "Output mode setting" to "Wave output mode (conversion speed: 50μs/CH)" or "Wave output mode (conversion speed: 80μs/CH)" in the switch setting.

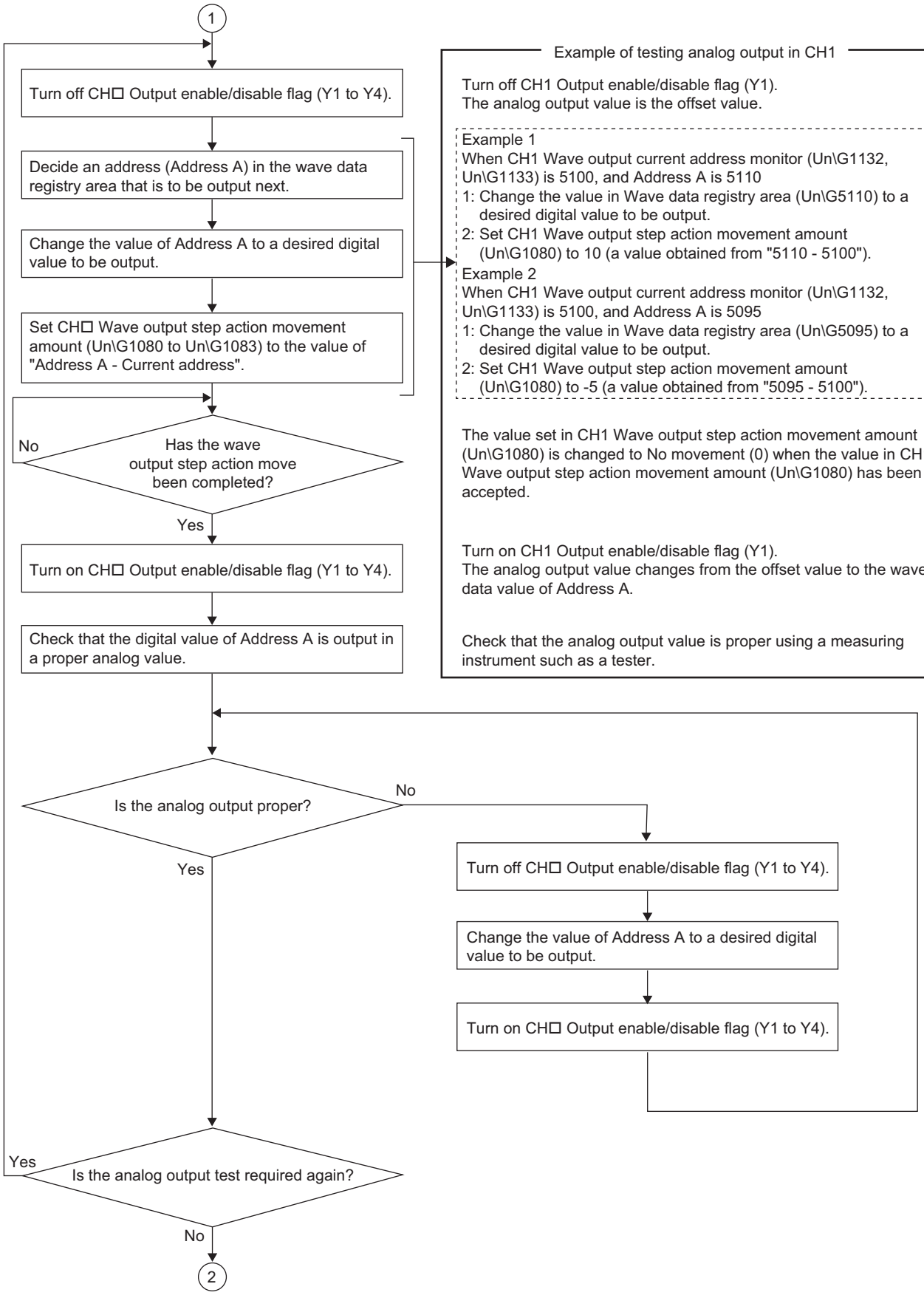
Set D/A conversion enable/disable (Un\G0) to 000EH.
(Set D/A conversion enable (0) only for CH1.)

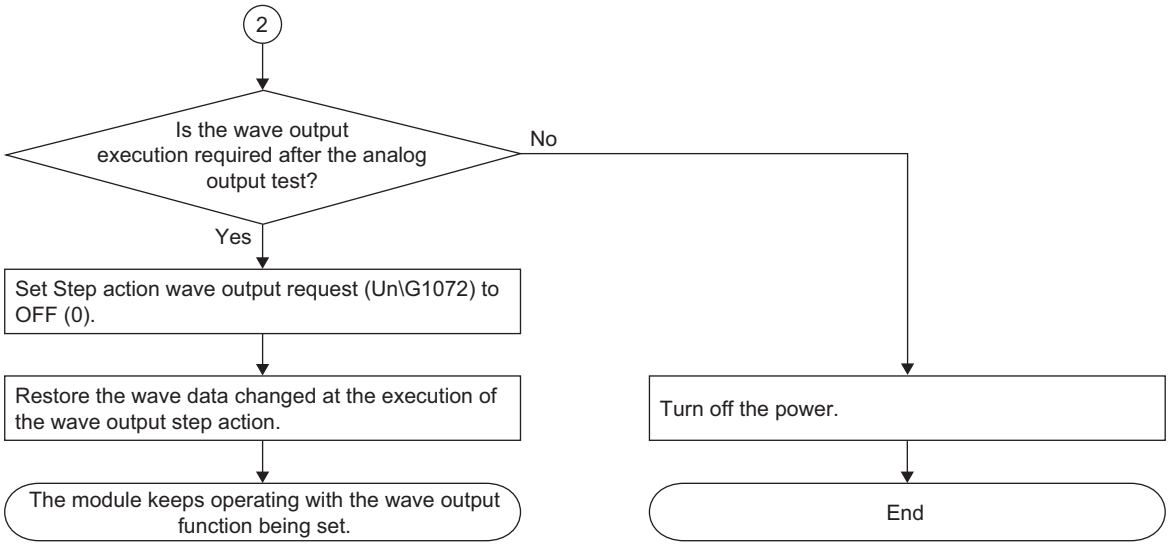
Turn on then off Operating condition setting request (Y9).
Even though the D/A conversion is enabled, the analog output value is the offset value since CH1 Output enable/disable flag (Y1) is off.

The value set in CH1 Wave output status monitor (Un\G1100) is changed to Wave output step action (3) when the value in Step action wave output request (Un\G1072) has been accepted.

Turn on CH1 Output enable/disable flag (Y1).
The analog output value changes from the offset value to the wave data value of the wave pattern start address.

Check that the analog output value is proper using a measuring instrument such as a tester.


1
Turn off CH☐ Output enable/disable flag (Y1 to Y4).
Decide an address (Address A) in the wave data registry area that is to be output next.
Change the value of Address A to a desired digital value to be output.
Set CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) to the value of "Address A - Current address".
No
Has the wave output step action move been completed?
Yes
Turn on CH☐ Output enable/disable flag (Y1 to Y4).
Check that the digital value of Address A is output in a proper analog value.
Is the analog output proper?
No
Turn off CH☐ Output enable/disable flag (Y1 to Y4).
Change the value of Address A to a desired digital value to be output.
Turn on CH☐ Output enable/disable flag (Y1 to Y4).
Yes
Is the analog output test required again?
Yes
No
2
Example of testing analog output in CH1
Turn off CH1 Output enable/disable flag (Y1).
The analog output value is the offset value.
Example 1
When CH1 Wave output current address monitor (Un\G1132, Un\G1133) is 5100, and Address A is 5110
1: Change the value in Wave data registry area (Un\G5110) to a desired digital value to be output.
2: Set CH1 Wave output step action movement amount (Un\G1080) to 10 (a value obtained from "5110 - 5100").
Example 2
When CH1 Wave output current address monitor (Un\G1132, Un\G1133) is 5100, and Address A is 5095
1: Change the value in Wave data registry area (Un\G5095) to a desired digital value to be output.
2: Set CH1 Wave output step action movement amount (Un\G1080) to -5 (a value obtained from "5095 - 5100").
The value set in CH1 Wave output step action movement amount (Un\G1080) is changed to No movement (0) when the value in CH1 Wave output step action movement amount (Un\G1080) has been accepted.
Turn on CH1 Output enable/disable flag (Y1).
The analog output value changes from the offset value to the wave data value of Address A.
Check that the analog output value is proper using a measuring instrument such as a tester.



Point

The operation of the wave output step action function partially differs depending on the version of the module used. For details, refer to the following.

- Modification of the Function (Page 227, Appendix 1)

4.9 Error Log Function

This function stores errors and alarms that occur in the D/A converter module to the buffer memory areas (Un\G1810 to Un\G1969) as history.
The total of 16 cases of history for errors and alarms are stored.

(1) Process of the error log function

The error code and the error time are stored in the buffer memory area, starting from Error history No.1 (start address: Un\G1810) and sequentially thereafter. Error time is stored as follows.

Ex. For error history No. 1

	b15 to b8	b7 to b0
Un\G1810	Error code	
Un\G1811	First two digits of the year	Last two digits of the year
Un\G1812	Month	Day
Un\G1813	Hour	Minute
Un\G1814	Second	Day of the week
Un\G1815 to Un\G1819	System area	

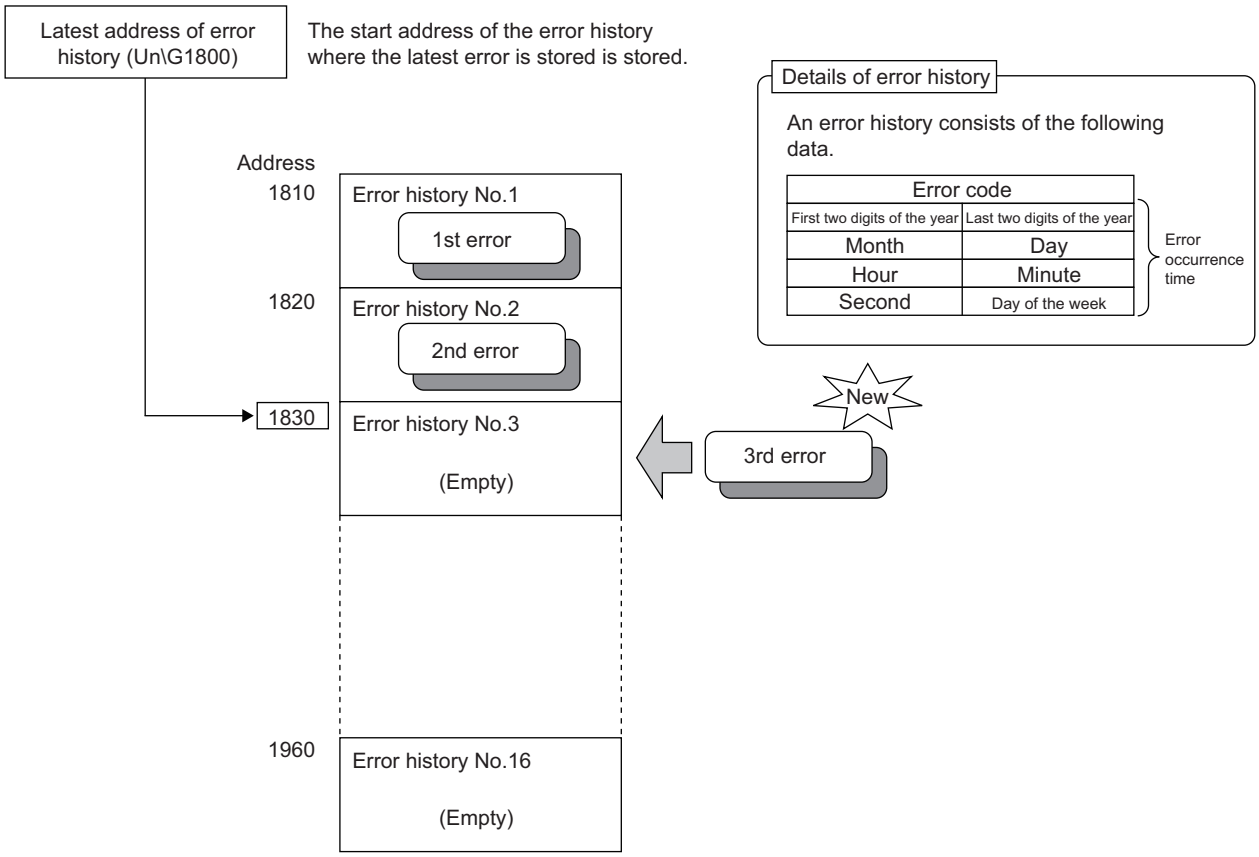
Item	Stored data	Example*1
First two digits of the year/ Last two digits of the year	Stored in BCD code.	2011_H
Month/Day		0329_H
Hour/Minute		1035_H
Second		40_H
Day of the week	The value that corresponds to the day of the week is stored in BCD code. • Sunday: 0 • Monday: 1 • Tuesday: 2 • Wednesday: 3 • Thursday: 4 • Friday: 5 • Saturday: 6	2_H

*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(2) Checking error history

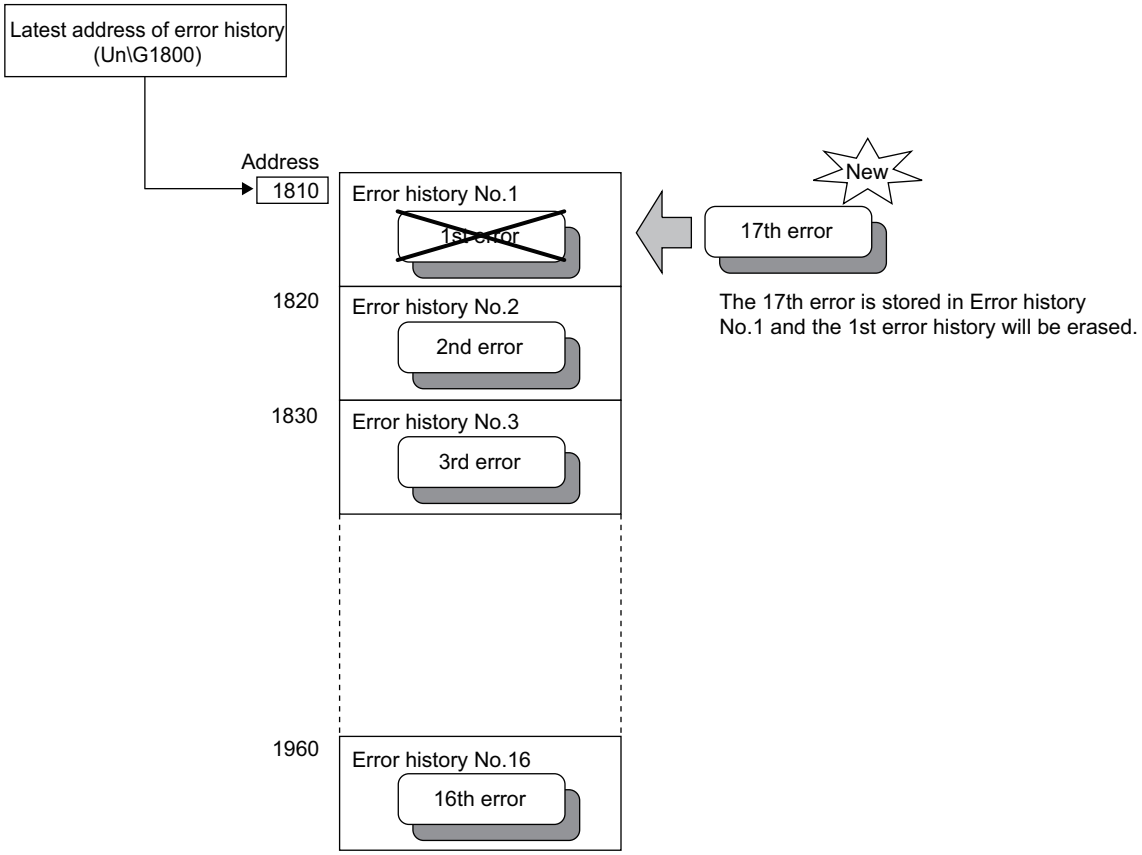
The start address of the latest stored error can be checked in Latest address of error history (Un\G1800).

Ex. When the third error occurs:
The third error is stored in error history No.3, and the value "1830" (start address of error history No.3) is stored to Latest address of error history (Un\G1800).



Ex. When the 17th error occurs:

The 17th error is stored in error history No.1, and the value "1810" (start address of error history No.1) is stored to Latest address of error history (Un\G1800).

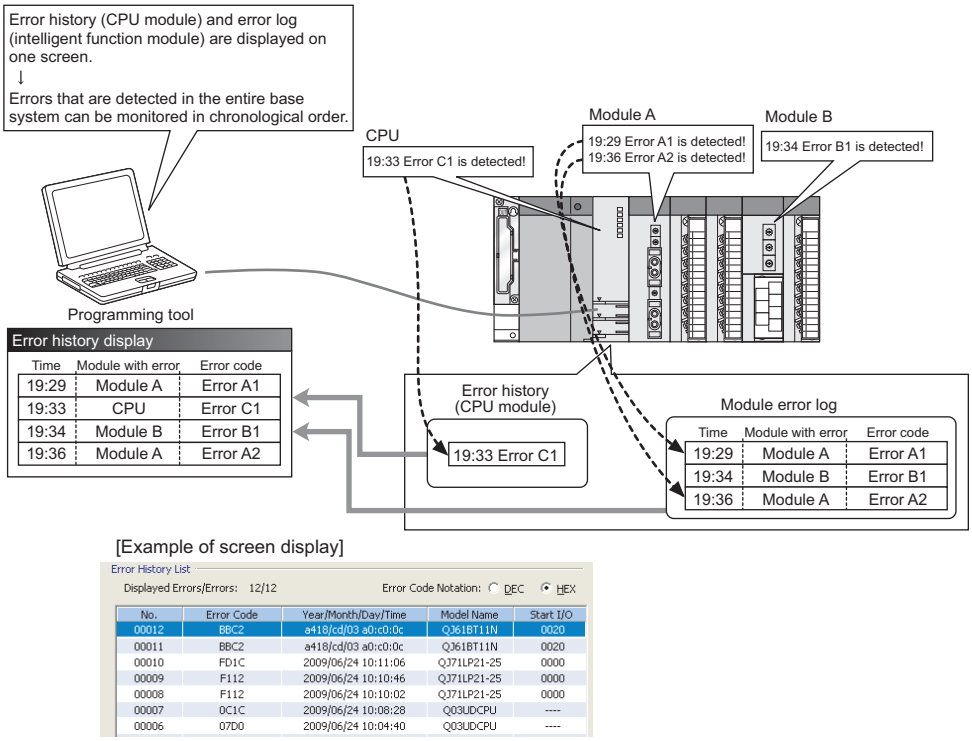


Point

- The same process for errors is used when an alarm occurs.
- Once the error history storage area becomes full, subsequent error information overwrites the existing data, starting from Error history No.1 (Un\G1810 to Un\G1819), and error history registration continues sequentially. (The existing data is deleted.)
- The stored error history is cleared when the D/A converter module is powered off, or when the CPU module is reset.

4.10 Module Error Collection Function

This function collects errors and alarms that occur in the D/A converter module into the CPU module. The error information can be held even after the power off or after a CPU module is reset because the information is stored as module error logs, in a CPU module memory that can hold data in the event of power failure.



[Example of screen display]

Point

For details on the module error collection function, refer to the following.

QnUCPU User's Manual (Function Explanation, Program Fundamentals)

(1) Compatible version

The following table lists the versions of CPU modules and GX Works2 compatible with the module error collection function.

Item	Version
CPU module	Universal model QCPU with a serial number (first five digits) of "11043" or later
GX Works2	Version 1.09K or later

4.11 Error Clear Function

When an error occurs, the error can be cleared on the "System Monitor".

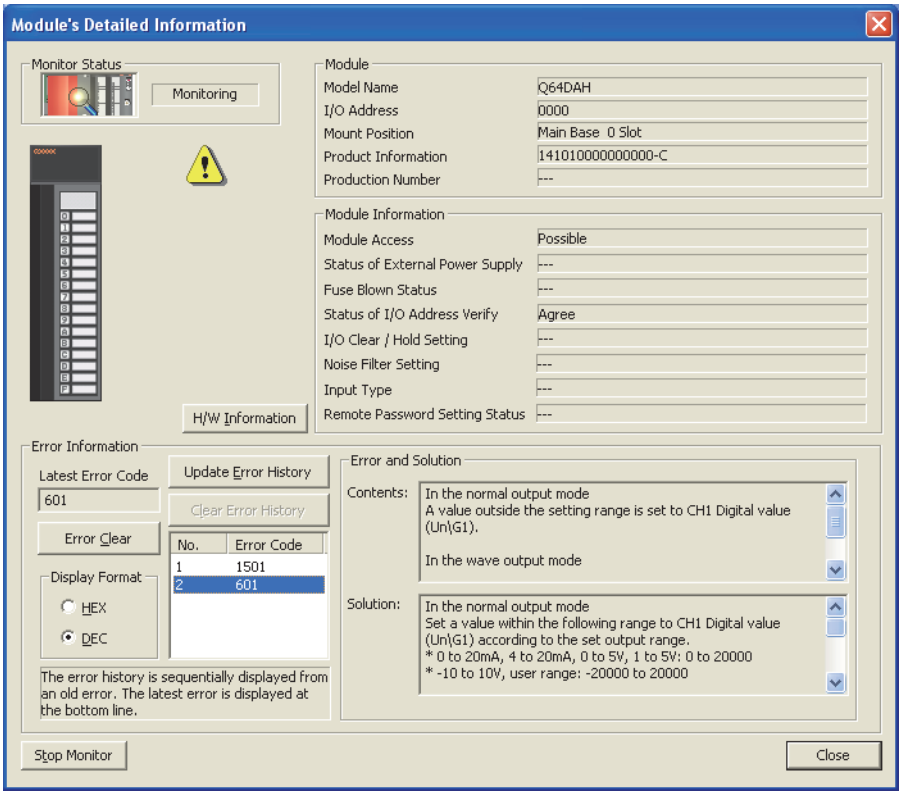
By clicking the Error Clear button in the system monitor, the latest error code stored in Latest error code (Un\G19) is cleared and the ERR. LED turns off. The operation is the same as that using Error clear request (YF).

However, the error history cannot be cleared with the button.

For instructions on Error clear request (YF), refer to the following.

- Error clear request (YF) (Page 102, Section 5.2 (7))

[Diagnostics] ⇨ [System Monitor...] ⇨ error module



CHAPTER 5 I/O SIGNALS ASSIGNED TO THE CPU MODULE

This chapter describes the D/A converter module I/O signals assigned to the CPU module.

5.1 I/O Signal List

The following table lists the I/O signals of the D/A converter module.
For details on the I/O signals, refer to the following.

- Details of I/O Signals (☞Page 95, Section 5.2)

Input signal		Output signal	
Device number	**Signal name**	**Device number**	**Signal name**
X0	Module READY	Y0	Use prohibited
X1	Use prohibited	Y1	CH1 Output enable/disable flag
X2		Y2	CH2 Output enable/disable flag
X3		Y3	CH3 Output enable/disable flag
X4		Y4	CH4 Output enable/disable flag
X5		Y5	Use prohibited
X6		Y6	
X7	External power supply READY flag	Y7	
X8	Use prohibited	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range writing request
XB	Channel change completed flag	YB	Channel change request
XC	Set value change completed flag	YC	Set value change request
XD	Use prohibited	YD	Use prohibited
XE	Warning output signal	YE	Warning output clear request
XF	Error flag	YF	Error clear request

Point

- The I/O numbers (X/Y) in the table above are for the case when the start I/O number of the D/A converter module is set to 0.
- Do not use the "Use prohibited" signals in the table above because the system uses them.
  If users use (turn on) the signals, the functions of the D/A converter module cannot be guaranteed.

5.2 Details of I/O Signals

The following describes the details of the D/A converter module I/O signals assigned to the CPU modules.
The I/O numbers (X/Y) described below show the case that the start I/O number of the D/A converter module is set to 0.

5.2.1 Input signal

(1) Module READY (X0)

Module READY (X0) turns on to indicate that the preparation for the D/A conversion is completed after the power-on or after the reset operation of the CPU module.
In the following cases, Module READY (X0) turns off.

- In the offset/gain setting mode (The D/A conversion processing is executed).
- When a watch dog timer error occurs in the D/A converter module (The D/A conversion processing is not executed).

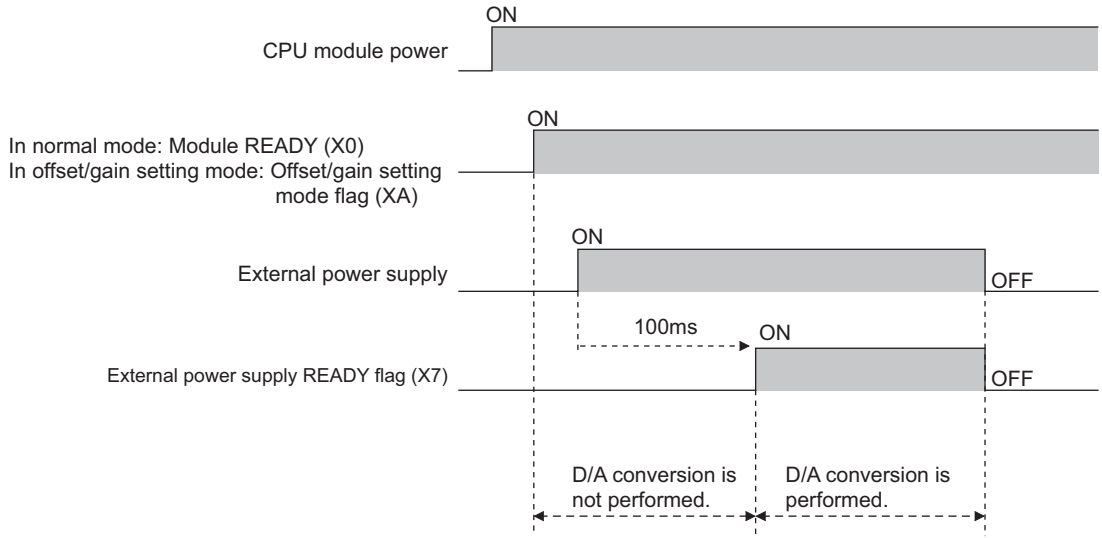
(2) External power supply READY flag (X7)

(a) When the external power supply is off, or where 100ms has not elapsed after turning on of the external power supply

External power supply READY flag (X7) remains off, and the D/A conversion processing is not executed.
At this time, the analog output value becomes 0V/0mA.

(b) When the external power supply is turned on

External power supply READY flag (X7) turns on when 100ms has elapsed after turning on of the external power supply. The D/A conversion processing starts for channels where conversion is set to be enabled.



(c) When the external power supply is turned off

External power supply READY flag (X7) turns off, and the D/A conversion processing stops.
At this time, the analog output value becomes 0V/0mA.

If the external power supply is turned on again with this state, External power supply READY flag (X7) performs the operation described in (b), and the D/A conversion processing resumes.

Point

- Use an external power supply that meets the specifications described in the Performance Specifications (Page 22, Section 3.2.). If the external power supply does not meet the specifications, External power supply READY flag (X7) may not turn on.
- When D/A output is executed, Module READY (X0) and External power supply READY flag (X7) must be on.

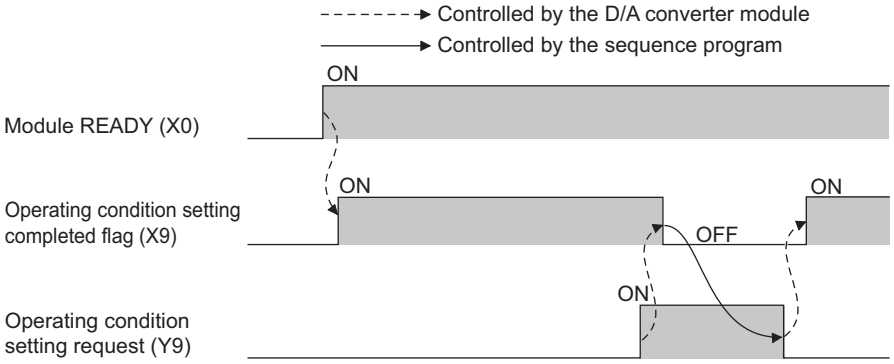
(3) Operating condition setting completed flag (X9)

When changing the following settings, use Operating condition setting completed flag (X9) as an interlock condition to turn on and off Operating condition setting request (Y9).

- D/A conversion enable/disable setting (Un\G0)
- Warning output setting (Un\G47)
- CH☐ Warning output upper limit value (Un\G86, Un\G88, Un\G90, Un\G92)
- CH☐ Warning output lower limit value (Un\G87, Un\G89, Un\G91, Un\G93)
- Scaling enable/disable setting (Un\G53)
- CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60)
- CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61)
- CH☐ Output setting during wave output stop (Un\G1008 to Un\G1011)
- CH☐ Output value during wave output stop (Un\G1016 to Un\G1019)
- CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031)
- CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047)
- CH☐ Wave pattern output repetition setting (Un\G1056 to Un\G1059)
- CH☐ Constant for wave output conversion cycle (Un\G1064 to Un\G1067)

In the case of the following status, Operating condition setting completed flag (X9) turns off.

- When Operating condition setting request (Y9) is on



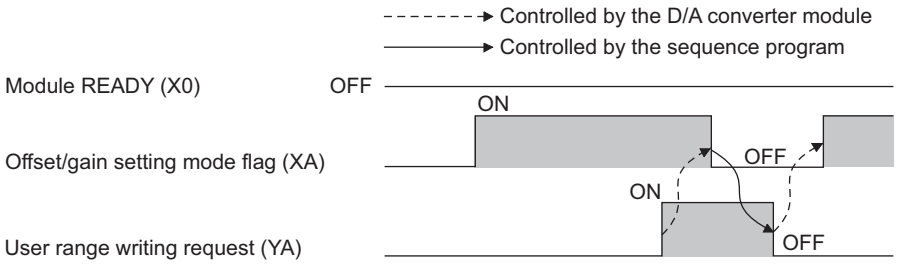
(4) Offset/gain setting mode flag (XA)

(a) Offset/gain setting mode

When the offset or gain value, which was adjusted with the offset/gain setting, is registered, Offset/gain setting mode flag (XA) is used as an interlock condition to turn on and off User range writing request (YA).

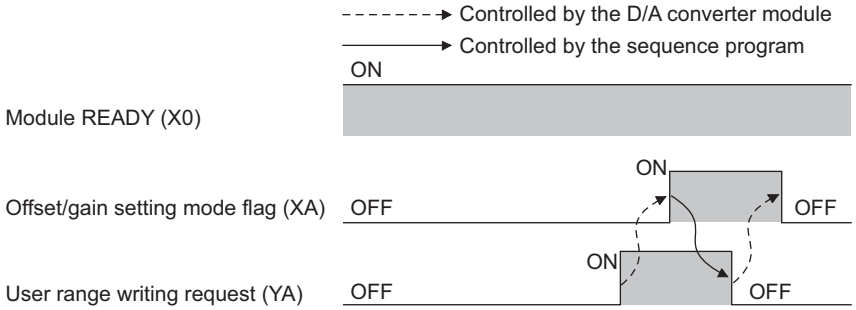
For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)



(b) Normal output mode

In the user range setting restoration, use Offset/gain setting mode flag (XA) as an interlock condition to turn on and off User range writing request (YA).

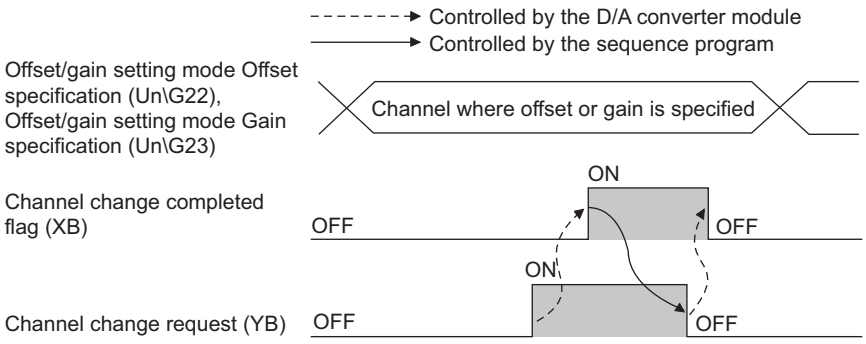


(5) Channel change completed flag (XB)

When a channel to perform the offset/gain setting is changed, use Channel change completed flag (XB) as an interlock condition to turn on and off Channel change request (YB).

For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

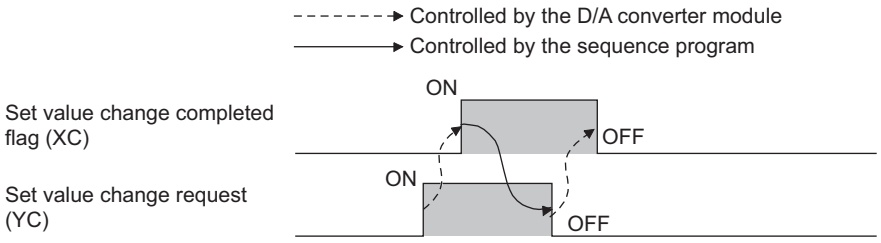


(6) Set value change completed flag (XC)

When the offset/gain setting is adjusted, use Set value change completed flag (XC) as an interlock condition to turn on and off Set value change request (YC).

For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

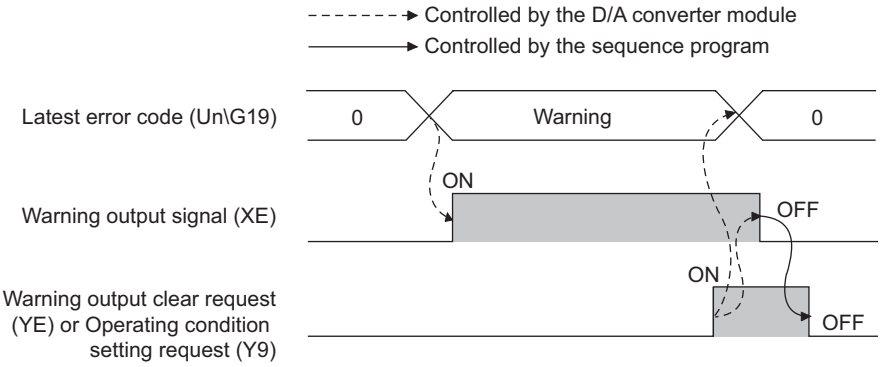


(a) When the external power supply is off

Set value change completed flag (XC) does not turn on. Turn on the external power supply, and then turn on and off Set value change request (YC) again.

(7) Warning output signal (XE)

In D/A conversion enabled channels, if any digital value exceeds the warning output upper limit value or is below the warning output lower limit value, Warning output signal (XE) turns on.

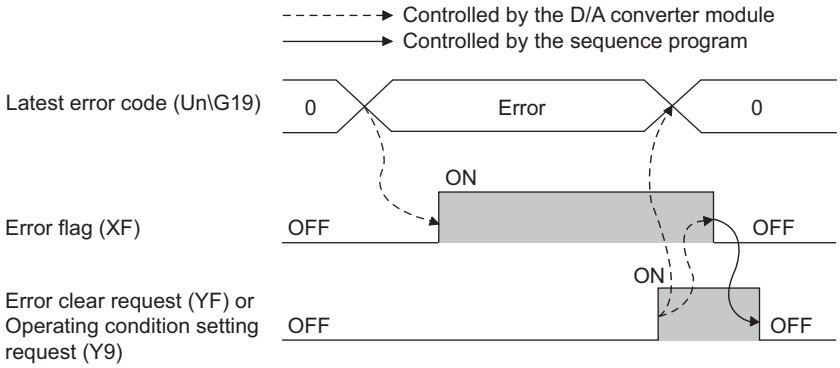


(a) Turning off Warning output signal (XE)

Correct the digital value so that the value is within the range between the warning output upper limit value and the warning output lower limit value, and turn on and off Warning output clear request (YE) or Operating condition setting request (Y9). (At the turning on of Warning output clear request (YE) or Operating condition setting request (Y9), Warning output signal (XE) and Latest error code (Un\G19) are cleared, and ALM LED turns off.)

(8) Error flag (XF)

Error flag (XF) turns on when an error occurs.



(a) Turning off Error flag (XF)

Error flag (XF) turns off by eliminating the error cause and performing either of following operation.

- Turn on and off Error clear request (YF)
- Turn on and off Operating condition setting request (Y9)

At the turning on of Error clear request (YF) or Operating condition setting request (Y9), Error flag (XF) and Latest error code (Un\G19) are cleared, and ERR. LED turns off.

5.2.2 Output signal

(1) CH□ Output enable/disable flag (Y1 to Y4)

This signal is used to set whether to output the D/A-converted value or the offset value, for each channel.
ON: D/A-converted value
OFF: offset value

(a) D/A conversion speed

The D/A conversion speed is calculated by 20μs × Number of conversion enabled channels, regardless of whether CH□ Output enable/disable flag (Y1 to Y4) is turned on or off.

(2) Operating condition setting request (Y9)

To enable the initial setting of the D/A converter module, turn on and off Operating condition setting request (Y9). For the contents of the initial setting which becomes enabled and the timing of turning on and off the signal, refer to the following.

- Operating condition setting completed flag (X9) (☞Page 97, Section 5.2.1 (3))

By eliminating the error cause and turning on and off this signal while an error or a warning is occurring, the error and the warning are cleared.

In the wave output mode, turn on and off Operating condition setting request (Y9), after checking that CH□ Wave output status monitor (Un\G1100 to Un\G1103) in all channels are set to Wave output stop (0). When Operating condition setting request (Y9) is turned on and off with a channel set to other than the Wave output stop, an error occurs. The error code (20□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The initial settings cannot be enabled.

(3) User range writing request (YA)

(a) Offset/gain setting mode

Turn on and off User range writing request (YA) to register the adjusted offset/gain setting values in the D/A converter module.
At the turning on of this signal, data are written to the flash memory.
For the timing of turning on and off the signal, refer to the following.

- Offset/gain setting mode flag (XA) (☞Page 98, Section 5.2.1 (4))

For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

(b) Normal output mode

Turn on and off User range writing request (YA) to restore the user range setting.
For the timing of turning on and off the signal, refer to the following.

- Offset/gain setting mode flag (XA) (☞Page 98, Section 5.2.1 (4))

(c) Wave output mode

Even when User range writing request (YA) is turned on and off in the wave output mode, the user range cannot be restored. To restore the user range, set the normal output mode.

(4) Channel change request (YB)

Turn on and off Channel change request (YB) to change a channel to perform the offset/gain setting.
For the timing of turning on and off the signal, refer to the following.

- Channel change completed flag (XB) (☞Page 98, Section 5.2.1 (5))

For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

(5) Set value change request (YC)

Turn on and off Set value change request (YC) to change the analog output value while the offset/gain setting is being adjusted.
The analog output value is changed according to the value set in Offset/gain adjustment value specification (Un\G24).
For the timing of turning on and off the signal, refer to the following.

- Set value change completed flag (XC) (☞Page 99, Section 5.2 (6))

For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 143, Section 8.5)

(6) Warning output clear request (YE)

Turn on and off Warning output clear request (YE) to clear the warning output.
For the timing of turning on and off the signal, refer to the following.

- Warning output signal (XE) (☞Page 99, Section 5.2.1 (7))

(7) Error clear request (YF)

Turn on and off Error clear request (YF) to clear Error flag (XF) and Latest error code (Un\G19).
For the timing of turning on and off the signal, refer to the following.

- Error flag (XF) (☞Page 100, Section 5.2.1 (8))

CHAPTER 6 BUFFER MEMORY

This chapter describes the buffer memory of the D/A converter module.

6.1 List of Buffer Memory Addresses

The following table lists the buffer memory addresses of the D/A converter module.

