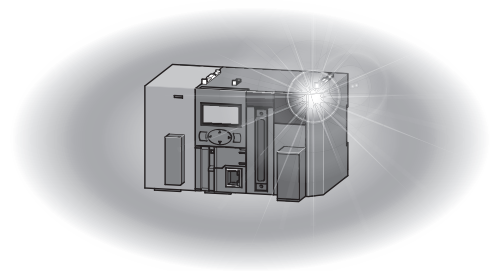# MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC *L* series

MELSEC-L Digital-Analog Converter Module User's Manual

-L60DA4

●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.

[Design Precautions]

⚠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.
● Power on or off the external power supply while the programmable controller is on. Failure to do so may result in incorrect output or malfunction.

[Installation Precautions]

⚠ **WARNING**
● Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠ **CAUTION**
● Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines provided with the CPU module or head module. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
● To interconnect modules, engage the respective connectors and securely lock the module joint levers until they click. Incorrect interconnection may cause malfunction, failure, or drop of the module.
● 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.
● 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 100 ohms or less. Failure to do so may result in electric shock or malfunction.
● Tighten the terminal block 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.
● Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring methods, refer to the MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection).

[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 block screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION
● Do not disassemble or modify the module. 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 a module. Failure to do so may cause the module to fail or malfunction.
● Tighten the terminal block 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.
● After the first use of the product (module, display unit, and terminal block), the number of connections/disconnections is limited to 50 times (in accordance with IEC 61131-2). Exceeding the limit may cause malfunction.
● Before handling the module, touch a conducting object such as a grounded metal 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.

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●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 MELSEC-L series programmable controllers.

This manual describes the functions and programming of a 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-L 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: L60DA4

> **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.
>
>   📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)
>
> ● Operating procedures are explained using GX Works2. When using GX Developer or GX Configurator-DA, refer to the following.
>   • When using GX Developer or GX Configurator-DA (👉 Page 203, Appendix 9)
>
> •

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.
- MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)
- MELSEC-L CC-Link IE Field Network Head Module User's Manual
- Safety Guidelines (This manual is included with the CPU module or head module.)

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 the EMC and Low Voltage Directives.

RELEVANT MANUALS

(1) CPU module user's manual

Manual name <manual number (model code)>	Description
MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection) <SH-080890ENG, 13JZ36>	Specifications of the CPU modules, power supply modules, display unit, branch module, extension module, SD memory cards, and batteries, information on how to establish a system, maintenance and inspection, and troubleshooting
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals) <SH-080889ENG, 13JZ35>	Functions and devices of the CPU module, and programming

(2) Head module User's Manual

Manual name <manual number (model code)>	Description
MELSEC-L CC-Link IE Field Network Head Module User's Manual <SH-080919ENG, 13JZ48>	Specifications, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting of the head module
MELSEC-Q CC-Link IE Field Network Master/Local Module User's Manual <SH-080917ENG, 13JZ47>	Overview of the CC-Link IE Field Network, and specifications, procedures before operation, system configuration, installation, settings, functions, programming, and troubleshooting of the CC-Link IE Field Network master/local module

(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

Memo

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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.

"" is used for screen names and items.

1. shows operating procedures.

✏ shows mouse operations.*1

[ ] is used for items in the menu bar and the project window.

Ex. shows setting or operating examples.

📖 shows reference manuals.

☞ shows reference pages.

The chapter of the current page is shown.

The section of the current page is shown.

Point shows notes that requires attention.

Remark shows useful information.

*1   The mouse operation example (for GX Works2) is provided below.

Menu bar

Ex. ✏ [Online] ⇨ [Write to PLC...]
Select [Online] on the menu bar, and then select [Write to PLC...].

A window selected in the view selection area is displayed.

Ex. ✏ Project window ⇨ [Parameter]
⇨ [PLC Parameter]
Select [Project] from the view selection area to open the Project window.
In the Project window, expand [Parameter] and select [PLC Parameter].

View selection area

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.

Instruction name

Execution condition of the instruction

Structure of the instruction in the ladder mode

○ shows the devices applicable to the instruction

Setting side
User : Device value is set by the user.
System: Device value is set by the CPU module.

Descriptions of setting data and data type

Descriptions of control data (if any)

CHAPTER 6 SOCKET COMMUNICATION FUNCTION

6.4.2 Disconnecting a connection (SP.SOCCLOSE)

Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H	Others
	Bit	Word		Bit	Word				
⑤₁	—	○	○			—		○	—
⑤₂	—	△ *1	△ *1			—		—	—
Ⓓ	△ *1	—	△ *1			—		—	—

*1 File registers set for each local device or program cannot be used.

(1) Setting data

Setting data	Description	Set by	Data type
U0	Dummy	—	Character string
⑤₁	Connection number (Setting range: 1 to 16)	User	BIN 16-bit
⑤₂	Start number of the device from which control data are stored	System	Device name
Ⓓ	Start number of the device which turns on for one scan upon completion of the instruction Ⓓ+1 also turns on when failed.	System	Bit

(2) Control data

Device	Item	Description	Setting range	Set by
⑤₂+0	System area	—	—	—
⑤₂+1	Completion status	Completion status is stored 0000H: Completed Other than 0000H: Failed (Error code)	—	System

6.4 Socket Communication Function Instruction
6.4.2 Disconnecting a connection (SP.SOCCLOSE)

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Detailed descriptions
of the instruction

(3) Function

This instruction closes a connection specified in ⑤. (Disconnection of a connection)

The result of the SP.SOCCLOSE instruction can be checked with the completion device, ⑩ + 0 and ⑩ + 1.

- Completion device ⑩ + 0
  Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.
- Completion device ⑩ + 1
  Turns on or off according to the result of the SP.SOCCLOSE instruction.

State	Description
When completed	Remains off.
When failed	Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.

Conditions for the error and
error codes
For the errors not described in
this manual, refer to the following.
📖 MELSEC-L CPU Module
User's Manual (Hardware Design,
Maintenance and Inspection)

(4) Error

A detection of an operation error turns on the Error flag (SM0) and a corresponding error code is stored in SD0 when:

- The connection number specified for ⑤ is other than 1 to 16.

  (Error code: 4101)

- The device numbers specified for ⑤ and ⑩ exceed the device point range.

  (Error code: 4101)

- An invalid device is specified.

  (Error code: 4004)

Simple program example(s)
and descriptions of the devices used

(5) Program example

When M2000 is turned on or when the connected device disconnects connection No.1, connection No.1 is disconnected by the following program.

- Device used

Device number	Application
SD1282	Open completion signal
SD1284	Open request signal
D200	SP.SOCCLOSE instruction control data
M200	SP.SOCCLOSE instruction completion device

- Program

Program		Description
SD1282.0 SD1284.0	[PLS M161]	Processing for disconnection of Connection No.1by the target
M2000 SD1282.0 M210	[SP.SOCCLOSE "U0" K1 D200 M200]	Connection No.1 close
M161	[SET M210]	Setting SP.SOCCLOSE executing flag
M200 M201	[SET M202]	Normal completion
M201	[SET M202]	Error completion
	[RST M210]	Resetting SP.SOCCLOSE executing flag
	[END]	

64

15
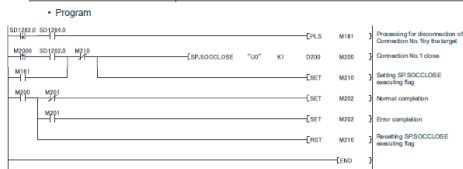
• Instructions can be executed under the following conditions.

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, DX, DY, N, BL, TR, BL\S,V

*1   For details on each device, refer to the following.
        📖 MELSEC-L CPU Module 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	Another term for the MELSEC-L series digital-analog converter module
GX Configurator-DA	A setting and monitoring tool added in GX Developer (for D/A converter modules)
GX Developer	The product name of the software package for the MELSEC programmable controllers
GX Works2	
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.
Offset/gain setting mode	"Offset/Gain Setting Mode" is the setting value of the drive mode setting in the switch setting.
Factory default setting	Generic term for analog output ranges of 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, and 4 to 20mA
Switch setting	A generic term for the setting items in the window that is displayed by double-clicking "Switch Setting" of the specified module on the project window of GX Works2
Normal mode	"Normal Mode" is the setting value 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.
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) exchanged with a CPU module are stored
Display unit	A liquid crystal display to be attached to the CPU module
Programming tool	A generic term for GX Works2 and GX Developer
Head module	Abbreviation for the LJ72GF15-T2 CC-Link IE Field Network head module
User range	An analog output range where a user can set any values. To use this range, the offset and gain values have to be set.

PACKING LIST

The following items are included in the package of this product. Before use, check that all the items are included.

L60DA4
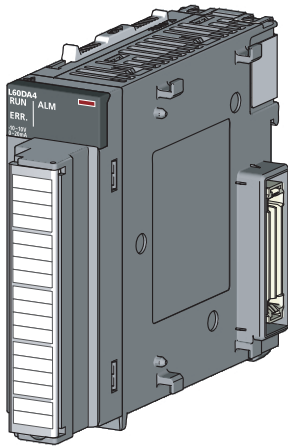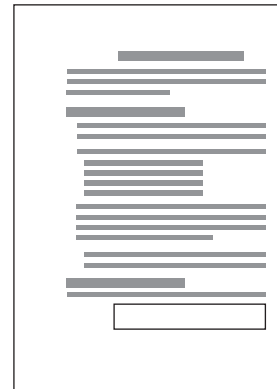
L60DA4	Before Using the Product

CHAPTER 1   D/A CONVERTER MODULE

This chapter describes the application and features of the D/A converter module.

1.1   Application

The D/A converter module converts the digital data received from the CPU module to the analog signal and outputs the signal to external devices. By converting the data, which has been processed through the CPU module, to an analog data, the input information can be sent to the devices including an inverter.

Digital to analog conversion

Digital signal (discrete signal)

Analog signal (continuous signal)
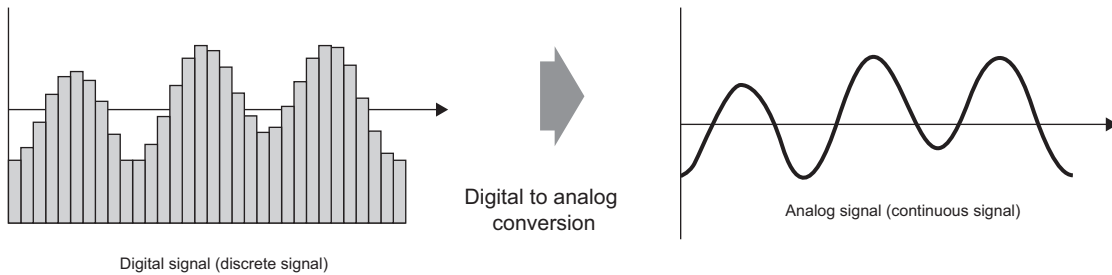
The D/A converter module enables works as follows.

Connect the module to the control valve to control the flow to a tank.
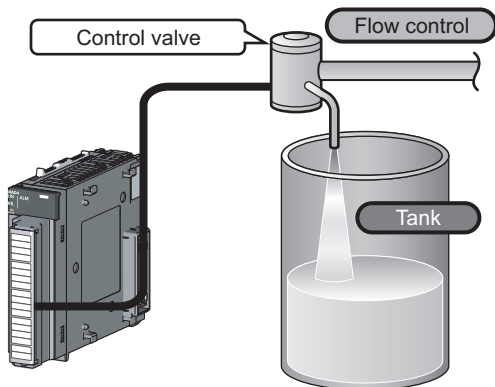
Connect the module to an inverter to control the conveyer belt speed.

Control valve

Flow control

Tank

Inverter

Conveyer
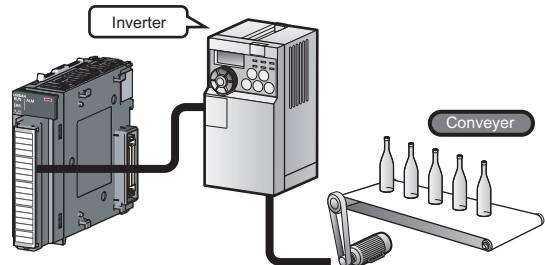
Connect the module to the power conditioning equipment to control the heating temperature of a heater or others.

Power conditioner

Heater

1.2 Features

1
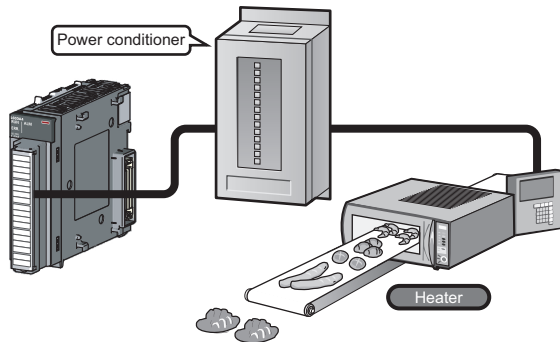
(1) Improved response by high-speed conversion

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±C) and ±0.3% (ambient temperature:0 to 55℃).

(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 an warning so that the digital value error monitoring and the output control are enabled.

(6) Wave output function

This function outputs any points of the 50000 point 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 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 equipment 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

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".

CHAPTER 2   PART NAMES

The following table shows the part names of the D/A converter module.
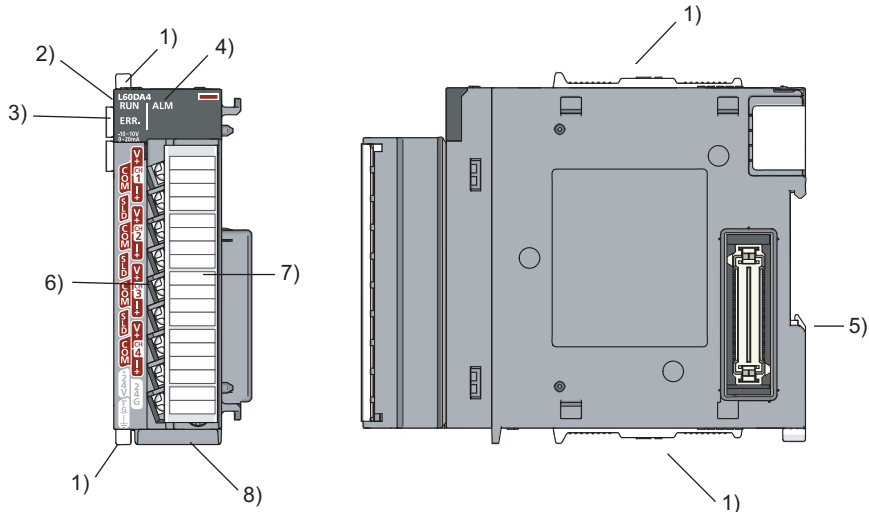
No.	Name	Description
1)	Module joint levers	Levers for connecting two modules
2)	RUN LED (green)	Displays the operating status of the D/A converter module. On: The module is operating normally. Flashing: In the offset/gain setting mode Off: The 5V power off or watchdog timer error has occurred.
3)	ERR. LED (red)	Displays the errors and status of the D/A converter module. On: an error has occurred except for error code: 112[1] Flashing: Error code: 112 has occurred. [1] Off : during normal operation
4)	ALM LED (red)	Displays the warning status of the D/A converter module. On: Warning output is occurring[2] Off : during normal operation
5)	DIN rail hook	A hook used to mount the module to a DIN rail
6)	Terminal Block[3]	18-point screw terminal block for connecting output signal lines of such as external devices
7)	Terminal block cover	Cover for preventing electric shock while the power is on.
8)	Serial number display	Displays the serial number printed on the rating plate.

*1   For details, refer to Error Code List (Page 149, Section 11.4).

*2   For details, refer to Alarm Code List (Page 152, Section 11.5).

*3   For the signal assignment for the terminal block, refer to Terminal Block (Page 37, Section 6.2).

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CHAPTER 3 SPECIFICATIONS

This chapter describes general specifications, performance specifications, function list, list of I/O signals, and list of buffer memory addresses.

3.1 General Specifications

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

📖 The manual "Safety Guidelines", the manual supplied with the CPU module or head module

3.2 Performance Specifications

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

Item			Model		
			L60DA4		
Number of analog output channels			4 channels		
Digital input			-20480 to 20479 (When the scaling function is used: -32768 to 32767)		
Analog output	Voltage		-10 to 10 VDC (external load resistance 1kΩ to 1MΩ)		
	Current		0 to 20 mADC (external load resistance 0Ω to 600Ω)		
I/O characteristics, resolution[*1]		Analog output range		Digital value	Resolution
		Voltage	0 to 5V	0 to 20000	250μV
			1 to 5V		200μV
			-10 to 10V	-20000 to 20000	500μV
			User range setting		333μV[*2]
		Current	0 to 20mA	0 to 20000	1000nA
			4 to 20mA		800nA
			User range setting	-20000 to 20000	700nA[*2]
Accuracy (accuracy for the maximum value of analog output value)[*3]	Ambient temperature 25 ±5℃		Within ±0.1% (voltage: ±10mV, current: ±20μA)		
	Ambient temperature 0 to 55℃		Within ±0.3% (voltage: ±30mV, current: ±60μA)		
Conversion speed	Normal output mode		20μs/channel		
	Wave output mode		50μs/channel 80μs/channel		
Number of offset/gain settings			Up to 50000 counts		
Output short protection			Protected		
Insulation method			Between I/O terminals and programmable controller power supply: photocoupler isolation Between output channels: no insulation Between external power supply and analog output: transformer insulation		
Dielectric withstand voltage			Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute Between external power supply and analog output: 500VACrms for 1 minute		
Insulation resistance			Between I/O terminals and programmable controller power supply: 500VDC 10MΩ or higher		
Number of occupied I/O points			16 points (I/O assignment: Intelligent 16 points)		
External interface			18-point terminal block		
Applicable wire size			0.3 to 0.75mm²		
Applicable solderless terminal			R1.25-3 (solderless terminals with sleeve are not usable)		
External power supply			24VDC +20%, -15%		
			Ripple, spike 500mVP-P or lower		
			Inrush current: 4.3A, 1000μs or shorter		
			Current consumption: 0.18A		
Internal current consumption (5VDC)			0.16A		
Weight			0.20kg		

*1   For details on the I/O conversion characteristics, refer to the following.
     I/O Conversion Characteristic of D/A Conversion (Page 187, Appendix 3)
*2   Maximum resolution in the user range setting.
*3   Except when receiving noise influence. Warm up (power on) the module for 30 minutes to satisfy the accuracy shown in
      the table.

3.2.1 Number of parameter settings

Set the initial setting of D/A converter module and the parameter setting of auto refresh setting so that the number of parameters, including these 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 (maximum number of parameter settings), refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

📖 MELSEC-L CC-Link IE Field Network Head Module User's Manual

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

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

Target module	Initial setting	Auto refresh setting
L60DA4	4	11 (maximum number of settings)

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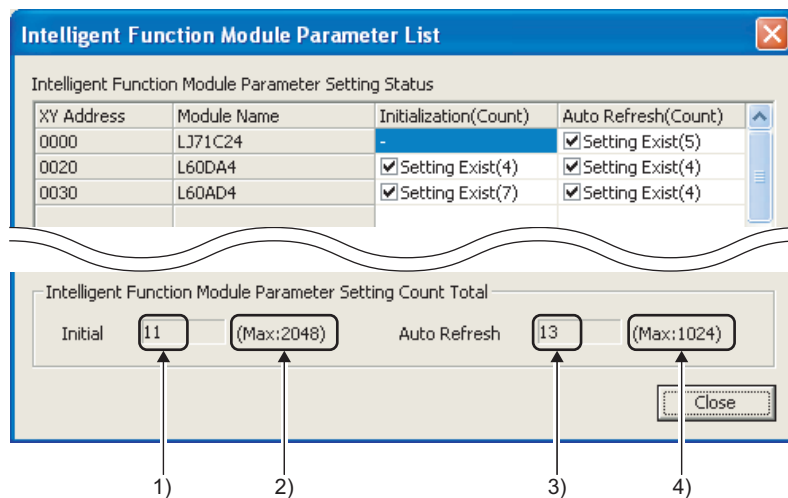
No.	Description
1)	The total number of parameters in the initial settings checked on the window
2)	The maximum number of parameter settings in the initial settings
3)	The total number of parameters in the auto refresh setting checked on the window
4)	The maximum number of parameter settings in the auto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

3.3 Function List

The following shows the function list 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 cycles.	Page 56, Section 8.2
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 56, Section 8.3
Range switching function		The output range to use can be selected from the following ranges: • Industrial shipment range (4 to 20mA, 0 to 20mA, 1 to 5V, 0 to 5V, -10 to 10V) • User range setting	Page 43, Section 7.2
Offset/gain setting function		This function compensates for errors in analog output values.	Page 47, Section 7.5
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 57, Section 8.4
Analog output test when CPU module is in STOP status		When the CPU module is in STOP operation status, forcibly turning on CH☐ Output enable/disable flag (Y1 to Y4) outputs the D/A-converted analog value.	Page 60, Section 8.5
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 programming for scale conversion can be omitted.	Page 62, Section 8.6
Warning output function		This function outputs a warning when the digital value exceeds the warning output upper limit value or becomes less than the warning output lower limit value.	Page 68, Section 8.7
Wave output function	—	This function registers the prepared wave data (digital value) into the D/A converter module and continuously outputs the data (analog value) in the set conversion cycle. A faster and smoother control than a program control 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 71, Section 8.8
	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 106, Section 8.8.4
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 157, Appendix 1.1 (2)
Error log function		This function stores errors and alarms that occurred in the D/A converter module to the buffer memory as history. A total of 16 errors and alarms can be stored.	Page 115, Section 8.9
Module error collection function		This function collects the errors and alarms caused in the D/A converter module into the CPU module.	Page 118, Section 8.10
Error clear function		This function clears errors that occur using the system monitor.	Page 119, Section 8.11
Save/restoration of offset/gain value		The offset/gain value of the user range setting can be saved or restored.	Page 120, Section 8.12

3

3.4   I/O Signal List

The following shows the I/O signal list of the D/A converter module.

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

- Details of I/O Signals (☞ Page 157, Appendix 1)

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 number (X/Y) described above shows the case that the start I/O number of the D/A converter module is set to "0".

- Do not use the "Use prohibited" signals shown above because the system uses them.
  If users use (turn on) the signals, the functions of the D/A converter module cannot be guaranteed.

3.5 List of Buffer Memory Address

The following shows the buffer memory list of the D/A converter module.

For details on buffer memory, refer to the following.

- Details of Buffer Memory Addresses (⟲ Page 164, Appendix 2)

Point

Do not write data to the system areas and read-only areas in the 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	0H	D/A conversion enable/disable setting	000FH	R/W
1	1H	CH1 Digital value	0	R/W
2	2H	CH2 Digital value	0	R/W
3	3H	CH3 Digital value	0	R/W
4	4H	CH4 Digital value	0	R/W
5 to 8	5H to 8H	System area	—	—
9	9H	Output mode	0000H	R
10	AH	System area	—	—
11	BH	CH1 Set value check code	0000H	R
12	CH	CH2 Set value check code	0000H	R
13	DH	CH3 Set value check code	0000H	R
14	EH	CH4 Set value check code	0000H	R
15 to 18	FH to 12H	System area	—	—
19	13H	Latest error code	0	R
20	14H	Setting range	0000H	R
21	15H	System area	—	—
22	16H	Offset/gain setting mode Offset specification	0000H	R/W
23	17H	Offset/gain setting mode Gain specification	0000H	R/W
24	18H	Offset/gain adjustment value specification	0	R/W
25	19H	System area	—	—
26	1AH	HOLD/CLEAR function setting	0000H	R
27 to 46	1BH to 2EH	System area	—	—
47	2FH	Warning output setting	000FH	R/W
48	30H	Warning output flag	0000H	R
49 to 52	31H to 34H	System area	—	—
53	35H	Scaling enable/disable setting	000FH	R/W
54	36H	CH1 Scaling lower limit value	0	R/W
55	37H	CH1 Scaling upper limit value	0	R/W
56	38H	CH2 Scaling lower limit value	0	R/W
57	39H	CH2 Scaling upper limit value	0	R/W
58	3AH	CH3 Scaling lower limit value	0	R/W
59	3BH	CH3 Scaling upper limit value	0	R/W
60	3CH	CH4 Scaling lower limit value	0	R/W
61	3DH	CH4 Scaling upper limit value	0	R/W
62 to 85	3EH to 55H	System area	—	—
86	56H	CH1 Warning output upper limit value	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default[1]	Read/Write[2]
87	57H	CH1 Warning output lower limit value	0	R/W
88	58H	CH2 Warning output upper limit value	0	R/W
89	59H	CH2 Warning output lower limit value	0	R/W
90	5AH	CH3 Warning output upper limit value	0	R/W
91	5BH	CH3 Warning output lower limit value	0	R/W
92	5CH	CH4 Warning output upper limit value	0	R/W
93	5DH	CH4 Warning output lower limit value	0	R/W
94 to 157	5EH to 9DH	System area	—	—
158	9EH	Mode switching setting	0	R/W
159	9FH		0	R/W
160 to 199	A0H to C7H	System area	—	—
200	C8H	Pass data classification setting	0	R/W
201	C9H	System area	—	—
202	CAH	CH1 Industrial shipment settings offset value	0	R/W
203	CBH	CH1 Industrial shipment settings gain value	0	R/W
204	CCH	CH2 Industrial shipment settings offset value	0	R/W
205	CDH	CH2 Industrial shipment settings gain value	0	R/W
206	CEH	CH3 Industrial shipment settings offset value	0	R/W
207	CFH	CH3 Industrial shipment settings gain value	0	R/W
208	D0H	CH4 Industrial shipment settings offset value	0	R/W
209	D1H	CH4 Industrial shipment settings gain value	0	R/W
210	D2H	CH1 User range settings offset value	0	R/W
211	D3H	CH1 User range settings gain value	0	R/W
212	D4H	CH2 User range settings offset value	0	R/W
213	D5H	CH2 User range settings gain value	0	R/W
214	D6H	CH3 User range settings offset value	0	R/W
215	D7H	CH3 User range settings gain value	0	R/W
216	D8H	CH4 User range settings offset value	0	R/W
217	D9H	CH4 User range settings gain value	0	R/W
218 to 999	DAH to 3E7H	System area	—	—
1000	3E8H	CH1 Wave output start/stop request	0	R/W
1001	3E9H	CH2 Wave output start/stop request	0	R/W
1002	3EAH	CH3 Wave output start/stop request	0	R/W
1003	3EBH	CH4 Wave output start/stop request	0	R/W
1004 to 1007	3ECH to 3EFH	System area	—	—
1008	3F0H	CH1 Output setting during wave output stop	1	R/W
1009	3F1H	CH2 Output setting during wave output stop	1	R/W
1010	3F2H	CH3 Output setting during wave output stop	1	R/W
1011	3F3H	CH4 Output setting during wave output stop	1	R/W
1012 to 1015	3F4H to 3F7H	System area	—	—
1016	3F8H	CH1 Output value during wave output stop	0	R/W
1017	3F9H	CH2 Output value during wave output stop	0	R/W
1018	3FAH	CH3 Output value during wave output stop	0	R/W
1019	3FBH	CH4 Output value during wave output stop	0	R/W
1020 to 1023	3FCH to 3FFH	System area	—	—
1024	400H	CH1 Wave pattern start address setting (L)	5000	R/W
1025	401H	CH1 Wave pattern start address setting (H)		
1026	402H	CH2 Wave pattern start address setting (L)	5000	R/W
1027	403H	CH2 Wave pattern start address setting (H)		

Address (decimal)	Address (hexadecimal)	Name	Default[1]	Read/Write[2]
1028	404H	CH3 Wave pattern start address setting (L)	5000	R/W
1029	405H	CH3 Wave pattern start address setting (H)		
1030	406H	CH4 Wave pattern start address setting (L)	5000	R/W
1031	407H	CH4 Wave pattern start address setting (H)		
1032 to 1039	408H to 40FH	System area	—	—
1040	410H	CH1 Wave pattern data points setting (L)	0	R/W
1041	411H	CH1 Wave pattern data points setting (H)		
1042	412H	CH2 Wave pattern data points setting (L)	0	R/W
1043	413H	CH2 Wave pattern data points setting (H)		
1044	414H	CH3 Wave pattern data points setting (L)	0	R/W
1045	415H	CH3 Wave pattern data points setting (H)		
1046	416H	CH4 Wave pattern data points setting (L)	0	R/W
1047	417H	CH4 Wave pattern data points setting (H)		
1048 to 1055	418H to 41FH	System area	—	—
1056	420H	CH1 Wave pattern output repetition setting	1	R/W
1057	421H	CH2 Wave pattern output repetition setting	1	R/W
1058	422H	CH3 Wave pattern output repetition setting	1	R/W
1059	423H	CH4 Wave pattern output repetition setting	1	R/W
1060 to 1063	424H to 427H	System area	—	—
1064	428H	CH1 Constant for wave output conversion cycle	1	R/W
1065	429H	CH2 Constant for wave output conversion cycle	1	R/W
1066	42AH	CH3 Constant for wave output conversion cycle	1	R/W
1067	42BH	CH4 Constant for wave output conversion cycle	1	R/W
1068 to 1071	42CH to 42FH	System area	—	—
1072	430H	Step action wave output request	0	R/W
1073 to 1079	431H to 437H	System area	—	—
1080	438H	CH1 Wave output step action movement amount	0	R/W
1081	439H	CH2 Wave output step action movement amount	0	R/W
1082	43AH	CH3 Wave output step action movement amount	0	R/W
1083	43BH	CH4 Wave output step action movement amount	0	R/W
1084 to 1099	43CH to 44BH	System area	—	—
1100	44CH	CH1 Wave output status monitor	0	R
1101	44DH	CH2 Wave output status monitor	0	R
1102	44EH	CH3 Wave output status monitor	0	R
1103	44FH	CH4 Wave output status monitor	0	R
1104 to 1107	450H to 453H	System area	—	—
1108	454H	CH1 Wave output conversion cycle monitor (L)	0	R
1109	455H	CH1 Wave output conversion cycle monitor (H)		
1110	456H	CH2 Wave output conversion cycle monitor (L)	0	R
1111	457H	CH2 Wave output conversion cycle monitor (H)		
1112	458H	CH3 Wave output conversion cycle monitor (L)	0	R
1113	459H	CH3 Wave output conversion cycle monitor (H)		
1114	45AH	CH4 Wave output conversion cycle monitor (L)	0	R
1115	45BH	CH4 Wave output conversion cycle monitor (H)		
1116 to 1123	45CH to 463H	System area	—	—
1124	464H	CH1 Wave pattern output count monitor	0	R
1125	465H	CH2 Wave pattern output count monitor	0	R
1126	466H	CH3 Wave pattern output count monitor	0	R
1127	467H	CH4 Wave pattern output count monitor	0	R
1128 to 1131	468H to 46BH	System area	—	—

3

Address (decimal)	Address (hexadecimal)	Name	Default[1]	Read/Write[2]
1132	46CH	CH1 Wave output current address monitor (L)	0	R
1133	46DH	CH1 Wave output current address monitor (H)		
1134	46EH	CH2 Wave output current address monitor (L)	0	R
1135	46FH	CH2 Wave output current address monitor (H)		
1136	470H	CH3 Wave output current address monitor (L)	0	R
1137	471H	CH3 Wave output current address monitor (H)		
1138	472H	CH4 Wave output current address monitor (L)	0	R
1139	473H	CH4 Wave output current address monitor (H)		
1140 to 1147	474H to 47BH	System area	—	—
1148	47CH	CH1 Wave output current digital value monitor	0	R
1149	47DH	CH2 Wave output current digital value monitor	0	R
1150	47EH	CH3 Wave output current digital value monitor	0	R
1151	47FH	CH4 Wave output current digital value monitor	0	R
1152 to 1155	480H to 483H	System area	—	—
1156	484H	CH1 Wave output digital value outside the range Address monitor (L)	0	R
1157	485H	CH1 Wave output digital value outside the range Address monitor (H)		
1158	486H	CH2 Wave output digital value outside the range Address monitor (L)	0	R
1159	487H	CH2 Wave output digital value outside the range Address monitor (H)		
1160	488H	CH3 Wave output digital value outside the range Address monitor (L)	0	R
1161	489H	CH3 Wave output digital value outside the range Address monitor (H)		
1162	48AH	CH4 Wave output digital value outside the range Address monitor (L)	0	R
1163	48BH	CH4 Wave output digital value outside the range Address monitor (H)		
1164 to 1171	48CH to 493H	System area	—	—
1172	494H	CH1 Wave output warning Address monitor (L)	0	R
1173	495H	CH1 Wave output warning Address monitor (H)		
1174	496H	CH2 Wave output warning Address monitor (L)	0	R
1175	497H	CH2 Wave output warning Address monitor (H)		
1176	498H	CH3 Wave output warning Address monitor (L)	0	R
1177	499H	CH3 Wave output warning Address monitor (H)		
1178	49AH	CH4 Wave output warning Address monitor (L)	0	R
1179	49BH	CH4 Wave output warning Address monitor (H)		
1180 to 1799	49CH to 707H	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 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	708H	Latest address of error history				0	R
1801 to 1809	709H to 711H	System area				—	—
1810	712H	No. 1	Error code			0	R
1811	713H		Error time	First two digits of the year	Last two digits of the year	0	R
1812	714H			Month	Day	0	R
1813	715H			Hour	Minute	0	R
1814	716H			Second	Day of the week	0	R
1815 to 1819	717H to 71BH		System area			—	—
1820 to 1829	71CH to 725H	No. 2	Same as No. 1				
1830 to 1839	726H to 72FH	No. 3	Same as No. 1				
1840 to 1849	730H to 739H	No. 4	Same as No. 1				
1850 to 1859	73AH to 743H	No. 5	Same as No. 1				
1860 to 1869	744H to 74DH	No. 6	Same as No. 1				
1870 to 1879	74EH to 757H	No. 7	Same as No. 1				
1880 to 1889	758H to 761H	No. 8	Same as No. 1				
1890 to 1899	762H to 76BH	No. 9	Same as No. 1				
1900 to 1909	76CH to 775H	No. 10	Same as No. 1				
1910 to 1919	776H to 77FH	No. 11	Same as No. 1				
1920 to 1929	780H to 789H	No. 12	Same as No. 1				
1930 to 1939	78AH to 793H	No. 13	Same as No. 1				
1940 to 1949	794H to 79DH	No. 14	Same as No. 1				
1950 to 1959	79EH to 7A7H	No. 15	Same as No. 1				
1960 to 1969	7A8H to 7B1H	No. 16	Same as No. 1				
1970 to 4999	7B2H to 1387H	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 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	1388H to D6D7H	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 programs is possible.
        R: Readable
        W: Writable

3

3.5 List of Buffer Memory Address

CHAPTER 4 PROCEDURES BEFORE STARTING THE OPERATION

This chapter describes the procedures before starting the operation.

```
                    ╭─────────────────────────────╮
                    │            Start            │
                    ╰─────────────────────────────╯
                                  │
                                  ▼
        ┌─────────────────────────────────────────┐
        │ Module connecting                       │
        │   Connect the D/A converter module in   │  · · ·  (1)
        │   any desired configuration.            │
        └─────────────────────────────────────────┘
                                  │
                                  ▼
        ┌─────────────────────────────────────────┐
        │ Wiring                                   │
        │   Connect external devices to the D/A    │  · · ·  (2)
        │   converter module.                      │
        └─────────────────────────────────────────┘
                                  │
                                  ▼                          No
              ◇ Are user range settings used? ◇ ──────────────┐
                                  │                            │
                                 Yes                           │
                                  ▼                            │
        ┌─────────────────────────────────────────┐           │
        │ Offset/gain setting                     │           │
        │   To use user range settings, configure │  · · · (3)│
        │   the offset/gain setting.              │           │
        └─────────────────────────────────────────┘           │
                                  │◄───────────────────────────┘
                                  ▼
        ┌─────────────────────────────────────────┐
        │ Programming and debugging               │
        │   Create and check a program.           │
        └─────────────────────────────────────────┘
```
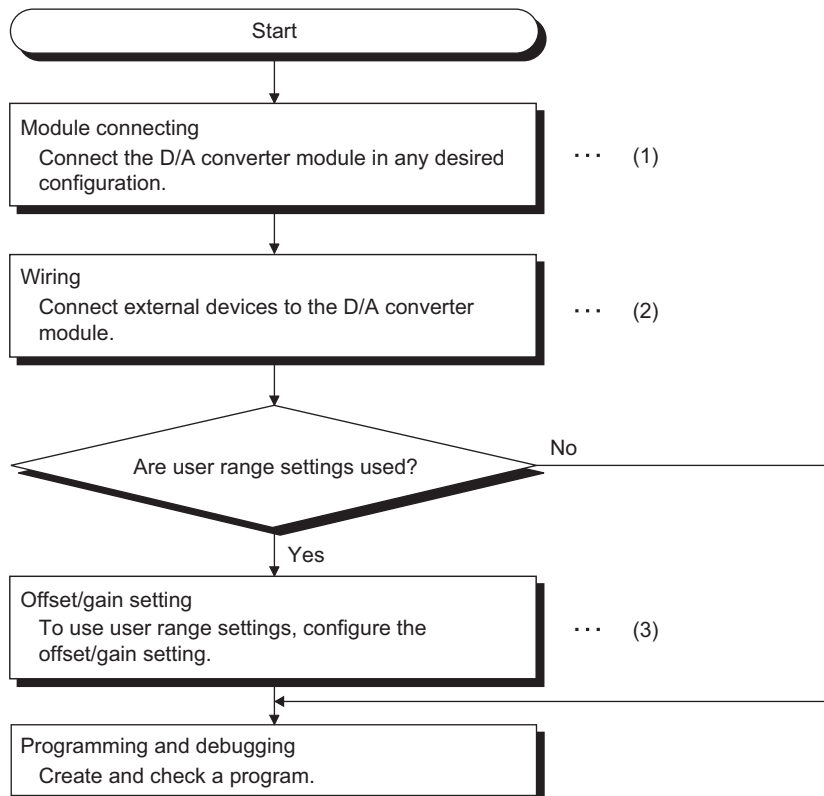
(1) ☞ Page 34, Section 5.1

(2) ☞ Page 40, Section 6.4

(3) ☞ Page 47, Section 7.5

Memo

4

CHAPTER 5   SYSTEM CONFIGURATION

This chapter describes the overall configuration, number of connectable modules, and compatible software version of the D/A converter module.

5.1   Overall System Configuration

The following shows a system configuration example for using the D/A converter module.

(1) When connected to a CPU module
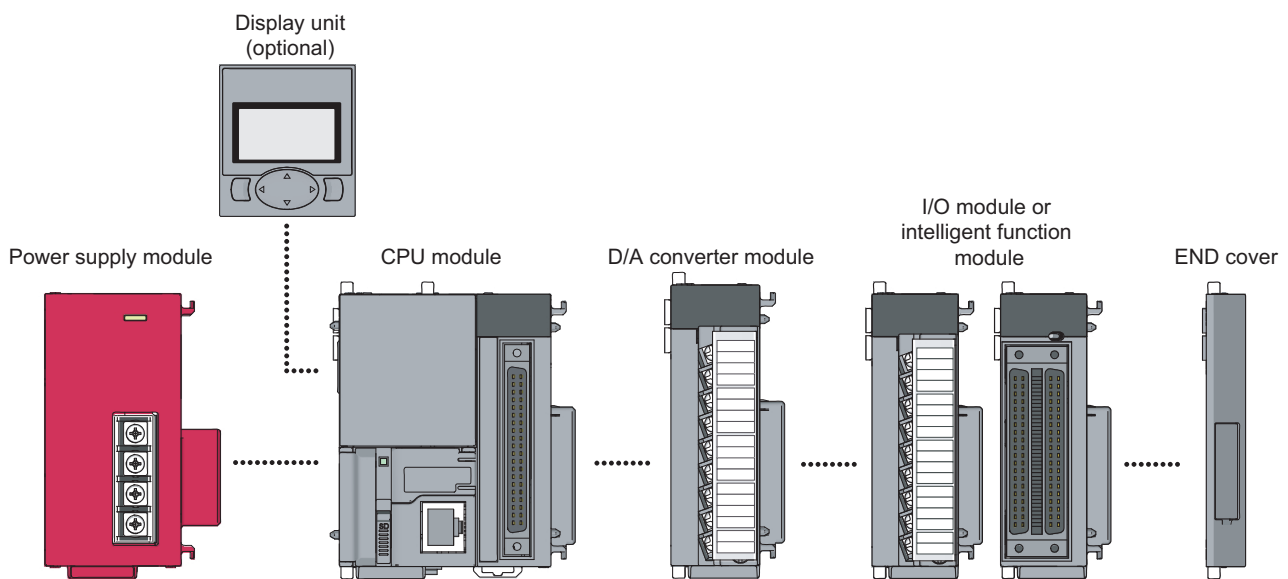
(2) When connected to a head module
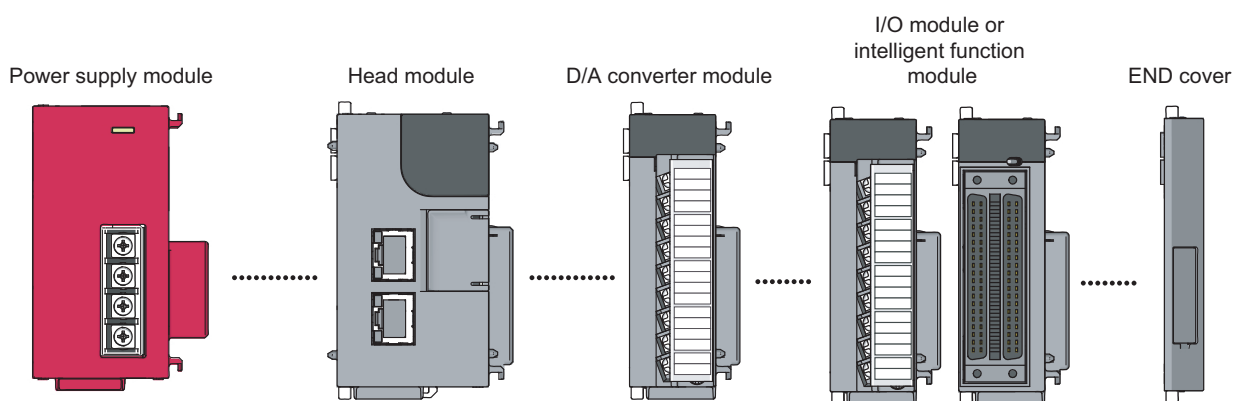
5.2 Applicable System

(1) Number of connectable modules

For the number of connectable modules, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

📖 MELSEC-L CC-Link IE Field Network Head Module User's Manual

(2) Compatible software version

For the compatible software versions, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

📖 MELSEC-L CC-Link IE Field Network Head Module User's Manual

5.3 Restrictions When D/A Converter Module is Connected to Head Module

The following describes the restriction when the D/A converter module is connected to a head module.

