MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-F series

MELSEC iQ-F
FX5 High-Speed Counter Module User's Manual

-FX5-2HC/ES

SAFETY PRECAUTIONS

(Read these precautions before use.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety in order to handle the product correctly.

This manual classifies the safety precautions into two categories: [⚠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.

Depending on the circumstances, failure to observe precautions indicated by [⚠CAUTION] may also cause severe injury.

It is important to follow all precautions for personal safety.

Store this manual in a safe place so that it can be read whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]

⚠WARNING

- Make sure to set up the following safety circuits outside the programmable controller to ensure safe system operation even during external power supply problems or programmable controller failure. Otherwise, malfunctions may cause serious accidents.
  - Emergency stop circuits, protection circuits, and protective interlock circuits (for conflicting operations such as forward/reverse rotations or for preventing damage to the equipment such as upper/lower limit positioning) must be configured external to the programmable controller.
  - Note that when the CPU module detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the CPU module occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- Construct an interlock circuit in the program so that the whole system always operates on the safe side before executing the control (for data change) of the programmable controller in operation. Read the manual thoroughly and ensure complete safety before executing other controls (program change, parameter change, forced output, and operation status change) to the programmable controller in operation. Otherwise, the machine may be damaged and accidents may occur due to erroneous operations.
- Outputs may remain on or off due to a failure of a transistor for external output. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- In an output circuit, when a load current exceeding the current rating or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.

[DESIGN PRECAUTIONS]

⚠CAUTION

- Simultaneously turn on and off the power supplies of the CPU module and extension modules.
- 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.

[INSTALLATION PRECAUTIONS]

⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Use the product in an environment that meets the general specifications in the User's Manual (Hardware) of the CPU module used.
  Never use the product in areas with excessive dust, oily smoke, conductive dust, corrosive gas (salt air, Cl_2, H_2S, SO_2, or NO_2), flammable gas, or vibration or impacts, or expose it to high temperature, condensation, or rain and wind.
  If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.

[INSTALLATION PRECAUTIONS]

⚠CAUTION

- Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions.
- When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits of the programmable controller. Failure to do so may cause fire, equipment failures or malfunctions.
- For the product supplied together with a dust proof sheet, the sheet should be affixed to the ventilation slits before the installation and wiring work to prevent foreign objects such as cutting and wiring debris.
  However, when the installation work is completed, make sure to remove the sheet to provide adequate ventilation. Failure to do so may cause fire, equipment failures or malfunctions.
- Install the product on a flat surface. If the mounting surface is rough, excessive force will be applied to the PC board, thereby causing malfunction.
- Install the product securely using a DIN rail or mounting screws.
- Work carefully when using a screwdriver such as installation of the product. Failure to do so may cause damage to the product or accidents.
- Connect the extension cables, peripheral device cables, input/output cables and battery connecting cable securely to their designated connectors. Loose connections may cause malfunctions.
- Turn off the power to the programmable controller before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions.
  - Peripheral devices, expansion board, expansion adapter, and connector conversion adapter
  - Extension modules, bus conversion module, and connector conversion module
  - Battery
- Connect this product to the extension connector on the CPU module or on a module connected to the CPU module.

[WIRING PRECAUTIONS]

⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, provided as an accessory, before turning on the power or initiating operation after installation or wiring work. Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80℃ or more.
- Make sure to properly wire to the spring clamp terminal block in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Twist the ends of stranded wires and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Fix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

[WIRING PRECAUTIONS]

⚠CAUTION

- Perform class D grounding (grounding resistance: 100Ω or less) to the grounding terminal on the CPU module with a wire 2 ㎟ or thicker. Do not use common grounding with heavy electrical systems (refer to the User's Manual (Hardware) of the CPU module used).
- Make sure to observe the following precautions to prevent any damage to the machinery or accidents due to malfunction of the programmable controller caused by abnormal data written to the programmable controller due to the effects of noise.
  - Do not bundle the control line and communication cables together with or lay them close to the main circuit, high-voltage line, load line or power line. As a guideline, lay the control line and communication cables at least 100 mm away from the main circuit, high-voltage line, load line or power line.
  - Be sure to perform class D grounding on both ends of the shield wire.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- To the terminal block, connect the circuit separated from a dangerous voltage by a double/reinforced insulation.
- Install the module so that excessive force will not be applied to terminal blocks or communication cables. Failure to do so may result in cable damage/breakage or module failure.

[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, retightening the terminal block screws or connector screws. Failure to do so may cause the module to fail or malfunction.

[STARTUP AND MAINTENANCE PRECAUTIONS]

⚠CAUTION

- Do not disassemble or modify the programmable controller. Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Do not drop or apply strong shock to this product. Doing so may damage the product.
- 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

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

[TRANSPORTATION PRECAUTIONS]

⚠CAUTION

- This product is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications by using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the product. After transportation, verify operation of the product and check for damage of the mounting part, etc.

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC iQ-F series programmable controllers.
This manual describes how to handle MELSEC iQ-F series high-speed counter module.
Please read this manual and the relevant manuals and fully understand the specifications before attempting to use the module.
Also, please ensure that the end users read this manual.

Regarding use of this product

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

Note

- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained in the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed without a notice for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you notice a doubtful point, an error, etc., please contact the nearest Mitsubishi Electric representative. When doing so, please provide the manual number given at the end of this manual.

CONTENTS

RELEVANT MANUALS

Manual name <manual number>	Description
MELSEC iQ-F FX5 High-Speed Counter Module User's Manual <SH-082631ENG> (this manual)	Describes the specifications of the high-speed counter module.
MELSEC iQ-F FX5 High-Speed Counter Module Function Block Reference <SH-082652ENG>	Describes the specifications of the high-speed counter module FBs.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) <SH-082452ENG>	Describes the details of hardware of the CPU module, including performance specifications, wiring, installation, and maintenance.
MELSEC iQ-F FX5 User's Manual (Application) <JY997D55401>	Describes the basic knowledge required for program design, functions of the CPU module, devices/labels, and parameters.
MELSEC iQ-F FX5 Programming Manual (Program Design) <JY997D55701>	Describes the specifications of ladder, ST, FBD/LD, and SFC programs, and labels.
MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/ Function Blocks) <JY997D55801>	Describes the specifications of instructions and functions that can be used in programs.
GX Works3 Operating Manual <SH-081215ENG>	Describes the system configuration, parameter settings, and online operations of GX Works3.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Engineering tool	The product name of the software package for the MELSEC programmable controllers

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
Battery	Generic term for FX3U-32BL
Extension module	Generic term for FX5 extension modules, FX3 extension modules, Extension modules (extension cable type) and Extension modules (extension connector type)
Extension power supply module	Generic term for FX5 extension power supply module and FX3 extension power supply module
FX5	Generic term for FX5UJ, FX5U, and FX5UC programmable controllers
FX5 CPU module	Generic term for FX5UJ CPU module, FX5U CPU module, and FX5UC CPU module
FX5U CPU module	Generic term for FX5U-32MR/ES, FX5U-32MT/ES, FX5U-32MT/ESS, FX5U-64MR/ES, FX5U-64MT/ES, FX5U-64MT/ESS, FX5U-80MR/ES, FX5U-80MT/ES, FX5U-80MT/ESS, FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, and FX5U-80MT/DSS
FX5UC CPU module	Generic term for FX5UC-32MT/D, FX5UC-32MT/DSS, FX5UC-64MT/D, FX5UC-64MT/DSS, FX5UC-96MT/D, FX5UC-96MT/DSS, FX5UC-32MT/DS-TS, FX5UC-32MT/DSS-TS, and FX5UC-32MR/DS-TS
FX5UJ CPU module	Generic term for FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, and FX5UJ-60MT/DSS
GX Works3	The product name of the software package, SWnDND-GXW3, for the MELSEC programmable controllers (The 'n' represents a version.)
High-speed counter module	Another name for FX5-2HC/ES
Intelligent function module	Generic term for FX5 intelligent function modules and FX3 intelligent function modules
Peripheral device	Generic term for engineering tools and GOTs
SD memory card	Generic term for NZ1MEM-2GBSD, NZ1MEM-4GBSD, NZ1MEM-8GBSD, NZ1MEM-16GBSD, L1MEM-2GBSD, and L1MEM-4GBSD SD memory cards Abbreviation for Secure Digital Memory Card. Device that stores data using flash memory.

1 OUTLINE

The high-speed counter module is a counter module for the MELSEC iQ-F series that supports differential line driver level input.

Features

■Maximum counting speed of 2MHz is supported in multiples of 1 for 1-phase and 2-phase inputs.

The module supports signal acquisition at a maximum of 2MHz to enable more accurate position measurement.

■Support for various pulse input modes

The module can count pulse input from devices that have various pulse output modes.

■Support for differential line driver level (5V) input

The module can be used for position measurement applications for which high-speed and anti-noise performance are required.

■For external input, equipped with preset input and disable input functions for each channel

Presetting and disabling from external devices are possible without being affected by scans.

■Support for digital filters on which multiple adjustments are possible

Influence of noise can be reduced by adjusting the set values.

■For external output, equipped with coincidence output for each channel

Coincidence output to external devices can be performed without being affected by scans.

■Coincidence output response time of 3μs

The module can be used for position measurement applications for which a fast response is required.

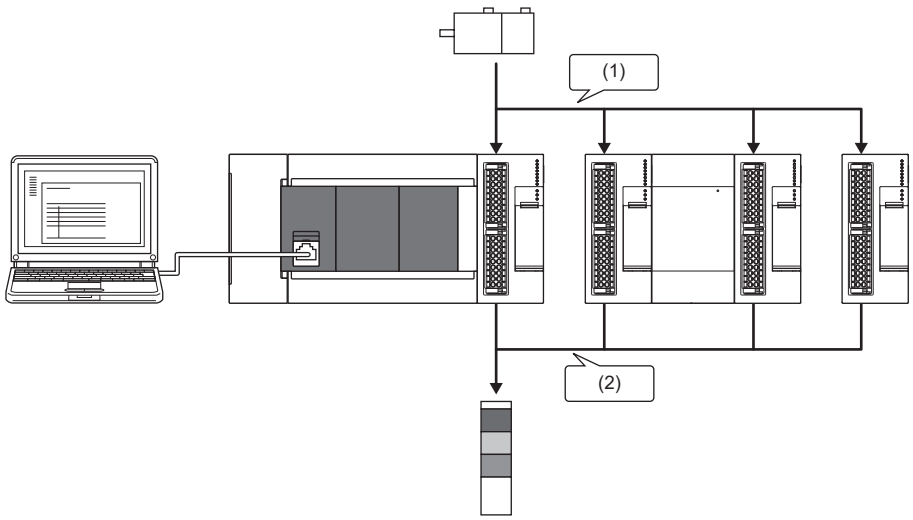
■Utilization of spring clamp terminal block

Wiring is easier when a multi-channel counter is used.

■Equipped with various counter functions

Various counter functions can be used without programming, simply by configuring parameter settings.

Application example



(1) CPU module
(2) High-speed counter module
(3) Extension power supply module

(a) Pulse input from a device such as a differential encoder or sensor
(b) Output to a device such as a lamp or switch when the count value and the comparison value match

MEMO

2 SPECIFICATIONS

This chapter describes the specifications of the high-speed counter module.

2.1 General Specifications

The general specifications other than those below are the same as the CPU module to be connected.
For the general specification, refer to the following manual.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

Item	Specifications	
Dielectric withstand voltage	500VAC for one minute	Between all terminals and the ground terminal "ground terminal"
Insulation resistance	10MΩ or higher by 500VDC insulation resistance tester	

2.2 Power Supply Specifications

This section describes the power supply specifications.

Item		Specifications
Internal power supply	Power supply voltage	Bus 5VDC
	Current consumption	210mA

2.3 Performance Specifications

This section describes the performance specifications.

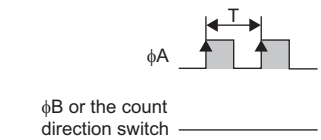
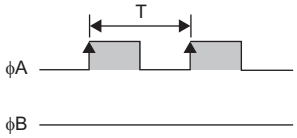
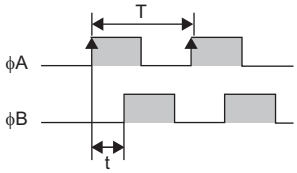
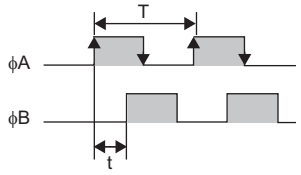
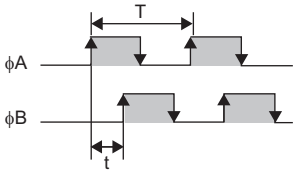
Item		Specifications
Number of channels		2 channels
Number of input points	Differential input (phase A, phase B)	2 points (1 point × 2 channels)
	Function start input	2 points (1 point × 2 channels)
	Preset input	2 points (1 point × 2 channels)
Number of output points		4 points (2 points × 2 channels)
Maximum input frequency		2MHz
Number of occupied I/O points		8 points
Count input signal	Phase	1-phase 1-input, 1-phase 2-input, 2-phase 2-input (multiple of 1/multiple of 2/multiple of 4), internal clock (1MHz)
	Signal level	EIA Standard RS-422-A Differential line driver level (equivalent to AM26LS31)
	Counting speed setting	10kHz, 50kHz, 100kHz, 200kHz, 500kHz, 1MHz, 2MHz
	Digital filter	When the counting speed setting is 2MHz: None When the counting speed setting is a value other than the above: Automatically set according to the counting speed setting value
Counter	Counting speed (maximum)	1-phase 1-input, 1-phase 2-input, 2-phase 2-input (multiple of 1): 2MHz 2-phase 2-input (multiple of 2): 1MHz 2-phase 2-input (multiple of 4): 500kHz
	Counting range	32-bit signed binary value (-2147483648 to 2147483647)
Coincidence output	Comparison range	32-bit signed binary value (-2147483648 to 2147483647)
	Comparison result	Set value < Count value, Set value = Count value, Set value > Count value
	Coincidence output response	When the counting speed setting is 2MHz: 3μs When the counting speed setting is a value other than the above : $\left(\frac{150}{\text{Counting speed setting value (kHz)}} + 3\right)$ μs
External input	Preset	[P24] 24VDC ±10%, current consumption 10mA or less [P12] 12VDC ±10%, current consumption 10mA or less [P5] 2.4 to 5.5VDC, current consumption 25mA or less
	Function start	[D24] 24VDC ±10%, current consumption 8mA or less [D12] 12VDC ±10%, current consumption 8mA or less [D5] 5VDC ±10%, current consumption 7mA or less
	Digital filter	None, 0.1ms, 1ms, 10ms
External output	Number of output points and output type	2 points/channel Transistor (sink output)
	Output capacity	5 to 30VDC 0.5A/point (resistive load)
	Response time	Off to on: 2.5μs or less On to off: 2.5μs or less
Compatible CPU module		FX5UJ CPU module (firmware version 1.060 or later) FX5U CPU module (firmware version 1.300 or later) FX5UC CPU module (firmware version 1.300 or later)
Supported engineering tool		FX5UJ CPU module: GX Works3 Version 1.100E or later FX5U CPU module: GX Works3 Version 1.100E or later FX5UC CPU module: GX Works3 Version 1.100E or later
Number of connectable modules	No extension power supply module	FX5UJ CPU module: 4 FX5U CPU module (FX5U-32M□): 4 FX5U CPU module (FX5U-64M□, FX5U-80M□): 5 FX5UC CPU module: 3
	With extension power supply module	FX5UJ CPU module: 8 (1 system) FX5U CPU module: 15 (1 system) FX5UC CPU module: 13 (1 system)

Minimum count pulse cycle and phase difference

The following table lists the minimum count pulse cycle and phase difference for setting each pulse input mode and counting speed.

For details on pulse input mode, refer to the following.

☞ Page 18 Counting Specifications

Pulse input mode	Waveform (at up-counting, duty ratio: 50%)	Minimum count pulse cycle, T, and phase difference, t (μs), at each counting speed						
		2MHz	1MHz	500kHz	200kHz	100kHz	50kHz	10kHz
1-phase 1-input		T = 0.5	T = 1	T = 2	T = 5	T = 10	T = 20	T = 100
1-phase 2-input		T = 0.5	T = 1	T = 2	T = 5	T = 10	T = 20	T = 100
2-phase 2-input (multiple of 1)		T = 0.5 t = 0.125	T = 1 t = 0.25	T = 2 t = 0.5	T = 5 t = 1.25	T = 10 t = 2.5	T = 20 t = 5	T = 100 t = 25
2-phase 2-input (multiple of 2)		—	T = 1 t = 0.25	T = 2 t = 0.5	T = 5 t = 1.25	T = 10 t = 2.5	T = 20 t = 5	T = 100 t = 25
2-phase 2-input (multiple of 4)		—	—	T = 2 t = 0.5	T = 5 t = 1.25	T = 10 t = 2.5	T = 20 t = 5	T = 100 t = 25

Relation between the input waveform and the phase difference of phase A pulse and phase B pulse

Inputting pulses of which the phase difference is small between the phase A pulse and phase B pulse can cause an incorrect count.

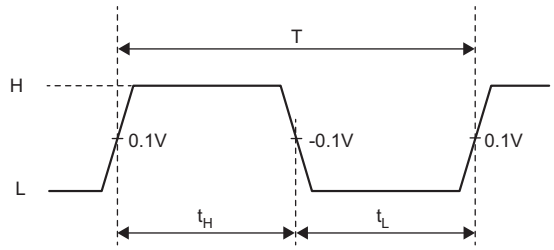
The following figures show the waveforms of pulses to be input to the high-speed counter module and the relationship of the phase differences between the phase A pulse and phase B pulse.

Input waveform in 1-phase input

An input pulse waveform in 1-phase input is subject to the following condition (duty ratio 50%):

$T (=t_H+t_L) \geq 0.5\mu s$

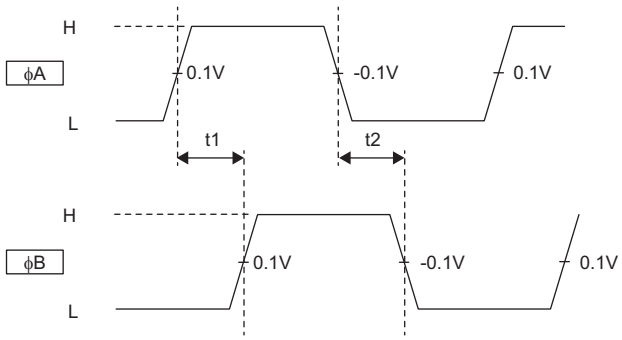
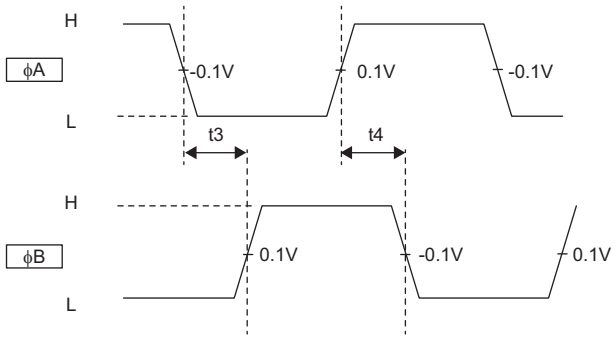
$t_H, t_L \geq 0.25\mu s (=0.5\times T)$



T: Minimum count pulse cycle
t: Phase difference
H: Differential voltage H level
L: Differential voltage L level

Phase difference in 2-phase input

An input pulse waveform in 2-phase input is subject to the condition in 1-pulse input, and the relationship of the phase difference between phase A pulse and phase B pulse should satisfy the following.

Count	Input pulse waveform
Up-counting	t1, t2, t3, t4 ≥ 0.125μs (=0.25×T) 
Down-counting	t1, t2, t3, t4 ≥ 0.125μs (=0.25×T) 

T: Minimum count pulse cycle
t: Phase difference
H: Differential voltage H level
L: Differential voltage L level

2.4 Counting Specifications

This section describes the counting specifications.

Point

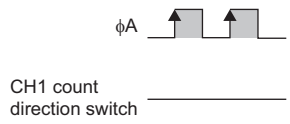
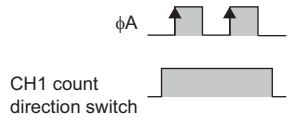
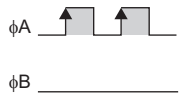
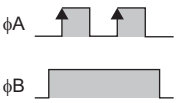
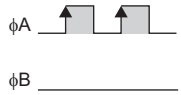
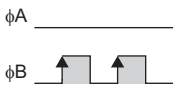
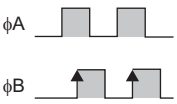
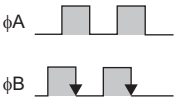
This section describes buffer memory CH1. To check the buffer memory addresses for CH2, refer to the following.

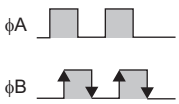
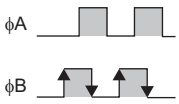
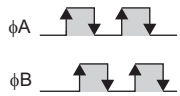
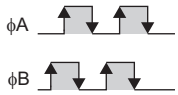
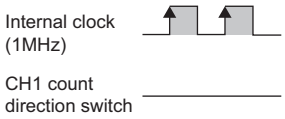
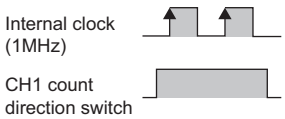
☞ Page 89 Buffer Memory Areas

Types of pulse input modes

There are seven types of pulse input modes: 1-phase 1-input (S/W up/down switch), 1-phase 1-input (H/W up/down switch), 1-phase 2-input, 2-phase 2-input (multiple of 1, multiple of 2, multiple of 4), and internal clock.

Pulse input modes and count timing

Pulse input mode	Count timing		
1-Phase 1 Input (S/W up/down switch)	At up-counting		Counts on the rising edge (↑) of phase A. The CH1 count direction switch (Un\G1) is off.
	At down-counting		Counts on the rising edge (↑) of phase A. The CH1 count direction switch (Un\G1) is on.
1-Phase 1 Input (H/W up/down switch)	At up-counting		Counts on the rising edge (↑) of phase A. Phase B is off.
	At down-counting		Counts on the rising edge (↑) of phase A. Phase B is on.
1-phase 2-input	At up-counting		Counts on the rising edge (↑) of phase A. Phase B is off.
	At down-counting		Phase A is off. Counts on the rising edge (↑) of phase B.
2-phase 2-input (multiple of 1)	At up-counting		Counts on the rising edge (↑) of phase B while phase A is on.
	At down-counting		Counts on the falling edge (↓) of phase B while phase A is on.

Pulse input mode	Count timing		
2-phase 2-input (multiple of 2)	At up-counting		Counts on the rising edge (↑) of phase B while phase A is on. Counts on the falling edge (↓) of phase B while phase A is off.
	At down-counting		Counts on the falling edge (↓) of phase B while phase A is on. Counts on the rising edge (↑) of phase B while phase A is off.
2-phase 2-input (multiple of 4)	At up-counting		Counts on the rising edge (↑) of phase A while phase B is off. Counts on the rising edge (↑) of phase B while phase A is on. Counts on the falling edge (↓) of phase A while phase B is on. Counts on the falling edge (↓) of phase B while phase A is off.
	At down-counting		Counts on the rising edge (↑) of phase B while phase A is off. Counts on the rising edge (↑) of phase A while phase B is on. Counts on the falling edge (↓) of phase B while phase A is on. Counts on the falling edge (↓) of phase A while phase B is off.
Internal clock	At up-counting		Counts on the rising edge (↑) of the internal clock. The CH1 count direction switch (Un\G1) is off.
	At down-counting		Counts on the rising edge (↑) of the internal clock. The CH1 count direction switch (Un\G1) is on.

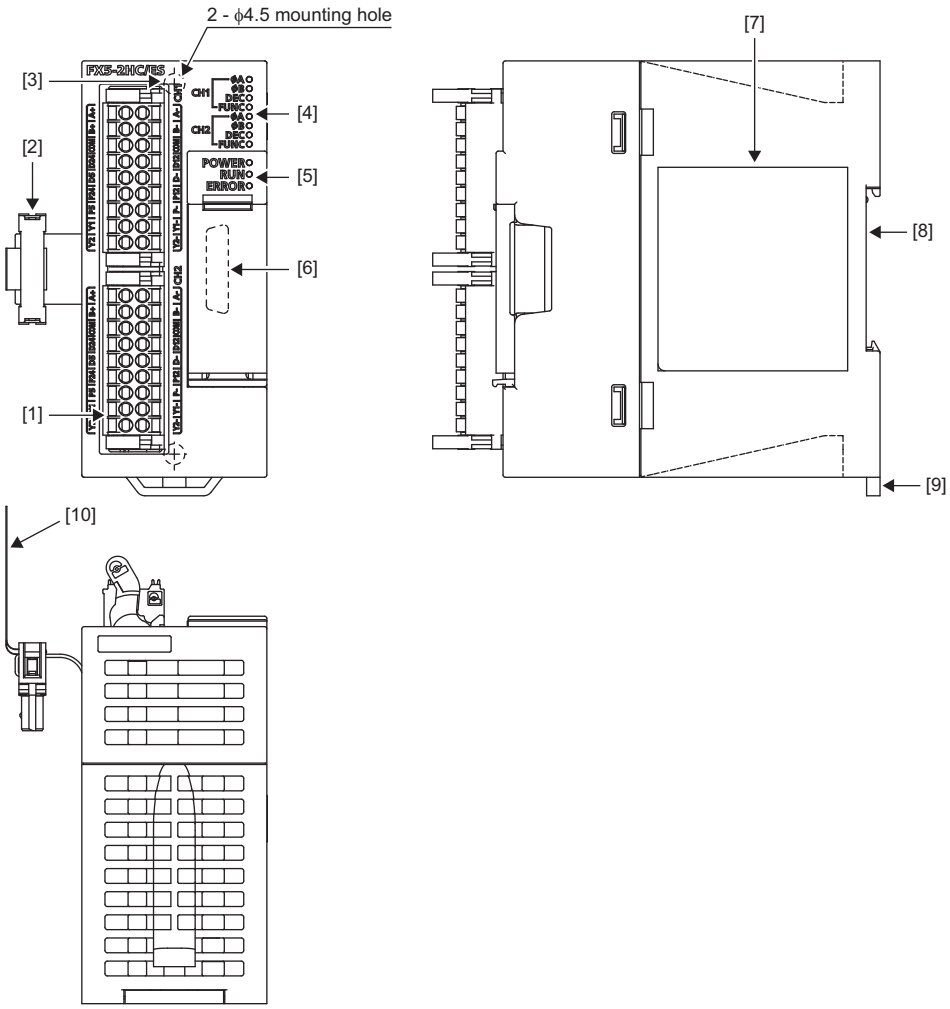
Setting a counting method

Set a counting method in "Basic setting". For details on the setting method, refer to the following.

☞ Page 58 Basic Setting

2.5 Part Names

This chapter describes the part names of the high-speed counter module.



No.	Name	Description
[1]	Terminal block (spring clamp terminal block)	A connector for connecting an encoder and a controller.
[2]	Extension cable	A connector for connecting to the CPU module or other devices.
[3]	Hole for direct installation	A hole used for direct installation. (2-ϕ4.5, Mounting screw: M4 screw, Tightening torque range: 0.83 to 1.11N·m)
[4]	Count status display LED	LED indicating the operating status of the module. For details, refer to the following. ☞ Page 21 LED indication
[5]	Operation status display LED	
[6]	Extension connector	A connector for connecting an extension module.
[7]	Nameplate	Serial number and other information are indicated.
[8]	DIN rail mounting groove	A groove for mounting on a DIN rail of DIN46277 (width: 35mm).
[9]	DIN rail mounting hook	A hook for mounting on a DIN rail.
[10]	Pullout tab	A tab used to pull out the extension cable.

LED indication

This subsection describes LED indication.

LED name		LED color	Description
POWER		Green	• On: Power-on • Off: Power-off or error
RUN		Green	• On: Normal operation • Off: Error
ERROR		Red	• On: Minor error • Flashing: Moderate error • Off: Normal operation
CH1/CH2	ϕA	Green	• On: A phase pulse input is on. • Off: A phase pulse input is off.
	ϕB	Green	• On: B phase pulse input is on. • Off: B phase pulse input is off.
	DEC	Green	• On: Performing down-counting • Off: Performing up-counting
	FUNC	Green	• On: Function start input is on. • Off: Function start input is off.

3 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.

1. Checking the specifications of the high-speed counter module

Check the specifications of the high-speed counter module. (☞ Page 13 SPECIFICATIONS)

2. Mounting the high-speed counter module

Connect the high-speed counter module to the CPU module. For details, refer to the following.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

3. Wiring

Perform wiring to the high-speed counter module. (☞ Page 51 WIRING)

4. Adding and setting the module

Add the high-speed counter module settings using GX Works3. (☞ Page 57 PARAMETER SETTINGS)

5. Programming

Create a program. (☞ Page 63 PROGRAMMING)

6. Checking the operating status

Check the operating status of the high-speed counter module. (☞ Page 78 Checking Module Status)

MEMO

4 FUNCTIONS

This chapter describes the functions of the high-speed counter modules.

Point

Throughout the chapter, the buffer memory is described on the basis of the case of CH1. To check the buffer memory addresses for CH2, refer to the following.

☞ Page 89 Buffer Memory Areas

4.1 Function List

Operation mode list

The following table lists operation modes of the high-speed counter module.

Operation mode setting	Description	Program examples
Normal mode	This mode operates as an ordinary high-speed counter.	Page 63 When Setting Normal Mode
Pulse density measurement mode	This mode counts pulses at the pulse input terminals for phase A and B, then automatically calculates the pulse density.	Page 68 When Setting Pulse Density Measurement Mode
Rotational speed measurement mode	This mode counts pulses at the pulse input terminals for phase A and B, then automatically calculates the rotational speed.	Page 71 When Setting Rotational Speed Measurement Mode
Pulse width measurement mode	This mode measures the width and cycle of the pulses input to phase A and phase B.	Page 74 When Setting Pulse Width Measurement Mode

Function detail list

The following table lists the detailed content of the functions of the high-speed counter module.

Function		Description	Reference
Ring counter function	Ring length setting disabled	Counts pulses in the range of -2147483648 (lower limit value) to 2147483647 (upper limit value). If a count exceeds the range, an overflow or underflow is detected.	Page 26 Ring counter function (ring length setting disabled)
	Ring length setting enabled	The count operation is performed repeatedly between 0 (lower limit value) and the CH1 Ring length (Un\G2 to 3) - 1.	Page 27 Ring counter function (ring length setting enabled)
Coincidence output function	—	Compares the present count value with the preset count value, and outputs a signal when they match.	Page 28 Coincidence Output Function
	Coincidence detection interrupt function	Outputs an interrupt request to the CPU module and starts an interrupt program when the present count value matches with the preset count value.	Page 30 Interruption occurrence request
Preset function		Overwrites the present count value with an arbitrary numerical value by using an external signal (preset input).	Page 32 Preset Function
Counter function selection	Count disable function	Stops counting of pulses while the count permit command is on. This function is performed with a program or an external signal (function start input).	Page 34 Count disable function
	Latch counter function	Stores the present count value at the signal input of Counter function selection start command into the buffer memory. This function is performed with a program or an external signal (function start input).	Page 35 Latch counter function
	Sampling counter function	Counts input pulses for a specified sampling time (T) and stores the count value into the buffer memory. This function is performed with a program or an external signal (function start input).	Page 36 Sampling counter function
Pulse density measurement function		Counts pulses at the pulse input terminals for phase A and B, then automatically calculates the pulse density.	Page 38 Pulse Density Measurement Function
Rotational speed measurement function		Counts pulses at the pulse input terminals for phase A and B, then automatically calculates the rotational speed.	Page 40 Rotational Speed Measurement Function
Pulse width measuring function		Measures the width and cycle of the pulses input to phase A and phase B.	Page 43 Pulse Width Measuring Function
Event history function		Saves errors that occurred in the high-speed counter module to the data memory of the CPU module or the SD memory card as events.	Page 47 Event History Function
Error history function		Collects error information onto the CPU module. The collected error information can be checked on GX Works3.	Page 48 Error History Function

4.2 Selecting a Counter Type

The count range and operation differ depending on the CH1 Ring length setting (Un\G5). (☞ Page 96 CH1/CH2 ring length setting)

- When Un\G5 is 0: ☞ Page 26 Ring counter function (ring length setting disabled)
- When Un\G5 is 1: ☞ Page 27 Ring counter function (ring length setting enabled)

Point

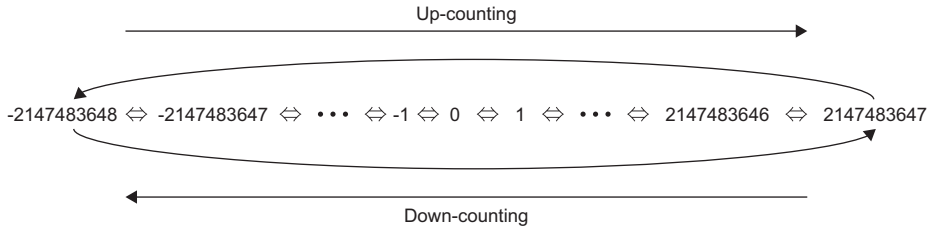
The counter operates as a ring counter (ring length setting disabled) when the operation mode is set to the pulse density measurement mode or rotational speed measurement mode.

Ring counter function (ring length setting disabled)

The count operation starts when CH1 Count permit command (Un\G4.0) is turned on. However, the count operation does not start when an error other than an underflow error or overflow error has occurred.

Operation

- This function counts pulses in the range of -2147483648 (lower limit value) to 2147483647 (upper limit value).
- The preset function and coincidence output function can be used with this function.