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

- Details of Buffer Memory Addresses (☞ Page 111, Section 6.2)

Point

Do not write data to the system area and the area where the data cannot be written in buffer memory.
Writing data to these areas may lead the module to malfunction.

(1) Un\G0 to Un\G1799

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
0	0_H	D/A conversion enable/disable setting	$000F_H$	R/W
1	1_H	CH1 Digital value	0	R/W
2	2_H	CH2 Digital value	0	R/W
3	3_H	CH3 Digital value	0	R/W
4	4_H	CH4 Digital value	0	R/W
5 to 8	5_H to 8_H	System area	–	–
9	9_H	Output mode	0000_H	R
10	A_H	System area	–	–
11	B_H	CH1 Set value check code	0000_H	R
12	C_H	CH2 Set value check code	0000_H	R
13	D_H	CH3 Set value check code	0000_H	R
14	E_H	CH4 Set value check code	0000_H	R
15 to 18	F_H to 12_H	System area	–	–
19	13_H	Latest error code	0	R
20	14_H	Setting range	0000_H	R
21	15_H	System area	–	–
22	16_H	Offset/gain setting mode Offset specification	0000_H	R/W
23	17_H	Offset/gain setting mode Gain specification	0000_H	R/W
24	18_H	Offset/gain adjustment value specification	0	R/W
25	19_H	System area	–	–

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
26	$1A_H$	HOLD/CLEAR function setting	0000_H	R
27 to 46	$1B_H$ to $2E_H$	System area	–	–
47	$2F_H$	Warning output setting	$000F_H$	R/W
48	30_H	Warning output flag	0000_H	R
49 to 52	31_H to 34_H	System area	–	–
53	35_H	Scaling enable/disable setting	$000F_H$	R/W
54	36_H	CH1 Scaling lower limit value	0	R/W
55	37_H	CH1 Scaling upper limit value	0	R/W
56	38_H	CH2 Scaling lower limit value	0	R/W
57	39_H	CH2 Scaling upper limit value	0	R/W
58	$3A_H$	CH3 Scaling lower limit value	0	R/W
59	$3B_H$	CH3 Scaling upper limit value	0	R/W
60	$3C_H$	CH4 Scaling lower limit value	0	R/W
61	$3D_H$	CH4 Scaling upper limit value	0	R/W
62 to 85	$3E_H$ to 55_H	System area	–	–
86	56_H	CH1 Warning output upper limit value	0	R/W
87	57_H	CH1 Warning output lower limit value	0	R/W
88	58_H	CH2 Warning output upper limit value	0	R/W
89	59_H	CH2 Warning output lower limit value	0	R/W
90	$5A_H$	CH3 Warning output upper limit value	0	R/W
91	$5B_H$	CH3 Warning output lower limit value	0	R/W
92	$5C_H$	CH4 Warning output upper limit value	0	R/W
93	$5D_H$	CH4 Warning output lower limit value	0	R/W
94 to 157	$5E_H$ to $9D_H$	System area	–	–
158	$9E_H$	Mode switching setting	0	R/W
159	$9F_H$		0	R/W
160 to 199	$A0_H$ to $C7_H$	System area	–	–
200	$C8_H$	Pass data classification setting	0	R/W
201	$C9_H$	System area	–	–
202	CA_H	CH1 Industrial shipment settings offset value	0	R/W
203	CB_H	CH1 Industrial shipment settings gain value	0	R/W
204	CC_H	CH2 Industrial shipment settings offset value	0	R/W
205	CD_H	CH2 Industrial shipment settings gain value	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
206	CE_H	CH3 Industrial shipment settings offset value	0	R/W
207	CF_H	CH3 Industrial shipment settings gain value	0	R/W
208	$D0_H$	CH4 Industrial shipment settings offset value	0	R/W
209	$D1_H$	CH4 Industrial shipment settings gain value	0	R/W
210	$D2_H$	CH1 User range settings offset value	0	R/W
211	$D3_H$	CH1 User range settings gain value	0	R/W
212	$D4_H$	CH2 User range settings offset value	0	R/W
213	$D5_H$	CH2 User range settings gain value	0	R/W
214	$D6_H$	CH3 User range settings offset value	0	R/W
215	$D7_H$	CH3 User range settings gain value	0	R/W
216	$D8_H$	CH4 User range settings offset value	0	R/W
217	$D9_H$	CH4 User range settings gain value	0	R/W
218 to 999	DA_H to $3E7_H$	System area	–	–
1000	$3E8_H$	CH1 Wave output start/stop request	0	R/W
1001	$3E9_H$	CH2 Wave output start/stop request	0	R/W
1002	$3EA_H$	CH3 Wave output start/stop request	0	R/W
1003	$3EB_H$	CH4 Wave output start/stop request	0	R/W
1004 to 1007	$3EC_H$ to $3EF_H$	System area	–	–
1008	$3F0_H$	CH1 Output setting during wave output stop	1	R/W
1009	$3F1_H$	CH2 Output setting during wave output stop	1	R/W
1010	$3F2_H$	CH3 Output setting during wave output stop	1	R/W
1011	$3F3_H$	CH4 Output setting during wave output stop	1	R/W
1012 to 1015	$3F4_H$ to $3F7_H$	System area	–	–
1016	$3F8_H$	CH1 Output value during wave output stop	0	R/W
1017	$3F9_H$	CH2 Output value during wave output stop	0	R/W
1018	$3FA_H$	CH3 Output value during wave output stop	0	R/W
1019	$3FB_H$	CH4 Output value during wave output stop	0	R/W
1020 to 1023	$3FC_H$ to $3FF_H$	System area	–	–
1024	400_H	CH1 Wave pattern start address setting (L)	5000	R/W
1025	401_H	CH1 Wave pattern start address setting (H)		
1026	402_H	CH2 Wave pattern start address setting (L)	5000	R/W
1027	403_H	CH2 Wave pattern start address setting (H)		
1028	404_H	CH3 Wave pattern start address setting (L)	5000	R/W
1029	405_H	CH3 Wave pattern start address setting (H)		

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
1030	406_H	CH4 Wave pattern start address setting (L)	5000	R/W
1031	407_H	CH4 Wave pattern start address setting (H)		
1032 to 1039	408_H to $40F_H$	System area	–	–
1040	410_H	CH1 Wave pattern data points setting (L)	0	R/W
1041	411_H	CH1 Wave pattern data points setting (H)		
1042	412_H	CH2 Wave pattern data points setting (L)	0	R/W
1043	413_H	CH2 Wave pattern data points setting (H)		
1044	414_H	CH3 Wave pattern data points setting (L)	0	R/W
1045	415_H	CH3 Wave pattern data points setting (H)		
1046	416_H	CH4 Wave pattern data points setting (L)	0	R/W
1047	417_H	CH4 Wave pattern data points setting (H)		
1048 to 1055	418_H to $41F_H$	System area	–	–
1056	420_H	CH1 Wave pattern output repetition setting	1	R/W
1057	421_H	CH2 Wave pattern output repetition setting	1	R/W
1058	422_H	CH3 Wave pattern output repetition setting	1	R/W
1059	423_H	CH4 Wave pattern output repetition setting	1	R/W
1060 to 1063	424_H to 427_H	System area	–	–
1064	428_H	CH1 Constant for wave output conversion cycle	1	R/W
1065	429_H	CH2 Constant for wave output conversion cycle	1	R/W
1066	$42A_H$	CH3 Constant for wave output conversion cycle	1	R/W
1067	$42B_H$	CH4 Constant for wave output conversion cycle	1	R/W
1068 to 1071	$42C_H$ to $42F_H$	System area	–	–
1072	430_H	Step action wave output request	0	R/W
1073 to 1079	431_H to 437_H	System area	–	–
1080	438_H	CH1 Wave output step action movement amount	0	R/W
1081	439_H	CH2 Wave output step action movement amount	0	R/W
1082	$43A_H$	CH3 Wave output step action movement amount	0	R/W
1083	$43B_H$	CH4 Wave output step action movement amount	0	R/W
1084 to 1099	$43C_H$ to $44B_H$	System area	–	–
1100	$44C_H$	CH1 Wave output status monitor	0	R
1101	$44D_H$	CH2 Wave output status monitor	0	R

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
1102	$44E_H$	CH3 Wave output status monitor	0	R
1103	$44F_H$	CH4 Wave output status monitor	0	R
1104 to 1107	450_H to 453_H	System area	–	–
1108	454_H	CH1 Wave output conversion cycle monitor (L)	0	R
1109	455_H	CH1 Wave output conversion cycle monitor (H)		
1110	456_H	CH2 Wave output conversion cycle monitor (L)	0	R
1111	457_H	CH2 Wave output conversion cycle monitor (H)		
1112	458_H	CH3 Wave output conversion cycle monitor (L)	0	R
1113	459_H	CH3 Wave output conversion cycle monitor (H)		
1114	$45A_H$	CH4 Wave output conversion cycle monitor (L)	0	R
1115	$45B_H$	CH4 Wave output conversion cycle monitor (H)		
1116 to 1123	$45C_H$ to 463_H	System area	–	–
1124	464_H	CH1 Wave pattern output count monitor	0	R
1125	465_H	CH2 Wave pattern output count monitor	0	R
1126	466_H	CH3 Wave pattern output count monitor	0	R
1127	467_H	CH4 Wave pattern output count monitor	0	R
1128 to 1131	468_H to $46B_H$	System area	–	–
1132	$46C_H$	CH1 Wave output current address monitor (L)	0	R
1133	$46D_H$	CH1 Wave output current address monitor (H)		
1134	$46E_H$	CH2 Wave output current address monitor (L)	0	R
1135	$46F_H$	CH2 Wave output current address monitor (H)		
1136	470_H	CH3 Wave output current address monitor (L)	0	R
1137	471_H	CH3 Wave output current address monitor (H)		
1138	472_H	CH4 Wave output current address monitor (L)	0	R
1139	473_H	CH4 Wave output current address monitor (H)		
1140 to 1147	474_H to $47B_H$	System area	–	–
1148	$47C_H$	CH1 Wave output current digital value monitor	0	R
1149	$47D_H$	CH2 Wave output current digital value monitor	0	R
1150	$47E_H$	CH3 Wave output current digital value monitor	0	R
1151	$47F_H$	CH4 Wave output current digital value monitor	0	R
1152 to 1155	480_H to 483_H	System area	–	–

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
1156	484_H	CH1 Wave output digital value outside the range Address monitor (L)	0	R
1157	485_H	CH1 Wave output digital value outside the range Address monitor (H)		
1158	486_H	CH2 Wave output digital value outside the range Address monitor (L)	0	R
1159	487_H	CH2 Wave output digital value outside the range Address monitor (H)		
1160	488_H	CH3 Wave output digital value outside the range Address monitor (L)	0	R
1161	489_H	CH3 Wave output digital value outside the range Address monitor (H)		
1162	$48A_H$	CH4 Wave output digital value outside the range Address monitor (L)	0	R
1163	$48B_H$	CH4 Wave output digital value outside the range Address monitor (H)		
1164 to 1171	$48C_H$ to 493_H	System area	–	–
1172	494_H	CH1 Wave output warning Address monitor (L)	0	R
1173	495_H	CH1 Wave output warning Address monitor (H)		
1174	496_H	CH2 Wave output warning Address monitor (L)	0	R
1175	497_H	CH2 Wave output warning Address monitor (H)		
1176	498_H	CH3 Wave output warning Address monitor (L)	0	R
1177	499_H	CH3 Wave output warning Address monitor (H)		
1178	$49A_H$	CH4 Wave output warning Address monitor (L)	0	R
1179	$49B_H$	CH4 Wave output warning Address monitor (H)		
1180 to 1799	$49C_H$ to 707_H	System area	–	–

*1 The default value is a value to be set after power-on or after resetting the CPU module.

*2 This shows whether reading the data from or writing the data to the area with sequence programs is possible.
R: Readable
W: Writable

(2) Un\G1800 to Un\G4999 (Error history)

Address (decimal)	Address (hexadecimal)	Name				Default *1	Read/Write *2
1800	708_H	Latest address of error history				0	R
1801 to 1809	709_H to 711_H	System area				–	–
1810	712_H	No. 1	Error code			0	R
1811	713_H		Error time	First two digits of the year	Last two digits of the year	0	R
1812	714_H			Month	Day	0	R
1813	715_H			Hour	Minute	0	R
1814	716_H			Second	Day of the week	0	R
1815 to 1819	717_H to $71B_H$		System area			–	–
1820 to 1829	$71C_H$ to 725_H	No. 2	Same as No. 1				
1830 to 1839	726_H to $72F_H$	No. 3	Same as No. 1				
1840 to 1849	730_H to 739_H	No. 4	Same as No. 1				
1850 to 1859	$73A_H$ to 743_H	No. 5	Same as No. 1				
1860 to 1869	744_H to $74D_H$	No. 6	Same as No. 1				
1870 to 1879	$74E_H$ to 757_H	No. 7	Same as No. 1				
1880 to 1889	758_H to 761_H	No. 8	Same as No. 1				
1890 to 1899	762_H to $76B_H$	No. 9	Same as No. 1				
1900 to 1909	$76C_H$ to 775_H	No. 10	Same as No. 1				

Address (decimal)	Address (hexadecimal)	Name		Default *1	Read/Write *2
1910 to 1919	776_H to $77F_H$	No. 11	Same as No. 1		
1920 to 1929	780_H to 789_H	No. 12	Same as No. 1		
1930 to 1939	$78A_H$ to 793_H	No. 13	Same as No. 1		
1940 to 1949	794_H to $79D_H$	No. 14	Same as No. 1		
1950 to 1959	$79E_H$ to $7A7_H$	No. 15	Same as No. 1		
1960 to 1969	$7A8_H$ to $7B1_H$	No. 16	Same as No. 1		
1970 to 4999	$7B2_H$ to 1387_H	System area		–	–

*1 The default value is a value to be set after power-on or after resetting the CPU module.

*2 This shows whether reading the data from or writing the data to the area with sequence programs is possible.
R: Readable
W: Writable

(3) Un\G5000 to Un\G54999 (Wave data registry area)

Address (decimal)	Address (hexadecimal)	Name	Default *1	Read/Write *2
5000 to 54999	1388_H to $D6D7_H$	Wave data registry area	0	R/W

*1 The default value is a value to be set after power-on or after resetting the CPU module.

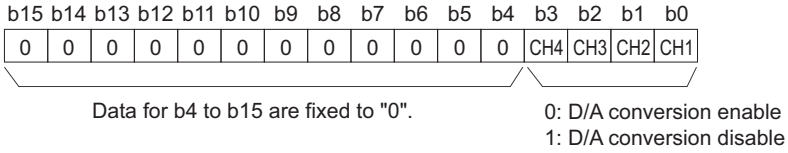
*2 This shows whether reading the data from or writing the data to the area with sequence programs is possible.
R: Readable
W: Writable

6.2 Details of Buffer Memory Addresses

This section describes the details of buffer memory addresses.

(1) D/A conversion enable/disable setting (Un\G0)

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



(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to D/A conversion disable (1).

(2) CH□ Digital value (Un\G1 to Un\G4)

The digital value is written to this area in signed 16-bit binary from the CPU module for performing the D/A conversion.

- The following table lists the setting range.

Output range setting	If the scaling function is disabled		If the scaling function is enabled*1
	Setting range (practical range)	A written digital value out of the setting range is treated as	Setting range
0: 4 to 20mA	0 to 20479 (practical range: 0 to 20000)	20480 or more: 20479 -1 or less: 0	-32000 to 32000
1: 0 to 20mA			
2: 1 to 5V			
3: 0 to 5V			
4: -10 to10V	-20480 to 20479 (practical range: -20000 to 20000)	20480 or more: 20479 -20481 or less: -20480	
F: User range setting			

*1 When the scaling function is enabled, the setting range and practical range depend on the settings for scaling upper and lower limit values.

- When the value out of the setting range is written, the D/A conversion is performed with the upper and lower limit value of the setting range. In addition, a check code is stored in CH□ Set value check code (Un\G11 to Un\G14), the error code (60□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

(a) Default value

0 is set.

Point

This area is disabled when the wave output mode is set because the module performs registered wave data output in wave output mode.

(3) Output mode (Un\G9)

This area is used to check which output mode is set with the switch setting.

Output mode	Conversion speed	Stored value
Normal output mode	20μs/CH	0
Wave output mode	50μs/CH	1
	80μs/CH	2

Point

The output mode cannot be changed with Output mode (Un\G9).
Change the output mode with the switch setting.
For the switch setting, refer to the following.

- Switch Setting (☞ Page 139, Section 8.2)

(4) CH□ Set value check code (Un\G11 to Un\G14)

When the set digital value is out of the setting range, a check code is stored. The check targets are as follows.

- In normal output mode: CH□ Digital value (Un\G1 to Un\G4)
- In wave output mode: Digital value that is currently being output from Wave data registry area (Un\G5000 to Un\G54999)

  [How to check the data]

  A buffer memory address of the wave data with the digital value out of the range can be checked with the following area.

  CH1 Wave output digital value outside the range Address monitor (L) (Un\G1156) to CH4 Wave output digital value outside the range Address monitor (H) (Un\G1163) (☞ Page 129, Section 6.2 (32))

The check codes are as follows.

Check code	Description
$000F_H$	A digital value exceeding the setting range is written.
$00F0_H$	A digital value falling short of the setting range is written.
$00FF_H$	A digital value falling short of the setting range and digital value exceeding the setting range are written. The check code of $00FF_H$ is stored in the following case, for example. • Write the digital value exceeding the setting range, first. • Then, write the digital value falling short of the setting range before resetting the check code.

Once the check code is stored, the code remains even when the digital value is within the setting range.
While the scaling function is enabled, the check is performed to the scale-converted value of CH□ Digital value (Un\G1 to Un\G4).
Note that some errors may be observed in the digital value for which a check code is stored due to the calculation error of scale conversion when a scale-converted value is out of the setting range.

(a) Resetting the set value check codes

Rewrite the digital value to the value within the setting range and turn on and off Error clear request (YF).

(5) Latest error code (Un\G19)

The latest error codes or alarm codes detected in the D/A converter module are stored.

For details on the error codes or alarm codes, refer to the following.

- Error Code List (☞ Page 212, Section 11.1)
- Alarm Code List (☞ Page 219, Section 11.2)

(a) How to clear an error

Turn on and off Error clear request (YF) or Operating condition setting request (Y9).

(6) Setting range (Un\G20)

This area is used to check which output range is set with the switch setting.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

Output range	Stored value
4 to 20mA	0_H
0 to 20mA	1_H
1 to 5V	2_H
0 to 5V	3_H
-10 to 10V	4_H
User range setting	F_H

Point

The output range cannot be changed with Setting range (Un\G20).
Change the output range with the switch setting.
For the switch setting, refer to the following.

- Switch Setting (☞ Page 139, Section 8.2)

(7) Offset/gain setting mode Offset specification (Un\G22), Offset/gain setting mode Gain specification (Un\G23)

Specify the channel to perform the offset/gain setting adjustment.

- Offset/gain setting mode Offset specification (Un\G22): For channel where an offset value is to be adjusted
- Offset/gain setting mode Gain specification (Un\G23): For channel where a gain value is to be adjusted

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Offset/gain setting mode Offset specification (Un\G22)	0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1
Offset/gain setting mode Gain specification (Un\G23)	0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Data for b4 to b15 are fixed to 0.

1: Setting-target channel
0: Invalid

(a) Enabling the setting

To enable the setting, turn on and off Channel change request (YB) in the offset/gain setting mode.

(b) Default value

All channels are set to Invalid (0).

Point

- Multiple channels cannot be set together. If multiple channels are set together, the offset/gain setting mode error occurs. The error code (500) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.
- Set Invalid (0) for either Offset/gain setting mode Offset specification (Un\G22) or Offset/gain setting mode Gain specification (Un\G23).
  If a channel is specified in both of the areas ((Un\G22) and (Un\G23)), the error (error code: 500) occurs.
- For details on the offset/gain setting, refer to the following.
  Offset/gain Setting (☞ Page 143, Section 8.5)

(8) Offset/gain adjustment value specification (Un\G24)

This area is for setting the adjustment value of analog output value in the offset/gain setting mode.

Ex. The setting value of 1000 corresponds to:
the analog adjustment value of approx. 0.33V (in voltage output) or approx. 0.69mA (in current output).

(a) Setting range

- The setting range is -3000 to 3000.
- If a value out of the above setting range is set, an error occurs. The error code (700) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.

(b) Enabling the setting

Turn on and off Set value change request (YC) to enable the setting.

(9) HOLD/CLEAR function setting (Un\G26)

The HOLD/CLEAR function setting status of the D/A converter module can be checked.
For details on the HOLD/CLEAR function, refer to the following.

- Analog Output HOLD/CLEAR Function (☞ Page 32, Section 4.4)

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1

HOLD/CLEAR function setting	Stored value
CLEAR	0_H
HOLD	1 to F_H (value other than 0)

Point

The setting cannot be changed with HOLD/CLEAR function setting (Un\G26).
For changing the setting, refer to the following.

- Switch Setting (☞ Page 139, Section 8.2)

(10)Warning output setting (Un\G47)

Sets whether to enable or disable the warning output for each channel.

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

- Warning Output Function (☞ Page 42, Section 4.7)

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

Data for b4 to b15 are fixed to "0".

0: Enable
1: Disable

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (1).

(11)Warning output flag (Un\G48)

Whether the warning is upper limit warning or lower limit warning can be checked for each channel.

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

- Warning Output Function (☞ Page 42, Section 4.7)

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 Lower limit value	CH4 Upper limit value	CH3 Lower limit value	CH3 Upper limit value	CH2 Lower limit value	CH2 Upper limit value	CH1 Lower limit value	CH1 Upper limit value

Data for b8 to b15 are fixed to "0".

0: Normal
1: Alarm on

(a) Warning output flag (Un\G48) status

When a warning is detected on any of the following conditions, Alarm on (1) is stored to Warning output flag (Un\G48) corresponding to the channel.

- When the digital value is out of the range set in CH1 Warning output upper limit value (Un\G86) to CH4 Warning output lower limit value (Un\G93) in the normal output mode
- When the value of Wave data registry area (Un\G5000 to Un\G54999) to be output is out of the range set in CH1 Warning output upper limit value (Un\G86) to CH4 Warning output lower limit value (Un\G93) in the wave output mode

When an error is detected in any D/A conversion enabled or Warning output enabled channels, Warning output signal (XE) also turns on.

(b) Clearing Warning output flag (Un\G48)

To clear Warning output flag (Un\G48), set the digital value within the range and turn on and off Warning output clear request (YE).

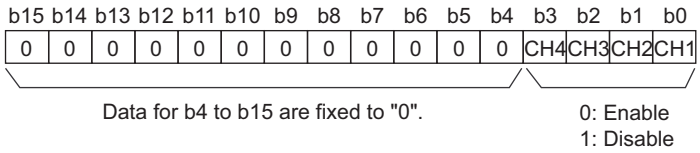
Warning output flag (Un\G48) can be also cleared by turning on and off Operating condition setting request (Y9).

(12)Scaling enable/disable setting (Un\G53)

Sets whether to enable or disable the scaling for each channel.

For details on the scaling function, refer to the following.

- Scaling Function (☞ Page 37, Section 4.6)



The scaling function cannot be used in the wave output mode. In the channel where Scaling enable/disable setting (Un\G53) is set to Enable (0), an error occurs. The error code (21☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (1).

(13)CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60), CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61)

Set the scale conversion range for each channel.

For details on the scaling function, refer to the following.

- Scaling Function (☞ Page 37, Section 4.6)

(a) Setting range

- Setting range: -32000 to 32000
- In the channel where a value out of the above setting range is set, an error occurs. The error code (90☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- The value to be set must satisfy the condition of Scaling upper limit value > Scaling lower limit value. In the channel where a value does not satisfy the condition, an error occurs. The error code (91☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- When Scaling enable/disable setting (Un\G53) is set to Disable (1), the settings for CH☐ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60) and CH☐ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61) are ignored.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

Because 0 is set as the default value, change the setting value for the scaling function.

(14)CH□ Warning output upper limit value (Un\G86, Un\G88, Un\G90, Un\G92), CH□ Warning output lower limit value (Un\G87, Un\G89, Un\G91, Un\G93)

Set the upper and lower limit values of the warning output range.

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

- Warning Output Function (☞Page 42, Section 4.7)

(a) Setting range

- Setting range: -32768 to 32767
- When using the scaling function, consider the scaling range and specify values.
- The value to be set must satisfy the condition of Warning output upper limit value > Warning output lower limit value. In the channel where a value does not satisfy the condition, an error occurs. The error code (62□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- When Warning output setting (Un\G47) is set to Disable (1), the settings for CH□ Warning output upper limit value (Un\G86, Un\G88, Un\G90, Un\G92) and CH□ Warning output lower limit value (Un\G87, Un\G89, Un\G91, Un\G93) are ignored.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

Because 0 is set as the default value, change the setting value for the warning output function.

(15)Mode switching setting (Un\G158, Un\G159)

Set the setting value for the mode to be switched to.

Mode switching to	Setting value	
	Un\G158	Un\G159
Normal output mode	0964_H	4144_H
Offset/gain setting mode	4144_H	0964_H

(a) Setting procedure

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) After the mode switching

When the mode is switched, this area is cleared to zero and Operating condition setting completed flag (X9) turns off.

After checking that Operating condition setting completed flag (X9) is off, turn off Operating condition setting request (Y9).

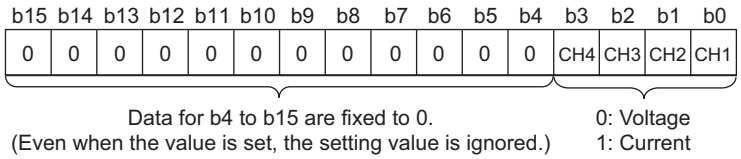
Point

- A value that is set in this area in the wave output mode is ignored, but only the operation condition is changed. (The mode cannot be switched from the normal mode to the offset/gain setting mode, and from the offset/gain setting mode to the normal mode.) To switch the mode in the wave output mode, use "Drive Mode Setting" of the switch setting.
  For the switch setting, refer to the following.
  - Switch Setting (☞ Page 139, Section 8.2)
- When the following operation is performed, the mode is not switched to, but only the operating condition is changed.
  - Write a value other than the above setting values and turn on and off Operating condition setting request (Y9).
  - Write a value so that the mode to be switched to becomes same as the current drive mode, and turn on and off Operating condition setting request (Y9).

(16)Pass data classification setting (Un\G200)

This area is for saving and restoring the offset/gain setting value in the user range setting.

Specify the offset/gain setting value to be saved and restored as either voltage or current.



(17)CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217)

This area is for restoring the offset/gain setting value in the user range setting.

The necessary data is stored (saved) when the following operation is performed.

- Writing the initial settings by a programming tool
- Turning on Operating condition setting request (Y9)*1
- Turning on User range writing request (YA) (in offset/gain setting mode)

*1 The data is not saved when the setting value is written to Mode switching setting (Un\G158, Un\G159).

When restoring the offset/gain setting value in the user range setting, set the data saved in this area to the same area in the D/A converter module where the data is restored.

(a) Procedure for saving offset/gain values in the buffer memory area

1. **Configure Pass data classification setting (Un\G200).**
2. **Turn on Operating condition setting request (Y9).**
3. **Compare the values in CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217) with the values in the range reference tables.**
4. **When the values are appropriate, save the values in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217).**

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

- Offset/gain Setting (☞ Page 143, Section 8.5)

(18)CH□ Wave output start/stop request (Un\G1000 to Un\G1003)

This area is for requesting the start, stop and pause of the wave output for each channel. This area can be set only in the wave output mode.

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

- Wave Output Function (☞Page 44, Section 4.8)

Wave output start/stop request	Setting value
Wave output stop request	0
Wave output start request	1
Wave output pause request	2

- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- Even when the setting value is changed with Step action wave output request (Un\G1072) being ON (1), the change is not applied.
- When Step action wave output request (Un\G1072) is set OFF (0) from ON (1), the wave output status becomes the wave output stop and Wave output stop request (0) is set for all channels.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (23□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The operation of the wave output before the change continues.

(a) Default value

All channels are set to Wave output stop request (0).

(19)CH□ Output setting during wave output stop (Un\G1008 to Un\G1011)

This area is for setting the analog output during the wave output stop for each channel. This area can be set only in the wave output mode.

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

- Wave Output Function (☞Page 44, Section 4.8)

Analog output value	Description	Setting value
0V/0mA	0V or 0mA is output.	0
Offset value	The offset value of the set output range is output.	1
Setting value during stop	The value set in CH□ Output value during wave output stop (Un\G1016 to Un\G1019) is output.	2

- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (30□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output cannot be executed.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Offset value (1).

(20)CH□ Output value during wave output stop (Un\G1016 to Un\G1019)

This area is for setting the value to be output during the wave output stop for each channel. When CH□ Output setting during wave output stop (Un\G1008 to Un\G1011) is set to Setting value during stop (2), the value set in this area is output after the D/A conversion. This area can be set only in the wave output mode.
For details on the wave output function, refer to the following.

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- The setting range depends on the set output range. Follow the setting range below.

Output range	Setting range
4 to 20mA	0 to 20479 (practical range: 0 to 20000)
0 to 20mA	
1 to 5V	
0 to 5V	
-10 to10V	-20480 to 20479 (practical range: -20000 to 20000)

- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (31□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output cannot be executed. However, when the value of CH□ Output setting during wave output stop (Un\G1008 to Un\G1011) is not Setting value during stop (2), the error above does not occur and Error code (31□) is not stored.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

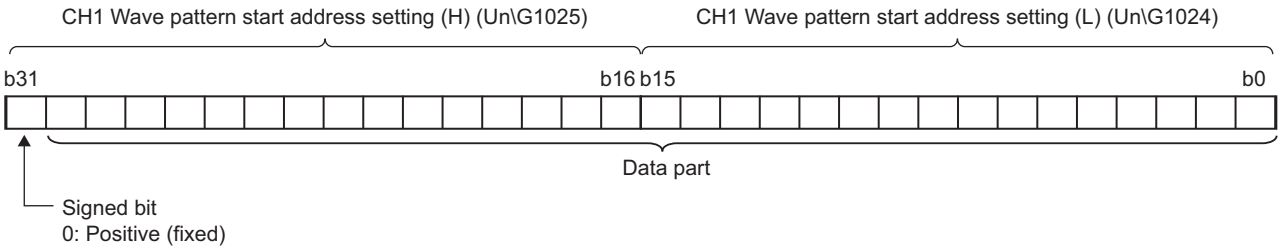
Because 0 is set as the default value, change the setting value for CH□ Output setting during wave output stop (Un\G1008 to Un\G1011) if Setting value during stop (2) is already set.

(21)CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031)

This area is for setting the start address of the wave pattern to be output for each channel. The D/A conversion starts from the digital value of the buffer memory address set in this area and the converted values are output sequentially.

This area can be set only in the wave output mode.

Set this area in 32-bit signed binary.



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

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- Setting range: 5000 to 54999
  Set this area within the range of the buffer memory address in Wave data registry area (Un\G5000 to Un\G54999).
- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (32□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output does not start.
- Set this area and CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047) under the following condition.

$$\left(\begin{array}{c}\text{Wave pattern start}\\ \text{address setting}\end{array} + \begin{array}{c}\text{Wave pattern data}\\ \text{points setting}\end{array} - 1\right) \leqq 54999$$

In the channel where a value does not satisfy the condition, an error occurs. The error code (37□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output does not start.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

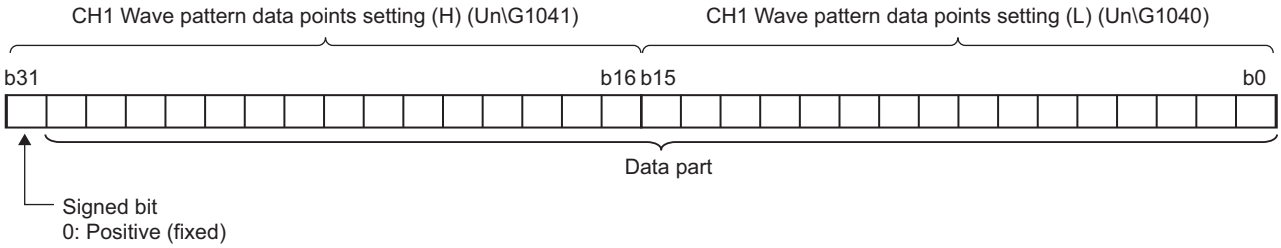
(c) Default value

All channels are set to 5000.

(22)CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047)

This area is for setting the points of the wave pattern to be output for each channel. From the start address of the wave pattern, the D/A conversion starts for the points of wave data set in this area and the converted values are output. This area can be set only in the wave output mode.

Set this area in 32-bit signed binary.



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

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- Setting range: 1 to 50000 (up to the number of the data points in Wave data registry area (Un\G5000 to Un\G54999))
- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (33□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output cannot be executed. However, when the values of CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031) are out of the setting range, the error above does not occur and Error code (33□) is not stored.
- Set this area and CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031) under the following condition.

$$\left(\begin{array}{c}\text{Wave pattern start}\\ \text{address setting}\end{array} + \begin{array}{c}\text{Wave pattern data}\\ \text{points setting}\end{array} - 1\right) \leqq 54999$$

In the channel where a value does not satisfy the condition, an error occurs. The error code (37□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

Because 0 is set as the default value, change the setting value for the wave output function.

(23)CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059)

This area is for setting the repeat count to output the wave pattern repeatedly. This area can be set only in the wave output mode.

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

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- Follow the setting range below.

Setting value	Description
-1	The wave pattern is output in analog unlimitedly.
1 to 32767	The wave pattern is output in analog for the counts of the setting value.

- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (34□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output cannot be executed.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 1.

(24)CH□ Constant for wave output conversion cycle (Un\G1064 to Un\G1067)

This area is for setting a constant to determine the conversion cycle (specifying a multiple of the conversion speed). The conversion cycle can be set with the value set in this area under the following conditions.

$$\text{Conversion cycle } (\mu s) = \begin{array}{c}\text{Conversion speed} \\ (50\mu s \text{ or } 80\mu s)\end{array} \times \begin{array}{c}\text{Number of channels where} \\ \text{D/A conversion is enabled}\end{array} \times \boxed{\begin{array}{c}\text{Constant for wave output} \\ \text{conversion cycle}\end{array}}$$

This area can be set only in the wave output mode.

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

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- Setting range: 1 to 5000
- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (35□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output cannot be executed.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 1.

(25)Step action wave output request (Un\G1072)

This area is for setting whether to start or end the wave output step action function for all channels in a batch.
This area can be set only in the wave output mode.
For details on the wave output step action function, refer to the following.

- Wave output step action function (☞Page 80, Section 4.8.4)

Step action wave output request	Setting value
OFF	0
ON	1

- When the setting value is changed to ON (1) from OFF (0), the wave output status of all the channels set to D/A conversion enable becomes to Wave output step action and the wave output step action function becomes valid.
- When the setting value is changed to OFF (0) from ON (1), the wave output status of all the channels becomes to Wave output stop and the wave output step action function ends.
- Even when the setting value is changed in the mode other than the wave output mode, the change is not applied.
- In the channel where a value out of the above setting range is set, an error occurs. The error code (360) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The current wave output status continues.

(a) Default value

OFF (0) is set.

(26)CH□ Wave output step action movement amount (Un\G1080 to Un\G1083)

This area is for setting the wave output step action movement amount and for checking the movement completion for each channel. The currently output wave data in Wave data registry area (Un\G5000 to Un\G54999) is changed to the data with the buffer memory address that is obtained by addition or subtraction of a value set in this area. The address shift of output data starts by setting a value in this area, and when the shift is completed, No movement (0) is stored in this area.

This area can be set only when the following conditions are satisfied.

- In wave output mode
- When Wave output step action (3) is stored in CH□ Wave output status monitor (Un\G1100 to Un\G1103)

Even when the setting value is changed when the above conditions are not satisfied, the change is not applied.

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

- Wave output step action function (☞Page 80, Section 4.8.4)

(a) Setting range

- Setting range: -30000 to 30000
- Set the following value according to the direction to move.

Movement direction	Description	Setting value
No movement	The buffer memory address of the wave data to be output is not moved.	0
Forward movement	The buffer memory address of the wave data to be output is moved in the address increasing direction from the buffer memory address of the currently output wave data. Example): When 10000 is set in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) with the buffer memory address of the currently output wave data being Un\G30000 → The buffer memory address of the wave data to be output is changed to Un\G40000.	1 to 30000
Reverse movement	The buffer memory address of the wave data to be output is moved in the address decreasing direction from the buffer memory address of the currently output wave data. Example): When -10000 is set in CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) with the buffer memory address of the currently output wave data being Un\G30000 → The buffer memory address of the wave data to be output is changed to Un\G20000.	-1 to -30000

- The following shows the available movement range with CH□ Wave output step action movement amount (Un\G1080 to Un\G1083).

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

- Even when the value which is out of the above setting range is set, no error occurs. When the value smaller than -30000 is set, the value is processed as -30000. When the value greater than 30000 is set, the value is processed as 30000.

(b) Default value

All channels are set to No movement (0).

(27)CH□ Wave output status monitor (Un\G1100 to Un\G1103)

This area stores the wave output status for each channel.

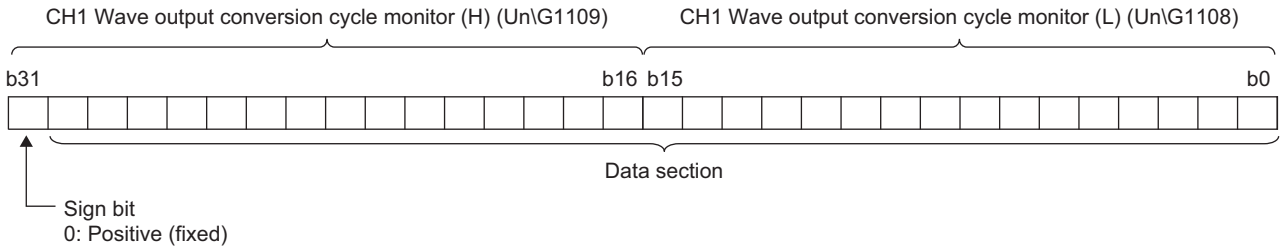
Wave output status	Stored value
Wave output stop	0
Wave output	1
Wave output pause	2
Wave output step action	3

The value is stored only in the wave output mode. In the mode other than the wave output mode, 0 is stored.

(28)CH1 Wave output conversion cycle monitor (L) (Un\G1108) to CH4 Wave output conversion cycle monitor (H) (Un\G1115)

This area stores the conversion cycle of the wave output in 32-bit signed binary for each channel. The unit of the stored value is μs.

In the mode other than the wave output mode, 0 is stored.



(a) Update of the stored value

When Operating condition setting request (Y9) is turned on and off, the stored value is updated.

(29)CH□ Wave pattern output count monitor (Un\G1124 to Un\G1127)

This area stores the output count of the wave pattern for each channel. The value is stored only in the wave output mode. In the mode other than the wave output mode, 0 is stored.

(a) Count of the wave pattern output

Outputting the set wave pattern once adds 1.

(b) Count range of the wave pattern output

- Count range: 0 to 32767

When the wave pattern output repetition setting is set to the unlimitedly repeat output, the count returns to 0 and starts again from 1 if it exceeds the count range.

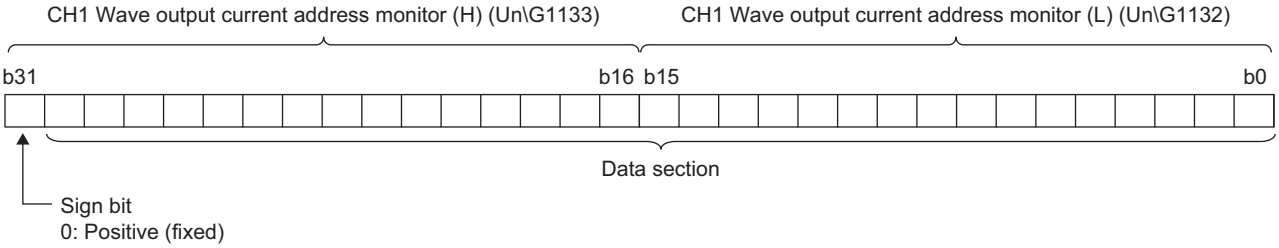
(c) Reset of the stored value

In the following cases, the stored value of CH□ Wave pattern output count monitor (Un\G1124 to Un\G1127) is reset.