- Dedicated instruction cannot be used.

5

CHAPTER 6　INSTALLATION AND WIRING

This chapter describes the installation and wiring of the D/A converter module.

6.1　Installation Environment and Installation Position

For precautions for installation environment and installation position, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

📖 MELSEC-L CC-Link IE Field Network Head Module User's Manual

6.2 Terminal Block

(1) Precautions

Tighten the terminal block screws within the following specified torque range.

Screw type	Tightening torque range
Terminal screw (M3 screw)	0.42 to 0.58N·m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.58N·m

The following table shows the applicable solderless terminal installed to the terminal block. For wiring, use the wire that satisfies the condition in the table below and attach the terminal with the applicable torque range. Use a UL-approved solderless terminal and tools recommended by the manufacturer of the solderless terminal. The sleeved solderless terminal cannot be used.

Solderless terminal		Wire			
Model name	Applicable tightening torque	Wire diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N·m	22 to 18 AWG	Stranded wire	Copper wire	75℃ or higher

(2) Signal names of the terminal block

The following shows signal names of the terminal block.

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	

(3) Removal and installation of the terminal block

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

(a) Removal procedure

Terminal block mounting screw
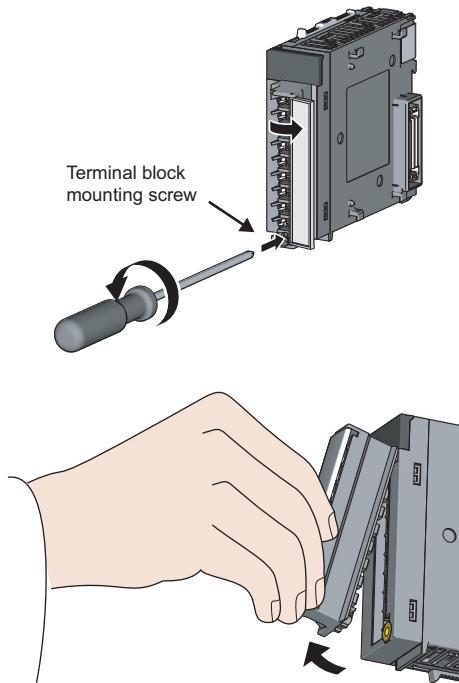
1. **Open the terminal cover and loosen the terminal block mounting screw.**

2. **Using the terminal block fixing holes as a fulcrum, remove the terminal block.**

(b) Installation procedure

Terminal block fixing hole
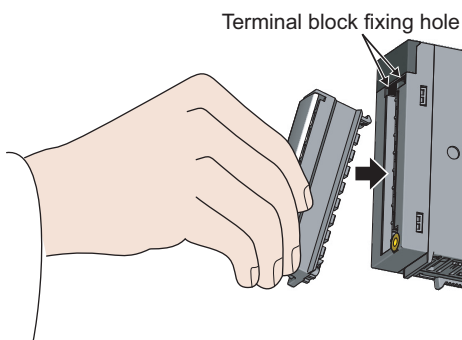
1. **Fully insert the projections on the top of the terminal block into the terminal block fixing holes and press the terminal block until it snaps into place.**

Terminal block mounting screw
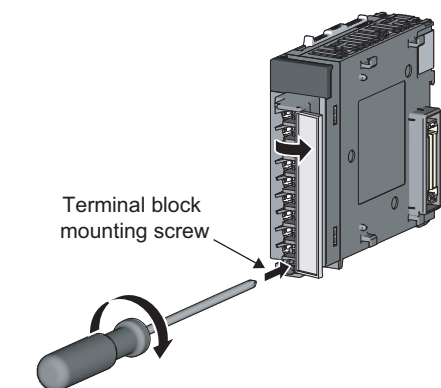
2. **Open the terminal cover and tighten the terminal block mounting screw.**

6.3 Wiring

(1) Wiring to a terminal block

The following shows wirings to a terminal block.

(a) For voltage output
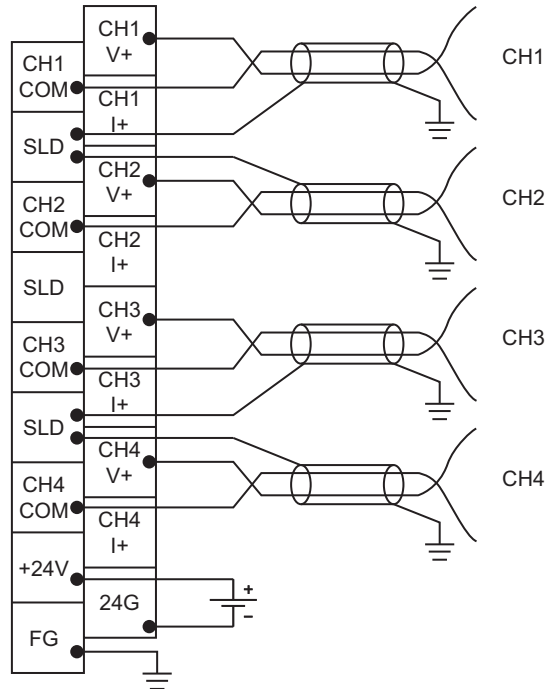
(b) For current output
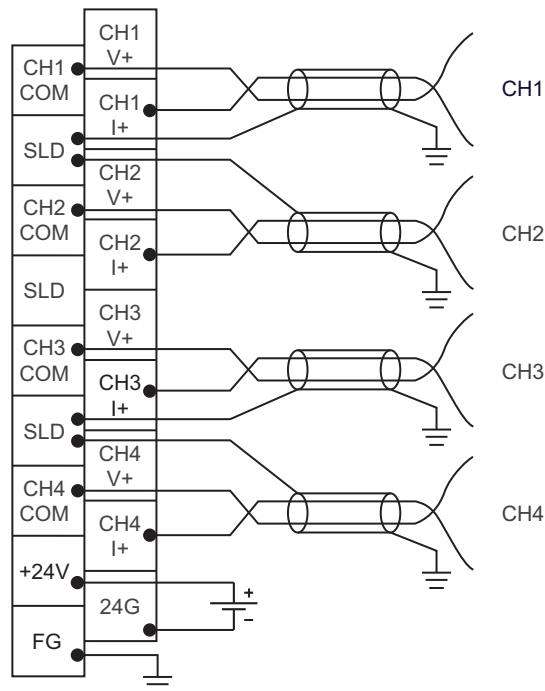
6.4 External Wiring

The following describes the external wiring.

(1) For voltage output
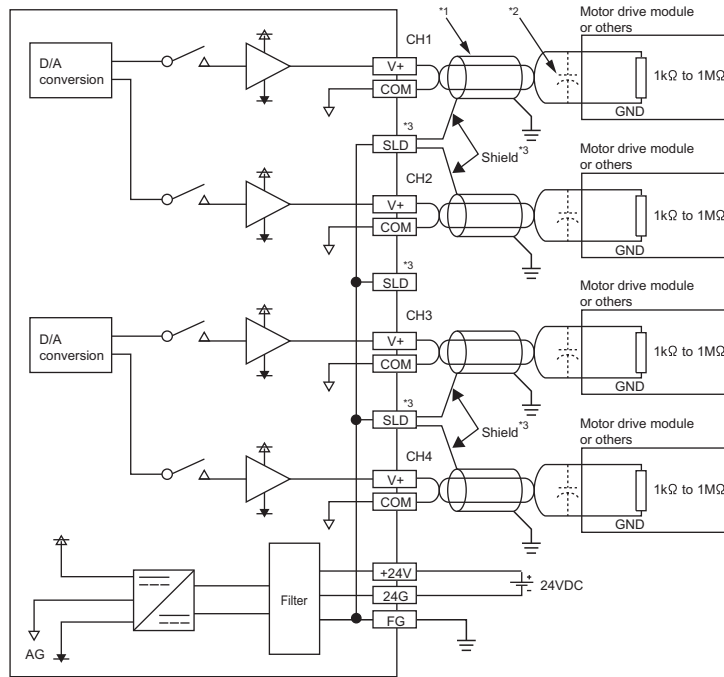
(2) For current output
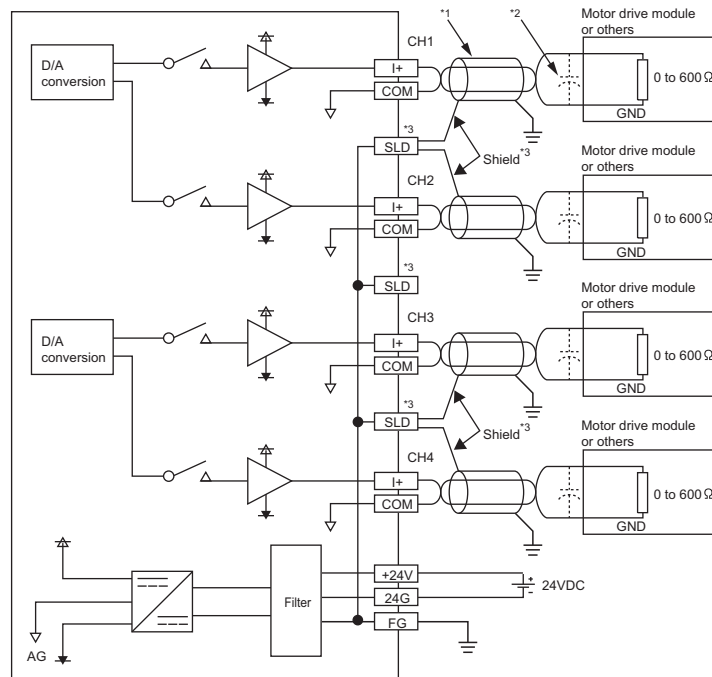
*1   For wire, use the shielded twisted pair cable.
*2   If noise or ripple occurs for analog signals, connect a capacitor with the value of 0.1 to 0.47μF (withstand voltage 25V or higher) to the input terminal of an external device.
*3   Connect the shielded wire for each channel to one of the three shield terminals. Be sure to ground the FG terminal. Also, ground the FG terminal of the power supply module.

CHAPTER 7   VARIOUS SETTINGS

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

> **Point**
>
> ● After writing the contents of new module, parameter settings, and auto refresh settings into the CPU module, reset the CPU module, switch STOP → RUN → STOP → RUN, or switch OFF → ON the power supply to enable the setting contents.
>
> ● After writing the contents of switch settings into the CPU module, reset the CPU module or switch OFF → ON the power supply to enable the setting contents.

7.1   Addition of Modules

Add the model name of D/A converter modules 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	Select the name of the module to be connected.
Mount Position	Mounted Slot No.	Set the slot No. where the module is connected.
	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.

7.2 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]	Select whether to hold or clear the output analog value (output offset value) in each channel when the CPU module enters to the STOP status or when an error occurs.	• CLEAR (default value) • HOLD
Drive Mode Setting		Set the drive mode of the D/A converter module. Set "Offset/Gain Setting Mode" to configure the offset/gain setting with the user range setting being selected.	• 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 57, Section 8.4)

(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 setting
- Switch 3: HOLD/CLEAR function setting
- Switch 4: Drive mode setting, output mode setting

For the setting procedure, refer to the following.

- Intelligent function module switch setting ()

Though the example of procedure is for GX Developer, same settings and values can be used for GX Works2 as well.

7.3 Parameter Setting

Set the parameters of each channel.

By setting the parameters, the setting by programming is not required.

(1) Setting procedure

Open the "Parameter" window.

1. Start "Parameter"

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

Pull-down list type

Text box type
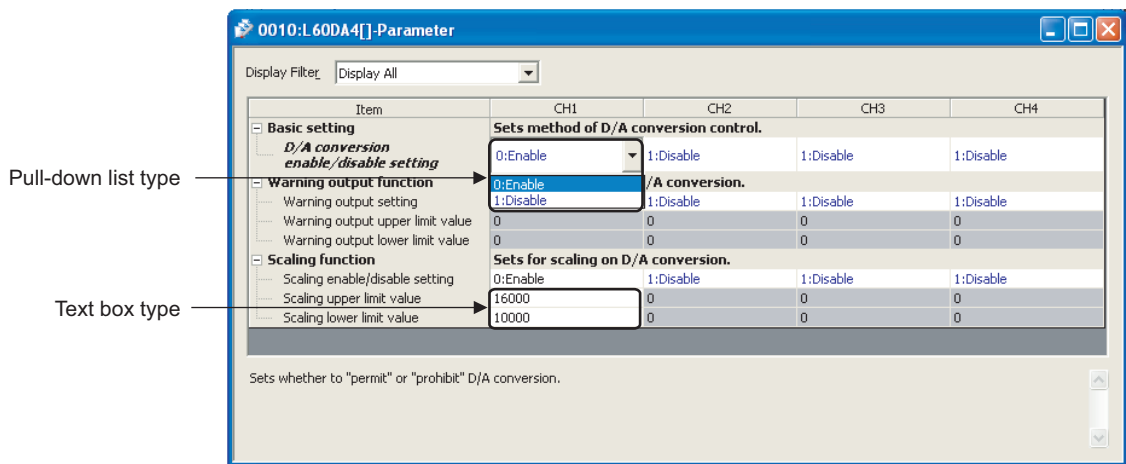
2. Double-click the item to change the setting, and input the setting value.

- 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 step2.

Item		Setting value	Reference
Basic setting	D/A conversion enable/disable setting	0: Enable 1: Disable (default value)	Page 56, Section 8.2
Warning output function	Warning output setting	0: Enable 1: Disable (default value)	Page 68, Section 8.7
	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 68, Section 8.7
	Scaling upper limit value	-32000 to 32000 (default value: 0)	
	Scaling lower limit value	-32000 to 32000 (default value: 0)	

7

7.3 Parameter Setting

7.4 Auto Refresh

Set the buffer memory of the D/A converter module to be refreshed automatically.

By the auto refresh setting, reading/writing data by programming becomes unnecessary.

(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 setup, and input the auto refresh target device.**

Item	CH1	CH2	CH3	CH4
⊟ *Transfer to PLC*	Transfers buffer memory data to the specified device.			
┈ Set value check code				
┈ Warning output flag				
┈ Latest error code				
┈ Latest address of error history				
⊟ Transfer to intelligent function module	Transfers the data of specified device to the buffer memory.			
┈ Digital value				

Display Filter: Display All

0010:L60DA4[]-Auto_Refresh

Transfers buffer memory data to the specified device.

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 from the set device No. (Example: When X10 is set, the data are stored in X10 to X1F.)

7.5 Offset/Gain Setting

When using the user range setting, configure the offset/gain setting with the following operations.

When the factory default setting is used, the offset/gain setting is not required.

The offset/gain setting can be configured by the following two types of operations.

- Setting from "Offset/Gain Setting" of GX Works2 ()
- Setting from a program ()

7.5.1 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.

In addition, do not turn off the external power supply during the offset/gain setting. If the external power supply is turned off, the offset/gain setting is not configured properly.

      [Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Analog Module]
            ⇨ [Offset/Gain Setting...]
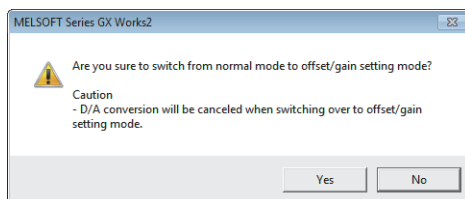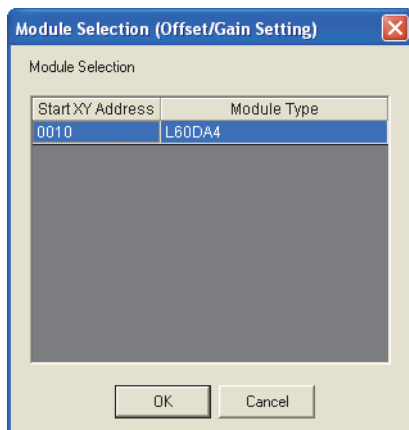
1. **Select the module to configure the offset/gain setting, and click the [OK] button.**

↓

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

↓

7.5 Offset/Gain Setting
7.5.1 Setting from "Offset/Gain Setting" of GX Works2.

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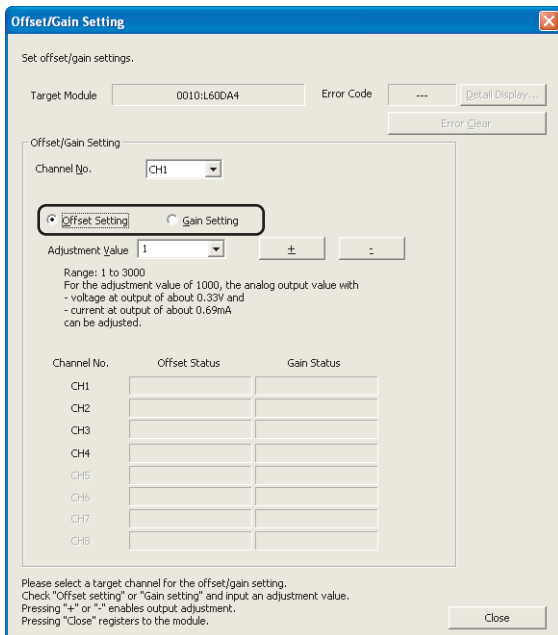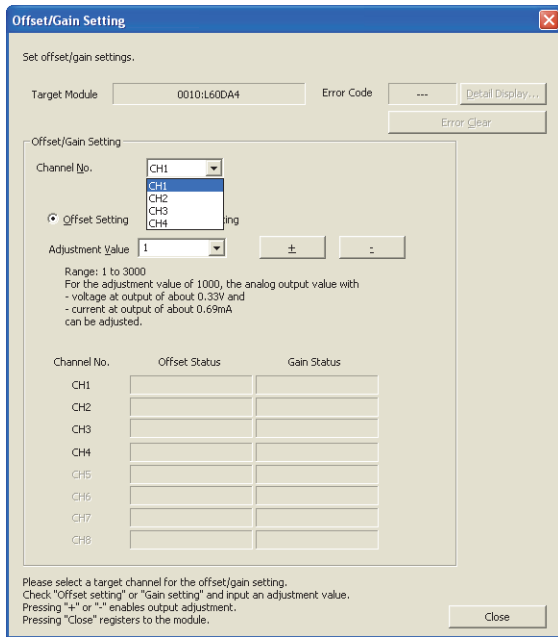
3. Specify the channel to use the offset/gain setting.

↓

4. Use the radio button to specify whether to perform the offset setting or gain setting. (Step 5 and later describe when the offset setting is specified.)

↓

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↓

↓

↓
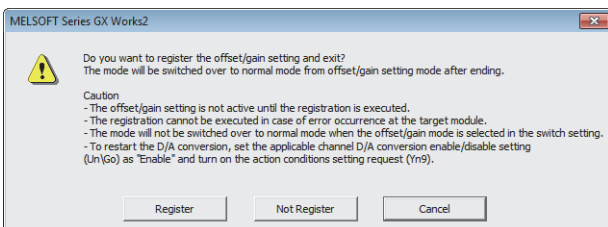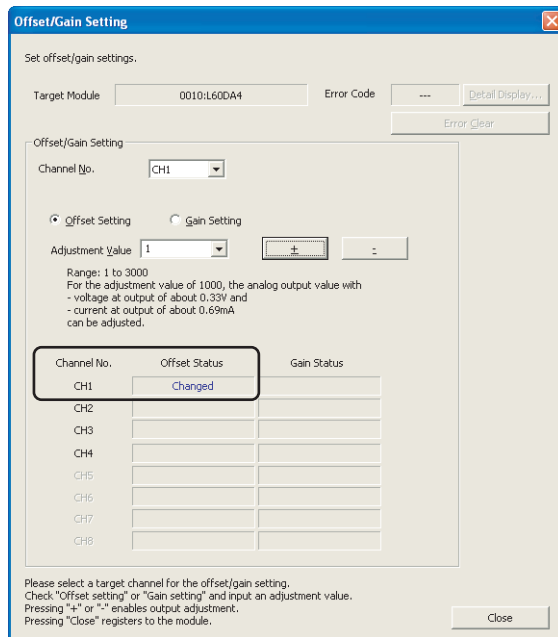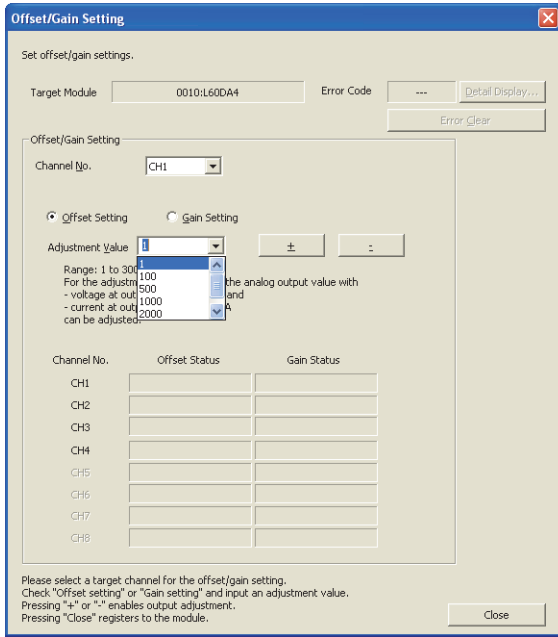
End

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 adjusted 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 [Entry] button.

7.5 Offset/Gain Setting
7.5.1 Setting from "Offset/Gain Setting" of GX Works2.

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7

7.5.2 Setting from a program

(1) Setting procedure

The following describes the procedures when setting the offset/gain from a program.

```
                      ┌────────────────────┐
                      │       Start        │
                      └────────────────────┘
  ①                            │
───────────────────────────────┤
                               ▼
              ┌──────────────────────────────────┐
              │ Switches to the Offset/gain       │
              │ setting mode.*1                    │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Checks that the module is in       │
              │ Offset/gain setting mode (the RUN  │
              │ LED is flashing).                  │
              └──────────────────────────────────┘
  ②                            │
───────────────────────────────┤
                               ▼
              ┌──────────────────────────────────┐
              │ Specifies the offset target        │
              │ channel in Offset/gain setting     │
              │ mode Offset specification          │
              │ (Un\G22).                          │
              │ Only one channel can be set at a   │
              │ time. Set "0" in Offset/gain       │
              │ setting mode Gain specification    │
              │ (Un\G23).                          │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Turns on Channel change request    │
              │ (YB).                              │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Checks that Channel change         │
              │ completed flag (XB) is on.         │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Turns off Channel change request   │
              │ (YB).                              │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Sets a value in Offset/gain        │
              │ adjustment value specification     │
              │ (Un\G24).                          │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Turns on Set value change request  │
              │ (YC).                              │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐   No
              │ Turns off Set value change request │
              │ (YC) when Set value change         │
              │ completed flag (XC) turns on by    │
              │ the analog output value changes.   │
              └──────────────────────────────────┘
                               │
                               ▼
              < Is the analog output value satisfied? >
                               │ Yes
                               ▼
              ┌──────────────────────────────────┐
              │ Specifies the offset target        │
              │ channel in Offset/gain setting     │
              │ mode Gain specification            │
              │ (Un\G23).                          │
              │ Only one channel can be set at a   │
              │ time. Set "0" in Offset/gain       │
              │ setting mode Offset specification  │
              │ (Un\G22).                          │
              └──────────────────────────────────┘
```

```
              ┌──────────────────────────────────┐
              │ Turns on Channel change request    │
              │ (YB).                              │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Checks that Channel change         │
              │ completed flag (XB) is on.         │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Turns off Channel change request   │
              │ (YB).                              │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Sets a value in Offset/gain        │
              │ adjustment value specification     │
              │ (Un\G24).                          │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Turns on Set value change request  │
              │ (YC).                              │
              └──────────────────────────────────┘
                               │                    No
                               ▼
              ┌──────────────────────────────────┐
              │ Turns off the Set value change     │
              │ request (YC) when Set value change │
              │ completed flag (XC) turns on by    │
              │ the analog output value changes.   │
              └──────────────────────────────────┘
                               │ No
                               ▼
              < Is the analog output value satisfied? >
                               │ Yes
                               ▼
              < Adjust other channels? > ──── Yes ──► ②
                               │ No
                               ▼
              ┌──────────────────────────────────┐
              │ Turns on User range writing        │
              │ request (YA).                      │
              └──────────────────────────────────┘
                               │
                               ▼
              ┌──────────────────────────────────┐
              │ Checks that Offset/gain setting    │
              │ mode flag (XA) has turned off, and │
              │ then turn off User range writing   │
              │ request (YA).                      │
              └──────────────────────────────────┘
                               │
                               ▼
              < Is the "ERR." LED on? > ──── Yes ──► ①
                               │ No
                               ▼
              ┌──────────────────────────────────┐
              │ Switches to the normal output      │
              │ mode.*1                            │
              └──────────────────────────────────┘
                               │
                               ▼
                      ┌────────────────────┐
                      │        End         │
                      └────────────────────┘
```

*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 191, Appendix 5.2)
- Setting to Mode switching setting (Un\G158, Un\G159) and OFF → ON → OFF of Operating condition setting request (Y9) (⟿ Page 172, Appendix 2 (15))
- Switch Setting (⟿ Page 43, Section 7.2 (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 OFF → ON → OFF User range writing request (YA). Once recorded, the values are not deleted even after turning the power off.
When the values are written 26 times in succession, an error occurs to prevent an improper write to the flash memory. The error code (162) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the 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 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 187, Appendix 3)

● Configure the offset/gain setting for each channel.
When settings are configured for offset and gain channels 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 the ERR. LED turns on.

● When error occurs even in one channel, 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 149, Section 11.4)

● 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 the initial setting process is executed at the switching of the mode if the sequence program executes the initial setting at Module READY (X0) ON.

● When the external power supply is off, Set value change completed flag (XC) does not turn on even though Set value change request (YC) is turned on. Turn on the external power supply, 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/Y30 to X/Y3F

The following shows 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 by the dedicated instruction (G.OFFGAN)

This program performs the followings:

- Switches the mode to the offset/gain setting mode by the dedicated instruction (G.OFFGAN).
- Switches the channels for which the offset/gain settings are configured.
- Writes the offset/gain value to the D/A converter module.
- Switches the mode back to the normal output mode by the dedicated instruction (G.OFFGAN).

Switches to the Offset/gain setting mode

M5	[MOVP K1 D2]	Stores the setting data of the dedicated instruction (G.OFFGAN) in D2.
	[G.OFFGAN U3 D2]	Dedicated instruction (G.OFFGAN).

Switches to the Offset/gain setting channel

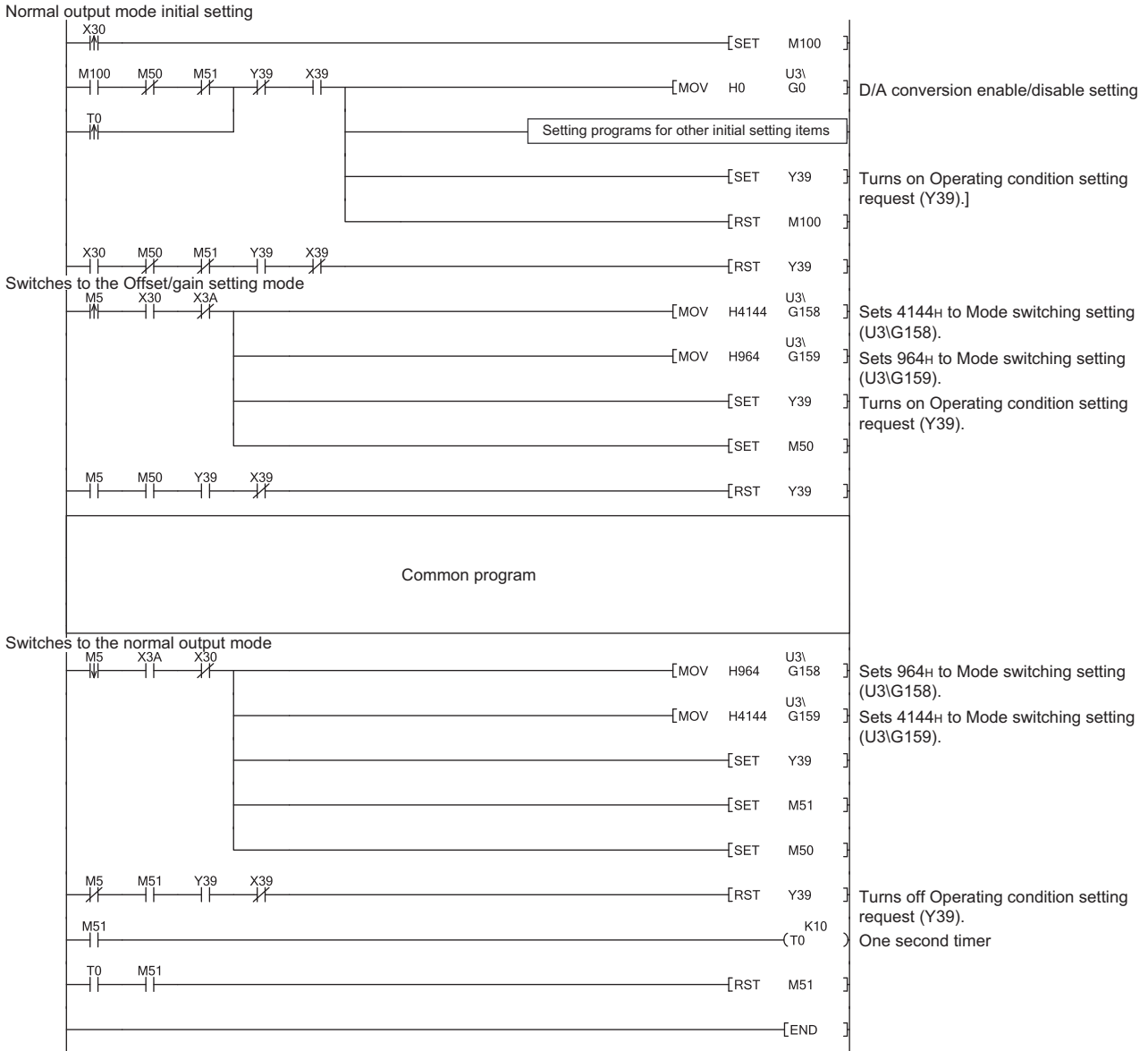|		
M0	[MOV H1 D0]	Sets the offset/gain setting mode. Stores the channel number to D0.
M2 M3 X3A	[MOV D0 U3\G22]	Specifies the offset target channel.
	[MOV K0 U3\G23]	Sets the buffer memory address 23 to 0.
M2 M3 X3A	[MOV K0 U3\G22]	Sets the buffer memory address 22 to 0.
	[MOV D0 U3\G23]	Specifies the gain target channel.
M4 X3A	[SET Y3B]	Turns on Channel change request (YB).
X3B	[RST Y3B]	Turns off Channel change request (YB).

Sets the changed value in one time for the range between -3000 and 3000 when adjusting

M8	[MOV K100 D1]	Sets the adjustment of offset value to D1.
	[MOV D1 U3\G24]	Sets the value in D1 as an offset/gain adjustment value.

Adjusts the analog output value

M6 X3A	[SET Y3C]	Turns on Set value change request (YC).
X3C	[RST Y3C]	Turns off Set value change request (YC).

Registers the Offset/gain setting result to the modules

M7 X3A	[SET Y3A]	Turns on User range writing request (YA).
X3A	[RST Y3A]	Turns off User range writing request (YA).

Switches to the normal output mode

M5	[MOVP K0 D2]	Stores the setting data of the dedicated instruction (G.OFFGAN) in D2.
	[G.OFFGAN U3 D2]	Dedicated instruction (G.OFFGAN)
X3A	[Processing in normal output mode]	
	[END]	

Point

The program in the dot-line box is common with the following three programs.

- Switching the mode by the dedicated instruction (G(P).OFFGAN) (☞ Page 52, Section 7.5.2 (2) (b))
- Switching the mode by Mode switching setting (Un\G158, Un\G159) and Operating condition setting request (Y9) (☞ Page 53, Section 7.5.2 (2) (c))
- Switching the mode by the switch setting (☞ Page 53, Section 7.5.2 (2) (d))

(c) Switching the mode by Mode switching setting (Un\G158, Un\G159) and Operating condition setting request (Y9)

Normal output mode initial setting

```
    X30
    ─┤↑├─────────────────────────────────────────────────[SET    M100 ]

    M100  M50   M51   Y39   X39                                  U3\
    ─┤├──┤/├──┤/├──┤/├──┤├─────────────────────────[MOV   H0    G0  ]   D/A conversion enable/disable setting
    T0  │
    ─┤├──┘         ┌─────────────────────────────────────────────────┐
                   │   Setting programs for other initial setting items │
                   └─────────────────────────────────────────────────┘

                                                    [SET    Y39  ]   Turns on Operating condition setting
                                                                     request (Y39).]

                                                    [RST    M100 ]

    X30   M50   M51   Y39   X39
    ─┤├──┤/├──┤/├──┤├──┤/├─────────────────────────[RST    Y39  ]
```

Switches to the Offset/gain setting mode

```
    M5    X30   X3A                                              U3\
    ─┤↑├──┤├──┤/├───────────────────────────────────[MOV   H4144 G158 ]   Sets 4144H to Mode switching setting
                                                                          (U3\G158).
                                                              U3\
                                                    [MOV   H964  G159 ]   Sets 964H to Mode switching setting
                                                                          (U3\G159).

                                                    [SET    Y39  ]   Turns on Operating condition setting
                                                                     request (Y39).

                                                    [SET    M50  ]

    M5    M50   Y39   X39
    ─┤├──┤├──┤├──┤/├─────────────────────────────[RST    Y39  ]
```

Common program

Switches to the normal output mode

```
    M5    X3A   X30                                              U3\
    ─┤↑├──┤├──┤/├───────────────────────────────────[MOV   H964  G158 ]   Sets 964H to Mode switching setting
                                                                          (U3\G158).
                                                              U3\
                                                    [MOV   H4144 G159 ]   Sets 4144H to Mode switching setting
                                                                          (U3\G159).

                                                    [SET    Y39  ]

                                                    [SET    M51  ]

                                                    [SET    M50  ]

    M5    M51   Y39   X39
    ─┤/├──┤├──┤├──┤/├─────────────────────────────[RST    Y39  ]   Turns off Operating condition setting
                                                                   request (Y39).
    M51                                                      K10
    ─┤├──────────────────────────────────────────────────(T0   )   One second timer

    T0    M51
    ─┤├──┤├────────────────────────────────────────[RST    M51  ]

                                                    [END         ]
```

(d) Switching the mode by using the switch setting

The program other than the common program is not required.

Configure the switch setting, and reset the CPU module or turn off and on the power to switch the mode.

CHAPTER 8 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 I/O signals and buffer memory, refer to the following.

- Details of I/O Signals (Page 157, Appendix 1)
- Details of Buffer Memory Addresses (Page 164, Appendix 2)

8.1 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 71, Section 8.8)

(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 47, Section 7.5)

(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)	Perform the mode transition by either of the 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 OFF → ON → OFF Operating condition setting request (Y9). • Un\G158: 0964H • Un\G159: 4144H	
4)	Perform the mode transition by either of the 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 OFF → ON → OFF Operating condition setting request (Y9). • Un\G158: 4144H • Un\G159: 0964H	
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 other mode. After the start in the wave output mode, the transition to other mode is not available. Also, after the start in other 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	ON[1]

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

8.2　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 cycles.

(1) Setting procedure

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

✍　Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]
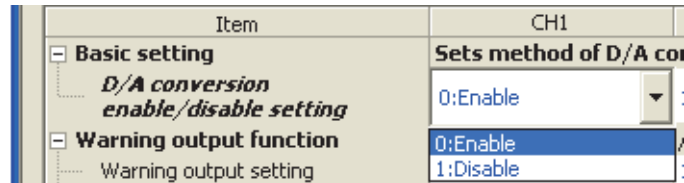
8.3　D/A Output Enable/Disable Function

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)	The D/A conversion value is output.
Disable (OFF)	The offset value is output.

8.4 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

The analog output status of the D/A converter module in the normal output mode differs from the status in the wave output mode, as described in (a) and (b).

(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).

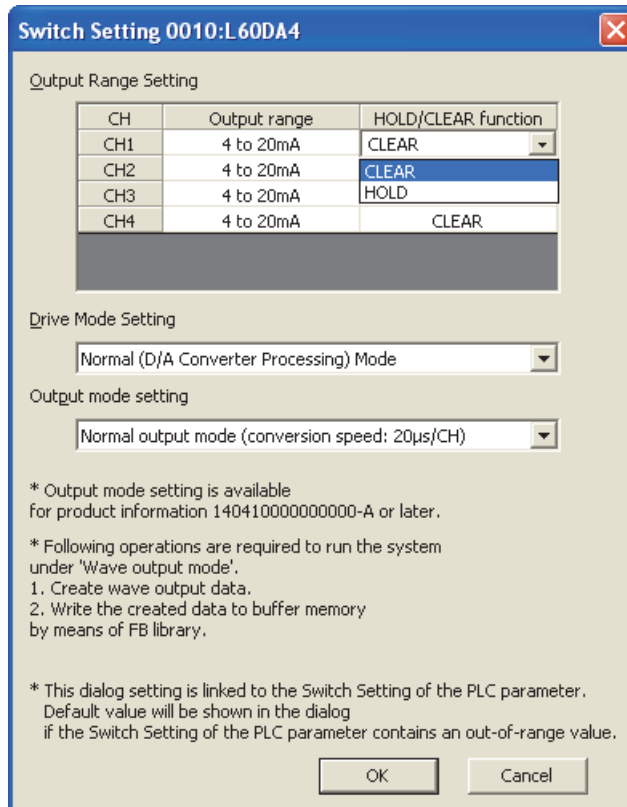| Execution status	D/A conversion enable/disable setting (Un\G0)	Enable			Disable
	CH□ Output enable/disable flag (Y1 to Y4)	Enable		Disable	Enable or disable
	Analog output HOLD/CLEAR function setting	HOLD	CLEAR	HOLD or CLEAR	HOLD or CLEAR
Analog output status when CPU module is in RUN status		Analog 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] The error occurs due to a hardware failure of the D/A converter module or other causes. Module READY (X0) and the RUN LED of the D/A converter module turn off.
> [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 to OFF → ON → OFF.
> • Output enable/disable flag OFF: 0V/0mA output
> • Output enable/disable flag OFF → 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] The error occurs due to a hardware failure of the D/A converter module or other causes. Module READY (X0) and the RUN LED of the D/A converter module turn off.
> [2] The value is output in analog according to the setting in CH□ Output setting during wave output stop (Un\G1008 to Un\G1011).

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(2) Setting procedure

Configure the setting from "HOLD/CLEAR function".

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

(3) When using the analog output HOLD/CLEAR function with the module connected to the head module

The following describes the conditions for using the analog output HOLD/CLEAR function when the analog I/O module is connected to the head module.

- Enable the station-based block data assurance of the cyclic data on the send side.
- When a link error occurs, configure the setting to hold the D/A conversion output through "Error time output mode"[1] of the I/O assignment setting. The analog output HOLD/CLEAR function setting of the switch setting is disabled.

This setting is enabled for each module. Setting by each channel are not available.

To match the output status given when CPU module is in the stop error or STOP status with that given when a link error occurs, choose the same setting for the analog output HOLD/CLEAR function setting for all the channels.

🖰 Project window ⇨ [Parameter] ⇨ [PLC Parameter] ⇨ [I/O Assignment]

⇨ Detailed Setting button
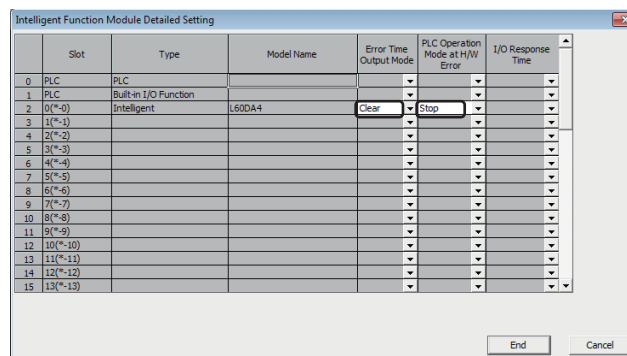
Operating status	Error time output mode[1]	Analog output HOLD/CLEAR function setting (Make the same setting for all the channels.)
Holds the analog output	Hold	HOLD
Clears the analog output (Outputs the offset value)	Clear	CLEAR

For the block guarantee of cyclic data per station, refer to the following manual.

