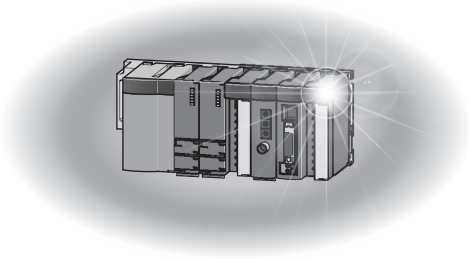
MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC Q series

MELSEC-Q Multi Function Counter/Timer Module User's Manual

-QD65PD2



●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

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

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

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

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

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

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 150mm or more between them. Failure to do so may result in malfunction due to noise.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the user's manual for the CPU module used. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module. When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screw within the specified torque range. Undertightening can cause drop of the screw, short circuit or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Shut off the external power supply for the system in all phases before mounting/removing a module or connecting/disconnecting a connector. Failure to do so may result in damage to the product.
- Do not directly touch any conductive parts and electronic components of the module and the connectors. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠CAUTION

- Connectors for external devices must be crimped with the tool specified by the manufacturer or must be correctly soldered.
  Incomplete connections may cause short circuit, fire, or malfunction.
- Ground the FG and LG terminals to the protective ground conductor dedicated to the programmable controller. Failure to do so may result in electric shock or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Ground the shield cable on the encoder side (relay box). Always ground the FG and LG terminals to the protective ground conductor. Failure to do so may cause malfunction.
- Check the rated voltage and terminal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause a fire or failure.

⚠ CAUTION

- Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring methods, refer to the QCPU User's Manual (Hardware Design, Maintenance and Inspection).

[Startup and Maintenance Precautions]

⚠ WARNING

- Do not touch the module and the connectors while power is on. Failure to do so may cause malfunction.
- Shut off the external power supply for the system in all phases before cleaning the module or retightening the screws. Failure to do so may cause the module to fail or malfunction. Undertightening can cause drop of the screw, short circuit or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

⚠ CAUTION

- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply for the system in all phases before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit of 50 times may cause malfunction.
- Before handling the module and the connectors, touch a grounded metal object to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.

[Disposal Precautions]

⚠ CAUTION

- When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

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

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

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

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-Q series programmable controllers.
This manual describes the operating procedure, system configuration, parameter setting, functions, programming, and troubleshooting of the Q series multi function counter/timer module QD65PD2 (hereafter abbreviated as QD65PD2).

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

■Relevant module: QD65PD2

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y00 to X/Y0F are assigned for the QD65PD2.
  For I/O number assignment, refer to the following manuals.
  QnUCPU Users Manual (Function Explanation, Program Fundamentals)
  Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- Operating procedures are explained using GX Works2.

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

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

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

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

(2) Additional measures

Please refer to ☞Page 172, Section 5.4.1 (5) for the compliance of this product with EMC and Low Voltage Directives.

RELEVANT MANUALS

(1) CPU module user's manual

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

(2) Programming manual

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

(3) Operating manual

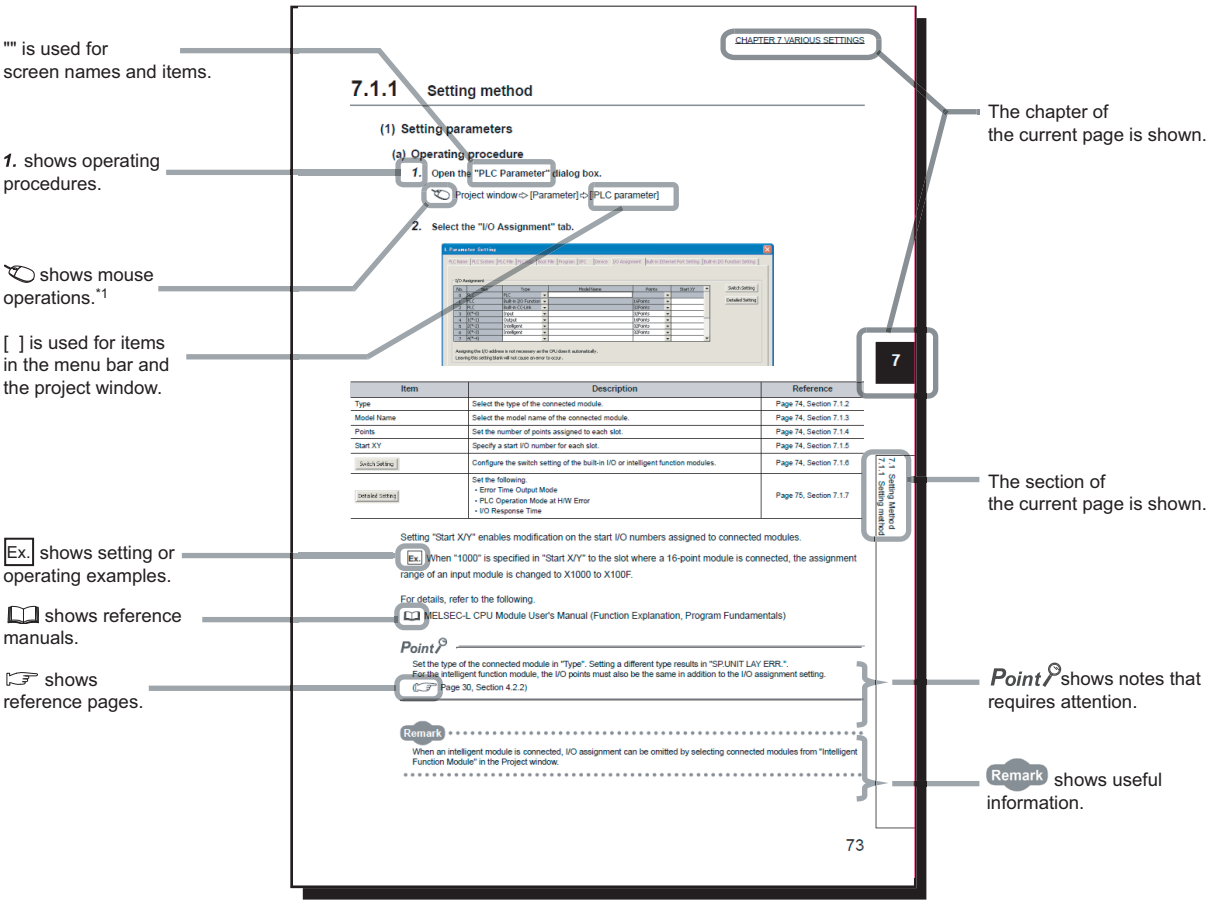
Manual name <manual number (model code)>	Description
GX Works2 Version1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

Memo

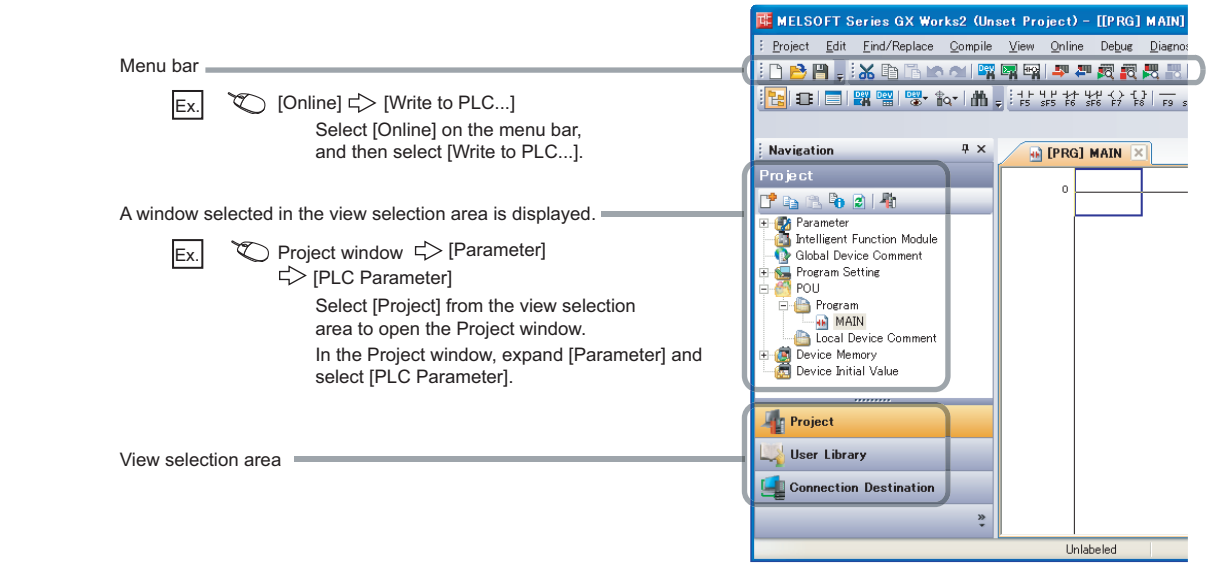
CONTENTS

MANUAL PAGE ORGANIZATION

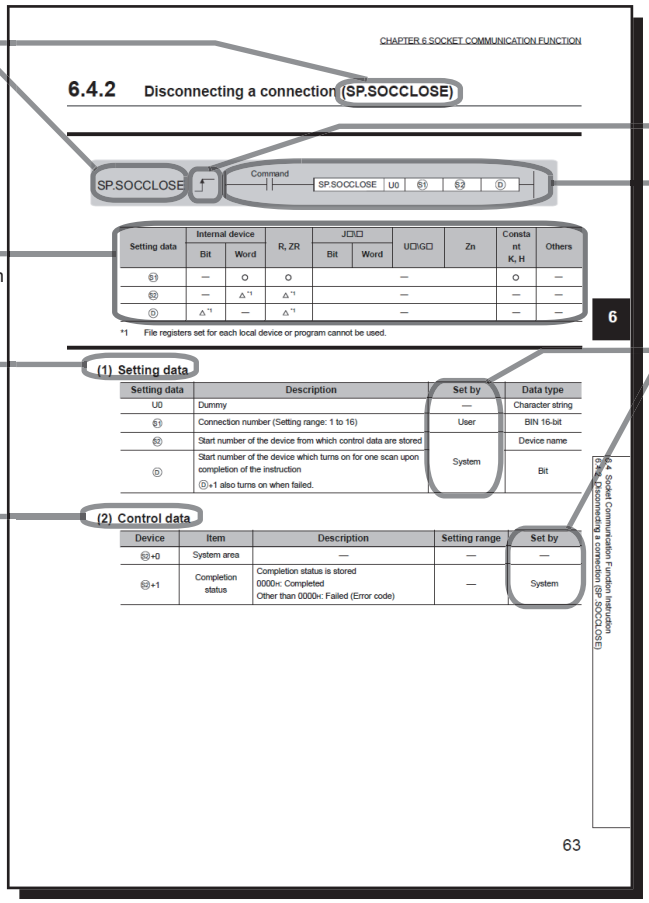
In this manual, pages are organized and the symbols are used as shown below. The following page illustration is for explanation purpose only, and is different from the actual pages.



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



Pages describing instructions are organized as shown below. The following page illustrations are for explanation purpose only, and are different from the actual pages.



Instruction name

Execution condition of the instruction

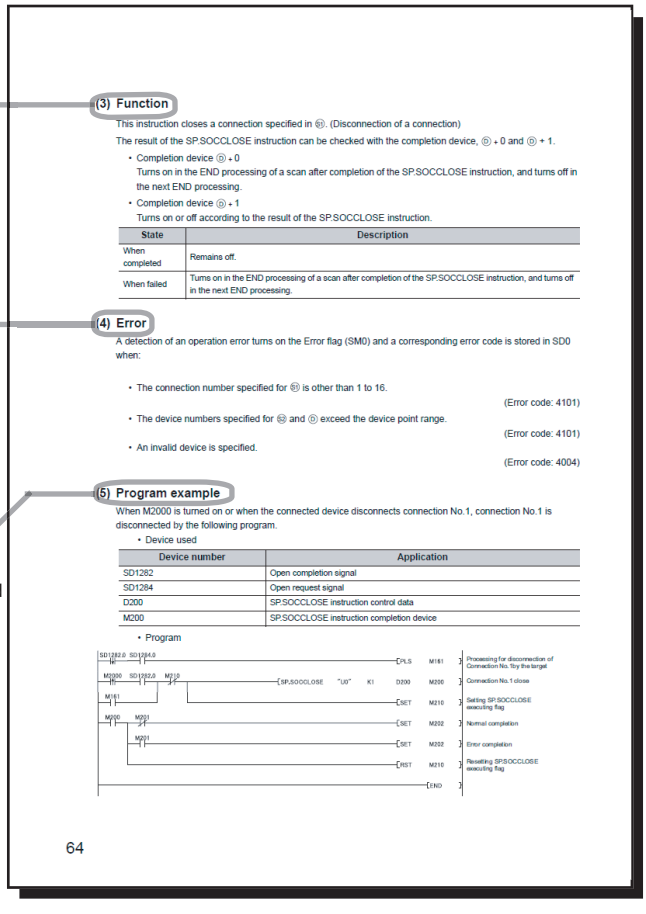
Structure of the instruction in the ladder mode

○ shows the devices applicable to the instruction

Descriptions of setting data and data type

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

Descriptions of control data (if any)



Detailed descriptions of the instruction

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

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

• Instructions can be executed under the following conditions.

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

• The following devices can be used.

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

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

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

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

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

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

• The following data types can be used.

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

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
QD65PD2	The abbreviation for the multi function counter/timer module, QD65PD2
CH□	A generic term for CH1 and CH2
QCPU	Another term for the MELSEC-Q series CPU module
Redundant CPU	A generic term for the Q12PRHCPU and Q25PRHCPU
External input	The abbreviation for input from connectors for external devices
External output	The abbreviation for output to connectors for external devices
Programming tool	A generic term for GX Works2 and GX Developer
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Developer	
Switch setting	The abbreviation for the intelligent function module switch setting
Buffer memory	The memory of an intelligent function module used to store data (such as setting values and monitored values) for communication with a CPU module
Step setting	A generic term for step type, number of steps, and step No.1 to No.16 setting values for the cam switch function
Periodic pulse count value	A generic term for difference value, present value, and update check value for the periodic pulse counter function
Dedicated instruction	An instruction that simplifies programming
PPCVRD□	A generic term for the dedicated instructions, PPCVRD1 and PPCVRD2

PACKING LIST

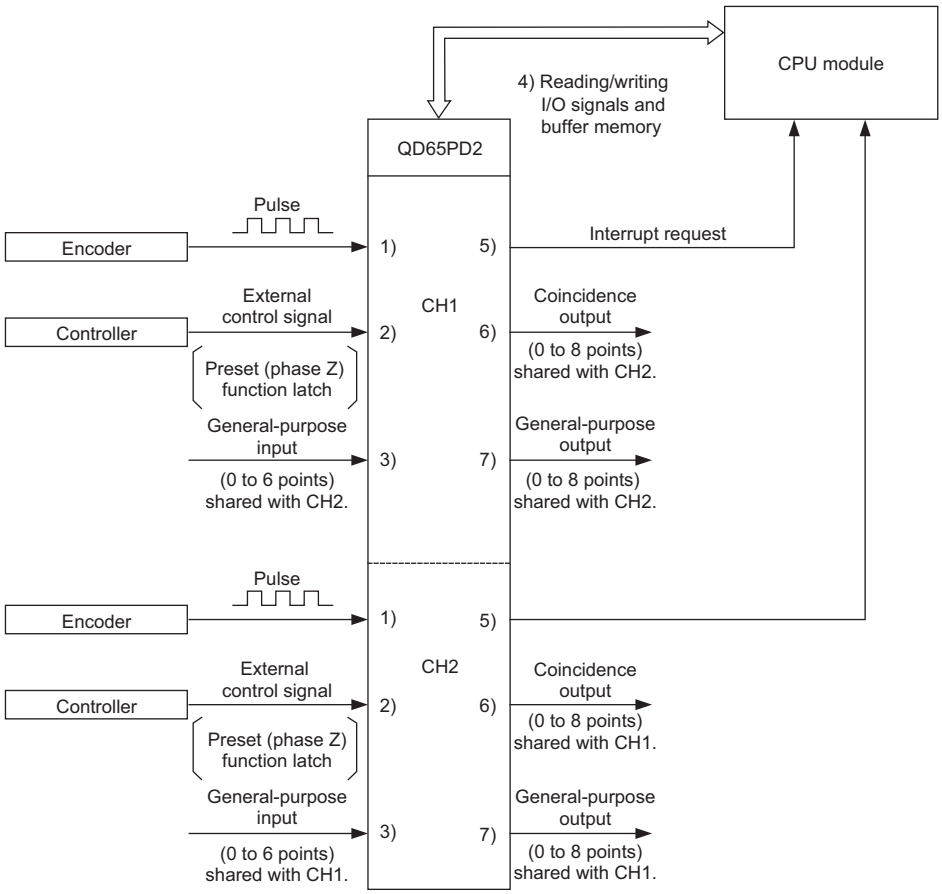
The following items are included in the package of this product.

Module name	Product name	Quantity
QD65PD2	Multi function counter/timer module	1
QD65PD2-U-HW	Before Using the Product	1

CHAPTER 1 OVERVIEW

The QD65PD2 is a multi function counter/timer module whose maximum counting speed of input pulse is 8Mpps (with differential input and 4 multiples of 2 phases).
The QD65PD2 has two channels and functions including the preset/replace function by external input or input from a CPU module, the latch counter function, counter function selection, external coincidence output by coincidence detection, and general-purpose input/output.

The illustration below shows the QD65PD2 operation overview.



1) Pulses input to the QD65PD2 are counted.
2) The preset function can be performed, counting can be paused, and a counter value can be latched with external control signal.
3) ON/OFF signals can be input from general-purpose input 1 to 6 terminals (IN1 to IN6).
4) Status of the I/O signals and buffer memory of the QD65PD2 can be checked with the sequence program. Also, counting can be started/stopped; and the preset function and the coincidence output function can be performed.
5) When the counter value matches with the set value or when a counted difference value is stored, an interrupt request can be issued to the CPU module.
6) The coincidence output signal can be output by the coincidence output function.
7) ON/OFF signals can be output from general-purpose output 1 to 8 terminals (OUT1 to OUT8).

1.1 Features

(1) Multiple functions

The QD65PD2 has the following functions.

- Counter function
- Frequency measurement function
- Rotation speed measurement function
- Pulse measurement function
- PWM output function
- Cam switch function
- General-purpose input/output

Use of the functions above reduces application creation work by the user.

(2) Count in the maximum counting speed of 8Mpps (with differential input and 4 multiples of 2 phases)

The QD65PD2 can be used with high resolution encoders (such as linear scale). Therefore, the position detection performance of equipment and the work transition speed can be improved.

(3) Count in a wide range from -2147483648 to 2147483647

Count values are stored in 32-bit signed binary.

(4) Pulse input selection

The pulse input mode can be selected from 1-phase multiple of 1, 1-phase multiple of 2, 2-phase multiple of 1, 2-phase multiple of 2, 2-phase multiple of 4, and CW/CCW.

(5) Two counter formats

The following counter formats are available.

(a) Linear counter format

Pulses are counted from -2147483648 to 2147483647, and an overflow or an underflow is detected when the count range is exceeded.

(b) Ring counter format

Pulses are repeatedly counted within the range between the upper limit value and the lower limit value of the ring counter.

(6) Coincidence detection

The coincidence detection compares the count value with any point or range set by the user. The comparison result can be notified by an input signal, or an interrupt program can be started when the both values match. The 8 points assigned to external coincidence output make it possible to work along with a complicated application. The coincidence output function or the cam switch function can be selected depending on a purpose.

(a) Coincidence output function

With this function, one coincidence detection point per one coincidence output point can be set, and the detection point is compared with the count value. The coincidence output signals can be reset and coincidence detection points can be changed by the sequence program. This function can be controlled depending on the operation condition of the equipment, such as changing the coincidence detection point based on certain conditions. The count value can be compared with a range also.

(b) Cam switch function

With this function, the output status (ON/OFF address) of coincidence output can be preset by the user. Then this function outputs ON/OFF signals from coincidence output comparing the preset status with the count value. The ON/OFF switching point can be used up to 16 points.

(7) Counter function selection

One of the following functions can be selected and used for each channel.

(a) Count disable function

This function inputs a signal while Count enable command (Y06) is on, and stops counting pulses.

(b) Latch counter function

This function latches the count value of the counter when a signal is input.

(c) Sampling counter function

This function counts pulses input during the preset time period after a signal is input.

(d) Periodic pulse counter function

This function stores the present value and the difference value of the counter at every time period preset by the user while a signal is input.

(e) Counter compound function

Two functions can be performed simultaneously without being switched to one another along with change in function input terminals (FUNC1, FUNC2) of external connectors.

- Count disable/preset/replace function
- Latch counter/preset/replace function

(8) The preset/replace function and the latch counter function with an external control signal

Variation in time until the preset/replace function or the latch counter function is performed is reduced without depending on the scan time of the CPU module.

(9) Easy setting by GX Works2

Sequence program can be reduced by managing default setting or auto refresh setting on the screen. Also, setting condition or operation condition of the module can be checked easily.

CHAPTER 2 SYSTEM CONFIGURATION

This chapter explains the QD65PD2 system configuration.

2.1 Applicable Systems

This section describes the applicable systems.

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

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

Note the following when mounting modules with the CPU module.

- The power supply capacity may become insufficient depending on the combination with other modules or the number of mounted modules.
  Select the power supply capacity according to the modules to be used.
  If the power supply capacity is insufficient, change the combination of the modules.
- Mount the modules within the number of I/O points range of the CPU module.
  Modules can be mounted on any slot within the number of available slots.

Remark

To use a C Controller module with the QD65PD2, refer to the C Controller Module User's Manual.

(a) When mounted to a MELSECNET/H remote I/O station

For an applicable MELSECNET/H remote I/O station and base units, and the number of mountable modules, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) Application to the multiple CPU system

When using the QD65PD2 in a multiple CPU system, refer to the following manual first.

QCPU User's Manual (Multiple CPU System)

(3) Applicable software packages

Systems with the QD65PD2 and the applicable software packages are shown in the following table.

Programming tools are required for the QD65PD2.

Item		Software Version	
		GX Developer	GX Works2
Q00J/Q00/Q01CPU	Single CPU system	Version 7 or later	Refer to the GX Works2 Version 1 Operating Manual (Common).
	Multiple CPU system	Version 8 or later	
Q02/Q02H/Q06H/Q12H/Q25HCPU	Single CPU system	Version 4 or later	
	Multiple CPU system	Version 6 or later	
Q02PH/Q06PHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q12PH/Q25PHCPU	Single CPU system	Version 7.10L or later	
	Multiple CPU system		
Q12PRH/Q25PRHCPU	Redundant system	Version 8.45X or later	
Q00UJ/Q00U/Q01UCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q02U/Q03UD/Q04UDH/Q06UDHCPU	Single CPU system	Version 8.48A or later	
	Multiple CPU system		
Q10UDH/Q20UDHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
Q13UDH/Q26UDHCPU	Single CPU system	Version 8.62Q or later	
	Multiple CPU system		
Q03UDE/Q04UDEH/Q06UDEH/Q13UDEH/Q26UDEHCPU	Single CPU system	Version 8.68W or later	
	Multiple CPU system		
Q10UDEH/Q20UDEHCPU	Single CPU system	Version 8.76E or later	
	Multiple CPU system		
CPU module other than the above	Single CPU system	Cannot be used	
	Multiple CPU system		
When installed to a MELSECNET/H remote I/O station		Version 6 or later	

(4) Connector

For the QD65PD2, the connector is sold separately.

Refer to Page 169, Section 5.3 (1) and make separate arrangements for the connector.

(5) Online module exchange

Online module exchange is not available for the QD65PD2.

2.2 When Using the QD65PD2 with Redundant CPU

This section lists restrictions when using the QD65PD2 with redundant CPU.

(1) Restrictions

- The coincidence detection interrupt function and the periodic interrupt function cannot be used.
- The dedicated instruction cannot be used.

2.3 When Using the QD65PD2 at a MELSECNET/H Remote I/O Station

This section describes the use of the QD65PD2 at a MELSECNET/H remote I/O station.

(1) Number of modules

For the number of modules that can be mounted, refer to Page 20, Section 2.1.

(2) Restrictions

- The coincidence detection interrupt function and the periodic interrupt function cannot be used.
- The dedicated instruction cannot be used.
- When the QD65PD2 is used on the MELSECNET/H remote I/O station, a delay will occur due to the link scan time. Therefore, fully verify that there will be no problem with controllability in the target system.

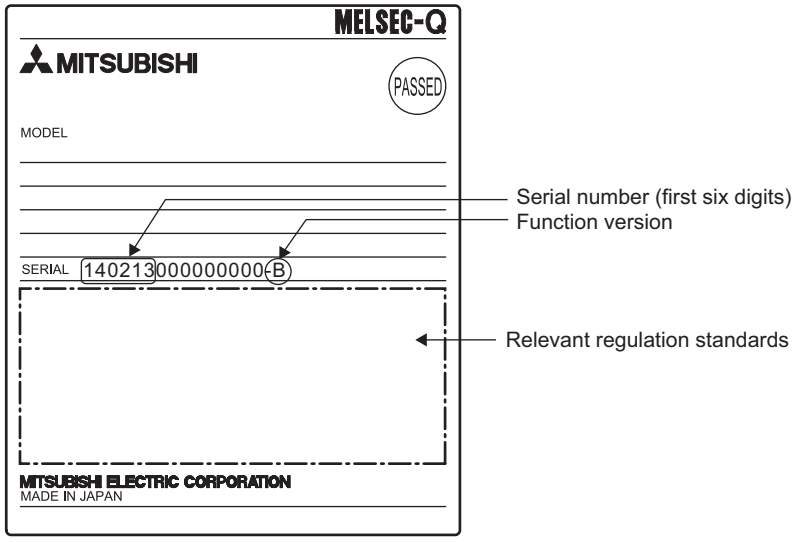
Ex. When processing is performed using the count value input by the sequence program, variations will occur due to a delay in the link scan time.

2.4 How to Check the Function Version/Serial No.

The function version and the serial No. of the QD65PD2 can be checked by the following methods.

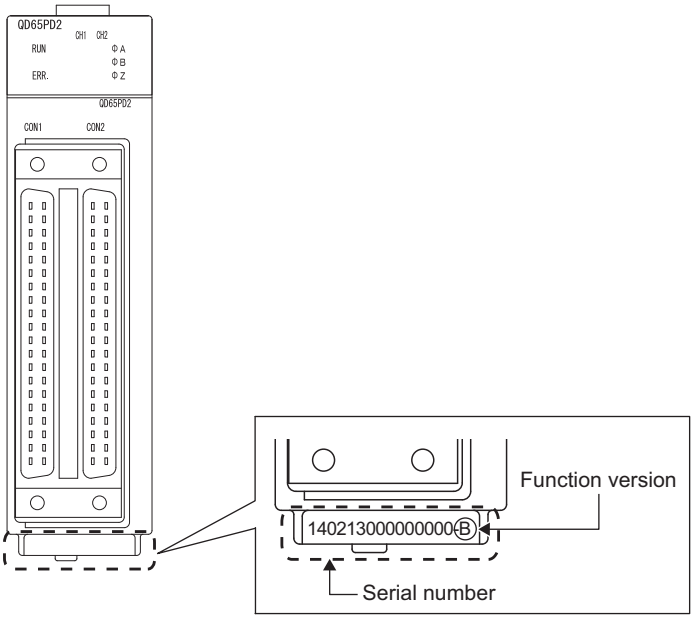
(1) On the rating plate

The rating plate is put on the side of the QD65PD2.



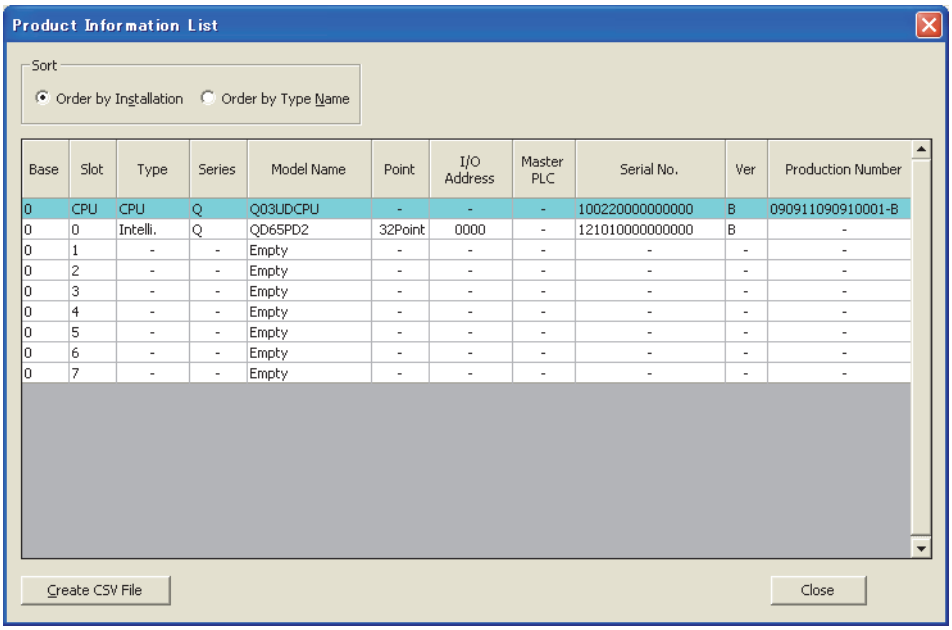
(2) On the front of the module

The serial No. on the rating plate is also indicated on the front of the module (lower part).



(3) On the system monitor (Product Information List)

To display the system monitor, select [Diagnostics]→[System Monitor]→Product Information List of the programming tool.



(a) Production number

Production number indication is not available for the QD65PD2; "-" is shown.

Point

The serial No. on the rating plate and the front of the module may be different from the serial No. displayed on the product information list of the programming tool.

- The serial No. on the rating plate indicates the management information of the product.
- The serial No. displayed on the product information list of the programming tool indicates the function information of the product. The function information of the product is updated when a new function is added.

CHAPTER 3 SPECIFICATIONS

This chapter describes the performance specifications of the QD65PD2, I/O signals to the CPU module, and buffer memories.

For the general specifications of the QD65PD2, refer to the following:

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

Point

The I/O numbers (X/Y), buffer memory addresses, and external input terminals described in this chapter are for CH1.
To check the I/O numbers (X/Y) for CH2, refer to the following:

Page 32, Section 3.3.1

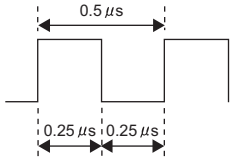
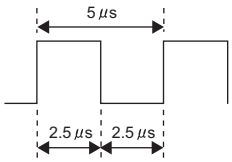
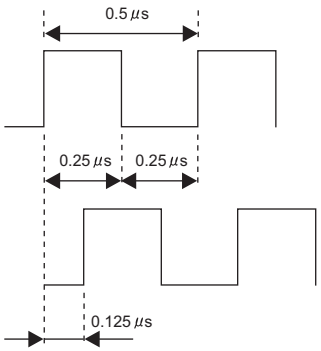
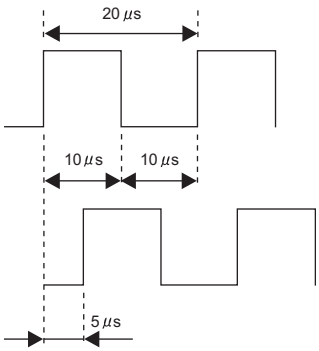
To check the buffer memory addresses for CH2, refer to the following:

Page 42, Section 3.4.1

3.1 Performance Specifications

The following table describes the performance specifications of the QD65PD2.

Item			Specifications	
			Differential input	DC input
Counting speed switch setting[*1]		1 multiple	10kpps/100kpps/200kpps/500kpps/1Mpps/2Mpps	10kpps/100kpps/200kpps
		2 multiples	10kpps/100kpps/200kpps/500kpps/1Mpps/2Mpps/4Mpps	
		4 multiples	10kpps/100kpps/200kpps/500kpps/1Mpps/2Mpps/4Mpps/8Mpps	
Number of occupied I/O points			32 points (I/O assignment: Intelligent, 32 points)	
Number of channels			2 channels	
Count input signal	Phase		1-phase input (1 multiple/2 multiples), 2-phase input (1 multiple/2 multiples/4 multiples), CW/CCW	
	Signal level (ϕA, ϕB)		EIA Standards RS-422-A, differential line driver level (AM26LS31 (manufactured by Texas Instruments Japan Limited.) or equivalent)	5/12/24VDC, 7 to 10mA

Item			Specifications	
			Differential input	DC input
Counter	Counting speed (Maximum)*2*3		8Mpps (4 multiples of 2 phases)	200kpps
	Counting range		32-bit signed binary (-2147483648 to 2147483647)	
	Format		Count, subtraction count Linear counter format, ring counter format Preset/replace function, latch counter function	
	Minimum count pulse width (Duty ratio 50%)		1-phase input (1 multiple/2 multiples), CW/CW  (Minimum pulse width in 2 multiples of 1 phase: 0.25μs)	1-phase input (1 multiple/2 multiples), CW/CW  (Minimum pulse width in 2 multiples of 1 phase: 2.5μs)
			2-phase input (1 multiple/2 multiples/4 multiples)  (Minimum pulse width in 4 multiples of 2 phases: 0.125μs)	2-phase input (1 multiple/2 multiples/4 multiples)  (Minimum pulse width in 4 multiples of 2 phases: 5μs)
Coincidence detection	Comparison range		32-bit signed binary	
	Comparison condition	Coincidence output	Setting value < Count value, Setting value = Count value, Setting value > Count value	
		In-range output	Setting value (lower limit value) ≤ Count value ≤ Setting value (upper limit value)	
		Not-in-range output	Count value < Setting value (lower limit value), Setting value (upper limit value) < Count value	
	Interrupt		Equipped with a coincidence detection interrupt function	
External input	Phase Z		EIA Standards RS-422-A, differential line driver level (AM26LS31 (manufactured by Texas Instruments Japan Limited.) or equivalent): 2 points	5/12/24VDC, 7 to 10mA: 2 points
	Function		5/12/24VDC, 7 to 10mA: 2 points	
	Latch counter		5/12/24VDC, 7 to 10mA: 2 points	
	General input (high speed)		24VDC, 7 to 10mA: 2 points	
	General input (low speed)		24VDC, 3mA: 4 points	

Item			Specifications	
			Differential input	DC input
External output	Coincidence output (high speed)		Transistor (sink type) output: 2 points 12/24VDC 0.1A/point, 0.8A/common	
	Coincidence output (low speed)		Transistor (sink type) output: 6 points 12/24VDC 0.1A/point, 0.8A/common	
	General output		Transistor (sink type) output: 8 points 12/24VDC 0.1A/point, 0.8A/common	
Pulse measurement	Measurement item		Pulse width (ON width/OFF width)	
	Measurement resolution		100ns	
	Measurement points		2 points/channel	
Cam switch	Number of output points		8 points	
	Number of steps per output point		Maximum 16 steps/point	
	Control cycle		1ms	
	Difference between each output duration in a channel		100μs or less	
PWM output	Output frequency range	Coincidence output (high speed)	DC and up to 200kHz	
		Coincidence output (low speed)	DC and up to 2kHz	
	Duty ratio		Any ratio (Can be set by 0.1μs)	
Internal current consumption (5VDC)			0.23A	
Applicable wire size			0.3mm^2 (22 AWG) (A6CON1 and A6CON4), 0.088mm^2 to 0.24mm^2 (24 to 28 AWG) (A6CON2)	
Applicable connector for external wiring (sold separately)			A6CON1, A6CON2, A6CON4	
External dimensions			98(H) × 27.4(W) × 90(D)mm	
Weight			0.15kg	

*1 Counting speed switch setting can be done using the switch setting. (☞ Page 180, Section 6.2)

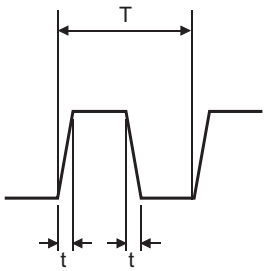
*2 Note that the count may be done incorrectly by inputting pulses whose phase difference is small between the phase A pulse and phase B pulse. To check the input waveform of the phase A pulse and phase B pulse, or to check phase difference between the phase A pulse and phase B pulse, refer to the following:

☞ Page 28, Section 3.1.1

*3 The counting speed is affected by the pulse rise/fall time.
The number of pulses that can be counted depending on the counting speed is listed below. Note that the count may be done incorrectly by counting pulses with long rise/fall time.

Counting speed switch setting	8Mpps 4Mpps 2Mpps	1Mpps	500kpps	200kpps	100kpps	10kpps
Rise/fall time	Both 1- and 2-phase inputs					
t=0.125μs	2Mpps	1Mpps	500kpps	200kpps	100kpps	10kpps
t=0.25μs or less	1Mpps	1Mpps	500kpps	200kpps	100kpps	10kpps
t=0.5μs or less	—	500kpps	500kpps	200kpps	100kpps	10kpps
t=1.25μs or less	—	—	200kpps	200kpps	100kpps	10kpps
t=2.5μs or less	—	—	—	100kpps	100kpps	10kpps
t=25μs or less	—	—	—	—	10kpps	10kpps
t=500μs	—	—	—	—	—	500pps

*Counting speed=1/T(pps)



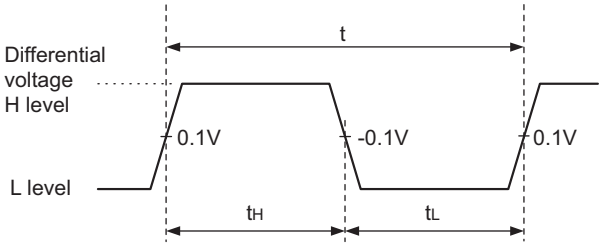
3.1.1 The input waveform and the phase difference between phase A pulse and phase B pulse

The count may be done incorrectly by inputting pulses whose phase difference is small between the phase A pulse and phase B pulse in 2-phase input. The following figures show the pulse waveform to be input to the QD65PD2 and the phase difference between the phase A pulse and phase B pulse in 2-phase input.
(Though the following are the cases for the differential input, they are also applied to the DC input.)

(1) Input waveform to the QD65PD2

Input pulse waveform should satisfy the condition shown below (the duty ratio is 50%).

$t\ (=t_H+t_L) \geqq 0.5\ \mu s$
$t_H,\ t_L \geqq 0.25\ \mu s\ (=0.5 \times t)$

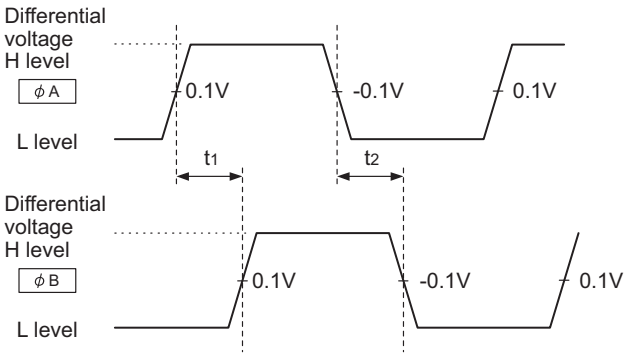


(2) Phase difference in 2-phase input

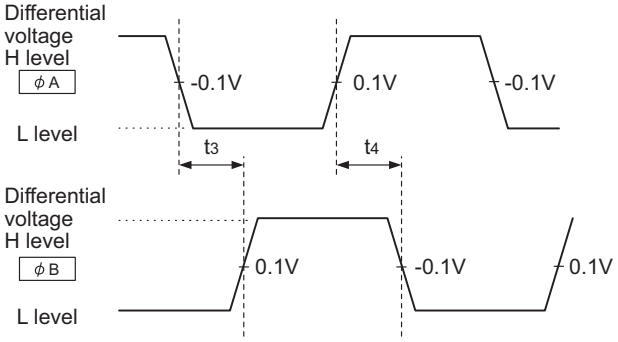
Input pulse waveform in 2-phase input should satisfy the above condition (the condition required for 1-phase input) and the conditions shown below.

$t_1, t_2, t_3, t_4 \geqq 0.125\ \mu s\ (=0.25 \times t)$

Count



Subtraction count



3.1.2 Number of parameter that can be set

Configure the parameters of the initial setting and the auto refresh setting of the QD65PD2 within the number of parameters that can be set to the CPU module, including the number of parameters set for other intelligent function modules. For the maximum number of parameters that can be set to the CPU module, refer to the following:

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

(1) Number of the QD65PD2 parameters

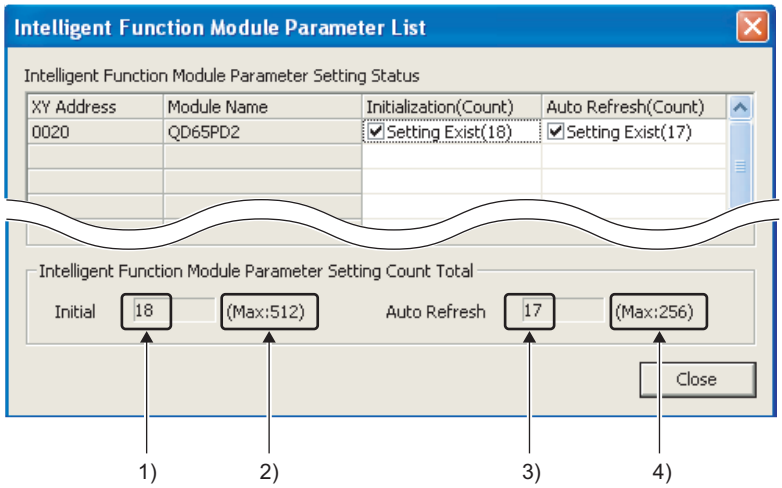
The following number of parameters can be set for the one piece of the QD65PD2

Initial setting	Auto refresh setting
18	62 (Maximum number)

(2) Checking the number of parameters

The number of parameters set for the intelligent function module and the maximum number of parameters can be checked by the following operation.

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



No.	Description
1)	The total number of parameters in the initial setting that are selected on the screen
2)	The maximum number of parameters in the initial setting
3)	The total number of parameters in the auto refresh setting that are selected on the screen
4)	The maximum number of parameters in the auto refresh setting

3.2 Function List

The following table lists the functions of the QD65PD2.

Item			Description	Operation mode[*1]	Reference
Linear counter function			This function counts pulses between -2147483648 and 2147483647, and detects an overflow/underflow when the count value is outside the range.	Normal mode	Page 103, Section 4.2.1
Ring counter function			This function repeatedly counts pulses between the upper limit value and lower limit value of the ring counter.		Page 104, Section 4.2.2
Comparison output function	Coincidence output function		This function compares the count value with the preset comparison condition, and outputs on or off signal when they match.		Page 109, Section 4.3.2
		Preset/replace (at coincidence output) function	This function replaces the count value with any preset numerical value at the rise time of the coincidence output 1 and 2.		Page 116, Section 4.3.3
		Coincidence detection interrupt function	This function outputs an interrupt signal to the CPU module and starts an interrupt program when the count value matches with the preset comparison condition.		Page 122, Section 4.3.5
	Cam switch function		This function compares the count value with the preset output status (ON/OFF address) of the coincidence output, and outputs on or off signal from the coincidence output when they match. The points for ON/OFF switch can be used up to 16 points.		Page 118, Section 4.3.4
Preset/replace function			This function replaces the count value with any preset numerical value. The function is executed by CH1 Preset/replace command (Y03) or by the phase Z input terminal (Z1) of the connector for external devices.		Page 125, Section 4.4
Latch counter function	Latch counter function by latch counter input terminal		This function latches the count value, and stores it to the buffer memory. The function is executed by the latch counter input terminal (LATCH1) of the connector for external devices.		Page 128, Section 4.5.1
	Latch counter function (counter function selection)		This function latches the count value, and stores it to the buffer memory. The function is executed by CH1 Selected counter function start command (Y07) or by the function input terminal (FUNC1) of the connector for external devices.		Page 129, Section 4.5.2

Item			Description	Operation mode*1	Reference
Counter function selection			This function executes the counter function selection using both the sequence program and the function input terminal (FUNC1) of the connector for external devices, or using either of them.	—	Page 131, Section 4.6
	Count disable function		This function stops counting pulses while CH1 Count enable command (Y06) is on.	Normal mode	Page 132, Section 4.7
	Latch counter function		This function latches the count value, and stores it to the buffer memory.		Page 129, Section 4.5.2
	Sampling counter function		This function counts pulses that are input during the preset sampling period.		Page 133, Section 4.8
	Periodic pulse counter function		This function stores the current value and difference value to the corresponding buffer memories by the preset cycle time.		Page 136, Section 4.9
		Periodic interrupt function	This function outputs an interrupt signal to the CPU module and starts an interrupt program by the cycle time using the periodic pulse counter function.		Page 139, Section 4.9.1
	Count disable/preset/ replace function		According to the status change of the function input terminal (FUNC1) of the connector for external devices, this function executes the count disable function and preset/replace function without switching the functions.		Page 141, Section 4.10
	Latch counter/preset/ replace function		According to the status change of the function input terminal (FUNC1) of the connector for external devices, this function executes the latch counter function and preset/replace function without switching the functions.		Page 143, Section 4.11
Internal clock function			This function does the count based on the clock incorporated in the QD65PD2.	Normal mode	Page 145, Section 4.12
Frequency measurement function			This function counts the pulses of the pulse input terminals in phase A and B, and automatically calculates the frequency.	Frequency measurement mode	Page 146, Section 4.13
Rotation speed measurement function			This function counts the pulses of the pulse input terminals in phase A and B, and automatically calculates the rotation speed.	Rotation speed measurement mode	Page 150, Section 4.14
Pulse measurement function			This function measures the function input terminal (FUNC1) of the connector for external devices or the latch counter input terminal (LATCH1), and calculates the ON width.	Pulse measurement mode	Page 155, Section 4.15
PWM output function			This function outputs the specified PWM waveform from any coincidence output terminals.	PWM output mode	Page 159, Section 4.16
General input function			This function stores the status of the general input 1 to 6 terminals (IN1 to IN6) of the connector for external devices to the input signal (X signal).	Common to all modes	Page 162, Section 4.17
General output function			This function stores the status of the general output 1 to 8 terminals (OUT1 to OUT8) of the connector for external devices to the output signal (Y signal).		Page 162, Section 4.18
Module error collection function			When an error occurs in the QD65PD2, this function sends the error description to the CPU module. The error description is stored to the memory inside the CPU module as a module error collection.		Page 164, Section 4.19

*1 The operation mode can be set using the switch setting. For details, refer to the following:
Page 180, Section 6.2

3.3 I/O Signals to the CPU Module

The following table lists the QD65PD2 I/O signals to the CPU module.
The I/O numbers (X/Y) described in this chapter or later are for the case when the QD65PD2 are mounted on the I/O slot No.0 of the main base unit.

3.3.1 List of I/O signals

(1) The list of input signals (Direction of signals: QD65PD2 to CPU module)

I/O number	Signal name		I/O number	Signal name
X00	Module ready		X10	Coincidence output 1
X01	Operating condition settings batch-changed		X11	Coincidence output 2
X02	CH1	Reserved	X12	Coincidence output 3
X03		Reserved	X13	Coincidence output 4
X04		Reserved	X14	Coincidence output 5
X05		External preset/replace (Z Phase) request detection	X15	Coincidence output 6
X06		Reserved	X16	Coincidence output 7
X07		Reserved	X17	Coincidence output 8
X08		Cam switch function execution/PWM output	X18	General input 1
X09	CH2	Reserved	X19	General input 2
X0A		Reserved	X1A	General input 3
X0B		Reserved	X1B	General input 4
X0C		External preset/replace (Z Phase) request detection	X1C	General input 5
X0D		Reserved	X1D	General input 6
X0E		Reserved	X1E	Error
X0F		Cam switch function execution/PWM output	X1F	Warning

Point

The reserved signals above are used by the system and not available for users. If they are used (turned on and off) by users, the performance of the QD65PD2 cannot be guaranteed.

(2) The list of output signals (Direction of signals: CPU module to QD65PD2)

I/O number	Signal name		Operation timing	I/O number	Signal name	Operation timing
Y00	Reserved		-	Y10	Reset command (coincidence output 1)	
Y01	Operating condition settings batch-change command			Y11	Reset command (coincidence output 2)	
Y02	CH1	Coincidence output enable command		Y12	Reset command (coincidence output 3)	
Y03		Preset/replace command		Y13	Reset command (coincidence output 4)	
Y04		Count down command		Y14	Reset command (coincidence output 5)	
Y05		External preset/replace (Z Phase) request detection reset command		Y15	Reset command (coincidence output 6)	
Y06		Count enable command		Y16	Reset command (coincidence output 7)	
Y07		Selected counter function start command[*1]		Y17	Reset command (coincidence output 8)	
Y08		Cam switch function/PWM output start command		Y18	General output 1	
Y09	CH2	Coincidence output enable command		Y19	General output 2	
Y0A		Preset/replace command		Y1A	General output 3	
Y0B		Count down command		Y1B	General output 4	
Y0C		External preset/replace (Z Phase) request detection reset command		Y1C	General output 5	
Y0D		Count enable command		Y1D	General output 6	
Y0E		Selected counter function start command		Y1E	General output 7	
Y0F		Cam switch function/PWM output start command		Y1F	General output 8	

*1 This signal is enabled while it is ON on the condition that the count disable function or the periodic pulse counter function is selected.
The signal is enabled at its rise time (OFF to ON) on the condition that the latch counter function or the sampling counter function is selected.
The signal is disabled on the condition that the count disable/preset/replace function or the latch counter/preset/replace function is selected.

Point

- The reserved signals above are used by the system and not available for users. If they are used (turned on and off) by users, the performance of the QD65PD2 cannot be guaranteed.
- The illustration meanings of the operation timing are described below.

 The signal is enabled while it is ON. 2ms or more are required for ON time.

 The signal is enabled at its rise time (OFF to ON). 2ms or more are required for ON time or OFF time.

3.3.2 Details on input signals

This section describes the input signals of the QD65PD2.

Point

The I/O numbers (X/Y), buffer memory addresses, and external input terminals described in this section are for CH1.
To check the I/O numbers (X/Y) for CH2, refer to the following:

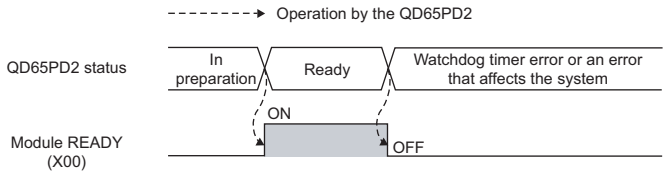
Page 32, Section 3.3.1

To check the buffer memory addresses for CH2, refer to the following:

Page 42, Section 3.4.1

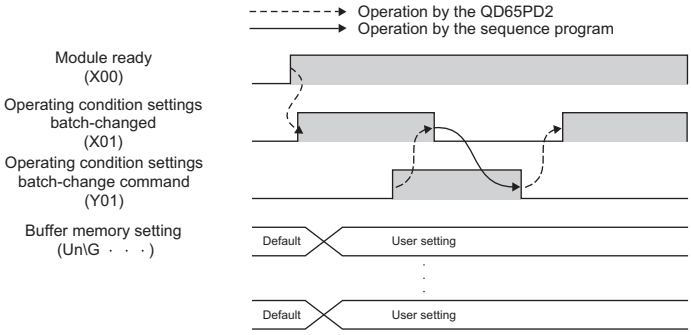
(1) Module ready (X00)

- This signal turns on by powering on the CPU module or resetting it while the QD65PD2 is ready for count, and the count starts.
- This signal turns off when a watchdog timer error or an error affecting the system (Last 3 digits of an error code: 800 to 859) occurs.
- The count does not start when this signal is OFF.
- Use this signal for an interlock to turn on and off a sequence program.



(2) Operating condition settings batch-changed (X01)

- Use this signal for an interlock to turn on and off Operating condition settings batch-change command (Y01) when selecting functions (the comparison output function, for instance) or changing setting values.
- The count doesn't start when this signal is OFF.
- This signal turns off in the following cases:
  - Module ready (X00) turns off.
  - Operating condition settings batch-change command (Y01) is turned off and on.
- This signal turns on in the following case:
  - Operating condition settings batch-change command (Y01) is turned on and off when all setting values for Pr1 or Pr2 (data classification) are normal.

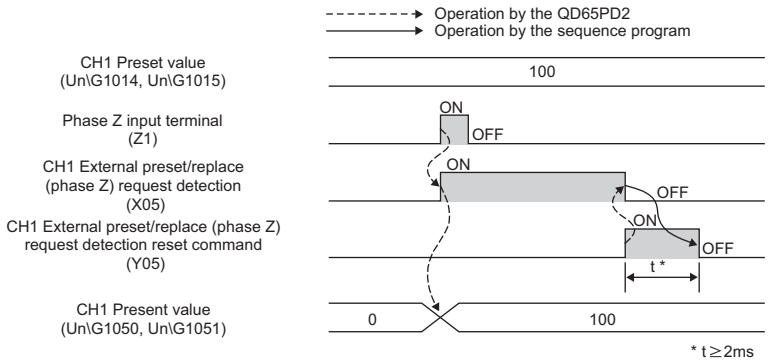


- Confirm that operating condition settings are changed and that this signal is ON before turning on CH1 Count enable command (Y06) and starting the pulse count.

- Buffer memories for the data classification Md1 (except for the Md1 associated with an error or a warning) are not updated when this signal is OFF.
  To check the data classification and corresponding buffer memories, refer to the following:
  ☞ Page 42, Section 3.4.1
- When this signal is OFF, buffer memories for the data classification Cd2 except CH1 Error reset command (Un\G1480) are disabled. (The values of these buffer memories remain set to Reset (1_H) or Requested (1_H), and will be enabled when this signal turns on.
- If output signal Y02 to Y1F is ON when this signal turns on, Y02 to Y1F are regarded as having risen after the signal, and the operation is performed accordingly. (The operation is performed with Y02 to Y1F regarded as being OFF when this signal turns on.)
- When this signal turns on, a count value is replaced by the preset value at the rise of the coincidence output No.1 and No.2, the memories to activate the preset/replace (at coincidence output) function.
  Note that the value is replaced on the condition that coincidence output is selected in "Comparison output setting value" in the switch setting and normal mode is selected in "Operation mode setting".
- When the setting values in buffer memories or in the switch setting are set beyond the setting range and an error is detected, this signal does not turn on even by turning on and off Operating condition settings batch-change command (Y01).
  In that case, turn off and on, and then off Operating condition settings batch-change command (Y01) after the error cause is removed. Keep the ON time 2ms or more.

(3) CH1 External preset/replace (Z Phase) request detection (X05)

- This signal turns on when a count value is replaced with the preset value by the phase Z input terminal (Z1) of the connector for external devices.
  Note that this signal does not turn on when Z phase (Preset) trigger setting (b0, b1) in CH1 Phase Z setting (Un\G1000) is set to 3: On.
- This signal turns off by CH1 External preset/replace (Z Phase) request detection reset command (Y05).
- The value is not replaced while this signal is ON.
- This signal does not turn on when External preset/replace (Z Phase) request detection setting (b4) in CH1 Phase Z setting (Un\G1000) is set to 1: The signal remains off when the preset/replace function is performed. This signal turns on only when b4 is set to 0: The signal turns on when the preset/replace function is performed.
- This signal responds with up to 2ms delay.
- The following figure shows the case when Z phase (Preset) trigger setting (b0, b1) in CH1 Phase Z setting (Un\G1000) is set to 0: Rise.

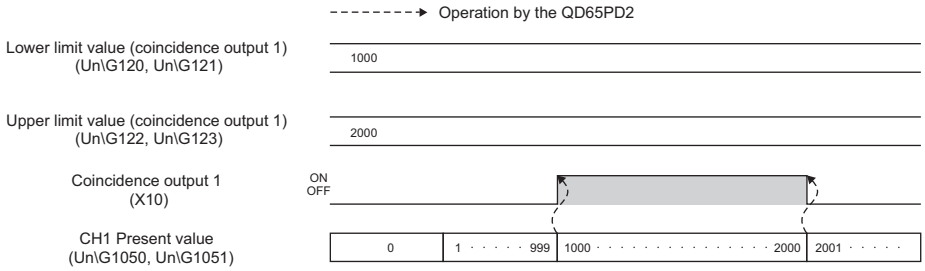


(4) CH1 Cam switch function execution/PWM output (X08)

- This signal turns on while the cam switch function is activated.
- This signal turns on when PWM is output.

(5) Coincidence output 1 to 8 (X10 to X17)

- This signal turns on when a count value satisfies the comparison condition of the coincidence output function or cam switch function.
  (To check the conditions on which this signal turns on or off, refer to the following:)
  ☞ Page 107, Section 4.3
- When using the coincidence output function, select the comparison conditions from Coincidence output, In-range output, and Not-in-range output in Coincidence output condition setting (Un\G0).
- This signal responds with up to 2ms delay.
- The following figure shows the case when Coincidence output 1 (b0, b1) in Coincidence output condition setting (Un\G0) is set to 1: In-range output, with the coincidence output function used.

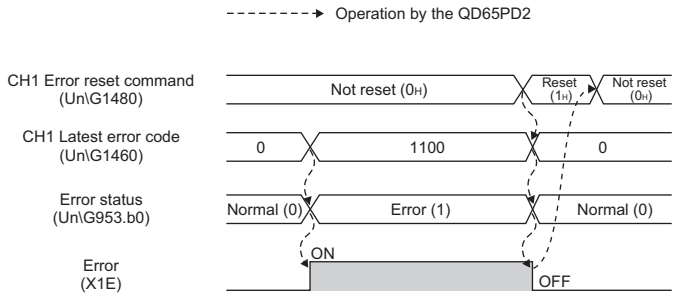


(6) General input 1 to 6 (X18 to X1D)

- Set input values to the general input 1 to 6 terminals (IN1 to IN6) for the external input.
- This signal turns on when ON voltage is applied to the general input 1 to 6 terminals (IN1 to IN6) for the external input.
- This signal responds with up to 2ms delay.

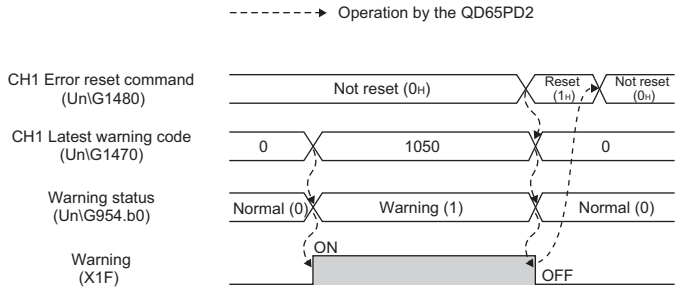
(7) Error (X1E)

- This signal turns on when an error occurs.
- Turn off this signal by Error reset command (Un\G1480) after eliminating the error cause.



(8) Warning (X1F)

- This signal turns on when a warning occurs.
- Turn off this signal by Error reset command (Un\G1480) after eliminating the warning cause.



3.3.3 Details on output signals

This section describes the output signals of the QD65PD2.

Point

The I/O numbers (X/Y), buffer memory addresses, and external input terminals described in this section are for CH1.
To check the I/O numbers (X/Y) for CH2, refer to the following:

Page 32, Section 3.3.1

To check the buffer memory addresses for CH2, refer to the following:

Page 42, Section 3.4.1

(1) Operating condition settings batch-change command (Y01)

- Turn on this signal to enable setting values of buffer memories (Coincidence output condition setting (Un\G0), for instance).
- Settings of buffer memories for data classification Pr1 or Pr2 are reflected to the module by turning on this signal. In that case, the settings of buffer memories for Cd2, which is the data classification corresponding to Pr1 or Pr2, are not required.

  Ex. Set a value to CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017) and turn on this signal to enable the value. In that case, settings by CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) are not required.

  To check the data classification and corresponding buffer memories, refer to the following:

  Page 42, Section 3.4.1
- Stored values of following buffer memories are cleared to 0 by turning on this signal. (This is also applied to CH2.)

Buffer memory	
Counter value greater/smaller (coincidence output) (Un\G190)	CH1 Frequency measurement flag (Un\G1130)
EQU1 to EQU8 terminal status (Un\G951)	CH1 Measured frequency value update flag (Un\G1131)
OUT1 to OUT8 terminal status (Un\G952)	CH1 Measured frequency value (Un\G1132, Un\G1133)
Error status (Un\G953)	CH1 Rotation speed measurement flag (Un\G1180)
Warning status (Un\G954)	CH1 Measured rotation speed value update flag (Un\G1181)
CH1 Present value (Un\G1050, Un\G1051)	CH1 Measured rotation speed value (Un\G1182, Un\G1183)
CH1 Latch count value (Un\G1052, Un\G1053)	CH1 Pulse measurement flag (function input terminal) (Un\G1220)
CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055)	CH1 Measured pulse value update flag (function input terminal) (Un\G1221)
CH1 Sampling count value (Un\G1056, Un\G1057)	CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223)
CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059)	CH1 Pulse measurement flag (latch counter input terminal) (Un\G1240)
CH1 Periodic pulse count, present value (Un\G1060, Un\G1061)	CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241)
CH1 Periodic pulse count value update check (Un\G1062, Un\G1063)	CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243)
CH1 Sampling counter/periodic pulse counter operation flag (Un\G1071)	CH1 External input status (Un\G1450)
CH1 Overflow/underflow detection flag (Un\G1072)	CH1 Latest error code (Un\G1460)
CH1 Latch count value update flag (Un\G1074)	CH1 Latest error detection time (Un\G1461 to Un\G1464)
CH1 Latch count value update flag (latch counter input terminal) (Un\G1075)	CH1 Latest warning code (Un\G1470)
CH1 Sampling count value update flag (Un\G1076)	CH1 Latest warning detection time (Un\G1471 to Un\G1474)
CH1 Periodic pulse count value update flag (Un\G1077)	—

- The following input signals turn off by turning on this signal. (This is also applied to CH2.)

Input signals	
CH1 External preset/replace (Z Phase) request detection (X05)	General input 1 to 6 (X18 to X1D)
CH1 Cam switch function execution/PWM output (X08)	Error (X1E)
Coincidence output 1 to 8 (X10 to X17)	Warning (X1F)

- To check the timing of turning on and off this signal, refer to the following:

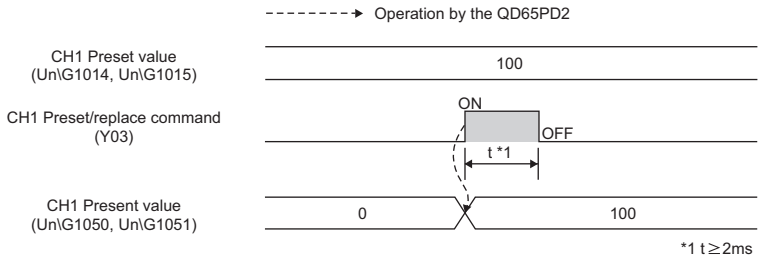
☞Page 34, Section 3.3.2 (2)

(2) CH1 Coincidence output enable command (Y02)

- When the coincidence output function or the cam switch function is used, turn on this signal to output signals from the coincidence output 1 to 8 terminals (EQU1 to EQU8).
- This signal works on any coincidence output 1 to 8 terminals (EQU1 to EQU8) that are assigned to the corresponding channel.

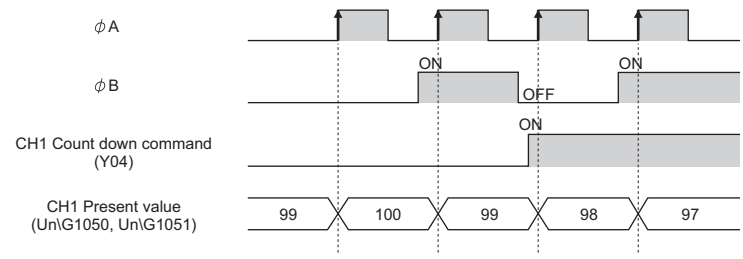
(3) CH1 Preset/replace command (Y03)

- Turn on this signal to replace a count value with the preset value.
- The value cannot be replaced by this signal while CH1 External preset/replace (Z Phase) request detection (X05) is ON. Turn off CH1 External preset/replace (Z Phase) request detection (X05) by using CH1 External preset/replace (Z Phase) request detection reset command (Y05).



(4) CH1 Count down command (Y04)

- Turn on this signal to count down pulses.
- This signal is enabled when the 1 multiple of 1 phase or the 2 multiples of 1 phase is selected for the pulse input mode.
- Inputting pulse in phase B can also start counting down pulses.
- The count is done as below in 1 multiple of 1 phase.



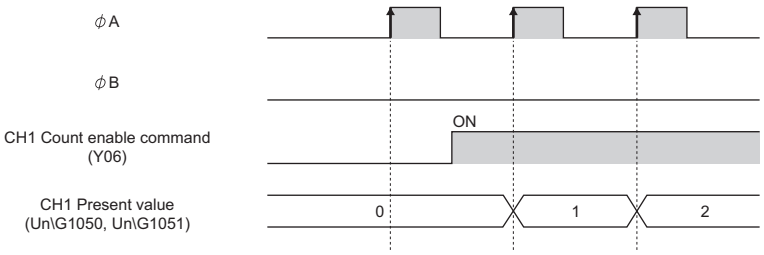
(5) CH1 External preset/replace (Z Phase) request detection reset command (Y05)

- Tune on this signal to turn off CH1 External preset/replace (Z Phase) request detection (X05).
- A count value cannot be replaced with the preset value while CH1 External preset/replace (Z Phase) request detection (X05) is ON.
- For details on the preset/replace operation, refer to the following:

☞Page 35, Section 3.3.2 (3)

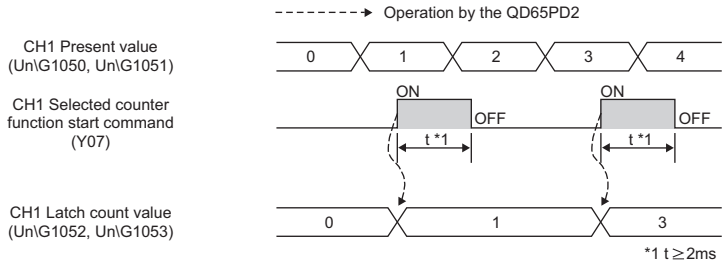
(6) CH1 Count enable command (Y06)

- Turn on this signal to count pulses.
- The count is done as below in 1 multiple of 1 phase.



(7) CH1 Selected counter function start command (Y07)

- Turn on this signal to perform the selected counter functions.
- The count is done as below with the latch counter function being selected.

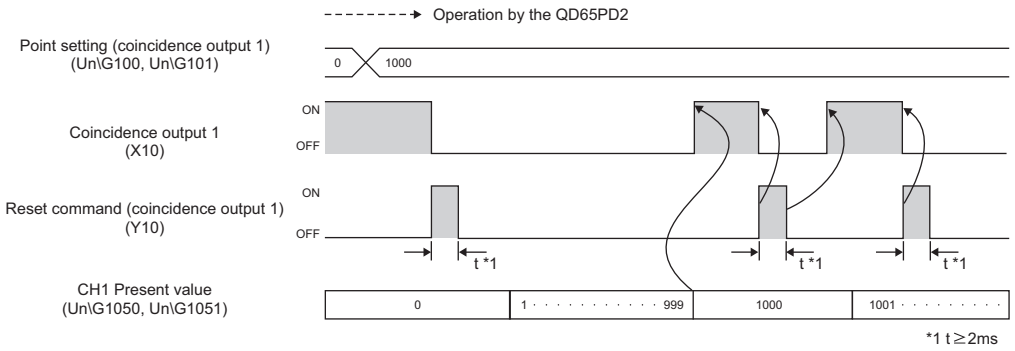


(8) CH1 Cam switch function/PWM output start command (Y08)

- Turn on this signal to execute the cam switch function.
- Turn on this signal to start PWM output.

(9) Reset command (coincidence output 1 to 8) (Y10 to Y17)

- Turn on this signal to turn off Coincidence output 1 to 8 (X10 to X17).
- This signal is enabled on the condition that Coincidence output is selected while the coincidence output function is activated as shown below.



(10)General output 1 to 8 (Y18 to Y1F)

- This signal is used to set the values that are output from the general output 1 to 8 terminals (OUT1 to OUT8) for external output.
- Signals are output from the general output 1 to 8 terminals (OUT1 to OUT8) for external output by turning on this signal.

3.4 Buffer Memory Assignment

This section describes the QD65PD2 buffer memories.

Point

The following describes the data classification in the list.

Pr1 and Pr2 are parameter data to be set by users.

- The setting values for Pr1 are reflected on the condition that Operating condition settings batch-change command (Y01) is turned off and on.
- The setting values for Pr2 are reflected when Operating condition settings batch-change command (Y01) is turned off and on, or at other timings.

Cd1, Cd2, and Cd3 are the data used for updating parameters, for starting, ending, or resetting each function of the counter.

- The values for Cd1 are set and reset by users. When values are set outside the range, they are ignored.
- The values for Cd2 are set by users, and automatically reset. When values are set outside the range, they are ignored.
- The setting values for Cd3 are enabled when the corresponding functions are executed.

Md1 and Md2 are monitor data used to check count values or errors.

- The stored values for Md1 are cleared to 0 when Operating condition settings batch-change command (Y01) is turned off and on.
- The stored values for Md2 are not cleared to 0 when Operating condition settings batch-change command (Y01) is turned off and on, and the values remain the same.