- When Operating condition setting request (Y9) is turned on and off
- When the wave output status becomes to other status from the wave output stop

(30)CH1 Wave output current address monitor (L) (Un\G1132) to CH4 Wave output current address monitor (H) (Un\G1139)

This area stores the buffer memory address of the currently output wave data in 32-bit signed binary for each channel. The value is stored only in the wave output mode. In the mode other than the wave output mode, 0 is stored.



(a) Update of the stored value

The stored value is updated when the wave output status is the wave output or the wave output step action.

(b) Reset of the stored value

When Operating condition setting request (Y9) is turned on and off, the stored value is reset.

(31)CH□ Wave output current digital value monitor (Un\G1148 to Un\G1151)

This area stores the currently output digital value for each channel. In the mode other than the wave output mode, 0 is stored.

The stored value depends on the wave output status.

<table>
<tr><th>Wave output status</th><th>Stored value*1</th></tr>
<tr><td>Wave output stop</td><td>The digital value of the output set in CH□ Output setting during wave output stop (Un\G1008 to Un\G1011) is stored.
<table>
<tr><th>Set value of CH□ Output setting during wave output stop (Un\G1008 to Un\G1011)</th><th>Stored value of CH□ Wave output current digital value monitor (Un\G1148 to Un\G1151)</th></tr>
<tr><td>0V/0mA (0)</td><td rowspan="2">0</td></tr>
<tr><td>Offset value (1)</td></tr>
<tr><td>Setting value during stop (2)</td><td>Set value of CH□ Output value during wave output stop (Un\G1016 to Un\G1019)</td></tr>
</table></td></tr>
<tr><td>Wave output</td><td>The following value is stored: The digital value stored in the buffer memory address indicated in CH1 Wave output current address monitor (L) (Un\G1132) to CH4 Wave output current address monitor (H) (Un\G1139).</td></tr>
<tr><td>Wave output pause</td><td>The stored value depends on the setting of the analog output HOLD/CLEAR function.
<table>
<tr><th>Analog output HOLD/CLEAR function setting</th><th>Stored value of CH□ Wave output current digital value monitor (Un\G1148 to Un\G1151)</th></tr>
<tr><td>HOLD setting</td><td>The digital value stored in the buffer memory address indicated in CH1 Wave output current address monitor (L) (Un\G1132) to CH4 Wave output current address monitor (H) (Un\G1139)</td></tr>
<tr><td>CLEAR setting</td><td>0</td></tr>
</table></td></tr>
<tr><td>Wave output step action</td><td>The following value is stored: The digital value stored in the buffer memory address indicated in CH1 Wave output current address monitor (L) (Un\G1132) to CH4 Wave output current address monitor (H) (Un\G1139).</td></tr>
</table>

*1 The stored value of when D/A conversion enable/disable setting (Un\G0) is set to D/A conversion enable (0) and CH□ Output enable/disable flag (Y1 to Y4) is on is shown. For the analog output in other status, refer to the following.

• Analog Output HOLD/CLEAR Function (☞ Page 32, Section 4.4)

In the mode other than the wave output mode, 0 is stored.

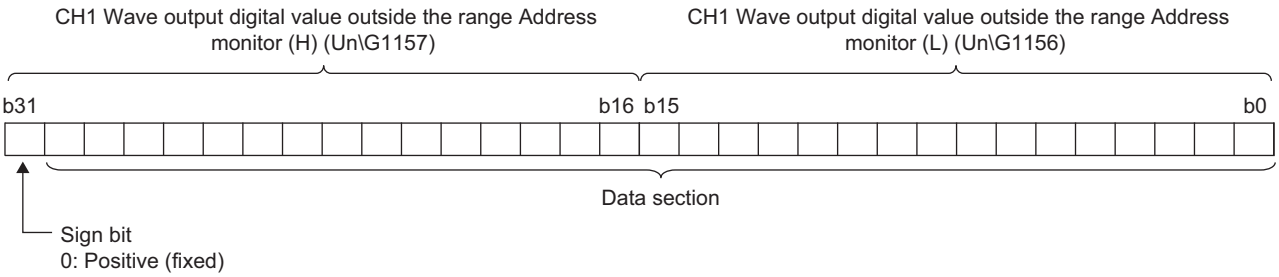
(a) Reset of the stored value

When Operating condition setting request (Y9) is turned on and off, the stored value is reset.

(32)CH1 Wave output digital value outside the range Address monitor (L) (Un\G1156) to CH4 Wave output digital value outside the range Address monitor (H) (Un\G1163)

If wave data with the digital value out of the setting range is output, this area stores the buffer memory address where that wave data is registered. The address is stored in 32-bit signed binary, for each channel. When the multiple wave data with the digital value out of the setting range are detected, only the buffer memory address of the wave data detected first is stored.

The value is stored only in the wave output mode. In the mode other than the wave output mode, 0 is stored.



(a) Update of the stored value

When the first digital value out of the range is detected in the wave output status other than the wave output stop, the stored value is updated.

(b) Reset of the stored value

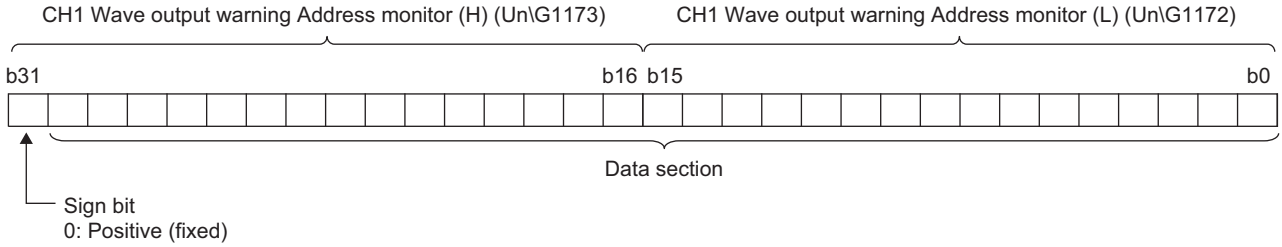
To reset the stored value, correct a value of wave data out of the setting range. When the value is set within the setting range, perform either of following operation.

- Turn on and off Error clear request (YF).
- Turn on and off Operating condition setting request (Y9).

(33)CH1 Wave output warning Address monitor (L) (Un\G1172) to CH4 Wave output warning Address monitor (H) (Un\G1179)

This area stores the buffer memory address of the wave data in which a warning has occurred in 32-bit signed binary for each channel. 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.

The value is stored only in the wave output mode. In the mode other than the wave output mode, 0 is stored.



(a) Update of the stored value

When the first warning has occurred in the wave output status other than the wave output stop, the stored value is updated.

(b) Reset of the stored value

Correct the value of the wave data in the wave output status which a warning has occurred so that the value is within the setting range. Turning Warning output clear request (YE) on and off or Operating condition setting request (Y9) on and off after correction resets the stored value.

(34)Latest address of error history (Un\G1800)

Among Error history No.□ (Un\G1810 to Un\G1969), a buffer memory address of the area where the latest error code is stored is stored.

(35)Error history No. ☐ (Un\G1810 to Un\G1969)

Up to 16 errors that occurred in the module are recorded.

For details on the error log function, refer to the following.

- Error Log Function (☞Page 89, Section 4.9)

	b15 to b8	b7 to b0
Un\G1810	Error code	
Un\G1811	First two digits of the year	Last two digits of the year
Un\G1812	Month	Day
Un\G1813	Hour	Minute
Un\G1814	Second	Day of the week
Un\G1815 to Un\G1819	System area	

Item	Stored data	Example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.	2011_H
Month/Day		0329_H
Hour/Minute		1035_H
Second		40_H
Day of the week	The value that corresponds to the day of the week is stored in BCD code. • Sunday: 0 • Monday: 1 • Tuesday: 2 • Wednesday: 3 • Thursday: 4 • Friday: 5 • Saturday: 6	02_H

*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(36)Wave data registry area (Un\G5000 to Un\G54999)

This area registers the wave data for analog output in the wave output mode.

This area can be set only in the wave output mode.

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

- Wave Output Function (☞Page 44, Section 4.8)

(a) Setting range

- The setting range depends on the set output range. Follow the setting range below.

Output range	Setting range
4 to 20mA	0 to 20479 (practical range: 0 to 20000)
0 to 20mA	
1 to 5V	
0 to 5V	
-10 to10V	-20480 to 20479 (practical range: -20000 to 20000)

- In the channel where the wave data with a value out of the above setting range is output, an error occurs. The error code (60☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. The wave output continues. However, while the value out of the setting range is set, the maximum or minimum value of the output range is output in analog.

CHAPTER 7 SETTINGS AND PROCEDURES BEFORE OPERATION

This chapter describes the procedure prior to a D/A converter module operation, each part name of a D/A converter module, and wiring method.

7.1 Handling Precautions

This section describes the handling precautions for a D/A converter module.

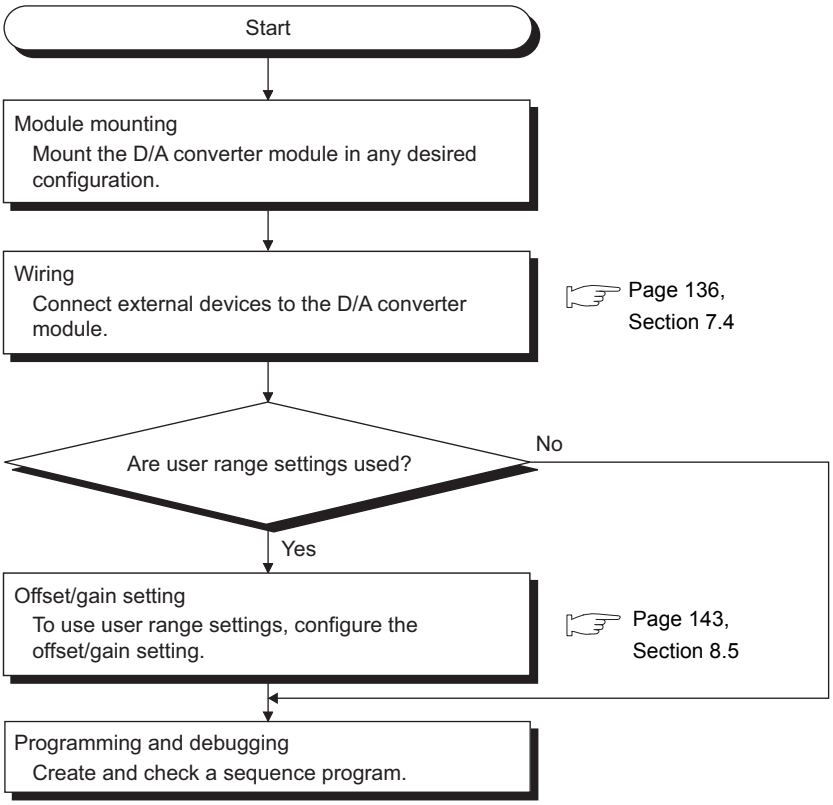
- Do not drop the module case, or do not subject it to strong impact.
- Do not remove the printed-circuit board from the case.
  Doing so can cause module failure.
- Do not disassemble the module.
  Doing so can cause module failure.
- Prevent foreign matter such as dust or wire chips from entering the module.
  Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring.
  Do not remove the film during wiring.
  Remove it for heat dissipation before system operation.
- Tighten the screws such as a module fixing screw within the specified torque range.
  Undertightening the screws can cause short circuit or malfunction.
  Overtightening can damage the screws and/or module, resulting in short circuit or malfunction.

Screw	Tightening torque
Module fixing screw (M3 screw)*1	0.36 to 0.48N•m
Terminal block terminal screw (M3 screw)	0.42 to 0.58N•m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.89N•m

*1 The module can be easily fixed onto the base unit using the hook at the top of the module.
However, it is recommended to secure the module with the module fixing screw if the module is subject to significant vibration.

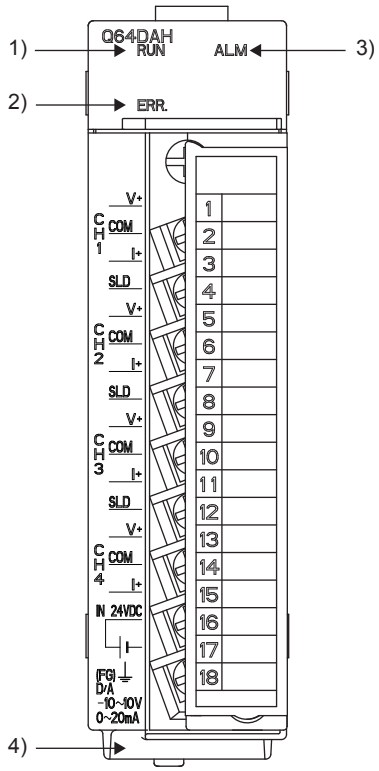
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection into the hole in the base unit and press the module until it snaps into place.
  Incorrect mounting may cause malfunction, failure or drop of the module.
- Before handling the module, touch a grounded metal object to discharge the static electricity from the human body.
  Failure to do so may cause the module to fail or malfunction.

7.2 Settings and Procedures Before Operation



7.3 Part Names

This section describes the part names of a D/A converter module.



(1) Part names

The following table lists the part names of a D/A converter module.

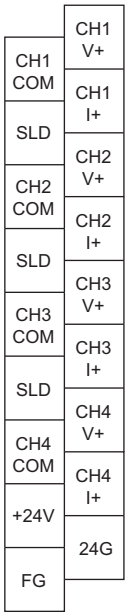
Number	Name	Description
1)	RUN LED (green)	Indicates the operating status of the D/A converter module. On: The module is operating normally. Flashing: In the offset/gain setting mode Off: The 5V power is off, watchdog timer error has occurred, or online module change is available.
2)	ERR. LED (red)	Indicates the errors and status of the D/A converter module. On: An error is occurring except for the error code: 112.*1 Flashing: The error code: 112 is occurring.*1 Off: The module is operating normally.
3)	ALM LED (red)	Indicates the warning status of the D/A converter module. On: Warning output is occurring.*2 Off: The module is operating normally.
4)	Serial number display	Displays the serial number printed on the rating plate.

*1 Error Code List (☞ Page 212, Section 11.1)

*2 Alarm Code List (☞ Page 219, Section 11.2)

(2) Signal names of the terminal block

The following shows signal names of the terminal block.



Pin number	Signal name	
1	CH1	V+
2		COM
3		I+
4	SLD	
5	CH2	V+
6		COM
7		I+
8	SLD	
9	CH3	V+
10		COM
11		I+
12	SLD	
13	CH4	V+
14		COM
15		I+
16	+24V	
17	24G	
18	FG	

7.4 Wiring

This section describes the wiring precautions and module connection examples of a D/A converter module.

7.4.1 Wiring precautions

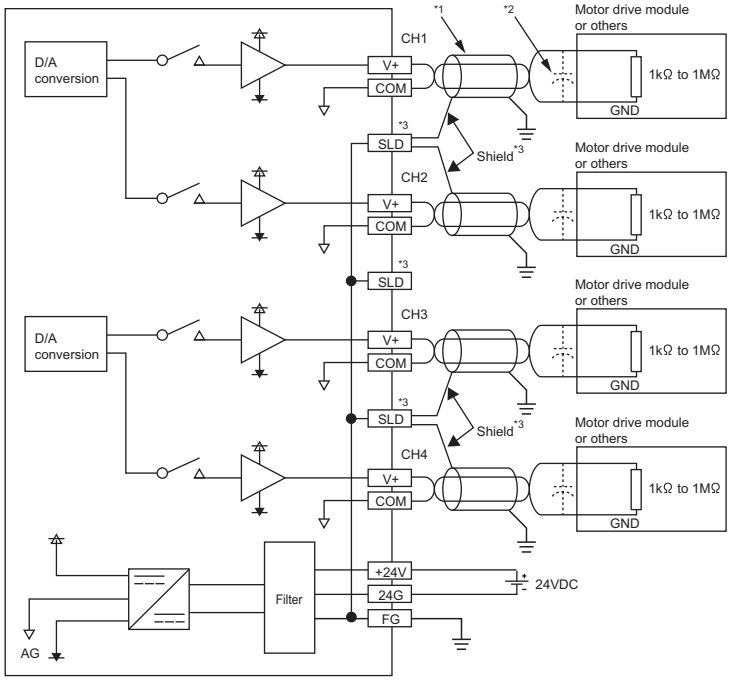
External wiring that is less likely to be affected by noise is one of the conditions for a highly reliable system that fully utilizes the D/A converter module.
This section describes the precautions on external wiring.

- Use separate cables for the AC control circuit and the D/A converter module's external I/O signals to avoid influence of AC side surges and induction.
- Do not locate external wires near the main circuit line, high-voltage circuit lines, and load circuit lines of devices other than programmable controllers. Also, do not bunch external wires with these lines. Otherwise, the external wires are more likely to be affected by noise, surges, and induction.
- Ground shielded cables at one end.
- A solderless terminal with an insulation sleeve cannot be used on the terminal block.
  It is recommended to put a mark tube or an insulation tube on the wire connection part of a solderless terminal.

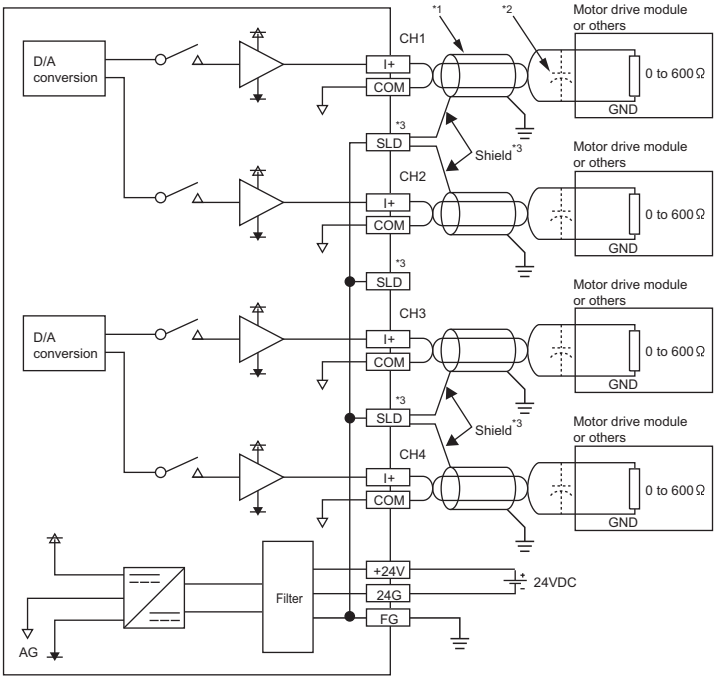
7.4.2 External wiring

The following describes the external wiring.

(1) For voltage output



(2) For current output



*1 For wire, use the shielded twisted pair cable.

*2 If noise or ripple occurs for analog signals, connect a capacitor with the value of 0.1 to 0.47μF (withstand voltage 25V or higher) to the input terminal of an external device.

*3 Connect the shielded wire for each channel to one of the three shield terminals. Make sure to ground the FG terminal. Also, ground the FG terminal of the power supply module.

CHAPTER 8 VARIOUS SETTINGS

This chapter describes the setting procedures of the D/A converter module.

Point

- After writing the contents of the new module, parameter settings, and auto refresh settings into the CPU module, reset the CPU module and switch its status as STOP → RUN → STOP → RUN, or turn off and on the power supply to activate the settings.
- After writing the contents of the switch settings, reset the CPU module or turn off and on the power supply to activate the settings.

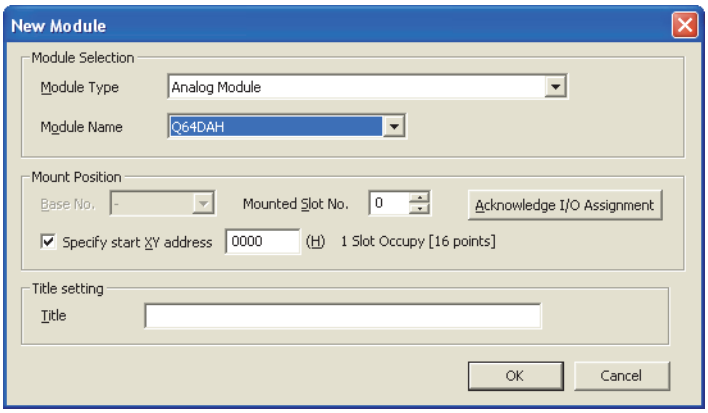
8.1 Adding a Module

Add the model name of the D/A converter module to use on the project.

(1) Addition procedure

Open the "New Module" window.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module...]



Item		Description
Module Selection	Module Type	Set "Analog Module".
	Module Name	Set the name of the module to be mounted.
Mount Position	Base No.	Set the base No. where the module is mounted.
	Mounted Slot No.	Set the slot No. where the module is mounted.
	Specify start XY address	The start I/O number (hexadecimal) of the module is set according to the mounted slot No. The start I/O number also can be set by a user.
Title setting	Title	Set any title.

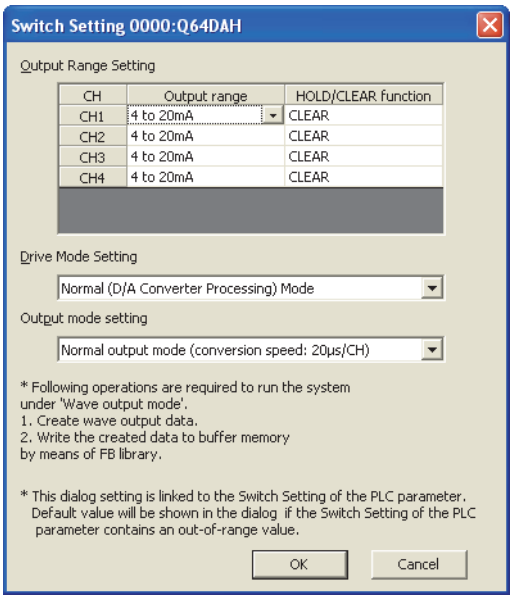
8.2 Switch Setting

Set the output range, HOLD/CLEAR function, drive mode, and output mode used for each channel.

(1) Setting procedure

Open the "Switch Setting" window.

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]



Item		Description	Setting value
Output Range Setting	Output range	Set the output range used in each channel.	• 4 to 20mA (default value) • 0 to 20mA • 1 to 5V • 0 to 5V • -10 to 10V • User Range Setting
	HOLD/CLEAR function*1	Set whether to hold the output analog value or clear the output analog value (output an offset value) for the cases when the CPU module enters to the STOP status or when an error occurs. Set this item for each channel.	• CLEAR (default value) • HOLD
Drive Mode Setting		Set the drive mode of the D/A converter module. When the user range setting is selected, set "Offset-Gain Setting Mode" to configure the offset/gain setting.	• Normal (D/A Converter Processing) Mode (default value) • Offset-Gain Setting Mode
Output mode setting		Set the output mode of the D/A converter module.	• Normal output mode (conversion speed: 20µs/CH) (default value) • Wave output mode (conversion speed: 50µs/CH) • Wave output mode (conversion speed: 80µs/CH)

*1 The operation of the D/A converter module in the normal output mode differs from the operation in the wave output mode. For details, refer to the following.

Analog Output HOLD/CLEAR Function (Page 32, Section 4.4)

(a) Intelligent function module switch setting (Switch 1 to 5)

The items described in (1) also can be set in Switch 1 to 5 of the intelligent function module switch setting of "PLC parameter". The following are the switches to set each item.

- Switch 1: Output range
- Switch 3: HOLD/CLEAR function
- Switch 4: Drive Mode Setting, Output mode setting

For the setting procedure, refer to the following.

- Intelligent function module switch setting (☞Page 238, Appendix 3 (2))

Though the example of procedure in the reference is for GX Developer, same settings and values can be used for GX Works2 as well.

8.3 Parameter Setting

Set the parameters of each channel.

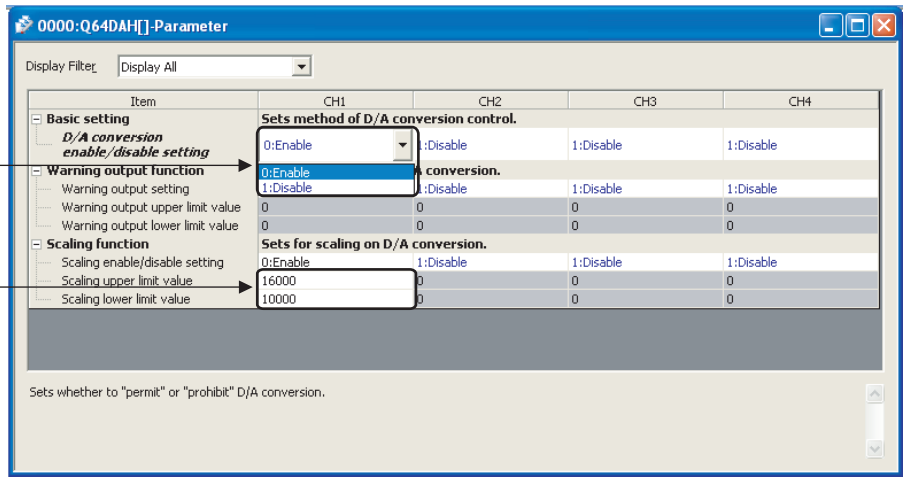
Setting the parameters here eliminates the necessity of the parameter settings by sequence program.

(1) Setting procedure

Open the "Parameter" window.

1. **Start "Parameter".**

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



Items to be selected from pull-down menus

Items to be entered in the text boxes

2. **Double-click the item to change the setting, and input the setting value.**

- Items to input from the pull-down list
  Double-click the item to set, to display the pull-down list. Select the item.
- Items to input from the text box
  Double-click the item to set, and input the setting value.

3. **For setting CH2 to CH4, follow the operation of step 2.**

Item		Setting value	Reference
Basic setting	D/A conversion enable/disable setting	0: Enable 1: Disable (default value)	Page 31, Section 4.2
Warning output function	Warning output setting	0: Enable 1: Disable (default value)	Page 42, Section 4.7
	Warning output upper limit value	-32768 to 32767 (default value: 0)	
	Warning output lower limit value	-32768 to 32767 (default value: 0)	
Scaling function	Scaling enable/disable setting	0: Enable 1: Disable (default value)	Page 37, Section 4.6
	Scaling upper limit value	-32000 to 32000 (default value: 0)	
	Scaling lower limit value	-32000 to 32000 (default value: 0)	

8.4 Auto Refresh

Set the buffer memory areas of the D/A converter module to be refreshed automatically.
The auto refresh setting eliminates the necessity of data reading/writing using the sequence program.

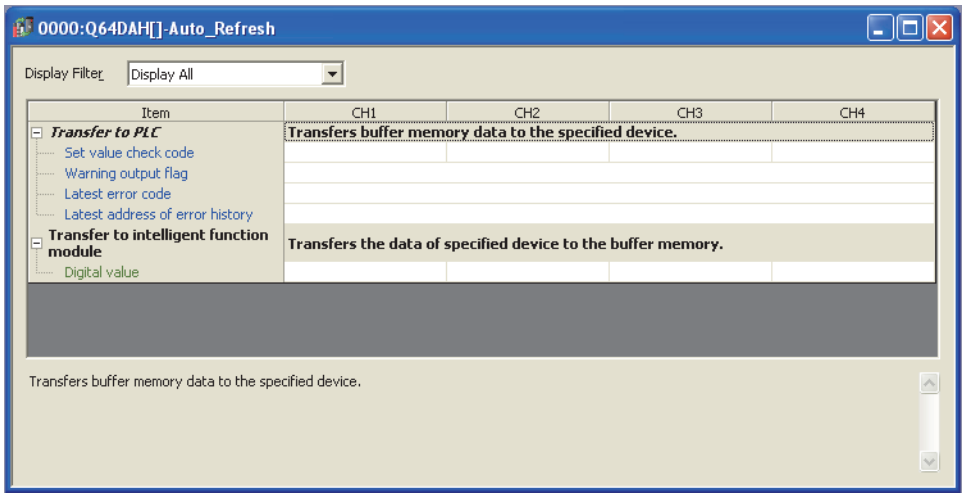
(1) Setting procedure

Open the "Auto_Refresh" window.

1. Start "Auto_Refresh".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Auto_Refresh]

2. Click the item to set, and input the destination device for auto refresh.



Point

Available devices are X, Y, M, L, B, T, C, ST, D, W, R, and ZR.
When a bit device X, Y, M, L, or B is used, set the number that is divisible by 16 points (example: X10, Y120, M16). Data in the buffer memory are stored in 16 points of devices starting from the set device No. (Example: When X10 is set, the data are stored in X10 to X1F.)

8.5 Offset/gain Setting

When using the user range setting, configure the offset/gain setting with the following operations.
When using the industrial shipment setting, the offset/gain setting is not required.
The offset/gain setting can be configured from the following two types of operations.

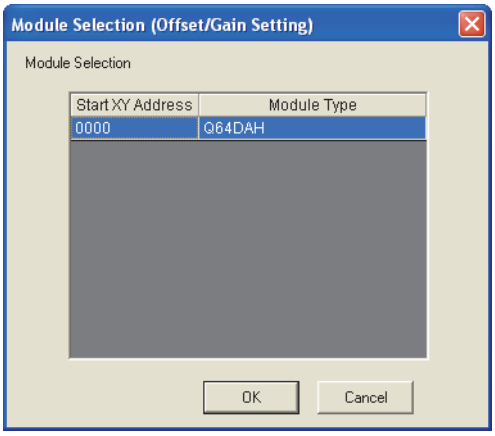
- Setting from "Offset/Gain Setting" of GX Works2 (Page 143, Section 8.5.1)
- Setting from a program (Page 146, Section 8.5.2)

8.5.1 Setting from "Offset/Gain Setting" of GX Works2

(1) Setting procedure

Open the "Offset/Gain Setting" window. However, this function cannot be used in the wave output mode. Set the normal output mode or offset/gain setting mode in advance.
Do not turn off the external power supply while offset/gain setting is being configured. If the external power supply is turned off during the setting, offset/gain setting is not configured properly.

[Tool] ⇨ [Intelligent Function Module] ⇨ [Analog Module] ⇨ [Offset/Gain Setting...]



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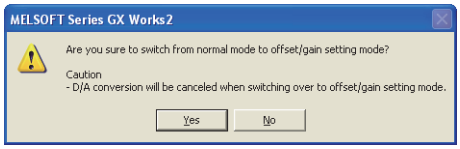
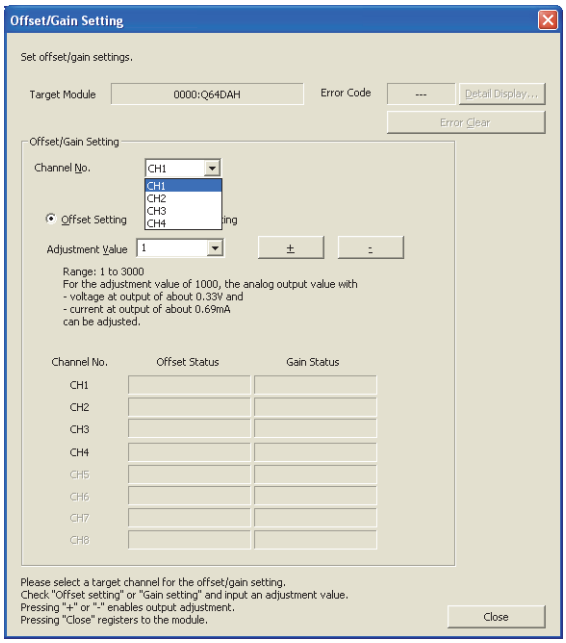


1. **Select the module to configure the offset/gain setting, and click the OK button.**

2. **Click the Yes button.**



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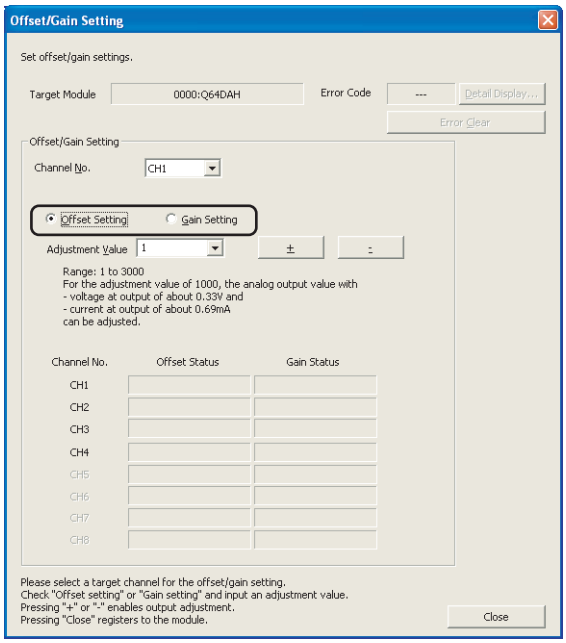
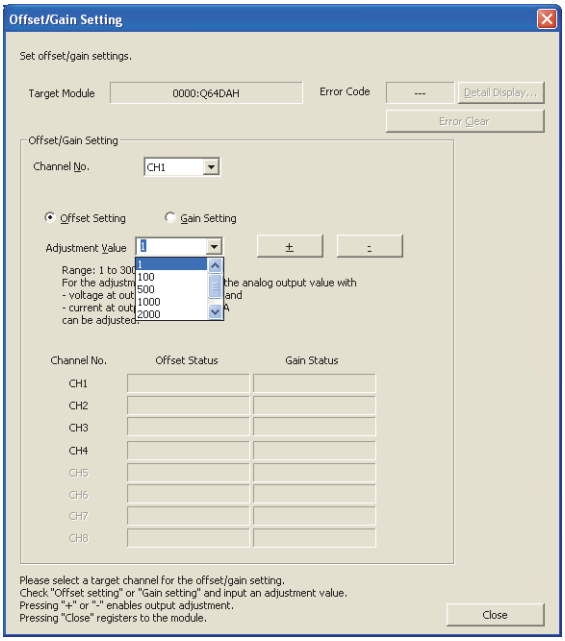


3. **Specify the channel to use the offset/gain setting.**

4. **Use the radio button to specify whether the offset setting or gain setting.**
(Step 5 and later describes when the offset setting is specified.)



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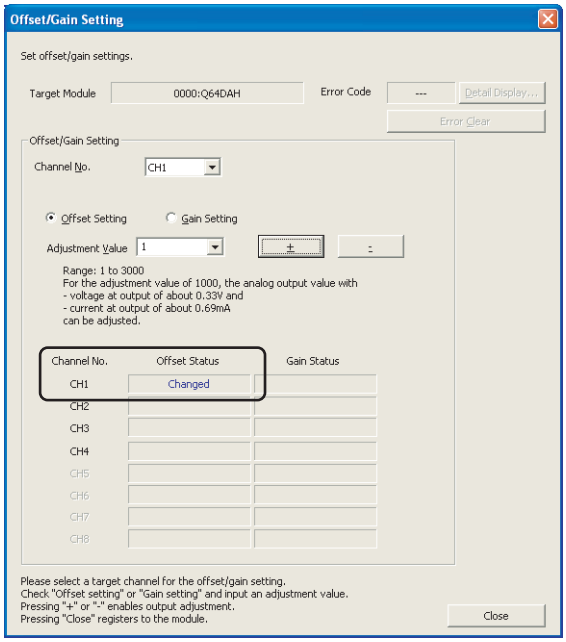

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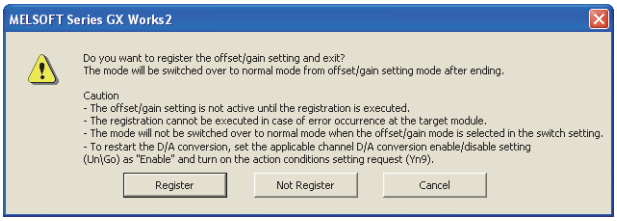


↓

End

5. **The adjustment amount of the offset value or gain value can be selected from "1", "100", "500", "1000", "2000", and "3000" or it can be set by inputting any value (1 to 3000).**

6. **Clicking the ± or - button fine-adjusts the analog output voltage or analog output current value by the set adjustment value.**

7. **The offset status in the specified channel is changed to "Changed".**

8. **To perform the gain setting, repeat from step 4.**

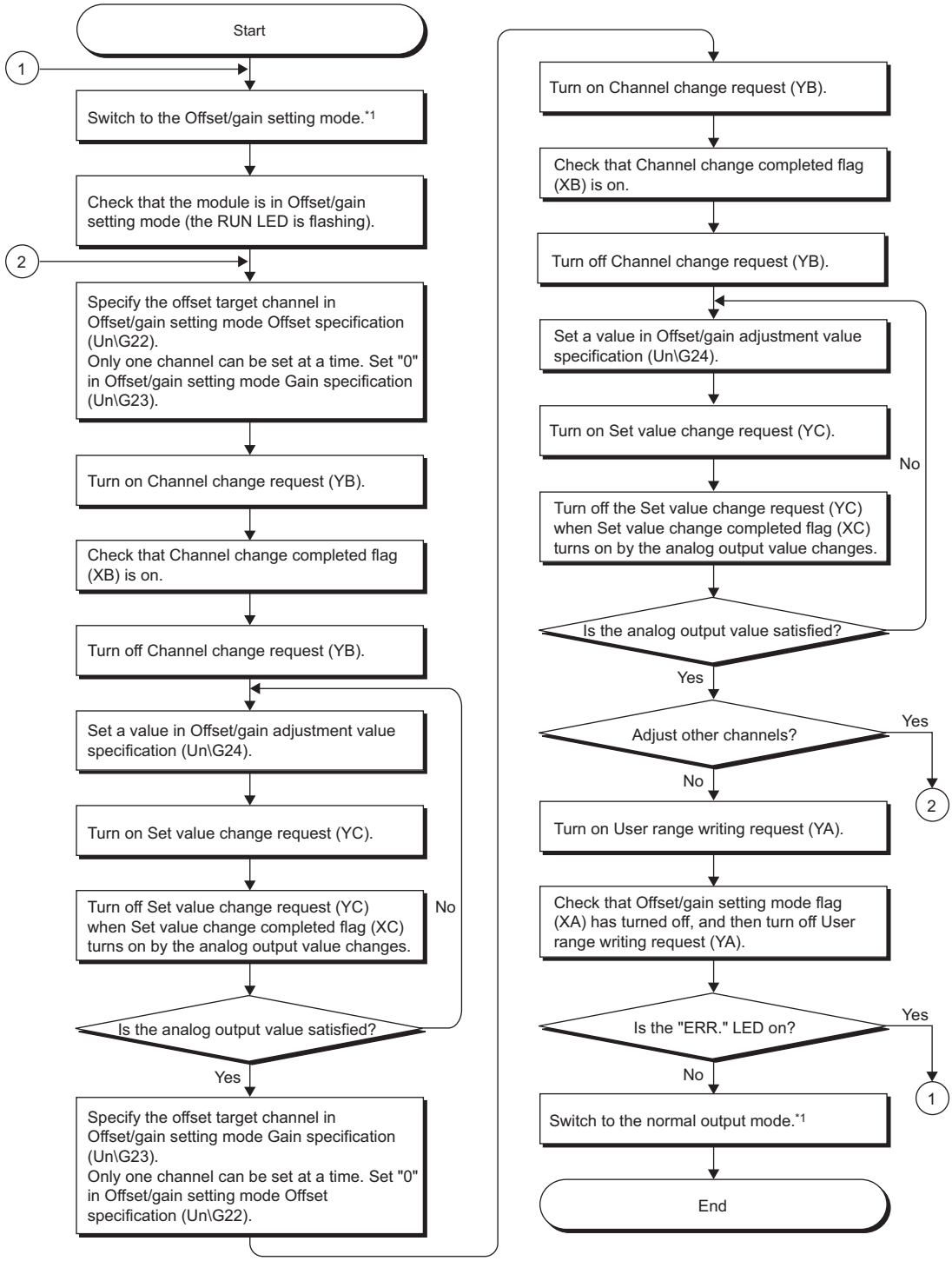
9. **After setting, click the Close button.**

10. **Click the Register button.**

8.5.2 Setting from a program

(1) Setting procedure

The following describes the procedures when setting the offset/gain from a sequence program.