📖 MELSEC-Q CC-Link IE Field Network Master/Local Module User's Manual

📖 MELSEC-L CC-Link IE Field Network Master/Local Module User's Manual

*1   When the error time output mode is enabled
- When a data link stops due to a network error
- When a data link stops for the CC-Link IE Field diagnostic of GX Works2

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8.5 Analog Output Test when CPU Module is in STOP Status

Analog output tests can be carried out when the CPU module is in the STOP status.

The following functions are enabled during the analog output test.

- Scaling Setting ()
- Warning Output Function ()

When a digital value out of the range is written to each channel, an error (error code: 60□) occurs and the corresponding 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 ()

(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 D/A conversion Enable (0) for the channel where the analog output test is performed.

2. Turn OFF → ON Operating condition setting request (Y9).

3. Check that Operating condition setting completed flag (X9) is turned off, and turn ON → 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 buffer memory.

5. Turn OFF → ON CH□ Output enable/disable flag (Y1 to Y4) for the channel where the analog output test is performed.
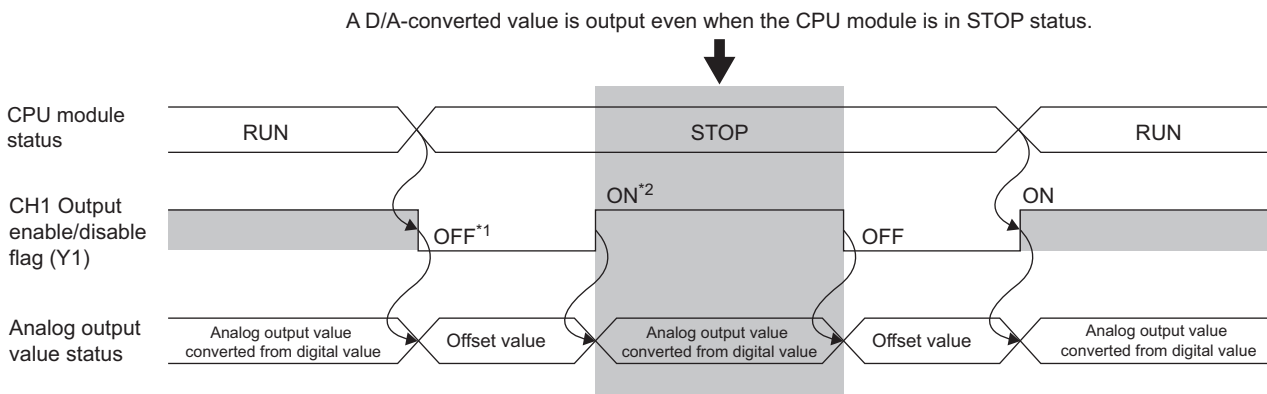
Setting combination	D/A conversion enable/disable setting (Un\G0)		Enable		Disable	
	CH□ Output enable/disable flag (Y1 to Y4)		Enable	Disable	Enable	Disable
Analog output test			Allowed	Not allowed	Not allowed[1]	

*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 CH□ Output enable/disable flag (Y1 to Y4) OFF → ON 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.

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

CPU module status	RUN	STOP	RUN
CH1 Output enable/disable flag (Y1)	OFF[1]	ON[2] OFF	ON
Analog output value status	Analog output value converted from digital value / Offset value	Analog output value converted from digital value / Offset value	Analog output value converted from digital value

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

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

Point

When the module is connected to the head module, analog output tests can be carried out even when the CPU module of the master station causes a stop error.

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8.5 Analog Output Test when CPU Module is in STOP Status

8.6 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 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 either the factory default setting or the user range setting is used for analog output range.

(a) When the factory default setting is used for analog output range

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

(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 factory default setting is used for output range

Voltage: 1 to 5 V, 0 to 5 V

Current: 4 to 20 mA, 0 to 20 mA

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

When the voltage is -10 to 10 V

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

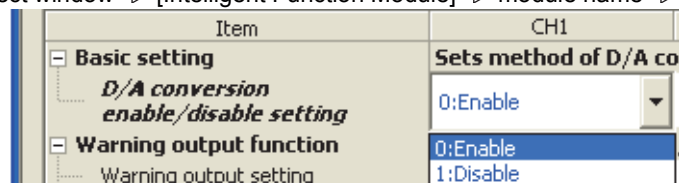### (b) When the user range setting is used for output range

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

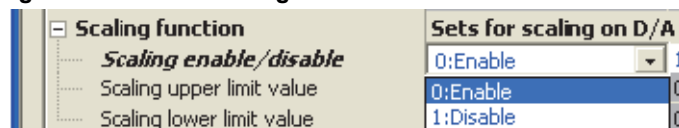| Item	Description
D_X	Digital value
S_H	Scaling upper limit value
S_L	Scaling lower limit value

(3) Setting procedure

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

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

Item	CH1
☐ **Basic setting**	**Sets method of D/A con**
D/A conversion enable/disable setting	0:Enable ▼
	0:Enable
	1:Disable
☐ **Warning output function**	
Warning output setting	

2. **Set "Scaling enable/disable setting" to "0: Enable".**

☐ **Scaling function**	**Sets for scaling on D/A**
Scaling enable/disable	0:Enable ▼
Scaling upper limit value	0:Enable
Scaling lower limit value	1:Disable

3. **Set values for "Scaling upper limit value" and "Scaling lower limit value".**

☐ **Scaling function**	**Sets for scaling on D/A**
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000
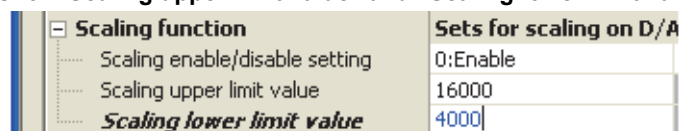
Item	Setting range
Scaling upper limit value	-32000 to 32000
Scaling lower limit value	

Point

● Your scaling settings must meet the following condition:
  Scaling upper limit value > Scaling lower limit value

● In the channel where "Scaling enable/disable setting" is set to "0: Enable" 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 the ERR.LED turns on.

● Even if the input range of the digital value is extended, the resolution does not become higher than that provided when the scaling function is not used.

(4) Scaling setting example

Ex. When the following values are set for a channel with an output range of 0 to 5V:
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

Scaling function	Sets for scaling on D/A
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The following shows the digital values before and after scaling.
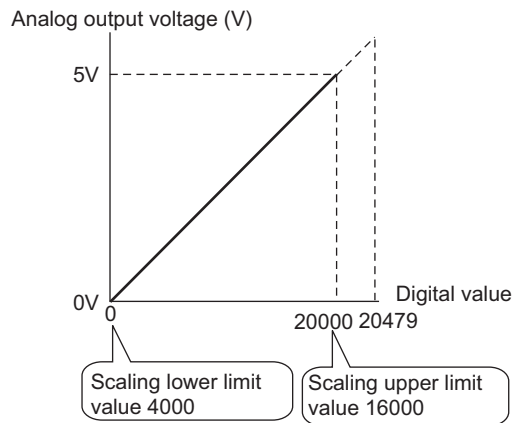
Digital value	Digital value after scaling	Analog output voltage (V)
4000	0	0
6400	4000	1
8800	8000	2
11200	12000	3
13600	16000	4
16000	20000	5

Ex. When the following values are set for a channel with an output range of -10 to 10V:
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

Scaling function	Sets for scaling on D/A
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The following shows the digital values before and after scaling.
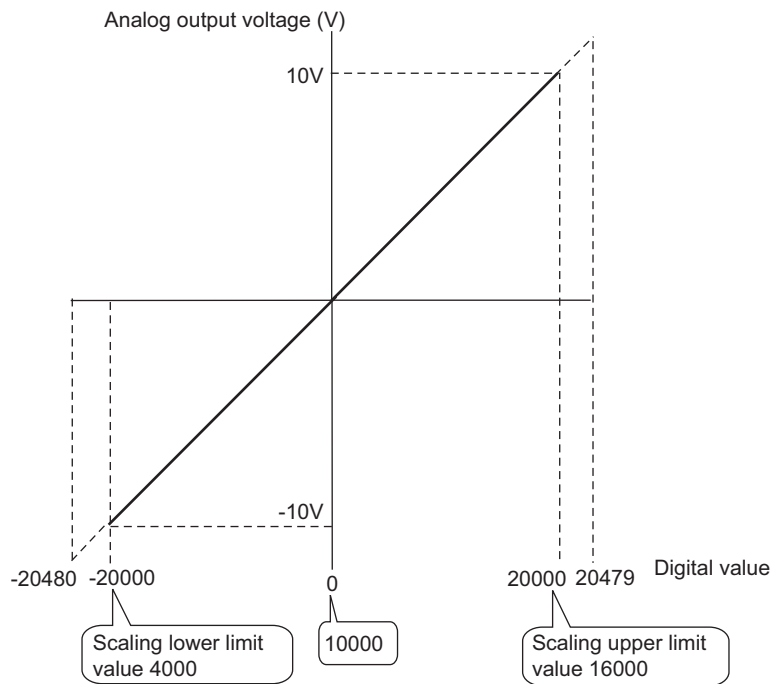
Digital value	Digital value after scaling	Analog output voltage (V)
4000	-20000	-10
7000	-10000	-5
10000	0	0
13000	10000	5
16000	20000	10

Ex. When the following values are set for a channel with a user range setting of -8 to 8V:
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

□ Scaling function	Sets for scaling on D/A
Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The following shows the digital values before and after scaling.
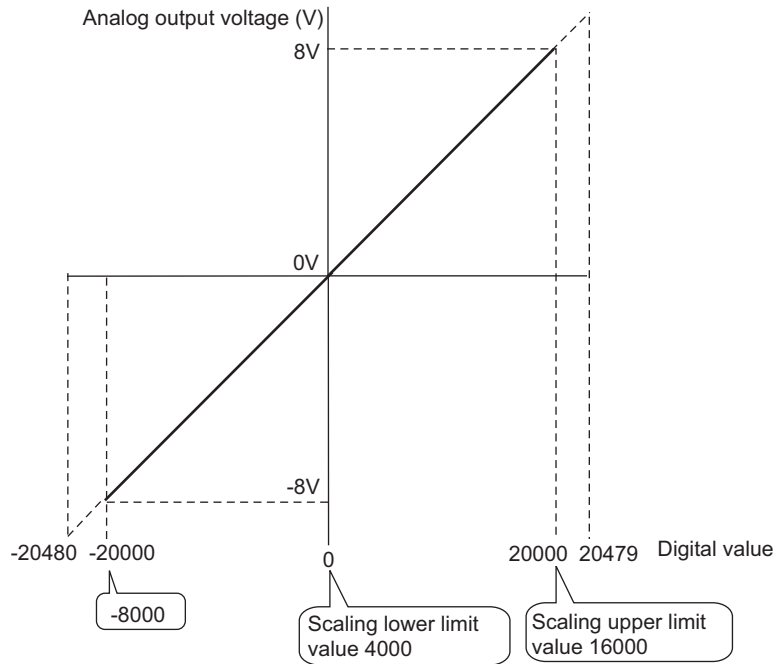
Digital value	Digital value after scaling	Analog output voltage (V)
-8000	-20000	-8
-2000	-10000	-4
4000	0	0
10000	10000	4
16000	20000	8

Point

● When using the scaling function, 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 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.
Especially in the examples of when the output range is 0 to 5V and -10 to 10V, the out-of-range digital value error occurs if CH☐ Output enable/disable flag (Y1 to Y4) is turned on with the digital value "0". 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.

60☐

Fixed — Error channel number

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

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8.6 Scaling function

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8.7　Warning Output Function

This function outputs a warning when the digital value exceeds the warning output upper limit value or becomes less than 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)
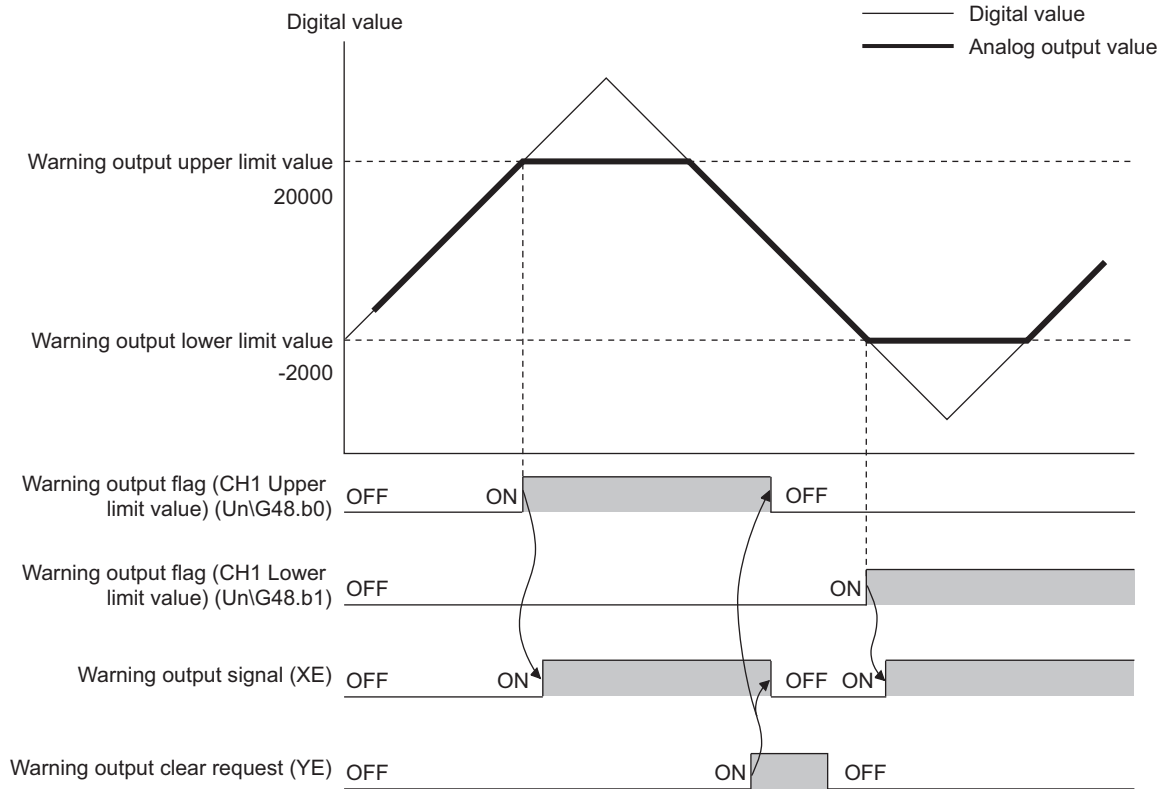
(1) Warning output notification

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

In addition, alarm code: 15△☐ is stored in Latest error code (Un\G19). The alarm code that is stored is shown below:
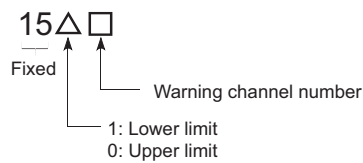
(2) Operation of warning output function

When the digital value moves above the warning output upper limit value, or below the warning output lower limit value, warning notifications are made, 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 is 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 a warning

A warning can be cleared in the following two methods:

- Turning OFF → ON → OFF Warning output clear request (YE)
- Turning OFF → ON → 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) is turned to OFF.
- ALM LED is turned off.
- Warning code: 15△□ stored in Latest error code (Un\G19) is cleared.
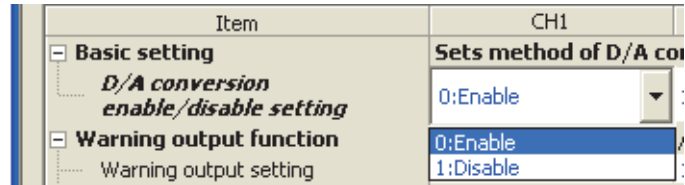
(4) If the scaling function is enabled

If Scaling enable/disable setting (Un\G53) is set to Enable (0), the digital value converted to the scaling range becomes a subject 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" to "0: Enable".**

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

Item	CH1
⊟ **Basic setting**	Sets method of D/A co
D/A conversion enable/disable setting	0:Enable ▼
⊟ **Warning output function**	0:Enable
Warning output setting	1:Disable

2. **Set "Warning output setting" to "0: Enable".**

⊟ **Warning output function**	Sets for warnings on D
Warning output setting	0:Enable ▼
Warning output upper limit value	0:Enable
Warning output lower limit value	1:Disable
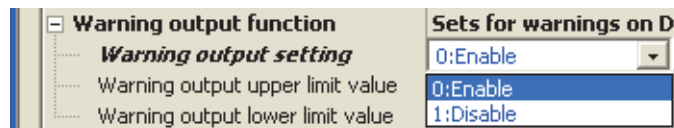
3. **Set values for "Warning output upper limit value" and "Warning output lower limit value".**

⊟ *Warning output function*	Sets for warnings on D
Warning output setting	0:Enable
Warning output upper limit value	16000
Warning output lower limit value	4000
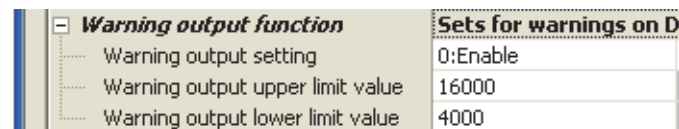
Item	Setting range
Warning output upper limit value	-32768 to 32767
Warning output lower limit value	

Point

Set the values so that they 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), and Error flag (XF) and the ERR.LED turn on.

8.8 Wave Output Function

This function registers the prepared wave data (digital value) into the D/A converter module and continuously outputs the data (analog value) in the set conversion cycle. A faster and smoother control than a program control 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)
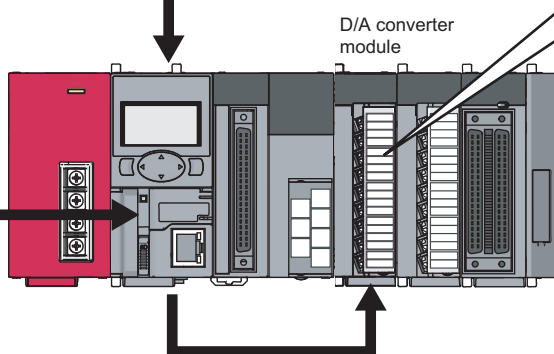- Wave output mode (conversion speed: 80μs/CH)

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

- Switch Setting (⟹ Page 91, Section 8.8.1 (4) (a))

1) Create wave data.
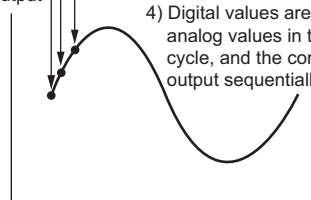Wave data can be created with easy mouse operation from "Create Wave Output Data" of GX Works2.
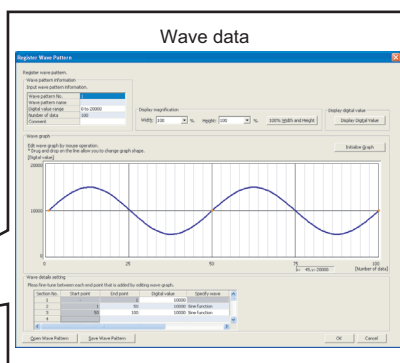
Wave data

2) Save the wave data to a CSV file or file register. Save a CSV file in a SD memory card.

Wave data registry area

Address	F E D C B A 9 8 7 6 5 4 3 2 1 0	
5000	0 0 0 0 0 1 1 1 1 1 0 1 0 0 0 0	2000
5001	0 0 0 1 0 0 1 1 1 0 0 0 1 0 0 0	5000
5002	0 0 0 1 1 1 1 1 0 1 0 0 0 0 0 0	8000
5003	0 0 1 0 0 1 1 1 0 0 0 1 0 0 0 0	10000
5004	0 0 0 1 0 1 1 1 0 1 1 1 0 0 0 0	6000
5005	0 0 0 1 0 1 1 1 0 1 0 1 1 0 0 0	3000
5006	0 0 0 0 0 0 1 1 1 1 1 0 1 0 0 0	1000

D/A converter module

Analog output

4) Digital values are converted to analog values in the set conversion cycle, and the converted values are output sequentially.

3) Register the wave data to the wave data registry area in the D/A converter module using a function block (FB) for wave data registration.

Subject to be controlled

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(1) Wave output function procedure

The following shows how to use the wave output function.

```
                              ┌─────────────────────────────┐
                              │            Start            │
                              └─────────────────────────────┘
                                            │
┌──────────────────────────┐    ┌ ─ ─ ─ ─ ─ │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ Initial settings of the  │    │           ▼                     │
│ wave output function ··· (1)   │   ┌─────────────────────────┐   │
└──────────────────────────┘    │   │ Creating wave data ··· (2)│  │
                                │   └─────────────────────────┘   │
                                │           │                     │
                                │           ▼                     │
                                │   ┌──────────────────────────────┐
                                │   │ Setting parameters of the     │
                                │   │ wave output function ··· (3)   │
                                │   └──────────────────────────────┘
                                │           │                     │
                                │           ▼                     │
                                │   ┌──────────────────────────────┐
                                │   │ Writing data to a file        │
                                │   │ register (ZR) or CSV file ··· (4)│
                                │   └──────────────────────────────┘
                                │           │                     │
                                │           ▼                     │
                                │   ┌──────────────────────────────┐
                                │   │ Switch setting and basic       │
                                │   │ setting ··· (5)                │
                                │   └──────────────────────────────┘
                                └ ─ ─ ─ ─ ─ │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
                                            │
┌──────────────────────────┐    ┌ ─ ─ ─ ─ ─ │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ Execution of the wave    │    │           ▼                     │
│ output function  ··· (6)  │    │   ┌──────────────────────────────┐
└──────────────────────────┘    │   │ Registering the wave data and  │
                                │   │ parameters of the wave output  │
                                │   │ function ··· (7)               │
                                │   └──────────────────────────────┘
                                │           │                     │
                                │           ▼                     │
                                │   ┌──────────────────────────────┐
                                │   │ Starting/stopping/pausing      │
                                │   │ wave output ··· (8)            │
                                │   └──────────────────────────────┘
                                └ ─ ─ ─ ─ ─ │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
                                            │
                                            ▼
                              ┌─────────────────────────────┐
                              │             End             │
                              └─────────────────────────────┘
```
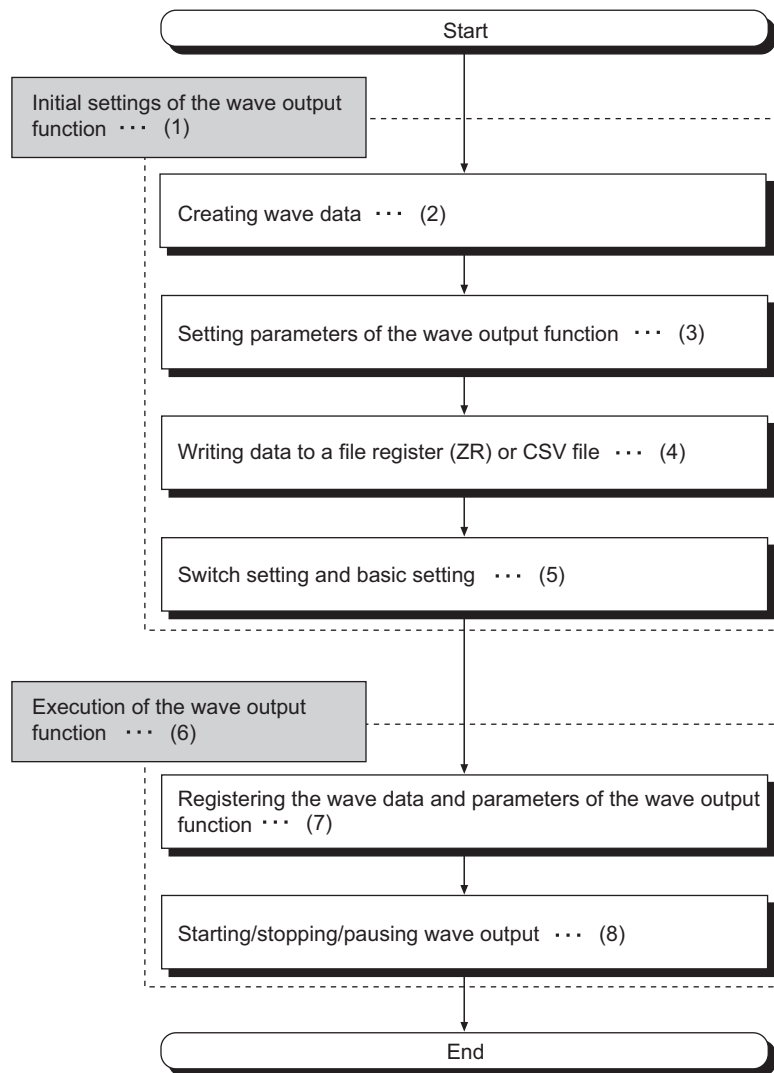
(1) ☞ Page 79, Section 8.8.1

(2) ☞ Page 79, Section 8.8.1 (1)

(3) ☞ Page 86, Section 8.8.1 (2)

(4) ☞ Page 88, Section 8.8.1 (3)

(5) ☞ Page 91, Section 8.8.1 (4)

(6) ☞ Page 93, Section 8.8.2

(7) ☞ Page 93, Section 8.8.2 (1)

(8) ☞ Page 94, Section 8.8.2 (2)

(a) Feature of a file register (ZR) and a CSV file concerning wave data storage

  * File register (ZR): The wave data and parameter setting contents remain in the CPU module even after power ON → 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 system 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 164, Appendix 2)

Setting item	Buffer memory address	Reference
Output setting during wave output stop	Un\G1008 to Un\G1011	Page 174, Appendix 2 (19)
Output value during wave output stop	Un\G1016 to Un\G1019	Page 175, Appendix 2 (20)
Wave pattern start address setting	Un\G1024 to Un\G1031	Page 176, Appendix 2 (21)
Wave pattern data points setting	Un\G1040 to Un\G1047	Page 177, Appendix 2 (22)
Wave pattern output repetition setting	Un\G1056 to Un\G1059	Page 178, Appendix 2 (23)
Constant for wave output conversion cycle	Un\G1064 to Un\G1067	Page 178, Appendix 2 (24)
Wave data registry area	Un\G5000 to Un\G54999	Page 186, Appendix 2 (36)

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

  * Setting parameters of the wave output function (☞ Page 86, Section 8.8.1 (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 91, Section 8.8.1 (4) (a))

(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 57, Section 8.4 (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.

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8.8 Wave Output Function

(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).
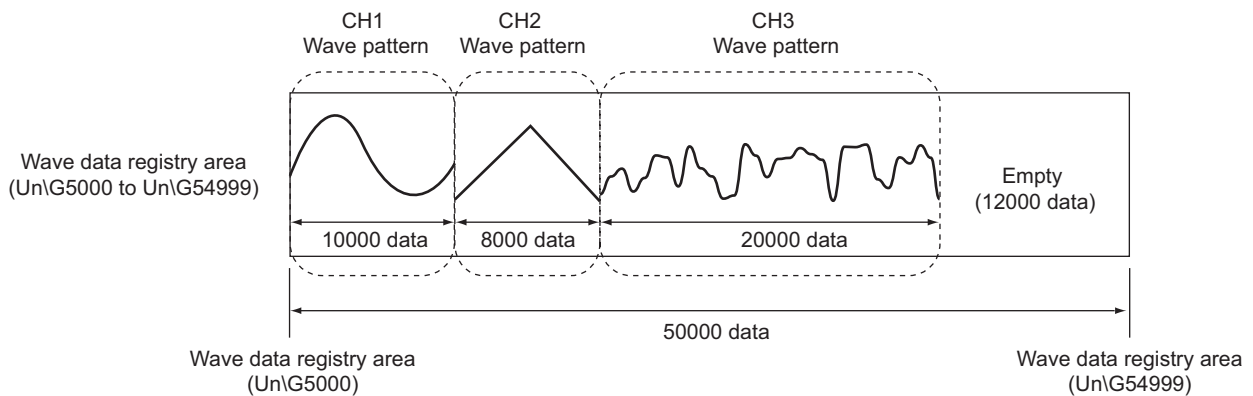
(5) Wave pattern

To use the wave output function, select any points from the registered wave data for each channel to set the wave pattern. The following shows 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 the 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

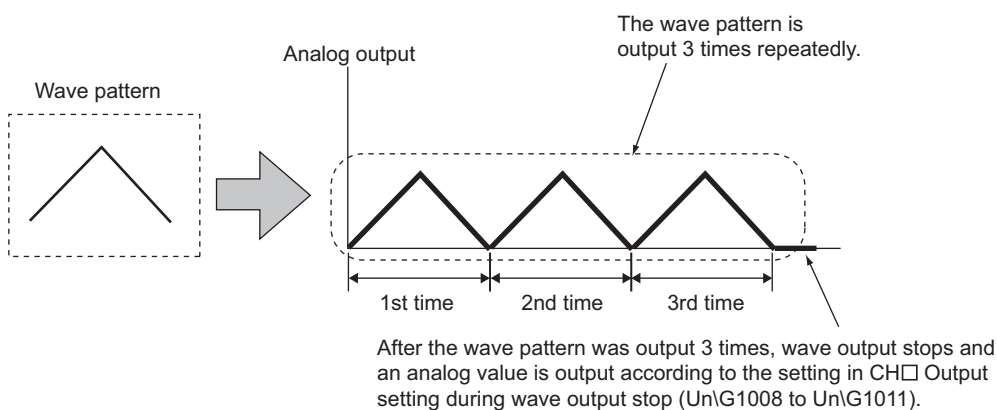Ex. Setting example to output the same wave from CH1 to CH3
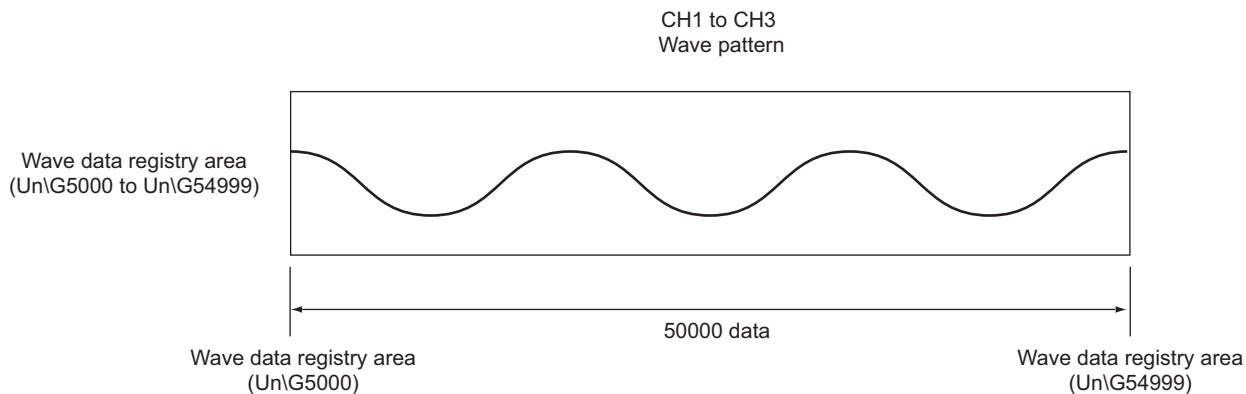
CH1 to CH3
Wave pattern

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

50000 data

Wave data registry area
(Un\G5000)

Wave data registry area
(Un\G54999)

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

Wave pattern

Analog output

The wave pattern is
output 3 times repeatedly.

1st time　2nd time　3rd time

After the wave pattern was output 3 times, wave output stops and
an analog value is output according to the setting in CH□ Output
setting during wave output stop (Un\G1008 to Un\G1011).

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.
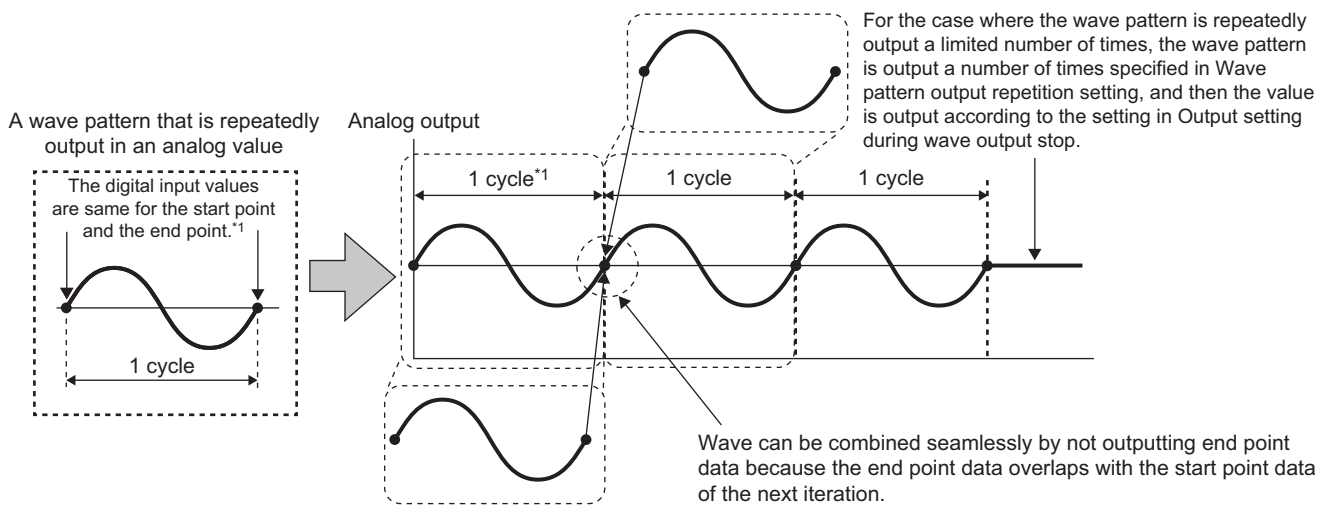
For the case where the wave pattern is repeatedly output a limited number of times, the wave pattern is output a number of times specified in Wave pattern output repetition setting, and then the value is output according to the setting in Output setting during wave output stop.

Wave can be combined seamlessly by not outputting end point data because the end point data overlaps with the start point data of the next iteration.

*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 wave output conversion cycle, refer to the following.
· Wave output conversion cycle (Page 78, Section 8.8 (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 (EH) for CH1 only
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.

$$\begin{aligned} \text{Output cycle of a wave pattern (μs)} &= \text{Conversion speed} \times \begin{array}{c}\text{Number of channels where D/A conversion is enabled}\end{array} \times \begin{array}{c}\text{Constant for wave output conversion cycle}\end{array} \times \text{(Wave pattern data points - 1)} \\ &= 50 \times 1 \times 1 \times 100 \\ &= \underline{5000} \end{aligned}$$

(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 end point is output in analog regardless of the setting in CH□ Wave pattern output repetition setting (Un\G1056 to Un\G1059).

A wave pattern that is repeatedly output in an analog value

The digital values are different between the start point and the end point.[*1]

Analog output

1 cycle[*1]   1 cycle   1 cycle

The digital values of the end point and the start point of the next iteration are consecutively output in an analog value.

For the case where the wave pattern is repeatedly output a limited number of times, the wave pattern is output a number of times specified in Wave pattern output repetition setting, and then the value is output according to the setting in Output setting during wave output stop.

*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 wave output conversion cycle, refer to the following.
· Wave output conversion cycle (Page 78, Section 8.8 (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 (EH) for CH1 only
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

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8.8 Wave Output Function

(7) Wave output conversion cycle

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

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

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 figure shows the conversion cycle of each channel with the above settings.

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

D/A conversion is performed with this conversion cycle, and an analog value is output.
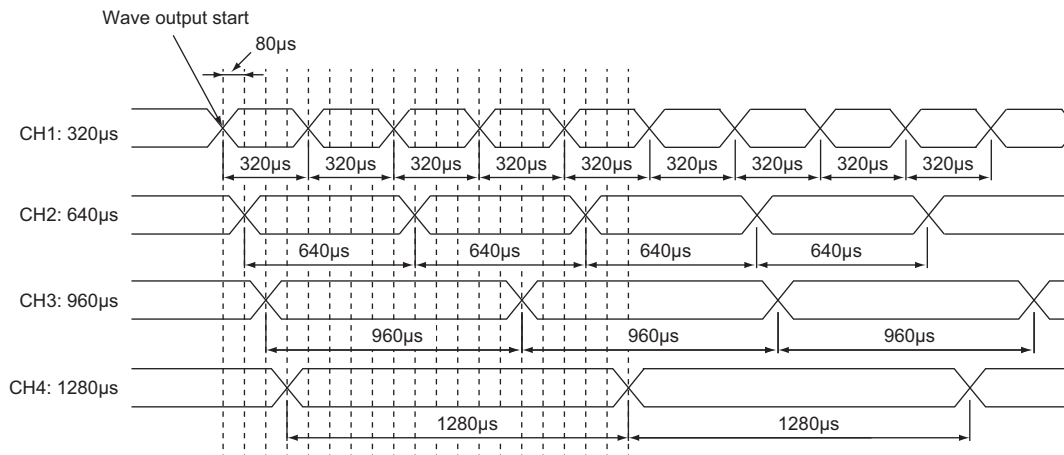
8.8.1 Initial settings of the wave output function

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 79, Section 8.8.1 (1))
- Setting parameters of the wave output function (Page 86, Section 8.8.1 (2))
- Writing data to a file register (ZR) or CSV file (Page 88, Section 8.8.1 (3))
- Switch setting and basic setting (Page 91, Section 8.8.1 (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" in "Module Type".**
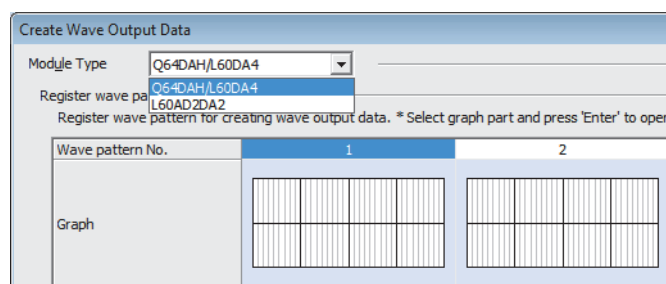
Point

● Set the correct value in "Module Type" and follow the procedure 3 or later to set "Wave pattern" and "Wave output data" properly.

● If "Module Type" is changed after the procedure 3 or later, "Wave pattern" and "Wave output data" are completely deleted.

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

The "Register Wave Pattern" window is displayed.

Press the [Enter] key.
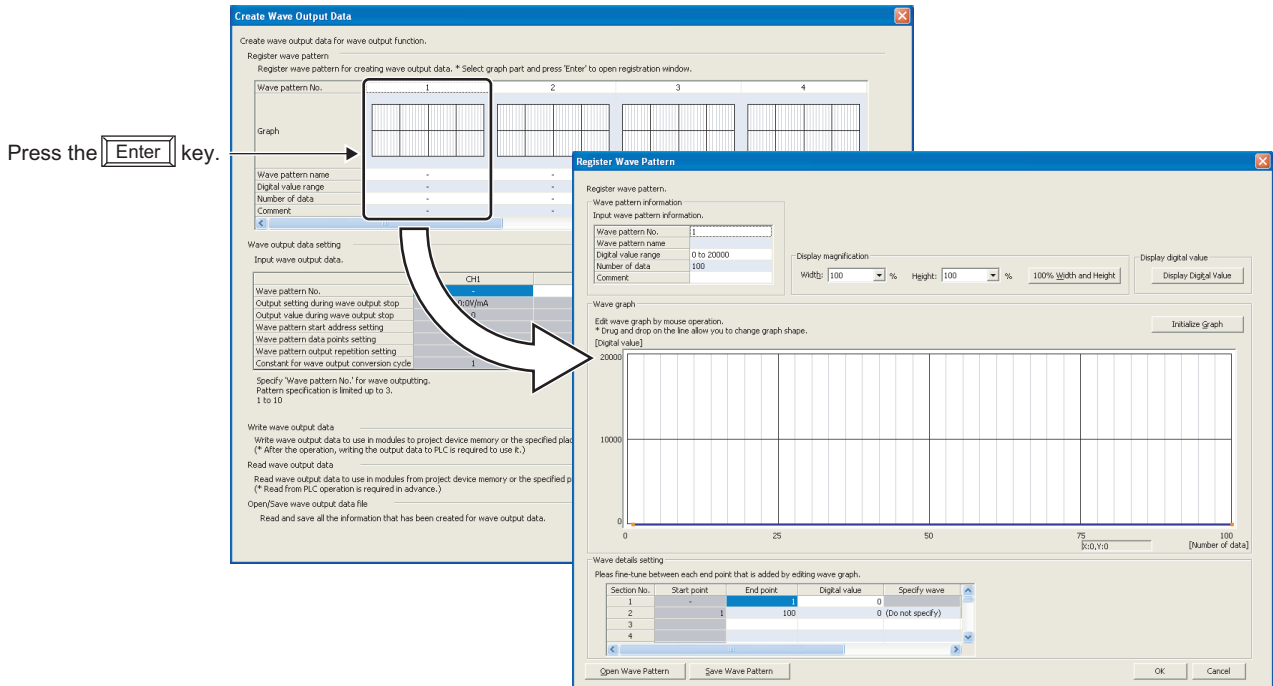
4. Set "Wave pattern information".
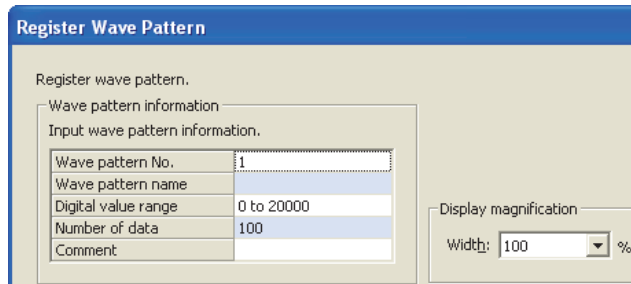
Item	Description	Setting range
Wave pattern No.	The wave pattern number selected in the "Create Wave Output Data" window is displayed. Up to 10 wave patterns can be created.	—
Wave pattern name	Set the name of the wave pattern.	16 characters
Digital value range	Select the setting range of the digital 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 ▪ .