Underflow error and overflow error

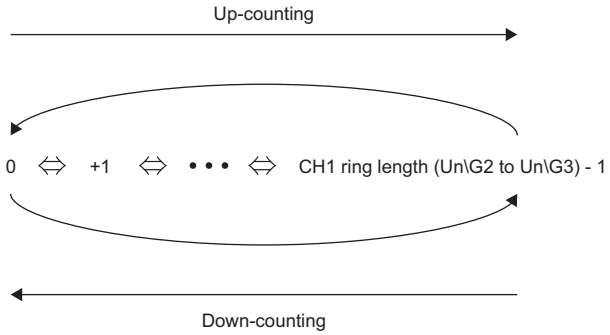
- When CH1 Current value (Un\G20 to 21) exceeds -2147483648 (lower limit value) during down-counting, an underflow error occurs and the current value becomes 21474783647 (upper limit value).
- When CH1 Current value (Un\G20 to 21) exceeds 2147483647 (upper limit value) during up-counting, an overflow error occurs and the current value becomes -2147483648 (lower limit value).
- When an underflow error occurs, the error flag (Un\G29.0) and CH1 Underflow (Un\G29.6) turn on. When an overflow error occurs, the error flag (Un\G29.0) and CH1 Overflow (Un\G29.5) turn on. (☞ Page 100 Error status)

Ring counter function (ring length setting enabled)

The count operation starts when CH1 Count permit command (Un\G4.0) is turned on. However, the count operation does not start when an error has occurred. Underflow error or overflow error does not occur when the ring counter is selected.

Operation

- The count operation is performed repeatedly between 0 (lower limit value) and the CH1 Ring length (Un\G2 to 3) - 1.
- The preset function and coincidence output function can be used with this function.



Point

- If CH1 Ring length (Un\G2 to 3) setting is out of the range, a ring length error (1900H) occurs.
- If CH1 Ring length setting (Un\G5) is 1 (enabled) and a value less than 0 or a value greater than or equal to CH1 Ring length (Un\G2 to 3) is set for CH1 Current value (Un\G20 to 21), a current value error (1940H) occurs.

Restriction

When using the sampling counter function while the ring length setting is enabled, the CH1 Ring length (Un\G2 to 3) requires some setting conditions. If the count operation is permitted when a value that ignores the conditions is set, a sampling counter function setting error (1980H) occurs, and count operation does not start. For details, refer to the following.

☞ Page 93 CH1/CH2 ring length

4.3 Coincidence Output Function

This function compares the present count value with the preset count value, and outputs a signal when they match.

Point

It can be used when the operation mode is set to normal mode, pulse density measurement mode, or rotational speed measurement mode.

Operation of the coincidence output function

- Up to two coincidence outputs can be set for each channel. (☞ Page 58 Basic Setting)
- Set the value to be compared with the current value to the CH1 Comparison setting value for Y1 output (Un\G12 to 13) and CH1 Comparison setting value for Y2 output (Un\G14 to 15). (☞ Page 96 CH1/CH2 comparison setting value for Y1 output, ☞ Page 97 CH1/CH2 comparison setting value for Y2 output)
- When the external output of the coincidence signal is used, turn on CH1 Y1 comparison output permit command (Un\G4.1)/ CH1 Y2 comparison output permit command (Un\G4.2).

Point

When CH1 Ring length setting (Un\G5) is set to 1 (enabled) and a value less than 0 or a value greater than or equal to CH1 Ring length (Un\G2 to 3) is set for CH1 Comparison setting value for Y1 output (Un\G12 to 13) and CH1 Comparison setting value for Y2 output (Un\G14 to 15), a comparison setting value for Y1 output error (1920H) and comparison setting value for Y2 output error (1930H) occur.

■Precautions for the coincidence output function

The coincidence output function performs the output judgment process when the current value changes due to pulse input. When the current value becomes equal to the comparison setting value as a result of the following method, Y1 output and Y2 output do not turn on.

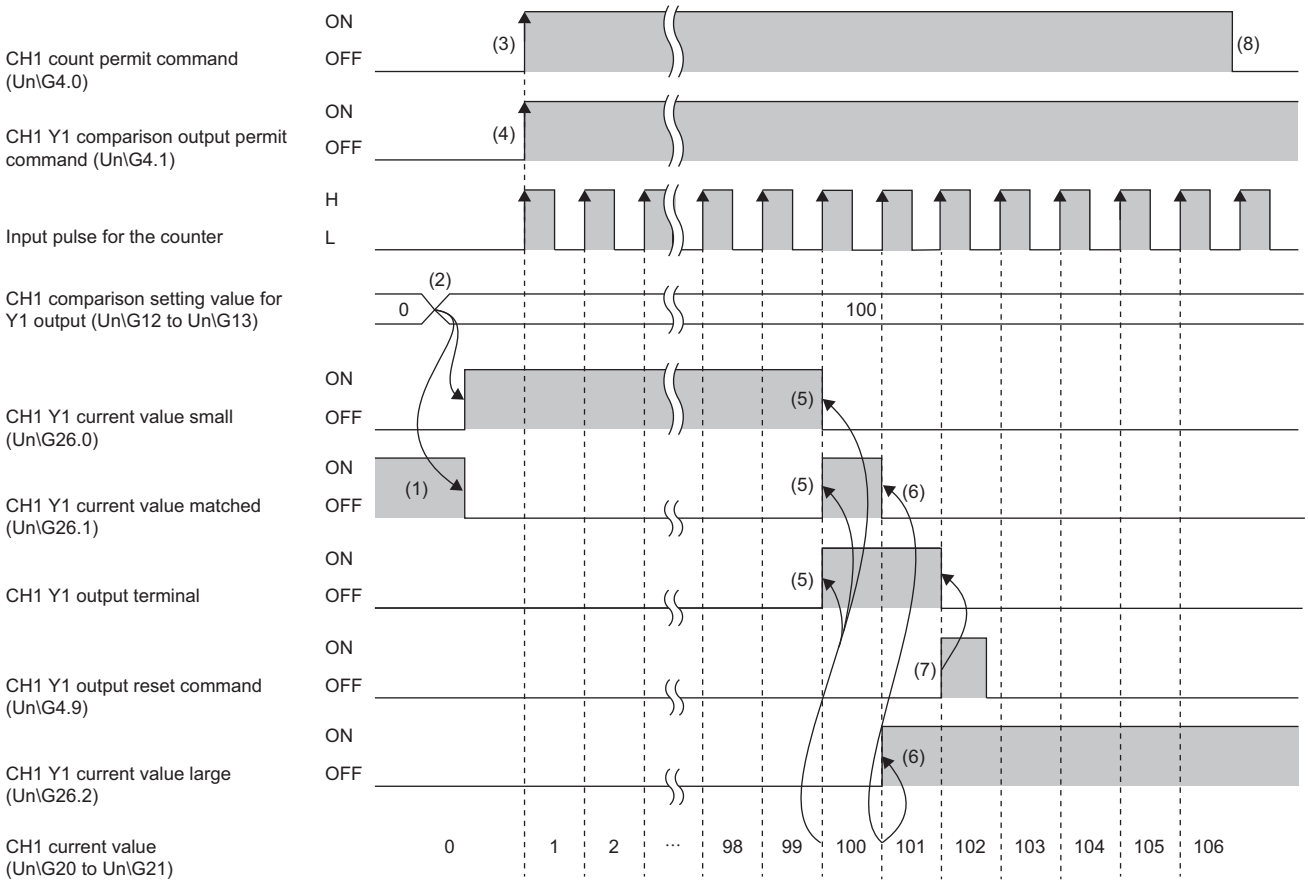
- When CH1 Current value (Un\G20 to 21) was changed
- When CH1 Comparison setting value for Y1 output (Un\G12 to 13) or CH1 Comparison setting value for Y2 output (Un\G14 to 15) was changed
- When the current value was changed by preset input

However, when pulse input is performed at the same time as the operation above, Y1 output or Y2 output may turn on. Prevent the current value from becoming equal to the comparison setting value by using the operation above during pulse input.

■Internal operations

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when resetting the current value coincidence signal after the current value coincidence signal was output.

Operation mode	Comparison setting value for Y1 output
Normal mode	100



No.	Description
(1)	Even when the count operation is prohibited, when CH1 Current value (Un\G20 to 21) becomes equal to CH1 Comparison setting value for Y1 output (Un\G12 to 13), CH1 Y1 current value matched (Un\G26.1) turns on.
(2)	When 100 is set for CH1 Comparison setting value for Y1 output (Un\G12 to 13), CH1 Current value (Un\G20 to 21) becomes smaller than CH1 Comparison setting value for Y1 output (Un\G12 to 13), and CH1 Y1 current value small (Un\G26.0) turns on. CH1 Y1 current value matched (Un\G26.1) turns off.
(3)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(4)	When performing coincidence output from CH1 Y1 output terminal, CH1 Y1 comparison output permit command (Un\G4.1) is turned on.
(5)	When CH1 Current value (Un\G20 to 21) is equal to CH1 Comparison setting value for Y1 output (Un\G12 to 13), CH1 Y1 current value matched (Un\G26.1) and CH1 Y1 output terminal turn on. Also, CH1 Y1 current value small (Un\G26.0) turns off.
(6)	When CH1 Current value (Un\G20 to 21) becomes larger than CH1 Comparison setting value for Y1 output (Un\G12 to 13), CH1 Y1 current value large (Un\G26.2) turns on. Also, CH1 Y1 current value matched (Un\G26.1) turns off.
(7)	When CH1 Y1 output reset command (Un\G4.9) is turned on, CH1 Y1 output terminal is turned off.
(8)	The count operation stops when CH1 Count permit command (Un\G4.0) is turned off. Even when the count operation is prohibited, because CH1 Current value (Un\G20 to 21) is larger than CH1 Comparison setting value for Y1 output (Un\G12 to 13), CH1 Y1 current value large (Un\G26.2) remains on.

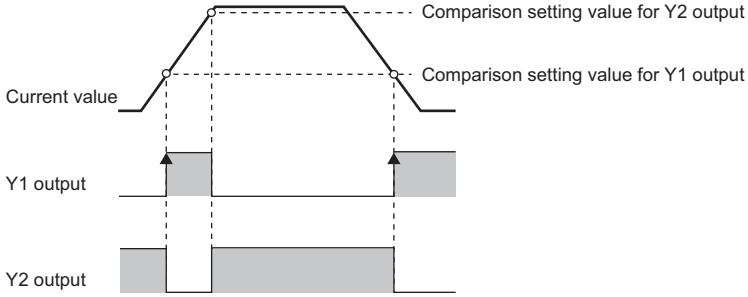
Point

- Y1 output and Y2 output remain on until they are reset by CH1 Y1 output reset command (Un\G4.9) or CH1 Y2 output reset command (Un\G4.A).
- Even when the current value matches the comparison setting value for Y1 output, turning on the Y1 output reset command turns off output from CH1 Y1 output terminal.
- Output from CH1 Y1 output terminal remains on even when the count operation is changed from permit to prohibit.
- As the CPU error output mode setting is fixed to clear, external output is cleared when a stop error occurs on the CPU.

Mutual reset action

When CH1 Mutual reset action command (Un\G4.3) is on, turning on the Y1 output turns off Y2 output. Inversely, turning on the Y2 output turns off Y1 output.

Mutual reset action is enabled only when both CH1 Y1 comparison output permit command (Un\G4.1) and CH1 Y2 comparison output permit command (Un\G4.2) are on. (☞ Page 94 CH1/CH2 command)

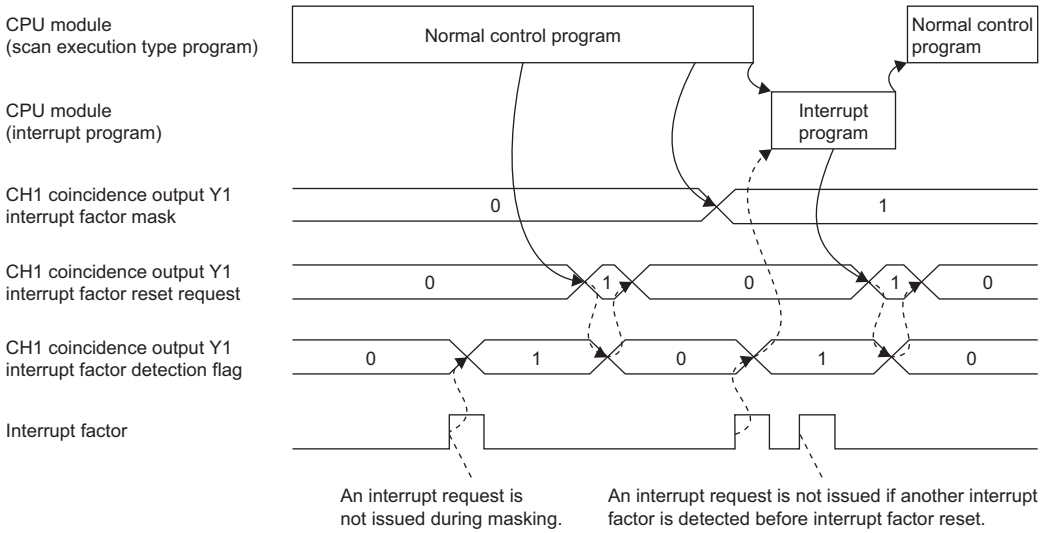


Interruption occurrence request

Output an interrupt request to the CPU module and start an interrupt program when the present count value matches with the preset count value.

The interrupt factors corresponding to the coincidence output are as follows.

- Coincidence detection of CH1/CH2 comparison setting value for Y1 output
- Coincidence detection of CH1/CH2 comparison setting value for Y2 output



Set interrupt pointers of the CPU module by using the parameters in GX Works3. (☞ Page 61 Interrupt Setting)

Point

- Coincidence detection interrupt occurs when the Y1/Y2 interrupt factor detection flag changes from 0 to 1. The next interrupt request is not issued until an interrupt factor reset is performed to set the Y1/Y2 interrupt factor detection flag back to 0.
- Coincidence detection interrupt occurs even when CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2) is off (Y1/Y2 comparison output prohibited) if masking has been canceled.
- When CH1 Coincidence output Y1 interrupt factor detection flag (Un\G160)/CH1 Coincidence output Y2 interrupt factor detection flag (Un\G163) becomes 1 (interrupt factor detected) during masking and masking is canceled, a coincidence detection interrupt occurs. To avoid this, write 1 (reset request) to CH1 Coincidence output Y1 interrupt factor reset request (Un\G162)/CH1 Coincidence output Y2 interrupt factor reset request (Un\G165) before canceling the mask and clear CH1 Coincidence output Y1 interrupt factor detection flag (Un\G160)/CH1 Coincidence output Y2 interrupt factor detection flag (Un\G163).
- Even during masking, CH1 Coincidence output Y1 interrupt factor detection flag (Un\G160)/CH1 Coincidence output Y2 interrupt factor detection flag (Un\G163) becomes 1 (interrupt factor detected) when CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2) is on (Y1/Y2 comparison output permitted).

Restriction

When the external output of the coincidence signal is used while CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2) is on or when starting the interrupt program while CH1 Coincidence output Y1 interrupt factor mask/CH1 Coincidence output Y2 interrupt factor mask is set to 1, set the comparison value or input frequency so that the interval*1 that the comparison value and the current value match is 1ms or more.

*1 For CH1 Y1, this means an interval after CH1 Y1 matches until the next time that CH1 Y1 matches. There are no restrictions on the matching of CH1 Y2, CH2 Y1, and CH2 Y2.

4.4 Preset Function

Turning on CH1 Preset permit command (Un\G4.4) while the count operation is prohibited enables the preset function from preset input of an external terminal.
This function overwrites the present count value with an arbitrary numerical value and is used to start the operation to count pulses from the set value.

Point

- The set value is referred to as a preset value.
- The preset function can be used only when the operation mode is set to normal mode.

Operation of the preset function

- The preset function operates even while the count operation is prohibited.
- The timing to execute the preset is determined by CH1 Preset input logic (Un\G220) and CH1 Preset control switch (Un\G222). (☞ Page 106 CH1/CH2 preset input logic, ☞ Page 107 CH1/CH2 preset control switch)
- Use the preset input response time to set the response time of the preset input terminal. (☞ Page 58 Basic Setting)

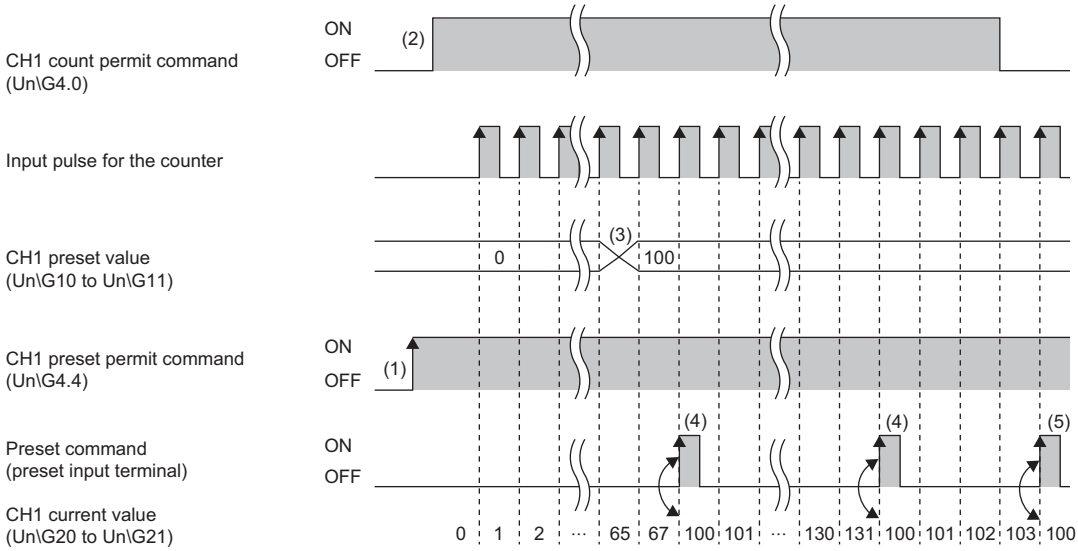
Point

If CH1 Ring length setting (Un\G5) is 1 (enabled) and a value less than 0 or a value greater than or equal to CH1 Ring length (Un\G2 to 3) is set for CH1 Preset value (Un\G10 to 11), a CH1 preset value error (1910H) occurs.

■Internal operations

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter in processes from setting the preset value to executing preset by turning on the preset input of external input.

Operation mode	Preset input logic	Preset control switch
Normal mode	Positive logic	Rising



No.	Description
(1)	Preset is permitted when CH1 Preset permit command (Un\G4.4) is turned on while the count operation is prohibited.
(2)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(3)	Write a value into CH1 Preset value (Un\G10 to 11) in 32-bit signed binary.
(4)	On the rising edge of the preset command, the preset value in CH1 Current value (Un\G10 to 11) is preset to the CH1 Current value (Un\G20 to 21).
(5)	The preset function is performed regardless of the on/off status of CH1 Count permit command (Un\G4.0).

4.5 Counter Function Selection

The following counter functions can be selected and used. Select a counter function by using parameter settings on GX Works3 or by executing CH1 Counter function selection setting (Un\G232). (☞ Page 60 Application Setting, ☞ Page 109 CH1/CH2 counter function selection setting)

Function[*1*2]	Description	Reference
Count disable function (initial setting)	Stops the count operation while the counter function selection start command[*3] is input when CH1 Count permit command (Un\G4.0) is on.	Page 34 Count disable function
Latch counter function	Latches the current value to CH1 Latch count value (Un\G308 to 309) when the counter function selection start command[*3] is input.	Page 35 Latch counter function
Sampling counter function	Counts input pulses for a preset sampling time (T) after the counter function selection start command[*3] is input.	Page 36 Sampling counter function

*1 When the operation mode is set to normal mode, only one of the three functions can be used.

*2 Only the count disable function can be used when the operation mode is set to the pulse density measurement mode or rotational speed measurement mode.

*3 Input of the counter function selection start command indicates ON of CH1 Counter function selection start command (Un\G200.0) or ON of the function start input. A signal that is input first takes priority.

Point

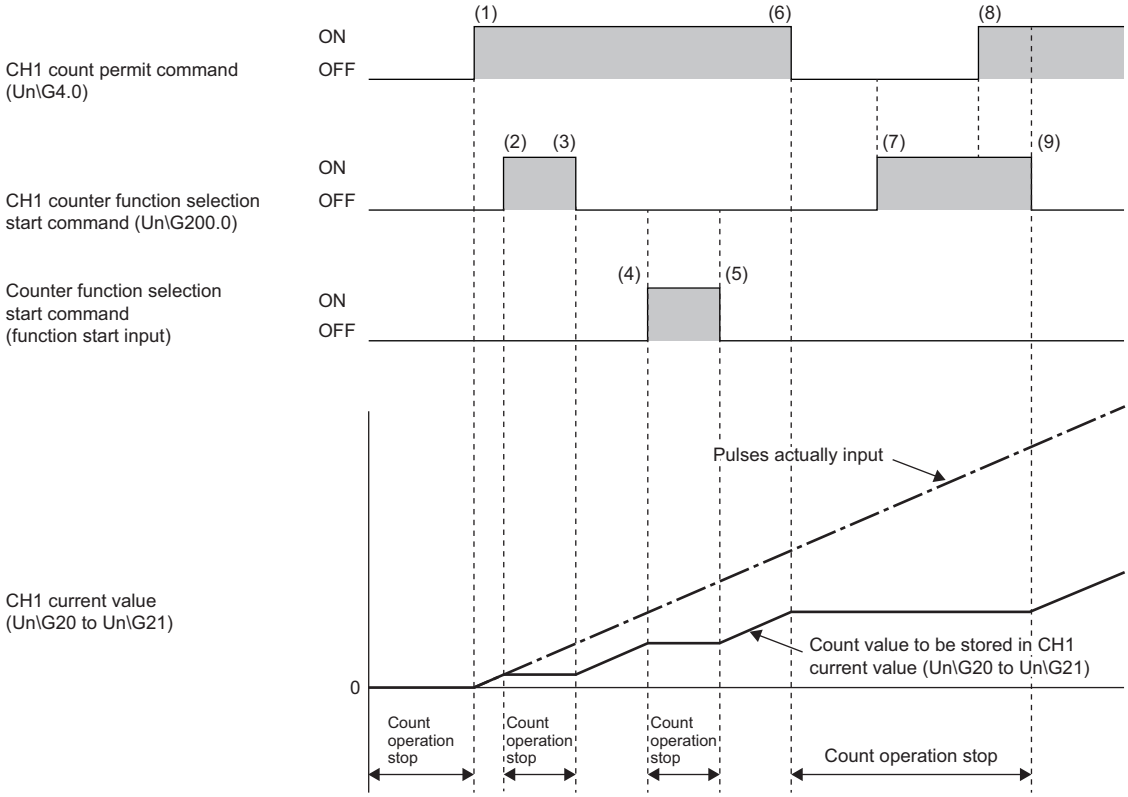
- To change the counter function, do so while the count operation is prohibited and the counter function selection start command is off, and write 1 (set request) to CH1 Counter function selection setting request (Un\G201). The completion of the change can be checked when the CH1 Counter function selection setting request (Un\G201) becomes 0 (no setting request). (☞ Page 105 CH1/CH2 counter function selection setting request)
- The sampling time (T) for the sampling counter function can be set using parameters in GX Works3 or CH1 Sampling time setting (Un\G233). (☞ Page 60 Application Setting, ☞ Page 109 CH1/CH2 sampling time setting)
- When the counter function selection start command is input by the function start input terminal, the response time for execution is "Function start input response time" in the parameter settings.

Count disable function

Stops the count operation while the counter function selection start command is input when CH1 Count permit command (Un\G4.0) is on.

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the count disable function is performed.

Operation mode	Counter function selection setting	Function start input logic
Normal mode	Count disable function	Positive logic



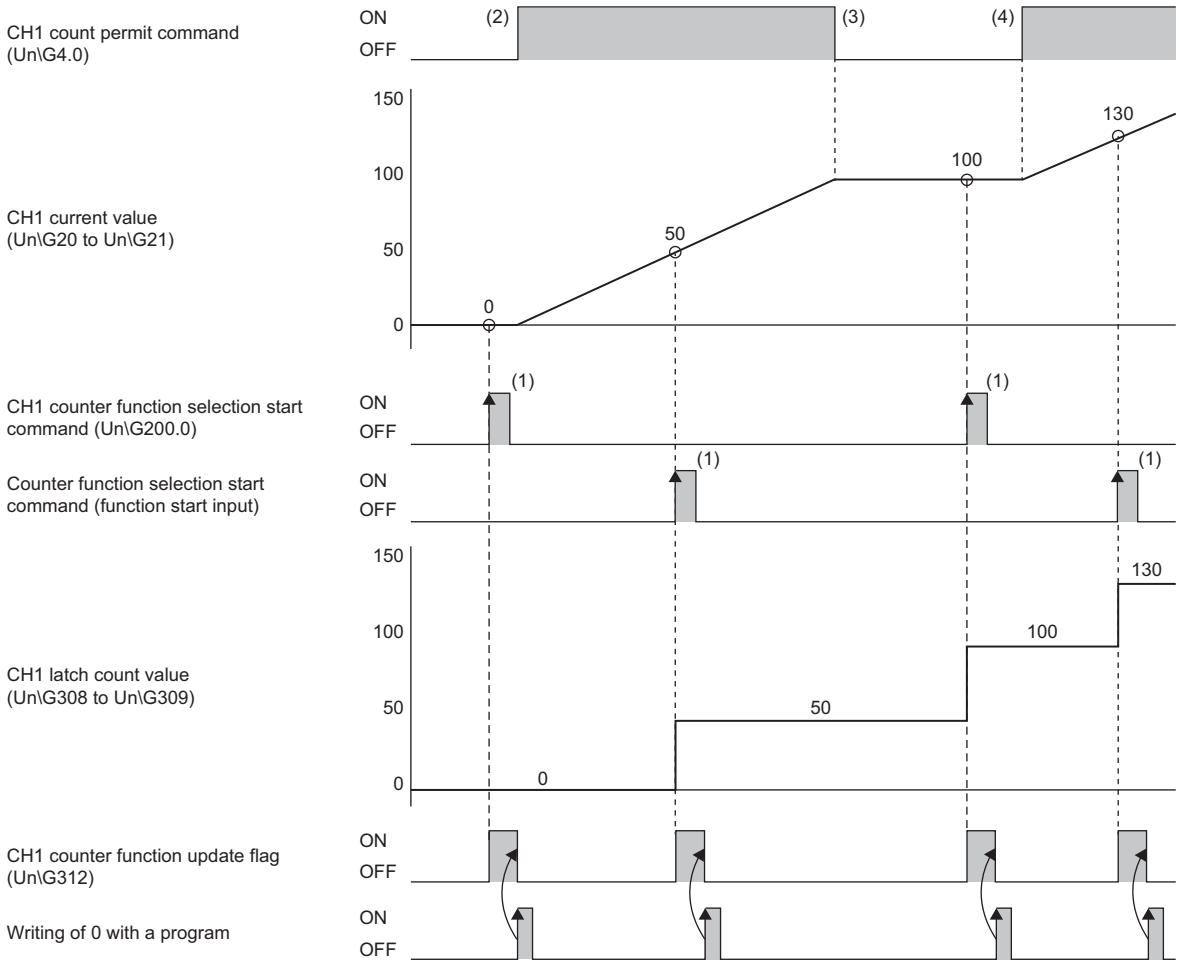
No.	Description
(1)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(2)	The count operation stops when CH1 Counter function selection start command (Un\G200.0) is turned on.
(3)	The count operation restarts when CH1 Counter function selection start command (Un\G200.0) is turned off.
(4)	The count operation stops when Counter function selection start command (function start input) is turned on.
(5)	The count operation restarts when Counter function selection start command (function start input) is turned off.
(6)	The count operation stops when CH1 Count permit command (Un\G4.0) is turned off.
(7)	The count operation stops regardless of the on/off status of CH1 Counter function selection start command (Un\G200.0) because CH1 Count permit command (Un\G4.0) is off.
(8)	Even though CH1 Count permit command (Un\G4.0) is turned on, the count operation remains stopped because CH1 Counter function selection start command (Un\G200.0) is on.
(9)	The count operation restarts when CH1 Counter function selection start command (Un\G200.0) is turned off.

Latch counter function

Latches the current value to CH1 Latch count value (Un\G308 to 309) when the counter function selection start command is input.

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the latch counter function is performed.

Operation mode	Counter function selection setting	Function start input logic
Normal mode	Latch counter function	Positive logic



No.	Description
(1)	• On the rising edge of CH1 Counter function selection start command (Un\G200.0) or Counter function selection start command (function start input), the present count value is stored in CH1 Latch count value (Un\G308 to 309), and CH1 Counter function update flag (Un\G312) is set to 1 (Updated). • Writing 0 to CH1 Counter function update flag (Un\G312) clears it to 0 (Not updated).
(2)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(3)	The count operation stops when CH1 Count permit command (Un\G4.0) is turned off.
(4)	The count operation restarts when CH1 Count permit command (Un\G4.0) is turned on.

Point

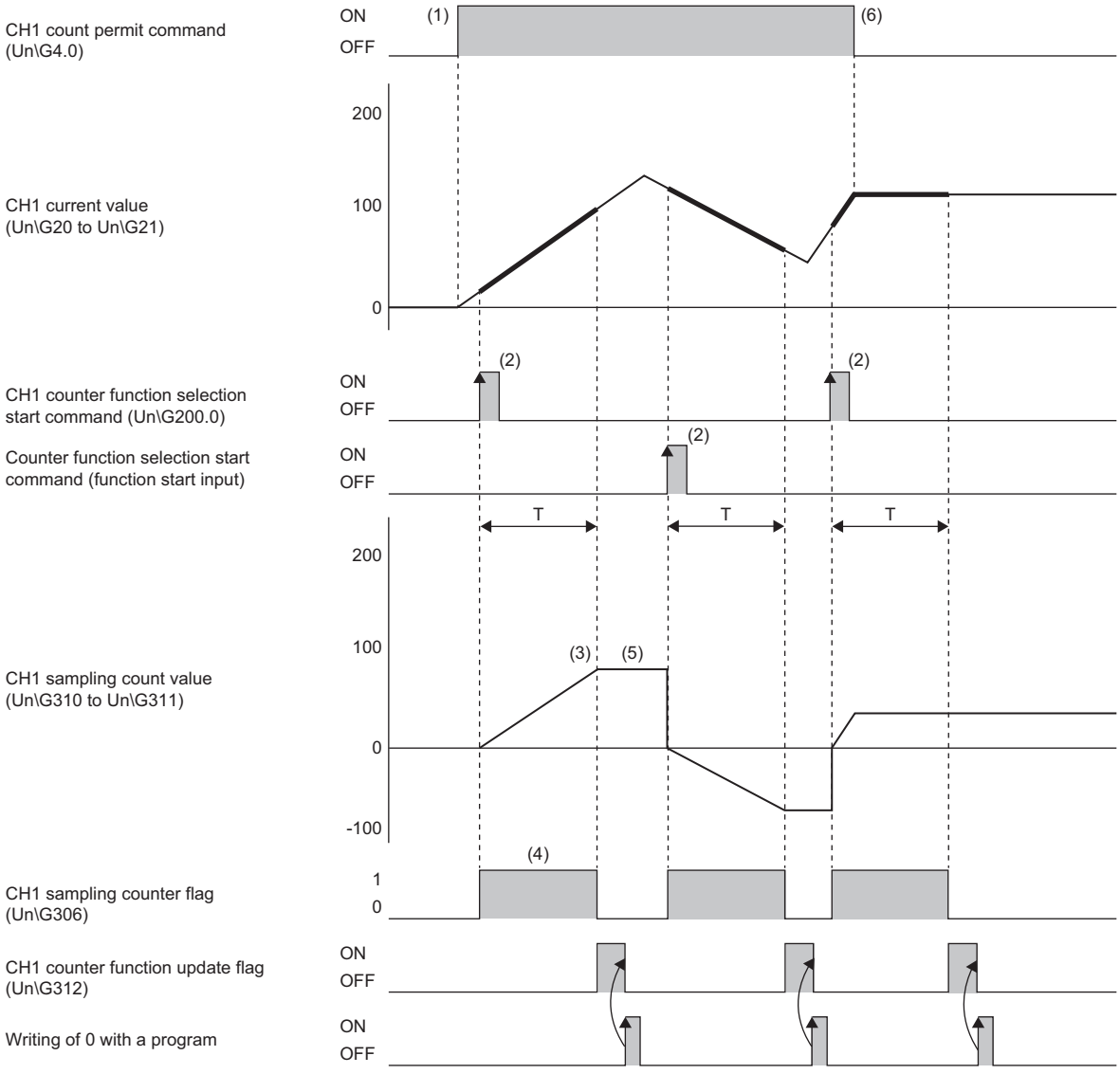
- The latch counter function is performed regardless of the on/off status of CH1 Count permit command (Un\G4.0).
- The latch counter function cannot be performed while CH1 Counter function selection start command (Un\G200.0) is on, even by turning on[*1] the function start input terminal.
- The latch counter function cannot be performed by turning on CH1 Counter function selection start command (Un\G200.0) while the function start input terminal is on[*1].

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace on with off when 1 (negative logic) is set.

Sampling counter function

Counts input pulses for a preset sampling time (T) after the counter function selection start command is input.
The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the sampling counter function is performed.

Operation mode	Counter function selection setting	Function start input logic
Normal mode	Sampling counter function	Positive logic



No.	Description
(1)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(2)	Input pulses are counted from 0 on the rising edge of CH1 Counter function selection start command (Un\G200.0) or Counter function selection start command (function start input).
(3)	The count operation stops when the specified sampling time has elapsed.
(4)	While the sampling counter function is performed, 1 is stored in CH1 Sampling counter flag (Un\G306).
(5)	Even after the sampling counter function is performed, the value stored in CH1 Sampling count value (Un\G310 to 311) is held.
(6)	The sampling counter function also stops counting when CH1 Count permit command (Un\G4.0) is turned off.

Point

- The sampling counter function cannot be performed while CH1 Counter function selection start command (Un\G200.0) is on, even by turning on[*1] the function start input terminal.
- The sampling counter function cannot be performed by turning on CH1 Counter function selection start command (Un\G200.0) while the function start input terminal is on[*1].
- If CH1 Counter function selection start command (Un\G200.0) is turned off and on again while the sampling counter function is performed, the measurement of the sampling time continues but pulse measurement starts from 0.
- If the function start input terminal is turned off[*1] and on[*1] again while the sampling counter function is performed, the measurement of the sampling time continues but pulse measurement starts from 0.
- If the current value is changed or preset is executed while the sampling counter function is performed, the measurement of the sampling time continues but pulse measurement starts from 0.

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace on with off or vice versa when 1 (negative logic) is set.

Restriction

When using the sampling counter function while the ring length setting is enabled, the CH1 Ring length (Un\G2 to 3) requires some setting conditions. If the count operation is permitted when a value that ignores the conditions is set, a sampling counter function setting error (1980H) occurs and count operation does not start. For details, refer to the following.

☞ Page 93 CH1/CH2 ring length

4.6 Pulse Density Measurement Function

This function counts pulses at the pulse input terminals for phase A and B, then automatically calculates the number of pulses for a specified amount of time.
To use this function, select pulse density measurement mode for the operation mode in the parameter settings of GX Works3.

Point

In pulse density measurement mode, the ring counter function (ring length setting disabled), coincidence output function, and count disable function can be used.

Measurement unit time setting

The pulse density measurement function calculates the number of pulses per measurement unit time.
Measurement unit time can be set using the parameter settings of GX Works3 or CH1 Measurement unit time (Un\G228 to 229). (☞ Page 58 Basic Setting, ☞ Page 108 CH1/CH2 measurement unit time)

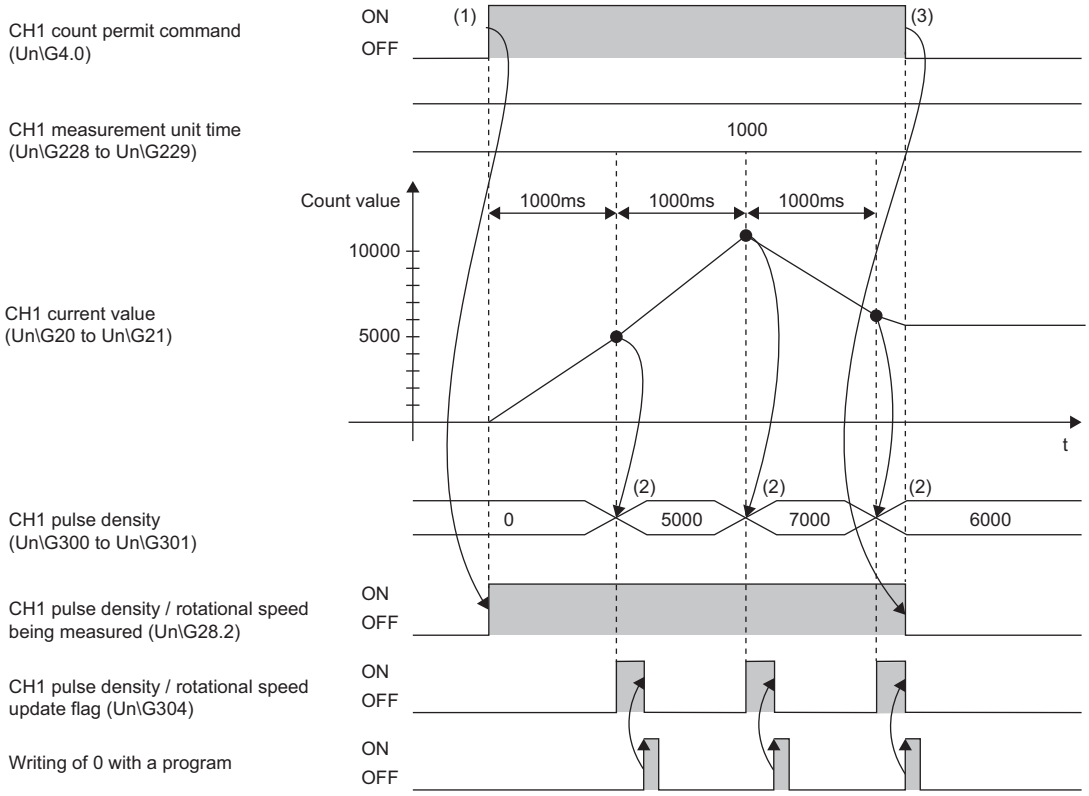
Point

- When "Pulse Input Mode" is set to either "2-Phase 2 Multiple" or "2-Phase 4 Multiple", the pulse density is calculated based on the count per unit time.
- If the measurement unit time is modified during measurement, the modified value is reflected after the measurement before the value was modified is finished.

Operation of the pulse density measurement function

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the pulse density measurement function is performed.

Operation mode	Measurement unit time
Pulse density measurement mode	1000ms



No.	Description
(1)	When CH1 Count permit command (Un\G4.0) is turned on, CH1 Pulse density/rotational speed being measured (Un\G28.2) is turned on (measuring), and the pulse density measurement starts.
(2)	The pulse density measurement value is stored in CH1 Pulse density (Un\G300 to 301) of the buffer memory.
(3)	When CH1 Count permit command (Un\G4.0) is turned off, CH1 Pulse density/rotational speed being measured (Un\G28.2) is turned off (operation stop), and the pulse density measurement stops.

Point

- If the count operation is stopped by using the count disable function during measurement, the pulse density is calculated using the number of pulses counted within the measurement unit time.
- The pulse density measurement mode calculates pulse density based on differences in the current values of high-speed counters. Therefore, the number of input pulses may differ from the measurement value when count direction of a high-speed counter is switched within the same measurement unit time.
- Pulse density can also be measured when pulses are input in the direction whereby current value of high-speed counter is reduced. However, the measurement result is stored as a positive value.
- Pulse density measurement can continue even when current value of high-speed counter overflows during measurement.
- When the current value is changed during pulse density measurement, measurement of the measurement time continues, but pulse measurement starts from 0.

4.7 Rotational Speed Measurement Function

This function counts pulses at the pulse input terminal for phase A and B, then automatically calculates the rotational speed for a specified amount of time.
To use this function, select rotational speed measurement mode for the operation mode in the parameter settings of GX Works3.

Point

- In rotation speed measurement mode, the ring counter function (ring length setting disabled), coincidence output function, and count disable function can be used.
- Pulse density is also measured during rotational speed measurement.

Measurement unit time and number of pulses per rotation setting

The rotational speed measurement function calculates the rotational speed from the following expression.

$$\text{Rotational speed (r/min)} = \frac{\text{Number of pulses per measurement unit time}}{\text{Measurement unit time (ms)}} \times 60000(\text{ms}) \times \frac{1}{\text{Number of pulses per rotation}}$$

Measurement unit time and number of pulses per rotation are set using the parameter settings of GX Works3, CH1 Measurement unit time (Un\G228 to 229), and CH1 Number of pulses per rotation (Un\G230 to 231). (☞ Page 58 Basic Setting, ☞ Page 109 CH1/CH2 number of pulses per rotation)

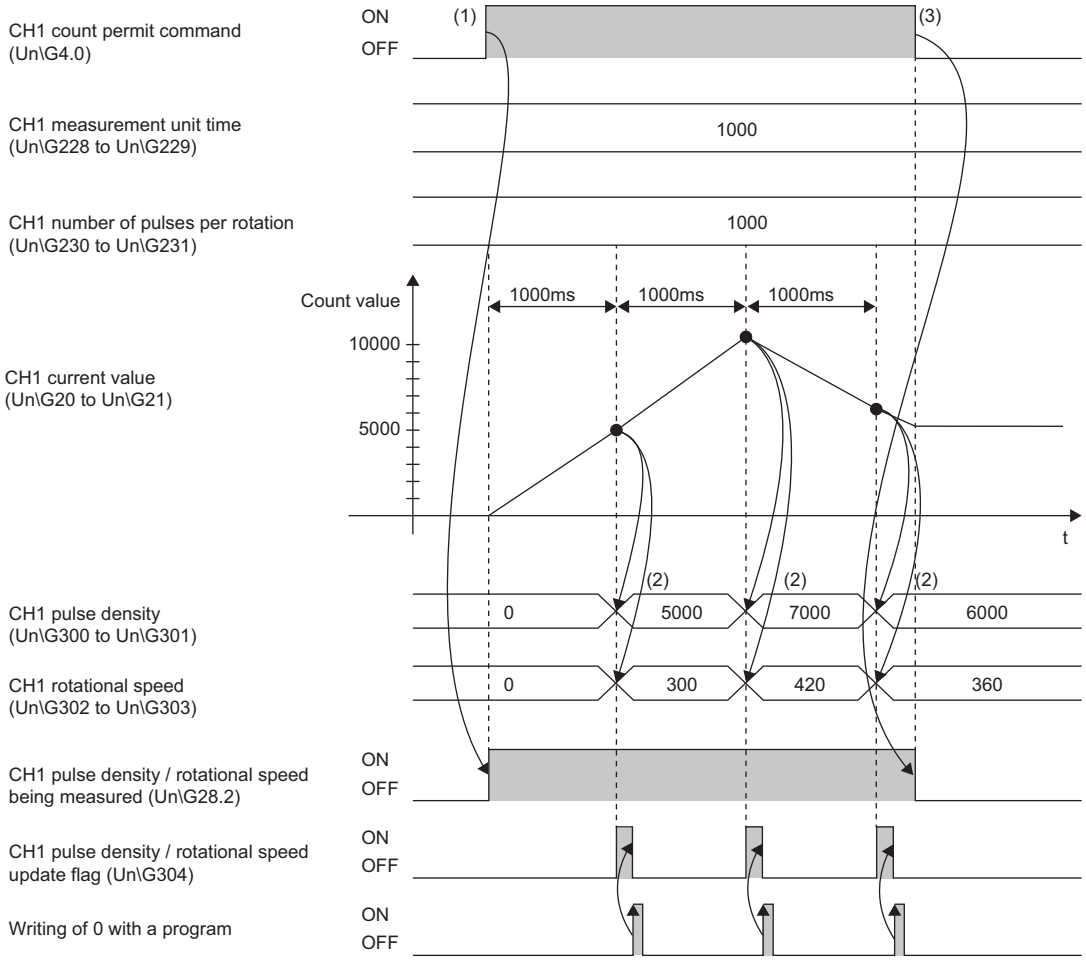
Point

- When "Pulse Input Mode" is set to either "2-Phase 2 Multiple" or "2-Phase 4 Multiple", the rotational speed (r/min) is calculated based on the count per unit time.
- If the measurement unit time and the number of pulses per rotation are modified during measurement, the modified value is reflected after the measurement before the values were modified is finished.

Operation of the rotational speed measurement function

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the rotational speed measurement function is performed.

Operation mode	Measurement unit time	Number of pulses per rotation
Rotational speed measurement mode	1000ms	1000pulse



No.	Description
(1)	When CH1 Count permit command (Un\G4.0) turns on, CH1 Pulse density/rotational speed being measured (Un\G28.2) is turned on (measuring), and the rotational speed measurement starts.
(2)	The pulse density measurement value is stored in CH1 Pulse density (Un\G300 to 301), and the measured rotational speed value is stored in CH1 Rotational speed (Un\G302 to 303) of the buffer memory.
(3)	When CH1 Count permit command (Un\G4.0) is turned off, CH1 Pulse density/rotational speed being measured (Un\G28.2) is turned off (operation stop), and the rotational speed measurement stops.

Point

- If the count operation is stopped by using the count disable function during measurement, the rotational speed is calculated using the number of pulses counted within the measurement unit time.
- The rotational speed measurement mode calculates rotational speed based on current value difference of high-speed counters. Therefore, the number of input pulses may differ from the measurement value when count direction of a high-speed counter is switched within the same measurement unit time.
- Rotational speed can also be measured when pulses are input in the direction whereby current value of high-speed counter is reduced. However, the measurement result is stored as a positive value.
- Rotational speed measurement can continue even when current value of high-speed counter overflows during measurement.
- When the current value is changed during rotational speed measurement, measurement of the measurement time continues, but pulse measurement starts from 0.

4.8 Pulse Width Measuring Function

The width and cycle of the pulses input to phase A and phase B of external input can be measured.
When the pulse width measurement start command is on, the values of 0.5μs ring counters at the input signal rising edge and falling edge are stored to the buffer memory. This function also stores the difference in the counter values (pulse width) between the rising edge and the falling edge or stores the difference in the counter values (cycle) between the previous rising edge and the current rising edge to the buffer memory in units of 0.5μs.
To use this function, select pulse width measurement mode for the operation mode in the parameter settings of GX Works3.
(☞ Page 58 Basic Setting)

Point

In pulse width measurement mode, functions other than the pulse width measuring function cannot be used.

Pulse measurement terminals

This function measures the pulse input in the phase A/phase B pulse input terminals.

Measurable range of the pulses

The table below shows the measurement frequencies and measurement precision.

Item		Description
Measurement frequencies		500kHz
Possible measurement range	Cycle	2μs
	Pulse width	2μs
Maximum measurable signal width		1073s 741ms 823μs
Resolution		0.5μs

Pulse measurement

The pulse width and period are stored in the pulse width latest value and period latest value of the buffer memory.

Pulse width maximum value and minimum value

The maximum and minimum values of the pulse width from the start of measurements are stored in the pulse width maximum value and pulse width minimum value of the buffer memory.
For changing the pulse width maximum value and pulse width minimum value, refer to the following.
☞ Page 114 CH1/CH2 pulse width maximum value
☞ Page 114 CH1/CH2 pulse width minimum value

Period maximum value and minimum value

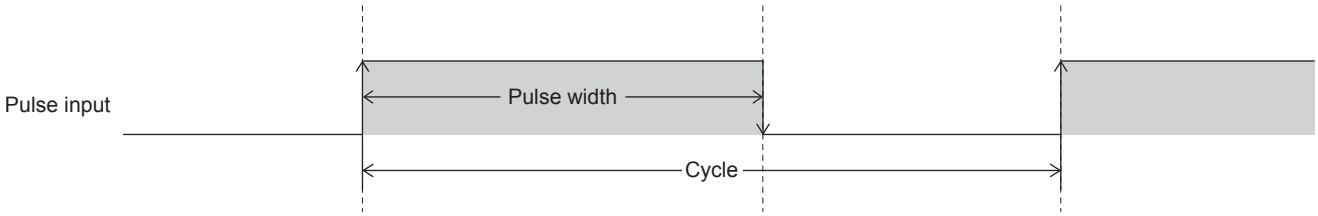
The maximum and minimum values of the period from the start of measurements are stored in the period maximum value and period maximum value of the buffer memory.
For changing the period maximum value and period minimum value, refer to the following.
☞ Page 115 CH1/CH2 period maximum value
☞ Page 115 CH1/CH2 period minimum value

Switching positive logic/negative logic

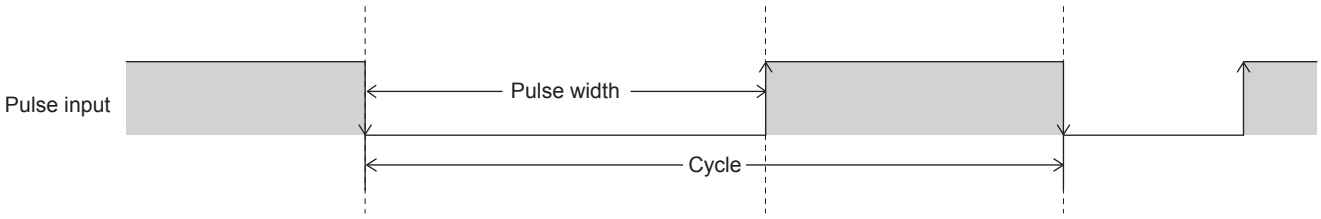
The pulse input logic can be switched.

Set positive logic or negative logic for each input by using parameter settings of GX Works3.

■When positive logic is set



■When negative logic is set



Continuous measurement/one-time measurement mode

The pulse width measurement mode can be set.

Set a measurement mode for each input by using the parameter settings of GX Works3 or CH1 Measurement mode (phase A) (Un\G224)/CH1 Measurement mode (phase B) (Un\G225). (☞ Page 60 Application Setting, ☞ Page 108 CH1/CH2 measurement mode)

Measurement mode is enabled when the pulse width measurement start command is turned on.

Measurement mode	Description
Continuous measurement mode	Constantly measures the pulse width and period.
One-time measurement mode	Measures the pulse width and period only once from the start of the measurement.

Counting speed setting

A digital filter for the measurement terminal can be set.

It can be set using the counting speed setting in the parameter settings of GX Works3. (☞ Page 58 Basic Setting)

Starting/stopping methods of the pulse measurement

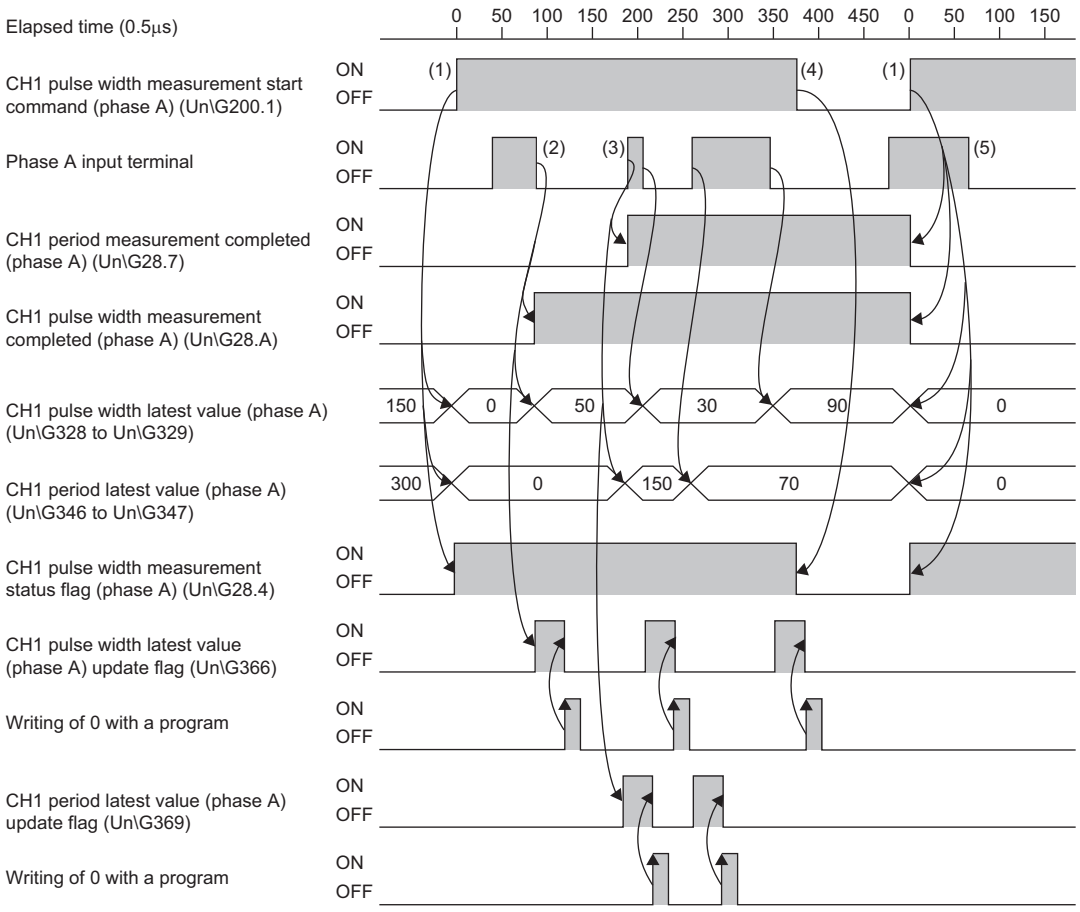
The start or stop of the pulse measurement is determined by the pulse measurement start command. The pulse measurement starts at the rising edge of the signal and stops at the falling edge of the signal.

Operation of the pulse width measuring function

The following section shows the relationship between signals and buffer memory areas, the operations, and the internal operations of the counter when the pulse width measuring function is performed.

■Continuous measurement mode

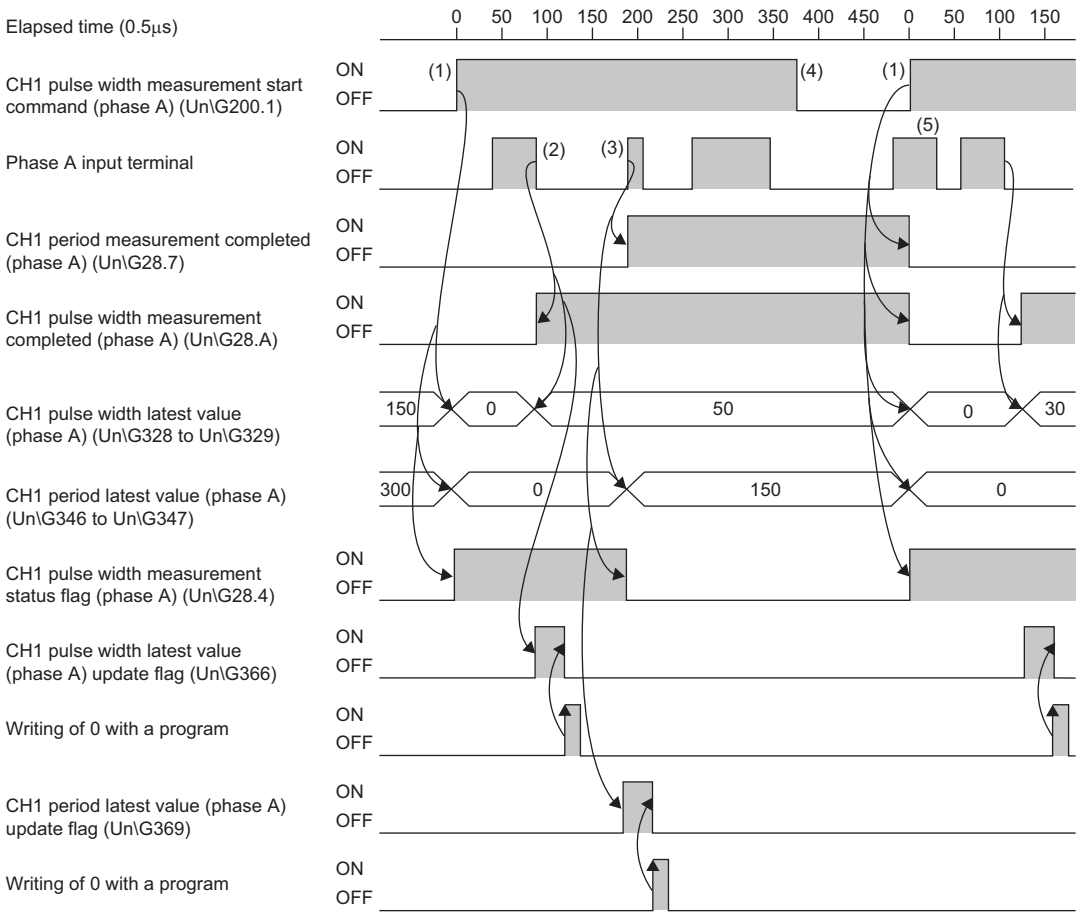
Operation mode	Pulse measurement terminal	Logic	Measurement mode
Pulse width measurement mode	Phase A pulse input terminal	Positive logic	Continuous measurement mode



No.	Description
(1)	When CH1 Pulse width measurement start command (phase A) (Un\G200.1) is turned on, the following processes are performed and CH1 Pulse width measurement status flag (phase A) (Un\G28.4) turns on (measuring). • CH1 Period measurement completed (phase A) (Un\G28.7) is turned off (not completed). • CH1 Pulse width measurement completed (phase A) (Un\G28.A) is turned off (not completed). • 0 is stored in CH1 Pulse width latest value (phase A) (Un\G328 to 329). • 0 is stored in CH1 Period latest value (phase A) (Un\G346 to 347).
(2)	When pulse width measurement is completed, CH1 Pulse width measurement completed (phase A) (Un\G28.A) is turned on (completed), and the measurement values are stored in CH1 Pulse width latest value (phase A) (Un\G328 to 329).
(3)	When period measurement is completed, CH1 Period measurement completed (phase A) (Un\G28.7) is turned on (completed), and the measurement values are stored in CH1 Period latest value (phase A) (Un\G346 to 347).
(4)	When CH1 Pulse width measurement start command (phase A) (Un\G200.1) is turned off, CH1 Pulse width measurement status flag (phase A) (Un\G28.4) turns off (operation stop), and pulse measurement stops.
(5)	If the pulse measurement target is input before the on (measuring) status is stored in CH1 Pulse width measurement status flag (phase A) (Un\G28.4), CH1 Pulse width latest value (phase A) (Un\G328 to 329) is not updated, even when the phase A pulse input terminal is turned from on to off. Note that only a pulse input after CH1 Pulse width measurement status flag (phase A) (Un\G28.4) is turned on (measuring) becomes the measurement target.

■One-time measurement mode

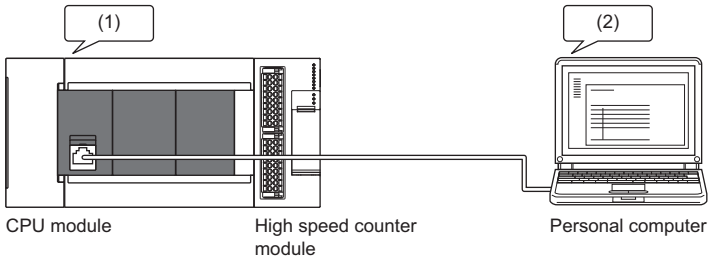
Operation mode	Pulse measurement terminal	Logic	Measurement mode
Pulse width measurement mode	Phase A pulse input terminal	Positive logic	One-time measurement mode



No.	Description
(1)	When CH1 Pulse width measurement start command (phase A) (Un\G200.1) is turned on, the following processes are performed and CH1 Pulse width measurement status flag (phase A) (Un\G28.4) turns on (measuring). • CH1 Period measurement completed (phase A) (Un\G28.7) is turned off (not completed). • CH1 Pulse width measurement completed (phase A) (Un\G28.A) is turned off (not completed). • 0 is stored in CH1 Pulse width latest value (phase A) (Un\G328 to 329). • 0 is stored in CH1 Period latest value (phase A) (Un\G346 to 347).
(2)	When pulse width measurement is completed, CH1 Pulse width measurement completed (phase A) (Un\G28.A) is turned on (completed), and the measurement values are stored in CH1 Pulse width latest value (phase A) (Un\G328 to 329).
(3)	When period measurement is completed, CH1 Period measurement completed (phase A) (Un\G28.7) is turned on (completed), and the measurement values are stored in CH1 Period latest value (phase A) (Un\G346 to 347). In one-time measurement mode, when period measurement is completed, CH1 Pulse width measurement status flag (phase A) (Un\G28.4) turns off (operation stop).
(4)	When CH1 Pulse width measurement start command (phase A) (Un\G200.1) is turned off, pulse measurement stops.
(5)	If the pulse measurement target is input before the on (measuring) status is stored in CH1 Pulse width measurement status flag (phase A) (Un\G28.4), CH1 Pulse width latest value (phase A) (Un\G328 to 329) is not updated, even when the phase A pulse input terminal is turned from on to off. Note that only a pulse input after CH1 Pulse width measurement status flag (phase A) (Un\G28.4) is turned on (measuring) becomes the measurement target.

4.9 Event History Function

This function saves error information to the data memory of the CPU module or the SD memory card as an event. The saved event information can be displayed on GX Works3 to check the occurrence history in chronological order. Also, detailed information for errors can be checked by referring to the additional information.



(1) The CPU module collects and saves information on events that occurred in the high-speed counter module.
(2) Event information saved in the CPU module is displayed on GX Works3.

Events that occur in the high-speed counter module

The following table lists events that occur in the high-speed counter module.

Event type	Description	Event item	Event code
Error	An error was detected in the high-speed counter module.	Moderate error	02000 to 03BFF
		Minor error	01000 to 01FFF

Detailed information on error events

Detailed information on error events stores detailed error information.
Items displayed in detailed information differ depending on the error classification.

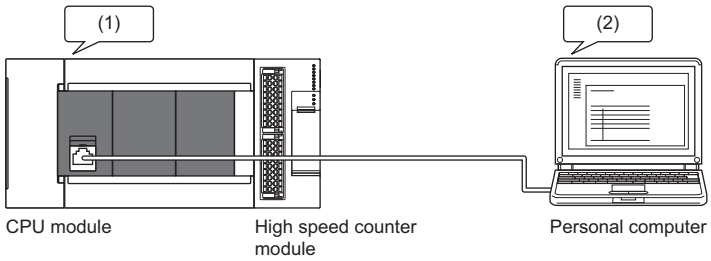
Error classification	Additional information 1	Additional information 2	Additional information 3
Hardware error	• Cause of the error	—	—
Ring length error Preset value error Comparison setting value for Y1 output error Comparison setting value for Y2 output error Current value error	• CH No. where the error occurred • Setting value • Operation mode • Pulse input mode • Counting speed setting • Operating status • Ring length setting • Ring length • Counter function selection setting • Counter function selection start command • Function start input		
Mode setting error			
Counter function setting error Counter function selection error Sampling counter function setting error			

Loss of event information

If module errors frequently occur on the high-speed counter module, at an interval that is shorter than the interval that the CPU module collects event history, the event history storage area inside the high-speed counter module may become full of error information that are not collected by the CPU module. If a new module error occurs in this condition, the high-speed counter module discards module error information and outputs the message "*HST.LOSS*" (event information has been lost) indicating the loss of event information.

4.10 Error History Function

This function collects error information onto the CPU module. The collected current error information can be displayed on GX Works3 to check the occurrence history in chronological order.



(1) The CPU module collects information on errors that occurred in the high-speed counter module.
(2) Error information saved in the CPU module is displayed on GX Works3.

Errors that occur on the high-speed counter module

For errors that occur on the high-speed counter module, refer to the following.
☞ Page 84 List of Error Codes

Detailed information on errors

Detailed information on error events stores detailed error information. (☞ Page 47 Detailed information on error events)

Operation to clear errors

In GX Works3, press the [Clear Error] button to issue an error clear request from the CPU module and clear the entire error history. The internal error status of the high-speed counter module is also cleared. However, it is not cleared when a hardware error has occurred.

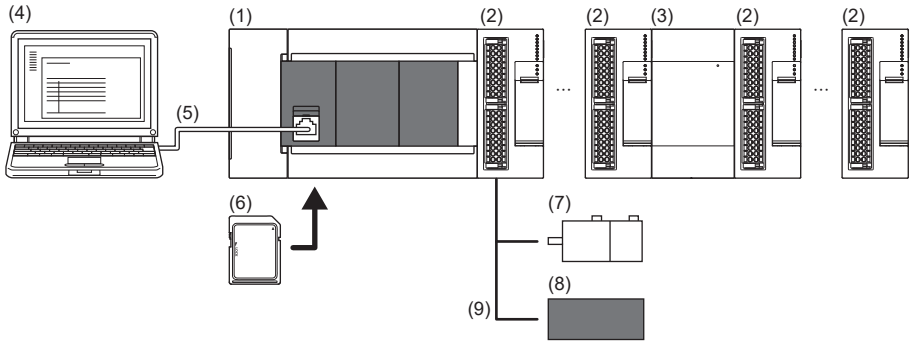
Point

The error history is not cleared by CH1/CH2 Error reset command (Un\G4.8/Un\G44.8) of the buffer memory.

5 SYSTEM CONFIGURATION

This chapter describes the system configuration when using high-speed counters.

System configuration



Configuration devices

No.	Device name	Description
(1)	CPU module	FX5U CPU module, FX5UC CPU module, and FX5UJ CPU module
(2)	High-speed counter module	FX5-2HC/ES
(3)	Extension power supply module	■Extension power supply module FX5-1PSU-5V, FX5-C1PS-5V ■Powered I/O module FX5-32ER/ES, FX5-32ET/ES(S), FX5-32ER/DS, FX5-32ET/DS(S)
(4)	Personal computer (GX Works3)	For the operating environment, refer to the following. GX Works3 Installation Instructions
(5)	Serial cable	A serial cable that connects the CPU module and personal computer
	Ethernet cable	An Ethernet cable that connects the CPU module and personal computer
	USB cable	A USB cable that connects the CPU module and personal computer
(6)	SD memory card	An SD memory card inserted into the CPU module
(7)	Encoder	Line driver output type encoder (TTL level voltage output type encoders cannot be used with high-speed counter modules.)
(8)	Sensor, controller	They are connected to preset input, function input, and coincidence output.
(9)	Connection cable	A cable that connects an encoder, a sensor, and a controller to the high-speed counter module

Restriction

Connect high-speed counter modules up to the eighth module from the power supply module (CPU module, extension power supply module, powered I/O module).

MEMO

6 WIRING

This chapter describes wiring of an encoder and a controller to the high-speed counter module.

6.1 Wiring Precautions

To obtain the maximum performance from the functions of the high-speed counter module and improve the system reliability, an external wiring with high durability against noise is required. Here are some precautions when wiring an encoder or a controller.

Point

For the procedures and precautions for installing and removing the spring clamp terminal block and the procedure and precautions for wiring to the terminal block, refer to the following manual.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

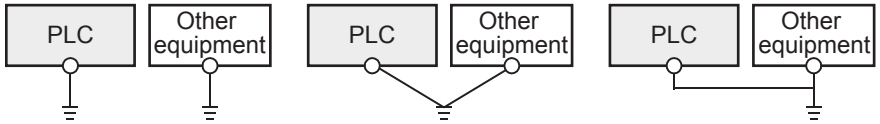
Wiring

- Different terminals are available depending on the voltage of the signal to be input. Connecting to a terminal with a different voltage may cause malfunction of the module or failure of the connected devices.
- In 1-phase 1-input, always connect a pulse input cable on the A-phase side.
- To prevent burnout or damage of the external devices and module in the event of a load short circuit, install a fuse for each one external terminal in the output circuit.

Grounding

Perform the following.