*1 The following shows the procedure for switching the mode (normal output mode → offset/gain setting mode, or offset/gain setting mode → normal output mode).

- Dedicated instruction (G(P).OFFGAN) (Page 229, Appendix 2.1)
- Setting to Mode switching setting (Un\G158, Un\G159) and turning on and off Operating condition setting request (Y9) (Page 117, Section 6.2 (15))
- Switch setting (Page 139, Section 8.2 (1))

The wave output mode cannot be switched to the offset/gain setting mode.

Point

- Configure the offset/gain setting in accordance with the actual use situation.
- Offset and gain values are recorded in the flash memory in the D/A converter module by turning on and off User range writing request (YA). Once recorded, the values are not deleted even after the power is turned off.
  When the values are written 26 times in succession, an error occurs to prevent an improper write to flash memory. The error code (162) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- Configure the offset/gain setting in the range satisfying the following condition.
  When the setting value out of the range is configured, the maximum resolution and accuracy of the module may not fall within the range shown in the following performance specifications.
  - I/O conversion characteristic of D/A conversion (☞ Page 24, Section 3.2.2)
- Configure the offset/gain setting for each channel.
  When the setting for offset and gain channels is configured at the same time, an error occurs. The error code (500) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.
- When an error occurs even in one channel, the offset/gain value is not written to the module.
  Check the value in Latest error code (Un\G19) and perform the following procedures to reconfigure the offset/gain setting from the beginning.
  - Error Code List (☞ Page 212, Section 11.1)
- When the mode is switched from the offset/gain setting mode to the normal output mode by the dedicated instruction (G(P).OFFGAN) or Mode switching setting (Un\G158, Un\G159), Module READY (X0) turns on.
  Note that initial settings are processed at this timing if any sequence program is set to configure initial settings when Module READY (X0) turns on.
- When Set value change request (YC) is turned on while the external power supply is off, Set value change completed flag (XC) does not turn on. Turn on the external power supply first, and turn on and off Set value change request (YC) again.

(2) Program example

(a) Device

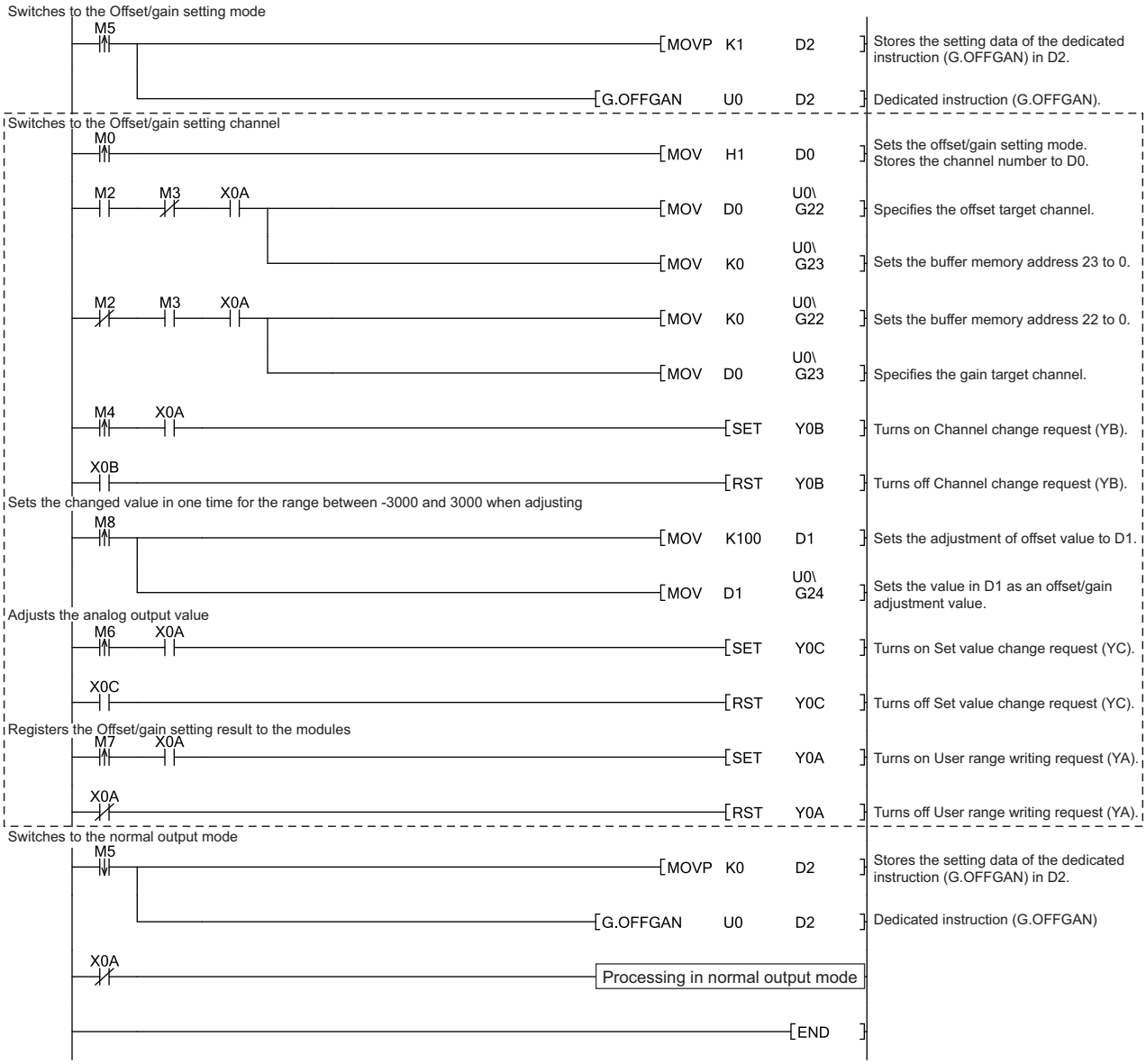
Ex. I/O number of D/A converter module is X/Y00 to X/Y0F.
The following table lists the devices used in the program example.

Device	Function
M0	Channel selection
M2	Offset setting
M3	Gain setting
M4	Offset/gain setting channel change command
M5	Mode switching
M6	Analog output value adjustment command
M7	Command to write offset/gain setting values to the module
M8	Adjustment amount setting
M50	Signal for checking the offset/gain setting mode
M51	Signal for checking the normal output mode
D0	Channel-specified storage device
D1	Adjustment amount setting storage device
D2	Storage device for the setting value of the dedicated instruction (G(P).OFFGAN)
M100	Module READY checking flag

(b) Switching the mode using the dedicated instruction (G(P).OFFGAN)

This sequence program executes the following operations.

- Switching the mode from the normal output mode to the offset/gain setting mode using the dedicated instruction (G(P).OFFGAN)
- Switching the channels for which the offset/gain settings are configured
- Writing the offset/gain values to the D/A converter module
- Switching the mode from the offset/gain setting mode back to the normal output mode using the dedicated instruction (G(P).OFFGAN)

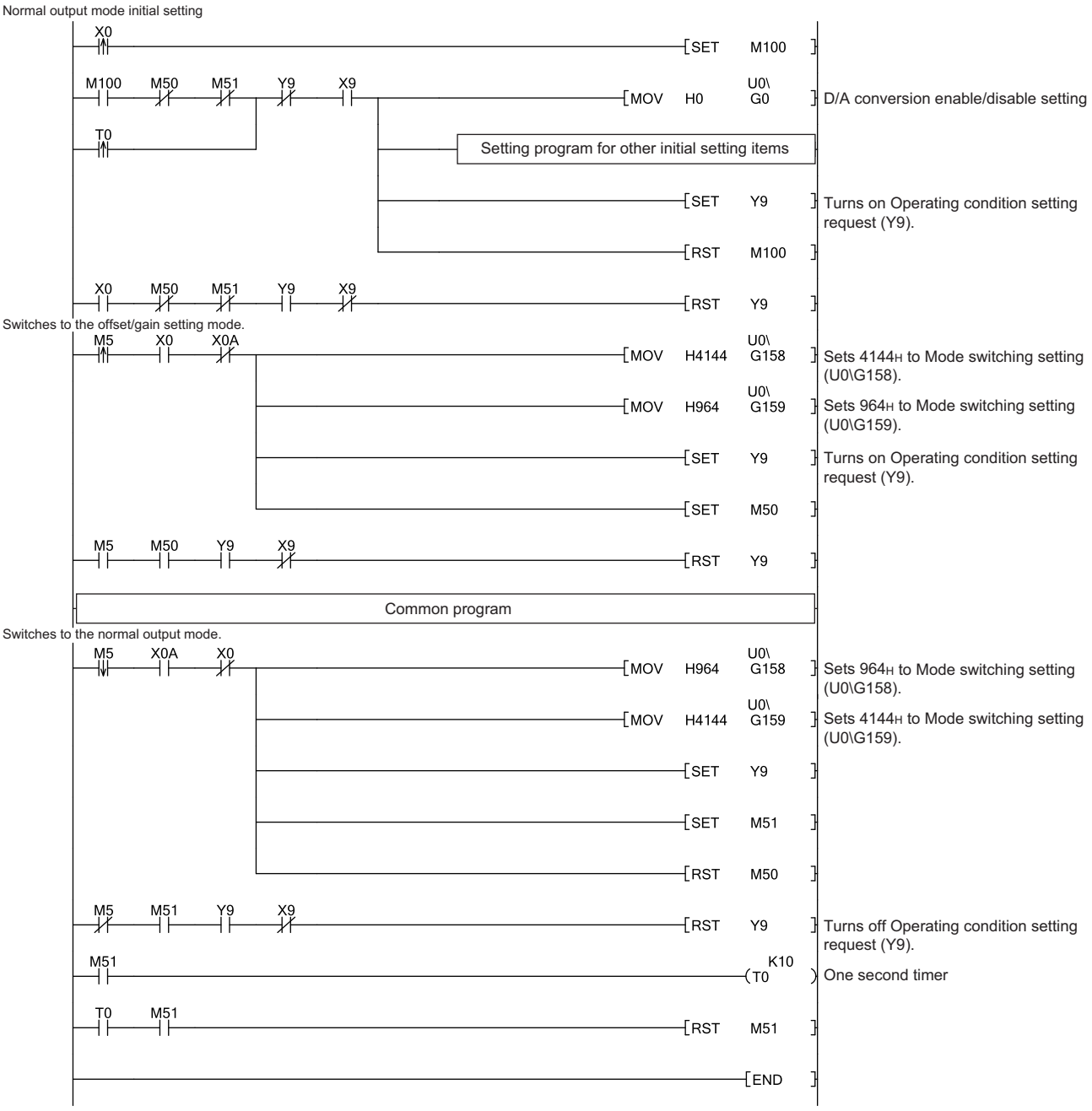


Point

The sequence program enclosed by the dotted line is the common programs among the following three programs.

- Switching the mode using the dedicated instruction (G(P).OFFGAN) (Page 148, Section 8.5.2 (2) (b))
- Switching the mode by setting Mode switching setting (Un\G158, Un\G159) and using Operating condition setting request (Y9) (Page 149, Section 8.5.2 (2) (c))
- Switching the mode using the switch setting (Page 149, Section 8.5.2 (2) (d))

(c) Switching the mode by setting Mode switching setting (Un\G158, Un\G159) and using Operating condition setting request (Y9)



(d) Switching the mode using the switch setting

The programs other than the common program are not necessary.

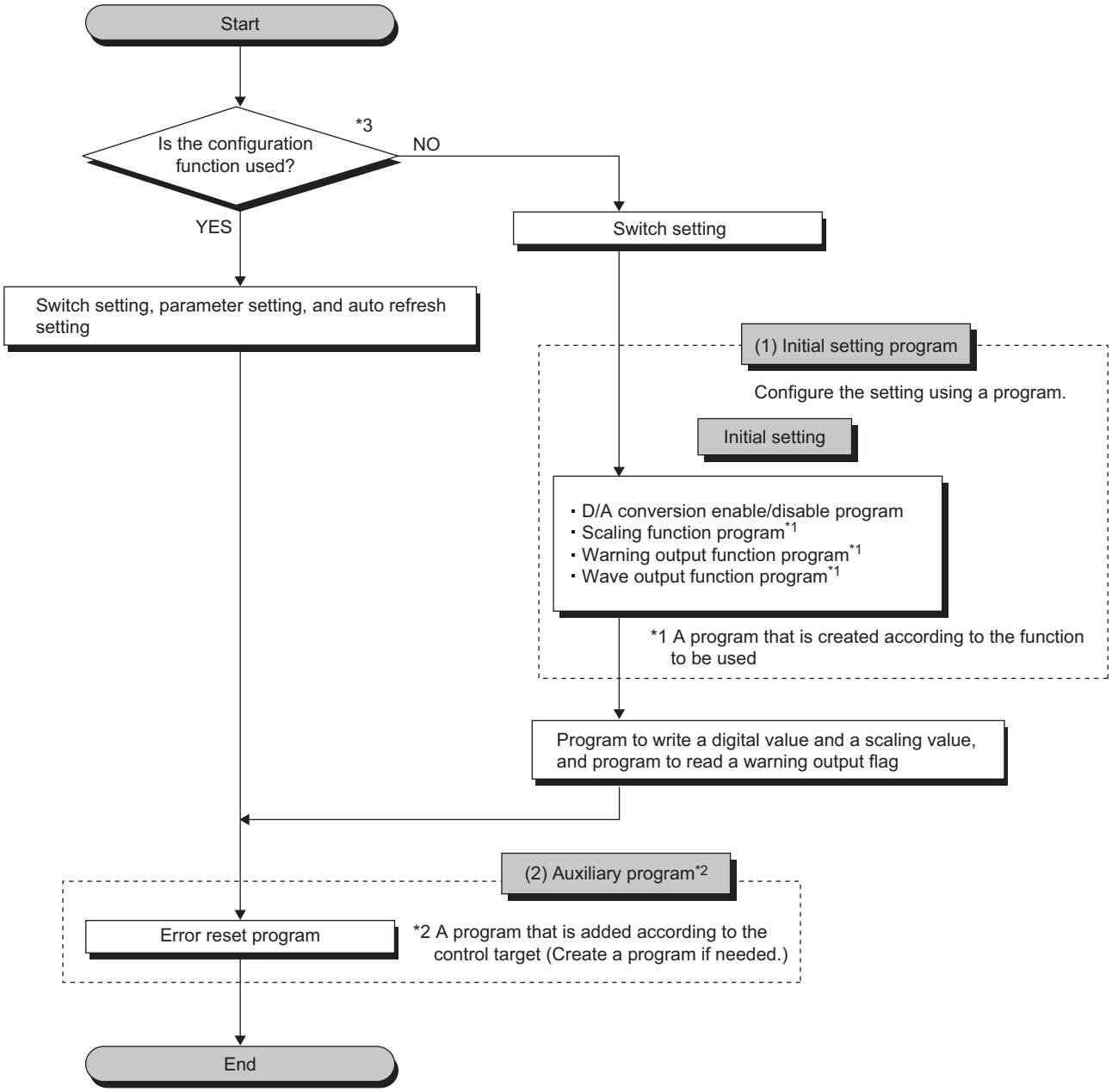
After configuring the switch setting, reset the CPU module or turn off and on the power to switch the mode.

CHAPTER 9 PROGRAMMING

This chapter describes the procedure for programming and the basic program of the D/A converter module.

9.1 Procedure for Programming

Create a program to execute the D/A conversion according to the following procedure.



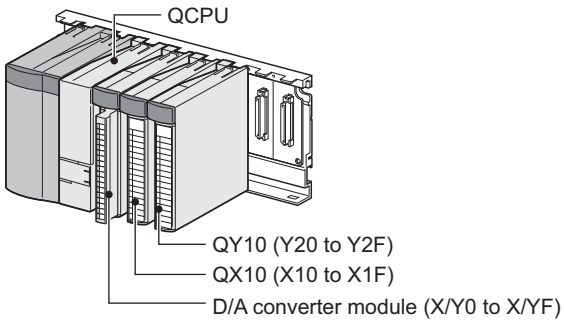
*3 When the wave output function is used, setting "D/A conversion enable/disable setting" to "0: Enable" in the parameter setting of the configuration function will cause an error at the start-up of the D/A converter module. The error code (33☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on. This error occurs because the wave pattern data points setting is set to 0 (default value) for the channel where D/A conversion enable is set.
To prevent the error, set D/A conversion enable by the procedure described in the following section.

• Basic setting (☞ Page 66, Section 4.8.1 (4) (b))

9.2 When Using the Module in a Standard System Configuration

This section shows program examples where the following system configuration and conditions apply.

(1) System configuration



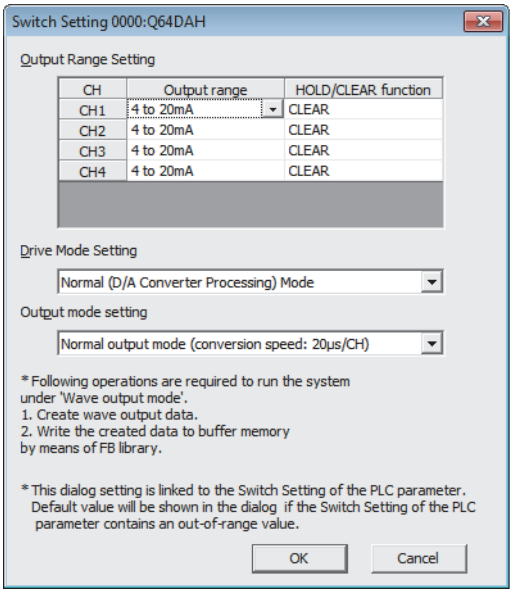
(2) Programming condition

Set CH1 and CH2 of the D/A converter module to D/A conversion enable, then write the digital values.
If a digital value write error occurs, an error code is displayed in BCD.
Configure the scaling setting in CH1 only, and configure the warning output setting in CH2 only.

(3) Switch setting

Set the output range, HOLD/CLEAR function, drive mode, and output mode.

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]



(4) Initial setting description

(a) Channel setting

Setting item	CH1	CH2	CH3	CH4
D/A conversion enable/disable setting	Enable	Enable	Disable	Disable
Warning output setting	Disable	Enable	Disable	Disable
Warning output lower limit value	–	3000	–	–
Warning output upper limit value	–	10000	–	–
Scaling enable/disable setting	Enable	Disable	Disable	Disable
Scaling upper limit value	32000	–	–	–
Scaling lower limit value	0	–	–	–

9.2.1 Program example when using parameters of intelligent function module

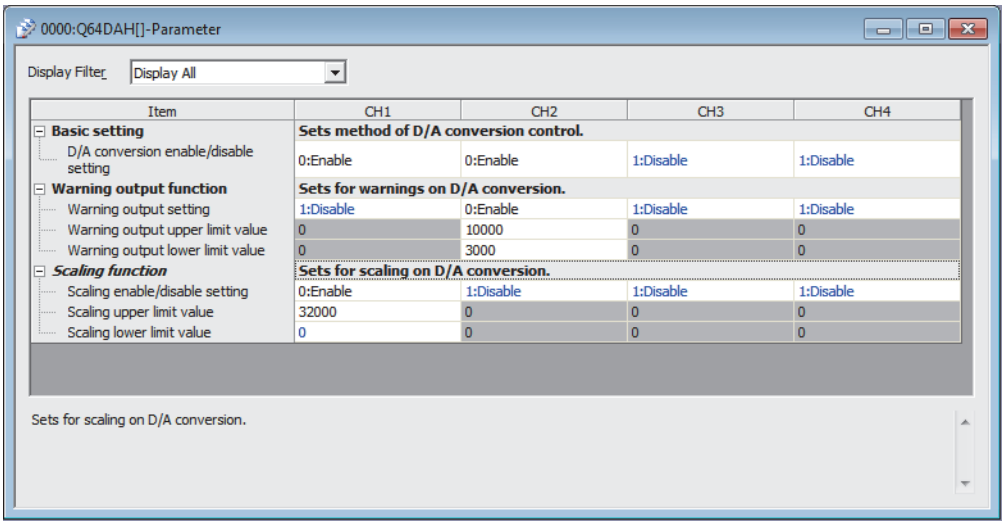
(1) Device for users

Device	Description	
D1	CH1 Digital value	
D2	CH2 Digital value	
D8	Warning output flag	
D10	Error code	
M20 to M27	Warning output flag	
X0	Module READY	D/A converter module (X/Y0 to X/YF)
X7	External power supply READY flag	
XE	Warning output signal	
XF	Error flag	
Y1	CH1 Output enable/disable flag	
Y2	CH2 Output enable/disable flag	
YE	Warning output clear request	
YF	Error clear request	
X11	Batch output enable signal	QX10 (X10 to X1F)
X12	Digital value write command input signal	
X14	Warning output reset signal	
X15	Error reset signal	
Y20 to Y2F	Error code notation (BCD 4 digits)	QY10 (Y20 to Y2F)

(2) Parameter setting

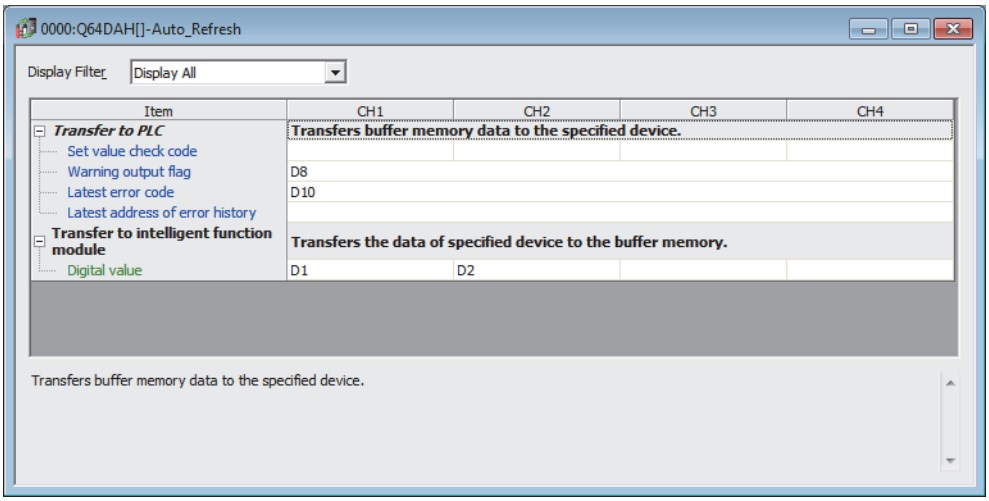
Set the contents of initial settings in the parameters.

Project window ⇨ [Intelligent Function Module] ⇨ [Q64DAH] ⇨ [Parameter]



(3) Auto refresh setting

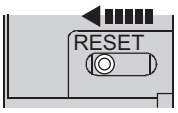
Project window ⇨ [Intelligent Function Module] ⇨ [Q64DAH] ⇨ [Auto_Refresh]



(4) Writing the parameters of intelligent function module

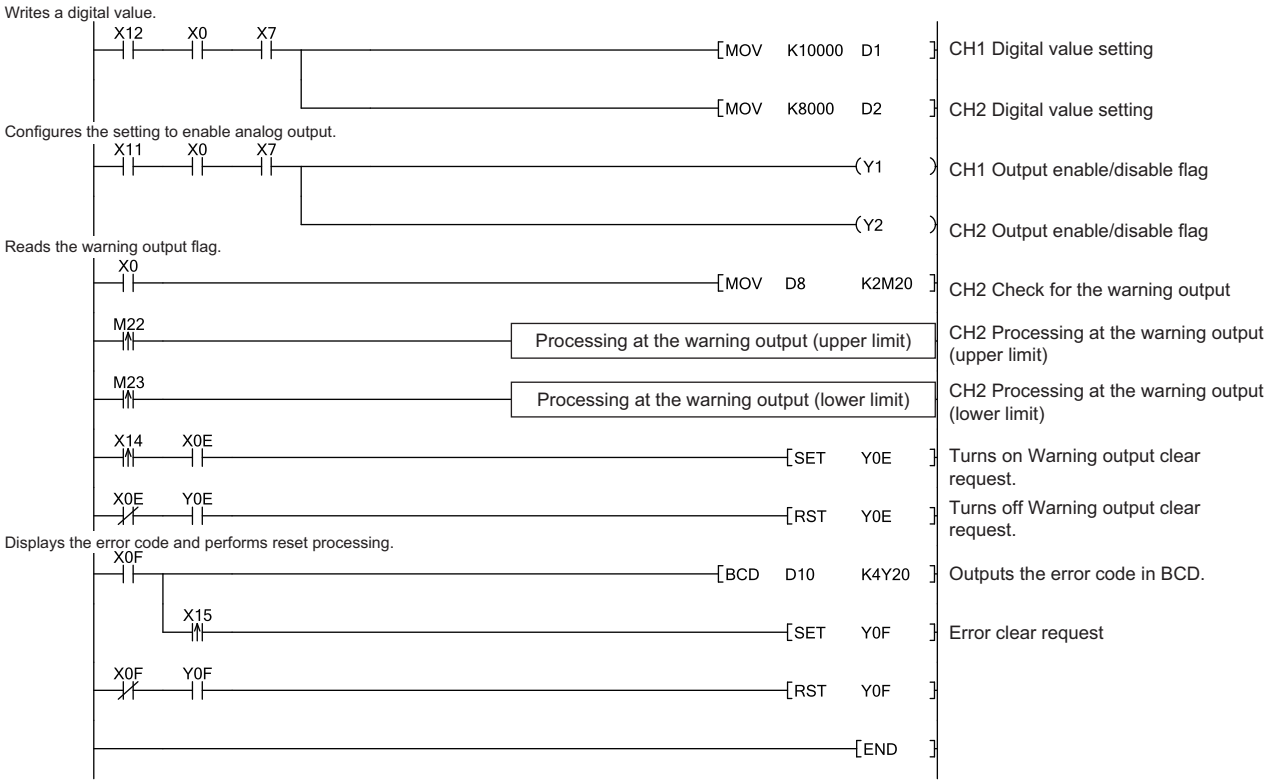
Write the set parameters to the CPU module. Then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online] ⇨ [Write to PLC...]



or power off and on

(5) Program example

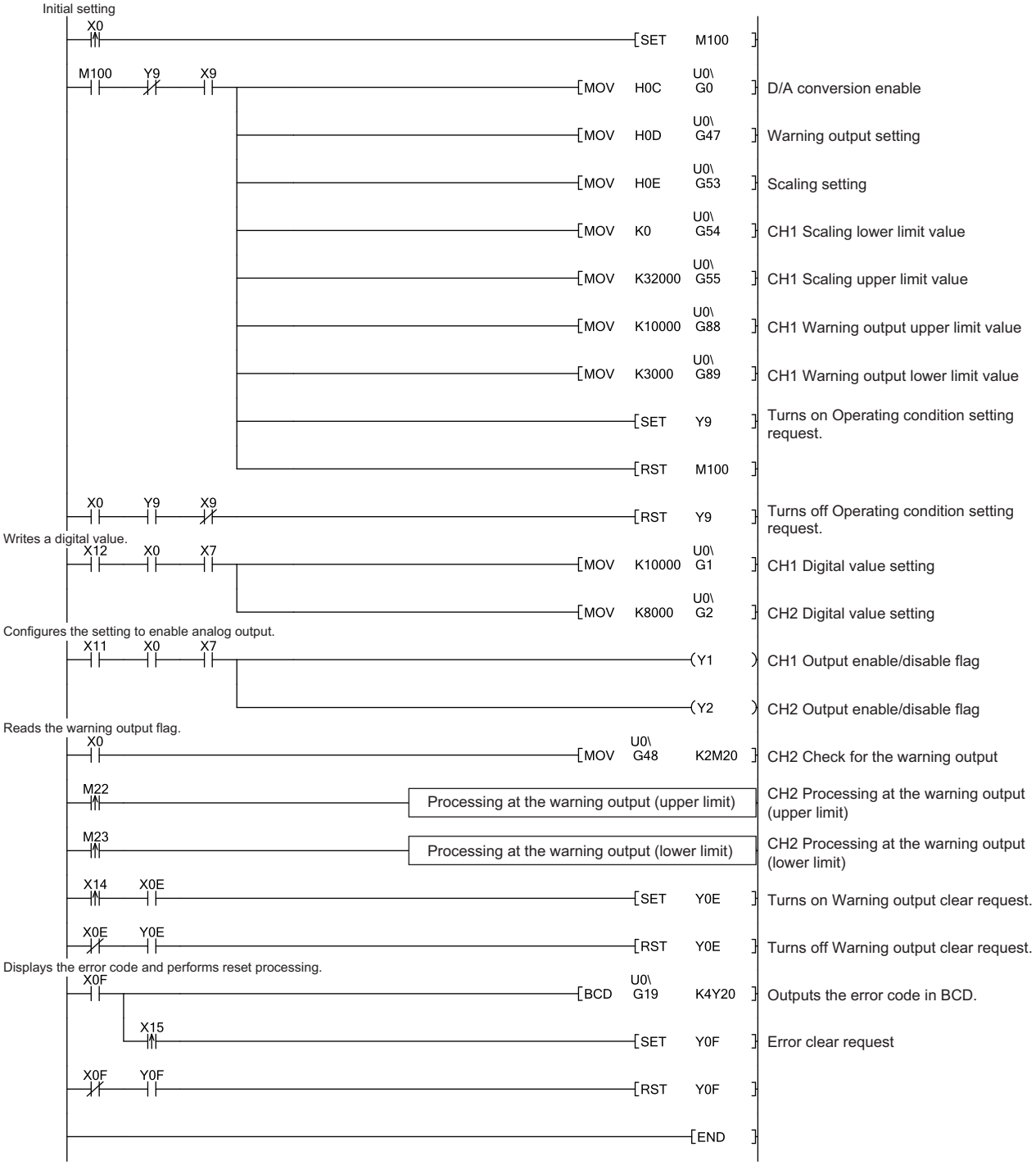


9.2.2 Program example when not using the parameters of intelligent function module

(1) Device for users

Device	Description	
M20 to M27	Warning output flag	
M100	Module READY checking flag	
X0	Module READY	D/A converter module (X/Y0 to X/YF)
X7	External power supply READY flag	
X9	Operating condition setting completed flag	
XE	Warning output signal	
XF	Error flag	
Y1	CH1 Output enable/disable flag	
Y2	CH2 Output enable/disable flag	
Y9	Operating condition setting request	
YE	Warning output clear request	
YF	Error clear request	
X11	Batch output enable signal	QX10 (X10 to X1F)
X12	Digital value write command input signal	
X14	Warning output reset signal	
X15	Error reset signal	
Y20 to Y2F	Error code notation (BCD 4 digits)	QY10 (Y20 to Y2F)

(2) Program example



9.3 When Using the Module on the Remote I/O Network

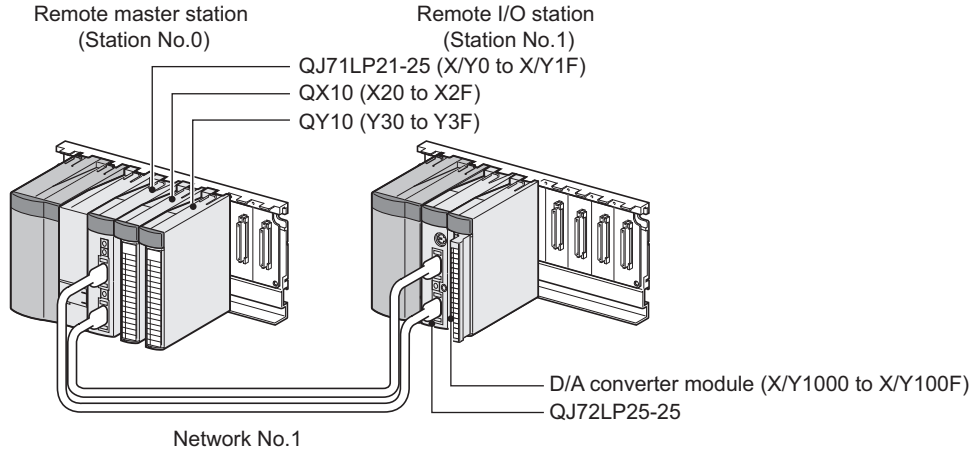
This section describes the system configuration and program examples of when the D/A converter module is used on a remote I/O network.

Point

For details on the MELSECNET/H remote I/O network, refer to the following.

Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

(1) System configuration



(2) Programming condition

Set CH1 and CH2 of the D/A converter module to D/A conversion enable, then write the digital values.

If a digital value write error occurs, an error code is displayed in BCD.

Configure the scaling setting in CH1 only, and configure the warning output setting in CH2 only.

(3) Switch setting

For the switch setting, refer to the procedure described in the following section.

Page 154, Section 9.2 (3)

(4) Initial setting description

(a) Channel setting

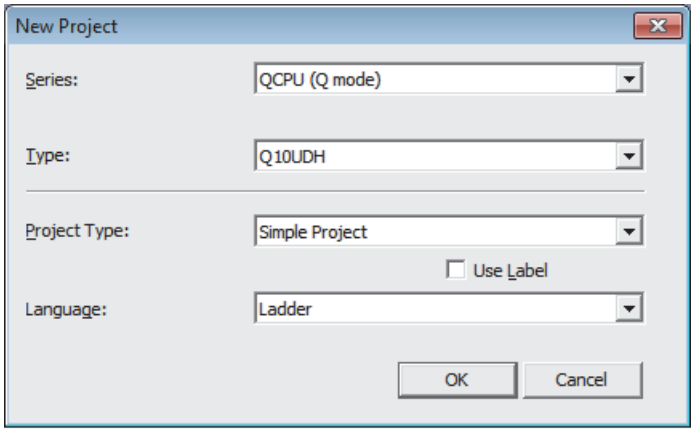
Setting item	CH1	CH2	CH3	CH4
D/A conversion enable/disable setting	Enable	Enable	Disable	Disable
Warning output setting	Disable	Enable	Disable	Disable
Warning output lower limit value	–	3000	–	–
Warning output upper limit value	–	10000	–	–
Scaling enable/disable setting	Enable	Disable	Disable	Disable
Scaling upper limit value	32000	–	–	–
Scaling lower limit value	0	–	–	–

(5) Setting on the master station

1. Create a project on GX Works2.

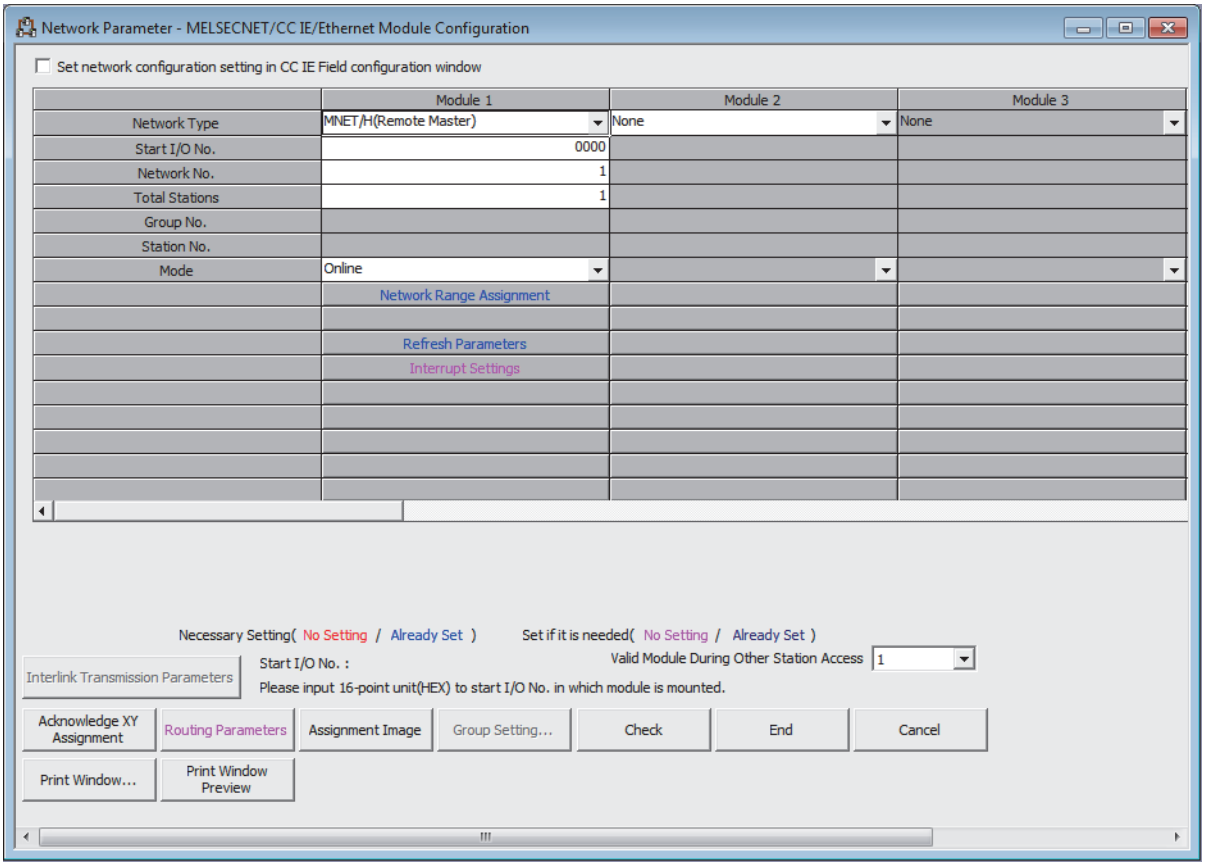
Select "QCPU (Q mode)" for "Series" and select a CPU module to be used for "Type".

[Project] ⇨ [New...]