Created end point
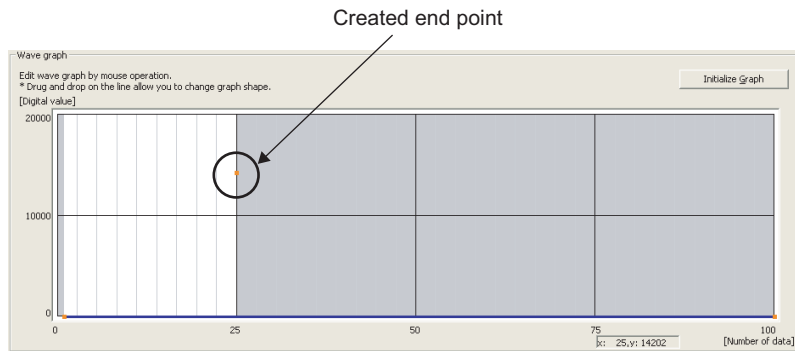
To delete the end point, move the mouse pointer to the point. Then select "Delete end point" from the right-click menu.

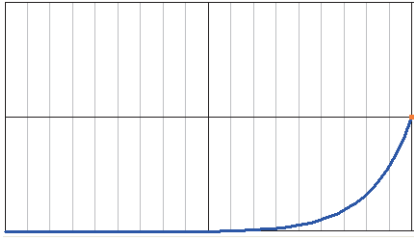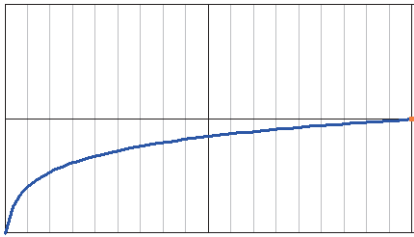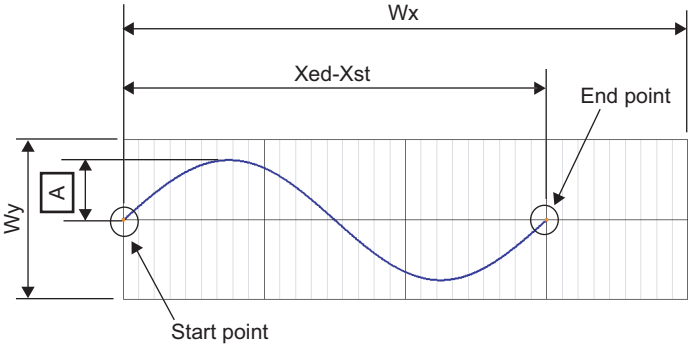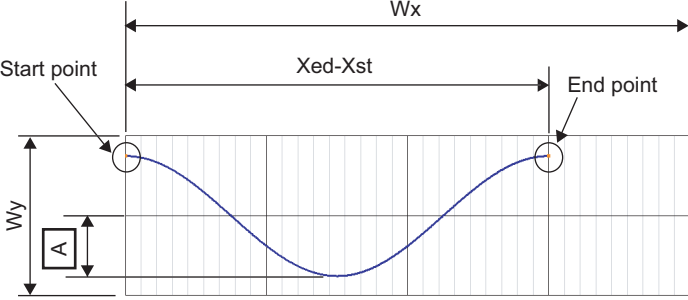When the mouse pointer is on the end point, the display of the mouse pointer is changed to ＋ .

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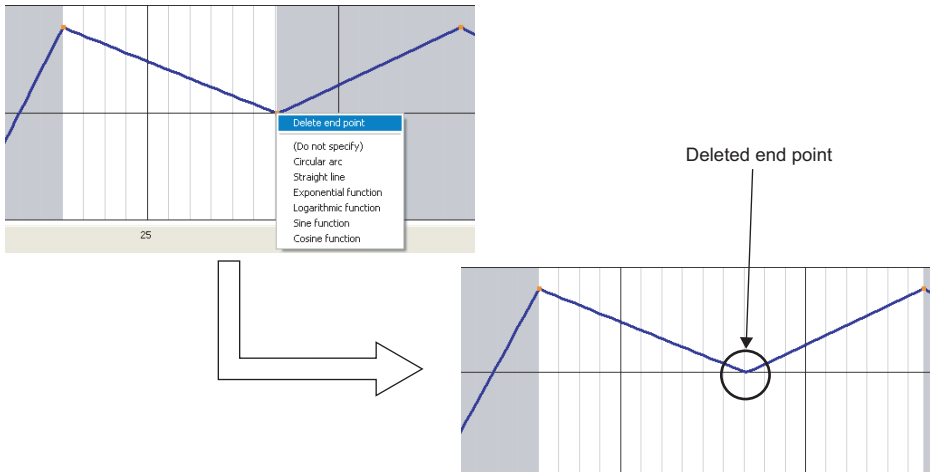
6. Set the wave between end points from the right-click menu or in "Specify wave" of "Wave details setting".
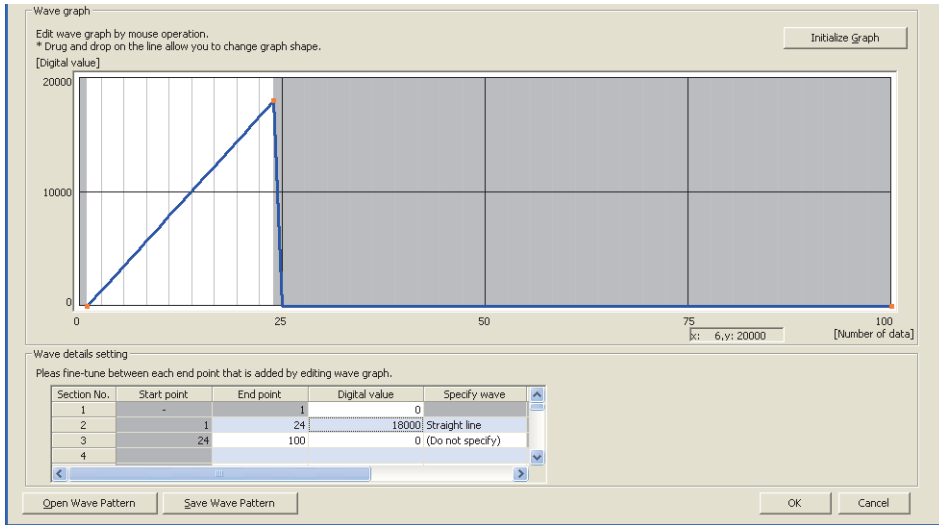

This setting enables the wave change in the specified interval as follows.

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. 1) Construct an equilateral triangle having the start and end points as its vertices. 2) Construct a circle having the other vertex of the triangle as its center and a side of the triangle as its radius. 3) Draw the minor arc connecting the start and end points on the wave graph. * The steps 1) and 2) are processed inside GX Works2, and not displayed on the wave graph.
Straight line	The interval of the start point and end point is drawn in a straight line.

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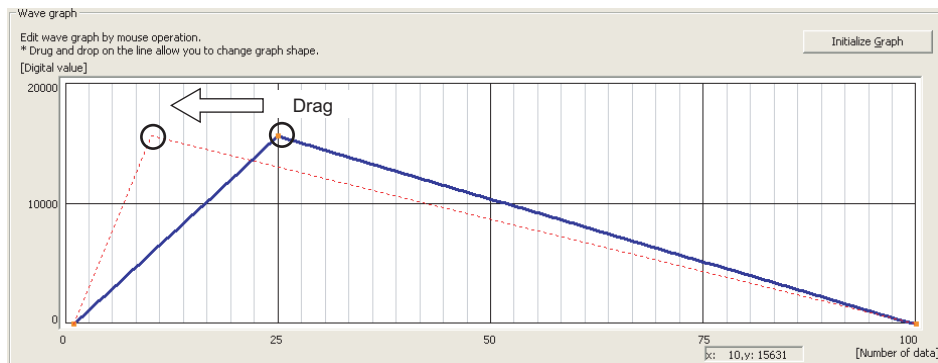
The end point position also can be adjusted by changing the value of "End point" and "Digital value" in "Wave details setting".

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 procedures 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.

Digital values of the wave pattern are displayed.

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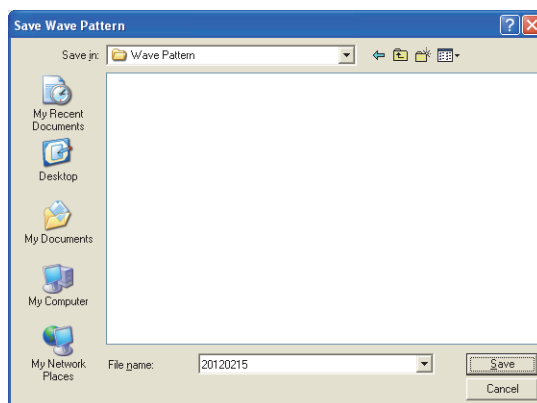
The saved wave pattern can be opened by clicking the [Open Wave Pattern] button.

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

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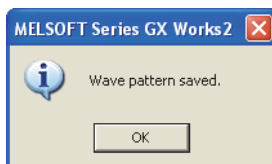
12. **Click the** [OK] **button in "Register Wave Pattern" to register the created wave pattern.**

13. **Repeat procedures 3 to 12 to create other wave pattern.**

8

8.8 Wave Output Function
8.8.1 Initial settings of the wave output function

(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" in "Module Type".**
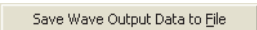
3. **Set the parameters of the wave output function in "Wave output data setting".**

Set parameters of the wave output function.

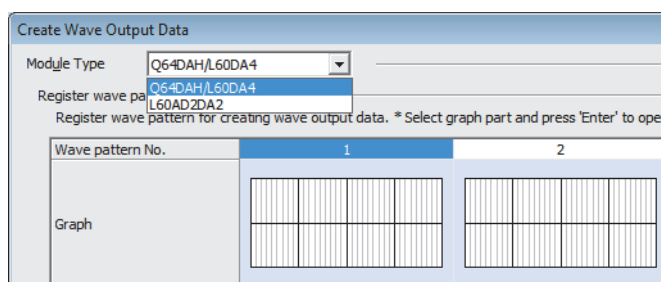| Item	Description	Setting range
Wave pattern No.	Up to three patterns can be specified at a time from registered wave patterns. When specifying multiple wave patterns, set the pattern No. as follows. • When No. 1 and No. 2 are used: 1, 2 • When No. 1, No. 5, and No. 10 are used: • When No. 1 to No. 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)
Wave pattern start address setting	Set the start address of the wave pattern to be output.	5000 to 54999 (default value:
Wave pattern data points setting	This setting is not required because the data points of the wave pattern to be used are stored automatically.	—
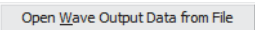
Item	Description	Setting range
Wave pattern output repetition setting	This area is for setting the repeat count to output the wave pattern repeatedly.	• -1 (Unlimitedly repeat output) • 1 to 32767 (default value: 1)
Constant for wave output conversion cycle	Set the constant to decide the conversion cycle (specify 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 78, Section 8.8 (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.
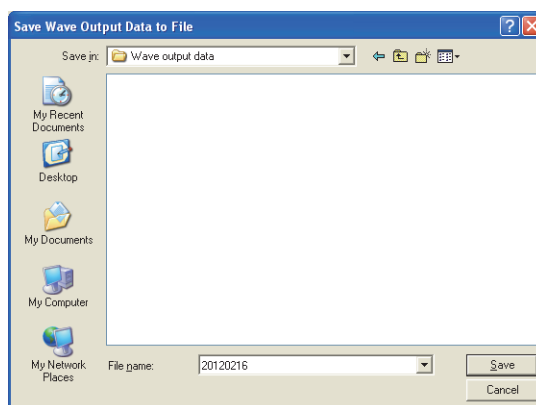
The saved wave pattern and parameter setting of the wave output function can be opened by clicking the `Open Wave Output Data from File` button.

Point

Note that if the data created for the module type other than "Q64DAH/L60DA4" is opened, the module type cannot be changed by setting "Q64DAH/L60DA4" to "Module Type".

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

6. **Click the** `OK` **button.**
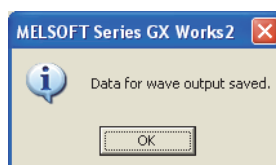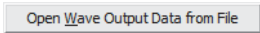
(3) Writing data to a file register (ZR) or CSV file

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

Point

Data unnecessary for control such as "Wave pattern name", "Comment", and "Wave details setting" is not written to the file register (ZR) or the CSV file.

Saving the wave data and the parameter setting of the wave output function using the [Open Wave Output Data from File] button before writing them is recommended.
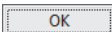
(a) Writing data to a file register (ZR)

When writing the data to the file register (ZR), set the capacity of the file register (ZR) for the number of required data points. For the setting method, refer to the following.

- 📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

1. Click the [Write to Device Memory] button in "Create Wave Output Data".
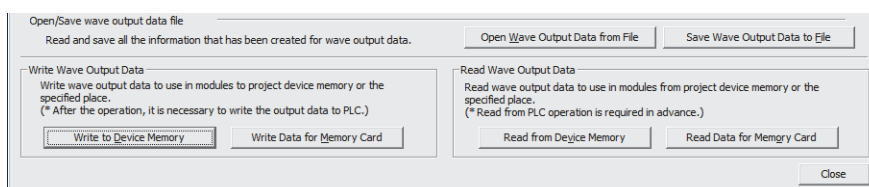
2. Click the [OK] button.
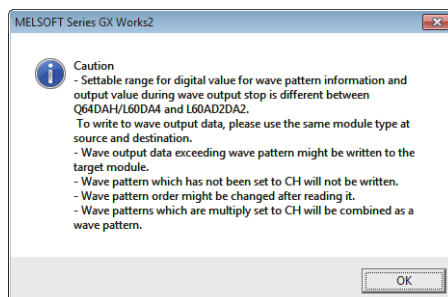
3. Set "Device memory name" and "Start device", then click the [OK] button.
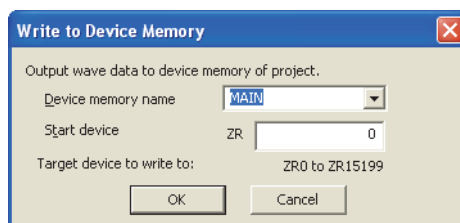
Item	Description
Device memory name	Set the device memory to be written to the file register (ZR). Select the device memory to be written from the pull-down menu or enter the device memory name to be created.
Start device	Set the start address for the output of the device memory.
Target device to write to	The file register (ZR) range to be written is displayed.

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

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⚠ Same device memory name exists in the project.
Devices value in the following range will be overwritten if the operation
is proceed.
ZR0 to ZR15199
Are you sure you want to continue?

[Yes]   [No]

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

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ⓘ Output the wave output data to device memory in the project.

<Caution>
- The following operation is required to execute wave output
based on the written data to device memory.
1. Write device memory written wave output data to PLC.
2. Write device memory data to buffer memory by means of
FB library.

[OK]

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...]

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(b) Writing data to a CSV file

When writing the data to the CSV file, store the CSV file to an SD memory card.

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

2. **Click the** [OK] **button.**
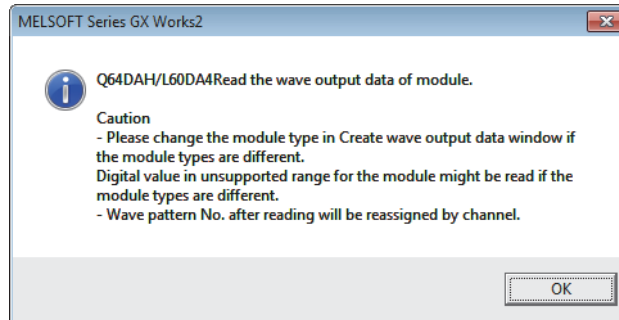
3. **Set the save destination and the file name, then click the** [Save] **button.**
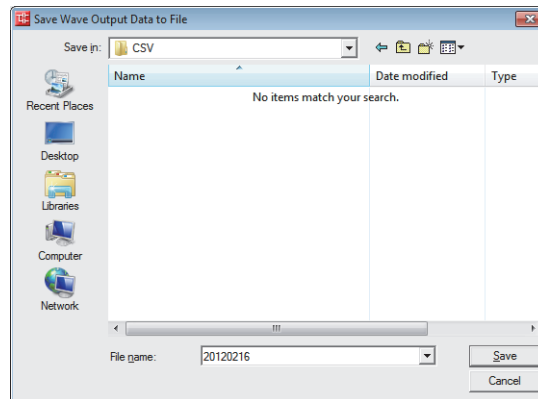
4. **Click the** [OK] **button.**
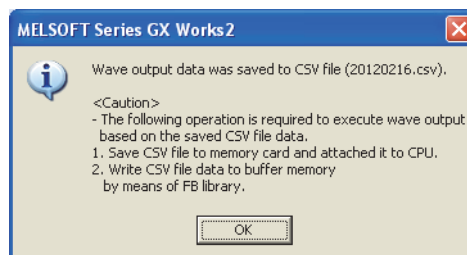
5. **Click the** [Close] **button in "Create Wave Output Data" to finish the window.**

6. **Store the CSV file to an SD memory card. Then install the SD memory card to the CPU module.**

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.

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(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 91, Section 8.8.1 (4) (a)
	Output mode setting	
Basic setting	D/A conversion enable/disable setting	Page 91, Section 8.8.1 (4) (b)

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

• Setting parameters of the wave output function (☞ Page 86, Section 8.8.1 (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".**
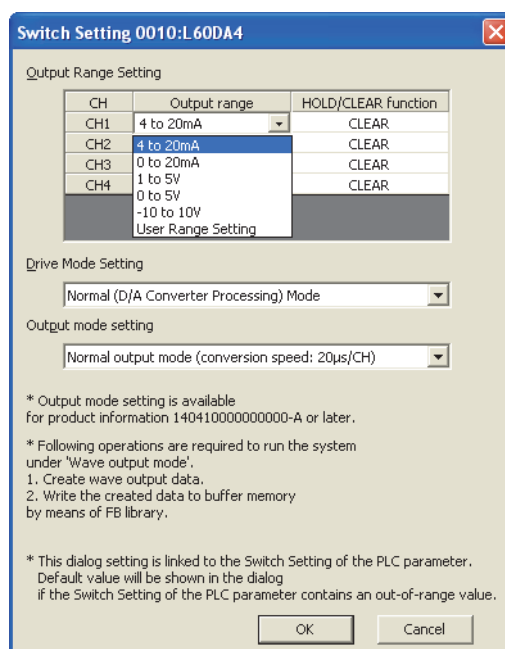
3. **Set "Output mode setting" to "Wave output mode (conversion speed: 50µs/CH)" or "Wave output mode (conversion speed: 80µs/CH)".**
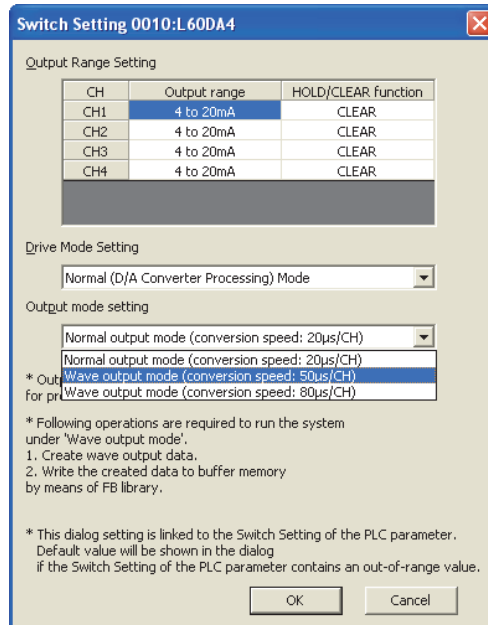
(b) Basic setting

Change D/A conversion enable/disable setting (Un\G0) using a 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 93, Section 8.8.2 (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".**
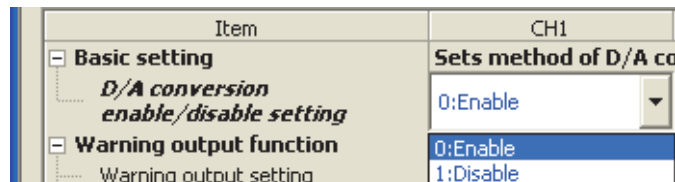
When the setting is configured by the above procedure, an error occurs if the setting content is activated by resetting the CPU module or by turning off and on the power. The error code (33☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR.LED turns on. This error occurs 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 OFF → ON → OFF Operating condition setting request (Y9) as in the procedure described in Page 93, Section 8.8.2 (1).

8.8.2 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

Register the wave data and parameter settings for the wave output function created from "Create Wave Output Data" of GX Works2, 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-L Digital-Analog Converter Module FB Library Reference Manual (FBM-M031)

The contents registered by the function block (FB) for the wave data registration need to be enabled by turning OFF → ON → 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.
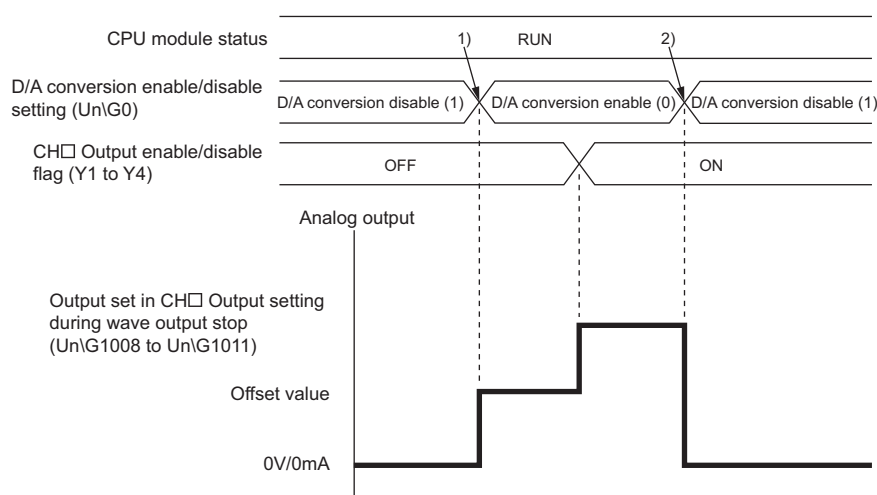
1): Set D/A conversion enable/disable (Un\G0) to D/A conversion enable (0), and turn on then off Operating condition setting request (Y9).

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 OFF → ON → 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 the ERR.LED turns on. The parameter setting cannot be enabled in this case.

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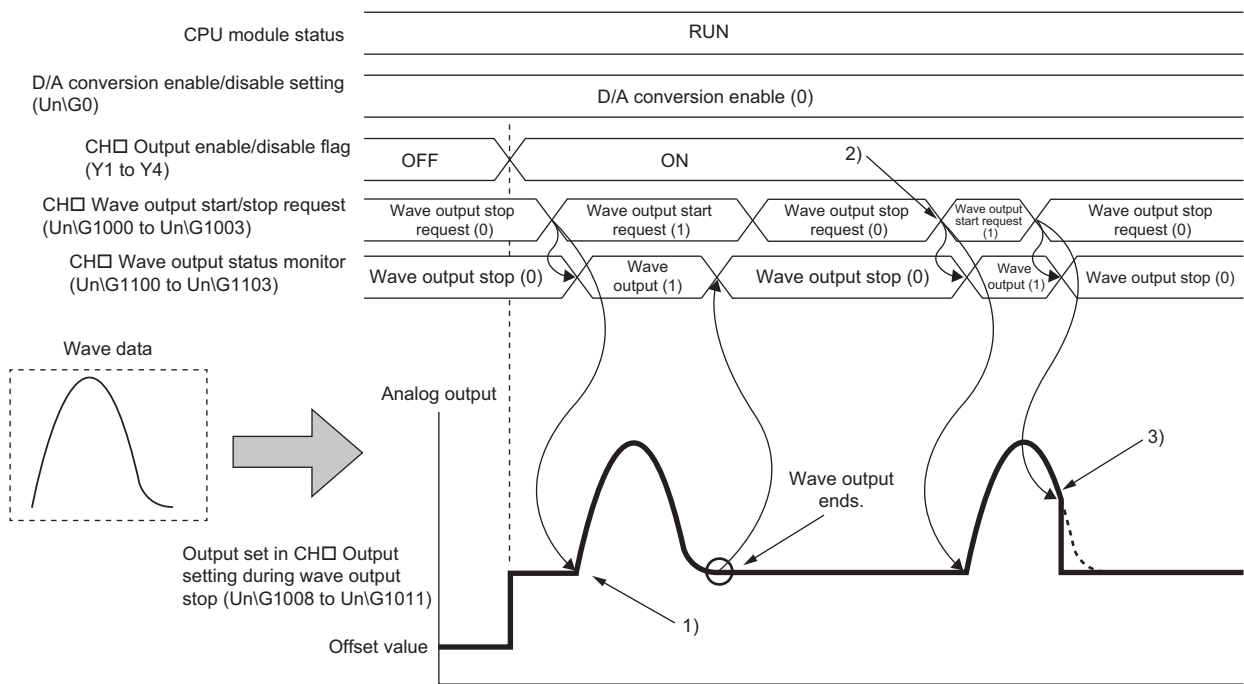
1): Wave output starts when CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) is set to Wave output start request (1).

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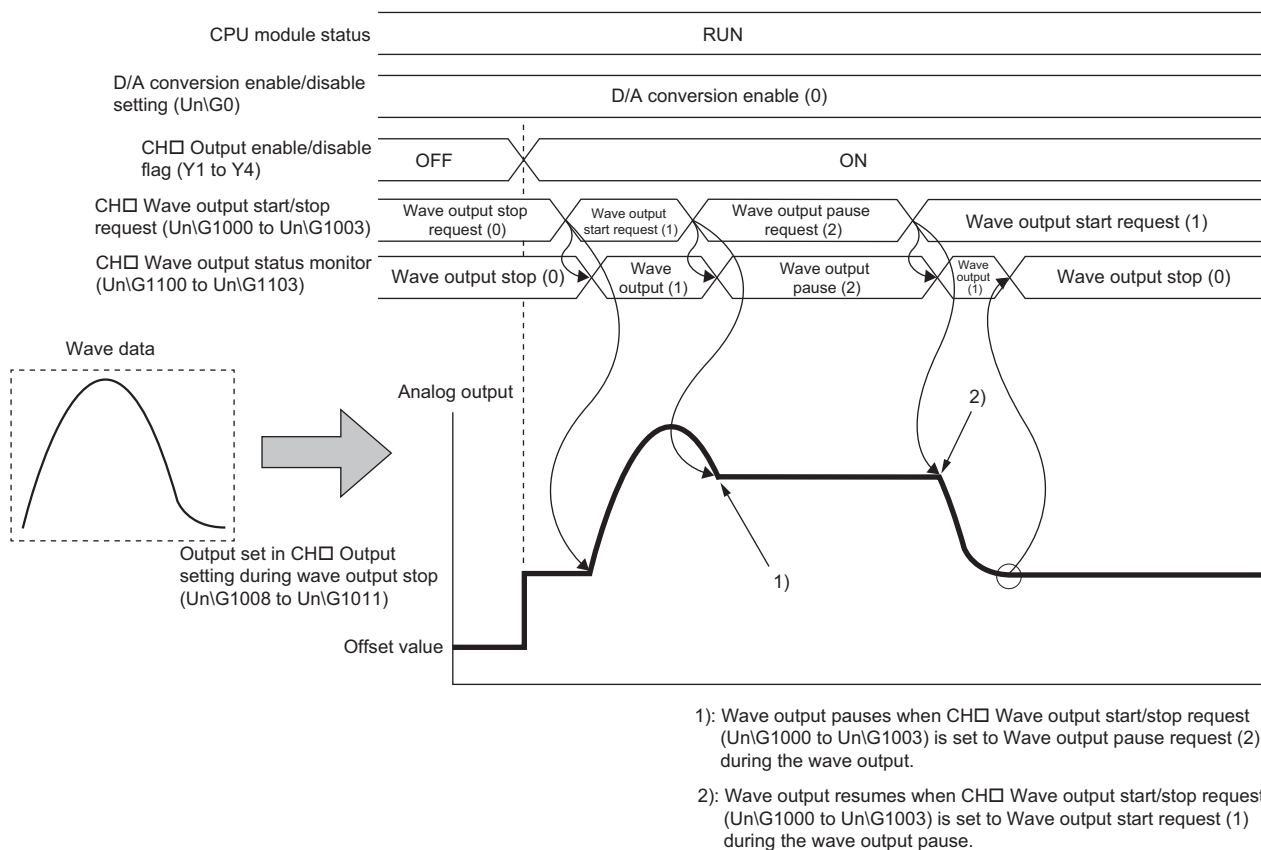
The analog output value while the wave output is paused differs depending on the setting of the analog output HOLD/CLEAR function. For details, refer to the following.

- Analog Output HOLD/CLEAR Function (☞ Page 57, Section 8.4 (1) (b))

- For HOLD setting: While the wave output is paused, analog output value during the pause is held.

CPU module status	RUN
D/A conversion enable/disable setting (Un\G0)	D/A conversion enable (0)
CH☐ Output enable/disable flag (Y1 to Y4)	OFF / ON
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) / Wave output start request (1)
CH☐ Wave output status monitor (Un\G1100 to Un\G1103)	Wave output stop (0) / Wave output (1) / Wave output pause (2) / Wave output (1) / Wave output stop (0)

Wave data

Analog output

If HOLD is set to the analog output HOLD/CLEAR function, the analog output value is held.

Output set in CH☐ Output setting during wave output stop (Un\G1008 to Un\G1011)

Offset value

- For CLEAR setting: While the wave output is paused, the offset value is output.

CPU module status	RUN
D/A conversion enable/disable setting (Un\G0)	D/A conversion enable (0)
CH☐ Output enable/disable flag (Y1 to Y4)	OFF / ON
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) / Wave output start request (1)
CH☐ Wave output status monitor (Un\G1100 to Un\G1103)	Wave output stop (0) / Wave output (1) / Wave output pause (2) / Wave output (1) / Wave output stop (0)

Wave data

Analog output

If CLEAR is set to the analog output HOLD/CLEAR function, the offset value is output.

Output set in CH☐ Output setting during wave output stop (Un\G1008 to Un\G1011)

Offset value

Point

● Wave output start request is accepted only when the CPU module is in the RUN status. Even 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 the 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 181, Appendix 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 this area. The unit of the stored value is μs.	Page 181, Appendix 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 181, Appendix 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 182, Appendix 2 (30)
Wave output current digital value monitor	Un\G1148 to Un\G1151	The currently output digital value is stored in this area.	Page 183, Appendix 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 184, Appendix 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 184, Appendix 2 (33)

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8.8 Wave Output Function
8.8.2 Execution of the wave output function

8.8.3 Points for the use of 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.
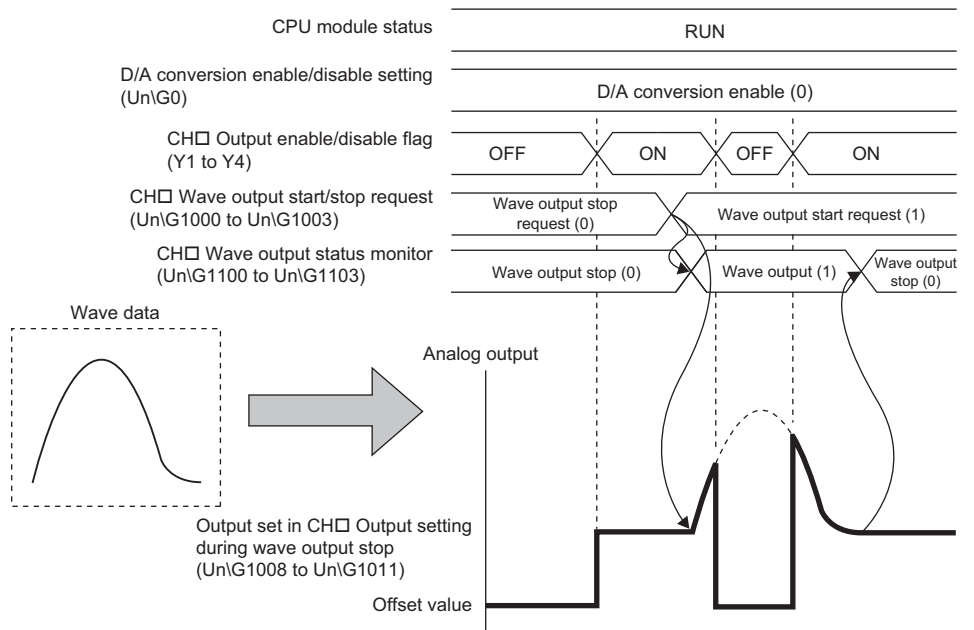
(2) When changing the CPU module status during the wave output

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.
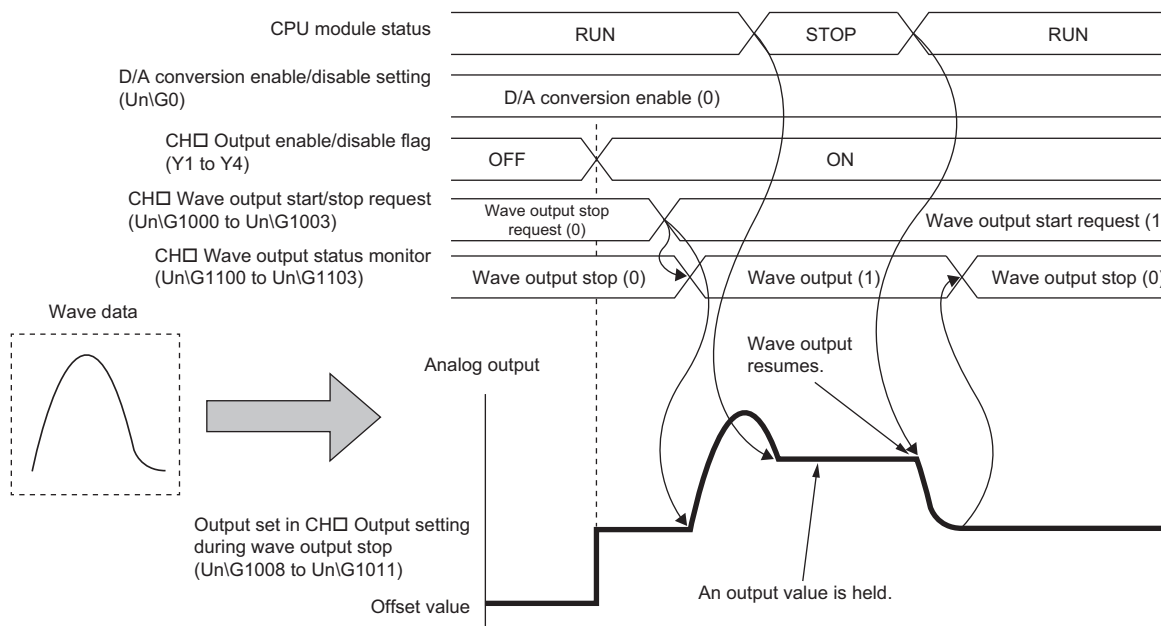
(b) **For CLEAR setting**

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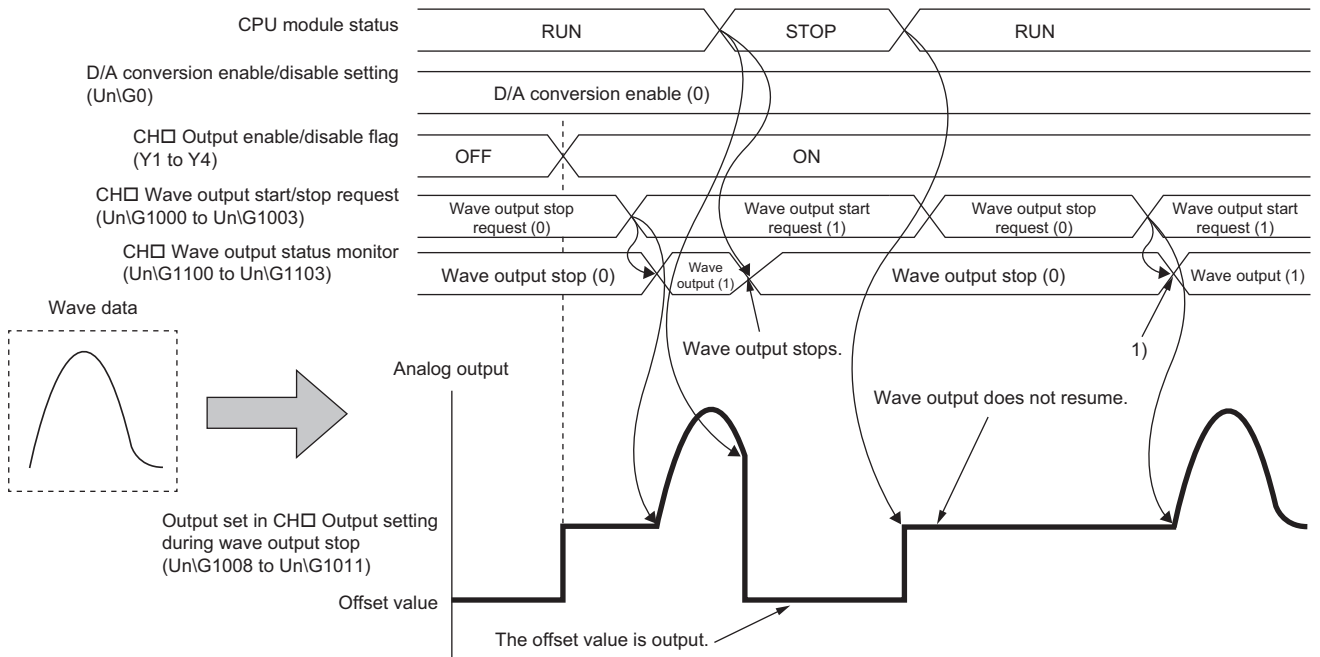
1): Wave output starts when the value set in CH☐ Wave output start/stop request (Un\G1000 to Un\G1003) is changed from Wave output stop request (0) to Wave output start request (1).

(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), and Error flag (XF) and the ERR.LED turn 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 OFF → ON → OFF Error clear request (YF).

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

CPU module status	RUN
D/A conversion enable/disable setting (Un\G0)	D/A conversion enable (0)
CH□ Output enable/disable flag (Y1 to Y4)	OFF / ON
CH□ Wave output start/stop request (Un\G1000 to Un\G1003)	Wave output stop request (0) / Wave output start request (1)
CH□ Wave output status monitor (Un\G1100 to Un\G1103)	Wave output stop (0) / Wave output (1) / Wave output stop (0)

Digital value
20000
-20000

Analog output

Maximum value of the set output range (10.2394V)

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

Offset value

Minimum value of the set output range (-10.24V)

Error occurrence (error code: 60□)

1): If the value to be output is smaller than the minimum value of the output range, the analog output value is the minimum value of the output range.

2): If the value to be output is greater than the maximum value of the output range, the analog output value is the maximum value of 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).