3.4.1 List of buffer memory assignment

(1) Common to all channels (Un\G0 to Un\G999)

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
0	Pr1	Coincidence output condition setting	0000_H	R/W	Use it when "Coincidence Output" is set in the Comparison output setting value.
1		Preset/replace setting at coincidence output			
2		Coincidence detection interrupt setting			
3	—	System area	—	—	—
⋮					
99					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
100	Pr2	Point setting (coincidence output 1) (L)[*3]	0	R/W	Use it when "Coincidence Output" is set in the Comparison output setting value and 0: Coincidence output is set to Coincidence output condition setting (Un\G0).
101		Point setting (coincidence output 1) (H)[*3]			
102		Point setting (coincidence output 2) (L)[*3]			
103		Point setting (coincidence output 2) (H)[*3]			
104		Point setting (coincidence output 3) (L)[*3]			
105		Point setting (coincidence output 3) (H)[*3]			
106		Point setting (coincidence output 4) (L)[*3]			
107		Point setting (coincidence output 4) (H)[*3]			
108		Point setting (coincidence output 5) (L)[*3]			
109		Point setting (coincidence output 5) (H)[*3]			
110		Point setting (coincidence output 6) (L)[*3]			
111		Point setting (coincidence output 6) (H)[*3]			
112		Point setting (coincidence output 7) (L)[*3]			
113		Point setting (coincidence output 7) (H)[*3]			
114		Point setting (coincidence output 8) (L)[*3]			
115		Point setting (coincidence output 8) (H)[*3]			
116	—	System area	—	—	—
⋮					
119					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
120	Pr2	Lower limit value (coincidence output 1) (L)[*3]	0	R/W	Use it when "Coincidence Output" is set in the Comparison output setting value and 1: In-range output or 2: Not-in-range output is set to Coincidence output condition setting (Un\G0).
121		Lower limit value (coincidence output 1) (H)[*3]			
122		Upper limit value (coincidence output 1) (L)[*3]			
123		Upper limit value (coincidence output 1) (H)[*3]			
124		Lower limit value (coincidence output 2) (L)[*3]			
125		Lower limit value (coincidence output 2) (H)[*3]			
126		Upper limit value (coincidence output 2) (L)[*3]			
127		Upper limit value (coincidence output 2) (H)[*3]			
128		Lower limit value (coincidence output 3) (L)[*3]			
129		Lower limit value (coincidence output 3) (H)[*3]			
130		Upper limit value (coincidence output 3) (L)[*3]			
131		Upper limit value (coincidence output 3) (H)[*3]			
132		Lower limit value (coincidence output 4) (L)[*3]			
133		Lower limit value (coincidence output 4) (H)[*3]			
134		Upper limit value (coincidence output 4) (L)[*3]			
135		Upper limit value (coincidence output 4) (H)[*3]			
136		Lower limit value (coincidence output 5) (L)[*3]			
137		Lower limit value (coincidence output 5) (H)[*3]			
138		Upper limit value (coincidence output 5) (L)[*3]			
139		Upper limit value (coincidence output 5) (H)[*3]			
140		Lower limit value (coincidence output 6) (L)[*3]			
141		Lower limit value (coincidence output 6) (H)[*3]			
142		Upper limit value (coincidence output 6) (L)[*3]			
143		Upper limit value (coincidence output 6) (H)[*3]			
144		Lower limit value (coincidence output 7) (L)[*3]			
145		Lower limit value (coincidence output 7) (H)[*3]			
146		Upper limit value (coincidence output 7) (L)[*3]			
147		Upper limit value (coincidence output 7) (H)[*3]			
148		Lower limit value (coincidence output 8) (L)[*3]			
149		Lower limit value (coincidence output 8) (H)[*3]			
150		Upper limit value (coincidence output 8) (L)[*3]			
151		Upper limit value (coincidence output 8) (H)[*3]			
152	—	System area	—	—	—
⋮					
179					
180	Cd2	Setting change request (coincidence output 1)	0	R/W	Use it when "Coincidence Output" is set in the Comparison output setting value.
181		Setting change request (coincidence output 2)			
182		Setting change request (coincidence output 3)			
183		Setting change request (coincidence output 4)			
184		Setting change request (coincidence output 5)			
185		Setting change request (coincidence output 6)			
186		Setting change request (coincidence output 7)			
187		Setting change request (coincidence output 8)			
188	—	System area	—	—	—
189					

Address (decimal notation)	Data classification	Contents	Default value*1	Read/ write*2	Remarks
190	Md1	Counter value greater/smaller (coincidence output)	0	R	Use it when "Coincidence Output" is set in the Comparison output setting value and 0: Coincidence output is set to Coincidence output condition setting (Un\G0).
191	—	System area	—	—	—
⋮					
199					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
200	Cd3	Cam switch function, step type (coincidence output 1)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
201		Cam switch function, number of steps (coincidence output 1)			
202		Cam switch function, step No.1 setting (coincidence output 1) (L)[*3]			
203		Cam switch function, step No.1 setting (coincidence output 1) (H)[*3]			
204		Cam switch function, step No.2 setting (coincidence output 1) (L)[*3]			
205		Cam switch function, step No.2 setting (coincidence output 1) (H)[*3]			
206		Cam switch function, step No.3 setting (coincidence output 1) (L)[*3]			
207		Cam switch function, step No.3 setting (coincidence output 1) (H)[*3]			
208		Cam switch function, step No.4 setting (coincidence output 1) (L)[*3]			
209		Cam switch function, step No.4 setting (coincidence output 1) (H)[*3]			
210		Cam switch function, step No.5 setting (coincidence output 1) (L)[*3]			
211		Cam switch function, step No.5 setting (coincidence output 1) (H)[*3]			
212		Cam switch function, step No.6 setting (coincidence output 1) (L)[*3]			
213		Cam switch function, step No.6 setting (coincidence output 1) (H)[*3]			
214		Cam switch function, step No.7 setting (coincidence output 1) (L)[*3]			
215		Cam switch function, step No.7 setting (coincidence output 1) (H)[*3]			
216		Cam switch function, step No.8 setting (coincidence output 1) (L)[*3]			
217		Cam switch function, step No.8 setting (coincidence output 1) (H)[*3]			
218		Cam switch function, step No.9 setting (coincidence output 1) (L)[*3]			
219		Cam switch function, step No.9 setting (coincidence output 1) (H)[*3]			
220		Cam switch function, step No.10 setting (coincidence output 1) (L)[*3]			
221		Cam switch function, step No.10 setting (coincidence output 1) (H)[*3]			
222		Cam switch function, step No.11 setting (coincidence output 1) (L)[*3]			
223		Cam switch function, step No.11 setting (coincidence output 1) (H)[*3]			
224		Cam switch function, step No.12 setting (coincidence output 1) (L)[*3]			
225		Cam switch function, step No.12 setting (coincidence output 1) (H)[*3]			
226		Cam switch function, step No.13 setting (coincidence output 1) (L)[*3]			
227		Cam switch function, step No.13 setting (coincidence output 1) (H)[*3]			
228		Cam switch function, step No.14 setting (coincidence output 1) (L)[*3]			
229		Cam switch function, step No.14 setting (coincidence output 1) (H)[*3]			
230		Cam switch function, step No.15 setting (coincidence output 1) (L)[*3]			
231		Cam switch function, step No.15 setting (coincidence output 1) (H)[*3]			
232		Cam switch function, step No.16 setting (coincidence output 1) (L)[*3]			
233		Cam switch function, step No.16 setting (coincidence output 1) (H)[*3]			
234 ⋮ 239	—	System area	—	—	—

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
240	Cd3	Cam switch function, step type (coincidence output 2)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
241		Cam switch function, number of steps (coincidence output 2)			
242		Cam switch function, step No.1 setting (coincidence output 2) (L)[*3]			
243		Cam switch function, step No.1 setting (coincidence output 2) (H)[*3]			
244		Cam switch function, step No.2 setting (coincidence output 2) (L)[*3]			
245		Cam switch function, step No.2 setting (coincidence output 2) (H)[*3]			
246		Cam switch function, step No.3 setting (coincidence output 2) (L)[*3]			
247		Cam switch function, step No.3 setting (coincidence output 2) (H)[*3]			
248		Cam switch function, step No.4 setting (coincidence output 2) (L)[*3]			
249		Cam switch function, step No.4 setting (coincidence output 2) (H)[*3]			
250		Cam switch function, step No.5 setting (coincidence output 2) (L)[*3]			
251		Cam switch function, step No.5 setting (coincidence output 2) (H)[*3]			
252		Cam switch function, step No.6 setting (coincidence output 2) (L)[*3]			
253		Cam switch function, step No.6 setting (coincidence output 2) (H)[*3]			
254		Cam switch function, step No.7 setting (coincidence output 2) (L)[*3]			
255		Cam switch function, step No.7 setting (coincidence output 2) (H)[*3]			
256		Cam switch function, step No.8 setting (coincidence output 2) (L)[*3]			
257		Cam switch function, step No.8 setting (coincidence output 2) (H)[*3]			
258		Cam switch function, step No.9 setting (coincidence output 2) (L)[*3]			
259		Cam switch function, step No.9 setting (coincidence output 2) (H)[*3]			
260		Cam switch function, step No.10 setting (coincidence output 2) (L)[*3]			
261		Cam switch function, step No.10 setting (coincidence output 2) (H)[*3]			
262		Cam switch function, step No.11 setting (coincidence output 2) (L)[*3]			
263		Cam switch function, step No.11 setting (coincidence output 2) (H)[*3]			
264		Cam switch function, step No.12 setting (coincidence output 2) (L)[*3]			
265		Cam switch function, step No.12 setting (coincidence output 2) (H)[*3]			
266		Cam switch function, step No.13 setting (coincidence output 2) (L)[*3]			
267		Cam switch function, step No.13 setting (coincidence output 2) (H)[*3]			
268		Cam switch function, step No.14 setting (coincidence output 2) (L)[*3]			
269		Cam switch function, step No.14 setting (coincidence output 2) (H)[*3]			
270		Cam switch function, step No.15 setting (coincidence output 2) (L)[*3]			
271		Cam switch function, step No.15 setting (coincidence output 2) (H)[*3]			
272		Cam switch function, step No.16 setting (coincidence output 2) (L)[*3]			
273		Cam switch function, step No.16 setting (coincidence output 2) (H)[*3]			
274	—	System area	—	—	—
⋮					
279					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
280	Cd3	Cam switch function, step type (coincidence output 3)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
281		Cam switch function, number of steps (coincidence output 3)			
282		Cam switch function, step No.1 setting (coincidence output 3) (L)[*3]			
283		Cam switch function, step No.1 setting (coincidence output 3) (H)[*3]			
284		Cam switch function, step No.2 setting (coincidence output 3) (L)[*3]			
285		Cam switch function, step No.2 setting (coincidence output 3) (H)[*3]			
286		Cam switch function, step No.3 setting (coincidence output 3) (L)[*3]			
287		Cam switch function, step No.3 setting (coincidence output 3) (H)[*3]			
288		Cam switch function, step No.4 setting (coincidence output 3) (L)[*3]			
289		Cam switch function, step No.4 setting (coincidence output 3) (H)[*3]			
290		Cam switch function, step No.5 setting (coincidence output 3) (L)[*3]			
291		Cam switch function, step No.5 setting (coincidence output 3) (H)[*3]			
292		Cam switch function, step No.6 setting (coincidence output 3) (L)[*3]			
293		Cam switch function, step No.6 setting (coincidence output 3) (H)[*3]			
294		Cam switch function, step No.7 setting (coincidence output 3) (L)[*3]			
295		Cam switch function, step No.7 setting (coincidence output 3) (H)[*3]			
296		Cam switch function, step No.8 setting (coincidence output 3) (L)[*3]			
297		Cam switch function, step No.8 setting (coincidence output 3) (H)[*3]			
298		Cam switch function, step No.9 setting (coincidence output 3) (L)[*3]			
299		Cam switch function, step No.9 setting (coincidence output 3) (H)[*3]			
300		Cam switch function, step No.10 setting (coincidence output 3) (L)[*3]			
301		Cam switch function, step No.10 setting (coincidence output 3) (H)[*3]			
302		Cam switch function, step No.11 setting (coincidence output 3) (L)[*3]			
303		Cam switch function, step No.11 setting (coincidence output 3) (H)[*3]			
304		Cam switch function, step No.12 setting (coincidence output 3) (L)[*3]			
305		Cam switch function, step No.12 setting (coincidence output 3) (H)[*3]			
306		Cam switch function, step No.13 setting (coincidence output 3) (L)[*3]			
307		Cam switch function, step No.13 setting (coincidence output 3) (H)[*3]			
308		Cam switch function, step No.14 setting (coincidence output 3) (L)[*3]			
309		Cam switch function, step No.14 setting (coincidence output 3) (H)[*3]			
310		Cam switch function, step No.15 setting (coincidence output 3) (L)[*3]			
311		Cam switch function, step No.15 setting (coincidence output 3) (H)[*3]			
312		Cam switch function, step No.16 setting (coincidence output 3) (L)[*3]			
313		Cam switch function, step No.16 setting (coincidence output 3) (H)[*3]			
314 ⋮ 319	—	System area	—	—	—

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
320	Cd3	Cam switch function, step type (coincidence output 4)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
321		Cam switch function, number of steps (coincidence output 4)			
322		Cam switch function, step No.1 setting (coincidence output 4) (L)[*3]			
323		Cam switch function, step No.1 setting (coincidence output 4) (H)[*3]			
324		Cam switch function, step No.2 setting (coincidence output 4) (L)[*3]			
325		Cam switch function, step No.2 setting (coincidence output 4) (H)[*3]			
326		Cam switch function, step No.3 setting (coincidence output 4) (L)[*3]			
327		Cam switch function, step No.3 setting (coincidence output 4) (H)[*3]			
328		Cam switch function, step No.4 setting (coincidence output 4) (L)[*3]			
329		Cam switch function, step No.4 setting (coincidence output 4) (H)[*3]			
330		Cam switch function, step No.5 setting (coincidence output 4) (L)[*3]			
331		Cam switch function, step No.5 setting (coincidence output 4) (H)[*3]			
332		Cam switch function, step No.6 setting (coincidence output 4) (L)[*3]			
333		Cam switch function, step No.6 setting (coincidence output 4) (H)[*3]			
334		Cam switch function, step No.7 setting (coincidence output 4) (L)[*3]			
335		Cam switch function, step No.7 setting (coincidence output 4) (H)[*3]			
336		Cam switch function, step No.8 setting (coincidence output 4) (L)[*3]			
337		Cam switch function, step No.8 setting (coincidence output 4) (H)[*3]			
338		Cam switch function, step No.9 setting (coincidence output 4) (L)[*3]			
339		Cam switch function, step No.9 setting (coincidence output 4) (H)[*3]			
340		Cam switch function, step No.10 setting (coincidence output 4) (L)[*3]			
341		Cam switch function, step No.10 setting (coincidence output 4) (H)[*3]			
342		Cam switch function, step No.11 setting (coincidence output 4) (L)[*3]			
343		Cam switch function, step No.11 setting (coincidence output 4) (H)[*3]			
344		Cam switch function, step No.12 setting (coincidence output 4) (L)[*3]			
345		Cam switch function, step No.12 setting (coincidence output 4) (H)[*3]			
346		Cam switch function, step No.13 setting (coincidence output 4) (L)[*3]			
347		Cam switch function, step No.13 setting (coincidence output 4) (H)[*3]			
348		Cam switch function, step No.14 setting (coincidence output 4) (L)[*3]			
349		Cam switch function, step No.14 setting (coincidence output 4) (H)[*3]			
350		Cam switch function, step No.15 setting (coincidence output 4) (L)[*3]			
351		Cam switch function, step No.15 setting (coincidence output 4) (H)[*3]			
352		Cam switch function, step No.16 setting (coincidence output 4) (L)[*3]			
353		Cam switch function, step No.16 setting (coincidence output 4) (H)[*3]			
354	—	System area	—	—	—
⋮					
359					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
360	Cd3	Cam switch function, step type (coincidence output 5)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
361		Cam switch function, number of steps (coincidence output 5)			
362		Cam switch function, step No.1 setting (coincidence output 5) (L)[*3]			
363		Cam switch function, step No.1 setting (coincidence output 5) (H)[*3]			
364		Cam switch function, step No.2 setting (coincidence output 5) (L)[*3]			
365		Cam switch function, step No.2 setting (coincidence output 5) (H)[*3]			
366		Cam switch function, step No.3 setting (coincidence output 5) (L)[*3]			
367		Cam switch function, step No.3 setting (coincidence output 5) (H)[*3]			
368		Cam switch function, step No.4 setting (coincidence output 5) (L)[*3]			
369		Cam switch function, step No.4 setting (coincidence output 5) (H)[*3]			
370		Cam switch function, step No.5 setting (coincidence output 5) (L)[*3]			
371		Cam switch function, step No.5 setting (coincidence output 5) (H)[*3]			
372		Cam switch function, step No.6 setting (coincidence output 5) (L)[*3]			
373		Cam switch function, step No.6 setting (coincidence output 5) (H)[*3]			
374		Cam switch function, step No.7 setting (coincidence output 5) (L)[*3]			
375		Cam switch function, step No.7 setting (coincidence output 5) (H)[*3]			
376		Cam switch function, step No.8 setting (coincidence output 5) (L)[*3]			
377		Cam switch function, step No.8 setting (coincidence output 5) (H)[*3]			
378		Cam switch function, step No.9 setting (coincidence output 5) (L)[*3]			
379		Cam switch function, step No.9 setting (coincidence output 5) (H)[*3]			
380		Cam switch function, step No.10 setting (coincidence output 5) (L)[*3]			
381		Cam switch function, step No.10 setting (coincidence output 5) (H)[*3]			
382		Cam switch function, step No.11 setting (coincidence output 5) (L)[*3]			
383		Cam switch function, step No.11 setting (coincidence output 5) (H)[*3]			
384		Cam switch function, step No.12 setting (coincidence output 5) (L)[*3]			
385		Cam switch function, step No.12 setting (coincidence output 5) (H)[*3]			
386		Cam switch function, step No.13 setting (coincidence output 5) (L)[*3]			
387		Cam switch function, step No.13 setting (coincidence output 5) (H)[*3]			
388		Cam switch function, step No.14 setting (coincidence output 5) (L)[*3]			
389		Cam switch function, step No.14 setting (coincidence output 5) (H)[*3]			
390		Cam switch function, step No.15 setting (coincidence output 5) (L)[*3]			
391		Cam switch function, step No.15 setting (coincidence output 5) (H)[*3]			
392		Cam switch function, step No.16 setting (coincidence output 5) (L)[*3]			
393		Cam switch function, step No.16 setting (coincidence output 5) (H)[*3]			
394 ⋮ 399	—	System area	—	—	—

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
400	Cd3	Cam switch function, step type (coincidence output 6)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
401		Cam switch function, number of steps (coincidence output 6)			
402		Cam switch function, step No.1 setting (coincidence output 6) (L)[*3]			
403		Cam switch function, step No.1 setting (coincidence output 6) (H)[*3]			
404		Cam switch function, step No.2 setting (coincidence output 6) (L)[*3]			
405		Cam switch function, step No.2 setting (coincidence output 6) (H)[*3]			
406		Cam switch function, step No.3 setting (coincidence output 6) (L)[*3]			
407		Cam switch function, step No.3 setting (coincidence output 6) (H)[*3]			
408		Cam switch function, step No.4 setting (coincidence output 6) (L)[*3]			
409		Cam switch function, step No.4 setting (coincidence output 6) (H)[*3]			
410		Cam switch function, step No.5 setting (coincidence output 6) (L)[*3]			
411		Cam switch function, step No.5 setting (coincidence output 6) (H)[*3]			
412		Cam switch function, step No.6 setting (coincidence output 6) (L)[*3]			
413		Cam switch function, step No.6 setting (coincidence output 6) (H)[*3]			
414		Cam switch function, step No.7 setting (coincidence output 6) (L)[*3]			
415		Cam switch function, step No.7 setting (coincidence output 6) (H)[*3]			
416		Cam switch function, step No.8 setting (coincidence output 6) (L)[*3]			
417		Cam switch function, step No.8 setting (coincidence output 6) (H)[*3]			
418		Cam switch function, step No.9 setting (coincidence output 6) (L)[*3]			
419		Cam switch function, step No.9 setting (coincidence output 6) (H)[*3]			
420		Cam switch function, step No.10 setting (coincidence output 6) (L)[*3]			
421		Cam switch function, step No.10 setting (coincidence output 6) (H)[*3]			
422		Cam switch function, step No.11 setting (coincidence output 6) (L)[*3]			
423		Cam switch function, step No.11 setting (coincidence output 6) (H)[*3]			
424		Cam switch function, step No.12 setting (coincidence output 6) (L)[*3]			
425		Cam switch function, step No.12 setting (coincidence output 6) (H)[*3]			
426		Cam switch function, step No.13 setting (coincidence output 6) (L)[*3]			
427		Cam switch function, step No.13 setting (coincidence output 6) (H)[*3]			
428		Cam switch function, step No.14 setting (coincidence output 6) (L)[*3]			
429		Cam switch function, step No.14 setting (coincidence output 6) (H)[*3]			
430		Cam switch function, step No.15 setting (coincidence output 6) (L)[*3]			
431		Cam switch function, step No.15 setting (coincidence output 6) (H)[*3]			
432		Cam switch function, step No.16 setting (coincidence output 6) (L)[*3]			
433		Cam switch function, step No.16 setting (coincidence output 6) (H)[*3]			
434	—	System area	—	—	—
⋮					
439					

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
440	Cd3	Cam switch function, step type (coincidence output 7)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
441		Cam switch function, number of steps (coincidence output 7)			
442		Cam switch function, step No.1 setting (coincidence output 7) (L)[*3]			
443		Cam switch function, step No.1 setting (coincidence output 7) (H)[*3]			
444		Cam switch function, step No.2 setting (coincidence output 7) (L)[*3]			
445		Cam switch function, step No.2 setting (coincidence output 7) (H)[*3]			
446		Cam switch function, step No.3 setting (coincidence output 7) (L)[*3]			
447		Cam switch function, step No.3 setting (coincidence output 7) (H)[*3]			
448		Cam switch function, step No.4 setting (coincidence output 7) (L)[*3]			
449		Cam switch function, step No.4 setting (coincidence output 7) (H)[*3]			
450		Cam switch function, step No.5 setting (coincidence output 7) (L)[*3]			
451		Cam switch function, step No.5 setting (coincidence output 7) (H)[*3]			
452		Cam switch function, step No.6 setting (coincidence output 7) (L)[*3]			
453		Cam switch function, step No.6 setting (coincidence output 7) (H)[*3]			
454		Cam switch function, step No.7 setting (coincidence output 7) (L)[*3]			
455		Cam switch function, step No.7 setting (coincidence output 7) (H)[*3]			
456		Cam switch function, step No.8 setting (coincidence output 7) (L)[*3]			
457		Cam switch function, step No.8 setting (coincidence output 7) (H)[*3]			
458		Cam switch function, step No.9 setting (coincidence output 7) (L)[*3]			
459		Cam switch function, step No.9 setting (coincidence output 7) (H)[*3]			
460		Cam switch function, step No.10 setting (coincidence output 7) (L)[*3]			
461		Cam switch function, step No.10 setting (coincidence output 7) (H)[*3]			
462		Cam switch function, step No.11 setting (coincidence output 7) (L)[*3]			
463		Cam switch function, step No.11 setting (coincidence output 7) (H)[*3]			
464		Cam switch function, step No.12 setting (coincidence output 7) (L)[*3]			
465		Cam switch function, step No.12 setting (coincidence output 7) (H)[*3]			
466		Cam switch function, step No.13 setting (coincidence output 7) (L)[*3]			
467		Cam switch function, step No.13 setting (coincidence output 7) (H)[*3]			
468		Cam switch function, step No.14 setting (coincidence output 7) (L)[*3]			
469		Cam switch function, step No.14 setting (coincidence output 7) (H)[*3]			
470		Cam switch function, step No.15 setting (coincidence output 7) (L)[*3]			
471		Cam switch function, step No.15 setting (coincidence output 7) (H)[*3]			
472		Cam switch function, step No.16 setting (coincidence output 7) (L)[*3]			
473		Cam switch function, step No.16 setting (coincidence output 7) (H)[*3]			
474 ⋮ 479	—	System area	—	—	—

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
480	Cd3	Cam switch function, step type (coincidence output 8)	0	R/W	Use it when "Cam Switch Function" is set in the Comparison output setting value.
481		Cam switch function, number of steps (coincidence output 8)			
482		Cam switch function, step No.1 setting (coincidence output 8) (L)[*3]			
483		Cam switch function, step No.1 setting (coincidence output 8) (H)[*3]			
484		Cam switch function, step No.2 setting (coincidence output 8) (L)[*3]			
485		Cam switch function, step No.2 setting (coincidence output 8) (H)[*3]			
486		Cam switch function, step No.3 setting (coincidence output 8) (L)[*3]			
487		Cam switch function, step No.3 setting (coincidence output 8) (H)[*3]			
488		Cam switch function, step No.4 setting (coincidence output 8) (L)[*3]			
489		Cam switch function, step No.4 setting (coincidence output 8) (H)[*3]			
490		Cam switch function, step No.5 setting (coincidence output 8) (L)[*3]			
491		Cam switch function, step No.5 setting (coincidence output 8) (H)[*3]			
492		Cam switch function, step No.6 setting (coincidence output 8) (L)[*3]			
493		Cam switch function, step No.6 setting (coincidence output 8) (H)[*3]			
494		Cam switch function, step No.7 setting (coincidence output 8) (L)[*3]			
495		Cam switch function, step No.7 setting (coincidence output 8) (H)[*3]			
496		Cam switch function, step No.8 setting (coincidence output 8) (L)[*3]			
497		Cam switch function, step No.8 setting (coincidence output 8) (H)[*3]			
498		Cam switch function, step No.9 setting (coincidence output 8) (L)[*3]			
499		Cam switch function, step No.9 setting (coincidence output 8) (H)[*3]			
500		Cam switch function, step No.10 setting (coincidence output 8) (L)[*3]			
501		Cam switch function, step No.10 setting (coincidence output 8) (H)[*3]			
502		Cam switch function, step No.11 setting (coincidence output 8) (L)[*3]			
503		Cam switch function, step No.11 setting (coincidence output 8) (H)[*3]			
504		Cam switch function, step No.12 setting (coincidence output 8) (L)[*3]			
505		Cam switch function, step No.12 setting (coincidence output 8) (H)[*3]			
506		Cam switch function, step No.13 setting (coincidence output 8) (L)[*3]			
507		Cam switch function, step No.13 setting (coincidence output 8) (H)[*3]			
508		Cam switch function, step No.14 setting (coincidence output 8) (L)[*3]			
509		Cam switch function, step No.14 setting (coincidence output 8) (H)[*3]			
510		Cam switch function, step No.15 setting (coincidence output 8) (L)[*3]			
511		Cam switch function, step No.15 setting (coincidence output 8) (H)[*3]			
512		Cam switch function, step No.16 setting (coincidence output 8) (L)[*3]			
513		Cam switch function, step No.16 setting (coincidence output 8) (H)[*3]			
514	—	System area	—	—	—
⋮					
949					
950	Md2	Channel assignment (coincidence output 1 to 8)	5555_H	R	—
951	Md1	EQU1 to EQU8 terminal status	0000_H		—
952		OUT1 to OUT8 terminal status			—
953		Error status			—
954		Warning status			—

Address (decimal notation)	Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
955	—	System area	—	—	—
⋮					
999					

(2) Different from each channel (Un\G1000 to Un\G5999)

Address (decimal notation)		Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
CH1	CH2					
1000	1500	Pr1	CH☐ Phase Z setting	0	R/W	Use it for the preset/replace function.
1001	1501		CH☐ Periodic interrupt setting			Use it for the periodic pulse counter function.
1002 ⋮ 1009	1502 ⋮ 1509	—	System area	—	—	—
1010	1510	Pr2	CH☐ Ring counter lower limit value (L)[*3]	0	R/W	Use it for the ring counter function.
1011	1511		CH☐ Ring counter lower limit value (H)[*3]			
1012	1512		CH☐ Ring counter upper limit value (L)[*3]			
1013	1513		CH☐ Ring counter upper limit value (H)[*3]			
1014	1514		CH☐ Preset value (L)[*3]			Use it for the preset/replace function.
1015	1515		CH☐ Preset value (H)[*3]			
1016	1516		CH☐ Time unit setting (sampling counter/periodic pulse counter)			Use it for the sampling counter function or the periodic pulse counter function.
1017	1517		CH☐ Cycle setting (sampling counter/periodic pulse counter)	1		
1018 ⋮ 1019	1518 ⋮ 1519	—	System area	—	—	—
1020	1520	Cd2	CH☐ Setting change request (sampling counter/periodic pulse counter)	0	R/W	Use it for the sampling counter function or the periodic pulse counter function.
1021	1521	—	System area	—	—	—

Address (decimal notation)		Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
CH1	CH2					
1022	1522	Cd2	CH☐ Latch count value update flag reset command	0	R/W	Use it for the latch counter function (counter function selection).
1023	1523		CH☐ Latch count value update flag reset command (latch counter input terminal)			Use it for the latch counter function by latch counter input terminal.
1024	1524		CH☐ Sampling count value update flag reset command			Use it for the sampling counter function.
1025	1525		CH☐ Periodic pulse count value update flag reset command			Use it for the periodic pulse counter function.
1026 ⋮ 1049	1526 ⋮ 1549	—	System area	—	—	—
1050	1550	Md1	CH☐ Present value (L)[*3]	0	R	—
1051	1551		CH☐ Present value (H)[*3]			
1052	1552		CH☐ Latch count value (L)[*3]			Use it for the latch counter function (counter function selection) or the latch counter/preset/ replace function.
1053	1553		CH☐ Latch count value (H)[*3]			
1054	1554		CH☐ Latch count value (latch counter input terminal) (L)[*3]			Use it for the latch counter function by latch counter input terminal.
1055	1555		CH☐ Latch count value (latch counter input terminal) (H)[*3]			
1056	1556		CH☐ Sampling count value (L)[*3]			Use it for the sampling counter function.
1057	1557		CH☐ Sampling count value (H)[*3]			
1058	1558		CH☐ Periodic pulse count, difference value (L)[*3]			Use it for the periodic pulse counter function.
1059	1559		CH☐ Periodic pulse count, difference value (H)[*3]			
1060	1560		CH☐ Periodic pulse count, present value (L)[*3]			
1061	1561		CH☐ Periodic pulse count, present value (H)[*3]			
1062	1562		CH☐ Periodic pulse count value update check (L)[*3]			
1063	1563		CH☐ Periodic pulse count value update check (H)[*3]			
1064 ⋮ 1069	1564 ⋮ 1569	—	System area	—	—	—

Address (decimal notation)		Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
CH1	CH2					
1070	1570	Md2	CH□ Selected counter function	0	R	—
1071	1571	Md1	CH□ Sampling counter/periodic pulse counter operation flag			Use it for the sampling counter function or the periodic pulse counter function.
1072	1572		CH□ Overflow/underflow detection flag	0000_H		Use it for the linear counter function.
1073	1573	—	System area	—	—	—
1074	1574	Md1	CH□ Latch count value update flag	0	R	Use it for the latch counter function (counter function selection) or the latch counter/preset/ replace function.
1075	1575		CH□ Latch count value update flag (latch counter input terminal)			Use it for the latch counter function by latch counter input terminal.
1076	1576		CH□ Sampling count value update flag			Use it for the sampling counter function.
1077	1577		CH□ Periodic pulse count value update flag			Use it for the periodic pulse counter function.
1078 ⋮ 1099	1578 ⋮ 1599	—	System area	—	—	—
1100	1600	Cd3	CH□ Time unit setting (frequency measurement)	0	R/W	Use it for the frequency measurement function.
1101	1601		CH□ Moving average count (frequency measurement)	1		
1102 ⋮ 1119	1602 ⋮ 1619	—	System area	—	—	—
1120	1620	Cd2	CH□ Measured frequency value update flag reset command	0	R/W	Use it for the frequency measurement function.
1121 ⋮ 1129	1621 ⋮ 1629	—	System area	—	—	—
1130	1630	Md1	CH□ Frequency measurement flag	0	R	Use it for the frequency measurement function.
1131	1631		CH□ Measured frequency value update flag			
1132	1632		CH□ Measured frequency value (L)[*3]			
1133	1633		CH□ Measured frequency value (H)[*3]			

Address (decimal notation)		Data classification	Contents	Default value[*1]	Read/ write[*2]	Remarks
CH1	CH2					
1134 ⋮ 1149	1634 ⋮ 1649	—	System area	—	—	—
1150	1650	Cd3	CH☐ Time unit setting (rotation speed measurement)	0	R/W	Use it for the rotation speed measurement function.
1151	1651		CH☐ Moving average count (rotation speed measurement)	1		
1152	1652		CH☐ Number of pulses per rotation (L)[*3]	1		
1153	1653		CH☐ Number of pulses per rotation (H)[*3]			
1154 ⋮ 1169	1654 ⋮ 1669	—	System area	—	—	—
1170	1670	Cd2	CH☐ Measured rotation speed value update flag reset command	0	R/W	Use it for the rotation speed measurement function.
1171 ⋮ 1179	1671 ⋮ 1679	—	System area	—	—	—
1180	1680	Md1	CH☐ Rotation speed measurement flag	0	R	Use it for the rotation speed measurement function.
1181	1681		CH☐ Measured rotation speed value update flag			
1182	1682		CH☐ Measured rotation speed value(L)[*3]			
1183	1683		CH☐ Measured rotation speed value(H)[*3]			
1184 ⋮ 1199	1684 ⋮ 1699	—	System area	—	—	—
1200	1700	Pr1	CH☐ Pulse measurement setting (function input terminal)	0	R/W	Use it for the pulse measurement function.
1201	1701		CH☐ Pulse measurement setting (latch counter input terminal)			
1202 ⋮ 1209	1702 ⋮ 1709	—	System area	—	—	—
1210	1710	Cd1	CH☐ Pulse measurement start command (function input terminal)	0	R/W	Use it for the pulse measurement function.
1211	1711	Cd2	CH☐ Measured pulse value update flag reset command (function input terminal)			
1212	1712	Cd1	CH☐ Pulse measurement start command (latch counter input terminal)			
1213	1713	Cd2	CH☐ Measured pulse value update flag reset command (latch counter input terminal)			
1214 ⋮ 1219	1714 ⋮ 1719	—	System area	—	—	—
1220	1720	Md1	CH☐ Pulse measurement flag (function input terminal)	0	R	Use it for the pulse measurement function.
1221	1721		CH☐ Measured pulse value update flag (function input terminal)			
1222	1722		CH☐ Measured pulse value (function input terminal) (L)[*3]			
1223	1723		CH☐ Measured pulse value (function input terminal) (H)[*3]			
1224 ⋮ 1239	1724 ⋮ 1739	—	System area	—	—	—

Address (decimal notation) CH1	Address (decimal notation) CH2	Data classification	Contents			Default value[*1]	Read/ write[*2]	Remarks
1240	1740	Md1	CH□ Pulse measurement flag (latch counter input terminal)			0	R	Use it for the pulse measurement function.
1241	1741		CH□ Measured pulse value update flag (latch counter input terminal)					
1242	1742		CH□ Measured pulse value (latch counter input terminal) (L)[*3]					
1243	1743		CH□ Measured pulse value (latch counter input terminal) (H)[*3]					
1244 ⋮ 1299	1744 ⋮ 1799	—	System area			—	—	—
1300	1800	Cd3	CH□ PWM output assignment			0000_H	R/W	Use it for the PWM output function.
1301	1801	—	System area			—	—	—
1302	1802	Cd3	CH□ On width setting (PWM output) (L)[*3]			0	R/W	Use it for the PWM output function.
1303	1803		CH□ On width setting (PWM output) (H)[*3]					
1304	1804		CH□ Cycle setting (PWM output) (L)[*3]			50		
1305	1805		CH□ Cycle setting (PWM output) (H)[*3]					
1306 ⋮ 1449	1806 ⋮ 1949	—	System area			—	—	—
1450	1950	Md1	CH□ External input status			0000_H	R	This memory stores the external input status of the phase Z , function, latch counter, phase A, and phase B as well as the count up/count down status.
1451	1951	Md2	CH□ Operation mode			0		—
1452 ⋮ 1459	1952 ⋮ 1959	—	System area			—	—	—
1460	1960	Md1	CH□ Latest error code			0	R	An error information is stored in it when an error is detected.
1461	1961		CH□ Latest error detection time	First two digits of the year	Last two digits of the year			
1462	1962			Month	Day			
1463	1963			Hour	Minute			
1464	1964			Second	Day of the week			
1465 ⋮ 1469	1965 ⋮ 1969	—	System area			—	—	—

Address (decimal notation)		Data classification	Contents			Default value[*1]	Read/ write[*2]	Remarks
CH1	CH2							
1470	1970	Md1	CH□ Latest warning code			0	R	An warning information is stored in it when a warning is detected.
1471	1971		CH□ Latest warning detection time	First two digits of the year	Last two digits of the year			
1472	1972			Month	Day			
1473	1973			Hour	Minute			
1474	1974			Second	Day of the week			
1475 ⋮ 1479	1975 ⋮ 1979	—	System area			—	—	—
1480	1980	Cd2	CH□ Error reset command			0	R/W	—
1481 ⋮ 1499	1981 ⋮ 1999	—	System area			—	—	—
2000 ⋮ 3999	4000 ⋮ 5999		System area					

(3) Error history (Un\G6000 to Un\G6199)

Address (decimal notation)	Data classification	Contents				Default value[*1]	Read/ write[*2]	Remarks
6000	Md2	Latest error code address				0	R	—
6001 ⋮ 6009	—	System area				—	—	—
6010	Md2	Error log 1	Error code			0	R	—
6011			Detection time	First two digits of the year	Last two digits of the year			
6012				Month	Day			
6013				Hour	Minute			
6014				Second	Day of the week			
6015 ⋮ 6019	—	System area				—	—	—
6020	Md2	Error log 2	Error code			0	R	—
6021			Detection time	First two digits of the year	Last two digits of the year			
6022				Month	Day			
6023				Hour	Minute			
6024				Second	Day of the week			
6025 ⋮ 6029	—	System area				—	—	—
6030	Md2	Error log 3	Error code			0	R	—
6031			Detection time	First two digits of the year	Last two digits of the year			
6032				Month	Day			
6033				Hour	Minute			
6034				Second	Day of the week			
6035 ⋮ 6039	—	System area				—	—	—
6040	Md2	Error log 4	Error code			0	R	—
6041			Detection time	First two digits of the year	Last two digits of the year			
6042				Month	Day			
6043				Hour	Minute			
6044				Second	Day of the week			
6045 ⋮ 6049	—	System area				—	—	—

Address (decimal notation)	Data classification	Contents				Default value[*1]	Read/ write[*2]	Remarks
6050	Md2	Error log 5	Error code			0	R	—
6051			Detection time	First two digits of the year	Last two digits of the year			
6052				Month	Day			
6053				Hour	Minute			
6054				Second	Day of the week			
6055 ⋮ 6059	—	System area				—	—	—
6060	Md2	Error log 6	Error code			0	R	—
6061			Detection time	First two digits of the year	Last two digits of the year			
6062				Month	Day			
6063				Hour	Minute			
6064				Second	Day of the week			
6065 ⋮ 6069	—	System area				—	—	—
6070	Md2	Error log 7	Error code			0	R	—
6071			Detection time	First two digits of the year	Last two digits of the year			
6072				Month	Day			
6073				Hour	Minute			
6074				Second	Day of the week			
6075 ⋮ 6079	—	System area				—	—	—
6080	Md2	Error log 8	Error code			0	R	—
6081			Detection time	First two digits of the year	Last two digits of the year			
6082				Month	Day			
6083				Hour	Minute			
6084				Second	Day of the week			
6085 ⋮ 6089	—	System area				—	—	—
6090	Md2	Error log 9	Error code			0	R	—
6091			Detection time	First two digits of the year	Last two digits of the year			
6092				Month	Day			
6093				Hour	Minute			
6094				Second	Day of the week			

Address (decimal notation)	Data classification	Contents				Default value[*1]	Read/ write[*2]	Remarks
6095 ⋮ 6099	—	System area				—	—	—
6100	Md2	Error log 10	Error code			0	R	—
6101			Detection time	First two digits of the year	Last two digits of the year			
6102				Month	Day			
6103				Hour	Minute			
6104				Second	Day of the week			
6105 ⋮ 6109	—	System area				—	—	—
6110	Md2	Error log 11	Error code			0	R	—
6111			Detection time	First two digits of the year	Last two digits of the year			
6112				Month	Day			
6113				Hour	Minute			
6114				Second	Day of the week			
6115 ⋮ 6119	—	System area				—	—	—
6120	Md2	Error log 12	Error code			0	R	—
6121			Detection time	First two digits of the year	Last two digits of the year			
6122				Month	Day			
6123				Hour	Minute			
6124				Second	Day of the week			
6125 ⋮ 6129	—	System area				—	—	—
6130	Md2	Error log 13	Error code			0	R	—
6131			Detection time	First two digits of the year	Last two digits of the year			
6132				Month	Day			
6133				Hour	Minute			
6134				Second	Day of the week			
6135 ⋮ 6139	—	System area				—	—	—

Address (decimal notation)	Data classification	Contents				Default value*1	Read/ write*2	Remarks
6140	Md2	Error log 14	Error code			0	R	—
6141			Detection time	First two digits of the year	Last two digits of the year			
6142				Month	Day			
6143				Hour	Minute			
6144				Second	Day of the week			
6145 ⋮ 6149	—	System area				—	—	—
6150	Md2	Error log 15	Error code			0	R	—
6151			Detection time	First two digits of the year	Last two digits of the year			
6152				Month	Day			
6153				Hour	Minute			
6154				Second	Day of the week			
6155 ⋮ 6159	—	System area				—	—	—
6160	Md2	Error log 16	Error code			0	R	—
6161			Detection time	First two digits of the year	Last two digits of the year			
6162				Month	Day			
6163				Hour	Minute			
6164				Second	Day of the week			
6165 ⋮ 6199	—	System area				—	—	—

*1 Default value means an initial value to be set by powering on or resetting the CPU module.

*2 Read/write shows whether reading or writing from/to the program is enabled.
R: Reading is enabled W: Writing is enabled

*3 Read and write a value in 32-bit signed binary format. (Make sure to use a value in units of 2 words.)

Point

Do not write any data to the system area or the area where the writing from a sequence program is prohibited in the buffer memory.
The performance of the QD65PD2 cannot be guaranteed when the writing is done.

3.4.2 Details of the buffer memory

This section describes the details of the QD65PD2 buffer memories.

Point

- The I/O numbers (X/Y), buffer memory addresses, and external input terminals described in this section are for CH1. To check the I/O numbers (X/Y) for CH2, refer to the following:

  Page 32, Section 3.3.1

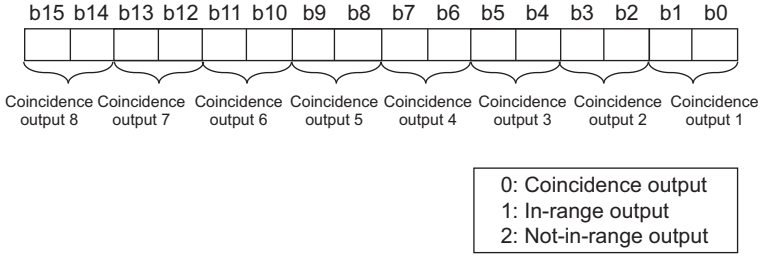
  To check the buffer memory addresses for CH2, refer to the following:

  Page 42, Section 3.4.1

- The system uses the buffer memories whose setting values are fixed to 0, and the memories are not available for users. Leave the values to be 0. If the memories are used (the values except 0 are set) by users, the performance of the QD65PD2 cannot be guaranteed.

(1) Coincidence output condition setting (Un\G0)

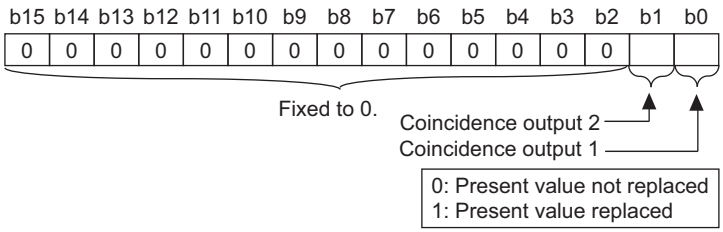
- Use this memory to select comparison conditions and to set the values to Coincidence output 1 to 8.



- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default values set to Coincidence output 1 to 8 are 0: Coincidence output.

(2) Preset/replace setting at coincidence output (Un\G1)

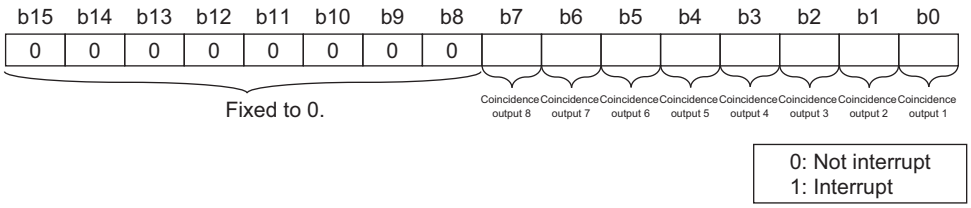
- Use this memory to set whether a present value is replaced or not at the timing of coincidence output.



- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default values set to Coincidence output 1 and 2 are 0: Present value not replaced.

(3) Coincidence detection interrupt setting (Un\G2)

- Use this memory when "Coincidence Output" is selected in the "Comparison output setting value" in the switch setting.
- Select whether coincidence detection interruption is executed or not and set the values of either 1: Interrupt or 0: Not interrupt.



- For details on Coincidence output 1 to 8 and corresponding interrupt factors, refer to the following:

☞ Page 122, Section 4.3.5

- Assign the interrupt factors to interrupt pointers in the CPU module before executing the coincidence detection interruption. Failure to do so may cause an error in the CPU module.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default values set to Coincidence output 1 to 8 are 0: Not interrupt.

(4) Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115)

- When the values set to these buffer memories are matched to the count value, signals are output.
- Use these memories on the condition that the bits corresponding to Coincidence output 1 to 8 in Coincidence output condition setting (Un\G0) are set to 0: Coincidence output. Don't use the memories when the bits are set to either 1: In-range output or 2: Not-in-range output.
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01), or by setting corresponding Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) to 1_H: Requested.
- The default values are 0.

(5) Upper/lower limit value (coincidence output 1 to 8) (Un\G120 to Un\G151)

- Use these memories to set the upper and lower limit value of the count range for the count value comparison.
- Use these memories on the condition that the bits corresponding to Coincidence output 1 to 8 in Coincidence output condition setting (Un\G0) are set to either 1: In-range output or 2: Not-in-range output. Don't use the memories when the bits are set to 0: Coincidence output.
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01), or by setting corresponding Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) to 1_H: Requested.
- The default values are 0.

(a) Lower limit value (coincidence output 1) (Un\G120, Un\G121)

- Use these memories to set the lower limit value of the count range for the count value comparison.
- These buffer memories correspond to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  ☞ Page 42, Section 3.4.1

(b) Upper limit value (coincidence output 1) (Un\G122, Un\G123)

- Use these memories to set the upper limit value of the count range for the count value comparison.
- These buffer memories correspond to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  ☞ Page 42, Section 3.4.1

Point

When the upper limit values set to Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151)are smaller than the lower limit values, Upper limit value setting error (coincidence output 1 to 8) (error code: □21n)*1 will be detected.

*1 □ indicates the number of channel with the error, and n indicates the number of Coincidence output with the error.

(6) Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187)

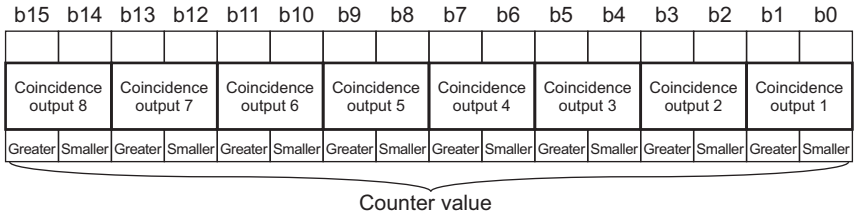
- Use these memories to enable the settings of the following buffer memories.

Buffer memory
Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115)
Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151)

- The values set to the above buffer memories are enabled by setting Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) to 1_H: Requested.
  Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) are automatically reset to 0_H: Not requested after the values are enabled.
- The default values are 0_H: Not requested.

(7) Counter value greater/smaller (coincidence output) (Un\G190)

- This memory stores the results of comparison between the values set to Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) and count values.
- Use this memory on the condition that the bits corresponding to Coincidence output 1 to 8 in Coincidence output condition setting (Un\G0) are set to 0: Coincidence output.



Point setting (coincidence output 1 to 8) = Present value	:	Both Counter value greater and Counter value smaller store "0".
Point setting (coincidence output 1 to 8) > Present value	:	Counter value greater stores "0" and Counter value smaller stores "1".
Point setting (coincidence output 1 to 8) < Present value	:	Counter value greater stores "1" and Counter value smaller stores "0".

- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(8) Cam switch function, step type (coincidence output 1) (Un\G200)

- Use this memory to set the step type to Coincidence output 1 when using the cam switch function.
- This memory corresponds to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  ☞ Page 42, Section 3.4.1

Operation	Setting value
Start from output status OFF	0_H
Start from output status ON	1_H

- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default values are 0_H: Start with output status OFF.

Point

Off signal is output in the following condition:
The number of steps and step type for a coincidence output is 0 and 0_H: Start from output status OFF respectively.
On signal is output in the following condition:
The number of steps and step type for a coincidence output is 0 and 1_H: Start from output status ON respectively.

(9) Cam switch function, number of steps (coincidence output 1) (Un\G201)

- Use this memory to set the number of steps to Coincidence output 1 when using the cam switch function.
- This memory corresponds to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  ☞ Page 42, Section 3.4.1
- The setting range is between 0 and 16.
- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default value is 0.

(10)Cam switch function, step No.1 to No.16 setting (coincidence output 1) (Un\G202 to Un\G233)

- Use these memories to set the comparison values to select whether on signal or off signal should be output. The values are set to step No.1 to No.16 for coincide output 1.
- This memory corresponds to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  ☞ Page 42, Section 3.4.1
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default values are 0.

Point

- Given that a step No. is m, set a smaller number to the step No.m than to the step No. (m+1). When the greater number is set, an error (error code:□3n1 to □3n5)*1 will be detected.

*1 □ indicates the number of channel with the error, and n indicates the number of Coincidence output with the error.

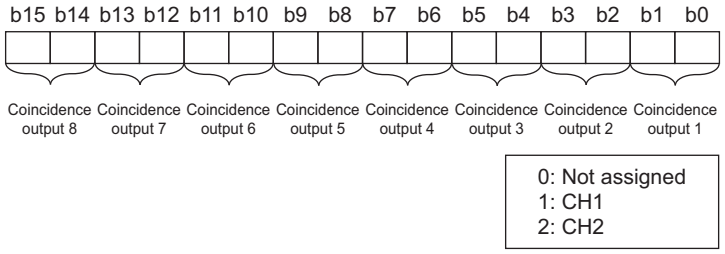
- Set the values of Step No. that satisfy the following formula so that the pulse input speed is not exceed the permissible speed.

  Pulse input speed (pps) ÷ 1000 ≤ (Setting values of the step No. (m+1) for Coincidence output 1 to 8) - (Setting values of the step No.m for Coincidence output 1 to 8)

  If the values do not satisfy the formula, the count values are not detected in the minimum unit, and on or off signals are not output.

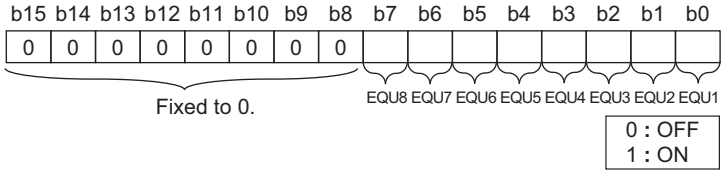
(11)Channel assignment (coincidence output 1 to 8) (Un\G950)

- This memory stores the channel assignment status for Coincidence output 1 to 8.



(12)EQU1 to EQU8 terminal status (Un\G951)

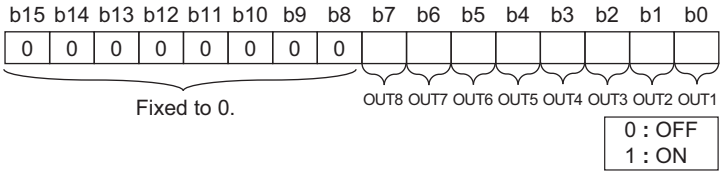
- This memory stores the status of EQU1 to EQU8, the output terminals of Coincidence output 1 to 8.



- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(13)OUT1 to OUT8 terminal status (Un\G952)

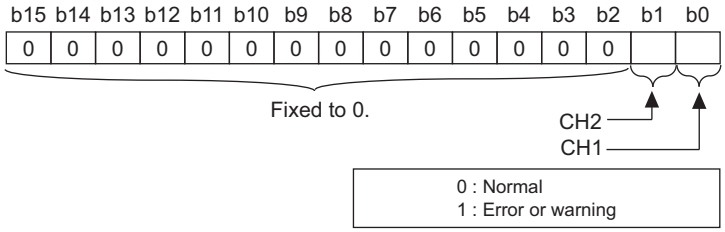
- This memory stores the status of OUT1 to OUT8, the output terminals of general output 1 to 8.



- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(14)Error status (Un\G953), Warning status (Un\G954)

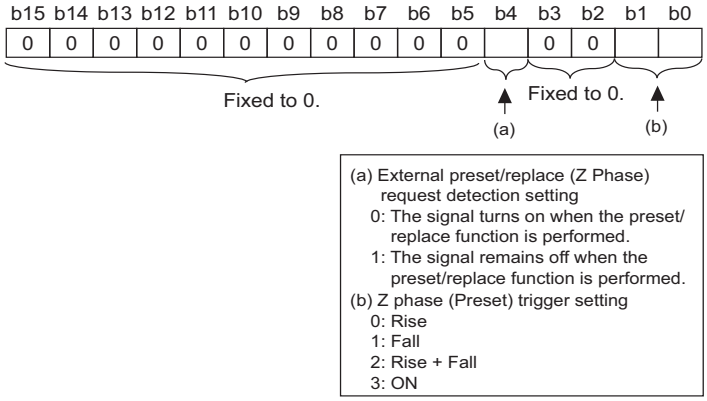
- These memories store the status of an error or a warning of each channel.



- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(15)CH1 Phase Z setting (Un\G1000)

- Use this memory to set the trigger condition to replace a count value with the preset value using the phase Z input terminal (Z1).
- Set whether to turn on CH1 External preset/replace (Z Phase) request detection (X05) when replacing a count value by the phase Z input terminal (Z1).
- When Z phase (Preset) trigger setting is ON, External preset/replace (Z Phase) request detection setting is disabled and CH1 External preset/replace (Z Phase) request detection (X05) remains off.



- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default values for External preset/replace (phase Z) request detection setting and Phase Z (preset/replace) trigger setting are 0: The signal turns on when the preset/replace function is performed and 0: Rise respectively.

(16)CH1 Periodic interrupt setting (Un\G1001)

- Use this memory to select whether the periodic interrupt function is executed or not and set the values of either 1_H: Interrupt or 0_H : Not interrupt.
- For details on corresponding interrupt factors, refer to the following:

☞ Page 139, Section 4.9.1

- Assign the interrupt factors to interrupt pointers in the CPU module before executing the periodic interrupt function. Failure to do so may cause an error in the CPU module.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default value is 0_H : Not interrupt.

(17)CH1 Ring counter lower limit value (Un\G1010, Un\G1011)

- Use these memories to set the lower limit value of the count range when the ring counter is selected for a counter format.
- Set the upper limit value of the ring counter as well.
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01) or CH1 Count enable command (Y06).
- The default value is 0.

(18)CH1 Ring counter upper limit value (Un\G1012, Un\G1013)

- Use these memories to set the upper limit value of the count range when the ring counter is selected for a counter format.
- Set the lower limit value of the ring counter as well.
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01) or CH1 Count enable command (Y06).
- The default value is 0.

Point

When the setting value of CH1 Ring counter upper limit value (Un\G1012, Un\G1013) is smaller than that of CH1 Ring counter lower limit value (Un\G1010, Un\G1011), CH1 Ring counter upper/lower limit value setting error (error code: 1110).

(19)CH1 Preset value (Un\G1014, Un\G1015)

- Use these memories to set a preset value.
- The setting range is between -2147483648 and 2147483647 in 32-bit signed binary format.
- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01).
- The setting values are enabled while Operating condition settings batch-changed (X01) is ON.
- The default value is 0.

(20)CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016)

- Use this memory to set a unit of time for the sampling counter function or the periodic pulse counter function.

A unit of time	Setting value
1ms	0_H
10ms	1_H

- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01) or setting CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested.
- The default value is 0_H: 1ms.

(21)CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017)

- Use this memory to set a sampling period for the sampling counter function or a cycle for the periodic pulse counter function.
- The setting range is shown below.

Condition	Setting value
CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016) is set to 0_H: 1ms.	1 to 65535 (1ms per unit)
CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016) is set to 1_H: 10ms.	1 to 65535 (10ms per unit)*1

*1 The value is converted to Setting value × 10ms and used for the operation in the module.

- The setting values are enabled by turning off and on Operating condition settings batch-change command (Y01) or setting CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested.
- The default value is 1.

(22)CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020)

- Use this memory to enable the setting values of the following buffer memories.

Buffer memory
CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016)
CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017)

- The values set to the above buffer memories are enabled by setting CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested. CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) is automatically reset to 0_H: Not requested after the values are enabled.
- The default value is 0_H: Not requested.

(23)CH1 Latch count value update flag reset command (Un\G1022)

- Use this memory to reset CH1 Latch count value update flag (Un\G1074).
- CH1 Latch count value update flag (Un\G1074) is reset by setting CH1 Latch count value update flag reset command (Un\G1022) to 1_H: Reset. CH1 Latch count value update flag reset command (Un\G1022) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(24)CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023)

- Use this memory to reset CH1 Latch count value update flag (latch counter input terminal) (Un\G1075).
- CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) is reset by setting CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023) to 1_H: Reset. CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(25)CH1 Sampling count value update flag reset command (Un\G1024)

- Use this memory to reset CH1 Sampling count value update flag (Un\G1076).
- CH1 Sampling count value update flag (Un\G1076) is reset by setting CH1 Sampling count value update flag reset command (Un\G1024) to 1_H: Reset. CH1 Sampling count value update flag reset command (Un\G1024) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(26)CH1 Periodic pulse count value update flag reset command (Un\G1025)

- Use this memory to reset CH1 Periodic pulse count value update flag (Un\G1077).
- CH1 Periodic pulse count value update flag (Un\G1077) is reset by setting CH1 Periodic pulse count value update flag reset command (Un\G1025) to 1_H: Reset. CH1 Periodic pulse count value update flag reset command (Un\G1025) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(27)CH1 Present value (Un\G1050, Un\G1051)

- These memories store a present value in the counter.
- The value is updated every 1ms.
  The update might be delayed for some reason. For the reasons of the delay, refer to the following:
  ☞ Page 165, Section 4.20
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(28)CH1 Latch count value (Un\G1052, Un\G1053)

- These memories store the count value that is latched when the following functions are used.

Function
Latch counter function (counter function selection)
Latch counter/preset/replace function

- These memories store the count value when the function input terminal (FUNC1) or CH1 Selected counter function start command (Y07) is input.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(29)CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055)

- These memories store the count value that is latched by the latch counter input terminal.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(30)CH1 Sampling count value (Un\G1056, Un\G1057)

- These memories store the count value during the sampling period when the sampling counter function is used.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(31)CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059)

- These memories store the difference of the count values between the previous one and the present one at regular time intervals when the periodic pulse counter function is used.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(32)CH1 Periodic pulse count, present value (Un\G1060, Un\G1061)

- These memories store the count value (present one) at regular time intervals when the periodic pulse counter function is used.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(33)CH1 Periodic pulse count value update check (Un\G1062, Un\G1063)

- When the periodic pulse counter function is used, these memories store the same value stored in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) after the completion of update of values both in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) and CH1 Periodic pulse count, present value (Un\G1060, Un\G1061).
- When the value in CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) differs from the one in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), read again all of the values in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), CH1 Periodic pulse count, present value (Un\G1060, Un\G1061), and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) because there is a value discrepancy.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(34)CH1 Selected counter function (Un\G1070)

- This memory stores the values indicating the selected counter functions.

Function	Value to be stored
Count disable function	0_H
Latch counter function	1_H
Sampling counter function	2_H
Periodic pulse counter function	3_H
Count disable/preset/replace function	4_H
Latch counter/preset/replace function	5_H

- The stored value is not cleared to 0 when Operating condition settings batch-change command (Y01) is turned off and on, and the value remains the same.

(35)CH1 Sampling counter/periodic pulse counter operation flag (Un\G1071)

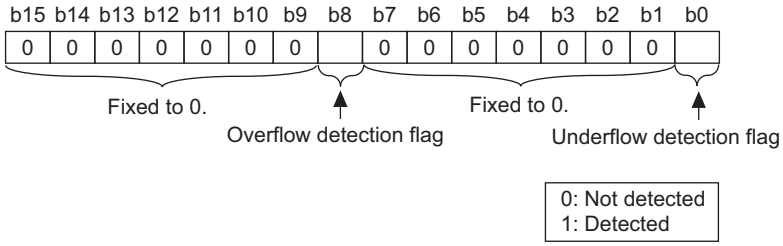
- This memory stores the values indicating the operation status of the sampling counter function or the periodic pulse counter function.

Operation status	Value to be stored
Not operating	0_H
Operating	1_H

- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(36)CH1 Overflow/underflow detection flag (Un\G1072)

- This memory stores the value indicating whether an overflow/underflow is detected in the counter.
- With the linear counter being selected for a counter format, the overflow detection flag is turned on (1) when a count value exceeds 2147483647. The underflow detection flag is turned on (1) as well when a count value falls below -2147483648.



- When either the overflow detection flag or the underflow detection flag is detected (1), CH1 Overflow/ underflow error (error code: 1100) will occur. Upon detection of the error, the module stops the count.
- By replacing the count value, the overflow detection flag or the underflow detection flag is turned off, and the module resumes the count.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

Point

Though the overflow or underflow detection flag is turned off by replacing the count value, Error (X1E) and CH1 Latest error code (Un\G1460) are not turned off nor cleared to 0 by doing so.
Reset the both of them by using CH1 Error reset command (Un\G1480) to turn it off or clear the value to 0.

(37)CH1 Latch count value update flag (Un\G1074)

- This memory stores the value indicating whether CH1 Latch count value (Un\G1052, Un\G1053) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Latch count value (Un\G1052, Un\G1053) are updated without resetting CH1 Latch count value update flag (Un\G1074).
  To check the update status of CH1 Latch count value (Un\G1052, Un\G1053) once again, reset CH1 Latch count value update flag (Un\G1074) by using CH1 Latch count value update flag reset command (Un\G1022).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Latch count value update flag (Un\G1074) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(38)CH1 Latch count value update flag (latch counter input terminal) (Un\G1075)

- This memory stores the value indicating whether CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) are updated without resetting CH1 Latch count value update flag (latch counter input terminal) (Un\G1075).
  To check the update status of CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) once again, reset CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) by using CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(39)CH1 Sampling count value update flag (Un\G1076)

- This memory stores the value indicating whether CH1 Sampling count value (Un\G1056, Un\G1057) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Sampling count value (Un\G1056, Un\G1057) are updated without resetting CH1 Sampling count value update flag (Un\G1076).
  To check the update status of CH1 Sampling count value (Un\G1056, Un\G1057) once again, reset CH1 Sampling count value update flag (Un\G1076) by using CH1 Sampling count value update flag reset command (Un\G1024).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Sampling count value update flag (Un\G1076) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(40)CH1 Periodic pulse count value update flag (Un\G1077)

- This memory stores the value indicating whether the following buffer memories are updated or not. When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.

Buffer memory
CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059)
CH1 Periodic pulse count, present value (Un\G1060, Un\G1061)
CH1 Periodic pulse count value update check (Un\G1062, Un\G1063)

- The above buffer memories are updated without resetting CH1 Periodic pulse count value update flag (Un\G1077).
  To check the update status of the above buffer memories once again, reset CH1 Periodic pulse count value update flag (Un\G1077) by using CH1 Periodic pulse count value update flag reset command (Un\G1025).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Periodic pulse count value update flag (Un\G1077) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(41)CH1 Time unit setting (frequency measurement) (Un\G1100)

- Use this memory to set a unit of time for the frequency measurement.

A unit of time for frequency measurement	Setting value
0.01s	0_H
0.1s	1_H
1s	2_H

- The setting value is enabled by turning off and on CH1 Count enable command (Y06).
- The default value is 0_H: 0.01s.

(42)CH1 Moving average count (frequency measurement) (Un\G1101)

- Use this memory to set the number of moving average count for the frequency measurement.
- The setting range is between 1 and 100. When 1 is set to CH1 Moving average count (frequency measurement) (Un\G1101), the operation is performed with the moving average count regarded as not being done.
- The setting value is enabled by turning off and on CH1 Count enable command (Y06).
- The default value is 1.

(43)CH1 Measured frequency value update flag reset command (Un\G1120)

- Use this memory to reset CH1 Measured frequency value update flag (Un\G1131).
- CH1 Measured frequency value update flag (Un\G1131) is reset by setting CH1 Measured frequency value update flag reset command (Un\G1120) to 1_H: Reset. CH1 Measured frequency value update flag reset command (Un\G1120) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(44)CH1 Frequency measurement flag (Un\G1130)

- This memory stores the value indicating whether the module is measuring the frequency or not.
  When the module is measuring the frequency, 1_H is stored. When the module is not measuring the frequency, 0_H is stored.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(45)CH1 Measured frequency value update flag (Un\G1131)

- This memory stores the value indicating whether CH1 Measured frequency value (Un\G1132, Un\G1133) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Measured frequency value (Un\G1132, Un\G1133) are updated without resetting CH1 Measured frequency value update flag (Un\G1131).
  To check the update status of CH1 Measured frequency value (Un\G1132, Un\G1133) once again, reset CH1 Measured frequency value update flag (Un\G1131) by using CH1 Measured frequency value update flag reset command (Un\G1120).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Measured frequency value update flag (Un\G1131) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(46)CH1 Measured frequency value (Un\G1132, Un\G1133)

- These memories store a measured frequency value.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).
- The default value is 0.

(47)CH1 Time unit setting (rotation speed measurement) (Un\G1150)

- Use this memory to set a unit of time for the rotation speed measurement.

A unit of time for rotation speed measurement	Setting value
0.01s	0_H
0.1s	1_H
1s	2_H

- The setting value is enabled by turning off and on CH1 Count enable command (Y06).
- The default value is 0_H: 0.01s.

(48)CH1 Moving average count (rotation speed measurement) (Un\G1151)

- Use this memory to set the number of moving average count for the rotation speed measurement.
- The setting range is between 1 and 100. When 1 is set to CH1 Moving average count (rotation speed measurement) (Un\G1151), the operation is performed with the moving average count regarded as not being done.
- The setting value is enabled by turning off and on CH1 Count enable command (Y06).
- The default value is 1.

(49)CH1 Number of pulses per rotation (Un\G1152, Un\G1153)

- Use these memories to set the number of pulses per rotation.
- The setting range is between 1 and 8000000.
- The setting value is enabled by turning off and on CH1 Count enable command (Y06).
- The default value is 1.

(50)CH1 Measured rotation speed value update flag reset command (Un\G1170)

- Use this memory to reset CH1 Measured rotation speed value update flag (Un\G1181).
- CH1 Measured rotation speed value update flag (Un\G1181) is reset by setting CH1 Measured rotation speed value update flag reset command (Un\G1170) to 1_H: Reset. CH1 Measured rotation speed value update flag reset command (Un\G1170) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(51)CH1 Rotation speed measurement flag (Un\G1180)

- This memory stores the value indicating whether the module is measuring the rotation speed or not. When the module is measuring the speed, 1_H is stored. When the module is not measuring the speed, 0_H is stored.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(52)CH1 Measured rotation speed value update flag (Un\G1181)

- This memory stores the value indicating whether CH1 Measured rotation speed value (Un\G1182, Un\G1183) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Measured rotation speed value (Un\G1182, Un\G1183) are updated without resetting CH1 Measured rotation speed value update flag (Un\G1181).
  To check the update status of CH1 Measured rotation speed value (Un\G1182, Un\G1183) once again, reset CH1 Measured rotation speed value update flag (Un\G1181) by using CH1 Measured rotation speed value update flag reset command (Un\G1170).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Measured rotation speed value update flag (Un\G1181) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(53)CH1 Measured rotation speed value (Un\G1182, Un\G1183)

- This memory stores a measured rotation speed value.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).
- The default value is 0.

(54)CH1 Pulse measurement setting (function input terminal) (Un\G1200)

- Use this memory to set which pulse width is to be measured. The pulse is input to the function input terminal (FUNC1).

Pulse width	Setting value
Pulse ON width	0_H
Pulse OFF width	1_H

- The setting value is enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default value is 0_H: Pulse ON width.

(55)CH1 Pulse measurement setting (latch counter input terminal) (Un\G1201)

- Use this memory to set which pulse width is to be measured. The pulse is input to the latch counter input terminal (LATCH1).

Pulse width	Setting value
Pulse ON width	0_H
Pulse OFF width	1_H

- The setting value is enabled by turning off and on Operating condition settings batch-change command (Y01).
- The default value is 0_H: Pulse ON width.

(56)CH1 Pulse measurement start command (function input terminal) (Un\G1210)

- When CH1 Count enable command (Y06) is ON, use this memory to start the measurement of pulse that is input to the function input terminal (FUNC1).
- Set CH1 Pulse measurement start command (function input terminal) (Un\G1210) to 1_H: Measured to start the pulse measurement.
- The default value is 0_H: Not measured.

(57)CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211)

- Use this memory to reset CH1 Measured pulse value update flag (function input terminal) (Un\G1221).
- CH1 Measured pulse value update flag (function input terminal) (Un\G1221) is reset by setting CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211) to 1_H: Reset. CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(58)CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212)

- When CH1 Count enable command (Y06) is ON, use this memory to start the measurement of pulse that is input to the latch counter input terminal (LATCH1).
- Set CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212) to 1_H: Measured to start the pulse measurement.
- The default value is 0_H: Not measured.

(59)CH1 Measured pulse value update flag reset command (latch counter input terminal) (Un\G1213)

- Use this memory to reset CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241).
- CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241) is reset by setting CH1 Measured pulse value update flag reset command (latch counter input terminal) (Un\G1213) to 1_H: Reset. CH1 Measured pulse value update flag reset command (latch counter input terminal) (Un\G1213) is automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(60)CH1 Pulse measurement flag (function input terminal) (Un\G1220)

- This memory stores the value indicating whether the pulse input to the function input terminal (FUNC1) is being measured.
- When the pulse is being measured, 1_H is stored. When the pulse is not being measured, 0_H is stored.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(61)CH1 Measured pulse value update flag (function input terminal) (Un\G1221)

- This memory stores the value indicating whether CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) are updated without resetting CH1 Measured pulse value update flag (function input terminal) (Un\G1221).
  To check the update status of CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) once again, reset CH1 Measured pulse value update flag (function input terminal) (Un\G1221) by using CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Measured pulse value update flag (function input terminal) (Un\G1221) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(62)CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223)

- These memories store the measured value of pulse ON width or pulse OFF width that is input to the function input terminal (FUNC1).
- The measurement range is between 2000 and 2147483647 (0.1μs per unit).
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(63)CH1 Pulse measurement flag (latch counter input terminal) (Un\G1240)

- This memory stores the value indicating whether the pulse input to the latch counter input terminal (LATCH1) is being measured.
- When the pulse is being measured, 1_H is stored. When the pulse is not being measured, 0_H is stored.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(64)CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241)

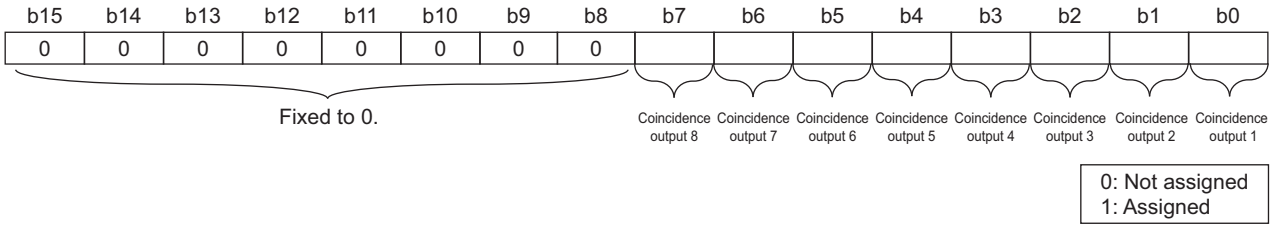
- This memory stores the value indicating whether CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243) are updated or not.
  When the memories are updated, 1_H is stored. When the memories are not updated, 0_H is stored.
- CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243) are updated without resetting CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241).
  To check the update status of CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243) once again, reset CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241) by using CH1 Measured pulse value update flag reset command (latch counter input terminal) (Un\G1213).
  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored value in CH1 Measured pulse value update flag (latch counter input terminal) (Un\G1241) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(65)CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243)

- These memories store the measured value of pulse ON width or pulse OFF width that is input to the latch counter input terminal (LATCH1).
- The measurement range is between 2000 and 2147483647 (0.1μs per unit).
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(66)CH1 PWM output assignment (Un\G1300)

- Out of eight Coincidence outputs (1 to 8), select just one for the PWM waveform output, and set the Coincidence output to 1: Assigned in this memory.



- Select Coincidence outputs that are assigned to the corresponding channel in "Coincidence output 1 to 8 channel assignment setting" in the switch setting. Coincidence outputs assigned to the other channel can not be used for the PWM waveform output.
- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default values set to Coincidence output 1 to 8 are 0: Not assigned.

(67)CH1 On width setting (PWM output) (Un\G1302, Un\G1303)

- Use these memories to set ON width of the PWM output.
- Setting range varies depending on which Coincidence output is set to 1: Assigned in CH1 PWM output assignment (Un\G1300).

Coincidence output[*1]	Setting range
Coincidence output 1 or 2	0 or 10 to 10000000 (0.1μs per unit)
Coincidence output 3 to 8	0 or 1000 to 10000000 (0.1μs per unit)

*1 For any Coincidence outputs, set the values that are equal to or smaller than the ones set to CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305).

- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default value is 0.

(68)CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305)

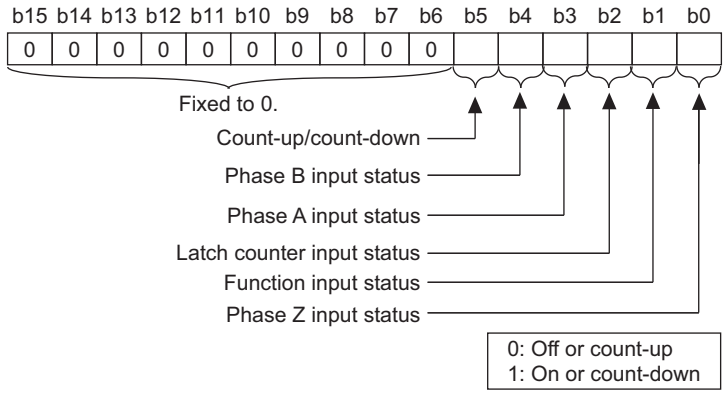
- Use these memories to set a cycle for the PWM output.
- Setting range varies depending on which Coincidence output is set to 1: Assigned in CH1 PWM output assignment (Un\G1300).

Coincidence output	Setting range
Coincidence output 1 or 2	50 to 10000000 (0.1μs per unit)
Coincidence output 3 to 8	5000 to 10000000 (0.1μs per unit)

- The setting values are enabled by turning off and on CH1 Cam switch function/PWM output start command (Y08).
- The default value is 50.

(69)CH1 External input status (Un\G1450)

- This memory stores the values indicating the external input status of the phase Z, function, latch counter, phase A, and phase B as well as the count-up/count-down status.



- The stored value of Function input status remains 0: Off or count-up when "Operation mode setting" in the switch setting is set to Frequency Measurement Mode, Rotation Speed Measurement Mode, or PWM Output Mode.
- With Negative Logic being set in the Function Input Logic Setting or Latch Counter Input Logic Setting, its input status becomes 0: Off or count-up when a voltage is applied.
- The stored value is cleared to 0 by turning off and on Operating condition settings batch-change command (Y01).

(70)CH1 Operation mode (Un\G1451)

- This memory stores the value indicating the current operation mode.

Operation mode	Value to be stored
Normal Mode	0_H
Frequency Measurement Mode	1_H
Rotation Speed Measurement Mode	2_H
Pulse Measurement Mode	3_H
PWM Output Mode	4_H

(71)CH1 Latest error code (Un\G1460), CH1 Latest warning code (Un\G1470)

- These memories store the latest error code and the latest warning code respectively.
- When errors or warnings are detected multiple times, the code of the latest error or warning is stored.
- For details on error codes, refer to the following:

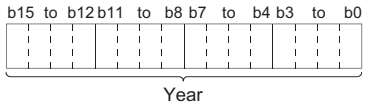
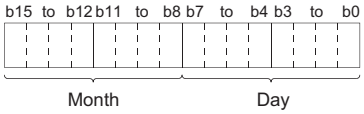
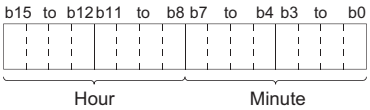
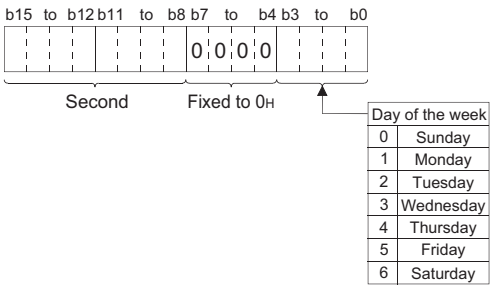
  ☞ Page 265, Section 8.5
- For details on warning codes, refer to the following:

  ☞ Page 271, Section 8.6
- Reset CH1 Latest error code (Un\G1460) and CH1 Latest warning code (Un\G1470) by using CH1 Error reset command (Un\G1480).

  If you try to reset it by turning off and on Operating condition settings batch-change command (Y01), not only the stored values in CH1 Latest error code (Un\G1460) and CH1 Latest warning code (Un\G1470) but also buffer memories for the data classification Md1 are cleared to 0. Please note that.

(72)CH1 Latest error detection time (Un\G1461 to Un\G1464), CH1 Latest warning detection time (Un\G1471 to Un\G1474)

- These memories store the time when the latest error or warning is detected in the form of BCD code.

Buffer memory address (error code/warning code)	Contents	Ex.
Un\G1461/Un\G1471		2010_H ↓ Year 2010
Un\G1462/Un\G1472		1004_H ↓ October 4th
Un\G1463/Un\G1473		1035_H ↓ 10:35
Un\G1464/Un\G1474		1701_H ↓ 17 seconds, Monday

(73)CH1 Error reset command (Un\G1480)

- Use this memory to reset the information of the latest error or warning.
- CH1 Latest error code (Un\G1460), CH1 Latest error detection time (Un\G1461 to Un\G1464), CH1 Latest warning code (Un\G1470), and CH1 Latest warning detection time (Un\G1471 to Un\G1474) are reset to 0_H by setting CH1 Error reset command (Un\G1480) to 1_H: Reset. CH1 Error reset command (Un\G1480) are automatically reset to 0_H: Not reset after the reset is completed.
- The default value is 0_H: Not reset.

(74)Latest error code address (Un\G6000)

- This memory store the value indicating the address of buffer memory in which the latest error code is stored. (The latest error code is selected from Error log (Un\G6010 to Un\G6164).)

Ex. The following table shows the example of the value to be stored in this memory.

Condition	Value to be stored (decimal notation)
No error occurred.	0
The error log of the latest error is 1.	6010
The error log of the latest error is 2.	6020
⋮	⋮
The error log of the latest error is 16.	6160

- The stored value is not cleared to 0 when Operating condition settings batch-change command (Y01) is turned off and on, and the value remains the same.

(75)Error log (Un\G6010 to Un\G6164)

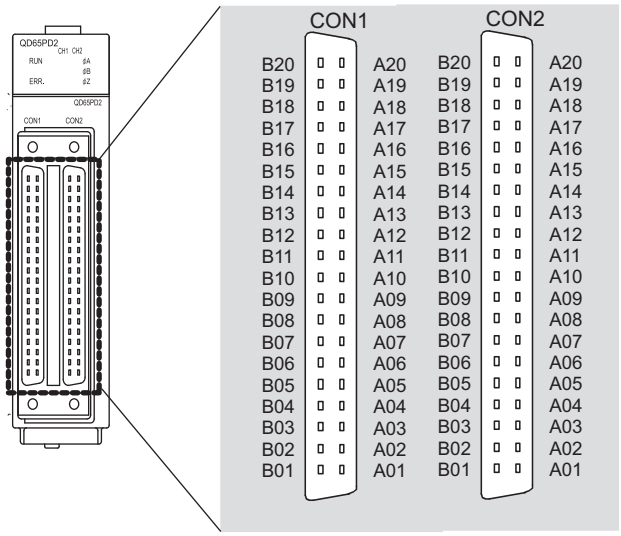
- These memories store up to 16 logs of the errors that occurred in the QD65PD2.
- When each error occurs, the error log is stored in ascending order. (starting with the error log 1 and ending with the error log 16)
  The error log of the 17th or later error is written over the oldest error log in these memories.
- The configuration of these buffer memory addresses is the same as that of CH1 Latest error code (Un\G1460) and CH1 Latest error detection time (Un\G1461 to Un\G1464).
- The stored value is not cleared to 0 when Operating condition settings batch-change command (Y01) is turned off and on, and the value remains the same.

3.5 Specifications of I/O Interfaces with External Devices

This clause describes the QD65PD2 interfaces to connect with external devices.

3.5.1 Terminal layouts and terminal numbers of connectors for external devices

The following figure and table show the terminal layouts and the terminal numbers of the QD65PD2 connector for external devices.



CON1				CON2			
CH1				CH2			
Terminal number	Symbol	Terminal number	Symbol	Terminal number	Symbol	Terminal number	Symbol
B20	NC	A20	NC	B20	NC	A20	NC
B19	A1-24V	A19	A1-12V	B19	A2-24V	A19	A2-12V
B18	A1-5V	A18	A1-DIF	B18	A2-5V	A18	A2-DIF
B17	A1-COM	A17	B1-24V	B17	A2-COM	A17	B2-24V
B16	B1-12V	A16	B1-5V	B16	B2-12V	A16	B2-5V
B15	B1-DIF	A15	B1-COM	B15	B2-DIF	A15	B2-COM
B14	Z1-24V	A14	Z1-12V	B14	Z2-24V	A14	Z2-12V
B13	Z1-5V	A13	Z1-DIF	B13	Z2-5V	A13	Z2-DIF
B12	Z1-COM	A12	FUNC1-24V	B12	Z2-COM	A12	FUNC2-24V
B11	FUNC1-12V	A11	FUNC1-5V	B11	FUNC2-12V	A11	FUNC2-5V
B10	CTRLCOM-1	A10	LATCH1-24V	B10	CTRLCOM-2	A10	LATCH2-24V
B09	LATCH1-12V	A09	LATCH1-5V	B09	LATCH2-12V	A09	LATCH2-5V
B08	OUT1	A08	EQU1	B08	OUT5	A08	EQU5
B07	OUT2	A07	EQU2	B07	OUT6	A07	EQU6
B06	OUT3	A06	EQU3	B06	OUT7	A06	EQU7
B05	OUT4	A05	EQU4	B05	OUT8	A05	EQU8
B04	12V/24V	A04	OUT_COM_0V	B04	12V/24V	A04	OUT_COM_0V
B03	IN_COM24V	A03	IN1	B03	IN_COM24V	A03	IN4
B02	IN2	A02	IN3	B02	IN5	A02	IN6
B01	NC	A01	NC	B01	NC	A01	NC

3.5.2 List of I/O signal details

The following table lists the signals for the QD65PD2 connectors for external devices.

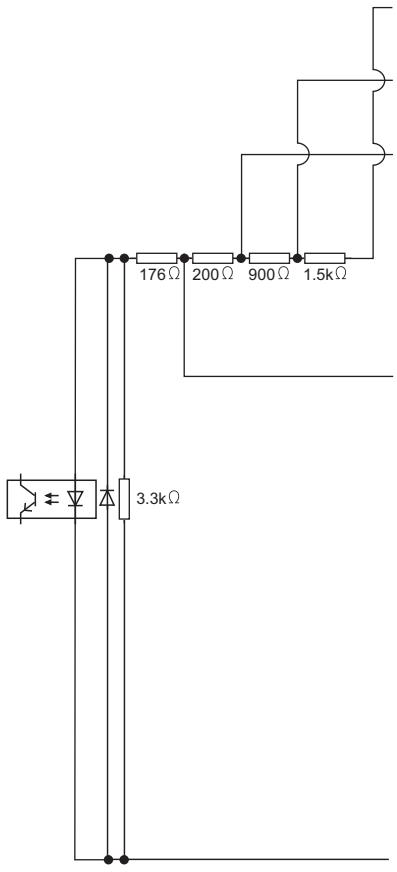
I/O classification	Symbol	Terminal number		Signal name	Description
		CON1	CON2		
Input	A1-24V, A2-24V	B19		Phase A pulse input 24V (+)	This signal inputs + (plus) side of phase A pulse.
	A1-12V, A2-12V	A19		Phase A pulse input 12V (+)	
	A1-5V, A2-5V	B18		Phase A pulse input 5V (+)	
	A1-DIF, A2-DIF	A18		Phase A pulse differential input (+)	
	A1-COM, A2-COM	B17		Phase A pulse input common (-)	This signal inputs - (minus) side of phase A pulse.
	B1-24V, B2-24V	A17		Phase B pulse input 24V (+)	This signal inputs + (plus) side of phase B pulse.
	B1-12V, B2-12V	B16		Phase B pulse input 12V (+)	
	B1-5V, B2-5V	A16		Phase B pulse input 5V (+)	
	B1-DIF, B2-DIF	B15		Phase B pulse differential input (+)	
	B1-COM, B2-COM	A15		Phase B pulse input common (-)	This signal inputs - (minus) side of phase B pulse.
	Z1-24V, Z2-24V	B14		Phase Z input 24V (+)	This signal inputs + (plus) side of phase Z. Turn on this signal to replace a count value by the external signal. By doing so, the count value is replaced with the preset value on the condition that Phase Z (preset/replace) trigger setting (b0, b1) in CH1 Phase Z setting (Un\G1000) is set to 0: Rise.
	Z1-12V, Z2-12V	A14		Phase Z input 12V (+)	
	Z1-5V, Z2-5V	B13		Phase Z input 5V (+)	
	Z1-DIF, Z2-DIF	A13		Phase Z differential input (+)	
	Z1-COM, Z2-COM	B12		Phase Z input common (-)	This signal inputs - (minus) side of phase Z.
	FUNC1-24V, FUNC2-24V	A12		Function input 24V (-)	Turn on this signal to perform the selected counter function by the external signal.
	FUNC1-12V, FUNC2-12V	B11		Function input 12V (-)	
	FUNC1-5V, FUNC2-5V	A11		Function input 5V (-)	
	LATCH1-24V, LATCH2-24V	A10		Latch counter input 24V (-)	Turn on this signal to latch an count value by the external signal. By doing so, the count value is latched and stored in buffer memories.
	LATCH1-12V, LATCH2-12V	B09		Latch counter input 12V (-)	
	LATCH1-5V, LATCH2-5V	A09		Latch counter input 5V (-)	
	CTRLCOM-1, CTRLCOM-2	B10		Control input common (+)	Common for latch counter input Common for function input It is separated from each channel.
	IN1	A03	—	General input 1 (-)	General input (high speed)
	IN2	B02	—	General input 2 (-)	
	IN3	A02	—	General input 3 (-)	General input (low speed)
	IN4	—	A03	General input 4 (-)	
	IN5	—	B02	General input 5 (-)	
	IN6	—	A02	General input 6 (-)	
	IN_COM24V	B03		General input common (+)	24V common for general input It is common between channels.

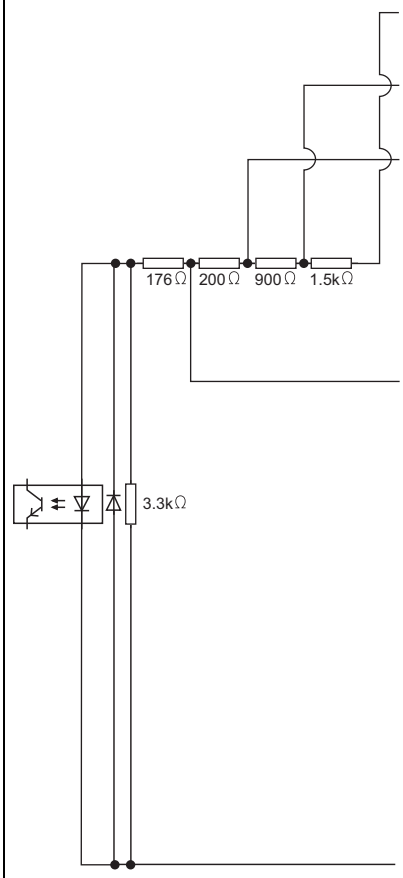
I/O classification	Symbol	Terminal number		Signal name	Description
		CON1	CON2		
Output	EQU1[*1]	A08	—	Coincidence output 1	Coincidence output (high speed) With the coincidence output function or the cam switch function being activated, this signal outputs an signal when an count value is matched the preset comparison condition. When PWM output function is used, this signal outputs the PWM waveform.
	EQU2[*1]	A07	—	Coincidence output 2	
	EQU3[*1]	A06	—	Coincidence output 3	Coincidence output (low speed) This signal has the same function as that of Coincidence output 1 and 2.
	EQU4[*1]	A05	—	Coincidence output 4	
	EQU5[*1]	—	A08	Coincidence output 5	
	EQU6[*1]	—	A07	Coincidence output 6	
	EQU7[*1]	—	A06	Coincidence output 7	
	EQU8[*1]	—	A05	Coincidence output 8	
	OUT1	B08	—	General output 1	General output
	OUT2	B07	—	General output 2	
	OUT3	B06	—	General output 3	
	OUT4	B05	—	General output 4	
	OUT5	—	B08	General output 5	
	OUT6	—	B07	General output 6	
	OUT7	—	B06	General output 7	
	OUT8	—	B05	General output 8	
	12V/24V	B04		Power supply for external output 12/24V	It supplies 12V or 24V when output signals are used. Power supply for output signals It is common between channels.
	OUT_COM_0V	A04		Power supply for external output OUT_COM_0V	It inputs 0V when output signals are used. Common for output signals It is common between channels.