2. Display the network parameter setting window and configure the setting as follows.

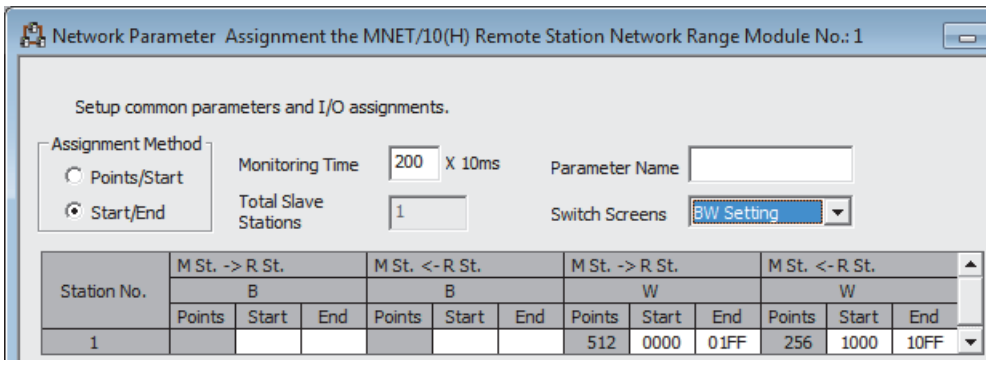
Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]



3. Display the network range assignment setting window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [Network Parameter]

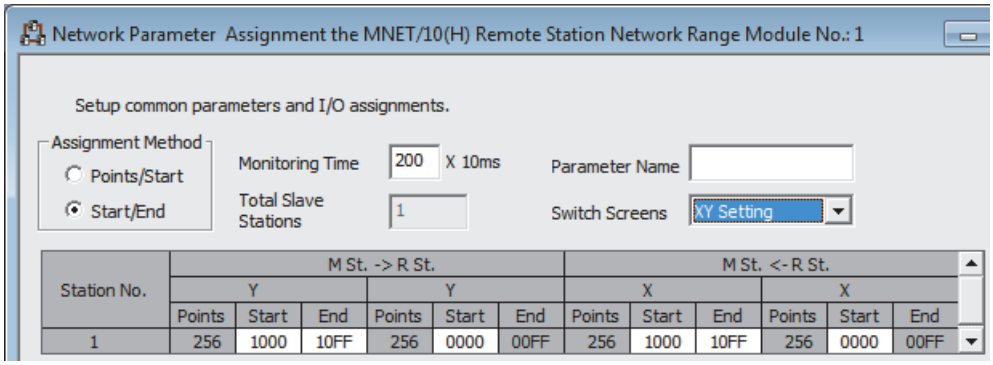
⇨ [Ethernet/CC IE/MELSECNET] ⇨ Network Range Assignment button



Project window ⇨ [Parameter] ⇨ [Network Parameter]

⇨ [Ethernet/CC IE/MELSECNET] ⇨ Network Range Assignment button ⇨ "Switch Screens"

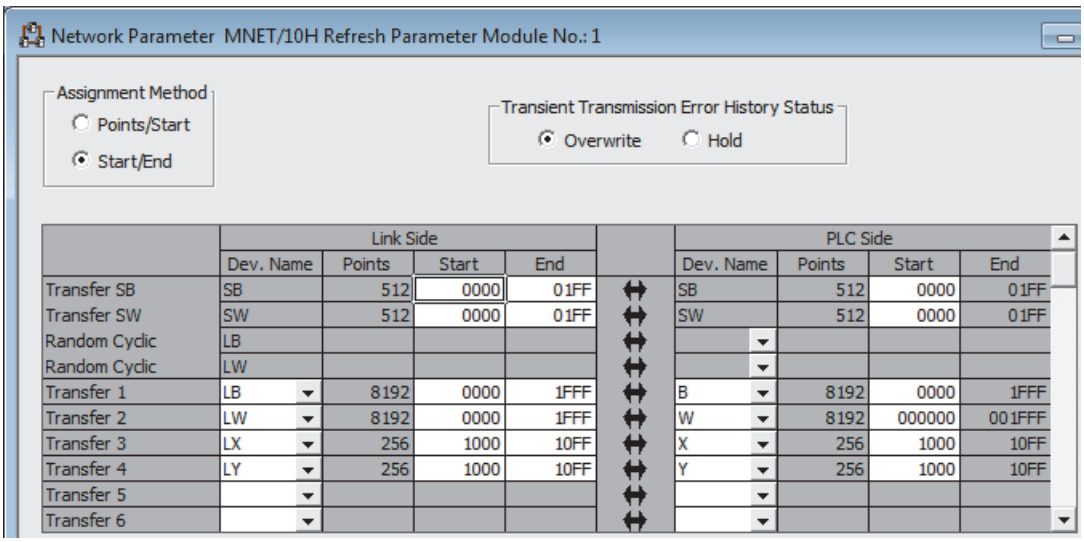
⇨ "XY Setting"



4. Display the refresh parameter setting window and configure the setting as follows.

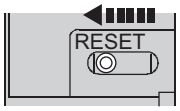
Project window ⇨ [Parameter] ⇨ [Network Parameter]

⇨ [Ethernet/CC IE/MELSECNET] ⇨ Refresh Parameters button



5. Write the set parameters to the CPU module of the master station. Then reset the CPU module or turn off and on the power supply of the programmable controller.

[Online] ⇨ [Write to PLC...]



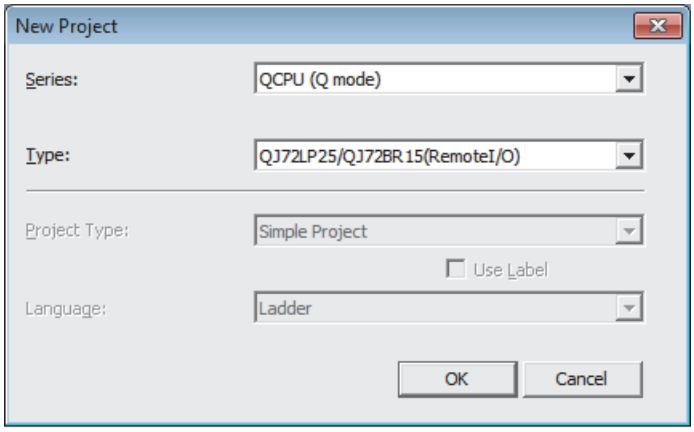
or power off and on

(6) Setting on the remote I/O station

1. Create a project on GX Works2.

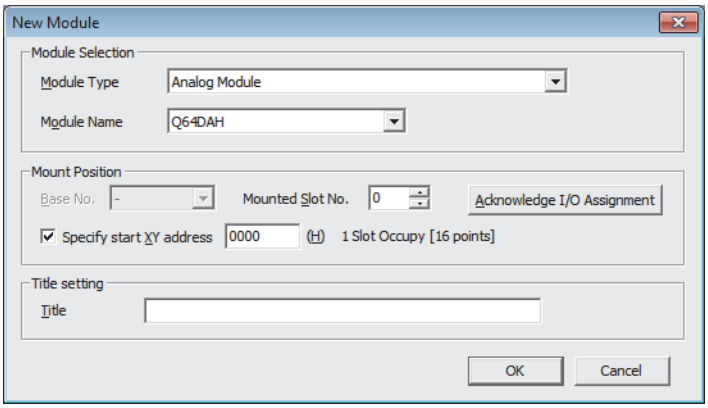
Select "QCPU (Q mode)" for "Series" and select "QJ72LP25/QJ72BR15(RemoteI/O)" for "Type".

[Project] ⇨ [New...]



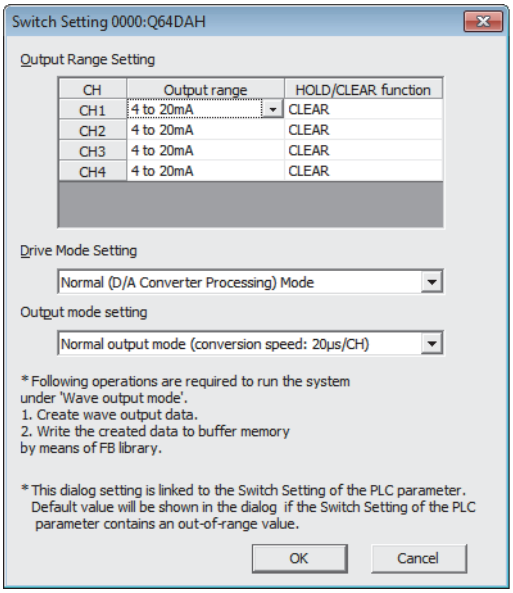
2. **Add the Q64DAH to the GX Works2 project.**

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module...]



3. **Display the "Switch Setting" window for the Q64DAH and configure the setting as follows.**

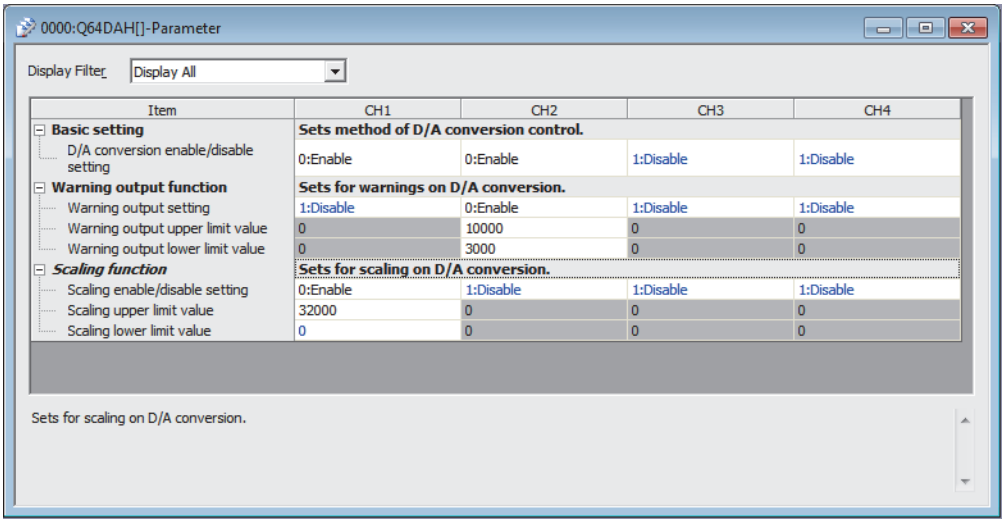
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]



4. **Display the initial setting window for the Q64DAH and configure the setting as follows.**

When creating a program without using parameters of an intelligent function module, skip this procedure.

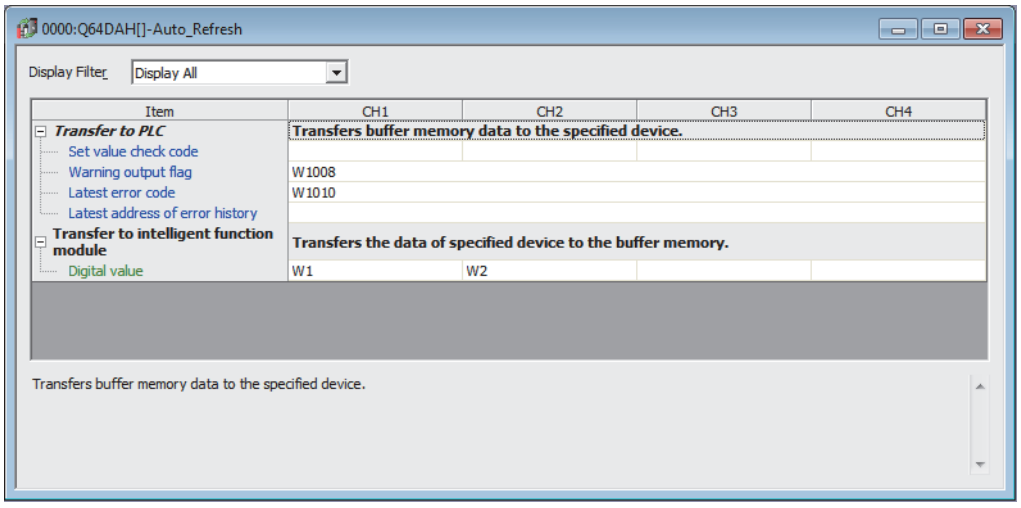
Project window ⇨ [Intelligent Function Module] ⇨ [Q64DAH] ⇨ [Parameter]



5. **Display the auto refresh setting window for the Q64DAH and configure the setting as follows.**

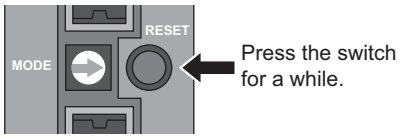
When creating a program without using parameters of an intelligent function module, skip this procedure.

Project window ⇨ [Intelligent Function Module] ⇨ [Q64DAH] ⇨ [Auto_Refresh]



6. **Write the set parameters to the remote I/O module and reset the remote I/O module.**

[Online] ⇨ [Write to PLC...]

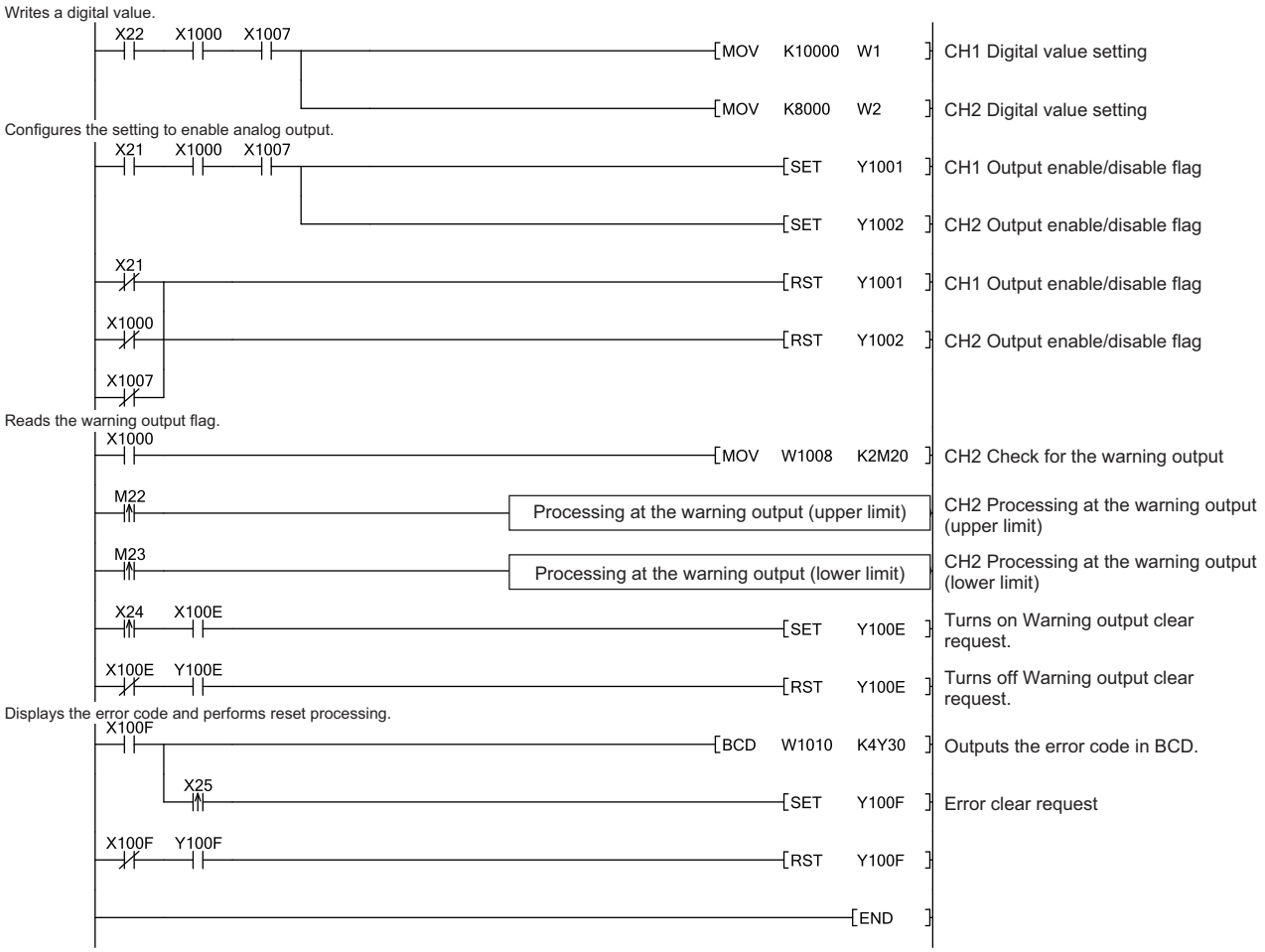


9.3.1 Program example when using parameters of intelligent function module

(1) Device for users

Device	Description	
W1	CH1 Digital value	
W2	CH2 Digital value	
W1008	Warning output flag	
W1010	Error code	
M20 to M27	Warning output flag	
X1000	Module READY	D/A converter module (X/Y1000 to X/Y100F)
X1007	External power supply READY flag	
X100E	Warning output signal	
X100F	Error flag	
Y1001	CH1 Output enable/disable flag	
Y1002	CH2 Output enable/disable flag	
Y100E	Warning output clear request	
Y100F	Error clear request	
X21	Batch output enable signal	QX10 (X20 to X2F)
X22	Digital value write command input signal	
X24	Warning output reset signal	
X25	Error reset signal	
Y30 to Y3F	Error code notation (BCD 4 digits)	QY10 (Y30 to Y3F)

(2) Program example

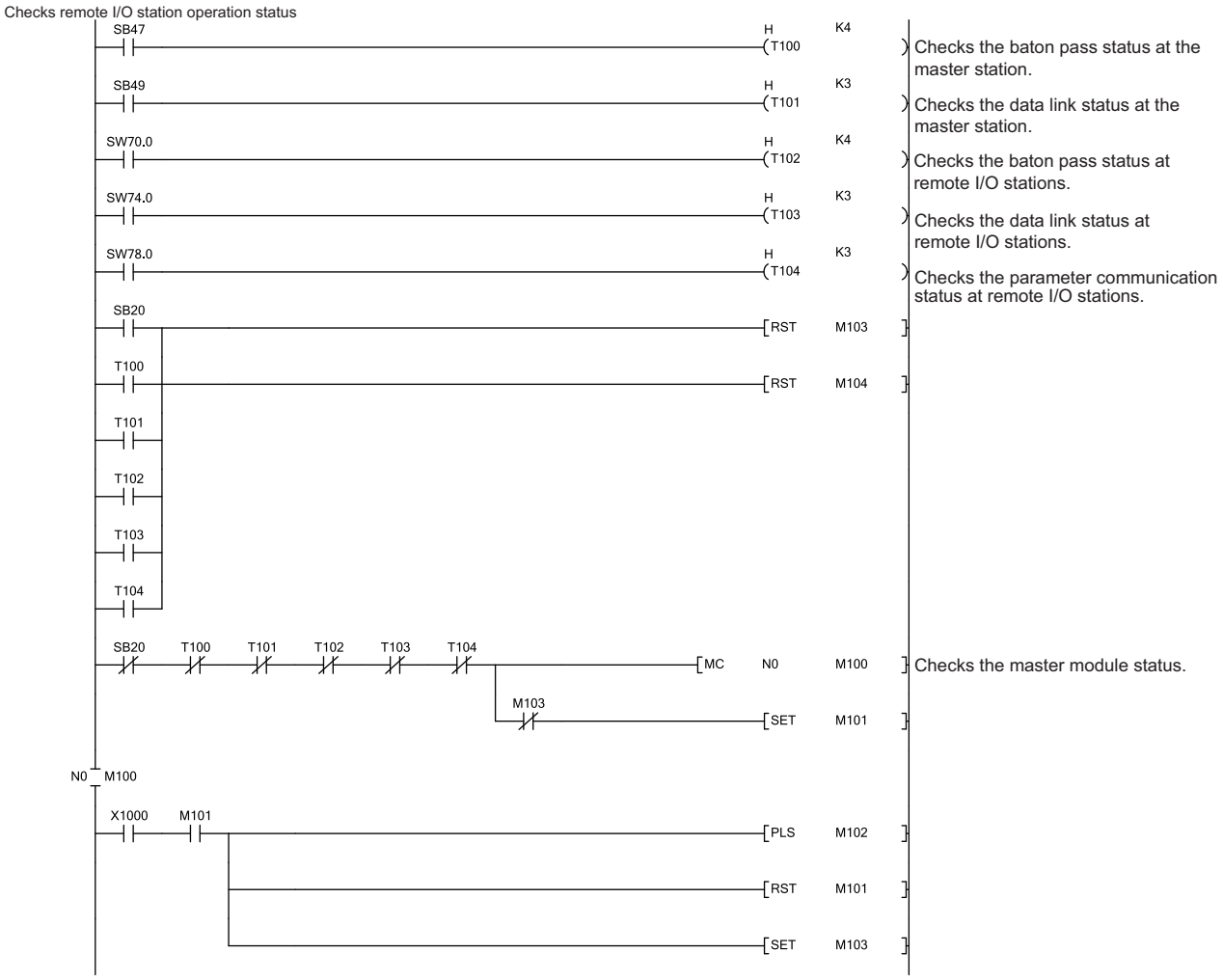


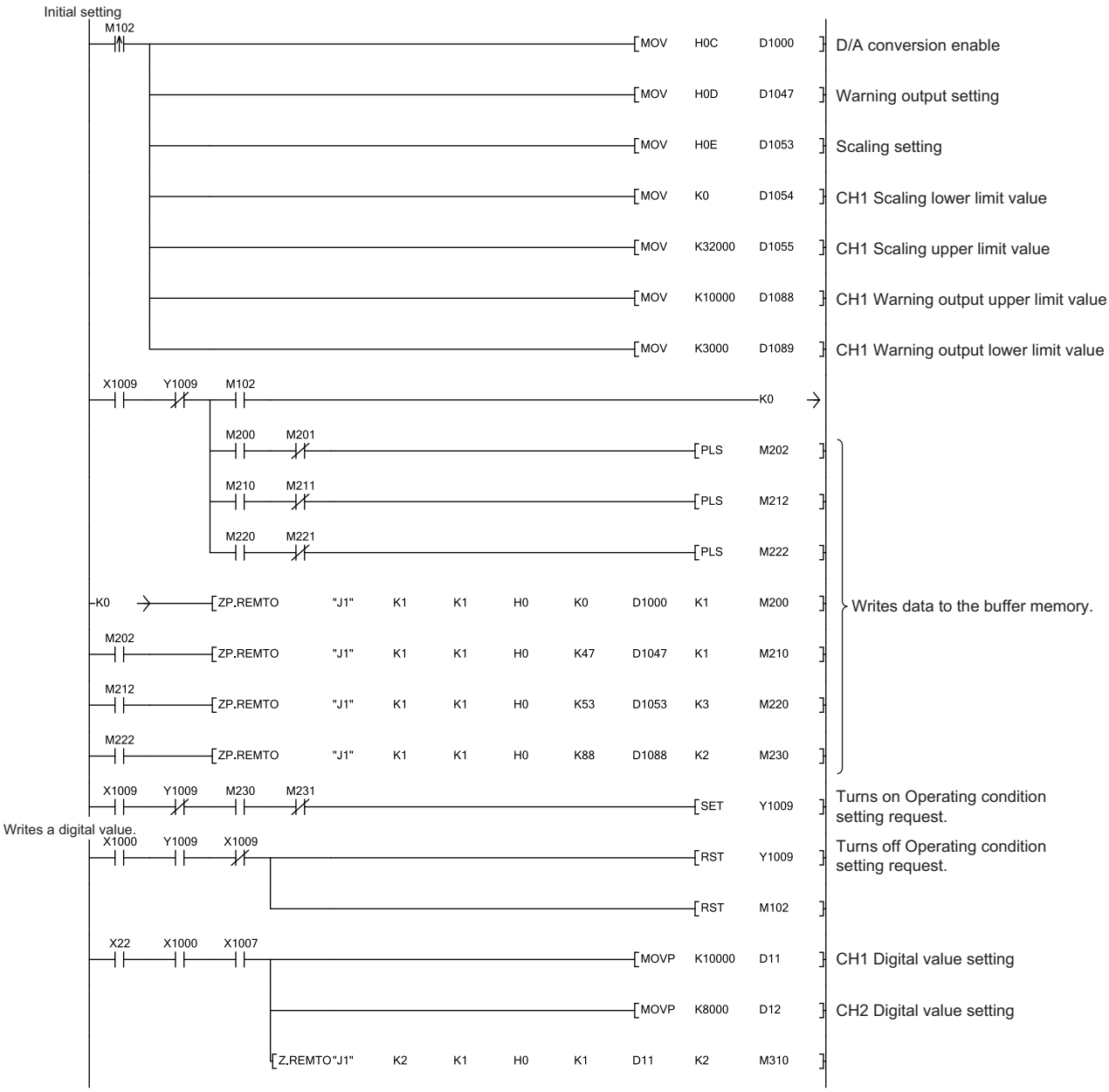
9.3.2 Program example when not using the parameters of intelligent function module

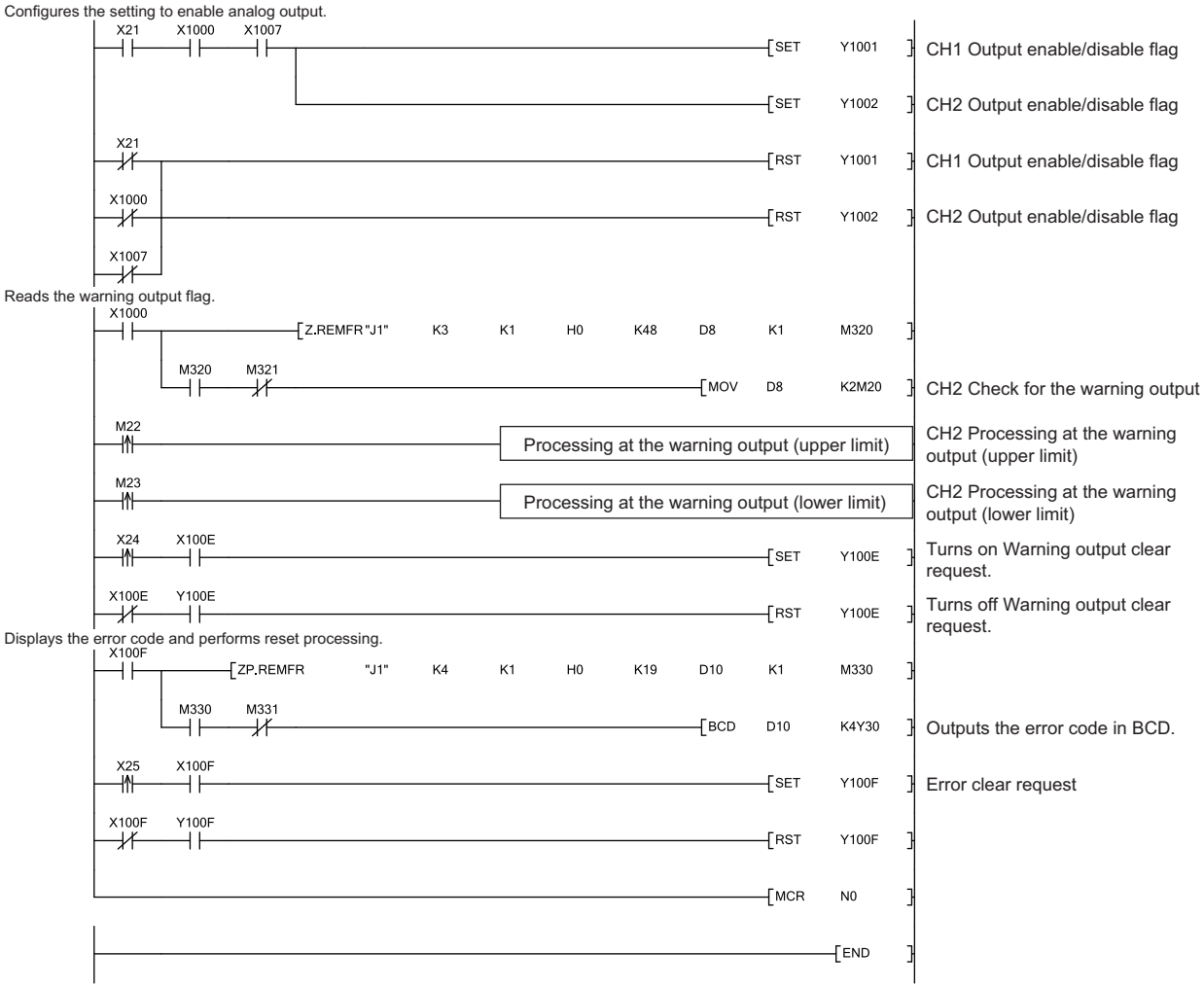
(1) Device for users

Device	Description	
D1000 to D1089	Device for initial value setting	
D11	CH1 Digital value	
D12	CH2 Digital value	
D8	Warning output flag	
D10	Error code	
M20 to M27	Warning output flag	
M100	Master station status check flag	
M101	Initial setting start trigger	
M102	Initial setting start flag	
M103	During initial setting flag	
M104	Initial setting completed flag	
M200 to M202	Z(P).REMTO and Z(P).REMFR instructions completion/result device	
M210 to M212		
M220 to M222		
M230, M231		
M310		
M320, M321		
M330, M331		
X1000	Module READY	D/A converter module (X/Y1000 to X/Y100F)
X1007	External power supply READY flag	
X100E	Warning output signal	
X100F	Error flag	
Y1001	CH1 Output enable/disable flag	
Y1002	CH2 Output enable/disable flag	
Y100E	Warning output clear request	
Y100F	Error clear request	
X21	Batch output enable signal	QX10 (X20 to X2F)
X22	Digital value write command input signal	
X24	Warning output reset signal	
X25	Error reset signal	
Y30 to Y3F	Error code notation (BCD 4 digits)	QY10 (Y30 to Y3F)
SB20	Module status	
SB47	Baton pass status of own station	
SB49	Data link status (own station)	
SW70	Baton pass status of each station	
SW74	Cyclic transmission status of each station	
SW78	Parameter communication status of each station	
T100 to T104	Interlock for own station and other stations	

(2) Program example




Initial setting
M102
MOV H0C D1000
D/A conversion enable
MOV H0D D1047
Warning output setting
MOV H0E D1053
Scaling setting
MOV K0 D1054
CH1 Scaling lower limit value
MOV K32000 D1055
CH1 Scaling upper limit value
MOV K10000 D1088
CH1 Warning output upper limit value
MOV K3000 D1089
CH1 Warning output lower limit value
X1009 Y1009 M102
K0
M200 M201
PLS M202
M210 M211
PLS M212
M220 M221
PLS M222
K0
ZP.REMTO "J1" K1 K1 H0 K0 D1000 K1 M200
M202
ZP.REMTO "J1" K1 K1 H0 K47 D1047 K1 M210
M212
ZP.REMTO "J1" K1 K1 H0 K53 D1053 K3 M220
M222
ZP.REMTO "J1" K1 K1 H0 K88 D1088 K2 M230
Writes data to the buffer memory.
X1009 Y1009 M230 M231
SET Y1009
Turns on Operating condition setting request.
Writes a digital value.
X1000 Y1009 X1009
RST Y1009
Turns off Operating condition setting request.
RST M102
X22 X1000 X1007
MOVP K10000 D11
CH1 Digital value setting
MOVP K8000 D12
CH2 Digital value setting
Z.REMTO "J1" K2 K1 H0 K1 D11 K2 M310


Configures the setting to enable analog output.
X21 X1000 X1007 SET Y1001 CH1 Output enable/disable flag
SET Y1002 CH2 Output enable/disable flag
X21 RST Y1001 CH1 Output enable/disable flag
X1000 RST Y1002 CH2 Output enable/disable flag
X1007
Reads the warning output flag.
X1000 Z.REMFR "J1" K3 K1 H0 K48 D8 K1 M320
M320 M321 MOV D8 K2M20 CH2 Check for the warning output
M22 Processing at the warning output (upper limit) CH2 Processing at the warning output (upper limit)
M23 Processing at the warning output (lower limit) CH2 Processing at the warning output (lower limit)
X24 X100E SET Y100E Turns on Warning output clear request.
X100E Y100E RST Y100E Turns off Warning output clear request.
Displays the error code and performs reset processing.
X100F ZP.REMFR "J1" K4 K1 H0 K19 D10 K1 M330
M330 M331 BCD D10 K4Y30 Outputs the error code in BCD.
X25 X100F SET Y100F Error clear request
X100F Y100F RST Y100F
MCR N0
END

CHAPTER 10 ONLINE MODULE CHANGE

This chapter describes the online module change procedure. In this manual, the online module change procedure is explained using GX Works2.
When performing an online module change, carefully read the following.

QCPU User's Manual (Hardware Design, Maintenance and Inspection)

10.1 Precautions on Online Module Change

This section lists precautions on an online module change.

- Always perform an online module change in the correct procedure (Page 173, Section 10.4).
  A failure to do so can cause a malfunction or failure.
- Perform an online module change after checking that the system outside the programmable controller will not malfunction.
- Provide means such as switches for powering off each of the external power supply and external devices connected to the module to be replaced online. Failure to do so may cause an electric shock and malfunction of operating modules.
- After the module has failed, the buffer memory data may not be saved properly. Prerecord the data to be saved.
- It is recommended to perform an online module change in the actual system in advance to check that it would not affect the other modules.
  For the operational verification, check the following:
  - Means of cutting off the connection to external devices and its configuration are correct.
  - Switching on/off does not bring any undesirable effect.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.

Point

Dedicated instructions cannot be executed during an online module change. Save and restore the offset/gain setting values in the user range using a dedicated instruction in another system.
Precautions for using other systems are as follows:

- To change a module mounted on the remote I/O station online, save and restore the offset/gain setting values in the user range using a dedicated instruction, in another system mounted on the main base unit.
- The offset/gain setting values cannot be saved and restored using a dedicated instruction in another system mounted on the remote I/O station.

If no other systems are available, restore the values by writing them to the buffer memory.

10.2 Conditions for Online Module Change

To perform an online module change, satisfy the following conditions.

Point

The function version of the first released D/A converter module is C, and the D/A converter module supports the online module change.

(1) CPU module

A Process CPU or Redundant CPU is required.

For the precautions on the multiple CPU system configuration, refer to the following.

- QCPU User's Manual (Multiple CPU System)

For the precautions on the redundant system configuration, refer to the following.

- QnPRHCPU User's Manual (Redundant System)

(2) Function version of MELSECNET/H remote I/O module

A module of function version D or later is required.

(3) Compatible version of programming tools

Programming tool	System configuration	Software version
GX Works2	Normal system	Version 1.87R or later
	Remote I/O station	Version 1.40S or later
GX Developer*1	Normal system	Version 7.10L or later
	Remote I/O station	Version 8.17T or later

*1 The D/A converter module does not support GX Configurator-DA; therefore, configure parameter settings in a sequence program when using GX Developer.

(4) Restrictions of base unit

When the module is mounted on any of the following base units, an online module change cannot be performed.

- Slim type main base unit (Q3□SB)
- Extension base unit (Q5□B) which does not require the power supply module (An online module change cannot be performed for all modules on the base unit.)

10.3 Online Module Change Operations

The following table describes the operations for an online module change.

○: Executed ×: Not executed

User operation	Operation of the D/A converter module	Operation of the CPU module				
		X/Y refresh	FROM/TO instructions *1	Dedicated instruction	Device test	Parameter setting
(1) Stop the operation. Turn off all of the Y signals turned on using the sequence program.*4	The module is operating normally.	○	○	○	○	×
(2) Remove the module. Start the online module change using GX Works2. Click the [Execution] button on GX Works2 to enable the module to be removed. Remove the module.	The operation of the module stops. ・The RUN LED turns off. ・Conversion disabled. ・The analog output is 0V/0mA.	×	×	×	×	×
(3) Mount a new module. Mount a new module. After mounting the module, click the [Execution] button on GX Works2. Check the operation before the control starts.	*3 The X/Y refresh restarts and the module starts up. ・The RUN LED turns on. ・Default operation starts. (Module READY (X0) remains off.) (When there are initial setting parameters, the module starts to operate based on the initial setting parameters at this point.)	○	×	×	×	○
(4) Check the operation. Click the [Cancel] button on GX Works2 to turn off the online mode. On "Device test" on GX Works2, test the operation of the replaced module. (Restore the user range settings by writing of buffer memory addresses at this point.) Operation check is completed.	The module operates based on the test operation.*2	○	×	×	○	×
(5) Resume the control. Restart the online module change mode using GX Works2. Click the [Execution] button to resume the control.	Module READY (X0) turns on. ↓ The module operates based on the initial setting sequence program which runs when Module READY (X0) turns on.*2	○	○	○	○	×

*1 An access to Intelligent function module device (U□\G□) is included.

*2 In the absence of the operation marked *2, the operation of the intelligent function module is the operation performed prior to that.

*4 The module starts up and the X/Y refresh restarts based on the operation of the intelligent function module switch (*3). When there are initial setting parameters, the module starts to operate based on the initial setting parameters. Thus, the analog output is performed at this point when the Y signals are not turned off. Never forget to turn off the Y signals using a sequence program.

10.4 Online Module Change Procedure

This section and the following sections describe two online module change procedures: setting parameters using the configuration function and setting parameters using a sequence program. The same procedures are applied to GX Developer.

- When using GX Works2

Range setting	Parameter setting	Another system*1	Reference
Industrial shipment range	Configuration function	–	Page 175, Section 10.5
	Sequence program	–	Page 180, Section 10.6
User range	Configuration function	Present	Page 186, Section 10.7
		Absent	Page 197, Section 10.9
	Sequence program	Present	Page 191, Section 10.8
		Absent	Page 204, Section 10.10

- When using GX Developer

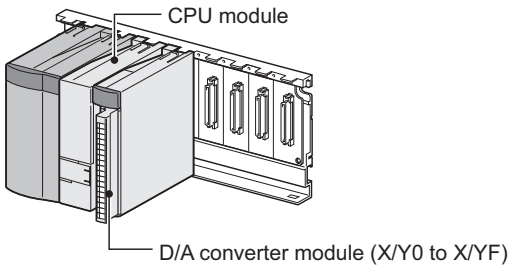
Range setting	Another system*1	Reference
Industrial shipment range	–	Page 180, Section 10.6
User range	Present	Page 191, Section 10.8
	Absent	Page 204, Section 10.10

*1 "Another system" is a programmable controller system which does not have the D/A converter module to be replaced, and is composed of modules such as a power supply module and a CPU module. "Another system" has power supply which can be turned on and off and modules which can be removed and mounted.

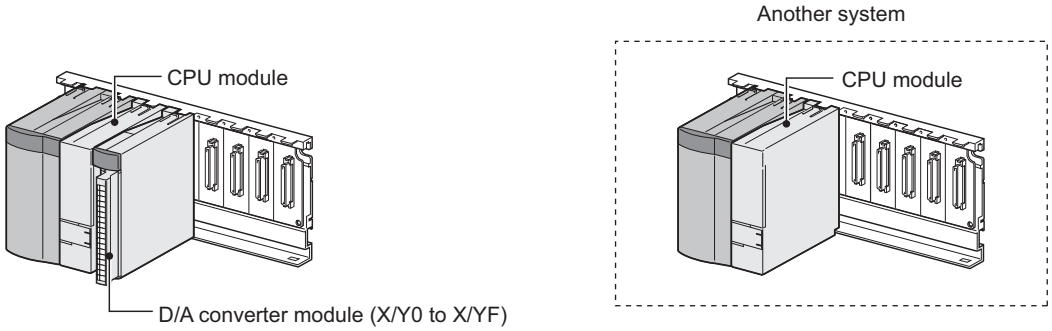
(1) System configuration

The following system configuration is used to explain the online module change procedure.

(a) Without another system

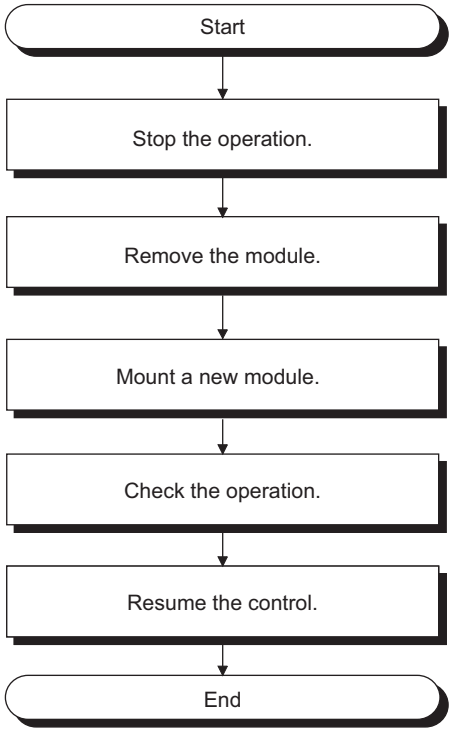


(b) With another system



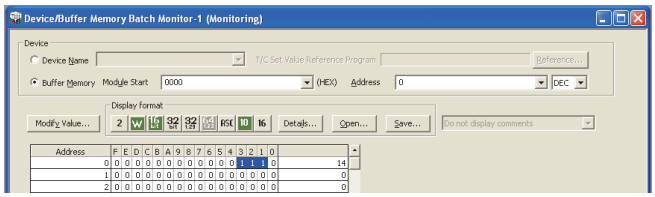
(2) Procedure

The following flow shows the online module change procedure.