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



Independent grounding (Best condition) | Shared grounding (Good condition) | Common grounding (Not allowed)

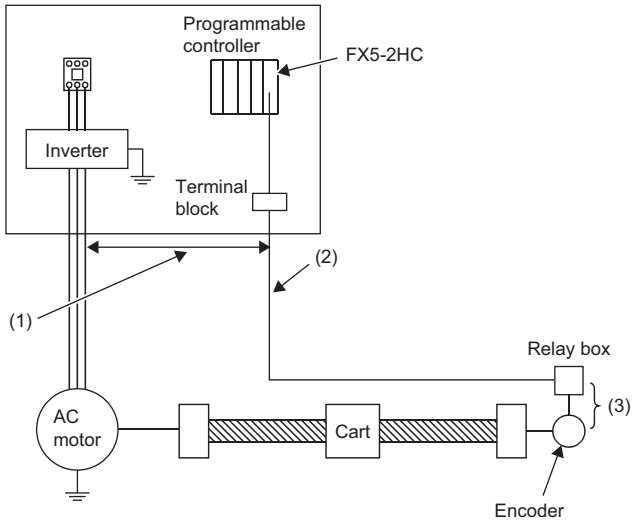
- Bring the grounding point close to the programmable controller as much as possible so that the ground cable can be shortened.

Measures against noise

The high-speed counter module may count pulses incorrectly if pulse-like noise is input. For the input of high-speed pulses, take the following measures against noise:

- Be sure to use the shielded twisted pair cables.
- Keep the shielded twisted pair cable at a distance of 150mm or more away from power lines and I/O lines containing much noise, with the cable not being close to them. The wiring distance also should be as short as possible.
- Be sure to perform class-D grounding on both ends of the shield wire.

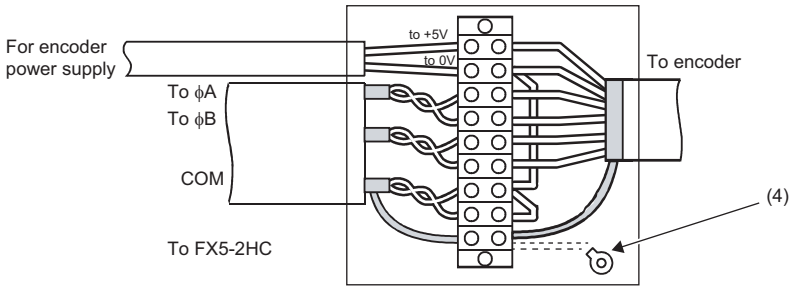
Ex.



(1) Provide a distance of 150mm or more away from I/O cables of the high voltage device such as a relay and inverter, regardless of whether inside or outside the panel.

(2) Prevent wiring that connects to a solenoid valve or inductive load from coexisting in the pipes. Where the separate distance from a high voltage line cannot be provided sufficiently because of duct wiring and others, use the shield wire such as CVVS for the high voltage line.

(3) The distance between the encoder and the relay box should be as short as possible. Check that the voltages both in operation and at rest of the encoder fall within the range of the rated voltage by using a measuring instrument such as a tester for the terminal block in the relay box because a long distance from the high-speed counter module to the encoder can cause a voltage drop. If the voltage drop is high, take measures such as replacing the wire with one that has a larger wire size.

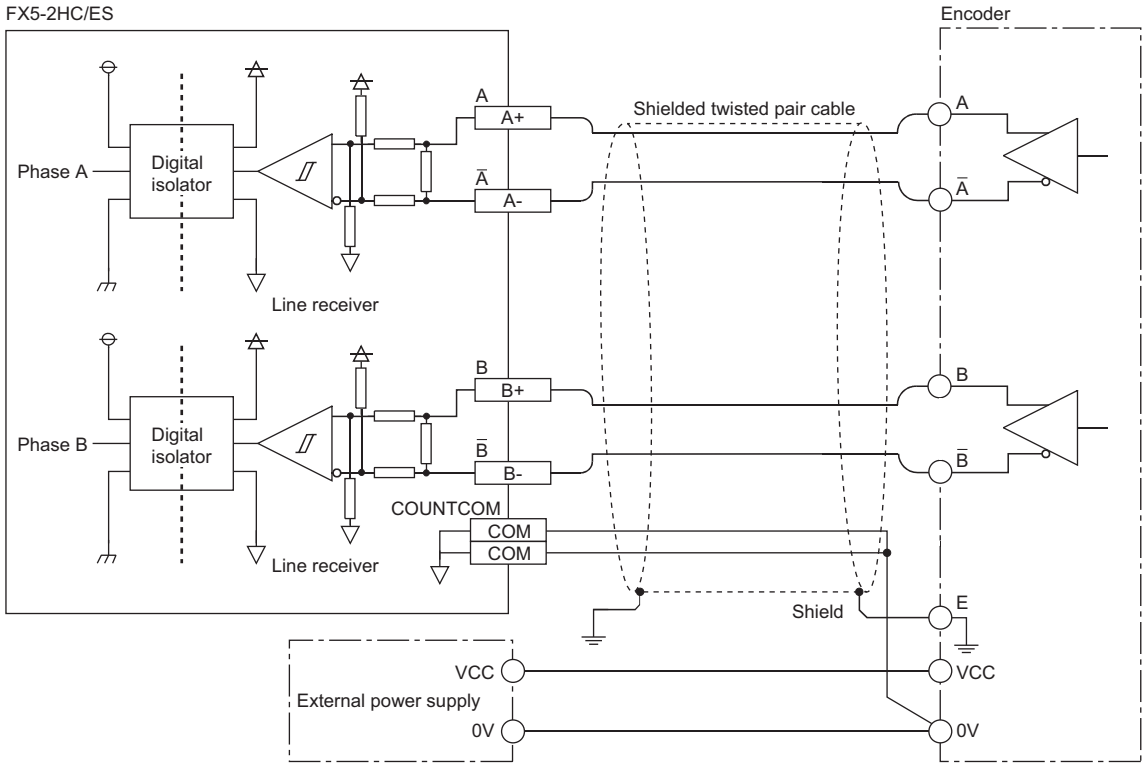


(4) Between the encoder and the shielded twisted pair cable, connect their shield wire together in the relay box. If the shield wire of the encoder to be used is not grounded in the encoder, ground it in the relay box as the dotted line shows.

6.2 Wiring Example

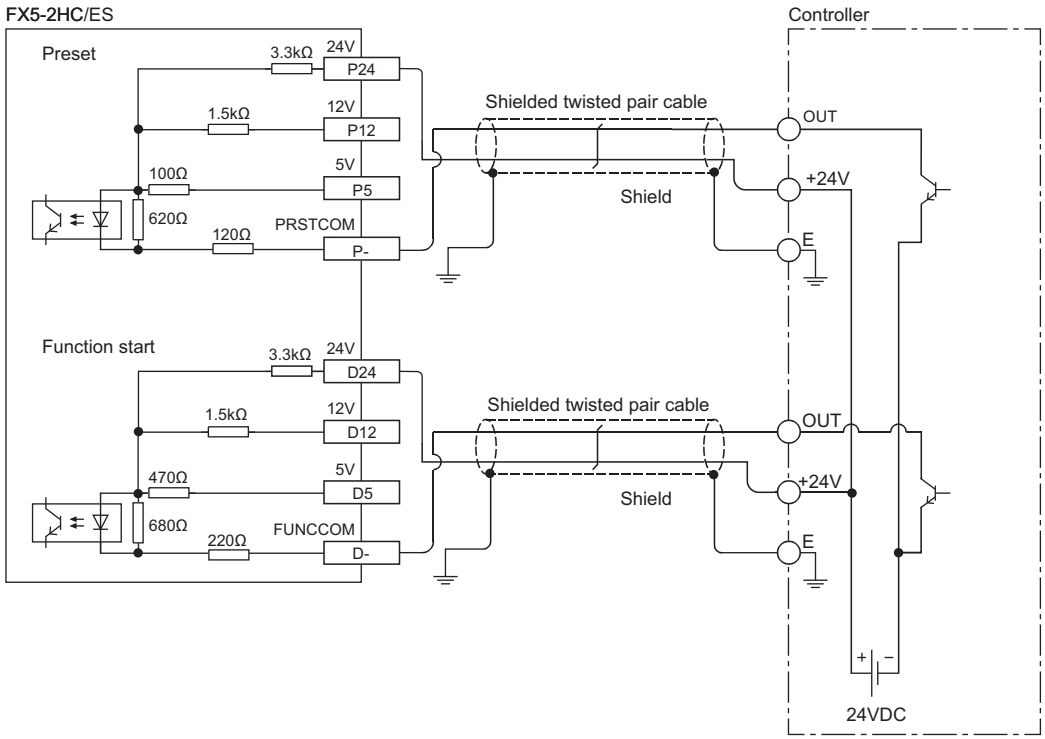
This section shows wiring examples.

Example of wiring between a module and an encoder

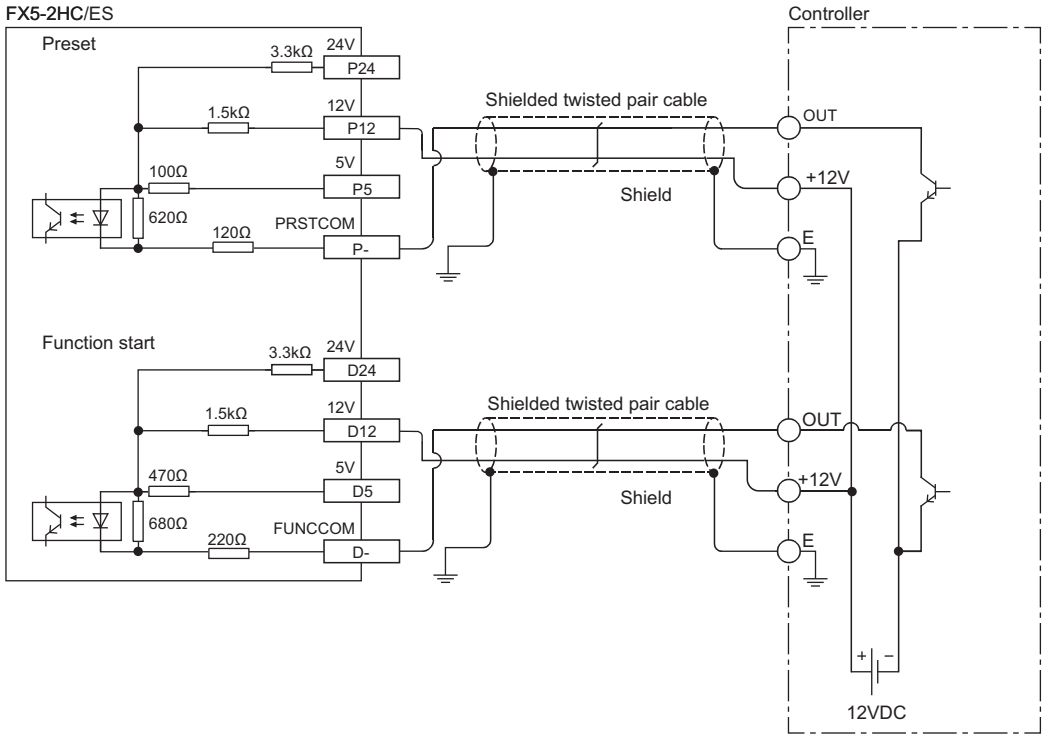


Examples of wiring between a controller and external input terminals

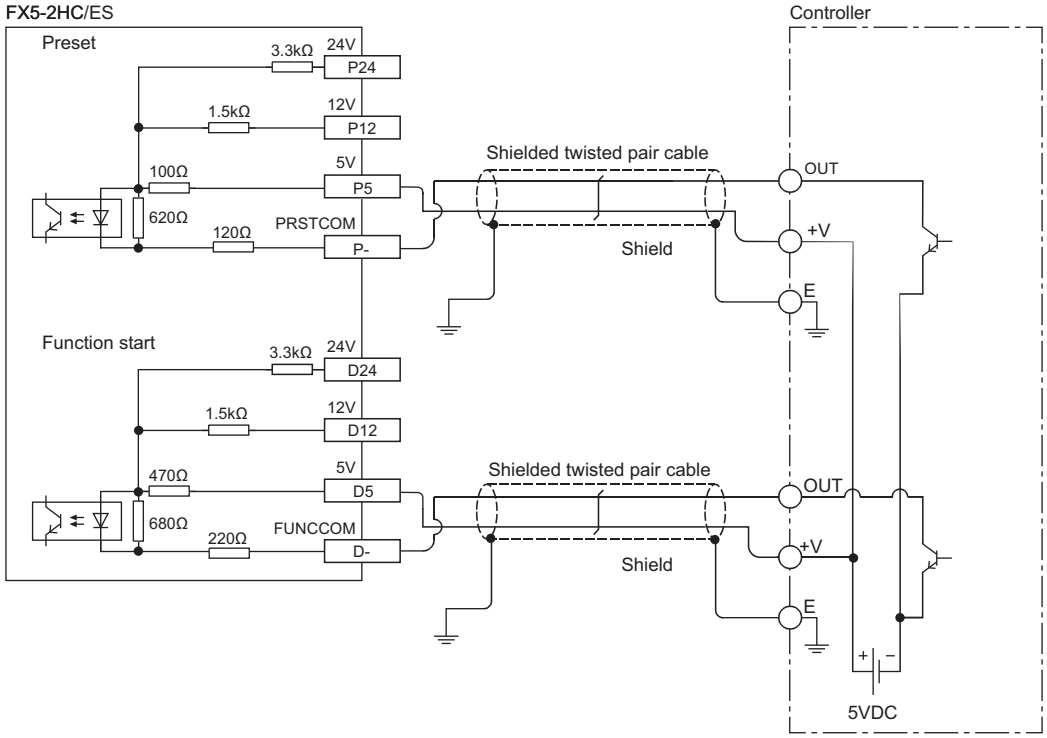
■When the controller (sink load type) has a voltage of 24VDC



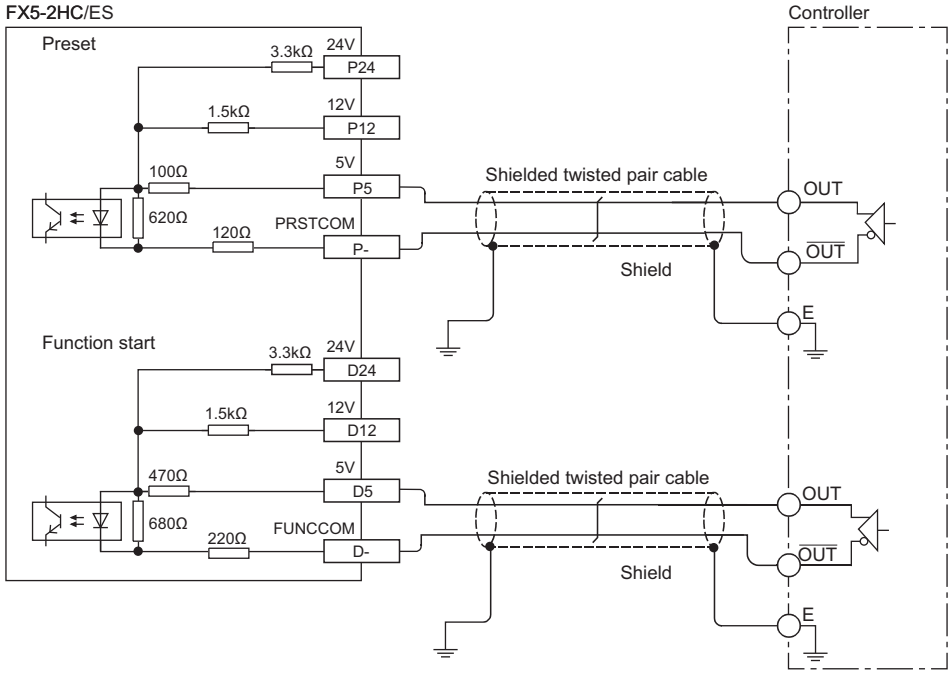
■When the controller (sink load type) has a voltage of 12VDC



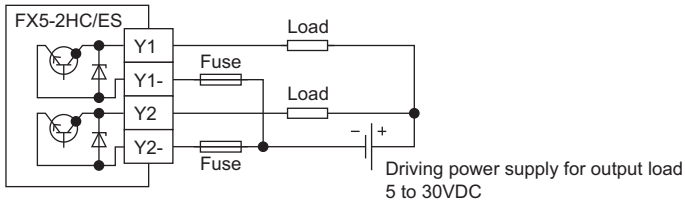
■When the controller (sink load type) has a voltage of 5VDC



■When the controller is a line driver type



Example of wiring with external output terminals

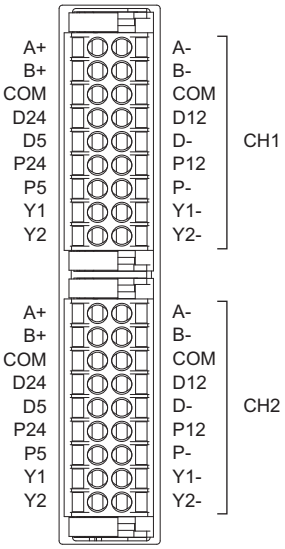


Point

To prevent burnout or damage of the external devices and module in the event of a load short circuit, install a fuse for each external terminal in the output circuit.

Terminal layout of the connector for external devices

The terminal layout of the connector for external devices of the high-speed counter module is shown below.

Terminal layout	Terminal name (CH1/CH2)	Signal name
	A+	Phase A (+) pulse input
	A-	Phase A (-) pulse input
	B+	Phase B (+) pulse input
	B-	Phase B (-) pulse input
	COM	COUNTCOM
	D24	Function start input 24V
	D12	Function start input 12V
	D5	Function start input 5V
	D-	FUNCCOM
	P24	Preset input 24V
	P12	Preset input 12V
	P5	Preset input 5V
	P-	PRSTCOM
	Y1	Y1 transistor output (+)
	Y1-	Y1 transistor output (-)
	Y2	Y2 transistor output (+)
	Y2-	Y2 transistor output (-)

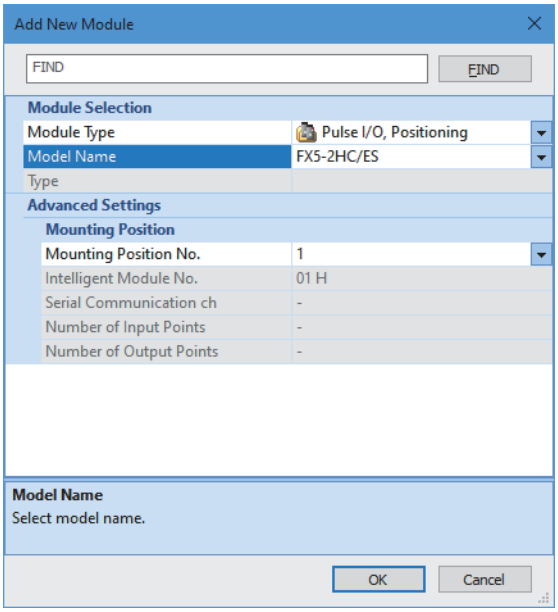
7 PARAMETER SETTINGS

This chapter describes the parameter settings of the high-speed counter module.

7.1 Parameter Setting Procedure

1. Add the high-speed counter module to GX Works3.

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



2. The basic setting, application setting, interrupt setting, and refresh settings are included in the parameter setting. Select one of the settings from the tree on the window shown below.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ High-speed counter module ⇨ [Module Parameter]

3. Write the setting to the CPU module using GX Works3.

[Online] ⇨ [Write to PLC]

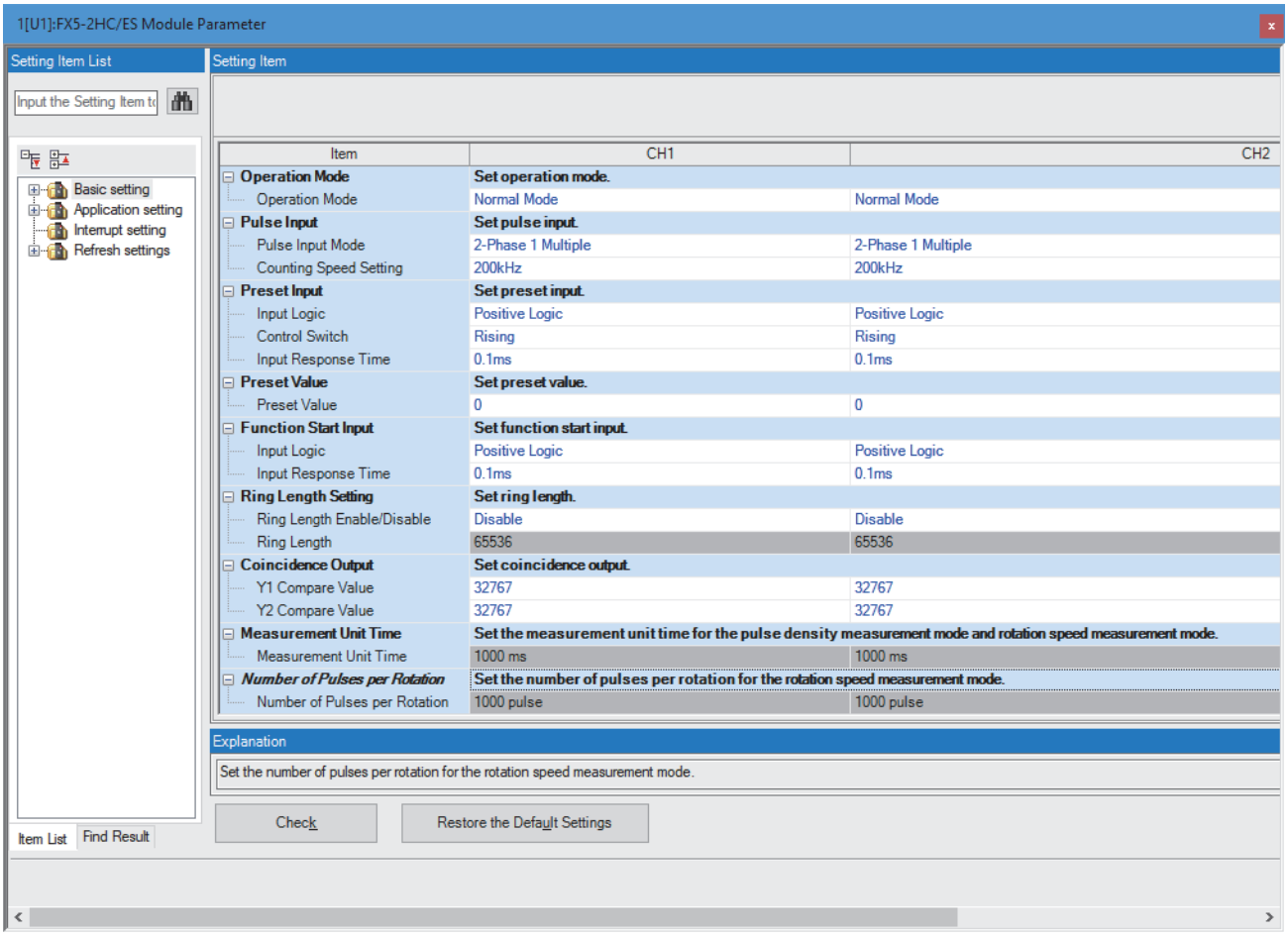
4. When the CPU module is reset or is powered off and on, the setting is reflected.

7.2 Basic Setting

Set the parameters for the basic functions of the high-speed counter module.

For functions, refer to the following.

☞ Page 24 FUNCTIONS



Item		Setting range	Default
Operation Mode	Operation Mode*1	• Normal Mode • Pulse Density Measurement Mode • Rotation Speed Measurement Mode • Pulse Width Measurement Mode	Normal Mode
Pulse Input	Pulse Input Mode	• 1-Phase 1 Input (S/W Up/Down Switch) • 1-Phase 1 Input (H/W Up/Down Switch) • 1-Phase 2 Input • 2-Phase 1 Multiple • 2-Phase 2 Multiple • 2-Phase 4 Multiple • Internal Clock (1MHz)	2-Phase 1 Multiple
	Counting Speed Setting*1	• 10kHz • 50kHz • 100kHz • 200kHz • 500kHz • 1MHz • 2MHz	200kHz

Item		Setting range	Default
Preset Input	Input Logic	• Positive Logic • Negative Logic	Positive Logic
	Control Switch	• Rising • Falling • Rising + Falling Edge • Always During Input ON	Rising
	Input Response Time*1	• None • 0.1ms • 1ms • 10ms	0.1ms
Preset Value	Preset Value	-2147483648 to 2147483647	0
Function Start Input	Input Logic	• Positive Logic • Negative Logic	Positive Logic
	Input Response Time*1	• None • 0.1ms • 1ms • 10ms	0.1ms
Ring Length Setting	Ring Length Enable/Disable	• Disable • Enable	Disable
	Ring Length	2 to 2147483648	65536
Coincidence Output	Y1 Compare Value	-2147483648 to 2147483647	32767
	Y2 Compare Value	-2147483648 to 2147483647	32767
Measurement Unit Time	Measurement Unit Time	1 to 2147483647ms	1000ms
Number of Pulses per Rotation	Number of Pulses per Rotation	1 to 2147483647 pulse	1000 pulse

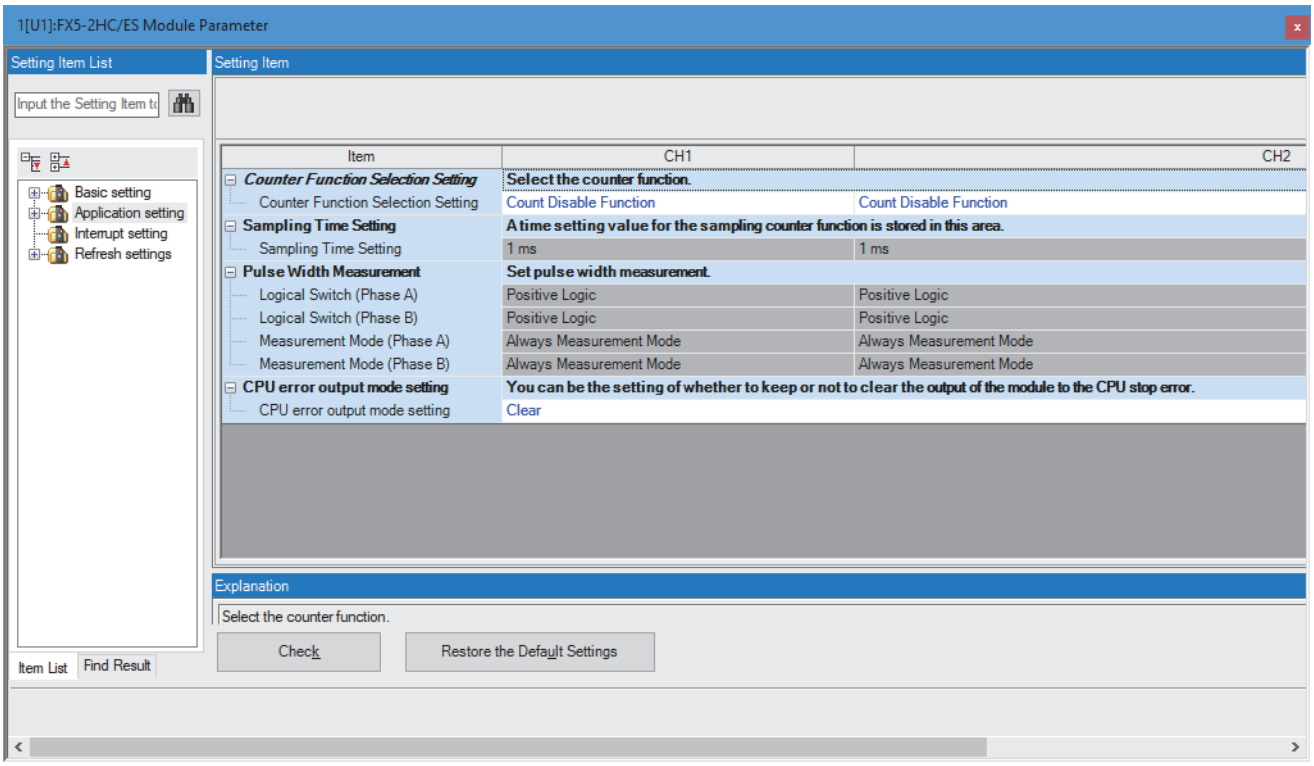
*1 It cannot be changed from the ladder program.

7.3 Application Setting

Set the parameters for the various functions of the high-speed counter module.

For further details on the functions, refer to the following.

☞ Page 24 FUNCTIONS

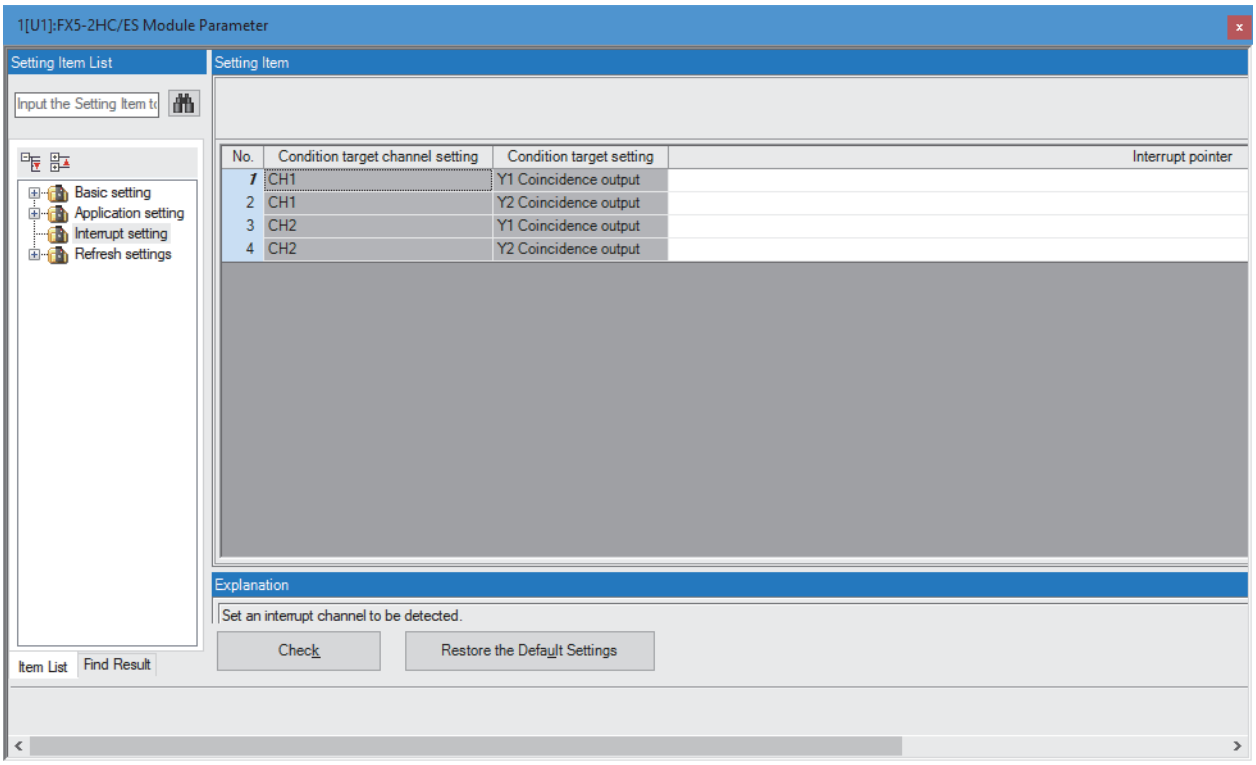


Item		Setting range	Default
Counter Function Selection Setting	Counter Function Selection Setting	• Count Disable Function • Latch Counter Function • Sampling Counter Function	Count Disable Function
Sampling Time Setting	Sampling Time Setting	1 to 65535 (ms)	1
Pulse Width Measurement	Logical Switch (Phase A)*1	• Positive Logic • Negative Logic	Positive Logic
	Logical Switch (Phase B)*1	• Positive Logic • Negative Logic	Positive Logic
	Measurement Mode (Phase A)	• Always Measurement Mode • 1 Time Measurement Mode	Always Measurement Mode
	Measurement Mode (Phase B)	• Always Measurement Mode • 1 Time Measurement Mode	Always Measurement Mode
CPU error output mode setting	CPU error output mode setting*1	Clear (fixed)	Clear

*1 It cannot be changed from the ladder program.

7.4 Interrupt Setting

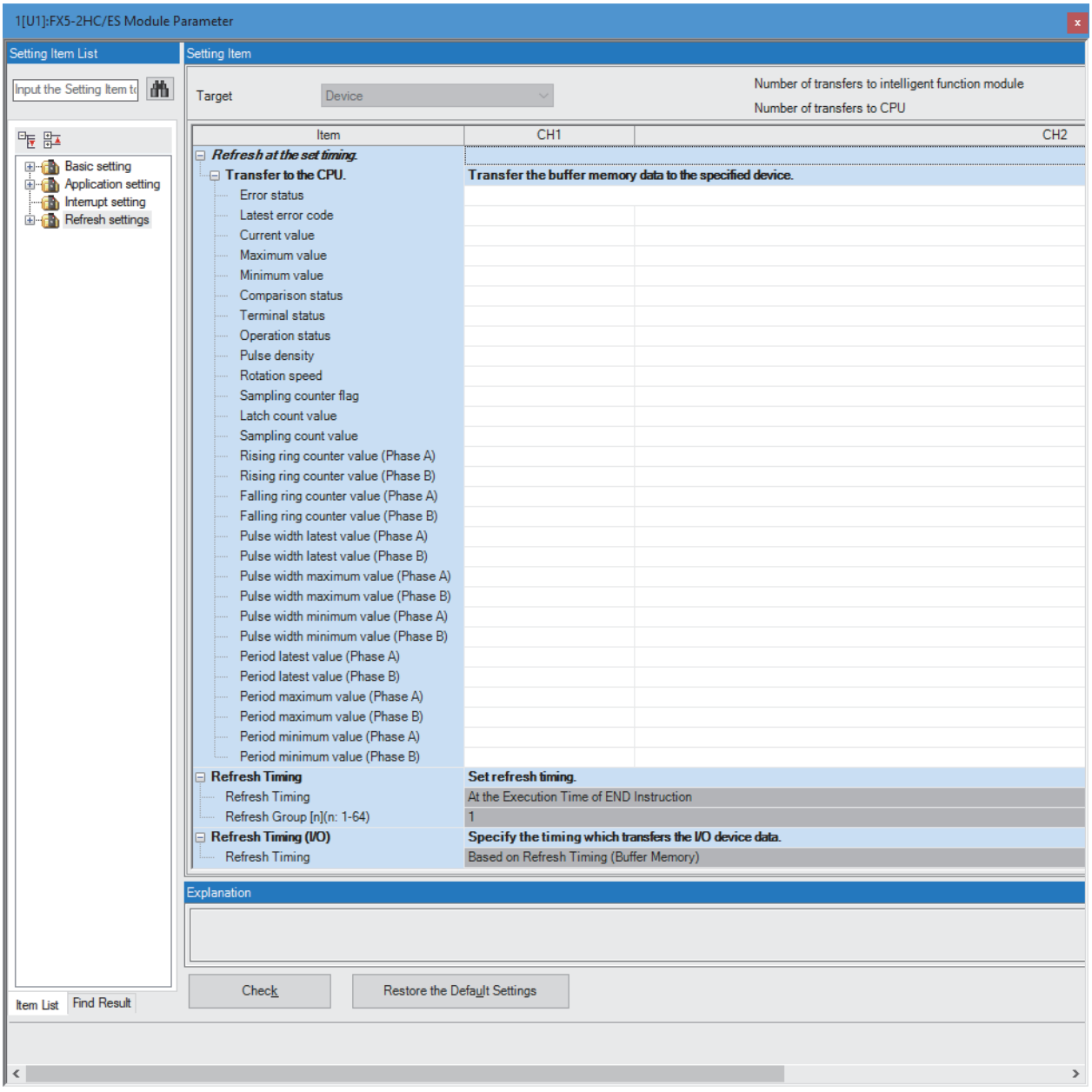
Configure the interrupt pointer setting upon interrupt factor detection.



Item	Setting range	Default
Interrupt pointer	I50 to I177	—

7.5 Refresh Setting

Configure the setting for transferring the content in the buffer memory of the high-speed counter module to devices of the CPU module.



Item		Setting range	Default
Target		Device (fixed)	
Refresh at the set timing	Transfer to the CPU	X, Y, M, L, D, B, W, R	—
Refresh Timing		At the Execution Time of END Instruction (fixed)	
Refresh Group [n](n: 1-64)		1 (fixed)	

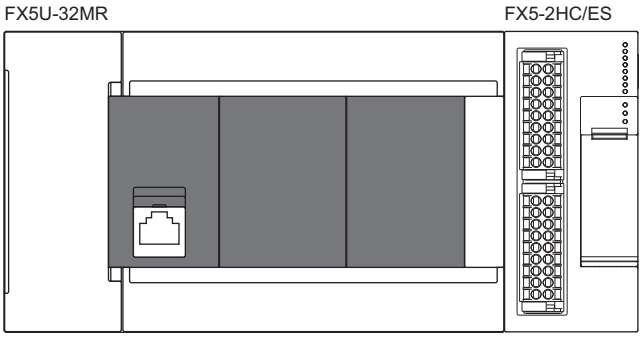
8 PROGRAMMING

This chapter describes program examples for system configuration and module setting conditions.

8.1 When Setting Normal Mode

System configuration

The following figure shows the system configuration of this program example. CH1 is used in the program example.



Module setting conditions

The initial settings are configured using the module parameter settings of GX Works3. Auto refresh settings are not changed.

Setting classification	Item		CH1
Basic setting	Operation Mode	Operation Mode	Normal Mode
	Pulse Input	Pulse Input Mode	2-Phase 1 Multiple
		Counting Speed Setting	200kHz
	Preset Input	Input Logic	Positive Logic
		Control Switch	Rising
		Input Response Time	0.1ms
	Preset Value	Preset Value	2500
	Function Start Input	Input Logic	Positive Logic
		Input Response Time	0.1ms
	Ring Length Setting	Ring Length Enable/Disable	Enable
		Ring Length	5000
	Coincidence Output	Y1 Compare Value	1000
		Y2 Compare Value	2000
Application setting	Counter Function Selection Setting	Counter Function Selection Setting	Set the item according to the function used. ☞ Page 67 Count disable function ☞ Page 67 Latch counter function ☞ Page 67 Sampling counter function
	Sampling Time Setting	Sampling Time Setting	1000*1
	CPU error output mode setting	CPU error output mode setting	Clear

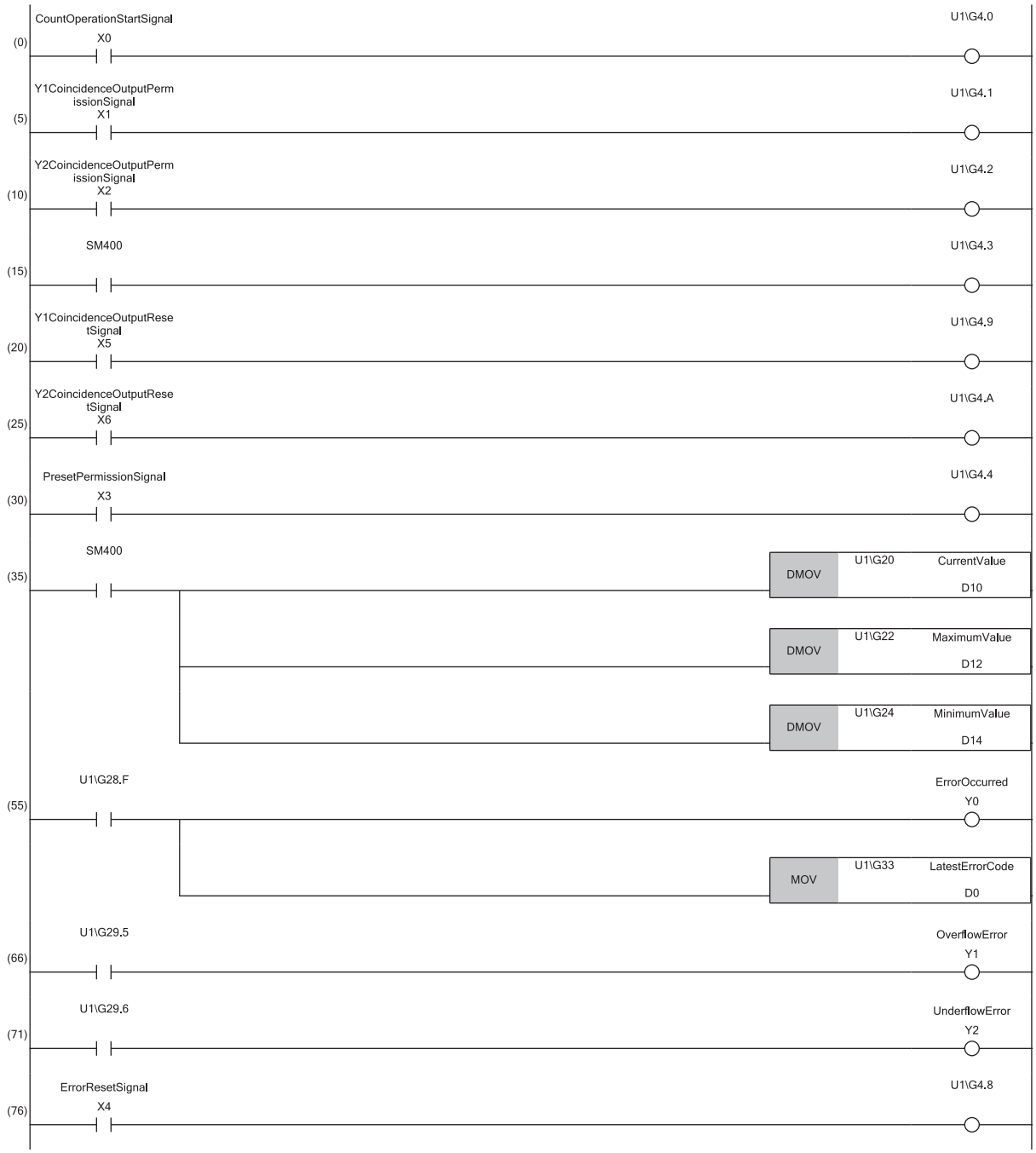
*1 Should be set when using the sampling counter function.

Initial setting

Global label

	Label Name	Data Type		Class	Assign
1	LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D0
2	CurrentValue	Double Word [Signed]	...	VAR_GLOBAL	D10
3	MaximumValue	Double Word [Signed]	...	VAR_GLOBAL	D12
4	MinimumValue	Double Word [Signed]	...	VAR_GLOBAL	D14
5	LatchCountValue	Double Word [Signed]	...	VAR_GLOBAL	D16
6	SamplingCountValue	Double Word [Signed]	...	VAR_GLOBAL	D18
7	CountOperationStartSignal	Bit	...	VAR_GLOBAL	X0
8	Y1CoincidenceOutputPermissionSignal	Bit	...	VAR_GLOBAL	X1
9	Y2CoincidenceOutputPermissionSignal	Bit	...	VAR_GLOBAL	X2
10	PresetPermissionSignal	Bit	...	VAR_GLOBAL	X3
11	ErrorResetSignal	Bit	...	VAR_GLOBAL	X4
12	Y1CoincidenceOutputResetSignal	Bit	...	VAR_GLOBAL	X5
13	Y2CoincidenceOutputResetSignal	Bit	...	VAR_GLOBAL	X6
14	CounterFunctionSelectionStartSignal	Bit	...	VAR_GLOBAL	X7
15	ErrorOccurred	Bit	...	VAR_GLOBAL	Y0
16	OverflowError	Bit	...	VAR_GLOBAL	Y1
17	UnderflowError	Bit	...	VAR_GLOBAL	Y2

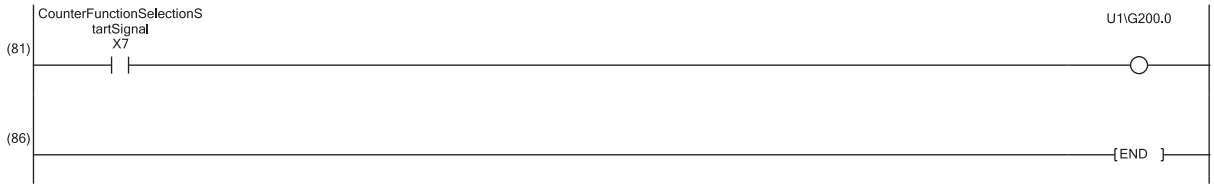
Program example



Step No.	Description
(0)	The count operation starts when CH1 Count permit command (Un\G4.0) is turned on.
(5) to (10)	When performing coincidence output from the coincidence output terminal (Y1/Y2), turn on CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2).
(15)	CH1 Mutual reset action command (Un\G4.3) sets whether the coincidence output terminal (Y1/Y2) performs either independent action or mutual reset action. In this program example, CH1 Mutual reset action command (Un\G4.3) is turned on, so mutual reset action is performed.
(20) to (25)	To turn off the coincidence output terminal (Y1/Y2), turn on CH1 Y1 output reset command (Un\G4.9)/CH1 Y2 output reset command (Un\G4.A).

Step No.	Description
(30)	To preset from the preset input terminal, turn on CH1 Preset permit command (Un\G4.4). Turn on CH1 Preset permit command (Un\G4.4) before starting the count operation (before turning on CH1 Count permit command (Un\G4.0)).
(35)	The current value, maximum count value, and minimum count value are obtained from CH1 Current value (Un\G20 to 21), CH1 Maximum count value (Un\G22 to 23), and CH1 Minimum count value (Un\G24 to 25).
(55) to (71)	The error status and details of errors that have occurred are checked by monitoring CH1 Error flag (Un\G28.F) and CH1 Latest error code (Un\G33). Regarding overflow and underflow, error codes are not stored in CH1 Latest error code (Un\G33). Therefore, the error status is checked by monitoring CH1 Overflow (Un\G29.5) and CH1 Underflow (Un\G29.6).
(76)	Remove the cause of the error that has occurred and turn on CH1 Error reset command (Un\G4.8) to clear the error.

Count disable function



Step No.	Description
(81)	When the count disable function is selected in the counter function selection setting in module parameter settings of GX Works3, turning on CH1 Counter function selection start command (Un\G200.0) stops counting pulses.

Latch counter function

Step No.	Description
(81)	When the latch counter function is selected in the counter function selection setting of the module parameter settings of GX Works3, turning on CH1 Counter function selection start command (Un\G200.0) latches the present counter value.
(86)	Latch completion can be checked with CH1 Counter function update flag (Un\G312.0) and the latched value is obtained from CH1 Latch count value (Un\G308 to 309). CH1 Counter function update flag (Un\G312.0) is cleared by the program, and preparation for the next latch completion is performed.

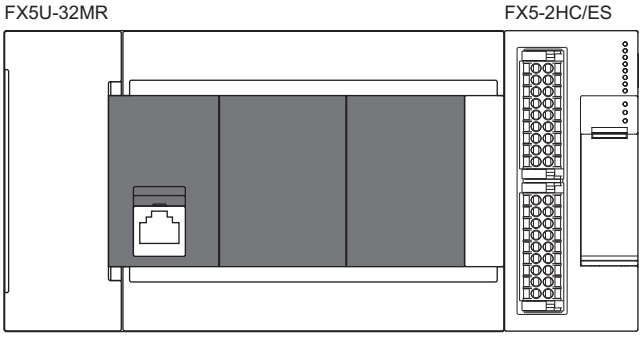
Sampling counter function

Step No.	Description
(81)	When the sampling counter function is selected in counter function selection setting in module parameter settings of GX Works3, turning on CH1 Counter function selection start command (Un\G200.0) counts pulses input during the sampling time (T).
(86)	Completion of sampling can be checked with CH1 Counter function update flag (Un\G312.0), and sampled values are obtained from CH1 Sampling count value (Un\G310 to 311). CH1 Counter function update flag (Un\G312.0) is cleared by the program, and preparation for the next sampling completion is performed.

8.2 When Setting Pulse Density Measurement Mode

System configuration

The following figure shows the system configuration of this program example. CH1 is used in the program example.



Module setting conditions

The initial settings are configured using the module parameter settings of GX Works3. Auto refresh settings are not changed.

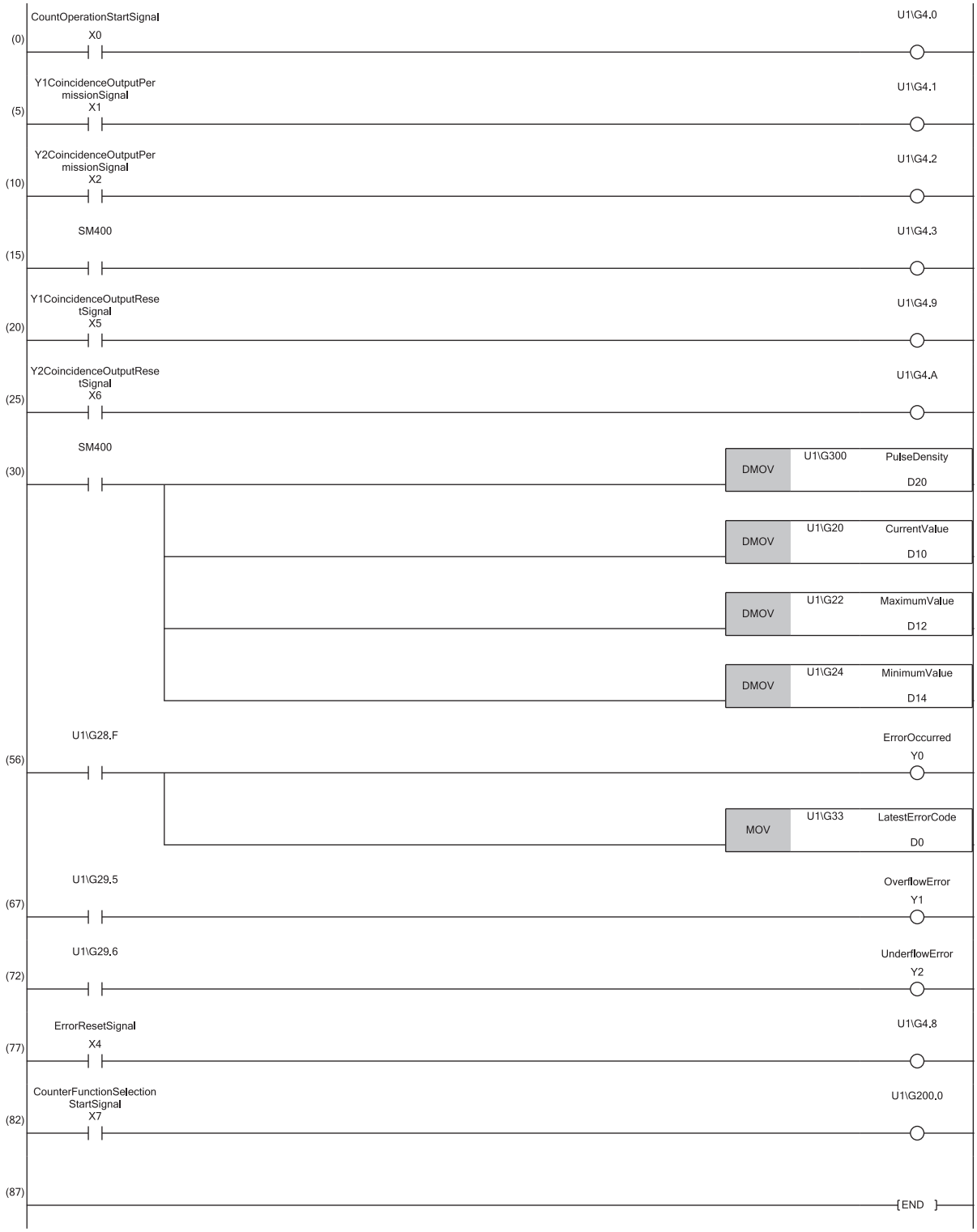
Setting classification	Item		CH1
Basic setting	Operation Mode	Operation Mode	Pulse Density Measurement Mode
	Pulse Input	Pulse Input Mode	2-Phase 1 Multiple
		Counting Speed Setting	200kHz
	Function Start Input	Input Logic	Positive Logic
		Input Response Time	0.1ms
	Coincidence Output	Y1 Compare Value	1000
		Y2 Compare Value	2000
	Measurement Unit Time	Measurement Unit Time	1000
Application setting	CPU error output mode setting	CPU error output mode setting	Clear

Initial setting

Global label

	Label Name	Data Type		Class	Assign (Device/Label)
1	LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D0
2	CurrentValue	Double Word [Signed]	...	VAR_GLOBAL	D10
3	MaximumValue	Double Word [Signed]	...	VAR_GLOBAL	D12
4	MinimumValue	Double Word [Signed]	...	VAR_GLOBAL	D14
5	PulseDensity	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D20
6	CountOperationStartSignal	Bit	...	VAR_GLOBAL	X0
7	Y1CoincidenceOutputPermissionSignal	Bit	...	VAR_GLOBAL	X1
8	Y2CoincidenceOutputPermissionSignal	Bit	...	VAR_GLOBAL	X2
9	ErrorResetSignal	Bit	...	VAR_GLOBAL	X4
10	Y1CoincidenceOutputResetSignal	Bit	...	VAR_GLOBAL	X5
11	Y2CoincidenceOutputResetSignal	Bit	...	VAR_GLOBAL	X6
12	CounterFunctionSelectionStartSignal	Bit	...	VAR_GLOBAL	X7
13	ErrorOccurred	Bit	...	VAR_GLOBAL	Y0
14	OverflowError	Bit	...	VAR_GLOBAL	Y1
15	UnderflowError	Bit	...	VAR_GLOBAL	Y2

Program example



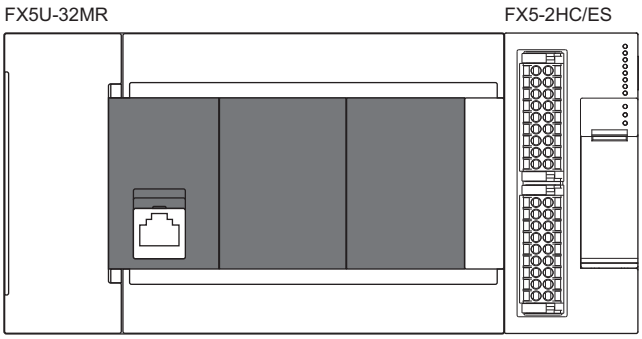
Step No.	Description
(0)	The pulse density measurement starts when CH1 Count permit command (Un\G4.0) is turned on.
(5) to (10)	When performing coincidence output from the coincidence output terminal (Y1/Y2), turn on CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2).

Step No.	Description
(15)	CH1 Mutual reset action command (Un\G4.3) sets whether the coincidence output terminal (Y1/Y2) performs either independent action or mutual reset action. In this program example, CH1 Mutual reset action command (Un\G4.3) is turned on, so mutual reset action is performed.
(20) to (25)	To turn off the coincidence output terminal (Y1/Y2), turn on CH1 Y1 output reset command (Un\G4.9)/CH1 Y2 output reset command (Un\G4.A).
(30)	The pulse density, current value, maximum count value, and minimum count value are obtained from CH1 Pulse density (Un\G300 to 301), CH1 Current value (Un\G20 to 21), CH1 Maximum count value (Un\G22 to 23), and CH1 Minimum count value (Un\G24 to 25).
(56) to (72)	The error status and details of errors that have occurred are checked by monitoring CH1 Error flag (Un\G28.F) and CH1 Latest error code (Un\G33). Regarding overflow and underflow, error codes are not stored in CH1 Latest error code (Un\G33). Therefore, the error status is checked by monitoring CH1 Overflow (Un\G29.5) and CH1 Underflow (Un\G29.6).
(77)	Remove the cause of the error that has occurred and turn on CH1 Error reset command (Un\G4.8) to clear the error.
(82)	In pulse density measurement mode, only the count disable function can be used. The operation to count pulses stops when CH1 Counter function selection start command (Un\G200.0) is turned on.

8.3 When Setting Rotational Speed Measurement Mode

System configuration

The following figure shows the system configuration of this program example. CH1 is used in the program example.



Module setting conditions

The initial settings are configured using the module parameter settings of GX Works3. Auto refresh settings are not changed.

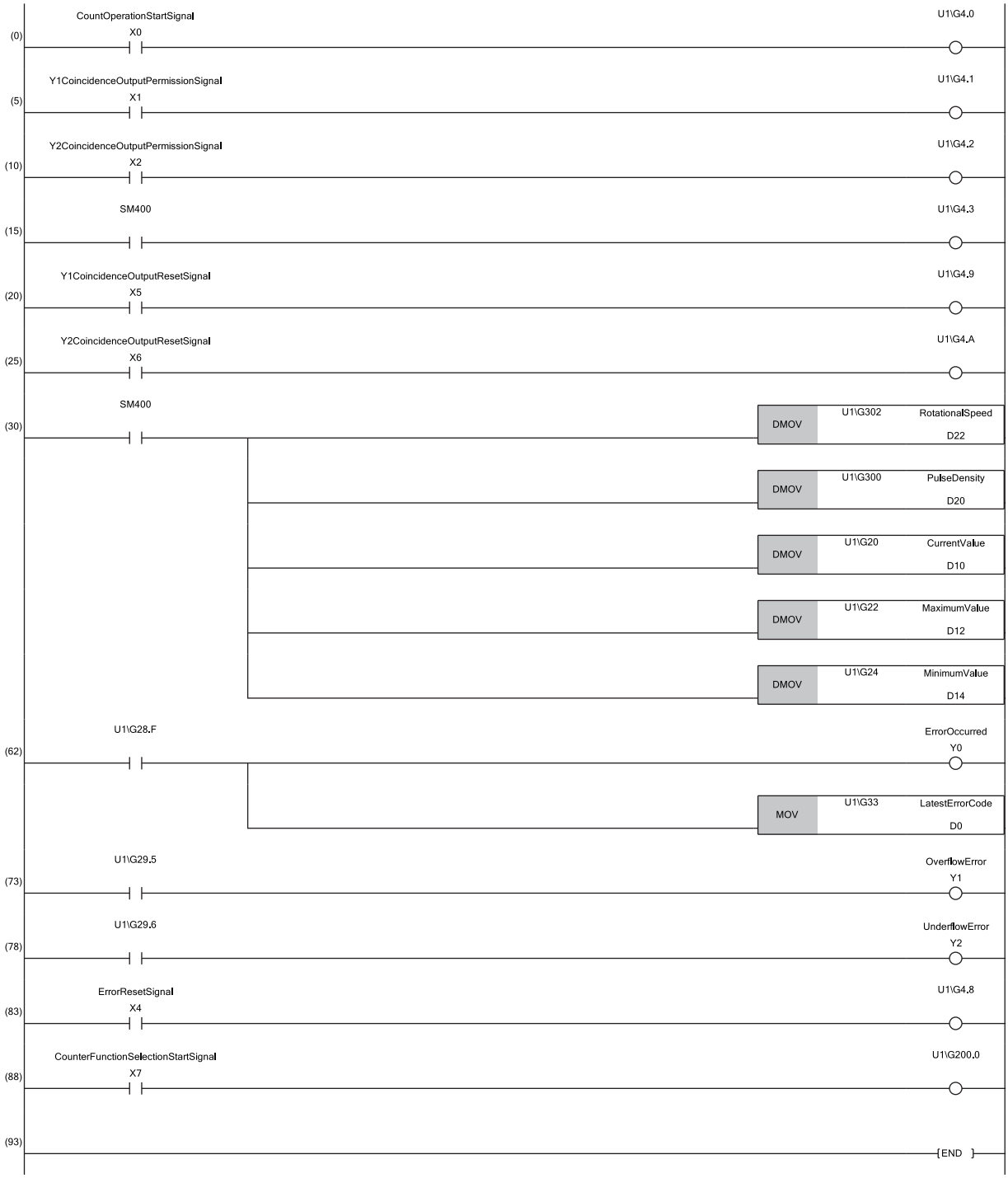
Setting classification	Item		CH1
Basic setting	Operation Mode	Operation Mode	Rotation Speed Measurement Mode
	Pulse Input	Pulse Input Mode	2-Phase 1 Multiple
		Counting Speed Setting	200kHz
	Function Start Input	Input Logic	Positive Logic
		Input Response Time	0.1ms
	Coincidence Output	Y1 Compare Value	1000
		Y2 Compare Value	2000
	Measurement Unit Time	Measurement Unit Time	10
	Number of Pulses per Rotation	Number of Pulses per Rotation	1000
Application setting	CPU error output mode setting	CPU error output mode setting	Clear

Initial setting

Global label

	Label Name	Data Type	Class	Assign
1	LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL	D0
2	CurrentValue	Double Word [Signed]	VAR_GLOBAL	D10
3	MaximumValue	Double Word [Signed]	VAR_GLOBAL	D12
4	MinimumValue	Double Word [Signed]	VAR_GLOBAL	D14
5	PulseDensity	Double Word [Unsigned]/Bit String [32-bit]	VAR_GLOBAL	D20
6	RotationalSpeed	Double Word [Unsigned]/Bit String [32-bit]	VAR_GLOBAL	D22
7	CountOperationStartSignal	Bit	VAR_GLOBAL	X0
8	Y1CoincidenceOutputPermissionSignal	Bit	VAR_GLOBAL	X1
9	Y2CoincidenceOutputPermissionSignal	Bit	VAR_GLOBAL	X2
10	ErrorResetSignal	Bit	VAR_GLOBAL	X4
11	Y1CoincidenceOutputResetSignal	Bit	VAR_GLOBAL	X5
12	Y2CoincidenceOutputResetSignal	Bit	VAR_GLOBAL	X6
13	CounterFunctionSelectionStartSignal	Bit	VAR_GLOBAL	X7
14	ErrorOccurred	Bit	VAR_GLOBAL	Y0
15	OverflowError	Bit	VAR_GLOBAL	Y1
16	UnderflowError	Bit	VAR_GLOBAL	Y2

Program example

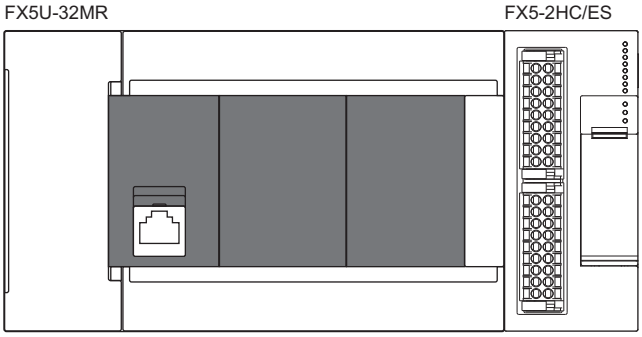


Step No.	Description
(0)	The rotational speed measurement starts when CH1 Count permit command (Un\G4.0) is turned on.
(5) to (10)	When performing coincidence output from the coincidence output terminal (Y1/Y2), turn on CH1 Y1 comparison output permit command (Un\G4.1)/CH1 Y2 comparison output permit command (Un\G4.2).
(15)	CH1 Mutual reset action command (Un\G4.3) sets whether the coincidence output terminal (Y1/Y2) performs either independent action or mutual reset action. In this program example, CH1 Mutual reset action command (Un\G4.3) is turned on, so mutual reset action is performed.
(20) to (25)	To turn off the coincidence output terminal (Y1/Y2), turn on CH1 Y1 output reset command (Un\G4.9)/CH1 Y2 output reset command (Un\G4.A).
(30)	The rotational speed, pulse density, current value, maximum count value, and minimum count value are obtained from CH1 Rotational speed (Un\G302 to 303), CH1 Pulse density (Un\G300 to 301), CH1 Current value (Un\G20 to 21), CH1 Maximum count value (Un\G22 to 23), and CH1 Minimum count value (Un\G24 to 25).
(62) to (78)	The error status and details of errors that have occurred are checked by monitoring CH1 Error flag (Un\G28.F) and CH1 Latest error code (Un\G33). Regarding overflow and underflow, error codes are not stored in CH1 Latest error code (Un\G33). Therefore, the error status is checked by monitoring CH1 Overflow (Un\G29.5) and CH1 Underflow (Un\G29.6).
(83)	Remove the cause of the error that has occurred and turn on CH1 Error reset command (Un\G4.8) to clear the error.
(88)	In rotational speed measurement mode, only the count disable function can be used. The operation to count pulses stops when CH1 Counter function selection start command (Un\G200.0) is turned on.

8.4 When Setting Pulse Width Measurement Mode

System configuration

The following figure shows the system configuration of this program example. CH1 is used in the program example.



Module setting conditions

The initial settings are configured using the module parameter settings of GX Works3. Auto refresh settings are not changed.

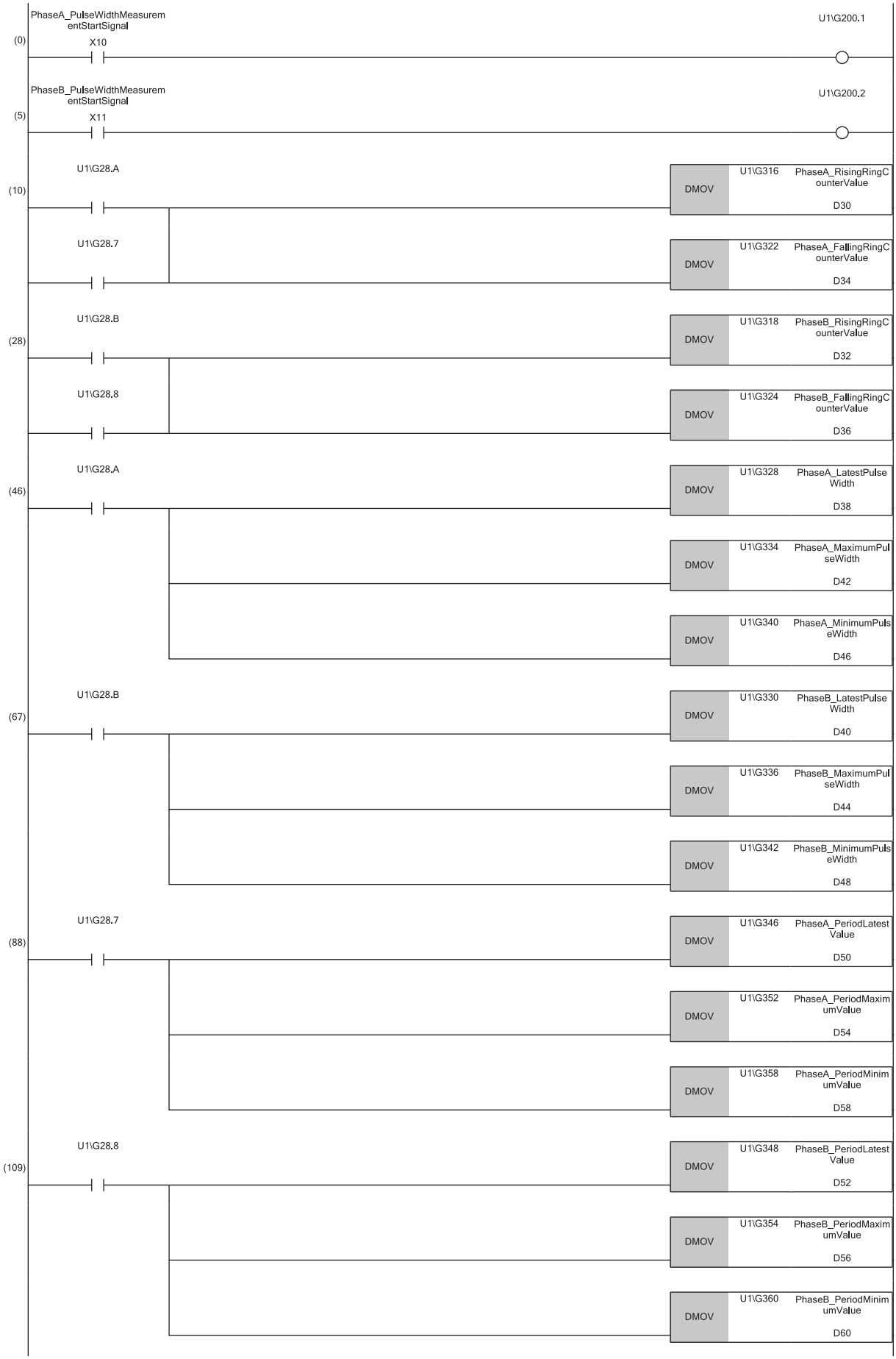
Setting classification	Item		CH1
Basic setting	Operation Mode	Operation Mode	Pulse Width Measurement Mode
	Pulse Input	Counting Speed Setting	200kHz
Application setting	Pulse Width Measurement	Logical Switch (Phase A)	Positive Logic
		Logical Switch (Phase B)	Positive Logic
		Measurement Mode (Phase A)	Always Measurement Mode
		Measurement Mode (Phase B)	Always Measurement Mode
	CPU error output mode setting	CPU error output mode setting	Clear

Initial setting

Global label

	Label Name	Data Type		Class	Assign
1	LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D0
2	PhaseA_RisingRingCounterValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D30
3	PhaseB_RisingRingCounterValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D32
4	PhaseA_FallingRingCounterValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D34
5	PhaseB_FallingRingCounterValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D36
6	PhaseA_LatestPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D38
7	PhaseB_LatestPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D40
8	PhaseA_MaximumPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D42
9	PhaseB_MaximumPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D44
10	PhaseA_MinimumPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D46
11	PhaseB_MinimumPulseWidth	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D48
12	PhaseA_PeriodLatestValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D50
13	PhaseB_PeriodLatestValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D52
14	PhaseA_PeriodMaximumValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D54
15	PhaseB_PeriodMaximumValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D56
16	PhaseA_PeriodMinimumValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D58
17	PhaseB_PeriodMinimumValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D60
18	ErrorResetSignal	Bit	...	VAR_GLOBAL	X4
19	PhaseA_PulseWidthMeasurementStartSignal	Bit	...	VAR_GLOBAL	X10
20	PhaseB_PulseWidthMeasurementStartSignal	Bit	...	VAR_GLOBAL	X11
21	ErrorOccurred	Bit	...	VAR_GLOBAL	Y0

Program example



Step No.	Description
(0) to (5)	Pulse width measurement for pulses input to phase A/phase B starts when CH1 Pulse width measurement start command (phase A) (Un\G200.1)/CH1 Pulse width measurement start command (phase B) (Un\G200.2) is turned on.
(10) to (28)	Phase A and B rising edge ring counter value and phase A and B falling edge ring counter value are obtained from the following. CH1 Rising edge ring counter value (phase A) (Un\G316 to 317), CH1 Rising edge ring counter value (phase B) (Un\G318 to 319) CH1 Falling edge ring counter value (phase A) (Un\G322 to 323), CH1 Falling edge ring counter value (phase B) (Un\G324 to 325)
(46) to (67)	Phase A and B pulse width latest value, phase A and B pulse width maximum value, phase A and B pulse width minimum value are obtained from the following. CH1 Pulse width latest value (phase A) (Un\G328 to 329), CH1 Pulse width latest value (phase B) (Un\G330 to 331) CH1 Pulse width maximum value (phase A) (Un\G334 to 335), CH1 Pulse width maximum value (phase B) (Un\G336 to 337) CH1 Pulse width minimum value (phase A) (Un\G340 to 341), CH1 Pulse width minimum value (phase B) (Un\G342 to 343) The values are obtained after CH1 Pulse width measurement complete (phase A) (Un\G28.A)/CH1 Pulse width measurement complete (phase B) (Un\G28.B) is turned on and pulse width measurement is completed.
(88) to (109)	Phase A and B period latest value, phase A and B period maximum value, and phase A and B period minimum value are obtained from the following. CH1 Period latest value (phase A) (Un\G346 to 347), CH1 Period latest value (phase B) (Un\G348 to 349) CH1 Period maximum value (phase A) (Un\G352 to 353), CH1 Period maximum value (phase B) (Un\G354 to 355) CH1 Period minimum value (phase A) (Un\G358 to 359), CH1 Period minimum value (phase B) (Un\G360 to 361) The values are obtained after CH1 Period measurement completed (phase A) (Un\G28.7)/CH1 Period measurement completed (phase B) (Un\G28.8) is turned on and period measurement is completed.
(130)	The error status and details of errors that have occurred are checked by monitoring CH1 Error flag (Un\G28.F) and CH1 Latest error code (Un\G33).
(141)	Remove the cause of the error that has occurred and turn on CH1 Error reset command (Un\G4.8) to clear the error.

9 TROUBLESHOOTING

This chapter describes errors that may occur while using the high-speed counter module, and those troubleshooting.

9.1 Checking with LEDs

This section describes troubleshooting using LEDs.

The error status can be distinguished by the on/off status of the RUN LED and ERROR LED as shown below.

RUN LED	ERROR LED	Error status	Action
On	On	Minor error	Check the error code displayed on the module diagnostics window on GX Works3 and take any actions described in the list of error codes.
Off	Flashing	Moderate error	
Off	Off	Error (Initial processing not completed)	

When the POWER LED turns off

When the POWER LED turns off after the high-speed counter module is powered on, check the following items.

Check item	Action
Is power supplied?	Verify that power is being supplied to the CPU module and extension power supply module.
Is the power capacity of the CPU module and extension power supply module sufficient?	Calculate the current consumption of modules such as the I/O module and intelligent function module and check that the power capacity of the CPU module and extension power supply module is sufficient.
Are the modules mounted properly?	Verify that the extension cable is inserted correctly.

When the RUN LED turns off

When the RUN LED turns off after the high-speed counter module is powered on, check the following items.

Check item	Action
Is power supplied?	Verify that power is being supplied to the CPU module and extension power supply module.
Is the power capacity of the CPU module and extension power supply module sufficient?	Calculate the current consumption of modules such as the I/O module and intelligent function module and check that the power capacity of the CPU module and extension power supply module is sufficient.
Are the modules mounted properly?	Verify that the extension cable is inserted correctly.

If the problem cannot be solved by taking the actions above, reset the CPU module and check if the RUN LED turns on.

If the RUN LED still does not turn on, the module may be faulty. Please consult your local Mitsubishi representative.

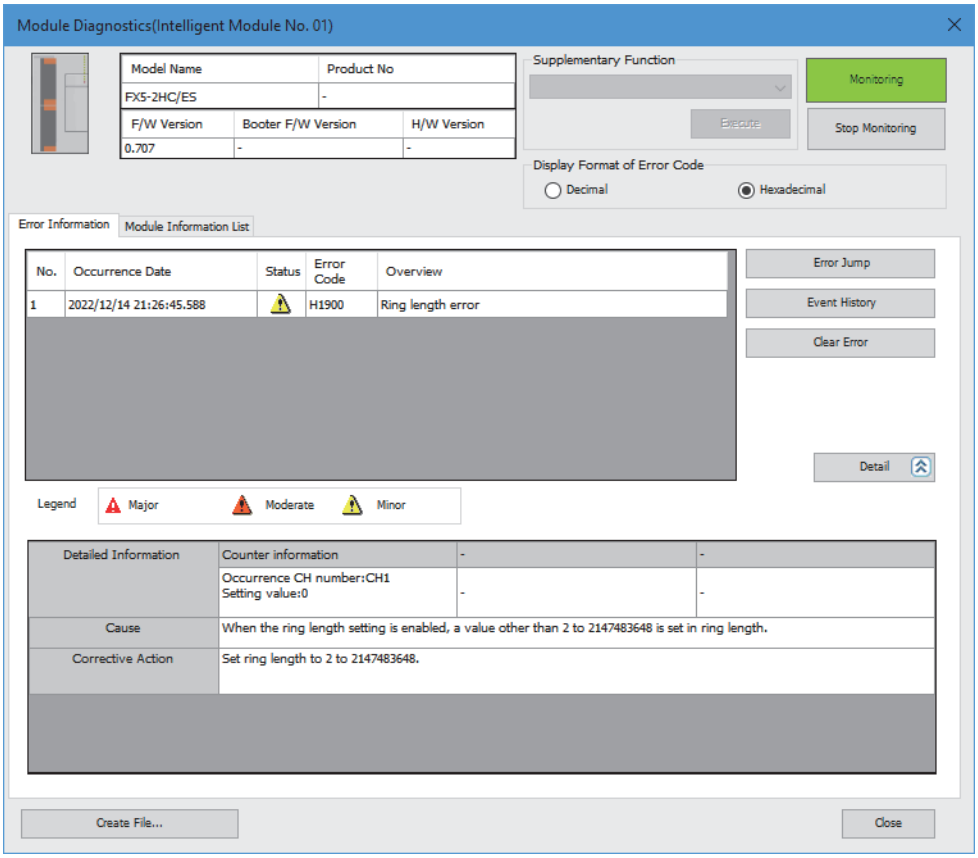
When the ERROR LED turns on or flashes

When the ERROR LED turns on or flashes, check the following items.

Check item	Action
Has a moderate error occurred?	Power off and on the system. If the error occurs again, the module may be faulty. Please consult your local Mitsubishi representative.
Has an error occurred?	Check the latest error code via module diagnostics and take any actions described in the list of error codes. (☞ Page 78 Checking Module Status)

9.2 Checking Module Status

From the module diagnostics window on GX Works3, error codes and error histories of the high-speed counter module can be checked.



Item	Description
Status	Major: Errors by which the module operation stops due to hardware failure or memory error.
	Moderate: Errors by which the module operation stops due to parameter error or other problems related to module operation.
	Minor: Errors including communication failure, during which the module keeps operating.
Detailed information	Up to three pieces of detailed information are displayed for each error.
Cause	A description of what caused the error is displayed.
Action	Action to take against the error is displayed.

9.3 Troubleshooting by Symptom

This section describes troubleshooting by symptom. If an error has occurred on the high-speed counter module, identify the cause of the error by using GX Works3. (☞ Page 78 Checking Module Status)

Point

This section describes buffer memory addresses and external input terminals for CH1.

When the count operation does not start

Check item	Action
Does the CPU module indicate any error?	If the CPU module indicates an error, recover normal operation according to the troubleshooting in the manual for the CPU module used.
Apply a voltage directly to the pulse input terminals of phase A and phase B, and check that the LEDs of phase A and phase B turn on.	• If the LEDs turn on, check the external wiring and wiring on the encoder side to correct the errors. • If the LEDs do not turn on, a hardware failure has occurred. Please consult your local Mitsubishi representative.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is CH1 Count permit command (Un\G4.0) on?	Turn on CH1 Count permit command (Un\G4.0) using a program.
Is the pulse input method the same as CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter settings?	Match the pulse input method to CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter setting.
Is the operation mode set to normal mode?	Set the operation mode to normal mode in Basic setting of the parameter settings.
Is CH1 Counter function selection start command (Un\G200.0) on, or is a voltage applied to the function start input terminals?	If the count disable function is set by the counter function selection, turn off CH1 Counter function selection start command (Un\G200.0) and turn off[*1] the function start input terminals.

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace off with on when 1 (negative logic) is set.

When the count operation is not normal

Check item	Action
Does the CPU module indicate any error?	If the CPU module indicates an error, recover normal operation according to the troubleshooting in the manual for the CPU module used.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is the maximum counting speed for input pulses within the range of the counting speed setting in Basic setting of the parameter settings?	Correct the counting speed setting of Basic setting to accommodate the maximum counting speed for input pulses.
Does the waveform of pulses being inputted meet the performance specifications?	Observe and check the pulse waveform with an oscilloscope. If the input pulse does not meet the performance specifications, input pulses which meet the performance specifications.
Is the count value data processed as 32-bit signed binary data in the program?	Correct the program to process the count value data in 32-bit signed binary.
Do both CH1 and CH2 return the same count value after the same count is inputted with the same parameter settings?	If these count values are different, a hardware failure has occurred. Please consult your local Mitsubishi representative.

■Measures against noise

Check item	Action
Are shielded twisted pair cables used?	Use shielded twisted pair cables.
Does any noise come from the grounded part of the high-speed counter module?	Separate the grounding cable of the high-speed counter module from the grounded part.
Are measures against noise taken for the adjacent devices and inside the control panel?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.
Is the distance between the high voltage device and pulse input line sufficient?	Bundle the pulse input lines separately from other lines in piping and tubing, and keep a distance of 150mm or more between the pulse input lines and the power line even inside the control panel.

When the coincidence output function does not operate normally

Check item	Action
Are CH1 Y1 comparison output permit command (Un\G4.1) and CH1 Y2 comparison output permit command (Un\G4.2) on?	Turn on CH1 Y1 comparison output permit command (Un\G4.1) and CH1 Y2 comparison output permit command (Un\G4.2).
Is external wiring of coincidence output terminals Y1 and Y2 normal?	Check the external wiring to correct the errors. (☞ Page 53 Wiring Example)

When a coincidence output interrupt does not occur

Check item	Action
Is the interrupt pointer of interrupt settings in the parameter settings set incorrectly?	Review the interrupt pointer setting in interrupt settings.
Has the program execution control instruction such as IMASK been used incorrectly?	Review and correct the program.
Is the coincidence output interrupt factor masked?	Set CH1 Coincidence output Y1 interrupt factor mask (Un\G161) and CH1 Coincidence output Y2 interrupt factor mask (Un\G164) to 1 (unmask).
Does the coincidence output interrupt factor detection flag remain 1 (interrupt factor detected)?	Write 1 (reset request) to CH1 Coincidence output Y1 interrupt factor reset request (Un\G162) and CH1 Coincidence output Y2 interrupt factor reset request (Un\G165), and clear CH1 Coincidence output Y1 interrupt factor detection flag (Un\G160) and CH1 Coincidence output Y2 interrupt factor detection flag (Un\G163).

When the preset cannot be executed

Check item	Action
Is CH1 Preset permit command (Un\G4.4) turned on?	Turn on CH1 Preset permit command (Un\G4.4).
Is the external wiring of the preset input terminal normal?	Check the external wiring to correct the errors. (☞ Page 53 Wiring Example)
Is the input to the preset input terminal performed in accordance with the preset input logic that was set in Basic setting of the parameter settings?	Correct the errors so that input is performed to the preset input terminal as set in the preset input logic in Basic setting.
Is input from the preset input terminal performed in accordance with the preset input control switch that was set in Basic setting of the parameter settings?	Correct the errors so that the input that was set in the preset input control switch in Basic setting is performed for the preset input terminal.

When the pulse density measurement does not start

Check item	Action
Apply a voltage directly to the pulse input terminals of phase A and phase B, and check that the LEDs of phase A and phase B turn on.	• If the LEDs turn on, check the external wiring and wiring on the encoder side to correct the errors. • If the LEDs do not turn on, a hardware failure has occurred. Please consult your local Mitsubishi representative.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is CH1 Count permit command (Un\G4.0) turned on?	Turn on CH1 Count permit command (Un\G4.0) using a program.
Is the pulse input method the same as CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter settings?	Match the pulse input method to CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter setting.
Is the operation mode set to pulse density measurement mode?	Set the operation mode to pulse density measurement mode in Basic setting of the parameter settings.
Is CH1 Counter function selection start command (Un\G200.0) on, or is a voltage applied to the function start input terminals?	In pulse density measurement mode, the count disable function is set by the counter function selection. Therefore, when performing measurement, turn off CH1 Counter function selection start command (Un\G200.0) and turn off*1 the function start input terminals.

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace off with on when 1 (negative logic) is set.

When the pulse density is not measured correctly

Check item	Action
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is the maximum counting speed for input pulses within the range of the counting speed setting in Basic setting of the parameter settings?	Correct the counting speed setting of Basic setting to accommodate the maximum counting speed for input pulses.
Does the waveform of pulses being inputted meet the performance specifications?	Observe and check the pulse waveform with an oscilloscope. If the input pulse does not meet the performance specifications, input pulses which meet the performance specifications.
Is the pulse density measurement value data processed as 32-bit signed binary data in the program?	Correct the program to process the pulse density measurement value data in 32-bit signed binary.
Do both CH1 and CH2 return the same pulse density measurement value after the same count is inputted with the same parameter settings?	If these pulse density measurement values are different, a hardware failure has occurred. Please consult your local Mitsubishi representative.

■Measures against noise

Check item	Action
Are shielded twisted pair cables used?	Use shielded twisted pair cables.
Does any noise come from the grounded part of the high-speed counter module?	If the high-speed counter module touches the grounded part, separate it.
Are measures against noise taken for the adjacent devices and inside the control panel?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.
Is the distance between the high voltage device and pulse input line sufficient?	Bundle the pulse input lines separately from other lines in piping and tubing, and keep a distance of 150mm or more between the pulse input lines and the power line even inside the control panel.

When the rotational speed measurement does not start

Check item	Action
Apply a voltage directly to the pulse input terminals of phase A and phase B, and check that the LEDs of phase A and phase B turn on.	• If the LEDs turn on, check the external wiring and wiring on the encoder side to correct the errors. • If the LEDs do not turn on, a hardware failure has occurred. Please consult your local Mitsubishi representative.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is CH1 Count permit command (Un\G4.0) turned on?	Turn on CH1 Count permit command (Un\G4.0) using a program.
Is the pulse input method the same as CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter settings?	Match the pulse input method to CH1 Pulse input mode (Un\G0) or the pulse input mode of Basic setting in the parameter setting.
Is the operation mode set to rotational speed measurement mode?	Set the operation mode to rotational speed measurement mode in Basic setting of the parameter settings.
Is CH1 Counter function selection start command (Un\G200.0) on, or is a voltage applied to the function start input terminals?	In rotational speed measurement mode, the count disable function is set by the counter function selection. Therefore, when performing measurement, turn off CH1 Counter function selection start command (Un\G200.0) and turn off*1 the function start input terminals.

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace off with on when 1 (negative logic) is set.

When the rotational speed is not measured correctly

Check item	Action
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)
Is the maximum counting speed for input pulses within the range of the counting speed setting in Basic setting of the parameter settings?	Correct the counting speed setting of Basic setting to accommodate the maximum counting speed for input pulses.
Does the waveform of pulses being inputted meet the performance specifications?	Observe and check the pulse waveform with an oscilloscope. If the input pulse does not meet the performance specifications, input pulses which meet the performance specifications.
Is the measured rotational speed value data processed as 32-bit signed binary data in the program?	Correct the program to process the measured rotational speed value data in 32-bit signed binary.
Do both CH1 and CH2 return the same measured rotation speed value after the same count is inputted with the same parameter settings?	If these measured rotational speed values are different, a hardware failure has occurred. Please consult your local Mitsubishi representative.

■Measures against noise

Check item	Action
Are shielded twisted pair cables used?	Use shielded twisted pair cables.
Does any noise come from the grounded part of the high-speed counter module?	If the high-speed counter module touches the grounded part, separate it.
Are measures against noise taken for the adjacent devices and inside the control panel?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.
Is the distance between the high voltage device and pulse input line sufficient?	Bundle the pulse input lines separately from other lines in piping and tubing, and keep a distance of 150mm or more between the pulse input lines and the power line even inside the control panel.

When the pulse width measurement does not start

Check item	Action
Is the operation mode set to pulse width measurement mode?	Set the operation mode to pulse width measurement mode in Basic setting of the parameter settings.
Are CH1 Pulse width measurement start command (phase A) (Un\G200.1) and CH1 Pulse width measurement start command (phase B) (Un\G200.2) on?	Turn on CH1 Pulse width measurement start command (phase A) (Un\G200.1) and CH1 Pulse width measurement start command (phase B) (Un\G200.2) using the program.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)

When the pulse width is not measured correctly

Check item	Action
Is input to phase A and phase B performed in accordance with the logic switching (phase A) and logic switching (phase B) that were set in Application setting of the parameter settings?	Correct the errors so that the input set in logic switching (phase A) and logic switching (phase B) in Application setting of the parameter settings is performed for phase A and phase B.
Are the measurement mode (phase A) and measurement mode (phase B) or CH1 Measurement mode (phase A) (Un\G224) and CH1 Measurement mode (phase B) (Un\G225) in Application setting of the parameter settings set in accordance with the mode to be measured?	Set the measurement mode (phase A) and measurement mode (phase B) or CH1 Measurement mode (phase A) (Un\G224) and CH1 Measurement mode (phase B) (Un\G225) in Application setting of the parameter settings in accordance with the mode to be measured.
When reading 2 word items such as pulse width latest value in the program, are they read in units of 2 words (32 bits)?	Read two words at once.
Is the external wiring of phase A and phase B, as well as the connected input terminal, correct?	Check for any incorrect external wiring or connection to an incorrect input terminal and connect the wires correctly. (☞ Page 53 Wiring Example)

■Measures against noise

Check item	Action
Are shielded twisted pair cables used?	Use shielded twisted pair cables.
Does any noise come from the grounded part of the high-speed counter module?	Separate the grounding cable of the high-speed counter module from the grounded part.
Are measures against noise taken for the adjacent devices and inside the control panel?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.
Is the distance between the high voltage device and pulse input line sufficient?	Bundle the pulse input lines separately from other lines in piping and tubing, and keep a distance of 150mm or more between the pulse input lines and the power line even inside the control panel.

When the error code cannot be reset

Check item	Action
Has the cause of the error been eliminated?	Check the cause of the error and eliminate it. (☞ Page 78 Checking Module Status)

9.4 List of Error Codes

A list of error codes used for high-speed counters is provided below.

Point

This section describes buffer memory addresses and external input terminals for CH1.

Error code	Error name	Error details and cause	Operation at the occurrence of an error	Action
1900H	Ring length error	A value other than 2 to 2147483648 is set for CH1 Ring length (Un\G2 to 3) while the ring length setting is enabled.	• CH with an error: If the count operation is permitted, the count operation continues with the value at the time of count permit. If the error occurs during count permit or it occurs at the timing of count permit, the count operation does not start. • CH other than the CH with an error: Operates normally.	Set CH1 Ring length (Un\G2 to 3) to a value between 2 and 2147483648.
1910H	Preset value error	A value other than 0 to the ring length - 1 is set to CH1 Preset value (Un\G10 to 11) when the ring length setting is enabled	• CH with an error: If the count operation is permitted, the count operation continues with the last value. If the error occurs during count permit or it occurs at the timing of count permit, the count operation does not start. • CH other than the CH with an error: Operates normally.	Set CH1 Preset value (Un\G10 to 11) to a value between 0 and ring length - 1.
1920H	Comparison setting value for Y1 output error	A value other than 0 to the ring length - 1 is set to CH1 Comparison setting value for Y1 output (Un\G12 to 13) when the ring length setting is enabled.	• CH with an error: If the count operation is permitted, the count operation continues with the last value. If the error occurs during count permit or it occurs at the timing of count permit, the count operation does not start. • CH other than the CH with an error: Operates normally.	Set CH1 Comparison setting value for Y1 output (Un\G12 to 13) to a value between 0 and the ring length - 1.
1930H	Comparison setting value for Y2 output error	A value other than 0 to the ring length - 1 is set to CH1 Comparison setting value for Y2 output (Un\G14 to 15) when the ring length setting is enabled.	• CH with an error: If the count operation is permitted, the count operation continues with the last value. If the error occurs during count permit or it occurs at the timing of count permit, the count operation does not start. • CH other than the CH with an error: Operates normally.	Set CH1 Comparison setting value for Y2 output (Un\G14 to 15) to a value between 0 and the ring length - 1.
1940H	Current value error	A value other than 0 to the ring length - 1 is set to CH1 Current value (Un\G20 to 21) when the ring length setting is enabled	• CH with an error: If the count operation is permitted, the count operation continues with the last value. If the error occurs during count permit, the count operation does not start. • CH other than the CH with an error: Operates normally.	Set CH1 Current value (Un\G20 to 21) to a value between 0 and the ring length - 1.
1950H	Mode setting error	A value other than 0 to 6 is set to CH1 Pulse input mode (Un\G0).	• CH with an error: The count operation does not start. • CH other than the CH with an error: Operates normally.	Set a value between 0 and 6 to CH1 Pulse input mode (Un\G0), and then turn on CH1 Count permit command (Un\G4.0).
1960H	Counter function setting error	CH1 Counter function selection setting request (Un\G201) is set to 1 (set request) while the count operation is permitted, CH1 Counter function selection start command (Un\G200.0) is on, or function start input is on[*1].	• CH with an error: The count operation does not start. While the count operation is permitted, the count operation continues. Counter function selection operates with the previous setting. • CH other than the CH with an error: Operates normally.	Set CH1 Counter function selection setting request (Un\G201) to 1 (set request) while the count operation is prohibited, CH1 Counter function selection start command (Un\G200.0) is off, and the function start input terminal is off[*1].
1970H	Counter function selection error	While the operation mode is set to pulse density measurement mode or rotational speed measurement mode, a function other than the count disable function is set, and CH1 Counter function selection setting request (Un\G201) is set to 1 (set request).	• CH with an error: The count operation does not start. While the count operation is permitted, the count operation continues. Counter function selection operates with the previous setting. • CH other than the CH with an error: Operates normally.	If the operation mode is set to pulse density measurement mode or rotational speed measurement mode, set the count disable function and set CH1 Counter function selection setting request (Un\G201) to 1 (set request).

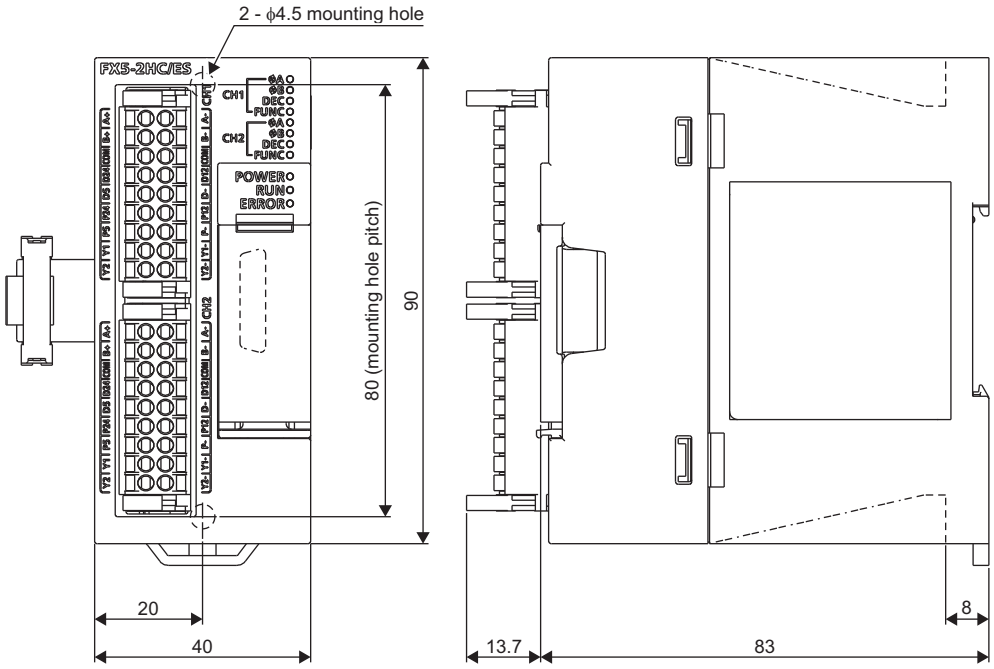
Error code	Error name	Error details and cause	Operation at the occurrence of an error	Action
1980H	Sampling counter function setting error	When the sampling counter function is used with the ring length setting enabled, a value outside the allowable range is set to CH1 Ring length (Un\G2 to 3) while CH1 Counter function selection setting request (Un\G201) is set to 1 (set request) or CH1 Count permit command (Un\G4.0) is on.	• CH with an error: The count operation does not start. During the count operation, the count operation continues. Counter function selection operates with the previous setting. • CH other than the CH with an error: Operates normally.	When using the sampling counter function with the ring length setting enabled, set CH1 Ring length (Un\G2 to 3) to a value greater than or equal to the values shown below, in accordance with CH1 Pulse input mode (Un\G0) and the counting speed setting, and set CH1 Counter function selection setting request (Un\G201) to 1 (set request). Or, turn on CH1 Count permit command (Un\G4.0). ■When CH1 Pulse input mode (Un\G0) is set to the internal clock (1MHz) • 2000 or higher ■When CH1 Pulse input mode (Un\G0) is set to other than the internal clock (1MHz) • When the counting speed setting is 10kHz: 20 or higher • When the counting speed setting is 50kHz: 100 or higher • When the counting speed setting is 100kHz: 200 or higher • When the counting speed setting is 200kHz: 400 or higher • When the counting speed setting is 500kHz: 1000 or higher • When the counting speed setting is 1MHz: 2000 or higher • When the counting speed setting is 2MHz: 4000 or higher
3001H	Hardware error	A hardware failure is detected.	• Processing other than error recovery processing is stopped, output at the coincidence output terminal is turned off, and update of CH1 Terminal status (Un\G27) is stopped. • Module ready (Un\G28.0) is turned off.	Turn off and on the power or reset the CPU module. If the error occurs again, the module may be faulty. Please consult your local Mitsubishi representative.

*1 This is for when CH1 Function start input logic (Un\G223) is set to 0 (positive logic). Replace on with off or vice versa when 1 (negative logic) is set.

APPENDICES

Appendix 1 External Dimensions

This section shows the external dimensions of the FX5-2HC/ES.



(Unit: mm)

Appendix 2 Standards

Compliance with UL and cUL standards

The FX5-2HC/ES complies with UL (UL, cUL) standards.
UL, cUL file number: E95239
For models that comply with UL standards, please consult your local Mitsubishi representative.
Use an external power supply that satisfies the Safety Extra Low Voltage (SELV) and is compliant with Limited Energy Circuit (LIM) or UL 1310 Class 2.

Compliance with EC directive (CE marking)

This document does not guarantee that a mechanical system including this product will comply with the directives described below.
Compliance to EMC directive and LVD directive of the entire mechanical module should be checked by the user/manufacturer. For details, please consult your local Mitsubishi representative.

Requirement for compliance with EMC directive

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

Notice

Use this product under a general industrial environment.

Items of the standards the products meet

Type: Programmable controller (open-type device)
Models: FX5 manufactured during the period below

On and after October 1st, 2023	FX5-2HC/ES

Electromagnetic compatibility (EMC) directive	Remarks
EN61131-2:2007 Programmable controllers - Equipment requirements and tests	Among the following test items, the tests relevant to this product have been conducted. EMI • Radiated emission • Conducted emission EMS • Radiated electromagnetic field • Fast transient burst • Electrostatic discharge • High-energy surge • Voltage drops and interruptions • Conducted RF • Power frequency magnetic field

A

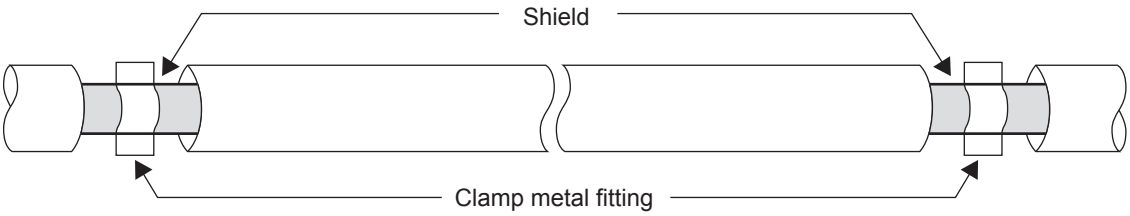
Things to be aware of in regards to compliance with EU directive

When using the FX5-2HC/ES

When using the FX5-2HC/ES, attach a ferrite core to the power supply of the CPU module. The ferrite core must be attached approximately 200mm or closer to the terminal block and the connector of the power cable, by winding the power cable around it by one (2 turns). (Ferrite core used in test by Mitsubishi Electric: E04SR401938 manufactured by SEIWA ELECTRIC MFG. CO., LTD.)

When using a control signal wire

Use a shielded cable of 30m or shorter as a control signal wire, and ground at both ends of the cable. Strip a part of the jacket of the cable as shown below and ground as large area of the exposed shield as possible.



Application for UKCA marking

The requirements for applying for the UKCA marking are the same as those for compliance with the EU directive (CE marking).

Appendix 3 Buffer Memory Areas

The buffer memory is an internal memory of the high-speed counter module that stores data temporarily.
The settings of the buffer memory return to the default (initial value) when the power is turned off and on or the CPU module is reset.

Point

When the CPU module changes from STOP to RUN, the values in the parameter settings of GX Works3 are reflected to the buffer memory. Note that if the buffer memory value was changed by the program, it will return to the parameter setting value.

List of buffer memory addresses

R: Read, W: Write

Buffer memory address Decimal (hexadecimal)		Name	Initial value	R/W
CH1	CH2			
0(0H)	40(28H)	CH1/CH2 pulse input mode	3	R/W
1(1H)	41(29H)	CH1/CH2 count direction switch	0	R/W
2(2H)	42(2AH)	CH1/CH2 ring length [L]	65536	R/W
3(3H)	43(2BH)	CH1/CH2 ring length [H]		
4(4H)	44(2CH)	CH1/CH2 command	0	R/W
5(5H)	45(2DH)	CH1/CH2 ring length setting	0	R/W
10(AH)	50(32H)	CH1/CH2 preset value [L]	0	R/W
11(BH)	51(33H)	CH1/CH2 preset value [H]		
12(CH)	52(34H)	CH1/CH2 comparison setting value for Y1 output [L]	32767	R/W
13(DH)	53(35H)	CH1/CH2 comparison setting value for Y1 output [H]		
14(EH)	54(36H)	CH1/CH2 comparison setting value for Y2 output [L]	32767	R/W
15(FH)	55(37H)	CH1/CH2 comparison setting value for Y2 output [H]		
20(14H)	60(3CH)	CH1/CH2 current value [L]	0	R/W
21(15H)	61(3DH)	CH1/CH2 current value [H]		
22(16H)	62(3EH)	CH1/CH2 maximum count value [L]	0	R
23(17H)	63(3FH)	CH1/CH2 maximum count value [H]		
24(18H)	64(40H)	CH1/CH2 minimum count value [L]	0	R
25(19H)	65(41H)	CH1/CH2 minimum count value [H]		
26(1AH)	66(42H)	CH1/CH2 compare results	0	R
27(1BH)	67(43H)	CH1/CH2 terminal status	0	R
28(1CH)	68(44H)	CH1/CH2 action status	0	R
29(1DH)		Error status	0	R
30(1EH)		Model identification code	63F0H	R
31(1FH)		Firmware version	1000 (For Ver.1.000)	R
33(21H)	73(49H)	CH1/CH2 latest error code	0	R
34(22H)	74(4AH)	CH1/CH2 latest error time	0	R
35(23H)	75(4BH)			
36(24H)	76(4CH)			
37(25H)	77(4DH)			
160(A0H)	170(AAH)	CH1/CH2 coincidence output Y1 interrupt factor detection flag	0	R
161(A1H)	171(ABH)	CH1/CH2 coincidence output Y1 interrupt factor mask	0	R/W
162(A2H)	172(ACH)	CH1/CH2 coincidence output Y1 interrupt factor reset request	0	R/W
163(A3H)	173(ADH)	CH1/CH2 coincidence output Y2 interrupt factor detection flag	0	R
164(A4H)	174(AEH)	CH1/CH2 coincidence output Y2 interrupt factor mask	0	R/W
165(A5H)	175(AFH)	CH1/CH2 coincidence output Y2 interrupt factor reset request	0	R/W
200(C8H)	400(190H)	CH1/CH2 function start command	0	R/W

Buffer memory address Decimal (hexadecimal)		Name	Initial value	R/W
CH1	CH2			
201(C9H)	401(191H)	CH1/CH2 counter function selection setting request	0	R/W
202(CAH)	402(192H)	CH1/CH2 maximum/minimum value setting request	0	R/W
220(DCH)	420(1A4H)	CH1/CH2 preset input logic	0	R/W
222(DEH)	422(1A6H)	CH1/CH2 preset control switch	0	R/W
223(DFH)	423(1A7H)	CH1/CH2 function start input logic	0	R/W
224(E0H)	424(1A8H)	CH1/CH2 measurement mode (phase A)	0	R/W
225(E1H)	425(1A9H)	CH1/CH2 measurement mode (phase B)	0	R/W
228(E4H)	428(1ACH)	CH1/CH2 measurement unit time [L]	1000	R/W
229(E5H)	429(1ADH)	CH1/CH2 measurement unit time [H]		
230(E6H)	430(1AEH)	CH1/CH2 number of pulses per rotation [L]	1000	R/W
231(E7H)	431(1AFH)	CH1/CH2 number of pulses per rotation [H]		
232(E8H)	432(1B0H)	CH1/CH2 counter function selection setting	0	R/W
233(E9H)	433(1B1H)	CH1/CH2 sampling time setting	1	R/W
234(EAH)	434(1B2H)	CH1/CH2 maximum setting value [L]	0	R/W
235(EBH)	435(1B3H)	CH1/CH2 maximum setting value [H]		
236(ECH)	436(1B4H)	CH1/CH2 minimum setting value [L]	0	R/W
237(EDH)	437(1B5H)	CH1/CH2 minimum setting value [H]		
238(EEH)	438(1B6H)	CH1/CH2 pulse width measurement maximum setting value [L]	0	R/W
239(EFH)	439(1B7H)	CH1/CH2 pulse width measurement maximum setting value [H]		
240(F0H)	440(1B8H)	CH1/CH2 pulse width measurement minimum setting value [L]	4294967295	R/W
241(F1H)	441(1B9H)	CH1/CH2 pulse width measurement minimum setting value [H]		
260(104H)	460(1CCH)	CH1/CH2 operating mode monitor	0	R
261(105H)	461(1CDH)	CH1/CH2 counting speed setting monitor	3	R
262(106H)	462(1CEH)	CH1/CH2 preset input response time monitor	1	R
263(107H)	463(1CFH)	CH1/CH2 function start input response time monitor	1	R
264(108H)	464(1D0H)	CH1/CH2 pulse width measurement logic switching (phase A) monitor	0	R
265(109H)	465(1D1H)	CH1/CH2 pulse width measurement logic switching (phase B) monitor	0	R
267(10BH)		CPU error output mode setting monitor	0	R
300(12CH)	500(1F4H)	CH1/CH2 pulse density [L]	0	R
301(12DH)	501(1F5H)	CH1/CH2 pulse density [H]		
302(12EH)	502(1F6H)	CH1/CH2 rotational speed [L]	0	R
303(12FH)	503(1F7H)	CH1/CH2 rotational speed [H]		
304(130H)	504(1F8H)	CH1/CH2 pulse density / rotational speed update flag	0	R/W
306(132H)	506(1FAH)	CH1/CH2 sampling counter flag	0	R
308(134H)	508(1FCH)	CH1/CH2 latch count value [L]	0	R
309(135H)	509(1FDH)	CH1/CH2 latch count value [H]		
310(136H)	510(1FEH)	CH1/CH2 sampling count value [L]	0	R
311(137H)	511(1FFH)	CH1/CH2 sampling count value [H]		
312(138H)	512(200H)	CH1/CH2 counter function update flag	0	R/W
316(13CH)	516(204H)	CH1/CH2 rising edge ring counter value (phase A) [L]	0	R
317(13DH)	517(205H)	CH1/CH2 rising edge ring counter value (phase A) [H]		
318(13EH)	518(206H)	CH1/CH2 rising edge ring counter value (phase B) [L]	0	R
319(13FH)	519(207H)	CH1/CH2 rising edge ring counter value (phase B) [H]		
322(142H)	522(20AH)	CH1/CH2 falling edge ring counter value (phase A) [L]	0	R
323(143H)	523(20BH)	CH1/CH2 falling edge ring counter value (phase A) [H]		
324(144H)	524(20CH)	CH1/CH2 falling edge ring counter value (phase B) [L]	0	R
325(145H)	525(20DH)	CH1/CH2 falling edge ring counter value (phase B) [H]		
328(148H)	528(210H)	CH1/CH2 pulse width latest value (phase A) [L]	0	R
329(149H)	529(211H)	CH1/CH2 pulse width latest value (phase A) [H]		
330(14AH)	530(212H)	CH1/CH2 pulse width latest value (phase B) [L]	0	R
331(14BH)	531(213H)	CH1/CH2 pulse width latest value (phase B) [H]		

Buffer memory address Decimal (hexadecimal)		Name	Initial value	R/W
CH1	CH2			
334(14EH)	534(216H)	CH1/CH2 pulse width maximum value (phase A) [L]	0	R
335(14FH)	535(217H)	CH1/CH2 pulse width maximum value (phase A) [H]		
336(150H)	536(218H)	CH1/CH2 pulse width maximum value (phase B) [L]	0	R
337(151H)	537(219H)	CH1/CH2 pulse width maximum value (phase B) [H]		
340(154H)	540(21CH)	CH1/CH2 pulse width minimum value (phase A) [L]	4294967295	R
341(155H)	541(21DH)	CH1/CH2 pulse width minimum value (phase A) [H]		
342(156H)	542(21EH)	CH1/CH2 pulse width minimum value (phase B) [L]	4294967295	R
343(157H)	543(21FH)	CH1/CH2 pulse width minimum value (phase B) [H]		
346(15AH)	546(222H)	CH1/CH2 period latest value (phase A) [L]	0	R
347(15BH)	547(223H)	CH1/CH2 period latest value (phase A) [H]		
348(15CH)	548(224H)	CH1/CH2 period latest value (phase B) [L]	0	R
349(15DH)	549(225H)	CH1/CH2 period latest value (phase B) [H]		
352(160H)	552(228H)	CH1/CH2 period maximum value (phase A) [L]	0	R
353(161H)	553(229H)	CH1/CH2 period maximum value (phase A) [H]		
354(162H)	554(22AH)	CH1/CH2 period maximum value (phase B) [L]	0	R
355(163H)	555(22BH)	CH1/CH2 period maximum value (phase B) [H]		
358(166H)	558(22EH)	CH1/CH2 period minimum value (phase A) [L]	4294967295	R
359(167H)	559(22FH)	CH1/CH2 period minimum value (phase A) [H]		
360(168H)	560(230H)	CH1/CH2 period minimum value (phase B) [L]	4294967295	R
361(169H)	561(231H)	CH1/CH2 period minimum value (phase B) [H]		
366(16EH)	566(236H)	CH1/CH2 pulse width latest value (phase A) update flag	0	R/W
367(16FH)	567(237H)	CH1/CH2 pulse width latest value (phase B) update flag	0	R/W
369(171H)	569(239H)	CH1/CH2 period latest value (phase A) update flag	0	R/W
370(172H)	570(23AH)	CH1/CH2 period latest value (phase B) update flag	0	R/W

Details of buffer memory areas

This section describes the details of the buffer memory in the high-speed counter module.

CH1/CH2 pulse input mode

This area is used to set the pulse input mode.

Address		Description
CH1	CH2	
Un\G0	Un\G40	• 0: 1-phase 1-input (S/W up/down switch) • 1: 1-phase 1-input (H/W up/down switch) • 2: 1-phase 2-input • 3: 2-phase multiple of 1 • 4: 2-phase multiple of 2 • 5: 2-phase multiple of 4 • 6: Internal clock (1MHz)

- When CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned on, the setting value of this buffer memory becomes effective.
- If a value outside the range is set during count permit, a mode setting error (1950H) occurs and counting does not start.
- If the setting value of the pulse input mode during count permit differs from the mode when count permit was previously enabled, the following buffer memory is initialized before counting starts.

Address		Name
CH1	CH2	
Un\G20 to Un\G21	Un\G60 to Un\G61	CH1/CH2 current value
Un\G22 to Un\G23	Un\G62 to Un\G63	CH1/CH2 maximum count value
Un\G24 to Un\G25	Un\G64 to Un\G65	CH1/CH2 minimum count value
Un\G26	Un\G66	CH1/CH2 compare results
Un\G300 to Un\G301	Un\G500 to Un\G501	CH1/CH2 pulse density
Un\G302 to Un\G303	Un\G502 to Un\G503	CH1/CH2 rotational speed
Un\G304	Un\G504	CH1/CH2 pulse density / rotational speed update flag
Un\G308 to Un\G309	Un\G508 to Un\G509	CH1/CH2 latch count value
Un\G310 to Un\G311	Un\G510 to Un\G511	CH1/CH2 sampling count value
Un\G312	Un\G512	CH1/CH2 counter function update flag

CH1/CH2 count direction switch

This area is used to switch the count direction when using 1-phase 1-input (S/W up/down switch) or the internal clock (1MHz).

Address		Description
CH1	CH2	
Un\G1	Un\G41	• 0: High-speed counter current value increases by 1 when input A phase is on. (Up-counting) • 1: High-speed counter current value decreases by 1 when input A phase is on. (Down-counting)

- The value can be changed while the count operation is permitted
- If the value of this buffer memory is changed, the changed value becomes effective immediately.

CH1/CH2 ring length

This area is used to set the ring length of the high-speed counter.

The value set in this area becomes valid when the CH1/CH2 ring length setting (Un\G5/Un\G45) is set to 1 (enabled).

Address		Setting range
CH1	CH2	
Un\G2 to 3	Un\G42 to 43	2 to 2147483648 (32-bit unsigned binary value)

- If the value of this buffer memory is changed while the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is off, the changed value becomes effective immediately.
- If the value of this buffer memory is changed while the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is on, the changed value is ignored, and operation uses the value when the CH1/ CH2 count permit command (Un\G4.0/Un\G44.0) turned on. The ignored value becomes valid when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned off.
- When the ring length setting value is out of the range, a ring length error (1900H) occurs.
- If a ring length error has occurred during count permit or at the timing of count permit, counting does not start.
- When using the sampling counter function while the ring length setting is enabled, the CH1/CH2 ring length (Un\G2 to 3/ Un\G42 to 43) must be set to the value shown below or larger according to the CH1/CH2 pulse input mode (Un\G0/Un\G40) and the counting speed setting. If a value smaller than the required value is set to count permit, a sampling counter function setting error (1980H) occurs and count operation does not start.

CH1/CH2 pulse input mode	Counting speed setting	CH1/CH2 ring length
When set to the internal clock (1MHz)	—	2000
When set to a value other than the internal clock (1MHz)	10kHz	20
	50kHz	100
	100kHz	200
	200kHz	400
	500kHz	1000
	1MHz	2000
	2MHz	4000

A

CH1/CH2 command

This buffer memory is used to control the high-speed counter module.

Address		Description
CH1	CH2	
Un\G4	Un\G44	Turning on or off each bit controls the high-speed counter module. What each bit controls is shown in the following table.

Bit	Name	Description
b0	CH1/CH2 count permit command	This bit is turned on to count pulses. • OFF: Count prohibit • ON: Count permit
b1	CH1/CH2 Y1 comparison output permit command	This bit is turned on when the comparison result is output to the external terminal Y1. • OFF: Y1 comparison output prohibit • ON: Y1 comparison output permit While this bit is on, if the CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y1 output (Un\G12 to 13/Un\G52 to 53) match, CH1/CH2 external terminal Y1 is turned on. External terminal Y1 can also be turned on or off by the CH1/CH2 Y1 output reset command (Un\G4.9/Un\G44.9) or CH1/CH2 Y1 output set command (Un\G4.B/Un\G44.B).
b2	CH1/CH2 Y2 comparison output permit command	This bit is turned on when the comparison result is output to the external terminal Y2. • OFF: Y2 comparison output prohibit • ON: Y2 comparison output permit While this bit is on, if the CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y2 output (Un\G14 to 15/Un\G54 to 55) match, CH1/CH2 external terminal Y2 is turned on. External terminal Y2 can also be turned on or off by the CH1/CH2 Y2 output reset command (Un\G4.A/Un\G44.A) or CH1/CH2 Y2 output set command (Un\G4.C/Un\G44.C).
b3	CH1/CH2 mutual reset action command	This bit is turned on when external terminals Y1/Y2 are to perform mutual reset actions. (When Y1 turns on, Y2 turns off; and when Y2 turns on, Y1 turns off.) • OFF: Y1 and Y2 operate independently • ON: Mutual reset action Mutual reset action is enabled only when both CH1/CH2 Y1 comparison output permit command (Un\G4.1/Un\G44.1) and CH1/CH2 Y2 comparison output permit command (Un\G4.2/Un\G44.2) are set to "permit".
b4	CH1/CH2 preset permit command	While this bit is on, the preset function from the preset input of the external terminal is enabled. • OFF: Preset prohibit • ON: Preset permit
b5	CH1/CH2 command for whether counter is stopped if PLC is set from RUN to STOP	When the operation mode is set to normal mode, pulse density measurement mode, or rotational speed measurement mode, counting is interrupted when the status of the programmable controller changes from RUN to STOP while this bit is on, and counting continues when this bit is off. • OFF: No action if PLC is set from RUN to STOP • ON: Counter is stopped if PLC is set from RUN to STOP When the status of the programmable controller changes from RUN to STOP while this bit is on, the following buffer memory returns to its initial value. • CH1/CH2 count permit command (Un\G4.0/Un\G44.0) • CH1/CH2 error reset command (Un\G4.8/Un\G44.8) When the operation mode is set to pulse width measurement mode, measurement stops regardless of the on/off status of this bit if the status of the CPU module changes from RUN to STOP. Even when this bit is off, if the status of the programmable controller changes from RUN to STOP, output from external terminals Y1/Y2 is stopped, so the following buffer memory is turned off. • CH1/CH2 Y1 comparison output permit command (Un\G4.1/Un\G44.1) • CH1/CH2 Y2 comparison output permit command (Un\G4.2/Un\G44.2) • CH1/CH2 Y1 output reset command (Un\G4.9/Un\G44.9) • CH1/CH2 Y2 output reset command (Un\G4.A/Un\G44.A) • CH1/CH2 Y1 output set command (Un\G4.B/Un\G44.B) • CH1/CH2 Y2 output set command (Un\G4.C/Un\G44.C) • CH1/CH2 pulse width measurement start command (phase A) (Un\G200.1/Un\G400.1) • CH1/CH2 pulse width measurement start command (phase B) (Un\G200.2/Un\G400.2) When the status of the programmable controller changes from STOP to RUN, the values in the parameter settings of GX Works3 are reflected to the buffer memory.
b6 to b7	Use prohibited	—
b8	CH1/CH2 error reset command	This bit is turned on when resetting an error. • OFF: Ignore • ON: Error reset When the CH1 error reset command is turned on, error status (Un\G29) b1 to b8 and CH1 error flag (Un\G28.F) are turned off; and CH1 latest error code (Un\G33) and CH1 latest error time (Un\G34 to 37) are reset to 0. When the CH2 error reset command is turned on, error status (Un\G29) b8 and b10 to b15 and CH2 error flag (Un\G68.F) are turned off; and CH2 latest error code (Un\G73) and CH2 latest error time (Un\G74 to 77) are reset to 0. After the error is reset, this bit automatically turns off.

Bit	Name	Description
b9	CH1/CH2 Y1 output reset command	This bit is turned on when resetting the output from Y1. • OFF: Ignore • ON: Y1 output reset When this bit is turned on, the output from external terminal Y1 is reset. If this command and CH1/CH2 Y1 output set command (Un\G4.B/Un\G44.B) are turned on at the same time, the output does not change. If one of them is turned on later (when turned on in another scan), the one that was turned on first becomes valid.
b10	CH1/CH2 Y2 output reset command	This bit is turned on when resetting the output from Y2. • OFF: Ignore • ON: Y2 output reset When this bit is turned on, the output from external terminal Y2 is reset. If this command and CH1/CH2 Y2 output set command (Un\G4.C/Un\G44.C) are turned on at the same time, the output does not change. If one of them is turned on later (when turned on in another scan), the one that was turned on first becomes valid.
b11	CH1/CH2 Y1 output set command	This bit is turned on when setting the output from Y1. • OFF: Ignore • ON: Y1 output set When this bit is turned on, the output from external terminal Y1 is set. If this command and CH1/CH2 Y1 output reset command (Un\G4.9/Un\G44.9) are turned on at the same time, the output does not change. If one of them is turned on later (when turned on in another scan), the one that was turned on first becomes valid. Even when CH1/CH2 Y1 comparison output permit command (Un\G4.1/Un\G44.1) is off, Y1 output is turned on if this bit turns on.
b12	CH1/CH2 Y2 output set command	This bit is turned on when setting the output from Y2. • OFF: Ignore • ON: Y2 output set When this bit is turned on, the output from external terminal Y2 is set. If this command and CH1/CH2 Y2 output reset command (Un\G4.A/Un\G44.A) are turned on at the same time, the output does not change. If one of them is turned on later (when turned on in another scan), the one that was turned on first becomes valid. Even when CH1/CH2 Y2 comparison output permit command (Un\G4.2/Un\G44.2) is off, Y2 output is turned on if this bit turns on.
b13 to b15	Use prohibited	—

Point

- Buffer memory other than CH1/CH2 preset permit command (Un\G4.4/Un\G44.4) can be changed even while the count operation is permitted.
- CH1/CH2 preset permit command (Un\G4.4/Un\G44.4) can only be changed while the count operation is prohibited. If the setting is changed while the count operation is permitted, the changes become enabled after the count operation is prohibited.

CH1/CH2 ring length setting

This area is used to enable or disable the ring length setting for ring counters.

Address		Description
CH1	CH2	
Un\G5	Un\G45	• 0: Ring length setting for a ring counter is disabled (counts in the range of -2147483648 to 2147483647). • 1: Ring length setting for a ring counter is enabled (counts in the range of 0 to ring length -1).

- If the value of this buffer memory is changed while the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is off, the changed value becomes effective immediately.
- If the value of this buffer memory is changed while the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is on, the changed value is ignored, and operation uses the value when the CH1/ CH2 count permit command (Un\G4.0/Un\G44.0) turned on. The ignored value becomes valid when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned off.
- If the operation mode is set to pulse density measurement mode or rotational speed measurement mode, the ring length setting is disabled.

CH1/CH2 preset value

This area is used to set the values to store in the current values when presets are executed.

Address		Setting range
CH1	CH2	
Un\G10 to 11	Un\G50 to 51	-2147483648 to 2147483647 (32-bit signed binary value)

- If the value of this buffer memory is changed, the changed value becomes effective immediately.
- The value can also be changed while the count operation is permitted.
- A preset value error (1910H) occurs when CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the preset value.
- If a preset value error occurs during count permit or if it occurs at the timing of count permit, the count operation does not start.
- If a preset value error occurs during count permit, the changed value is ignored and counting continues with the previous value.

CH1/CH2 comparison setting value for Y1 output

This area is used to write comparison setting value for Y1 output for comparison with the current value of the counter.

Address		Setting range
CH1	CH2	
Un\G12 to 13	Un\G52 to 53	-2147483648 to 2147483647 (32-bit signed binary value)

- If the value of this buffer memory is changed, the changed value becomes effective immediately.
- The value can also be changed while the count operation is permitted.
- When CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the comparison setting value for Y1, a comparison setting value for Y1 output error (1920H) occurs.
- If a comparison setting value for Y1 output error occurs during count permit or if it occurs at the timing of count permit, counting does not start.
- If a comparison setting for Y1 output error occurs during count permit, the changed value is ignored and counting continues with the previous value.

CH1/CH2 comparison setting value for Y2 output

This area is used to write comparison setting value for Y2 output for comparison with the current value of the counter.

Address		Setting range
CH1	CH2	
Un\G14 to 15	Un\G54 to 55	-2147483648 to 2147483647 (32-bit signed binary value)

- If the value of this buffer memory is changed, the changed value becomes effective immediately.
- The value can also be changed while the count operation is permitted.
- When CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the comparison setting value for Y2 output, a comparison setting value for Y2 output error (1930H) occurs.
- If a comparison setting value for Y2 output error occurs during count permit or if it occurs at the timing of count permit, counting does not start.
- If a comparison setting for Y2 output error occurs during count permit, the changed value is ignored and counting continues with the previous value.

CH1/CH2 current value

This area stores the current value of the high speed counter.

The signed 32-bit ring counter changes from the upper limit value +1 to the lower limit value and from the lower limit value -1 to the upper limit value.

Address		Description
CH1	CH2	
Un\G20 to 21	Un\G60 to 61	• When the ring length is not set: lower limit value = -2147483648, upper limit value = 2147483647 • When the ring length is set: lower limit value = 0, upper limit value = ring length -1

- The current value can be rewritten by the user program.
- Since the current value is 32-bit signed binary data, read and write in batches of 2 words.
- If the value of this buffer memory is changed, the changed value becomes effective immediately.
- The value can also be changed while the count operation is permitted.
- A current value error (1940H) occurs when CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the current value.
- If a current value error occurs during count permit, counting does not start.
- When the conditions causing the current value error to occur are satisfied at count permit, the count operation starts with the current value changed.
- If a current value error occurs during count permit, the changed value is ignored and counting continues with the previous value.

CH1/CH2 maximum count value

This area stores the maximum count value of the high-speed counter.

Address		Description
CH1	CH2	
Un\G22 to 23	Un\G62 to 63	High-speed counter maximum value

- The maximum count value can be rewritten by the user program. Set a value to CH1/CH2 maximum setting value (Un\G234 to 235/Un\G434 to 435), and turn on b0 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).
- The value can also be changed while the count operation is permitted.
- When CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 is written, then 0 is set.

CH1/CH2 minimum count value

This area stores the minimum count value of the high-speed counter.

Address		Description
CH1	CH2	
Un\G24 to 25	Un\G64 to 65	High-speed counter minimum value

- The minimum count value can be rewritten by the user program. Set a value to CH1/CH2 minimum setting value (Un\G236 to 237/Un\G436 to 437), and turn on b1 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).
- The value can also be changed while the count operation is permitted.
- When CH1/CH2 ring length setting (Un\G5/Un\G45) is 1 (enabled) and a value less than 0 is written, then 0 is set.

CH1/CH2 compare results

This buffer memory is used to check the comparison result of the high-speed counter module.

Address		Description
CH1	CH2	
Un\G26	Un\G66	Check the comparison result of the high-speed counter module by on or off status of each bit. Each bit is described in the following table.

Bit	Name	Description
b0	CH1/CH2 Y1 current value small	■ON • When CH1 current value (Un\G20 to 21) < CH1 comparison setting value for Y1 output (Un\G12 to 13) • When CH2 current value (Un\G60 to 61) < CH2 comparison setting value for Y1 output (Un\G52 to 53) ■OFF • When CH1 current value ≥ CH1 comparison setting value for Y1 output • When CH2 current value ≥ CH2 comparison setting value for Y1 output
b1	CH1/CH2 Y1 current value matched	■ON • When CH1 current value (Un\G20 to 21) = CH1 comparison setting value for Y1 output (Un\G12 to 13) • When CH2 current value (Un\G60 to 61) = CH2 comparison setting value for Y1 output (Un\G52 to 53) ■OFF • When CH1 current value ≠ CH1 comparison setting value for Y1 output • When CH2 current value ≠ CH2 comparison setting value for Y1 output
b2	CH1/CH2 Y1 current value large	■ON • When CH1 current value (Un\G20 to 21) > CH1 comparison setting value for Y1 output (Un\G12 to 13) • When CH2 current value (Un\G60 to 61) > CH2 comparison setting value for Y1 output (Un\G52 to 53) ■OFF • When CH1 current value ≤ CH1 comparison setting value for Y1 output • When CH2 current value ≤ CH2 comparison setting value for Y1 output
b3	CH1/CH2 Y2 current value small	■ON • When CH1 current value (Un\G20 to 21) < CH1 comparison setting value for Y2 output (Un\G14 to 15) • When CH2 current value (Un\G60 to 61) < CH2 comparison setting value for Y2 output (Un\G54 to 55) ■OFF • When CH1 current value ≥ CH1 comparison setting value for Y2 output • When CH2 current value ≥ CH2 comparison setting value for Y2 output
b4	CH1/CH2 Y2 current value matched	■ON • When CH1 current value (Un\G20 to 21) = CH1 comparison setting value for Y2 output (Un\G14 to 15) • When CH2 current value (Un\G60 to 61) = CH2 comparison setting value for Y2 output (Un\G54 to 55) ■OFF • When CH1 current value ≠ CH1 comparison setting value for Y2 output • When CH2 current value ≠ CH2 comparison setting value for Y2 output
b5	CH1/CH2 Y2 current value large	■ON • When CH1 current value (Un\G20 to 21) > CH1 comparison setting value for Y2 output (Un\G14 to 15) • When CH2 current value (Un\G60 to 61) > CH2 comparison setting value for Y2 output (Un\G54 to 55) ■OFF • When CH1 current value ≤ CH1 comparison setting value for Y2 output • When CH2 current value ≤ CH2 comparison setting value for Y2 output
b6 to b15	Use prohibited	—

CH1/CH2 terminal status

This buffer memory is used to check the terminal status of the high-speed counter module.

Address		Description
CH1	CH2	
Un\G27	Un\G67	Check the terminal status of the high-speed counter module by on or off status of each bit. Each bit is described in the following table.

Bit	Name	Description
b0	CH1/CH2 preset input	Indicates the ON/OFF status of the external terminal preset input.
b1	CH1/CH2 function start input	Indicates the ON/OFF status of the external terminal function start input.
b2	CH1/CH2 Y1 output	Indicates the ON/OFF status of external terminal Y1.
b3	CH1/CH2 Y2 output	Indicates the ON/OFF status of external terminal Y2.
b4 to b15	Use prohibited	—

CH1/CH2 action status

This buffer memory is used to check the operating status of the high-speed counter module.

Address		Description
CH1	CH2	
Un\G28	Un\G68	Check the operating status of the high-speed counter module by on or off status of each bit. Each bit is described in the following table.

Bit	Name	Description
b0	Module ready (Use of Un\G68 is prohibited.)	This bit turns on when the high-speed counter module is ready for counting operations after the CPU module is powered on or is reset. When off, pulses are not counted.
b1	CH1/CH2 in operation	This area is used to monitor the operating status of the high-speed counters. • OFF: High-speed counter stopped • ON: High-speed counter operating ON is stored when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned on to start counting, and OFF is stored when the command is turned off to stop counting.
b2	CH1/CH2 pulse density/ rotational speed being measured	This area is used to monitor the operation of the high-speed counter when using pulse density/rotational speed measurement mode. • OFF: Pulse density/rotational speed measurement mode stopped • ON: Pulse density/rotational speed measurement mode operating With the operation mode set to the pulse density/rotational speed measurement mode in the parameters, ON is stored if the pulse density/rotational speed measurement is started when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned on, or OFF is stored if the pulse density/rotational speed measurement is stopped when the command is turned off.
b3	CH1/CH2 counting direction monitoring	This area is used to monitor the count direction. • OFF: High-speed counter counting in direction whereby current value is increased (up-counting) • ON: High-speed counter counting in direction whereby current value is decreased (down-counting)
b4	CH1/CH2 pulse width measurement status flag (phase A)	This area is used to monitor the measurement in progress/measurement stopped status of phase A pulse width measurement. • OFF: Pulse width measurement stopped • ON: Pulse width measurement in progress ON is stored when the CH1/CH2 pulse width measurement start command (phase A) (Un\G200.1/Un\G400.1) is turned on to start measurement, and OFF (measurement stopped) is stored when the command is turned off to stop the measurement. In one-time measurement mode, it turns off when the measurement is completed.
b5	CH1/CH2 pulse width measurement status flag (phase B)	This area is used to monitor the measurement in progress/measurement stopped status of phase B pulse width measurement. • OFF: Pulse width measurement stopped • ON: Pulse width measurement in progress ON is stored when the CH1/CH2 pulse width measurement start command (phase B) (Un\G200.2/Un\G400.2) is turned on to start measurement, and OFF is stored when the command is turned off to stop the measurement. In one-time measurement mode, it turns off when the measurement is completed.
b6	Use prohibited	—
b7	CH1/CH2 period measurement completed (phase A)	This area is used to monitor the completion status of phase A period measurement. • OFF: Period measurement not completed • ON: Period measurement completed OFF is stored when the CH1/CH2 pulse width measurement start command (phase A) (Un\G200.1/Un\G400.1) is turned on to start measurement, and ON is stored when the first period measurement is completed. During measurement in the always measurement mode, it stays ON.

Bit	Name	Description
b8	CH1/CH2 period measurement completed (phase B)	This area is used to monitor the completion status of phase B period measurement. • OFF: Period measurement not completed • ON: Period measurement completed OFF is stored when the CH1/CH2 pulse width measurement start command (phase B) (Un\G200.2/Un\G400.2) is turned on to start measurement, and ON is stored when the first period measurement is completed. During measurement in the always measurement mode, it stays ON.
b9	Use prohibited	—
b10	CH1/CH2 pulse width measurement completed (phase A)	This area is used to monitor the completion status of phase A pulse width measurement. • OFF: Pulse width measurement not completed • ON: Pulse width measurement completed OFF is stored when the CH1/CH2 pulse width measurement start command (phase A) (Un\G200.1/Un\G400.1) is turned on to start measurement, and ON is stored when the first pulse width measurement is completed. During measurement in the always measurement mode, it stays ON.
b11	CH1/CH2 pulse width measurement completed (phase B)	This area is used to monitor the completion status of phase B pulse width measurement. • OFF: Pulse width measurement not completed • ON: Pulse width measurement completed OFF is stored when the CH1/CH2 pulse width measurement start command (phase B) (Un\G200.2/Un\G400.2) is turned on to start measurement, and ON is stored when the first pulse width measurement is completed. During measurement in the always measurement mode, it stays ON.
b12 to b14	Use prohibited	—
b15	CH1/CH2 error flag	This area is used to detect and store high-speed counter errors. • OFF: No error • ON: Error ON is stored when a CH1/CH2 error or an error shared by all CH has occurred. OFF is stored when the CH1/CH2 error reset command (Un\G4.8/Un\G44.8) turns on.

Error status

This buffer memory is used to check the error status of the high-speed counter module.

Address	Description
Un\G29	Check the error status of the high-speed counter module by on or off status of each bit. Each bit is described in the following table.

Bit	Name	Description
b0	Error flag	This area is used to detect and store high-speed counter errors. • OFF: No error • ON: Error ON is stored when any of b1 to b15 of Un\G29 is on. OFF is stored when all the values of b1 to b15 of Un\G29 turn off by turning on of the CH1/CH2 error reset command (Un\G4.8/Un\G44.8).
b1	CH1 set when the value of the ring length is written incorrectly	This area is used to detect and store write errors of CH1 ring length (Un\G2 to 3) of the high-speed counter. • OFF: No ring length write error • ON: Ring length write error occurred ON is stored when a ring length write error is detected (when the ring length setting value is out of range). OFF is stored when the CH1 error reset command (Un\G4.8) turns on.
b2	CH1 set when the preset value is written incorrectly	This area is used to detect and store write errors of CH1 preset value (Un\G10 to 11) of the high-speed counter. • OFF: No preset value write error • ON: Preset value write error occurred ON is stored when a preset value write error is detected (when CH1 ring length setting (Un\G5) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the preset value). OFF is stored when the CH1 error reset command (Un\G4.8) turns on.
b3	CH1 set when the compare value is written incorrectly	This area is used to detect and store write errors of CH1 comparison setting value for Y1 output (Un\G12 to 13) and CH1 comparison setting value for Y2 output (Un\G14 to 15) of the high-speed counter. • OFF: No setting value write error • ON: Setting value write error occurred ON is stored when a setting value write error is detected (when CH1 ring length setting (Un\G5) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the comparison setting value for Y1/Y2 output). OFF is stored when the CH1 error reset command (Un\G4.8) turns on.
b4	CH1 set when the current value is written incorrectly	This area is used to detect and store write errors of CH1 current value (Un\G20 to 21) of the high-speed counter. • OFF: No current value write error • ON: Current value write error occurred ON is stored when a current value write error is detected (when CH1 ring length setting (Un\G5) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the current value). OFF is stored when the CH1 error reset command (Un\G4.8) turns on.

Bit	Name	Description
b5	CH1 overflow	This area is used to detect and store overflow of the counter value of the high-speed counter. • OFF: No overflow • ON: Overflow occurred (current value counted = maximum positive value +1) ON is stored when overflow is detected. OFF is stored when the CH1 error reset command (Un\G4.8) turns on. • This area does not operate when CH1 ring length setting (Un\G5) is 1 (enabled). • If an overflow occurs, counting does not stop and the ERROR LED does not turn on.
b6	CH1 underflow	This area is used to detect and store underflow of the counter value of the high-speed counter. • OFF: No underflow • ON: Underflow occurred (current value counted = maximum negative value -1) ON is stored when underflow is detected. OFF is stored when the CH1 error reset command (Un\G4.8) turns on. • This area does not operate when CH1 ring length setting (Un\G5) is 1 (enabled). • If an underflow occurs, counting does not stop and the ERROR LED does not turn on.
b7	Use prohibited	—
b8	Mode setting error	This area is used to detect and store mode setting errors of the high-speed counter. • OFF: No mode setting error • ON: Mode setting error ON is stored when a mode setting error is detected (when CH1/CH2 pulse input mode (Un\G0/Un\G40) is set to a value other than 0 to 6). OFF is stored when the CH1/CH2 error reset command (Un\G4.8/Un\G44.8) turns on.
b9	Hardware error	This area is used to detect and store hardware errors of the high-speed counter. • OFF: No hardware error • ON: Hardware error ON is stored when a hardware error is detected. Even if the CH1/CH2 error reset command (Un\G4.8/Un\G44.8) is turned on, it cannot be turned off. If a hardware error occurs, the RUN LED turns off and the ERROR LED flashes.
b10	CH2 set when the value of the ring length is written incorrectly	This area is used to detect and store write errors of CH2 ring length (Un\G42 to 43) of the high-speed counter. • OFF: No ring length write error • ON: Ring length write error occurred ON is stored when a ring length write error is detected (when the ring length setting value is out of range). OFF is stored when the CH2 error reset command (Un\G44.8) turns on.
b11	CH2 set when the preset value is written incorrectly	This area is used to detect and store write errors of CH2 preset value (Un\G50 to 51) of the high-speed counter. • OFF: No preset value write error • ON: Preset value write error occurred ON is stored when a preset value write error is detected (when CH2 ring length setting (Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the preset value). OFF is stored when the CH2 error reset command (Un\G44.8) turns on.
b12	CH2 set when the compare value is written incorrectly	This area is used to detect and store write errors of CH2 comparison setting value for Y1 output (Un\G52 to 53) and CH2 comparison setting value for Y2 output (Un\G54 to 55) of the high-speed counter. • OFF: No setting value write error • ON: Setting value write error occurred ON is stored when a setting value write error is detected (when CH2 ring length setting (Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the comparison setting value for Y1/Y2 output). OFF is stored when the CH2 error reset command (Un\G44.8) turns on.
b13	CH2 set when the current value is written incorrectly	This area is used to detect and store write errors of CH2 current value (Un\G60 to 61) of the high-speed counter. • OFF: No current value write error • ON: Current value write error occurred ON is stored when a current value write error is detected (when CH2 ring length setting (Un\G45) is 1 (enabled) and a value less than 0 or a value greater than or equal to the ring length is set as the current value). OFF is stored when the CH2 error reset command (Un\G44.8) turns on.
b14	CH2 overflow	This area is used to detect and store overflow of the counter value of the high-speed counter. • OFF: No overflow • ON: Overflow occurred (current value counted = maximum positive value +1) ON is stored when overflow is detected. OFF is stored when the CH2 error reset command (Un\G44.8) turns on. • This area does not operate when CH2 ring length setting (Un\G45) is 1 (enabled). • If an overflow occurs, counting does not stop and the ERROR LED does not turn on.
b15	CH2 underflow	This area is used to detect and store underflow of the counter value of the high-speed counter. • OFF: No underflow • ON: Underflow occurred (current value counted = maximum negative value -1) ON is stored when underflow is detected. OFF is stored when the CH2 error reset command (Un\G44.8) turns on. • This area does not operate when CH2 ring length setting (Un\G45) is 1 (enabled). • If an underflow occurs, counting does not stop and the ERROR LED does not turn on.

Model identification code

The model identification code of the high-speed counter module is stored.

Address	Description
Un\G30	63F0H

Firmware version

The firmware version of the high-speed counter module is stored.

Address	Description
Un\G31	For Ver.1.000: 1000

CH1/CH2 latest error code

The latest error code that occurred in the high-speed counter module is stored.

Address		Description
CH1	CH2	
Un\G33	Un\G73	Latest error code (when normal: 0)

To reset this buffer memory, use CH1/CH2 error reset command (Un\G4.8/Un\G44.8).

For error code details, refer to the following.

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CH1/CH2 latest error time

The time when the latest error occurred in the high-speed counter module is stored in BCD code.

To reset this buffer memory, use CH1/CH2 error reset command (Un\G4.8/Un\G44.8).

Address		Description	Example
CH1	CH2		
Un\G34	Un\G74	b15 … b8 b7 … b0 Year (00H to 99H) first two digits of the year | Year (00H to 99H) last two digits of the year	2023H → 2023
Un\G35	Un\G75	b15 … b8 b7 … b0 Month (01H to 12H) | Day (01H to 31H)	1030H → October 30
Un\G36	Un\G76	b15 … b8 b7 … b0 Hour (00H to 23H) | Minute (00H to 59H)	0935H → 9:35
Un\G37	Un\G77	b15 … b8 b7 … b0 Second (00H to 59H) | Day of week (0 (Sunday) to 6 (Saturday))	1703H → 17 seconds, Wednesday

CH1/CH2 coincidence output Y1 interrupt factor detection flag

This area stores the detection status of interrupt factors.

Address		Description
CH1	CH2	
Un\G160	Un\G170	• 0: No interrupt factor detected • 1: Interrupt factor detected

- If CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y1 output (Un\G12 to 13/Un\G52 to 53) match, 1 is stored. However, if they match when CH1/CH2 Y1 comparison output permit command (Un\G4.1/Un\G44.1) is off (Y1 comparison output prohibited) and CH1/CH2 coincidence output Y1 interrupt factor mask (Un\G161/Un\G171) is 0 (mask), the value remains 0 (no interrupt factor detected).
- 0 is stored by setting 1H (reset request) to CH1/CH2 coincidence output Y1 interrupt factor reset request (Un\G162/Un\G172).

CH1/CH2 coincidence output Y1 interrupt factor mask

This area is used to set a mask for interrupt factors.

Address		Description
CH1	CH2	
Un\G161	Un\G171	• 0: Mask (do not use interrupt) • 1: Unmask (use interrupt)

- If 1 is set, when CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y1 output (Un\G12 to 13/Un\G52 to 53) match, an interrupt request is issued to the CPU module.

CH1/CH2 coincidence output Y1 interrupt factor reset request

This area is used to set the reset requests for interrupt factors.

Address		Description
CH1	CH2	
Un\G162	Un\G172	• 0: No reset request • 1: Reset request

- If 1 is set, the interrupt factor is reset.
- When acceptance of the interrupt factor reset request is completed, 0 is automatically stored. Storing 0 indicates completion of acceptance of the interrupt factor reset request.

CH1/CH2 coincidence output Y2 interrupt factor detection flag

This area stores the detection status of interrupt factors.

Address		Description
CH1	CH2	
Un\G163	Un\G173	• 0: No interrupt factor detected • 1: Interrupt factor detected

- If CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y2 output (Un\G14 to 15/Un\G54 to 55) match, 1 is stored. However, if they match when CH1/CH2 Y2 comparison output permit command (Un\G4.2/Un\G44.2) is off (Y2 comparison output prohibited) and CH1/CH2 coincidence output Y2 interrupt factor mask (Un\G164/Un\G174) is 0 (mask), the value remains 0 (no interrupt factor detected).
- 0 is stored by setting 1 (reset request) to CH1/CH2 coincidence output Y2 interrupt factor reset request (Un\G165/Un\G175).

CH1/CH2 coincidence output Y2 interrupt factor mask

This area is used to set a mask for interrupt factors.

Address		Description
CH1	CH2	
Un\G164	Un\G174	• 0: Mask (do not use interrupt) • 1: Unmask (use interrupt)

- If 1 is set, when CH1/CH2 current value (Un\G20 to 21/Un\G60 to 61) and CH1/CH2 comparison setting value for Y2 output (Un\G14 to 15/Un\G54 to 55) match, an interrupt request is issued to the CPU module.

CH1/CH2 coincidence output Y2 interrupt factor reset request

This area is used to set the reset requests for interrupt factors.

Address		Description
CH1	CH2	
Un\G165	Un\G175	• 0: No reset request • 1: Reset request

- If 1 is set, the interrupt factor is reset.
- When acceptance of the interrupt factor reset request is completed, 0 is automatically stored. Storing 0 indicates completion of acceptance of the interrupt factor reset request.

CH1/CH2 function start command

This buffer memory is used to control the high-speed counter module.

Address		Description
CH1	CH2	
Un\G200	Un\G400	Turning on or off each bit controls the high-speed counter module. What each bit controls is shown in the following table.

Bit	Name	Description
b0	CH1/CH2 counter function selection start command	This bit is turned on to execute the counter function selection. The operation timing differs depending on the function used. ■Latch counter function, sampling counter function • When this bit is turned on while the operation timing is edge detection, the latch and sampling counters are started. ■Count disable function • When the operation timing is level detection, count is disabled when this bit is on.
b1	CH1/CH2 pulse width measurement start command (phase A)	This bit is turned on when executing pulse width measurement of phase A. • OFF: Measurement stopped • ON: Start measurement
b2	CH1/CH2 pulse width measurement start command (phase B)	This bit is turned on when executing pulse width measurement of phase B. • OFF: Measurement stopped • ON: Start measurement
b3 to b15	Use prohibited	—

CH1/CH2 counter function selection setting request

This area is used to set the setting request of counter function selection.

Address		Description
CH1	CH2	
Un\G201	Un\G401	• 0: No setting request • 1: Setting request

- If 1 is set, set the counter function selection setting.
- When the counter function selection setting is completed, 0 is automatically stored. Storing 0 indicates completion of the counter function selection setting.
- If the counter function has been changed, set this buffer memory to 1 while the count operation is prohibited, the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) is off, and the function start input terminal is also off[*1] to enable the change. While the count operation is permitted, if this buffer memory is set to 1 while the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) is on or the function start input is on[*1], a counter function setting error (1960H) occurs.
- If the operation mode is set to pulse density measurement mode or rotational speed measurement mode, only the count disable function can be used. If this buffer memory is set to 1 by using a function other than the count disable function, a counter function selection error (1970H) will occur.
- When using the sampling counter function while the ring length setting is enabled, the CH1/CH2 ring length (Un\G2 to 3/Un\G42 to 43) must be set to the specified value or larger in accordance with the CH1/CH2 pulse input mode (Un\G0/Un\G40) and the counting speed setting. (☞ Page 93 CH1/CH2 ring length)

*1 This is for when CH1/CH2 function start input logic (Un\G223/Un\G423) is set to 0 (positive logic). Replace on with off and vice versa when 1 (negative logic) is set.

CH1/CH2 maximum/minimum value setting request

This area is used to set the maximum/minimum value setting request.

Address		Description
CH1	CH2	
Un\G202	Un\G402	Set the setting request by turning on or off each bit. • ON: Setting request • OFF: No setting request Each bit is described in the following table.

Bit	Setting target	Description
b0*1	CH1/CH2 maximum count value	If this bit is set to ON, the values set in CH1/CH2 maximum setting value (Un\G234 to 235/Un\G434 to 435) are set in the buffer memory indicated in the setting target.
b1*1	CH1/CH2 minimum count value	If this bit is set to ON, the values set in CH1/CH2 minimum setting value (Un\G236 to 237/Un\G436 to 437) are set in the buffer memory indicated in the setting target.
b2*2	CH1/CH2 pulse width maximum value (phase A)	If this bit is set to ON, the values set in CH1/CH2 pulse width measurement maximum setting value (Un\G238 to 239/Un\G438 to 439) are set in the buffer memory indicated in the setting target.
b3*2	CH1/CH2 pulse width maximum value (phase B)	
b4	—	Use prohibited
b5*2	CH1/CH2 pulse width minimum value (phase A)	If this bit is set to ON, the values set in CH1/CH2 pulse width measurement minimum setting value (Un\G240 to 241/Un\G440 to 441) are set in the buffer memory indicated in the setting target.
b6*2	CH1/CH2 pulse width minimum value (phase B)	
b7	—	Use prohibited
b8*2	CH1/CH2 period maximum value (phase A)	If this bit is set to ON, the values set in CH1/CH2 pulse width measurement maximum setting value (Un\G238 to 239/Un\G438 to 439) are set in the buffer memory indicated in the setting target.
b9*2	CH1/CH2 period maximum value (phase B)	
b10	—	Use prohibited
b11*2	CH1/CH2 period minimum value (phase A)	If this bit is set to ON, the values set in CH1/CH2 pulse width measurement minimum setting value (Un\G240 to 241/Un\G440 to 441) are set in the buffer memory indicated in the setting target.
b12*2	CH1/CH2 period minimum value (phase B)	
b13 to b15	—	Use prohibited

*1 Valid when CH1/CH2 operating mode monitor (Un\G260/Un\G460) is 0 (normal mode), 1 (pulse density measurement mode), or 2 (rotational speed measurement mode)

*2 Valid when CH1/CH2 operating mode monitor (Un\G260/Un\G460) is 3 (pulse width measurement mode)

- The setting request can turn on multiple bits at the same time and set the maximum/minimum value.
- When the maximum/minimum value setting is completed, OFF is automatically stored. Storing OFF indicates completion of maximum/minimum value setting.

CH1/CH2 preset input logic

This area is used to set the preset input logic.

Address		Description
CH1	CH2	
Un\G220	Un\G420	• 0: The preset input operates with positive logic. • 1: The preset input operates with negative logic.

- The timing to execute the preset is determined by the preset input logic and the preset control switch. (☞ Page 107 CH1/CH2 preset control switch)
- The setting value of this buffer memory becomes valid when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned from off to on. If count permit has not been enabled even once, it operates with the value set in the parameters of GX Works3.

CH1/CH2 preset control switch

This area is used to set the preset input operation.

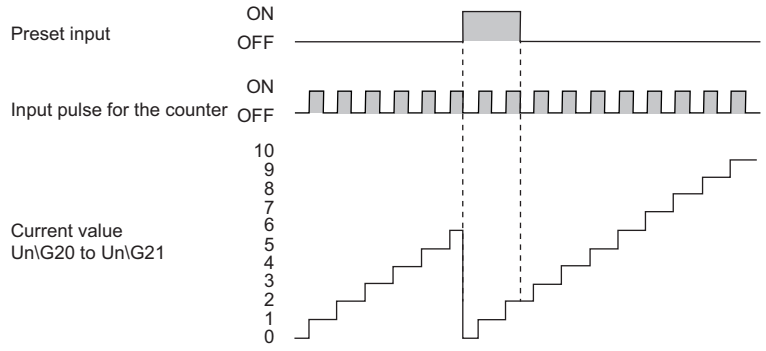
Address		Description
CH1	CH2	
Un\G222	Un\G422	• 0: Rising edge • 1: Falling edge • 2: Rising + Falling edge • 3: Constant when ON

- The setting value of this buffer memory becomes valid when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned from off to on. If count permit has not been enabled even once, it operates with the value set in the parameters of GX Works3.

■Timing to execute the preset determined by the preset control switch

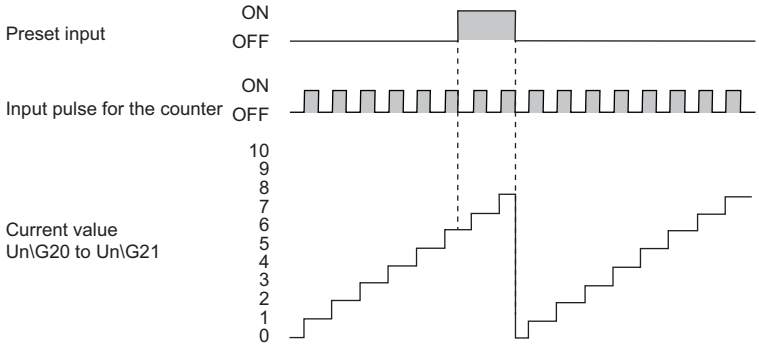
Explanation is provided assuming that the CH1 preset value is 0 and the preset input logic is set to positive logic. Replace ON with OFF and vice versa for the preset input when negative logic is set.

- Rising edge



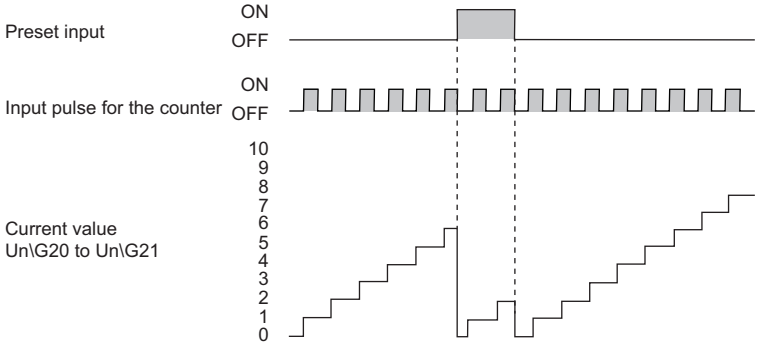
The preset is executed when the preset input changes OFF→ON.

- Falling edge



The preset is executed when the preset input changes ON→OFF.

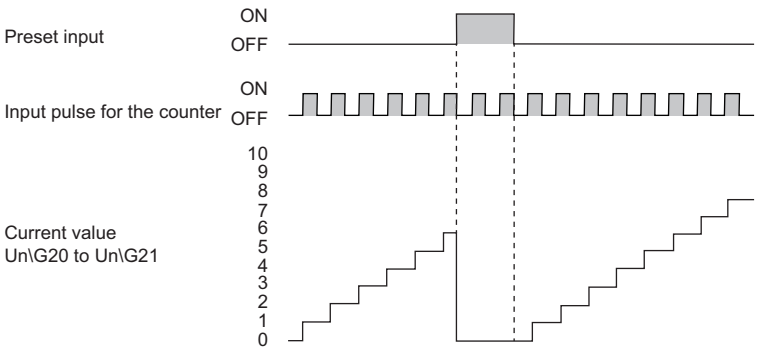
- Rising + Falling edge



The preset is executed when the preset input changes OFF→ON and when it changes ON→OFF.

A

• Constant when ON



The preset is constantly executed while the preset input is ON.

CH1/CH2 function start input logic

This area is used to set the logic of the function start input.

Address		Description
CH1	CH2	
Un\G223	Un\G423	• 0: Function start input operates as positive logic. • 1: Function start input operates as negative logic.

• The setting value of this buffer memory becomes valid when the CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned from off to on. If count permit has not been enabled even once, it operates with the value set in the parameters of GX Works3.

CH1/CH2 measurement mode

This area is used to set the measurement mode for pulse width measurement.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G224	Un\G225	Un\G424	Un\G425	• 0: Continuous measurement mode • 1: One-time measurement mode

The measurement mode is applied when measurement is started by the following command. If the measurement mode is changed during measurement, operation in the measurement mode after the change begins when the next measurement is started.

• CH1 pulse width measurement start command (phase A) (Un\G200.1)
• CH1 pulse width measurement start command (phase B) (Un\G200.2)
• CH2 pulse width measurement start command (phase A) (Un\G400.1)
• CH2 pulse width measurement start command (phase B) (Un\G400.2)

CH1/CH2 measurement unit time

This area is used to set the measurement unit time when operating in pulse density measurement mode/rotational speed measurement mode.

Address		Setting range
CH1	CH2	
Un\G228 to 229	Un\G428 to 429	1 to 2147483647 (ms)

• When CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned on, the setting value of this buffer memory becomes effective.
• If the value is modified while the count operation is permitted, the modified value is reflected after the measurement before the value was modified is finished.
• If the setting value is less than or equal to the lower limit value or greater than or equal to the upper limit value, the lower limit value or upper limit value will be used as the measurement unit time. (The buffer memory value remains the value set by the user, and only the operation is rounded.)

CH1/CH2 number of pulses per rotation

This area is used to set the number of pulses per rotation for rotational speed measurement.

Address		Setting range
CH1	CH2	
Un\G230 to 231	Un\G430 to 431	1 to 2147483647 (pulse)

- When CH1/CH2 count permit command (Un\G4.0/Un\G44.0) is turned on, the setting value of this buffer memory becomes effective.
- If the value is modified while the count operation is permitted, the modified value is reflected after the measurement before the value was modified is finished.
- If the setting value is less than or equal to the lower limit value or greater than or equal to the upper limit value, the lower limit value or upper limit value will be used as the number of pulses per rotation. (The buffer memory value remains the value set by the user, and only the operation is rounded.)

CH1/CH2 counter function selection setting

A value to select the counter function is stored in this area.

Address		Setting range
CH1	CH2	
Un\G232	Un\G432	• 0: Count disable function • 1: Latch counter function • 2: Sampling counter function

- If the counter function has been changed, set CH1/CH2 counter function selection setting request (Un\G201/Un\G401) to 1 (setting request) while the count operation is prohibited with the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) set to off and the function start input terminal also set to off[*1] to enable the change. When the count operation is permitted, if CH1/CH2 counter function selection setting request (Un\G201/Un\G401) is set to 1 (setting request) while either the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) is on or the function start input is on[*1], a counter function setting error (1960H) occurs.
- If the operation mode is set to pulse density measurement mode or rotational speed measurement mode, only the count disable function can be used. If a function other than the count disable function is set and CH1/CH2 counter function selection setting request (Un\G201/Un\G401) is set to 1 (setting request), a counter function selection error (1970H) occurs.
- When using the sampling counter function while the ring length setting is enabled, the CH1/CH2 ring length (Un\G2 to 3/Un\G42 to 43) must be set to the specified value or larger in accordance with the CH1/CH2 pulse input mode (Un\G0/Un\G40) and the counting speed setting. (☞ Page 93 CH1/CH2 ring length)

*1 This is for when CH1/CH2 function start input logic (Un\G223/Un\G423) is set to 0 (positive logic). Replace on with off and vice versa when 1 (negative logic) is set.

CH1/CH2 sampling time setting

This area is used to write the time value for the sampling counter function of counter function selection.

Address		Setting range
CH1	CH2	
Un\G233	Un\G433	1 to 65535 (16-bit unsigned binary value) ■Time unit • 1ms

- When the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) is turned on or the function start input is turned on[*1], the setting value of this buffer memory becomes effective.
- This setting cannot be changed during measurement. It operates with the setting values at the start of measurement.
- If the setting value is less than or equal to the lower limit value or greater than or equal to the upper limit value, the lower limit value or the upper limit value will be used as the sampling time setting. (The buffer memory value remains the value set by the user, and only the operation is rounded.)

*1 This is for when CH1/CH2 function start input logic (Un\G223/Un\G423) is set to 0 (positive logic). Replace on with off when 1 (negative logic) is set.

CH1/CH2 maximum setting value

This area is used to store the value to be set as the maximum value of the high-speed counter.

Address		Setting range
CH1	CH2	
Un\G234 to 235	Un\G434 to 435	-2147483648 to 2147483647 (32-bit signed binary value)

CH1/CH2 minimum setting value

This area is used to store the value to be set as the minimum value of the high-speed counter.

Address		Setting range
CH1	CH2	
Un\G236 to 237	Un\G436 to 437	-2147483648 to 2147483647 (32-bit signed binary value)

CH1/CH2 pulse width measurement maximum setting value

This area is used to store the value to be set as the maximum value of the high-speed counter.

Address		Setting range
CH1	CH2	
Un\G238 to 239	Un\G438 to 439	0 to 4294967295 (32-bit unsigned binary value)

CH1/CH2 pulse width measurement minimum setting value

This area is used to store the value to be set as the minimum value of the high-speed counter.

Address		Setting range
CH1	CH2	
Un\G240 to 241	Un\G440 to 441	0 to 4294967295 (32-bit unsigned binary value)

CH1/CH2 operating mode monitor

This area is used to monitor the contents that were set for the operation mode in the parameter settings of GX Works3.

Address		Description
CH1	CH2	
Un\G260	Un\G460	• 0: Normal Mode • 1: Pulse density measurement mode • 2: Rotational speed measurement mode • 3: Pulse width measurement mode

CH1/CH2 counting speed setting monitor

This area is used to monitor the contents that were set for the counting speed setting in the parameter settings of GX Works3.

Address		Description
CH1	CH2	
Un\G261	Un\G461	• 0: 10kHz • 1: 50kHz • 2: 100kHz • 3: 200kHz • 4: 500kHz • 5: 1MHz • 6: 2MHz

CH1/CH2 preset input response time monitor

This area is used to monitor the contents that were set for the input response time of the preset input in the parameter settings of GX Works3.

Address		Description
CH1	CH2	
Un\G262	Un\G462	• 0: N/A • 1: 0.1ms • 2: 1ms • 3: 10ms

CH1/CH2 function start input response time monitor

This area is used to monitor the contents that were set for the input response time of the function start input in the parameter settings of GX Works3.

Address		Description
CH1	CH2	
Un\G263	Un\G463	• 0: N/A • 1: 0.1ms • 2: 1ms • 3: 10ms

CH1/CH2 pulse width measurement logic switching monitor

This area is used to monitor the contents that were set for pulse width measurement logic switching in the parameter settings of GX Works3.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G264	Un\G265	Un\G464	Un\G465	• 0: Positive logic • 1: Negative logic

CPU error output mode setting monitor

This area is used to monitor the contents that were set for the CPU error output mode setting in the parameter settings of GX Works3.

Address	Description
Un\G267	0: Clear

CH1/CH2 pulse density

This area is used to store the measurement results of the pulse density measurement mode.

Address		Description
CH1	CH2	
Un\G300 to 301	Un\G500 to 501	0 to 2147483647 (32-bit unsigned binary value) (Pulse density is stored even in the rotational speed measurement mode.)

CH1/CH2 rotational speed

This area is used to store the measurement results of the rotational speed measurement mode.

Address		Description
CH1	CH2	
Un\G302 to 303	Un\G502 to 503	0 to 2147483647 (32-bit unsigned binary value)

CH1/CH2 pulse density / rotational speed update flag

This area is used to store the update status of the target buffer memory.

Address		Target buffer memory	Description
CH1	CH2		
Un\G304	Un\G504	CH1 pulse density (Un\G300 to 301)/CH2 pulse density (Un\G500 to 501) CH1 rotational speed (Un\G302 to 303)/CH2 rotational speed (Un\G502 to 503)	• 0: No update • 1: Updated

- The buffer memory is updated without resetting this area. To check the update status again, write 0 in this area using a program and reset this area.

Point

When this area is used as an interlock, consider the scan time. Depending on the program used, immediately after 0 is written by a program, either of the buffer memory areas shown above may be updated, and 1 may be stored in this area.

CH1/CH2 sampling counter flag

This area is used to store the operating status of the sampling counter function of the counter function selection during its execution.

Address		Description
CH1	CH2	
Un\G306	Un\G506	• 0: Function stopped • 1: Function being executed

- 1 is stored if sampling is started by turning on of the CH1/CH2 counter function selection start command (Un\G200.0/Un\G400.0) or turning on[*1] of the function start input, and 0 is stored if sampling is completed.

*1 This is for when CH1/CH2 function start input logic (Un\G223/Un\G423) is set to 0 (positive logic). Replace on with off when 1 (negative logic) is set.

CH1/CH2 latch count value

The latch count value is stored in this area during the execution of the latch counter function.

Address		Description
CH1	CH2	
Un\G308 to 309	Un\G508 to 509	-2147483648 to 2147483647 (32-bit signed binary value)

CH1/CH2 sampling count value

The sampling count value is stored in this area during the execution of the sampling counter function.

Address		Description
CH1	CH2	
Un\G310 to 311	Un\G510 to 511	-2147483648 to 2147483647 (32-bit signed binary value)

CH1/CH2 counter function update flag

This area is used to store the update status of the buffer memory according to the selected counter function.

Address		Description	Update status
CH1	CH2		
Un\G312	Un\G512	■Latch counter function • CH1 latch count value (Un\G308 to 309) • CH2 latch count value (Un\G508 to 509) ■Sampling counter function • CH1 sampling count value (Un\G310 to 311) • CH2 sampling count value (Un\G510 to 511)	• 0: No update • 1: Updated

- The buffer memory areas shown above are updated without resetting this area. To check the update status again, write 0 in this area using a program and reset this area.

Point

When this area is used as an interlock, consider the scan time.
Depending on the program, immediately after 0 is written by a program, one of the buffer memory areas shown above may be updated, and 1 may be stored in this area.

CH1/CH2 rising edge ring counter value

This area is used to store the ring counter value when a rising edge is detected during pulse width measurement.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G316 to 317	Un\G318 to 319	Un\G516 to 517	Un\G518 to 519	0 to 4294967295 (32-bit unsigned binary value)

CH1/CH2 falling edge ring counter value

This area is used to store the ring counter value when a falling edge is detected during pulse width measurement.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G322 to 323	Un\G324 to 325	Un\G522 to 523	Un\G524 to 525	0 to 4294967295 (32-bit unsigned binary value)

CH1/CH2 pulse width latest value

This area is used to store the pulse width latest value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G328 to 329	Un\G330 to 331	Un\G528 to 529	Un\G530 to 531	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the rising edge up to the falling edge • When logic switching is set to negative logic, the difference from the falling edge up to the rising edge

CH1/CH2 pulse width maximum value

This area is used to store the pulse width maximum value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G334 to 335	Un\G336 to 337	Un\G534 to 535	Un\G536 to 537	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the rising edge up to the falling edge • When logic switching is set to negative logic, the difference from the falling edge up to the rising edge

Point

The pulse width maximum value can be changed by the user program.
Set a value to CH1/CH2 pulse width measurement maximum setting value (Un\G238 to 239/Un\G438 to 439), and turn on b2 and b3 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).

CH1/CH2 pulse width minimum value

This area is used to store the pulse width minimum value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G340 to 341	Un\G342 to 343	Un\G540 to 541	Un\G542 to 543	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the rising edge up to the falling edge • When logic switching is set to negative logic, the difference from the falling edge up to the rising edge

Point

The pulse width minimum value can be changed by the user program.
Set a value to CH1/CH2 pulse width measurement minimum setting value (Un\G240 to 241/Un\G440 to 441), and turn on b5 and b6 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).

CH1/CH2 period latest value

This area is used to store the period latest value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G346 to 347	Un\G348 to 349	Un\G546 to 547	Un\G548 to 549	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the previous rising edge up to the latest rising edge • When logic switching is set to negative logic, the difference from the previous falling edge up to the latest falling edge

CH1/CH2 period maximum value

This area is used to store the period maximum value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G352 to 353	Un\G354 to 355	Un\G552 to 553	Un\G554 to 555	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the previous rising edge up to the latest rising edge • When logic switching is set to negative logic, the difference from the previous falling edge up to the latest falling edge

Point

The period maximum value can be changed by the user program.
Set a value to CH1/CH2 pulse width measurement maximum setting value (Un\G238 to 239/Un\G438 to 439), and turn on b8 and b9 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).

CH1/CH2 period minimum value

This area is used to store the period minimum value.

Address				Description
CH1		CH2		
Phase A	Phase B	Phase A	Phase B	
Un\G358 to 359	Un\G360 to 361	Un\G558 to 559	Un\G560 to 561	0 to 4294967295 (32-bit unsigned binary value) • When logic switching is set to positive logic, the difference from the previous rising edge up to the latest rising edge • When logic switching is set to negative logic, the difference from the previous falling edge up to the latest falling edge

Point

The period minimum value can be changed by the user program.
Set a value to CH1/CH2 pulse width measurement minimum setting value (Un\G240 to 241/Un\G440 to 441), and turn on b11 and b12 of CH1/CH2 maximum/minimum value setting request (Un\G202/Un\G402).

CH1/CH2 pulse width latest value update flag

This area is used to store the update status of the target buffer memory.

Address	Target buffer memory	Description
Un\G366	CH1 pulse width latest value (phase A) (Un\G328 to 329)	• 0: No update • 1: Updated
Un\G367	CH1 pulse width latest value (phase B) (Un\G330 to 331)	
Un\G566	CH2 pulse width latest value (phase A) (Un\G528 to 529)	
Un\G567	CH2 pulse width latest value (phase B) (Un\G530 to 531)	

- The buffer memory is updated without resetting this area. To check the update status again, write 0 in this area using a program and reset this area.

Point

When this area is used as an interlock, consider the scan time. Depending on the program used, immediately after 0 is written by a program, either of the buffer memory areas shown above may be updated, and 1 may be stored in this area.

CH1/CH2 period latest value update flag

This area is used to store the update status of the target buffer memory.

Address	Target buffer memory	Description
Un\G369	CH1 period latest value (phase A) (Un\G346 to 347)	• 0: No update • 1: Updated
Un\G370	CH1 period latest value (phase B) (Un\G348 to 349)	
Un\G569	CH2 period latest value (phase A) (Un\G546 to 547)	
Un\G570	CH2 period latest value (phase B) (Un\G548 to 549)	

- The buffer memory is updated without resetting this area. To check the update status again, write 0 in this area using a program and reset this area.

Point

When this area is used as an interlock, consider the scan time. Depending on the program used, immediately after 0 is written by a program, either of the buffer memory areas shown above may be updated, and 1 may be stored in this area.

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REVISIONS

Revision date	Revision	Description
October 2023	A	First Edition
November 2024	B	■Added or modified parts Section 2.1, 2.3

Japanese manual number: SH-082630-B

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. Relay failure or output contact failure caused by usage beyond the specified life of contact (cycles).
   6. 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.
   7. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
   8. 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 to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi programmable controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for railway companies or public service purposes shall be excluded from the programmable controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the user's discretion.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

TRADEMARKS

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.
In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

Manual number: SH(NA)-082631ENG-B
MODEL: FX5-U-HC-E
MODEL CODE: 09R745

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