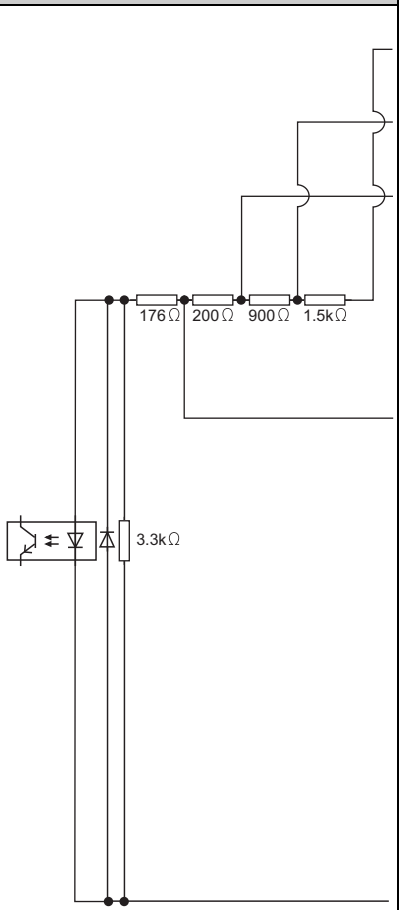
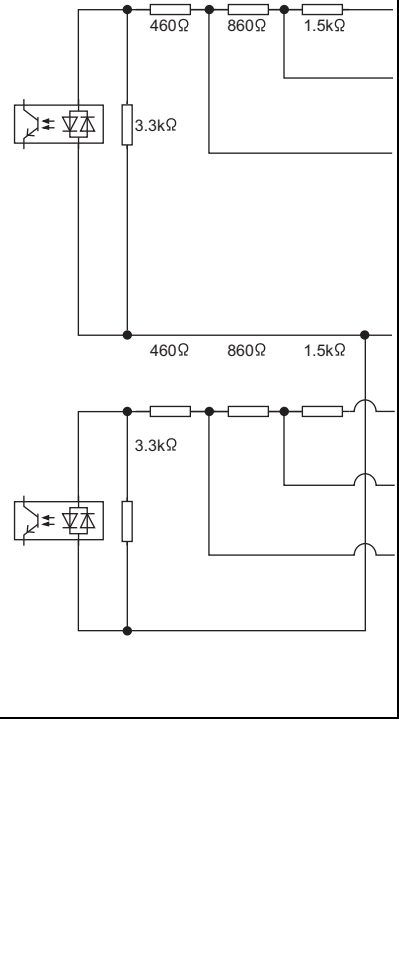
*1 For EQU1 to 8, the assignment to CH1 or CH2 can be changed.

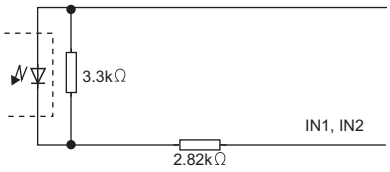
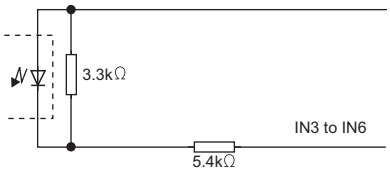
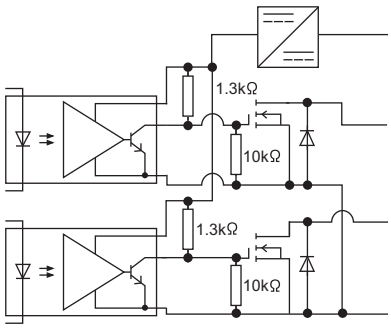
3.5.3 Interface with external devices

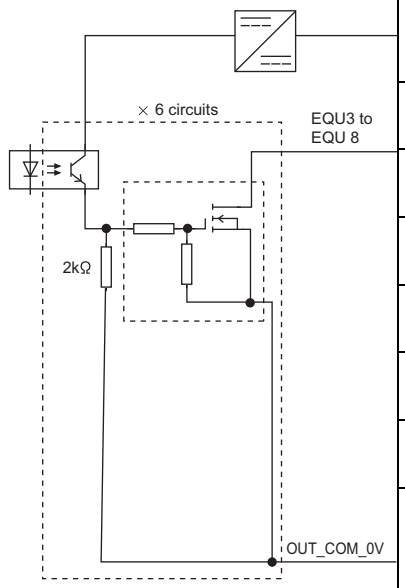
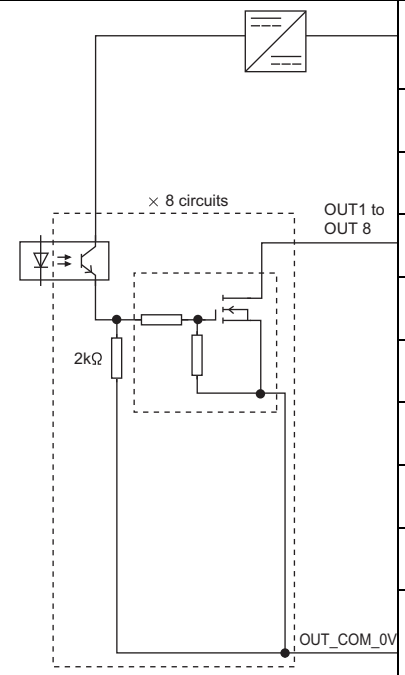
The following table lists the QD65PD2 interfaces to connect with external devices.

I/O classification	Internal circuit	Terminal number CON1 (CH1)	Terminal number CON2 (CH2)	Signal name	Operation	Input voltage (guaranteed value)	Operating current (guaranteed value)
Input		B19		Phase A pulse input 24V (+)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	5V or lower	1.0mA or lower
		A19		Phase A pulse input 12V (+)	When ON	10.8 to 13.2V	7 to 10mA
					When OFF	3V or lower	1.0mA or lower
		B18		Phase A pulse input 5V (+)	When ON	4.5 to 5.5V	7 to 10mA
					When OFF	2V or lower	1.0mA or lower
		—		—	Phase A pulse DC input response time (maximum input speed: 200kHz)	OFF→ON 1.25μs or less	ON→OFF 1.25μs or less
		A18		Phase A pulse differential input (+)	Differential input	EIA Standard RS-422-A line receiver (AM26C32 (manufactured by Texas Instruments Japan Limited.) or equivalent)	
		—		—	Phase A pulse differential input response time (maximum input speed: 2MHz)	OFF→ON 125ns or less	ON→OFF 125ns or less
		B17		Phase A pulse input common (-)	—	—	—

I/O classification	Internal circuit	Terminal number CON1 (CH1)	Terminal number CON2 (CH2)	Signal name	Operation	Input voltage (guaranteed value)	Operating current (guaranteed value)
Input		A17		Phase B pulse input 24V (+)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	5V or lower	1.0mA or lower
		B16		Phase B pulse input 12V (+)	When ON	10.8 to 13.2V	7 to 10mA
					When OFF	3V or lower	1.0mA or lower
		A16		Phase B pulse input 5V (+)	When ON	4.5 to 5.5V	7 to 10mA
					When OFF	2V or lower	1.0mA or lower
		—		—	Phase B pulse DC input response time (maximum input speed: 200kHz)	OFF→ON 1.25μs or less	ON→OFF 1.25μs or less
		B15		Phase B pulse differential input (+)	Differential input	EIA Standard RS-422-A line receiver (AM26C32 (manufactured by Texas Instruments Japan Limited.) or equivalent)	
		—		—	Phase B pulse differential input response time (maximum input speed: 2MHz)	OFF→ON 125ns or less	ON→OFF 125ns or less
		A15		Phase B pulse input common (-)	—	—	—

I/O classification	Internal circuit	Terminal number CON1 (CH1)	Terminal number CON2 (CH2)	Signal name	Operation	Input voltage (guaranteed value)	Operating current (guaranteed value)
Input		B14		Phase Z input 24V (+)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	5V or lower	1.0mA or lower
		A14		Phase Z input 12V (+)	When ON	10.8 to 13.2V	7 to 10mA
					When OFF	3V or lower	1.0mA or lower
		B13		Phase Z input 5V (+)	When ON	4.5 to 5.5V	7 to 10mA
					When OFF	2V or lower	1.0mA or lower
		—		—	Phase Z DC input response time (maximum input speed: 200kHz)	OFF→ON 1.25μs or less	ON→OFF 2.5μs or less
		A13		Phase Z differential input (+)	Differential input	EIA Standard RS-422-A line receiver (AM26C32 (manufactured by Texas Instruments Japan Limited.) or equivalent)	
		—		—	Phase Z differential input minimum response time (maximum input speed: 2MHz)	OFF→ON 0.25μs or less	ON→OFF 2.5μs or less
		B12		Phase Z input common (-)	—	—	—
		A12		Function input 24V (-)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	4V or lower	1.0mA or lower
		B11		Function input 12V (-)	When ON	10.8 to 13.2V	7 to 10mA
					When OFF	2.5V or lower	1.0mA or lower
		A11		Function input 5V (-)	When ON	4.5 to 5.5V	7 to 10mA
					When OFF	1.6V or lower	1.0mA or lower
		—		—	Function input minimum response time	OFF→ON 20μs or less	ON→OFF 100μs or less
		B10		Control input common (+)	—	—	—
		A10		Latch counter input 24V (-)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	4V or lower	1.0mA or lower
		B9		Latch counter input 12V (-)	When ON	10.8 to 13.2V	7 to 10mA
					When OFF	2.5V or lower	1.0mA or lower
		A9		Latch counter input 5V (-)	When ON	4.5 to 5.5V	7 to 10mA
					When OFF	1.6V or lower	1.0mA or lower
		—		—	Latch counter input minimum response time	OFF→ON 20μs or less	ON→OFF 100μs or less

I/O classification	Internal circuit	Terminal number CON1 (CH1)	Terminal number CON2 (CH2)	Signal name	Operation	Input voltage (guaranteed value)	Operating current (guaranteed value)
Input		B03		General input common (+)	—	—	—
		A03	—	General input 1 (-)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	4V or lower	1.0mA or lower
		B02	—	General input 2 (-)	When ON	21.6 to 26.4V	7 to 10mA
					When OFF	4V or lower	1.0mA or lower
		—		—	General input (high speed) response time	OFF→ON 20μs or less	ON→OFF 100μs or less
		B03		General input common (+)	—	—	—
		A02	—	General input 3 (-)	When ON	21.6 to 26.4V	3mA or higher
					When OFF	3.5V or lower	0.3mA or lower
		—	A03	General input 4 (-)	When ON	21.6 to 26.4V	3mA or higher
					When OFF	3.5V or lower	0.3mA or lower
		—	B02	General input 5 (-)	When ON	21.6 to 26.4V	3mA or higher
					When OFF	3.5V or lower	0.3mA or lower
		—	A02	General input 6 (-)	When ON	21.6 to 26.4V	3mA or higher
					When OFF	3.5V or lower	0.3mA or less
		—		—	General input (low speed) response time	OFF→ON 2ms or less	ON→OFF 2ms less
Output		B04		Power supply for external output 12/24V	• Input voltage: 10.8 to 26.4V		
		A08	—	Coincidence output 1[*1]	• Operating voltage: 10.2 to 30V • Current consumption/point: 6mA or lower • Maximum load current: 0.1A/point • Maximum voltage drop at ON: 0.2V • Response time OFF→ON: 1μs or less (rated load, resistive load) ON→OFF: 1μs or less (rated load, resistive load)		
		A07	—	Coincidence output 2[*1]			
		A04		Power supply for external output OUT_COM_0V	• Current consumption: 0.04A (at all points ON/per common)		

I/O classification	Internal circuit	Terminal number CON1 (CH1)	Terminal number CON2 (CH2)	Signal name	Operation	Input voltage (guaranteed value)	Operating current (guaranteed value)
Output		B04		Power supply for external output 12/24V	• Input voltage: 10.8 to 26.4V		
		A06	—	Coincidence output 3*1	• Operating voltage: 10.2 to 30V • Current consumption/point: 6mA or lower • Maximum load current: 0.1A/point • Maximum voltage drop at ON: 0.2V • Response time OFF→ON: 100μs or less (rated load, resistive load) ON→OFF: 100μs or less (rated load, resistive load)		
		A05	—	Coincidence output 4*1			
		—	A08	Coincidence output 5*1			
		—	A07	Coincidence output 6*1			
		—	A06	Coincidence output 7*1			
		—	A05	Coincidence output 8*1			
		A04		Power supply for external output OUT_COM_0V	• Current consumption: 0.04A (at all points ON/per common)		
		B04		Power supply for external output 12/24V	• Input voltage: 10.8 to 26.4V		
		B08	—	General output 1	• Operating voltage: 10.2 to 30V • Current consumption/point: 3.75mA(TYP.DC24V) • Maximum load current: 0.1A/point • Maximum voltage drop at ON: 0.2V • Response time OFF→ON: 100μs or less (rated load, resistive load) ON→OFF: 100μs or less (rated load, resistive load)		
		B07	—	General output 2			
		B06	—	General output 3			
		B05	—	General output 4			
		—	B08	General output 5			
		—	B07	General output 6			
		—	B06	General output 7			
		—	B05	General output 8			
		A04		Power supply for external output OUT_COM_0V	• Current consumption: 0.04A (at all points ON/per common)		

*1 For EQU1 to 8, the assignment to CH1 or CH2 can be changed.

3.6 Encoders that can be Connected

The encoders that can be connected to the QD65PD2 are described below.

- Open collector output type encoders
- CMOS level voltage output type encoders
- Line driver output type encoders (AM26LS31 or equivalent)

Point

- Verify that the encoder output voltage meets the specifications of the QD65PD2.
- TTL level voltage output type encoders cannot be used with the QD65PD2.

CHAPTER 4 FUNCTION

This chapter describes the QD65PD2 functions.

Point

I/O numbers (X/Y), buffer memory addresses, and external input terminals are for CH1 in this chapter.
For CH2 I/O numbers (X/Y), refer to the following section.

Page 32, Section 3.3.1

For CH2 buffer memory addresses, refer to the following section.

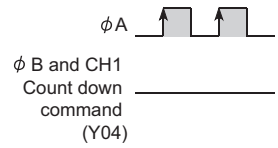
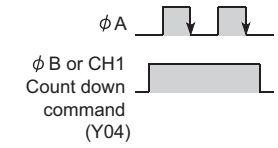
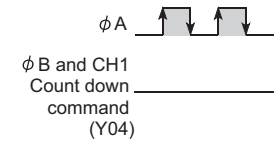
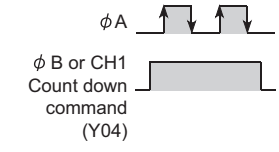
Page 42, Section 3.4.1

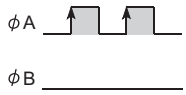
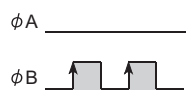
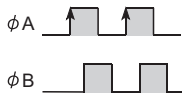
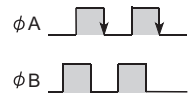
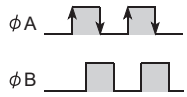
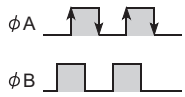
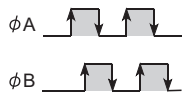
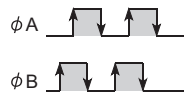
4.1 Pulse Input Mode and Counting Method

4.1.1 Pulse input mode types

Six types of pulse input mode are available: 1-phase pulse input (multiple of 1 and 2), CW/CCW pulse input, and 2-phase pulse input (multiple of 1, 2, and 4).

(1) Pulse input mode and count timing

Pulse input mode	Count timing		
1-phase multiple of 1	For counting up		Counts on the rising edge (↑) of ϕA. ϕB and CH1 Count down command (Y04) are OFF.
	For counting down		Counts on the falling edge (↓) of ϕA. ϕB or CH1 Count down command (Y04) is ON.
1-phase multiple of 2	For counting up		Counts on the rising edge (↑) and the falling edge (↓) of ϕA. ϕB and CH1 Count down command (Y04) are OFF.
	For counting down		Counts on the rising edge (↑) and the falling edge (↓) of ϕA. ϕB or CH1 Count down command (Y04) is ON.

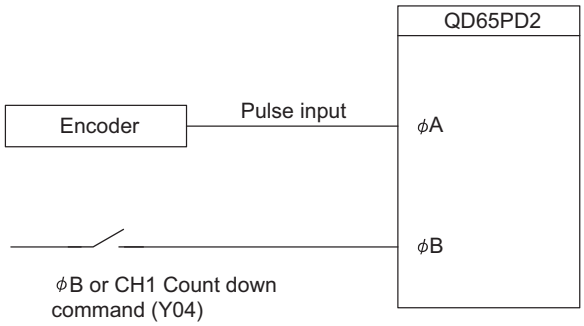
Pulse input mode	Count timing		
CW/CCW	For counting up		Counts on the rising edge (↑) of ϕA. ϕB is OFF.
	For counting down		ϕA is OFF. Counts on the rising edge (↑) of ϕB.
2-phase multiple of 1	For counting up		Counts on the rising edge (↑) of ϕA while ϕB is OFF.
	For counting down		Counts on the falling edge (↓) of ϕA while ϕB is OFF.
2-phase multiple of 2	For counting up		Counts on the rising edge (↑) of ϕA while ϕB is OFF. Counts on the falling edge (↓) of ϕA while ϕB is ON.
	For counting down		Counts on the rising edge (↑) of ϕA while ϕB is ON. Counts on the falling edge (↓) of ϕA while ϕB is OFF.
2-phase multiple of 4	For counting up		Counts on the rising edge (↑) of ϕA while ϕB is OFF. Counts on the falling edge (↓) of ϕA while ϕB is ON. Counts on the rising edge (↑) of ϕB while ϕA is ON. Counts on the falling edge (↓) of ϕB while ϕA is OFF.
	For counting down		Counts on the rising edge (↑) of ϕA while ϕB is ON. Counts on the falling edge (↓) of ϕA while ϕB is OFF. Counts on the rising edge (↑) of ϕB while ϕA is OFF. Counts on the falling edge (↓) of ϕB while ϕA is ON.

Point

In the case of using the phase B pulse input or CH1 Count down command (Y04) for 1-phase pulse input, turn off unused signals.
When the phase B pulse input or CH1 Count down command (Y04) is on, countdown is performed with the phase A pulse input.

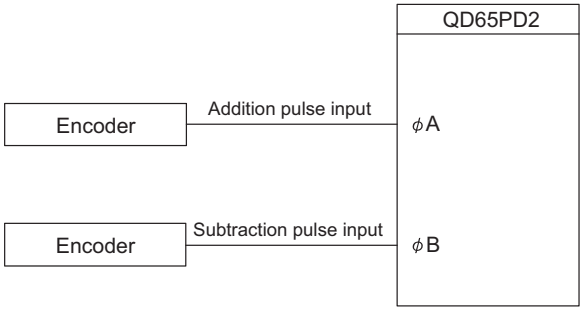
(a) 1-phase pulse input

For 1-phase pulse input, multiple of 1 or multiple of 2 can be selected as a counting method.
The following figure shows the relationship between phase A pulse input, and phase B pulse input or the CH1 Count down command (Y04).



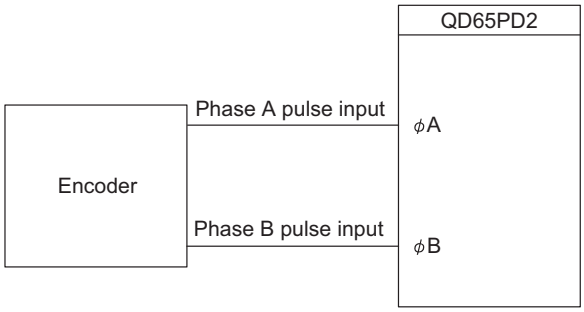
(b) CW/CCW pulse input

For CW/CCW pulse input, pulses can be counted up with the phase A pulse input and counted down with the phase B pulse input .
The following figure shows the relationship between phase A pulse input and phase B pulse input.



(c) 2-phase pulse input

For 2-phase pulse input, a counting method can be selected from multiple of 1, multiple of 2, or multiple of 4.
The phase difference between phase A pulses and phase B pulses determines whether the pulses are counted up or down.
The following figure shows the relationship between phase A pulse input and phase B pulse input.



4.1.2 Counting method setting

Configure a counting method in the switch setting.
For details on the setting method, refer to the following section.

☞ Page 180, Section 6.2

4.2 Counter Format Selection

Select a counter format in the switch setting.

For details on the setting method, refer to the following section.

☞Page 180, Section 6.2

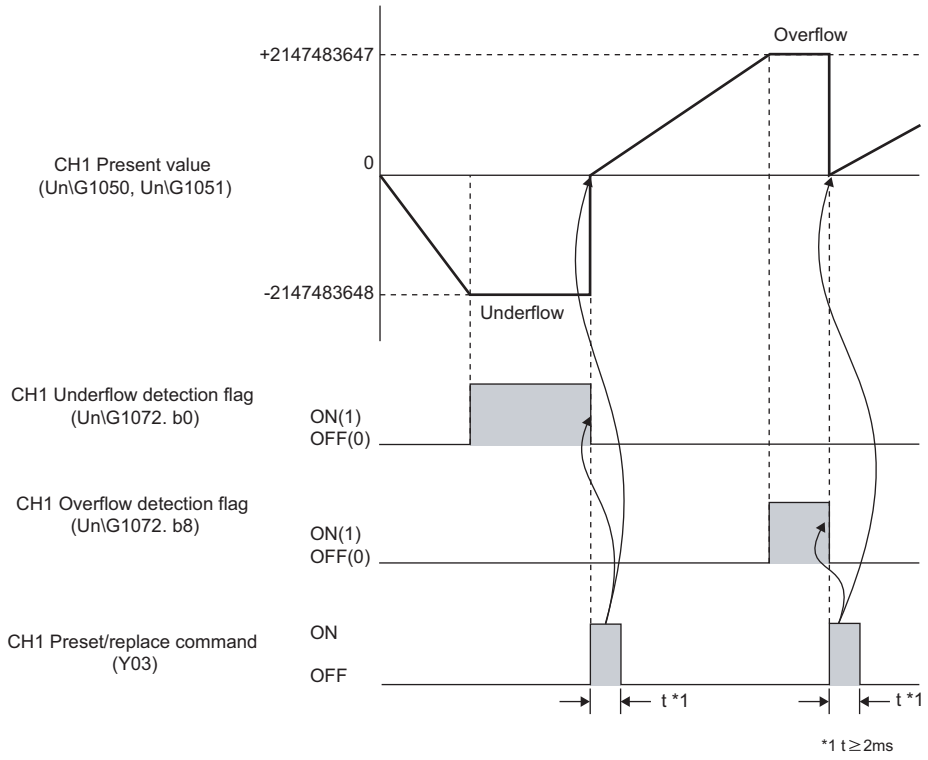
For details on each buffer memory setting or performance, refer to the following section.

☞Page 65, Section 3.4.2

4.2.1 Linear counter function

(1) Operation of the linear counter

- When linear counter is selected, pulses are counted between -2147483648 (lower limit) and 2147483647 (upper limit).
- The preset/replace function and the comparison output function can be used together.



(2) Overflow/Underflow error

- Under the linear counter, CH1 Overflow/underflow error (error code: 1100) is stored into CH1 Latest error code (Un\G1460) when CH1 Present value (Un\G1050, Un\G1051) exceeds 2147483647 (upper limit) or falls below -2147483648 (lower limit).
- The counting stops if an overflow/underflow error occurs, and CH1 Present value (Un\G1050, Un\G1051) does not change from -2147483648 or 2147483647 even when pulses are input.
- An overflow/underflow error can be cleared by performing the preset/replace function. When the preset/replace function is performed, the value in CH1 Preset value (Un\G1014, Un\G1015) is stored into CH1 Present value (Un\G1050, Un\G1051), and the counting resumes.
  Though, CH1 Latest error code (Un\G1460) is held until it is reset. Reset CH1 Latest error code (Un\G1460) by CH1 Error reset command (Un\G1480).
- Overflow/underflow errors can be checked on the System monitor screen. (☞Page 253, Section 8.2)

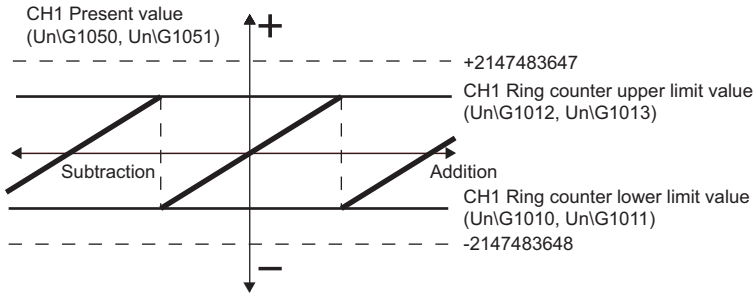
4.2.2 Ring counter function

(1) Operation of the ring counter

When ring counter is selected, pulses are counted repeatedly within the range between CH1 Ring counter lower limit value (Un\G1010, Un\G1011) and CH1 Ring counter upper limit value (Un\G1012, Un\G1013) specified by the user in the buffer memory.

Overflow/underflow errors do not occur under the ring counter function.

The preset/replace function and the comparison output function can be used together.



(2) Counting range of the ring counter

The counting range of the ring counter is determined by the relationship between CH1 Present value (Un\G1050, Un\G1051) and CH1 Ring counter lower limit value (Un\G1010, Un\G1011)/CH1 Ring counter upper limit value (Un\G1012, Un\G1013) at the time when CH1 Count enable command (Y06) is turned on or when the preset/replace function is performed.

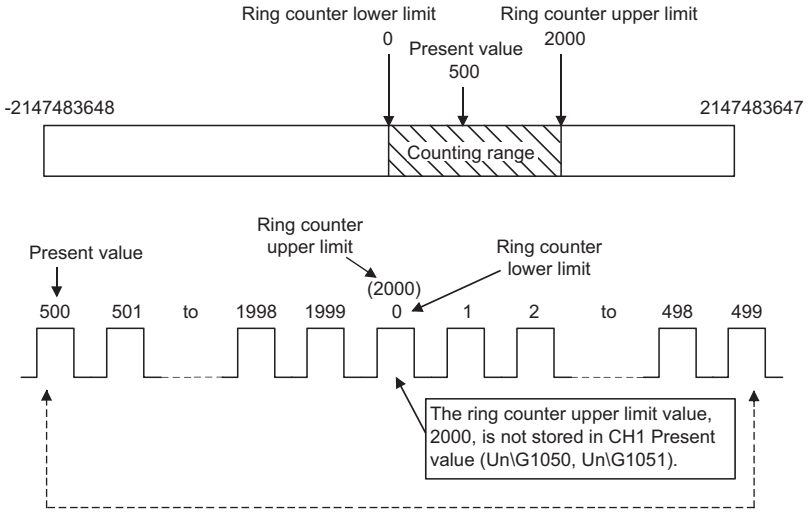
Normally, the counting range is as follows:

Ring counter lower limit value ≤ Present value ≤ Ring counter upper limit value

(a) When the ring counter lower limit value ≤ the present value ≤ the ring counter upper limit value (common use)

- When counting up
  When the present value reaches the ring counter upper limit value, the ring counter lower limit value is automatically stored in CH1 Present value (Un\G1050, Un\G1051).
- When counting down
  When the present value reaches the ring counter lower limit value, the ring counter lower limit value is held as the present value. The value (ring counter upper limit value - 1) is stored in CH1 Present value (Un\G1050, Un\G1051) at the next count-down pulse input.

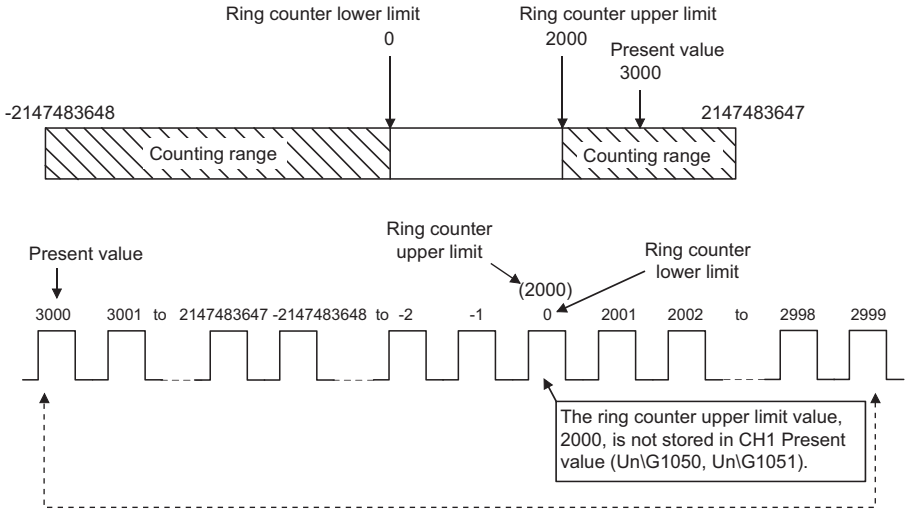
Both when counting up and down, the ring counter upper limit value is not stored in CH1 Present value (Un\G1050, Un\G1051). (Except for the case that the present value equals to the ring counter upper limit value at the rising state (off to on) of CH1 Count enable command (Y06), or when the preset/replace function is performed.)
For example, if CH1 Count enable command (Y06) is turned on when the ring counter lower limit value is 0, the ring counter upper limit value is 2000, and the present value is 500, the counting range and the present value change as follows.



(b) When the "Present value < Ring counter lower limit value" or "Ring counter upper limit value < Present value"

- When counting up
  When the present value reaches the ring counter lower limit value, the ring counter lower limit value is held as the present value. The value (ring counter upper limit value + 1) is stored in CH1 Present value (Un\G1050, Un\G1051) at the next count-up pulse input.
- When counting down
  When the present value reaches the ring counter upper limit value, the ring counter lower limit value is automatically stored in CH1 Present value (Un\G1050, Un\G1051).

Both when counting up and down, the ring counter upper limit value is not stored in CH1 Present value (Un\G1050, Un\G1051).
For example, if CH1 Count enable command (Y06) is turned on when the ring counter lower limit value is 0, the ring counter upper limit value is 2000, and the present value is 3000, the counting range and the present value change as follows.



(c) When the ring counter lower limit = the ring counter upper limit

When the ring counter lower limit equals to the ring counter upper limit, the counting range is from -2147483648 to 2147483647 regardless of the present value.

Point

- The setting values of the ring counter upper/lower limit value can be reflected by Operating condition settings batch-change command (Y01).
  In that case, however, buffer memory whose data classification is Md1 such as CH1 Present value (Un\G1050, Un\G1051) is cleared. For ordinary use, reflect the setting values by CH1 Count enable command (Y06).
- When CH1 Count enable command (Y06) is on, the stored value does not change even if a value is written to CH1 Ring counter lower limit value (Un\G1010, Un\G1011) and CH1 Ring counter upper limit value (Un\G1012, Un\G1013). Turn off CH1 Count enable command (Y06) before changing the ring counter upper/lower limit value. Then turn on CH1 Count enable command (Y06). The OFF time must be 2ms or longer.
- Turn off CH1 Count enable command (Y06) before changing the counting range by the preset/replace function to prevent a miscount.

4.3 Comparison Output Function

The comparison output function outputs ON/OFF signals comparing the count value with any point or range set by the user.
The coincidence output function or the cam switch function can be selected depending on the processing method in need.
Set the comparison output setting value in the switch setting.
For details on the setting method, please refer to the following section.
☞Page 180, Section 6.2

4.3.1 Overview of the coincidence output function and the cam switch function

The following table shows the operation overview of the coincidence output function and the cam switch function.

Item		Coincidence output function	Cam switch function
Comparison target		CH1 Present value (Un\G1050, Un\G1051)	
Number of output points per channel		0 to 8 points	
Comparison start timing		When Operating condition settings batch-changed (X01) is ON	When CH1 Cam switch function execution/PWM output (X08) is ON
Comparison point/range setting item		• Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) • Upper/lower limit value (coincidence output 1 to 8) (Un\G120 to Un\G151)	• Cam switch function, step type (coincidence output 1 to 8) (Un\G200, Un\G240, Un\G280, Un\G320, Un\G360, Un\G400, Un\G440, Un\G480) • Cam switch function, number of steps (coincidence output 1 to 8) (Un\G201, Un\G241, Un\G281, Un\G321, Un\G361, Un\G401, Un\G441, Un\G481) • Cam switch function, step No.1 to 16 setting (coincidence output 1 to 8) (Un\G202 to Un\G233, Un\G242 to Un\G273, Un\G282 to Un\G313, Un\G322 to Un\G353, Un\G362 to Un\G393, Un\G402 to Un\G433, Un\G442 to Un\G473, Un\G482 to Un\G513)
Reflection method of comparison point/range		• Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) • Operating condition settings batch-change command (Y01) OFF→ON	CH1 Cam switch function execution/PWM output (X08) OFF→ON
Comparison result	internal output	• Coincidence output 1 to 8 (X10 to X17) • Counter value greater/smaller (coincidence output) (Un\G190)	Coincidence output 1 to 8 (X10 to X17)
	external output	Coincidence output terminals 1 to 8	
Preset/replace (at coincidence output) function		Yes	No
Coincidence detection interrupt		Yes	No

Item	Coincidence output function	Cam switch function
Output reset timing	• Reset command (coincidence output 1 to 8) (Y10 to Y17) OFF→ON • When values are counted outside the detection area	Automatically reset depending on Cam switch function, step No.1 to 16 setting (coincidence output 1 to 8) (Un\G202 to Un\G233, Un\G242 to Un\G273, Un\G282 to Un\G313, Un\G322 to Un\G353, Un\G362 to Un\G393, Un\G402 to Un\G433, Un\G442 to Un\G473, Un\G482 to Un\G513)
External output enable timing	When CH1 Coincidence output enable command (Y02) is ON	

4.3.2 Coincidence output function

The coincidence output function compares the count value with a coincidence detection point or with an area divided by the coincidence output upper/lower limit value.
The function then outputs the comparison result to Coincidence output 1 to 8 (X10 to X17) and coincidence output 1 to 8 terminals (EQU1 to EQU8)
Coincidence output means that the count value matches with the point or range specified by the user, then the result is output to signals.
8 points are assigned to coincidence output, and each of them works individually for a different comparison/output tasks.
Select a target channel in "Coincidence output (1 to 8) channel assignment setting" of the switch setting, and a comparison condition in Coincidence output condition setting (Un\G0).

Point

When the operation mode is set to a mode other than the normal mode, the setting configured to Coincidence output condition setting (Un\G0) is ignored.

(1) Setting method of the coincidence output function

By selecting "Coincidence Output" as "Comparison output setting value" in the switch setting, the coincidence output function operates.

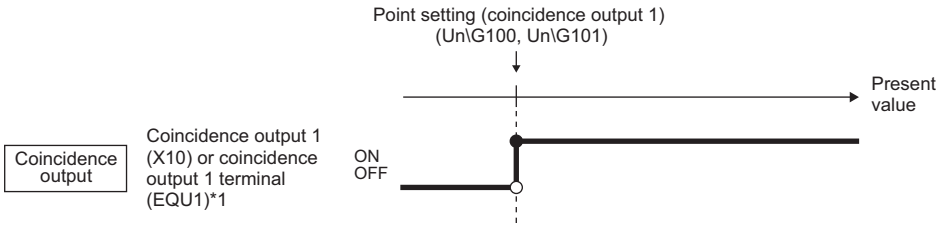
☞ Page 180, Section 6.2

(2) Comparison condition types and setting

Depending on the selected comparison condition, the range to be compared with the count value differs.

(a) Coincidence output

Coincidence output 1 (X10) turns on when the count value matches with a point set in Point setting (coincidence output 1) (Un\G100, Un\G101)



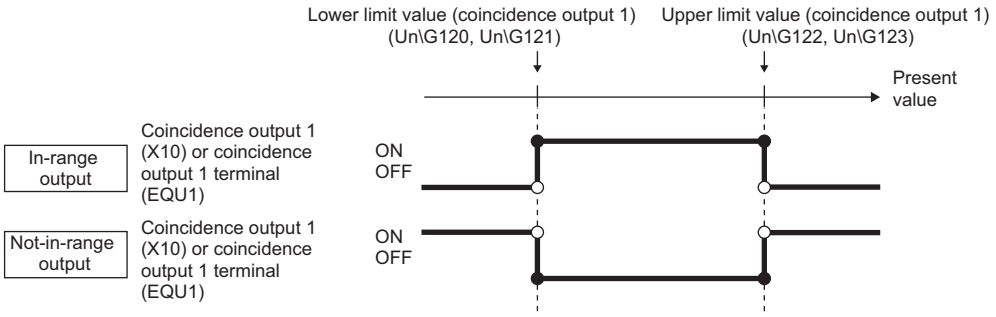
*1 To turn off Coincidence output 1 (X10), turn on Reset command (coincidence output 1) (Y10).

(b) In-range output

Coincidence output 1 (X10) turns on when the count value is Lower limit value (coincidence output 1) (Un\G120, Un\G121) or more and Upper limit value (coincidence output 1) (Un\G122, Un\G123) or less.

(c) Not-in-range output

Coincidence output 1 (X10) turns on when the count value is less than Lower limit value (coincidence output 1) (Un\G120, Un\G121) and more than Upper limit value (coincidence output 1) (Un\G122, Un\G123).



Comparison condition	Setting item	Setting contents	Reference
Coincidence output	Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115)	Set a point to be compared with the count value.	Page 66, Section 3.4.2 (4)
In-range output or Not-in-range output	Upper/lower limit value (coincidence output 1 to 8) (Un\G120 to Un\G151)	Set upper/lower limit value of an area to be compared with the count value.	Page 66, Section 3.4.2 (5)

(3) Comparison start timing of the coincidence output function

The coincidence output function starts comparison when the operation mode is set to the normal mode , and when Operating condition settings batch-changed (X01) turns on (OFF→ON).

The following table shows the activation timing of the settings related to the coincidence output function.

Setting item	When Operating condition settings batch-change command (Y01) is turned on (OFF→ON)	When Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) is set to Requested (1_H)	Reference
Coincidence output condition setting (Un\G0)	○	—	Page 65, Section 3.4.2 (1)
Preset/replace setting at coincidence output (Un\G1)*1	○	—	Page 65, Section 3.4.2 (2)
Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115)	○	○	Page 66, Section 3.4.2 (4)
Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151)	○	○	Page 66, Section 3.4.2 (5)

○: Activated, — : N/A

*1 For the preset/replace (at coincidence output) function, refer to the following section.

☞ Page 116, Section 4.3.3

(4) Output destination of comparison result for the coincidence output function

The following table shows the output destination of comparison result for each comparison condition.

Setting item	Comparison condition			Output overview
	Coincidence output	In-range output	Not-in-range output	
Coincidence output 1 to 8 (X10 to X17)	○	○	○	Outputs the result whether the specified comparison condition was made or not.
Coincidence output 1 to 8 terminals (EQU1 to EQU8)	○	○	○	
Counter value greater/smaller (coincidence output) (Un\G190)	○	—	—	Outputs a relationship (greater or smaller) between the count value and the point setting (coincidence output 1 to 8).

○: Can be used, —: N/A

(5) Output setting on coincidence output 1 to 8 terminals (EQU1 to EQU8)

In order to output signals from coincidence output 1 to 8 terminals (EQU1 to EQU8) to outside, enable output by turning on CH1 Coincidence output enable command (Y02). Doing so enable all coincidence output assigned to the target channel in "Coincidence output (1 to 8) channel assignment setting".

Point

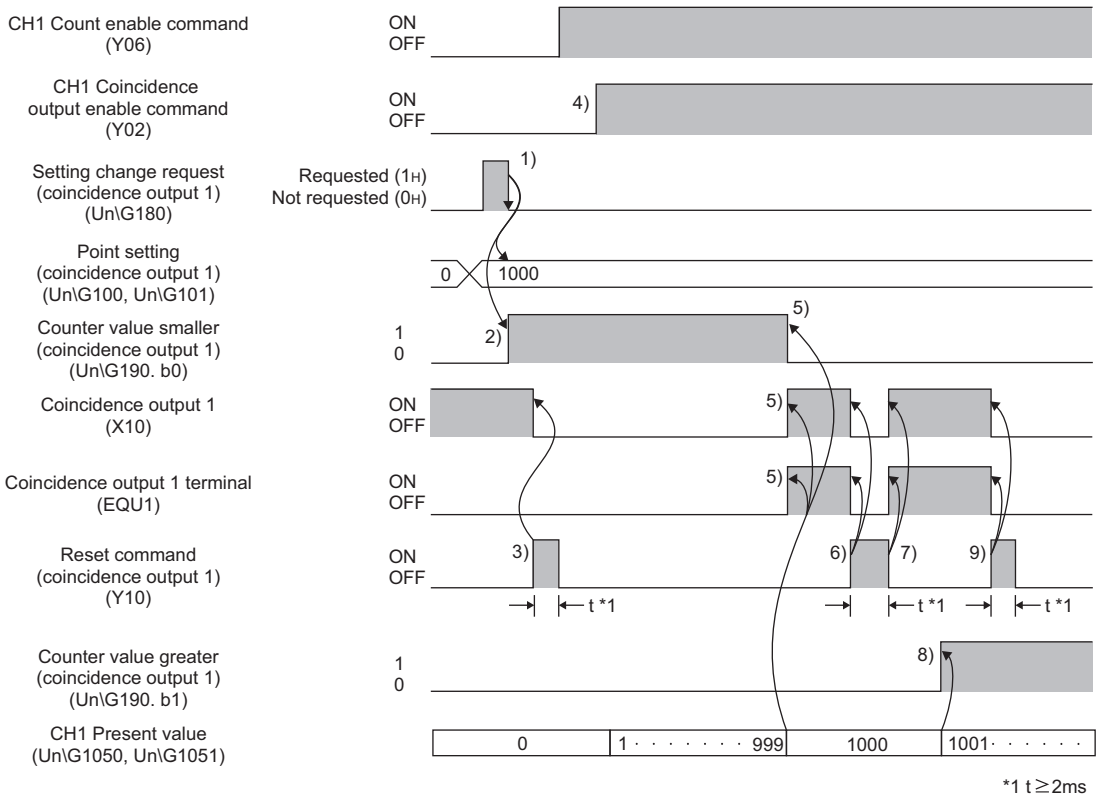
The initial value of Coincidence output condition setting (Un\G0) is all 0000_H (all coincidence output) right after the CPU module is powered on or reset. Also, the initial value of Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) and CH1 Present value (Un\G1050 to Un\G1051) are 0. Therefore, Coincidence output 1 to 8 (X10 to X17) turn on.
When CH1 Coincidence output enable command (Y02) is turned on, signals are output as if coincidence output was detected.
In order to prevent the condition above, take one of the following measures before turning on CH1 Coincidence output enable command (Y02).

- Measure 1
  When using only coincidence output as the comparison condition, and besides when not using Operating condition settings batch-change command (Y01) or the parameter settings of the programming tool, set a different value for CH1 Present value (Un\G1050 to Un\G1051) and Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) by one of the methods below. Then switch Reset command (coincidence output 1 to 8) (Y10 to Y17) as follows; OFF, ON, then OFF.
  - Change Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115), and reflect the change by Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187).
  - Change CH1 Present value (Un\G1050, Un\G1051) by the preset/replace function.
  - Change CH1 Present value (Un\G1050, Un\G1051) by start counting.
- Measure 2
  When using in-range output or not-in-range output as the comparison condition, or when using Operating condition settings batch-change command (Y01) or the parameter setting of the programming tool, configure related settings in Page 110, Section 4.3.2 (3) by one of the methods below.
  - Set them by the sequence program, and switch Operating condition settings batch-change command (Y01) as follows; OFF, ON, then OFF.
  - Write the parameter settings into the CPU module from the programming tool, and reflect the settings by switching the CPU module as follow; STOP, RUN, STOP, and RUN.

(6) Operation example of each comparison condition

(a) Operation example of coincidence output

The following figure shows an operation example when coincidence output is set as the comparison condition. Note that the coincidence output 1 is assigned to CH1.



Number	Description
1)	Start comparison of the count value and a value set to Point setting (coincidence output 1) (Un\G100, Un\G101) in the following order. (1) Write 1000 into Point setting (coincidence output 1) (Un\G100, Un\G101). (2) Write Requested (1_H) into Setting change request (coincidence output 1) (Un\G180). (3) The setting value of (1) is reflected at the time when Setting change request (coincidence output 1) (Un\G180) is automatically reset from Requested (1_H) to Not requested (0_H) by the QD65PD2.
2)	When CH1 Present value (Un\G1050, Un\G1051) < Point setting (coincidence output 1) (Un\G100, Un\G101) is made, 1 is stored into Counter value smaller (coincidence output 1) (Un\G190.b0).
3)	When Reset command (coincidence output 1) (Y10) is turned on, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn off.
4)	If performing coincidence output from the coincidence output 1 terminal (EQU1), turn on CH1 Coincidence output enable command (Y02).
5)	When CH1 Present value (Un\G1050, Un\G1051) = Point setting (coincidence output 1) (Un\G100, Un\G101) is made, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn on. Also, Counter value smaller (coincidence output 1) (Un\G190.b0) becomes 0.
6)	If Reset command (coincidence output 1) (Y10) is turned on while CH1 Present value (Un\G1050, Un\G1051) and Point setting (coincidence output 1) (Un\G100, Un\G101) match, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn off.
7)	If Reset command (coincidence output 1) (Y10) is turned off while CH1 Present value (Un\G1050, Un\G1051) and Point setting (coincidence output 1) (Un\G100, Un\G101) match, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn on again.

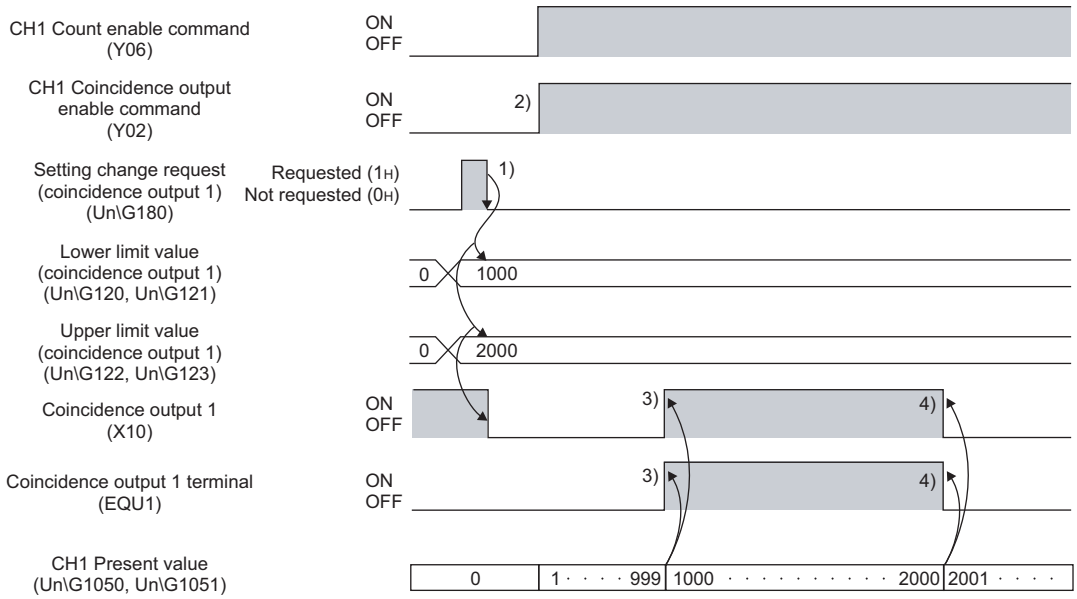
Number	Description
8)	When CH1 Present value (Un\G1050, Un\G1051) > Point setting (coincidence output 1) (Un\G100, Un\G101) is made, Counter value greater (coincidence output 1) (Un\G190.b1) becomes 1.
9)	Turn on Reset command (coincidence output 1) (Y10) to reset Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1). If these are not reset, the next coincidence output 1 cannot be detected.

Point

- Coincidence output 1 to 8 (X10 to X17) turn on regardless of CH1 Coincidence output enable command (Y02).
- Set the ON time of Reset command (coincidence output 1 to 8) (Y10 to Y17) 2ms or longer using a timer.
- Due to coincidence detection processing inside the QD65PD2, the counter value greater/smaller applicable to Counter value greater/smaller (coincidence output) (Un\G190) are not updated at the same time when Coincidence output 1 to 8 (X10 to X17) turn on (OFF→ON).
  Therefore, the counter value greater/smaller may be 1 even though it is not the correct value.
- Even if Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) is changed, the count value is not compared with the changed value when Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) is not set to Requested (1_H).
- The initial value of Coincidence output condition setting (Un\G0) is all 0000_H (all coincidence output) right after the CPU module is powered on or reset. Also, the initial value of Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) and CH1 Present value (Un\G1050 to Un\G1051) are 0. Therefore, Coincidence output 1 to 8 (X10 to X17) turn on. When CH1 Coincidence output enable command (Y02) is turned on, signals are output as if coincidence output was detected.
  In order to prevent the condition above, take one of the following measures described in Point in Page 111, Section 4.3.2 (5) before turning on CH1 Coincidence output enable command (Y02).

(b) Operation example of in-range output

The following figure shows an operation example when in-range output is set as the comparison condition. Note that the coincidence output 1 is assigned to CH1.



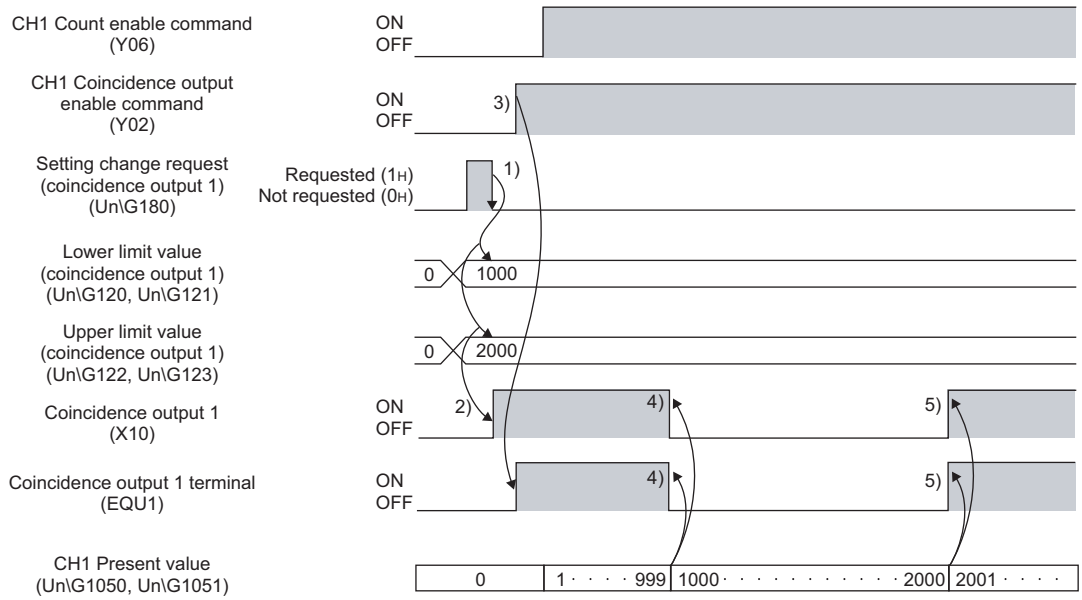
Number	Description
1)	Start comparison of the count value and values set to Lower limit value (coincidence output 1) (Un\G120, Un\G121) and Upper limit value (coincidence output 1) (Un\G122, Un\G123) in the following order. (1) Write 1000 into Lower limit value (coincidence output 1) (Un\G120, Un\G121). (2) Write 2000 into Upper limit value (coincidence output 1) (Un\G122, Un\G123). (3) Write Requested (1_H) into Setting change request (coincidence output 1) (Un\G180). (4) The setting value of (1) and (2) is reflected at the time when Setting change request (coincidence output 1) (Un\G180) is automatically reset from Requested (1_H) to Not requested (0_H) by the QD65PD2.
2)	To output signals from the coincidence output 1 terminal (EQU1), turn on CH1 Coincidence output enable command (Y02).
3)	When CH1 Present value (Un\G1050, Un\G1051) ≥ Lower limit value (coincidence output 1) (Un\G120, Un\G121) is made, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn on since the present value is within the specified range.
4)	When CH1 Present value (Un\G1050, Un\G1051) > Upper limit value (coincidence output 1) (Un\G122, Un\G123) is made, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn off since the present value is outside the specified range.

Point

- Coincidence output 1 to 8 (X10 to X17) turn on regardless of CH1 Coincidence output enable command (Y02).
- Even if Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151) are changed, the count value is not compared with the changed value when Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) is not set to Requested (1_H).

(c) Operation example of not-in-range output

The following figure shows an operation example when not-in-range output is set as the comparison condition. Note that the coincidence output 1 is assigned to CH1.



Number	Description
1)	Start comparison of the count value and values set to Lower limit value (coincidence output 1) (Un\G120, Un\G121) and Upper limit value (coincidence output 1) (Un\G122, Un\G123) in the following order. (1) Write 1000 into Lower limit value (coincidence output 1) (Un\G120, Un\G121). (2) Write 2000 into Upper limit value (coincidence output 1) (Un\G122, Un\G123). (3) Write Requested (1_H) into Setting change request (coincidence output 1) (Un\G180). (4) The setting value of (1) and (2) is reflected at the time when Setting change request (coincidence output 1) (Un\G180) is automatically reset from Requested (1_H) to Not requested (0_H) by the QD65PD2.
2)	When CH1 Present value (Un\G1050, Un\G1051) < Lower limit value (coincidence output 1) (Un\G120, Un\G121) is made, Coincidence output 1 (X10) turns on since the present value is outside the specified range.
3)	To output signals from the coincidence output 1 terminal (EQU1), turn on CH1 Coincidence output enable command (Y02). In this case, the coincidence output 1 terminal turns on immediately since Coincidence output 1 (X10) is already on.
4)	When CH1 Present value (Un\G1050, Un\G1051) ≥ Lower limit value (coincidence output 1) (Un\G120, Un\G121) is made, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn off since the present value is within the specified range.
5)	When CH1 Present value (Un\G1050, Un\G1051) > Upper limit value (coincidence output 1) (Un\G122, Un\G123) is made, Coincidence output 1 (X10) and the coincidence output 1 terminal (EQU1) turn on since the present value is outside the specified range.

Point

- Coincidence output 1 to 8 (X10 to X17) turn on regardless of CH1 Coincidence output enable command (Y02).
- Even if Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151) are changed, the count value is not compared with the changed value when Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) is not set to Requested (1_H).

4.3.3 Preset/replace (at coincidence output) function

The preset/replace (at coincidence output) function performs the preset/replace function (replaces the count value with a value preset by the user) at the rising state (off to on) of the coincidence output 1 and 2.
The preset/replace by this function is performed to the channel assigned to coincidence output 1 and 2.
This function is not available for coincidence output 3 to 8.

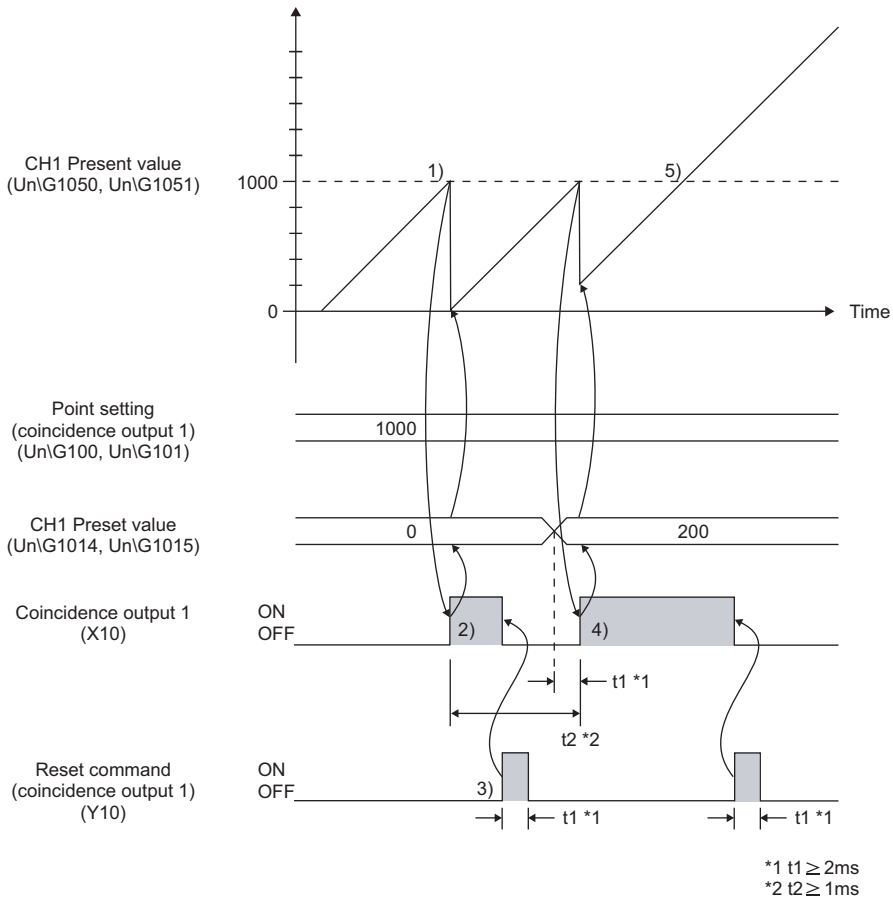
(1) Setting method of the preset/replace (at coincidence output) function

Set the preset/replace (at coincidence output) function in the following buffer memory.

Setting item	Setting contents	Reference
Preset/replace setting at coincidence output (Un\G1)	Set whether to perform the preset/replace function to each of the coincidence output 1 and 2 or not.	Page 65, Section 3.4.2 (2)
CH1 Preset value (Un\G1014, Un\G1015)	Set a value to be preset.	Page 72, Section 3.4.2 (19)

(2) Operation example of the preset/replace (at coincidence output) function

The following figure shows an operation example of the preset/replace (at coincidence output) function. Note that the comparison condition of the coincidence output 1 is set to coincidence output, and it is assigned to CH1.



Number	Description
1)	When CH1 Present value (Un\G1050, Un\G1051) = Point setting (coincidence output 1) (Un\G100, Un\G101) is made, Coincidence output 1 (X10) turns on.
2)	The preset/replace function is performed at the rising state (off to on) of Coincidence output 1 (X10).
3)	Reset Coincidence output 1 (X10) so that Coincidence output 1 (X10) rises (off to on) when the next CH1 Present value (Un\G1050, Un\G1051) = Point setting (coincidence output 1) (Un\G100, Un\G101) is made.
4)	If CH1 Preset value (Un\G1014, Un\G1015) was changed in advance, perform the preset/replace function with the changed value.
5)	If Coincidence output 1 (X10) was not reset, Coincidence output 1 (X10) remains on without rising (off to on) when the next CH1 Present value (Un\G1050, Un\G1051) = Point setting (coincidence output 1) (Un\G100, Un\G101) is made. Therefore, the preset/replace function does not operate.

Point

- The preset/replace function cannot be performed while CH1 External preset/replace (Z Phase) request detection (X05) is on.
  Reset CH1 CH1 External preset/replace (Z Phase) request detection (X05) by CH1 External preset/replace (Z Phase) request detection reset command (Y05).
- Have a 2ms or longer interval before performing the preset/replace function since there is maximum of 2ms until the change in CH1 Preset value (Un\G1014, Un\G1015) is reflected.
- To perform the preset/replace (at coincidence output) function continuously using the same coincidence output (coincidence output 1 or 2), have a 1ms or longer interval. The preset/replace function may not operate if there is not a 1ms or longer interval. The following is the rough standard of an interval.

  (|Point setting (coincidence output 1 and 2)*1 - Preset value|) > (Input pulse speed (pps)/1000)

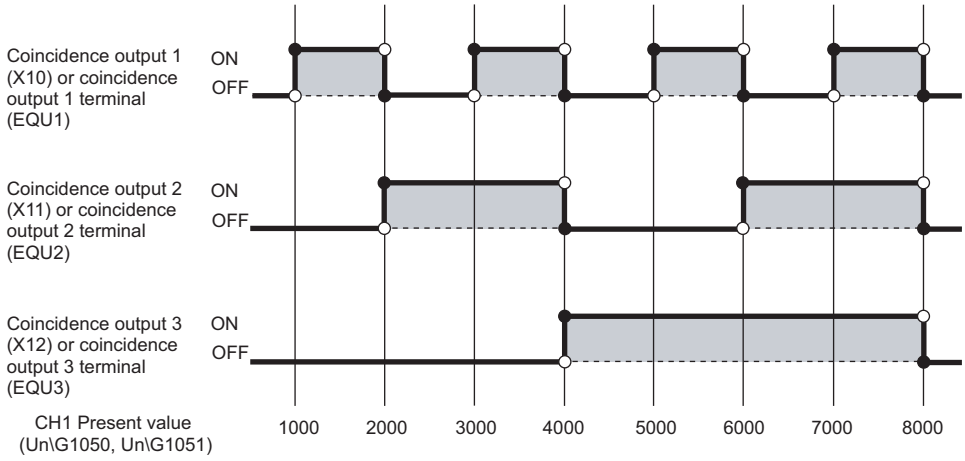
*1 When the comparison condition is in-rage output or not-in-range output, change this into the upper/lower limit value (coincidence output 1 and 2) that is equivalent to the rise (off to on) of the coincidence output 1 and 2.

- When the preset/replace (at coincidence output) function is used while counting pulses input in a counting speed of 2Mpps or faster, create the sequence program considering pulse count difference (plus 1 or minus 1 pulse).

4.3.4 Cam switch function

The cam switch function allow users to set the ON/OFF status of Coincidence output 1 to 8 (X10 to X17) and coincidence output 1 to 8 terminals (EQU1 to 8) depending on the count value. The maximum of 16 steps of ON/OFF switching can be set per one coincidence output point.
By using this function, coincidence output can be performed under complicated conditions.

Ex. Control of coincidence output that turns on or off depending on CH1 present value by the cam switch function.



(1) Setting method of the cam switch function

The cam switch function operates by selecting "Cam Switch Function" as the comparison output setting value in the switch setting.

☞Page 180, Section 6.2

Point

While the cam switch function is selected, set "Operation mode setting" in the switch setting to "Normal Mode". If the operation mode is set to a mode other than the normal mode (including out-of-setting range), an error (error code: 811) occurs.

(2) How to assign output terminals

Assign coincidence output terminals to either one of CH1 or CH2 in "Coincidence output (1 to 8) channel assignment setting" of the switch setting.

☞Page 180, Section 6.2

(3) Output range setting

With the cam switch setting, the maximum of 16 steps of ON/OFF switching can be set per one output point. The part where the ON/OFF signal status is switched is referred to as a step.

Setting item	Setting contents	Reference
Cam switch function, step type (coincidence output 1) (Un\G200)	Set the ON/OFF status of Coincidence output 1 (X10) at the time when the pulse counting starts.	Page 68, Section 3.4.2 (8)
Cam switch function, number of steps (coincidence output 1) (Un\G201)	Set the number of steps for the coincidence output 1.	Page 68, Section 3.4.2 (9)
Cam switch function, step No.1 to No.16 setting (coincidence output 1) (Un\G202 to Un\G233)	Set the count value where the ON/OFF status of Coincidence output 1 (X10) is to be switched.	Page 69, Section 3.4.2 (10)

A setting example with the coincidence output 1 is shown below.

For signals applied to coincidence output 2 to 8, refer to the following section.

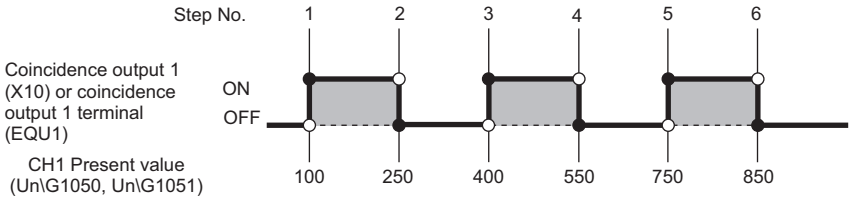
Page 32, Section 3.3.1

For buffer memory addresses applied to coincidence output 2 to 8, refer to the following section.

Page 42, Section 3.4.1

Ex. Cam switch function, step type (coincidence output 1) (Un\G200) is set to OFF, and Cam switch function, number of steps (coincidence output 1) (Un\G201) is set to 6

Setting item	Setting value
Cam switch function, step type (coincidence output 1) (Un\G200)	0
Cam switch function, number of steps (coincidence output 1) (Un\G201))	6
Cam switch function, step No.1 setting (coincidence output 1) (Un\G202 to Un\G203)	100
Cam switch function, step No.2 setting (coincidence output 1) (Un\G204 to Un\G205)	250
Cam switch function, step No.3 setting (coincidence output 1) (Un\G206 to Un\G207)	400
Cam switch function, step No.4 setting (coincidence output 1) (Un\G208 to Un\G209)	550
Cam switch function, step No.5 setting (coincidence output 1) (Un\G210 to Un\G211)	700
Cam switch function, step No.6 setting (coincidence output 1) (Un\G212 to Un\G213)	850
Cam switch function, step No.7 setting (coincidence output 1) (Un\G214 to Un\G215) ⋮ Cam switch function, step No.16 setting (coincidence output 1) (Un\G232 to Un\G233)	Setting not necessary



(4) Minimum setting width of the ON/OFF status

The value of each step No. need to be set so that the setting width (between a step and the next step) has the minimum of 1ms for the pulse input speed not to exceed the limit. Therefore, the following condition need to be satisfied.

Pulse input speed (pps)/1000 ≤ (Setting value of coincidence output 1 to 8 step No.m + 1) - (Setting value of coincidence output 1 to 8 step No.m)

- m=1 to 15

If the condition above is not satisfied, ON/OFF signals cannot be output as they are set.

(5) Activation timing of the cam switch function setting

The table below shows the activation timing of the cam switch function. The settings are for the coincidence output 1.

For buffer memory addresses of the coincidence output 2 to 8, refer to the following section.

☞ Page 42, Section 3.4.1

CH1 Cam switch function/PWM output start command (Y08) is activated while Operating condition settings batch-changed (X01) is on.

Setting item	When Operating condition settings batch-change command (Y01) is turned on (OFF→ON)	When CH1 Cam switch function/PWM output start command (Y08) is turned on (OFF→ON)	Reference
Cam switch function, step type (coincidence output 1) (Un\G200)	—	○	Page 68, Section 3.4.2 (8)
Cam switch function, number of steps (coincidence output 1) (Un\G201)	—	○	Page 68, Section 3.4.2 (9)
Cam switch function, step No.1 to No.16 setting (coincidence output 1) (Un\G202 to Un\G233)	—	○	Page 69, Section 3.4.2 (10)

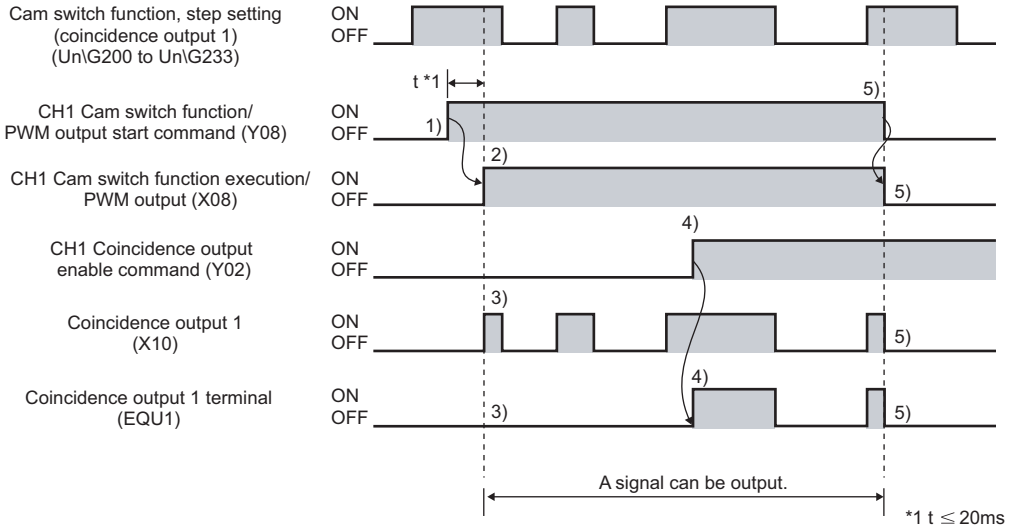
○:Activated, — : Not activated

(6) Output setting to coincidence output 1 to 8 terminals (EQU1 to EQU8)

In order to output signals from coincidence output 1 to 8 terminals (EQU1 to EQU8) to outside, enable output by turning on CH1 Coincidence output enable command (Y02). Doing so enable all coincidence output assigned to the target channel in "Coincidence output (1 to 8) channel assignment setting" in the switch setting.

(7) Signal timing of the cam switch function

The following figure shows signal timing of the cam switch function. Note that the coincidence output 1 is assigned to CH1.



Number	Description
1)	When CH1 Cam switch function/PWM output start command (Y08) is turned on (OFF→ON), the step setting is latched and CH1 Cam switch function execution/PWM output (X08) turns on. (If the setting value of the step setting is changed while the cam switch function is in operation, the change is ignored.)
2)	The cam switch function operates when CH1 Cam switch function execution/PWM output (X08) turns on.
3)	CH1 Present value (Un\G1050, Un\G1051) and the step setting is compared and the result is output to coincidence output 1 (X10). If CH1 Coincidence output enable command (Y02) is off, the result is not output to the coincidence output 1 terminal (EQU1).
4)	To output signals from the coincidence output 1 terminal (EQU1), turn on CH1 Coincidence output enable command (Y02).
5)	When CH1 Cam switch function/PWM output start command (Y08) is turned off (ON→OFF), CH1 Cam switch function execution/PWM output (X08), coincidence output 1 (X10), and the coincidence output 1 terminal (EQU1) turn off.

Point

The cam switch function can be performed regardless of the ON/OFF status of CH1 Count enable command (Y06).

4.3.5 Coincidence detection interrupt function

The coincidence detection interrupt function performs an interrupt request to the CPU module, and starts an interrupt program when the count value matches with the specified value or range.
Note that this function can be used only when the coincidence output function is selected as the comparison output setting value, and the normal mode is selected as the operation mode.
The comparison output setting value and the operation mode setting can be set in the switch setting.
☞Page 180, Section 6.2

(1) Interrupt factors

The QD65PD2 has the following ten interrupt factors, and eight of them correspond to coincidence output.

SI No.	Interrupt factor	Note
0	Coincidence detection of the coincidence output 1	—
1	Coincidence detection of the coincidence output 2	
2	Coincidence detection of the coincidence output 3	
3	Coincidence detection of the coincidence output 4	
4	Coincidence detection of the coincidence output 5	
5	Coincidence detection of the coincidence output 6	
6	Coincidence detection of the coincidence output 7	
7	Coincidence detection of the coincidence output 8	
8	Cycle passing of CH1 periodic pulse counter function	☞Page 139, Section 4.9.1
9	Cycle passing of CH2 periodic pulse counter function	

(2) Interrupt request setting method

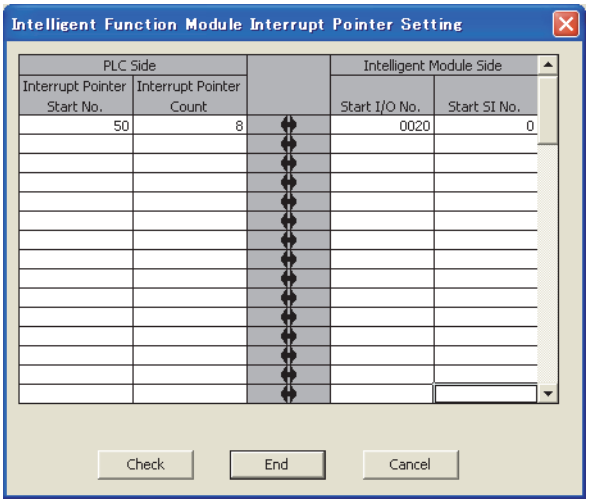
In order to issue an interrupt request when interrupt factors (SI No.0 to 7) occur, set the coincidence output which uses the interrupt request at Coincidence detection interrupt setting (Un\G2).
☞Page 66, Section 3.4.2 (3)

(3) Interrupt pointer setting method

Assign the interrupt factors (SI) of the QD65PD2 and the interrupt pointers of the CPU module in the intelligent function module interrupt pointer setting of the programming tool.

☞Page 250, Section 7.3

Ex. When assigning SI0 to 7 of the QD65PD2 to the interrupt pointers I50 to I53 (QD65PD2 is mounted to the slot whose start I/O number is 20.)

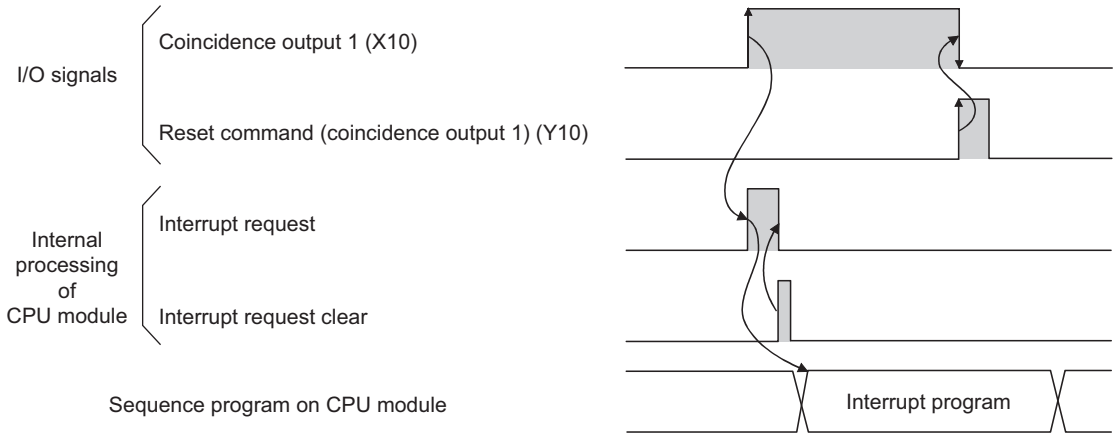


(4) Interrupt timing for each comparison condition

An interrupt occurs at the rising state (off to on) of Coincidence output 1 to 8 (X10 to X17).
Note that interrupt timing depends on the comparison condition.

(a) Coincidence output

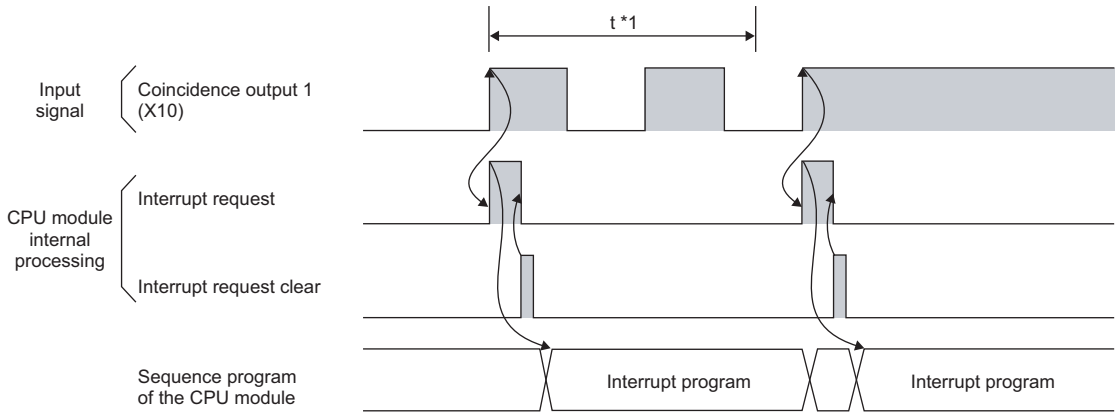
The figure below shows the timing of an interrupt signal when the comparison condition for the coincidence output 1 is coincidence output.
In this case, Coincidence output 1 (X10) must be reset by Reset command (coincidence output 1) (Y10).



(b) Within-range output/out-of-range output

The figure below shows the timing of an interrupt signal when the comparison condition for the coincidence output 1 is in-range output or not-in-range output.

After an interrupt occurs, another interrupt does not occur at the rising state (off to on) of Coincidence output 1 to 8 (X10 to 17) for the certain duration (t in the figure)



*1 0.5ms ≤ t ≤ 2.5ms
During this time, an interrupt does not occur at the rise of Coincidence output 1 to 8 (X10 to X17).

Point

- After coincidence detection, it takes approximately 150μs until an interrupt request is issued to the CPU module.
- The coincidence detection interrupt function can be used only when the coincidence output function is selected as the comparison output setting value, and the normal mode is selected as the operation mode.
- With coincidence output selected as the comparison condition, a coincidence detection interrupt occurs at the timing of a rising edge (off to on) of Coincidence output 1 to 8 (X10 to X17). For this reason, the next interrupt request is not issued unless the coincidence output is reset and Coincidence output 1 to 8 (X10 to X17) is turned off.
- With in-range output or not-in-range output selected as the comparison condition, a coincidence detection interrupt does not occur at the timing of a rising edge (off to on) of Coincidence output 1 to 8 (X10 to X17) for a certain period of time (from 0.5ms to 2.5ms) after the occurrence of an interrupt. Provide an interval of at least 2.5ms to generate an interrupt. Here is a formula for estimating the interval with the count value:

  Interval (by the count value) ≥ (pulse input speed (pps)/2500)

4.4 Preset/replace Function

The preset/replace function replaces the count value with any value preset by the user. This value is called a preset value. This function can be used to start counting pulses from the preset value.

Point

The preset/replace function cannot be performed while CH1 External preset/replace (Z Phase) request detection (X05) is on.

(1) Preset/replace function by GX Works2

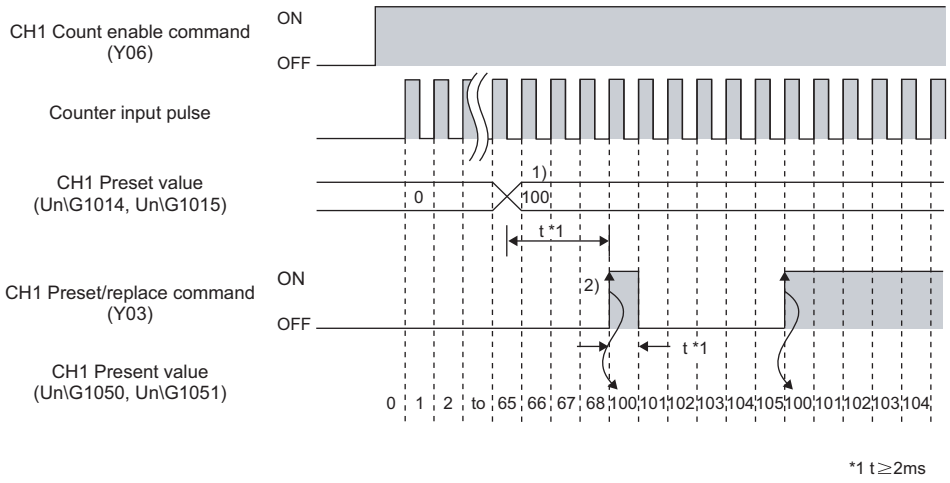
With GX Works2, the preset/replace function can be performed without using the sequence program or external input. For more details, refer to the following section.

Page 189, Section 6.5

(2) Preset/replace function by CH1 Preset/replace command (Y03)

Turning on CH1 Preset/replace command (Y03) in the sequence program performs the preset/replace function.

(a) Operation example of the preset/replace function by CH1 Preset/replace command (Y03)



Number	Description
1)	Write any value within the rage from -2147483648 to 2147483647 (in 32-bit signed binary) to CH1 Preset value (Un\G1014, Un\G1015).
2)	The preset value in CH1 Preset value (Un\G1014, Un\G1015) is stored in CH1 Present value (Un\G1050, Un\G1051) on the rising edge (OFF to ON) of CH1 Preset/replace command (Y03). The preset/replace function is performed regardless of the status of CH1 Count enable command (Y06).

(3) Preset/replace function by the phase Z input terminal (Z1)

(a) Setting method of the preset/replace function by the phase Z input terminal (Z)

The preset/replace function by the phase Z input terminal (Z1) can be performed by meeting the set trigger condition

- A trigger condition can be set at CH1 Z phase (Preset) trigger setting (Un\G1000.b0, b1)
- CH1 External preset/replace (Z Phase) request detection (X05) can be set in CH1 External preset/replace (Z Phase) request detection setting (Un\G1000.b4).