10.5 When an Industrial Shipment Range Is Used and Parameters Are Set Using the Configuration Function

(1) Stopping operation



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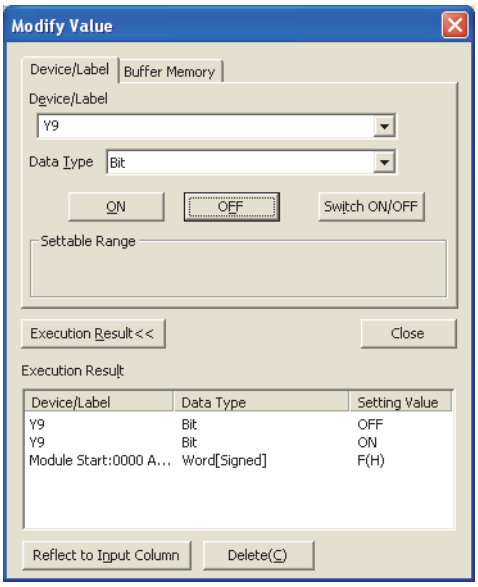


1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

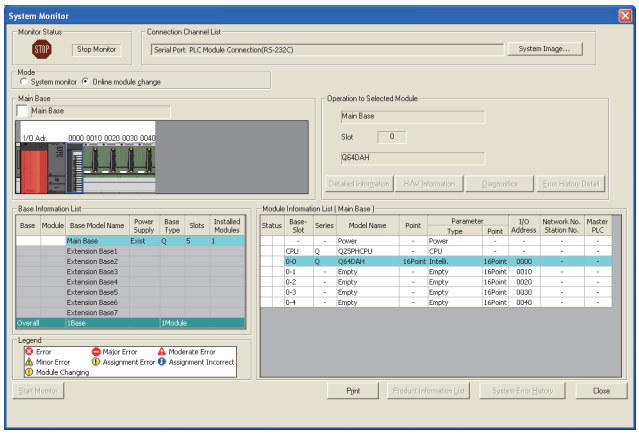
3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**

4. **Turn on Operating condition setting request (Y9).**

5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**

6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

(2) Removing a module



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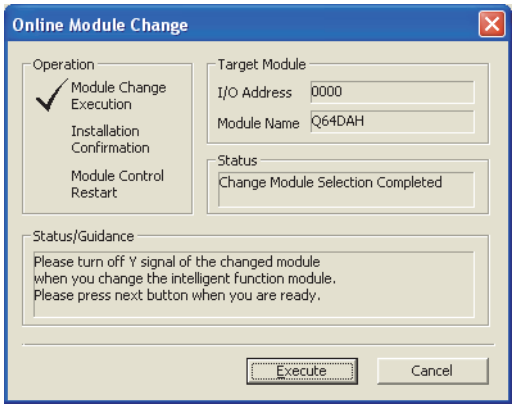


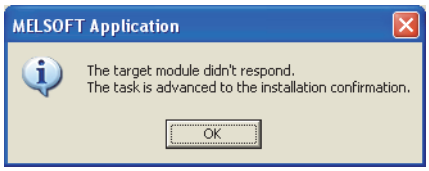
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 177, Section 10.5 (3).**



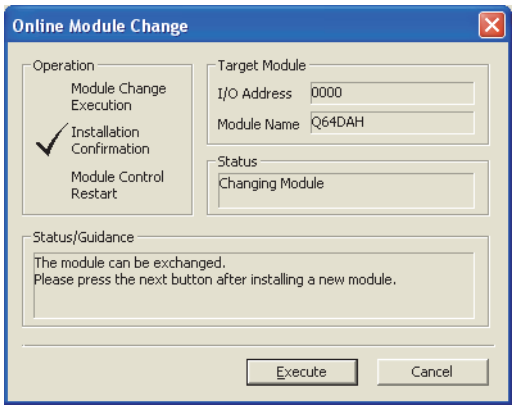
5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

6. **Remove the module.**

Point

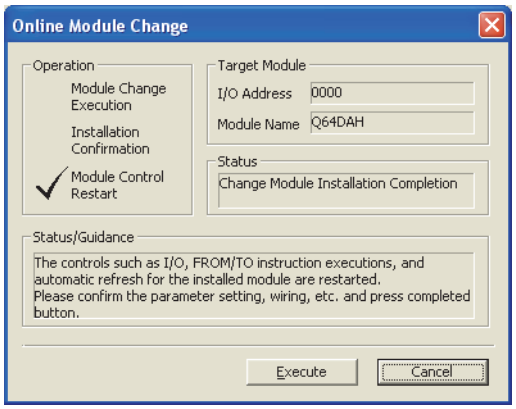
Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

(3) Mounting a new module



1. **Mount a new module in the same slot and install the terminal block.**
2. **After mounting the module, click the [Execute] button and check that the RUN LED turns on. Module READY (X0) remains off.**

(4) Checking operation



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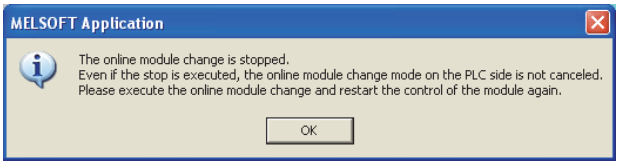

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1. **To check the operation, click the [Cancel] button to cancel the control restart.**
2. **Click the [OK] button to leave the "Online module change" mode.**

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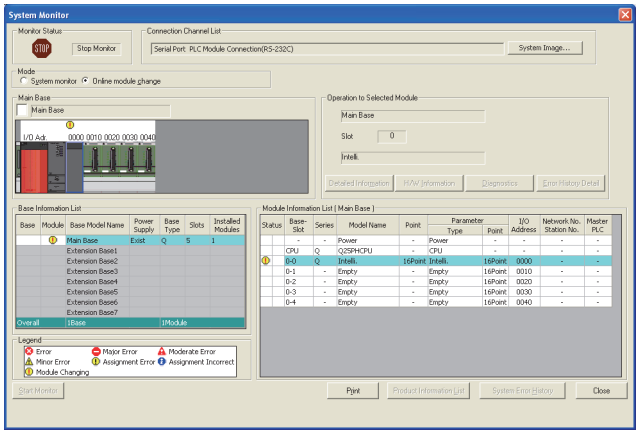

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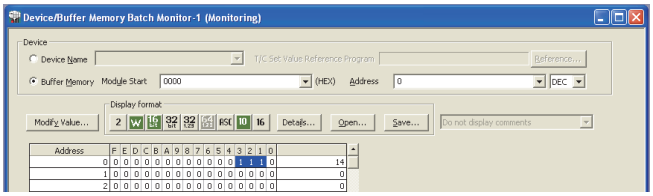
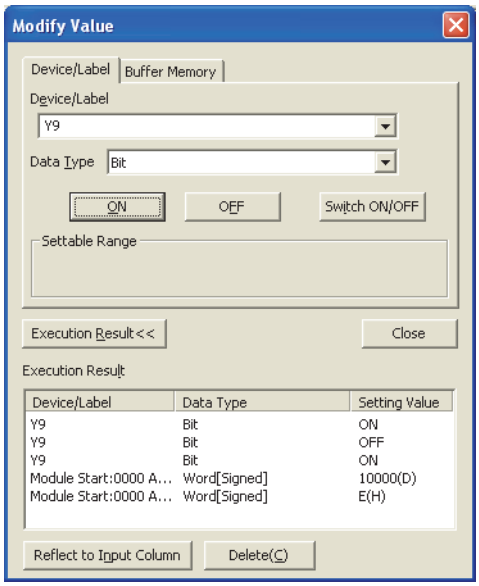




3. **Click the [Close] button to close the "System Monitor" window.**

4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

5. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

6. **Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.**

7. **Enter and display the buffer memory address of CH□ Digital value (Un\G1 to Un\G4) of the channel used.**

8. **Set a digital value for CH□ Digital value (Un\G1 to Un\G4).**

9. **Turn on Operating condition setting request (Y9).**

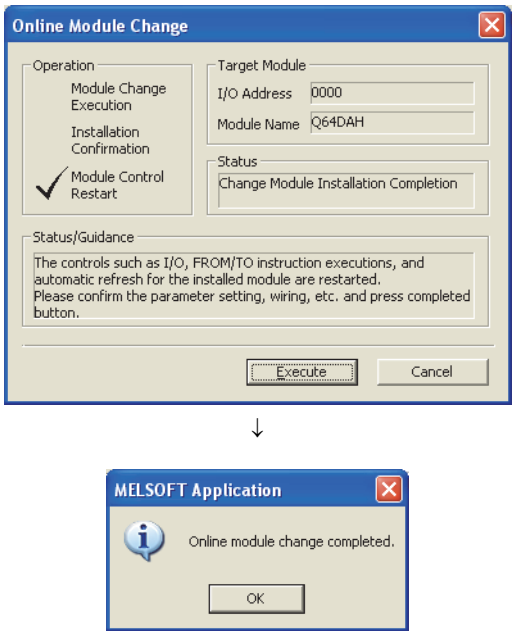
10. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

11. **Turn on CH□ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.**
(Note that the analog output is actually performed.)
When the mode is the wave output mode, use the wave output step action function (☞ Page 80, Section 4.8.4) to check the operation.

12. **Before starting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞ Page 212, CHAPTER 11) and take a corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

(5) Resuming operation



1. **Open the "Online Module Change" window again.**

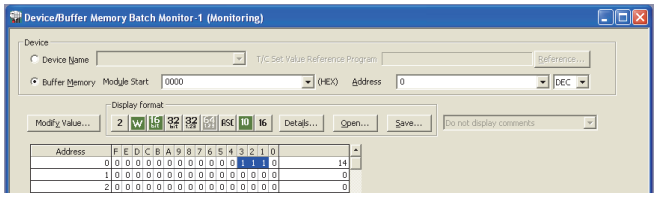
[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.6 When an Industrial Shipment Range Is Used and Initial Settings Are Configured Using a Sequence Program

(1) Stopping operation



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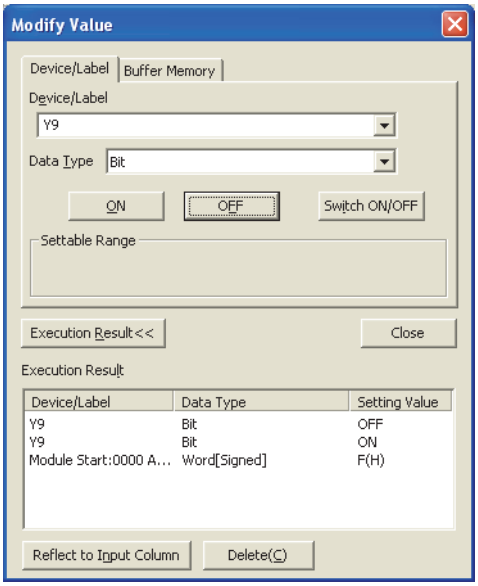


1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

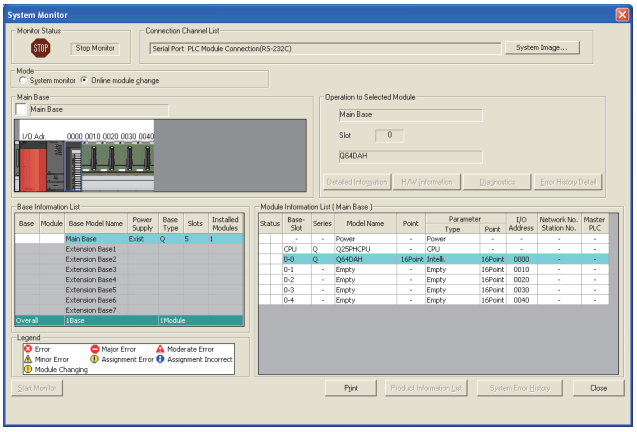
3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**

4. **Turn on Operating condition setting request (Y9).**

5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**

6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

(2) Removing a module



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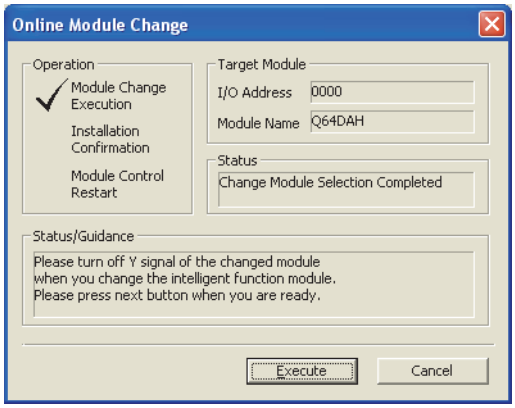


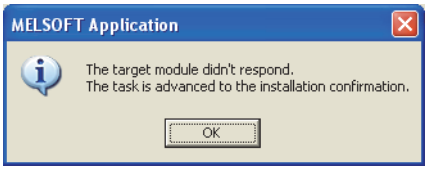
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 182, Section 10.6 (3).**



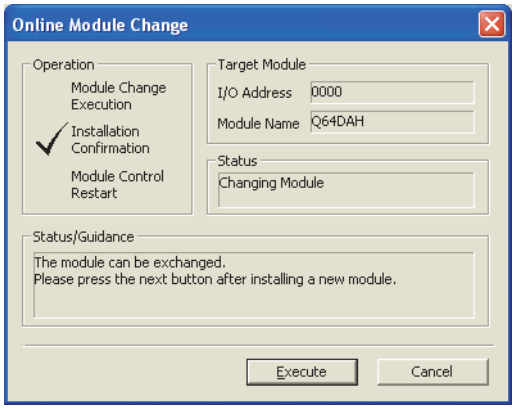
5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

6. **Remove the module.**

Point

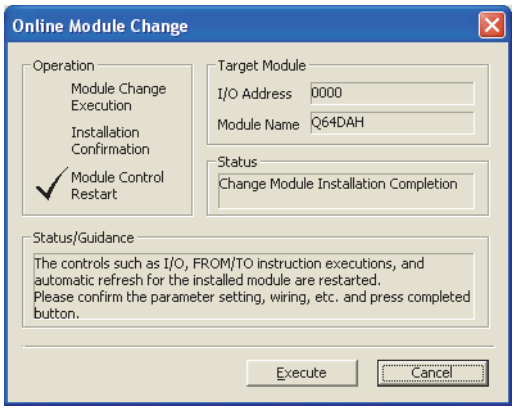
Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

(3) Mounting a new module



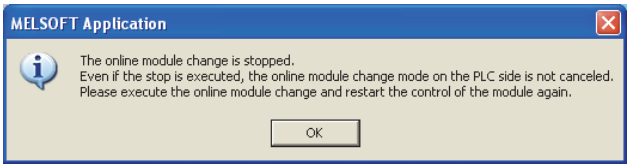
1. Mount a new module in the same slot and install the terminal block.
2. After mounting the module, click the [Execute] button and check that the RUN LED turns on. Module READY (X0) remains off.

(4) Checking operation



1. To check the operation, click the [Cancel] button to cancel the control restart.

↓



2. Click the [OK] button to leave the "Online module change" mode.

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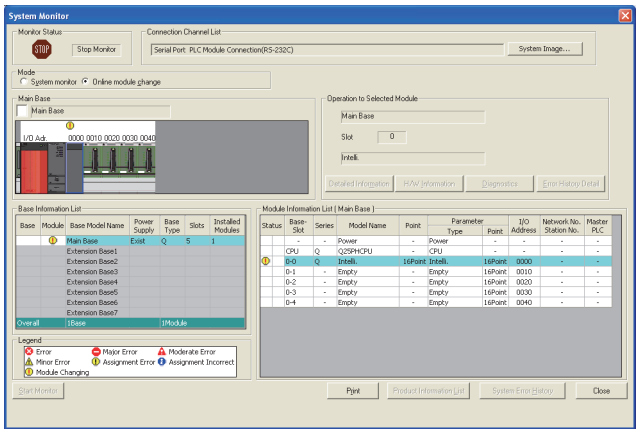

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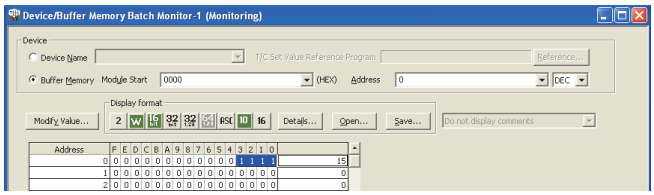

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3. **Click the Close button to close the "System Monitor" window.**

4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

5. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

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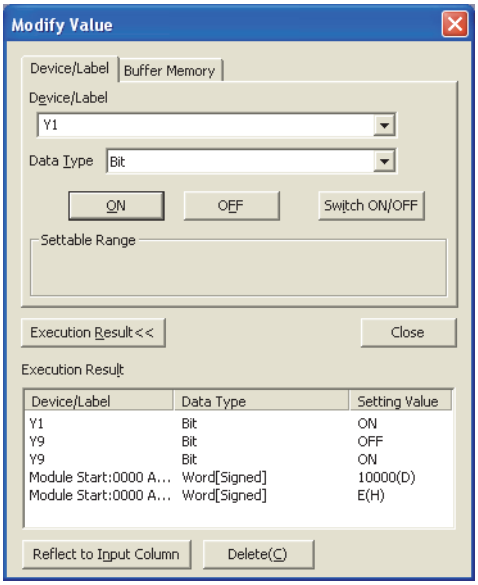


6. **Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.**

7. **Enter and display the buffer memory address of CH☐ Digital value (Un\G1 to Un\G4) of the channel used.**

8. **Set a digital value for CH☐ Digital value (Un\G1 to Un\G4).**

9. **Turn on Operating condition setting request (Y9).**

10. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

11. **Turn on CH☐ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.**
(Note that the analog output is actually performed.)
When the mode is the wave output mode, use the wave output step action function (☞ Page 80, Section 4.8.4) to check the operation.

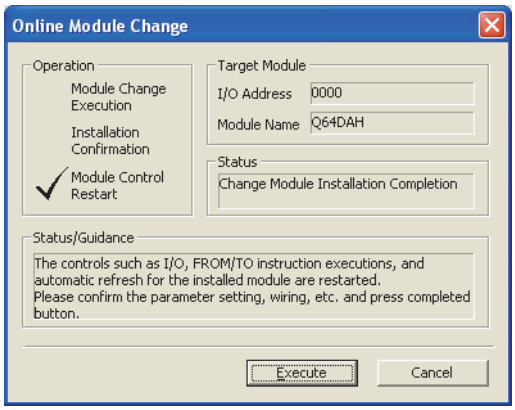
12. **Before restarting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞ Page 212, CHAPTER 11) and take a corrective action.**
- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

13. **Since the new module is in the default status, initial settings must be configured using a sequence program after the control resumed. Before configuring the initial settings, check that the initial setting program is proper, satisfying the following.**

Normal system configuration
- Create a sequence program that sets the initial settings when Module READY (X0) of the D/A converter module turns on.
- Do not create a sequence program which sets the initial settings for only one scan after RUN. In this case, the initial settings are not set.

When used on remote I/O network
- Insert a user device where the initial settings will be set at any timing (initial setting request signal) into the sequence program.
- Do not create a sequence program which sets the initial settings for only one scan after a data link start of the remote I/O network. In this case, the initial settings are not set.

(5) Resuming operation



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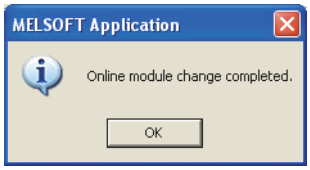


1. **Open the "Online Module Change" window again.**

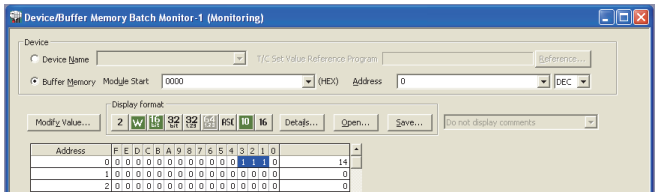
[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.7 When a User Range Is Used and Initial Settings Are Configured Using the Configuration Function (with Another System)

(1) Stopping operation



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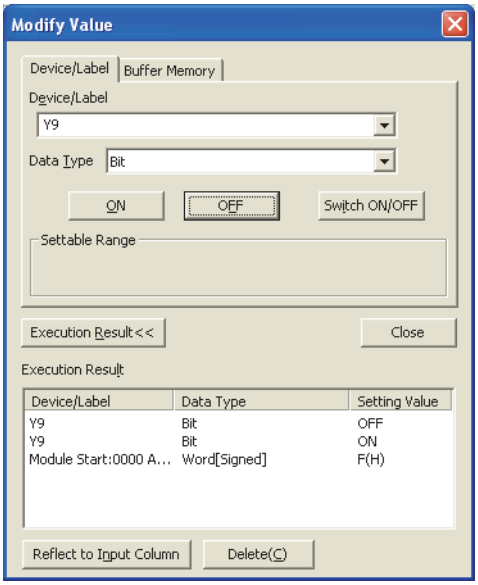


1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

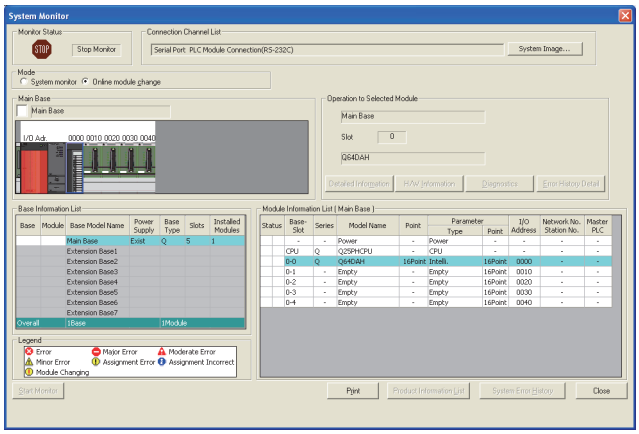
3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**

4. **Turn on Operating condition setting request (Y9).**

5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**

6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

(2) Removing a module



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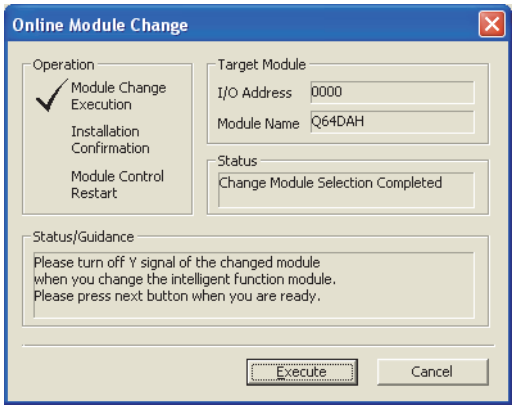


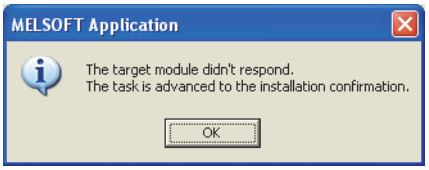
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 188, Section 10.7 (3).**



5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

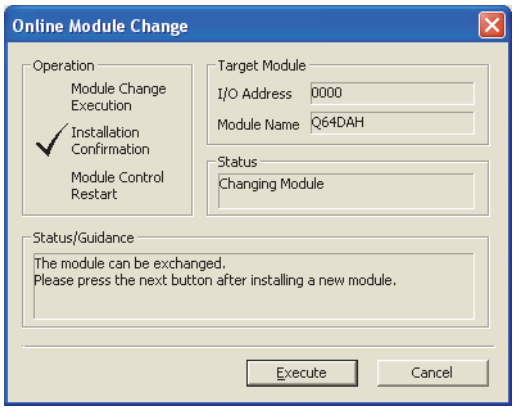
6. **Remove the module.**

Point

Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

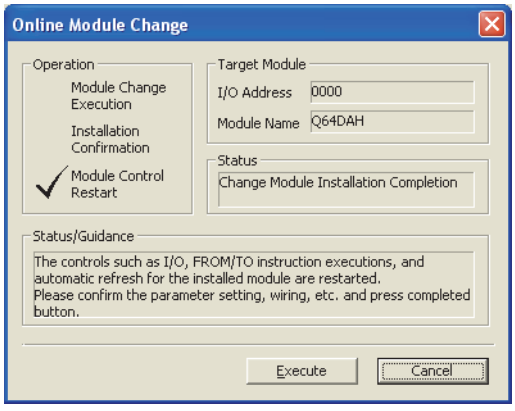
(3) Mounting a new module

1. Mount the removed module and a new module to another system.
2. Using the G(P).OGLOAD instruction, save the offset/gain setting values in the user range from the removed module to the CPU device. For the G(P).OGLOAD instruction, refer to Page 231, Appendix 2.2.
3. Using the G(P).OGSTOR instruction, restore the offset/gain setting values in the user range to a new module. For the G(P).OGSTOR instruction, refer to Page 234, Appendix 2.3.
4. Remove the new module from another system, mount it to the slot from where the old module was removed in the original system, and install the terminal block.
5. After mounting the module, click the [Execute] button and check that the RUN LED turns on. Module READY (X0) remains off.



(4) Checking operation

1. To check the operation, click the [Cancel] button to cancel the control restart.



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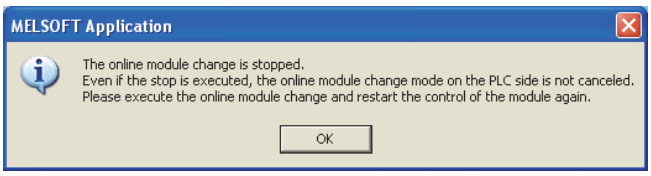

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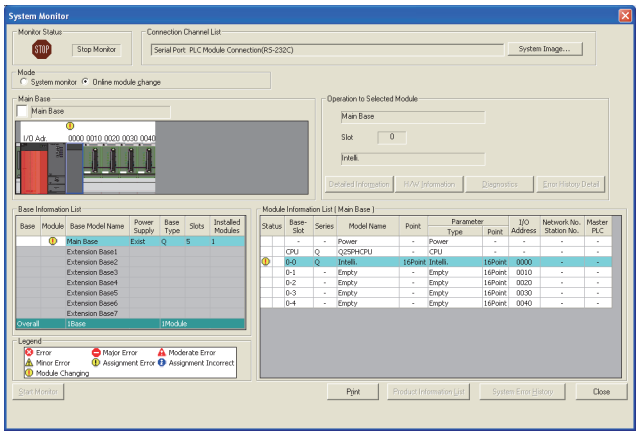

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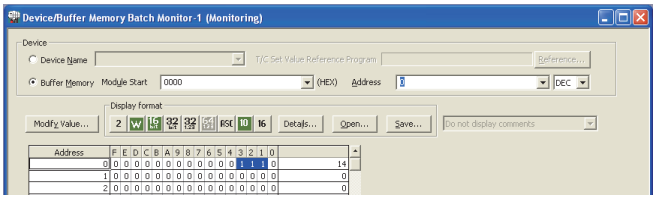

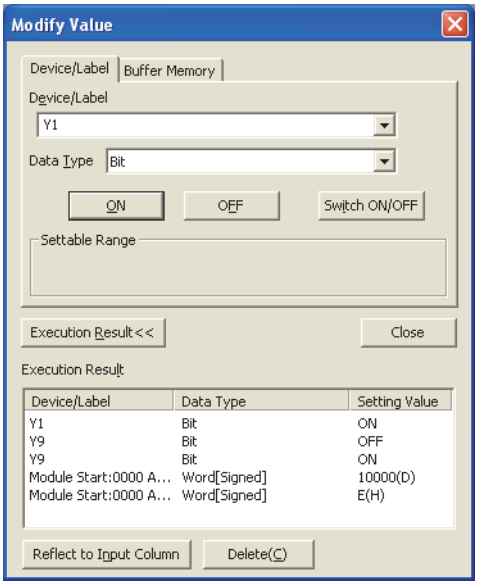

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2. Click the OK button to leave the "Online module change" mode.

3. Click the Close button to close the "System Monitor" window.

4. Open the "Device/Buffer Memory Batch Monitor" window.

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

5. Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).

6. Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.

7. Enter and display the buffer memory address of CH☐ Digital value (Un\G1 to Un\G4) of the channel used.

8. Set a digital value for CH☐ Digital value (Un\G1 to Un\G4).

9. Turn on Operating condition setting request (Y9).

10. Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).

11. Turn on CH☐ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.
(Note that the analog output is actually performed.)

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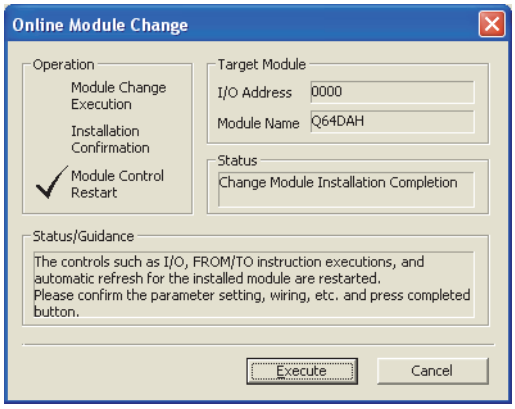
12. **Before starting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞Page 212, CHAPTER 11) and take a corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

(5) Resuming operation



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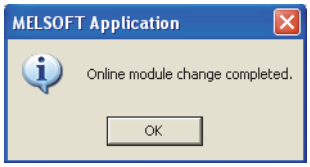


1. **Open the "Online Module Change" window again.**

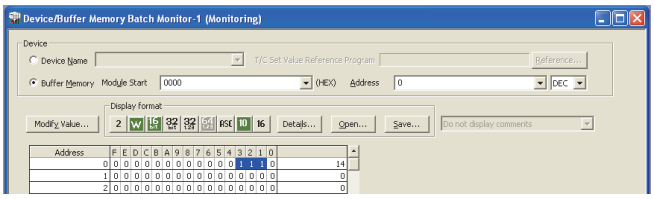
[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.8 When a User Range Is Used and Initial Settings Are Configured Using a Sequence Program (with Another System)

(1) Stopping operation



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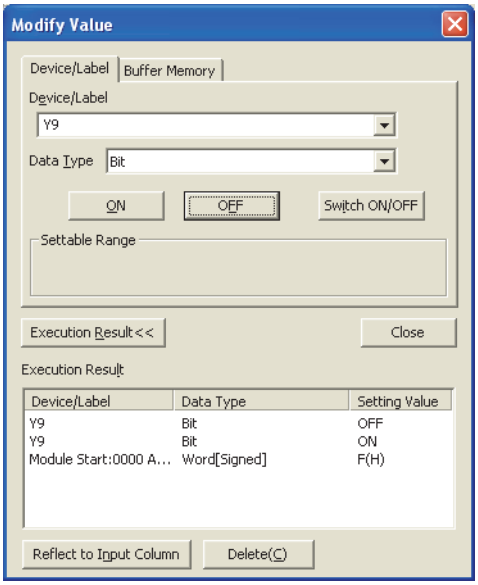


1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

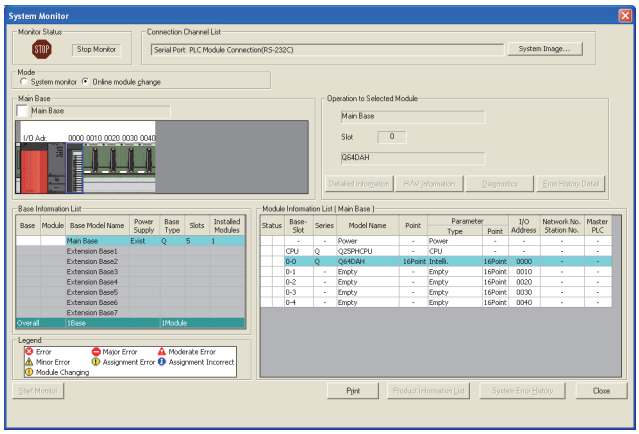
3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**

4. **Turn on Operating condition setting request (Y9).**

5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**

6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

(2) Removing a module



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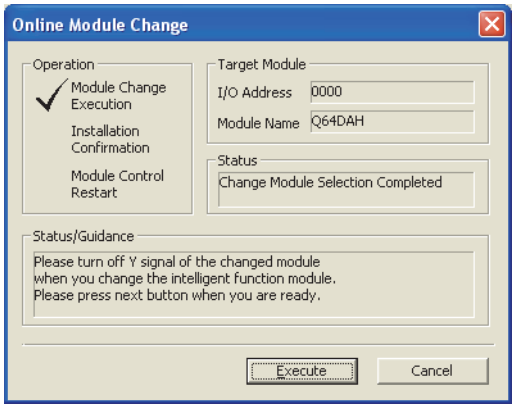


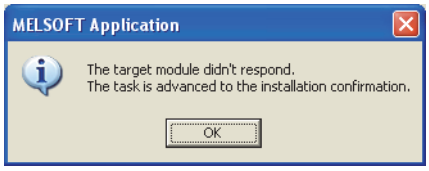
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 193, Section 10.8 (3).**



5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

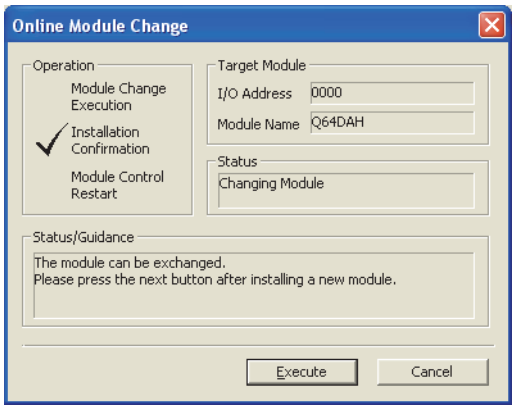
6. **Remove the module.**

Point

Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

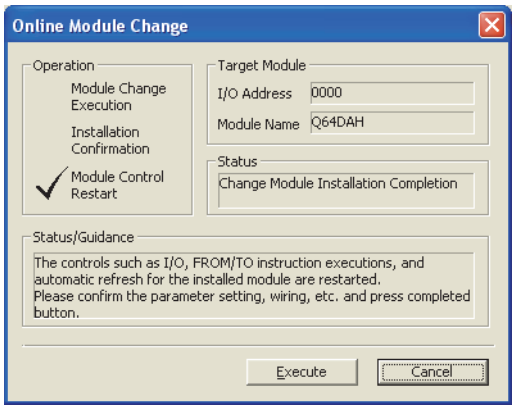
(3) Mounting a new module

1. Mount the removed module and a new module to another system.
2. Using the G(P).OGLOAD instruction, save the offset/gain setting values in the user range from the removed module to the CPU device. For the G(P).OGLOAD instruction, refer to Page 231, Appendix 2.2.
3. Using the G(P).OGSTOR instruction, restore the offset/gain setting values in the user range to a new module. For the G(P).OGSTOR instruction, refer to Page 234, Appendix 2.3.
4. Remove the new module from another system, mount it to the slot from where the old module was removed in the original system, and install the terminal block.
5. After mounting the module, click the Execute button and check that the RUN LED turns on. Module READY (X0) remains off.



(4) Checking operation

1. To check the operation, click the Cancel button to cancel the control restart.



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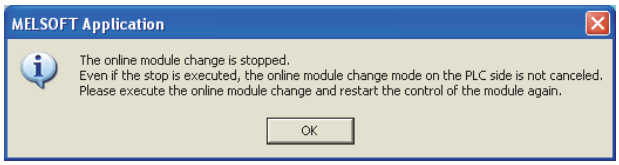

2. **Click the [OK] button to leave the "Online module change" mode.**

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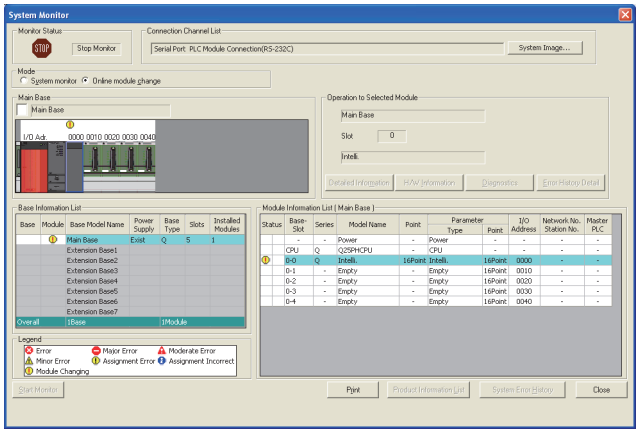

3. **Click the [Close] button to close the "System Monitor" window.**

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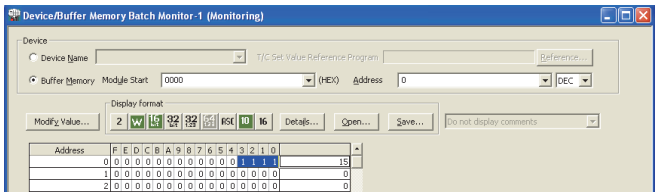

4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

5. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

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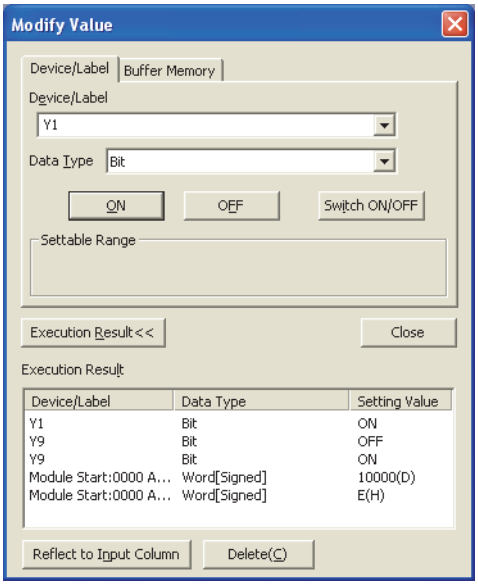


6. **Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.**

7. **Enter and display the buffer memory address of CH☐ Digital value (Un\G1 to Un\G4) of the channel used.**

8. **Set a digital value for CH☐ Digital value (Un\G1 to Un\G4).**

9. **Turn on Operating condition setting request (Y9).**

10. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

11. **Turn on CH☐ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.**
(Note that the analog output is actually performed.)

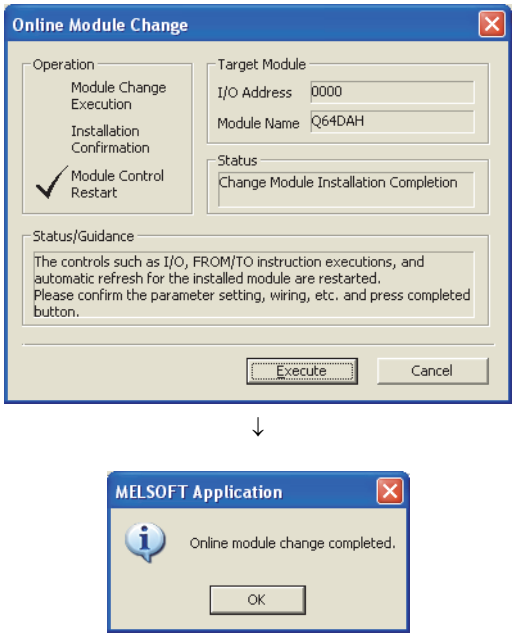
12. **Before restarting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞ Page 212, CHAPTER 11) and take a corrective action.**
- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

13. **Since the new module is in the default status, initial settings must be configured using a sequence program after the control resumed. Before configuring the initial settings, check that the initial setting program is proper, satisfying the following.**

Normal system configuration
- Create a sequence program that sets the initial settings when Module READY (X0) of the D/A converter module turns on.
- Do not create a sequence program which sets the initial settings for only one scan after RUN. In this case, the initial settings are not set.

When used on remote I/O network
- Insert a user device where the initial settings will be set at any timing (initial setting request signal) into the sequence program.
- Do not create a sequence program which sets the initial settings for only one scan after a data link start of the remote I/O network. In this case, the initial settings are not set.