To check the buffer memory address where the wave data with the value out of the range is to be registered, use 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 become the wave output stop (the wave output stops). The wave output does not resume even though 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).
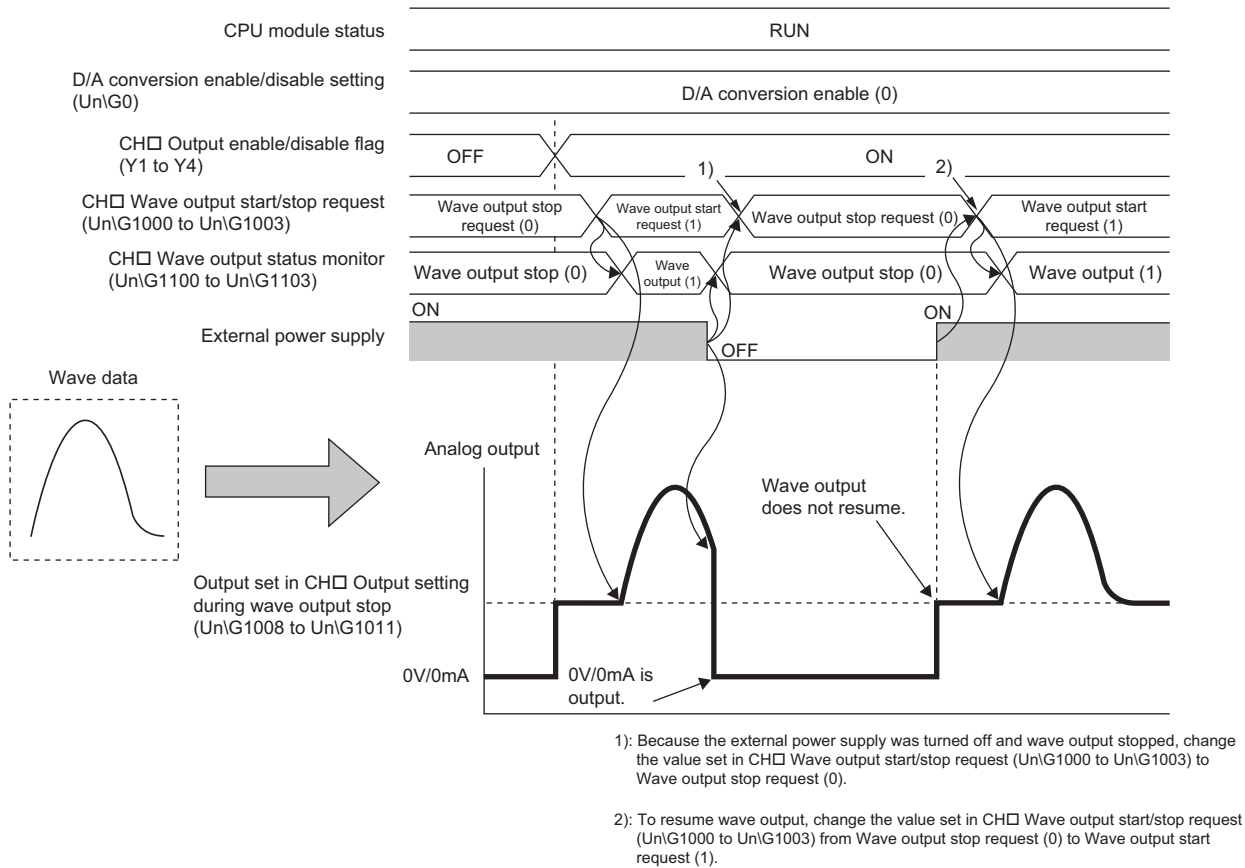
(5) When using the wave output function as PWM

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 the pulse width of 50μs, amplitude of 5V, and duty ratio of 50%

1. **Configure the "Switch Setting" as shown below.**
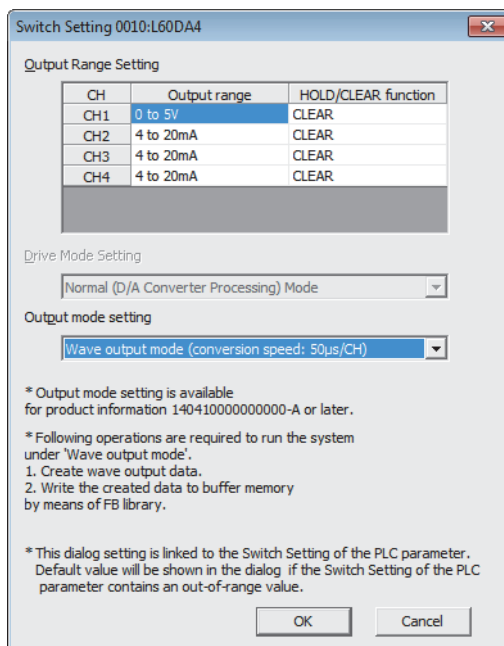
Setting item	Setting content
Output range for CH1	0 to 5V
Output mode setting	Wave output mode (conversion speed: 50μs/CH)

2. Create a wave pattern[1] for one pulse in "Create Wave Output Data".
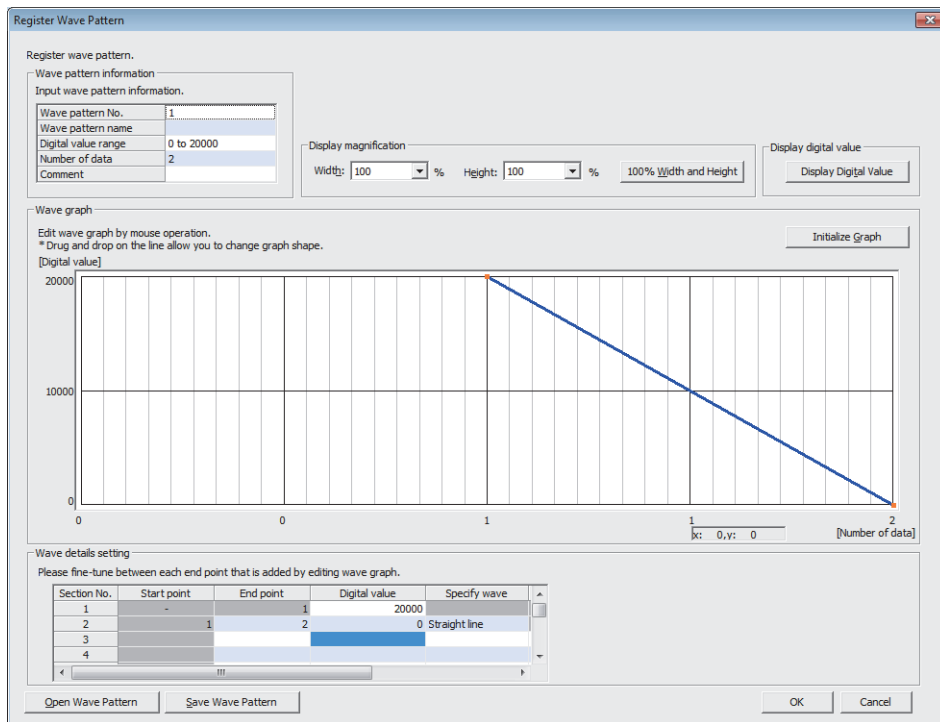
Setting item		Setting content
Wave pattern information	Digital value range	0 to 20000
	Number of data	2
Wave details setting	Digital value for Section No.1	20000
	Digital value for Section No.2	0
	Specify wave for Section No.2	Straight line

*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 them, refer to the following.**

• Registering the wave data and parameters of the wave output function (☞ Page 93, Section 8.8.2 (1))

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

6. **Turn OFF → ON → 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.**
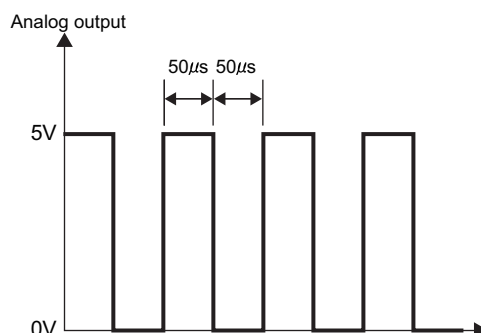
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8.8 Wave Output Function
8.8.3 Points for the use of the wave output function

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8.8.4 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.

◯ : Settings configured by a user

▭ : Processing performed by the D/A converter module

Analog output value

Address	Digital value
Un\G5000	0
Un\G5001	1000
Un\G5002	2000
Un\G5003	3000
Un\G14988	8000
Un\G14989	9000
Un\G14990	10000
Un\G14991	11000
Un\G14992	12000
Un\G14993	13000
Un\G14994	14000
Un\G14995	15000
Un\G14996	16000
Un\G14997	17000
Un\G14998	18000
Un\G14999	19000
Un\G15000	20000

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

Current address

Analog output (digital value)

10V (20000)

5V (10000)

0V (0)

2) The digital value of Un\G14990 (10000) is held.

1)[*1]

2) The D/A converter module accepts the request.
↓
The update of the address to be output stops.

*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).

Analog output value

Address	Digital value
Un\G5000	0
Un\G5001	1000
Un\G5002	2000
Un\G5003	3000
Un\G14988	8000
Un\G14989	9000
Un\G14990	10000
Un\G14991	11000
Un\G14992	12000
Un\G14993	13000
Un\G14994	14000
Un\G14995	15000
Un\G14996	16000
Un\G14997	17000
Un\G14998	18000
Un\G14999	19000
Current address Un\G15000	20000

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

Analog output (digital value)

10V (20000)

5V (10000)

0V (0)

4) The digital value of Un/G15000 (20000) is output in an analog value.

3)

4) The D/A converter module accepts the movement amount.
↓
The address to be output is moved by the movement amount.

8

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).

Analog output value

Address	Digital value
Un\G5000	0
Un\G5001	1000
Un\G5002	2000
Un\G5003	3000
Un\G14988	8000
Un\G14989	9000
Un\G14990	10000
Un\G14991	11000
Un\G14992	12000
Un\G14993	13000
Current address Un\G14994	14000 → 10000
Un\G14995	15000
Un\G14996	16000
Un\G14997	17000
Un\G14998	18000
Un\G14999	19000
Un\G15000	20000

5) Change the digital value of the address 14994.

6) Set CH□ Wave output step action movement amount (Un\G1080 to Un\G1083) to -6 (6 in the reverse direction).

7) The digital value of Un/G14994 (10000) is output in an analog value.

Analog output (digital value)

10V (20000)

5V (10000)

0V (0)

5) 6)

7) The D/A converter module accepts the movement amount.
↓
The address to be output is moved by the movement amount.

8.8 Wave Output Function
8.8.4 Wave output step action function

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

Analog output value

Address	Digital value
Un\G5000	0
Un\G5001	1000
Un\G5002	2000
Un\G5003	3000
Un\G14988	8000
Un\G14989	9000
Un\G14990	10000
Un\G14991	11000
Un\G14992	12000
Un\G14993	13000
Un\G14994	10000
Un\G14995	15000
Un\G14996	16000
Un\G14997	17000
Un\G14998	18000
Un\G14999	19000
Un\G15000	20000

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

Current address

Analog output (digital value)

10V (20000)

5V (10000)

0V (0)

8)

9) The D/A converter module accepts the request.

↓

The wave output status is changed to the wave output stop.

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

*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.
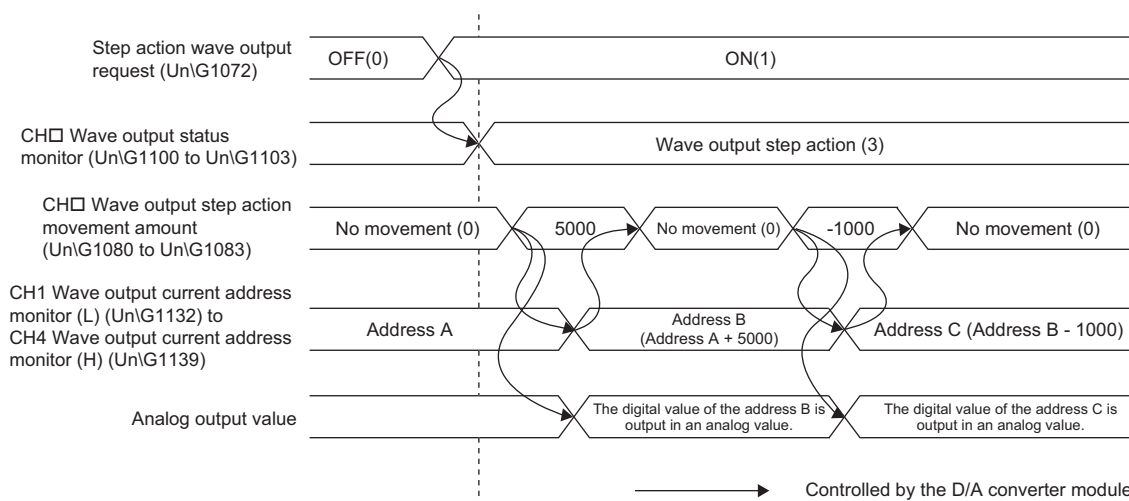
Set Step action wave output request (Un\G1072) OFF (0) → ON (1) to set the wave output status to the wave output step action.

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.

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

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 79, Section 8.8.1)
- Registering the wave data and parameters of the wave output function (⟲☞ Page 93, Section 8.8.2 (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) OFF (0) → 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. Repeating this procedure tests analog output in the wave output mode and debugs the wave output function.

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. **Ex.** 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. **Ex.** 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) ON(1) → 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 a 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 significantly when a value is set for CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083). To prevent a significant 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 57, Section 8.4)

  An analog output can be changed at any timing as well by using CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) in combination with CH☐ Output enable/disable flag (Y1 to Y4) during the wave output step action. For details, refer to the following.
  - Analog output test in the wave output mode (🖙 Page 112, Section 8.8.4 (3))

- During the wave output step action, the wave output status is not changed even if 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).

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(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.
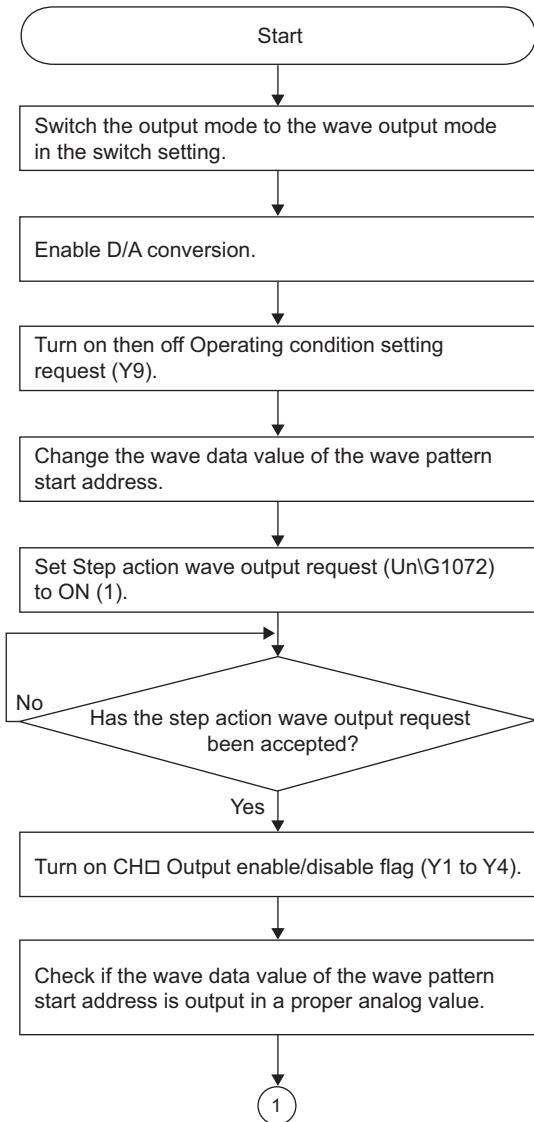
Start	Example of testing analog output in CH1
Switch the output mode to the wave output mode in the switch setting.	Set "Output mode setting" to "Wave output mode (conversion speed: 50μs/CH)" or "Wave output mode (conversion speed: 80μs/CH)" in the switch setting.
Enable D/A conversion.	Set D/A conversion enable/disable (Un\G0) to 000E$_H$. (Set D/A conversion enable (0) only for CH1.)
Turn on then off Operating condition setting request (Y9).	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.
Change the wave data value of the wave pattern start address.	
Set Step action wave output request (Un\G1072) to ON (1).	
Has the step action wave output request been accepted? — No / Yes	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 CH□ Output enable/disable flag (Y1 to Y4).	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 if the wave data value of the wave pattern start address is output in a proper analog value.	Check that the analog output value is proper using a measuring instrument such as a tester.

1

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```
                                    ( 2 )
                                      │
                                      ▼
                          ╱───────────────────────╲
                         ╱   Is the wave output     ╲          No
                        ◄   execution required after  ►──────────────────────┐
                         ╲  the analog output test?  ╱                        │
                          ╲───────────────────────╱                          │
                                      │ Yes                                   │
                                      ▼                                       │
            ┌─────────────────────────────────────────┐                      │
            │ Set Step action wave output request      │                      │
            │ (Un\G1072) to OFF (0).                   │                      │
            └─────────────────────────────────────────┘                      │
                                      │                                       │
                                      ▼                                       ▼
            ┌─────────────────────────────────────────┐    ┌─────────────────────────────────────────┐
            │ Restore the wave data changed at the     │    │ Turn off the power.                      │
            │ execution of the wave output step action.│    │                                          │
            └─────────────────────────────────────────┘    └─────────────────────────────────────────┘
                                      │                                       │
                                      ▼                                       ▼
            ╭─────────────────────────────────────────╮    ╭─────────────────────────────────────────╮
            │ The module keeps operating with the wave │    │                  End                     │
            │ output function being set.                │    │                                          │
            ╰─────────────────────────────────────────╯    ╰─────────────────────────────────────────╯
```
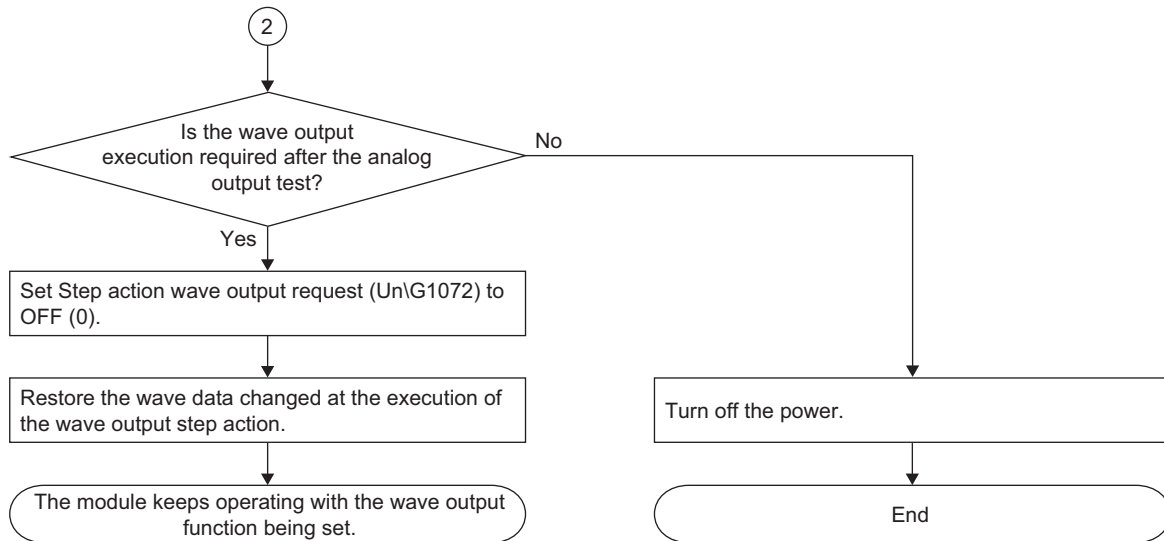
Point

Some operations of the wave output step action function differ depending on the version of the module used. For details, refer to the following.

- Change of functions (Page 200, Appendix 7.2)

8.9 Error Log Function

This function stores a history of errors and alarms that occurred in the D/A converter module to the buffer memory (Un\G1810 to Un\G1969).
A maximum of 16 errors and alarms can be 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.	2011H
Month/Day		0329H
Hour/Minute		1035H
Second		40H
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	02H

*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).
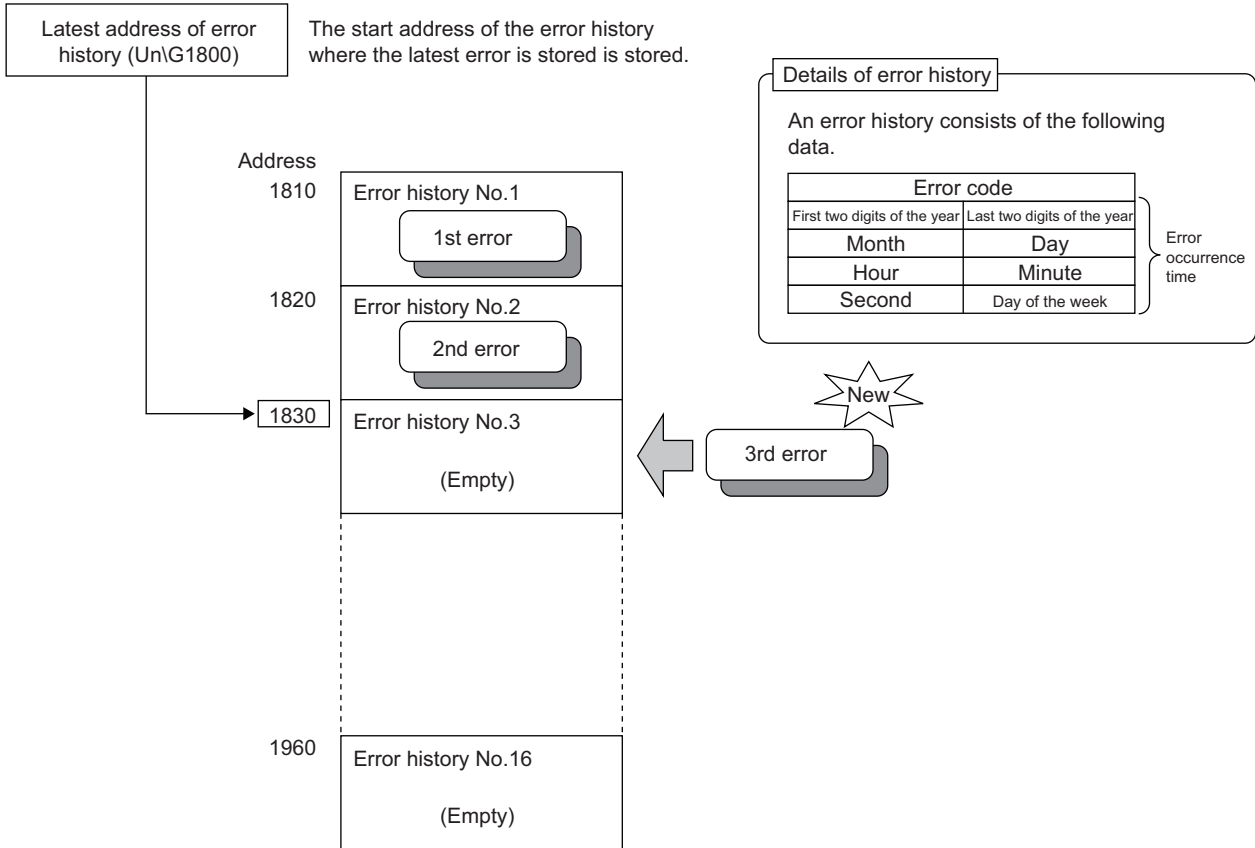
Ex. When the 17th error occurs:

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).
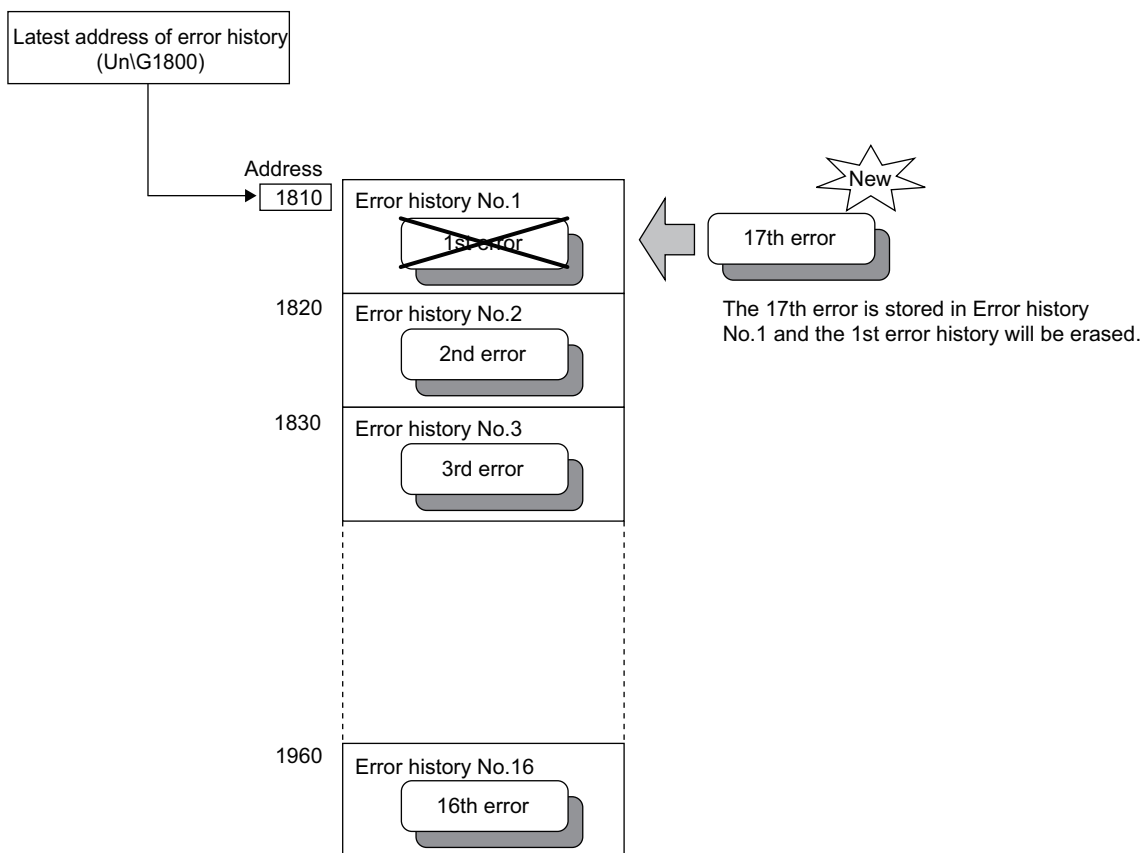
Point

● The same process for errors is used when an alarm occurs.

● Once the error history storage area becomes full, subsequent error information will overwrite the existing data, starting from Error history No.1 (Un\G1810 to Un\G1819), and continues sequentially thereafter. (The overwritten history is deleted.)

● The stored error history is cleared when the D/A converter module is powered off, or when the CPU module is reset.

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8.9 Error Log Function

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8.10 Module Error Collection Function

This function collects the errors and alarms caused in the D/A converter module into the CPU module. By holding the module errors in a CPU module memory that can hold data in the event of power failure, the details on errors can be held even after the module is powered off or reset.
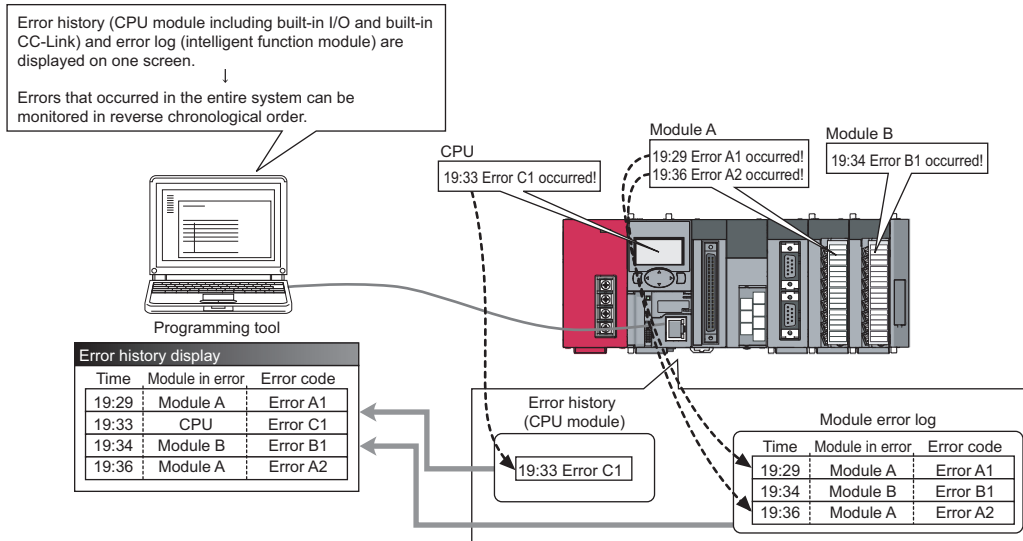
[Example of screen display]

No.	Error Code	Date and Time	Model Name	Start I/O
00125	0070	2009/12/10 17:02:37	L60AD4	0030
00124	0070	2009/12/10 17:00:05	L60AD4	0030
00123	0CE4	2009/12/10 17:00:04	L26CPU-BT	----
00122	05DC	2009/12/10 16:15:50	L26CPU-BT	----
00121	0070	2009/12/10 15:59:30	L60DA4	0030
00120	0070	2009/12/10 15:45:02	L60DA4	0010
00119	05DC	2009/12/10 14:14:38	L26CPU-BT	----
00118	0070	2009/12/10 14:12:03	L60DA4	0010
00117	0CE4	2009/12/10 13:59:54	L26CPU-BT	----
00116	0CE4	2009/12/10 13:35:11	L26CPU-BT	----
00115	05DC	2009/12/10 11:11:45	L26CPU-BT	----
00114	0070	2009/12/10 11:07:05	L60AD4	0010
00113	0CE4	2009/12/10 11:07:04	L26CPU-BT	----
00112	0070	2009/12/10 11:03:49	L60AD4	0010
00111	0CE4	2009/12/10 11:03:48	L26CPU-BT	----
00110	05DC	2009/12/09 16:30:58	L26CPU-BT	----
00109	0070	2009/12/09 16:29:33	L60DA4	0010
00108	0070	2009/12/09 16:29:12	L60DA4	0010
00107	083B	2009/12/09 16:29:11	L26CPU-BT	----

Point

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

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

8.11 Error Clear Function

This function clears errors that occur using 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 is also turned off. The operation is the same as Error clear request (YF) as well as executing error clear from the display unit.

However, error history cannot be cleared.

For instructions on Error clear request (YF) and executing error clear from the display unit, refer to the following.

- Error clear request (YF) (☞ Page 157, Appendix 1)
- Checking and Clearing Errors (☞ Page 130, Section 9.4)

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

Module's Detailed Information	

Monitor Status

Monitoring

Module
Model Name	L60DA4
I/O Address	0010
Mount Position	Main Block Slot 0
Product Information	111110000000000-A
Production Number	---

Module Information
Module Access	Possible
Status of External Power Supply	---
Fuse Blown Status	---
Status of I/O Address Verify	Agree
I/O Clear / Hold Setting	---
Noise Filter Setting	---
Input Type	---
Remote Password Setting Status	---

H/W Information

Error Information

Latest Error Code: 601

Update Error History

Clear Error History

Error Clear

No.	Error Code

Display Format
- ○ HEX
- ● DEC

The error history is sequentially displayed from an old error. The latest error is displayed at the bottom line.

Error and Solution

Contents:

Solution:

Stop Monitor   Close

8.12 Save/Restoration of Offset/Gain Value

The D/A converter module can save and restore the offset/gain values in the user range setting.

- Save: Saves the offset/gain information, registered in this module by making the offset/gain setting, in the CPU module.
- Restoration: Writes the information saved in the CPU module to this module.

When the D/A converter module needs to be replaced in case of failure, this function enables to pass the offset/gain value from a module to be changed (disconnected) to the newly-connected module.

If multiple D/A converter modules are installed in the same system, this function enables to apply the offset/gain value set with one D/A converter module to the other D/A converter modules.

However, if the offset/gain values are saved and restored, the accuracy after the restoration decreases by approximately three times compared to that before the restoration. Reconfigure the offset/gain setting when required.

(1) Procedure for saving and restoring offset/gain values

(a) To restore offset/gain values onto a new replacement module:

1. **Save the offset/gain values.**
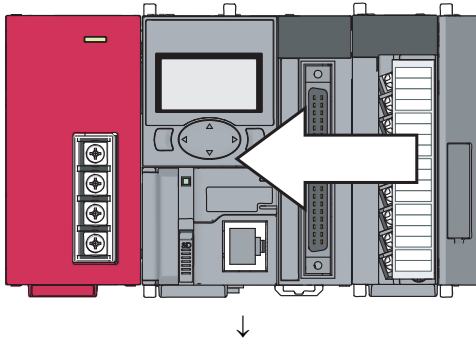
2. **Replace the D/A converter module.**
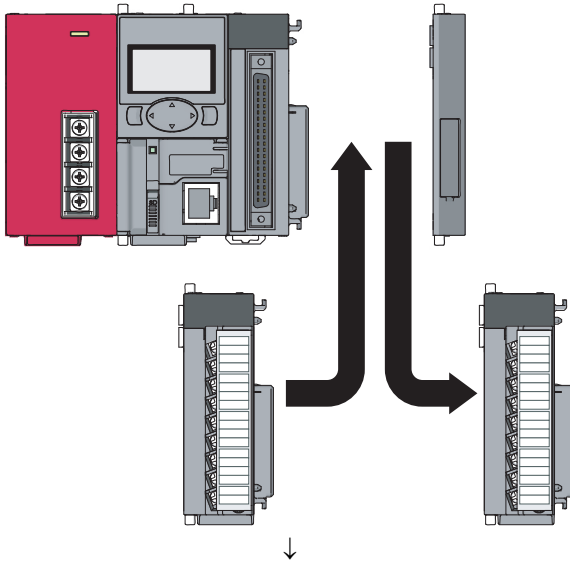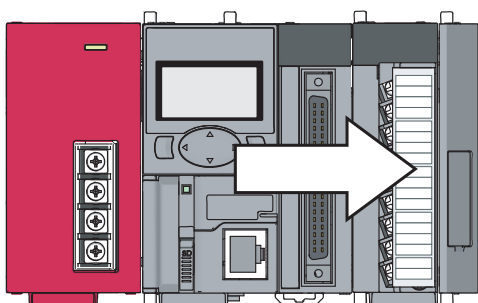
3. **Restore the offset/gain values.**

(b) To apply the offset/gain values set in one module to the other modules in the same system:

Ex. When the offset/gain values in module No.1 are applied to modules No.2 to No.4
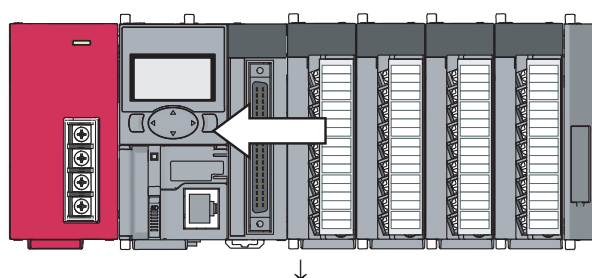
1. **Save the offset/gain values of module No.1.**
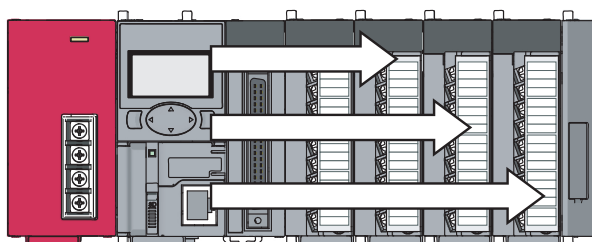
2. **Apply the offset/gain values to modules No.2 to No.4.**

(2) Methods for saving and restoring offset/gain values

There are two methods for saving and restoring offset/gain values.
- Saving and restoring by dedicated instructions
- Saving and restoring by reading from and writing to the buffer memory

(a) Saving and restoring by dedicated instructions

Temporarily save the offset/gain value in the source D/A converter module into the internal device of CPU module using G(P).OGLOAD of dedicated instruction. Then, write the data to the restoring target D/A converter module using G(P).OGSTOR.

You can prevent the saved offset/gain value data from getting deleted, by doing one of the following before replacing the modules:
- Use latch settings for the internal device of the destination module.
- Save the data onto an SD memory card. (use the SP.FWRITE instruction to write data or the SP.FREAD instruction to read data.)
- Store the saved data

For use of dedicated instructions, refer to the following.
- Dedicated Instruction (Page 190, Appendix 5)

Point

When performing the dedicated instruction G(P).OGSTOR, the D/A conversion is stopped.
Turn OFF → ON → OFF Operating condition setting request (Y9) to restart the D/A conversion.

(b) Saving and restoring by reading from and writing to the buffer memory

In the buffer memory, use Pass data classification setting (Un\G200), CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217) and User range writing request (YA) to read the offset/gain values from the source D/A converter module, then use the buffer memory again to write to the destination D/A converter module.

The procedure for using the buffer memory is described below.

• To restore offset/gain values onto a new replacement module:

```
                    ┌──────────────────────────┐
                    │          Start           │
                    └──────────────────────────┘
                                 │
   ┌─────────────────────────────────────────────────┐  ┐
   │ Sets values in Pass data classification setting  │  │
   │ (Un\G200).                                        │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Turns off, then on, and off again Operating      │  │  For the source D/A converter module
   │ condition setting request (Y9).                  │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Takes down the values stored 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).*1                                      │  │
   └─────────────────────────────────────────────────┘  ┘
                                 │
   ┌─────────────────────────────────────────────────┐
   │ Turns off the power.                              │
   └─────────────────────────────────────────────────┘
                                 │
   ┌─────────────────────────────────────────────────┐
   │ Replaces the D/A converter module.                │
   └─────────────────────────────────────────────────┘
                                 │
   ┌─────────────────────────────────────────────────┐
   │ Turns on the power.                               │
   └─────────────────────────────────────────────────┘
                                 │
   ┌─────────────────────────────────────────────────┐  ┐
   │ Writes the recorded data to Pass data             │  │
   │ classification setting (Un\G200) and CH1          │  │
   │ Industrial shipment settings offset value         │  │
   │ (Un\G202) to CH4 User range settings gain value   │  │
   │ (Un\G217).*1                                      │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Turns off and then on User range writing          │  │
   │ request (YA).                                      │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │  For the destination D/A converter module
   │ Checks that Offset/gain setting mode flag (XA)    │  │
   │ is on.                                            │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Turns on and then off User range writing          │  │
   │ request (YA).                                      │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Turns off, then on, and off again Operating       │  │
   │ condition setting request (Y9).                   │  │
   └─────────────────────────────────────────────────┘  │
                                 │                         │
   ┌─────────────────────────────────────────────────┐  │
   │ Checks that the replaced D/A converter module     │  │
   │ operates with the restored offset/gain values.    │  │
   └─────────────────────────────────────────────────┘  ┘
                                 │
                    ┌──────────────────────────┐
                    │           End            │
                    └──────────────────────────┘
```
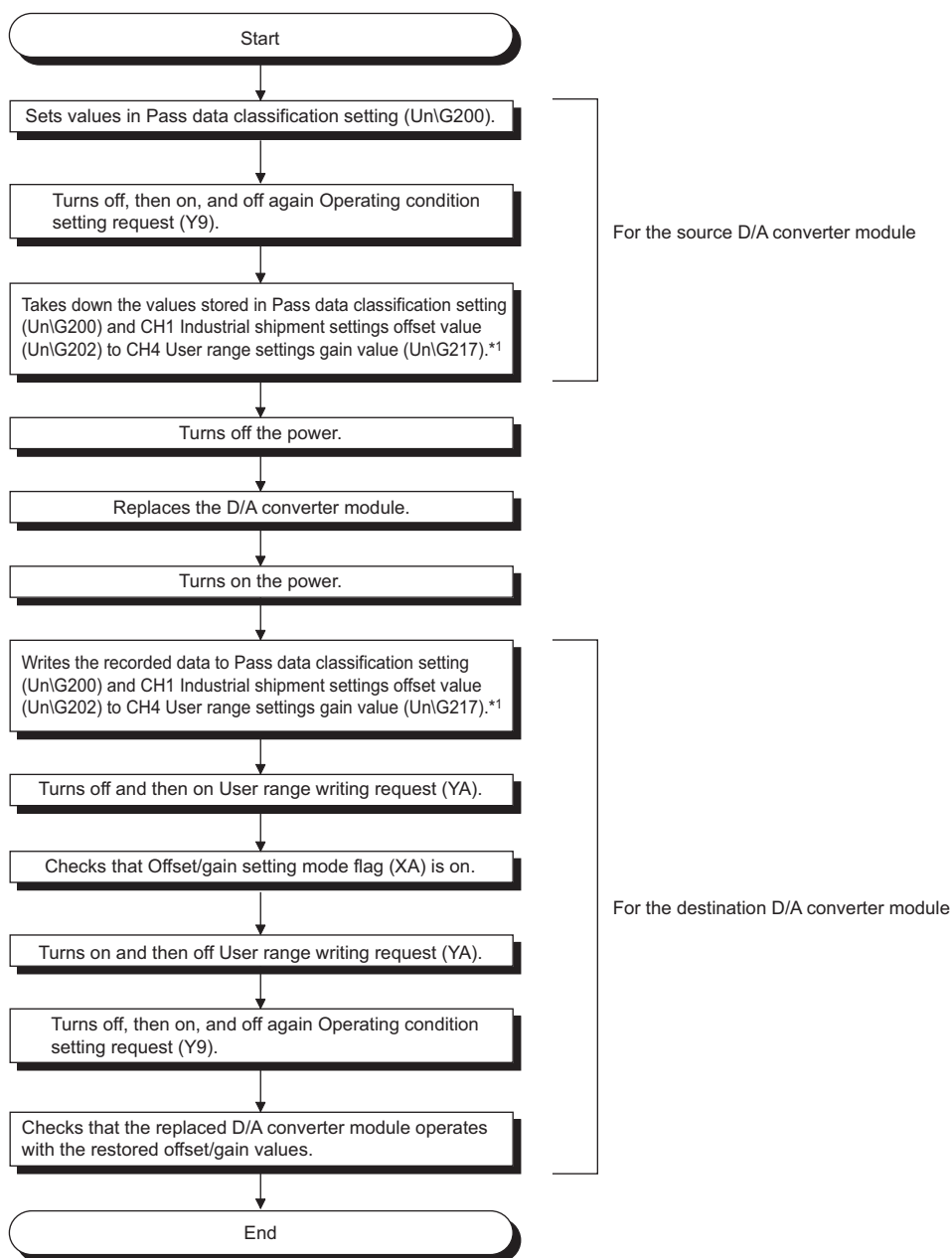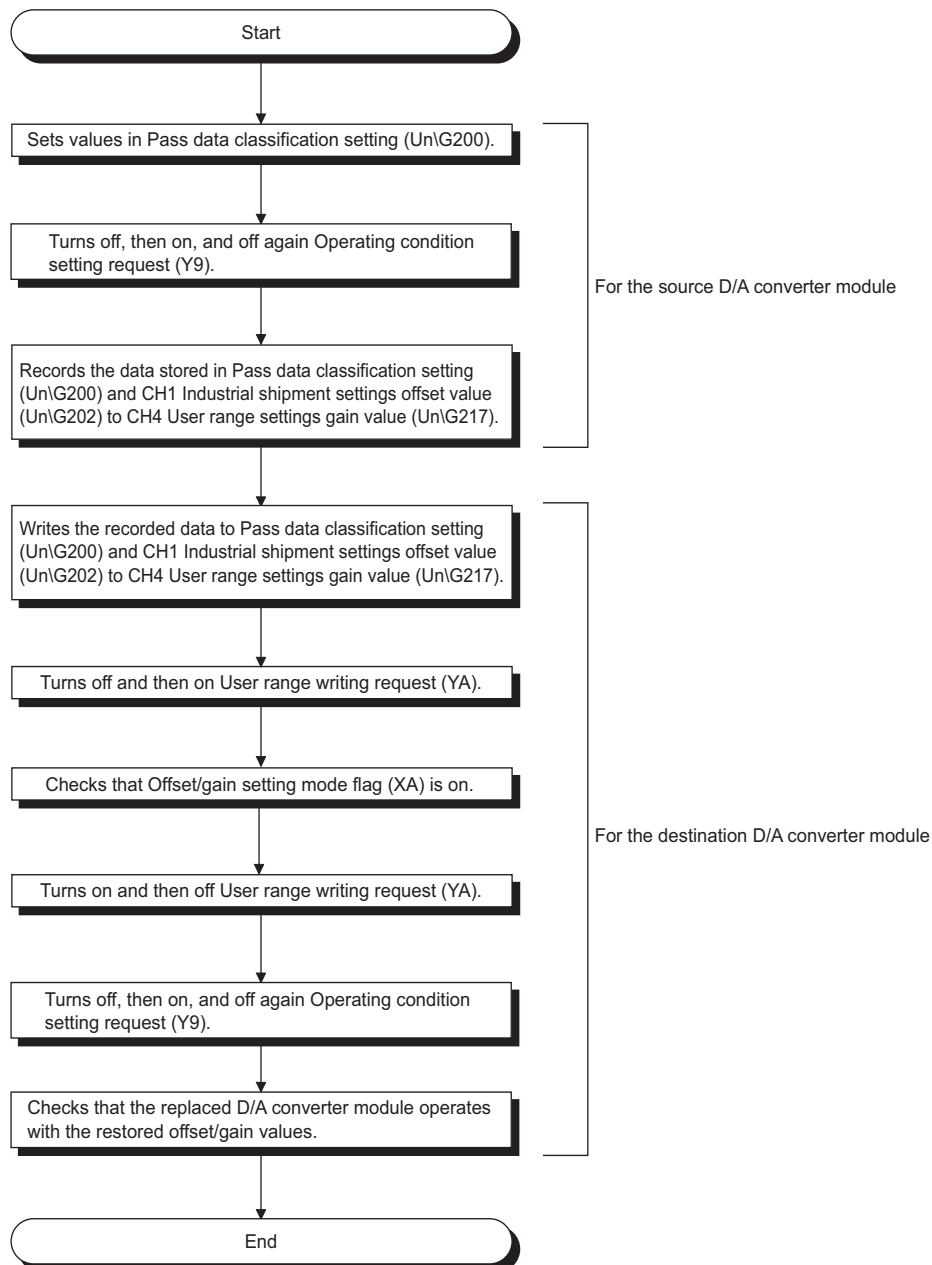
*1   When replacing modules, you can prevent the saved offset/gain value data from getting deleted, by doing one of the
      following before turning the power off:
         • Use latch settings for the internal device of the destination module.
         • Save the data onto an SD memory card. (use the SP.FWRITE instruction to write data or the SP.FREAD
           instruction to read data.)
         • Store the saved data

   • To apply the offset/gain values of one module to the other modules:

```
                        ┌─────────────────────────────┐
                        │            Start            │
                        └─────────────────────────────┘
                                      │
                        ┌─────────────────────────────┐
                        │ Sets values in Pass data    │
                        │ classification setting      │         ┐
                        │ (Un\G200).                  │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Turns off, then on, and off │         │
                        │ again Operating condition   │         │  For the source D/A converter module
                        │ setting request (Y9).       │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Records the data stored 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).       │         ┘
                        └─────────────────────────────┘
                                      │
                        ┌─────────────────────────────┐         ┐
                        │ Writes the recorded data to │         │
                        │ Pass data classification    │         │
                        │ setting (Un\G200) and CH1   │         │
                        │ Industrial shipment settings│         │
                        │ offset value (Un\G202) to   │         │
                        │ CH4 User range settings     │         │
                        │ gain value (Un\G217).       │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Turns off and then on User  │         │
                        │ range writing request (YA). │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Checks that Offset/gain     │         │
                        │ setting mode flag (XA) is on│         │
                        └─────────────────────────────┘         │  For the destination D/A converter module
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Turns on and then off User  │         │
                        │ range writing request (YA). │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Turns off, then on, and off │         │
                        │ again Operating condition   │         │
                        │ setting request (Y9).       │         │
                        └─────────────────────────────┘         │
                                      │                         │
                        ┌─────────────────────────────┐         │
                        │ Checks that the replaced    │         │
                        │ D/A converter module        │         │
                        │ operates with the restored  │         │
                        │ offset/gain values.         │         ┘
                        └─────────────────────────────┘
                                      │
                        ┌─────────────────────────────┐
                        │             End             │
                        └─────────────────────────────┘
```

Point

When the data is written to the following buffer memory address in the source D/A converter module and User range writing
request (YA) is turned from OFF to ON, the D/A conversion is stopped.
   • Pass data classification setting (Un\G200)
   • CH1 Industrial shipment settings offset value (Un\G202) to CH4 User range settings gain value (Un\G217)
Turn OFF → ON → OFF Operating condition setting request (Y9) to restart the D/A conversion.

(3) Range reference tables

Below are reference ranges to be used for saving and restoring offset/gain values.

(a) Reference table for CH1 Industrial shipment settings offset value (Un\G202) to CH4 Industrial shipment settings gain value (Un\G209)

The reference values will vary depending on the 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. 8000H
					Current	Approx. 8000H
203	205	207	209	Industrial shipment settings gain value	Voltage	Approx. F712H
					Current	Approx. F166H

(b) Reference table for 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. 8000H
	1V	Approx. 8BE8H
	5V	Approx. BB89H
	10V	Approx. F712H
Current	0mA	Approx. 8000H
	4mA[1]	Approx. 96AEH
	20mA[2]	Approx. F166H

[1]   This is the value that is stored in user range settings offset value at the time of shipping.
[2]   This is the value that is stored in user range settings gain value at the time of shipping.

9

CHAPTER 9 DISPLAY UNIT

This chapter describes the functions of the display unit that can be used in D/A converter module.
For instruction on operating the display unit, or for details on the functions and menu configuration, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

9.1 Display Unit

The display unit is an LCD to be attached to the CPU module. By attaching the display unit to the CPU module, the system status can be checked and the system settings can be changed without using the software package. In addition, in the event a problem occurs, you can identify the cause of the problem by displaying the error information on the display unit.
For details on how to check and clear an error from the display unit, refer to the following.

- Checking and Clearing Errors ()

9.2 Menu Structure

(1) Organization

The diagram below shows how the "MOD MON/TEST" menu and "MOD SETTINGS" are organized.

9.1 Display Unit
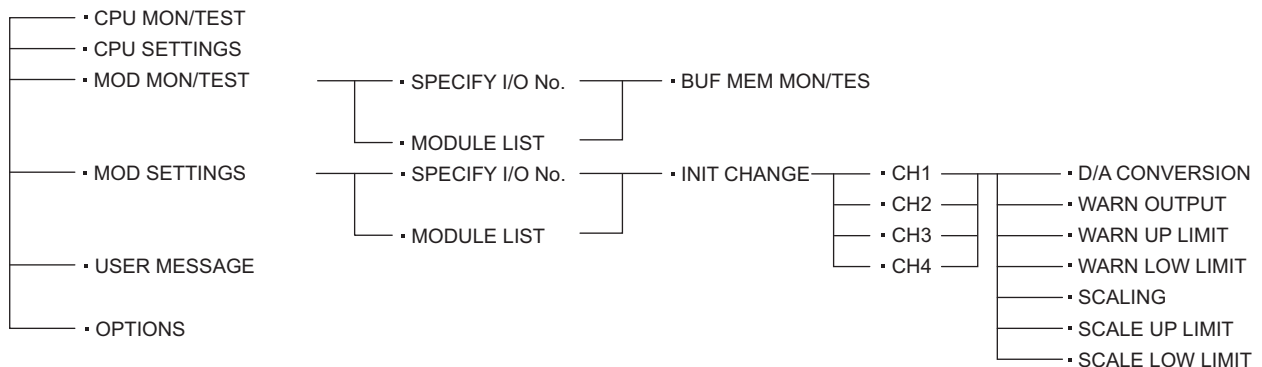
(2) Screen transitions up to the initial setting change screen

The diagram below shows how the screens transition to the initial setting change screen.

Standby screen

```
2009/04/20 (MON)
   12:00:00
```

Function selection screen

```
MENU SELECT
·CPU SETTINGS    ▶
·MOD MON/TEST    ▶
·MOD SETTINGS    ▶
```

Module setting_module specification screen

```
MENU>MOD SET
·SPECIFY I/O No.
·MODULE LIST
```

Module setting_start I/O No. specification screen

```
I/O No.
           0000H
```

Module setting_module selection screen

```
·01:I/O No.0010H
 BLT-IN CC-Link
·02:I/O No.0030H
 L60DA4
```

INIT CHANGE

D/A conversion enable and disable setting screen

```
D/A CONVERSION
·DISABLE
·ENABLE
```

Warning output setting screen

```
WARNING OUTPUT
·DISABLE
·ENABLE
```

Warning output upper limit screen

```
WARN UP LIMIT

           00000
```

Warning output lower limit screen

```
WARN LOW LIMIT

           00000
```

Scaling setting screen

```
SCALING
·DISABLE
·ENABLE
```

Scaling upper limit screen

```
SCALE UP LIMIT

           00000
```

Scaling lower limit screen

```
SCALE LOW LIMIT

           00000
```

Initial setting change screen

```
·INIT CHANGE
```

Change item selection menu screen

```
·D/A CONVERSION
·WARNING OUTPUT
·WARN UP LIMIT
·WARN LOW LIMIT
·SCALING
·SCALE UP LIMIT
·SCALE LOW LIMIT
```

Parameter-valid drive confirmation screen

```
The change will
be applied to
the parameter.
```

Channel selection screen

```
·CH1
·CH2
·CH3
·CH4
```

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9.3   List of Setting Value Change Screens

The following is a list of setting value change screens.

(1) Displayed in English:

Name		Screen format	Input regulation	
Setting item	Screen display		Upper limit value	Lower limit value
D/A conversion enable/disable setting	D/A CONVERSION	Selection	—	—
Warning output setting	WARNING OUTPUT	Selection	—	—
Warning output upper limit value	WARN UP LIMIT	Numeric value	32767	-32768
Warning output lower limit value	WARN LOW LIMIT	Numeric value	32767	-32768
Scaling enable/disable setting	SCALING	Selection	—	—
Scaling upper limit value	SCALE UP LIMIT	Numeric value	32000	-32000
Scaling lower limit value	SCALE LOW LIMIT	Numeric value	32000	-32000

(2) D/A conversion enable/disable setting

Select "DISABLE" or "ENABLE" in the "D/A CONVERSION" screen.

"D/A CONVERSION" screen
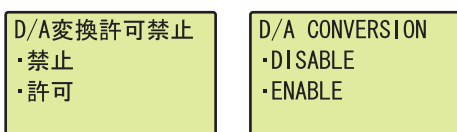
```
D/A変換許可禁止
・禁止
・許可
```

```
D/A CONVERSION
・DISABLE
・ENABLE
```

1. Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the ⎆OK button.

(3) Warning output setting

Select "DISABLE" or "ENABLE" on the "WARNING OUTPUT" screen.

"WARNING OUTPUT" screen

```
警報出力設定
・禁止
・許可
```

```
WARNING OUTPUT
・DISABLE
・ENABLE
```

↓

"WARN UP LIMIT" screen

```
警報出力上限

        00000
```

```
WARN UP LIMIT

        00000
```

↓

"WARN LOW LIMIT" screen

```
警報出力下限

        00000
```

```
WARN LOW LIMIT

        00000
```
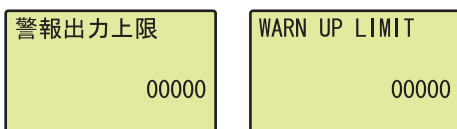
1. Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm the ⎆OK button. (If you selected "ENABLE", follow the rest of the procedure.)

2. Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the ⎆OK button.

3. Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the ⎆OK button.

Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
WARN UP LIMIT	32767	-32768
WARN LOW LIMIT		

Point

Set the values so that WARN UP LIMIT is greater than WARN LOW LIMIT.
Even though the value satisfying the condition where "WARN UP LIMIT" is equal to or smaller than "WARN LOW LIMIT" can be input on the display unit, an error occurs on the D/A converter module.

(4) Scaling setting

Select "DISABLE" or "ENABLE" in the "SCALING" screen.

"SCALING" screen

スケーリング 設定
・無効
・有効

SCALING
・DISABLE
・ENABLE

1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the ⎆OK⎆ button. (If you selected "ENABLE", follow the rest of the procedure.)**

↓

"SCALE UP LIMIT" screen

スケーリング 上限

00000

SCALE UP LIMIT

00000

2. **Move the cursor using the ◄ and ► buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the ⎆OK⎆ button.**

↓

"SCALE LOW LIMIT" screen

スケーリング 下限

00000

SCALE LOW LIMIT

00000

3. **Move the cursor using the ◄ and ► buttons, then increment or decrement the value at the cursor, using the ▲ and ▼ buttons, respectively. Confirm with the ⎆OK⎆ button.**

Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
SCALE UP LIMIT	32000	-32000
SCALE LOW LIMIT		

Point

Set the values so that SCALE UP LIMIT is greater than SCALE LOW LIMIT.
Even though the value satisfying the condition where "SCALE UP LIMIT" is equal to or smaller than "SCALE LOW LIMIT" can be input on the display unit, an error occurs on the D/A converter module.

9.4 Checking and Clearing Errors

You can check the errors that occurred in the D/A converter module, from the display unit. In addition, you can also clear an error during its occurrence.

(1) Checking errors

You can check the error that occurred in the D/A converter module, by specifying Latest error code (Un\G19) from "buffer memory monitor/test".

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

- Error Code List (Page 149, Section 11.4)
- Alarm Code List (Page 152, Section 11.5)

Ex. When an error occurs in the D/A converter module with a start I/O number of 10

"Buffer memory monitor/test" screen

```
・バッファメモリモニタ/テスト        ・BUF MEM MON/TES
```

↓
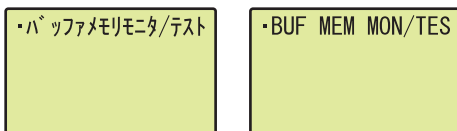
"Buffer memory address input format selection" screen

```
バッファメモリアドレス            BUFF MEM ADDR
入力形式                  INPUT FORMAT
・10進                    ・DEC
・16進                    ・HEX
```

↓
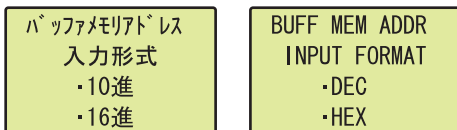
"Buffer memory address setting" screen

```
バッファメモリアドレス            BUFF MEM ADDR

      00019                      00019
```

↓

"Buffer memory monitor" screen

```
0010H 19    16整      0010H 19    IT16
           112                  112
FEDCBA9876543210      FEDCBA9876543210
_____■■___      _____■■■___
```
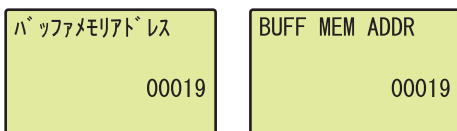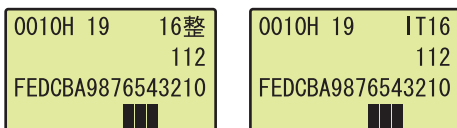
1. Press the ⟩OK) button.

2. Use the ▲ and ▼ buttons to select "DEC" for the input format of the buffer memory address, and then confirm with the ⟩OK) button.

3. Move the cursor using the ◀ and ▶ buttons, and increment or decrement the value at the cursor using the ▲ and ▼ buttons to set the value to 19. Confirm with the ⟩OK) button.

4. You can check the error that occurred, in the "Buffer memory monitor" screen.

9

(2) Clearing errors

An error can be cleared by eliminating the cause of the error, and turning on and off Error clear request (YF) from "DEV MON/TEST".

Ex. When an error occurs in the D/A converter module with a start I/O number of 10

"CPU monitor/test" screen

メニュー>CPUモニタ/テスト	MENU>CPU MON/TES
・デバイスモニタ/テスト	・DEV MON/TEST
・デバイスクリア ▶	・DEVICE CLEAR ▶
・強制ON/OFF ▶	・FORCED ON/OFF ▶

↓

"Device monitor" screen

X0 16整	X0 IT16
0	0
FEDCBA9876543210	FEDCBA9876543210
＿＿＿＿＿＿＿＿	＿＿＿＿＿＿＿＿

↓
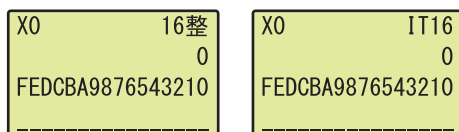
"Device selection" window

・X	・X
・Y	・Y
・M	・M
・L	・L

↓

"DEVICE No. SET" window

デバイスNo. 指定	DEVICE No. SET
Y	Y
0000	0000

↓

"Device monitor" screen

Y1F 16整	Y1F IT16
0	0
FEDCBA9876543210	FEDCBA9876543210
＿＿＿＿＿＿＿＿	＿＿＿＿＿＿＿＿

↓

"Device test" screen

デバイステスト	DEVICE TEST
Y1F	Y1F
OFF	OFF

↓
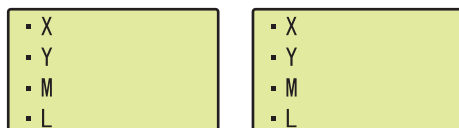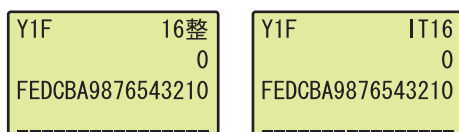
デバイステスト	DEVICE TEST
Y1F	Y1F
ON	ON
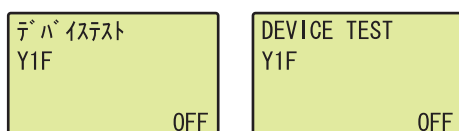
1. Use the ▲ and ▼ buttons to select "DEV MON/TEST", and confirm with the ⓞⓚ button.

2. Press the ◀ button.

3. Use the ▲ and ▼ buttons to set the device to Y, and then confirm with the ⓞⓚ button.

4. Set the device to Error clear request (Y1F) and press the ⓞⓚ button.

5. Press the ⓞⓚ button.

6. Press the ⓞⓚ button.

7. Use the ▲ and ▼ buttons to switch ON, and confirm with the ⓞⓚ button.

CHAPTER 10 PROGRAMMING

This chapter describes the procedure for programming and the basic program of the D/A converter module.

10.1 Procedure for Programming

Create a program executed by D/A converter module according to the following procedure.
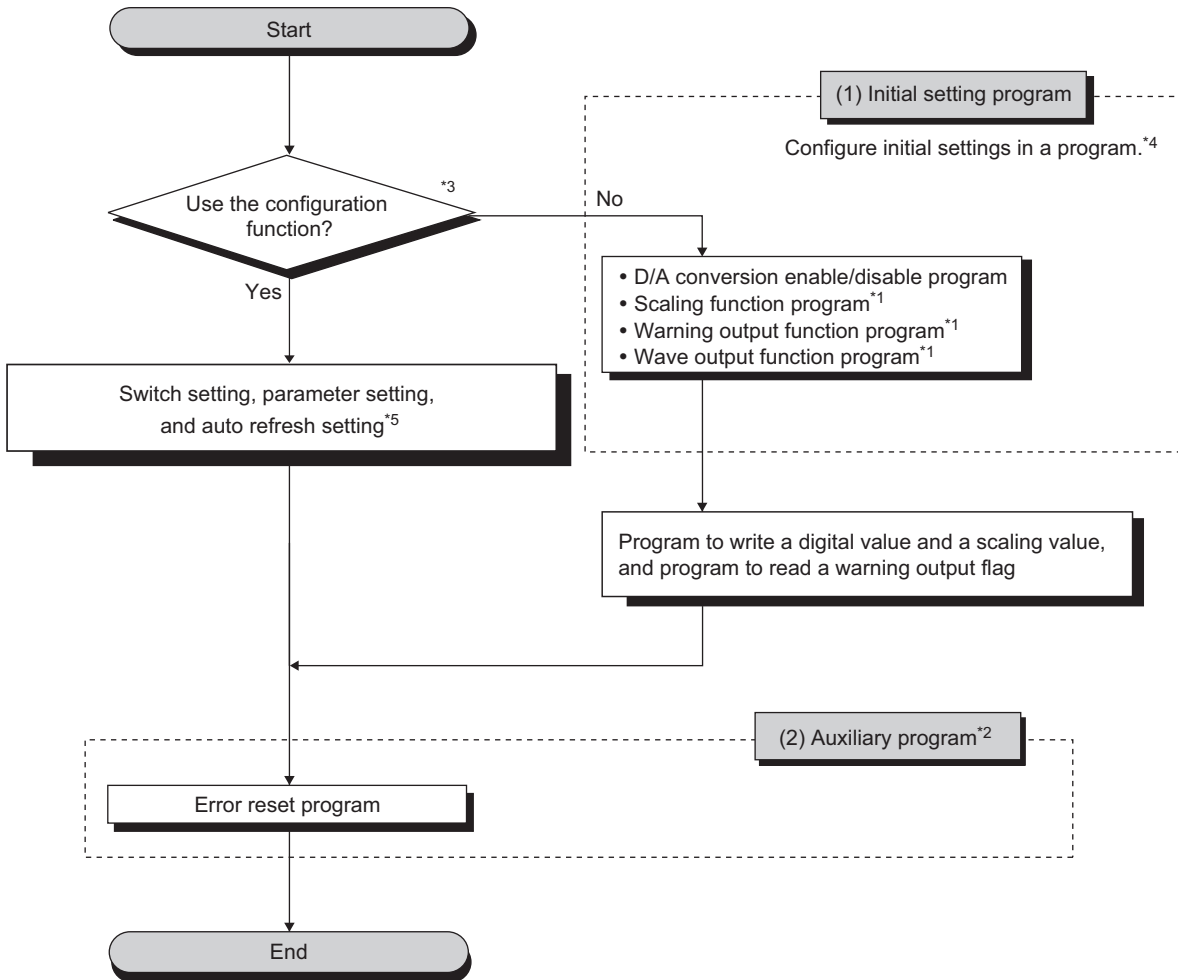
*1   A program which is created according to the used function.

*2   A program which is added according to the control target. (Create it as needed.)

*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 the 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 92, Section 8.8.1 (4) (b))

*4   ☞ Page 133, Section 10.2

*5   ☞ Page 133, Section 10.2

10.2 When Using the Module in a Standard System Configuration

This section shows a program example where the following system configuration and conditions apply.

(1) System configuration

The following shows a system configuration example.

- D/A converter module (L60DA4)
- Input module (LX40C6)
- Output module (LY42NT1P)
- CPU module (L26CPU-BT)
- Power supply module (L61P)
- END cover (L6EC)

X/Y00 to X/Y0F X/Y10 to X/Y2F X/Y30 to X/Y3F X/Y40 to X/Y4F X/Y50 to X/Y8F
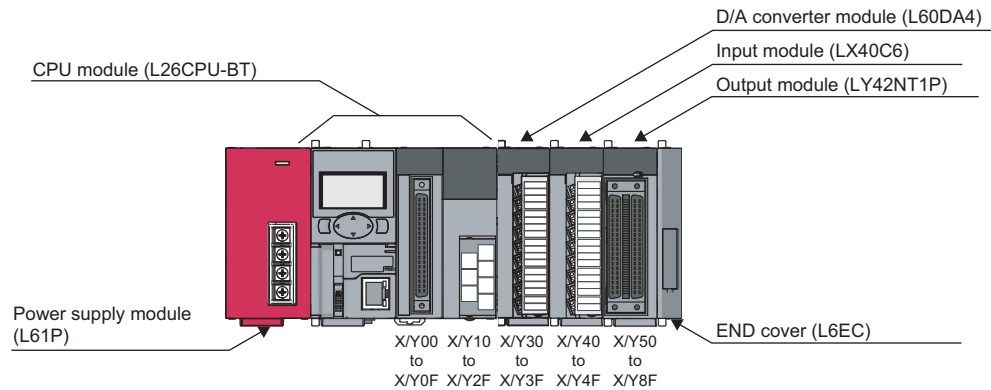
(2) Programming condition

Set CH1 and CH2 of the D/A converter module to D/A conversion enable, and 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 function 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]
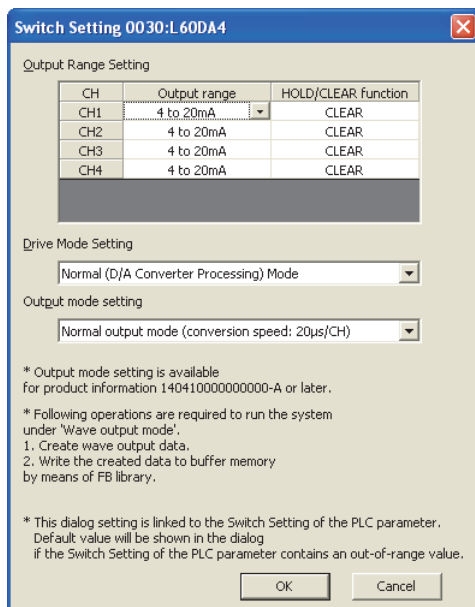
(4) Description of initial setting

(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	Invalid	Invalid	Invalid
Scaling upper limit value	32000	—	—	—
Scaling lower limit value	0	—	—	—

(b) Devices 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	
M100	Module READY checking flag	
X41	Batch output enable signal	
X42	Digital value write command input signal	LX40C6 (X40 to X4F)
X44	Warning output reset signal	
X45	Error reset signal	
Y50 to 5F	Error code notation (BCD 4 digits)	LY42NT1P (Y50 to Y5F)

(5) Program example when using the parameter of intelligent function module

(a) Parameter Setting

Set the contents of initial settings in the parameter.

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

Item	CH1	CH2	CH3	CH4
Basic setting	**Sets method of D/A conversion control.**			
D/A conversion enable/disable setting	0:Enable	0:Enable	1:Disable	1:Disable
Warning output function	**Sets for warnings on D/A conversion.**			
Warning output setting	1:Disable	0:Enable	1:Disable	1:Disable
Warning output upper limit	0	10000	0	0
Warning output lower limit value	0	3000	0	0
Scaling function	**Sets for scaling on D/A conversion.**			
Scaling enable/disable setting	0:Enable	1:Disable	1:Disable	1:Disable
Scaling upper limit value	32000	0	0	0
Scaling lower limit value	0	0	0	0

Display Filter: Display All

0030:L60DA4[]-Parameter

Sets upper limit of digital input value for warning output so that upper limit > lower limit is met.
-32768 to 32767

(b) Auto refresh setting

Project window ➭ [Intelligent Function Module] ➭ module name
➭ [Auto_Refresh]

0010:L60DA4[]-Auto_Refresh

Display Filter: Display All

Item	CH1	CH2	CH3	CH4
Transfer to PLC	**Transfers buffer memory data to the specified device.**			
Set value check code				
Warning output flag	D8			
Latest error code	D10			
Latest address of error history				
Transfer to intelligent function module	**Transfers the data of specified device to the buffer memory.**			
Digital value	D1	D2		

Transfers buffer memory data to the specified device.

(c) Writing the parameter of intelligent function module

Write the set parameter to the CPU module and reset the CPU module, or turn off and on the programmable controller power supply.

[Online] ➭ [Write to PLC...]

or   Power OFF → ON

### (d) Program example

Writes a digital value

```
     X42    X30    X37
──────┤├─────┤├─────┤├──────────────────────────────────[MOV    K10000    D1  ]   CH1 Digital value setting
      │
      └────────────────────────────────────────────────[MOV    K8000     D2  ]   CH2 Digital value setting
```

Sets the analog output enable

```
     X41    X30    X37
──────┤├─────┤├─────┤├──────────────────────────────────────────────(Y31 )       CH1 Output enable/disable flag
      │
      └──────────────────────────────────────────────────────────────(Y32 )       CH2 Output enable/disable flag
```

Reads the warning output flag

```
     X30
──────┤├───────────────────────────────────────────────[MOV    D8     K2M20 ]    Checks the CH2 warning output.

     M22
──────┤↑├──────────────────────────────────┤ Warning output processing │        CH2 Warning output processing
                                            │ (upper limit)             │        (upper limit)

     M23
──────┤↑├──────────────────────────────────┤ Warning output processing │        CH2 Warning output processing
                                            │ (lower limit)             │        (lower limit)

     X44    X3E
──────┤↑├────┤├────────────────────────────────────────[SET    Y3E ]            Turns on Warning output clear.

     X3E    Y3E
──────┤/├────┤├────────────────────────────────────────[RST    Y3E ]            Turns off Warning output clear.
```
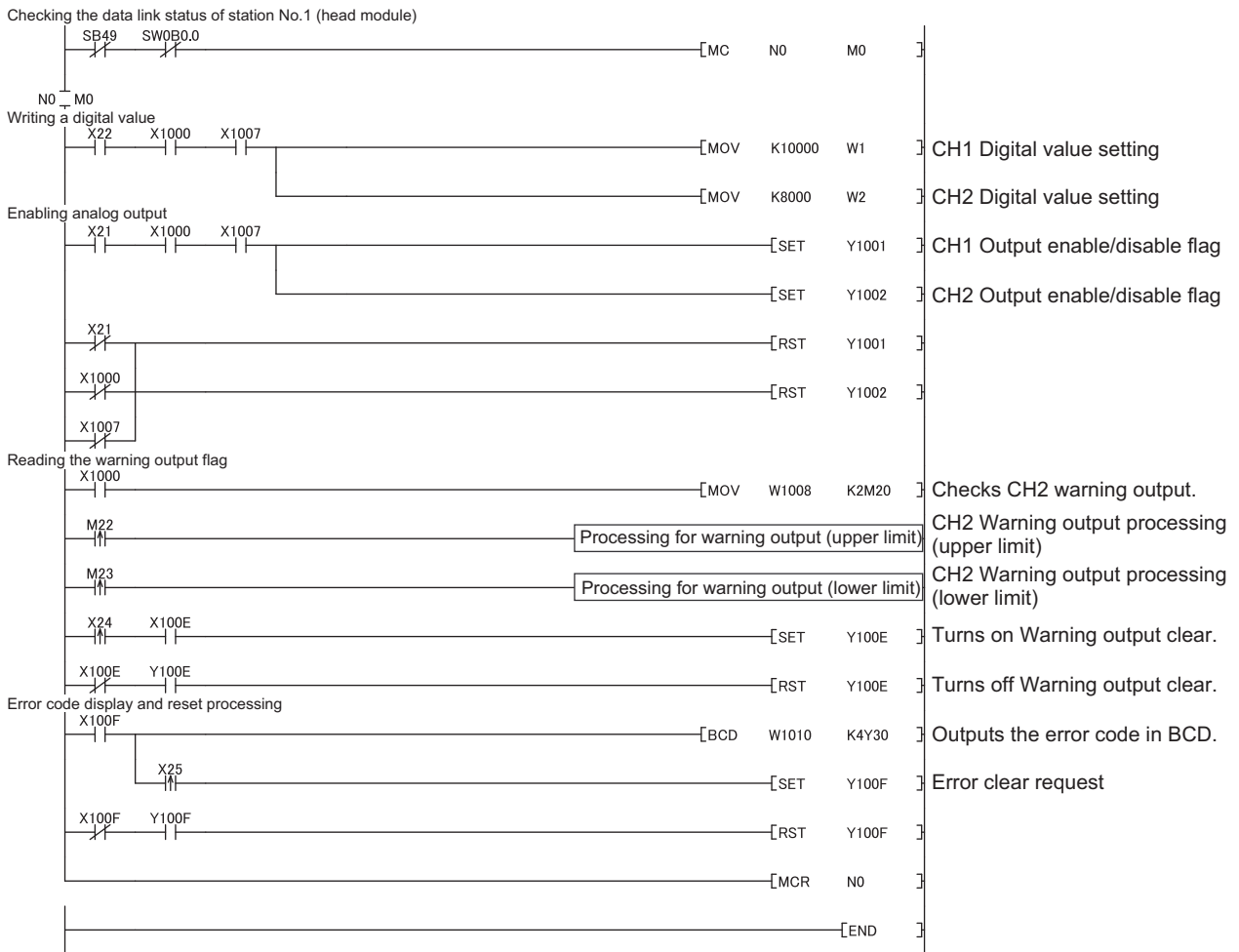
Error code display and reset processing

```
     X3F
──────┤├───────────────────────────────────────────────[BCD    D10    K4Y50 ]    Outputs the error code in BCD.
      │
      │      X45
      └──────┤↑├──────────────────────────────────────[SET    Y3F ]             Error clear request

     X3F    Y3F
──────┤/├────┤├────────────────────────────────────────[RST    Y3F ]

──────────────────────────────────────────────────────────────────[END ]
```

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(6) Program example when not using the parameter of intelligent function module

Initial setting

X30 ↑				[SET M100]	
M100 ┤├	Y39 ┤/├	X39 ┤├		[MOV H0C U3¥G0]	D/A conversion enable
				[MOV H0E U3¥G53]	Scaling setting
				[MOV H0D U3¥G47]	Warning output setting
				[MOV K0 U3¥G54]	CH1 Scaling lower limit value
				[MOV K32000 U3¥G55]	CH1 Scaling upper limit value
				[MOV K10000 U3¥G88]	CH2 Warning output upper limit value
				[MOV K3000 U3¥G89]	CH2 Warning output lower limit value
				[SET Y39]	Turns on Operating condition setting request
				[RST M100]	
X30 ┤├	Y39 ┤├	X39 ┤/├		[RST Y39]	Turns off Operating condition setting request

Writes a digital value

X42 ┤├	X30 ┤├	X37 ┤├		[MOV K10000 U3¥G1]	CH1 Digital value setting
				[MOV K8000 U3¥G2]	CH2 Digital value setting

Sets the analog output enable

X41 ┤├	X30 ┤├	X37 ┤├	(Y31)	CH1 Output enable/disable flag
			(Y32)	CH2 Output enable/disable flag

Reads the warning output flag

X30 ┤├		[MOV U3¥G48 K2M20]	Checks the CH2 warning output.
M22 ↑		Warning output processing (upper limit)	CH2 Warning output processing (upper limit)
M23 ↑		Warning output processing (lower limit)	CH2 Warning output processing (lower limit)
X44 ↑	X3E ┤├	[SET Y3E]	Turns on Warning output clear.
X3E ┤/├	Y3E ┤├	[RST Y3E]	Turns off Warning output clear.

Error code display and reset processing

X3F ┤├		[BCD U3¥G19 K4Y50]	Outputs the error code in BCD.
	X45 ↑	[SET Y3F]	Error clear request
X3F ┤/├	Y3F ┤├	[RST Y3F]	
		[END]	

10.3 When D/A Converter Module is Connected to Head Module

This section shows a program example where the following system configuration and conditions apply.

(1) System configuration

Power supply module (Q62P)
CPU module (Q10UDHCPU)
Master/local module (QJ71GF11-T2)
Input module (QX10)
Output module (QY10)

Power supply module (L61P)
Head module (LJ72GF15-T2)
D/A converter module (L60DA4)
Input module (LX40C6)
Output module (LY10R2)
END cover (L6EC)

X/Y00 to X/Y1F   X/Y20 to X/Y2F   X/Y30 to X/Y3F

X/Y1000 to X/Y100F   X/Y1010 to X/Y101F   X/Y1020 to X/Y102F

Master station (Station No.0)

Intelligent device station (Station No.1)

Ethernet cable (1000BASE-T)

Network No.1

(2) Programming condition

Set CH1 and CH2 of the D/A converter module to D/A conversion enable, and 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 function in CH2 only.

(3) Description of initial 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 upper limit value	—	10000	—	—
Warning output lower limit value	—	3000	—	—
Scaling enable/disable setting	Enable	Invalid	Invalid	Invalid
Scaling upper limit value	32000	—	—	—
Scaling lower limit value	0	—	—	—

(4) Devices used by a user

Device	Description	
W1	CH1 Digital value	
W2	CH2 Digital value	
W1008	Warning output flag	
W1010	Latest error code	
M20 to M27	Warning output flag	
X21	Batch output enable signal	QX10 (X20 to X2F)
X22	Digital value write command input signal	
X24	Warning output reset signal	
X45	Error reset signal	
Y30 to Y3F	Error code notation (BCD 4 digits)	QY10 (Y30 to Y3F)
SB49	Data link status (own station)	
SWB0.0	Data link status (each station) (station number 1)	
N0	Nesting (station number 1)	
M0	Flag for meeting the communication condition (station number 1)	

(5) Setting on master station

1. **Create a project on GX Works2.**

Select "QCPU (Q mode)" for "Series" and select "Q10UDH" for "Type".

🖱 [Project] ⇨ [New...]
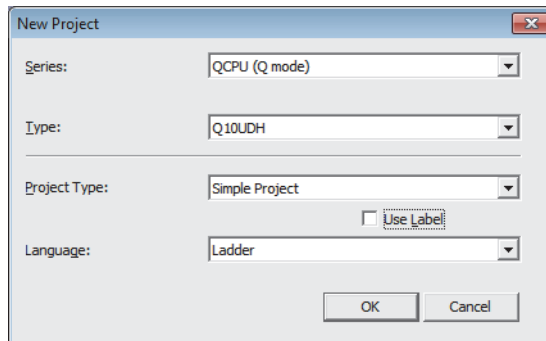
2. **Display the network parameter setting window and configure the setting as follows.**

🖱 Project window ⇨ [Parameter] ⇨ [Network Parameter]

⇨ [Ethernet/CC IE/MELSECNET]

10.3 When D/A Converter Module is Connected to Head Module
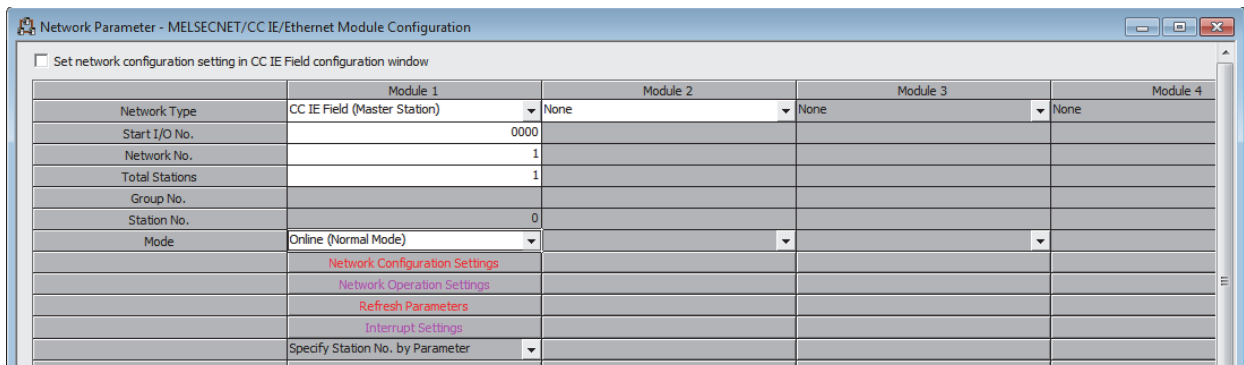
3. **Display the Network Configuration Setting window and configure the setting as follows.**

🖱️ Project window ➪ [Parameter] ➪ [Network Parameter]

➪ [Ethernet/CC IE/MELSECNET] ➪ Network Configuration Setting button

			RX/RY Setting			RWw/RWr Setting			Refresh Device			
Module No.	Station No.	Station Type	Points	Start	End	Points	Start	End	RX	RY	RWw	RWr
0	0	Master Station										
1	1	Intelligent Device Station	256	0000	00FF	256	0000	00FF	X1000(256)	Y1000(256)	W0(256)	W1000(256)

Network Parameter - CC IE Field - Network Configuration Settings - Module No.: 1

Set up Network configuration.

Assignment Method
○ Points/Start
⦿ Start/End

The column contents for refresh device will be changed corresponding to refresh parameter setting contents.
Please reopen the window after completing refresh parameter setting when changing refresh parameter.

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

Network Parameter - CC IE Field - Refresh Parameters - Module No.: 1

Assignment Method
○ Points/Start
⦿ Start/End

	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Transfer 1	RX	256	0000	00FF	↔	X	256	1000	10FF
Transfer 2	RY	256	0000	00FF	↔	Y	256	1000	10FF
Transfer 3	RWw	256	0000	00FF	↔	W	256	000000	0000FF
Transfer 4	RWr	256	0000	00FF	↔	W	256	001000	0010FF
Transfer 5					↔				
Transfer 6					↔				
Transfer 7					↔				

5. **Write the set parameter to the CPU module of the master station and reset the CPU module, or turn off and on the programmable controller power supply.**

🖱️ [Online] ➪ [Write to PLC...]

RESET ◆●◆ RUN STOP   or   Power OFF → ON

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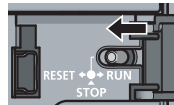
(6) Setting on intelligent device station

1. **Create a project on GX Works2.**

Select "LCPU" for "Series" and select "LJ72GF15-T2" for "Type".

🖱 [Project] ⇨ [New...]
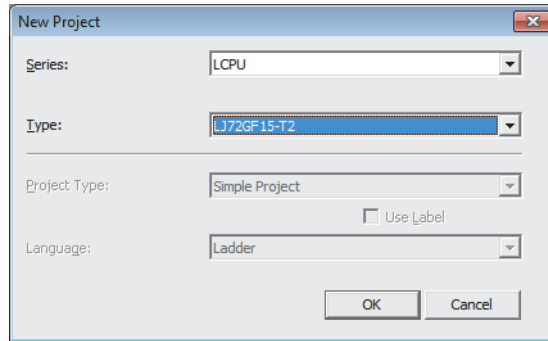
2. **Display the PLC Parameter setting window and configure the setting as follows.**

🖱 Project window ⇨ [Parameter] ⇨ [PLC Parameter] ⇨ "Communication Head Setting"
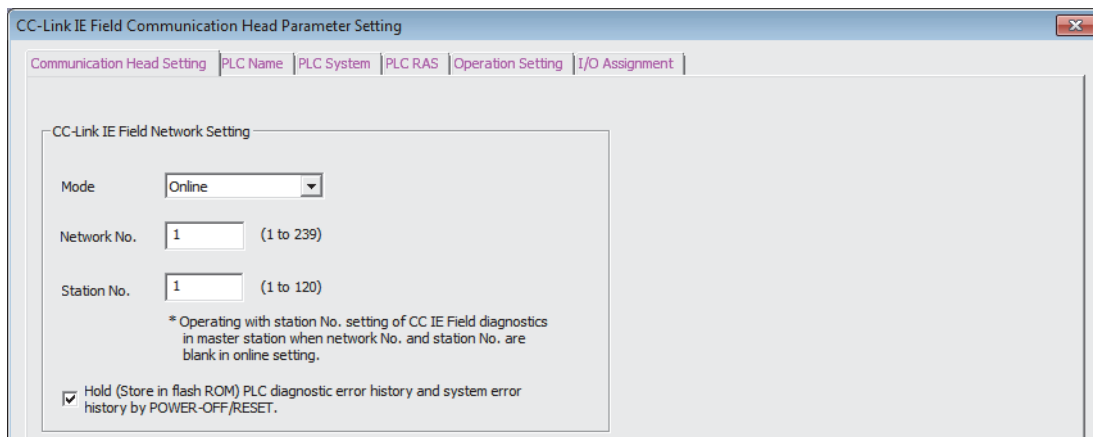
3. Add the D/A converter module (L60DA4) to the GX Works2 project.

🖱 Project window ⇨ [Intelligent Function Module] ⇨ Right-click

⇨ [New Module...]

New Module

Module Selection

Module Type | Analog Module

Module Name | L60DA4

Mount Position

Base No. | - | Mounted Slot No. | 0 | Acknowledge I/O Assignment

☑ Specify start XY address | 0000 | (H) | 1 Module Occupy [16 points]

Title setting

Title |

OK | Cancel

4. Display the Switch Setting window for the D/A converter module (L60DA4) and configure the setting as follows.

🖱 Project window ⇨ [Intelligent Function Module] ⇨ [L60DA4] ⇨ [Switch Setting]

Switch Setting 0000:L60DA4

Output Range Setting

CH	Output range	HOLD/CLEAR function
CH1	4 to 20mA	CLEAR
CH2	4 to 20mA	CLEAR
CH3	4 to 20mA	CLEAR
CH4	4 to 20mA	CLEAR

Drive Mode Setting

Normal (D/A Converter Processing) Mode

Output mode setting

Normal output mode (conversion speed: 20µs/CH)

* Output mode setting is available
for product information 140410000000000-A or later.

* Following operations are required to run the system
under 'Wave output mode'.
1. Create wave output data.
2. Write the created data to buffer memory
by means of FB library.

* This dialog setting is linked to the Switch Setting of the PLC parameter.
Default value will be shown in the dialog if the Switch Setting of the PLC
parameter contains an out-of-range value.

OK | Cancel

5. **Display the initial setting window for the D/A converter module (L60DA4) and configure the setting as follows.**

Project window ➪ [Intelligent Function Module] ➪ [L60DA4] ➪ [Parameter]

Item	CH1	CH2	CH3	CH4
Basic setting	Sets method of D/A conversion control.			
D/A conversion enable/disable setting	0:Enable	0:Enable	1:Disable	1:Disable
Warning output function	Sets for warnings on D/A conversion.			
Warning output setting	1:Disable	0:Enable	1:Disable	1:Disable
Warning output upper limit value	0	10000	0	0
Warning output lower limit	0	3000	0	0
Scaling function	Sets for scaling on D/A conversion.			
Scaling enable/disable setting	0:Enable	1:Disable	1:Disable	1:Disable
Scaling upper limit value	32000	0	0	0
Scaling lower limit value	0	0	0	0

Sets lower limit of digital input value for warning output so that upper limit > lower limit is met.
-32768 to 32767

6. **Display the Auto Refresh setting window for the D/A converter module (L60DA4) and configure the setting as follows.**

Project window ➪ [Intelligent Function Module] ➪ [L60DA4]
➪ [Auto_Refresh]

Item	CH1	CH2	CH3	CH4
Transfer to PLC	Transfers buffer memory data to the specified device.			
Set value check code				
Warning output flag	W1008			
Latest error code	W1010			
Latest address of error history				
Transfer to intelligent function module	Transfers the data of specified device to the buffer memory.			
Digital value	W1	W2		

Transfer Direction [Intelligent Function Module -> PLC]
Buffer Memory Address [19 (13h)], Transfer Word Counts[1]

Stores the error codes detected in D/A converter module.

7. **Write the set parameter to the head module and reset the head module, or turn off and on the programmable controller power supply.**

[Online] ➪ [Write to PLC...]
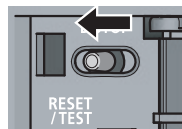
or   Power OFF→ON

(7) Program example

The following shows a program example. The program is written to the CPU module of the master station.

Checking the data link status of station No.1 (head module)