  For more details, refer to the following section.

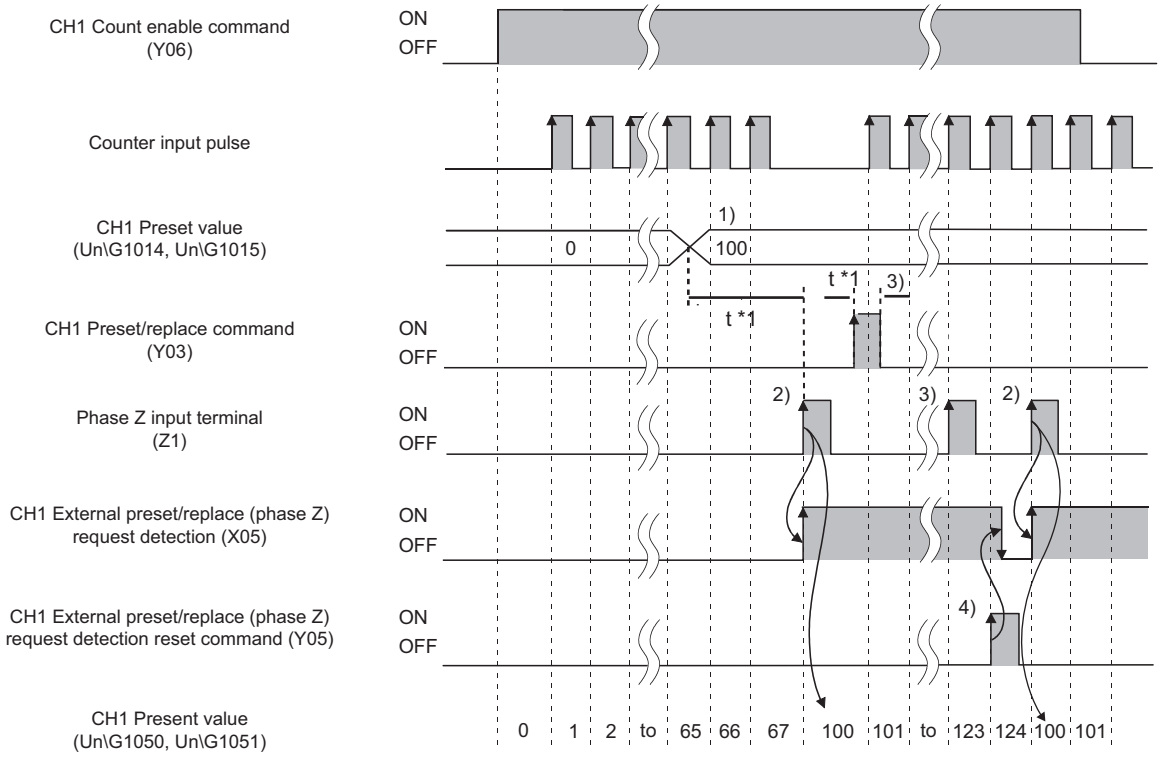
  ☞ Page 71, Section 3.4.2 (15)

(b) Operation example of the preset/replace function by the phase Z input terminal

The figure below shows an operation example with the setting as follows:

CH1 Z phase (Preset) trigger setting (Un\G1000.b0, b1): Rising (0)

CH1 External preset/replace (Z Phase) request detection setting (Un\G1000.b4): ON at detection (0)



*1 t≤2ms

Number	Description
1)	Write any value within the range from -2147483648 to 2147483647 (in 32-bit signed binary) to CH1 Preset value (Un\G1014, Un\G1015).
2)	The preset value in CH1 Preset value (Un\G1014, Un\G1015) is stored in CH1 Present value (Un\G1050, Un\G1051) on the rising edge (off to on) of the phase Z input terminal (Z1). CH1 External preset/replace (Z Phase) request detection (X05) turns on. The preset/replace function is performed regardless of the ON/OFF status of CH1 Count enable command (Y06).
3)	The preset/replace function cannot be performed while CH1 External preset/replace (Z Phase) request detection (X05) is on even if electrical voltage is applied to the phase Z input terminal (Z1) or CH1 Preset/replace command (Y03) is turned on.
4)	Turn on CH1 External preset/replace (Z Phase) request detection reset command (Y05). Then CH1 External preset/replace (Z Phase) request detection (X05) is turned off, and the preset/replace function is enabled.

Point

- Have a 2ms or more interval after changing CH1 Preset value (Un\G1014, Un\G1015) and before turning on the phase Z input terminal since there are maximum of 2ms until change in CH1 Preset value (Un\G1014, Un\G1015) is reflected. An interval is not necessary when the preset/replace function is performed by CH1 Preset/replace command (Y03).
- When the preset/replace function is performed by the phase Z input terminal (Z1), the operation response time follows "Z phase input response time setting" in the switch setting.
  Since the present value is updated synchronizing with the internal control cycle, a delay occurs until the preset value is stored (the maximum delay: 2ms + set time of "Z phase input response time setting" minutes).

4.5 Latch Counter Function

The latch counter function latches the count value when external input and an output signal (Y signal) are input.

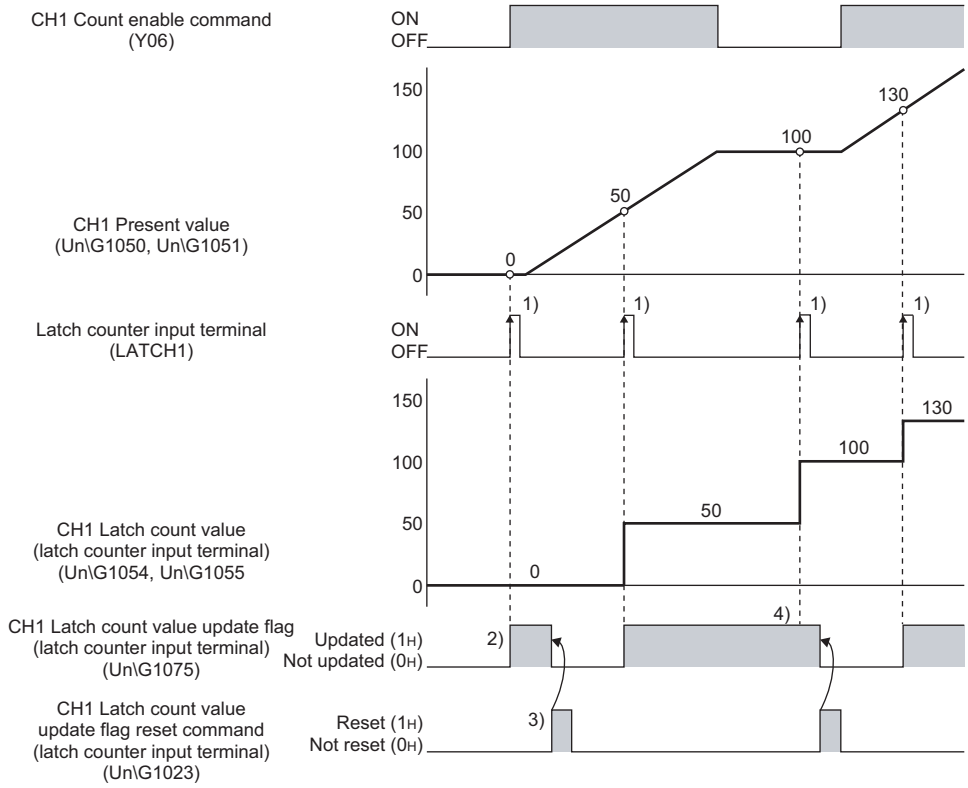
4.5.1 Latch counter function by latch counter input terminal

(1) Latching the present value by the latch counter input terminal

The latch counter function by the latch counter input terminal latches and stores the count value into the buffer memory when the latch counter input terminal (LATCH1) of external input is input.

(a) Operation example of the latch counter function by the latch counter input terminal

The following figure shows an operation example of the latch counter function by the latch counter input terminal.



Number	Description
1)	CH1 Present value (Un\G1050, Un\G1051) is stored into CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) at the rise of the latch counter input terminal (LATCH1).
2)	After CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) is updated, Updated (1_H) is stored into CH1 Latch count value update flag (latch counter input terminal) (Un\G1075).
3)	Set Reset (1_H) to CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023), and reset CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) to Not updated (0_H). After that, CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023) is automatically reset to Not reset (0_H).
4)	CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) is updated even if CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) is Updated (1_H).

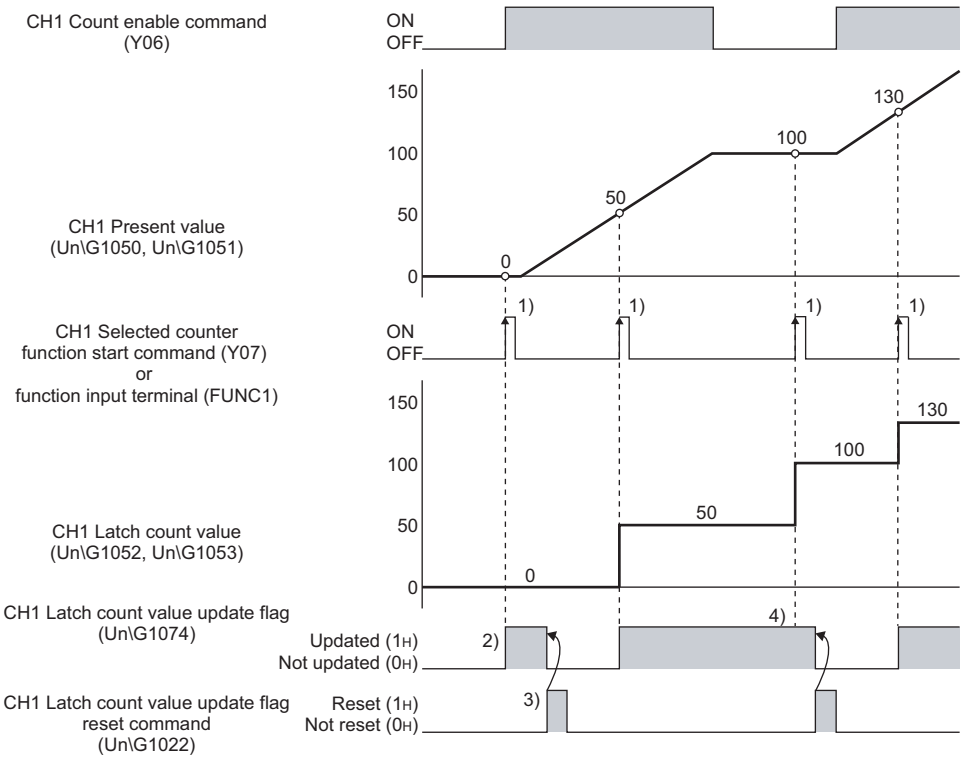
4.5.2 Latch counter function (counter function selection)

(1) Setting method of the latch counter function (counter function selection)

The latch counter function by counter function selection latches the count value when "Latch Counter Function" is selected for "Counter function selection" in the switch setting, then the function input terminal (FUNC1) of external input or CH1 Selected counter function start command (Y07) is input.

(2) Operation example of the latch counter function (counter function selection)

The following figure shows an operation example of the latch counter function (counter function selection).



Number	Description
1)	CH1 Present value (Un\G1050, Un\G1051) is stored into CH1 Latch count value (Un\G1052, Un\G1053) at the rise of CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1).
2)	After CH1 Latch count value (Un\G1052, Un\G1053) is updated, Updated (1_H) is stored into CH1 Latch count value update flag (Un\G1074).
3)	Set CH1 Latch count value update flag reset command (Un\G1022) to Reset (1_H), and reset CH1 Latch count value update flag (Un\G1074) to Not updated (0_H). After that, CH1 Latch count value update flag reset command (Un\G1022) is automatically reset to Not reset (0_H).
4)	CH1 Latch count value (Un\G1052, Un\G1053) is updated even if CH1 Latch count value update flag (Un\G1074) is Updated (1_H).

Point

- The latch counter function operates regardless of the ON/OFF status of CH1 Count enable command (Y06).
- IN addition to the latch counter function introduced in this section, there is the latch counter/preset/replace function. (☞Page 143, Section 4.11)
- When the latch counter function by the latch counter input terminal is performed, operation response time follows "Latch counter input response time setting" in the switch setting.
  Since CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) is updated synchronizing with the internal control cycle, a delay occurs until the latched value is stored (the maximum delay: 2ms + set time of "Latch counter input response time setting" minutes).
- When the latch counter function (counter function selection) is performed by the function input terminal (FUNC1), operation response time follows "Function input response time setting" in the switch setting.
  Since CH1 Latch count value (Un\G1052, Un\G1053) is updated synchronizing with the internal control cycle, a delay occurs until the latched value is stored (the maximum delay: 2ms + set time of "Function input response time setting" minutes).
- The latch counter function (counter function selection) cannot be performed while CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1) is on even if the other one of them is turned on.
- When reading out CH1 Latch count value (latch counter input terminal) (Un\G1054, Un\G1055) through a device that auto refresh is to be performed, CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) and CH1 Latch count value update flag reset command (latch counter input terminal) (Un\G1023) cannot be used. (If CH1 Latch count value update flag (latch counter input terminal) (Un\G1075) is Updated (1_H) after the auto refresh, the value before the update is read out.)
- When reading out CH1 Latch count value (Un\G1052, Un\G1053) through a device that auto refresh is to be performed, CH1 Latch count value update flag (Un\G1074) and CH1 Latch count value update flag reset command (Un\G1022) cannot be used. (If CH1 Latch count value update flag (Un\G1074) is Updated (1_H) after the auto refresh, the value before the update is read out.

4.6 Counter Function Selection

When CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1) is input, one of the functions below can be used.
A function can be selected for each channel.

(1) Counter function selection view

Function	Switch setting		Method		Reference
	Function selection setting	Related setting	CH1 Selected counter function start command (Y07)	Function input (FUNC1)	
Count disable function	Operation mode setting: Set to the normal mode. Counter function selection: Select a function.	• Function input logic setting • Function input response time setting	○	○	Page 132, Section 4.7
Latch counter function			○	○	Page 129, Section 4.5.2
Sampling counter function			○	○	Page 133, Section 4.8
Periodic pulse counter function			○	○	Page 136, Section 4.9
Count disable/preset/replace function			—	○	Page 141, Section 4.10
Latch counter/preset/replace function			—	○	Page 143, Section 4.11

○: Applicable, —: N/A

Point

A time lag occurs before the start of the selected function due to any of the following factors:

- Input response time of the function input terminal (FUNC1)
- Scan time of the sequence program (for CH1 Selected counter function start command (Y07))
- Internal control cycle (1ms) of the QD65PD2 (for CH1 Selected counter function start command (Y07)

The count error is as follows:

- Count error (maximum) which occurs when a function is performed by the function input terminal (FUNC1)

$$\frac{\text{Function input response time setting (ms)}}{1000}\ \text{(s)} \times \text{Pulse input speed (pps)}\ ^{*1}$$

- Count error (maximum) which occurs when a function is performed by CH1 Selected counter function start command (Y07)

$$\left(\frac{\text{1 scan time (ms)} + 2\ \text{(ms)}}{1000}\right)\ \text{(s)} \times \text{Pulse input speed (pps)}\ ^{*1}$$

For the sampling counter function and the periodic pulse counter function, a sampling/periodic time error due to a component error (±100 ppm) occurs. The count error is as follows:

$$\text{Sampling/periodic time (s)}^{*2} \times \frac{100\ \text{(ppm)}}{1000000} \times \text{Pulse input speed (pps)}^{*1}$$

*1 Pulse input speed (pps) = pulse input frequency (Hz) × number of multiples (count)

*2 Sampling/periodic time (s) = Sampling/periodic time setting value × Sampling/periodic time unit (s)[*3]
To calculate the time from the value on the programming tool setting screen, use the following formula.

$$\text{Sampling/periodic time (s)} = \frac{\text{Sampling/periodic time setting value (unit: 1ms)}}{1000}$$

*3 When CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016) is 1ms (0_H), this becomes 0.001(s).
When the time unit setting is 10ms (1_H), this becomes 0.01(s).

4.7 Count Disable Function

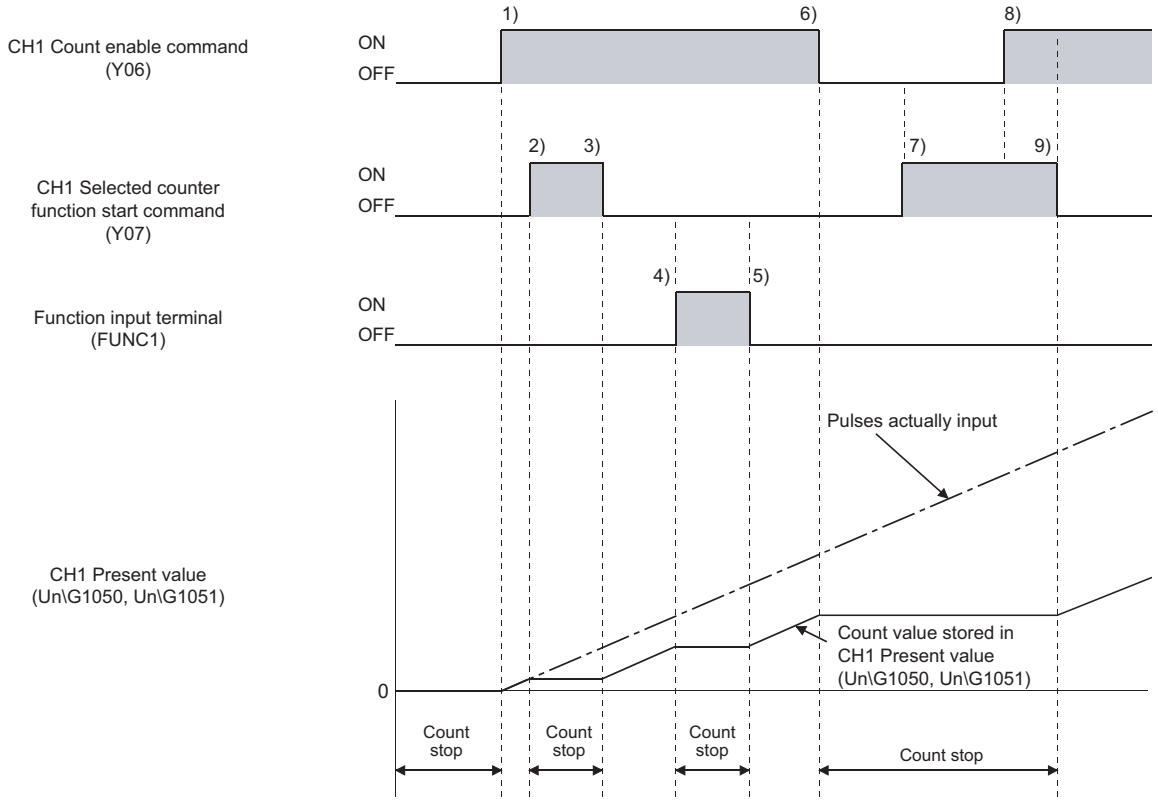
The count disable function stops counting when the function input terminal (FUNC1) or CH1 Selected counter function start command (Y07) is input while CH1 Count enable command (Y06) is on.

(1) Setting method of the count disable function

The count disable function can be used by selecting "Count Disabling Function" for "Counter function selection" in the switch setting.

(2) Operation example of the count disable function

The following figure shows an operation example of the count disable function.



Number	Description
1)	Counting starts by turning on CH1 Count enable command (Y06).
2)	Counting stops by turning on CH1 Selected counter function start command (Y07).
3)	Counting resumes by turning off CH1 Selected counter function start command (Y07).
4)	Counting stops by turning on the function input terminal (FUNC1).
5)	Counting resumes by turning off the function input terminal (FUNC1).
6)	Counting stops by turning off CH1 Count enable command (Y06).
7)	Counting stops regardless of CH1 Selected counter function start command (Y07) since CH1 Count enable command (Y06)is off.
8)	Counting remains stopped even if CH1 Count enable command (Y06) is turned on since CH1 Selected counter function start command (Y07) is on.
9)	Counting resumes by turning off CH1 Selected counter function start command (Y07).

4.8 Sampling Counter Function

The sampling counter function is used to count pulses that are input during the specified sampling period (T).

(1) Setting for the sampling counter function

To use the sampling counter function, select "Sampling Counter Function" in the "Counter function selection" in the switch setting.

(2) Setting of the sampling period

Set the sampling period (T) by setting values to CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017) and CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016).

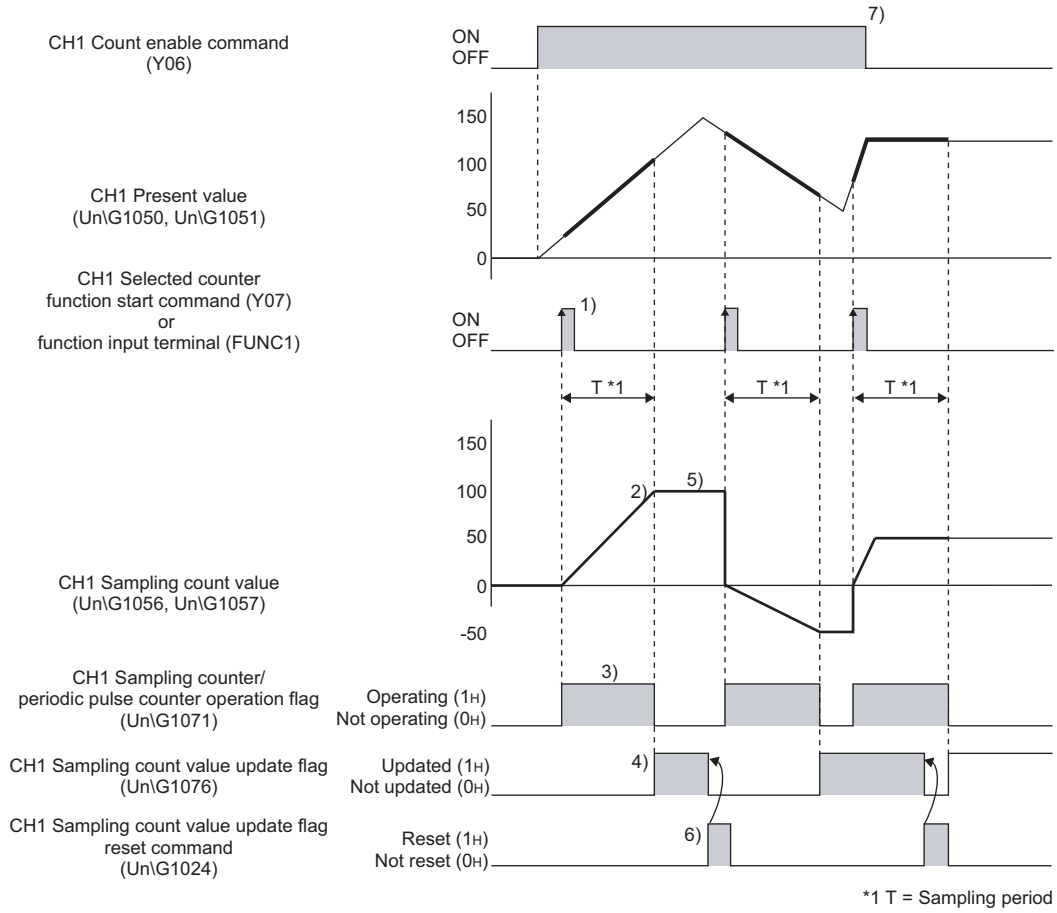
The setting values are enabled by setting CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested.

Yet the setting values are not enabled by doing only the above operation if the setting is changed while the sampling counter function is working. To enable the values, stop the function and then start it again.

Setting item	Setting contents	Reference
CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016)	Select the unit of sampling period from 1ms or 10ms, and set it.	Page 72, Section 3.4.2 (20)
CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017)	Set the sampling period in the range of 1 to 65535.	Page 73, Section 3.4.2 (21)

(3) Operation example of the sampling counter function

The following figure shows an operation example of the sampling counter function.



Number	Description
1)	The module starts counting input pulses from 0 at the rise of CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1).
2)	The module stops counting at the end of the preset sampling period.
3)	When the sampling counter function is working, 1_H: Operating is stored in CH1 Sampling counter/periodic pulse counter operation flag (Un\G1071).
4)	At the end of each sampling period, 1_H: Updated is stored in CH1 Sampling count value update flag (Un\G1076).
5)	Even after the sampling count is completed, the values stored in CH1 Sampling count value (Un\G1056, Un\G1057) remain the same.
6)	Reset CH1 Sampling count value update flag (Un\G1076) to 0_H: Not updated by setting CH1 Sampling count value update flag reset command (Un\G1024) to 1_H: Reset. CH1 Sampling count value update flag reset command (Un\G1024) is automatically reset to 0_H: Not reset after the completion of the reset.
7)	Although the sampling counter function works regardless of CH1 Count enable command (Y06) status (ON or OFF), the count does not start when CH1 Count enable command (Y06) is OFF.

Point

- You can use Operating condition settings batch-change command (Y01) to enable the setting of the sampling period. Yet buffer memories for the data classification Md1, for example, CH1 Present value (Un\G1050, Un\G1051) are also cleared by using Operating condition settings batch-change command (Y01). To avoid that, use CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) instead.
- When either of CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1) is ON, the sampling counter function can not be executed by turning on the other.
- By turning off both CH1 Selected counter function start command (Y07) and the function input terminal (FUNC1) and then turning on one of them during the operation of the sampling counter function, the pulses are counted from 0 again.
- Depending on the pulse input speed and sampling period, the values stored in CH1 Sampling count value (Un\G1056, Un\G1057) might be over 2147483647 (upper limit value) or below -2147483648 (lower limit value).
  In that case, the values in CH1 Sampling count value (Un\G1056, Un\G1057) remain 2147483647 (upper limit value) or -2147483648 (lower limit value), and CH1 Overflow/underflow error (sampling count value/periodic pulse count, difference value) (warning code 1050) will be detected.
  Despite of this warning, the count is continued till the end of the sampling period.
- Do not use CH1 Sampling count value update flag (Un\G1076) and CH1 Sampling count value update flag reset command (Un\G1024) when retrieving CH1 Sampling count value (Un\G1056, Un\G1057) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Sampling count value update flag (Un\G1076) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)
- To use CH1 Sampling count value update flag (Un\G1076), reset it before executing the sampling counter function. If you do not reset it, you cannot tell whether its value was updated after the execution.
- When changing the sampling period by using CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020), note the following:
  Do not execute the sampling counter function by the function input terminal (FUNC1) until the value in CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) turns from 1_H: Requested to 0_H: Not requested.
  If you do so, the count might be done with the previous setting.
- When the sampling counter function is used, the sampling period might slightly differs due to component error (±100ppm).
  For details, refer to the Point described in the following clause:
  Page 131, Section 4.6

4.9 Periodic Pulse Counter Function

The periodic pulse counter function is used to store the present count value and the difference value (the difference of the count values between the present one and the previous one) in CH1 Periodic pulse count, present value (Un\G1060, Un\G1061) and CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) every specified cycle time (T).

(1) Setting for the periodic pulse counter function

To use the periodic pulse counter function, select "Periodic Pulse Counter Function" in the "Counter function selection" in the switch setting.

(2) Setting of the cycle time

Set the cycle time (T) by setting values to CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017) and CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016).

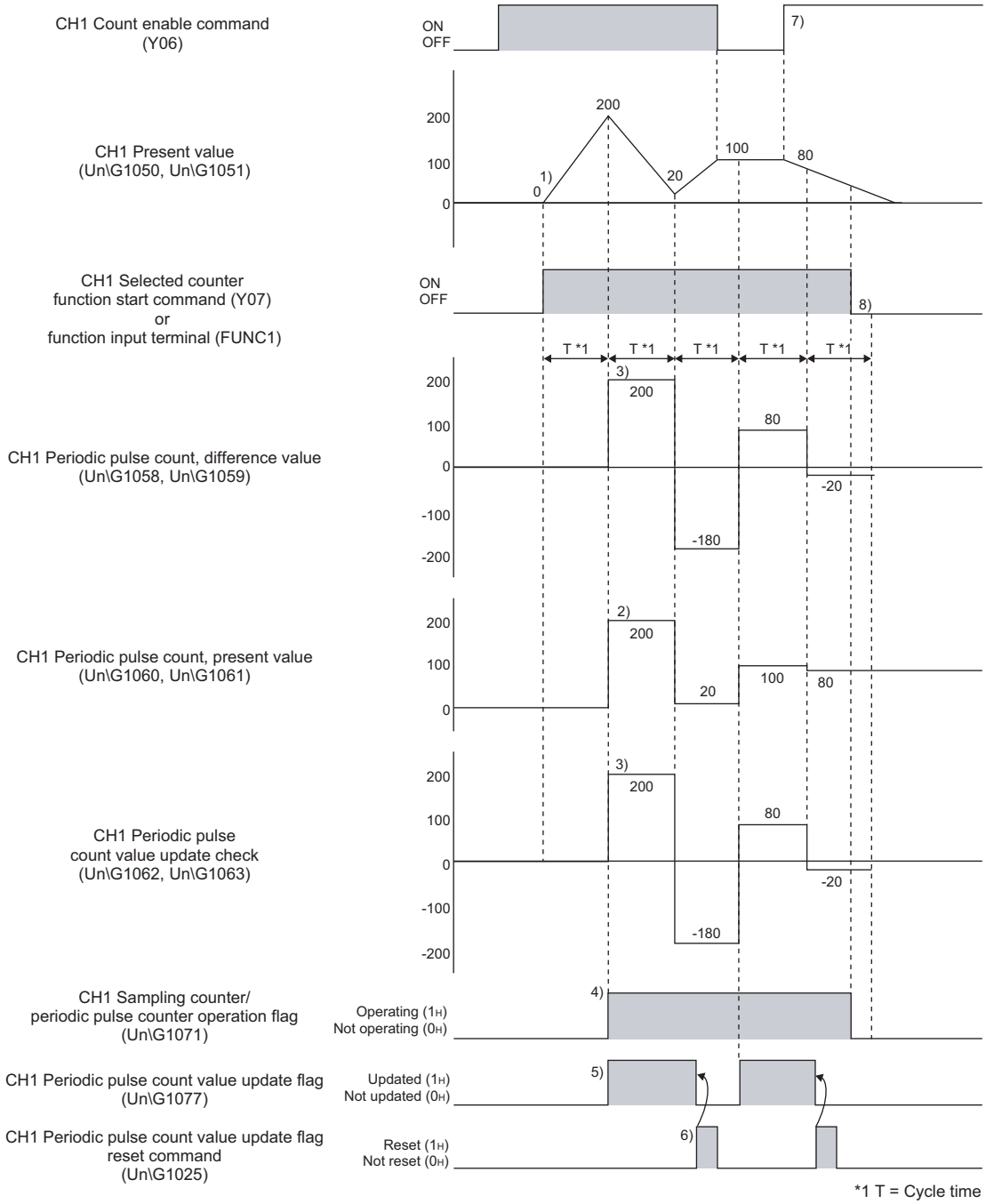
The setting values are enabled by setting CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested.

Yet the setting values are not enabled by doing only the above operation if the setting is changed while the periodic pulse counter function is working. To enable the values, stop the function and then start it again.

Setting item	Setting contents	Reference
CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016)	Select the unit of cycle time from 1ms or 10ms, and set it.	Page 72, Section 3.4.2 (20)
CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017)	Set the cycle time in the range of 1 to 65535.	Page 73, Section 3.4.2 (21)

(3) Operation example of the periodic pulse counter function

The following figure shows an operation example of the periodic pulse counter function.



*1 T = Cycle time

Number	Description
1)	The module starts counting input pulses from 0 at the rise of CH1 Selected counter function start command (Y07) or the function input terminal (FUNC1).
2)	Every preset cycle time, the values in CH1 Present value (Un\G1050, Un\G1051) are stored in CH1 Periodic pulse count, present value (Un\G1060, Un\G1061).
3)	Every preset cycle time, the difference of the count values between the previous one and the present one are stored in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063).
4)	When the periodic pulse counter function is working, 1_H: Operating is stored in CH1 Sampling counter/periodic pulse counter operation flag (Un\G1071).
5)	When CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), CH1 Periodic pulse count, present value (Un\G1060, Un\G1061), and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) are updated, 1_H: Updated is stored in CH1 Periodic pulse count value update flag (Un\G1077).
6)	Reset CH1 Periodic pulse count value update flag (Un\G1077) to 0_H: Not updated by setting CH1 Periodic pulse count value update flag reset command (Un\G1025) to 1_H: Reset. CH1 Periodic pulse count value update flag reset command (Un\G1025) is automatically reset to 0_H: Not reset after the completion of the reset.
7)	The periodic pulse counter function works regardless of CH1 Count enable command (Y06) status (ON or OFF).
8)	The periodic pulse counter function is stopped by turning off both CH1 Selected counter function start command (Y07) and the function input terminal (FUNC1).

Point

- You can use Operating condition settings batch-change command (Y01) to enable the setting of the cycle time.
  Yet buffer memories for the data classification Md1, for example, CH1 Present value (Un\G1050, Un\G1051) are also cleared by using Operating condition settings batch-change command (Y01). To avoid that, use CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) instead.
- Depending on the pulse input speed and cycle time, the values stored in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) might be over 2147483647 (upper limit value) or below -2147483648 (lower limit value).
  In that case, the values in CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059) and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) remain 2147483647 (upper limit value) or -2147483648 (lower limit value), and CH1 Overflow/underflow error (sampling count value/periodic pulse count, difference value) (warning code 1050) will be detected.
  Despite of this warning, the periodic pulse counter function keeps working.
- Do not use CH1 Periodic pulse count value update flag (Un\G1077) and CH1 Periodic pulse count value update flag reset command (Un\G1025) when retrieving CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), CH1 Periodic pulse count, present value (Un\G1060, Un\G1061), and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Periodic pulse count value update flag (Un\G1077) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)
- To use CH1 Periodic pulse count value update flag (Un\G1077), reset it before executing the periodic pulse counter function.
  If you do not reset it, you cannot tell whether its value was updated after the execution.
- When changing the cycle time by using CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020), note the following:
  Do not execute the periodic pulse counter function by the function input terminal (FUNC1) until the value in CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) turns from 1_H: Requested to 0_H: Not requested.
  If you do so, the function might work with the previous setting.
- When the periodic pulse counter function is used, the cycle time might slightly differs due to component error (±100ppm). For details, refer to the Point described in the following clause:
  Page 131, Section 4.6

4.9.1 Periodic interrupt function

The periodic interrupt function conducts the interrupt request to the CPU module by the cycle time of the periodic pulse counter function and starts an interrupt program.

(1) List of the interrupt factors

The QD65PD2 has total 10 points of interrupt factors (SI) as shown below, and 2 of them are corresponding to the periodic pulse counter function.

SI No.	Interrupt factor	Reference
0	Coincidence detection at coincidence output 1	Page 122, Section 4.3.5
⋮	⋮	
7	Coincidence detection at coincidence output 8	
8	At the end of the cycle time of CH1 periodic pulse counter function	—
9	At the end of the cycle time of CH2 periodic pulse counter function	

(2) Setting for the interrupt request

To conduct the interrupt request with the interrupt factor SI No.8 or 9, set CH1 Periodic interrupt setting (Un\G1001) to 1_H: Interrupt.

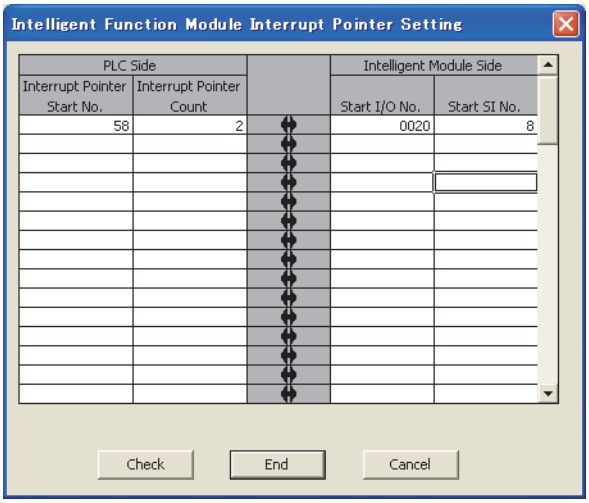
Page 71, Section 3.4.2 (16)

(3) Setting of the interrupt pointer

Set and assign the interrupt factor (SI) of the QD65PD2 and the interrupt pointer of the programmable controller CPU in the Intelligent Function Module Interrupt Pointer Setting of the programming tool.

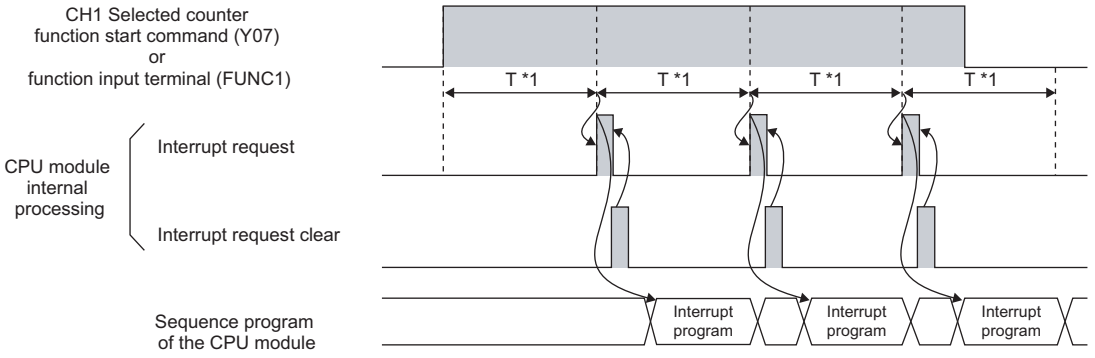
Page 250, Section 7.3

Ex. The following figure shows an example of the setting to assign the interrupt factor SI No.8 or 9 to the interrupt pointer I58 or 59, given that the QD65PD2 is mounted on the I/O slot No.20 of the main base unit.



(4) Timing of interrupt request

The following figure shows the timing of the interrupt signal output in case of the interrupt factor SI No.8 or 9.
The interrupt request is made to the CPU module just after the periodic pulse count values are updated.



*1 T = Cycle time

Point

The interrupt request to the CPU module is made with a delay less than 1ms from the end of the cycle time, since the update of the periodic pulse count values coincide with the internal control cycle (1ms).

4.10 Count Disable/Preset/replace Function

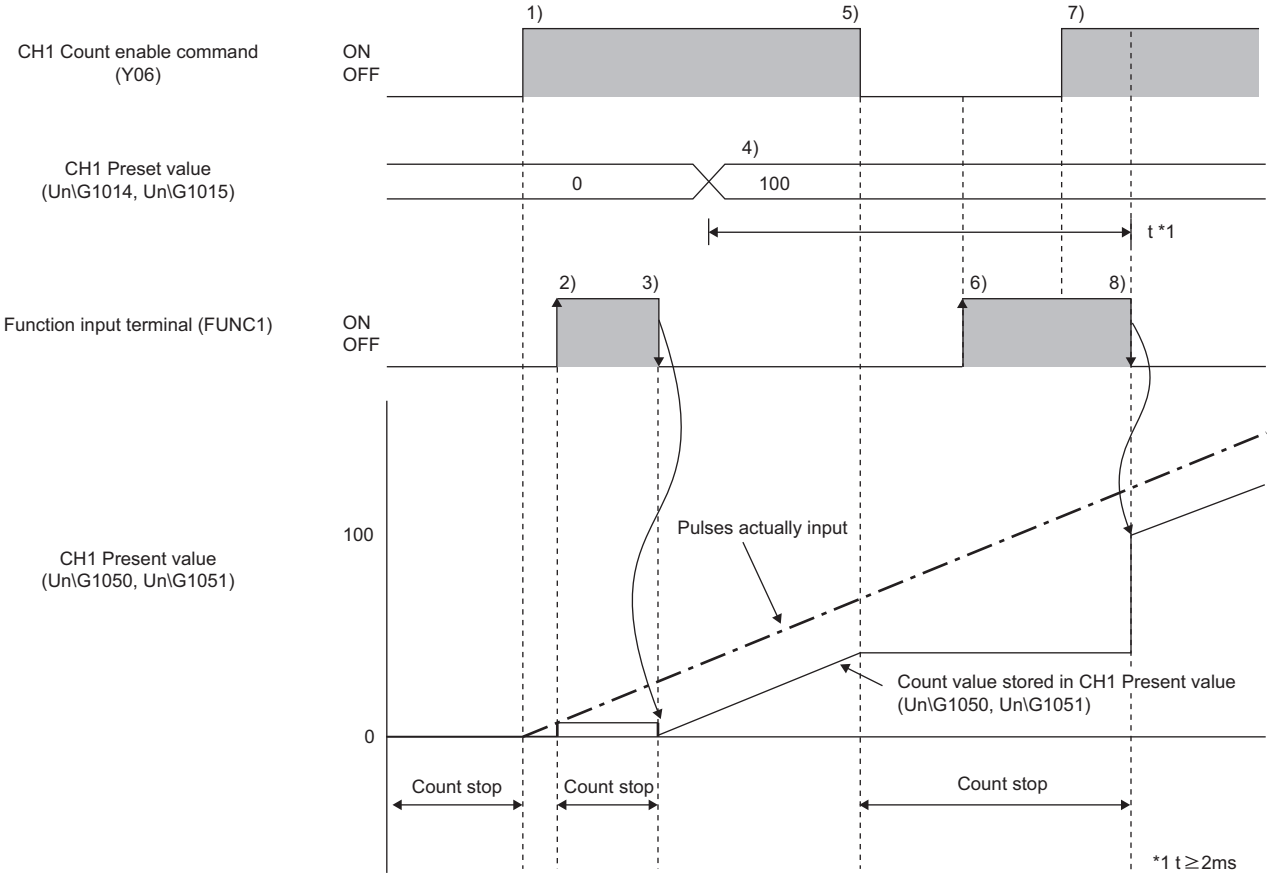
The count disable/preset/replace function enables the QD65PD2 to execute either of the count disable function or the preset/replace function according to the status change of the function input terminal (FUNC1).

(1) Setting for the count disable/preset/replace function

To use the count disable/preset/replace function, select "Count disable/Preset/replace Function" in the "Counter function selection" in the switch setting.

(2) Operation example of the count disable/preset/replace function

The following figure shows an operation example of the count disable/preset/replace function.



Number	Description
1)	The module starts counting by turning on CH1 Count enable command (Y06).
2)	The module stops counting at the rise of the function input terminal (FUNC1).
3)	At the fall of the function input terminal (FUNC1), the values in CH1 Preset value (Un\G1014, Un\G1015) are stored in CH1 Present value (Un\G1050, Un\G1051), and the module resumes the count.
4)	Set any values to CH1 Preset value (Un\G1014, Un\G1015).
5)	The module stops counting by turning off CH1 Count enable command (Y06).
6)	The module continues to stop counting regardless of the function input terminal (FUNC1) status, since CH1 Count enable command (Y06) remains OFF.
7)	With the function input terminal (FUNC1) being ON, the module does not start counting even by turning on CH1 Count enable command (Y06).
8)	At the fall of the function input terminal (FUNC1), the values in CH1 Preset value (Un\G1014, Un\G1015) are stored in CH1 Present value (Un\G1050, Un\G1051), and the module resumes the count.

Point

- The present values are not replaced with the preset values while CH1 External preset/replace (Z phase) request detection (X05) is ON.
  To avoid that, turn on CH1 External preset/replace (Z phase) request detection reset command (Y05) and turn off CH1 External preset/replace (Z phase) request detection (X05) before executing the preset/replace function.
- The values set to CH1 Preset value (Un\G1014, Un\G1015) are enabled with up to 2ms delay. So when you execute the preset/replace function, take at least 2ms after changing the setting value of CH1 Preset value (Un\G1014, Un\G1015).

4.11 Latch Counter/Preset/replace Function

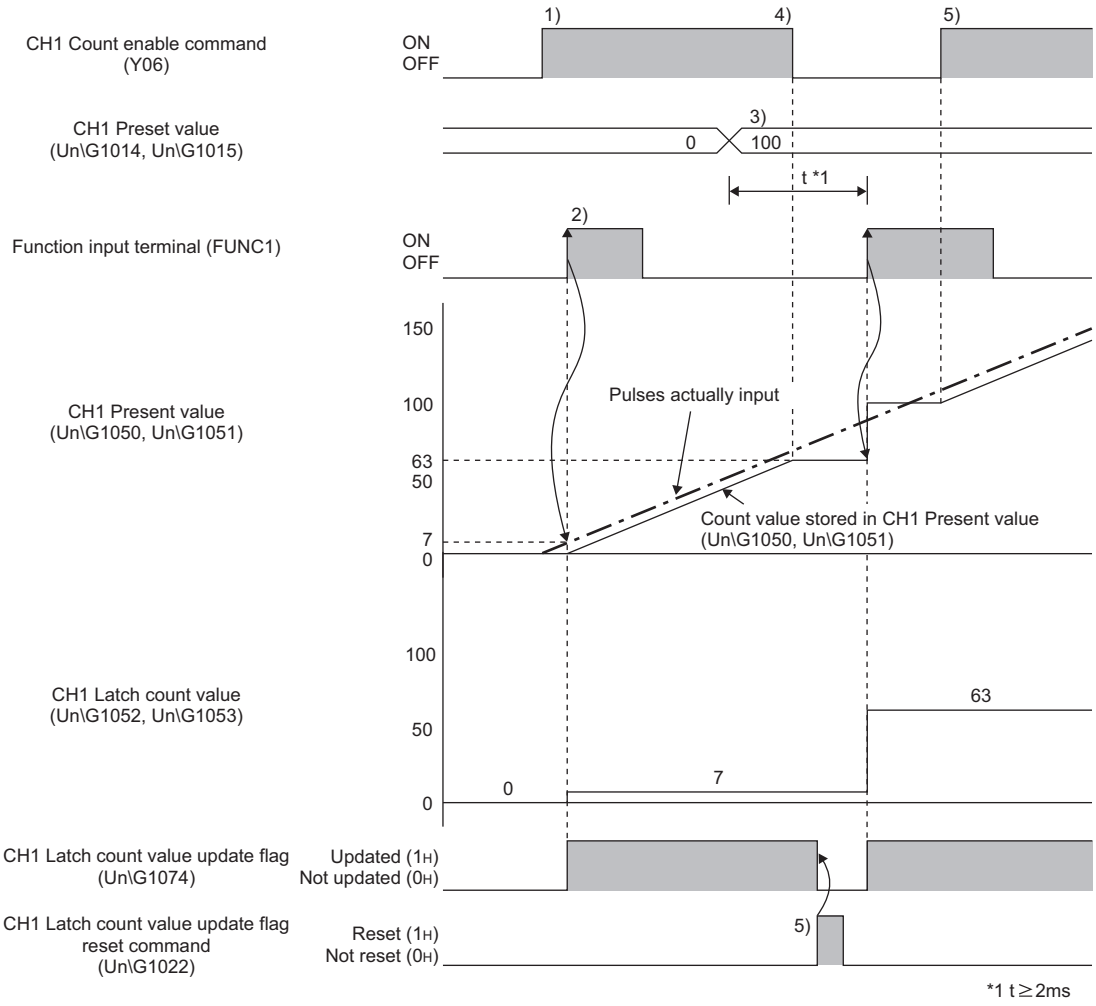
The latch counter/preset/replace function enables the QD65PD2 to execute either of the latch counter function or the preset/replace function according to the status change of the function input terminal (FUNC1).

(1) Setting for the latch counter/preset/replace function

To use the latch counter/preset/replace function, select "Latch counter/Preset/replace Function" in the "Counter function selection" in the switch setting.

(2) Operation example of the latch counter/preset/replace function

The following figure shows an operation example of the latch counter/preset/replace function.



Number	Description
1)	The module starts counting by turning on CH1 Count enable command (Y06).
2)	At the rise of the function input terminal (FUNC1), the values in CH1 Present value (Un\G1050, Un\G1051) are stored in CH1 Latch count value (Un\G1052, Un\G1053), and the values in CH1 Preset value (Un\G1014, Un\G1015) are stored in CH1 Present value (Un\G1050, Un\G1051). Also, 1_H: Updated is stored in CH1 Latch count value update flag (Un\G1074) when CH1 Latch count value (Un\G1052, Un\G1053) is updated.
3)	Set any values to CH1 Preset value (Un\G1014, Un\G1015).
4)	The module stops counting by turning off CH1 Count enable command (Y06).
5)	Reset CH1 Latch count value update flag (Un\G1074) to 0_H: Not updated by setting CH1 Latch count value update flag reset command (Un\G1022) to 1_H: Reset. CH1 Latch count value update flag reset command (Un\G1022) is automatically reset to 0_H: Not reset after the completion of the reset.
6)	The module resumes the count by turning on CH1 Count enable command (Y06).

Point

- The present values are not replaced with the preset values while CH1 External preset/replace (Z Phase) request detection (X05) is ON.
  To avoid that, turn on CH1 External preset/replace (Z Phase) request detection reset command (Y05) and turn off CH1 External preset/replace (Z Phase) request detection (X05) before executing the preset/replace function.
- The values set to CH1 Preset value (Un\G1014, Un\G1015) are enabled with up to 2ms delay. So when you execute the preset/replace function, take at least 2ms after changing the setting value of CH1 Preset value (Un\G1014, Un\G1015).
- When the latch counter function (counter function selection) is executed by the function input terminal (FUNC1), the response time of the function varies according to the time set in "Function input response time setting" in the switch setting.
  Yet the latched values are stored in CH1 Latch count value (Un\G1052, Un\G1053) with a delay up to 2ms + the time set in "Function input response time setting", since the update of CH1 Latch count value (Un\G1052, Un\G1053) coincide with the internal control cycle.
- Do not use CH1 Latch count value update flag (Un\G1074) and CH1 Latch count value update flag reset command (Un\G1022) when retrieving CH1 Latch count value (Un\G1052, Un\G1053) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Latch count value update flag (Un\G1074) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)

4.12 Internal Clock Function

The internal clock function is the function that does the count by using internal clocks incorporated in the QD65PD2. For instance, an on delay timer consists of this function and the coincidence output function.

(1) List of the internal clocks

The following table lists the internal clocks incorporated in the QD65PD2.

Name	Description	Remark
Internal clock (0.1μs)	A clock with 0.1μs per cycle	The clock has +1.7252604% of time lag relative to the actual time. (The percentage is rounded off to seven decimal places.)
Internal clock (1μs)	A clock with 1μs per cycle	The clock has +0.3689236% of time lag relative to the actual time. (The percentage is rounded off to seven decimal places.)
Internal clock (10μs)	A clock with 10μs per cycle	The clock has -0.0379774% of time lag relative to the actual time. (The percentage is rounded off to seven decimal places.)
Internal clock (100μs)	A clock with 100μs per cycle	The clock has +0.0027127% of time lag relative to the actual time. (The percentage is rounded off to seven decimal places.)

(2) Internal clock selection

Select internal clocks in the "Count source selection" in the switch setting.

(3) Calculation of a count value and time

The formulas for calculating a count value and time in case an internal clock is used for counting are shown below.

- Count value = Time(S) ÷ One cycle of an internal clock(s)
- Time(s) = Count value × One cycle of an internal clock(s)

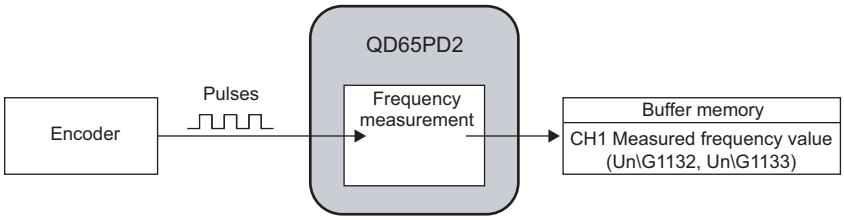
Point

- When measuring time by using an internal clock, consider the time lag relative to the actual time. Also, the component error (±100ppm) of each internal clock affects the time.

  Ex. In case the count is done from 0 to 10000 by using an internal clock (0.1μs), the time calculated with the above formula is 1ms(=(10000-0)×0.1μs).
  But the actual time becomes as shown below.
  (1ms×(1-0.0001)×(1+0.017252604)) to (1ms×(1+0.0001)×(1+0.017252604))

4.13 Frequency Measurement Function

The frequency measurement function is the function that counts the pulses of the pulse input terminals in phase A and B, and automatically calculates the frequency.



(1) Setting for the frequency measurement function

To use the frequency measurement function, select "Frequency Measurement Mode" in the "Operation mode setting" in the switch setting.

(2) Calculation of the frequency

The frequency measurement function calculates the frequency from the following formula.

- Frequency(Hz) = Count value per a unit of time ÷ A unit of time

So when the count value per a unit of time is 0, the frequency becomes 0(Hz).
Also the value of the frequency becomes negative at subtraction count.

(3) Setting of the unit of time for frequency measurement

Set a unit of time to CH1 Time unit setting (frequency measurement) (Un\G1100).

Setting item	Setting contents	Reference
CH1 Time unit setting (frequency measurement) (Un\G1100)	Select a unit of time for the frequency measurement from 0.01s, 0.1s, or 1s, and set it.	Page 80, Section 3.4.2 (41)

Point

- Whichever mode ("1-Phase Multiple of 2", "2-Phase Multiple of 2", or "2-Phase Multiple of 4") is set in "Pulse input mode" in the switch setting, the frequency (Hz) is calculated based on the count value per a unit of time.

  Ex. In case "1-Phase Multiple of 2" is set in "Pulse input mode" and the input frequency in phase A is 10kHz (10000 per second), the measured frequency value becomes 20kHz since the pulse count is regarded as 20000 based on the calculation below.
  A Pulse count = 10000 (pulse) × 2 = 20000 (pulse/s)

- When the count value per a unit of time is 0, the frequency becomes 0(Hz).
  Also the value of the frequency becomes negative at subtraction count.

(4) Measurable frequency (minimum)

The frequency, which is calculated from the count value per a unit of time, should be the value with which the calculated count value becomes an integer number. Therefore, the frequency smaller than the one in the following table cannot be measured correctly.

For measurement, input the frequency shown below or higher.

A unit of time	Measurable frequency (minimum)
1s	1Hz
0.1s	10Hz
0.01s	100Hz

Ex. In case a unit of time is 0.01s and the input frequency is 1234Hz, measured frequency value becomes 1200Hz or 1300Hz.

By doing the moving average count, the fluctuation of the measured values can be lowered.

(5) Moving average count

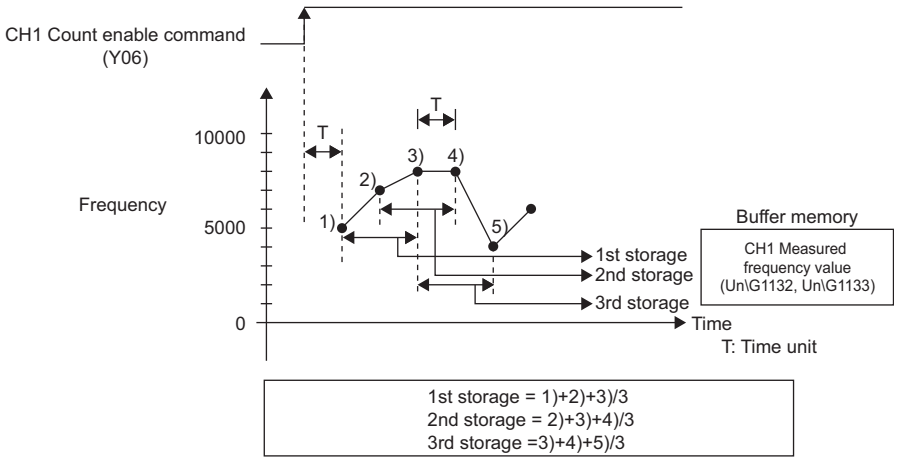
When the frequency measurement function is used, the fluctuation of the measured frequency values can be lowered by doing the moving average count.

The number of the moving average count is set to CH1 Moving average count (frequency measurement) (Un\G1101).

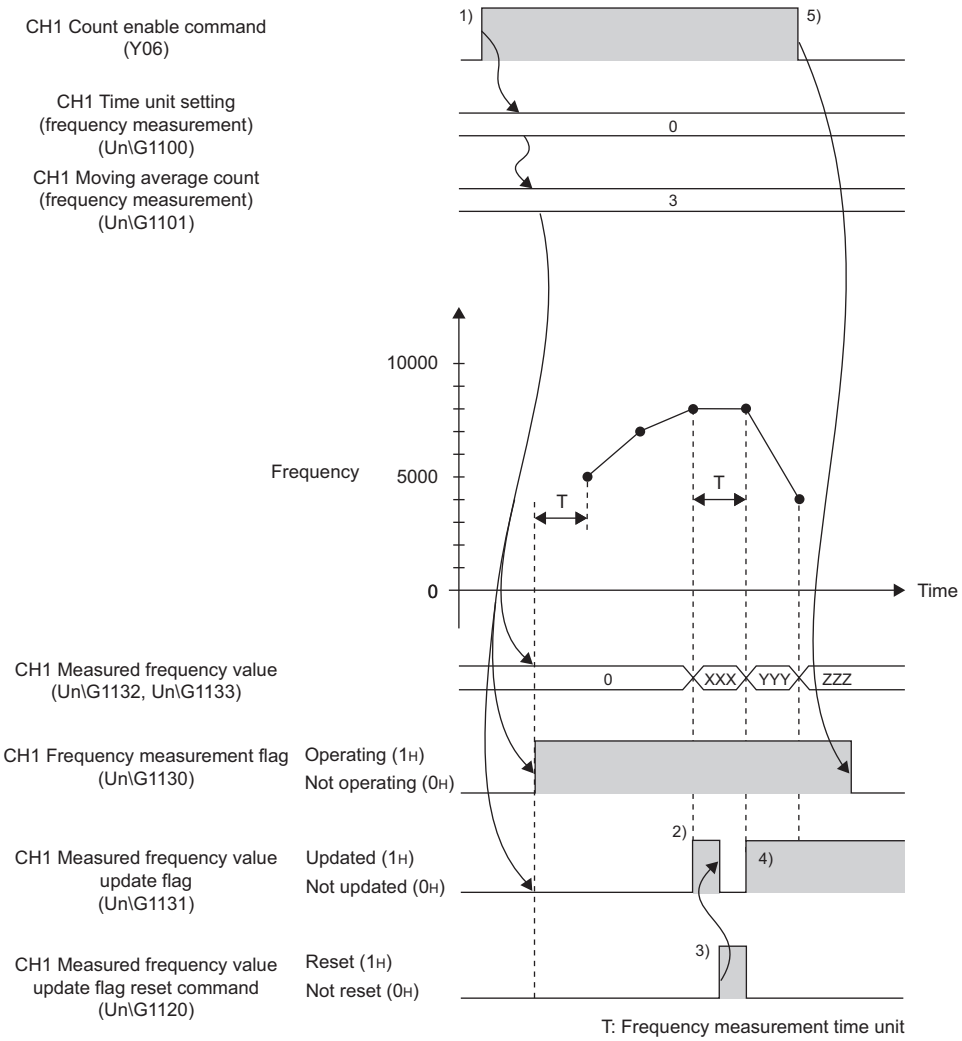
Setting item	Setting contents	Reference
CH1 Moving average count (frequency measurement) (Un\G1101)	Set the number of moving average count in the range of 1 to 100. When 1 (default value) is set, the operation is performed with the moving average count regarded as not being done.	Page 82, Section 3.4.2 (48)

After the specified number of counts are done, the average of the measured frequency values is stored in CH1 Measured frequency value (Un\G1132, Un\G1133).

Ex. In case the number of moving average count is set to 3



(6) Operation example of the frequency measurement function



Number	Description
1)	Perform the following operations when CH1 Count enable command (Y06) is turned on: • Latch the values in CH1 Time unit setting (frequency measurement) (Un\G1100) and CH1 Moving average count (frequency measurement) (Un\G1101). (The change of the setting values during the frequency measurement is ignored.) • Reset CH1 Measured frequency value update flag (Un\G1131) to 0_H: Not updated. • Clear the values in CH1 Measured frequency value (Un\G1132, Un\G1133) to 0. Also, 1_H: Operating is stored in CH1 Frequency measurement flag (Un\G1130) when CH1 Count enable command (Y06) is turned on.
2)	The following operation is performed when the measured frequency value is stored in CH1 Measured frequency value (Un\G1132, Un\G1133): • 1_H: Updated is stored in CH1 Measured frequency value update flag (Un\G1131).
3)	Reset CH1 Measured frequency value update flag (Un\G1131) to 0_H: Not updated by setting CH1 Measured frequency value update flag reset command (Un\G1120) to 1_H: Reset. CH1 Measured frequency value update flag reset command (Un\G1120) is automatically reset to 0_H: Not reset after the completion of the reset.
4)	CH1 Measured frequency value (Un\G1132, Un\G1133) is updated when 1_H: Updated is stored in CH1 Measured frequency value update flag (Un\G1131).
5)	0_H: Not operating is stored in CH1 Frequency measurement flag (Un\G1130) by turning off CH1 Count enable command (Y06).

Point

- After the start of the frequency measurement, 1_H: Updated is stored in CH1 Measured frequency value update flag (Un\G1131) every time the measured value is stored in CH1 Measured frequency value (Un\G1132, Un\G1133).
  The value previously stored in CH1 Measured frequency value (Un\G1132, Un\G1133) is hold while 0_H: Not updated is being stored in CH1 Measured frequency value update flag (Un\G1131).
- The margin of error (maximum) of the frequency measurement function is calculated from the following formula.

$$\text{Real frequency (Hz)} \times \frac{100(\text{ppm})}{1000000} + \frac{1}{\text{A unit of time for frequency measurement (s)} \times \text{Number of moving average count for frequency measurement}}$$

Ex. The table below shows the each value to be put into the formula.

Item	Value
Real frequency (Hz)	1234Hz
A unit of time for frequency measurement (s)	0.01s
Number of moving average count for frequency measurement	2 times

The margin of error (maximum) is calculated as shown below.

$$1234(\text{Hz}) \times \frac{100(\text{ppm})}{1000000} + \frac{1}{0.01(\text{s}) \times 2}$$

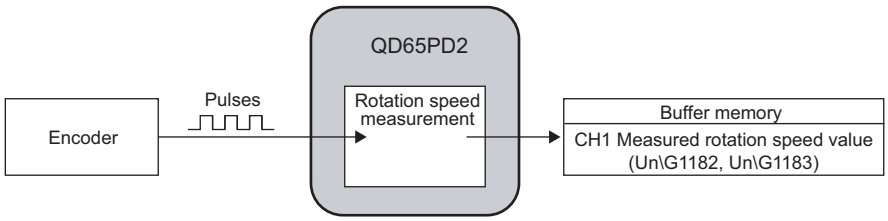
$$= 0.1234(\text{Hz}) + 50(\text{Hz})$$

$$= 50.1234(\text{Hz})$$

- CH1 Measured frequency value update flag reset command (Un\G1120) responds within 2ms after the action.
- Do not use CH1 Measured frequency value update flag (Un\G1131) and CH1 Measured frequency value update flag reset command (Un\G1120) when retrieving CH1 Measured frequency value (Un\G1132, Un\G1133) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Measured frequency value update flag (Un\G1131) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)

4.14 Rotation Speed Measurement Function

The rotation speed measurement function is the function that counts the pulses of the pulse input terminals in phase A and B, and automatically calculates the rotation speed.



(1) Setting for the rotation speed measurement function

To use the rotation speed measurement function, select "Rotation Speed Measurement Mode" in the "Operation mode setting" in the switch setting.

(2) Calculation of the rotation speed

The rotation speed measurement function calculates the rotation speed from the following formula:

- Rotation speed(r/min) = (60 × Count value per a unit of time) ÷ (A unit of time × The number of pulses per rotation)

So when the count value per a unit of time is 0, the rotation speed becomes 0(r/min).

Also the value of the rotation speed becomes negative at subtraction count.

(3) Setting of the unit of time for rotation speed measurement, and the number of pulses per rotation

Set a unit of time to CH1 Time unit setting (rotation speed measurement) (Un\G1150).

Set the number of pulses per rotation to CH1 Number of pulses per rotation (Un\G1152, Un\G1153).

Setting item	Setting contents	Reference
CH1 Time unit setting (rotation speed measurement) (Un\G1150)	Select a unit of time for rotation speed measurement from 0.01s, 0.1s, or 1s, and set it.	Page 81, Section 3.4.2 (47)
CH1 Number of pulses per rotation (Un\G1152, Un\G1153)	Set the number of pulses per rotation in the range of 1 to 8000000.	Page 82, Section 3.4.2 (49)

Point

- Whichever mode ("1-Phase Multiple of 2", "2-Phase Multiple of 2", or "2-Phase Multiple of 4") is set in "Pulse input mode" in the switch setting, the rotation speed (r/min) is calculated based on the count value per a unit of time.
- When the count value per a unit of time is 0, the rotation speed becomes 0(r/min).
  Also the value of the rotation speed becomes negative at subtraction count.

(4) Required pulse speed (minimum)

The rotation speed, which is calculated from the count value per a unit of time, should be the value with which the calculated count value becomes an integer number. Therefore, with the pulse speed lower than the one in the following table, the rotation speed cannot be measured correctly.

For measurement, input the pulse with the speed shown below or higher.

A unit of time	Required pulse speed (minimum)
1s	1pps
0.1s	10pps
0.01s	100pps

Ex. In case a unit of time is 0.01s, the number of pulses per rotation is 60, and the pulse input speed is 1234pps, the value of the measured rotation speed becomes 1200r/min or 1300r/min.

By doing the moving average count, the fluctuation of the measured values can be lowered.

(5) Moving average count

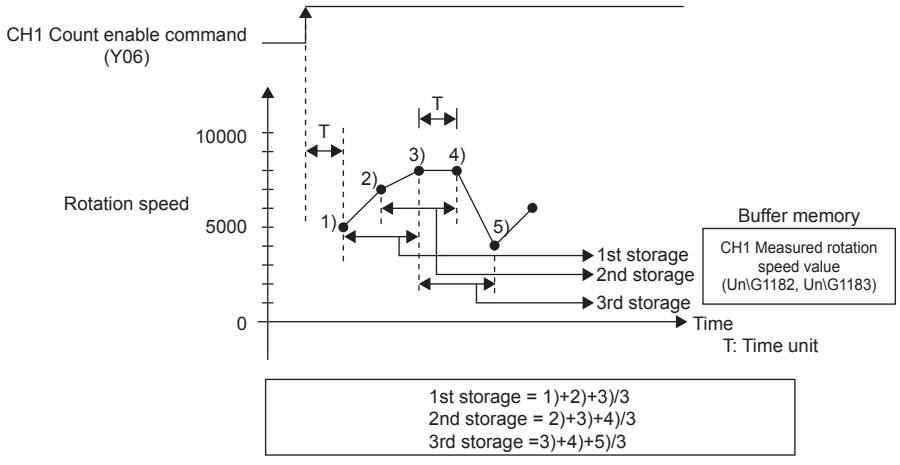
When the rotation speed measurement function is used, the fluctuation of the measured values of the rotation speed can be lowered by doing the moving average count.

The number of the moving average count is set to CH1 Moving average count (rotation speed measurement) (Un\G1151).

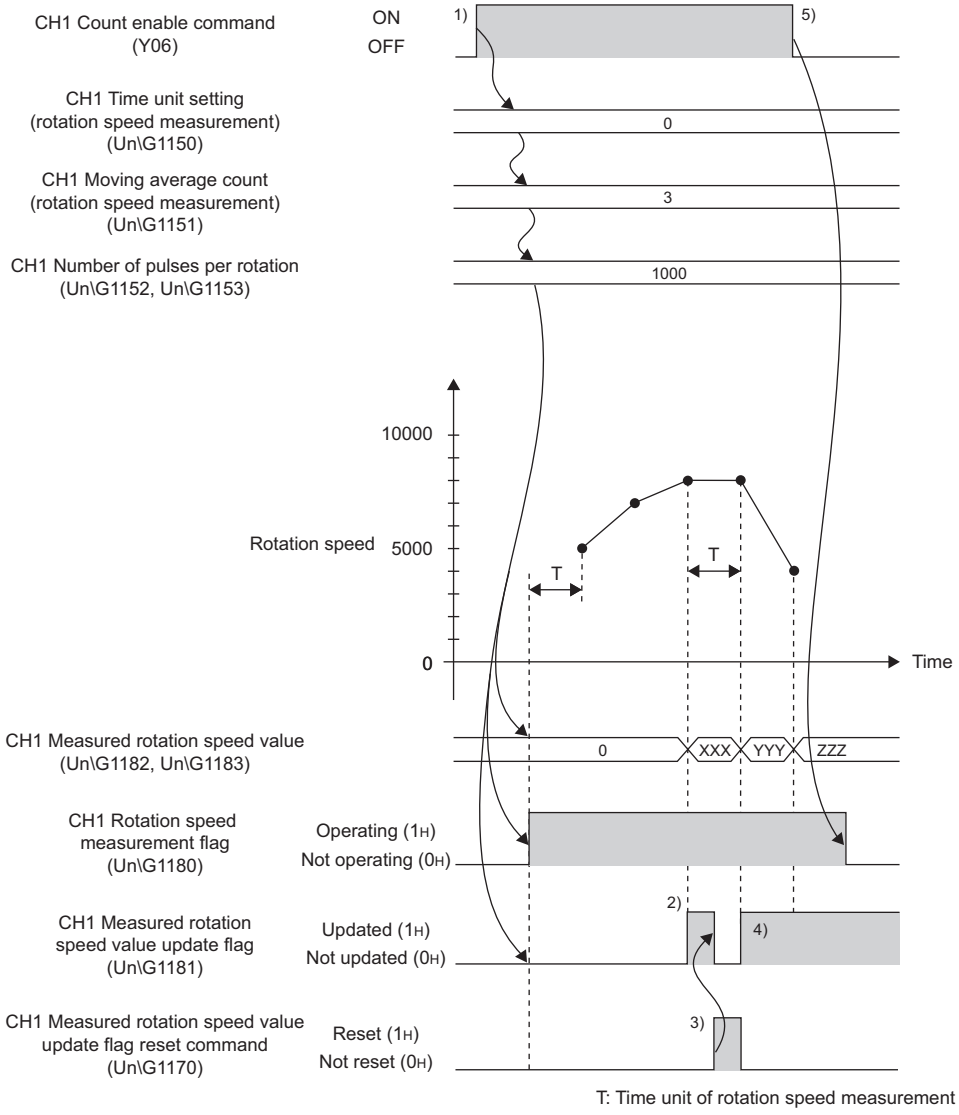
Setting item	Setting contents	Reference
CH1 Moving average count (rotation speed measurement) (Un\G1151)	Set the number of moving average count in the range of 1 to 100. When 1 (default value) is set, the operation is performed with the moving average count regarded as not being done.	Page 82, Section 3.4.2 (48)

After the specified number of counts are done, the average of the measured values of the rotation speed is stored in CH1 Measured rotation speed value (Un\G1182, Un\G1183).

Ex. In case the number of moving average count is set to 3



(6) Operation example of the rotation speed measurement function



Number	Description
1)	Perform the following operations when CH1 Count enable command (Y06) is turned on: • Latch the values in CH1 Time unit setting (rotation speed measurement) (Un\G1150), CH1 Moving average count (rotation speed measurement) (Un\G1151), and CH1 Number of pulses per rotation (Un\G1152, Un\G1153). (The change of the setting values during the rotation speed measurement is ignored.) • Reset CH1 Measured rotation speed value update flag (Un\G1181) to 0_H: Not updated. • Clear the values in CH1 Measured rotation speed value (Un\G1182, Un\G1183) to 0. Also, 1_H: Operating is stored in CH1 Rotation speed measurement flag (Un\G1180) when CH1 Count enable command (Y06) is turned on.
2)	The following operation is performed when the measured value of the rotation speed is stored in CH1 Measured rotation speed value (Un\G1182, Un\G1183): • 1_H: Updated is stored in CH1 Measured rotation speed value update flag (Un\G1181).
3)	Reset CH1 Measured rotation speed value update flag (Un\G1181) to 0_H: Not updated by setting CH1 Measured rotation speed value update flag reset command (Un\G1170) to 1_H: Reset. CH1 Measured rotation speed value update flag reset command (Un\G1170) is automatically reset to 0_H: Not reset after the completion of the reset.
4)	CH1 Measured rotation speed value (Un\G1182, Un\G1183) is updated when 1_H: Updated is stored in CH1 Measured rotation speed value update flag (Un\G1181).
5)	0_H: Not operating is stored in CH1 Rotation speed measurement flag (Un\G1180) by turning off CH1 Count enable command (Y06).

Point

- After the start of the rotation speed measurement, 1_H: Updated is stored in CH1 Measured rotation speed value update flag (Un\G1181) every time the measured value is stored in CH1 Measured rotation speed value (Un\G1182, Un\G1183). The value previously stored in CH1 Measured rotation speed value (Un\G1182, Un\G1183) is hold while 0_H: Not updated is being stored in CH1 Measured rotation speed value update flag (Un\G1181).
- The margin of error (maximum) of the rotation speed measurement function is calculated from the following formula.

$$\text{Real rotation speed (r/min)} \times \frac{100(\text{ppm})}{1000000} + \frac{60}{\text{A unit of time for rotation speed measurement (s)} \times \text{Number of moving average count for rotation speed measurement} \times \text{Number of pulses per rotation}}$$

Ex. The table below shows the each value to be put into the formula.

Item	Value
Real rotation speed (r/min)	1234r/min
A unit of time for rotation speed measurement (s)	0.01s
Number of moving average count for rotation speed measurement	4 times
Number of pulses per rotation	60

The margin of error (maximum) is calculated as shown below.

$$1234(\text{r/min}) \times \frac{100(\text{ppm})}{1000000} + \frac{60}{0.01(\text{s}) \times 4 \times 60}$$

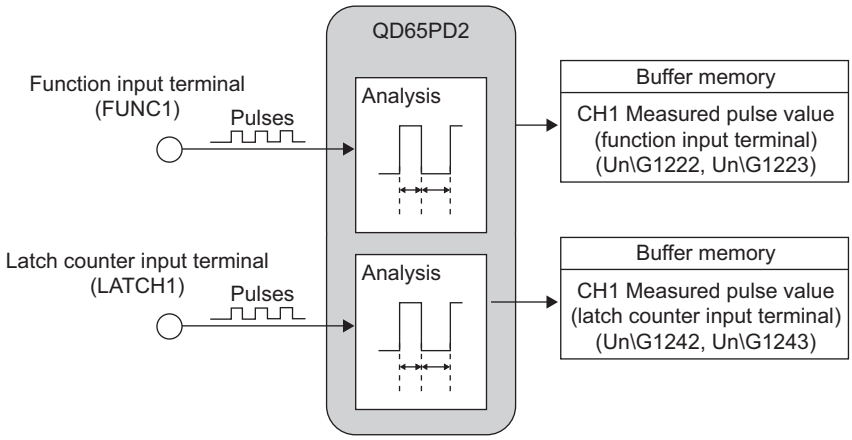
$$= 0.1234(\text{r/min}) + 25(\text{r/min})$$

$$= 25.1234(\text{r/min})$$

- CH1 Measured rotation speed value update flag reset command (Un\G1170) responds within 2ms after the action.
- Do not use CH1 Measured rotation speed value update flag (Un\G1181) and CH1 Measured rotation speed value update flag reset command (Un\G1170) when retrieving CH1 Measured rotation speed value (Un\G1182, Un\G1183) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Measured rotation speed value update flag (Un\G1181) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)

4.15 Pulse Measurement Function

The pulse measurement function is used to measure the ON width or OFF width of pulses that are input to the external input terminals, the function input terminal (FUNC1) or the latch counter input terminal (LATCH1). When the following pulse is measured, the measured value is written over the previous value.



(1) Setting for the pulse measurement function

To use the pulse measurement function, select "Pulse Measurement Mode" in the "Operation mode setting" in the switch setting.

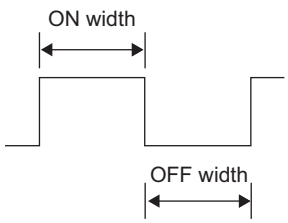
(2) Terminals for the pulse measurement

The following table lists the terminals that are used for the pulse measurement.

Terminals for the pulse measurement
Function input terminal (FUNC1)
Latch counter input terminal (LATCH1)

(3) Pulse width to be measured

Set which pulse width (ON or OFF) is to be measured by using CH1 Pulse measurement setting (function input terminal) (Un\G1200) or CH1 Pulse measurement setting (latch counter input terminal) (Un\G1201).
The setting value is enabled by turning off and on Operating condition settings batch-change command (Y01)



Setting item	Setting contents	Reference
CH1 Pulse measurement setting (function input terminal) (Un\G1200)	Select which pulse width (ON or OFF) is to be measured, and set it.	Page 83, Section 3.4.2 (54)
CH1 Pulse measurement setting (latch counter input terminal) (Un\G1201)		Page 83, Section 3.4.2 (55)

(4) How to start or stop the pulse measurement

The start or stop of the pulse measurement is determined by the combined operation of CH1 Count enable command (Y06) and CH1 Pulse measurement start command (function input terminal) (Un\G1210) or CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212).

The following table shows the detail of the combination.

Measurement	Operation	CH1 Count enable command (Y06)	CH1 Pulse measurement start command (function input terminal) (Un\G1210)	CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212)
Measurement with the function input terminal	Start	OFF→ON	Measured (1_H)	—
		ON	Not measured (0_H)→Measured (1_H)	—
	Stop	ON→OFF	Measured (1_H)	—
		ON	Measured (1_H)→Not measured (0_H)	—
Measurement with the latch counter input terminal	Start	OFF→ON	—	Measured (1_H)
		ON	—	Not measured (0_H)→Measured (1_H)
	Stop	ON→OFF	—	Measured (1_H)
		ON	—	Measured (1_H)→Not measured (0_H)

(5) Measurable range of the pulses

The measured values of the pulses are stored in CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) or CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243).

The measurable range of the pulses is between 2000 and 2147483647 (0.2ms to approx.214s).

When the input pulses are beyond the measurable range, Pulse measurement range overflow error (function input terminal)(error code: 1660) or Pulse measurement range overflow error (latch counter input terminal)(error code: 1662) will be detected.

To resume the measurement, input the pulses once again, or operate the signal and the buffer memories with the combination as shown below.