(5) Resuming operation



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1. **Open the "Online Module Change" window again.**

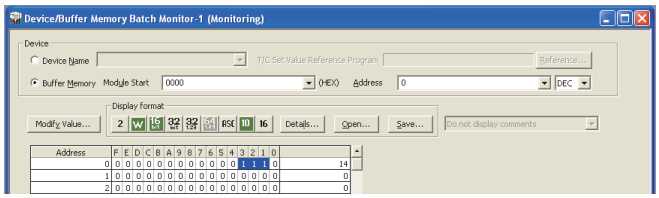
[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.9 When a User Range Is Used and Initial Settings Are Configured Using the Configuration Function (Without Another System)

(1) Stopping operation



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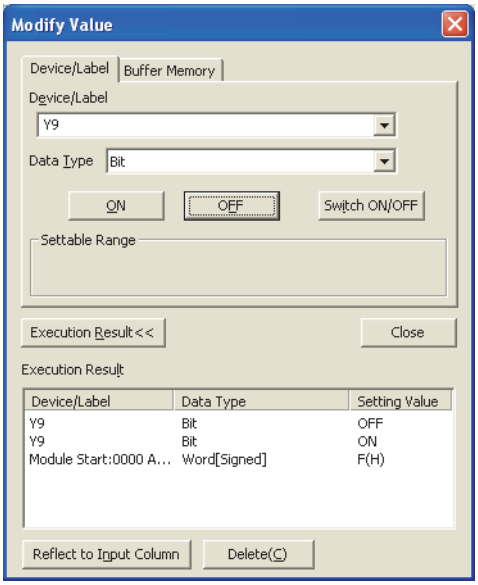

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1. **Open the "Device/Buffer Memory Batch Monitor" window.**

   [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**
4. **Turn on Operating condition setting request (Y9).**
5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**
6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

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7. **If the buffer memory data are not recorded, follow the procedures 8 to 11.**

8. **Set Pass data classification setting (Un\G200).**

9. **Turn on Operating condition setting request (Y9).**

10. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

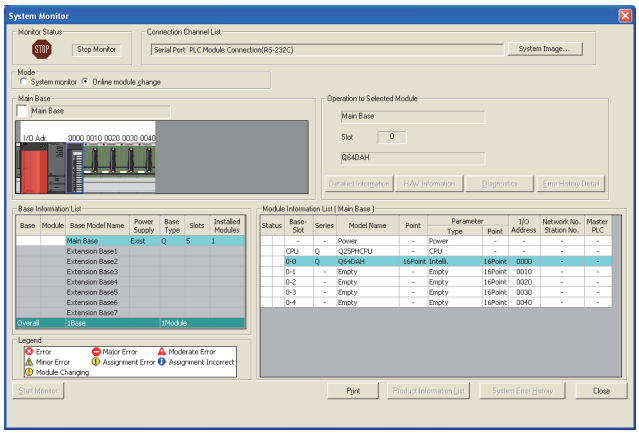
11. **Compare the values in CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217) with the values in the range reference tables (☞ Page 211, Section 10.11).**

12. **If the values are proper, save the values in CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217).**

Point

- If the buffer memory values are improper compared to the reference tables, the offset/gain setting values cannot be saved and restored. Before resuming the control, configure an offset/gain setting according to the flowchart (☞ Page 146, Section 8.5.2).
  Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.
- Switch the mode by setting Mode switching setting (Un\G158, Un\G159) and turning on Operating condition setting request (Y9).

(2) Removing a module



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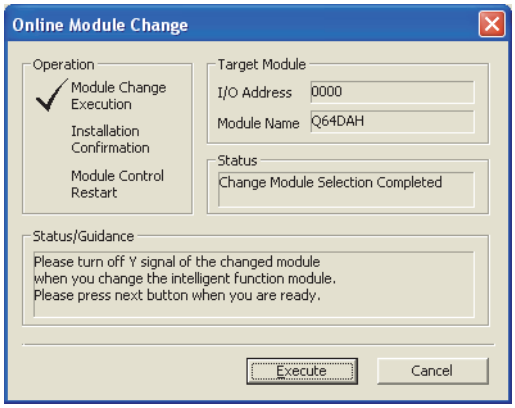


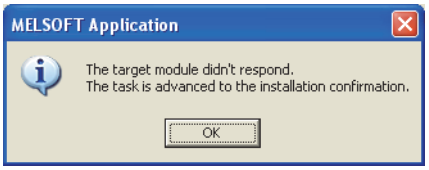
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 200, Section 10.9 (3).**



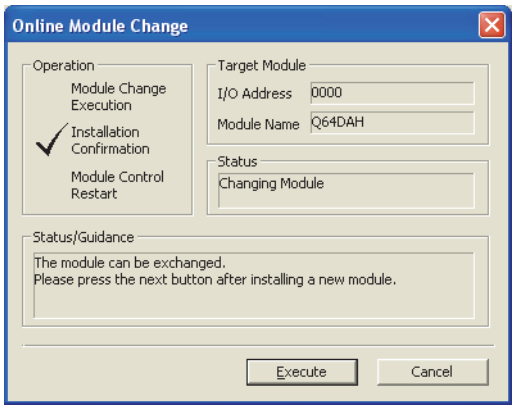
5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

6. **Remove the module.**

Point

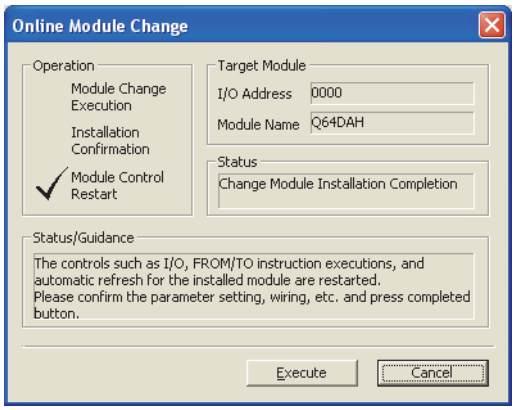
Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

(3) Mounting a new module



1. **Mount a new module in the same slot and install the terminal block.**
2. **After mounting the module, click the [Execute] button and check that the RUN LED turns on. Module READY (X0) remains off.**

(4) Checking operation



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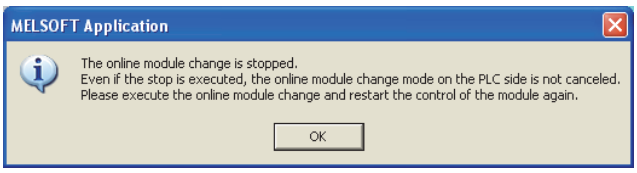

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1. **To check the operation, click the [Cancel] button to cancel the control restart.**
2. **Click the [OK] button to leave the "Online module change" mode.**

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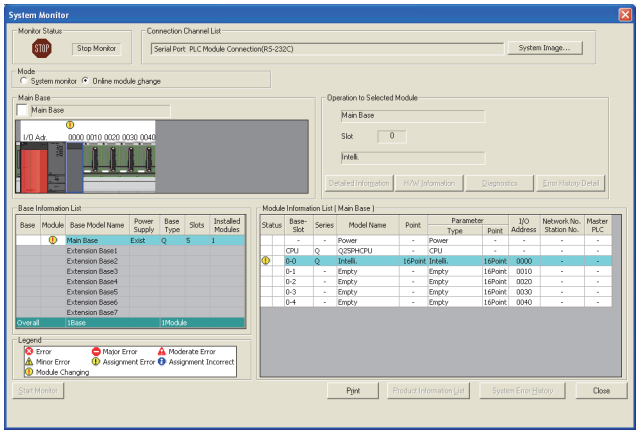

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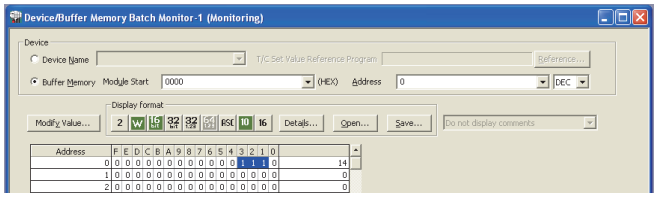

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3. **Click the Close button to close the "System Monitor" window.**

4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

5. **Display the address of the prerecorded buffer memory area and select it. Then click the Modify Value... button.**

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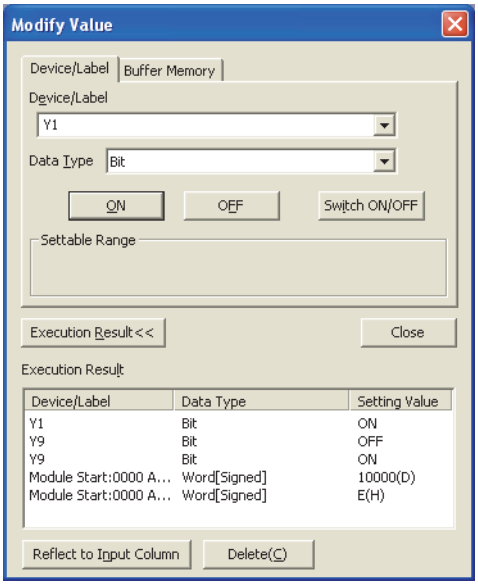


6. **Set the prerecorded data to the buffer memory.**

7. **Turn on User range writing request (YA) to restore the offset/gain setting value in the user range to the module.**

8. **After checking that Offset/gain setting mode flag (XA) is on, turn off User range writing request (YA).**

9. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

10. **Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.**

11. **Enter and display the buffer memory address of CH□ Digital value (Un\G1 to Un\G4) of the channel used.**

12. **Set a digital value for CH□ Digital value (Un\G1 to Un\G4).**

13. **Turn on Operating condition setting request (Y9).**

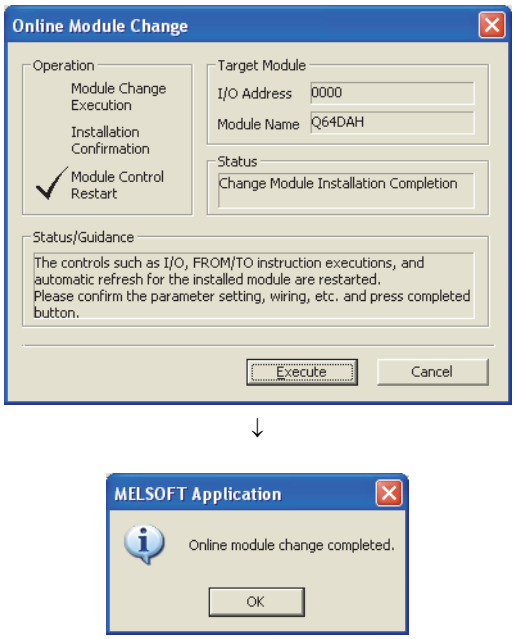
14. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

15. **Turn on CH□ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.**
(Note that the analog output is actually performed.)

16. **Before restarting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞Page 212, CHAPTER 11) and take a corrective action.**

- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

(5) Resuming operation



1. **Open the "Online Module Change" window again.**

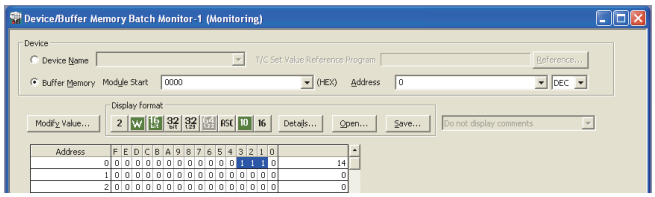
[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.10 When a User Range Is Used and Initial Settings Are Configured Using a Sequence Program (Without Another System)

(1) Stopping operation



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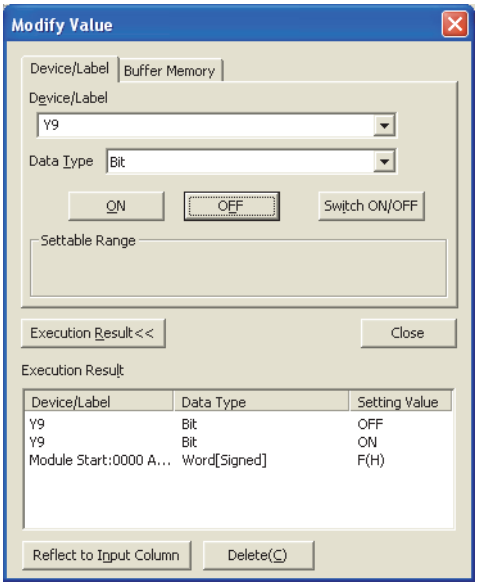

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1. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

2. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

3. **Set D/A conversion enable/disable setting (Un\G0) to Disable (1) for all channels.**

4. **Turn on Operating condition setting request (Y9).**

5. **Check that the D/A conversion has stopped and the analog output value is 0V/0mA.**

6. **After checking the analog output value, check that Operating condition setting completed flag (X9) turns off, then turn off Operating condition setting request (Y9).**

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7. **If the buffer memory data are not recorded, follow the procedures 8 to 11.**

8. **Set Pass data classification setting (Un\G200).**

9. **Turn on Operating condition setting request (Y9).**

10. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

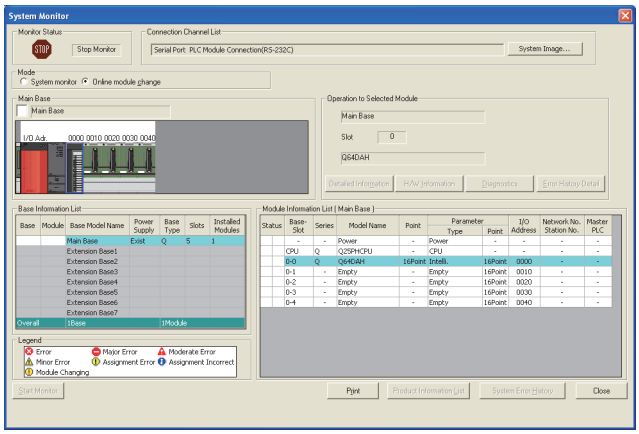
11. **Compare the values in CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217) with the values in the range reference tables (☞ Page 211, Section 10.11).**

12. **If the values are proper, save the values in CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217).**

Point

- If the buffer memory values are improper compared to the reference tables, the offset/gain setting values cannot be saved and restored. Before resuming the control, configure an offset/gain setting according to the flowchart (☞ Page 146, Section 8.5.2).
  Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.
- Switch the mode by setting Mode switching setting (Un\G158, Un\G159) and turning on Operating condition setting request (Y9).

(2) Removing a module



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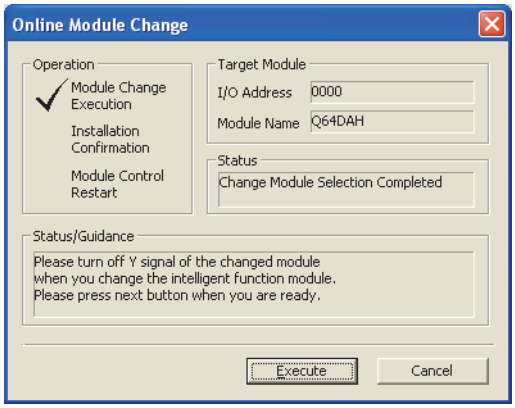


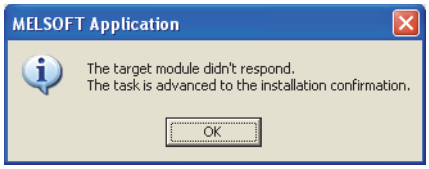
1. **Open the "System Monitor" window.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Select "Online module change" under the "Mode" field and double-click the module name to be changed online.**

3. **Click the Execute button to enable a module change.**

4. **When the following error window appears, click the OK button and perform the operation described in Page 207, Section 10.10 (3).**



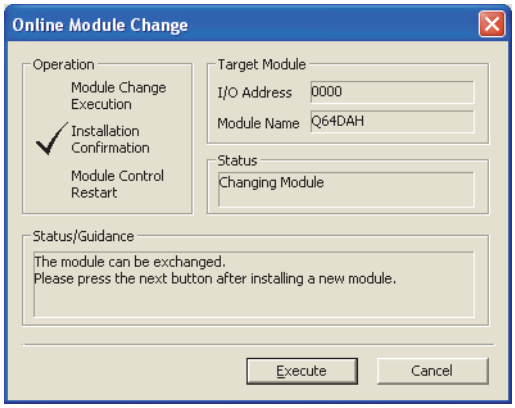
5. **After checking that the RUN LED of the module has turned off, remove the terminal block.**

6. **Remove the module.**

Point

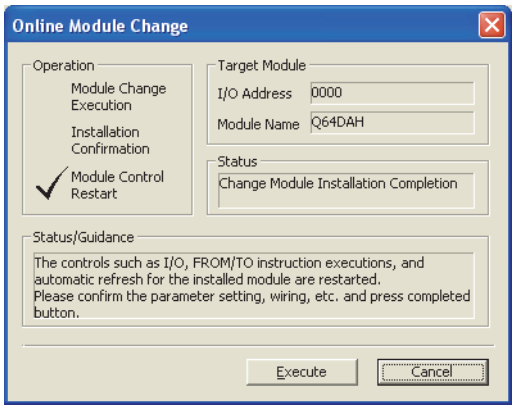
Always remove the module. If mounting confirmation is made without the module being removed, the module will not start properly and the RUN LED will not turn on.

(3) Mounting a new module



1. **Mount a new module in the same slot and install the terminal block.**
2. **After mounting the module, click the [Execute] button and check that the RUN LED turns on. Module READY (X0) remains off.**

(4) Checking operation



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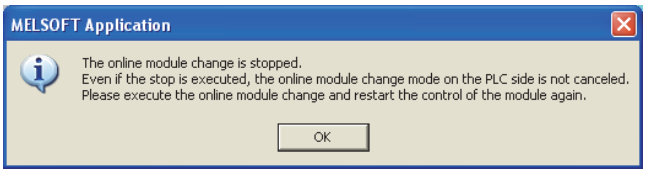

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1. **To check the operation, click the [Cancel] button to cancel the control restart.**
2. **Click the [OK] button to leave the "Online module change" mode.**

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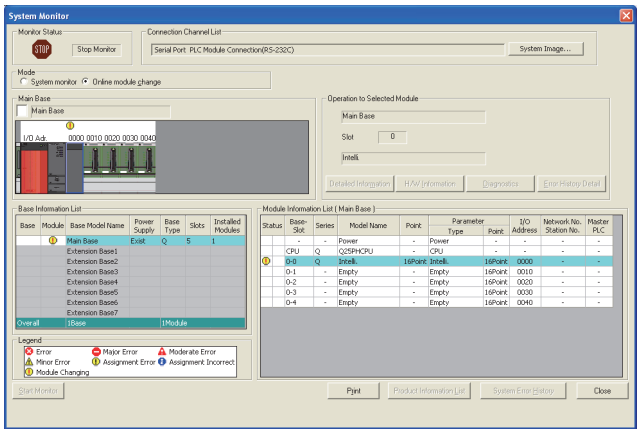

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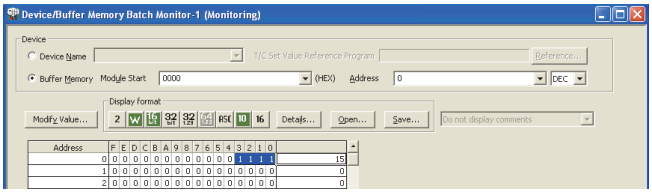

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3. **Click the Close button to close the "System Monitor" window.**

4. **Open the "Device/Buffer Memory Batch Monitor" window.**

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

When using GX Developer, open the "Device test" window.

[Online] ⇨ [Debug] ⇨ [Device test...]

5. **Display the address of the prerecorded buffer memory area and select it. Then click the Modify Value... button.**

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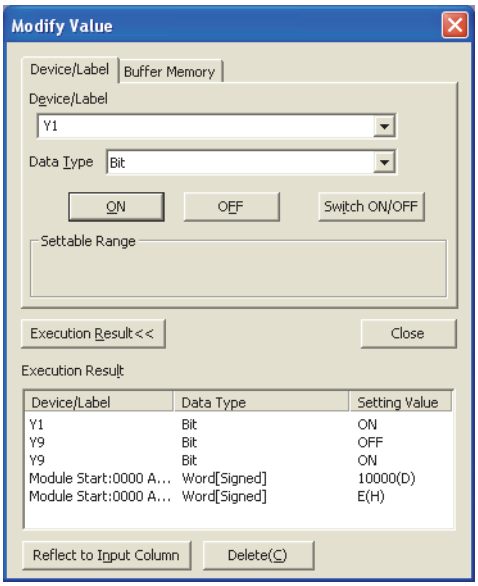

6. **Set the prerecorded data to the buffer memory.**

7. **Turn on User range writing request (YA) to restore the offset/gain setting value in the user range to the module.**

8. **After checking that Offset/gain setting mode flag (XA) is on, turn off User range writing request (YA).**

9. **Enter and display the buffer memory address of D/A conversion enable/disable setting (Un\G0).**

10. **Set D/A conversion enable/disable setting (Un\G0) to Enable (0) for the channel used.**

11. **Enter and display the buffer memory address of CH□ Digital value (Un\G1 to Un\G4) of the channel used.**

12. **Set a digital value for CH□ Digital value (Un\G1 to Un\G4).**

13. **Turn on Operating condition setting request (Y9).**

14. **Check that Operating condition setting completed flag (X9) turns off, and turn off Operating condition setting request (Y9).**

15. **Turn on CH□ Output enable/disable flag (Y1 to Y4) for the channel used to check that the D/A conversion is performed properly.**
(Note that the analog output is actually performed.)

16. **Before restarting the control, check the D/A converter module for the following. If an error occurs, refer to TROUBLESHOOTING (☞ Page 212, CHAPTER 11) and take a corrective action.**
- If the RUN LED is on.
- If the ERR. LED is off.
- If Error flag (XF) is off.

17. **Since the new module is in the default status, initial settings must be configured using a sequence program after the control resumed. Before configuring the initial settings, check that the initial setting program is proper, satisfying the following.**
Normal system configuration
- Create a sequence program that sets the initial settings when Module READY (X0) of the D/A converter module turns on.
- Do not create a sequence program which sets the initial settings for only one scan after RUN. In this case, the initial settings are not set.

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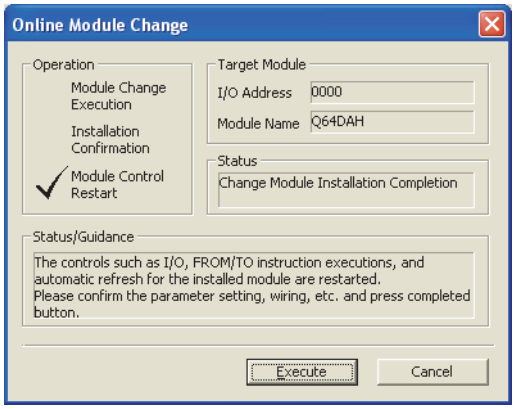
When used on remote I/O network

- Insert a user device where the initial settings will be set at any timing (initial setting request signal) into the sequence program.
- Do not create a sequence program which sets the initial settings for only one scan after a data link start of the remote I/O network. In this case, the initial settings are not set.

(5) Resuming operation



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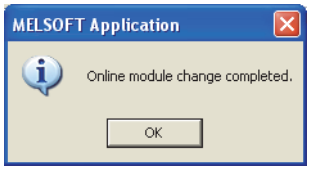


1. **Open the "Online Module Change" window again.**

[Diagnostics] ⇨ [Online Module Change...]

2. **Click the Execute button on the appeared window to resume control. Module READY (X0) turns on.**

3. **The online module change is completed.**

10.11 Range Reference Table

This section lists range reference used for an online module change.

(1) CH1 Industrial shipment settings offset value (Un\G202) to CH4 Industrial shipment settings gain value (Un\G209)

The reference values differs depending on the setting of Pass data classification setting (Un\G200) (voltage or current).

Address (decimal)				Description	Pass data classification setting	Reference value (hexadecimal)
CH1	CH2	CH3	CH4			
202	204	206	208	Industrial shipment settings offset value	Voltage	Approx. 8000_H
					Current	Approx. 8000_H
203	205	207	209	Industrial shipment settings gain value	Voltage	Approx. $F712_H$
					Current	Approx. $F166_H$

(2) CH1 User range settings offset value (Un\G210) to CH4 User range settings gain value (Un\G217)

Offset/gain value		Reference value (hexadecimal)
Voltage	0V	Approx. 8000_H
	1V	Approx. $8BE8_H$
	5V	Approx. $BB89_H$
	10V	Approx. $F712_H$
Current	0mA	Approx. 8000_H
	4mA*1	Approx. $96AE_H$
	20mA*2	Approx. $F166_H$

*1 This is the value that is stored in User range settings offset value by default.

*2 This is the value that is stored in User range settings gain value by default.

CHAPTER 11 TROUBLESHOOTING

This chapter describes errors that may occur while the D/A converter module is used, and those troubleshooting.

11.1 Error Code List

This section describes error codes that occur in a D/A converter module.

(1) Error code checking method

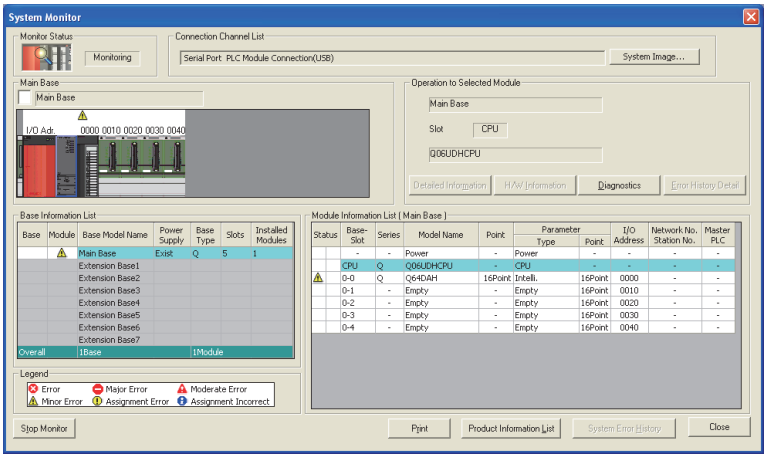
The errors that occur in the D/A converter module can be checked with the following methods.
Choose a method depending on the purpose and application.

- Checking on the "Module's Detailed Information" window (☞Page 213, Section 11.1 (1) (a))
- Checking in Latest error code (Un\G19) (☞Page 213, Section 11.1 (1) (b))
- Checking through the module error collection function (☞Page 214, Section 11.1 (1) (c))

(a) Checking on the "Module's Detailed Information" window

The following section describes how to check the errors on the module detailed information.

[Diagnostics] ⇨ [System Monitor]



1. **Select the D/A converter module in "Main Base" and click the Detailed Information button.**

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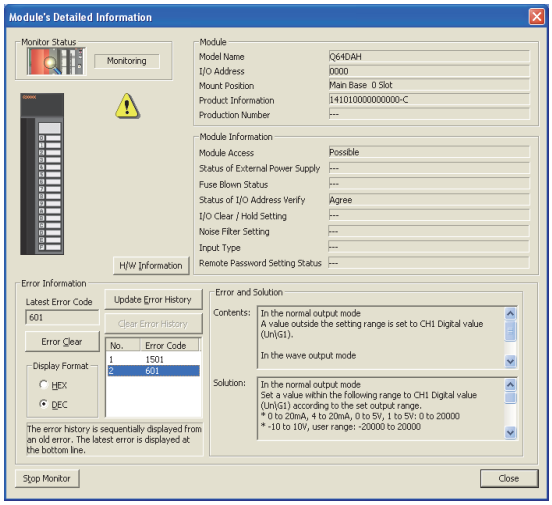
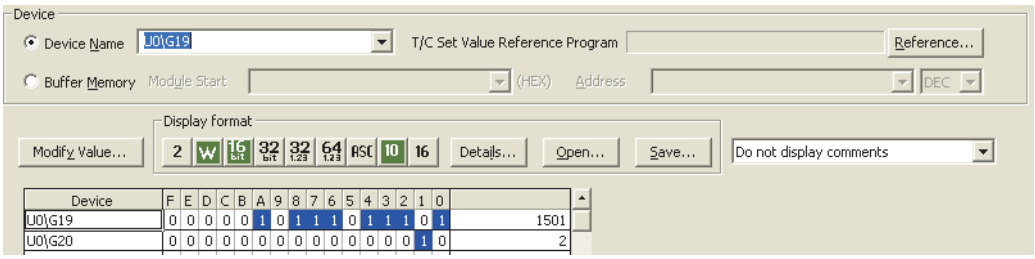


2. **"Module's Detailed Information" of the D/A converter module is displayed.**

(b) Checking in Latest error code (Un\G19)

The following section describes how to check the errors in Latest error code (Un\G19).

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]



Point

When multiple errors or multiple warnings occur, the latest error code or latest alarm code is stored in Latest error code (Un\G19).

(c) Checking through the module error collection function

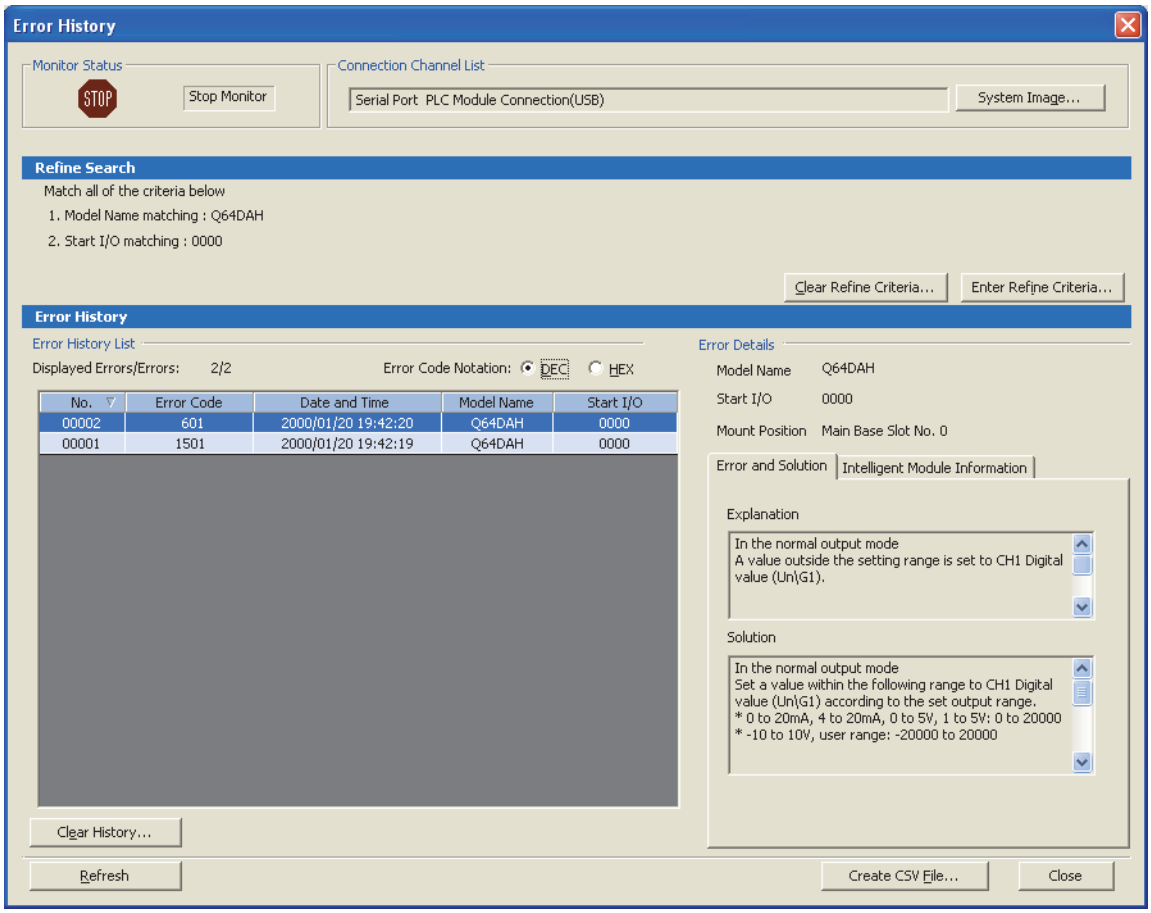
The errors that occurred in the D/A converter module can be saved in the CPU module using the module error collection function.

The error details are held even after the power is turned off or the CPU module is reset.

- How to check the errors through the module error collection function

  To check the errors of the D/A converter module collected by the CPU module, open the "Error History" window.

  [Diagnostics] ⇨ [System Monitor...] ⇨ Click the Error History Detail button.



- Errors to be collected

  The contents under Error code list (Page 215, Section 11.1 (2)) are reported to the CPU module.

(2) Error code list

The following table lists error codes.

The error code of an error that occurred is stored in Latest error code (Un\G19).

At the same time, the D/A converter module reports the errors to the CPU module.

Error code (decimal)	Description and the error cause	Action
10□	The output range is set with a value outside the setting range for Switch 1 of the intelligent function module switch setting. The channel where the error has occurred fits in □.	Set a valid value on the intelligent function module switch setting in the parameter setting.
111	A hardware failure occurs in the module.	Power off and then on the module. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
112	A value other than 0 is set to Switch 5 on the intelligent function module switch setting.	Set 0 to Switch 5 on the intelligent function module switch setting in the parameter setting.
113*1	The flash memory data is an error.	Check the analog output value. If the error occurs again, please consult your local Mitsubishi representative.
114	The output mode setting is set with a value outside the setting range for Switch 4 of the intelligent function module switch setting.	Set a valid value to Switch 4 on the intelligent function module switch setting in the parameter setting.
120*1*2	An invalid value is set to the offset/gain setting. The number of an error channel cannot be identified.	Perform offset/gain setting again for all channels where the user range setting has been configured. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
12□*1*3	An invalid value is set to the offset/gain setting. The channel where the error has occurred fits in □.	Start over the offset/gain setting of the channel where the error has occurred. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
161*1*4	The G(P).OGSTOR instruction was executed in the offset/gain setting mode or the wave output mode.	Do not execute the G(P).OGSTOR instruction in the offset/gain setting mode or the wave output mode.
162*1	• The G(P).OGSTOR instruction has been consecutively executed. • For the offset/gain setting, a setting value has been consecutively written to the flash memory more than 25 times.	• Execute the G(P).OGSTOR instruction once per module. • Write the setting value into the flash memory only once for each offset/gain setting.
163*1	• The G(P).OGSTOR instruction has been executed on a module different from the one on which the G(P).OGLOAD instruction was executed. • The G(P).OGSTOR instruction has been executed ahead of the G(P).OGLOAD instruction.	• Execute the G(P).OGLOAD and G(P).OGSTOR instructions to the same module. • After executing the G(P).OGLOAD instruction on the module from which data is saved, execute the G(P).OGSTOR instruction on the module to which the data is restored.
170*1	The offset/gain setting is configured exceeding the maximum number of times.	No more offset/gain setting is reflected on the operation successfully.
20□*1	Operating condition setting request (Y9) was turned on and off in a status other than "wave output stop". The channel where the error has occurred fits in □.	Turn on and off Operating condition setting request (Y9) after stopping wave output in all channels.
21□*1	Scaling function is enabled in the wave output mode. The channel where the error has occurred fits in □.	Set Disable (1) to Scaling enable/disable setting (Un\G53) in the wave output mode.

Error code (decimal)	Description and the error cause	Action
22□[*1]	Both the user range and a wave output mode are set in the intelligent function module switch setting. The channel where the error has occurred fits in □.	• When using the wave output mode, set an output range other than the user range on the intelligent function module switch setting in the parameter setting. • When using the user range, set the normal output mode to Switch 4 on the intelligent function module switch setting in the parameter setting.
23□[*1]	A value other than 0 to 2 is set to CH□ Wave output start/stop request (Un\G1000 to Un\G1003). The channel where the error has occurred fits in □.	Set one of the following to CH□ Wave output start/stop request (Un\G1000 to Un\G1003). • Wave output stop request (0) • Wave output start request (1) • Wave output pause request (2)
30□[*1]	A value other than 0 to 2 is set to CH□ Output setting during wave output stop (Un\G1008 to Un\G1011). The channel where the error has occurred fits in □.	Set one of the following to CH□ Output setting during wave output stop (Un\G1008 to Un\G1011). • 0V/0mA (0) • Offset value (1) • Output value during wave output stop (2)
31□[*1]	A value outside the setting range is set to CH□ Output value during wave output stop (Un\G1016 to Un\G1019). The channel where the error has occurred fits in □.	Set a value within the following range to CH□ Output value during wave output stop (Un\G1016 to Un\G1019) according to the set output range. • 0 to 20mA, 4 to 20mA, 0 to 5V, 1 to 5V: 0 to 20000 • -10 to 10V: -20000 to 20000
32□[*1]	A value other than 5000 to 54999 is set to CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031). The channel where the error has occurred fits in □.	Set a value within 5000 to 54999 to CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031).
33□[*1]	A value other than 1 to 50000 is set to CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047). The channel where the error has occurred fits in □.	Set a value within 1 to 50000 to CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047)
34□[*1]	A value outside the setting range is set to CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059). The channel where the error has occurred fits in □.	Set one of the following to CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059). • Unlimited repetition (-1) • Specified number of times (1 to 32767)
35□[*1]	A value other than 1 to 5000 is set to CH□ Constant for wave output conversion cycle (Un\G1064 to Un\G1067). The channel where the error has occurred fits in □.	Set a value within 1 to 5000 to CH□ Constant for wave output conversion cycle (Un\G1064 to Un\G1067).
360[*1]	A value other than 0 and 1 is set to Step action wave output request (Un\G1072).	Set OFF (0) or ON (1) to Step action wave output request (Un\G1072).
37□[*1]	The value obtained from the following formula is greater than 54999 (last buffer memory address in Wave data registry area). CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031) + CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047) - 1 The channel where the error has occurred fits in □.	Set the values in CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031) and CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047) so that they meet the following condition: • ["Wave pattern start address setting" + "Wave pattern data points setting" - 1] is equal to or smaller than 54999.
40□[*1]	When the user range setting is performed or restored, the offset value is greater than or equal to the gain value. The channel where the error has occurred fits in □.	Correct the value so that the offset value may be smaller than the gain value.

Error code (decimal)	Description and the error cause		Action
500*1	• When the offset/gain setting is performed, several channels have been set. • In offset/gain setting, channel numbers or "0" is set for both Offset/gain setting mode Offset specification (Un\G22) and Offset/gain setting mode Gain specification (Un\G23).		Correct the Offset/gain setting mode Offset specification (Un\G22) value and/or the Offset/gain setting mode Gain specification (Un\G23) value.
60□*1	In the normal output mode	A value outside the setting range is set to CH□ Digital value (Un\G1 to Un\G4). The channel where the error has occurred fits in □.	Set a value within the following range to CH□ Digital value (Un\G1 to Un\G4) according to the set output range. • 0 to 20mA, 4 to 20mA, 0 to 5V, 1 to 5V: 0 to 20000 • -10 to 10V, user range: -20000 to 20000 However, when Scaling enable/disable setting (Un\G53) is set to Enable (0), set a value within the following range. • CH□ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60), CH□ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61)
	In the wave output mode	A digital value outside the setting range is set to a part of areas used for channel wave output in Wave data registry area (Un\G5000 to Un\G54999). The channel where the error has occurred fits in □.	Set a value within the following range to the corresponding part of areas used for the channel in Wave data registry area (Un\G5000 to Un\G54999) according to the set output range. • 0 to 20mA, 4 to 20mA, 0 to 5V, 1 to 5V: 0 to 20000 • -10 to 10V: -20000 to 20000 (The error can be checked in CH1 Wave output digital value outside the range Address monitor (L) (Un\G1156) to CH4 Wave output digital value outside the range Address monitor (H) (Un\G1163).)
62□*1	Among CH1 Warning output upper limit value (Un\G86) to CH4 Warning output lower limit value (Un\G93), any of the lower limit value is greater than or equal to the corresponding upper limit value. The channel where the error has occurred fits in □.		Correct the value so that the upper limit value may be greater than the lower limit value.
700*1	In offset/gain setting mode, a value set to Offset/gain adjustment value specification (Un\G24) is outside the range.		Set a value within -3000 to 3000 to Offset/gain adjustment value specification (Un\G24).
90□*1	A value outside -32000 to 32000 is set to any of CH1 Scaling lower limit value (Un\G54) to CH4 Scaling upper limit value (Un\G61). The channel where the error has occurred fits in □.		Set a value within the range of -32000 to 32000 in CH1 Scaling lower limit value (Un\G54) to CH4 Scaling upper limit value (Un\G61).
91□*1	Among CH1 Scaling lower limit value (Un\G54) to CH4 Scaling upper limit value (Un\G61), any of the lower limit value is greater than or equal to the corresponding upper limit value. The channel where the error has occurred fits in □.		Correct the value so that the upper limit value may be greater than the lower limit value.

*1 This error code can be cleared by setting a value within the setting range and performing either of the following operations.
• Turning on and off Error clear request (YF)
• Turning on and off Operating condition setting request (Y9)

*2 If an error occurs, D/A conversion performed in all channels will stop.
Therefore, after performing the offset/gain setting again, reconfigure initial settings.

*3 If an error occurs, D/A conversion performed in the error channel will stop.
Therefore, after performing the offset/gain setting again, reconfigure initial settings.

*4 An error code is not stored in Latest error code (Un\G19) but in the completion status of the G(P). OGSTOR instruction Ⓢ +1.

Point

For the Switch 1 to 5, refer to the following.

- Intelligent function module switch setting (☞Page 238, Appendix 3.1 (2))

11.2 Alarm Code List

This section describes alarm codes that occur in a D/A converter module.

(1) Alarm code checking method

Alarms occurred in the D/A converter module can be checked by the same methods as those for errors.

(☞Page 212, Section 11.1 (1))

(2) Alarm Code List

The following table lists alarm codes.

Alarm code (decimal)	Description and the alarm cause	Action	
15△□	A warning is occurring. The channel where the warning has occurred fits in □. A value that fits in △ indicates that the warning status is as follows: 0: Upper limit of a warning 1: Lower limit of a warning	In the normal output mode	Set a value within the following range to CH□ Digital value (Un\G1 to Un\G4), and turn on and off Warning output clear request (YE). • Warning upper limit value ≥ Set value ≥ Warning lower limit value
		In the wave output mode	Set a value within the following range to the corresponding part of areas used for the channel in Wave data registry area (Un\G5000 to Un\G54999). Then, turn on and off Warning output clear request (YE). • Warning upper limit value ≥ Set value ≥Warning lower limit value (The error data can be checked in CH1 Wave output warning Address monitor (L) (Un\G1172) to CH4 Wave output warning Address monitor (H) (Un\G1179).)

11.3 Troubleshooting

11.3.1 When the RUN LED flashes or turns off

(1) When flashing

Check item	Cause	Action
Is the offset/gain setting mode set?	The drive mode setting is set to the offset/gain setting mode in the switch setting.	Set the drive mode setting to the normal output mode in the switch setting. After that, turn off and on the power, or reset the CPU module.
	The instruction (G(P).OFFGAN) was executed and the mode was switched to the offset/gain setting mode.	When using the D/A converter module in the normal output mode, check whether the program using the G(P).OFFGAN has been accidentally executed.
	The value set in Mode switching setting (Un\G158, Un\G159) was changed and the mode was switched to the offset/gain setting mode.	When using the D/A converter module in the normal output mode, check whether the program to change a value in Mode switching setting (Un\G158, Un\G159) has been accidentally executed.

(2) When turning off

Check item	Action
Is the power supplied?	Check that the supply voltage of power supply module is within the rated range.
Is the capacity of power supply module enough?	Check that the power capacity is enough by calculating the current consumption of such as the CPU module, I/O modules, and intelligent function modules mounted on the base unit.
Is the module mounted on the base unit properly?	Check the module connection.
Is a module change enabled during an online module change?	Refer to the following and take the corrective action. • ONLINE MODULE CHANGE (☞ Page 170, CHAPTER 10)
Other than the above	A watchdog timer error may have occurred. Reset the CPU module and check that the RUN LED turns on. If the RUN LED does not turn on, the module may have failed. Please consult your local Mitsubishi representative.

11.3.2 When the ERR. LED turns on or flashes

(1) When turning on

Check item	Action
Does any error occur?	Check Latest error code (Un\G19), and take actions described in the error code list. • Error Code List (☞ Page 215, Section 11.1 (2))

(2) When flashing

Check item	Action
Is the value other than 0 set for Switch 5 of the intelligent function module switch setting?	With the parameter setting, set 0 for Switch 5 in the intelligent function module switch setting.

11.3.3 When the ALM LED turns on

Check item	Action
Is there any warning?	Check Warning output flag (Un\G48) and Latest error code (Un\G19). For the action, refer to the following. • Alarm Code List (☞ Page 219, Section 11.2 (2))

11.3.4 When analog output value does not come out

Check item	Action
Is the external power supply 24VDC supplied?	Check External power supply READY flag (X7), and if the flag is turned off, provide a 24VDC power supply to the external power supply terminal (pin number 16, 17).
Is there any problem with wiring, such as off or disconnection of analog signal lines?	Check the faulty area by checking the signal line visually or conductively.
Is the CPU module in the STOP status?	Change the status of the CPU module to RUN.
Is the offset/gain setting correct?	After turning on and off Operating condition setting request (Y9), compare the values of CH1 User range settings offset value (Un\G210) to CH4 User range settings gain value (Un\G217) with the values in the range reference tables. If the stored values are not desired offset/ gain values, perform the offset/gain setting again. For the range reference table, refer to the following. • Range Reference Table(☞ Page 211, Section 10.11)
Is the output range setting correct?	Check Setting range (Un\G20). When the output range setting is not correct, configure the switch setting again.
Is D/A conversion enable/disable setting (Un\G0) of the channel to output a signal set to D/A conversion disable (1)?	Check D/A conversion enable/disable setting (Un\G0). And then, correct the value to D/A conversion enable (0) with the sequence program or the parameter setting.
Is CH☐ Output enable/disable flag (Y1 to Y4) of the channel to output a signal turned off?	Check the status of CH☐ Output enable/disable flag (Y1 to Y4). If CH☐ Output enable/disable flag (Y1 to Y4) is off, review the sequence program. Or check that the CPU module is not in STOP status.
Is any digital value written to the channel to output?	Check CH☐ Digital value (Un\G1 to Un\G4).
Has Operating condition setting request (Y9) been executed?	Turn on and off Operating condition setting request (Y9) and check that analog values are output properly. When analog values are output properly, check whether descriptions related to Operating condition setting request (Y9) are correct or not in the sequence program.

Point

If the analog output value does not come out even after the above actions are taken, the module may be failed. Please consult your local Mitsubishi representative.

11.3.5 When HOLD of analog output value is not available

Check item	Action
Is the setting for the analog output HOLD/CLEAR function correct?	Check HOLD/CLEAR function setting (Un\G26). If the setting is not correct, configure the switch setting again.
Is the D/A converter module used in the MELSECNET/H remote I/O station?	Refer to the points in the following section and check that the setting is made for using the analog output HOLD/CLEAR function in the MELSECNET/H remote I/O station. • Analog Output HOLD/CLEAR Function (☞ Page 32, Section 4.4)

11.3.6 When analog value is not output in the wave output mode

Check the items in the following procedure.

No.	Check item		Action
1	Checking the switch setting	Is the Drive Mode Setting correct?	Check that Offset/gain setting mode flag (XA) is off. Then, check Normal (D/A Converter Processing) Mode is set for the Drive Mode Setting. If Normal (D/A Converter Processing) Mode is not set, set Drive Mode Setting to Normal (D/A Converter Processing) Mode.
		Is the output mode setting correct?	Check whether the wave output mode is set for the output mode setting using Output mode (Un\G9). If the wave output mode is not set, set Output mode setting to either of the following. • Wave output mode (conversion speed: 50μs/CH) • Wave output mode (conversion speed: 80μs/CH)
		Is User Range Setting selected?	Do not select User Range Setting for Output range when using the wave output mode. If Output range is set to User Range Setting, select a value other than User Range Setting for Output range.
2	Checking the program	Is D/A conversion enable/disable setting (Un\G0) of the channel to output a wave signal set to D/A conversion disable (1)?	Check D/A conversion enable/disable setting (Un\G0) and set D/A conversion enable (0).
		Is Operating condition setting request (Y9) being executed?	Turn on and off Operating condition setting request (Y9) to enable the parameter setting of the wave output function.
		Is any value written to Wave data registry area (Un\G5000 to Un\G54999) which is used for the channel to output a wave signal?	Check the value in Wave data registry area (Un\G5000 to Un\G54999) which is used for the channel to output a wave signal. During a pause of the wave output, the monitors of the wave output function can be checked. After setting the analog output HOLD/CLEAR function to HOLD, set CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output pause request (2) to pause the wave output. Then, check the monitors.
		Is CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) of the channel to output a wave signal set to Wave output stop request (0)?	Check CH☐ Wave output status monitor (Un\G1100 to Un\G1103) of the channel to output a wave signal. If CH☐ Wave output status monitor (Un\G1100 to Un\G1103) is set to Wave output stop (0), set CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) to Wave output start request (1).
		Is CH☐ Output enable/disable flag (Y1 to Y4) of the channel to output a wave signal on?	Check the status of CH☐ Output enable/disable flag (Y1 to Y4). If CH☐ Output enable/disable flag (Y1 to Y4) is off, review the sequence program.
3	Checking the connection method	Is the external power supply 24VDC supplied?	Check External power supply READY flag (X7), and if the flag is turned off, provide a 24VDC power supply to the external power supply terminal (pin number 16, 17).

Point

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

• Wave Output Function (☞Page 44, Section 4.8)

11.3.7 When External power supply READY flag (X7) does not turn on

Check item	Action
Is the external power supply 24VDC supplied? (1) Is the wiring correct? (2) Is the external power supply 24VDC supplied within the specified range?	(1) Wire external devices by referring to the External wiring. (☞ Page 137, Section 7.4.2) (2) Supply the 24VDC power within the range described in the Performance specifications list. (☞ Page 22, Section 3.2.1)
Other than the above	The D/A converter module may have failed. Please consult your local Mitsubishi representative.

11.4 Checking the D/A Converter Module Status on GX Works2 System Monitor

To check the LED status or the setting status of the intelligent function module switch setting, select the "H/W Information" of the D/A converter module on the system monitor of GX Works2.

(1) Hardware LED information

LED status is displayed.

No.	LED name	Status
1)	RUN LED	0000_H: Indicates that the LED is off. 0001_H: Indicates that the LED is on. Alternating indication between 0000_H and 0001_H: Indicates that the LED is flashing. (GX Works2 displays the communication status with the D/A converter module. The values 0000_H and 0001_H are not always displayed evenly.)
2)	ERR. LED	
3)	ALM LED	

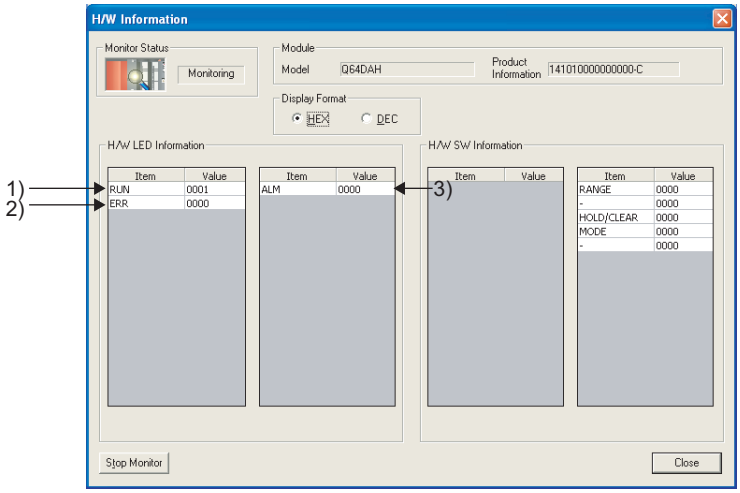
(2) Hardware switch information

The setting status of the intelligent function module switch setting is displayed.

For details on the setting status, refer to the following.

- Intelligent function module switch setting (Page 238, Appendix 3.1 (2))

Item	Intelligent function module switch
RANGE	Switch 1
–	Switch 2
HOLD/CLEAR	Switch 3
MODE	Switch 4
–	Switch 5



APPENDICES

Appendix 1 Modification of the Function

This section describes the modified function of the D/A converter module.

Modified function	Product information (first five digits) of applicable D/A converter module	Version of applicable GX Works2	Reference
Wave output step action function	15042 or later	-	Page 80, Section 4.8.4

(1) Wave output step action function

In modified function, the procedure of changing a digital value of wave data that is currently being output and changing analog output accordingly is simplified by using CH☐ Output enable/disable flag (Y1 to Y4) in combination with other factors during the wave output step action.

The procedure is shown below.

1. **Turn off CH☐ Output enable/disable flag (Y1 to Y4).**
2. **Change a digital value of wave data that is currently being output to a digital value corresponding to an analog value to be output.**
3. **Turn on CH☐ Output enable/disable flag (Y1 to Y4).**

(a) When a D/A converter module not supporting the modified function is used

To change a digital value of wave data that is currently being output and then change analog output accordingly, follow the procedure below.

1. **Turn off CH☐ Output enable/disable flag (Y1 to Y4).**
2. **Set a value in CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) to shift to another address from which wave data is to be output.**
3. **Change a digital value of wave data with the address before the shift to a digital value corresponding to an analog value to be output.**
4. **Set a value in CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) to shift to the previous address where a digital value of wave data has been changed.**
5. **Turn on CH☐ Output enable/disable flag (Y1 to Y4).**

Appendix 2 Dedicated Instruction

(1) Dedicated instruction

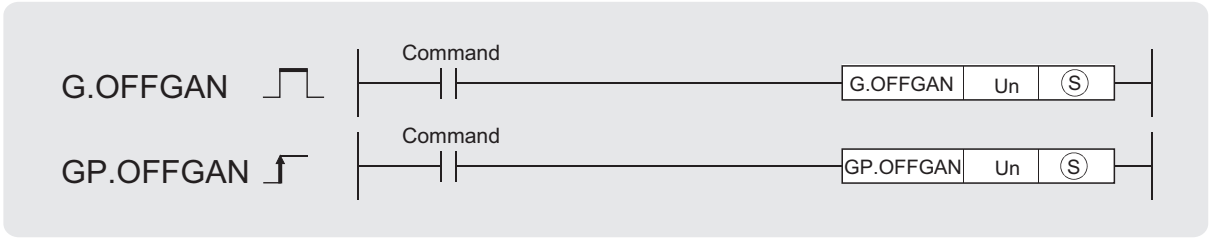
The following table lists the dedicated instructions that can be used in a D/A converter module.

Instruction	Description
G(P).OFFGAN	• The mode is switched from the normal output mode to the offset/gain setting mode. • The mode is switched from the offset/gain setting mode to the normal output mode.
G(P).OGLOAD	The offset/gain setting value in the user range setting is read out to the CPU module.
G(P).OGSTOR	The offset/gain setting value in the user range setting stored in the CPU module is restored to the D/A converter module.

Point

When the module is mounted on a MELSECNET/H remote I/O station, the dedicated instructions cannot be used.

Appendix 2.1 G(P).OFFGAN



Setting data	Internal device		R, ZR	J□\□		U□\□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	-	○		-					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FE_H	BIN 16 bits
Ⓢ	Mode change 0: switch to the normal output mode 1: switch to the offset/gain setting mode When a value other than above is set, the mode is switched to the offset/gain setting mode. The mode cannot be switched to the wave output mode.	0, 1	BIN 16 bits

(2) Functions

This instruction switches the mode of the D/A converter module. The following table lists the G(P).OFFGAN execution result of each mode.

Setting dataⓈ	Mode of when G(P).OFFGAN is executed			
	Offset/gain setting mode	Normal output mode	Wave output mode (conversion speed: 50μs/CH)	Wave output mode (conversion speed: 80μs/CH)
0: switch to the normal output mode	To the normal output mode*1	Invalid	Invalid	Invalid
1: switch to the offset/gain setting mode	Disable	To the offset/gain setting mode*2		
Other than above				

*1 Offset/gain setting mode flag (XA) turns off and the RUN LED turns on.
*2 Offset/gain setting mode flag (XA) turns on and the RUN LED flashes.

Point

- When the mode is switched from the offset/gain setting mode to the normal output mode, Module READY (X0) turns on. Note that if a sequence program includes the initial settings to be executed at ON of Module READY (X0), this instruction performs the initial setting process.
- When the mode is switched, the D/A conversion stops.
- When the mode is switched from the offset/gain setting mode to the normal output mode, all-channel D/A conversion disable ($000F_H$) is stored in D/A conversion enable/disable setting (Un\G0).
  To resume the D/A conversion, set D/A conversion enable (0) for the corresponding channels and turn on and off Operating condition setting request (Y9).

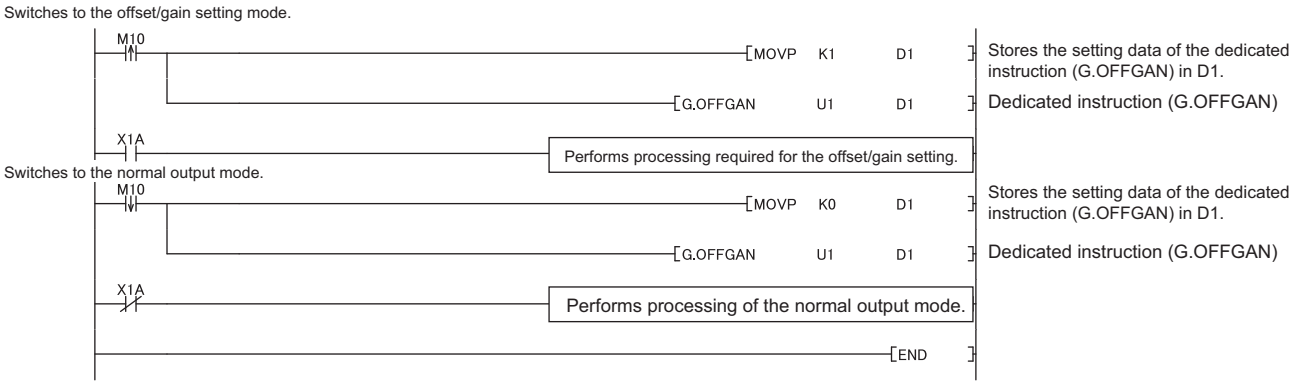
(3) Errors

The instruction has no errors.

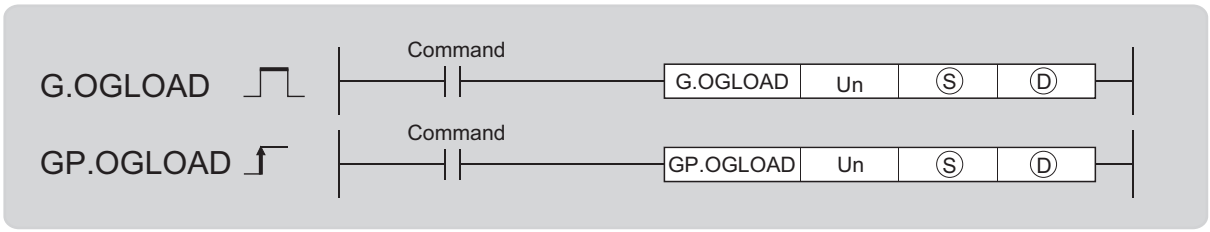
(4) Program example

The following shows the sequence program of the D/A converter module, installed in I/O number X/Y10 to X/Y1F, with the following conditions:

- Turning on M10 switches the mode of the D/A converter module to the offset/gain setting mode
- Turning off M10 restores the mode of the D/A converter module to the normal output mode



Appendix 2.2 G(P).OGLOAD



Setting data	Internal device		R, ZR	J□\□		U□\□	Zn	Constant	Others
	Bit	Word		Bit	Word				
Ⓢ	-	○		-					
Ⓓ	○			-					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FE_H	BIN 16 bits
Ⓢ	Start number of the device where control data is stored	Within the range of the specified device	Device name
Ⓓ	Device which turns on for one scan at the processing completion of the dedicated instruction. In error completion, Ⓓ+1 also turns on.	Within the range of the specified device	Bit

(2) Control data*1

Device	Item	Setting data	Setting range	Set by
Ⓢ	System area	-	-	-
Ⓢ+1	Completion status	The status on instruction completion is stored. 0: normal completion Other than 0: error completion (error code)	-	System
Ⓢ+2	Pass data classification setting	Specify the type of offset/gain setting value to read out. 0: voltage 1: current b15 … b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	User
Ⓢ+3	System area	-	-	-
Ⓢ+4	CH1 Industrial shipment settings offset value	-	-	System
Ⓢ+5	CH1 Industrial shipment settings gain value	-	-	System
Ⓢ+6	CH2 Industrial shipment settings offset value	-	-	System
Ⓢ+7	CH2 Industrial shipment settings gain value	-	-	System
Ⓢ+8	CH3 Industrial shipment settings offset value	-	-	System
Ⓢ+9	CH3 Industrial shipment settings gain value	-	-	System
Ⓢ+10	CH4 Industrial shipment settings offset value	-	-	System
Ⓢ+11	CH4 Industrial shipment settings gain value	-	-	System
Ⓢ+12	CH1 User range settings offset value	-	-	System
Ⓢ+13	CH1 User range settings gain value	-	-	System
Ⓢ+14	CH2 User range settings offset value	-	-	System
Ⓢ+15	CH2 User range settings gain value	-	-	System
Ⓢ+16	CH3 User range settings offset value	-	-	System
Ⓢ+17	CH3 User range settings gain value	-	-	System
Ⓢ+18	CH4 User range settings offset value	-	-	System
Ⓢ+19	CH4 User range settings gain value	-	-	System

*1 Configure the setting only for Pass data classification setting Ⓢ+2.
When the data is written to the area to be set by system, offset/gain setting values are not correctly read out.

(3) Functions

- This instruction reads out the offset/gain setting values in the user range setting of the D/A converter module to the CPU module.
- This instruction is disabled in the wave output mode.
- The interlock signal of G(P).OGLOAD includes a completion device Ⓓ and a completion status indication device Ⓓ+1.

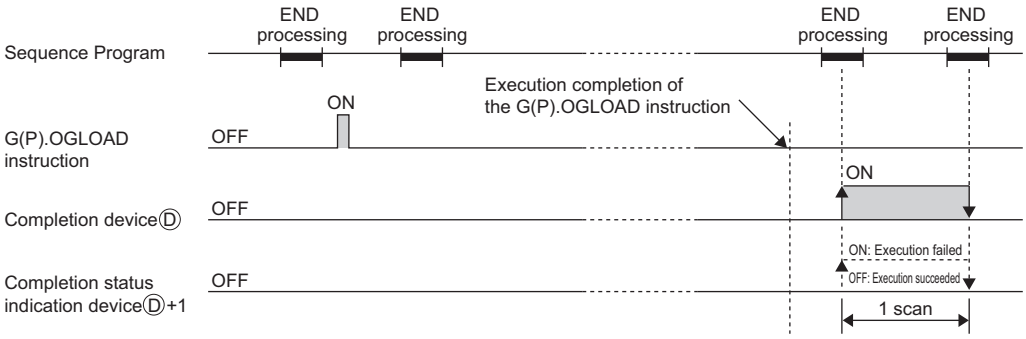
(a) Completion device

The device turns on at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns off at the next END processing.

(b) Completion status indication device

This device turns on or off depending on the status of the G(P).OGLOAD instruction completion.

- Normal completion: the device remains off.
- Error completion: the device turns on at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns off at the next END processing.



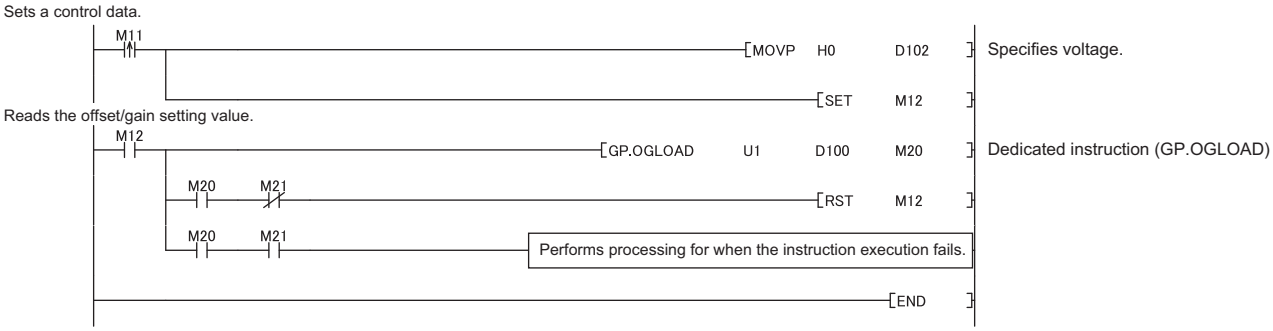
(4) Errors

The instruction has no errors.

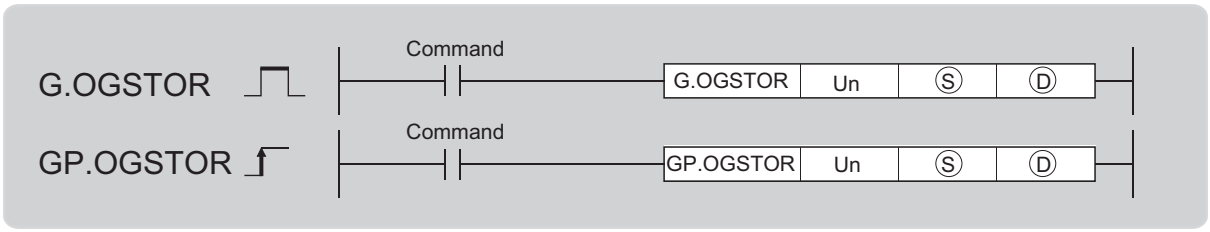
(5) Program example

The following shows the sequence program performing the following operation.

- Turning on M11 reads out the offset/gain setting values of the D/A converter module that is installed in the position of I/O number X/Y10 to X/Y1F.



Appendix 2.3 G(P).OGSTOR



Setting data	Internal device		R, ZR	J□\□		U□\□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	-	○		-					
Ⓓ	○			-					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FE_H	BIN 16 bits
Ⓢ*1	Start number of the device where control data is stored	Within the range of the specified device	Device name
Ⓓ	Device which turns on for one scan at the processing completion of the dedicated instruction. In error completion, Ⓓ+1 also turns on.	Within the range of the specified device	Bit

*1 Specify the device specified to Ⓢ on execution of the G(P).OGLOAD instruction.
Do not change the data which is read out by the G(P).OGLOAD instruction. If the data is changed, the normal operation may not be ensured.

(2) Control data

Device	Item	Setting data	Setting range	Set by
Ⓢ	System area	-	-	-
Ⓢ+1	Completion status	The status on instruction completion is stored. 0: normal completion Other than 0: error completion (error code)	-	System
Ⓢ+2	Pass data classification setting	The value which is set for Pass data classification setting Ⓢ+2 by the G(P).OGLOAD instruction is stored. 0: voltage 1: current b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	System
Ⓢ+3	System area	-	-	-
Ⓢ+4	CH1 Industrial shipment settings offset value	-	-	System
Ⓢ+5	CH1 Industrial shipment settings gain value	-	-	System
Ⓢ+6	CH2 Industrial shipment settings offset value	-	-	System
Ⓢ+7	CH2 Industrial shipment settings gain value	-	-	System
Ⓢ+8	CH3 Industrial shipment settings offset value	-	-	System
Ⓢ+9	CH3 Industrial shipment settings gain value	-	-	System
Ⓢ+10	CH4 Industrial shipment settings offset value	-	-	System
Ⓢ+11	CH4 Industrial shipment settings gain value	-	-	System
Ⓢ+12	CH1 User range settings offset value	-	-	System
Ⓢ+13	CH1 User range settings gain value	-	-	System
Ⓢ+14	CH2 User range settings offset value	-	-	System
Ⓢ+15	CH2 User range settings gain value	-	-	System
Ⓢ+16	CH3 User range settings offset value	-	-	System
Ⓢ+17	CH3 User range settings gain value	-	-	System
Ⓢ+18	CH4 User range settings offset value	-	-	System
Ⓢ+19	CH4 User range settings gain value	-	-	System

(3) Functions

- The offset/gain setting values in the user range setting stored in the CPU module is restored to the D/A converter module.
- The interlock signal of G(P).OGSTOR includes a completion device Ⓓ and a completion status indication device Ⓓ+1.

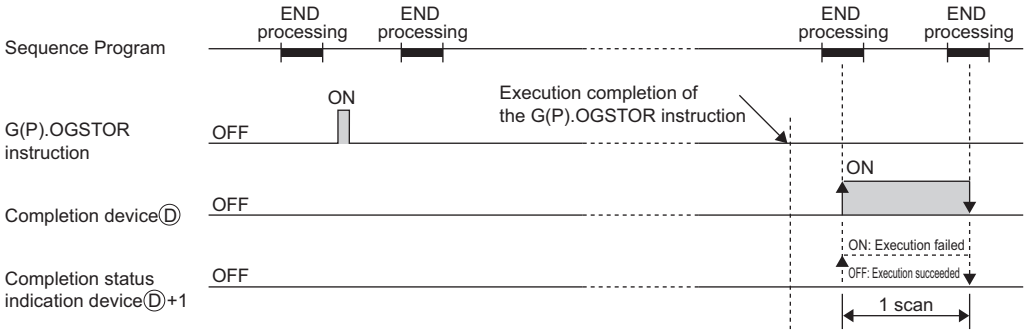
(a) Completion device

The device turns on at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns off at the next END processing.

(b) Completion status indication device

This device turns on or off depending on the status of the G(P).OGSTOR instruction completion.

- Normal completion: the device remains off.
- Error completion: the device turns on at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns off at the next END processing.



(c) Accuracy

The accuracy after the restoration of the offset/gain setting values is lower than the one before the restoration. The difference is about three times.

(4) Errors

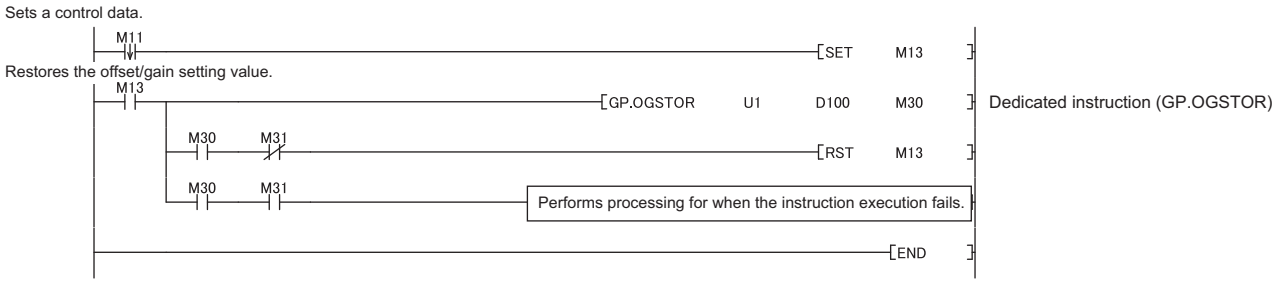
In the following cases, an error occurs and an error code is stored in completion status area (S)+1.

Error code	Description of operation error
161	The G(P).OGSTOR instruction is executed in the offset/gain setting mode or the wave output mode.
162	The G(P).OGSTOR instruction is continuously executed.
163	• The G(P).OGSTOR instruction is executed to the different model from the one to which the G(P).OGLOAD instruction is executed. • The G(P).OGSTOR instruction has been executed before the execution of the G(P).OGLOAD instruction.

(5) Program example

The following shows the sequence program performing the following operation.

- Turning off M11 writes the offset/gain setting values to the D/A converter module that is installed in the position of I/O number X/Y10 to X/Y1F.



Point

When the dedicated instruction G(P).OGSTOR is executed, the D/A conversion stops.
Turning on and off Operating condition setting request (Y9) resumes the D/A conversion.

Appendix 3 When Using GX Developer

This section describes the operating procedure when using GX Developer.

(1) Applicable software version

For the applicable software version, refer to the following.

- Applicable software packages (☞Page 18, Section 2.1 (4))

Appendix 3.1 Operation of GX Developer

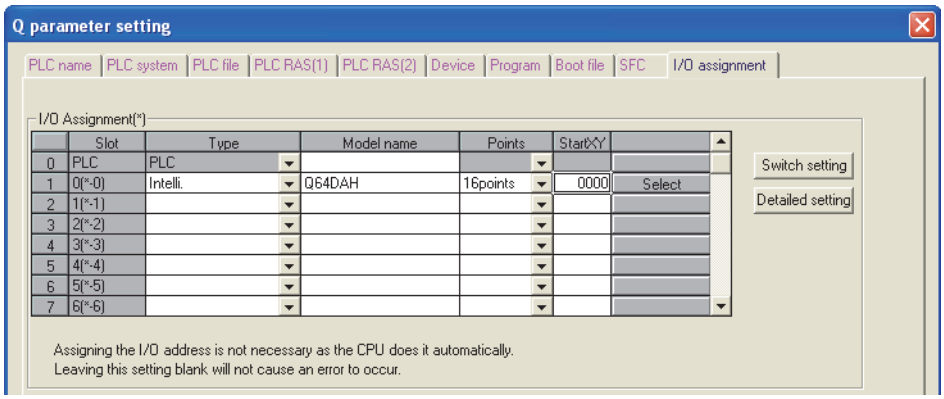
Configure the following settings when using GX Developer.

Window name	Application	Reference
I/O assignment	Set the type of the module to be mounted and the range of I/O signal.	Page 237, Appendix 3.1 (1)
Switch setting	Configure the switch setting of an intelligent function module.	Page 238, Appendix 3.1 (2)
Offset/gain setting	Configure the setting when using a user range setting for the input range.	Page 146, Section 8.5.2

(1) I/O assignment

Configure the setting on "I/O assignment" in "PLC parameter".

Parameter ⇨ [PLC Parameter] ⇨ [I/O assignment]

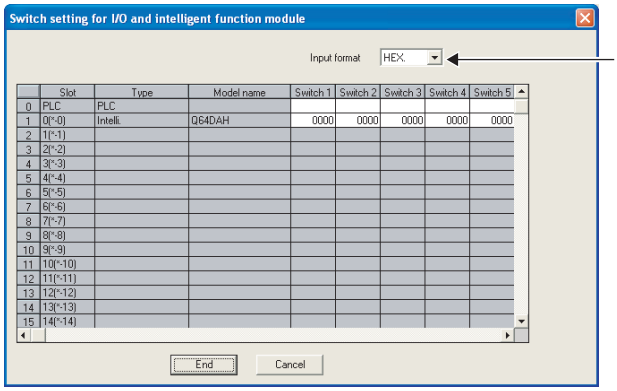


Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the D/A converter module.
Points	Select "16point".
StartXY	Enter a desired start I/O number of the D/A converter module.

(2) Intelligent function module switch setting

Configure the setting on "Switch setting" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment] ⇨ Click the Switch setting button.



Item	Setting item		
Switch 1	Output range setting (CH1 to CH4) □□□□ H CH4 CH3 CH2 CH1	**Analog output range**	**Output range setting**
		4 to 20mA	0_H
		0 to 20mA	1_H
		1 to 5V	2_H
		0 to 5V	3_H
		-10 to10V	4_H
		User range setting	F_H
Switch 2	0: Fixed (blank)		
Switch 3	HOLD/CLEAR function setting (CH1 to CH4) □□□□ H CH4 CH3 CH2 CH1	**Setting value**	**HOLD/CLEAR**
		0	CLEAR
		1 to F_H*1	HOLD
Switch 4*3	□□□□ H Output mode setting 00H : Normal output mode (conversion speed: 20μs/CH) 01H : Wave output mode (conversion speed: 50μs/CH) 02H : Wave output mode (conversion speed: 80μs/CH) 03H to FFH : Invalid*2 Fixed to 0H Drive mode setting 0H : Normal (D/A converter processing) mode 1H to FH (A value other than 0H)*1 : Offset-gain setting mode		
Switch 5	0: Fixed (blank)*4		

*1 The operation is the same when any value within the setting range is set.

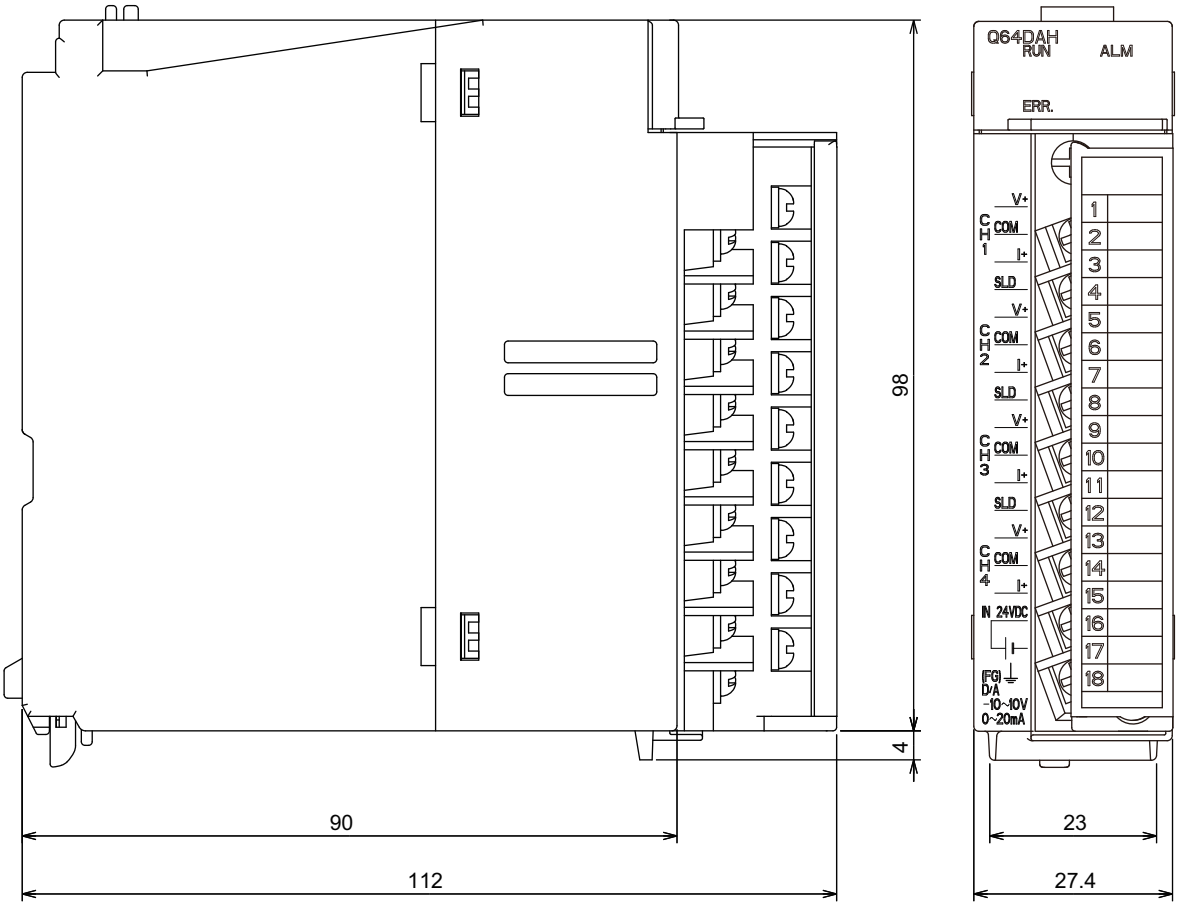
*2 If a value other than 00_H to 02_H is set, an error occurs. The error code (114) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED turns on.

*3 Setting the switch 4 to the wave output mode enables the wave output function. To use the wave output function, set the wave data and parameters of the wave output function in the sequence program.

*4 If a value other than 0 is set, an error occurs. The error code (114) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and ERR. LED flashes.

Appendix 4 External Dimensions

The following shows the external dimensions of the D/A converter module.



(Unit: mm)

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REVISIONS

*The manual number is given on the bottom left of the back cover.

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February 2013	SH(NA)-081101ENG-A	First edition
April 2018	SH(NA)-081101ENG-B	Specifications change of the wave output step action function Partial correction INTRODUCTION, Section 2.1, 2.2, 3.2.1, 4.8, 4.8.1, 4.8.3, 4.8.4, 6.2, 7.3, 9.2, 9.2.1, Section 9.3, 11.1, Appendix 4 Addition Section 11.3.7, Appendix 1

Japanese manual version SH-081100-D

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MODEL CODE: 13JZ71

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