```
    SB49    SW0B0.0
    ─┤/├─────┤/├──────────────────────────────────────────[MC     N0      M0    ]

N0 ─┬─ M0
Writing a digital value
    X22     X1000   X1007
    ─┤├──────┤├──────┤├───┬─────────────────────────────[MOV    K10000  W1    ]   CH1 Digital value setting

                          └─────────────────────────────[MOV    K8000   W2    ]   CH2 Digital value setting

Enabling analog output
    X21     X1000   X1007
    ─┤├──────┤├──────┤├───┬─────────────────────────────[SET    Y1001   ]         CH1 Output enable/disable flag

                          └─────────────────────────────[SET    Y1002   ]         CH2 Output enable/disable flag

    X21
    ─┤/├──┬──────────────────────────────────────────────[RST    Y1001   ]

    X1000 │
    ─┤/├──┤

    X1007 │
    ─┤/├──┴──────────────────────────────────────────────[RST    Y1002   ]

Reading the warning output flag
    X1000
    ─┤├──────────────────────────────────────────────────[MOV    W1008   K2M20 ]   Checks CH2 warning output.

    M22
    ─┤↑├───────────────────────[ Processing for warning output (upper limit) ]     CH2 Warning output processing (upper limit)

    M23
    ─┤↑├───────────────────────[ Processing for warning output (lower limit) ]     CH2 Warning output processing (lower limit)

    X24     X100E
    ─┤↑├─────┤├──────────────────────────────────────────[SET    Y100E   ]         Turns on Warning output clear.

    X100E   Y100E
    ─┤/├─────┤├──────────────────────────────────────────[RST    Y100E   ]         Turns off Warning output clear.

Error code display and reset processing
    X100F
    ─┤├──────────────────────────────────────────────────[BCD    W1010   K4Y30 ]   Outputs the error code in BCD.

             X25
             ─┤↑├────────────────────────────────────────[SET    Y100F   ]         Error clear request

    X100F   Y100F
    ─┤/├─────┤├──────────────────────────────────────────[RST    Y100F   ]

    ─────────────────────────────────────────────────────[MCR    N0      ]

    ─────────────────────────────────────────────────────[END    ]
```

CHAPTER 11 TROUBLESHOOTING

This chapter describes errors that may occur while using the D/A converter module, and those troubleshooting.

(1) Checking for the error codes and the alarm codes

Errors and alarms occurred in the D/A converter module can be checked with the following methods. Check according to the purpose and application.

- Checking on the Module Detailed Information (☞ Page 146, Section 11.1)
- Checking by Latest Error Code (Un\G19) (☞ Page 147, Section 11.2)
- Checking on the Module Error Collection Function (☞ Page 148, Section 11.3)
- Checking by a display unit (☞ Page 130, Section 9.4)

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11.1 Checking on the Module Detailed Information

The following describes how to check the errors on the module detailed information.

[Diagnostics] ⇨ [System Monitor...]

↓
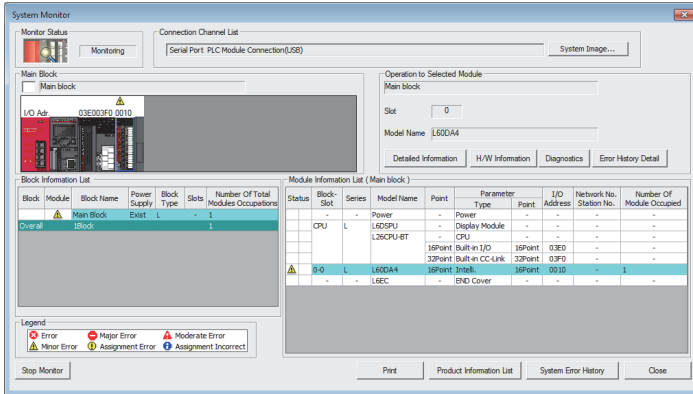
1. Select the D/A converter module in "Main Block" and click the Detailed Information button.
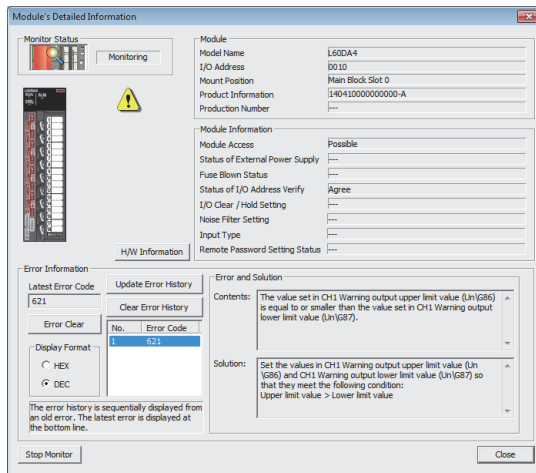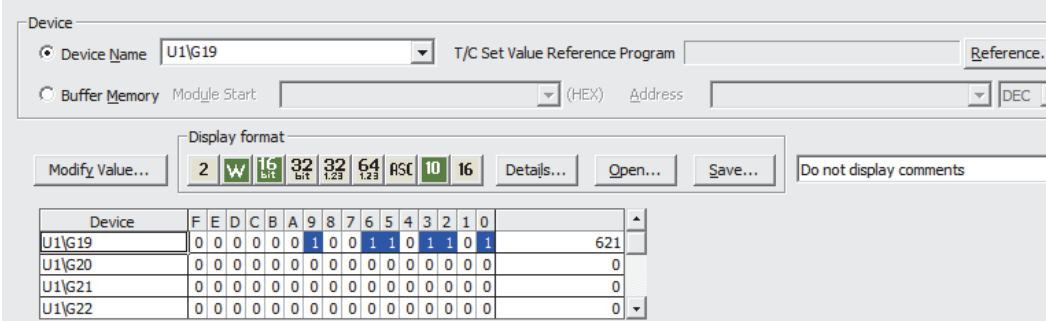
2. "Module's Detailed Information" of the D/A converter module is displayed.

11.2 Checking by Latest Error Code (Un\G19)

The following describes how to check the error codes and alarm codes in Latest error code (Un\G19).

🖰 [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]

Point

When multiple errors or warnings occur, the latest error code or alarm code is stored in Latest error code (Un\G19).

11.3 Checking on the Module Error Collection Function

By using the module error collection function, the errors occurred in the D/A converter module can be saved in the CPU module. The error information can be held even after the CPU module is powered off and on or is reset.

(1) How to check the errors by 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.
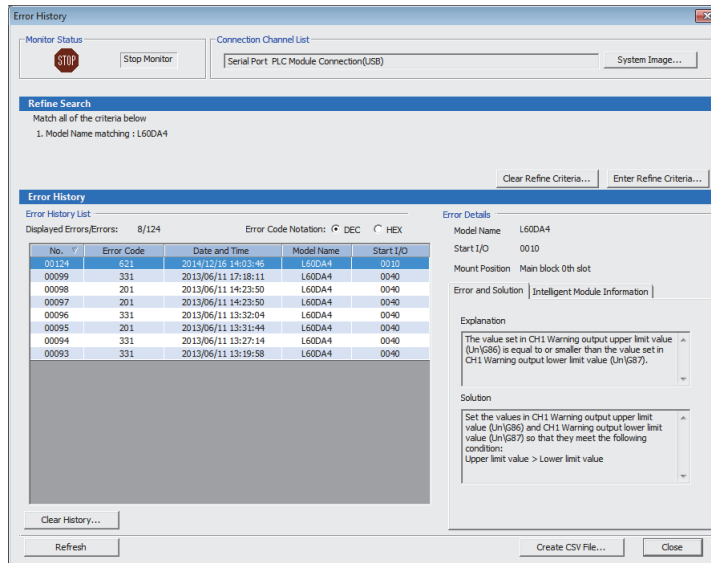
(2) Errors to be collected

The D/A converter module reports the following information to the CPU module:
- Error Code List (☞ Page 149, Section 11.4)
- Alarm Code List (☞ Page 152, Section 11.5)

11.4 Error Code List

The following table lists error codes.

When an error occurs, the error code 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 cause of error	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 a 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 a 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 a 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 a 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.
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)

Error code (decimal)	Description and cause of error		Action
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 becomes smaller than the gain value.
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. The setting range is shown below. • 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), the setting range is as follows. • CH□ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60) to 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. The setting range is shown below. • 0 to 20mA, 4 to 20mA, 0 to 5V, 1 to 5V: 0 to 20000 • -10 to 10V: -20000 to 20000 (The error data 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).)

Error code (decimal)	Description and cause of error	Action
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 Switch 1 to 5, refer to the following.
   • Intelligent function module switch setting (⟳ Page 204, Appendix 9.1 (2))

11.5 Alarm Code List

The following shows the alarm code list.

Alarm code (decimal)	Description and cause of alarm		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). The setting range is shown below. • Warning output upper limit value ≥ Setting value ≥ Warning output 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). The setting range is shown below. • Warning output upper limit value ≥ Setting value ≥ Warning output 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).)

11.6 Troubleshooting

(1) When the RUN LED flashes or turns off

(a) When flashing

Check item	Cause	Action
Is the operation mode setting in the offset/gain setting mode?	Offset/gain setting mode is set to the drive mode setting in the switch setting.	Set the the drive mode setting in the switch setting to the normal output mode. After that, power off and on the module or reset the CPU module.
	The G(P).OFFGAN instruction has been executed and the mode has been switched to offset/gain setting mode.	When using the D/A converter module in the normal output mode, check if the program for the G(P).OFFGAN instruction has been mistakenly executed.
	The value in Mode switching setting (Un\G158, Un\G159) has been changed and the mode has been switched to the offset/gain setting mode.	When using the D/A converter module in the normal output mode, check if the program to change the value in Mode switching setting (Un\G158, Un\G159) has been mistakenly executed.

(b) 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?	Make sure that the power capacity is enough by calculating the current consumption of such as the connected CPU module, I/O modules, and intelligent function modules.
Is the module installed properly?	Check the module connection.
The case 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 remains off, the module may be failed. Please consult a local Mitsubishi representative.

(2) When the ERR. LED turns on or flashes

(a) 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 ( )

(b) 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.

(3) When the ALM LED flashes

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 152, Section 11.5)

(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 OFF → ON → 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 tables (⤷ Page 124, Section 8.12 (3))
Is the output range setting correct?	Check Setting range (Un\G20). If the output range setting is incorrect, correct the switch setting.
Is D/A conversion enable/disable setting (Un\G0) of the channel to output data set to D/A conversion disable (1)?	Check D/A conversion enable/disable setting (Un\G0), and set D/A conversion enable (0) using a program or parameter setting.
Is CH□ Output enable/disable flag (Y1 to Y4) of the channel to output data 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 program. In addition, check that the CPU module is not in the STOP status.
Is any digital value written to the channel to output?	Check CH□ Digital value (Un\G1 to Un\G4).
Is Operating condition setting request (Y9) being executed?	Turn on and off Operating condition setting request (Y9) and check that the analog output is performed properly. If the analog output is performed properly, check the program whether the descriptions of Operating condition setting request (Y9) is correct.

Point

If the analog output value does not come out even after taking the above actions, the module may be failed. Please consult a local Mitsubishi representative.

(5) When HOLD of analog output value is not available

Check item	Action
Is the analog output HOLD/CLEAR function setting correct?	Check HOLD/CLEAR function setting (Un\G26). If the HOLD/CLEAR function setting is incorrect, correct the switch setting.
Is the D/A converter module used with the head module?	Refer to the points in the following section and check that the setting is made for using the analog output HOLD/CLEAR function with the head module. • Analog Output HOLD/CLEAR Function (☞ Page 57, Section 8.4)

(6) When analog value is not output in the wave output mode

Check the items in the following procedure.

No.	Check item		Action
1	Check 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 that Wave output mode is set for Output mode (Un\G9). If Wave output mode is not set, set "Output mode setting" of "Switch Setting" to any of the following. • Wave output mode (conversion speed: 50μs/CH) • Wave output mode (conversion speed: 80μs/CH)
		Is the user range setting selected?	When Wave output mode is used, the user range setting cannot be selected for the output range. If the user range setting is set to the output range, set the value other than the user range setting.
2	Checking the program	Is D/A conversion enable/disable setting (Un\G0) of the channel to output wave data 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 OFF → ON → 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 wave data?	Check the value in Wave data registry area (Un\G5000 to Un\G54999) which is used for the channel to output wave data. 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 wave data set to Wave output stop request (0)?	Check CH□ Wave output status monitor (Un\G1100 to Un\G1103) of the channel to output wave data. 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 wave data 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 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 71, Section 8.8)

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11.7 Checking the Status of D/A Converter Module by the System Monitor

To check the LED status or the setting status of the intelligent function module switch setting, select "H/W Information" in the D/A converter module on the system monitor of GX Works2.

(1) Hardware LED information

LED status is displayed.

No.	LED name	On status
1)	RUN LED	0000H: Indicates the LED off.
2)	ERR. LED	0001H: Indicates the LED on. Alternating indication between 0000H and 0001H: Indicates the LED flashing.
3)	ALM LED	(GX Works2 displays the communication status with the D/A converter module, so that the displaying intervals of 0000H and 0001H are not always even.)

(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.

Item	Intelligent function module switch
RANGE	Switch 1
—	Switch 2
HOLD/CLEAR	Switch 3
MODE	Switch 4
—	Switch 5
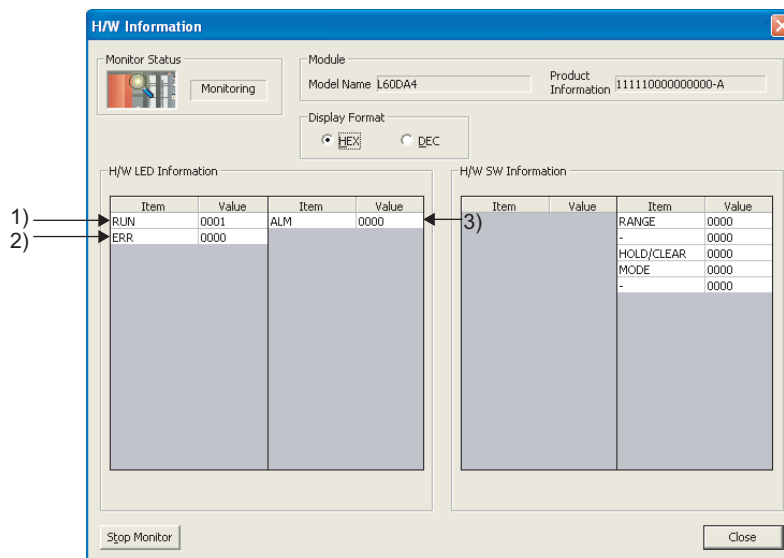
APPENDICES

Appendix 1   Details of I/O Signals

This section describes the details of I/O signals of D/A converter module for the CPU module.

The I/O number described in Appendix 1 shows the case that the start I/O number of the D/A converter module is set to "0".

Appendix 1.1   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 (In this case, the D/A conversion processing is executed).
- When a watch dog timer error occurs to the D/A converter module (In this case, the D/A conversion processing is not executed).

(2) External power supply READY flag (X7)

(a) When the external power supply is off, or when the time after the supply is less than 100ms

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

(b) When the external power supply is turned off and on

External power supply READY flag (X7) turns on after 100ms. The D/A conversion processing is started on the channels where the conversion is enabled.
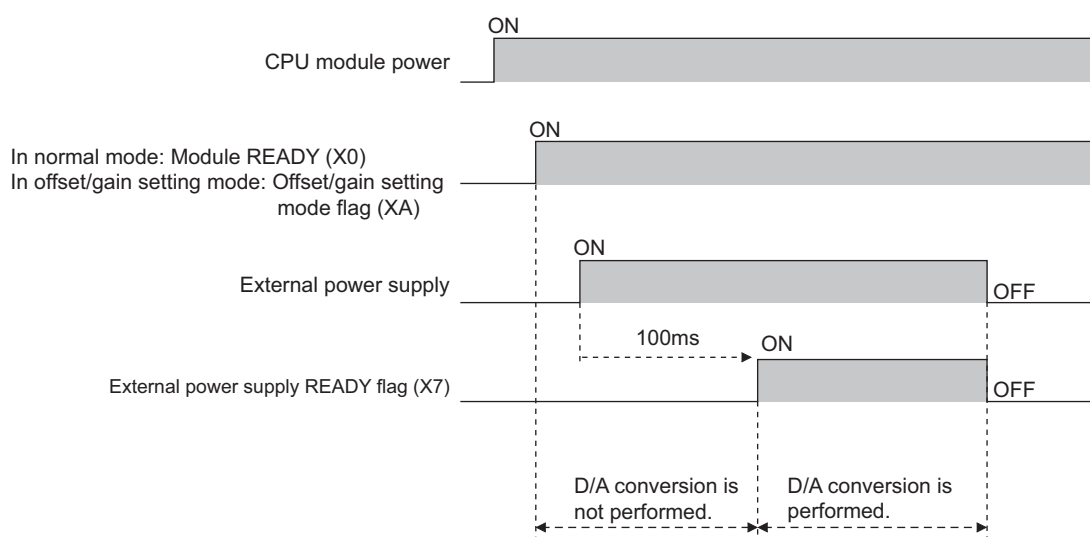
(c) When the external power supply is turned on and off

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

When the external power supply is turned on again, External power supply READY flag (X7) changes its status as described in (b) above, and the D/A conversion processing is restarted.

Point

● Use an external power supply that meets the specifications described in Performance Specifications (◻☞ Page 23, Section 3.2). If an external power supply that does not meet the specifications is used, External power supply READY flag (X7) may not turn on.

● When executing D/A output, make sure that Module READY (X0) and External power supply READY flag (X7) are on.

```
Digital
value write
command   X0      X7                                          U0\
 ┤├──────┤├──────┤├─────────────────────────[MOVP  K4000   G1    ]
```

(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 Operating condition setting request (Y9) OFF → ON → OFF.

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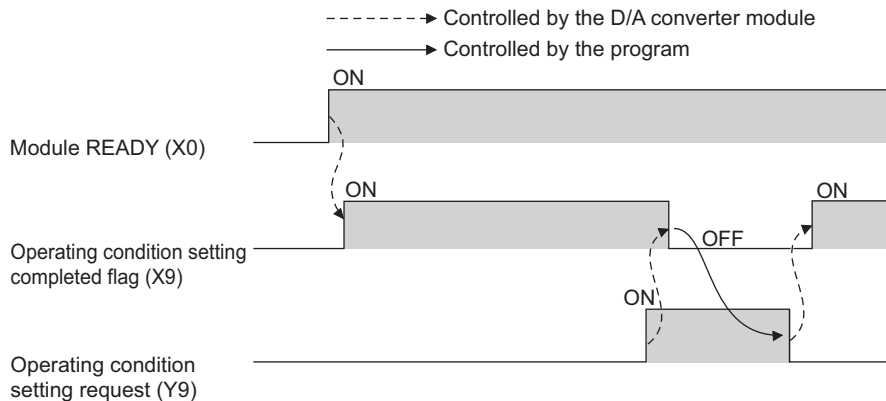
(4) Offset/gain setting mode flag (XA)

(a) Offset/gain setting mode

When registering the offset or gain value, which was adjusted with the offset/gain setting, Offset/gain setting mode flag (XA) is used as an interlock condition to turn User range writing request (YA) OFF → ON → OFF. For the offset/gain setting, refer to the following.

- Offset/Gain Setting (⟲ Page 47, Section 7.5)
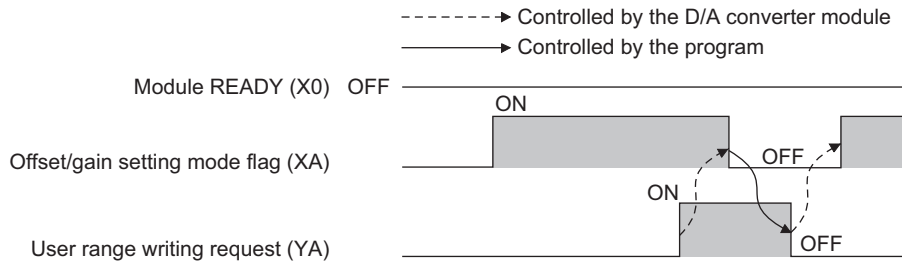
(b) Normal output mode

In the user range setting restoration, use Offset/gain setting mode flag (XA) as an interlock condition to turn User range writing request (YA) OFF → ON → OFF.
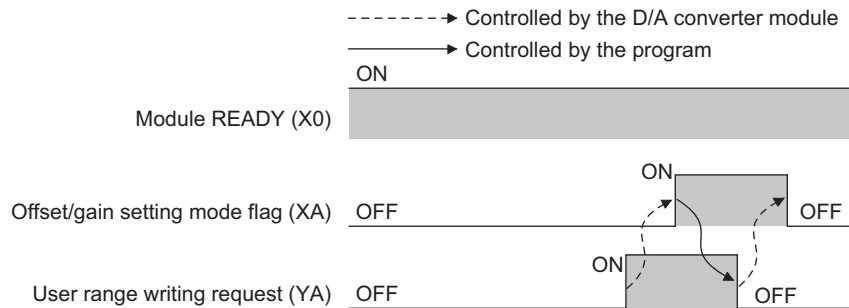
(5) Channel change completed flag (XB)

When changing a channel to perform the offset/gain setting, use Channel change completed flag (XB) as an interlock condition to turn Channel change request (YB) OFF → ON → OFF.

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

- Offset/Gain Setting (⟲ Page 47, Section 7.5)

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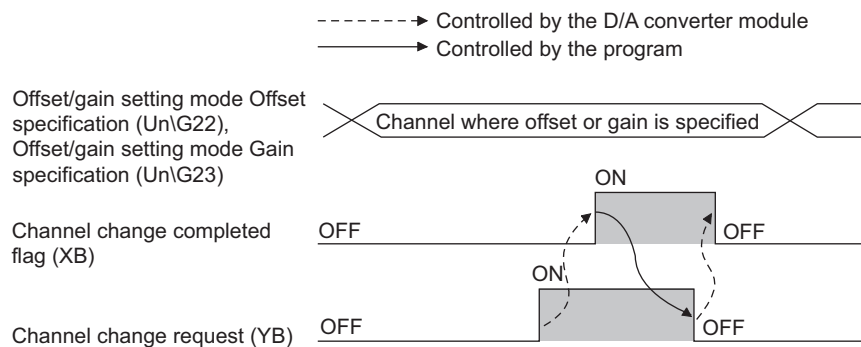
(6) Set value change completed flag (XC)

When adjusting the offset/gain setting, Set value change completed flag (XC) is used as an interlock condition to turn Set value change request (YC) OFF → ON → OFF.

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

- Offset/Gain Setting (⯈ Page 47, Section 7.5)
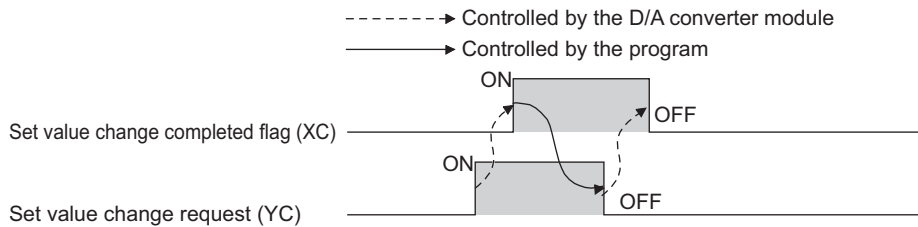
(a) When the external power supply is off

Set value change completed flag (XC) does not turn on. Turn on the external power supply, and 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.
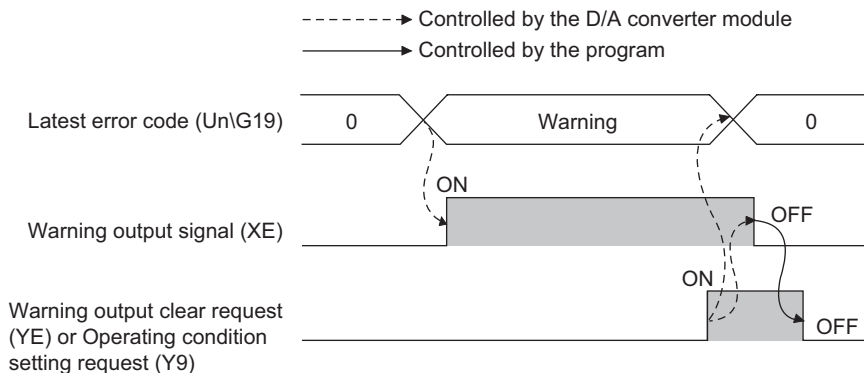
(a) Turning OFF Warning output signal (XE)

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

(8) Error flag (XF)

Error flag (XF) turns ON if an error occurs.
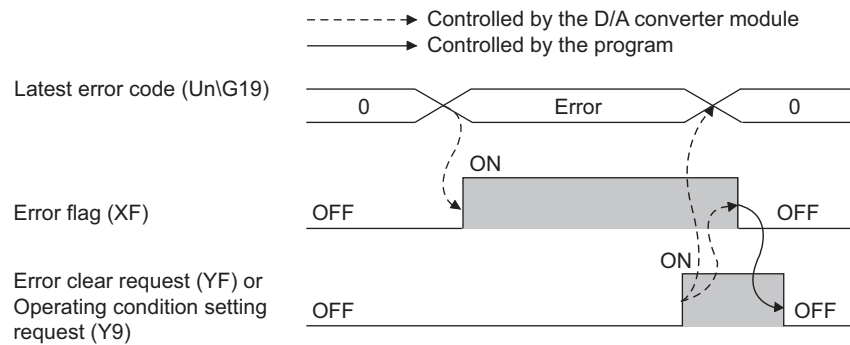
(a) Turning OFF Error flag (XF)

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

- Turning on and off Error clear request (YF)
- Turning OFF → ON → OFF Operating condition setting request (Y9)

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

Appendix 1.2   Output signal

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

This function sets whether to output the D/A-converted value or the offset value, for each channel.
ON : D/A conversion value
OFF : offset value

(a) D/A conversion speed

The D/A conversion speed is calculated by $20\mu s \times$ (Number of conversion enabled channels), regardless of the turning of CH□ Output enable/disable flag (Y1 to Y4) from OFF to ON.

(2) Operating condition setting request (Y9)

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

- Operating condition setting completed flag (X9) (⮕ Page 158, Appendix 1.1 (3))

By eliminating the error cause and turning OFF → ON → OFF this signal while an error or a warning is occurring, the error and the warning is cleared.

In the wave output mode, turn Operating condition setting request (Y9) OFF → ON → OFF, 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 the ERR.LED turns on. The initial setting cannot be enabled.

(3) User range writing request (YA)

(a) Offset/gain setting mode

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

- Offset/gain setting mode flag (XA) (⮕ Page 159, Appendix 1.1 (4))

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

- Offset/Gain Setting (⮕ Page 47, Section 7.5)

(b) Normal output mode

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

- Offset/gain setting mode flag (XA) (⮕ Page 159, Appendix 1.1 (4))

For user range restoration, refer to the following.

- Save/Restoration of Offset/Gain Value (⮕ Page 120, Section 8.12)

(c) Wave output mode

Even though User range writing request (YA) is turned OFF → ON → OFF in the wave output mode, the user range cannot be restored. When restoring the user range, set the normal output mode.

(4) Channel change request (YB)

Turn Channel change request (YB) OFF → ON → OFF to change a channel to perform the offset/gain setting.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Channel change completed flag (XB) (⟟☞ Page 159, Appendix 1.1 (5))

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

- Offset/Gain Setting (⟟☞ Page 47, Section 7.5)

(5) Set value change request (YC)

Turn Set value change request (YC) OFF → ON → OFF to change the analog output value during the adjustment of offset/gain setting.

The analog output value is changed according to the value set in Offset/gain adjustment value specification (Un\G24).

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Set value change completed flag (XC) (⟟☞ Page 160, Appendix 1.1 (6))

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

- Offset/Gain Setting (⟟☞ Page 47, Section 7.5)

(6) Warning output clear request (YE)

Turn Warning output clear request (YE) OFF → ON → OFF to clear the warning output.

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Warning output signal (XE) (⟟☞ Page 160, Appendix 1.1 (7))

(7) Error clear request (YF)

To clear Error flag (XF) and Latest error code (Un\G19), turn on and off Error clear request (YF).

For the timing of turning the signal OFF → ON → OFF, refer to the following.

- Error flag (XF) (⟟☞ Page 161, Appendix 1.1 (8))

Appendix 1 Details of I/O Signals
Appendix 1.2 Output signal

Appendix 2 Details of Buffer Memory Addresses

The following describes the details of buffer memory.

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

Set whether to enable or disable D/A conversion for each channel.
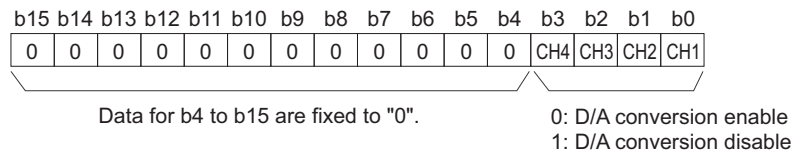
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

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

0: D/A conversion enable
1: D/A conversion disable

(a) Enabling the setting

Turn OFF → ON → 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)

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

• The setting range is as follows;

Output range setting	If the scaling function is disabled		If the scaling function is enabled[*1]
	Settable range (practical range)	A written digital value out of the settable range is treated as	Settable 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 to 10V	-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 settable 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 settable 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 the ERR. LED turns on.

(a) Default value

All channels are set to 0.

Point

In the wave output mode, this area is disabled because registered wave data is output.

(3) Output mode (Un\G9)

The output mode set in the switch setting can be checked in this area.

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 in Output mode (Un\G9).
Change the output mode in the switch setting.
For the switch setting, refer to the following.

- Switch Setting (Page 43, Section 7.2)

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

When the set digital value is out of the settable range, a check code is stored. The following items are the checking targets.

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

[Data checking method]

The buffer memory address of the wave data with the digital value out of the setting range can be checked by the following.

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 184, Appendix 2 (32))

The following shows the check codes.

Check code	Description
000FH	A digital value exceeding the settable range is written.
00F0H	A digital value falling short of the settable range is written.
00FFH	A digital value falling short of the setting range and digital value exceeding the setting range are written. The check code of 00FFH is stored in the following case, for example. Write the digital value exceeding the settable range, first. Then, write the digital value falling short of the settable range before resetting the check code.

Once the check code is stored, the code remains even the digital value is within the settable 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 to which a check code is stored due to the calculation error of scale conversion when a scale-converted value is out of the settable range.

(a) Resetting the set value check codes

Rewrite the digital value to the value within the settable range and turn Error clear request (YF) OFF → ON → OFF.

(5) Latest error code (Un\G19)

Error codes or alarm codes detected in the D/A converter module are stored.

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

- Error Code List (Page 149, Section 11.4)
- Alarm Code List (Page 152, Section 11.5)

(a) Clearing the error

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

(6) Setting range (Un\G20)

The output range set in the switch setting can be checked in this area.

```
b15    to    b12 b11    to    b8 b7    to    b4 b3    to    b0
```

| CH4 | CH3 | CH2 | CH1 |

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

Point

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

- Switch Setting (Page 43, Section 7.2)

(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): Channel in which the offset value is adjusted
- Offset/gain setting mode Gain specification (Un\G23): Channel in which the gain value is 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

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

(b) Default value

All channels are set to Invalid (0).

Point

- Multiple channels cannot be set at a time. When multiple channels are set at a time, 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 one of Offset/gain setting mode Offset specification (Un\G22) or Offset/gain setting mode Gain specification (Un\G23) to Invalid (0).
  If both buffer memory areas are set to Invalid (0) at a time, an error (error code: 500) occurs.

- For details on offset/gain setting, refer to the following.
  Offset/Gain Setting (Page 47, Section 7.5)

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

This is the area to set 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 OFF → ON → 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 ()

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

HOLD/CLEAR function setting	Stored value
CLEAR	0H
HOLD	1 to FH (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 ()

(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 ()

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 OFF → ON → 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 68, Section 8.7)

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 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) is also turned on.

(b) Clearing the Warning output flag

To clear Warning output flag (Un\G48), set a digital value within the setting range and turn on and off Warning output clear request (YE). Warning output flag (Un\G48) can also be 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 62, Section 8.6)

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

The scaling function cannot be used in the wave output mode. In the channel where Scaling enable/disable setting 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 the ERR. LED turns on.

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (1).
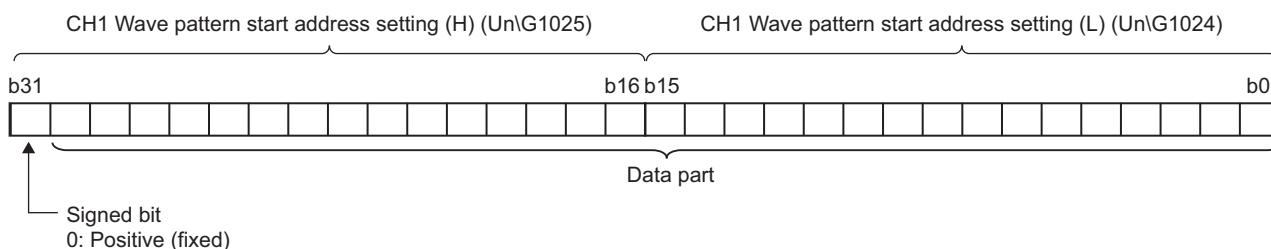
(13)CH□ Scaling lower limit value (Un\G54, Un\G56, Un\G58, Un\G60), CH□ Scaling upper limit value (Un\G55, Un\G57, Un\G59, Un\G61)

Set the scale conversion range for each channel.

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

- Scaling Function (Page 62, Section 8.6)

(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 the 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), and Error flag (XF) and the ERR.LED turn 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 OFF → ON → 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.

A

(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 68, Section 8.7)

(a) Setting range

- Setting range: -32768 to 32767
- When the scaling function is used, 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), and Error flag (XF) and the ERR.LED turn 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 OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(c) Default value
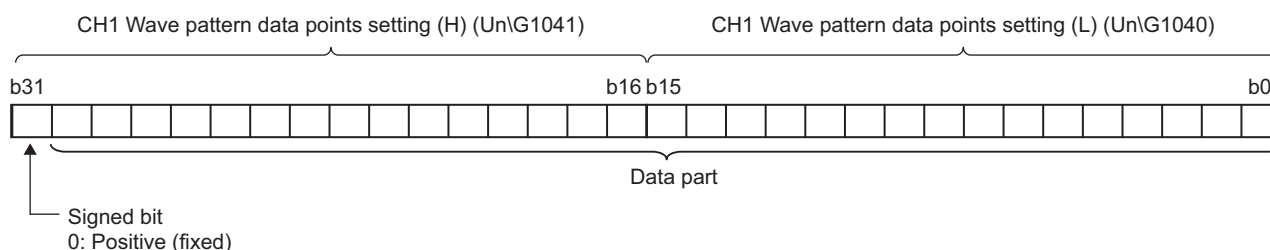
All channels are set to 0.

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	0964H	4144H
Offset/gain setting mode	4144H	0964H

(a) Setting procedure

Turn OFF → ON → 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) is turned to OFF.

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

> **Point**
>
> ● Even though a value is set in this area in the wave output mode, the set value is ignored and only the operating 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 43, Section 7.2)
>
> ● In the following cases, the mode is not switched and only the operating condition is changed.
> - When a value other than the above setting values is written and Operating condition setting request (Y9) is turned on and off
> - When the same setting value as the one of the current drive mode is written and Operating condition setting request (Y9) is turned on and off

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

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

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

```
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".
(Even when the value is set, the setting value is ignored.)

0: Voltage
1: Current

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

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

When the following operations are performed, data to be used is stored (saved).

- Writing the initial settings by a programming tool
- Turning OFF → ON Operating condition setting request (Y9)[1]
- Turning OFF → 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 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.

For details on the offset/gain value setting and how to save/restore the offset/gain value, refer to the following.

- Offset/Gain Setting (☞ Page 47, Section 7.5)
- Save/Restoration of Offset/Gain Value (☞ Page 120, Section 8.12)

(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 71, Section 8.8)

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

- Even though the setting value is changed in the mode other than the wave output mode, the change is not applied.
- Even though 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 ON (1) → OFF (0), the wave output status becomes a 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 the 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 71, Section 8.8)

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
Output value during wave output stop	The value set in CH□ Output value during wave output stop (Un\G1016 to Un\G1019) is output.	2

- Even though 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 the ERR. LED turns on. The wave output cannot be executed.

(a) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Offset value (1).

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(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 Output value during wave output 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 ()

(a) Setting range

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

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

- Even though 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 the 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 other than Output value during wave output stop (2), the error above does not occur and Error code (31☐) is not stored.

(b) Enabling the setting

Turn OFF → ON → 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 Output value during wave output 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.

CH1 Wave pattern start address setting (H) (Un\G1025)　　CH1 Wave pattern start address setting (L) (Un\G1024)

```
b31                                    b16 b15                              b0
┌──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┐
└──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘
                                        Data part
```

Signed bit
0: Positive (fixed)

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

  • Wave Output Function (⟶ Page 71, Section 8.8)

(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 though 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 the ERR. LED turns on. The wave output cannot be executed.
  • Set the values satisfying the following condition in this area and in CH1 Wave pattern data points setting (L) (Un\G1040) to CH4 Wave pattern data points setting (H) (Un\G1047).

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

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), and Error flag (XF) and the ERR.LED turn on. The wave output cannot be executed.

(b) Enabling the setting

Turn OFF → ON → 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.

CH1 Wave pattern data points setting (H) (Un\G1041)   CH1 Wave pattern data points setting (L) (Un\G1040)

b31   b16 b15   b0

Data part

Signed bit
0: Positive (fixed)

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

• Wave Output Function (⤷ Page 71, Section 8.8)

(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 though 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 the 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 the values satisfying the following condition in this area and in CH1 Wave pattern start address setting (L) (Un\G1024) to CH4 Wave pattern start address setting (H) (Un\G1031).

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

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), and Error flag (XF) and the ERR.LED turn on. The wave output cannot be executed.

(b) Enabling the setting

Turn OFF → ON → 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 71, Section 8.8)

(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 though 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 the ERR. LED turns on. The wave output cannot be executed.

(b) Enabling the setting

Turn OFF → ON → 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)

Set the constant to decide the conversion cycle (specify a multiple of the conversion speed). The conversion cycle can be set with the value set in this area under the following conditions.

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

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 71, Section 8.8)

(a) Setting range

- Setting range: 1 to 5000
- Even though 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 the ERR. LED turns on. The wave output cannot be executed.

(b) Enabling the setting

Turn OFF → ON → OFF Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 1.

A

(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 106, Section 8.8.4)

Step action wave output request	Setting value
OFF	0
ON	1

- When the setting value is changed OFF (0) → ON (1), 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. Wave output step action (3) is stored in CH□ Wave output status monitor (Un\G1100 to Un\G1103).

- When the setting value is changed ON (1) → OFF (0), the wave output status of all the channels becomes to Wave output stop and the wave output step action function ends.

- Even though 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 the ERR. LED turns on. The current wave output status continues.

(a) Default value

OFF (0) is set.

Appendix 2 Details of Buffer Memory Addresses

(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 which is added or subtracted by the setting value in this area. Setting a value in this area starts to change the data. After the change is completed, No movement (0) is stored.

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 CHo Wave output status monitor (Un\G1100 to Un\G1103)

Even though the setting value is changed not under the above conditions, the change is not applied.

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

- Wave output step action function ($\mathbb{I}\mathbb{F}$ Page 106, Section 8.8.4)

(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. **Ex.** 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. **Ex.** 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).

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

- Even though 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 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.

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

CH1 Wave output conversion cycle monitor (H) (Un\G1109)　　CH1 Wave output conversion cycle monitor (L) (Un\G1108)

b31　　　　　　　　　　　　　　　b16 b15　　　　　　　　　　　　　　b0

Data section

Sign bit
0: Positive (fixed)
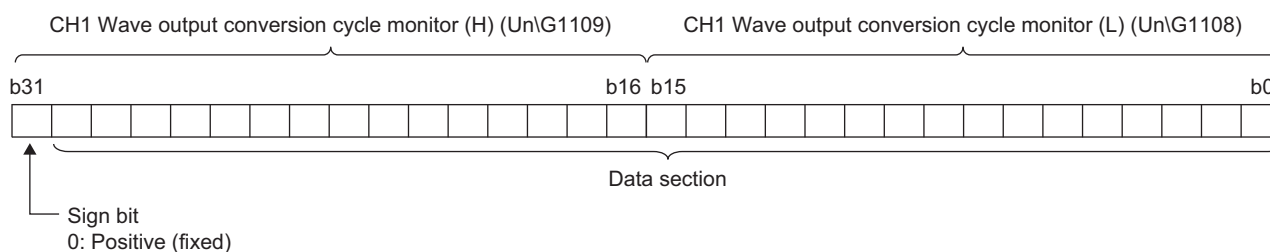
(a) Update of the stored value

When Operating condition setting request (Y9) is turned OFF → ON → 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 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 count is set to the unlimited repeat output, the count returns to 0 and starts from 1 again 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 OFF → ON → 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 other than the wave output mode, 0 is stored.
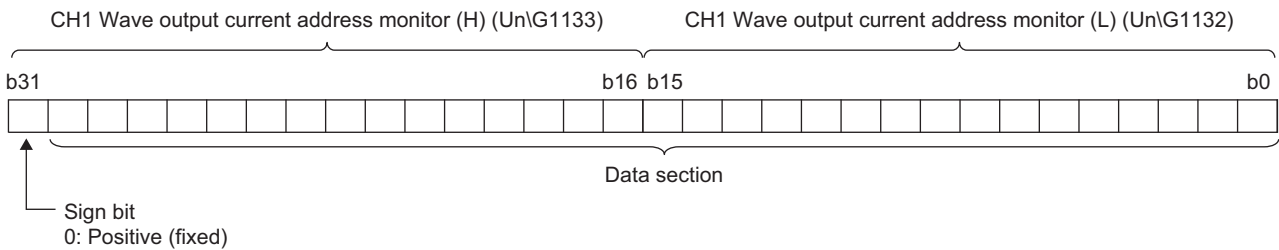
(a) Update of the stored value

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 OFF → ON → OFF, the stored value is reset.

A

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

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

The stored value depends on the wave output status.

Wave output status	Stored value[1]
Wave output stop	The digital value of the output set in CH□ Output setting during wave output stop (Un\G1008 to Un\G1011) is stored. <table><tr><td>Set value of CH□ Output setting during wave output stop (Un\G1008 to Un\G1011)</td><td>Stored value of CH□ Wave output current digital value monitor (Un\G1148 to Un\G1151)</td></tr><tr><td>0V/0mA (0)</td><td rowspan="2">0</td></tr><tr><td>Offset value (1)</td></tr><tr><td>Output value during wave output stop (2)</td><td>Set value of CH□ Output value during wave output stop (Un\G1016 to Un\G1019)</td></tr></table>
Wave output	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) is stored.
Wave output pause	The stored value depends on the setting of the analog output HOLD/CLEAR function. <table><tr><td>Analog output HOLD/CLEAR function setting</td><td>Stored value of CH□ Wave output current digital value monitor (Un\G1148 to Un\G1151)</td></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>
Wave output step action	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) is stored.

[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 57, Section 8.4)
In other than the wave output mode, 0 is stored.

(a) Reset of the stored value

When Operating condition setting request (Y9) is turned OFF → ON → 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)

When the wave data with the digital value out of the setting range is output for each channel, the buffer memory address to register the wave data 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.

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

CH1 Wave output digital value outside the range Address monitor (H) (Un\G1157)   CH1 Wave output digital value outside the range Address monitor (L) (Un\G1156)

```
b31                                    b16 b15                                    b0
┌──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┐
└──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘
 ▲    └──────────────────────────────────────────────────────────────────────────────┘
 │                                      Data section
 └─ Sign bit
    0: Positive (fixed)
```
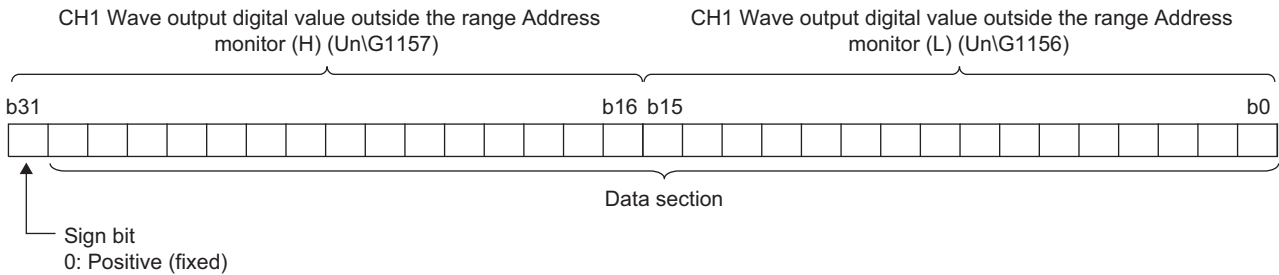
(a) Update of the stored value

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 the value of the wave data out of the setting range so that the value is within the range, and perform any of the following operations.

- Turning on and off Error clear request (YF)
- Turning OFF → ON → 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 other than the wave output mode, 0 is stored.

CH1 Wave output warning Address monitor (H) (Un\G1173)   CH1 Wave output warning Address monitor (L) (Un\G1172)

```
b31                                    b16 b15                                    b0
┌──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┐
└──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘
 ▲    └──────────────────────────────────────────────────────────────────────────────┘
 │                                      Data section
 └─ Sign bit
    0: Positive (fixed)
```
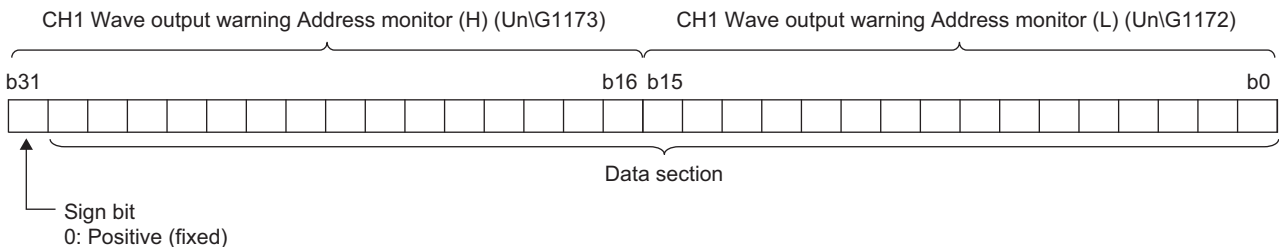
(a) Update of the stored value

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) OFF → ON → OFF or Operating condition setting request (Y9) OFF → ON → OFF after correction resets the stored value.

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

Among Error history No. □ (Un\G1810 to Un\G1969), the buffer memory address where the latest error code has been 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 ( )

	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.	2011H
Month/Day		0329H
Hour/Minute		1035H
Second		40H
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	02H

[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 71, Section 8.8)

(a) Setting range

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

Output range	Settable range
4 to 20mA	0 to 20479 (practical range: 0 to 20000)
0 to 20mA	
1 to 5V	
0 to 5V	
-10 to 10V	-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 the 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.

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Appendix 3 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

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

(2) Gain value

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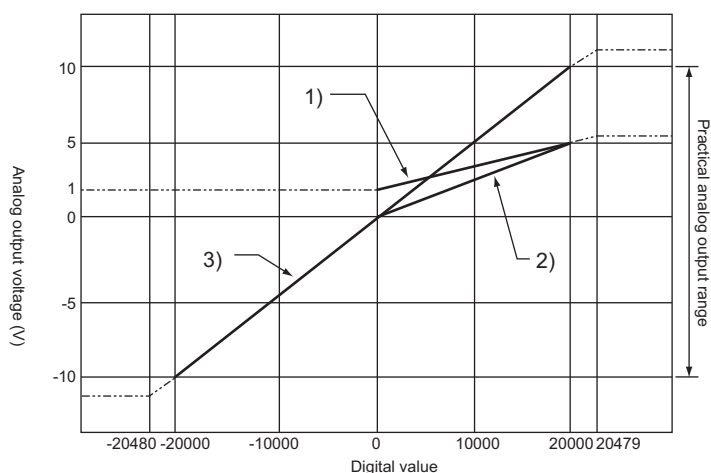
No.	Output range setting	Offset value	Gain value	Digital value	Resolution
1)	1 to 5V	1V	5V	0 to 20000	200µV
2)	0 to 5V	0V	5V		250µV
3)	-10 to 10V	0V	10V	-20000 to 20000	500µV
—	User range setting	*1	*1		333µV*2

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

Point

Use the value within the practical digital input range and practical analog output range of each output range. If a value out of the range is used, the accuracy may not fall within the range of 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.
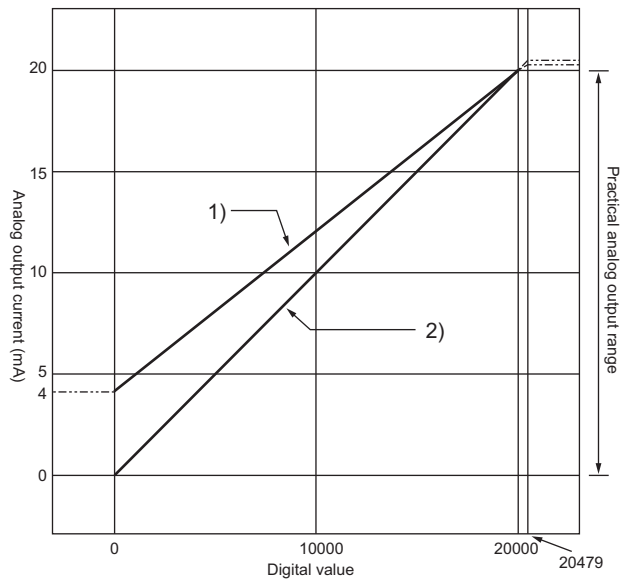
No.	Output range setting	Offset value	Gain value	Digital value	Resolution
1)	4 to 20mA	4mA	20mA	0 to 20000	800nA
2)	0 to 20mA	0mA	20mA		1000nA
—	User range setting	[*1]	[*1]	-20000 to 20000	700nA[*2]

[*1] Set the offset value and gain value in user range setting within the range satisfying the following two conditions.
- Setting range: 0 to 20mA
- Gain value - offset value $\geq$ 13.8mA

[*2] Maximum resolution in the user range setting.

Point

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

Appendix 4   D/A Conversion Accuracy

A

This is the accuracy for the maximum value of analog output value.

Even when changing the offset/gain setting and output range to change the output characteristics, the accuracy does not change and is kept within the range of described 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℃ and within ±0.3% (±30mV) when the ambient temperature is 0 to 55℃. (Excluding the case under noise effect.)
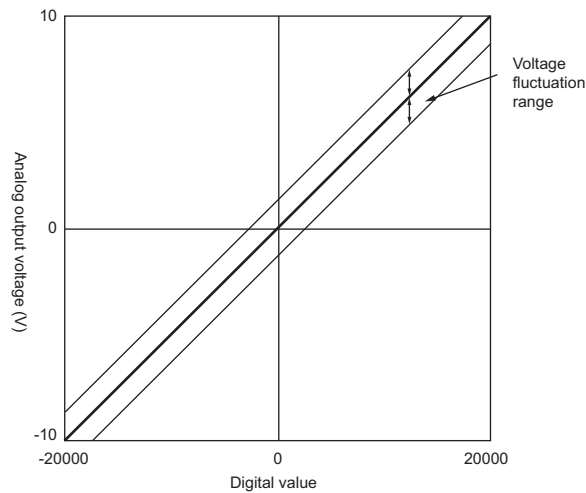
Appendix 5   Dedicated Instruction

This chapter describes the dedicated instructions that can be used in D/A converter module.

Appendix 5.1   Instruction list

The following shows the dedicated instructions that can be used in D/A converter module.

Instruction	Description
G(P).OFFGAN	• The operation mode is changed from the normal output mode to the offset/gain setting mode. • The operation mode is changed from the offset/gain setting mode to the normal output mode.
G(P).OGLOAD	The offset/gain set value in the user range setting is read out to the CPU module.
G(P).OGSTOR	The offset/gain set value in the user range setting stored in the CPU module is restored to the D/A converter module.

Appendix 5.2   G(P).OFFGAN

Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant	Others
	Bit	Word		Bit	Word				
Ⓢ	—	○				—			

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FEH	BIN 16-bit
Ⓢ	Switching the operation mode 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 switches to the offset/gain setting mode. The mode cannot switch to the wave output mode.	0, 1	BIN 16-bit

(2) Functions

This instruction switches the drive 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	Invalid	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 from OFF to ON. Note the initial setting process is performed at the switching of the mode if a program executes the initial setting when Module READY (X0) turns on.

● When the mode switching (normal output mode → offset/gain setting mode, or offset/gain setting mode → normal output mode) is performed, 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 (000FH) 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 Operating condition setting request (Y9) OFF → ON → OFF.

(3) Errors

The instruction has no errors.

(4) Program example

The following shows the 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 operation mode to the offset/gain setting mode, and turning OFF M10 changes the operation mode back to the normal output mode.

```
Switches to the offset/gain setting mode.
   M10
   ↑↓├─────────────────────────────────[MOVP    K1      D1 ]   Stores the setting data of the dedicated
      │                                                        instruction (G.OFFGAN) in D1.
      │
      └──────────────────────────[G.OFFGAN    U1      D1 ]   Dedicated instruction (G.OFFGAN)

   X1A
   ─┤ ├──────────────────────────────┌────────────────────────────┐
                                      │ Processing in offset/gain setting mode │
                                      └────────────────────────────┘
Switches to the normal output mode.
   M10
   ↑↓├─────────────────────────────────[MOVP    K0      D1 ]   Stores the setting data of the dedicated
      │                                                        instruction (G.OFFGAN) in D1.
      │
      └──────────────────────────[G.OFFGAN    U1      D1 ]   Dedicated instruction (G.OFFGAN)

   X1A
   ─┤/├──────────────────────────────┌────────────────────────────┐
                                      │ Processing in normal output mode │
                                      └────────────────────────────┘

                                                    [END ]
```

Appendix 5.3   G(P).OGLOAD

Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant	Others
	Bit	Word		Bit	Word				
Ⓢ	—	○				—			
Ⓓ	○					—			

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FEH	BIN 16-bit
Ⓢ	Start number of device where the control data is stored	Within the range of specified device	Device name
Ⓓ	Device to turn ON for one scan after the processing completion of the dedicated instruction. In error completion, Ⓓ+1 also turns ON.	Within the range of specified device	Bit

(2) Control data[*1]

Device	Item	Setting data	Setting range	Set by
ⓈS	System area	—	—	—
ⓈS+1	Completion status	The status on instruction completion is stored. 0: normal completion Other than 0: error completion (error code)	—	System
ⓈS+2	Pass data classification setting	Specify the type of offset/gain setting value to read out. 0: voltage 1: current b15 b4 b3 b2 b1 b0 | 0 | ~ | ~ | ~ | ~ | ~ | 0 | CH4|CH3|CH2|CH1|	0000H to 000FH	User
ⓈS+3	System area	—	—	—
ⓈS+4	CH1 Industrial shipment settings offset value	—	—	System
ⓈS+5	CH1 Industrial shipment settings gain value	—	—	System
ⓈS+6	CH2 Industrial shipment settings offset value	—	—	System
ⓈS+7	CH2 Industrial shipment settings gain value	—	—	System
ⓈS+8	CH3 Industrial shipment settings offset value	—	—	System
ⓈS+9	CH3 Industrial shipment settings gain value	—	—	System
ⓈS+10	CH4 Industrial shipment settings offset value	—	—	System
ⓈS+11	CH4 Industrial shipment settings gain value	—	—	System
ⓈS+12	CH1 User range settings offset value	—	—	System
ⓈS+13	CH1 User range settings gain value	—	—	System
ⓈS+14	CH2 User range settings offset value	—	—	System
ⓈS+15	CH2 User range settings gain value	—	—	System
ⓈS+16	CH3 User range settings offset value	—	—	System
ⓈS+17	CH3 User range settings gain value	—	—	System
ⓈS+18	CH4 User range settings offset value	—	—	System
ⓈS+19	CH4 User range settings gain value	—	—	System

*1　Configure the setting only for the Pass data classification setting ⓈS +2.
　　When the data is written to the area to be set by system, offset/gain setting value is not correctly read out.

(3) Functions

- This instruction reads out the offset/gain setting value in the user range setting of the D/A converter module to 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 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.

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(b) Completion status indication device

This device turns OFF → ON → OFF depending on the status of the G(P).OGLOAD instruction completion.

- Normal completion: the device is kept to be 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.
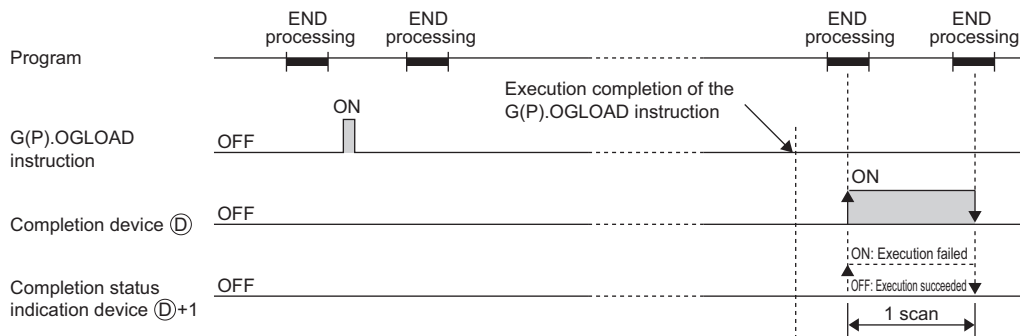
(4) Errors

The instruction has no errors.

(5) Program example

The following shows the program to read out the offset/gain setting value of the D/A converter module, installed in I/O number X/Y10 to X/Y1F, by turning ON M11.
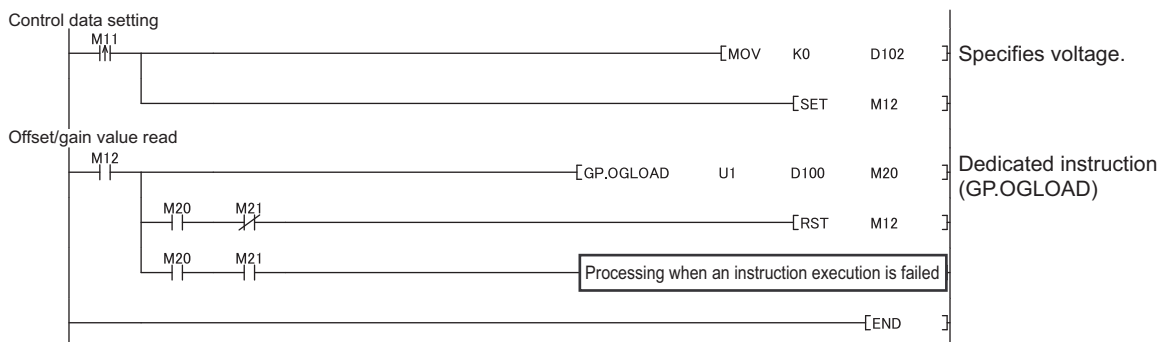
Appendix 5.4   G(P).OGSTOR

Setting data	Internal device Bit	Internal device Word	R, ZR	J□\□ Bit	J□\□ Word	U□\G□	Zn	Constant K, H, $	Others
ⓈS	—	○				—			
ⒹD		○				—			

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FEH	BIN 16-bit
ⓈS*1	Start number of device where the control data is stored	Within the range of specified device	Device name
ⒹD	Device to turn ON for one scan after the processing completion of the dedicated instruction. In error completion, ⒹD+1 also turns ON.	Within the range of specified device	Bit

*1   Specify the device specified to ⓈS 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
(S)	System area	—	—	—
(S)+1	Completion status	The status on instruction completion is stored. 0: normal completion Other than 0: error completion (error code)	—	System
(S)+2	Pass data classification setting	The value which is set for Pass data classification setting (S) +2 by G(P).OGLOAD instruction is stored. 0: voltage 1: current b15 b4 b3 b2 b1 b0 `0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1`	0000H to 000FH	System
(S)+3	System area	—	—	—
(S)+4	CH1 Industrial shipment settings offset value	—	—	System
(S)+5	CH1 Industrial shipment settings gain value	—	—	System
(S)+6	CH2 Industrial shipment settings offset value	—	—	System
(S)+7	CH2 Industrial shipment settings gain value	—	—	System
(S)+8	CH3 Industrial shipment settings offset value	—	—	System
(S)+9	CH3 Industrial shipment settings gain value	—	—	System
(S)+10	CH4 Industrial shipment settings offset value	—	—	System
(S)+11	CH4 Industrial shipment settings gain value	—	—	System
(S)+12	CH1 User range settings offset value	—	—	System
(S)+13	CH1 User range settings gain value	—	—	System
(S)+14	CH2 User range settings offset value	—	—	System
(S)+15	CH2 User range settings gain value	—	—	System
(S)+16	CH3 User range settings offset value	—	—	System
(S)+17	CH3 User range settings gain value	—	—	System
(S)+18	CH4 User range settings offset value	—	—	System
(S)+19	CH4 User range settings gain value	—	—	System

(3) Functions

- The offset/gain set value 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 (D) and a completion status indication device (D) +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 OFF → ON → OFF depending on the status of the G(P).OGSTOR instruction completion.
- Normal completion: the device is kept to be 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.
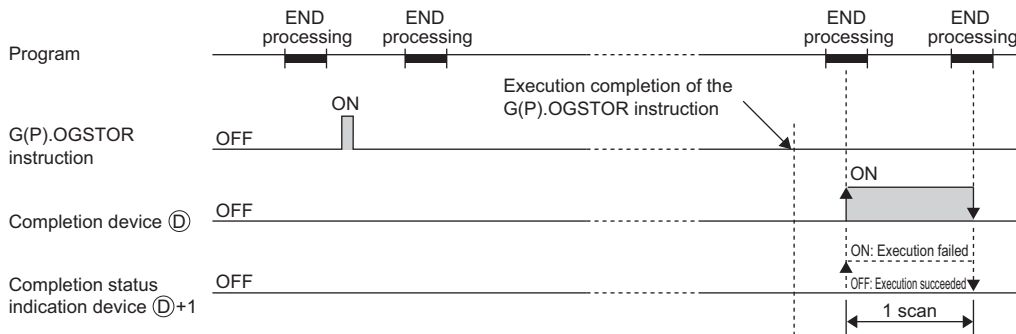
(c) Accuracy

The accuracy after the restoration of the offset/gain setting value is lower than the one before the restoration. The difference is about three times.

(4) Errors

In the following cases, an error occurs and error code is stored in completion status area ⓢ +1.

Error code	Description of operation error
161	G(P).OGSTOR instruction is executed in the offset/gain setting mode or the wave output mode.
162	G(P).OGSTOR instruction is continuously executed.
163	· G(P).OGSTOR instruction is executed to the different model from the one to which G(P).OGLOAD instruction is executed. · G(P).OGSTOR instruction has been executed before the execution of G(P).OGLOAD instruction.

(5) Program example

The following shows the programs to write the offset/gain setting value to the D/A converter module, installed in I/O number X/Y10 to X/Y1F, by turning OFF M11.
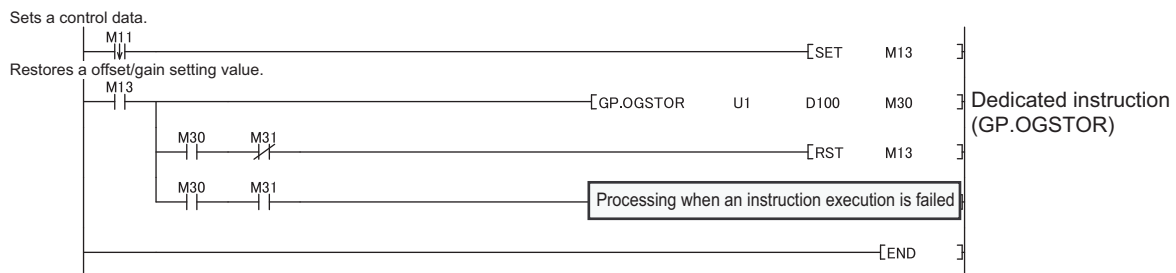
Point

When performing the dedicated instruction G(P).OGSTOR, the D/A conversion is stopped.
Turn OFF → ON → OFF Operating condition setting request (Y9) to restart the D/A conversion.

Appendix 6   Checking Serial Number and Function Version

For details on how to check the serial number and function version, refer to the following.

📖   MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 7   Addition and Change of Functions

Appendix 7.1   Additional function

The following table lists a function added to the D/A converter module and GX Works2, and product information of compatible D/A converter module and software version of GX Works2.

Additional function	Upper 5 digits of product information	Compatible version of GX Works2	Reference
Wave output function	14041 or later	1.87R or later	Page 71, Section 8.8

Appendix 7.2   Change of functions

The following table lists a function changed in the D/A converter module and GX Works2, and product information of compatible D/A converter module and software version of GX Works2.

Changed function	Upper 5 digits of product information	Compatible version of GX Works2	Reference
Switch 4 of the intelligent function module switch setting	14041 or later	1.87R or later	Page 200, Appendix 7.2 (1)
Wave output step action function	15042 or later	—	Page 106, Section 8.8.4

(1) Switch 4 of the intelligent function module switch setting

The output mode setting is added.

D/A converter module with product information (first five digits) of 14041 or later	D/A converter module with product information (first five digits) earlier than 14041
☐☐☐ 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 Fixed to 0H Drive mode setting 0H: Normal (D/A conversion) mode 1H to FH (A value other than 0H): Offset/gain setting mode	☐☐☐ H Fixed to 00H 0H : Normal (D/A conversion) mode 1H to FH (A value other than 0H) : Offset/gain setting mode

(a) When an incompatible version of D/A converter module is used

The output mode cannot be set. When an incompatible version of D/A converter module is used, do not change the lower two digits' setting of the switch 4 from the default value.

(2) Wave output step action function

A change in digital value of the currently output wave data can be easily reflected to the analog output by using CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) in combination with CH☐ Output enable/disable flag (Y1 to Y4) during the wave output step action.

The following shows the procedure.

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

2. **Change the digital value of the currently output wave data to the digital value corresponding to an analog value to be output.**

3. **Turn off and on CH☐ Output enable/disable flag (Y1 to Y4).**

(a) When an incompatible version of D/A converter module is used

Perform the following procedure to change the digital value of the currently output wave data and reflect the change to the analog output.
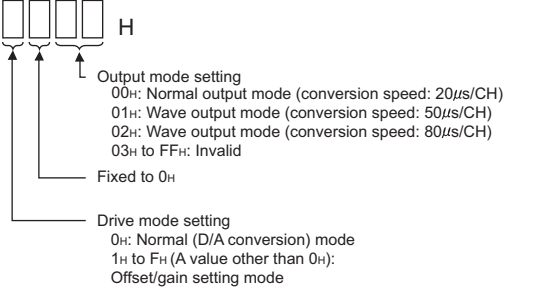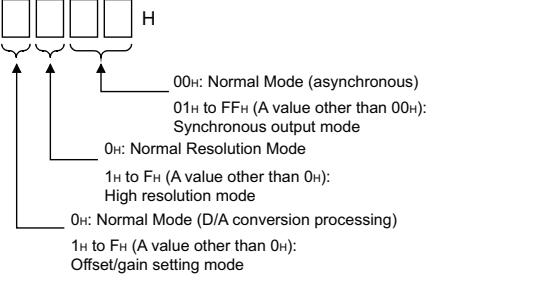
1. **Turn on and off CH☐ Output enable/disable flag (Y1 to Y4).**

2. **Set a value in CH☐ Wave output step action movement amount (Un\G1080 to Un\G1083) to move to another wave data.**

3. **Change the digital value of the output wave data before the movement to the 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 move to an address of the wave data after the change.**

5. **Turn off and on CH☐ Output enable/disable flag (Y1 to Y4).**

Appendix 8   Differences with Q Series

The following table shows a comparison of the specifications between the L60DA4 and the Q64DAN.

For the function comparison between LCPU and QCPU, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Difference	L60DA4	Q64DAN
Resolution switching function	One type: 1/20000 (resolution switching function is not installed)	Two types: normal resolution (1/4000) and high resolution (1/12000 or 1/16000)
Synchronous output function	Not available	Protected
Switch 4 in switch setting	Output mode setting 00_H: Normal output mode (conversion speed: 20μs/CH) 01_H: Wave output mode (conversion speed: 50μs/CH) 02_H: Wave output mode (conversion speed: 80μs/CH) 03_H to FF_H: Invalid Fixed to 0_H Drive mode setting 0_H: Normal (D/A conversion) mode 1_H to F_H (A value other than 0_H): Offset/gain setting mode	00_H: Normal Mode (asynchronous) 01_H to FF_H (A value other than 00_H): Synchronous output mode 0_H: Normal Resolution Mode 1_H to F_H (A value other than 0_H): High resolution mode 0_H: Normal Mode (D/A conversion processing) 1_H to F_H (A value other than 0_H): Offset/gain setting mode

Appendix 9 When Using GX Developer or GX Configurator-DA

Appendix 9 describes the operating procedure when using GX Developer and GX Configurator-DA.

(1) Compatible software version

For compatible software version, refer to the following.

📖 MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 9.1 Operation of GX Developer

Configure the setting on the following window when using GX Developer.

Window name	Application	Reference
I/O assignment	Set the type of module to be installed and the range of I/O signal.	Page 203, Appendix 9.1 (1)
Switch setting	Configure the switch setting for an intelligent function module.	Page 204, Appendix 9.1 (2)
Offset/gain setting	Configure the setting when using the user range setting for output range.	Page 50, Section 7.5.2 (1)

(1) I/O assignment

Configure the setting from "I/O assignment" in "PLC parameter".

🖱 Parameter ⇨ [PLC Parameter] ⇨ [I/O Assignment]
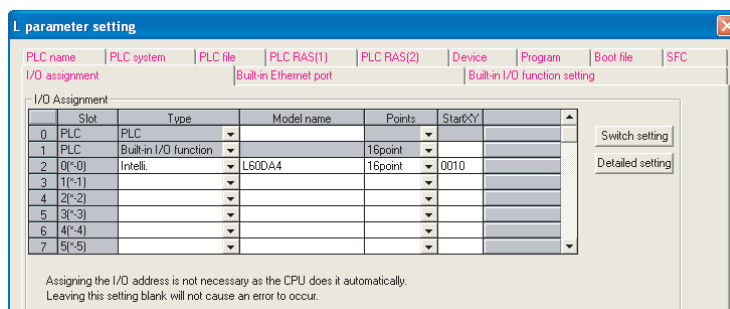
Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the D/A converter module.
Points	Select "16 point".
Start XY	Enter a desired start I/O number of D/A converter module.

(2) Intelligent function module switch setting

Configure the setting from "Switch setting" in "PLC parameter".

🖱 Parameter ⇨ [PLC Parameter] ⇨ [I/O Assignment] ⇨ Click the Switch setting button.

Select "HEX.".

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	0H
		0 to 20mA	1H
		1 to 5V	2H
		0 to 5V	3H
		-10 to 10V	4H
		User range setting	FH
Switch 2	Fixed (blank)		
Switch 3	HOLD/CLEAR function setting (CH1 to CH4) ☐☐☐☐ H CH4 CH3 CH2 CH1	Setting value	HOLD/CLEAR
		0	CLEAR
		1 to FH[*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 conversion) mode 1H to FH (A value other than 0H)[*1] : Offset/gain setting mode		
Switch 5	Fixed (blank)[*4]		

*1 The operation is the same when any value within the setting range is set.
*2 If a value other than 00H to 02H is set, an error occurs. The error code (114) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the 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 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 the ERR. LED flashes.

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Appendix 9.2   Operation of GX Configurator-DA

When setting the D/A converter module parameter using GX Configurator-DA, the display method such as a setting window differs from that of GX Works2.

This section describes how to display windows of GX Configurator-DA.

Functions added to D/A converter modules with product information (first five digits) of 14041 or later cannot be set through GX Configurator-DA. Set them through a program. All the other settings are the same as those of GX Works2. (⟲Page 42, CHAPTER 7)

When using GX Configurator-DA, configure the settings on the following windows.

Window name	Application
Initial setting	This setting configures the settings such as D/A conversion enable/disable setting.
Auto refresh setting	This setting transfers data in the buffer memory to specified devices.
Monitor/test	This function enables the user to monitor/test the buffer memory and I/O signals, and configure the operating condition setting and offset/gain setting.
FB conversion	This function generates FB automatically from the intelligent function module parameter (initial setting/auto refresh).

1)

[Online] - [Monitor/Test]　　　　　　　　　　　　<<FB Support Parameter>>tab - FB conversion

Select monitor/test module window　　　　　　　　　FB conversion window
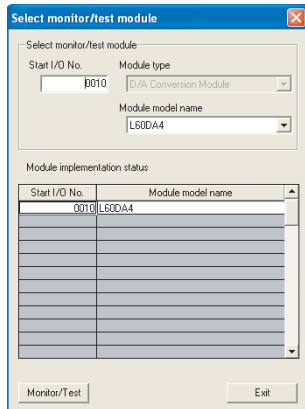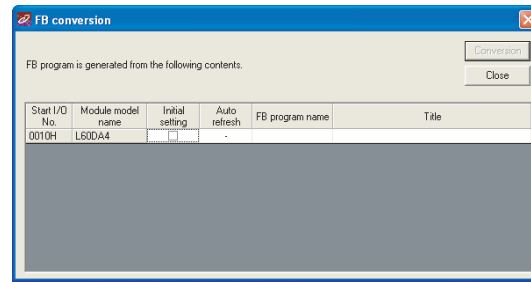
Select a module to be monitored/tested.

Monitor/Test window

A
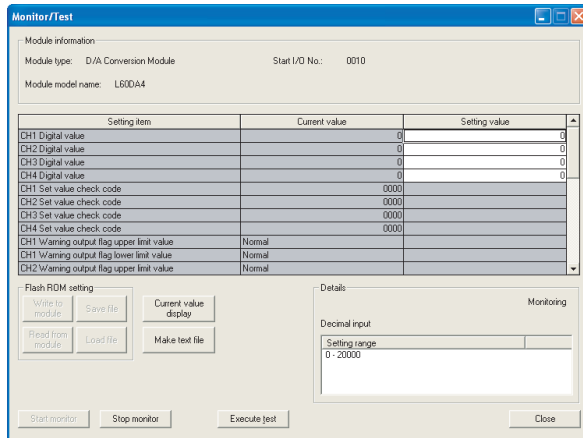
Appendix 10 External Dimensions

The following shows the external dimensions of D/A converter module.

(1) L60DA4

DIN rail center

95

117

45

(45)

4

4

90

4

28.5

(Unit: mm)

INDEX

I

INSTRUCTION INDEX

Memo

REVISIONS

Print date	*Manual number	Revision
January 2010	SH(NA)-080900ENG-A	First edition
April 2010	SH(NA)-080900ENG-B	Partial correction SAFETY PRECAUTIONS, COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES, RELEVANT MANUALS, TERMS, CHAPTER 3, Section 3.1, 3.2.1, 3.3, 3.5, CHAPTER 4, Section 5.1, 5.2, Section 6.1, Section 7.1, 7.2, 7.3, 7.4, 7.5, Section 8.3, 8.4, 8.5, 8.6, Section 9.3, 9.4, Section 10.2, CHAPTER 11, Section 11.4, 11.6, APPENDICES 2 Addition Section 5.3, Section 7.5.1, Section 10.3 Correction APPENDICES 8.1 Section 7.5.2
February 2012	SH(NA)-080900ENG-C	Partial correction COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES, RELEVANT MANUALS, Section 3.2, 7.2, 8.3, 8.9, 10.2, 10.3, Appendix 8.1
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August 2015	SH(NA)-080900ENG-F	Partial correction Section 8.8.1, 9.4, 10.3

Japanese manual version SH-080878-H

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

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MODEL: L-D/A-U-E
MODEL CODE: 13JZ43

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