Measurement to be resumed	CH1 Count enable command (Y06)	CH1 Pulse measurement start command (function input terminal) (Un\G1210)	CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212)
Measurement with the function input terminal	ON→OFF→ON	Measured (1_H)	—
	ON	Measured (1_H)→Not measured (0_H)→Measured (1_H)	—
Measurement with the latch counter input terminal	ON→OFF→ON	—	Measured (1_H)
	ON	—	Measured (1_H)→Not measured (0_H)→Measured (1_H)

(6) Update timing of the measured values of pulses

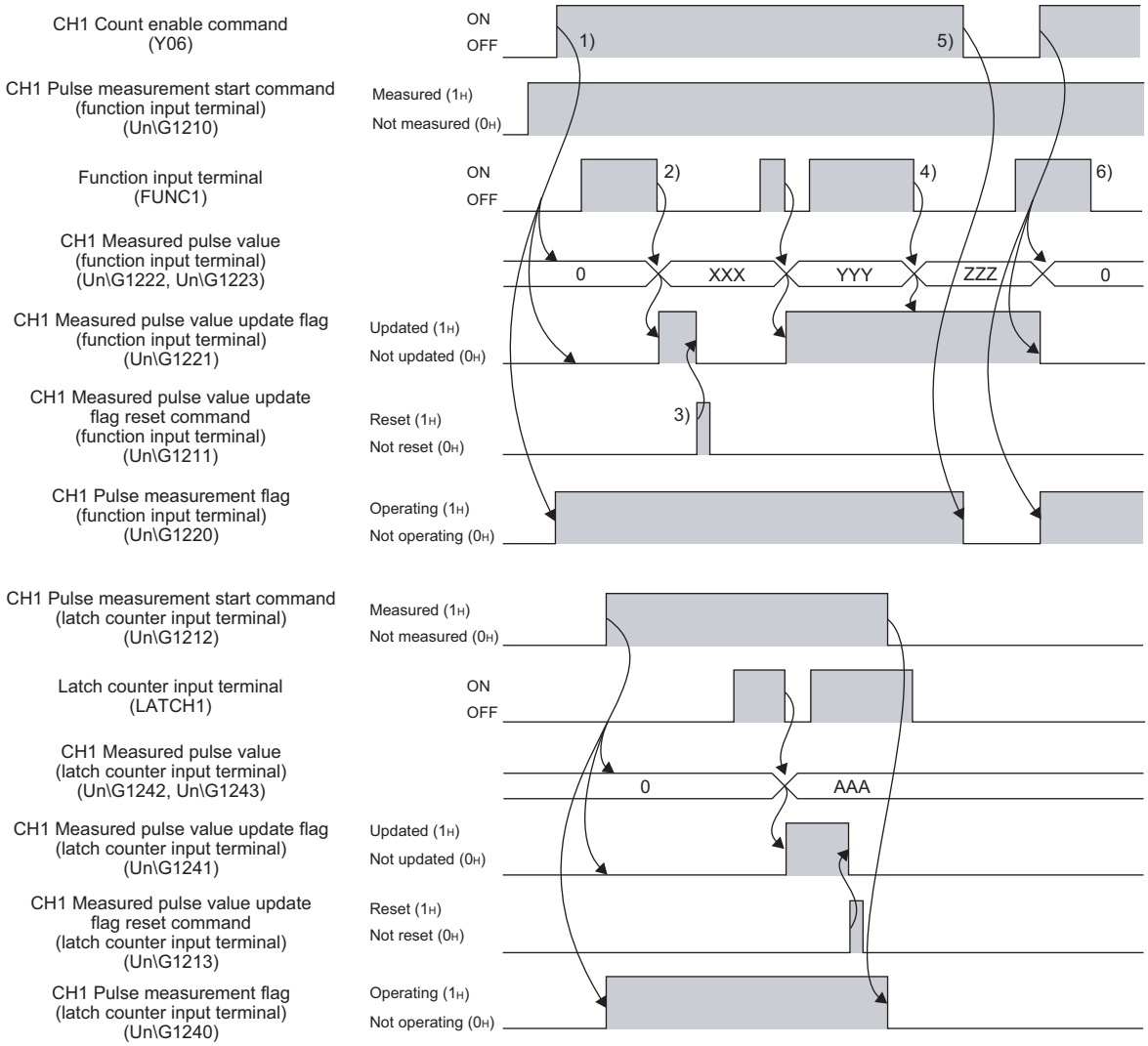
CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) and CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243) are updated every 1ms.

So when the measurement is done twice or more within 1ms, only the latest measured value is stored in the buffer memories.

(7) Operation example of the pulse measurement function

The following figure shows an operation example of the pulse measurement function when Pulse ON width is set to the pulse measurement setting.

The explanations in the table below are for the measurement with the function input terminal (FUNC1). The same can be applied to the measurement with the latch counter input terminal (LATCH1) except the difference of the input terminal, signal, and buffer memories.



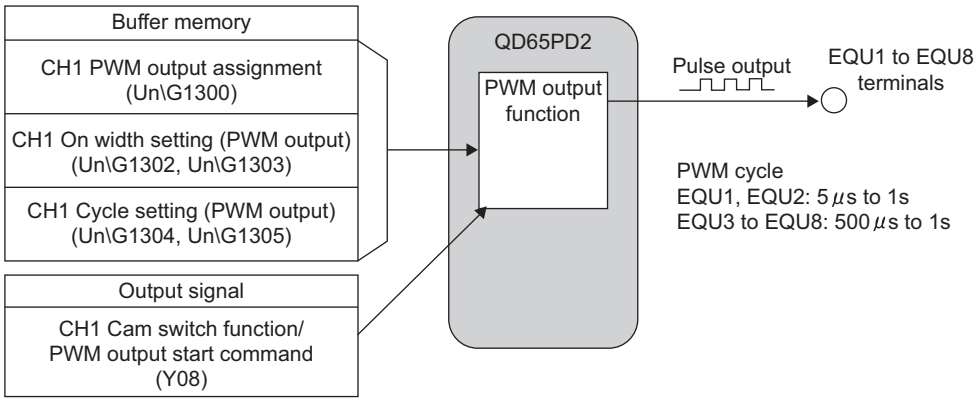
Number	Description
1)	Perform the following operations when CH1 Count enable command (Y06) is turned on with 1_H: Measured being set to CH1 Pulse measurement start command (function input terminal) (Un\G1210): • Reset CH1 Measured pulse value update flag (function input terminal) (Un\G1221) to 0_H: Not updated. • Clear the values in CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) to 0. Also, 1_H: Operating is stored in CH1 Pulse measurement flag (function input terminal) (Un\G1220) when CH1 Count enable command (Y06) is turned on.
2)	The following operation is performed when the measured value of the pulse is stored in CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223): • 1_H: Updated is stored in CH1 Measured pulse value update flag (function input terminal) (Un\G1221).
3)	Reset CH1 Measured pulse value update flag (function input terminal) (Un\G1221) to 0_H: Not updated by setting CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211) to 1_H: Reset. CH1 Measured pulse value update flag reset command (function input terminal) (Un\G1211) is automatically reset to 0_H: Not reset after the completion of the reset.
4)	CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) is updated when 1_H: Updated is stored in CH1 Measured pulse value update flag (function input terminal) (Un\G1221).
5)	0_H: Not operating is stored in CH1 Pulse measurement flag (function input terminal) (Un\G1220) by turning off CH1 Count enable command (Y06) or setting 0_H: Not measured to CH1 Pulse measurement start command (function input terminal) (Un\G1210).
6)	If the pulse (pulse ON width in this case) is input before 1_H: Operating is stored in CH1 Pulse measurement flag (function input terminal) (Un\G1220), CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) is not updated even when the function input terminal (FUNC1) is turned off. Note that the pulse that is input after 1_H: Operating is stored in CH1 Pulse measurement flag (function input terminal) (Un\G1220) is to be measured.

Point

- Turn on CH1 Count enable command (Y06) regardless of the number of the input terminals to be used for the measurement.
- When the pulse measurement function is executed by the function input terminal (FUNC1), the time to be taken to update CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) varies according to the time set in "Function input response time setting" in the switch setting.
- When the pulse measurement function is executed by the latch counter input terminal (LATCH1), the time to be taken to update CH1 Measured pulse value (latch counter input terminal) (Un\G1242, Un\G1243) varies according to the time set in "Latch counter input response time setting" in the switch setting.
- Do not use CH1 Measured pulse value update flag (function input terminal) (Un\G1221) and CH1 Pulse measurement start command (function input terminal) (Un\G1210) when retrieving CH1 Measured pulse value (function input terminal) (Un\G1222, Un\G1223) via the auto refresh target device. (In case 1_H: Updated is stored in CH1 Measured pulse value update flag (function input terminal) (Un\G1221) after the auto refresh is done, the updated values are not reflected to the auto refresh target device and therefore, the values retrieved via the auto refresh target device are the ones before the updating.)
  The same can be applied to the measurement with the latch counter input terminal (LATCH1) except the difference of buffer memories.

4.16 PWM Output Function

The PWM output function is used to output the PWM waveform from one of the coincidence output 1 to 8 terminals (EQU1 to EQU8). (Note that the PWM waveform of up to 200kHz is output from the coincidence output terminal 1 or 2. Up to 2kHz waveform is output from the coincidence output terminal 3 to 8.)



(1) Setting for the PWM output function

To use the PWM output function, select "PWM Output Mode" in the "Operation mode setting" in the switch setting.

(2) Assignment of the PWM output terminals

- To output the PWM waveform, assign Coincidence output 1 to 8 to the corresponding channel in the "Coincidence output 1 to 8 channel assignment setting" in the switch setting.
- By using CH1 PWM output assignment (Un\G1300), assign which Coincidence output is used for the PWM waveform output.
  For details, refer to the following:
  ☞ Page 86, Section 3.4.2 (66)

The following table shows the setting examples of the assignment.

Assigned channel for Coincidence output 1 to 8	CH1 PWM output assignment (Un\G1300)	Setting detail	Operation
Coincidence output 1 to 4: CH1 Coincidence output 5 to 8: CH2	0000_H	No Coincidence output is assigned as the PWM output terminal.	CH1 PWM output assignment error (error code: 1670) is detected since no Coincidence output is assigned as the PWM output terminal.
	0004_H	Coincidence output 3 is assigned as the PWM output terminal.	The operation is performed normally.
	$000C_H$	Coincidence output 3 and 4 are assigned as the PWM output terminal.	CH1 PWM output assignment error (error code: 1670) is detected since two Coincidence output is assigned as the PWM output terminal.
	0010_H	Coincidence output 5 is assigned as the PWM output terminal.	CH1 PWM output assignment error (error code: 1670) is detected since the Coincidence output that is assigned to CH2 is assigned as the PWM output terminal.

Point

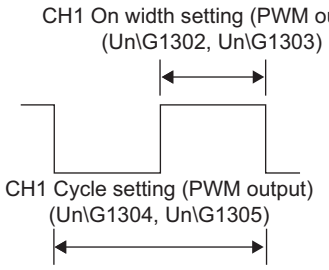
For the Coincidence output that is assigned as the PWM output terminal in CH1 PWM output assignment (Un\G1300), the setting in Coincidence output condition setting (Un\G0) is disabled.
Even so, set any of 0_H to 2_H to Coincidence output condition setting (Un\G0).

(3) Setting of the output waveform

Set the output waveform by using CH1 On width setting (PWM output) (Un\G1302, Un\G1303) and CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305).
Note that the setting range varies depending on which Coincidence output is assigned as the PWM output terminal.

Setting item	PWM output terminal	Setting contents	Reference
CH1 On width setting (PWM output) (Un\G1302, Un\G1303)	Coincidence output 1 or 2	Set ON width of the output pulse from 0 or in the range of 10 to 10000000 (0.1μs per unit).*1	Page 86, Section 3.4.2 (67)
	Coincidence output 3 to 8	Set ON width of the output pulse from 0 or in the range of 1000 to 10000000 (0.1μs per unit).*1	
CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305)	Coincidence output 1 or 2	Set the cycle of the output pulse in the range of 50 to 10000000 (0.1μs per unit).	Page 87, Section 3.4.2 (68)
	Coincidence output 3 to 8	Set the cycle of the output pulse in the range of 5000 to 10000000 (0.1μs per unit).	

*1 Set the value that is equal to or smaller than the one set to CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305)

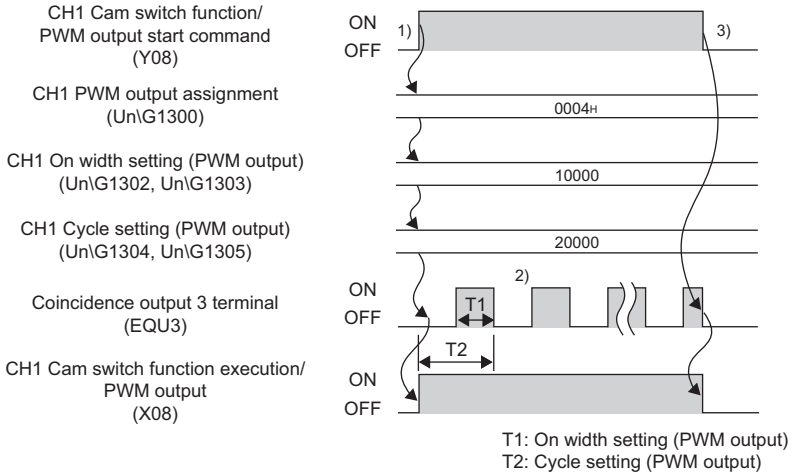


Point

- ON width of the PWM output is calculated by inputting the duty ratio into the following formula:
  - ON width of the PWM output = A cycle of the PWM output × Duty ratio(%) ÷ 100
- Given that output circuits or connected devices of the QD65PD2 do not affect the value, the margin of error (maximum) of each setting value is calculated as shown below.
  - Setting value of PWM output ON width (μs) × 100 (ppm) ÷ 1000000 + 0.1 (μs)
  - Setting value of PWM output cycle (μs) × 100 (ppm) ÷ 1000000 + 0.1 (μs)

(4) Operation example of the PWM output function

The following figure shows an operation example of the PWM output function when Coincidence output 3 is assigned to the corresponding channel in the "Coincidence output 1 to 8 channel assignment setting" in the switch setting.



Number	Description
1)	Perform the following operation when CH1 Cam switch function/PWM output start command (Y08) is turned on: • Latch the values in CH1 PWM output assignment (Un\G1300), CH1 On width setting (PWM output) (Un\G1302, Un\G1303), and CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305). (The change of the setting values during the PWM output is ignored.) • The PWM waveform is output from one of the coincidence output 1 to 8 terminal (EQU1 to EQU8) based on the settings. (The PWM waveform is output starting with OFF.) CH1 Cam switch function execution/PWM output (X08) turns on.
2)	Based on the latched settings, the PWM waveform continues to be output until CH1 Cam switch function/PWM output start command (Y08) is turned off.
3)	CH1 Cam switch function execution/PWM output (X08) turns off and the coincidence output 1 to 8 terminal (EQU 1 to EQU8) is turned off by turning off CH1 Cam switch function/PWM output start command (Y08).

Point

- The waveform that is output from the coincidence output 1 to 8 terminal (EQU 1 to EQU8), the external output terminals, can be affected by output circuits or connected devices and change its form.
  So check the waveform by using, for example, a synchroscope, and then set the output waveform.
- The PWM waveform is output starting with OFF.
- When changing the output waveform, turn off CH1 Cam switch function/PWM output start command (Y08) to turn off CH1 Cam switch function execution/PWM output (X08).
  After confirming that CH1 Cam switch function execution/PWM output (X08) is OFF, change the setting of CH1 On width setting (PWM output) (Un\G1302, Un\G1303), and turn on CH1 Cam switch function/PWM output start command (Y08) again.

4.17 General Input Function

The general input function is used to store the status of the general input 1 to 6 terminals (IN1 to IN6), the terminals for external input.
The following table lists the general input terminals and the storage locations of their status.

General input terminal	Storage location of the terminal status*1	Remark
General input 1 terminal (IN1)	General input 1 (X18)	The input speed of the general input 1 or 2 is faster than that of the general input 3 to 6.
General input 2 terminal (IN2)	General input 2 (X19)	
General input 3 terminal (IN3)	General input 3 (X1A)	—
General input 4 terminal (IN4)	General input 4 (X1B)	
General input 5 terminal (IN5)	General input 5 (X1C)	
General input 6 terminal (IN6)	General input 6 (X1D)	

*1 The input number shown in the list is for when the QD65PD2 is mounted on the I/O slot No.0 of the main base unit.

(1) Response time of a general input

When the general input function is used, the response time of a general input is 2ms or less. (The response time of the input circuit is included.)

4.18 General Output Function

The general output function is used to output the output status set to the CPU module from the general output 1 to 8 terminals (OUT1 to OUT8), the terminals for external output.
The following table lists the locations to which the output status is set, and the general output terminals.

The location to which the output status is set*1	General output terminal
General output 1 (Y18)	General output 1 terminal (OUT1)
General output 2 (Y19)	General output 2 terminal (OUT2)
General output 3 (Y1A)	General output 3 terminal (OUT3)
General output 4 (Y1B)	General output 4 terminal (OUT4)
General output 5 (Y1C)	General output 5 terminal (OUT5)
General output 6 (Y1D)	General output 6 terminal (OUT6)
General output 7 (Y1E)	General output 7 terminal (OUT7)
General output 8 (Y1F)	General output 8 terminal (OUT8)

*1 The output number shown in the list is for when the QD65PD2 is mounted on the I/O slot No.0 of the main base unit.

(1) Response time of a general output

When the general output function is used, the response time of a general output is 2ms or less. (The response time of the QD65PD2 output circuit is excluded.)

(2) Error time output mode setting

Only "Clear" can be set to "Error Time Output Mode" for the QD65PD2. When "Hold" is set to "Error Time Output Mode", Hold error (error code: 800) will be detected.

For details on the error time output mode setting, refer to the following according to the CPU module used:

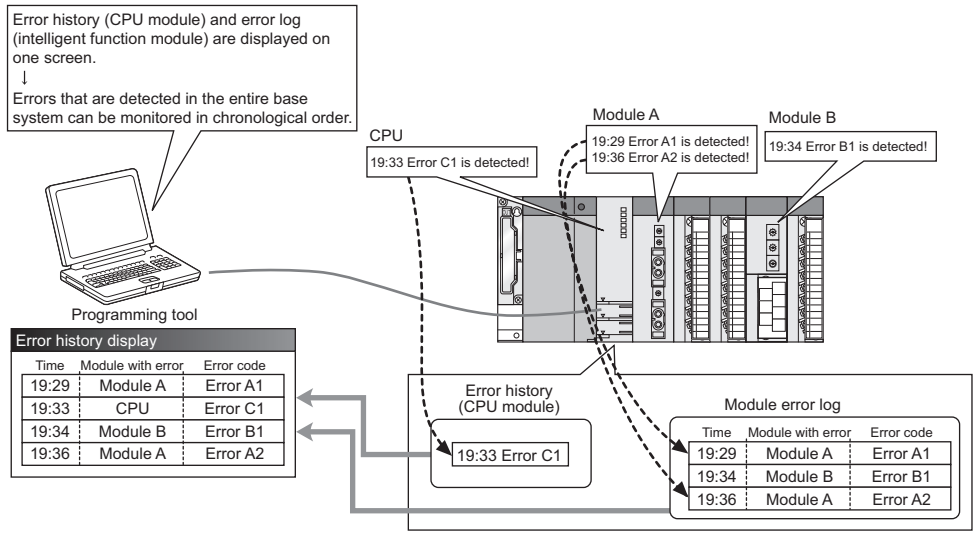
QnUCPU User's Manual (Function Explanation, Program Fundamentals)

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

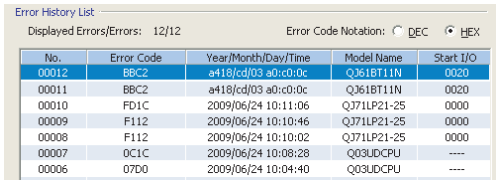
4.19 Module Error Collection Function

The information of the errors that are detected in the QD65PD2 is stored in the CPU module.
The error information collected from the QD65PD2 is stored as a module error collection in the memory of the CPU module. Since the memory has the backup power function, the information is not cleared even by powering off and then on, or resetting the CPU module and then clearing the reset.

(1) Operation example of the module error collection function



[Example of screen display]



(2) Applicable version

The module error collection function can be used when the CPU module or GX Works2 is the following version.

Item	Version
CPU module	Universal model QCPU whose serial number (the first 5 digits) is 11043 or later.
GX Works2	Version 1.09K or later

Point

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

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

4.20 Response Delay Time

This section described the response delay time of I/O signals and buffer memory.

Maximum delay time [ms] = [Time of (1)] + [Maximum time of (2)]
= Sequence program scan time + 2 [ms]

(1) Scan time of the sequence program

The CPU module processes I/O signals by refreshing them all at once before the operation start of a sequence program. Therefore, the signals are delayed.

Use direct access input (DX) or direct access output (DY) to minimize the delay.

For details on direct access input (DX) or direct access output (DY), refer to the following:

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

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

(2) Control cycle (1ms) of the QD65PD2

The QD65PD2 reads out the output signals and buffer memories updated by the sequence program and completes processing with up to 2ms (1 control cycle × 2) delay.

The update timing of the input signals and buffer memories vary within the range of the control cycle.

CHAPTER 5 SETTINGS AND PROCEDURE BEFORE OPERATION

This chapter describes the procedure prior to the QD65PD2 operation, the name and setting of each part of the QD65PD2, and the wiring method.

5.1 Handling Precautions

This section describes the precautions for handling the QD65PD2.

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

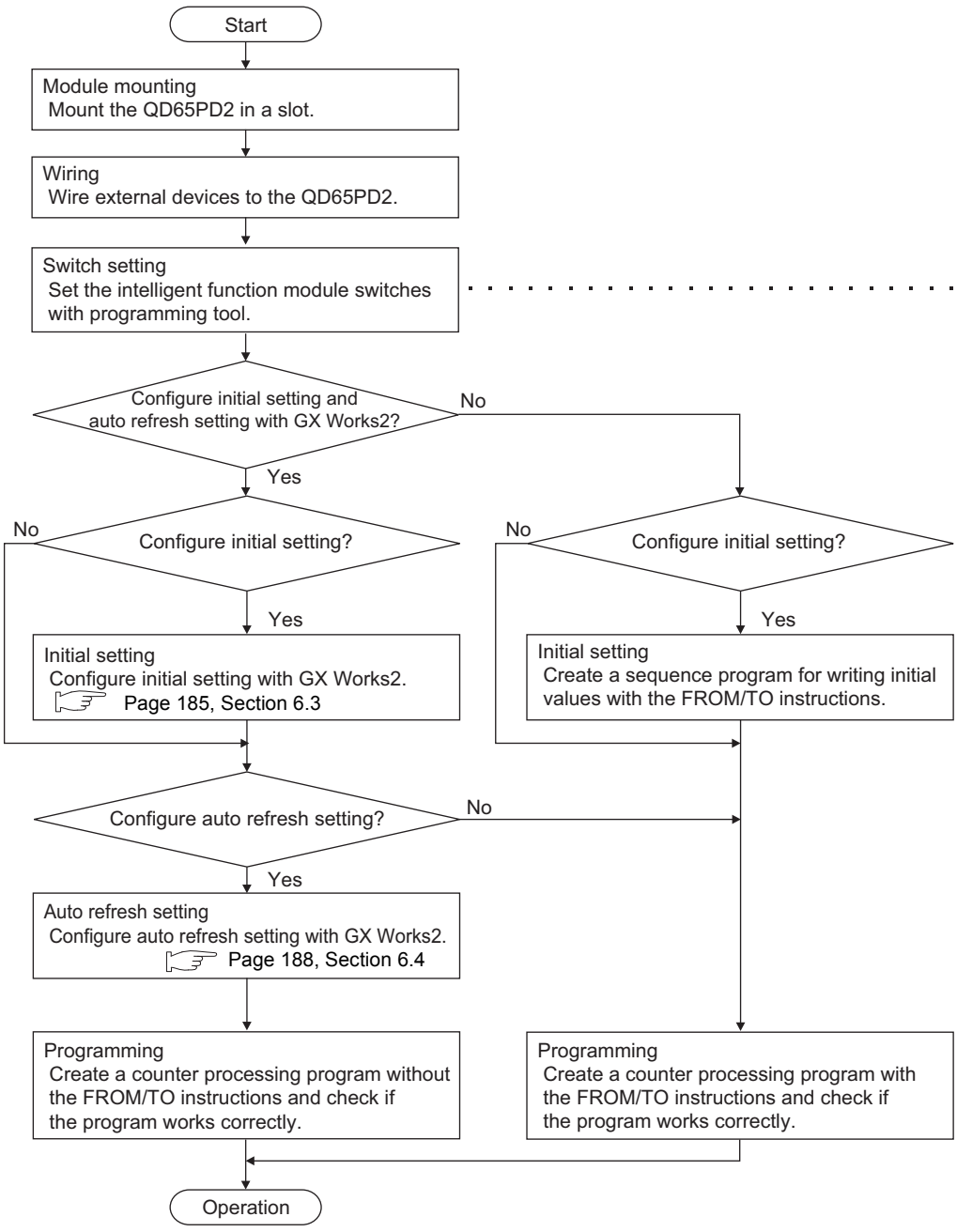
Screw location	Tightening torque range
Module fixing screw (M3 screw)*1	0.36 to 0.48N•m
Connector screw (M2.6 screw)	0.20 to 0.29N•m

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

- To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
  When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.

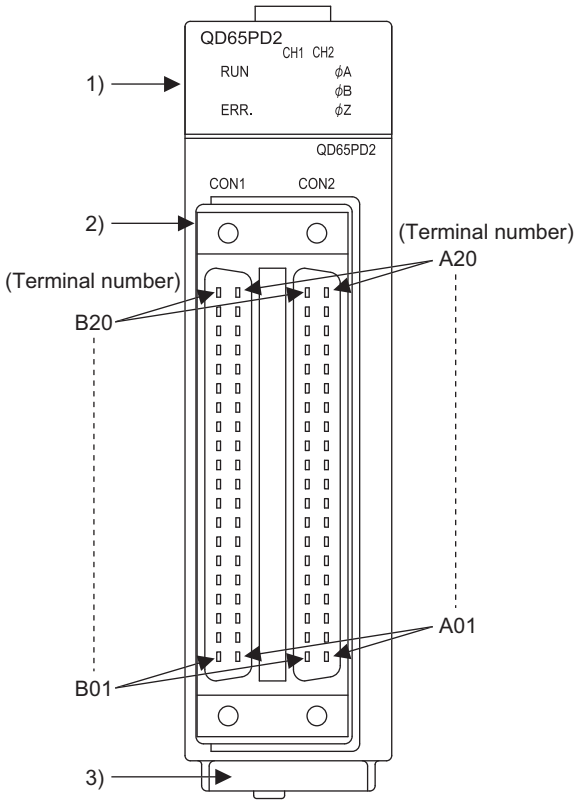
5.2 Procedure Before Operation

The figure below shows the steps before starting the QD65PD2 operation.



5.3 Part Identification Nomenclature

The figure below shows the name for each part of the QD65PD2.



Number	Name		Description
1)	LED	RUN	Indicates the operation status of the QD65PD2. ON : normal OFF: the watchdog timer error has occurred
		ERR.	Indicates the error status of the QD65PD2. ON : an error is occurring at more than one channel OFF: all channels operate normally
		ϕA_CH1 to CH2	Indicates the input status of the phase A pulse input terminals (A1, A2). ON : pulse ON OFF: pulse OFF
		ϕB_CH1 to CH2	Indicates the input status of the phase B pulse input terminals (B1, B2). ON : pulse ON OFF: pulse OFF
		ϕZ_CH1 to CH2	Indicates the input status of the phase Z pulse input terminals (Z1, Z2). ON : pulse ON OFF: pulse OFF

Number	Name	Description
2)	Connectors for external devices (40 pins)	Connectors for encoders, controllers, and others. Refer to the following section for the terminal diagram. ☞ Page 90, Section 3.5.1
3)	Serial No. display	Displays the serial No. of the QD65PD2.

Point

When the phase Z of the encoder is connected to the phase Z pulse input terminals (Z1, Z2), pulses are counted per rotation of the encoder. Therefore, lighting of the ϕZ_CH1 to CH2 LEDs may be missed.

(1) Connector for external wiring

The connectors for use with the QD65PD2 should be purchased separately by the user.
The following tables show the connector types and the crimp-contact tool.

(a) Precautions

- Use copper wires having temperature rating of 75°C or more for the connectors.
- When required, use UL-approved connectors.

(b) Connector types*1

Type	Model name	Applicable wire size
Soldering type (straight out)	A6CON1	0.3mm^2 (22AWG) (stranded)
Crimp-contact type (straight out)	A6CON2	0.088mm^2 to 0.24mm^2 (28 to 24 AWG) (stranded)
Soldering type (straight out/diagonal out)	A6CON4	0.3mm^2(22AWG) (stranded)

*1 The A6CON3 (pressure-displacement type, straight out) connector cannot be used for the QD65PD2.

(c) Crimp-contact tool

Type	Model name	Applicable wire size	Contact
Crimp-contact tool	FCN-363T-T005/H	0.088mm^2 to 0.24mm^2 (28 to 24 AWG)	FUJITSU COMPONENT LIMITED http://www.fcl.fujitsu.com/en/

5.4 Wiring

This section describes how to wire the QD65PD2 with an encoder or a controller.

5.4.1 Wiring precautions

To maximize the functions of the QD65PD2 and ensure high-reliability of the system, external wiring that is less susceptible to noise is required.
Observe the following precautions for the external wiring.

(1) Wiring

- Terminals are prepared depending on the voltage of the signal to be input. Connecting to a terminal with a different voltage may cause malfunction of the module and failure of the connected devices.
- In 1-phase input, be sure to connect a pulse input cable to the A-phase side.

(2) Connectors for external devices

- Securely connect the connectors for external devices (A6CON1/A6CON2/A6CON4 to the QD65PD2 connectors and securely tighten the two screws.
- When disconnecting the cable from the QD65PD2, do not pull the cable by the cable part. Hold the connector part of the cable. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.

(3) DC power

- Each DC power to be connected to the QD65PD2, encoder, and controller should be connected to a different power supply.

(4) Measures against noise

- The QD65PD2 may incorrectly count the pulses when pulse-state noises are input.
- When inputting high-speed pulses, take the following measures against noise.

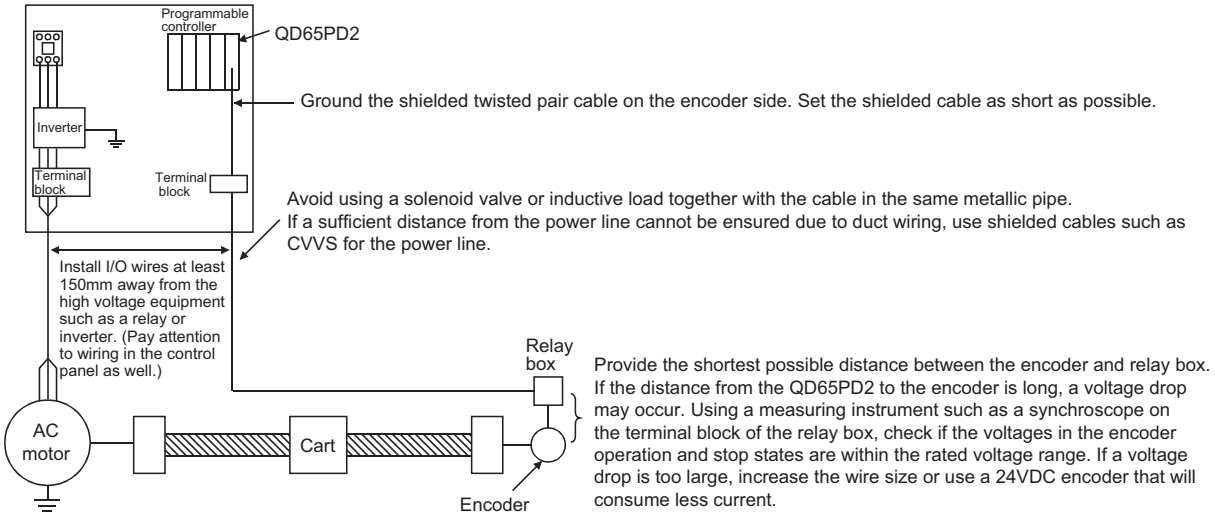
Measure 1

Use shielded twisted pair cables, and ground them to the encoder side.
Always ground the FG and LG terminals to the protective ground conductor.

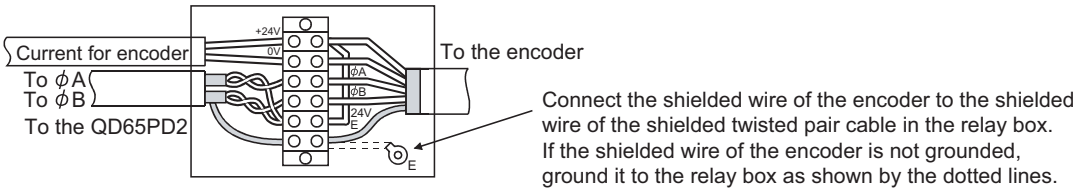
Measure 2

Use the shortest possible shielded twisted pair cables, placing them not parallel with noise-generating power cables or I/O cables and at a distance of 150mm or more.

- The following figure shows an example of a noise reduction measure.



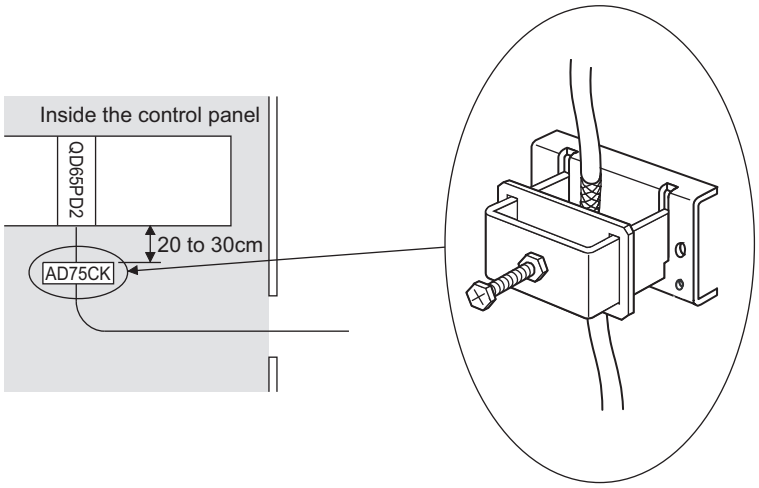
- Ground the shielded twisted pair cable on the encoder side (relay box). (Wiring example: with a sink type encoder (24V))



(5) Requirements for compliance with the EMC and Low Voltage Directives

Take the following measures to comply the system with the EMC and Low Voltage Directives.

- Install the DC power connected to the encoder inside the same control panel as the QD65PD2.
- Be sure to attach ferrite cores to the DC power cables to be connected to the QD65PD2 and the controller. The ferrite core ZCAT3035-1330 (manufactured by TDK Corporation) is recommended.
- Keep the length of the cables between the QD65PD2 and the encoder to 3m or less.
- Keep the length of the cables between the QD65PD2 and the controller or external output to 30m or less.
- Keep the length of the DC power cables to be connected to external devices for the QD65PD2 to 3m or less.
- Use a shielded twisted pair cable and ground the shielded part of the cable to the control panel with the AD75CK-type cable clamp (Mitsubishi).



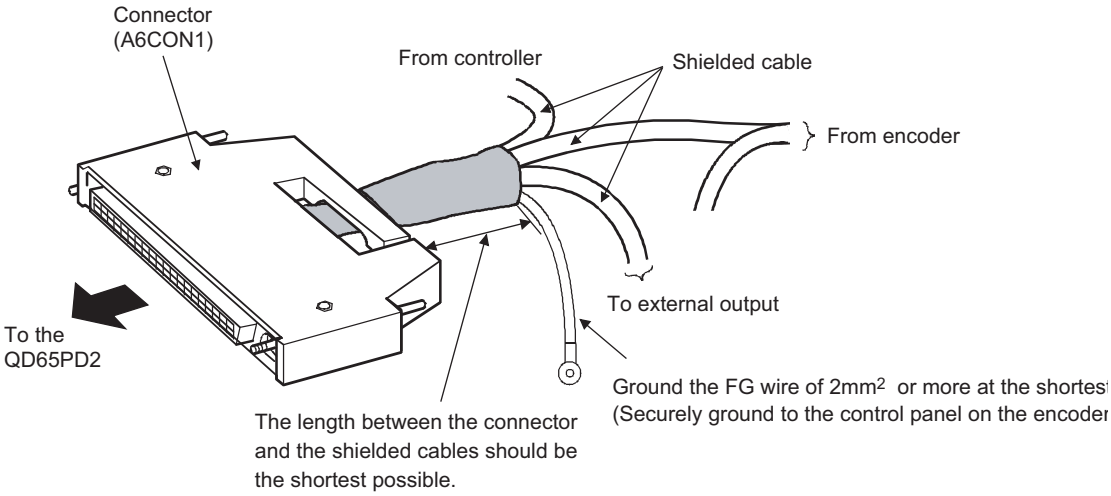
For details on the AD75CK, refer to the following manual.

AD75CK-type Cable Clamping Instruction Manual

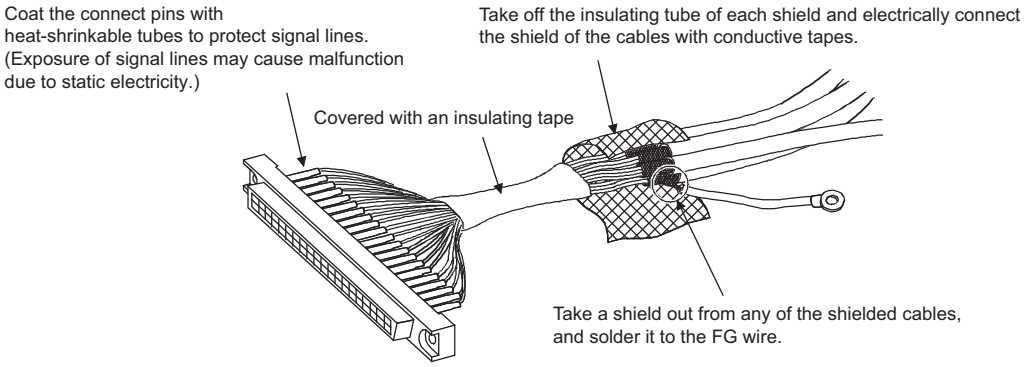
- Take the following noise reduction measures when wiring a connector for external devices.

  [Example of wiring using a shielded cable]

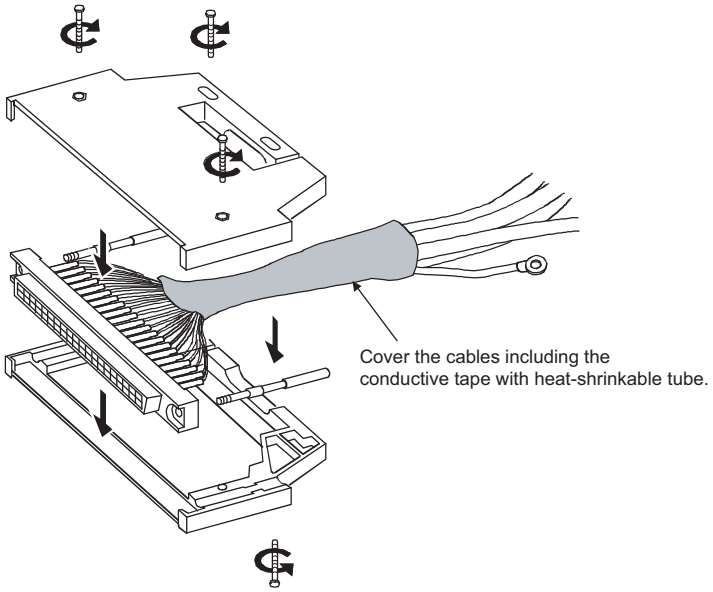
  The following figure shows an example of wiring for noise reduction using the A6CON1.



[Example of a noise reduction measure taken on a shielded cable]

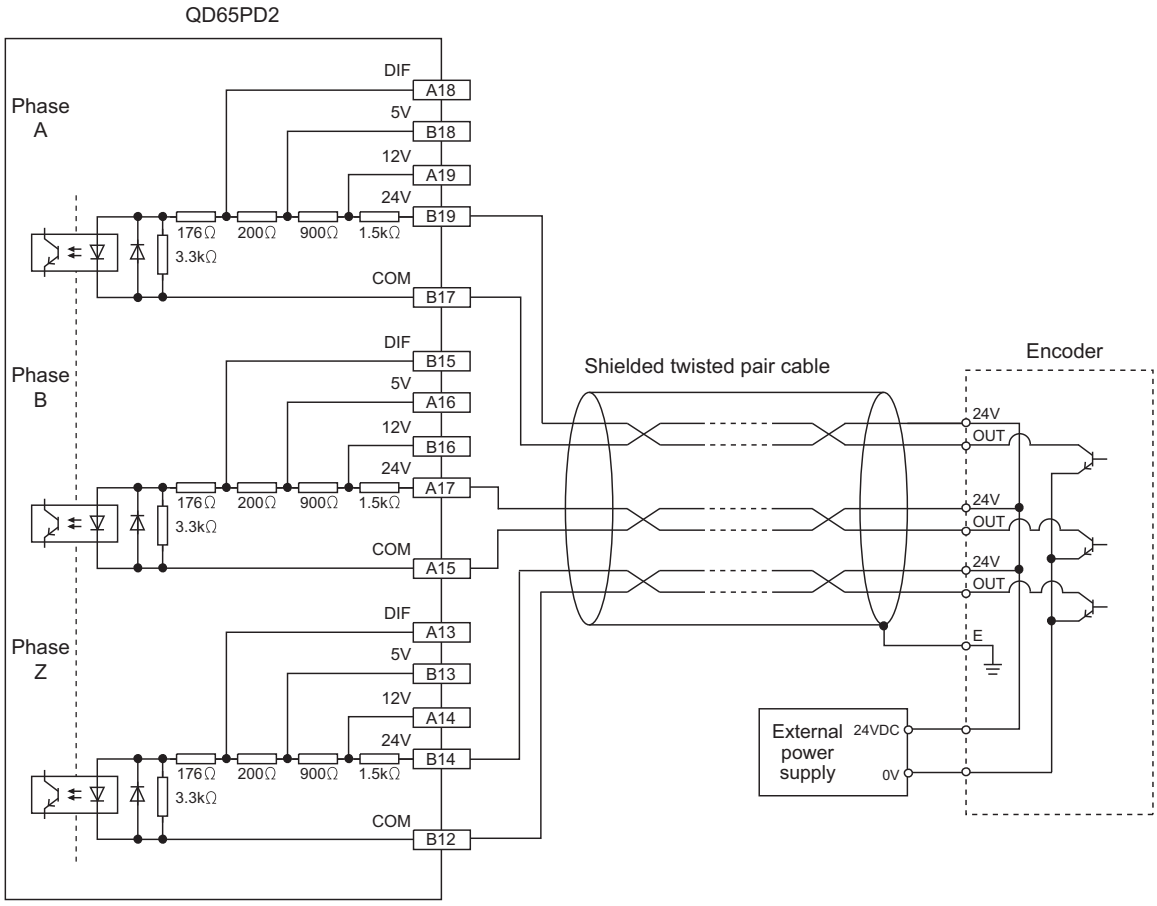


Assembling A6CON1



5.4.2 Wiring example (between module and encoder)

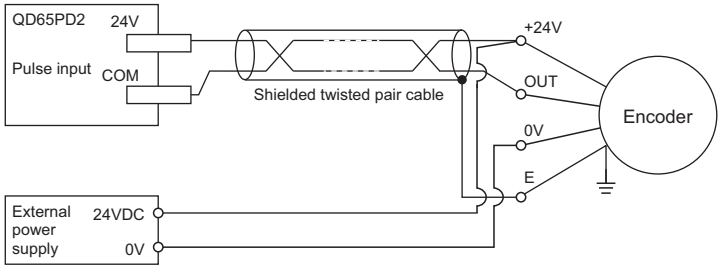
(1) Example of wiring with an open collector output type encoder (24VDC)



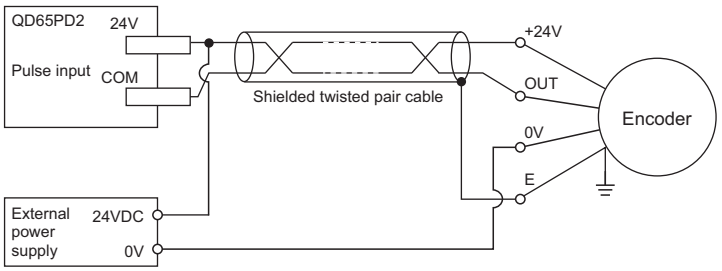
Point

When wiring the QD65PD and an encoder, separate power cables and signal cables. The following figure shows examples.

- Example of correct wiring

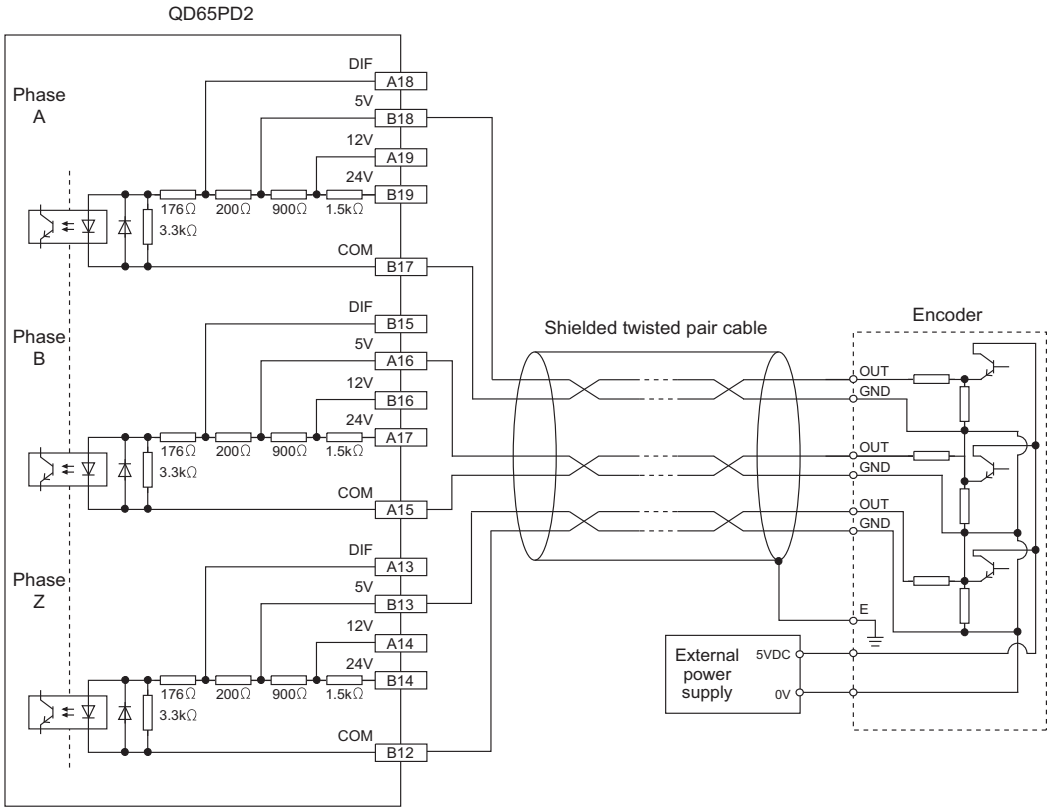


- Example of incorrect wiring

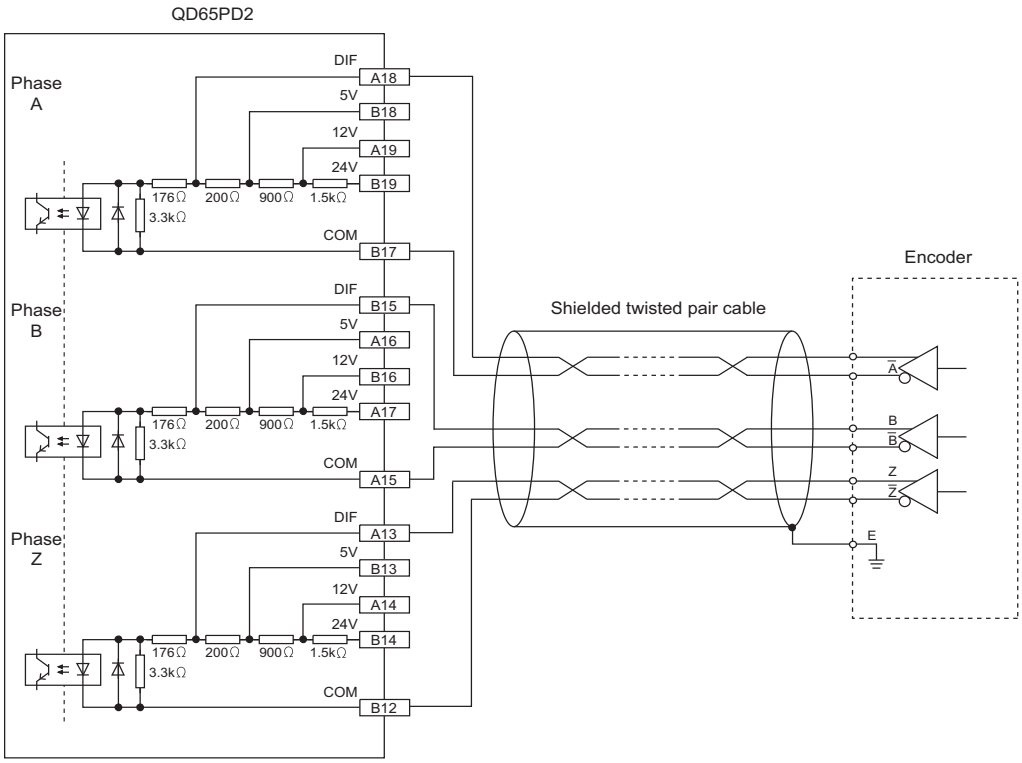


Since a current flows through the shielded twisted pair cables in the same direction, canceling effect does not work and pulses become susceptible to electromagnetic induction.

(2) Example of wiring with a voltage output type encoder (5VDC)

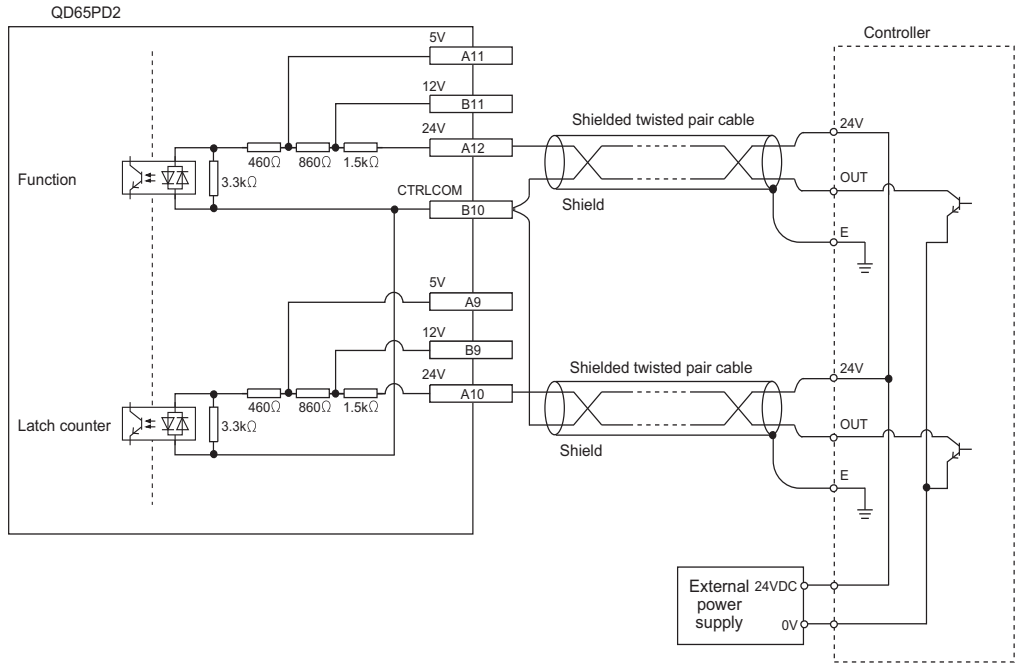


(3) Example of wiring with a line driver (equivalent to AM26LS31) encoder

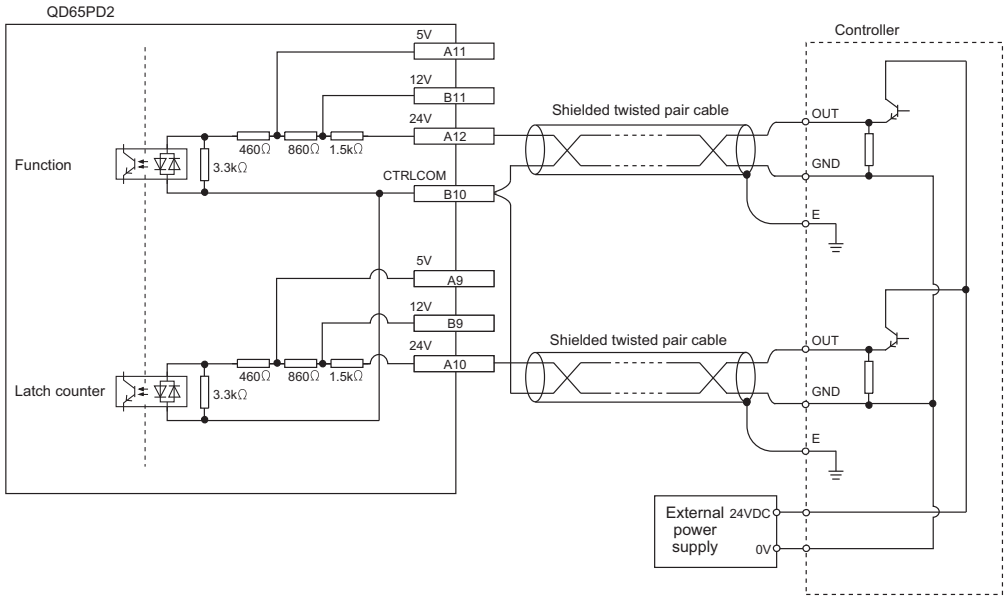


5.4.3 Wiring example (between controller and external input terminals)

(1) Example of wiring with a sink type controller

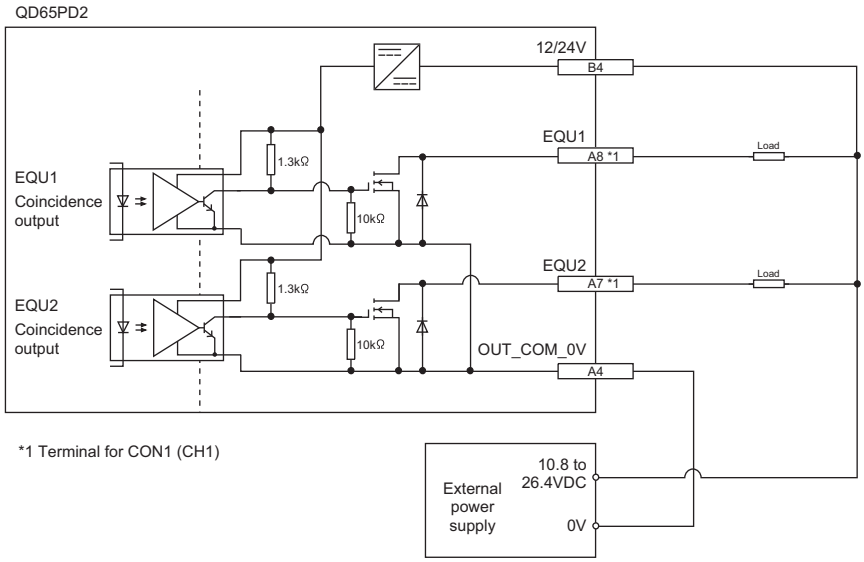


(2) Example of wiring with a source type controller

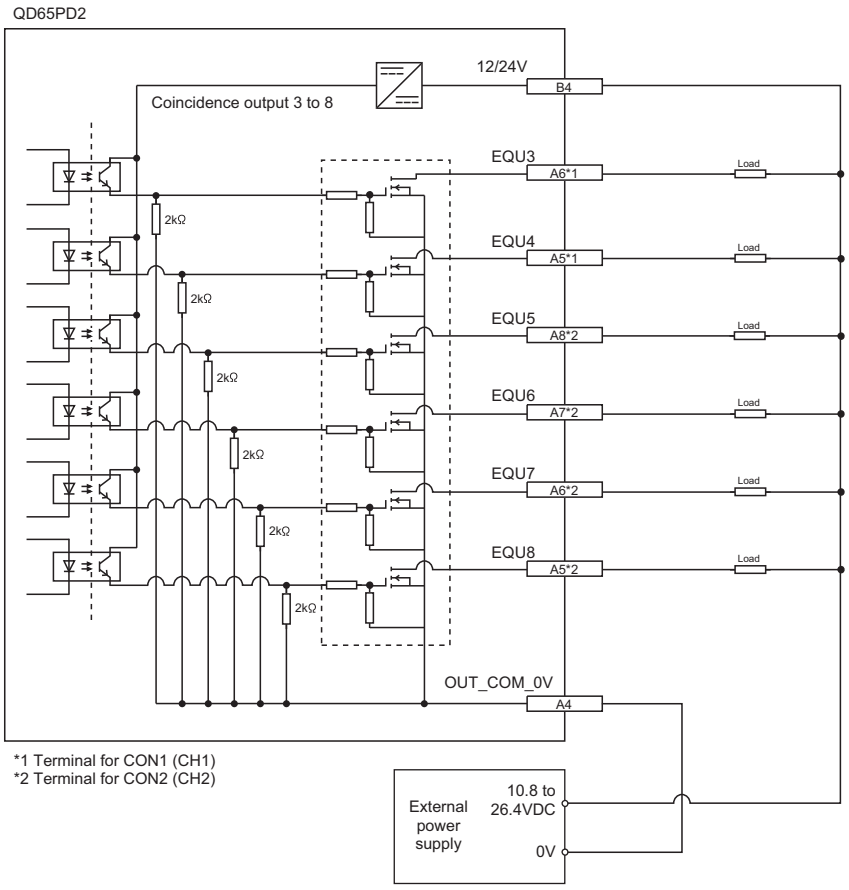


5.4.4 Wiring example (external output terminals)

(1) Example of wiring with coincidence output (high speed) terminals (sinking output)



(2) Example of wiring with coincidence output (low speed) terminals (sinking output)



Point

- To use coincidence output (EQU1 to 8), an external power supply of 10.8 to 26.4VDC is required to operate the internal photo coupler.
- For specifications such as response time, refer to the following section.
  Page 90, Section 3.5

CHAPTER 6 SETTINGS

This chapter describes how to specify the QD65PD2 settings.

Point

- To activate module settings, parameter settings, and auto refresh settings, write the settings to the CPU module. Then, reset the CPU module, switch the operating status of the CPU module as follows: STOP, RUN, STOP, and RUN, or power off and on the system.
- To activate switch settings, write the settings to the CPU module. Then, reset the CPU module or power off and on the system.
- Keep the intelligent function module detailed setting as the default.
  "Error Time Output Mode" and "PLC Operation Mode at H/W Error" on the intelligent function module detailed setting are always "Clear" and "Stop". If those other than these are set, an error (error code: 800) occurs.

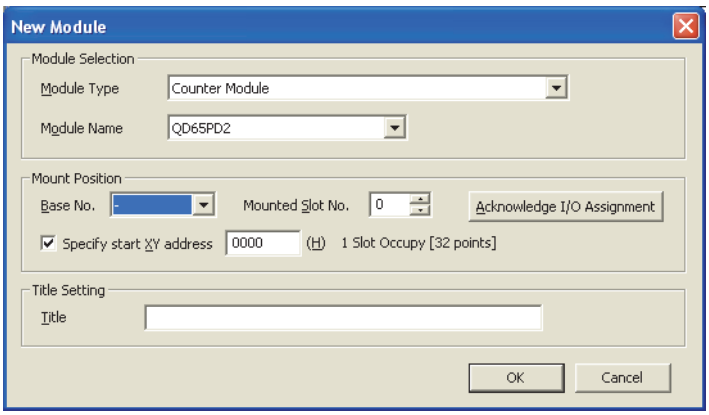
6.1 Adding a Module

Add the model name of the QD65PD2 to be used in the project.

(1) How to add a module

Open "New Module".

Project window ⇨ [Intelligent Function Module] ⇨ right-click ⇨ [New Module]



Item		Description
Module Selection	Module Type	Set "Counter Module".
	Module Name	Select the model name of the module to be connected.
Mount Position	Base No.	Set the base unit where the module is mounted.
	Mounted Slot No.	Select the number of the slot where the module is mounted.
	Specify start XY address	The start I/O number (hexadecimal) of the module to be mounted on the slot set in "Mounted Slot No." is displayed. Any number can be set.
Title Setting	Title	Set any title.

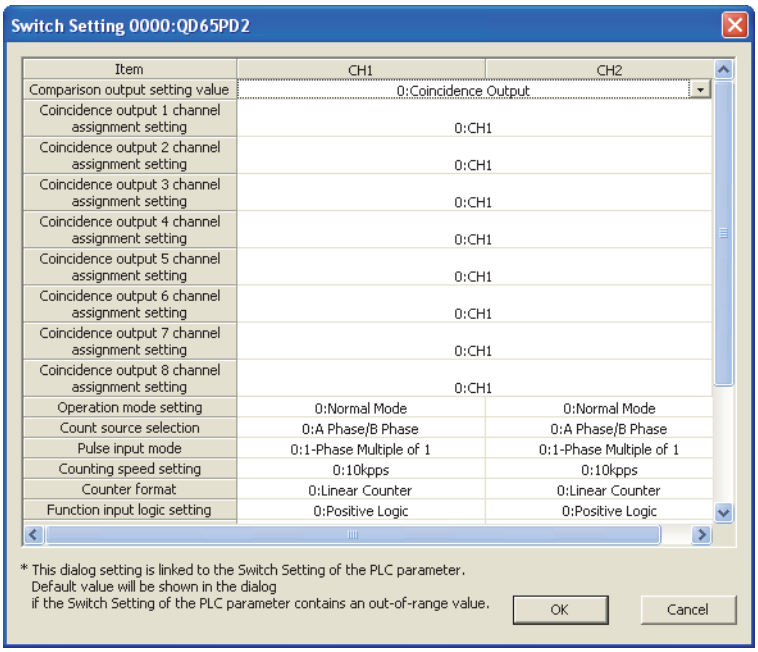
6.2 Switch Setting

Specify settings to be used for each channel.

(1) Setting method

Open "Switch Setting".

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



Item	Description	Setting value
Comparison output setting value	Set the comparison output function. This is the same for each channel.	• 0: Coincidence Output • 1: Cam Switch Function
Coincidence output 1 channel assignment setting ⋮ Coincidence output 8 channel assignment setting	Set the channel to be compared.	• 0: CH1 • 1: CH2
Operation mode setting	Set the operation mode for each channel.	• 0: Normal Mode • 1: Frequency Measurement Mode • 2: Rotation Speed Measurement Mode • 3: Pulse Measurement Mode • 4: PWM Output Mode
Count source selection	Set the count source for each channel	• 0: A Phase/B Phase • 1: Internal Clock (0.1μs) • 2: Internal Clock (1μs) • 3: Internal Clock (10μs) • 4: Internal Clock (100μs) • 5: Coincidence Output 1 • 6: Coincidence Output 2

Item	Description	Setting value
Pulse input mode	Set the pulse input mode for each channel.	• 0: 1-Phase Multiple of 1 • 1: 1-Phase Multiple of 2 • 2: CW/CCW • 3: 2-Phase Multiple of 1 • 4: 2-Phase Multiple of 2 • 5: 2-Phase Multiple of 4
Counting speed setting*1	Set the counting speed for each channel.	• 0: 10kpps • 1: 100kpps • 2: 200kpps • 3: 500kpps • 4: 1Mpps • 5: 2Mpps • 6: 4Mpps • 7: 8Mpps
Counter format	Select the linear counter or the ring counter for each channel.	• 0: Linear Counter • 1: Ring Counter
Function input logic setting	Set the function input logic for each channel	• 0: Positive Logic • 1: Negative Logic
Latch counter input logic setting	Set the latch counter input logic for each channel	• 0: Positive Logic • 1: Negative Logic
Counter function selection	Select the counter function activated when the operation mode setting of each channel is the normal mode.	• 0: Count Disabling Function • 1: Latch Counter Function • 2: Sampling Counter Function • 3: Periodic Pulse Counter Function • 4: Count disable/Preset/replace Function • 5: Latch counter/Preset/replace Function
Z phase input response time setting	Set the response time of the phase Z input signal for each channel.	• 0: OFF → ON Response time 0.25μs, ON → OFF Response time 2.5μs • 1: OFF → ON Response time 0.1ms, ON → OFF Response time: 0.1ms • 2: OFF → ON Response time 1.0ms, ON → OFF Response time 1.0ms
Function input response time setting*2	Set the response time of the function input signal for each channel.	• 0: OFF → ON Response time 0.02ms, ON → OFF Response time 0.1ms • 1: OFF → ON Response time 0.1ms, ON → OFF Response time 0.1ms • 2: OFF → ON Response time 1.0ms, ON → OFF Response time 1.0ms
Latch counter input response time setting*2	Set the response time of the latch counter input signal for each channel.	• 0: OFF → ON Response time 0.02ms, ON → OFF Response time 0.1ms • 1: OFF → ON Response time 0.1ms, ON → OFF Response time 0.1ms • 2: OFF → ON Response time 1.0ms, ON → OFF Response time 1.0ms

*1 When connected with DC input, set counting speed to 200kpps or slower.

*2 When the function input logic setting and the latch counter input logic setting are set to negative logic, the OFF → ON response time and the ON → OFF response time invert.
For example, when 0 is set, the OFF → ON response time is 0.1ms, and the ON → OFF response time is 0.02ms.

(2) Switch setting combination

(a) Combination availability by the operation mode setting

		Comparison output setting value	
		0: Coincidence Output	1: Cam Switch Function
Operation mode setting	0: Normal Mode	○	○
	1: Frequency Measurement Mode	○	× *2
	2: Rotation Speed Measurement Mode	○	× *2
	3: Pulse Measurement Mode	○	× *2
	4: PWM Output Mode	○ *1	× *2

○: Available, ×: Unavailable (Error)

*1 If the channel set to the PWM output mode is not set to "Channel assignment (coincidence output 1 to 8), an error occurs (error code: □812 or □814, The channel where the error has occurred is stored in □).

*2 If "Comparison output setting value" is the cam switch function, and "Operation mode setting" for both channels are the mode other than the normal mode (including out of setting range), the error code: 811 occurs.

		Count source selection		
		0: A Phase/B Phase	1: Internal Clock (0.1μs) 2: Internal Clock (1μs) 3: Internal Clock (10μs) 4: Internal Clock (100μs)	5: Coincidence output 1 6: Coincidence output 2
Operation mode setting	0: Normal mode	○	○	○*1
	1: Frequency Measurement Mode	○	×	×
	2: Rotation Speed Measurement Mode	○	×	×
	3: Pulse Measurement Mode	△	△	△
	4: PWM Output Mode	△	△	△

○: Available, ×: Unavailable (Error), △: Setting ignored

*1 One of the following conditions need to be satisfied; Otherwise, an error occurs (error code: □812 or □814, The channel where the error has occurred is stored in □).

Condition 1

- "Coincidence output setting value" is coincidence output.
- "Operation mode setting" of the other channel is the normal mode.
- Different channel is set to "Coincidence output 1 channel assignment setting" and "Coincidence output 2 channel assignment setting". (If "Count source selection" is coincidence output 2, "Coincidence output 2 channel assignment setting" must be the other channel.)

Condition 2

- "Coincidence output setting value" is coincidence output.
- "Operation mode setting" of the other channel is the PWM output mode.
- Different channel is set to "Coincidence output 1 channel assignment setting" and "Coincidence output 2 channel assignment setting".

		Counter format (all)	Function input logic setting (all)	Latch counter input logic setting (all)	Counter function selection (all)	Z phase input response time setting (all)	Function input response time setting (all)	Latch counter input response time setting (all)
Operation mode setting	0: Normal Mode	○	○	○	○	○	○	○
	1: Frequency Measurement Mode	△	△	△	△	○	○	○
	2: Rotation Speed Measurement Mode	△	△	△	△	○	○	○
	3: Pulse Measurement Mode	△	△	△	△	○	○	○
	4: PWM Output Mode	△	△	△	△	○	○	○

○: Available, △: Setting ignored

(b) Combination availability by count source selection and the pulse input mode

		Pulse input mode (all)	Counting speed setting (all)
Count source selection	0: A Phase/B Phase	○	○
	1: Internal Clock (0.1μs)	△	△
	2: Internal Clock (1μs)	△	△
	3: Internal Clock (10μs)	△	△
	4: Internal Clock (100μs)	△	△
	5: Coincidence output 1	△	△
	6: Coincidence output 2	△	△

○: Available, △: Setting ignored

		Counting speed setting							
		0: 10kpps	1: 100kpps	2: 200kpps	3: 500kpps	4: 1Mpps	5: 2Mpps	6: 4Mpps	7: 8Mpps
Pulse input mode	0: 1-Phase Multiple of 1	○	○	○	○	○	○	× *1	× *1
	1: 1-Phase Multiple of 2	○	○	○	○	○	○	○	× *1
	2: CW/CCW	○	○	○	○	○	○	× *1	× *1
	3: 2-Phase Multiple of 1	○	○	○	○	○	○	× *1	× *1
	4: 2-Phase Multiple of 2	○	○	○	○	○	○	○	× *1
	5: 2-Phase Multiple of 4	○	○	○	○	○	○	○	○

○: Available, ×: Unavailable (Error)

*1 If this is set, an error occurs (error code: □812 or □814, The channel where the error has occurred is stored in □).

6.3 Parameter Setting

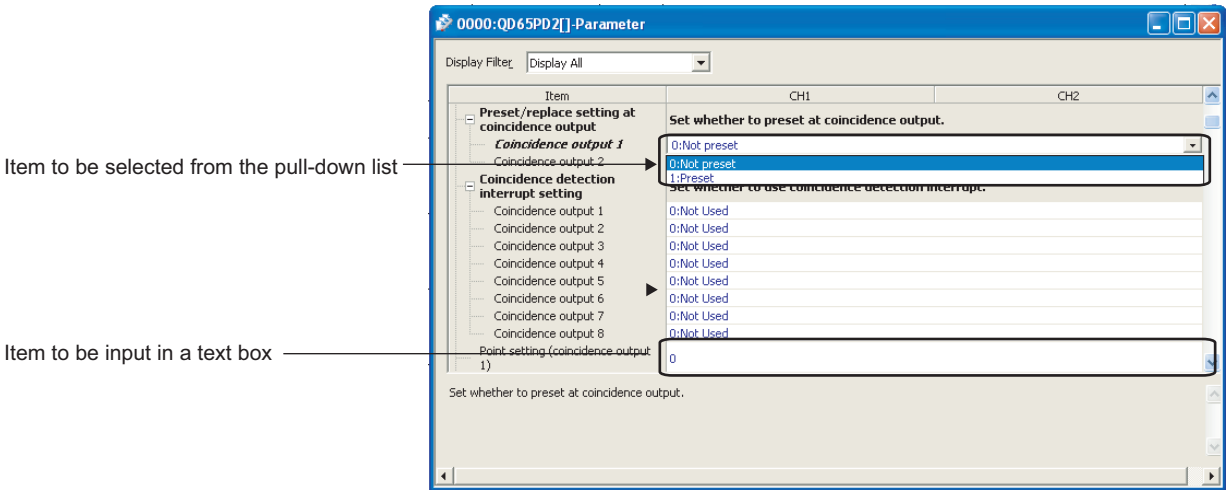
Set the parameters for each channel.

(1) Setting method

Open "Parameter".

1. Start "Parameter" in the project window.

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



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

- Item to be selected from the pull-down list
  Double-click the item to be set to display the pull-down list, and select the item.
- Item to be input in a text box
  Double-click the item and enter a value.

Item			Setting value	Reference
Basic setting	Coincidence output condition setting		—	Page 109, Section 4.3.2
		Coincidence output 1 to 8	• 0: Coincidence output (default value) • 1: In-Range Output • 2: Not-In-Range Output	
	Preset/replace setting at coincidence output		—	Page 116, Section 4.3.3
		Coincidence output 1	• 0: Not preset (default value) • 1: Preset	
		Coincidence output 2		
	Coincidence detection interrupt setting		—	Page 122, Section 4.3.5
		Coincidence output 1 to 8	• 0: Not used • 1: Use	

Item			Setting value	Reference
Basic setting	Point setting (coincidence output 1) ⋮ Point setting (coincidence output 8)		-2147483648 to 2147483647 (default value: 0)	Page 109, Section 4.3.2
	Lower limit value (coincidence output 1)		-2147483648 to 2147483647 (default value: 0)	
	Upper limit value (coincidence output 1)			
	⋮			
	Lower limit value (coincidence output 8)			
	Upper limit value (coincidence output 8)			
	Cam switch function (coincidence output 1 to 8)		—	Page 118, Section 4.3.4
		Step type	• 0: Start from output status OFF (default value) • 1: Start from output status ON	
		Number of steps	0 to 16 (default value: 0)	
		Step No.1 setting ⋮ Step No.16 setting	-2147483648 to 2147483647 (default value: 0)	
	Z phase setting		—	Page 126, Section 4.4 (3)
		Z phase (Preset) trigger setting	• 0: Rising • 1: Falling • 2: Rising+Falling • 3: During ON	
		External preset/replace (Z phase) request detection setting	• 0: ON at detection (default value) • 1: Not ON at detection	
	Periodic interrupt setting		• 0: Not used • 1: Use	Page 139, Section 4.9.1
	Ring counter lower limit value		-2147483648 to 2147483647 (default value: 0)	Page 104, Section 4.2.2
	Ring counter upper limit value			
	Preset value		-2147483648 to 2147483647 (default value: 0)	Page 125, Section 4.4
	Time unit setting (sampling counter/ periodic pulse counter)		• 0: 1ms (default value) • 1: 10ms	Page 133, Section 4.8 Page 136, Section 4.9
	Cycle setting (sampling counter/periodic pulse counter)		1 to 65535 (default value: 1)	
	Time unit setting (frequency measurement)		• 0: 0.01s (default value) • 1: 0.1s • 2: 1s	Page 146, Section 4.13
	Moving average count (frequency measurement)		1 to 100 (default value: 1)	
	Time unit setting (rotation speed measurement)		• 0: 0.01s (default value) • 1: 0.1s • 2: 1s	Page 150, Section 4.14
	Moving average count (rotation speed measurement)		1 to 100 (default value: 1)	
	Number of pulses per rotation		1 to 8000000 (default value: 1)	

Item		Setting value	Reference
Basic setting	Pulse measurement setting (function input terminal)	0: Pulse ON Width 1: Pulse OFF Width	Page 155, Section 4.15
	Pulse measurement setting (latch counter input terminal)	0: Pulse ON Width 1: Pulse OFF Width	
	PWM output assignment	—	Page 159, Section 4.16
	PWM output assignment (coincidence output 1) ⋮ PWM output assignment (coincidence output 8)	• 0: No Assignment • 1: Assignment	
	ON width setting (PWM output)	• 0, 10 to 10000000 (PWM output: coincidence output 1 and 2) • 0, 1000 to 10000000 (PWM output: coincidence output 3 to 8) (default value: 0)	
	Cycle setting (PWM output)	• 50 to 10000000 (PWM output: coincidence output 1 and 2) • 5000 to 10000000 (PWM output: coincidence output 3 to 8) (default value: 50)	

6.4 Auto Refresh

Transfer the buffer memory data to the specified device.

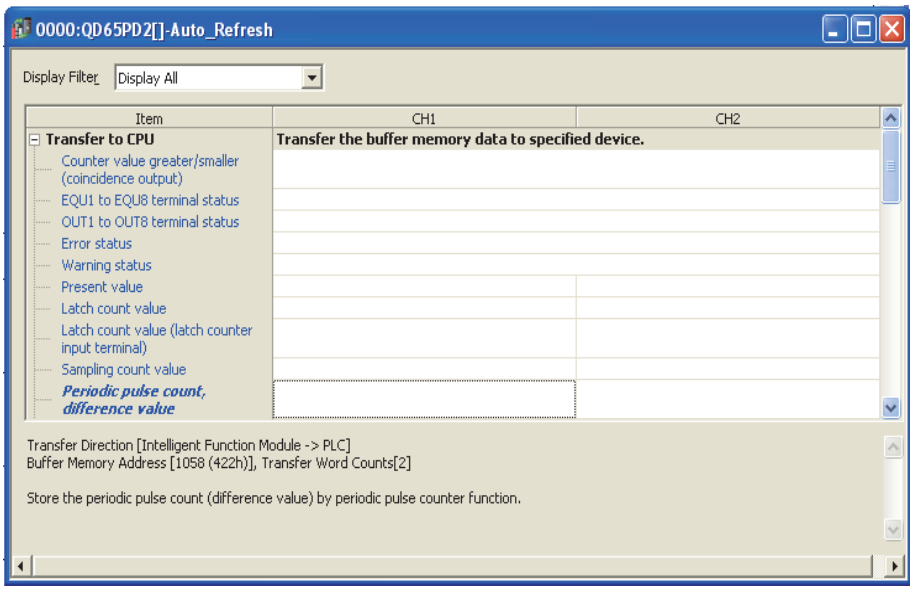
(1) Setting method

Open "Auto_Refresh".

1. **Start "Auto_Refresh" in the project window**

Project window ⇨ [Intelligent Function Module] ⇨ Module name ⇨ [Auto_Refresh]

2. **Click the item to be set and enter the auto refresh target device.**



6.5 Preset Setting

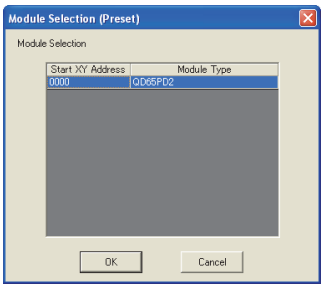
Preset a value to be replaced with the count value.

(1) Setting method

Go to "Preset".

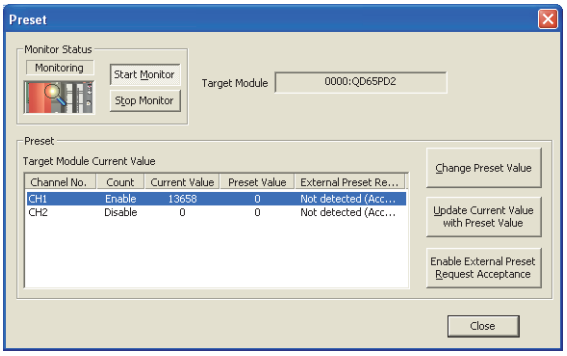
1. **Open "Module Selection (Preset)" dialogue box.**

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Counter Module] ⇨ [Preset]



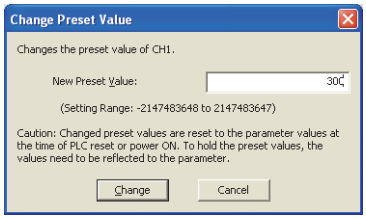
↓

2. **Select "QD65PD2", then click** OK **.**



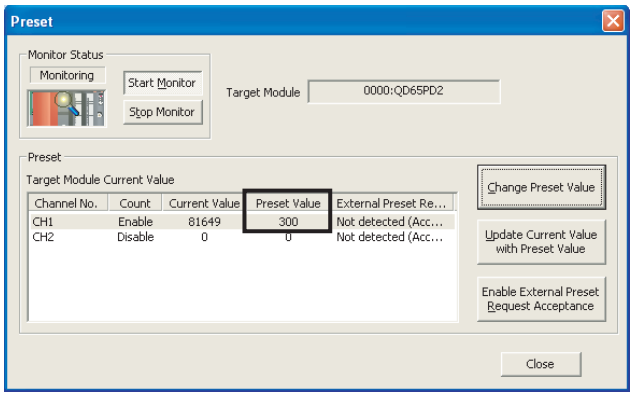
↓

3. **Select the row for the channel to be preset, then click** Change Preset Value **.**

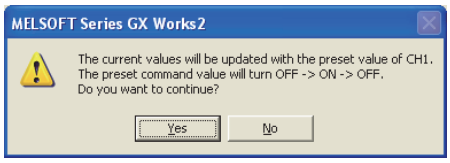


↓

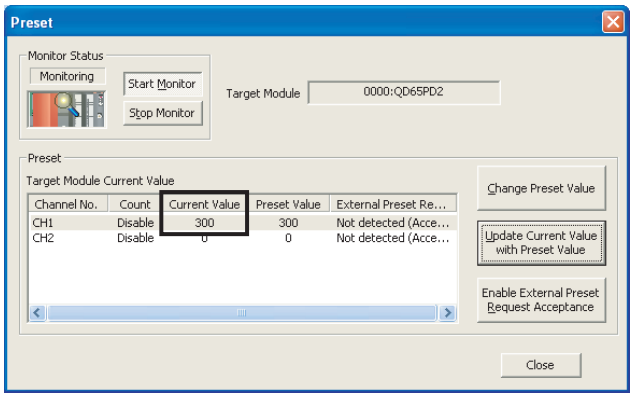
4. **Input a preset value, then click** Change **.**



↓



↓



5. **After confirming that the preset value is reflected on "Preset Value", click** Update Current Value with Preset Value **.**

6. **Click** Yes **.**

7. **The value on "Preset Value" is reflected on "Current Value".**

Point

- When CH1 Count enable command (Y06) is OFF, the present value cannot be replaced with the preset value; "Count" in the "Preset" dialogue box shows "Disable".
- While CH1 External preset/replace (Z Phase) request detection (X05) is ON, the preset/replace function cannot be performed; "External Preset Request" in the "Preset" dialogue box shows "Detected (Unacceptable)". For the case above, clicking Enable External Preset Request Acceptance button in the "Preset" dialogue box turns off CH1 External preset/replace (Z Phase) request detection (X05). Then, the present value can be replaced with a preset value.
- The preset value changed in "Change Preset Value" is changed back to the preset value set in "Parameter" when the CPU module is reset or at the rising state (OFF→ ON) of the power.
  To keep the change made on the preset value, set the change from "Preset value" in "Parameter".

CHAPTER 7 PROGRAMMING

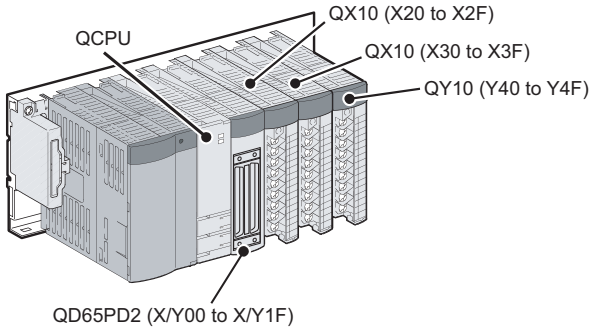
This chapter describes the QD65PD2 basic programs.

7.1 Using the Module in a Standard System Configuration

This section describes the system configuration and program examples for the QD65PD2.
Note that CH1 is used for program examples in this section.

(1) System configuration

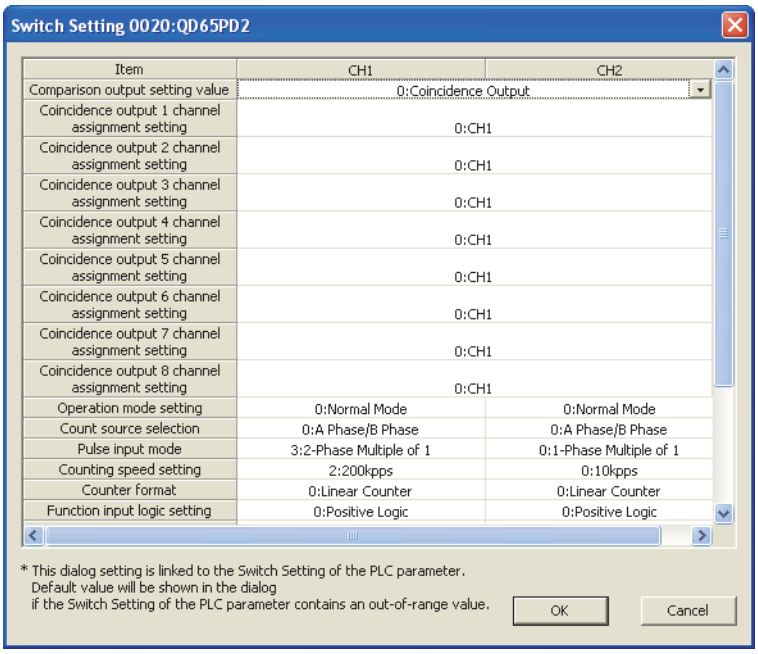
The following figure shows a system configuration where the QD65PD2 is used in a standard system configuration.



(2) Switch setting

Set the switch setting as follows.

Project window ⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Switch Setting]



Item	Setting value
Comparison output setting value	Set comparison output depending on the program example to be used.
Coincidence output 1 channel assignment setting	0: CH1
Coincidence output 2 channel assignment setting	0: CH1
Coincidence output 3 channel assignment setting	Setting is not necessary for the program examples in this chapter.
⋮	
Coincidence output 8 channel assignment setting	
Operation mode setting	Set operation mode depending on the program example to be used.
Count source selection	0: A Phase/B Phase
Pulse input mode	3: 2-Phase Multiple of 1
Counting speed setting	2: 200kpps
Counter format	Set a counter format depending on the program example to be used.
Function input logic setting	0: Positive Logic
Latch counter input logic setting	0: Positive Logic
Counter function selection	Set a counter function depending on the program example to be used.
Z phase input response time setting	Set any response time.
Function input response time setting	
Latch counter input response time setting	

(3) Initial setting of the program.

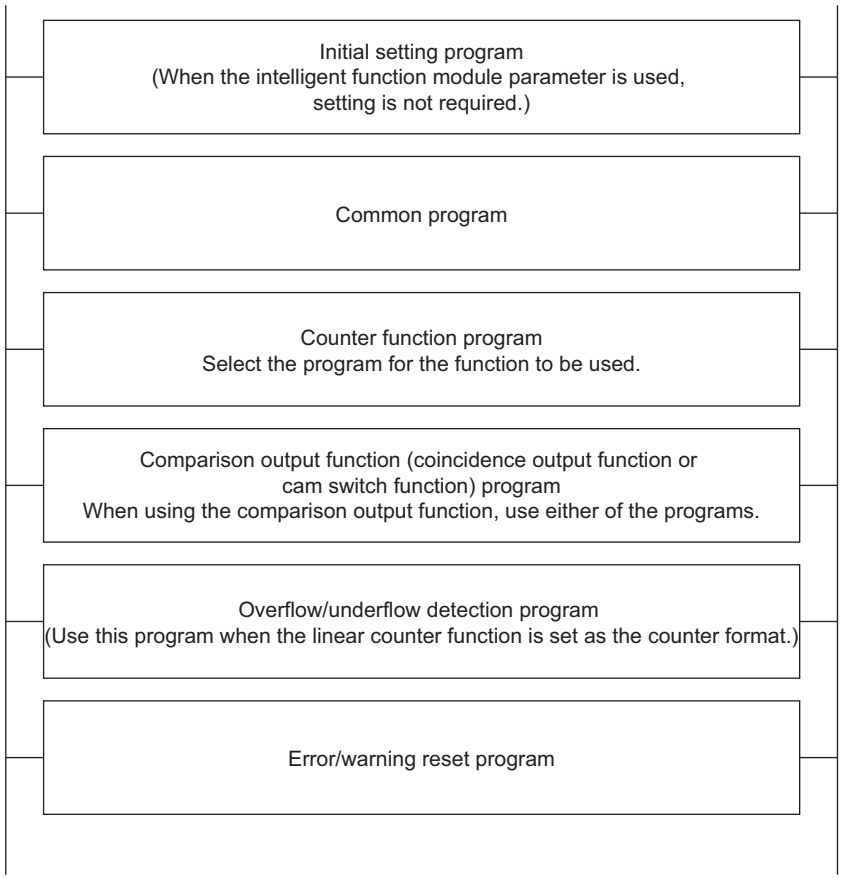
Item			Setting value
Preset value			100
Z phase setting			Rising, ON at detection
Ring counter lower limit value		*1	-5000
Ring counter upper limit value		*1	5000
Coincidence output 1	Comparison condition setting	*2	Coincidence output
	Point setting	*2	1000
Coincidence output 2	Comparison condition setting	*2	In-Range Output
	Upper/lower limit value setting	*2	lower limit value 1000, upper limit value 2000
Cam switch function	Step setting (coincidence output 1)	*3	Start from output status OFF, number of steps is 6 Step No.1: 100 Step No.2: 250 Step No.3: 400 Step No.4: 550 Step No.5: 700 Step No.6: 850
Time unit setting (sampling counter/periodic pulse counter)		*4	1ms
Cycle setting (sampling counter/periodic pulse counter)		*4	2000ms
Frequency measurement	Time unit setting	*5	0.01 second
	Moving average count	*5	3
Rotation speed measurement	Time unit setting	*6	0.01 second
	Moving average count	*6	3
	Number of pulses per rotation	*6	1000
Pulse measurement target	Pulse measurement setting (function input terminal)	*7	Pulse ON Width
	Pulse measurement setting (latch counter input terminal)	*7	Pulse OFF Width
PWM output	PWM output assignment	*8	outputs to coincidence output 1
	ON width setting	*8	100.0μs
	Cycle setting	*8	200.0μs

*1 Set only when using the ring counter function.
*2 Set only when using the coincidence output function.
*3 Set only when using the cam switch function.
*4 Set only when using the sampling counter function or the periodic pulse counter function.
*5 Set only under the frequency measurement mode.
*6 Set only under the rotation speed measurement mode.
*7 Set only under the pulse measurement mode.
*8 Set only under the PWM output mode.

(4) Configuration of program examples

The following figure is a configuration of a program example.

(a) Program configuration under the normal mode



(b) Program configuration under a mode other than the normal mode

Program examples under a mode other than the normal mode operate in a single-program example.

Point

If error or warning processing is required for a program example under a mode other than the normal mode, add the error/warning reset program of the normal mode shown in this section before the END instruction of each program.

7.1.1 Program example when the parameters of the intelligent function module are used

(1) Devices used by the user

Device	Description	
D0. D1	Present value	Devices in which data is written by auto refresh
D2, D3	Latch count value (counter function selection)	
D4, D5	Latch count value (latch counter input terminal)	
D6, D7	Sampling count value	
D8. D9	Periodic pulse count, difference value	
D10, D11	Periodic pulse count, present value	
D12, D13	Periodic pulse count value update check	
D14	Overflow/underflow detection flag	
D16	Counter value greater/smaller (coincidence output)	
D32	Error status	
D33	Error code latch (latest error code)*1	
D35	Warning status	
D36	Warning code latch (Latest warning code)*3	
D44, D45	Measured frequency value	
D54, D55	Measured rotation speed value	
D62, D63	Measured pulse value (function input terminal)	
D72, D73	Measured pulse value (latch counter input terminal)	
D34	Detected error code*2	
D37	Detected warning code*4	
D130, D131	stores the periodic pulse count difference value	
D132, D133	stores the periodic pulse count present value	
D134, D135	stores the periodic pulse count update check value	
X0	Module ready	QD65PD2(X/Y00 to X/Y1F)
X1	Operating condition settings batch-changed signal	
X8	CH1 Cam switch function execution/PWM output signal	
X10	Coincidence output 1 signal	
X11	Coincidence output 2 signal	
Y2	CH1 Coincidence output enable command	
Y3	Preset/replace command	
Y6	CH1 Count enable command	
Y7	CH1 Selected counter function start command	
Y8	CH1 Cam switch function/PWM output start command	
Y10	Reset command (coincidence output 1)	

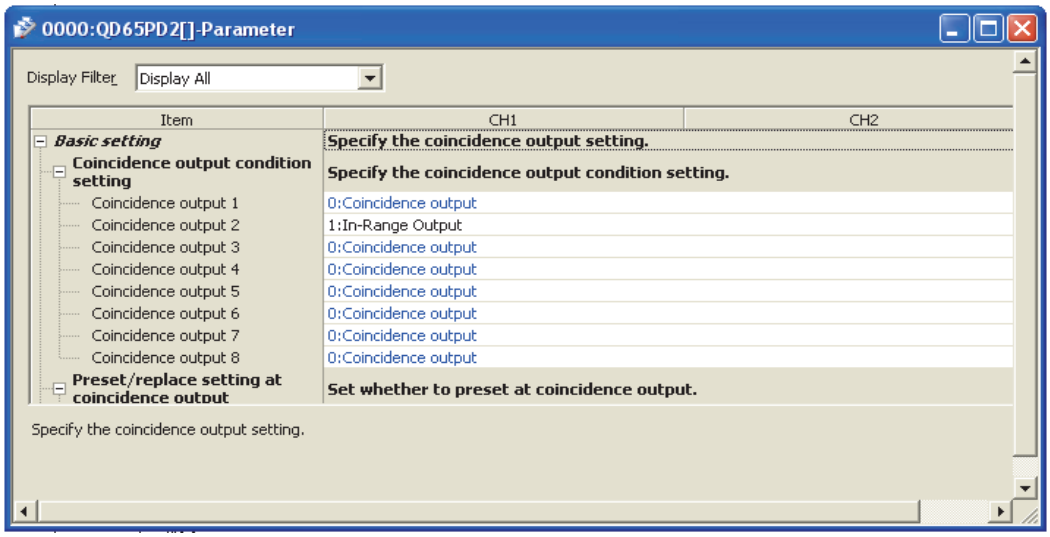
Device	Description	
X20	Count start signal	QX10(X20 to X2F)
X22	Allow coincidence output signal	
X23	Preset/replace command signal	
X24	Count stop signal	
X25	Coincidence LED clear signal	
X27	Count disable start signal	
X29	Latch counter start signal	
X2B	Sampling counter start signal	
X2C	Periodic pulse count read signal	
X2D	Periodic pulse counter start signal	
X2E	Cam switch start signal	
X32	Frequency measurement start signal	QX10(X30 to X3F)
X33	Frequency measurement stop signal	
X34	Rotation speed measurement start signal	
X35	Rotation speed measurement stop signal	
X36	Pulse measurement (function input terminal) start signal	
X37	Pulse measurement (latch counter input terminal) start signal	
X38	Pulse measurement (function input terminal) stop signal	
X39	Pulse measurement (latch counter input terminal) stop signal	
X3A	PWM output start signal	
X3B	Error/warning reset command signal	
Y40	LED signal for checking the coincidence output 1	QY10(Y40 to Y4F)
Y41	LED signal for checking the coincidence output 2	
Y42	LED signal for checking underflow occurrence	
Y43	LED signal for checking overflow occurrence	
Y44	LED signal for checking that PWM output is in process	

*1 Stores the error code of the error in process.
*2 Stores the latest error, and hold it also after an error reset.
*3 Stores the warning code of the warning in process.
*4 Stores the latest warning, and hold it also after an error reset.

(2) Parameter setting

Set the initial settings in the parameters.

Project window⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Parameter]



Item		Description	Setting value
Coincidence output condition setting	*1	Set the comparison condition when performing coincidence output.	—
Coincidence output 1		Set the comparison condition for the coincidence output 1.	0: Coincidence output
Coincidence output 2		Set the comparison condition for the coincidence output 2.	1: In-Range Output
Coincidence detection interrupt setting	*2	Set whether to perform an interrupt when the count value matches with a preset value or range.	—
Coincidence output 1		Set whether to perform an interrupt when the coincidence output 1 is detected with a matched value or range.	1: Use
Point setting (coincidence output 1)	*1	Set the value where the count value is to be compared with for the coincidence output 1.	1000
Lower limit value (coincidence output 2)		Set the lower limit value of the range where the count value is to be compared with for the coincidence output 2.	1000
Upper limit value (coincidence output 2)		Set the upper limit value of the range where the count value is to be compared with for the coincidence output 2.	2000

Item		Description	Setting value
Cam switch function (coincidence output 1)	*3	Set the cam switch for the coincidence output 1.	—
Step type		Set whether to start from output status ON or OFF for the coincidence output 1.	0: Start from output status OFF
Number of steps		Set the number of steps for the coincidence output 1.	6
Step No.1 setting		Set the value of the step No.1 where ON/OFF status of the coincidence output 1 is to be switched.	100
Step No.2 setting		Set the value of the step No.2 where ON/OFF status of the coincidence output 1 is to be switched.	250
Step No.3 setting		Set the value of the step No.3 where ON/OFF status of the coincidence output 1 is to be switched.	400
Step No.4 setting		Set the value of the step No.4 where ON/OFF status of the coincidence output 1 is to be switched.	550
Step No.5 setting		Set the value of the step No.5 where ON/OFF status of the coincidence output 1 is to be switched.	700
Step No.6 setting		Set the value of the step No.6 where ON/OFF status of the coincidence output 1 is to be switched.	850
Periodic interrupt setting	*4	Set whether to perform an interrupt after a cycle passed.	1: Use
Z phase setting		Configure settings correspond to the preset/replace function by the phase Z input terminals (Z1, Z2).	—
Z phase (Preset) trigger setting		Set the trigger to which the preset/replace function is performed by the phase Z input terminals (Z1, Z2).	0: Rising
External preset/replace (Z phase) request detection setting		Set whether CH1 External preset/replace (Z Phase) request detection (X05) is turned ON when the preset/ replace function is performed by the phase Z input terminals (Z1, Z2).	0: ON at detection
Ring counter lower limit value	*5	Set the lower limit value of the range for the ring counter format.	-5000
Ring counter upper limit value		Set the upper limit value of the range for the ring counter format.	5000
Preset value		Set the value to preset and replaced with the count value.	100
Time unit setting (sampling counter/periodic pulse counter)	*6	Set the time unit of the sampling time for the sampling counter function, or of the cycle time for the periodic pulse counter function.	0: 1ms
Cycle setting (sampling counter/periodic pulse counter)		Set the sampling time for the sampling counter function, or the cycle time for the periodic pulse counter function.	2000
Time unit setting (frequency measurement)	*7	Set the time unit for frequency measurement.	0: 0.01s
Moving average count (frequency measurement)		Set the moving average count of frequency measurement.	3
Time unit setting (rotation speed measurement)	*8	Se the time unit for rotation speed measurement.	0: 0.01s
Moving average count (rotation speed measurement)		Set the moving average time of rotation speed measurement.	3
Number of pulses per rotation		Set the number of pulses per rotation.	1000
Pulse measurement setting (function input terminal)	*9	Set the pulse measurement target of the function input terminals (FUNC1, FUNC2).	Pulse ON Width
Pulse measurement setting (latch counter input terminal)		Set the pulse measurement target of the latch counter input terminals (LATCH1, LATCH2).	Pulse ON Width

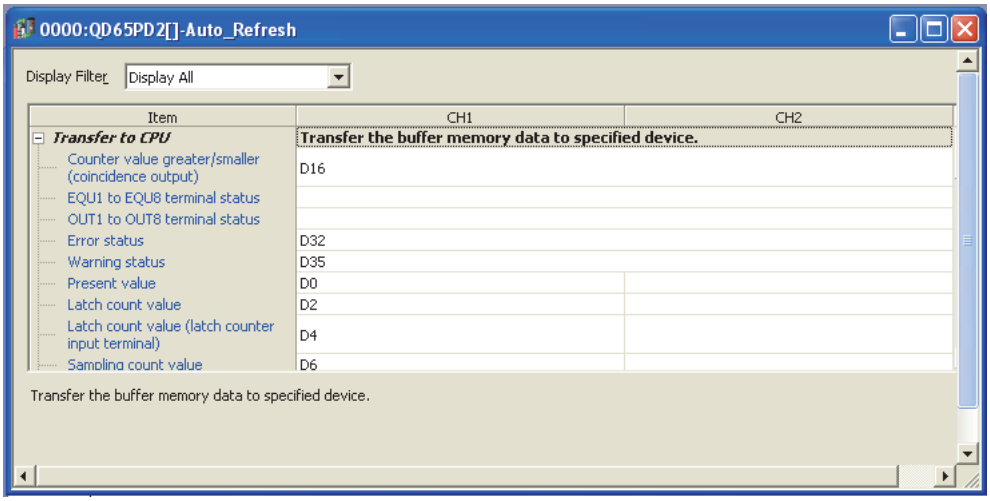
Item		Description	Setting value
PWM output assignment	*10	Select any from coincidence output 1 to 8 to output the PWM wave form.	—
PWM output assignment (coincidence output 1)		Set whether to assign the coincidence output 1 to PWM output.	1: Assignment
ON width setting (PWM output)		Set the ON time of output pulses for PWM output.	100.0μs
Cycle setting (PWM output)		Set the cycle time of output pulses for PWM output.	200.0μs

*1 Set only when using the coincidence output function.
*2 Set only when using the coincidence detection interrupt function.
*3 Set only when using the cam switch function.
*4 Set only when using the periodic interrupt function.
*5 Set only when using the ring counter function.
*6 Set only when using the sampling counter function or periodic pulse counter function.
*7 Set only under the frequency measurement mode.
*8 Set only under the rotation speed measurement mode.
*9 Set only under the pulse measurement mode.
*10 Set only under the PWM output mode.

(3) Auto refresh setting

Set the target device for auto refresh.

Project window⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Auto_Refresh]



Item		Description	Setting value
Counter value greater/smaller (coincidence output)	*1	stores the relationship (greater or smaller) between the point setting of coincidence output 1 to 8 and the present value.	D16
Error status		Set the device that stores the error status of each channel.	D32
Warning status		Set the device that stores the warning status of each channel.	D35
Present value		Set the device that stores the present value.	D0
Latch count value	*2	Set the device that stores the latch count value when the latch counter function (counter function selection) is used.	D2
Latch count value (latch counter input terminal)	*3	Set the device that stores the latch count value by the latch counter input terminals (LATCH1, LATCH2).	D4
Sampling count value	*4	Set the device that stores the sampling count value when the sampling counter function is used.	D6
Periodic pulse count, difference value	*5	Set the device that stores the periodic pulse count difference value when the periodic pulse counter function is used.	D8
Periodic pulse count, present value		Set the device that stores the periodic pulse count present value when the periodic pulse counter function is used.	D10
Periodic pulse count value update check		Set the device that stores the periodic pulse count update check value when the periodic pulse counter function is used.	D12
Overflow/underflow detection flag		Set the device that stores the detected result of overflow/ underflow error when the linear counter function is used.	D14
Measured frequency value	*6	Set the device that stores the periodic pulse count value when the periodic pulse counter function is used.	D44
Measured rotation speed value	*7	Set the device that stores the measured value of the rotation speed when the rotation speed measurement function is used.	D54
Measured pulse value (function input terminal)	*8	Set the device to store the measured pulse value of the function input terminal when a pulse measurement function is used.	D62
Measured pulse value (latch counter input terminal)		Set the device to store the measured pulse value of the latch counter input terminal when a pulse measurement function is used.	D72

Item	Description	Setting value
Latest error code	Stores the error code of the error in process.	D33
Latest warning code	Stores the warning code of the warning in process.	D36

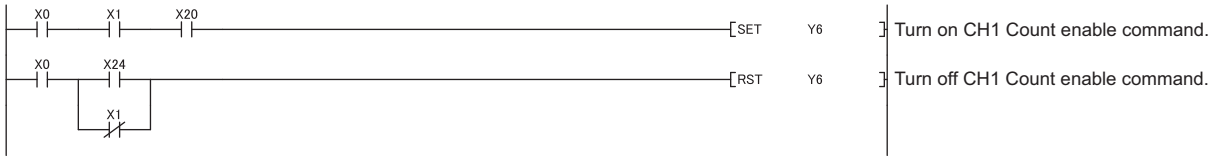
*1 Set only when using the coincidence output function.
*2 Set only when using the latch counter function (counter function selection).
*3 Set only when using the latch counter function by latch counter input terminal.
*4 Set only when using the sampling counter function or periodic pulse counter function.
*5 Set only when using the periodic pulse counter function.
*6 Set only under the frequency measurement mode.
*7 Set only under the rotation speed measurement mode.
*8 Set only under the pulse measurement mode.

(4) Program example under the normal mode

(a) Initial setting program

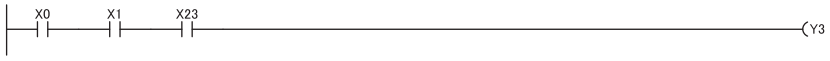
This program is not necessary in this program example since the initial setting is set with the parameter setting in Page 197, Section 7.1.1 (2).

(b) Common program



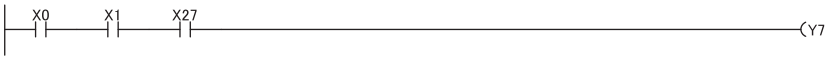
(c) Counter function program

• program for the preset/replace function



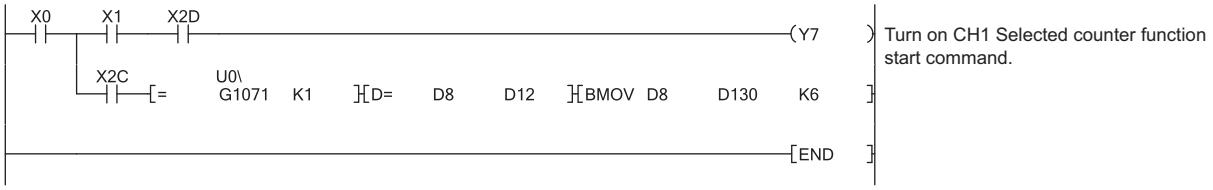
• program for the latch counter function by counter function selection

• program for the count disable function



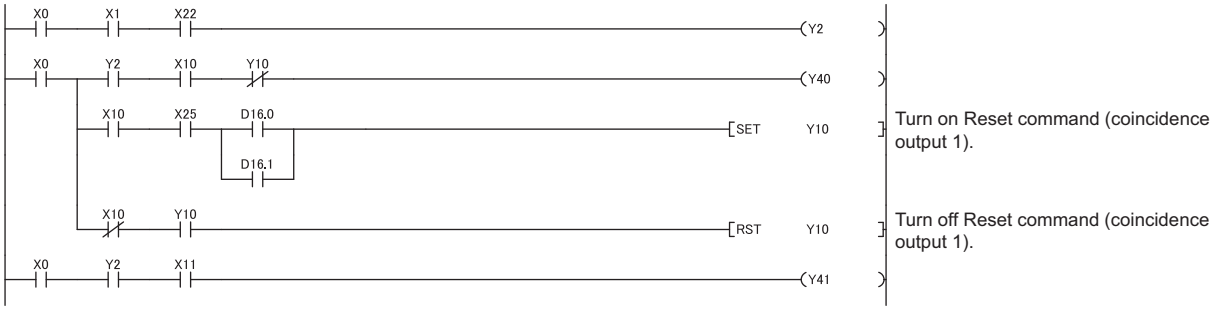
• program for the sampling counter function

• program for the periodic pulse counter function

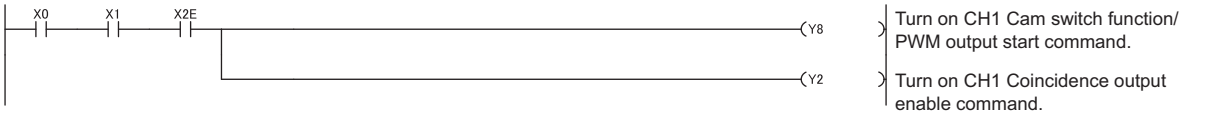


(d) Program for the comparison output function

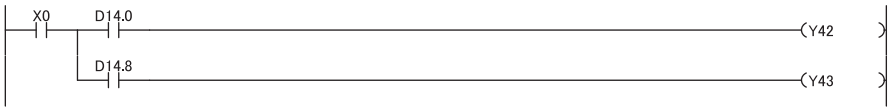
• program for the coincidence output function



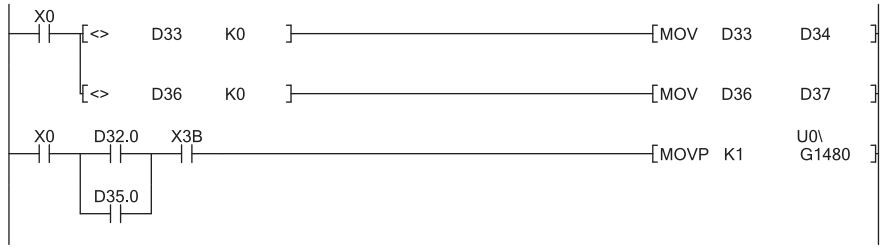
• program for the cam switch function



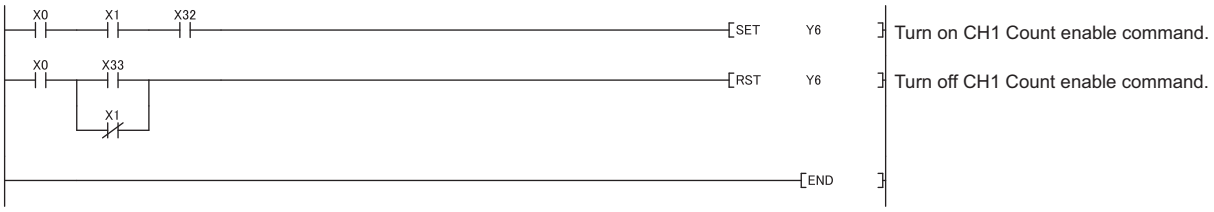
(e) Program for overflow/underflow detection processing



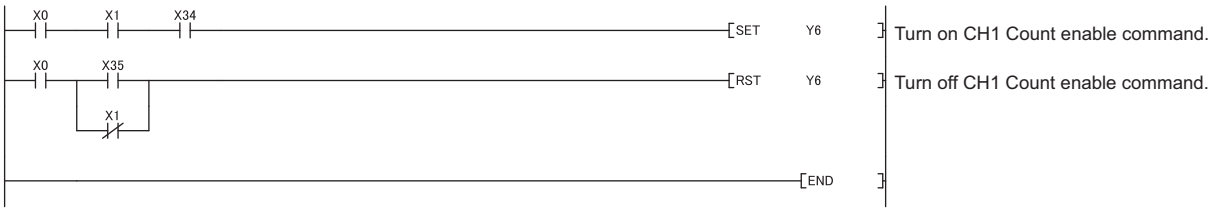
(f) Program for an error/warning reset



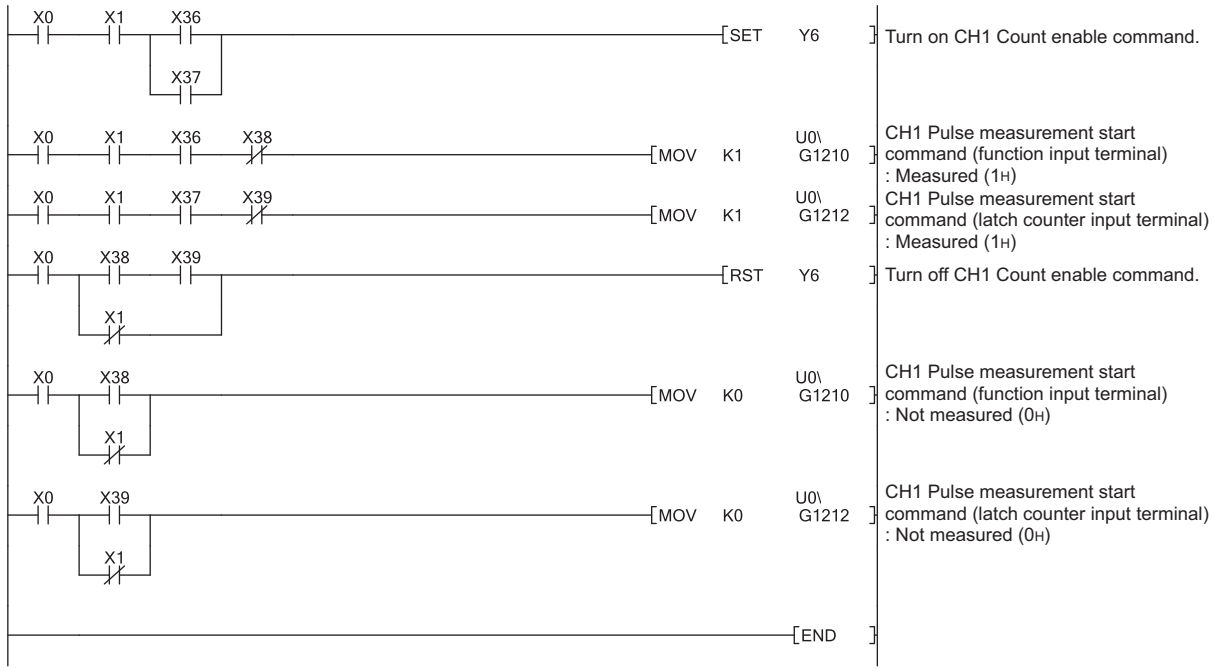
(5) Program example of the frequency measurement mode



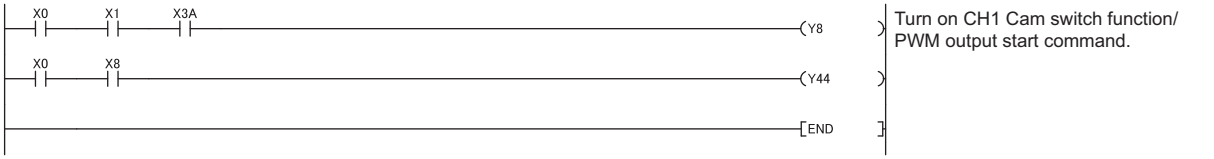
(6) Program example of the rotation speed measurement mode



(7) Program example of the pulse measurement mode



(8) Program example of the PWM output mode



7.1.2 Program example when the parameters of the intelligent function module are not used

(1) Devises used by the user

Device	Description
D0, D1	Present value
D2, D3	Latch count value (counter function selection)
D4, D5	Latch count value (latch counter input value)
D6, D7	Sampling count value
D8, D9	Periodic pulse count, difference value
D10, D11	Periodic pulse count, present value
D12, D13	Periodic pulse count value update check
D14	Overflow/underflow detection flag
D16	Counter value greater/smaller (coincidence output)
D32	Error status
D33	Error code latch[*1]
D34	Detected error code[*2]
D35	Warning status
D36	Warning code latch[*3]
D37	Detected warning code[*4]
D44, D45	Measured frequency value
D54, D55	Measured rotation speed value
D62, D63	Measured pulse value (function input terminal)
D72, D73	Measured pulse value (latch counter input terminal)
D500	PPCVRD1 System area
D501	PPCVRD1 Complete status
D502, D503	PPCVRD1 Periodic pulse count difference value
D504, D505	PPCVRD1 Periodic pulse count present value
M10	Initial setting complete signal
M1000	PPCVRD1 Complete device
M1001	Indicates the status when PPCVRD1 is completed

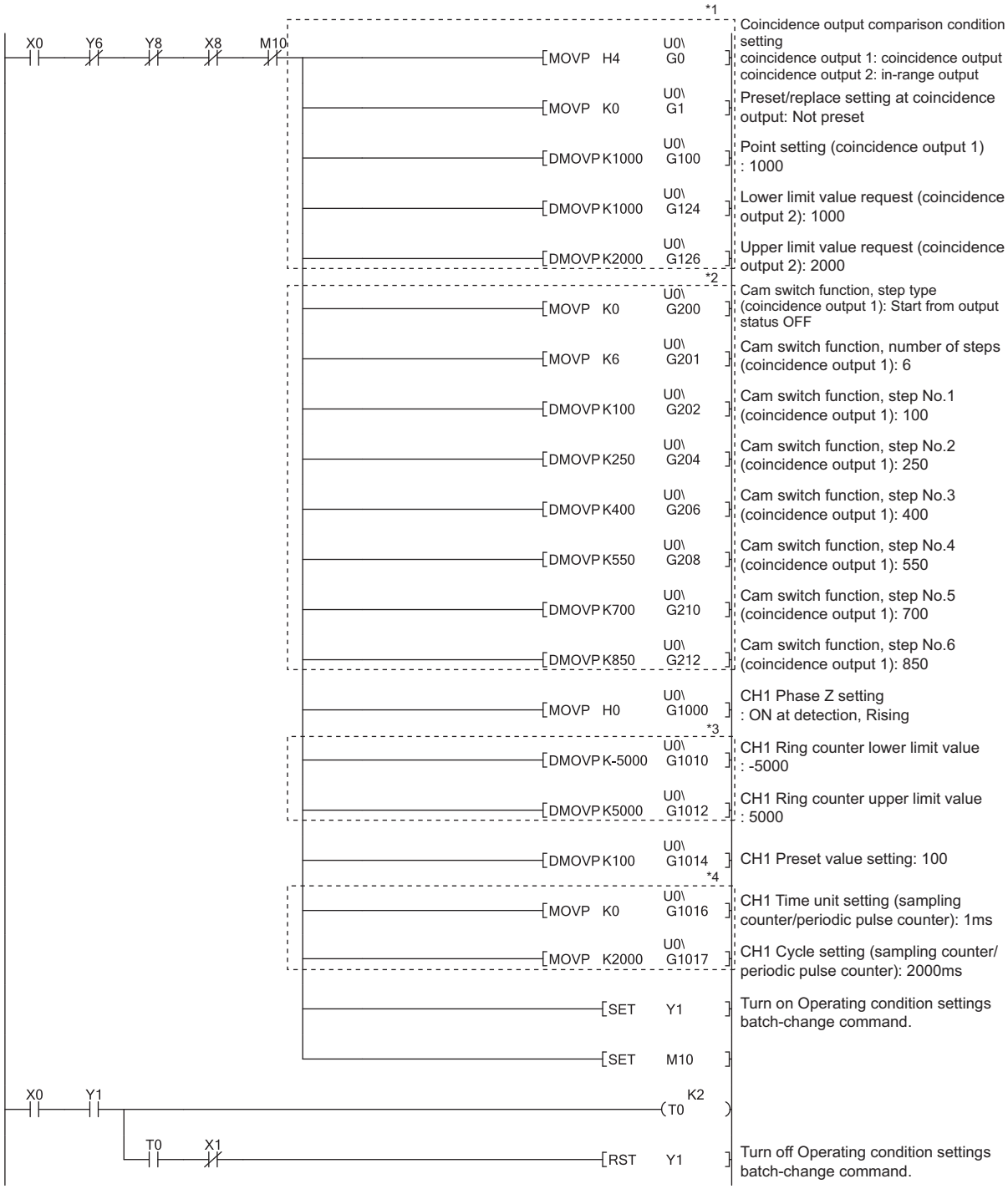
Device	Description	
X0	Module ready	QD65PD2(X/Y00 to X/Y1F)
X1	Operating condition settings batch-changed signal	
X8	CH1 Cam switch function/PWM output in process signal	
X10	Coincidence output 1 signal	
X11	Coincidence output 2 signal	
Y1	Operating condition settings batch-change command	
Y2	CH1 Coincidence output enable command	
Y3	CH1 Preset/replace command	
Y6	CH1 Count enable command	
Y7	CH1 Selected counter function start command	
Y8	CH1 Cam switch function/PWM output start command	
Y10	Reset command (coincidence output 1)	
X20	Count start signal	QX10(X20 to X2F)
X21	Present value read signal	
X22	Allow coincidence output signal	
X23	Preset/replace command signal	
X24	Count stop signal	
X25	Coincidence LED clear signal	
X26	Count disable start signal	
X27	Count disable stop signal	
X28	Latch count value read signal	
X29	Latch counter start command signal	
X2A	Sampling count value read signal	
X2B	Sampling counter start signal	
X2C	Periodic pulse count value read signal	
X2D	Periodic pulse counter start signal	
X2E	Cam switch start signal	
X30	Latch count value (latch counter input terminal) read signal	QX10(X30 to X3F)
X32	Frequency measurement start signal	
X33	Frequency measurement stop signal	
X34	Rotation speed measurement start signal	
X35	Rotation speed measurement stop signal	
X36	Pulse measurement (function input terminal) start signal	
X37	Pulse measurement (latch counter input terminal) start signal	
X38	Pulse measurement (function input terminal) stop signal	
X39	Pulse measurement (latch counter input terminal) stop signal	
X3A	PWM output start signal	
X3B	Error/warning reset command signal	

Device	Description	
Y40	LED signal for checking the coincidence output 1	QY10(Y40 to Y4F)
Y41	LED signal for checking the coincidence output 2	
Y42	LED signal for checking underflow occurrence	
Y43	LED signal for checking overflow occurrence	
Y44	LED signal for checking that PWM output is in process	
T0	For interlock with Operating condition settings batch-change command	

*1 Stores the error code of the error in process.
*2 Stores the latest error, and hold it also after an error reset.
*3 Stores the warning code of the warning in process.
*4 Stores the latest warning, and hold it also after an error reset.

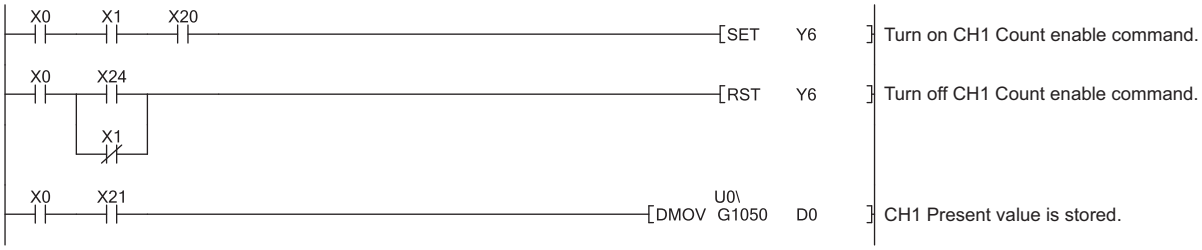
(2) Program example under the normal mode

(a) Initial setting program



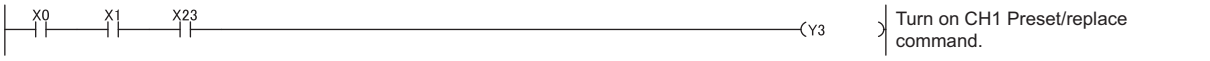
*1 Set only when using the coincidence output function.
*2 Set only when using the cam switch function.
*3 Set only when using the ring counter function.
*4 Set only when using the sampling counter function or periodic pulse counter function.

(b) Common program

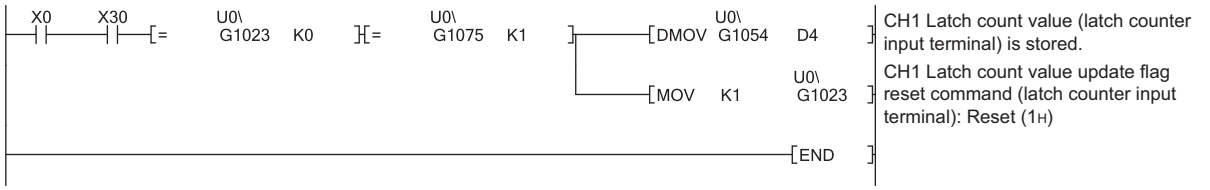


(c) Counter function program

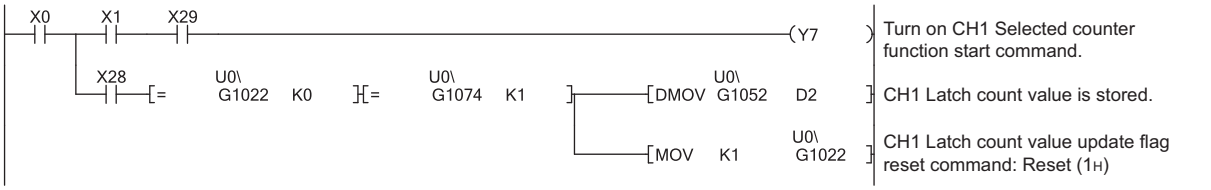
- program for the preset/replace function



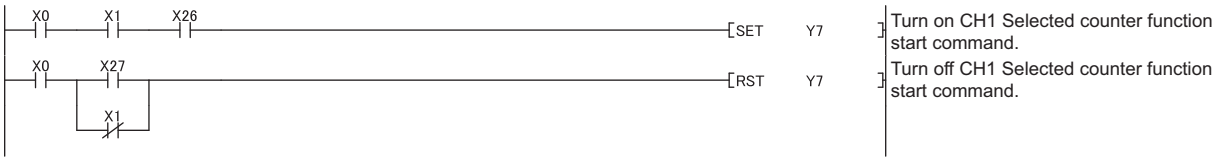
- program for the latch counter function by latch counter input terminal



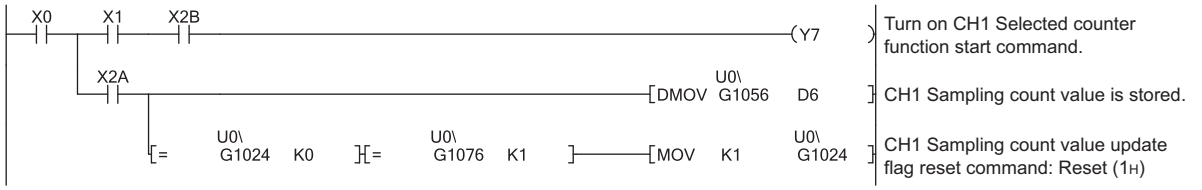
- program for the latch counter function by counter function selection



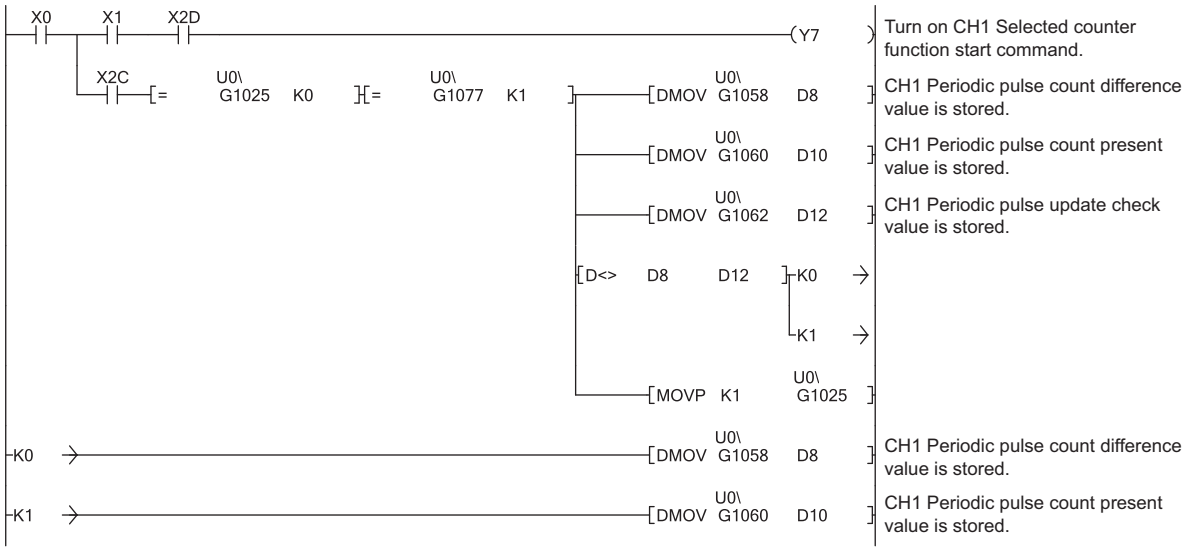
- program for the count disable function



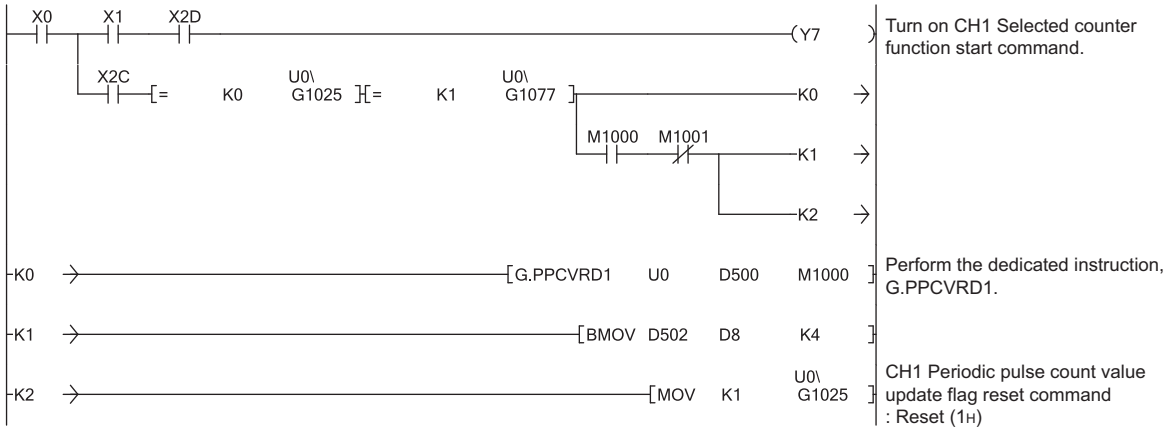
- program for the sampling counter function



• program for the periodic pulse counter function

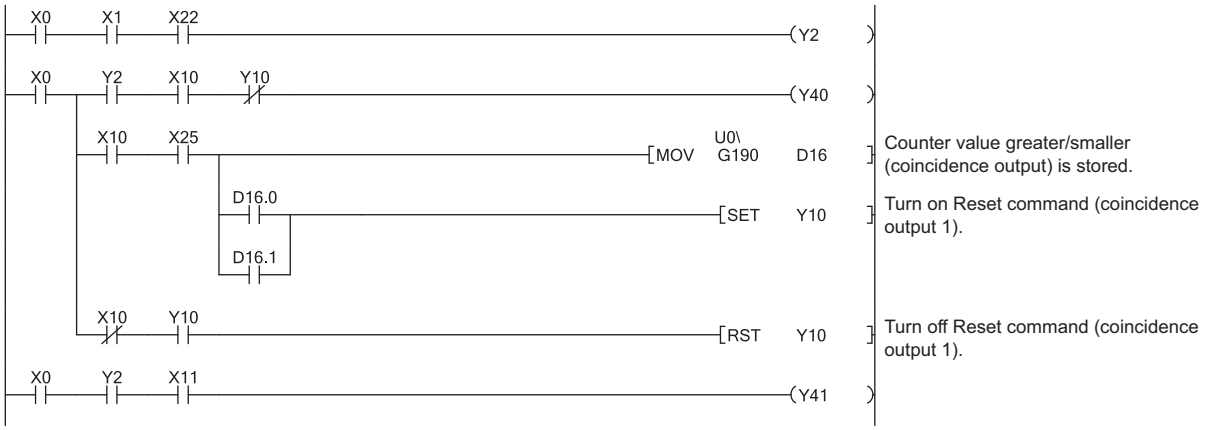


• program for the periodic pulse counter function using the dedicated instruction, PPCVRD1

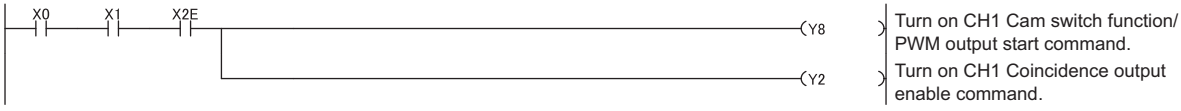


(d) Program for the comparison output function

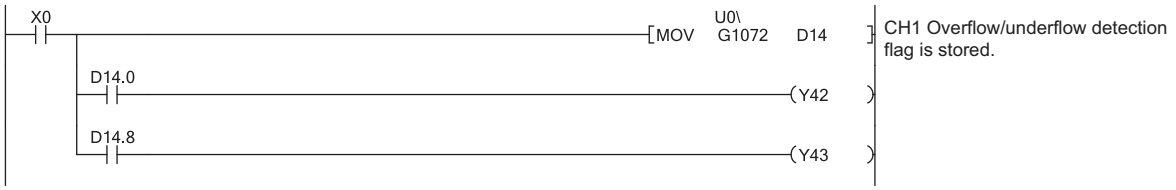
• program for the coincidence output function



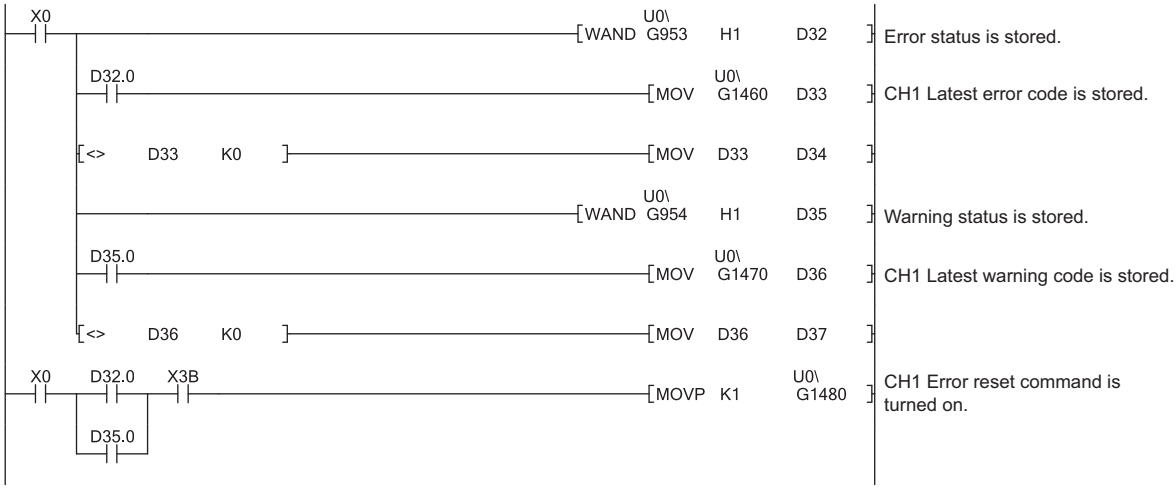
• program for the cam switch function



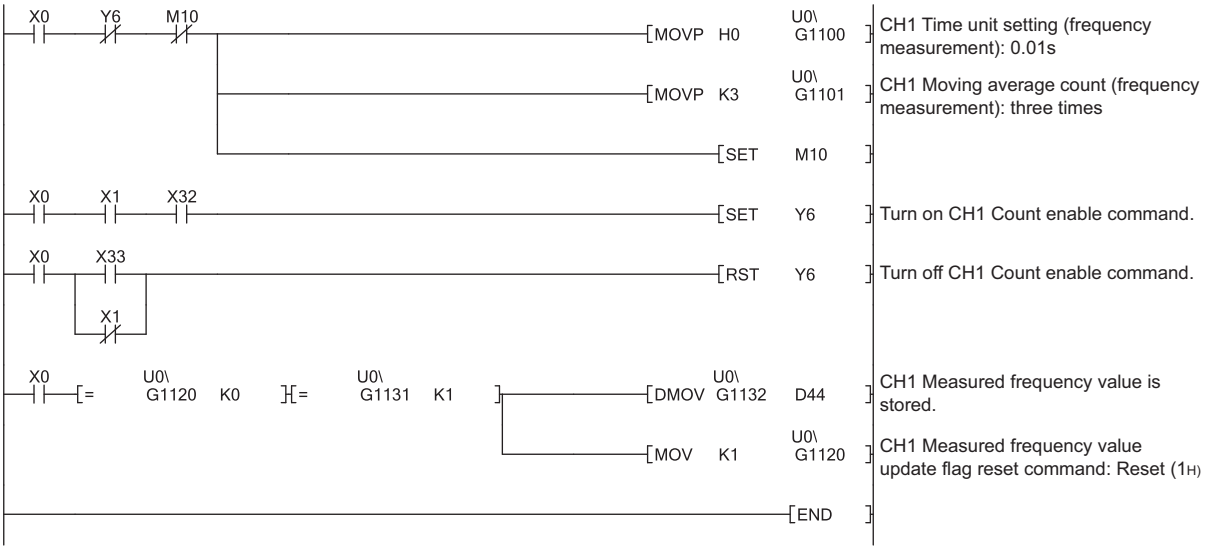
(e) Program for overflow/underflow detection processing



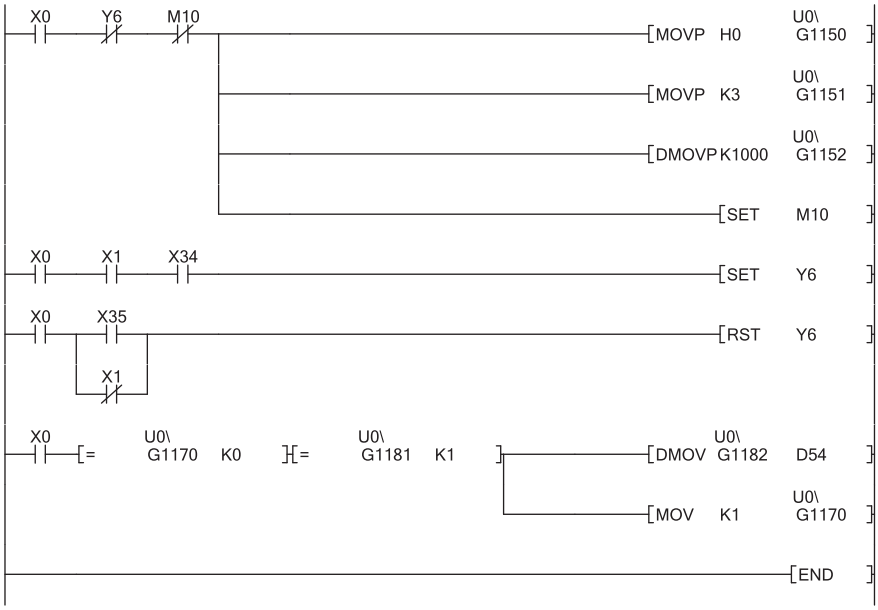
(f) Program for an error/warning reset



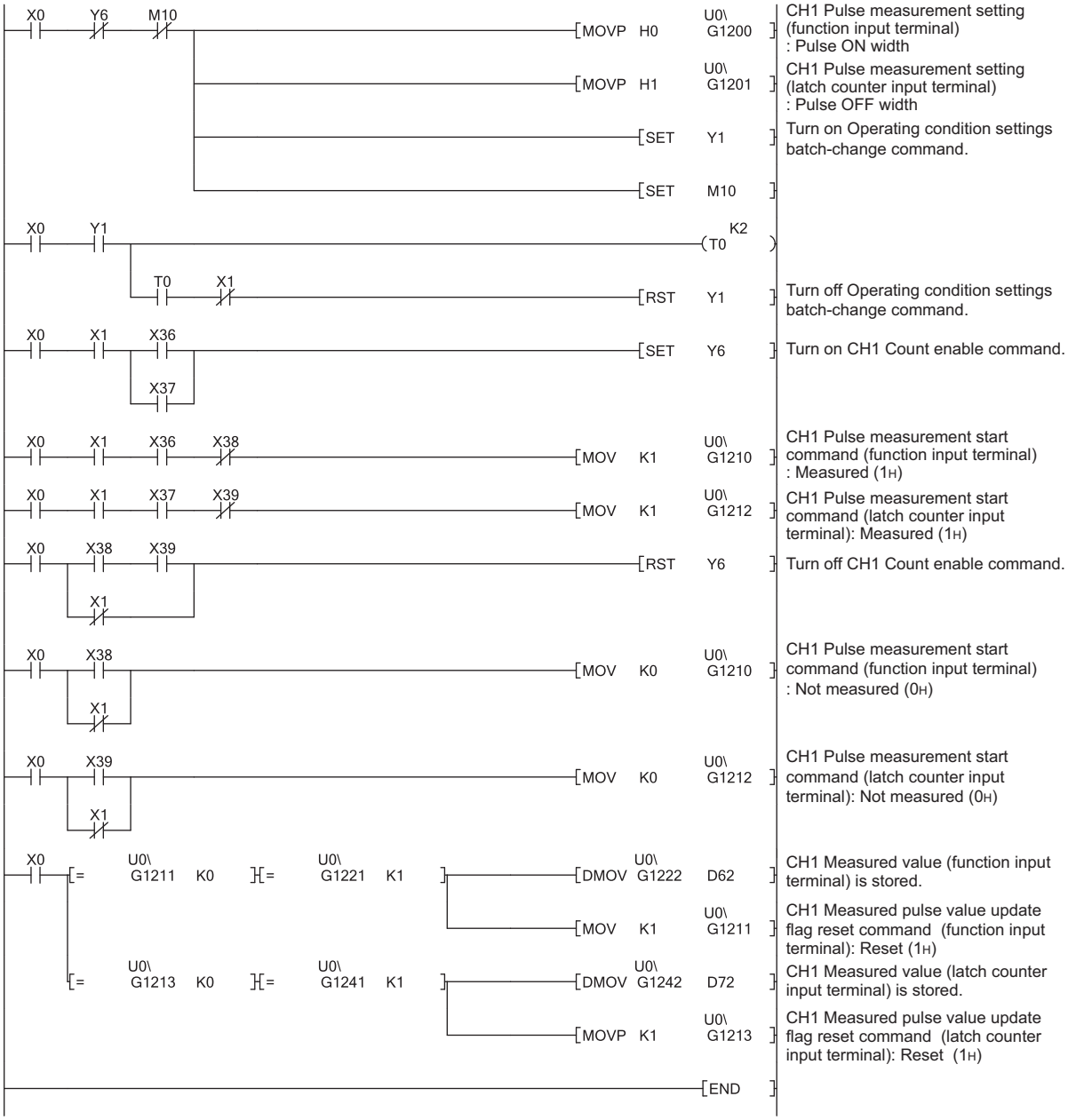
(3) Program example of the frequency measurement mode



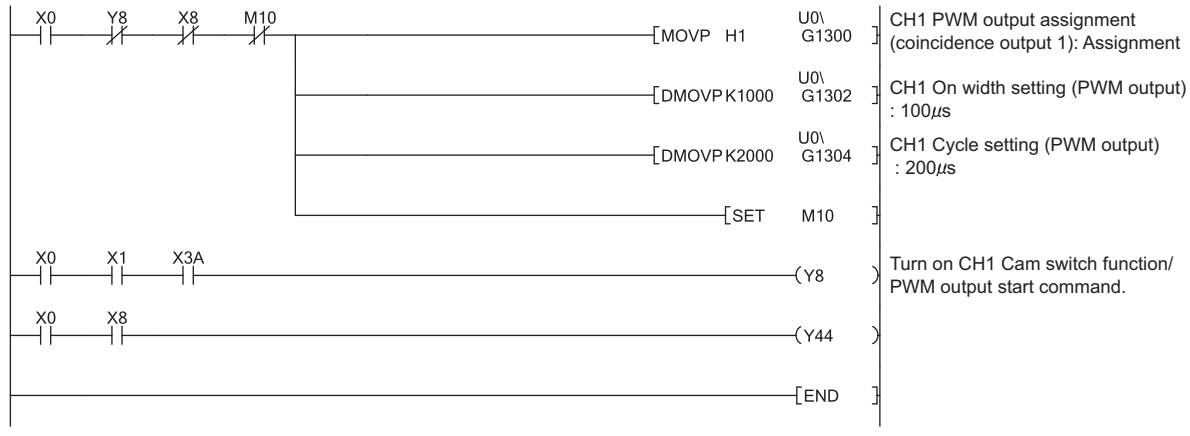
(4) Program example of the rotation speed measurement mode



(5) Program example of the pulse measurement mode



(6) Program example of the PWM output mode

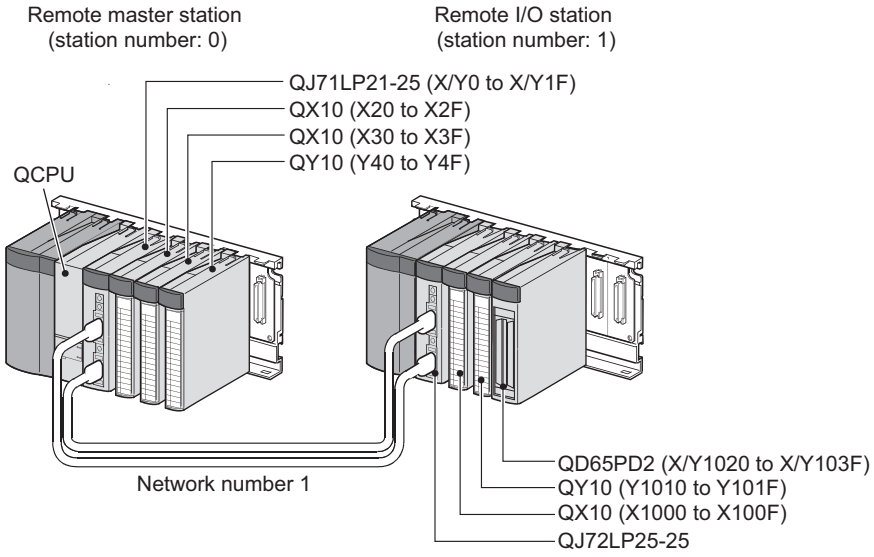


7.2 When Using the QD65PD2 in a MELSECNET/H Remote I/O net

This section describes program examples and the system configuration when using the QD65PD2 in a MELSECNET/H remote I/O net.
Note that the examples in this section use only CH1.

(1) System configuration

The following figure shows a system configuration example when using the QD65PD2 in a MELSECNET/H remote I/O net.



(2) Switch setting

For the switch setting, refer to the procedure in Page 216, Section 7.2 (6)

(3) Initial setting of the program

The initial setting of the program is the same as the program example used in a standard system configuration.

☞ Page 193, Section 7.1 (3)

(4) Configuration of program examples

Program configurations are described below.

(a) Program configuration under the normal mode

A program configuration under the normal mode is the same as the program example used in a standard system configuration.

☞ Page 194, Section 7.1 (4) (a)

(b) Program configuration under a mode other than the normal mode

Program examples under a mode other than the normal mode operate in a single-program example.

Point

If error or warning processing is required for a program example under a mode other than the normal mode, take the following measures.

- When using the parameters of the intelligent function module (mode other than the pulse measurement mode)*1
  - Add the common program of the normal mode shown in the same section to each program.
  - Add the error/warning reset program of the normal mode shown in the same section before the END instruction of each program.

*1 If error or warning processing is required for a program example under the pulse measurement mode, add the error/warning reset program of the normal mode shown in the same section before the MCR instruction.

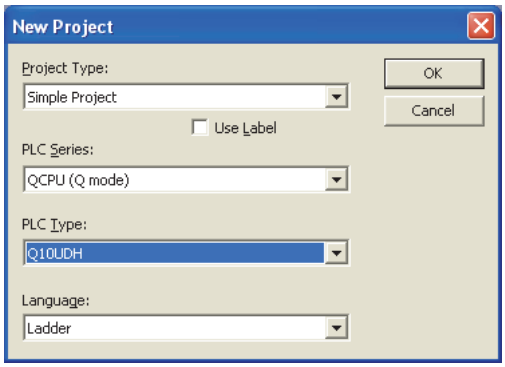
- When not using the parameters of the intelligent function module
  Add the error/warning reset program of the normal mode shown in the same section before the MCR instruction of each program.

(5) Master station setting

1. Create a project using GX Works2.

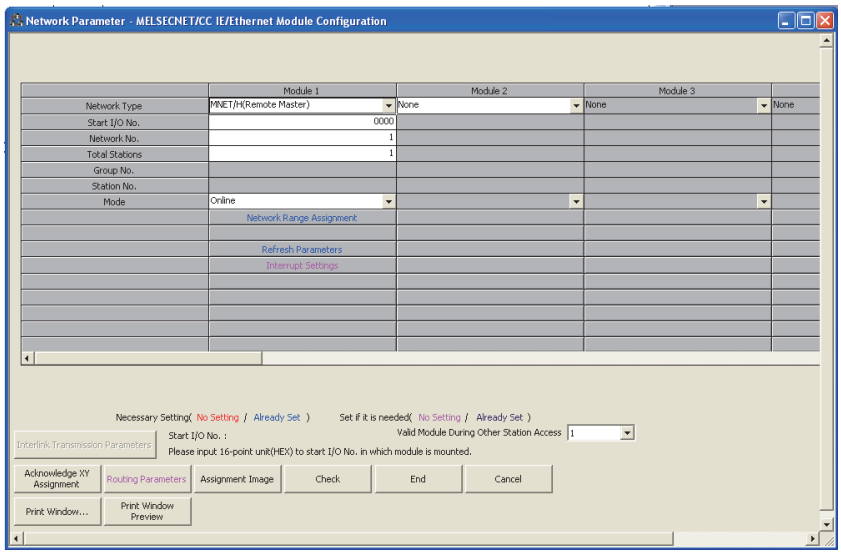
Select "QCPU(Q mode)" for "PLC Series" and the CPU module to be used for "PLC Type".

[Project]⇨ [New...]



2. Open the network parameter setting window and set parameters as shown below.

Project window⇨[Parameter]⇨[Network Parameter]⇨[Ethernet/CC IE/MELSECNET]



3. Open the network range assignment setting window and set parameters as shown below.

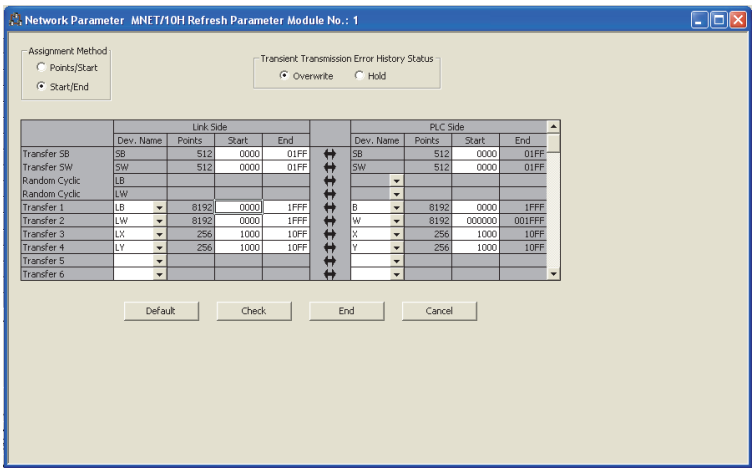
[Ethernet/CC IE/MELSECNET]⇨ Network Range Assignment button

Station No.	M Station -> R Station						M Station <- R Station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	1000	10FF	256	0000	00FF	256	1000	10FF	256	0000	00FF

Station No.	M Station -> R Station			M Station <- R Station			M Station -> R Station			M Station <- R Station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							160	0100	019F	160	0000	009F

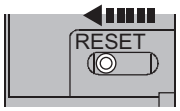
4. Open the refresh parameter setting window and set parameters as shown below.

[Ethernet/CC IE/MELSECNET]⇨ Refresh Parameters button



5. Write the set parameter data to the CPU module on the master station. Then reset the CPU module or turn the CPU module power off, then on.

[Online]⇨[Write to PLC...]



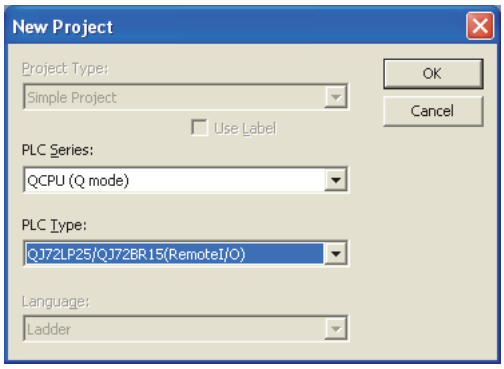
or Power OFF → ON

(6) Remote I/O station setting

1. Create a project using GX Works2.

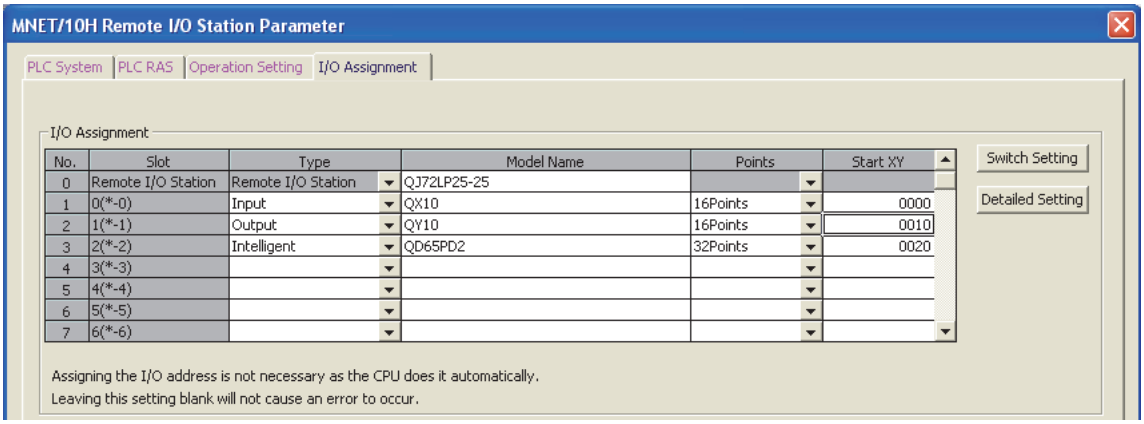
Select "QCPU(Q mode)" for "PLC Series" and "QJ72LP25/QJ72BR15(Remote I/O)" for "PLC Type".

[Project]⇨[New...]



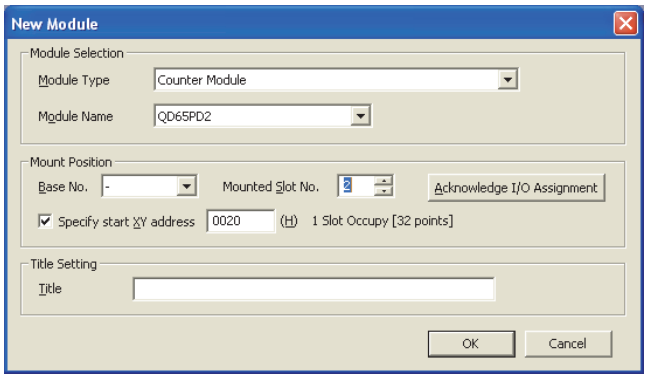
2. Open the PLC parameter setting dialog box and set parameters as shown below.

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



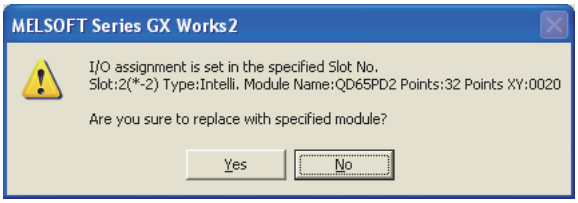
3. Add the QD65PD2 to the GX Works2 project.

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



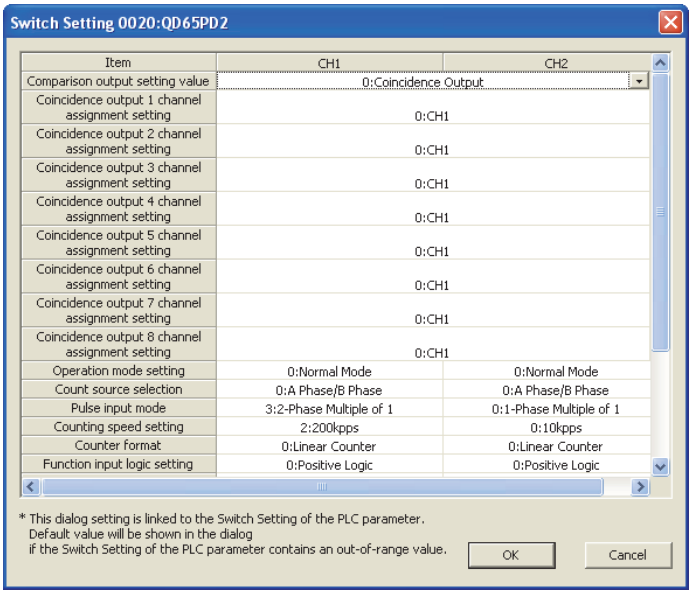
4. **The following dialog box will be displayed.**

Click the [Yes] button.



5. **Open the switch setting dialog box for the QD65PD2 and set parameters as shown below.**

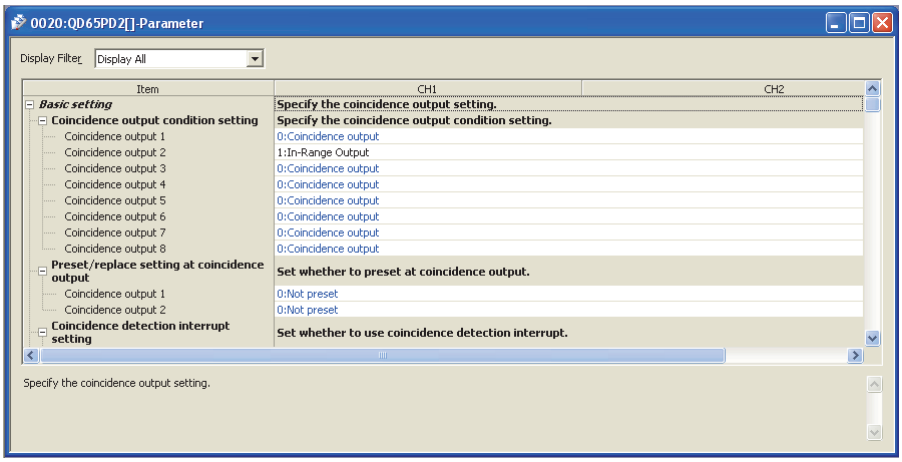
Project window⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Switch Setting]



Item	Setting value
Comparison output setting value	Set comparison output depending on the program example to be used.
Coincidence output 1 channel assignment setting	CH1
Coincidence output 2 channel assignment setting	CH1
Coincidence output 3 channel assignment setting	Setting is not necessary for the program examples in this chapter.
⋮	
Coincidence output 8 channel assignment setting	
Operation mode setting	Set operation mode depending on the program example to be used.
Count source selection	A Phase/B Phase
Pulse input mode	2-Phase Multiple of 1
Counting speed setting	200kpps
Counter format	Set a counter format depending on the program example to be used.
Function input logic setting	Positive Logic
Latch counter input logic setting	Positive Logic
Counter function selection	Set a counter function depending on the program example to be used.
Z phase input response time setting	Set any response time.
Function input response time setting	
Latch counter input response time setting	

6. **Open the initial setting window for the QD65PD2 and set parameters as shown below.**
When creating a program without using the parameters of the intelligent function module, skip this procedure.

Project window⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Parameter]



Item		Description	Setting value
Coincidence output condition setting	*1	Set the comparison condition when performing coincidence output.	—
Coincidence output 1		Set the comparison condition for the coincidence output 1.	0: Coincidence output
Coincidence output 2		Set the comparison condition for the coincidence output 2.	1: In-Range Output
Coincidence detection interrupt setting	*2	Set whether to perform an interrupt when the count value matches with a preset value or range.	—
Coincidence output 1		Set whether to perform an interrupt when the coincidence output 1 is detected with a matched value or range.	1: Use
Point setting (coincidence output 1)	*1	Set the value where the count value is to be compared with for the coincidence output 1.	1000
Lower limit value (coincidence output 2)		Set the lower limit value of the range where the count value is to be compared with for the coincidence output 2.	1000
Upper limit value (coincidence output 2)		Set the upper limit value of the range where the count value is to be compared with for the coincidence output 2.	2000

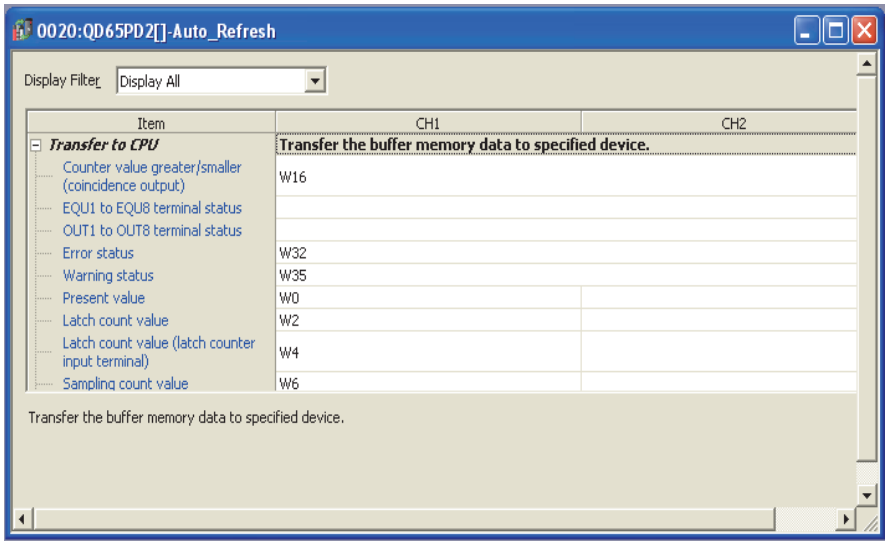
Item		Description	Setting value
Cam switch function (coincidence output 1)	*3	Set the cam switch for the coincidence output 1.	—
Step type		Set whether to start from output status ON or OFF for the coincidence output 1.	0: Start from output status OFF
Number of steps		Set the number of steps for the coincidence output 1.	6
Step No.1 setting		Set the value of the step No.1 where ON/OFF status of the coincidence output 1 is to be switched.	100
Step No.2 setting		Set the value of the step No.2 where ON/OFF status of the coincidence output 1 is to be switched.	250
Step No.3 setting		Set the value of the step No.3 where ON/OFF status of the coincidence output 1 is to be switched.	400
Step No.4 setting		Set the value of the step No.4 where ON/OFF status of the coincidence output 1 is to be switched.	550
Step No.5 setting		Set the value of the step No.5 where ON/OFF status of the coincidence output 1 is to be switched.	700
Step No.6 setting		Set the value of the step No.6 where ON/OFF status of the coincidence output 1 is to be switched.	850
Periodic interrupt setting	*4	Set whether to perform an interrupt after a cycle passed.	1: Use
Z phase setting		Configure settings correspond to the preset/replace function by the phase Z input terminals (Z1, Z2).	—
Z phase (Preset) trigger setting		Set the trigger to which the preset/replace function is performed by the phase Z input terminals (Z1, Z2).	0: Rising
External preset/replace (Z phase) request detection setting		Set whether CH1 External preset/replace (Z Phase) request detection (X05) is turned ON when the preset/replace function is performed by the phase Z input terminals (Z1, Z2).	0: ON at detection
Ring counter lower limit value	*5	Set the lower limit value of the range for the ring counter format.	-5000
Ring counter upper limit value		Set the upper limit value of the range for the ring counter format.	5000
Preset value		Set the value to preset and replaced with the count value.	100
Time unit setting (sampling counter/periodic pulse counter)	*6	Set the time unit of the sampling time for the sampling counter function, or of the cycle time for the periodic pulse counter function.	0: 1ms
Cycle setting (sampling counter/periodic pulse counter)		Set the sampling time for the sampling counter function, or the cycle time for the periodic pulse counter function.	2000
Time unit setting (frequency measurement)	*7	Set the time unit for frequency measurement.	0: 0.01s
Moving average count (frequency measurement)		Set the moving average count of frequency measurement.	3
Time unit setting (rotation speed measurement)	*8	Se the time unit for rotation speed measurement.	0: 0.01s
Moving average count (rotation speed measurement)		Set the moving average time of rotation speed measurement.	3
Number of pulses per rotation		Set the number of pulses per rotation.	1000
Pulse measurement setting (function input terminal)	*9	Set the pulse measurement target of the function input terminals (FUNC1, FUNC2).	Pulse ON Width
Pulse measurement setting (latch counter input terminal)		Set the pulse measurement target of the latch counter input terminals (LATCH1, LATCH2).	Pulse ON Width

Item		Description	Setting value
PWM output assignment	*10	Select any from coincidence output 1 to 8 to output the PWM wave form.	—
PWM output assignment (coincidence output 1)		Set whether to assign the coincidence output 1 to PWM output.	1: Assignment
ON width setting (PWM output)		Set the ON time of output pulses for PWM output.	100.0us
Cycle setting (PWM output)		Set the cycle time of output pulses for PWM output.	200.0us

*1 Set only when using the coincidence output function.
*2 Set only when using the coincidence detection interrupt function.
*3 Set only when using the cam switch function.
*4 Set only when using the periodic interrupt function.
*5 Set only when using the ring counter function.
*6 Set only when using the sampling counter function or periodic pulse counter function.
*7 Set only under the frequency measurement mode.
*8 Set only under the rotation speed measurement mode.
*9 Set only under the pulse measurement mode.
*10 Set only under the PWM output mode.

7. Open the auto refresh window and set parameters as shown below.
When creating a program without using the parameters of the intelligent function module, skip this procedure.

Project window⇨[Intelligent Function Module]⇨[QD65PD2]⇨[Auto_Refresh]

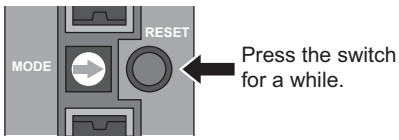


Item		Description	Setting value
Counter value greater/smaller (coincidence output)	*1	stores the relationship (greater or smaller) between the point setting of coincidence output 1 to 8 and the present value.	W16
Error status		Set the device that stores the error status of each channel.	W32
Warning status		Set the device that stores the warning status of each channel.	W35
Present value		Set the device that stores the present value.	W0
Latch count value	*2	Set the device that stores the latch count value when the latch counter function (counter function selection) is used.	W2
Latch count value (latch counter input terminal)	*3	Set the device that stores the latch count value by the latch counter input terminals (LATCH1, LATCH2).	W4
Sampling count value	*4	Set the device that stores the sampling count value when the sampling counter function is used.	W6
Periodic pulse count, difference value	*5	Set the device that stores the periodic pulse count difference value when the periodic pulse counter function is used.	W8
Periodic pulse count, present value		Set the device that stores the periodic pulse count present value when the periodic pulse counter function is used.	W10
Periodic pulse count value update check		Set the device that stores the periodic pulse count update check value when the periodic pulse counter function is used.	W12
Overflow/underflow detection flag		Set the device that stores the detected result of overflow/underflow error when the linear counter function is used.	W14
Measured frequency value	*6	Set the device that stores the periodic pulse count value when the periodic pulse counter function is used.	W44
Measured rotation speed value	*7	Set the device that stores the measured value of the rotation speed when the rotation speed measurement function is used.	W54

Item		Description	Setting value
Measured pulse value (function input terminal)	*8	Set the device to store the measured pulse value of the function input terminal when a pulse measurement function is used.	W62
Measured pulse value (latch counter input terminal)		Set the device to store the measured pulse value of the latch counter input terminal when a pulse measurement function is used.	W72
Latest error code		Stores the error code of the error in process.	W33
Latest warning code		Stores the warning code of the warning in process.	W36

*1 Set only when using the coincidence output function.
*2 Set only when using the latch counter function (counter function selection).
*3 Set only when using the latch counter function by latch counter input terminal.
*4 Set only when using the sampling counter function or periodic pulse counter function.
*5 Set only when using the periodic pulse counter function.
*6 Set only under the frequency measurement mode.
*7 Set only under the rotation speed measurement mode.
*8 Set only under the pulse measurement mode.

8. Write the set parameter data to the remote I/O module and reset the remote I/O module.



7.2.1 Program example when the parameters of the intelligent function module are used

(1) Devices used by the user

Device	Description	
W0, W1	Present value	Devices in which data is written by auto refresh
W2, W3	Latch count value (counter function selection)	
W4, W5	Latch count value (latch counter input terminal)	
W6, W7	Sampling count value	
W8, W9	Periodic pulse count, difference value	
W10, W11	Periodic pulse count, present value	
W12, W13	Periodic pulse count value update check	
W14	Overflow/underflow detection flag	
W16	Counter value greater/smaller (coincidence output)	
W32	Error status	
W33	Error code latch (latest error code)*1	
W35	Warning status	
W36	Warning code latch (Latest warning code)*3	
W44, W45	Measured frequency value	
W54, W55	Measured rotation speed value	
W62, W63	Measured pulse value (function input terminal)	
W72, W73	Measured pulse value (latch counter input terminal)	
D34	Detected error code*2	
D37	Detected warning code*4	
D38	Error/warning reset	
D61	Pulse measurement (function input terminal) start command	
D71	Pulse measurement (latch counter input terminal) start command	
D131, D132	Stores the periodic pulse count difference value	
D133, D134	Stores the periodic pulse count present value	
D135, D136	Stores the periodic pulse count update check value	
M100	Device for checking the master module status (for performing the MC/MCR instruction)	

Device	Description	
X1020	Module ready	QD65PD2(X/Y1020 to X/Y103F)
X1021	Operating condition settings batch-changed signal	
X1028	CH1 Cam switch function execution/PWM output signal	
X1030	Coincidence output 1 signal	
X1031	Coincidence output 2 signal	
Y1022	CH1 Coincidence output enable command	
Y1023	Preset/replace command	
Y1026	CH1 Count enable command	
Y1027	CH1 Selected counter function start command	
Y1028	CH1 Cam switch function/PWM output start command	
Y1030	Reset command (coincidence output 1)	
X20	Count start signal	QX10(X20 to X2F)
X22	Allow coincidence output signal	
X23	Preset/replace command signal	
X24	Count stop signal	
X25	Coincidence LED clear signal	
X26	Count disable start signal	
X27	Count disable stop signal	
X29	Latch counter start signal	
X2B	Sampling counter start signal	
X2D	Periodic pulse counter start signal	
X2E	Cam switch start signal	
X32	Frequency measurement start signal	QX10(X30 to X3F)
X33	Frequency measurement stop signal	
X34	Rotation speed measurement start signal	
X35	Rotation speed measurement stop signal	
X36	Pulse measurement (function input terminal) start signal	
X37	Pulse measurement (latch counter input terminal) start signal	
X38	Pulse measurement (function input terminal) stop signal	
X39	Pulse measurement (latch counter input terminal) stop signal	
X3A	PWM output start signal	
X3B	Error/warning reset command signal	
Y40	LED signal for checking the coincidence output 1	QY10(Y40 to Y4F)
Y41	LED signal for checking the coincidence output 2	
Y42	LED signal for checking underflow occurrence	
Y43	LED signal for checking overflow occurrence	
Y44	LED signal for checking that PWM output is in process	

Device	Description
M492, M493	Stores that the Z(P).REMTO instruction is complete or the result of the instruction
M512, M513	
M550, M551	
SB20	Network module status
SB47	Baton pass status (own station)
SB49	Data link status (own station)
SW70	Baton pass status of each station
SW74	Cyclic transmission status of each station
SW78	Parameter communication status of each station
T2 to T5, T100 to T104	For interlock between own station and other station

*1 Stores the error code of the error in process.
*2 Stores the latest error, and hold it also after an error reset.
*3 Stores the warning code of the warning in process.
*4 Stores the latest warning, and hold it also after an error reset.

(2) Parameter setting and auto refresh setting

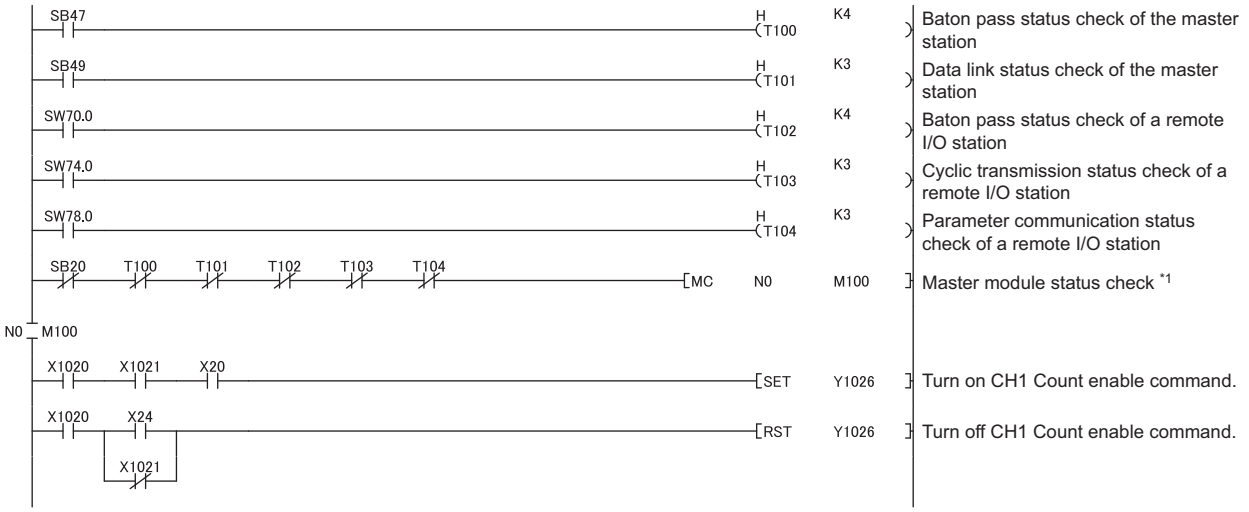
For parameter setting and auto refresh setting, refer to the procedure in Page 216, Section 7.2 (6).

(3) Program example under the normal mode

(a) Initial setting program

This program is not necessary in this program example since the initial setting is set in Page 216, Section 7.2 (6).

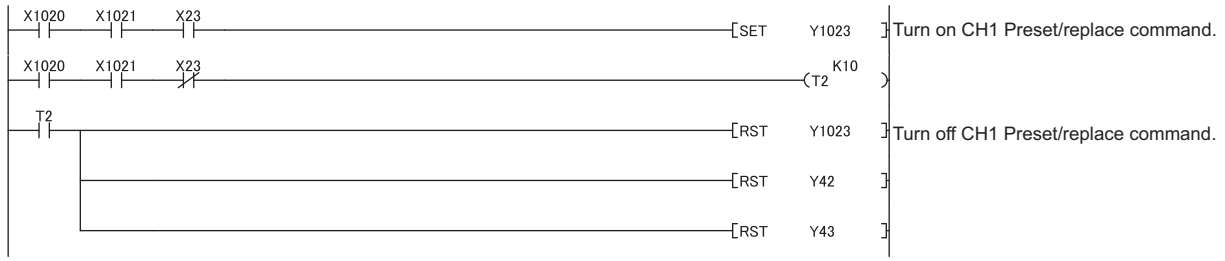
(b) Common program



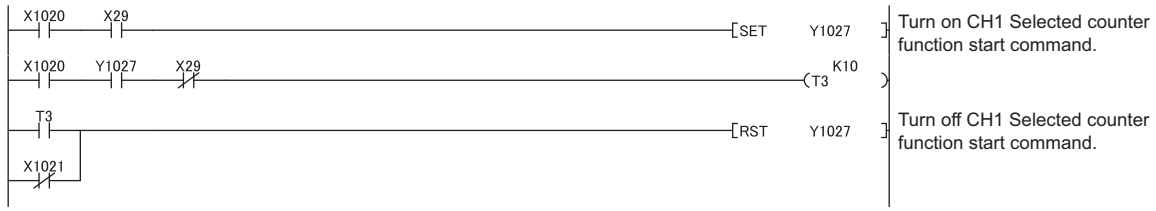
*1 Add the following MCR instruction at the end of the program.

(c) Counter function program

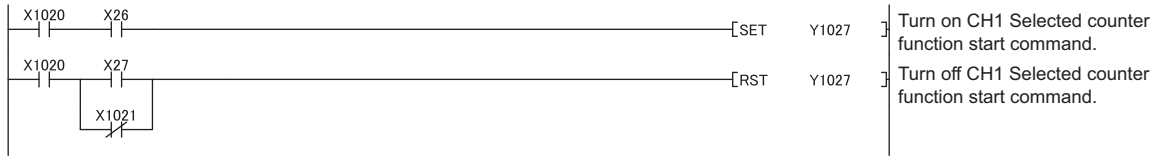
- program for the preset/replace function



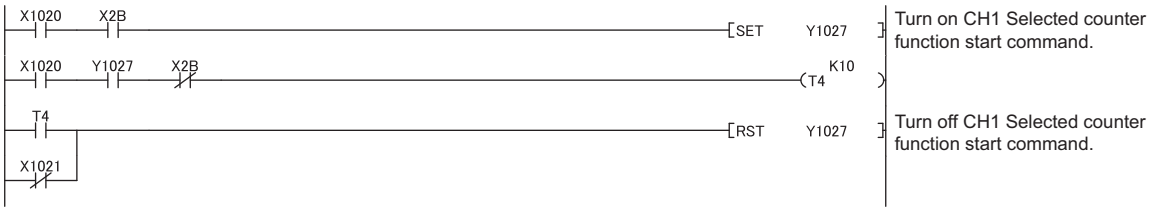
- program for the latch counter function by counter function selection



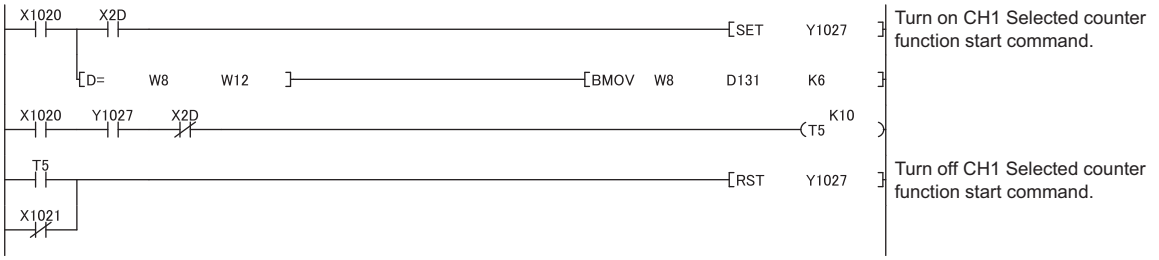
- program for the count disable function



• program for the sampling counter function

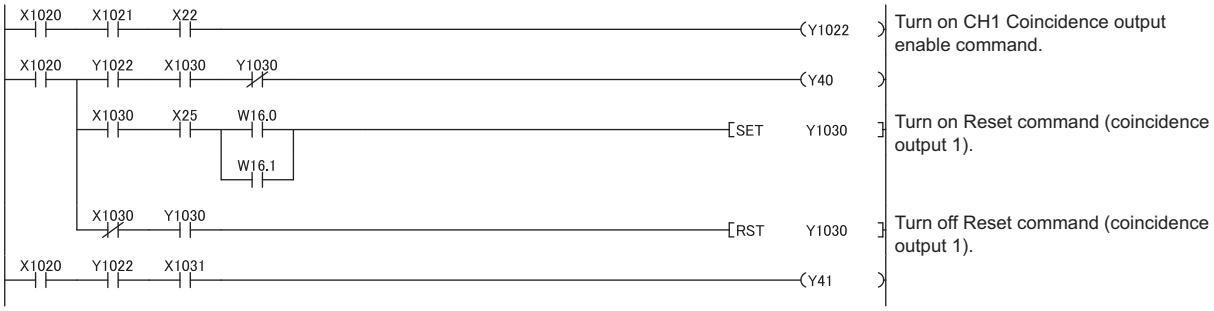


• program for the periodic pulse counter function

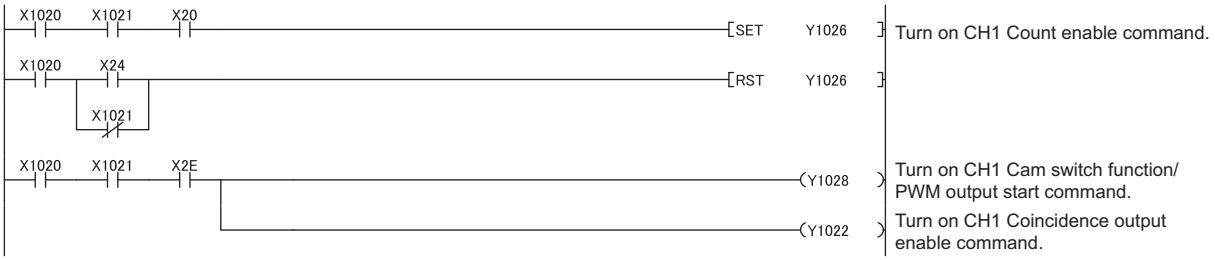


(d) Program for the comparison output function

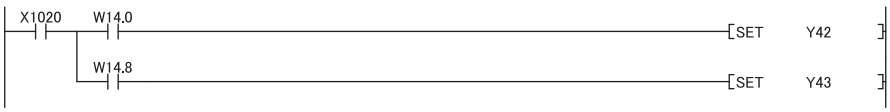
• program for the coincidence output function



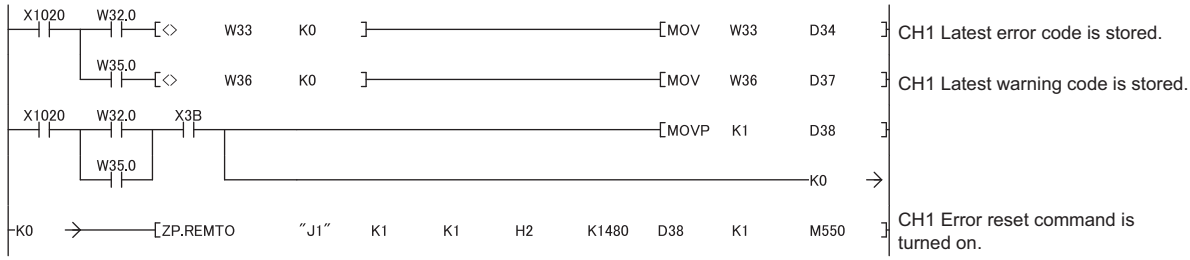
• program for the cam switch function



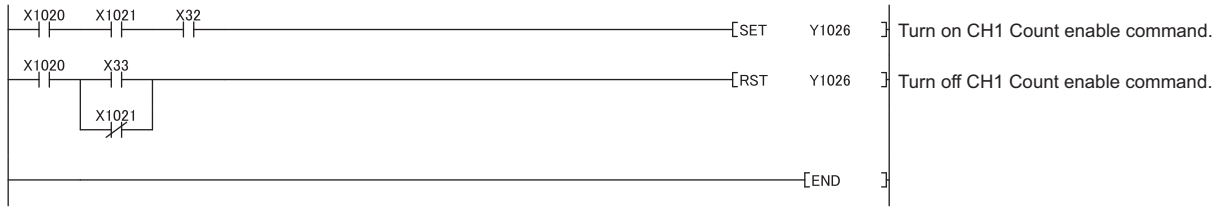
(e) Program for overflow/underflow detection processing



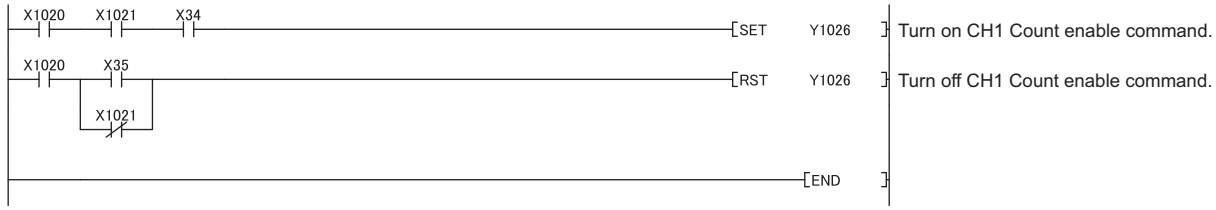
(f) Program for an error/warning reset



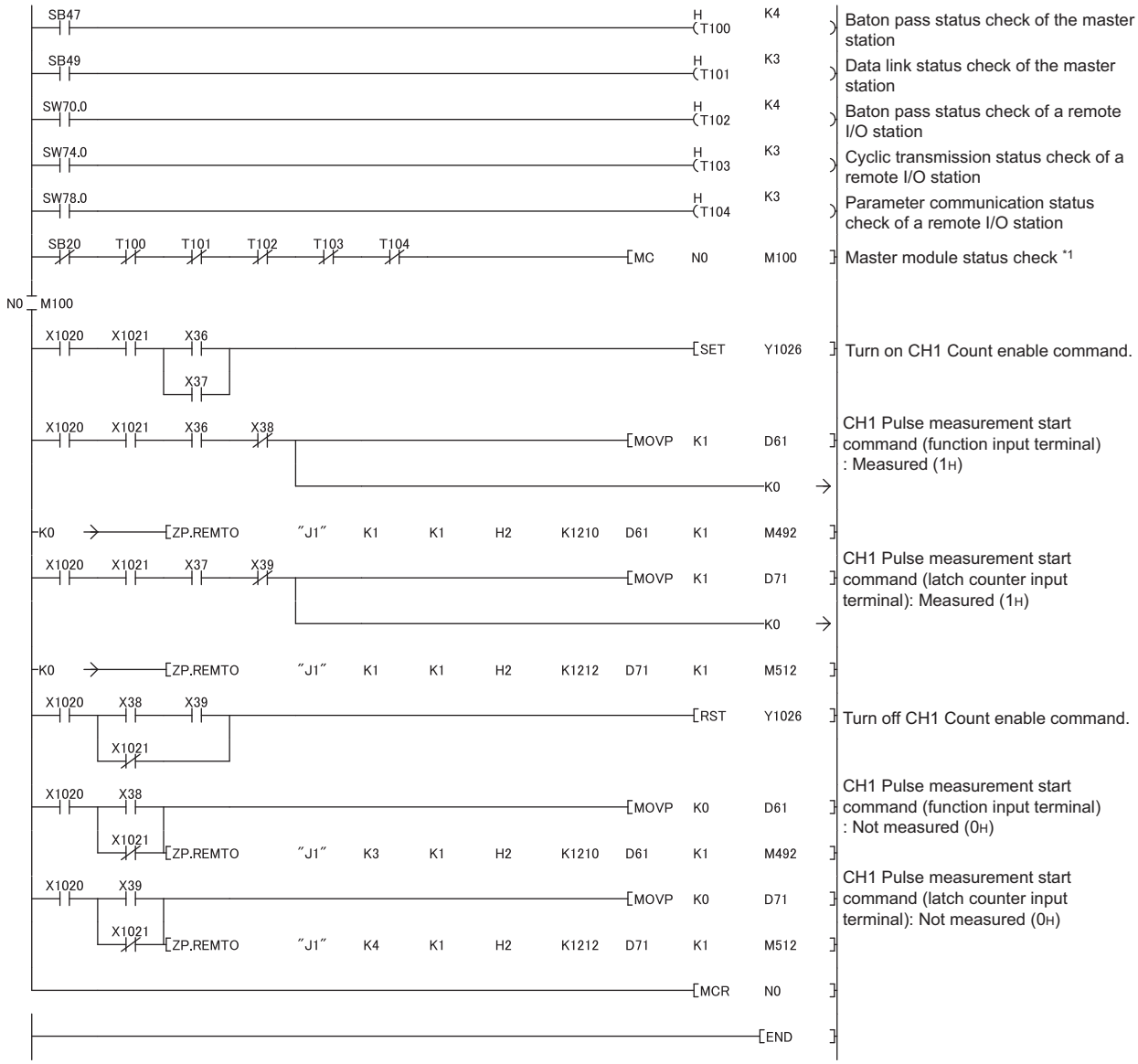
(4) Program example of the frequency measurement mode



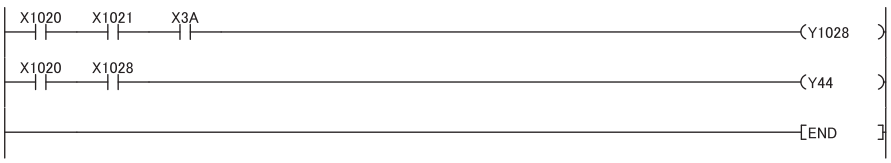
(5) Program example of the rotation speed measurement mode



(6) Program example of the pulse measurement mode



(7) Program example of the PWM output mode



7.2.2 Program example when the parameters of the intelligent function module are not used

(1) Devices used by the user

Device	Description
D0, D1	Present value
D2, D3	Latch count value (counter function selection)
D4, D5	Latch count value (latch counter input value)
D6, D7	Sampling count value
D8, D9	Periodic pulse count, difference value
D10, D11	Periodic pulse count value
D12, D13	Periodic pulse count value update check
D14	Overflow/underflow detection flag
D16	Counter value greater/smaller (coincidence output)
D18	Latch count value update flag
D19	Latch count value update flag reset command
D20	Latch count value update flag (latch counter input terminal)
D21	Latch count value update flag reset command (latch counter input terminal)
D22	Sampling count value update flag
D23	Sampling count value update flag reset command
D24	Periodic pulse count value update flag
D25	Periodic pulse count value update flag reset command
D30	Device used for checking the error status
D32	Error status
D33	Error code latch[*1]
D34	Detected error code[*2]
D31	Device used for checking the warning status
D35	Warning status
D36	Warning code latch[*3]
D37	Detected warning code[*4]
D38	Error/warning reset
D44, D45	Measured frequency value
D46	Measured frequency value update flag
D47	Measured frequency value update flag reset command
D54, D55	Measured rotation speed value
D56	Measured rotation speed value update flag
D57	Measured rotation speed value update flag reset command
D61	Pulse measurement (function input terminal) start command
D62, D63	Measured pulse value (function input terminal)
D64	Measured pulse value update flag (function input terminal)
D65	Measured pulse value update flag reset command (function input terminal)
D71	Pulse measurement (latch counter input terminal) start command
D72, D73	Measured pulse value (latch counter input terminal)
D74	Measured pulse value update flag (latch counter input terminal)
D75	Measured pulse value update flag reset command (latch counter input terminal)
D300, D301	Device used for transition of processing

Device	Description	
X20	Count start signal	QX10(X20 to X2F)
X21	Present value read signal	
X22	Allow coincidence output signal	
X23	Preset/replace command signal	
X24	Count stop signal	
X25	Coincidence LED clear signal	
X26	Count disable start signal	
X27	Count disable stop signal	
X28	Latch count value read signal	
X29	Latch counter start command signal	
X2A	Sampling count value read signal	
X2B	Sampling counter start signal	
X2C	Periodic pulse count value read signal	
X2D	Periodic pulse counter start signal	
X2E	Cam switch start signal	
X30	Latch count value (latch counter input terminal) read signal	QX10(X30 to X3F)
X32	Frequency measurement start signal	
X33	Frequency measurement stop signal	
X34	Rotation speed measurement start signal	
X35	Rotation speed measurement stop signal	
X36	Pulse measurement (function input terminal) start signal	
X37	Pulse measurement (latch counter input terminal) start signal	
X38	Pulse measurement (function input terminal) stop signal	
X39	Pulse measurement (latch counter input terminal) stop signal	
X3A	PWM output start signal	
X3B	Error/warning reset command signal	
Y40	LED signal for checking the coincidence output 1	QY10(Y40 to Y4F)
Y41	LED signal for checking the coincidence output 2	
Y42	LED signal for checking underflow occurrence	
Y43	LED signal for checking overflow occurrence	
Y44	LED signal for checking that PWM output is in process	

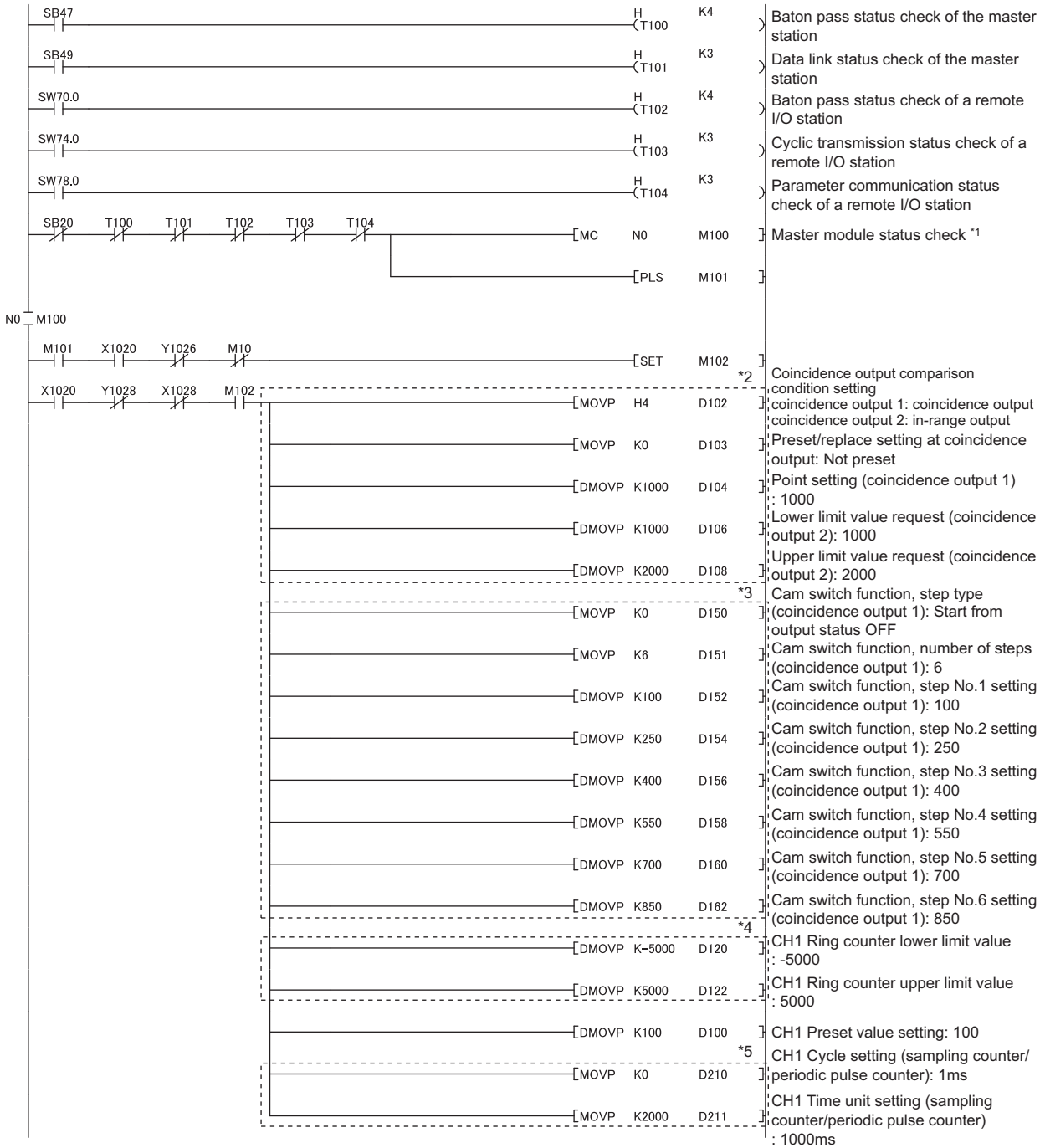
Device	Description	
X1020	Module ready	QD65PD2(X/Y1020 to X/Y103F)
X1021	Operating condition settings batch-changed signal	
X1028	CH1 Cam switch function/PWM output in process signal	
X1030	Coincidence output 1 signal	
X1031	Coincidence output 2 signal	
Y1021	Operating condition settings batch-change command	
Y1022	CH1 Coincidence output enable command	
Y1023	CH1 Preset/replace command	
Y1026	CH1 Count enable command	
Y1027	CH1 Selected counter function start command	
Y1028	CH1 Cam switch function/PWM output start command	
Y1030	Reset command (coincidence output 1)	
M10	Initial setting complete signal	
M100	Device for checking the master module status (for performing the MC/MCR instruction)	
M101 to M103	Initial setting complete flag	
M138	Error status acquired	
M139	Warning status acquired	
M200, M201	Stores that the Z(P).REMTO instruction is complete or the result of the instruction	
M204, M205		
M208 to M213		
M216, M217		
M220, M221		
M230, M231		
M234, M235		
M238, M239		
M242, M243		
M400, M401		
M450, M451		
M452, M453		
M470, M471		
M472, M473		
M490, M491		
M492, M493		
M494, M495		
M510, M511		
M512, M513		
M514, M515		
M530 to M533		
M550, M551		

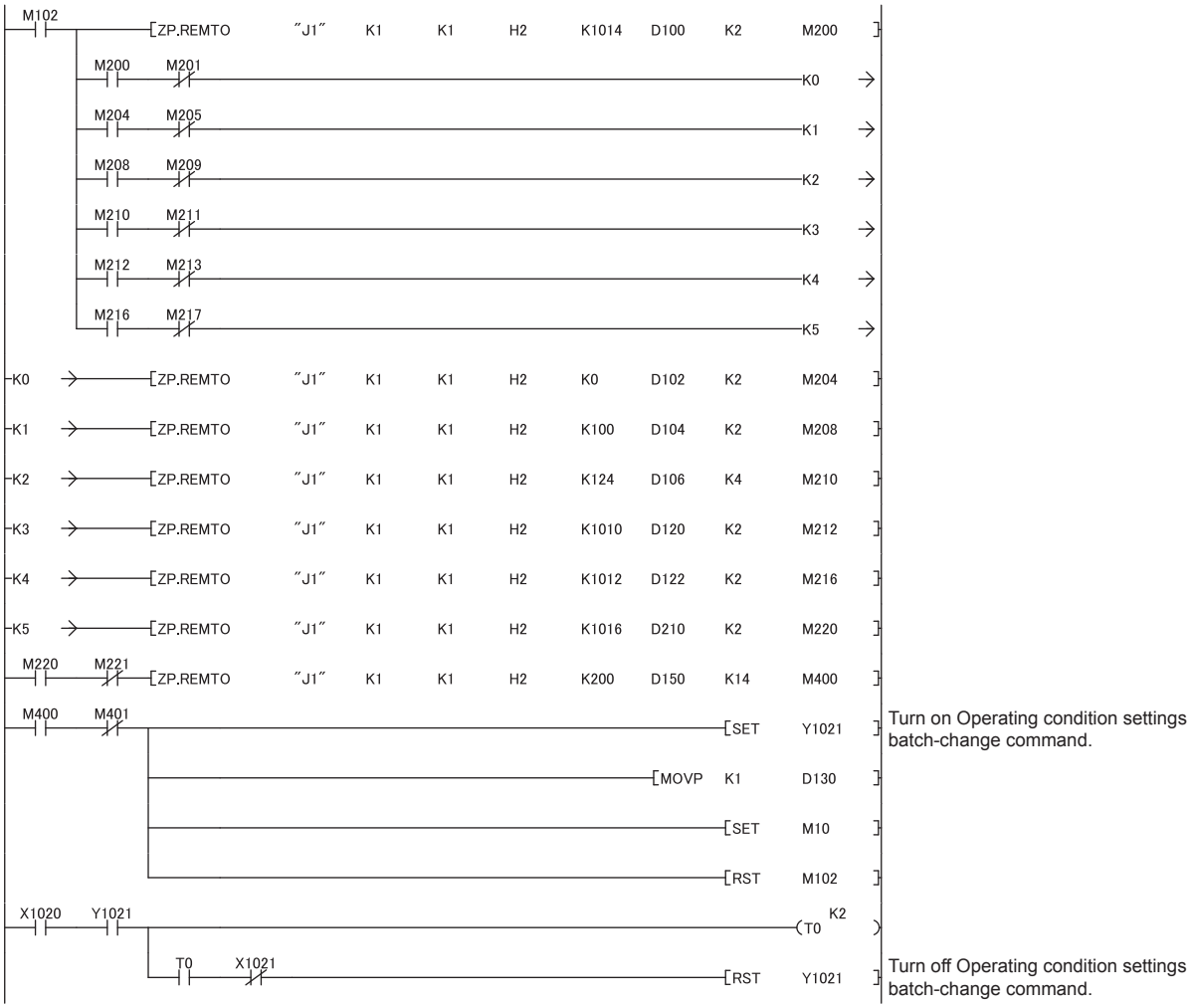
Device	Description
M250, M251	Stores that the Z(P).REMTO instruction is complete or the result of the instruction
M254, M255	
M258, M259	
M262, M263	
M266, M267	
M270, M271	
M282, M283	
M300 to M303	
M306 to M309	
M312 to M315	
M318 to M321	
M460 to M465	
M480 to M485	
M500 to M505	
M520 to M525	
M552 to M557	
D100 to D109	Stores data written by the Z(P).REMTO instruction (for default setting)
D120 to D123	
D130	
D150 to D163	
D40, D41	
D50 to D53	
D60	
D70	
D80 to D84	
D210, D211	
SB20	Network module status
SB47	Baton pass status (own station)
SB49	Data link status (own station)
SW70	Baton pass status of each station
SW74	Cyclic transmission status of each station
SW78	Parameter communication status of each station
T0	For interlock with Operating condition settings batch-change command
T2 to T5	For interlock between own station and other station
T100 to T104	

*1 Stores the error code of the error in process.
*2 Stores the latest error code, and hold it also after an error reset.
*3 Stores the warning code of the warning in process.
*4 Stores the latest warning code, and hold it also after an error reset.

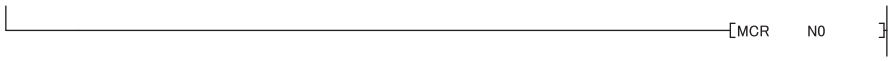
(2) Program example under the normal mode

(a) Initial setting program



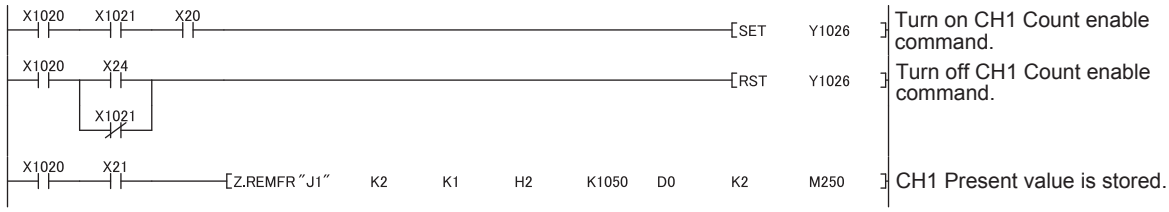


*1 Add the following MCR instruction at the end of the program.



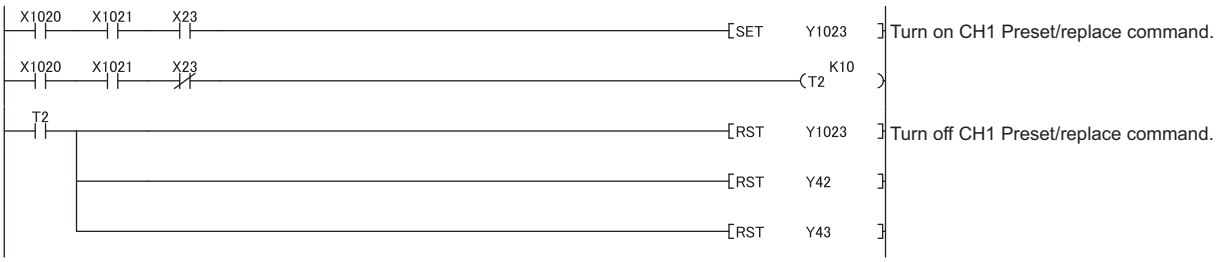
*2 Set only when using the coincidence output function.
*3 Set only when using the cam switch function.
*4 Set only when using the ring counter function.
*5 Set only when using the sampling counter function or periodic pulse counter function.

(b) Common program

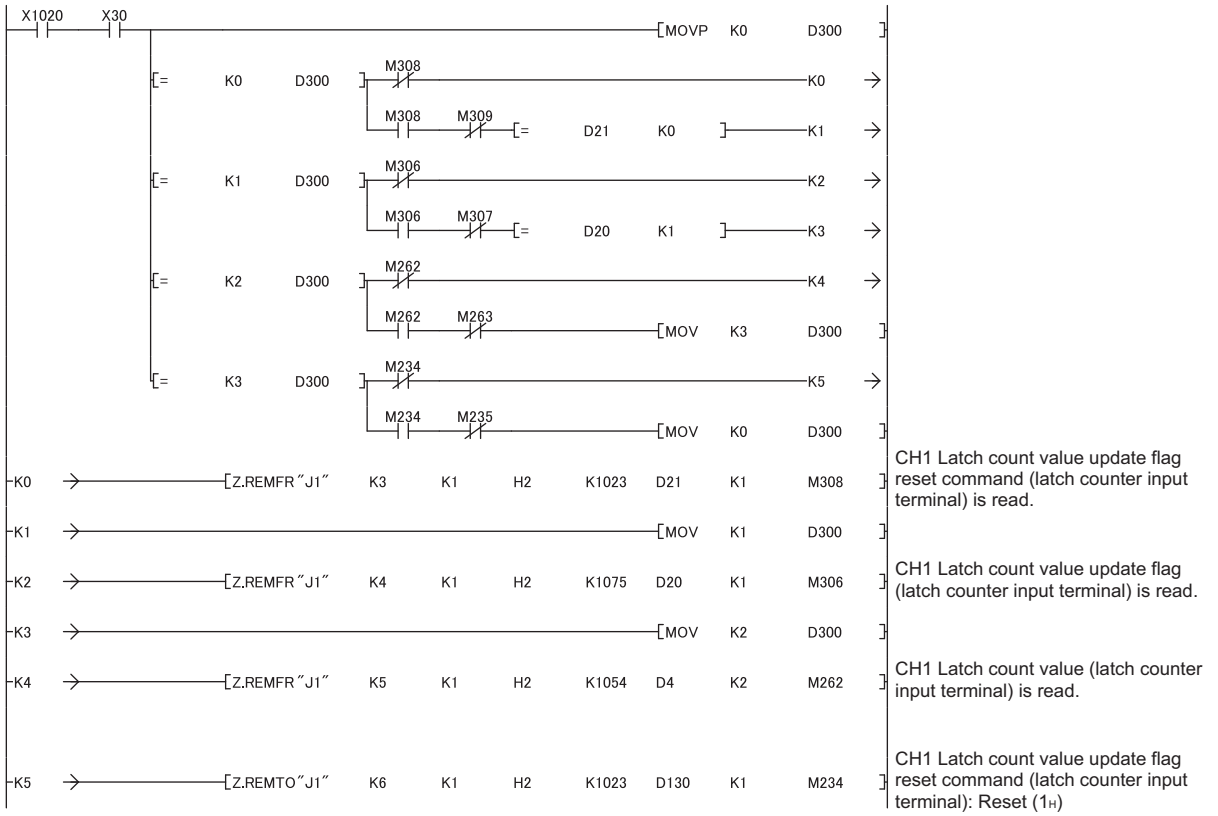


(c) Counter function program

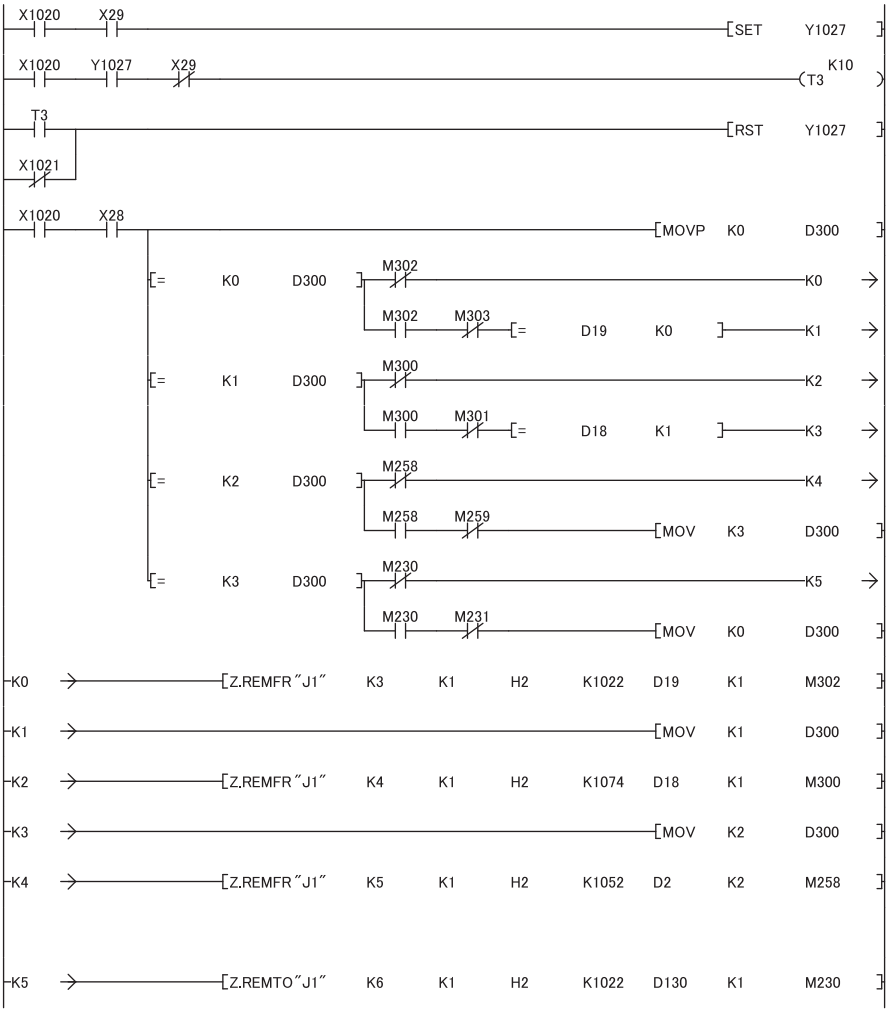
- program for the preset/replace function



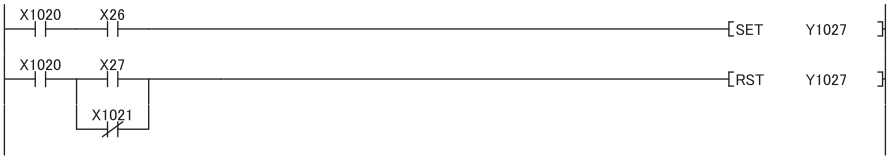
- program for the latch counter function by latch counter input terminal



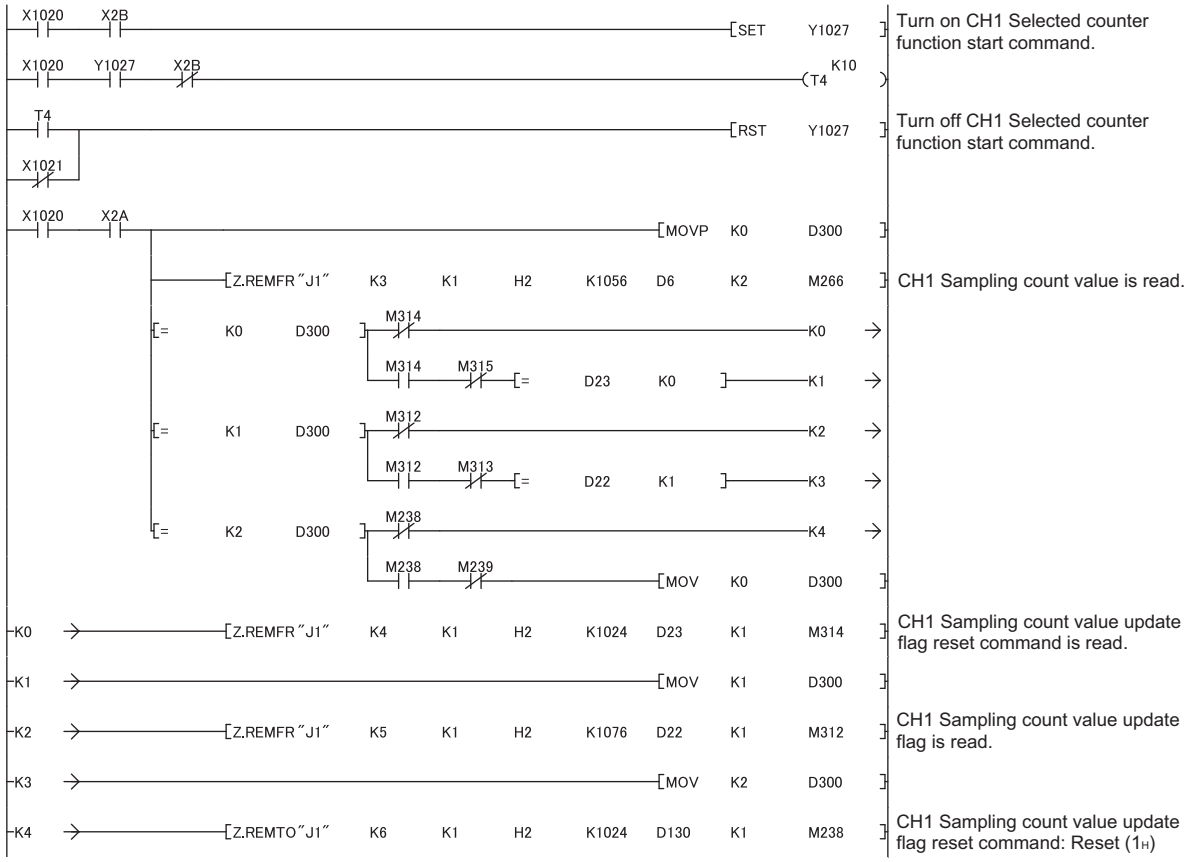
• program for the latch counter function by counter function selection



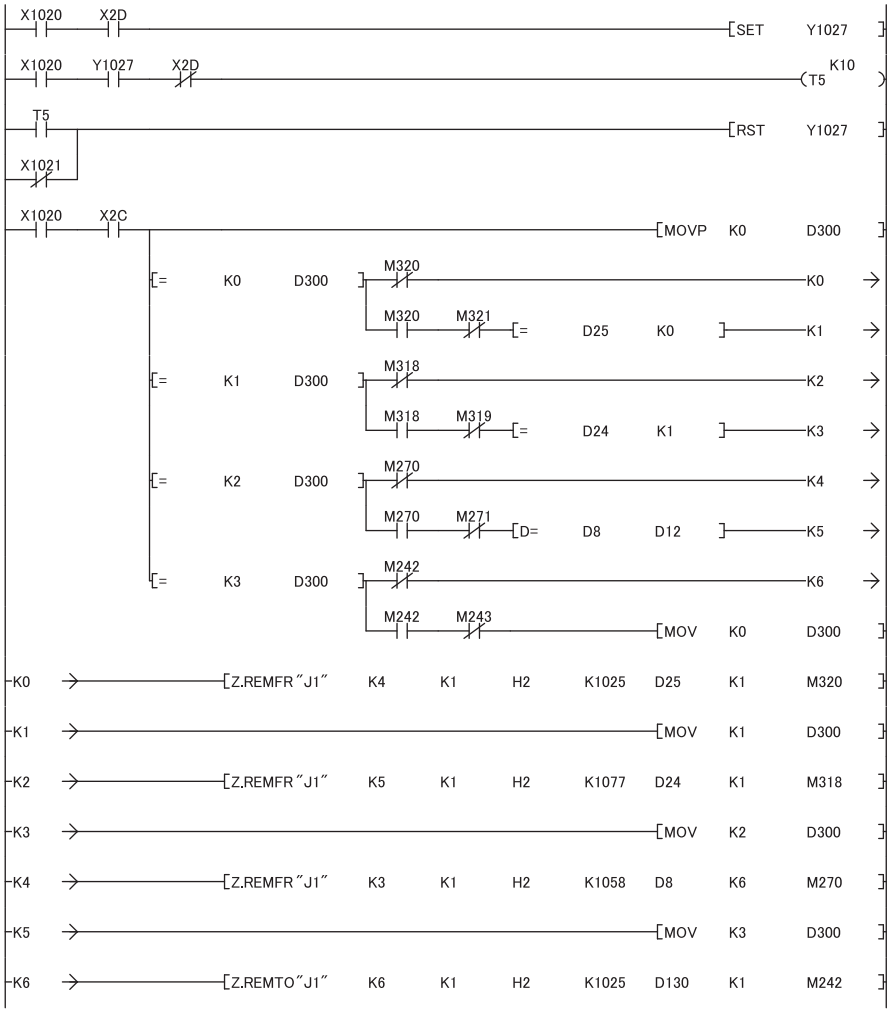
• program for the count disable function



• program for the sampling counter function

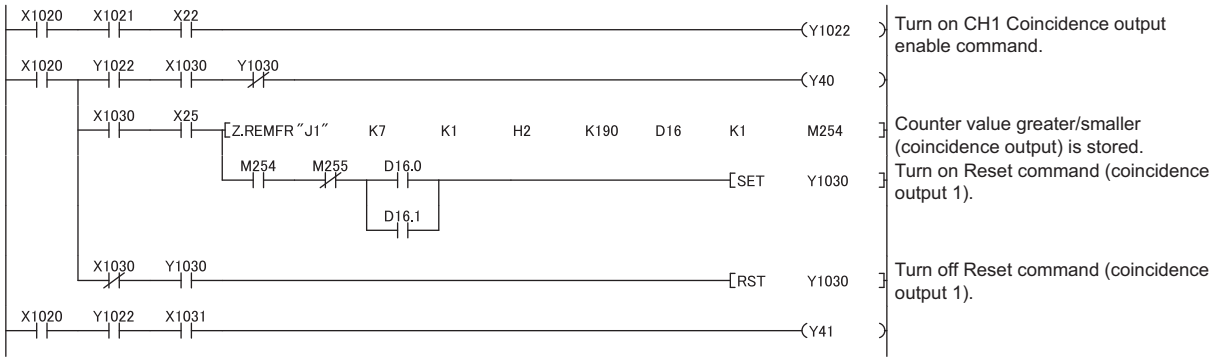


• program for the periodic pulse counter function

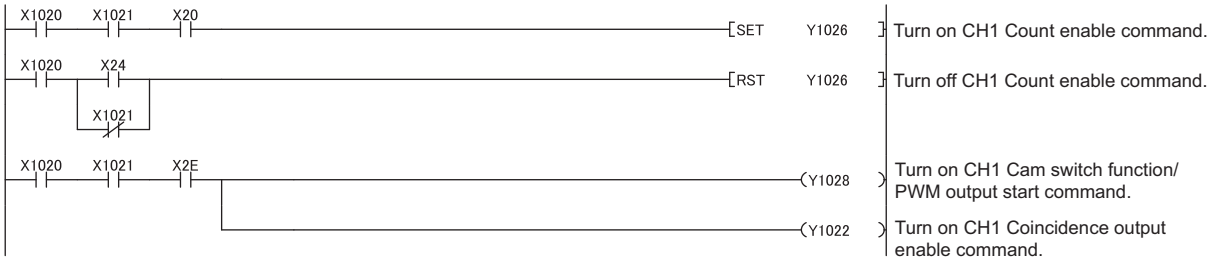


(d) Program for the comparison output function

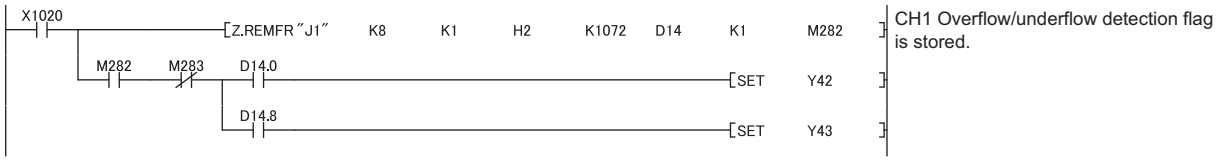
• program for the coincidence output function



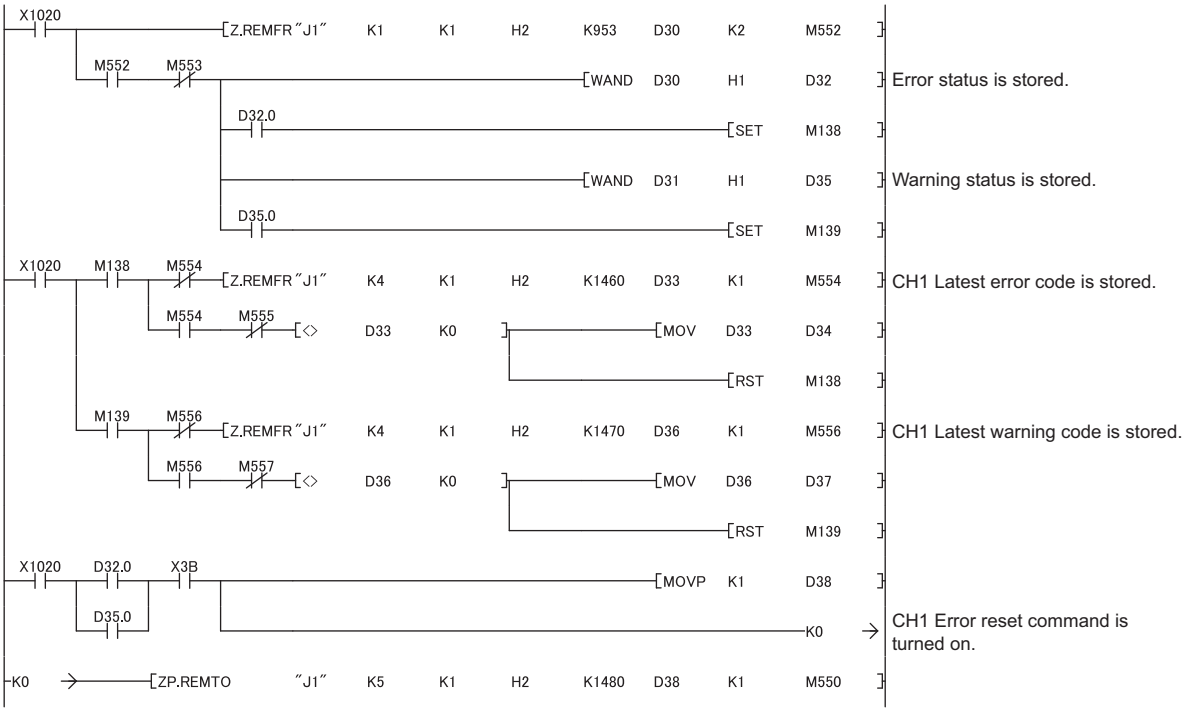
• program for the cam switch function



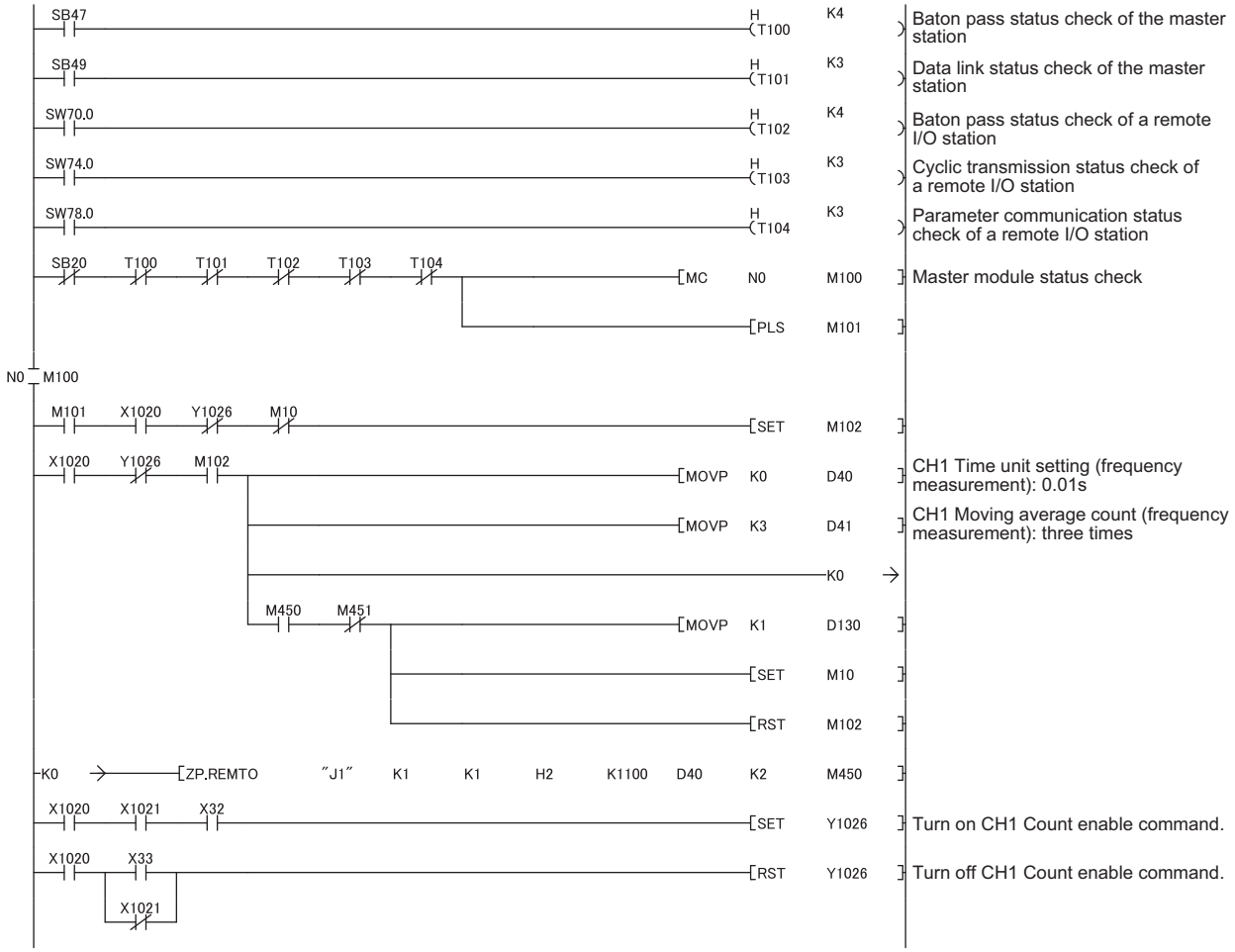
(e) Program for overflow/underflow detection processing

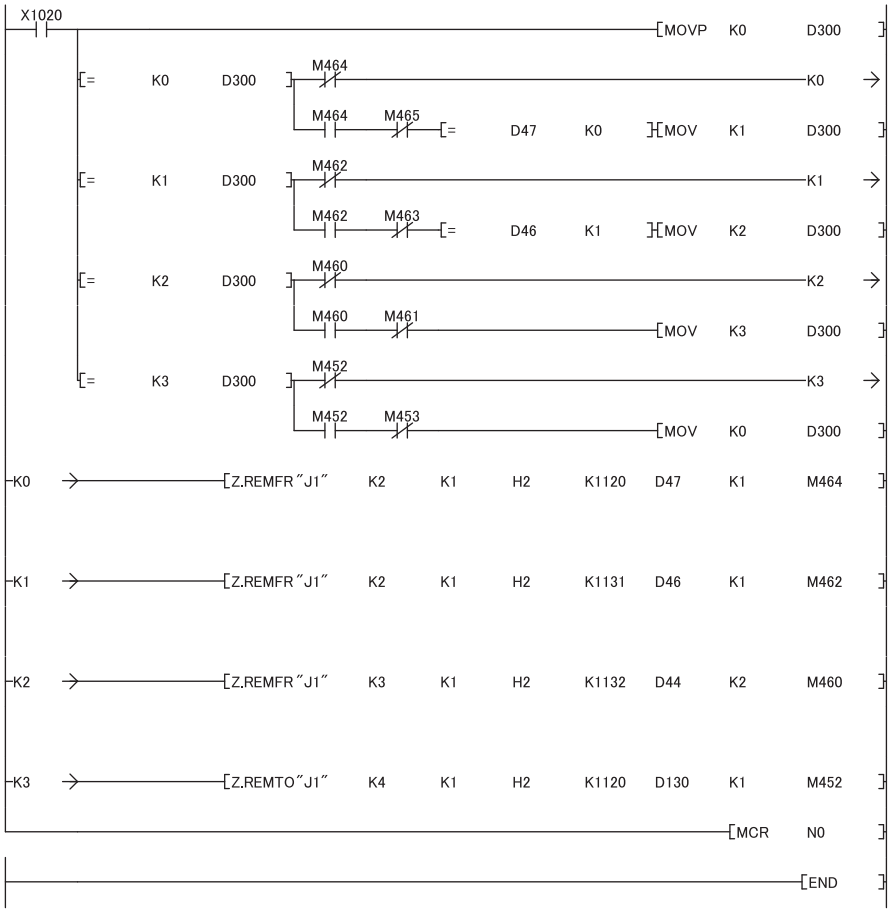


(f) Program for an error/warning reset



(3) Program example of the frequency measurement mode

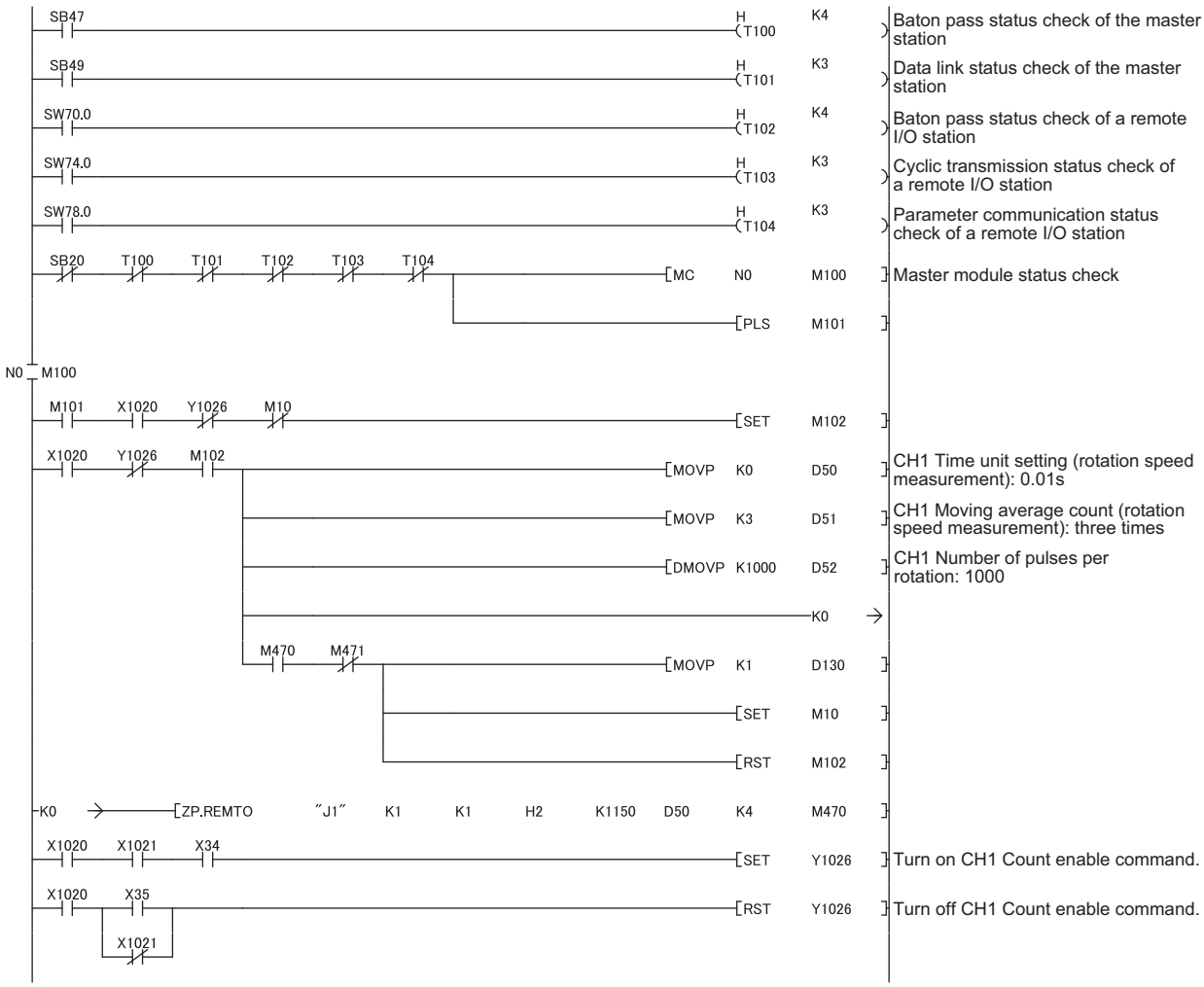


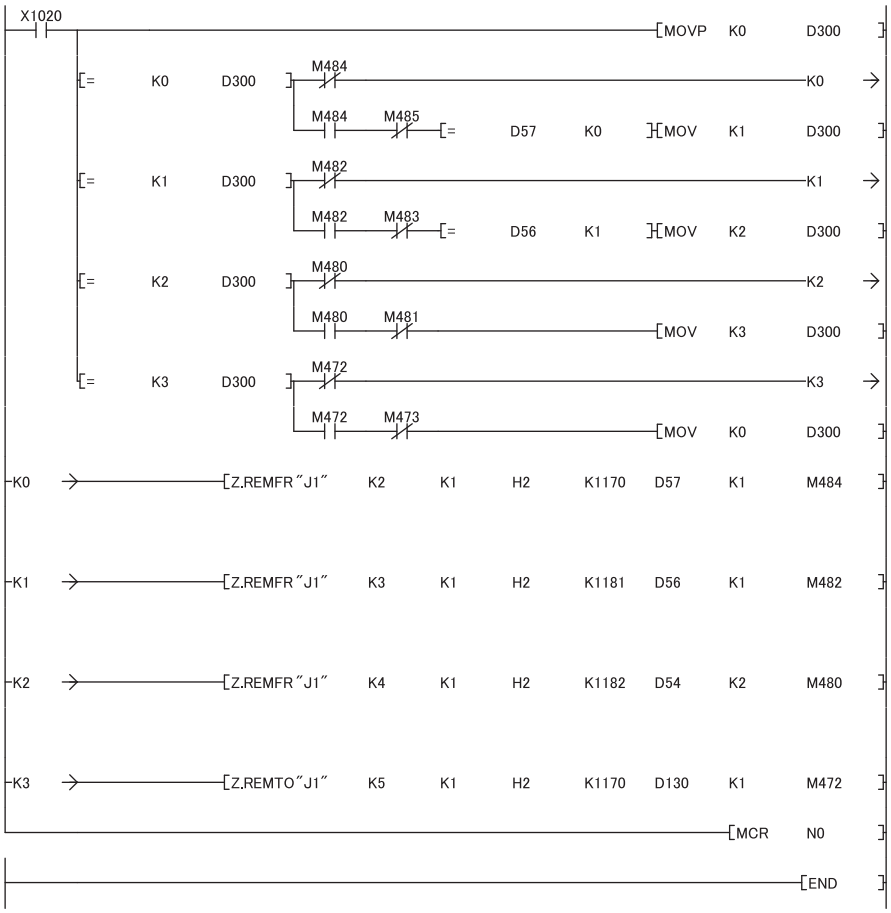


CH1 Measured frequency value is read.

CH1 Measured frequency value update flag reset command : Reset (1H)

(4) Program example of the rotation speed measurement mode

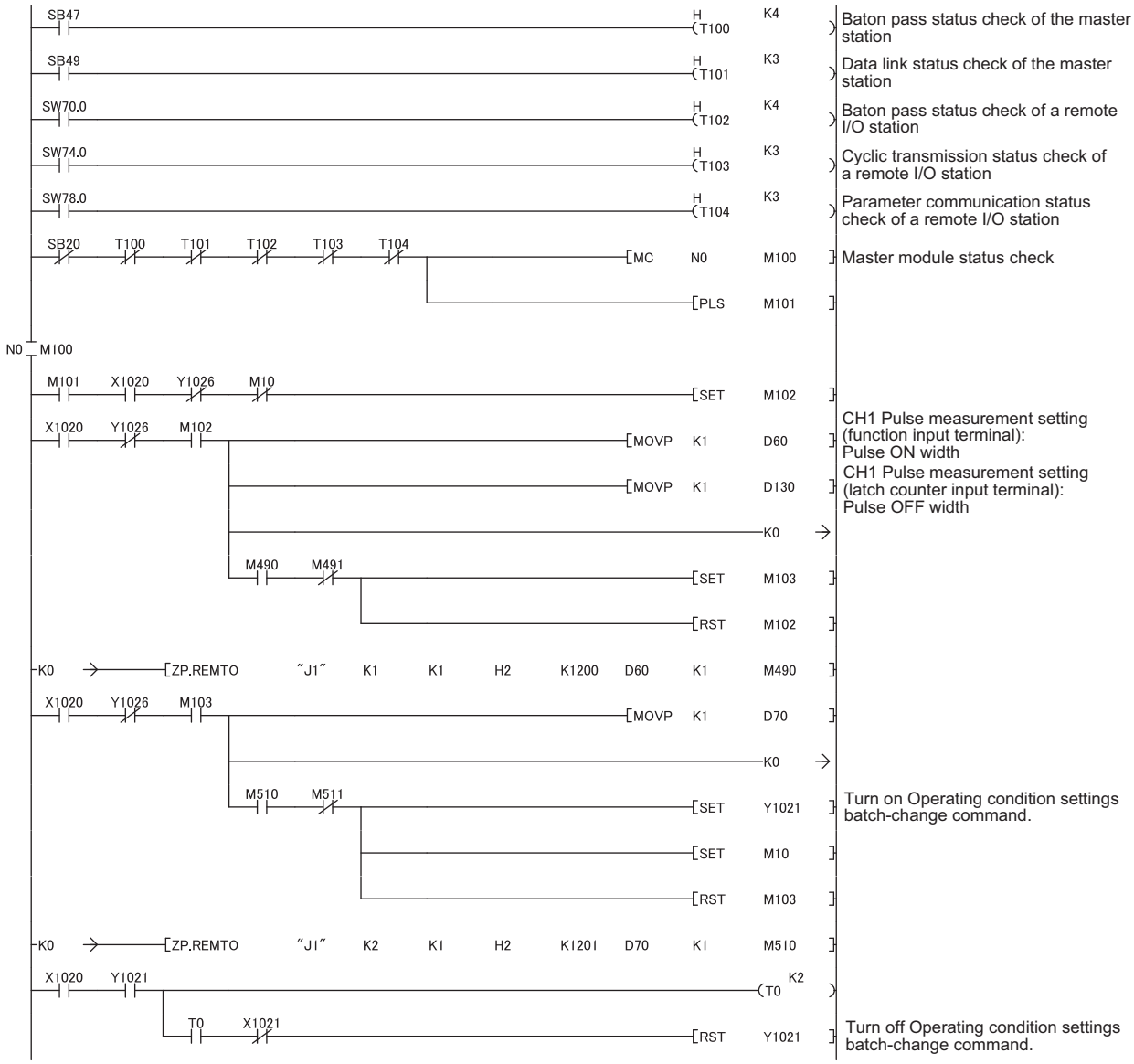


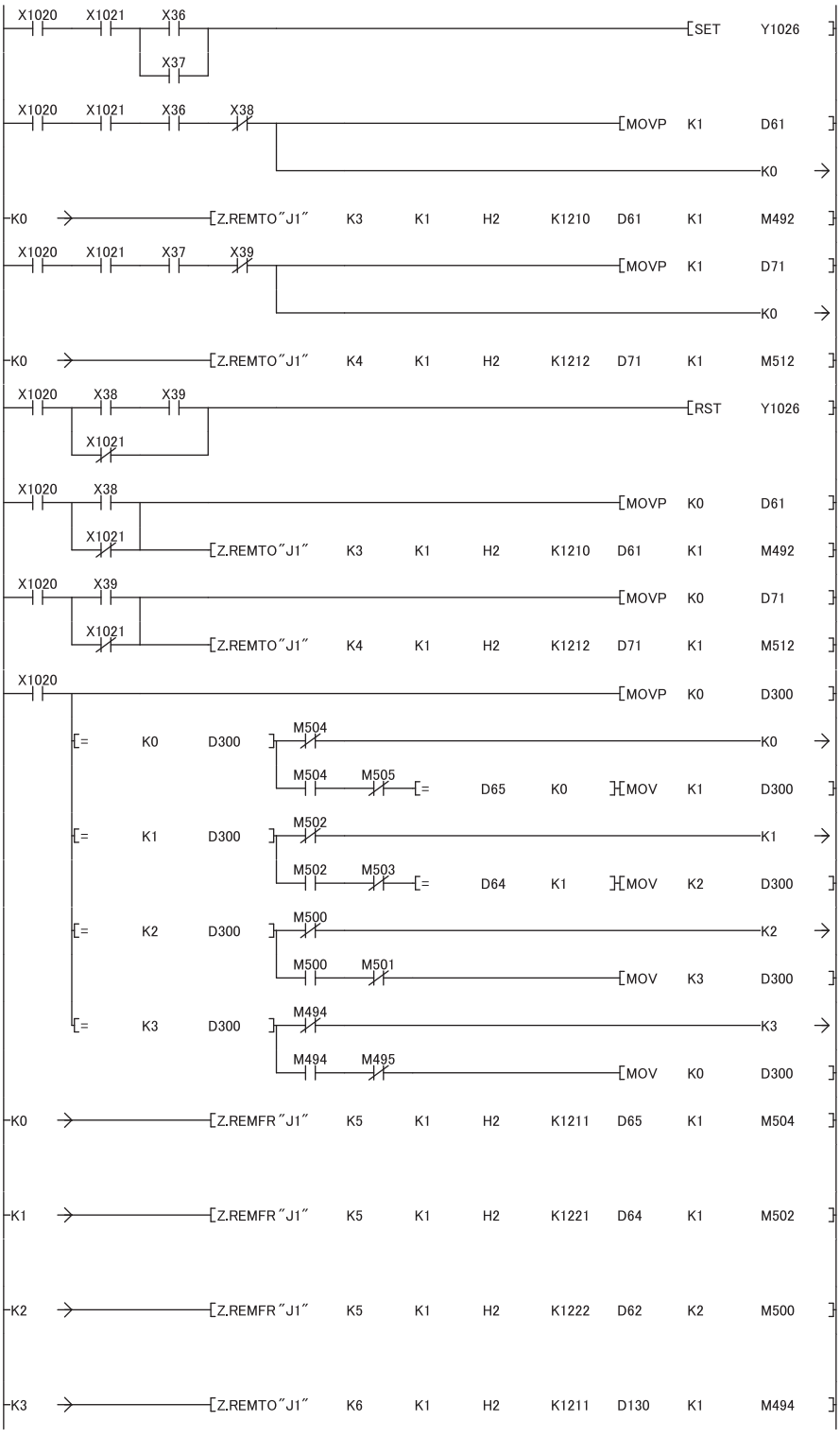


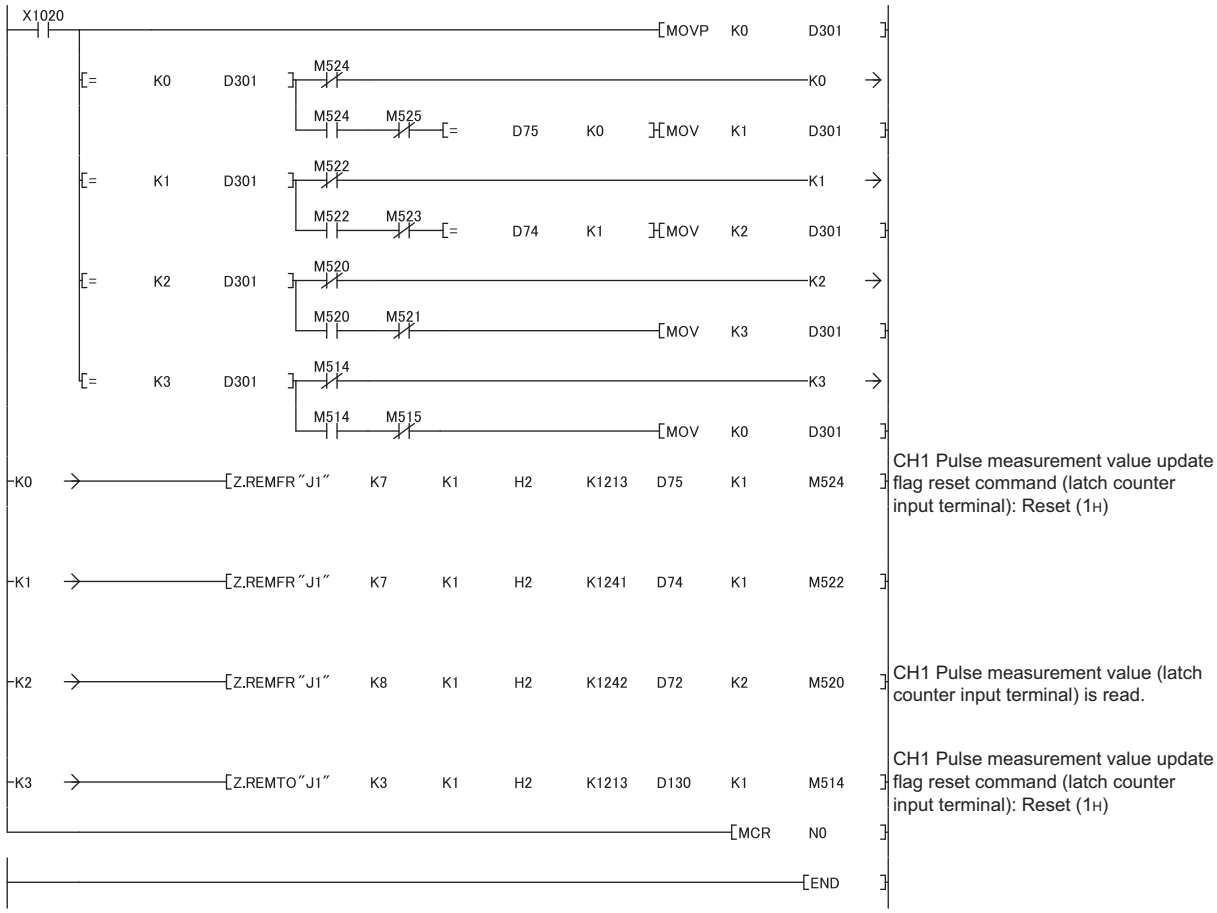
CH1 Measured rotation speed value is read.

CH1 Measured rotation speed value flag reset command: Reset (1H)

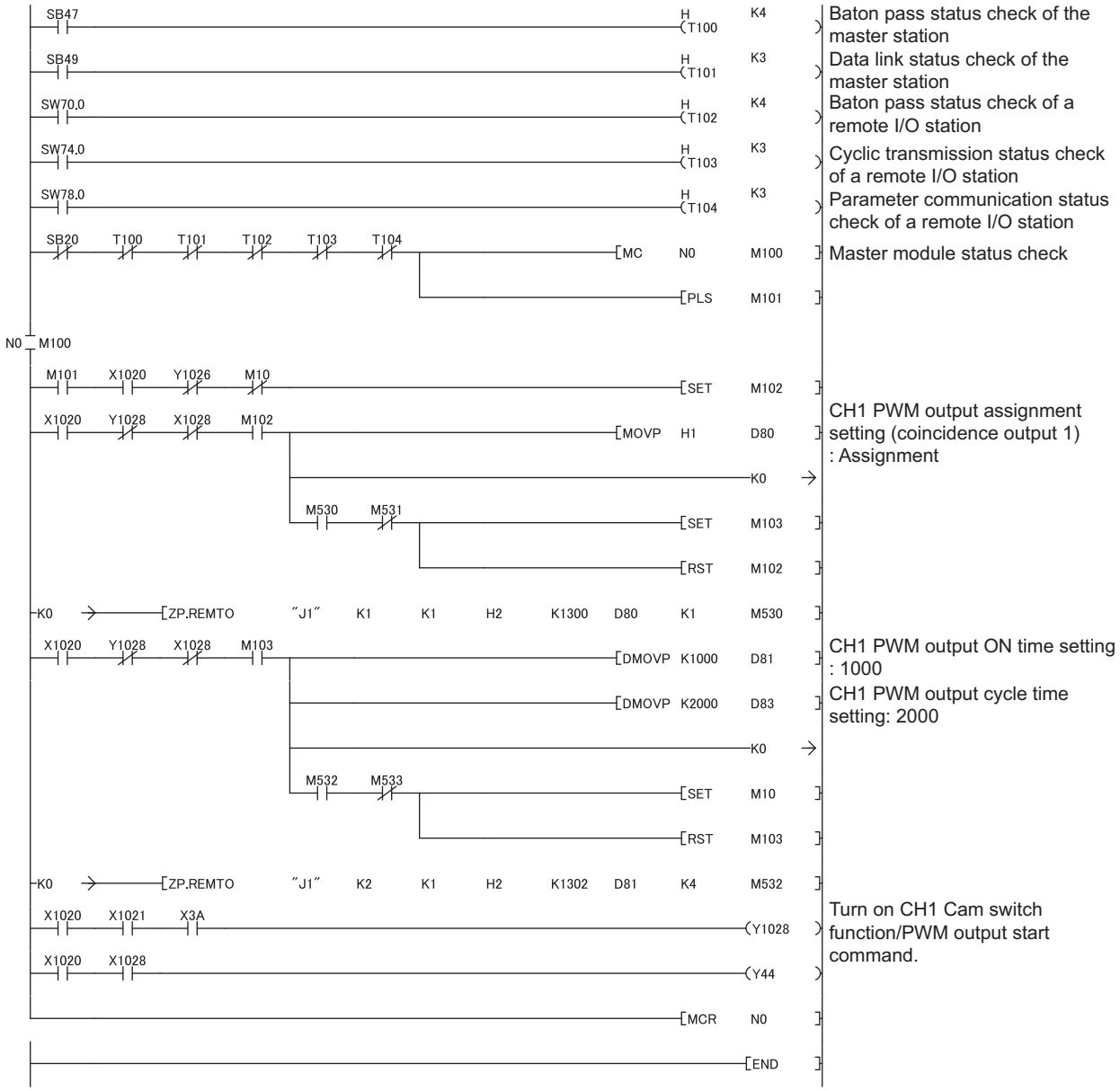
(5) Program example of the pulse measurement mode




X1020 X1021 X36 SET Y1026
X37
Turn on CH1 Count enable command.
X1020 X1021 X36 X38 MOVP K1 D61
K0
CH1 Pulse measurement (function input terminal) start command : Measured (1H)
K0 Z.REMTO"J1" K3 K1 H2 K1210 D61 K1 M492
X1020 X1021 X37 X39 MOVP K1 D71
K0
CH1 Pulse measurement (latch counter input terminal) start command : Measured (1H)
K0 Z.REMTO"J1" K4 K1 H2 K1212 D71 K1 M512
X1020 X38 X39 RST Y1026
X1021
Turn off CH1 Count enable command.
X1020 X38 MOVP K0 D61
X1021 Z.REMTO"J1" K3 K1 H2 K1210 D61 K1 M492
CH1 Pulse measurement (function input terminal) start command: Not measured (0H)
X1020 X39 MOVP K0 D71
X1021 Z.REMTO"J1" K4 K1 H2 K1212 D71 K1 M512
CH1 Pulse measurement (latch counter input terminal) start command : Not measured (0H)
X1020 MOVP K0 D300
= K0 D300 M504 K0
M504 M505 = D65 K0 MOV K1 D300
= K1 D300 M502 K1
M502 M503 = D64 K1 MOV K2 D300
= K2 D300 M500 K2
M500 M501 MOV K3 D300
= K3 D300 M494 K3
M494 M495 MOV K0 D300
K0 Z.REMFR"J1" K5 K1 H2 K1211 D65 K1 M504
CH1 Pulse measurement update flag reset command (function input terminal): Reset (1H)
K1 Z.REMFR"J1" K5 K1 H2 K1221 D64 K1 M502
K2 Z.REMFR"J1" K5 K1 H2 K1222 D62 K2 M500
CH1 Pulse measured value (function input terminal) is read.
K3 Z.REMTO"J1" K6 K1 H2 K1211 D130 K1 M494
CH1 Pulse measurement update flag reset command (function input terminal): Reset (1H)


X1020
MOVP K0 D301
= K0 D301
M524
K0
M524 M525
= D75 K0
MOV K1 D301
= K1 D301
M522
K1
M522 M523
= D74 K1
MOV K2 D301
= K2 D301
M520
K2
M520 M521
MOV K3 D301
= K3 D301
M514
K3
M514 M515
MOV K0 D301
K0
Z.REMFR"J1" K7 K1 H2 K1213 D75 K1 M524
CH1 Pulse measurement value update flag reset command (latch counter input terminal): Reset (1H)
K1
Z.REMFR"J1" K7 K1 H2 K1241 D74 K1 M522
K2
Z.REMFR"J1" K8 K1 H2 K1242 D72 K2 M520
CH1 Pulse measurement value (latch counter input terminal) is read.
K3
Z.REMTO"J1" K3 K1 H2 K1213 D130 K1 M514
CH1 Pulse measurement value update flag reset command (latch counter input terminal): Reset (1H)
MCR N0
END

(6) Program example of the PWM output mode



7.3 Program Example with the Coincidence Detection Interrupt Function

This section describes a program example in which an interrupt program starts when the count value matches with a value or range specified by the user, or at cycle transition when the periodic pulse counter function is used.

(1) System configuration

System configuration is the same as the example used in a standard system configuration.

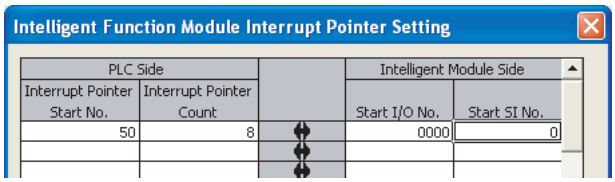
Page 191, Section 7.1 (1)

(2) Program condition

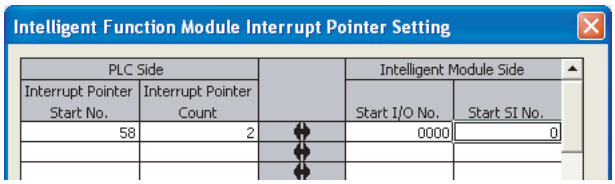
(a) Interrupt pointer setting

Project window ⇨[Parameter]⇨[PLC Parameter]⇨[PLC System]⇨[Intelligent Function Module Setting]⇨ Interrupt Pointer Setting button

- Setting example for the coincidence detection interrupt function



- Setting example for the periodic interrupt function



(b) To use only particular SI No.

- Setting in the "Intelligent Function Module Interrupt Pointer Setting" dialogue box
  Interrupt factors as many as the number of interrupt pointers (Interrupt Pointer Count) starting from the specified Start SI No. are used. (Start SI No. specified in the "Intelligent Function Module Interrupt Pointer Setting" dialogue box)
  For example, if 1 is set for "Start SI No." and 2 for "Interrupt Pointer Count", only SI1 and SI2 are used.
  If the interrupt pointer setting is not configured in the dialogue box, the interrupt function is not performed.
  For SI No. not to be used, set them not to use in Coincidence detection interrupt setting (Un\G2) or CH1 Periodic interrupt setting (Un\G1001).
- Using the IMASK instruction from the sequence program
  By using the IMASK instruction, an interrupt program can be enabled or disabled (interrupt mask). This setting is available per interrupt pointer number.
  For details on the IMASK instruction, refer to the following manual.
  MELSEC-Q/L Programming Manual (Common Instructions)

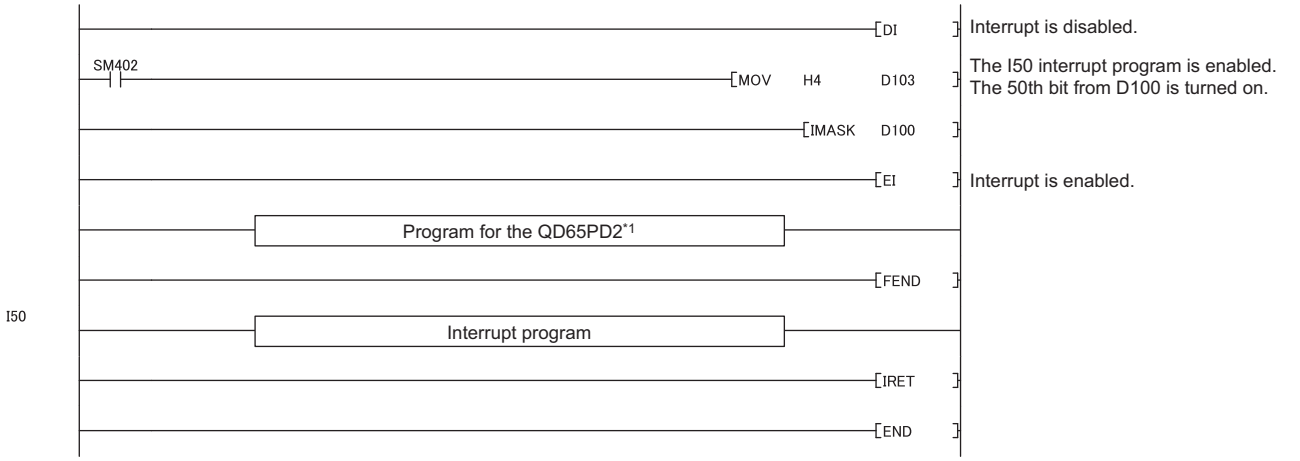
7.3.1 Program example with the coincidence detection interrupt function

(1) Devices used by the user

Device	Description
D100 to D115	stores interrupt enable flag for the IMASK instruction

(2) Program example

Before using an interrupt pointer, enable an interrupt by the IMASK instruction.



*1 When using the coincidence detection interrupt function, Coincidence detection interrupt setting (Un\G2) needs to be set.
After Coincidence detection interrupt setting (Un\G2) is set, the setting is activated by switching Operating condition settings batch-change command (Y01) from off to on.

Point

- In the above program example, interrupt programs except for the I50 interrupt program are disabled by the IMASK instruction.
  To execute any interrupt program other than I50, set the bit that corresponds to the execution-target interrupt pointer to 1 (enabled).
- For details on IMASK instruction, please refer to the following manual.
  MELSEC-Q/L Programming Manual (Common Instructions)

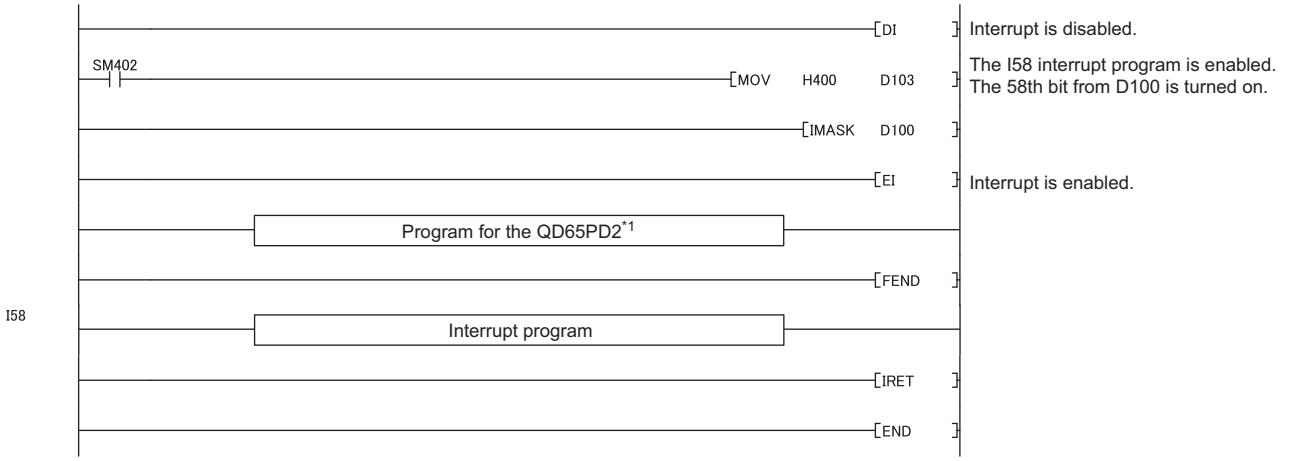
7.3.2 Program example with the periodic interrupt function

(1) Devices used by the user

Device	Description
D100 to D115	stores interrupt enable flag for the IMASK instruction

(2) Program example

Before using an interrupt pointer, enable an interrupt by the IMASK instruction.



*1 When using the periodic interrupt function, CH1 Periodic interrupt setting (Un\G1001) needs to be set.
After CH1 Periodic interrupt setting (Un\G1001) is set, the setting is activated by switching Operating condition settings batch-change command (Y01) from off to on.

Point

- In the above program example, interrupt programs except for the I58 interrupt program are disabled by the IMASK instruction.
  To execute any interrupt program other than I58, set the bit that corresponds to the execution-target interrupt pointer to 1 (enabled).
- For details on IMASK instruction, please refer to the following manual.
  MELSEC-Q/L Programming Manual (Common Instructions))

CHAPTER 8 TROUBLESHOOTING

This chapter describes how to identify error causes and to correct errors when they occur on the QD65PD2.

8.1 Before Troubleshooting

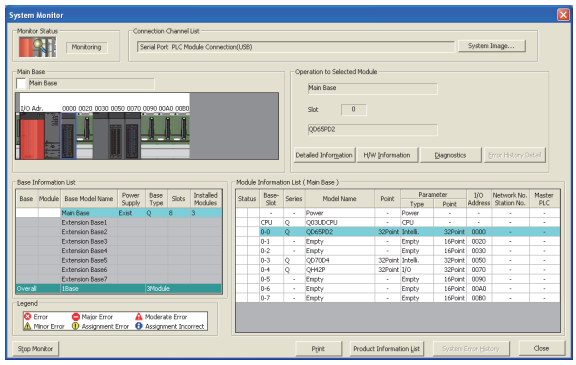
Check if the POWER LED of the power supply module and the MODE LED of the CPU module are on. If any of them is off, troubleshoot the CPU module.

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

8.2 Troubleshooting Procedure

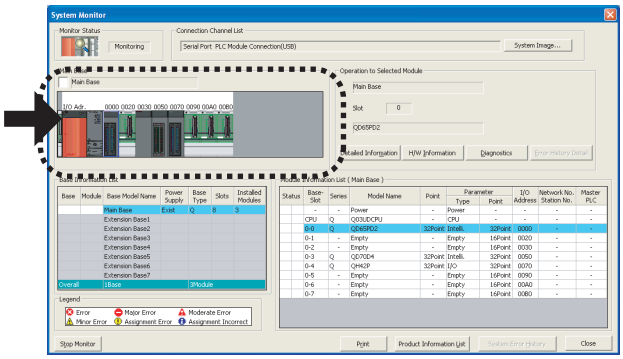
This section explains the procedure to identify the problem cause and to take corrective actions. Use GX Works2 for this procedure.

(1) Procedure



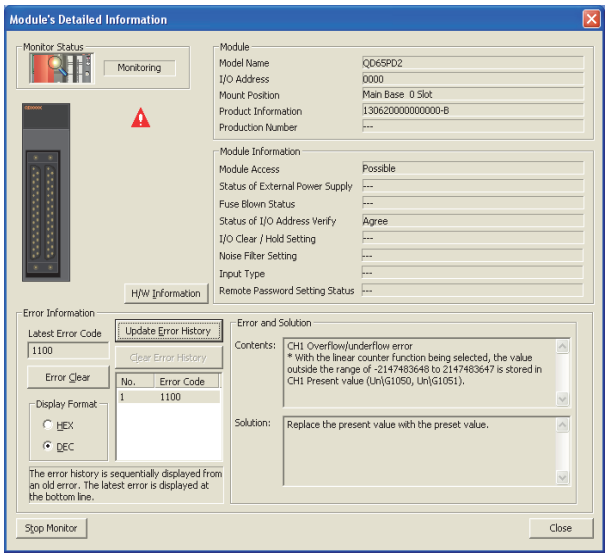
1. Connect GX Works2 to the CPU module, and open the "System Monitor" dialog box.

[Diagnostics]⇨[System Monitor]



2. After confirming that an error is indicated on the QD65PD2, select the QD65PD2, then click Detailed Information button.

If an error is indicated on a module other than the QD65PD2, refer to the user's manual corresponds to the module and take a corrective action.



3. **When Detailed Information button is clicked, "Module's Detailed Information" opens.**

When Update Error History button is clicked, the error content and its solution method are shown in "Error and Solution".

4. **If the error detail cannot be confirmed by the procedure above, perform troubleshooting described in the following sections.**

- (☞ Page 255, Section 8.3)
- (☞ Page 256, Section 8.4)

8.3 Checking the LEDs

The following tables show how to troubleshoot the system by the LEDs.

8.3.1 When both the RUN LED and the ERR. LED turned off

Check item	Corrective action
Is the power supplied?	Check if the supplied voltage of the power supply module is within rated range.
Is the capacity of the power supply module enough?	Calculate current consumption of the CPU module, I/O module, and intelligent function module mounted on the base unit, and check if the capacity of current is sufficient.
Is the module mounted on the base unit correctly?	Check the mounting condition of the module.
Has a watchdog timer error occurred?	Reset the CPU module and check if the LEDs turn on. If the RUN LED is still off, the possible cause is a failure of the QD65PD2. Please consult your local Mitsubishi representative.

8.3.2 When the RUN LED turned on and the ERR. LED turned on

Check Item	Corrective action
Has an error occurred?	Check the error code and take a corrective action described in ☞Page 265, Section 8.5.

8.4 Troubleshooting by Symptoms

This section describes troubleshooting methods by symptom.

Point

In this section, I/O numbers (X/Y), buffer memory addresses, and external input terminals are those of CH1.
For I/O numbers (X/Y) of CH2, refer to the following section.

Page 32, Section 3.3.1

For buffer memory addresses of CH2, refer to the following section.

Page 42, Section 3.4.1

8.4.1 When counting (measurement) does not start, or when not counted (measured) correctly

Check item	Corrective action
Is CH1 Count enable command (Y06) on?	Turn on CH1 Count enable command (Y06) by the sequence program.
When the count disable function is selected at counter function selection, check if the function input terminal (FUNC1) has been on.	Turn off the function input terminal (FUC1).
Is the pulse input method the same as the pulse input mode set at the switch setting?	Set the pulse input method and the pulse input mode set at the switch setting the same.
When reading out the present value by the sequence program, is it read in 2 word (32bit) unit?	Read out the value in 2 word (32bit) unit.
Does the input pulse waveform meet the performance specifications?	Check the pulse waveform with a synchronoscope. If the input pulse does not meet the performance specifications, input pulses which meet the performance specifications.
When the same count value is input to the other channel, is the count result the same as that of the other channel?	If they differ, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
Does the CPU module indicate any error?	If an error is indicated with the CPU module, please refer to the following manual. QCPU User's Manual (Hardware Design, Maintenance and Inspection)
Do the LEDs of ϕA and ϕB turn on by applying a voltage to the pulse input terminals of ϕA and ϕB using such as a voltage stabilizer?	If they turn on, check the external wiring and wiring on the encoder side. If they do not turn on, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
When the counter format is the ring counter, is the preset/ replace function performed out of the count range of the ring counter?	Perform the preset/replace function within the count range of the ring counter.
Is the external wiring of ϕA and ϕB correct?	Check the external wiring and correct errors.
Is CH1 Pulse measurement start command (function input terminal) (Un\G1210) or CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212) set to Measured (1_H) depending on the terminal to be measured? (only when the operation mode is set to the pulse measurement mode)	Set CH1 Pulse measurement start command (function input terminal) (Un\G1210) or CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212) to Measured (1_H) depending on the terminal to be measured.
Is the external wiring of the pulse measurement terminals (FUNC1, LATCH1) correct? (only when the operation mode is set to the pulse measurement mode)	Check the external wiring and correct errors.

Check item		Corrective action
Noise reduction measures	Are the shielded twisted pair cables used for pulse input wiring?	Use the shielded twisted pair cables for pulse input wiring.
	Have measures against noise been taken to 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 equipment and pulse input line kept enough?	Bundle the pulse input lines and put them in a single tube, and keep a distance of 150mm or more with the power line even inside the control panel.
	Does any noise come from the grounded part of the QD65PD2.	Separate the grounding cable of the QD65PD2 from the grounded part. If the QD65PD2 case touches to the grounded part, separate it.

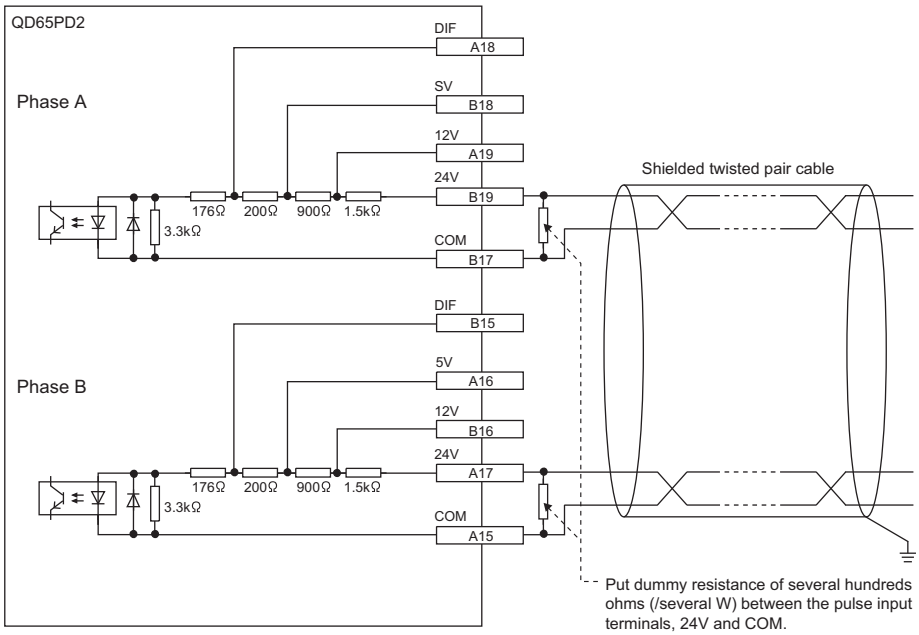
Point

How to fix pulse form

This portion describes how to fix pulse waveform by dummy resistance that can be used for noises from outside or distortion of pulse waveform. To fix the pulse waveform effectively, increase load current inside cables by applying dummy resistance of several hundreds ohms (/several W) between the pulse input terminals that are connected to the encoder.

The greater the load current, the more effective this method is.

- Effect
  - When the distance between the encoder and the QD65PD2 is long, distortion of waveform gets fixed and the pulse waveform becomes stable.
  - When the pulse waveform is distorted due to noses from outside, taking the method above stabilizes pulse waveform; Distortion of pulse waveform by noise can be reduced.
- Example of dummy resistance at 24VDC.



- How to choose dummy resistance

  An example of how to choose the resistance amount and rated-standard electricity of dummy resistance is indicated below. If load current is set to approximately 35mA, the resistance amount and the rated-standard electricity become as follows.
  - How to calculate resistance amount (at 24VDC)
    Calculation: R = V ÷ I = 24V ÷ 35mA = 680Ω
  - How to calculate rated-standard electricity (at 24VDC)
    Calculation: P1 = V × I = 24V × 35mA = 0.84W (approximately 1W)
    Calculation including margin: P2 = P1 × 2 = 0.84W × 2 = 1.68W (approximately 2W)
  - Result: Put dummy resistance of 680Ω (/2W)between the pulse input terminals.

8.4.2 When the coincidence output function or the cam switch function does not operate normally

(1) When coincidence output 1 to 8 (X10 to X17) do not turn on

Check item		Corrective action
Common	is the assignment of the coincidence output 1o to 8 proper?	Review "Coincidence output (1 to 8) channel assignment setting" in the switch setting.
Coincidence output function	Is the comparison condition for coincidence output 1 to 8 proper?	Review the setting of Coincidence output condition setting (Un\G0).
	After changing Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) or Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151), has Operating condition settings batch-change command (Y01) been turned on, or has Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187) been set to Requested (1_H)?	After changing Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) or Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151), turn on Operating condition settings batch-change command (Y01), or set Setting change request (coincidence output 1 to 8) (Un\G180 to Un\G187)been to Requested (1_H).
	Has Reset command (coincidence output 1 to 8) (Y10 to Y17) been turned on? (only when Coincidence output condition setting (Un\G0) is coincidence output (0))	Turn off Reset command (coincidence output 1 to 8) (Y10 to Y17).
	Have Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) and Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151) been set outside the count range of the ring counter when the counter format is the ring counter?	Set Point setting (coincidence output 1 to 8) (Un\G100 to Un\G115) and Upper/lower limit values (coincidence output 1 to 8) (Un\G120 to Un\G151) within the count range of the ring counter.
Cam switch function	At the step setting, is the minimum setting width of the ON/OFF status proper?	Review the minimum setting width of the ON/OFF status referring to the section on the cam switch function. (☞ Page 118, Section 4.3.4)
	Have the steps been set outside the count range of the ring counter when the counter format is the ring counter?	Review the step setting and set steps within the count range of the ring counter.

(2) When coincidence output 1 to 8 (X10 to X17) do not turn off

	Check item	Corrective action
Coincidence output function	Is the ON time of Reset command (coincidence output 1 to 8) (Y10 to Y17) 2ms or longer? (only when Coincidence output condition setting (Un\G0) is coincidence output (0))	Set the ON time of Reset command (coincidence output 1 to 8) (Y10 to Y17) 2ms or longer.
Cam switch function	At the step setting, is the minimum setting width of the ON/OFF status proper?	Review the minimum setting width of the ON/OFF status referring to the section on the cam switch function. (☞ Page 118, Section 4.3.4)

(3) When only coincidence output terminal 1 to 8 (EQU1 to 8) do not turn on

Check item	Corrective action
Has CH1 Coincidence output enable command (Y02) been turned on?	Turn on CH1 Coincidence output enable command (Y02).
Has voltage been added to the power supply for external output (12V/24V)?	Add voltage to the power supply for external output (12V/24V).
Is the external wiring of the coincidence output 1 to 8 terminals (EQU1 to 8) correct?	Check the external wiring and correct errors.

(4) When the count value cannot be replaced with a preset value by the preset/replace (at coincidence output) function

Check item	Corrective action
Has CH1 External preset/replace (Z Phase) request detection (X05) turned on?	Turn off CH1 External preset/replace (Z Phase) request detection (X05) by CH1 External preset/replace (Z Phase) request detection reset command (Y05). Also, set ON/OFF time of CH1 External preset/replace (Z Phase) request detection reset command (Y05) to 2ms or longer.
Has Preset/replace setting at coincidence output (Un\G1) been set to Not preset (0)?	Set Preset/replace setting at coincidence output (Un\G1) to Preset (1).
Have coincidence output 1 and 2 (X10 and X11) been kept on?	With this function, the count value is replaced with a value preset by the user at the rising state (OFF to ON) of the coincidence output 1 and 2 (X10 and X11). Therefore, turn them off before performing this function.
Has an interval of 1ms or longer been set between each operation of this function?	Set an interval of 1ms or longer between each operation of the preset/replace function.
After changing CH1 Preset value (Un\G1014, Un\G1015) is there an interval of 2ms or longer before the preset/replace function is performed?	Set an interval of 2ms or longer after changing CH1 Preset value (Un\G1014, Un\G1015) and before performing the preset/replace function.

8.4.3 When an coincidence detection interrupt does not occur

Check item	Corrective action
Has the following CPU module been used? • Q00J/Q00/Q01CPU(function version A) • Redundant CPU	Change to the CPU module applicable to the intelligent function module interrupt pointer setting.
Have the coincidence output 1 to 8 in Coincidence detection interrupt setting (Un\G2) been set to Use (1)?	Set the coincidence output 1 to 8 in Coincidence detection interrupt setting (Un\G2) to Use (1), and switch Operating condition settings batch-change command (Y01) as follows; OFF, ON, and OFF.
Is the intelligent function module interrupt pointer setting in PLC Parameter correct?	Review the intelligent function module interrupt pointer setting.
Are the program operation control instructions, such as IMASK, used correctly?	Review the sequence program.
Have the coincidence output 1 to 8 (X10 to X17) been kept on if the coincidence output function is set for the comparison output setting, and coincidence output is selected as the comparison condition?	Reset (off) the coincidence output 1 to 8 (X10 to X17) by Reset command (coincidence output 1 to 8) (Y10 to Y17). When doing so, set the ON time of Reset command (coincidence output 1 to 8) (Y10 to Y17) 2ms or longer.
Have the intervals between interrupts been kept 2.5ms or longer if the coincidence output function is set for the comparison output setting, and in-range output or not-in-range output is set for Coincidence output condition setting (Un\G0)?	Have an interval of 2.5ms or longer between interrupts.

8.4.4 When the count value cannot be replaced with a value preset by the user

(1) When the count value cannot be replaced with a preset value by the preset/replace command

Check item	Corrective action
Is the ON/OFF time of CH1 Preset/replace command (Y03) 2ms or longer?	Set the ON/OFF time of CH1 Preset/replace command (Y03) 2ms or longer.
Has CH1 External preset/replace (Z Phase) request detection (X05) been on?	Turn off CH1 External preset/replace (Z Phase) request detection (X05) by CH1 External preset/replace (Z Phase) request detection reset command (Y05). When doing so, set the ON/OFF time of CH1 External preset/replace (Z Phase) request detection reset command (Y05) 2ms or longer.

(2) When the count value cannot be replaced with a preset value by the phase Z input terminal (Z1)

Check item	Corrective action
Is the external wiring of the phase Z input terminal (Z1) correct?	Check the external wiring and correct errors.
Is there an interval of 2ms or longer after changing CH1 Preset value (Un\G1014, Un\G1015) and before performing the preset/replace function?	Have an interval of 2ms or longer after changing CH1 Preset value (Un\G1014, Un\G1015) and before performing the preset/replace function.
Has CH1 External preset/replace (Z Phase) request detection (X05) been on?	Turn off CH1 External preset/replace (Z Phase) request detection (X05) by CH1 External preset/replace (Z Phase) request detection reset command (Y05). When doing so, set the ON/OFF time of CH1 External preset/replace (Z Phase) request detection reset command (Y05) 2ms or longer.

(3) When the count value cannot be replaced with a preset value by the function input terminal (FUNC1)

Check item	Corrective action
Is the external wiring of the function input terminal (FUNC1) correct?	Check the external wiring and correct errors.
Is there an interval of 2ms or longer after changing CH1 Preset value (Un\G1014, Un\G1015) and before performing the preset/replace function?	Have an interval of 2ms or longer after changing CH1 Preset value (Un\G1014, Un\G1015) and before performing the preset/replace function.
Has CH1 External preset/replace (Z Phase) request detection (X05) been on?	Turn off CH1 External preset/replace (Z Phase) request detection (X05) by CH1 External preset/replace (Z Phase) request detection reset command (Y05). When doing so, set the ON/OFF time of CH1 External preset/replace (Z Phase) request detection reset command (Y05) 2ms or longer.

8.4.5 When counter function selection cannot be performed

(1) When counter function selection does not start by CH1 Selected counter function start command (Y07)

Check item	Corrective action
Is it counter function selection that uses CH1 Selected counter function start command (Y07)?	Check by referring to the following section. (☞ Page 131, Section 4.6)
Is the ON/OFF time of CH1 Selected counter function start command (Y07) 2ms or longer?	Set the ON/OFF time of CH1 Selected counter function start command (Y07) 2ms or longer.
Has the function input terminal (FUNC1) been on?	Turn off the function input terminal (FUNC1).

(2) When counter function selection does not start by the function input terminal (FUNC1)

Check item	Corrective action
Is the external wiring of the function input terminal (FUNC1) correct?	Check the external wiring and correct errors.
Has CH1 Selected counter function start command (Y07) been on?	Turn off CH1 Selected counter function start command (Y07).

(3) When an periodic interrupt does not occur

Check item	Corrective action
Has the following CPU module been used? • Q00J/Q00/Q01CPU(function version A) • Redundant CPU	Change to the CPU module applicable to the intelligent function module interrupt pointer setting.
Has CH1 Periodic interrupt setting (Un\G1001) been set to Use (1_H)	Set CH1 Periodic interrupt setting (Un\G1001) to Use (1_H), and switch Operating condition settings batch-change command (Y01) as follows; OFF, ON, and OFF.
Is the intelligent function module interrupt pointer setting in PLC Parameter correct?	Review the intelligent function module interrupt pointer setting.
Are the program operation control instructions, such as IMASK, used correctly?	Review the sequence program.

8.4.6 When the waveform is not output properly with the PWM output mode being set

Check item		Corrective action
Does the CPU module indicate any errors?		When the CPU module indicates an error, refer to the following: QCPU User's Manual (Hardware Design, Maintenance and Inspection)
Are Coincidence output 1 to 8 assigned properly?		Check "Coincidence output 1 to 8 channel assignment setting" in the switch setting and CH1 PWM output assignment (Un\G1300).
Is a voltage applied to the power supply terminal for external output?		Apply a voltage to the power supply terminal for external output.
Is the external wiring of the coincidence output 1 to 8 terminals (EQU1 to EQU8) correct?		Check the external wiring and correct errors.
Is the load other than a resistive load connected to the coincidence output 1 to 8 terminals (EQU1 to EQU8)?		Connect a resistive load since the output waveform is highly distorted by connecting the load other than a resistive load.
Measures against noise	Are the shielded twisted pair cables used for the PWM output wiring?	Use the shielded twisted pair cables for the PWM output wiring.
	Have noise reduction measures been taken to the inside of the control panel or the adjacent devices?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.
	Are high voltage equipments separated far enough from the PWM output wiring?	Bundle the PWM output wires and put them in a single tube, and keep a distance of 150mm or more from the power lines in the control panel.
	Does any noise come from the grounded part of the QD65PD2?	Separate the grounding cable of the QD65PD2 from the grounded part. When the QD65PD2 case contacts with the grounded part, separate the case from the part.

8.4.7 When the input from the general input 1 to 6 terminals (IN1 to IN6) is not done

Check item	Corrective action
Does the CPU module indicate any errors?	When the CPU module indicates an error, refer to the following: QCPU User's Manual (Hardware Design, Maintenance and Inspection)
Is the external wiring of the general input 1 to 6 terminals (IN1 to IN6) correct?	Check the external wiring and correct errors.

8.4.8 When the output from the general output 1 to 8 terminals (OUT1 to OUT8) is not done

Check item	Corrective action
Does the CPU module indicate any errors?	When the CPU module indicates an error, refer to the following: QCPU User's Manual (Hardware Design, Maintenance and Inspection)
Is a voltage applied to the power supply terminal for external output?	Apply a voltage to the power supply terminal for external output.
Is the external wiring of the general output 1 to 8 terminals (OUT1 to OUT8) correct?	Check the external wiring and correct errors.

8.4.9 When an error code or warning code cannot be reset

Check item	Corrective action
Is the error cause or warning cause removed?	Refer to the following and remove the cause: (☞ Page 265, Section 8.5, Page 271, Section 8.6)

8.5 List of Error Code

This clause shows the list of error codes.

☐ of each error code and error name indicates the number of the channel in which an error occurs.

Point

- This clause describes errors and their corrective actions in case of the I/O numbers (X/Y), buffer memory addresses, and external input terminals for CH1.
  To check the I/O numbers (X/Y) for CH2, refer to the following:
  Page 32, Section 3.3.1
  To check the buffer memory addresses for CH2, refer to the following:
  Page 42, Section 3.4.1
- This clause describes errors and their corrective actions by using the buffer memory addresses corresponding to Coincidence output 1.
  To check the buffer memory addresses corresponding to Coincidence output 2 to 8, refer to the following:
  Page 42, Section 3.4.1

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
0	Normal	—	—	—	—
☐100	CH☐ Overflow/ underflow error	With the linear counter function being selected, the value outside the range of -2147483648 to 2147483647 is stored in CH1 Present value (Un\G1050, Un\G1051).	*2	*3	Replace the present value with the preset value.
☐110	CH☐ Ring counter upper/lower limit value setting error	With the ring counter function being selected, the value set to CH1 Ring counter upper limit value (Un\G1012, Un\G1013) is smaller than the one set to CH1 Ring counter lower limit value (Un\G1010, Un\G1011).	In case of turning off and on Operating condition settings batch-change command (Y01) *7		Set the values that satisfy the following formula: CH1 Ring counter lower limit value (Un\G1010, Un\G1011) ≤ CH1 Ring counter upper limit value (Un\G1012, Un\G1013) And then perform either of the following operations: • Turn off and on Operating condition settings batch-change command (Y01) when Operating condition settings batch-changed (X01) is OFF. • Turn off and on CH1 Count enable command (Y06) when Operating condition settings batch-changed (X01) is ON.
			In case of turning off and on CH1 Count enable command (Y06) *4	In case of turning off and on CH1 Count enable command (Y06) *3	
☐20n*1	Comparison condition setting error (coincidence output 1 to 8)	The values other than 0 to 2 are set to Coincidence output 1 to 8 in Coincidence output condition setting (Un\G0).	*7		Set the values between 0 and 2 to Coincidence output 1 to 8 in Coincidence output condition setting (Un\G0), and then turn off and on Operating condition settings batch-change command (Y01).

*2 The linear counter function stops counting pulses.
*3 The operation is performed normally unless an error occurs.
*4 The ring counter does not start counting pulses.
*7 All operations except the error handling are stopped. Yet dedicated instructions are processed on the condition that the error does not affect the system (in case its error code (last 3 digits) is the numbers other than 800 to 859).
The signal output to the coincidence output 1 to 8 terminals (EQU1 to EQU8) or to the general output 1 to 8 terminals (OUT1 to OUT8) is stopped.
Also, the updating of EQU1 to EQU8 terminal status (Un\G951), OUT1 to OUT8 terminal status (Un\G952), or CH1 External input status (Un\G1450) is stopped.

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
□21n*1*8	Upper limit value setting error (coincidence output 1 to 8)	The value set to Upper limit value (coincidence output 1) (Un\G122, Un\G123) is smaller than the one set to Lower limit value (coincidence output 1) (Un\G120, Un\G121).	In case of turning off and on Operating condition settings batch-change command (Y01) *7		Set the values that satisfy the following formula: Lower limit value (coincidence output 1) (Un\G120, Un\G121) ≤ Upper limit value (coincidence output 1) (Un\G122, Un\G123) And then perform either of the following operations: • Turn off and on Operating condition settings batch-change command (Y01) when Operating condition settings batch-changed (X01) is OFF. • Set Setting change request (coincidence output 1) (Un\G180) to 1_H: Requested when Operating condition settings batch-changed (X01) is ON.
			In case of setting Setting change request (coincidence output 1) (Un\G180) to 1_H: Requested *5	In case of setting Setting change request (coincidence output 1) (Un\G180) to 1_H: Requested *3	
□25n*1	Cam switch function, number of steps setting error (coincidence output 1 to 8)	The value other than 0 to 16 is set to Cam switch function, number of steps (coincidence output 1) (Un\G201).	*6	*3	Set the value between 0 and 16 to Cam switch function, number of steps (coincidence output 1) (Un\G201), and then turn off and on CH1 Cam switch function/PWM output start command (Y08).
□26n*1	Cam switch function, step type setting error (coincidence output 1 to 8)	The value other than 0 or 1 is set to Cam switch function, step type (coincidence output 1) (Un\G200).			Set the value of 0 or 1 to Cam switch function, step type (coincidence output 1) (Un\G200), and then turn off and on CH1 Cam switch function/ PWM output start command (Y08).
□3n1*1	Cam switch function, step No.1 to No.4 setting error (coincidence output 1 to 8)	The values set to Cam switch function, step No.1 to No.4 setting (coincidence output 1) (Un\G202 to Un\G209) are not ascending sequence.			Set values to Cam switch function, step No.1 to No.4 setting (coincidence output 1) (Un\G202 to Un\G209) in ascending sequence, and then turn off and on CH1 Cam switch function/PWM output start command (Y08).
□3n2*1	Cam switch function, step No.4 to No.7 setting error (coincidence output 1 to 8)	The values set to Cam switch function, step No.4 to No.7 setting (coincidence output 1) (Un\G208 to Un\G215) are not ascending sequence.			Set values to Cam switch function, step No.4 to No.7 setting (coincidence output 1) (Un\G208 to Un\G215) in ascending sequence, and then turn off and on CH1 Cam switch function/PWM output start command (Y08).
□3n3*1	Cam switch function, step No.7 to No.10 setting error (coincidence output 1 to 8)	The values set to Cam switch function, step No.7 to No.10 setting (coincidence output 1) (Un\G214 to Un\G221) are not ascending sequence.			Set values to Cam switch function, step No.7 to No.10 setting (coincidence output 1) (Un\G214 to Un\G221) in ascending sequence, and then turn off and on CH1 Cam switch function/PWM output start command (Y08).
□3n4*1	Cam switch function, step No.10 to No.13 setting error (coincidence output 1 to 8)	The values set to Cam switch function, step No.10 to No.13 setting (coincidence output 1) (Un\G220 to Un\G227) are not ascending sequence.			Set values to Cam switch function, step No.10 to No.13 setting (coincidence output 1) (Un\G220 to Un\G227) in ascending sequence, and then turn off and on CH1 Cam switch function/PWM output start command (Y08).

*1 "n" of the error code indicates the number (1 to 8) of Coincidence output in which the error occurs.

*3 The operation is performed normally unless an error occurs.

*5 The comparison is made by using normal setting values that were set just before the wrong values were set. The error does not affect either the functions of Coincidence output 1 to 8 assigned to the error channel or the other functions.

*6 The cam switch function is not executed. The error does not affect the other functions.

*7 All operations except the error handling are stopped. Yet dedicated instructions are processed on the condition that the error does not affect the system (in case its error code (last 3 digits) is the numbers other than 800 to 859).
The signal output to the coincidence output 1 to 8 terminals (EQU1 to EQU8) or to the general output 1 to 8 terminals (OUT1 to OUT8) is stopped.
Also, the updating of EQU1 to EQU8 terminal status (Un\G951), OUT1 to OUT8 terminal status (Un\G952), or CH1 External input status (Un\G1450) is stopped.

*8 The sampling counter function or the periodic pulse counter function is executed by using normal setting value that was set just before the wrong values was set.

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
□3n5*1	Cam switch function, step No.13 to No.16 setting error (coincidence output 1 to 8)	The values set to Cam switch function, step No.13 to No.16 setting (coincidence output 1) (Un\G226 to Un\G233) are not ascending sequence.	*6	*3	Set values to Cam switch function, step No.13 to No.16 setting (coincidence output 1) (Un\G226 to Un\G233) in ascending sequence, and then turn off and on CH1 Cam switch function/PWM output start command (Y08).
□501	CH□ Time unit setting error (sampling counter/ periodic pulse counter)	The value other than 0 or 1 is set to CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016).	In case of turning off and on Operating condition settings batch-change command (Y01) *7		Set the value of 0 or 1 to CH1 Time unit setting (sampling counter/periodic pulse counter) (Un\G1016), and then perform either of the following operations: • Turn off and on Operating condition settings batch-change command (Y01) when Operating condition settings batch-changed (X01) is OFF. • Set CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested when Operating condition settings batch-changed (X01) is ON.
			In case of setting CH1 Setting change request (sampling counter/ periodic pulse counter) (Un\G1020) to 1_H: Requested *8	In case of setting CH1 Setting change request (sampling counter/ periodic pulse counter) (Un\G1020) to 1_H: Requested *3	
□502	CH□ Cycle setting error (sampling counter/periodic pulse counter)	The value of 0 is set to CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017).	In case of turning off and on Operating condition settings batch-change command (Y01) *7		Set the value between 1 and 65535 to CH1 Cycle setting (sampling counter/periodic pulse counter) (Un\G1017), and then perform either of the following operations: • Turn off and on Operating condition settings batch-change command (Y01) when Operating condition settings batch-changed (X01) is OFF. • Set CH1 Setting change request (sampling counter/periodic pulse counter) (Un\G1020) to 1_H: Requested when Operating condition settings batch-changed (X01) is ON.
			In case of setting CH1 Setting change request (sampling counter/ periodic pulse counter) (Un\G1020) to 1_H: Requested *8	In case of setting CH1 Setting change request (sampling counter/ periodic pulse counter) (Un\G1020) to 1_H: Requested *3	
□503	CH□ Periodic interrupt setting error	The value other than 0 or 1 is set to CH1 Periodic interrupt setting (Un\G1001).	*7		Set the value of 0 or 1 to CH1 Periodic interrupt setting (Un\G1001), and then turn off and on Operating condition settings batch-change command (Y01).

*1 "n" of the error code indicates the number (1 to 8) of Coincidence output in which the error occurs.

*3 The operation is performed normally unless an error occurs.

*6 The cam switch function is not executed. The error does not affect the other functions.

*7 All operations except the error handling are stopped. Yet dedicated instructions are processed on the condition that the error does not affect the system (in case its error code (last 3 digits) is the numbers other than 800 to 859).
The signal output to the coincidence output 1 to 8 terminals (EQU1 to EQU8) or to the general output 1 to 8 terminals (OUT1 to OUT8) is stopped.
Also, the updating of EQU1 to EQU8 terminal status (Un\G951), OUT1 to OUT8 terminal status (Un\G952), or CH1 External input status (Un\G1450) is stopped.

*8 The sampling counter function or the periodic pulse counter function is executed by using normal setting value that was set just before the wrong values was set.

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
☐601	CH☐ Moving average count setting error (frequency measurement)	The value other than 1 to 100 is set to CH1 Moving average count (frequency measurement) (Un\G1101).	*9	*3	Set the value between 1 and 100 to CH1 Moving average count (frequency measurement) (Un\G1101), and then turn off and on CH1 Count enable command (Y06).
☐602	CH☐ Time unit setting error (frequency measurement)	The value other than 0 to 2 is set to CH1 Time unit setting (frequency measurement) (Un\G1100).			Set the value between 0 and 2 to CH1 Time unit setting (frequency measurement) (Un\G1100), and then turn off and on CH1 Count enable command (Y06).
☐621	CH☐ Moving average count setting error (rotation speed measurement)	The value other than 1 to 100 is set to CH1 Moving average count (rotation speed measurement) (Un\G1151).	*10		Set the value between 1 and 100 to CH1 Moving average count (rotation speed measurement) (Un\G1151), and then turn off and on CH1 Count enable command (Y06).
☐622	CH☐ Time unit setting error (rotation speed measurement)	The value other than 0 to 2 is set to CH1 Time unit setting (rotation speed measurement) (Un\G1150).			Set the value between 0 and 2 to CH1 Time unit setting (rotation speed measurement) (Un\G1150), and then turn off and on CH1 Count enable command (Y06).
☐623	CH☐ Number of pulses per rotation setting error	The value other than 1 to 8000000 is set to CH1 Number of pulses per rotation (Un\G1152, Un\G1153).			Set the value between 0 and 8000000 to CH1 Number of pulses per rotation (Un\G1152, Un\G1153), and then turn off and on CH1 Count enable command (Y06).
☐660	Pulse measurement range overflow error (function input terminal)	The pulse that is input to the function input terminal (FUNC1) is beyond the measurable range (approx. 214s).	*11		Measure the pulse within the measurable range. To resume the measurement, input the pulse once again, or perform the following operations: • Turn off and on CH1 Count enable command (Y06). • Switch CH1 Pulse measurement start command (function input terminal) (Un\G1210) from 0H: Not measured to 1H: Measured.
☐661	CH☐ Pulse measurement setting error (function input terminal)	The value other than 0 or 1 is set to CH1 Pulse measurement setting (function input terminal)(Un\G1200).	*7		Set the value of 0 or 1 to CH1 Pulse measurement setting (function input terminal) (Un\G1200), and then turn off and on Operating condition settings batch-change command (Y01).
☐662	Pulse measurement range overflow error (latch counter input terminal)	The pulse that is input to the latch counter input terminal (LATCH1) is beyond the measurable range (approx. 214s).	*11	*3	Measure the pulse within the measurable range. To resume the measurement, input the pulse once again, or perform the following operations: • Turn off and on CH1 Count enable command (Y06). • Switch CH1 Pulse measurement start command (latch counter input terminal) (Un\G1212) from 0H: Not measured to 1H: Measured.
☐663	CH☐ Pulse measurement setting error (latch counter input terminal)	The value other than 0 or 1 is set to CH1 Pulse measurement setting (latch counter input terminal) (Un\G1201).	*7		Set the value of 0 or 1 to CH1 Pulse measurement setting (latch counter input terminal) (Un\G1201), and then turn off and on Operating condition settings batch-change command (Y01).

*3 The operation is performed normally unless an error occurs.

*7 All operations except the error handling are stopped. Yet dedicated instructions are processed on the condition that the error does not affect the system (in case its error code (last 3 digits) is the numbers other than 800 to 859).
The signal output to the coincidence output 1 to 8 terminals (EQU1 to EQU8) or to the general output 1 to 8 terminals (OUT1 to OUT8) is stopped.
Also, the updating of EQU1 to EQU8 terminal status (Un\G951), OUT1 to OUT8 terminal status (Un\G952), or CH1 External input status (Un\G1450) is stopped.

*9 The frequency measurement is not started.

*10 The rotation speed measurement is not started.

*11 The pulse measurement is stopped.

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
□670	CH□ PWM output assignment error	CH1 PWM output assignment (Un\G1300) is set as mentioned below. • Two or more bits out of eight (bit 0 to 7) are set to 1: Assigned. Or any bits is not set to 1: Assigned. • A bit, whose Coincidence output (1 to 8) is assigned to the other channel, is set to 1: Assigned.	*12	*3	Perform either of the following operations: • Set just one bit out of eight (bit 0 to 7) to 1: Assigned. • Select the bits whose Coincidence output (1 to 8) are assigned to the corresponding channel, and set it to 1: Assigned. And then turn off and on CH1 Cam switch function/ PWM output start command (Y08).
□671	CH□ ON width setting error (PWM output)	The value out of the setting range is set to CH1 On width setting (PWM output) (Un\G1302, Un\G1303).			According to the Coincidence output assigned for PWM output, set the following value to CH1 On width setting (PWM output) (Un\G1302, Un\G1303): • In case of Coincidence output 1 or 2 Setting range: 0 or 10 to 10000000 • In case of Coincidence output 3 to 8 Setting range: 0 or 1000 to 10000000 And then turn off and on CH1 Cam switch function/ PWM output start command (Y08).
□672	CH□ Cycle setting error (PWM output)	The value out of the setting range is set to CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305).			According to the Coincidence output assigned for PWM output, set the following value to CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305): • In case of Coincidence output 1 or 2 Setting range: 50 to 10000000 • In case of Coincidence output 3 to 8 Setting range: 5000 to 10000000 And then turn off and on CH1 Cam switch function/ PWM output start command (Y08).
□673	CH□ On width/ cycle setting error (PWM output)	The value set to CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305) is smaller than the one set to CH1 On width setting (PWM output) (Un\G1302, Un\G1303).			Set the values that satisfy the following formula: CH1 On width setting (PWM output) (Un\G1302, Un\G1303) ≤ CH1 Cycle setting (PWM output) (Un\G1304, Un\G1305) And then turn off and on CH1 Cam switch function/ PWM output start command (Y08).

*3 The operation is performed normally unless an error occurs.
*12 The PWM waveform is not output.

Error code (decimal notation)	Error name	Description	Operation at error		Action
			Error channel	Other channel	
800	Hold error	"Hold" is set to "Error Time Output Mode" in the Intelligent Function Module Detailed Setting of the CPU module.	*13, *14		Check the Intelligent Function Module Detailed Setting from the parameter setting window of the programming tool, and then set "Clear" to "Error Time Output Mode".
811	Switch setting error (switch 1)	A wrong value is set in the switch 1 in the switch setting.			Check the switch 1 in the switch setting from the parameter setting window of the programming tool, and then set the correct value in the switch 1.
□81n *15	Switch setting error (switch 2 to 5)	A wrong value is set in the switch 2 to 5 in the switch setting.			Check the switch 2 to 5 in the switch setting from the parameter setting window of the programming tool, and then set the correct value in the switch 2 to 5.
820	CPU module error	An error occurred in the CPU module.			Power off and then on, or reset the CPU module.
830	CPU module WDT error	A watchdog timer error occurred in the CPU module.			
850 ⋮ 859	Hardware error	A hardware error occurred.			Power off and then on, or reset the CPU module. If the same error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
870	Stored information error	An error related to stored information was detected in the module.	The counting function works properly despite of the stored information error.		Perform either of the following operations: • Reset the error. • Power off and then on, or reset the CPU module. If the same error occurs again, Please consult local Mitsubishi representative.

*13 All operations except the error handling are stopped. Yet dedicated instructions are processed on the condition that the error does not affect the system (in case its error code (last 3 digits) is the numbers other than 800 to 859).
The signal output to the coincidence output 1 to 8 terminals (EQU1 to EQU8) or to the general output 1 to 8 terminals (OUT1 to OUT8) is stopped.
Also, the updating of EQU1 to EQU8 terminal status (Un\G951), OUT1 to OUT8 terminal status (Un\G952), or CH1 External input status (Un\G1450) is stopped.

*14 Module ready (X00) turns off.

*15 "n" of the error code indicates the number (2 to 5) of the switch with the error.

Point

- When another error is detected during the error occurrence, the information of the new error are overwritten in CH1 Latest error code (Un\G1460) and in CH1 Latest error detection time (Un\G1461 to Un\G1464). Also, the error log is stored in Error log (Un\G6010 to Un\G6164) in order of error occurrence. (For the error whose error code does not have □, the error information is stored in both channels.)
- An error code can be reset by CH1 Error reset command (Un\G1480). Yet unless the error cause is removed, the cause is detected again and the error code is stored.

8.6 List of Warning Code

This clause shows the list of warning codes.

☐ of each warning code and warning name indicates the number of channel with a warning.

Warning code (decimal notation)	Warning name	Description	Operation at warning		Action
			Warning channel	Other channel	
0	Normal	—	—	—	—
☐050	CH☐ Overflow/ underflow error (sampling count value/ periodic pulse count, difference value)	The values stored in CH1 Sampling count value (Un\G1056, Un\G1057), CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063) are outside the range of -2147483648 to 2147483647.	*1	*2	Adjust corresponding values to satisfy the following formula: -2147483648 ≤ Pulse input speed [pps] × Cycle (sampling counter/ periodic pulse counter) [s] ≤ 2147483647

*1 While the value of either -2147483648 or 2147483647 is stored in CH1 Sampling count value (Un\G1056, Un\G1057), CH1 Periodic pulse count, difference value (Un\G1058, Un\G1059), and CH1 Periodic pulse count value update check (Un\G1062, Un\G1063), the count is continued.

*2 The operation is performed normally unless an error or a warning occurs.

Point

- When another warning is detected during the warning occurrence, the information of the new warning are overwritten in CH1 Latest warning code (Un\G1470) and in CH1 Latest warning detection time (Un\G1471 to Un\G1474).
- A warning code can be reset by CH1 Error reset command (Un\G1480). Yet unless the warning cause is removed, the cause is detected again and the warning code is stored.

APPENDICES

Appendix 1 Dedicated Instructions

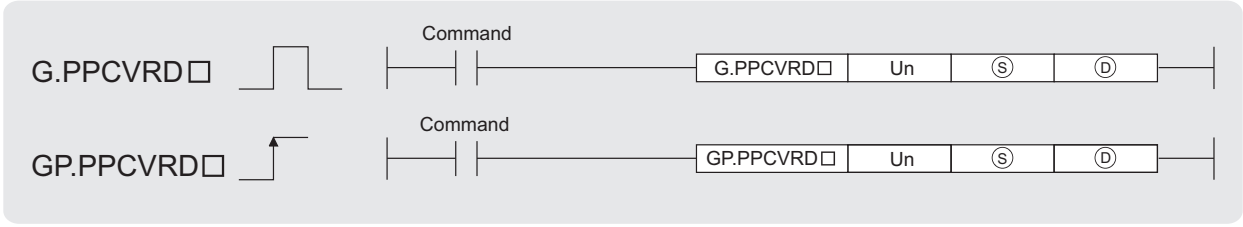
The following table shows the dedicated instructions that can be used with the QD65PD2.

No.	Function	Dedicated instruction	Description
1	Periodic pulse counter function	PPCVRD1	Reads the periodic pulse count value of CH1.
2		PPCVRD2	Reads the periodic pulse count value of CH2.

Point

When the QD65PD2 is mounted to the MELSECNET/H remote I/O station or the redundant CPU, the dedicated instructions cannot be used.

Appendix 1.1 G(P).PPCVRD



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

(1) Setting data

Setting data	Description	Setting range	Data type
Un	Module head I/O number	0000_H to $00FE_H$	BIN 16 bits
Ⓢ	Head number of the device storing the control data	Within the specified device range	Device name
Ⓓ	Turns ON for one scan on completion of the dedicated instruction processing. Also turns ON (D)+1 at device error completion.	Within the specified device range	Bit

(2) Control data

Device	Item	Setting data	Setting range	Setting side
Ⓢ	System area	—	—	—
Ⓢ+1	Completion status	Stores the status on completion of the instruction. 0: Normal completion Other than 0: Error completion	—	System
Ⓢ+2	Periodic pulse count difference value	Stores the periodic pulse count difference value	-2147483648 to 2147483647	System
Ⓢ+3				
Ⓢ+4	Periodic pulse count present value	Stores the periodic pulse count present value	-2147483648 to 2147483647	System
Ⓢ+5				

(3) Function

- Reads the periodic pulse count value.
- When reading the periodic pulse count value using the PPCVRD□ instruction, consistency between the periodic pulse count difference value and the periodic pulse count present value is retained.
- Completion device (D) and completion status indication device (D) +1 are available for the interlock signal of the PPCVRD□ instruction.

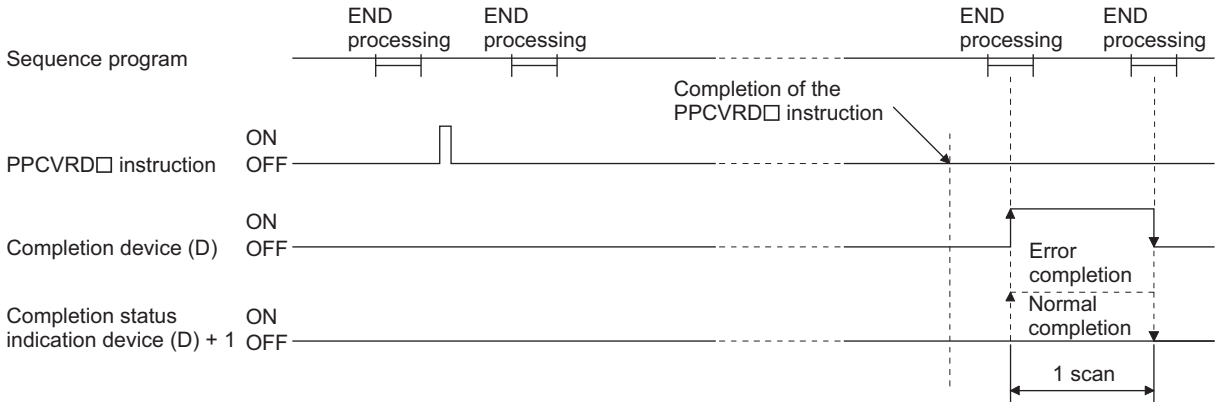
(a) Completion device

Turns ON at END processing in the scan where the PPCVRD□ instruction is completed, and turns OFF at the next END processing.

(b) Completion status indication device

Turns ON/OFF according to the status on completion of the PPCVRD□ instruction.

- Normal completion: Remains OFF.
- Error completion: Turns ON at END processing in the scan where the PPCVRD□ instruction is completed, and turns OFF at the next END processing.



- The PPCVRD1 instruction and PPCVRD2 instruction can be performed simultaneously.
- The PPCVRD□ instruction can be performed while the module READY signal is ON. If performed while the signal is OFF, the instruction is ignored.

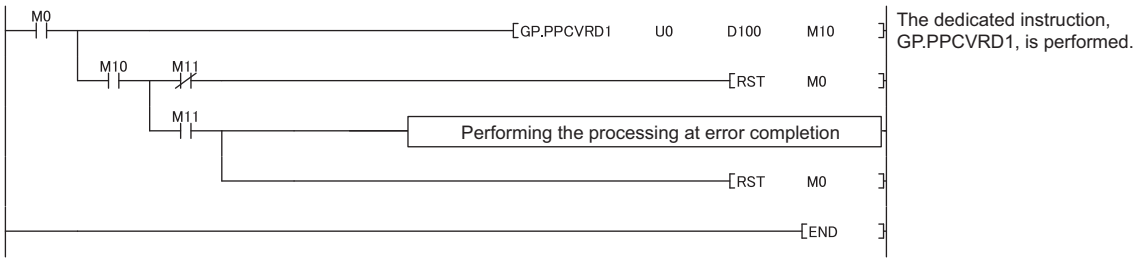
(4) Error

The following occasion results in an error, and the error code is stored into completion status area, (s)+1. Note that the error code is not stored into CH1 Latest error code (Un\G1460).

Error code	Description
10	The PPCVRD□ instruction was performed when both of the following conditions are not met. • Condition 1: "Operation mode setting" of CH□ is the normal mode. • Condition 2: "Counter function selection" of CH□ is the periodic pulse counter.

(5) Program example

The following example shows the program which reads the periodic pulse count value of CH 1 for the QD65PD2 mounted to the slot where I/O number X/Y00 to X/Y1F are assigned when the read command M0 is turned ON.



Point

When the periodic pulse count value is read with the PPCVRD□ instruction, the determination on consistency in the sequence program is unnecessary.

A

Appendix 2 When Using GX Developer

This appendix explains how to operate GX Developer.

When using GX Developer, configure the initial settings and the auto refresh settings with the sequence program.

- Program example when the parameters of the intelligent function module are not used (Page 204, Section 7.1.2)

(1) Applicable software version

For applicable software versions, refer to the following section.

Page 21, Section 2.1 (3)

Appendix 2.1 Operation of GX Developer

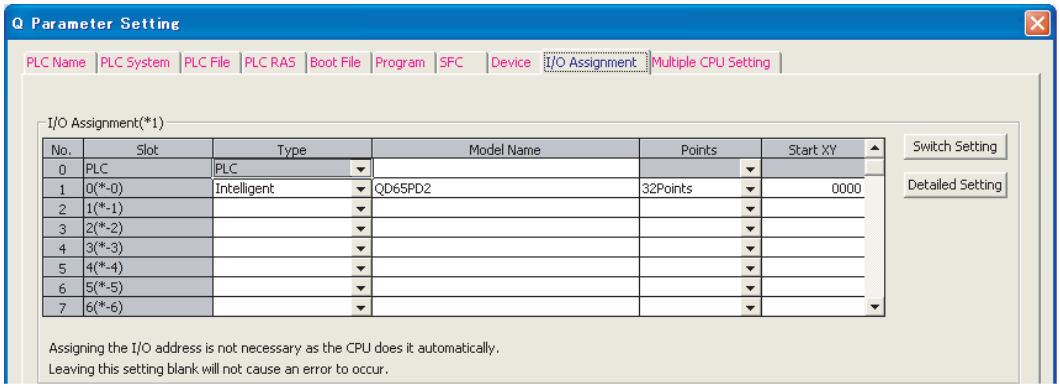
When using GX Developer, set the following dialogue boxes.

Dialogue box name	Use	Reference
I/O Assignment	Set the type of the module to be mounted and the I/O signal range.	Page 275, Appendix 2.1(1)
Switch Setting	Set each setting of the QD65PD2 counter functions.	Page 276, Appendix 2.1(2)

(1) I/O Assignment

Open "I/O Assignment".

Parameter⇨[PLC Parameter]⇨[I/O Assignment]



Item	Setting
Type	Select "Intelligent".
Module Name	Input the model name of the module.
Points	Select 32 points.
Start XY	Input any start I/O number of the QD65PD2.

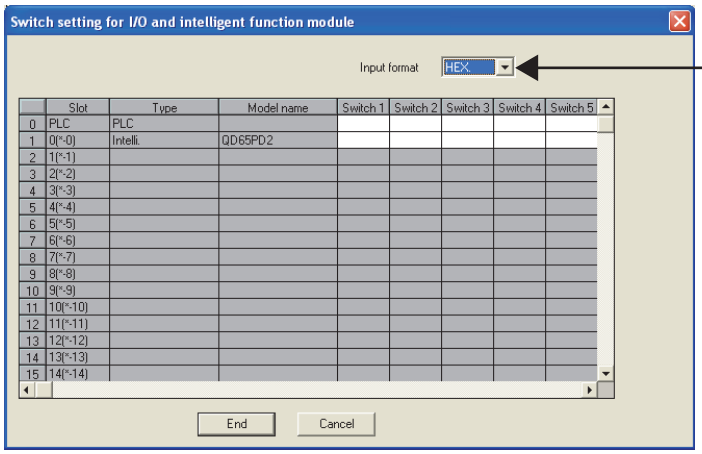
(2) Switch setting

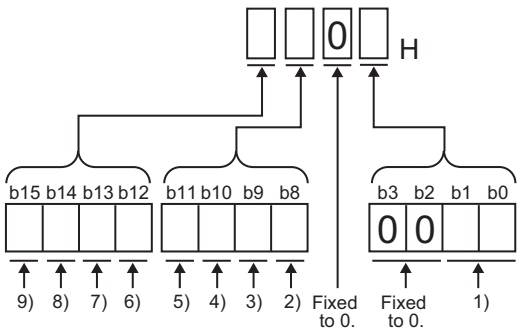
Open "I/O Assignment".

Parameter⇨[PLC Parameter]⇨[I/O Assignment]⇨ Switch Setting button

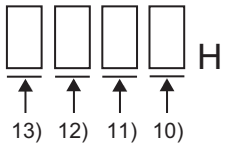
For the description of the setting items, refer to the switch setting of GX Works2 in the following section.

Page 180, Section 6.2 (1)

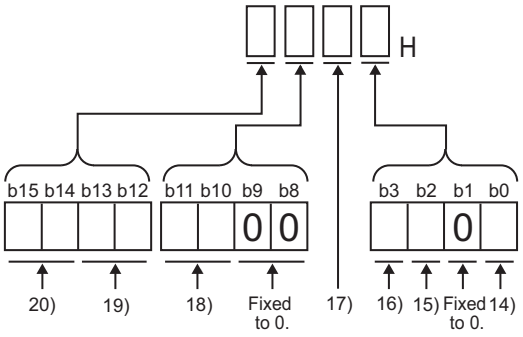


Switch No.	Switch setting	Setting item and setting value	Default value
Switch 1 (common setting)		1) Comparison output setting value 0_H: Coincidence Output 1_H: Cam Switch Function	0_H
		2) Coincidence output 1 channel assignment setting 0: CH1 1: CH2	0
		3) Coincidence output 2 channel assignment setting*1	
		4) Coincidence output 3 channel assignment setting*1	
		5) Coincidence output 4 channel assignment setting*1	
		6) Coincidence output 5 channel assignment setting*1	
		7) Coincidence output 6 channel assignment setting*1	
		8) Coincidence output 7 channel assignment setting*1	
		9) Coincidence output 8 channel assignment setting*1	

*1 The setting values are the same as 2).

Switch No.	Switch setting	Setting item and setting value	Default value
Switch 2 (CH1)		10) Operation mode setting 0_H: Normal Mode 1_H: Frequency Measurement Mode 2_H: Rotation Speed Measurement Mode 3_H: Pulse Measurement Mode 4_H: PWM Output Mode	0000_H
		11) Count source selection 0_H: A Phase/B Phase 1_H: Internal Clock (0.1μs) 2_H: Internal Clock (1μs) 3_H: Internal Clock (10μs) 4_H: Internal Clock (100μs) 5_H: Coincidence Output 1 6_H: Coincidence Output 2	
		12) Pulse input mode 0_H: 1-Phase Multiple of 1 1_H: 1-Phase Multiple of 2 2_H: CW/CCW 3_H: 2-Phase Multiple of 1 4_H: 2-Phase Multiple of 2 5_H: 2-Phase Multiple of 4	
		13) Counting speed setting*2 0_H: 10kpps 1_H: 100kpps 2_H: 200kpps 3_H: 500kpps 4_H: 1Mpps 5_H: 2Mpps 6_H: 4Mpps 7_H: 8Mpps	

*2 When connected with DC input, set this to 200kpps or slower.

<table>
<tr><th>Switch No.</th><th>Switch setting</th><th colspan="3">Setting item and setting value</th><th>Default value</th></tr>
<tr><td rowspan="20">Switch 3
(CH1)</td><td rowspan="20"> 
</td><td colspan="3">14) Counter format
0: Linear Counter
1: Ring Counter</td><td rowspan="3">0</td></tr>
<tr><td colspan="3">15) Function input logic setting
0: Positive Logic
1: Negative Logic</td></tr>
<tr><td colspan="3">16) Latch counter input logic setting
0: Positive Logic
1: Negative Logic</td></tr>
<tr><td colspan="3">17) Counter function selection
0_H: Count Disabling Function
1_H: Latch Counter Function
2_H: Sampling Counter Function
3_H: Periodic Pulse Counter Function
4_H: Count disable/Preset/replace Function
5_H: Latch counter/Preset/replace Function</td><td>0_H</td></tr>
<tr><td colspan="3">18) Z Phase input response time setting</td><td rowspan="11">00</td></tr>
<tr><td></td><td>OFF→ON Response time</td><td>ON→OFF Response time</td></tr>
<tr><td>00:</td><td>0.25μs</td><td>2.5μs</td></tr>
<tr><td>01:</td><td>0.1ms</td><td>0.1ms</td></tr>
<tr><td>10:</td><td>1.0ms</td><td>1.0ms</td></tr>
<tr><td colspan="3">19)Function input response time setting*3</td></tr>
<tr><td></td><td>OFF→ON Response time</td><td>ON→OFF Response time</td></tr>
<tr><td>00:</td><td>0.02ms</td><td>0.1ms</td></tr>
<tr><td>01:</td><td>0.1ms</td><td>0.1ms</td></tr>
<tr><td>10:</td><td>1.0ms</td><td>1.0ms</td></tr>
<tr><td colspan="3">20)Latch counter input response time setting*3</td></tr>
<tr><td></td><td>OFF→ON Response time</td><td>ON→OFF Response time</td></tr>
<tr><td>00:</td><td>0.02ms</td><td>0.1ms</td></tr>
<tr><td>01:</td><td>0.1ms</td><td>0.1ms</td></tr>
<tr><td>10:</td><td>1.0ms</td><td>1.0ms</td></tr>
<tr><td>Switch 4
(CH2)</td><td colspan="4">Same as the switch 2</td><td>0000_H</td></tr>
<tr><td>Switch 5
(CH2)</td><td colspan="4">Same as the switch 3</td><td>0000_H</td></tr>
</table>

*3 When the function input logic setting and the latch counter input logic setting are set to negative logic, the OFF→ON response time and the ON→OFF response time invert.
For example, when 00 is set, the OFF→ON response time is 0.1ms, and the ON→OFF response time is 0.02ms.

Point

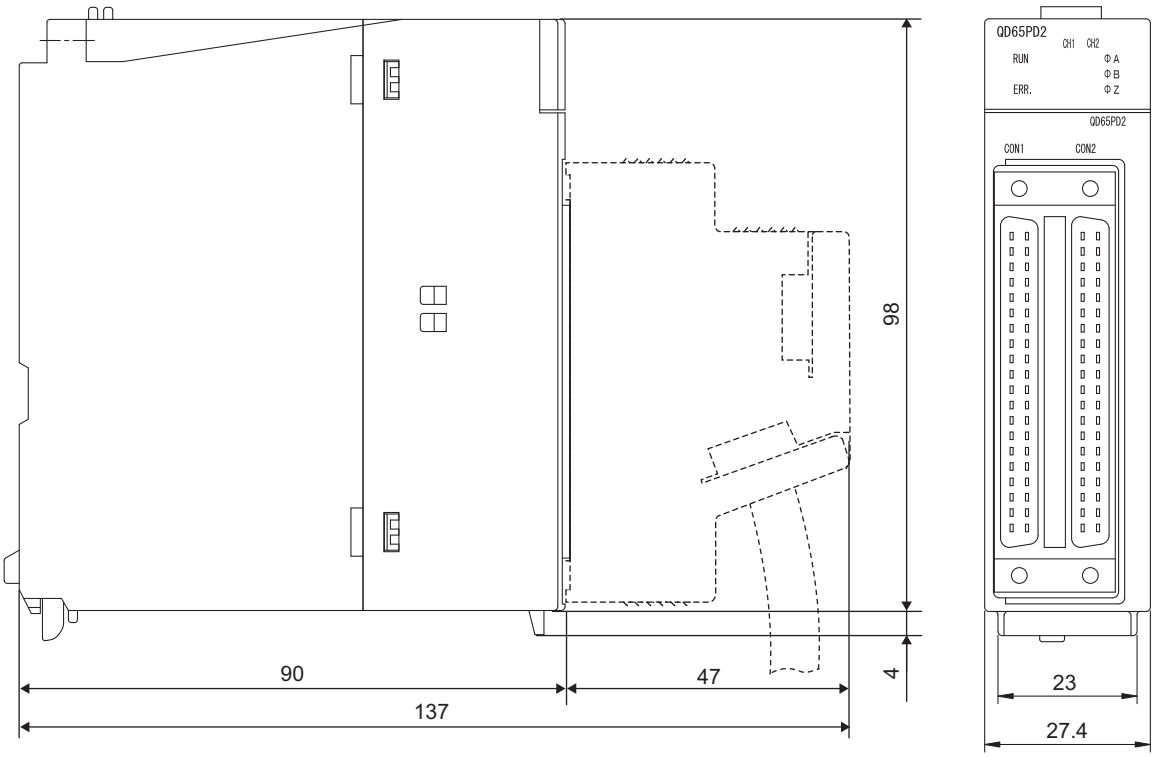
- Those where 0 is fixed cannot be used by the user since they are used by the system. Always set to 0. If they are used by the user (set to value other than 0), the GD65PD2 function is not guaranteed.

(3) Switch setting combination availability

For the switch setting combination availability, refer to the following section.

☞ Page 182, Section 6.2 (2)

Appendix 3 External Dimensions



(Unit: mm)

INDEX

0 to 9

A

C

D

E

F

G

I

L

M

N

O

P

R

S

U

W

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print date	*Manual number	Revision
January 2011	SH(NA)-080964ENG-A	First edition
October 2011	SH(NA)-080964ENG-B	Partial correction COMPLIANCE WITH THE EMC AND LOW VOLTAGE, Section 2.1, 2.4, 3.5.3, 4.13, 4.14, 4.20, 6.1, 6.2, 7.1, 7.1.1, 7.1.2, 7.2, 8.2
May 2012	SH(NA)-080964ENG-C	Partial correction Section 2.4, Chapter 6
March 2015	SH(NA)-080964ENG-D	Partial correction Section 2.1, 3.5.3, 4.3.5, Appendix 2
February 2016	SH(NA)-080964ENG-E	Partial correction Section 2.1, 4.2.2, 4.3.5

Japanese manual version SH-080963-E

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation 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.

SH(NA)-080964ENG-E(1602)MEE
MODEL: QD65PD2-U-E
MODEL CODE: 13JZ51

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN