

PROGRAMMABLE CONTROLLER
FP7 High-speed Counter Unit
User's Manual

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

- Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
- Do not use this product in areas with inflammable gas. It could lead to an explosion.
- Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

- To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
- Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
- Do not touch the terminal while turning on electricity. It could lead to an electric shock.
- Use the external devices to function the emergency stop and interlock circuit.
- Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
- Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
- Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the users manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website:
http://industrial.panasonic.com/ac/e/dl_center/manual/ .

Unit name or purpose of use	Manual name	Manual code	
FP7 Power Supply Unit	FP7 CPU Unit Users Manual (Hardware)	WUME-FP7CPUH	
FP7 CPU Unit	FP7 CPU Unit Programming Manual	WUME-FP7CPUPGR	
	Instructions for Built-in COM Port FP7 Extension (Communication) Cassette	WUME- FP7COM	
	Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
	FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit Users Manual	WUME-FP7AIH	
FP7 Analog Output Unit	FP7 Analog Output Unit Users Manual	WUME-FP7AOH	
FP7 High-speed Counter unit	FP7 High-speed Counter Unit Users Manual	WUMJ-FP7HSC	
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP	
PHLS System	PHLS System Users Manual	WUME-PHLS	
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7	

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1

Unit Functions and Restrictions

1.1 Unit Functions and How They Work

1.1.1 Functions of Unit

■ **Two or four-point 4 MHz/signed 32-bit high-speed counters are provided.**

- High-speed counting of input signals is available up to the maximum frequency 4 MHz (16MHz for 2-phase 4 multiple). It is selectable from 2-phase input (phase differential input), individual input or direction detection input in accordance with input devices such as an encoder and sensor.

■ **24 VDC, 12 VDC, 5 VDC inputs and line driver input are available.**

- The count input circuit supports both an open collector output and a line driver output (Differential output: Equivalent to AM26LS31).

■ **Selectable from ring counter or linear counter.**

- Both the ring counter and linear counter are available. The Z phase of an encoder can be used as count reset timing in the both methods.

■ **Frequency measurement function and Rotation speed measurement function are provided.**

- Frequencies are automatically measured in the unit from count values. Also, the rotation speed is automatically measured from count values and the pulse number for one rotation. The calculation results are directly stored in unit memories, thus no calculation using ladder programs is needed.

■ **The count of internal clocks is available..**

- Internal clocks occurred in the unit can be selected as count input signals. Timing measurement is achievable with high accuracy of the maximum resolution 0.25 μ s. The selectable internal clocks are 0.25 μ s (4 MHz), 1 μ s (1 MHz), 10 μ s (100 kHz) and 100 μ s (10 kHz).

■ **Capture function and Sampling capture function are provided.**

- It is possible to store the count value at the moment of the occurrence of a trigger assigned to a control signal. The count value independent of the scan time of PLC can be confirmed.
- The capture function is used to execute capturing at the leading and trailing edges of control signals, and the sampling capture function is used to execute capturing every sampling time (T [ms]) by signal input.

■ **14 counter operations by input signals (input z signal, control signal and output relay (Y relay)).**

- 1) Reset operation at rising edge, 2) Reset operation at trailing edge, 3) Positive logic reset operation, 4) Negative logic reset operation, 5) Preset operation at rising edge, 6)Preset operation at trailing edge, 7) Positive logic preset operation, 8) Negative logic preset operation, 9)Positive logic enable operation, 10) Negative logic enable operation, 11) Positive logic enable operation and reset operation at rising edge, 12) Negative logic enable operation and reset operation at trailing edge, 13) Positive logic enable operation and preset operation at rising edge, 14) Negative logic enable operation and preset operation at trailing edge

■ **Forced ON/OFF of external output relays (Y relays) is available.**

- External output relays can be forcibly turned on/off by the monitoring function of a programming tool or ladder program. It is usable for checking wirings when setting up the system.

■ **Band comparison function and Target value match comparison function are provided.**

- Two types of comparison functions are selectable for count values.
- In the band comparison function, a maximum of 16 band comparison conditions (max. 16 sets of upper and lower limits) can be specified for each counter. A maximum 16 outputs can be turned on/off for each comparison condition. It is also possible to turn on an external output relay when the count value is in the range of the specified condition.
- In the target value match comparison function, a maximum of 16 target value match comparison conditions can be specified for each counter. A maximum of 16 outputs are set or reset for each comparison condition in accordance with the count direction when the count value reaches a target value. It is also possible to turn on external output relays.

■ **Programmable output ON function**

- When using the band comparison function, the ON timing characteristics of external output relays can be changed.
 ON timing delay [1 ms ~ 9999 ms]: Delays the ON timing of output.
 ON hold time [1 ms ~ 9999 ms]: Holds the on state of output during a specified time.
 The ON timing delay and the ON hold time can be used in combination.

■ **Input time constant (Noise filter)**

- The noise filter function is available which sets the input time constant to reduce noises of input A, B and Z signals of each counter, and control signal lines.

Input signal name	Noise filter type
Input A signal, input B signal (The same time constant for the both signals)	0.1 μs (2 MHz), 0.2 μs (1 MHz), 0.5 μs (500 kHz), 1.0 μs (250 kHz), 2.0 μs (100 kHz), 10.0 μs (10 kHz)
Input Z signal	0.1 μs (2 MHz), 0.2 μs (1 MHz), 0.5 μs (500 kHz), 1.0 μs (250 kHz), 2.0 μs (100 kHz), 10.0 μs (10 kHz)
Control signal	2 μs, 5μs, 10 μs, 20 μs, 50 μs, 100 μs, 500 μs, 1 ms, 2 ms, 5 ms, 10 ms

1.1.2 Unit Type and Product Number

Name		Product No.
FP7 High-speed counter unit	2-ch type	AFP7HSC2T
	4-ch type	AFP7HSC4T

1.2 Restrictions on Combinations of Units

1.2.1 Restrictions on Power Consumption

The internal current consumption of the unit is as follows. Make sure that the total current consumption is within the capacity of the power supply with consideration of all other units used in combination with this unit.

Name		Product No.	Current consumption
FP7 High-speed counter unit	2-ch type	AFP7HSC2T	65 mA or less
	4-ch type	AFP7HSC4T	65 mA or less

1.2.2 Applicable Versions of FPWIN GR7 and Units

For using the high-speed counter unit, the following versions of FPWIN GR7 and units are required.

Item	Applicable version
Programming tool software FPWIN GR7	Ver.1.2 or later
FP7 CPU unit	Ver.1.2 or later
FP7 Positioning unit	For using the interrupt function with the high-speed counter unit, Ver.1.1 or later is required.

1.2.3 Restrictions on Interrupt Function

- The high-speed counter unit can activate interrupt programs of CPU using comparison match flags.
- However, the units which can use the function to activate interrupt programs should be in the range of the following specifications.

■ Interrupt program specifications

Item	Specifications	
Interrupt program activation condition	Activates corresponding interrupt programs when the comparison match 0 flag and comparison match 1 flag of each channel turns on.	
No. of interrupt programs	Per 1 channel of High-speed counter unit	Max. 2 programs
	Per 1 High-speed counter unit	Max. 4 programs (2-ch type High-speed counter unit) Max. 8 programs (4-ch type High-speed counter unit)
	Per 1 CPU unit	Max. 64 programs (8 programs x 8 units)

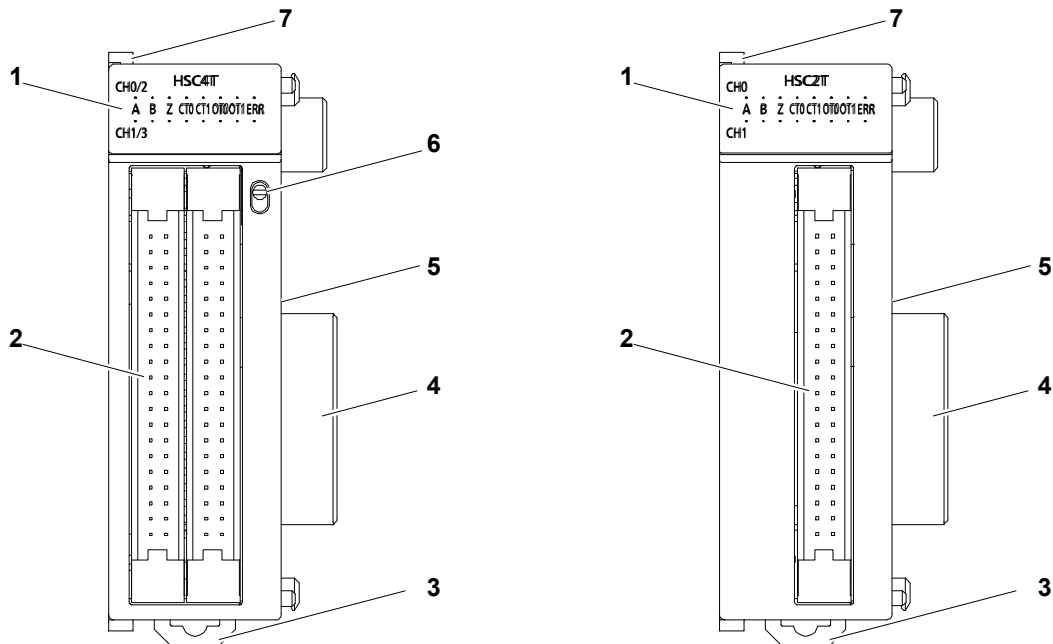
(Note 1): The interrupt input function can be used for 8 points per unit and for a maximum of 8 units (max. 64 points) in the whole system. However, the entire scan time slows down as more interrupt programs are used. Minimize the use of interrupt programs.

(Note 2): The priority order for interrupt inputs is as follows; In a unit, from the smallest interrupt bit. In the whole system, from the smallest unit number.

2

Names and Functions of Parts

2.1 Names and Functions of Parts



① Operation monitor LEDs

Displays the on/off status of two channels. Use the display changeover switch to toggle between the channel number CH0/CH1 and CH2/CH3. The LEDs show the same information for each channel.

LED	Description	Color	ON	OFF	Flashing
HSC	Power supply of the unit	Blue	ON	OFF	—
A	Pulse input A signal display	Green	Displays the status of the input signal		
B	Pulse input B signal display	Green	Displays the status of the input signal		
Z	Pulse input Z signal display	Green	Displays the status of the input signal		
CT0	Control 0 signal display	Green	Positive logic	Negative logic	—
CT1	Control 1 signal display	Green	Positive logic	Negative logic	—
OT0	External output 0 signal display	Green	ON	OFF	—
OT1	External output 1 signal display	Green	ON	OFF	—
ERR	Error display	Red	If an error occurs	Normal operation	—

(Note1): The LEDs for the pulse input signals flash according to the input statuses, thus look as if they are continuously lit if the input frequencies are high.

(Note 2): The LED of each input signal indicates the status after an input time constant processing.

② Input/output connector

Connector for input and output (40 pins) (Conforms to MIL standard)

③ **DIN hook**

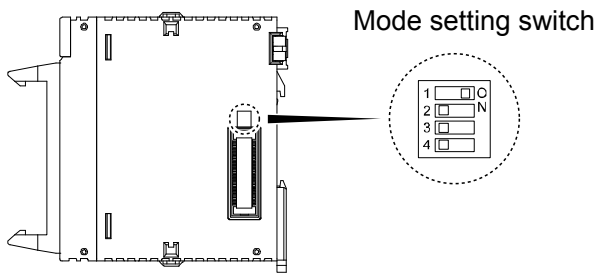
This hook is used to install the unit on a DIN rail.

④ **Unit connector**

Connects the internal circuits between units.

⑤ **Mode setting switch**

- Change the switch to use the interrupt function.
- At the factory setting, it is set to off (no interrupt function).



	Description
1	ON: Interrupt function is enabled. OFF: Interrupt function is disabled.
2	Not used
3	
4	

⑥ **Display changeover switch**

Toggle between the display of 0ch/1ch and that of 2ch/3ch.

⑦ **Fixing hook**

This hook is used to fix units.

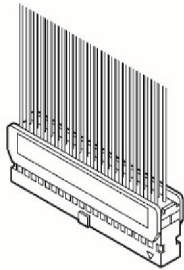
3

Wiring and Input/Output Specifications

3.1 Connection over Wire-pressed Terminal Cable

3.1.1 Specifications of Wire-pressed Terminal Cable

This is a connector that allows loose wires to be connected without removing the wires' insulation. The pressure connection tool is required to connect the loose wires.



Discrete-wire connector (40P)

Suitable wires (strand wire)

Size	Nominal cross-sectional area	Insulation thickness	Rated current
AWG#22	0.3 mm ²	1.5 to 1.1 dia.	3 A
AWG#24	0.2 mm ²		

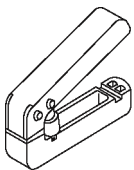
Connector for wire-pressed terminal cable (provided with the unit)

Manufacturer	Composition of parts	Unit type and required quantity	
		2-ch type	4-ch type
Panasonic made	Housing (40P)	1 x 1 set	1 x 2 sets
	Semi-cover (40P)	2 x 1 set	2 x 2 sets
	5-pin contact (for AWG 22 and AWG24)	8 x 1 set	8 x 2 sets

(Note) 1 connector set and 2 connector set are supplied with the 2-ch type unit and 4-ch type unit, respectively. If you need more connectors, purchase AFP2801 (2 sets/pack).

Pressure connection tool

Manufacturer	Product no.
Panasonic made	AXY52000FP



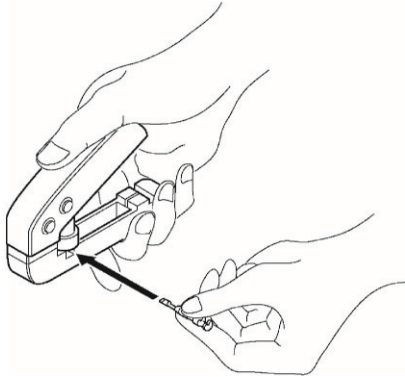
Pressure connection tool

3.1.2 Assembly of Connector for Wire-pressed Terminal Cable

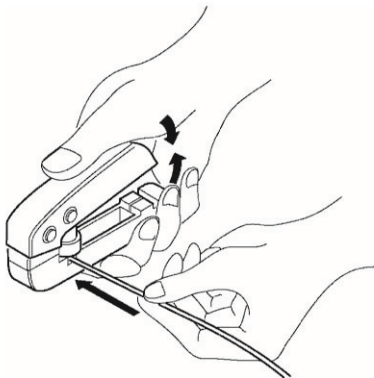
The wire end can be directly crimped without removing the wire's insulation, which saves wiring effort.

(Procedure)

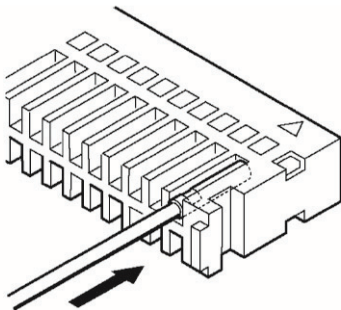
1. Bend the contact back from the carrier, and set it in the pressure connection tool.



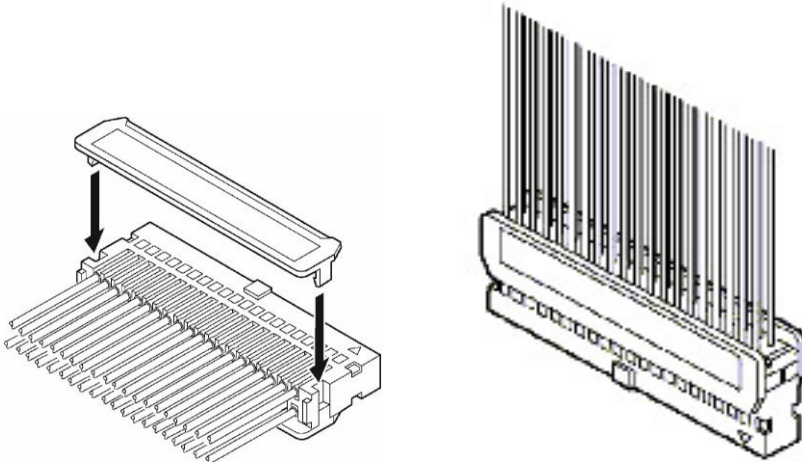
2. Insert the wire without removing its insulation until it stops, and lightly grip the tool.



3. After press fitting the wire, insert it into the housing.

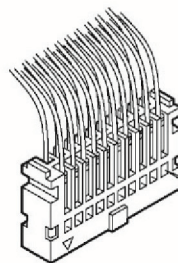
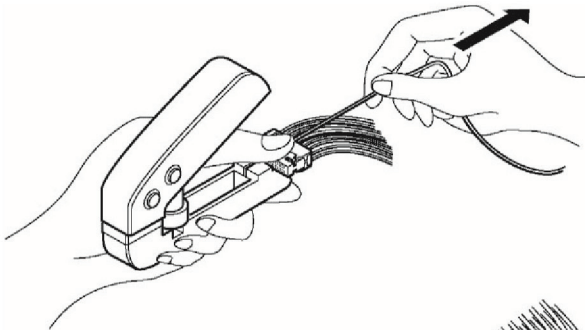


4. When all wires have been inserted, fit the semi-cover into place.



◆ KEY POINTS

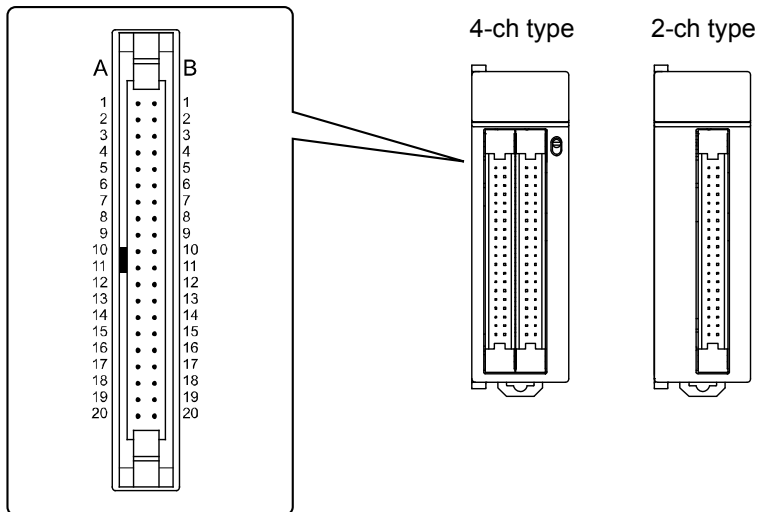
- **Contact puller pin to redo wiring**
If there is a wiring mistake or the wire is incorrectly pressure-connected, use the contact puller pin provided with the fitting to remove the contact.



Press the housing against the pressure connection tool so that the contact puller pin comes in contact with this section.

3.2 Terminal Circuit Diagram

3.2.1 I/O Terminal Layout Diagram



- Two connectors are used to connect the 4-ch type and one connector to connect the 2-ch type.
- The signal pins for two channels are assigned to one connector. There is no difference in pin arrangement between the CH0/CH1 connector and the CH2/CH3 connector if the unit is of the 4-ch type. Any pins with the same in number have the same function.

Input terminal

Pin No.		Circuit	Signal name
ch0/2	ch1/3		
A1	A11		Input A: 24 VDC (12 to 24 VDC)
A2	A12		Input A: 5 VDC (3.5 to 5 VDC)
B1	B11		Input A: COM
B2	B12		Input A: COM
A3	A13		Input B: 24 VDC (12 to 24 VDC)
A4	A14		Input B: 5 VDC (3.5 to 5 VDC)
B3	B13		Input B: COM
B4	B14		Input B: COM
A5	A15		Input Z: 24 VDC (12 to 24 VDC)
A6	A16		Input Z: 24 VDC (3.5 to 5 VDC)
B5	B15		Input Z: COM
B6	B16		Input Z: COM

Control 0/1 (common)

Pin No.		Circuit	Signal name
ch0/2	ch1/3		
A7	A17		Control 0: (12 to 24 VDC)
B7	B17		Control 0: COM
A8	A18		Control 1: (12 to 24 VDC)
B8	B18		Control 1: COM

External output 0/1 and Power supply terminal (common)

Pin No.		Circuit	Signal name
ch0/2	ch1/3		
A9	A19		External output 0: Sink output (5 to 24 VDC, 15 mA)
B9	B19		External output 1: Sink output (5 to 24 VDC, 15 mA)
A10	A20		Power supply for output: 24 VDC
B10	B20		Power supply for output: GND

(Note 1): For using external output (A9, A19, B9, B19), power should be supplied to the power supply for output (A10, A20, B10, B20). When the external output is not used, there is no need to supply the power to the power supply for output.

3.3 Input/Output Specifications

3.3.1 Input Specifications

Item	Description			
	Input A, B, Z signals			Control signal
	24VDC	5VDC		
		Open collector connection	Line driver connection	
Insulation method	Optical coupler			Optical coupler
Rated input voltage	12 V DC to 24 V DC	5VDC	Equivalent to AM26LS31	12VDC to 24VDC
Operating voltage range	10.8 V DC to 26.4 V DC	3.5VDC to 5.5VDC		10.8VDC to 26.4VDC
Input points per common	Independent common for each point			Independent common for each point
Min. on voltage/Min. on current	10V DC / 4 mA	3 V DC / 4 mA		10 V DC / 4 mA
Max. off voltage/Max. off current	2V DC / 2mA	1 V DC / 0.5 mA		2V DC / 2 mA
Input impedance	Approx. k Ω	Approx. 390 Ω		Approx. 3 k Ω
Operating mode indicator	LED display			LED display

(Note) The duty ratio of count input should be $50\pm 10\%$. Also, the phase shifting of 2-phase input should be less than 5%.

3.3.2 Output Specifications

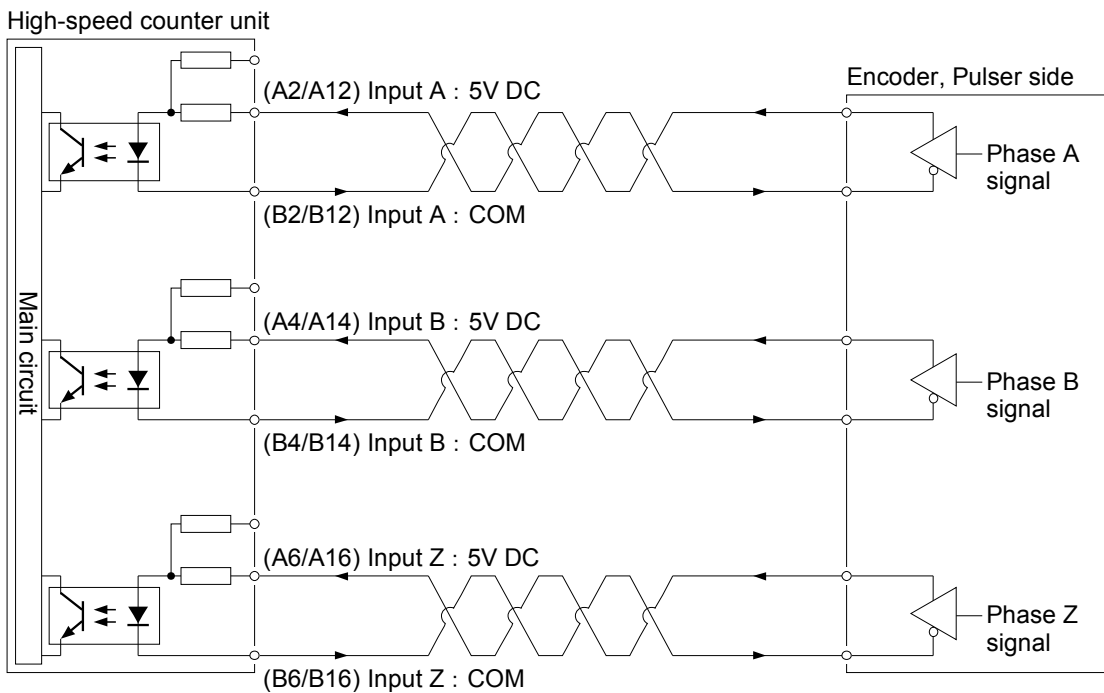
Item	Description	
Insulation method	Optical coupler	
Output type	Open collector (Sink output)	
Rated load voltage	5 V DC to 24 V DC	
Allowable load voltage range	4.75 V DC to 26.4 V DC	
Max. load current	15 mA	
Output points per common	2 points/common	
Off state leakage current	1 μ A or less	
ON Max. voltage drop	0.2 VDC or less	
External power supply	Voltage	21.6VDC to 26.4VDC
	Current	30 mA or less
Surge absorber	Zener diode	
Operating mode indicator	LED display	

3.4 Precautions on Wiring and Connection of Count Input

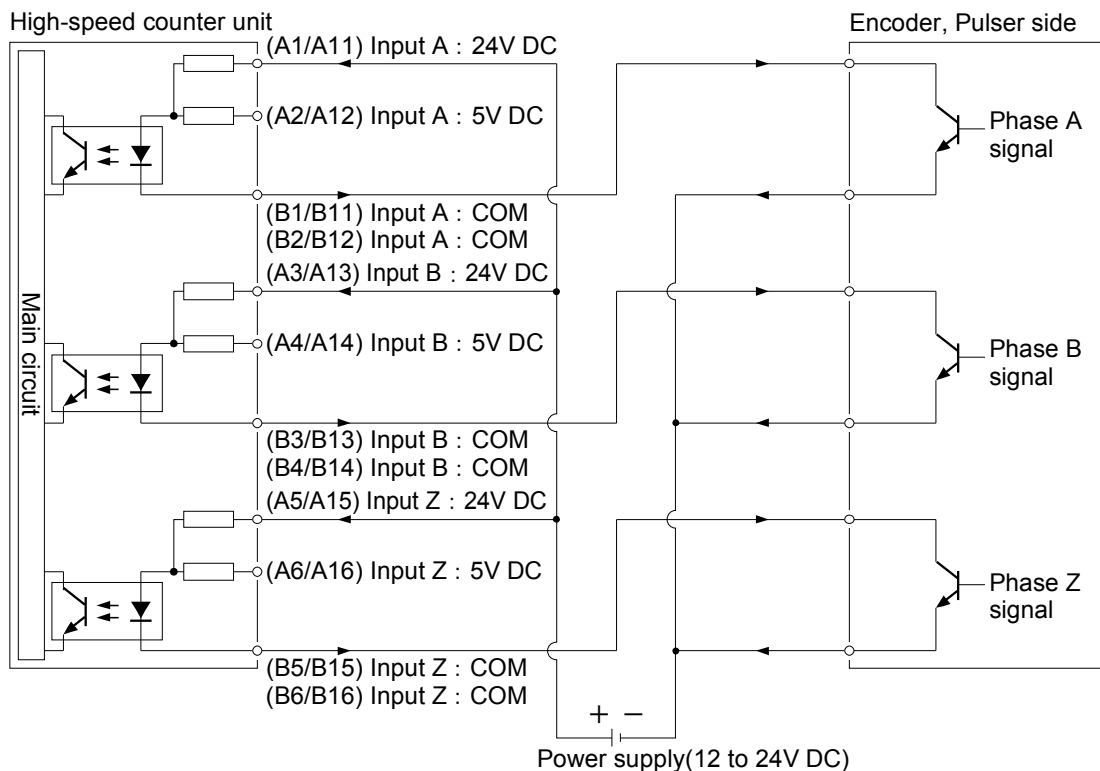
3.4.1 Precautions on Wiring

- For the connection between the count input (phases A, B, Z) and encoder, etc., use shielded twisted-pair cables.
- The length of connected wires should be within 10 m.

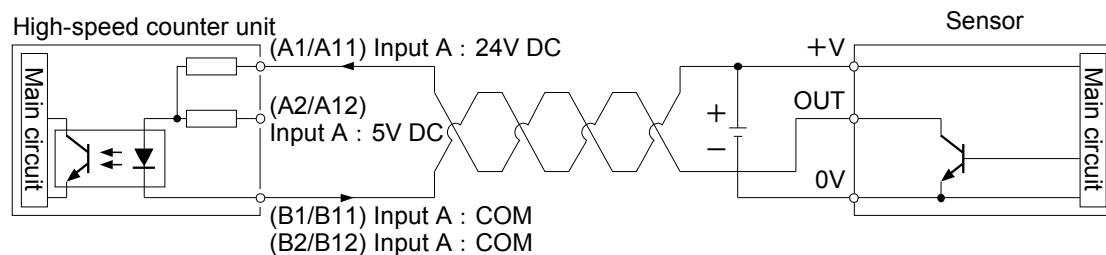
3.4.2 For Line Driver of Encoder Input



3.4.3 For Transistor Open Collector Type of Encoder Input



3.4.4 For Sensor Input



4

Unit Allocation and Parameter Settings

4.1 Unit Allocation

4.1.1 Confirmation of I/O Allocation Information

Input and output relays are allocated.

■ Input relays

I/O number				Name	Description	
CH0	CH1	CH2	CH3			
WX0	X0	X20	X40	X60	Operation ready done	Flag to indicate the counter operation is ready.
	X1	X21	X41	X61	Counter enable	Flag to indicate the counter operation is enabled.
	X2	X22	X42	X62	Count direction	Flag to indicate a count direction. ON: Forward (Addition) OFF: Reverse (Subtraction)
	X3	X23	X43	X63	—	—
	X4	X24	X44	X64	Capture 0 done flag	Flag to acquire the count value, save it in capture 0 register, and announce the completion.
	X5	X25	X45	X65	Capture 1 done flag	Flag to acquire the count value, save it in capture 1 register, and announce the completion.
	X6	X26	X46	X66	External output 0 signal monitor	Monitors the output state of external output 0 signal.
	X7	X27	X47	X67	External output 1 signal monitor	Monitors the output state of external output 1 signal.
	X8	X28	X48	X68	Input A signal monitor	Monitors the input state of input A signal.
	X9	X29	X49	X69	Input B signal monitor	Monitors the input state of input B signal.
	XA	X2A	X4A	X6A	Input Z signal monitor	Monitors the input state of input Z signal.
	XB	X2B	X4B	X6B	Control 0 signal monitor	Monitors the output state of control 0 signal.
	XC	X2C	X4C	X6C	Control 1 signal monitor	Monitors the output state of control 1 signal.
	XD	X2D	X4D	X6D	Overflow annunciation	Flag to announce the occurrence of overflow or underflow (Enabled for the linear counter only.)
	XE	X2E	X4E	X6E	Underflow annunciation	
	XF	X2F	X4F	X6F	Error annunciation	Flag to announce the occurrence of an error.
WX1	X10	X30	X50	X70	Comparison match 0 flag	Flag to reflect the results of the band comparison function or target value match function.
	~	~	~	~	~	
	X19	X39	X59	X79	Comparison match 9 flag	
	X1A	X3A	X5A	X7A	Comparison match A flag	
	~	~	~	~	~	
X1F	X3F	X5F	X7F	Comparison match F flag		

(Note 1): The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.
 Example) When the starting word number for the unit is "10", the operation ready done flag for CH0 is X100.

■ Output relays

I/O number				Name	Enabled condition	Description	
CH0	CH1	CH2	CH3				
WY0	Y0	Y10	Y20	Y30	Operation ready request	Level	Relay to recalculate the setting parameter of counter.
	Y1	Y11	Y21	Y31	Enable request	Level	Relay to start the counter operation.
	Y2	Y12	Y22	Y32	Reset request	ON edge	Relay to reset count values.
	Y3	Y13	Y23	Y33	Preset request	ON edge	Relay to preset count values.
	Y4	Y14	Y24	Y34	Reset enable request	Level	Relay to enable the reset by the control signal and input Z signal.
	Y5	Y15	Y25	Y35	Current value change request	ON edge	Relay to request for changing the current value of counter.
	Y6	Y16	Y26	Y36	Preset value change request	ON edge	Relay to request for changing preset values.
	Y7	Y17	Y27	Y37	Sampling capture request	Level	Relay to enable the sampling capture function.
	Y8	Y18	Y28	Y38	—	—	—
	Y9	Y19	Y29	Y39	External output 0 forced ON	Level	Relay to forcibly turn on the external output 0.
	YA	Y1A	Y2A	Y3A	External output 0 forced OFF	Level	Relay to forcibly turn off the external output 0.
	YB	Y1B	Y2B	Y3B	External output 1 forced ON	Level	Relay to forcibly turn on the external output 1.
	YC	Y1C	Y2C	Y3C	External output 1 forced OFF	Level	Relay to forcibly turn off the external output 1.
	YD	Y1D	Y2D	Y3D	Overflow clear	ON edge	Relay to clear the overflow annunciation flag.
	YE	Y1E	Y2E	Y3E	Underflow clear	ON edge	Relay to clear the underflow annunciation flag.
	YF	Y1F	Y2F	Y3F	Error clear	ON edge	Relay to clear errors.

(Note 1): The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.
 Example) When the starting word number for the unit is "10", the operation ready request flag for CH0 is Y100.

4.1.2 Number of Occupied Points of High-speed Counter Unit

- The following I/O numbers are used for the high-speed counter unit.
- As the input and output starts from the same I/O numbers in FP7 series, the following number of words is occupied.

Name	Product No.	No. of I/O points actually used		No. of occupied words (No. of occupied points)
		Input	Output	
2-ch type	AFP7HSC2T	8 words (128 points)	4 words (64 points)	8 words (128 points)
4-ch type	AFP7HSC4T			

Example) The both 2-ch type and 4-ch type high-speed counter units occupy 8 words (128 points).

Slot No.	Unit to use	Starting word...
<input type="checkbox"/>	0 CPS4E CPU unit	0
<input type="checkbox"/>	1 High-speed counter unit (4 ch)	10
<input checked="" type="checkbox"/>	2 Input unit (DC type), 64 points	18

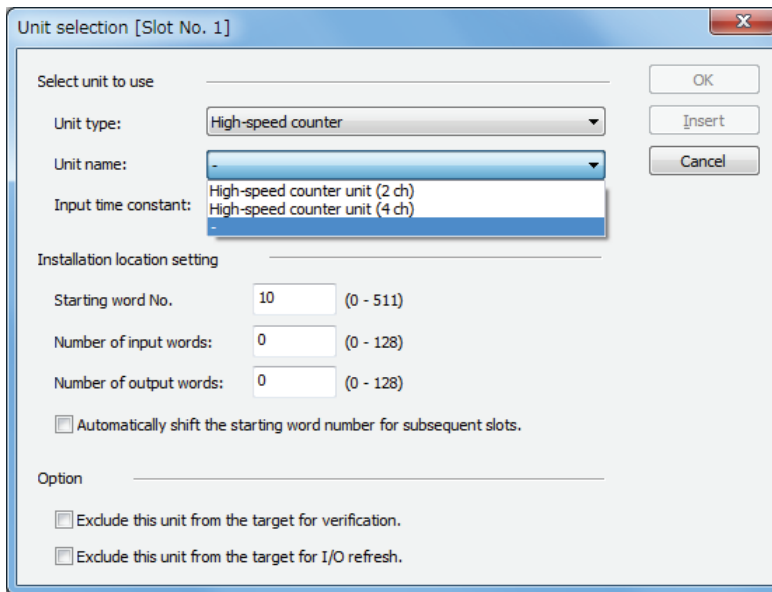
4.1.3 Registration in I/O Map

Before setting parameters, register the unit to be used in the I/O map.



◆ PROCEDURE

1. **Select "Options" > "FP7 Configuration" in the menu bar.**
The FP7 Configuration dialog box is displayed.
2. **Select "I/O map" in the left pane.**
The allocation menu of the I/O map is displayed.
3. **Double-click a desired slot.**
The Unit selection dialog box is displayed.
4. **Select "High-speed counter" for "Unit type" and select the unit name used, and press the "OK" button.**



The selected unit is now registered in the I/O map.

4.2 Configuration of High-speed Counter Unit

4.2.1 Configuration Using Tool Software

The counter type, operation mode and the settings of the high-speed counter are specified in the configuration menu of FPWIN GR7.

■ Setting method

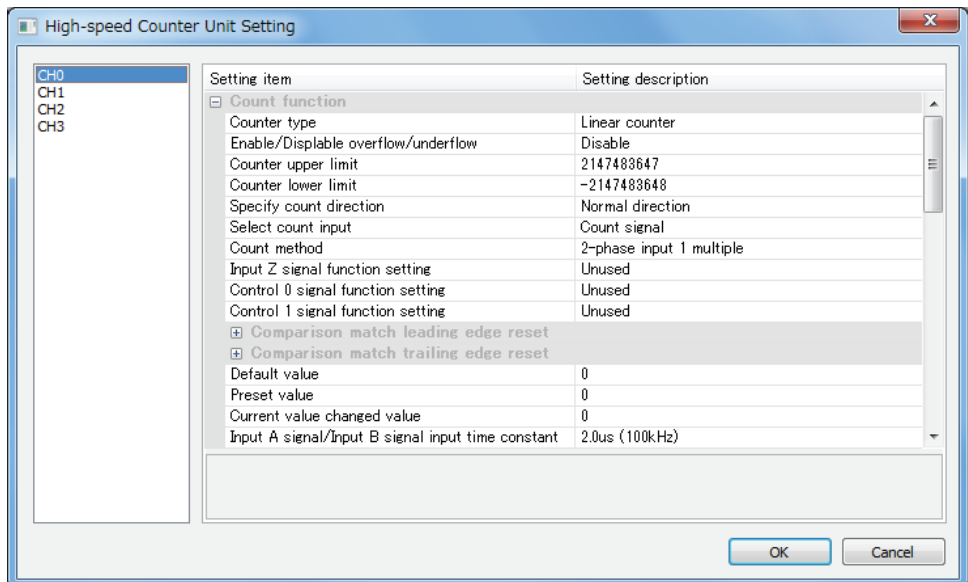
The following procedure describes the process when the high-speed counter unit has been already allocated in the I/O map.



◆ PROCEDURE

1. Select "Options" > "FP7 Configuration" in the menu bar.
2. Select "I/O map" in the field.
3. Select the slot where the high-speed counter unit has been registered, and select the "Advanced" button.

The High-speed Counter Unit Setting dialog box is displayed.



4. Select items according to the conditions used.
5. Press the [OK] button.
6. The set values are downloaded with programs as a project, and will be effective when the operation ready request is executed.

4.2.2 Configuration Data Setting Items

■ Count function (Settable for each channel)

item	Description	Default
Counter type	Linear counter/Ring counter	Linear counter
Enable/Disable overflow/underflow	Disable/Enable	Disable
Counter upper limit	-2,147,483,647 to 2,147,483,647	2,147,483,647
Counter lower limit	-2,147,483,648 to 2,147,483,646	-2,147,483,648
Count direction	Normal direction/Reverse direction	Normal direction
Count input selection	Count signal Internal clock 0.25 us (4 MHz) Internal clock 1.00 us (1 MHz) Internal clock 10 us (100 kHz) Internal clock 100 us (10 kHz)	Count signal
Count method	2-phase input 1 multiple, 2-phase input 2 multiple, 2-phase input 4 multiple, Individual input 1 multiple, Individual input 2 multiple, Direction detection input 1 multiple, Direction detection input 2 multiple	2-phase input 1 multiple
Input Z signal function setting	Not used Reset operation at rising edge Reset operation at trailing edge Positive logic reset operation Negative logic reset operation Preset operation at rising edge Preset operation at trailing edge Positive logic preset operation Negative logic preset operation	Not used
Control 0 signal function setting	Not used Positive logic enable operation Negative logic enable operation Positive logic enable operation and reset operation at rising edge Negative logic enable operation and reset operation at trailing edge Positive logic enable operation and preset operation at rising edge Negative logic enable operation and preset operation at trailing edge	Not used
Control 1 signal function setting	Not used Positive logic enable operation Negative logic enable operation	Not used
Comparison match leading edge reset	Specify the comparison match flag used as a reset signal for resetting count values at the rising edge of comparison match flag.	Not reset
Comparison match trailing edge reset	Specify the comparison match flag used as a reset signal for resetting count values at the trailing edge of comparison match flag.	Not reset
Default value	Set the count value when the power is turned on. -2,147,483,648 to 2,147,483,647	0
Preset value	Set the count value for the preset operation. -2,147,483,648 to 2,147,483,647	0
Current value changed value	Set the current value changed value to change the count value. -2,147,483,648 to 2,147,483,647	0

Input A signal/Input B signal input time constant	No input time constant, 0.1 us (2 MHz), 0.2 us (1 MHz), 0.5 us (500 kHz), 1.0 us (250 kHz), 2.0 us (100 kHz), 10.0 us (10 kHz)	2.0 us (100 kHz)
Input Z signal input time constant		
Control signal input time constant	No input time constant /2 us / 5 us / 10 us / 20 us / 50 us / 100 us / 500 us / 1.0 ms / 2.0 ms / 5.0 ms / 10.0 ms	2.0 ms

(Note 1): The control 0 signal and control 1 signal cannot be assigned to the capture function if they are assigned to the enable operation.

■ Measurement function (Settable for each channel)

item	Description	Default
Measurement function selection	Not use measurement function Frequency measurement Frequency measurement and rotation speed measurement A Frequency measurement and rotation speed measurement B	Not use measurement function
Pulse number per rotation	Set the pulse number for one rotation of the encoder. Setting range: 1 to 1,048,575	1
Average number of frequency measurement processes	No averaging, 2, 4, 8, 16, 32, 64, 128 times	No averaging
Average number of rotation speed measurement processes	No averaging, 2, 4, 8, 16, 32, 64, 128 times	No averaging

■ Comparison function (Settable for each channel)

item	Description	Default	
Comparison function selection	Not use Band comparison Target value match comparison	Not use	
Comparison input selection	Count value Measurement value (Frequency) Measurement value (Rotation speed)	Count value	
Nmber of comparison data	Set the judgement value for the comparison function. Setting range: 1 to 16	16	
Comparison data 0 ~ Comparison data 15 (For band comparison)	Specify the lower and upper limits for each comparison data. (Note 1) Setting range: -2,147,483,648 to 2,147,483,647	0	
	Select the set patterns, on or off, for the comparison match 0 flag to the comparison match F flag for each comparison data.	OFF	
Comparison data 0 ~ Comparison data 15 (For target value match)	Specify target values for each comparison data. Setting range: -2,147,483,648 to 2,147,483,647	0	
	Select the pattern, set or reset, according to the situation when reaching the target value (addition or subtraction) for each comparison data.	No change	
	Addition set pattern:		Set output, no change
	Addition reset pattern:		Reset output, no change
	Subtraction set pattern:		Set output, no change
	Subtraction reset pattern:	Reset output, no change	

(Note 1): Lower and upper limits can be set in the range of the lower and upper limits of the counters.
For the linear counter, the set lower limit should be less than the upper limit. For the ring counter, they can be set in any range.

■ External output function (Settable for each channel)

item		Description	Default
External output 0	Signal setting	Not output/Output	Not output
	Output hold setting	Set the condition of the output when a CPU or high-speed counter error occurs. Not hold/Hold	Not hold
	ON timing delay	Setting range: 0 to 1,000 ms	0 ms
	ON hold time	Setting range: 0 to 1,000 ms	0 ms
External output 1	Signal setting	Not output/Output	Not output
	Output hold setting	Set the condition of the output when a CPU or high-speed counter error occurs. Not hold/Hold	Not hold
	ON timing delay	Setting range: 0 to 1,000 ms	0 ms
	ON hold time	Setting range: 0 to 1,000 ms	0 ms

(Note 1): The ON timing delay and ON hold time are enabled only when the band comparison function is used.

■ Capture function (Settable for each channel)

item	Description	Default
Capture 0 setting	Not use capture 0 function Capture function at rising edge of control 0 signal Capture function at trailing edge of control 0 signal Capture function at rising edge of control 1 signal Capture function at trailing edge of control 1 signal Control 0 signal positive logic sampling capture function Control 0 signal negative logic sampling capture function Control 1 signal positive logic sampling capture function Control 1 signal negative logic sampling capture function Output relay (Y relay) sampling capture function	Not use
Capture 1 setting	Not use capture 1 function Capture function at rising edge of control 0 signal Capture function at trailing edge of control 0 signal Capture function at rising edge of control 1 signal Capture function at trailing edge of control 1 signal	Not use
Sampling capture function operation setting	One operation/Continuous operation	One operation
Sampling time	1 to 65,535 ms	1ms

(Note 1): When the sampling capture function has been selected in the capture 0 setting, the capture 1 setting is invalid.

■ Interrupt function (Settable for each channel)

item	Description		Default
Interrupt function enable/disable setting	Comparison match 0 flag	Enable/Disable	Enable
	Comparison match 1 flag	Enable/Disable	Enable

(Note 1): Use the dip switches on the side of the unit to enable the interrupt function.

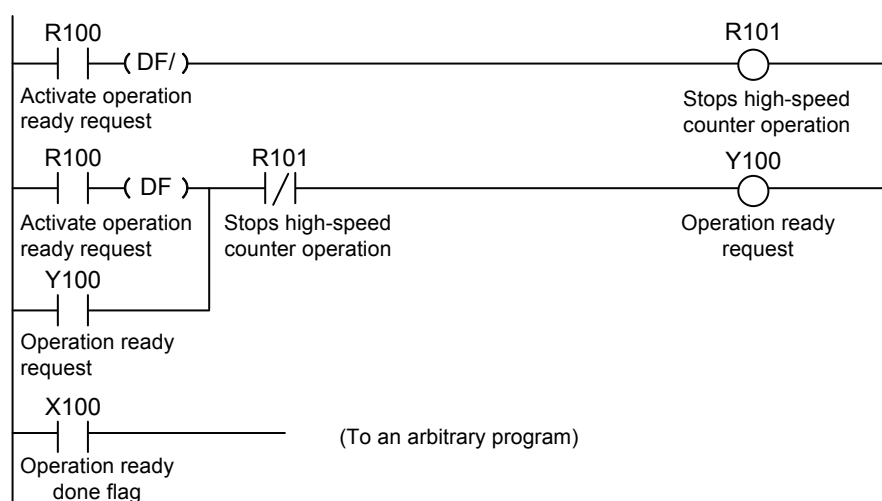
4.3 Configuration Data and Operation Ready Request

4.3.1 Operation Ready Request Program

- For enabling the settings of the high-speed counter unit, the operation ready request program should be executed.
- After downloading a project, insert the program to make it be executed early in the process.

■ Operation ready request program

Example) Program to request the preparation of the CH0 operation of the high-speed counter unit installed in the slot 1



■ Allocation of I/O signals

Signal name	Effective condition	CH0	CH1	CH2	CH3
Operation ready request	Level	Y100	Y110	Y120	Y130
Operation ready done flag	-	X100	X120	X140	X160

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

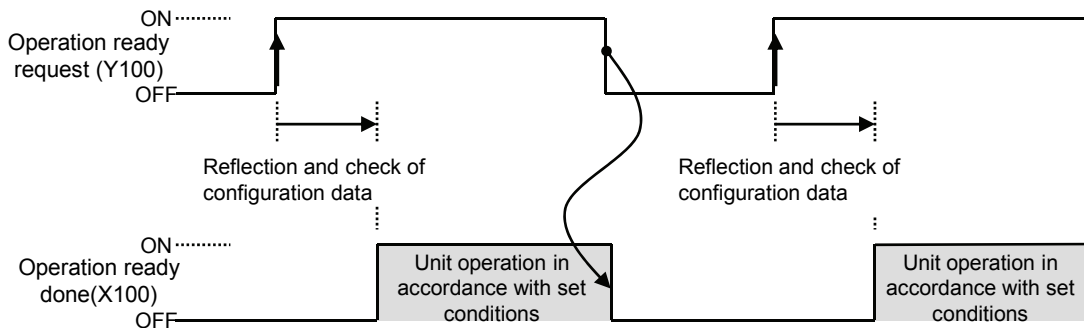
4.3.2 Downloading Configuration Data

- The configuration information of the high-speed counter unit is downloaded to the CPU together with user programs.
- The above programs are executed in the RUN mode, and each function of the high-speed counter unit will be enabled once the operation ready done flag turns on.

4.3.3 Operation When Operation Ready Request Program is Executed

- The operation ready done flag will be on when the operation ready request program is executed and each operation set in the unit becomes executable.

■ Operation of operation ready request flag



◆ KEY POINTS

- When an error occurs, such as an abnormality in the settings of parameters, the operation ready done flag will not be turned on.

4.4 Configuration Using User Programs

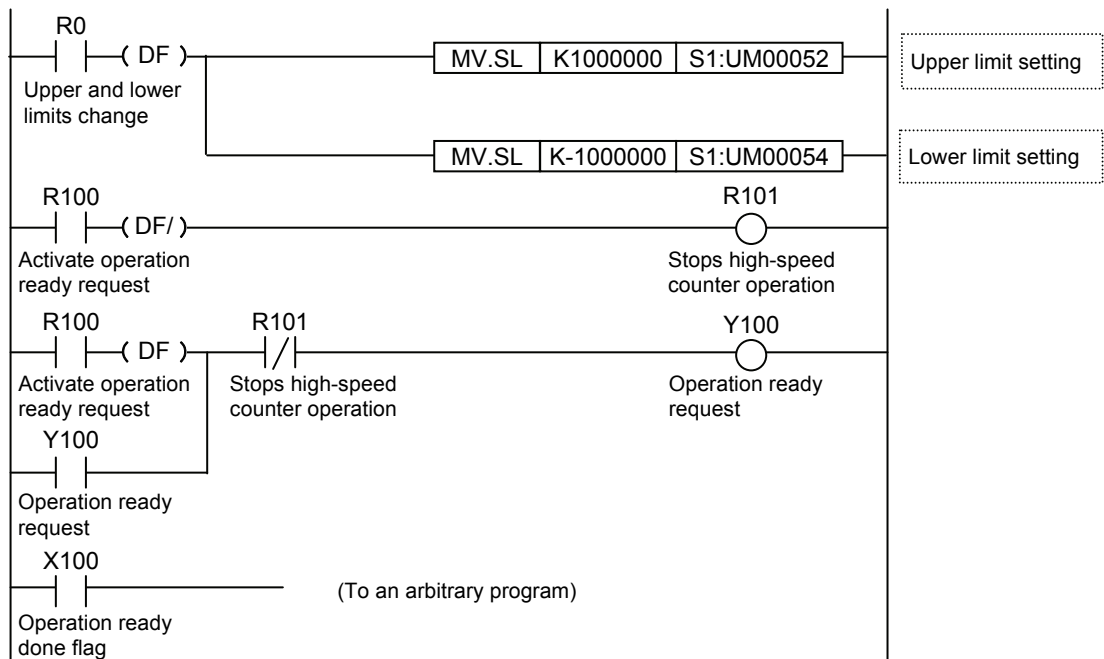
Configuration information can be rewritten using user programs.

■ Overview of function

- The values of configuration information are stored in unit memories (UM) in which arbitrary parameters are set. The values will be updated by turning on the operation ready request flag (Y0) when you want to reflect them in the configuration.
- If the configuration information is updated, the operation ready done flag (X0) will be on.

■ Sample program

Program to change the upper and lower limits of CH0 of the high-speed counter unit installed in the slot 1 using user programs



■ Allocation of I/O signals

Signal name	Effective condition	CH0	CH1	CH2	CH3
Operation ready request	Level	Y100	Y110	Y120	Y130
Operation ready done flag	-	X100	X120	X140	X160

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

➡ next page



◆ KEY POINTS

- **The configuration using user programs can be changed even when the counter is running. However, the changed values will not be effective until the operation ready done flag (Y0) is turned on.**
- **The operation ready request can be executed for each channel regardless whether it has been executed in other channels or not.**

5

Count Function

5.1 Selection of Counters and Basic Settings

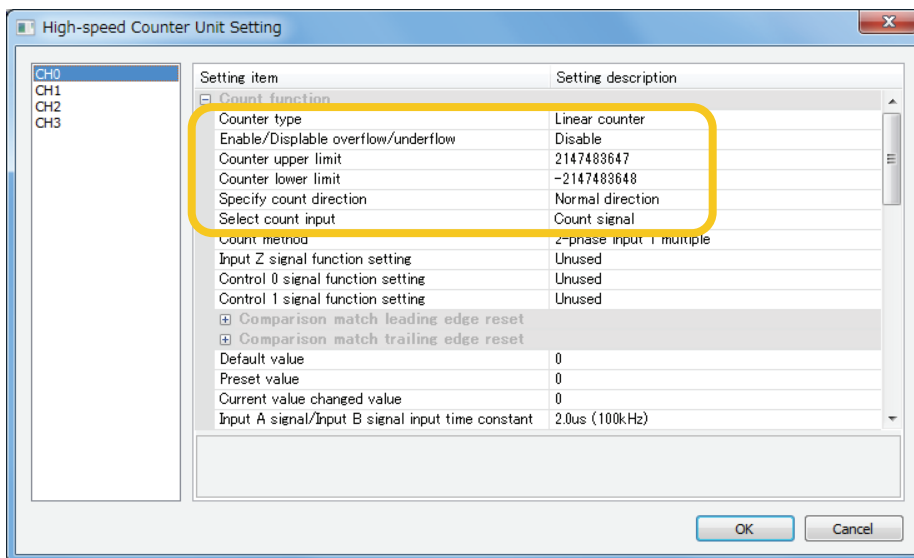
5.1.1 Basic Settings of Counters

The basic settings are set in the configuration menu of FPWIN GR7 or unit memories (UM).

■ Count function configuration

Item	Description	Default
Counter type	Linear counter/Ring counter	Linear counter
Enable/Disable overflow/underflow	Disable/Enable	Disable
Counter upper limit	-2,147,483,647 to 2,147,483,647	2,147,483,647
Counter lower limit	-2,147,483,648 to 2,147,483,646	-2,147,483,648
Specify count direction	Normal direction/Reverse direction	Normal direction
Select count input	Count signal / Internal clock 0.25 us (4 MHz) / Internal clock 1.00 us (1 MHz) / Internal clock 10us (100 kHz) / Internal clock 100 us (10 kHz)	Count signal
Count method	2-phase input 1 multiple, 2-phase input 2 multiple, 2-phase input 4 multiple, Individual input 1 multiple, Individual input 2 multiple, Direction detection input 1 multiple, Direction detection input 2 multiple	2-phase input 1 multiple

■ Example of settings by FPWIN GR7



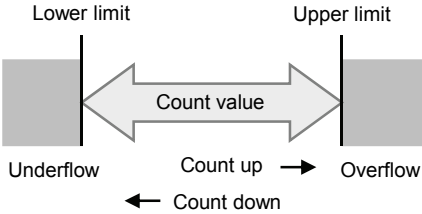
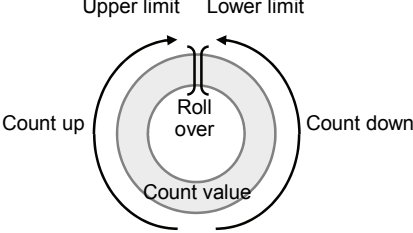
5.1.2 Selection of Count Input

- Select the count input to import input signals from an external device.
- For measuring the frequencies of external input signals or time based on the internal clock of the unit, select "Internal clock".

5.1.3 Linear Counter and Ring Counter

The operation changes depending on the types of counter as below.

■ Operational difference between the counter types

Comparison item	Linear counter	Ring counter
Operation image		
Operation when reaching the upper limit or lower limit	<p>If the count value exceeds the upper limit, the upper limit will be held.</p> <p>If the count value falls below the lower limit, the lower limit will be held.</p> <p>(Note 1) (Note 2)</p>	<p>If the count value exceeds the upper limit, the count value will be the lower limit automatically and the count operation will continue.</p> <p>If the count value falls below the lower limit, the count value will return to the upper limit automatically and the count operation will continue.</p> <p>(Note 1)</p>
Overflow and underflow settings	<p>It can be announced as an error by the setting of configuration menu.</p> <p>If the lower limit or the upper limit has been set using the configuration menu, an error is announced based on the set values.</p>	Not settable.

(Note 1): When the upper limit or the lower limit has been changed in the configuration menu, the counter operates based on its range.

(Note 2): Even when the upper and lower limits have been set on the linear counter, counting continues up to the range that is countable as a system (-2,147,483,648 to 2,147,483,647) if the overflow and under flow settings have been set to "Disable".

■ Operation in case of overflow or underflow (Linear counter only)

- When "Enable" has been selected in the configuration menu, the error will be announced once the overflow or underflow annunciation flag turns on.
- The overflow or underflow flag can be cleared by the following operations; Overflow clear request, Underflow clear request, Reset or Preset operation
- The error clear operation is required to clear error flags.



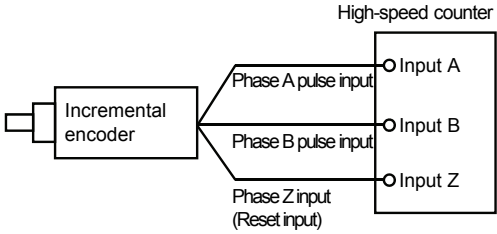
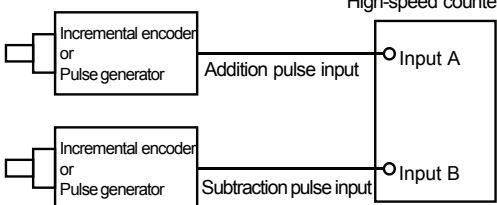
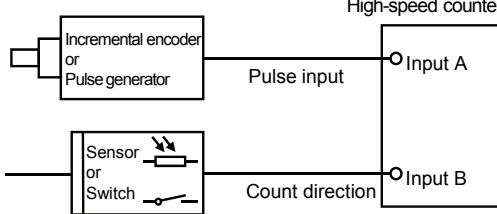
◆ REFERENCE

- For details of the error clear method, refer to 10.1 Self-diagnostic Function.

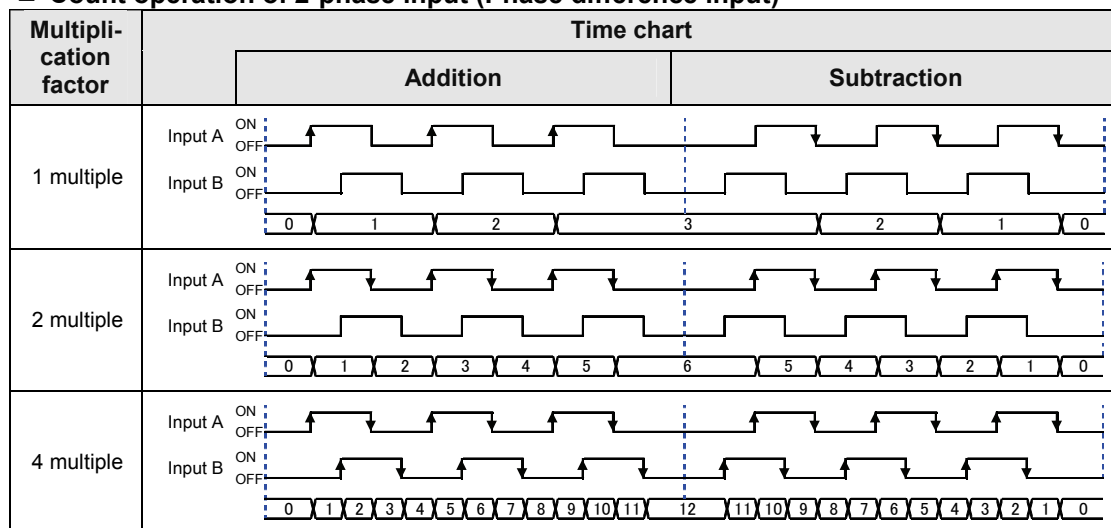
5.1.4 Selection of Count Methods

- Select from the following three types according to input devices to be connected.
- The count operation varies depending on the settings of multiplication factor as shown in the next page.

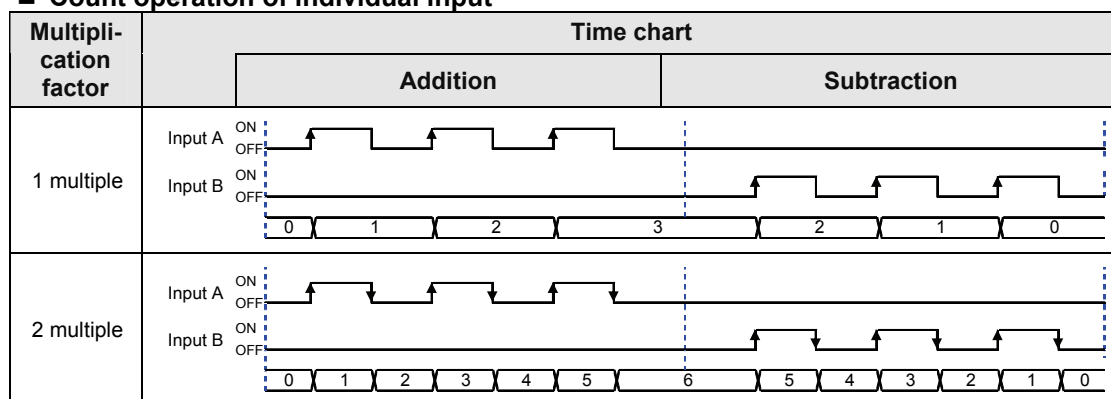
■ Count method

Method	Connection	Count
2-phase (Phase difference)		<p>For the 2-phase input, the input A signal and input B signal of each counter are connected to the phase A and phase B of an encoder.</p> <p>The count direction depends on the phase difference between phases A and B. When the phase A is proceeding by 90 degrees in electrical angle than the phase B, the count value is incremented. When the phase A is delayed by 90 degrees in electrical angle than the phase B, the count value is decremented.</p>
Individual		<p>In the individual input method, the counter is incremented when the input A signal rises or falls, and decremented when the input B signal rises or falls.</p>
Direction detection		<p>For the direction detection input, the count signal is connected to the input A signal. The count direction is controlled by the level of the direction signal of input B signal.</p> <p>When the input B signal is on, the counter is incremented when the input A signal rises or falls. When the input B signal is off, the counter is decremented.</p>

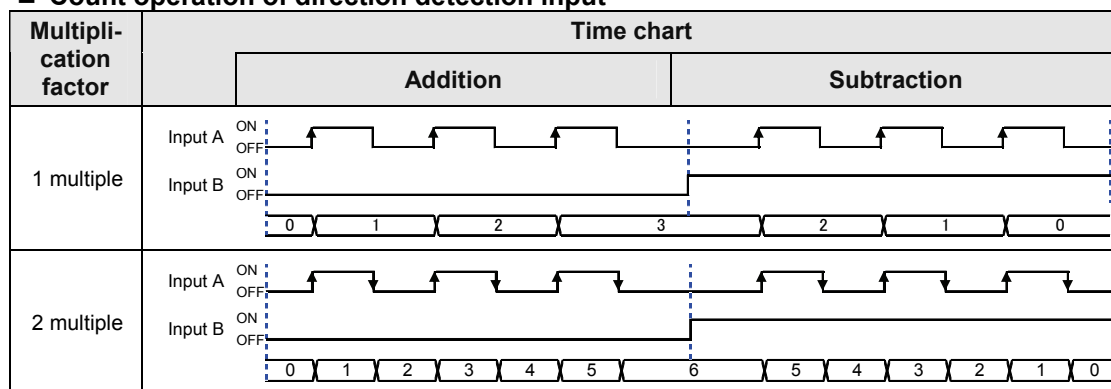
■ Count operation of 2-phase input (Phase difference input)



■ Count operation of individual input



■ Count operation of direction detection input



5.2 Types of Count Operations

5.2.1 Types and Features of Count Operations

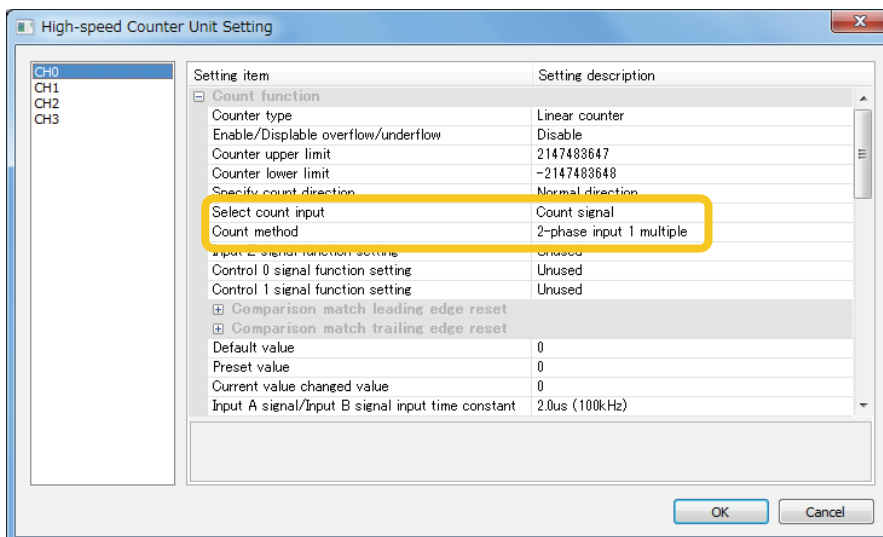
■ Types of count operations and input signals

Operation Type	Feature	External input signal used		
		Z-phase input signal	Control 0 signal	Control 1 signal
Simple count operation	Performs the count operation regardless of external control input signals.			
Reset count operation	Performs the reset operation according to the change in the z-phase input signal (rising, trailing, positive logic or negative logic).	●		
Preset count operation	Performs the preset operation according to the change in the z-phase input signal (rising, trailing, positive logic or negative logic).	●		
Enable count operation	Performs the count operation while the control signal allocated to the enable input is effective.		●	●
Enable reset count operation	Performs the count operation while the control signal allocated to the enable input is effective. Resets the count value at the timing at which the counter becomes enabled by the control signal allocated to the enable input.		●	
Enable preset count operation	Performs the count operation while the control signal allocated to the enable input is effective. Presets the count value at the timing at which the counter becomes enabled by the control signal allocated to the enable input.		●	

(Note 1): In any of these cases, resetting or presetting values can be performed by output relays (Y).

(Note 2): If the control signals are used in the above operations, the same signals cannot be used for the capture function or sampling capture function.

■ Example of settings by FPWIN GR7

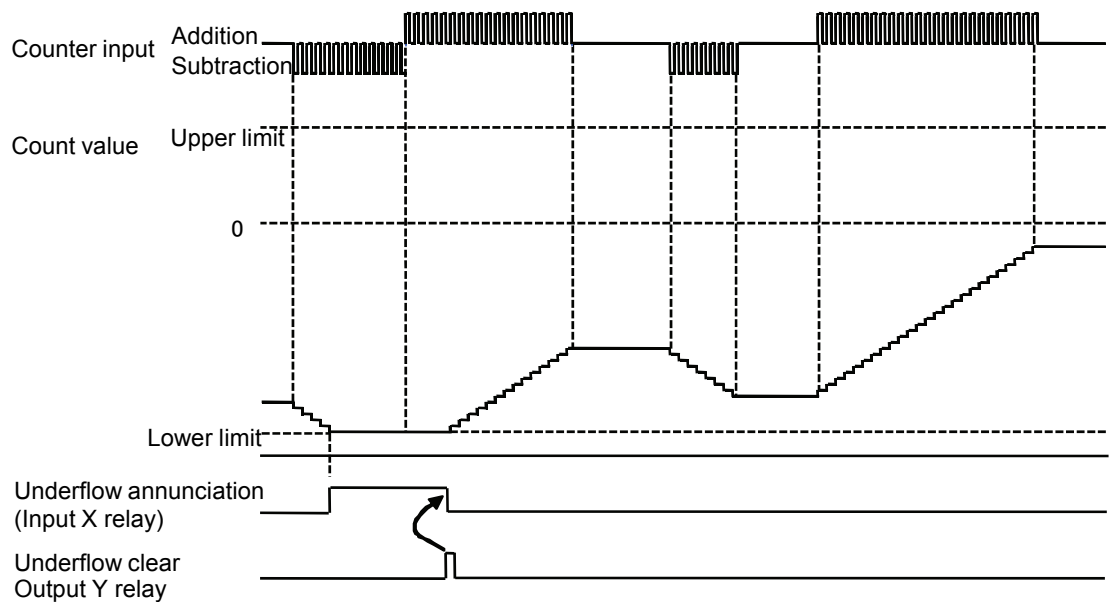


5.2.2 Simple Count Operation

- Simply counts count input signals.

■ Linear counter

The overflow and underflow annunciation can be set for the cases when the count value exceeds the upper limit or the lower limit.

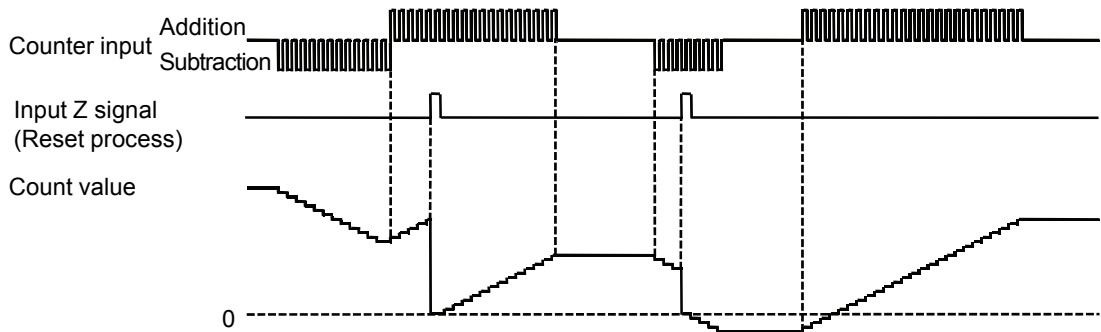


■ Ring counter

- If the lower limit is counted down, the count value will be rolled over, and counting down will continue from the upper limit.
- If the upper limit is counted up, the count value will be rolled over, and counting up will continue from the lower limit.

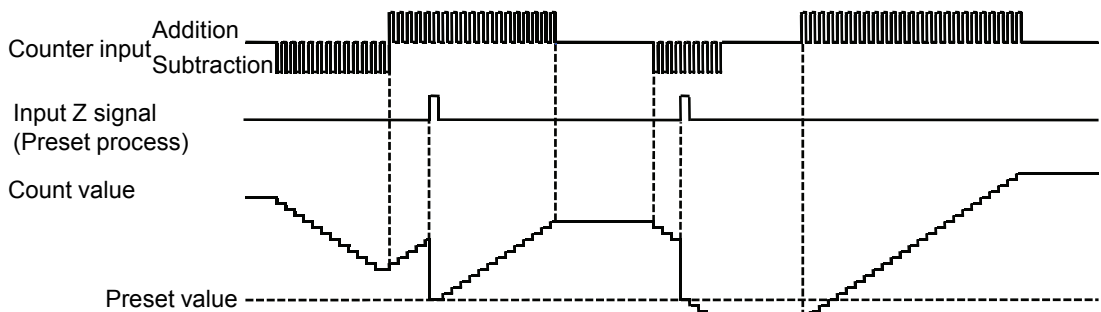
5.2.3 Reset Count Operation

Resets the count value to zero by the input Z signal.



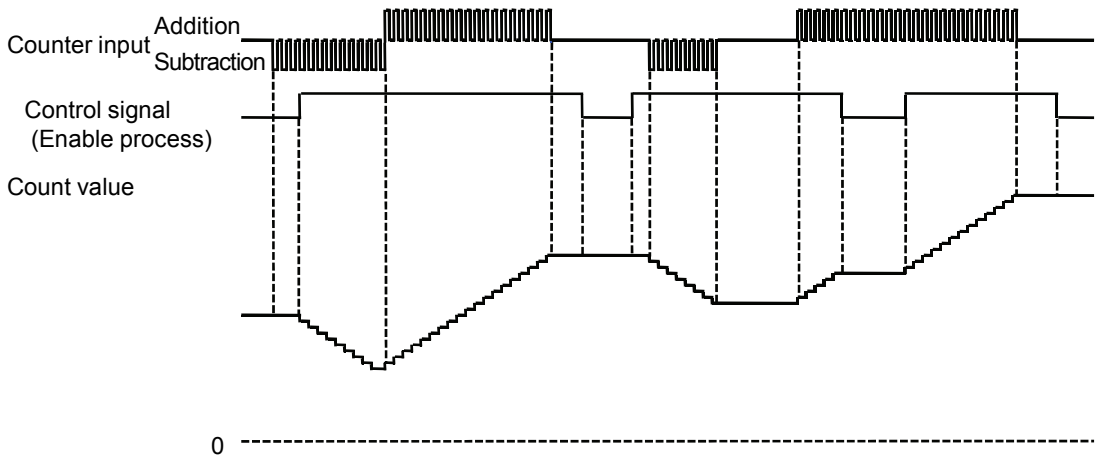
5.2.4 Preset Count Operation

- The preset count operation is allocated to the input Z signal and is used to change the current value of the counter to the preset value.
- It can be also used for starting the counter operation from the preset value.
- The preset value is set in the configuration menu or unit memory (UM) area.



5.2.5 Enable Count Operation

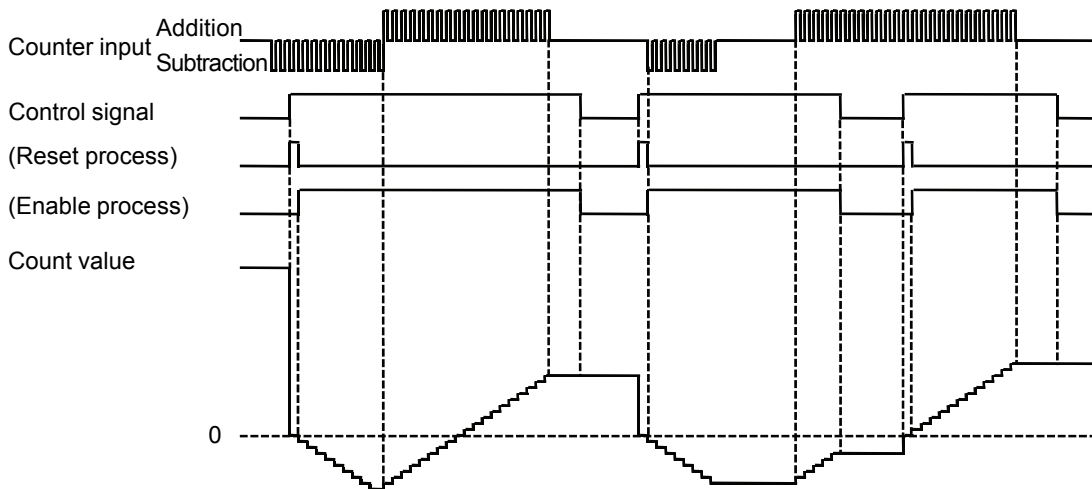
- The enable function is allocated to the control signal for using the enable count operation.
- Performs the count operation while the control signal is effective.



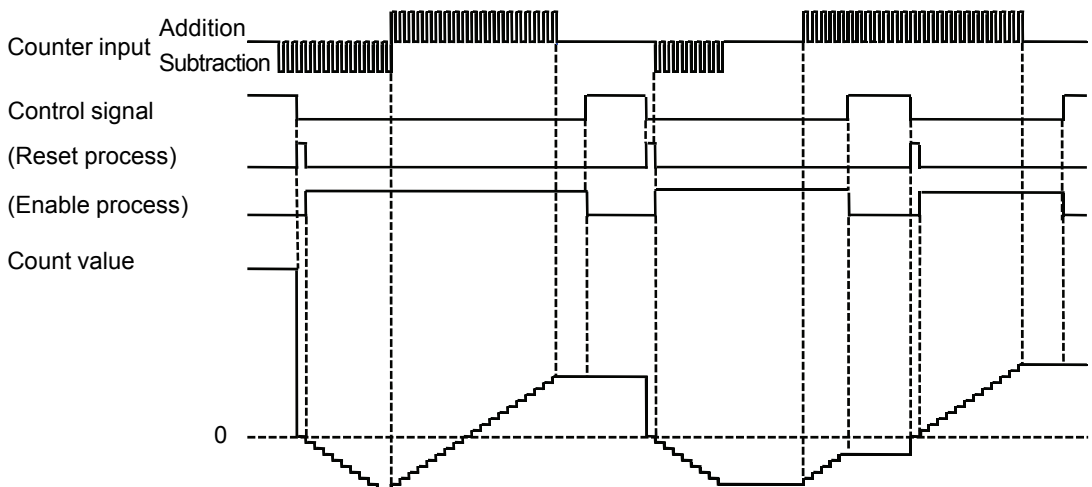
5.2.6 Enable Reset Count Operation

- The enable reset count operation is the operation that the enable and reset functions are allocated to the control signal.
- Resets the count value to zero when the counter becomes enabled by the change in the control signal.

■ Positive logic enable operation and reset operation at rising edge



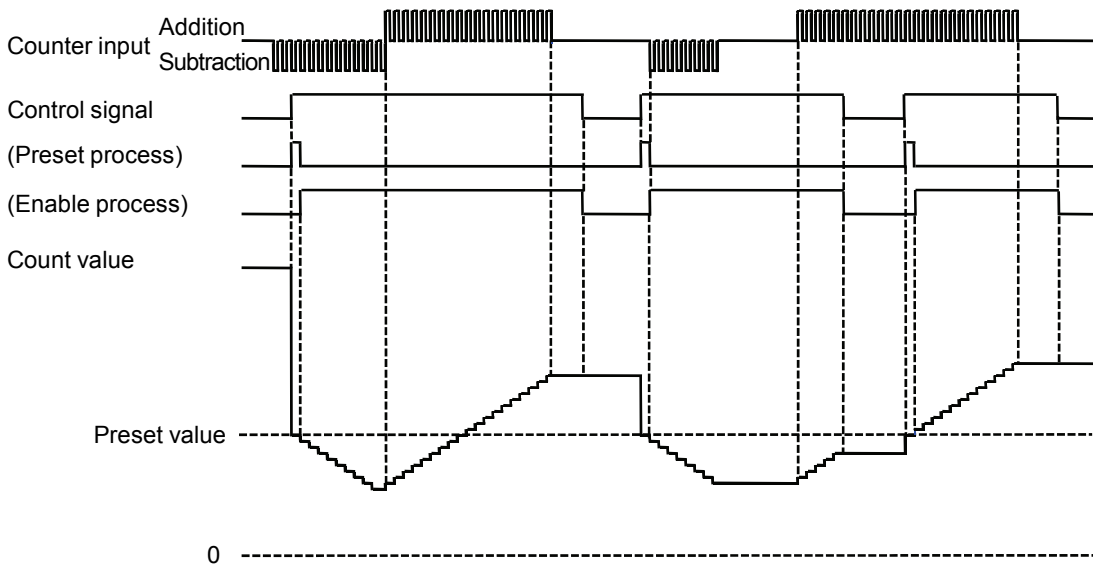
■ Negative logic enable operation and reset operation at trailing edge



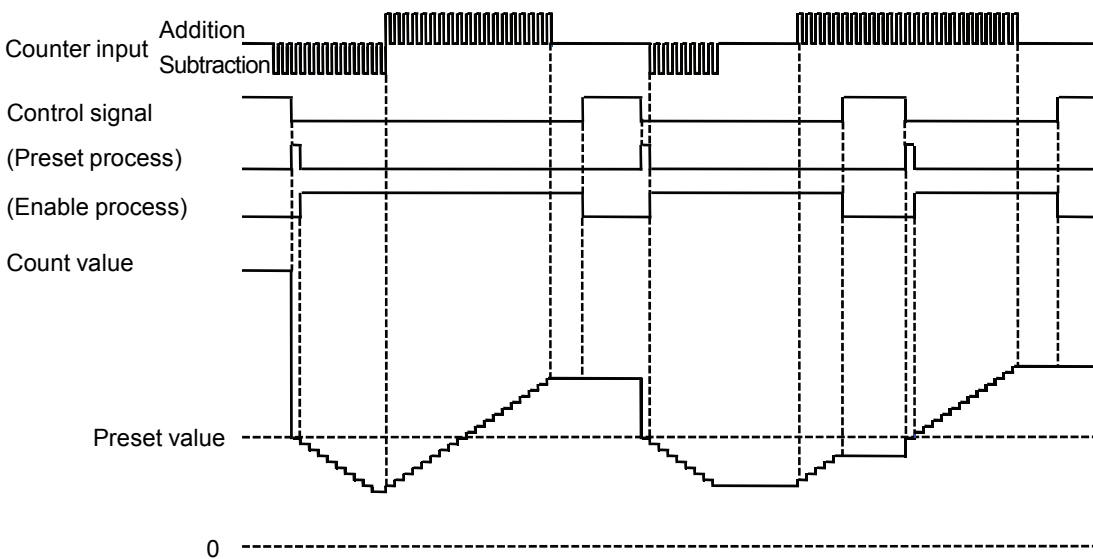
5.2.7 Enable Preset Count Operation

- The enable preset count operation is that the enable and preset functions are allocated to the control signal.
- Resets the count value to a specified preset value when the counter becomes enabled by the change in the control signal.

■ Positive logic enable operation and preset operation at rising edge



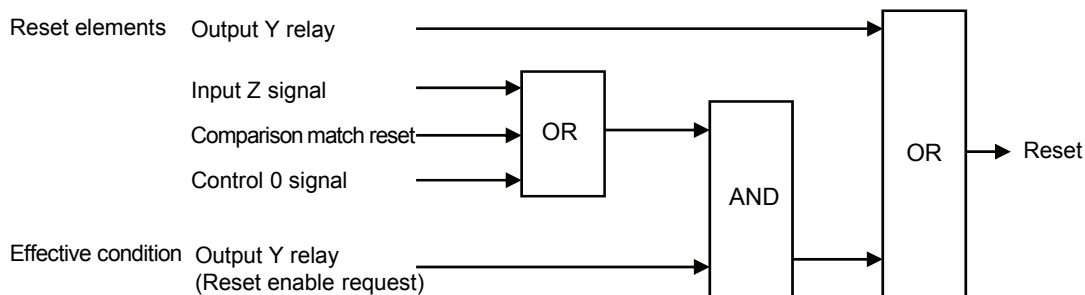
■ Negative logic enable operation and preset operation at trailing edge



5.3 Allocation of Reset, Preset and Enable Signals

5.3.1 Reset Input

The following four reset methods are available.



■ Type of reset signals

Reset element	Setting method	Reset condition			
		ON OFF 	ON OFF 	ON ... OFF ... 	ON OFF ...
Output Y relay	Activates the reset request signal by a user program.	●			
Input Z signal	Allocates the Z-phase input signal to any reset operation using the configuration menu.	●	●	●	●
Control 0 signal	Allocates the control 0 signal to either reset operation using the configuration menu. Positive logic enable operation and reset operation at rising edge Negative logic enable operation and reset operation at trailing edge	●	●		
Comparison match flag	Allocates the comparison match flag operation to "Reset execution" using the configuration menu.	●	●		

■ I/O allocation

Signal name	Effective condition	CH0	CH1	CH2	CH3
Reset request	ON edge	Y102	Y112	Y122	Y132
Reset enable request	Level	Y104	Y114	Y124	Y134
Input Z signal monitor	-	X10A	X12A	X14A	X16A
Control 0 signal monitor	-	X10B	X12B	X14B	X16B
Comparison match flag	-	X110-X11F	X130-X13F	X150-X15F	X170-X17F

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.



◆ **KEY POINTS**

- For using the Z-phase signal, control signal or comparison match flag as reset signals, turn on the reset enable request signal using user programs.

5.3.2 Preset Input

The following three preset methods are available.

■ **Type of reset signals**

Preset element	Setting method	Preset condition			
		ON OFF ———	ON ——— OFF	ON ... OFF —	ON — OFF ..
Output Y relay	Activates the preset request signal by a user program.	●			
Input Z signal	Allocates the Z-phase input signal to either preset operation using the configuration menu.	●	●	●	●
Control 0 signal	Allocates the control 0 signal to either reset operation using the configuration menu. Positive logic enable operation and preset operation at rising edge Negative logic enable operation and preset operation at trailing edge	●	●		

■ **I/O Allocation**

Signal name	Effective condition	CH0	CH1	CH2	CH3
Preset request	ON edge	Y103	Y113	Y123	Y133
Input Z signal monitor	-	X10A	X12A	X14A	X16A
Control 0 signal monitor	-	X10B	X12B	X14B	X16B

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

■ **Setting of preset values**

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00062 UM 00063	Preset value	0	Set preset values. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 00132 UM 00133				
UM 00202 UM 00203				
UM 002D2 UM 002D3				





◆ KEY POINTS

- **Preset values are set in unit memories (UM) using the configuration menu or user programs.**

5.3.3 Enable Input

The following enable input methods are available.

■ Type of enable signals

Enable operation element	Setting method	Enable condition	
		 ON ... OFF ...	 ON ... OFF ...
Output Y relay	Activates the enable request signal by a user program.	●	
Control 0 signal	Allocates the control 0 signal to any of these operations using the configuration menu. Positive logic enable operation Negative logic enable operation Positive logic enable operation and reset operation at rising edge Negative logic enable operation and reset operation at trailing edge Positive logic enable operation and preset operation at rising edge Negative logic enable operation and preset operation at trailing edge	●	●
Control 1 signal	Allocates the control 0 signal to either operation using the configuration menu. Positive logic enable operation Negative logic enable operation	●	●

■ I/O Allocation

Signal name	Effective condition	CH0	CH1	CH2	CH3
Enable request	Level	Y101	Y111	Y121	Y131
Control 0 signal monitor	-	X10B	X12B	X14B	X16B
Control 1 signal monitor	-	X10C	X12C	X14C	X16C

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.



◆ KEY POINTS

- The enable input works as a level signal.

5.4 Reading Count Value and Changing Current Value

5.4.1 Areas Related to Count Value

■ Monitor area related to count values

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 003A0 UM 003A1	Count value Current value	0	Current count value of counter Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003B0 UM 003B1				
UM 003C0 UM 003C1				
UM 003D0 UM 003D1				

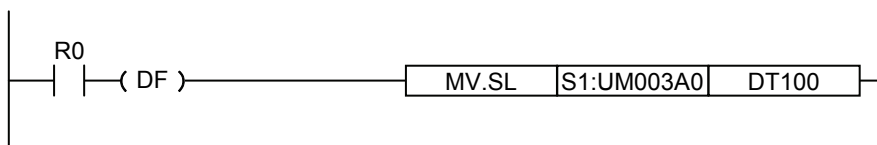
■ Configuration area related to count value

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00060 UM 00061	Default value (when power turns on)	0	Set the default value used when the power turns on. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 00130 UM 00131				
UM 00200 UM 00201				
UM 002D0 UM 002D1				
UM 00062 UM 00063	Preset value	0	Set the preset value for using the preset count function. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 00132 UM 00133				
UM 00202 UM 00203				
UM 002D2 UM 002D3	Current value changed value	0	Set the changed value to change the current value of counter. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 00064 UM 00065				
UM 00134 UM 00135				
UM 00204 UM 00205				
UM 002D4 UM 002D5				

5.4.2 Reading Count Value

- The count value (current value) can be read from the monitor area.

Example) Program to change the current value of CH0 of the high-speed counter unit



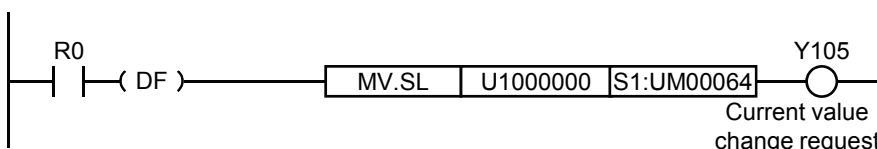
5.4.3 Count Value When Power Turns On

- The count value when the power turns on can be set to any value as necessary. Set the default value (when the power turns on) using the configuration menu of tool software FPWIN GR7 or user programs.
- The default for the count value when the power turns on is "0".

5.4.4 Changing Count Current Value

- The count current value can be set to any value as necessary.
- Set a value in the current value changed value area using the user program and turn on the current value change request signal.

Example) Program to change the current value of CH0 of the high-speed counter unit



■ Allocation of I/O Numbers

Signal name	Effective condition	CH0	CH1	CH2	CH3
Current value change request	ON edge	Y105	Y115	Y125	Y135

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.



◆ KEY POINTS

- **The current value of the count value can be changed by writing an arbitrary value in the configuration area and turning on the current value request signal. Values cannot be written in the monitor area directly.**

5.5 Input Time Constant Setting Function

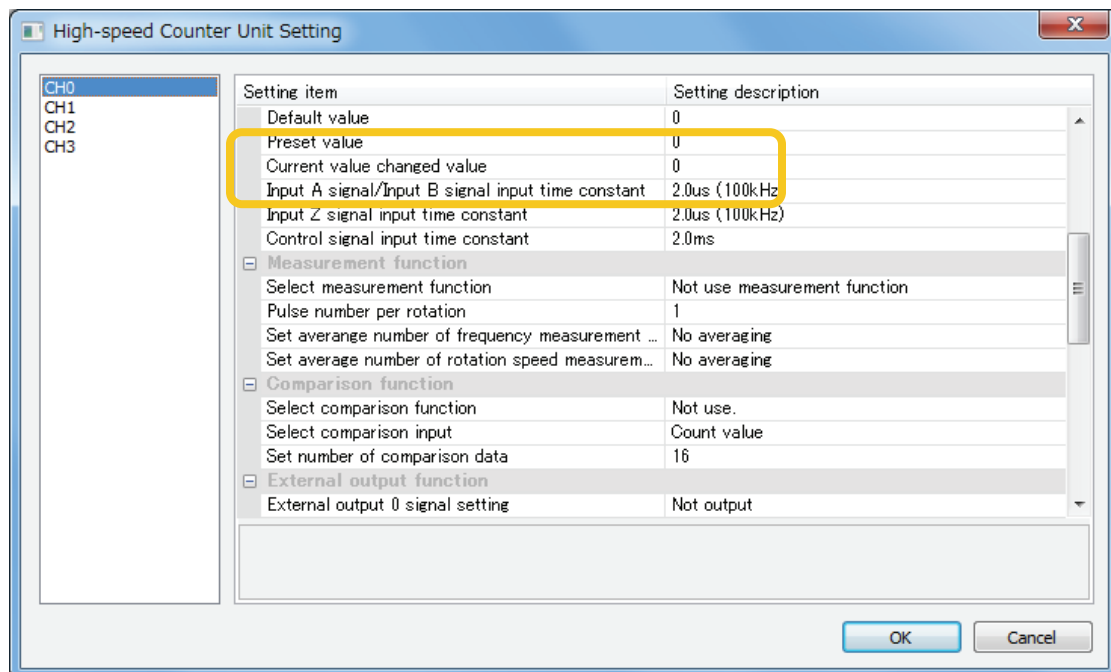
5.5.1 Input Time Constant

- Time constants can be set as noise filters for input signals (phases A, B and Z) and control signals.
- When selecting "No input time constant", input signals are processed without the time constant filter.

■ Count function (Settable for each channel)

Setting item	Settings	Default
Input A signal/Input B signal input time constant	No input time constant / 0.1 us (2 MHz) / 0.2 us (1 MHz) / 0.5 us (500 kHz) / 1.0 us (250 kHz) / 2.0 us (100 kHz) / 10.0 us (10 kHz)	2.0 us (100 kHz)
Input Z signal input time constant		
Control signal input time constant	No input time constant / 2 us / 5 us / 10 us / 20 us / 50 us / 100 us / 500 us / 1.0 ms / 2.0 ms / 5.0 ms / 10.0 ms	2.0 ms

■ Example of settings by FPWIN GR7



6

Measurement Function

6.1 Overview of Measurement Function

6.1.1 Types of Measurement Function

■ **Measurement function**

- The measurement function is to measure the changes in the count values of the high-speed counter and to output them as frequencies or number of rotations.
- Measuring results are stored in unit memories (UM). They can be read by user programs if necessary.

■ **Types of measurement function**

Type	Operation image	Feature
Frequency measurement function		<p>Measures the time in which the count value changes, and calculates the frequency.</p> <p>Frequency (Hz) = 1/Time between pulses (s)</p> <p>When there is no change in the count value for one second, the result is 0 Hz.</p>
Rotation speed measurement A function		<p>Calculates a rotation speed (rpm) from the time interval of the change in the counter and the specified pulse number per rotation, and stores the measuring result after averaging in the unit memory (UM).</p> <p>Any number can be set for the number of averaging.</p> <p>Measures the time interval of the change in the counter, and calculates the rotation speed (rpm).</p> <p>Rotation speed (rpm) = 60/(Time between pulses x Number of pulses per rotation)</p> <p>The rotation speed measurement A function can be used for the case such as the interval of the change in the counter is large (low-speed pulse).</p> <p>When there is no change in the count value for one second or more, the result is 0 rpm.</p>
Rotation speed measurement B function		<p>Automatically calculates a rotation speed (rpm) from the time interval of the change in the counter and the specified pulse number per rotation, and stores the measuring result after averaging in the unit memory.</p> <p>Any number can be set for the number of averaging.</p> <p>Measures the time which counts the specified pulse number per rotation, and calculates the rotation speed per rotation (rpm).</p> <p>Rotation speed (rpm) = 60/(Time taken for one rotation)</p> <p>The rotation speed measurement B function can be used for the case such as the time interval of the change in the counter is not even. However, when it takes for one second or more for one rotation, the result is 0 rpm.</p>



◆ **KEY POINTS**

- **When the measurement function has been selected in the configuration area, the measuring operation starts once the operation ready done flag turns on.**

6.1.2 Configuration

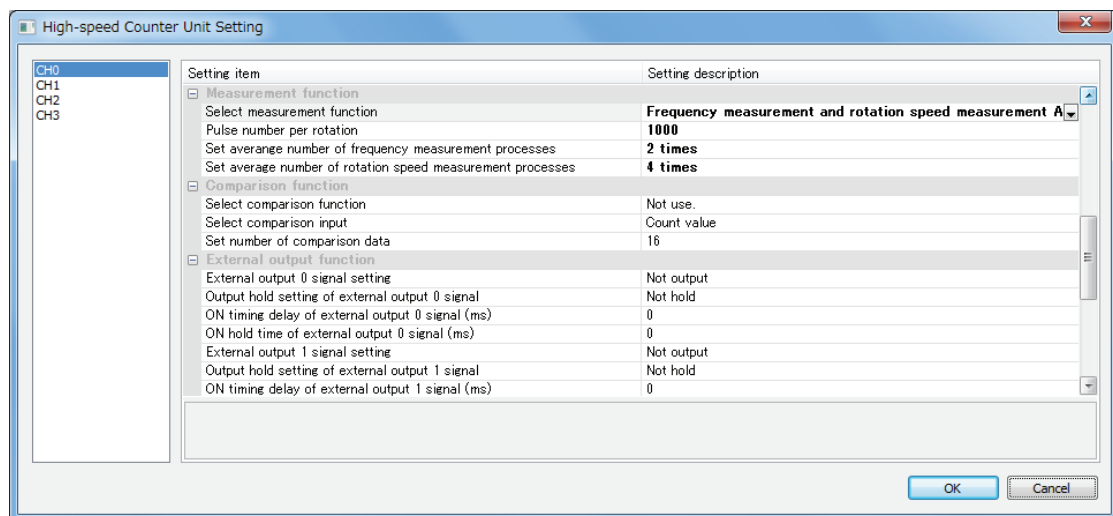
For using the measurement function, set the following items using the configuration menu of tool software FPWIN GR7 or user programs.

■ Setting area

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00070 UM 00140 UM 00210 UM 002E0	Select measurement function	H0	H0: Not use measurement function H1: Frequency measurement H2: Frequency measurement and rotation speed measurement A H3: Frequency measurement and rotation speed measurement B	—
UM 00071 UM 00072 UM 00141 UM 00142 UM 00211 UM 00212 UM 002E1 UM 002E2	Pulse number per rotation	U1	Set the pulse number for one rotation of the encoder. Setting range: 1 to 1,048,575 (The values out of the setting range are invalid.)	Pulse
UM 00073 UM 00143 UM 00213 UM 002E3	Set average number of frequency measurement processes	H0	Set the number of averaging of frequency measurement values. H0: No averaging, H1: 2 times, H2: 4 times, H3: 8 times, H4: 16 times, H5: 32 times, H6: 64 times, H7: 128 times	Times
UM 00074 UM 00144 UM 00214 UM 002E4	Set average number of rotation speed measurement processes	H0	Set the number of averaging of rotation speed measurement values. H0: No averaging, H1: 2 times, H2: 4 times, H3: 8 times, H4: 16 times, H5: 32 times, H6: 64 times, H7: 128 times	Times

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

■ Example of settings by FPWIN GR7



6.1.3 Reading Measuring Results

Measuring results are stored in the following area.

■ Read area

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 003A8 UM 003A9	Frequency measurement value (After averaging)	U0	Frequency measurement value after averaging procedure Range: 0 to 20,000,000 Signed 32-bit	Hz
UM 003B8 UM 003B9				
UM 003C8 UM 003C9				
UM 003D8 UM 003D9				
UM 003AA UM 003AB	Rotation speed measurement value (After averaging)	U0	Rotation speed measurement value after averaging procedure Range: -1,200,000,000 to +1,200,000,000 Signed 32-bit	rpm
UM 003BA UM 003BB				
UM 003CA UM 003CB				
UM 003DA UM 003DB				

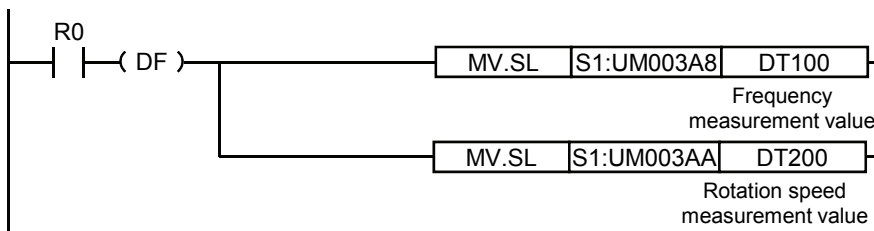
(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

6.1.4 Sample Program

- It can be read at any time.
- The values stored in unit memories can be monitored by the device monitor function of programming tool FPWIN GR7.

■ Read program

Example) Program to read the frequency measurement value and the rotation speed measurement value for CH0 of the high-speed counter unit installed in the slot number 1



7

Comparison Function

7.1 Overview of Comparison Function

7.1.1 Types of Comparison Function

■ Comparison function

- Compares the current value of the high-speed counter with a specified target value, and reflects the matched value in the comparison match flag.
- There are two methods, which are the target value match comparison and the band comparison.
- Comparison results can be output to external devices from the unit.

■ Comparison match function specifications

Item	Description	Remark
No. of comparison data	Max. 16 data per channel (Comparison data 0 ~ Comparison data 15)	
Comparison match flag	Max. 16 points per channel (Comparison match 0 flag to Comparison match F flag) Read as input relays (X) by user programs. Multiple comparison match flags can be set for single comparison data.	
Comparison method	Target value match comparison Sets or resets the comparison match flag when the elapsed value matches the target value.	
	Band comparison Turns on or off the comparison match flag when the elapsed value is in the range of specified lower and upper limits.	
External output	Max. 2 points per channel The comparison match 0 flag can be allocated to the external output 0 terminal of the unit. The comparison match 1 flag can be allocated to the external output 1 terminal of the unit.	
	The following settings are available only when the band comparison function is used. ON delay timing: 0 to 1,000 ms ON hold time: 0 to 1,000 ms	
	Forced output function Output hold setting when a CPU unit error or high-speed counter unit error occurs.	

■ I/O Allocation

Signal name	CH0	CH1	CH2	CH3
Comparison match flag	X110-X11F	X130-X13F	X150-X15F	X170-X17F

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.



◆ KEY POINTS

- Only the comparison match 0 flag or comparison match 1 flag can be set as the external output of the high-speed counter unit.
- The default for the external output 0 and 1 settings is "Not output". Change the settings in the configuration menu as necessary.
- There is no need to arrange comparison data in ascending or descending order.

7.1.2 Target Value Match Comparison and Band Comparison

- The main difference is as below.
- The comparison methods can be selected for each channel.

■ Main difference in characteristics

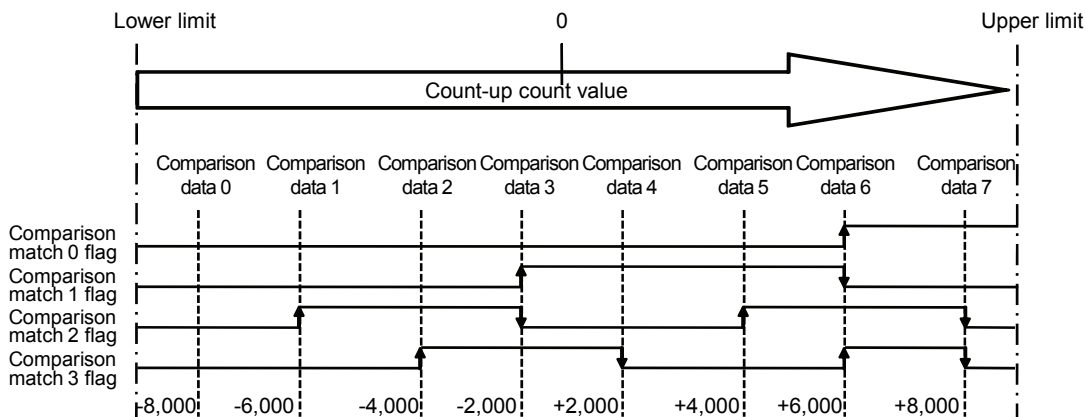
Item	Target value match comparison	Band comparison
Setting of comparison value data	Comparison value data is specified as points.	Comparison value data is specified with upper and lower limits.
Setting when comparison value data matches	<p>The operation when reaching the target value is selected from the following four patterns.</p> <p>Sets when the values are matched at the time of addition.</p> <p>Resets when the values are matched at the time of addition.</p> <p>Sets when the values are matched at the time of subtraction.</p> <p>Resets when the values are matched at the time of subtraction.</p>	Specify ON or OFF for the state of the comparison match flag when the current value is in a specified band.
Operation when comparison value data matches	The operations when the value reaches the same comparison data may differ between the cases of addition and subtraction.	The same operation is performed for the same comparison data in the cases of both addition and subtraction.
Time setting of external output signal	The settings listed on the right are not available.	<p>ON delay timing: 0 to 1,000 ms</p> <p>ON hold time: 0 to 1,000 ms</p> <p>The ON delay timing and ON hold time can be specified in combination.</p>

7.2 Operation of Target Value Match Function

7.2.1 Examples of Linear counter Settings

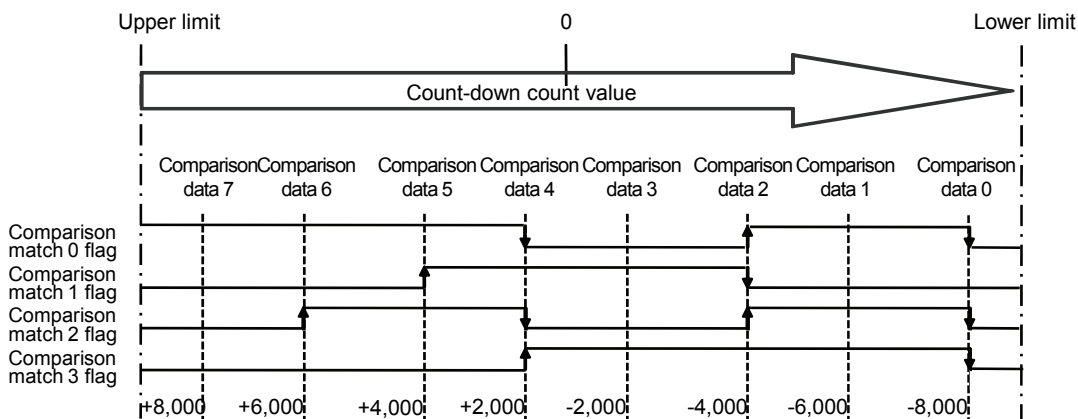
■ **Example of comparison match flag operation when counting up.**

Operates according to the settings of addition set pattern and addition reset pattern when the current value matches the comparison data.



■ **Example of comparison match flag operation when counting down.**

Operates according to the settings of subtraction set pattern and addition reset pattern when the current value matches the comparison data.



■ Examples of output pattern settings

Comparison data	Target value	Output pattern	Comparison match 0 flag	Comparison match 1 flag	Comparison match 2 flag	Comparison match 3 flag
0	-8,000	Addition set pattern				
		Addition reset pattern				
		Subtraction set pattern				
		Subtraction reset pattern	○		○	○
1	-6,000	Addition set pattern			○	
		Addition reset pattern				
		Subtraction set pattern				
		Subtraction reset pattern				
2	-4,000	Addition set pattern				○
		Addition reset pattern				
		Subtraction set pattern	○		○	
		Subtraction reset pattern		○		
3	-2,000	Addition set pattern		○		
		Addition reset pattern			○	
		Subtraction set pattern				
		Subtraction reset pattern				
4	+2,000	Addition set pattern				○
		Addition reset pattern				
		Subtraction set pattern				○
		Subtraction reset pattern	○		○	
5	+4,000	Addition set pattern			○	
		Addition reset pattern				
		Subtraction set pattern		○		
		Subtraction reset pattern				
6	+6,000	Addition set pattern	○			○
		Addition reset pattern		○		
		Subtraction set pattern			○	
		Subtraction reset pattern				
7	+8,000	Addition set pattern				
		Addition reset pattern			○	○
		Subtraction set pattern				
		Subtraction reset pattern				



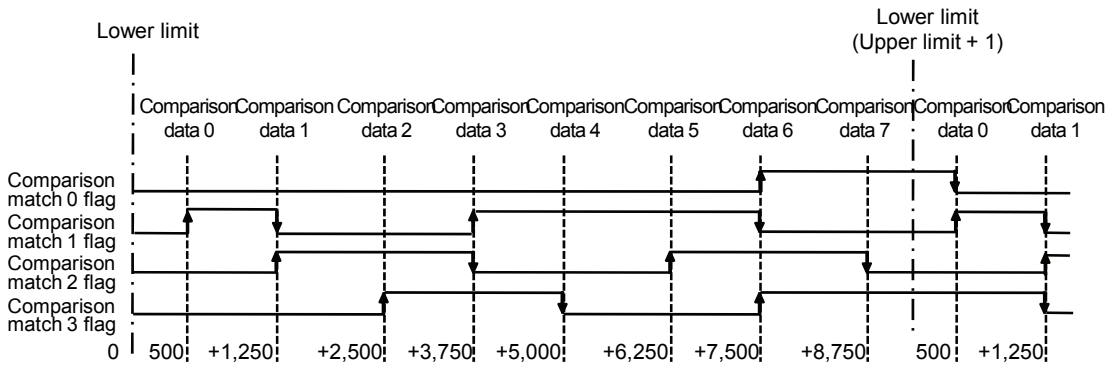
◆ KEY POINTS

- The operation of comparison match flag when the count value reaches the target value can be changed depending on the cases of addition and subtraction.
- If the contents of comparison data 0 to 15 are overlapped and the specified reset conditions are different, the priority of data is in the following order. (High) 0 > 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9 > 10 > 11 > 12 > 13 > 14 > 15 (Low)

7.2.2 Examples of Ring Counter Settings

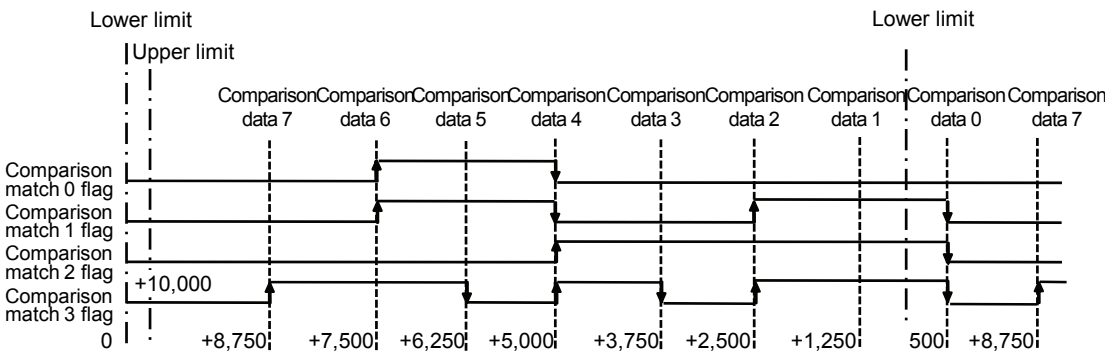
■ Comparison match flag operation when counting up

Operates according to the settings of addition set pattern and addition reset pattern when the current value matches the comparison data.



■ Comparison match flag operation when counting down

Operates according to the settings of subtraction set pattern and addition reset pattern when the current value matches the comparison data.



◆ KEY POINTS

- The ring counter continues to count even if the count value falls below the lower limit or exceeds the upper limit, or even in the range in which the count value is rolled over. The target value match comparison operation also continues in accordance with set patterns.

■ Examples of output pattern settings

Comparison data	Target value	Output pattern	Comparison match 0 flag	Comparison match 1 flag	Comparison match 2 flag	Comparison match 3 flag
0	+500	Addition set pattern		○		
		Addition reset pattern	○			
		Subtraction set pattern				
		Subtraction reset pattern		○	○	○
1	+1,250	Addition set pattern			○	
		Addition reset pattern		○		○
		Subtraction set pattern				
		Subtraction reset pattern				
2	+2,500	Addition set pattern				○
		Addition reset pattern				
		Subtraction set pattern		○		○
		Subtraction reset pattern				
3	+3,750	Addition set pattern		○		
		Addition reset pattern			○	
		Subtraction set pattern				
		Subtraction reset pattern				○
4	+5,000	Addition set pattern				
		Addition reset pattern				○
		Subtraction set pattern			○	○
		Subtraction reset pattern	○	○		
5	+6,250	Addition set pattern			○	
		Addition reset pattern				
		Subtraction set pattern				
		Subtraction reset pattern				○
6	+7,500	Addition set pattern	○			○
		Addition reset pattern		○		
		Subtraction set pattern	○	○		
		Subtraction reset pattern				
7	+8,750	Addition set pattern				
		Addition reset pattern			○	
		Subtraction set pattern				○
		Subtraction reset pattern				



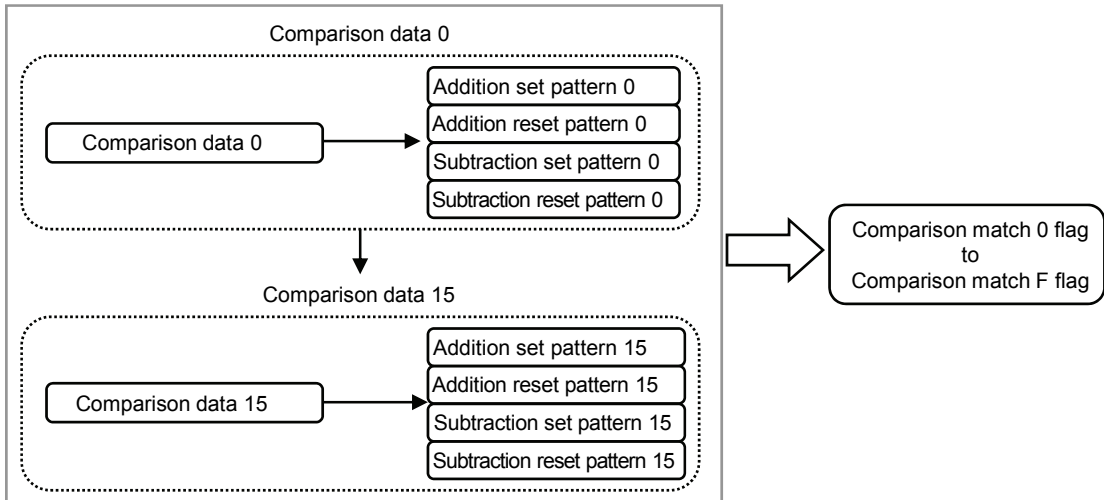
◆ KEY POINTS

- The operation of comparison match flag when the count value reaches the target value can be changed depending on the cases of addition and subtraction.
- If the contents of comparison data 0 to 15 are overlapped and the specified reset conditions are different, the priority of data is in the following order. (High) 0 > 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9 > 10 > 11 > 12 > 13 > 14 > 15 (Low)

7.2.3 Configuration of Target Value Match Comparison

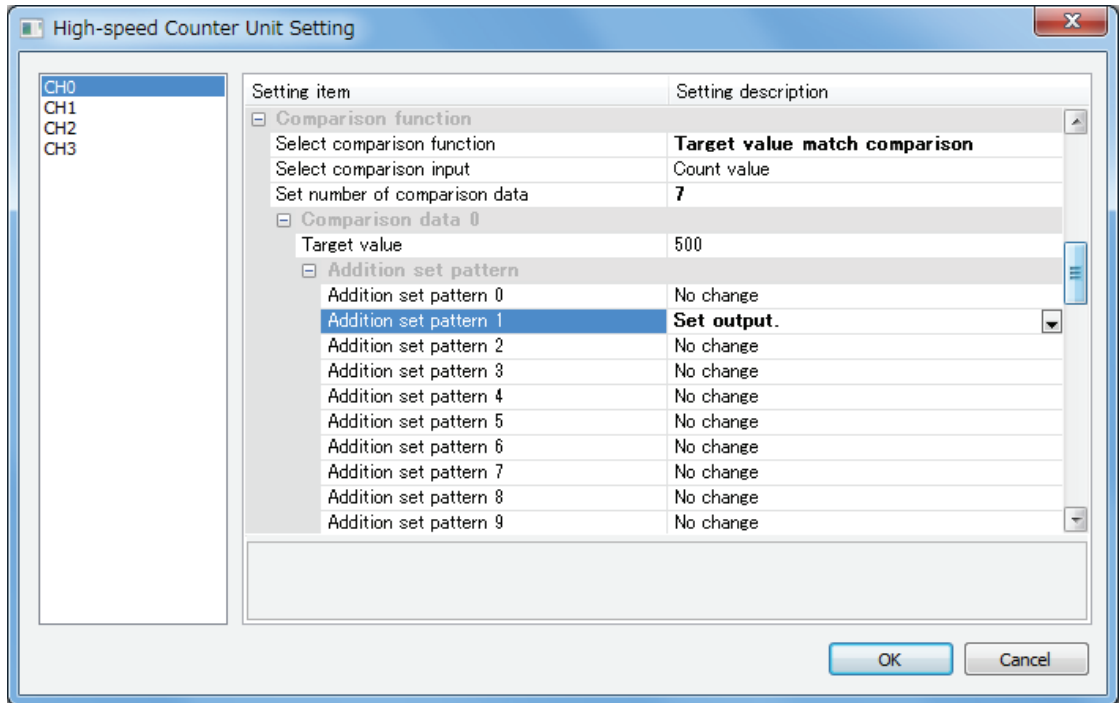
■ Overview of setting items

- For each comparison data, specify whether to set or reset each flag when the current value matches the target value.
- Multiple comparison match flags can be set for one comparison data.
- Different flag operations can be set depending on the count direction when the values are matched (at the time of addition or subtraction).



Setting for Target value match comparison

■ Example of settings by FPWIN GR7



■ **Pattern of storage in unit memories (UM)**

- Set data is stored in 8-word blocks of corresponding unit memories in the following format.
- When using user programs, set data in corresponding unit memory numbers.

Example 1) For the comparison data 0 of CH0, it is allocated to UM00080 to UM00087.

Example 2) For the comparison data 1 of CH0, it is allocated to UM00088 to UM00095.

- The bit numbers 0 to 15 in the areas of +2 to +5 in the figure below correspond to the comparison match 0 flag to F flag.

0	Low words of target value																Target values	
+1	High words of target value																	
+2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subtraction reset pattern	1: Set output, 0: No change
+3	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Addition reset pattern	1: Reset output, 0: No change
+4	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subtraction set pattern	1: Set output, 0: No change
+5	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Subtraction reset pattern	1: Reset output, 0: No change
+6	Not used																Reserved for system	
+7	Not used																	



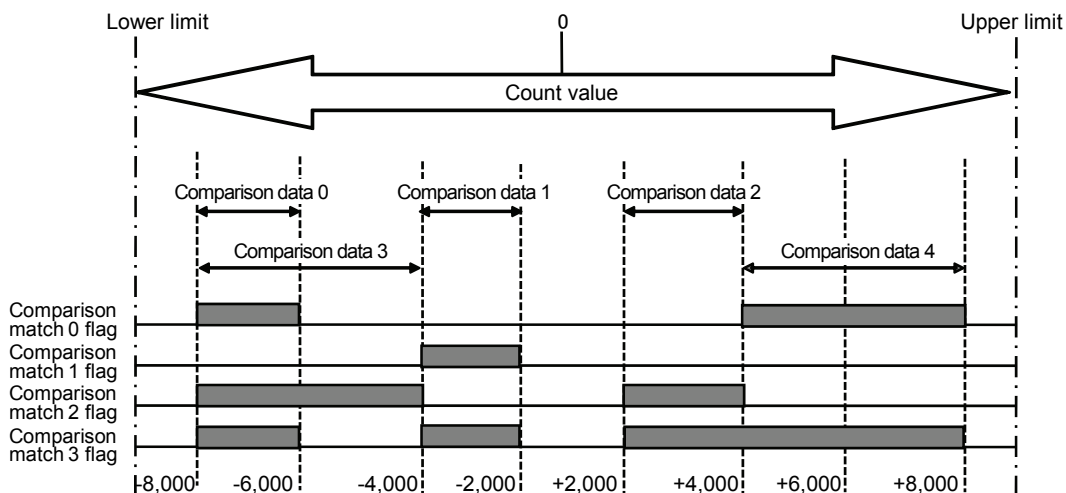
◆ **REFERENCE**

- For details of unit memory numbers, refer to 11.4 Unit Memory Detailed Specifications.

7.3 Operation of Band Comparison Function

7.3.1 Examples of Linear counter Settings

■ Operation of band comparison match flag



■ Examples of output pattern settings

Comparison data	Band comparison value		Output pattern	Comparison match 0 flag	Comparison match 1 flag	Comparison match 2 flag	Comparison match 3 flag
	Lower limit	Upper limit					
0	-8,000	-6,000	Set pattern	ON	OFF	ON	ON
1	-4,000	-2,000	Set pattern	OFF	ON	OFF	ON
2	+2,000	+4,000	Set pattern	OFF	OFF	ON	ON
3	-8,000	-4,000	Set pattern	OFF	OFF	ON	OFF
4	+4,000	+8,000	Set pattern	ON	OFF	OFF	ON

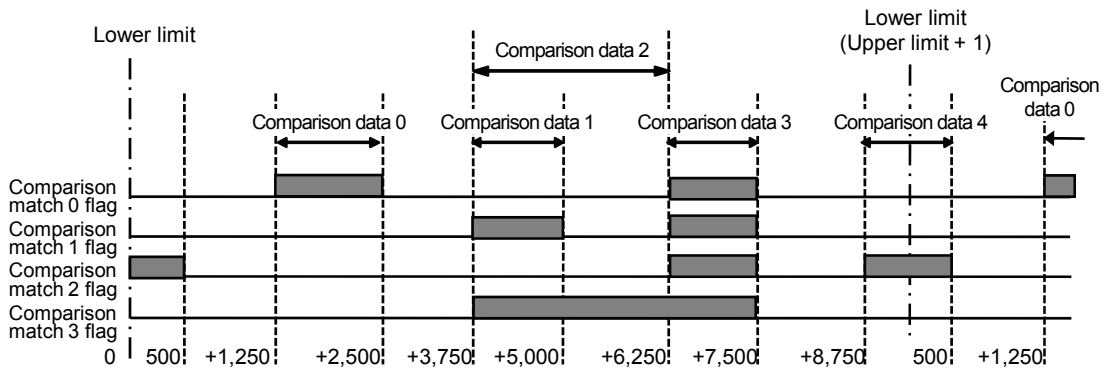
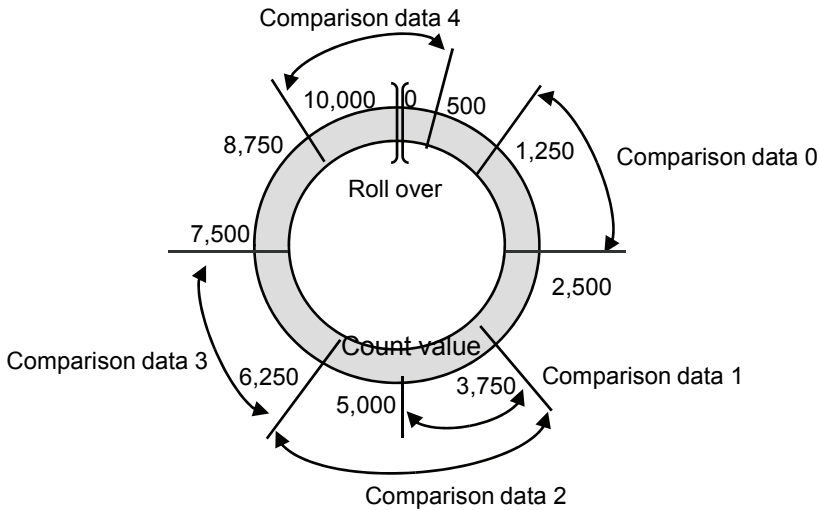


◆ KEY POINTS

- The output is off in the areas of the bands in which comparison data is not set.
- Multiple comparison data can be set for the same band.
- If the contents of comparison data 0 to 15 are overlapped and the specified reset conditions are different, the priority of data is in the following order. (High) 0 > 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9 > 10 > 11 > 12 > 13 > 14 > 15 (Low)

7.3.2 Examples of Ring Counter Settings

■ Operation of band comparison match flag



■ Examples of output pattern settings

Comparison data	Band comparison value		Output pattern	Comparison match 0 flag	Comparison match 1 flag	Comparison match 2 flag	Comparison match 3 flag
	Lower limit	Upper limit					
0	+1,250	2,500	Set pattern	ON	OFF	OFF	OFF
1	+3,750	+5,000	Set pattern	OFF	ON	OFF	ON
2	+3,750	+7,500	Set pattern	OFF	OFF	OFF	ON
3	+6,250	+7,500	Set pattern	ON	ON	ON	ON
4	+8,750	+500	Set pattern	OFF	OFF	ON	OFF



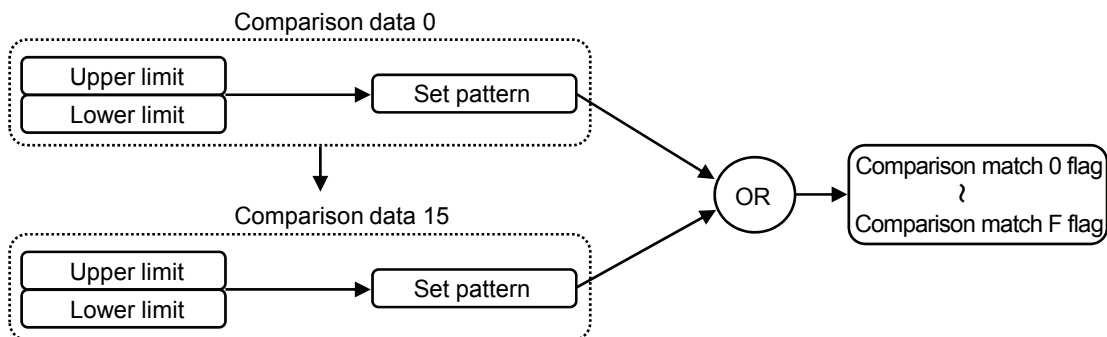
◆ KEY POINTS

- For the ring counter, comparison data is set for the area including the upper and lower limits in which the count value is rolled over, and set patterns can be set.

7.3.3 Configuration of Band Comparison

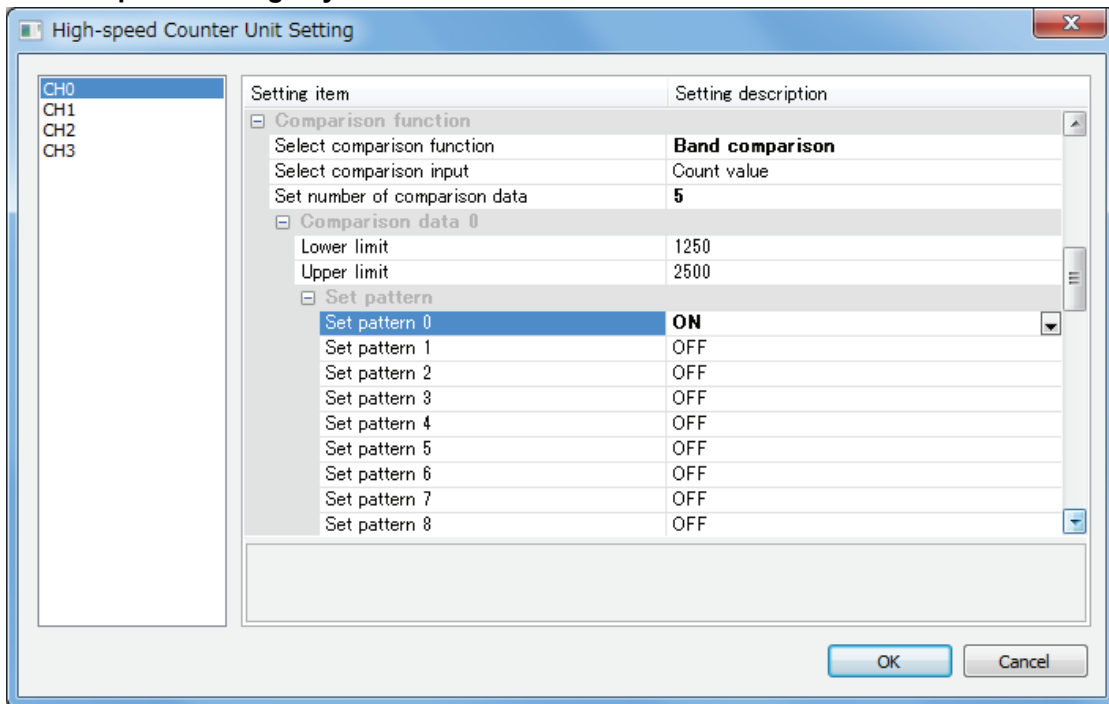
■ Overview of setting items

- When the current value exists between the lower and upper limits of each comparison data, the ON or OFF state of each flag is set for each comparison data.
- Multiple comparison match flags can be set for one comparison data.
- Multiple comparison data can be set for the same band.



Setting for Band comparison

■ Example of settings by FPWIN GR7



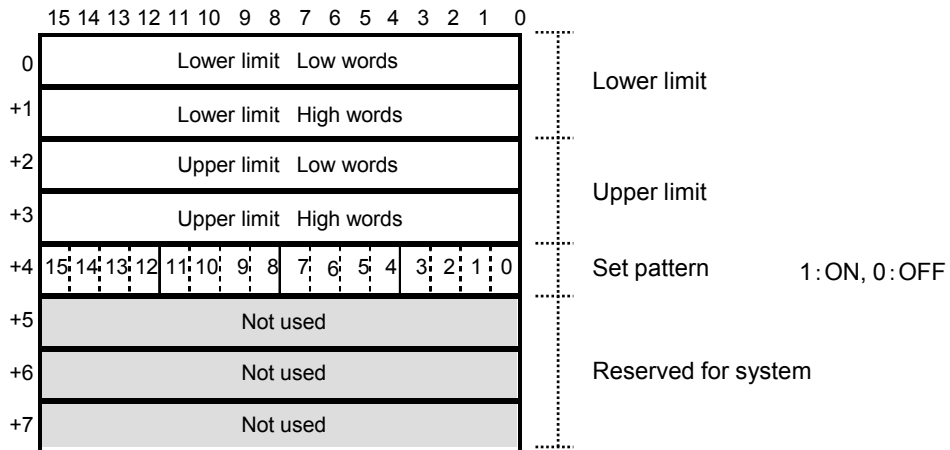
■ **Pattern of storage in unit memories (UM)**

- Set data is stored in 8-word blocks of corresponding unit memories in the following format.
- When using user programs, set data in corresponding unit memory numbers.

Example 1) For the comparison data 0 of CH0, it is allocated to UM00080 to UM00087.

Example 2) For the comparison data 1 of CH0, it is allocated to UM00088 to UM0008F.

- The bit numbers 0 to 15 in the area of +4 in the figure below correspond to the comparison match 0 flag to F flag.



◆ **REFERENCE**

- For details of unit memory numbers, refer to 11.4 Unit Memory Detailed Specifications.

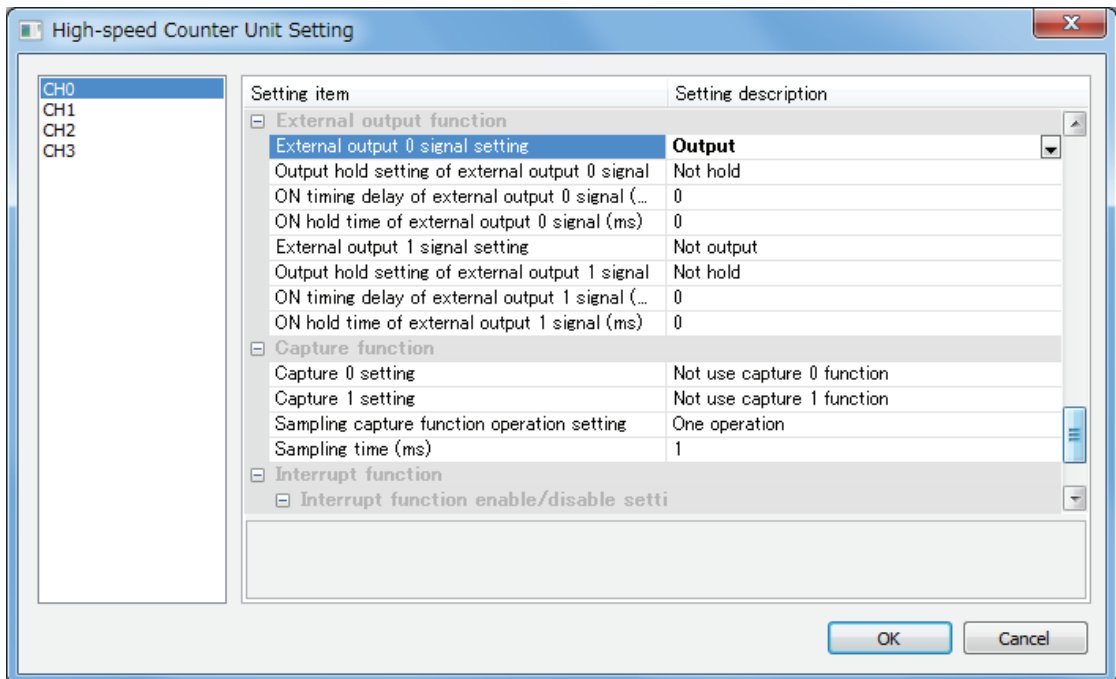
7.4 External Output

7.4.1 Overview of External Output Function

■ External output function

- The result of comparison is reflected in 16 flags (comparison match 0 flag to comparison match F flag), and the two of them (comparison match 0 flag and comparison match 1 flag) can be retrieved as external outputs by being allocated to the external output terminals of the unit.
- The configuration menu of FPWIN GR7 or the corresponding unit memories (UM) are used for the allocation.

■ Example of settings by FPWIN GR7



■ Setting items and corresponding unit memory numbers

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00100 UM 001D0 UM 002A0 UM 00370	External output 0 signal setting	H0	Set whether or not to output the comparison match 0 flag to the external output 0 signal. H0: Not output H1: Output	—
UM 00101 UM 001D1 UM 002A1 UM 00371	Output hold setting of external output 0 signal	H0	Set whether or not to hold the output signal in the program mode when an error occurs. H0: Not hold H1: Hold	—
UM 00102 UM 001D2 UM 002A2 UM 00372	External output 0 signal ON timing delay (Available when band comparison function is used)	0	Set the ON timing delay of external output 0 signal. Setting range: 0 to 1,000(The values out of the setting range are invalid.)	ms
UM 00103 UM 001D3 UM 002A3 UM 00373	External output 0 signal ON hold time (Available when band comparison function is used)	0	Set the ON hold time of external output 0 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms
UM 00104 UM 001D4 UM 002A4 UM 00374	External output 1 signal setting	H0	Set whether or not to output the comparison match 1 flag to the external output 1 signal. H0: Not output H1: Output	—
UM 00105 UM 001D5 UM 002A5 UM 00375	Output hold setting of external output 1 signal	H0	Set whether or not to hold the output signal in the program mode when an error occurs. H0: Not hold H1: Hold	—
UM 00106 UM 001D6 UM 002A6 UM 00376	External output 1 signal ON timing delay (Available when band comparison function is used)	0	Set the ON timing delay of external output 1 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms
UM 00107 UM 001D7 UM 002A7 UM 00377	External output 1 signal ON hold time (Available when band comparison function is used)	0	Set the ON hold time of external output 1 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

7.4.2 Output Pattern Setting (Only for Band Comparison)

When using the band comparison function, the ON timing delay time or ON hold time can be set for output signals.

■ Operational difference between settings

ON hold time	ON timing delay	Timing chart of comparison match 0 flag and external output
0	0	
0	1 to 1,000 ms	
1 to 1,000 ms	0	
1 to 1,000 ms	1 to 1,000 ms	

7.4.3 Forced Output Function

- The outputs of external output 0 terminal and external output 1 terminal can be controlled on the ladder monitor or device monitor of tool software FPWIN GR7. They can be also turned on or off by user programs.
- It can be used for the confirmation of wirings.

■ I/O Allocation of external output terminals

Signal name	Effective condition	CH0	CH1	CH2	CH3
External output 0 forced ON	Level	Y109	Y119	Y129	Y139
External output 0 forced OFF	Level	Y10A	Y11A	Y12A	Y13A
External output 1 forced ON	Level	Y10B	Y11B	Y12B	Y13B
External output 1 forced OFF	Level	Y10C	Y11C	Y12C	Y13C

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.



◆ KEY POINTS

- **The above forced output function is a function of the high-speed counter unit. The forced I/O function of programming tool FPWIN GR7 is not used.**

8

Capture Function and Sampling Capture Function

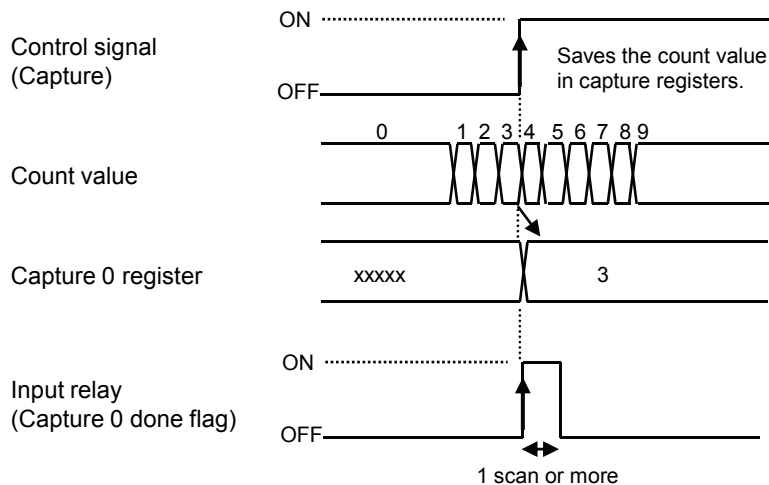
8.1 Capture Function and Sampling Capture Function

8.1.1 Capture Function

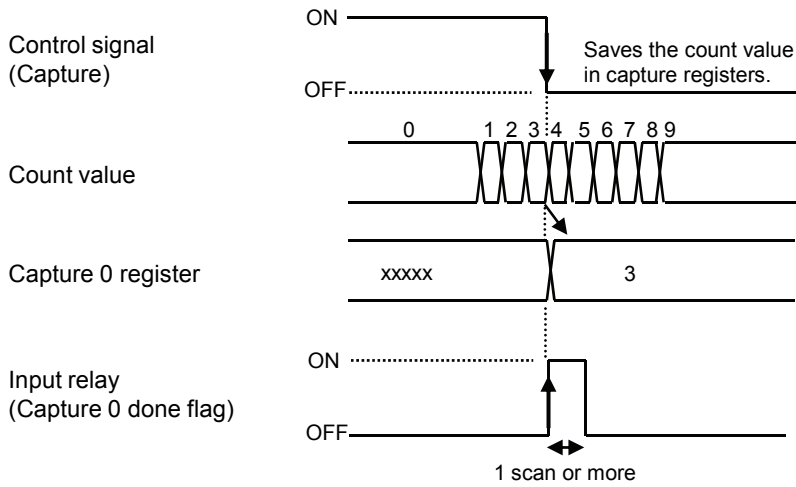
■ Capture function

- The capture function is to store the count value in corresponding capture registers (unit memories) when the control signal rises or falls.
- The value is stored in two capture registers and one difference value register.
- The width of the control signal can be also measured by setting the capture operations of one control signal at the time of rising and falling.
- Once the capture operation is complete, the corresponding flag turns on for a period of one scan.

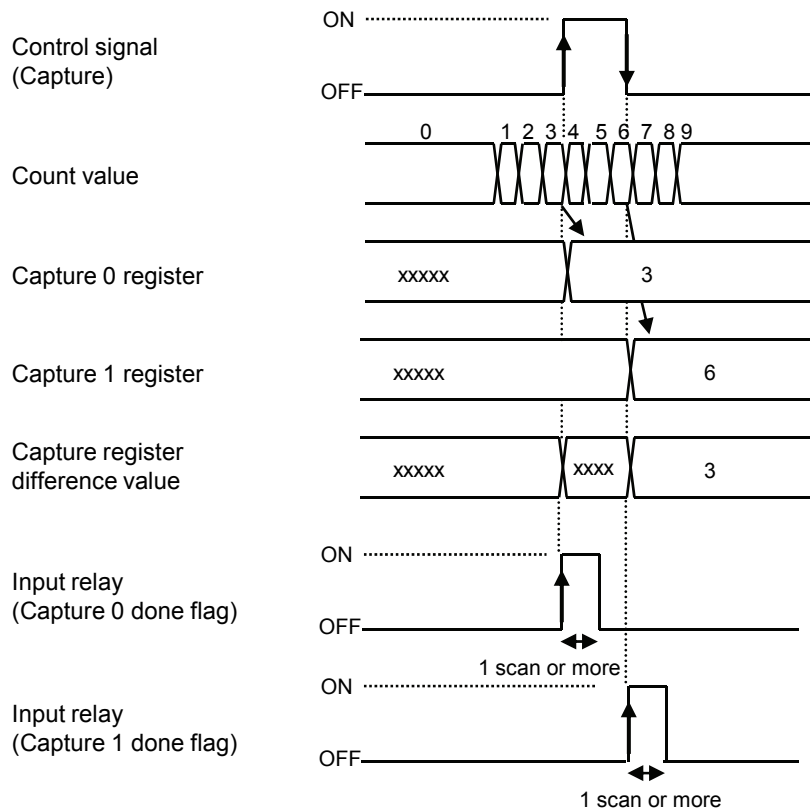
■ Operation when the control signal rises



■ Operation when the control signal falls



■ Operation when one control signal rises and falls

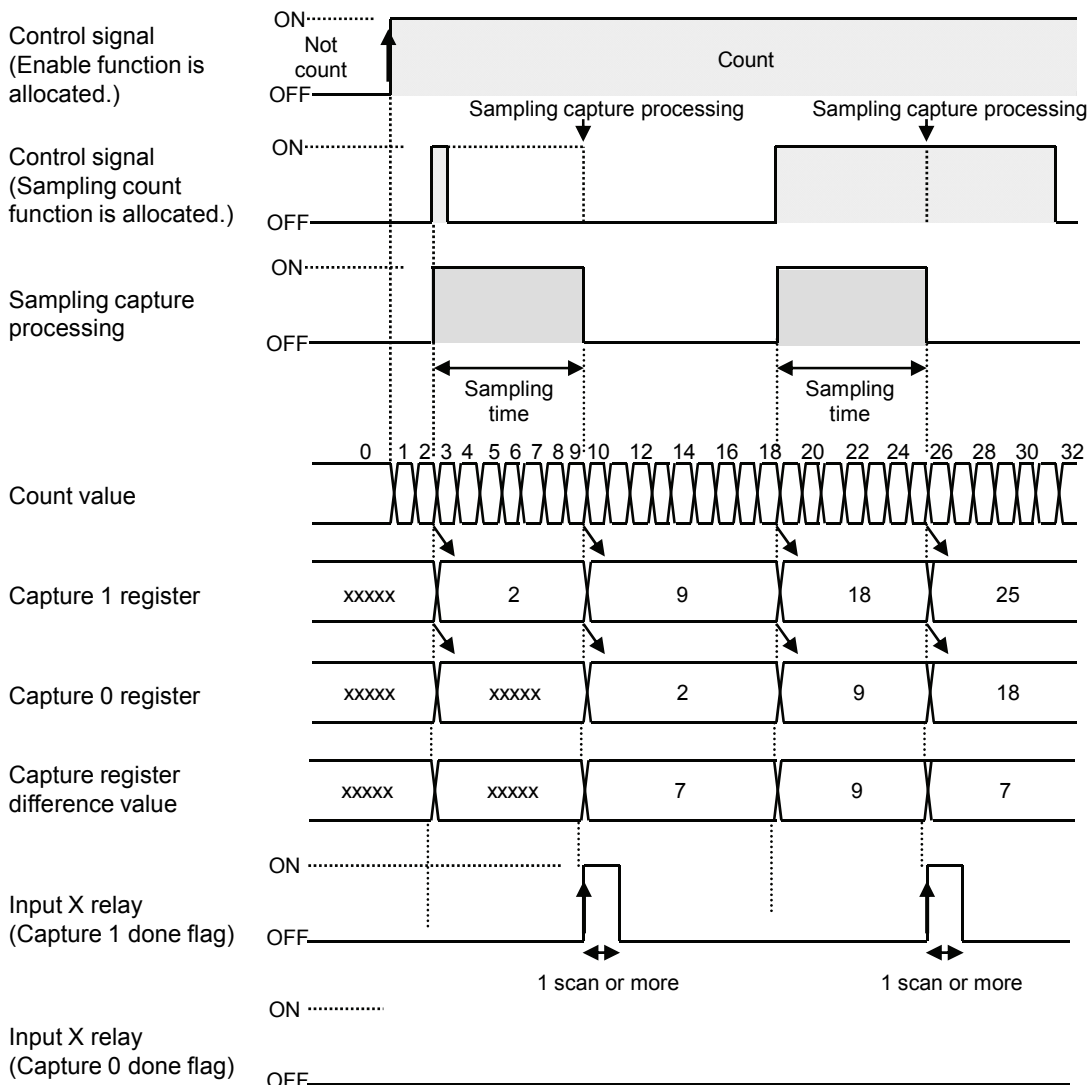


8.1.2 Sampling Capture Function

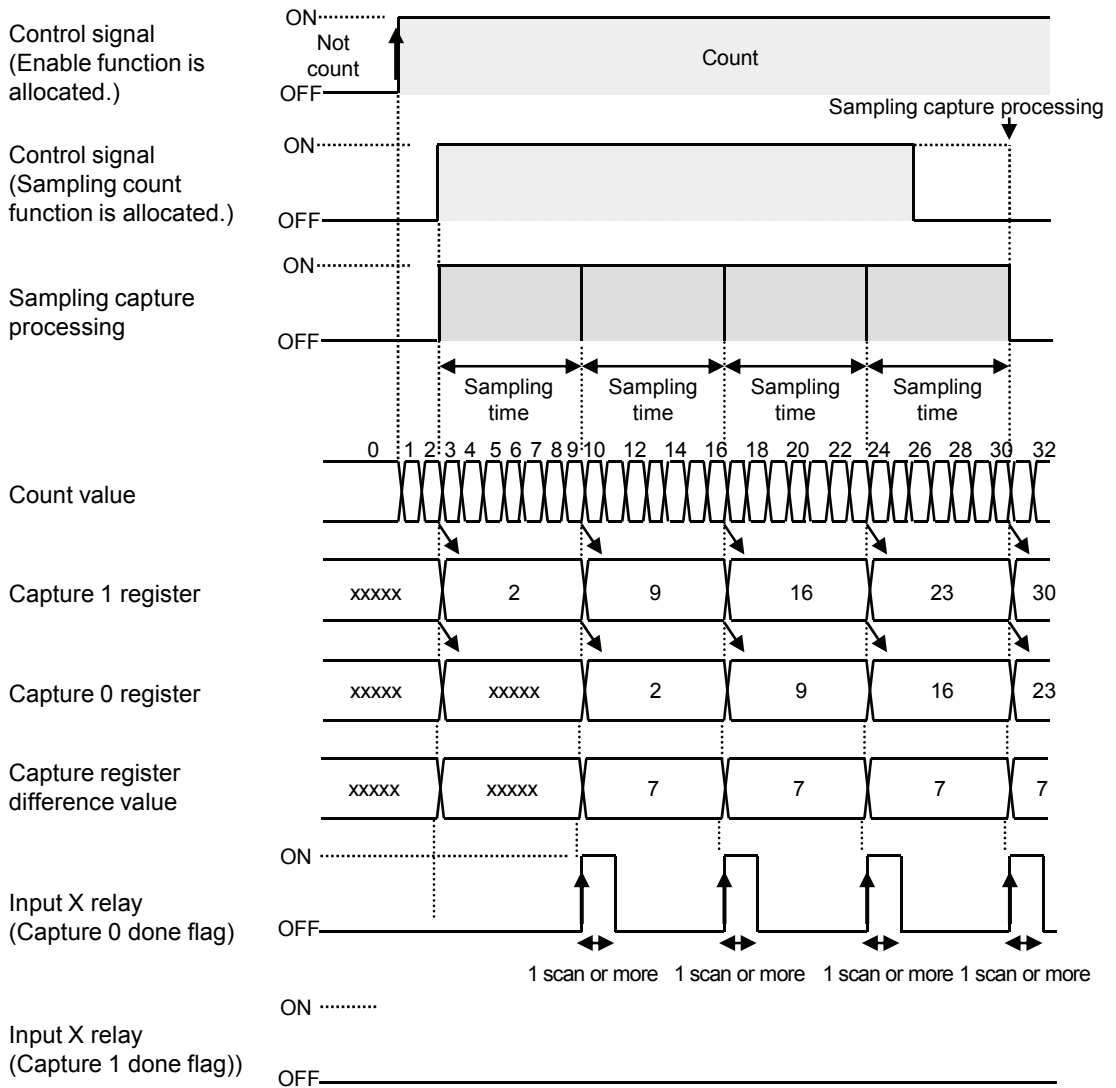
■ Sampling capture function

- The sampling capture function is to store the difference between the count value at the time of turning on or off the control signal and the count value for a specified sampling time, in capture registers (unit memories).
- While the control signal is on, this function can be executed continuously.
- The control signal (positive logic), control signal (negative logic) or output relays (Y7, Y17, Y27, Y37) can be selected for the execution condition of sampling capture.
- Once the capture operation is complete, the corresponding flag turns on for a period of one scan.

■ When specifying One operation



■ When specifying Continuous operation



◆ KEY POINTS

- The above time chart shows the examples in the case that the control signals 0 and 1 are allocated to the enable signal and the sampling capture request signal respectively. The sampling capture function is activated by the allocated request signal regardless of the operation of the enable signal.

8.1.3 Configuration

For using the measurement function, set the following items using the configuration menu of tool software FPWIN GR7 or user programs.

■ Setting area

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00110 UM 001E0 UM 002B0 UM 00380	Capture 0 setting	H0	Set the capture function or sampling capture function by the control 0 signal. H0: Not use capture 0 function H1: Capture function at rising edge of control 0 signal H2: Capture function at trailing edge of control 0 signal H3: Capture function at rising edge of control 1 signal H4: Capture function at trailing edge of control 1 signal H5: Control 0 signal positive logic sampling capture function H6: Control 0 signal negative logic sampling capture function H7: Control 1 signal positive logic sampling capture function H8: Control 1 signal negative logic sampling capture function H9: Output relay (Y relay) sampling capture function	—
UM 00111 UM 001E1 UM 002B1 UM 00381	Capture 1 setting	H0	Set the capture function or sampling capture function by the control 1 signal. H0: Not use capture 1 function H1: Capture function at rising edge of control 0 signal H2: Capture function at trailing edge of control 0 signal H3: Capture function at rising edge of control 1 signal H4: Capture function at trailing edge of control 1 signal However, this setting area is invalid when the sampling capture function (H5 to H9) is selected in the capture 0 setting.	—
UM 00112 UM 001E2 UM 002B2 UM 00382	Sampling capture function operation setting	H0	Set the operation of the sampling capture function. H0: One operation H1: Continuous operation	—
UM 00113 UM 001E3 UM 002B3 UM 00383	Sampling time	1	Set a sampling time. Setting range: 1 to 65,535 (The values out of the setting range are invalid.)	ms

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

8.1.4 Reading Capturing Results

■ Read area

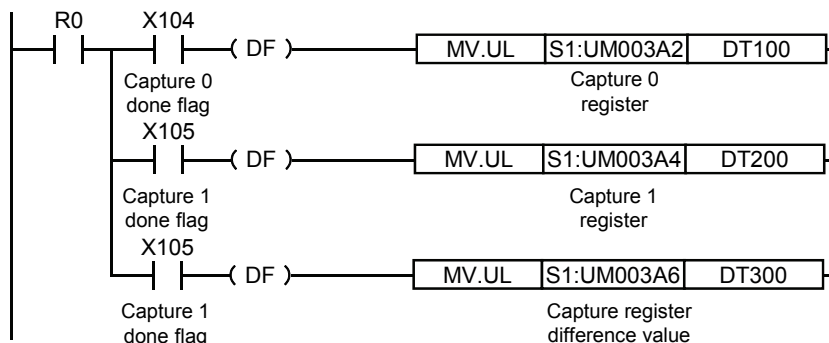
Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 003A2 UM 003A3	Capture 0 register	0	Value of capture 0 register. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003B2 UM 003B3				
UM 003C2 UM 003C3				
UM 003D2 UM 003D3				
UM 003A4 UM 003A5	Capture 1 register	0	Value of capture 1 register. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003B4 UM 003B5				
UM 003C4 UM 003C5				
UM 003D4 UM 003D5				
UM 003A6 UM 003A7	Capture register difference value	0	Calculated difference between the capture registers (Capture register 1 - Capture register 0) Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003B6 UM 003B7				
UM 003C6 UM 003C7				
UM 003D6 UM 003D7				

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

8.1.5 Sample Program

■ Read program for capture function

Example) Program to read the capture values and difference value of CH0 of the high-speed counter unit installed in the slot number 1.



9

Interrupt Program Activation Function

9.1 Interrupt Program Activation Function

9.1.1 Overview of Interrupt Program

- The high-speed counter unit can activate interrupt programs of CPU using comparison match flags.
- If the activation condition is met, the interrupt program of a corresponding program number will be activated. Once the execution of the interrupt program is complete, the process returns to the execution of the main program.

■ Interrupt program specifications

Item	Description	
Interrupt program activation condition	Activates a corresponding interrupt program when the comparison match 0 flag and comparison match 1 flag of each channel turns on.	
No. of interrupt programs	Per 1 channel of high-speed counter unit	Max. 2 programs
	Per 1 high-speed counter unit	Max. 4 programs (2-ch type High-speed counter unit) Max. 8 programs (4-ch type High-speed counter unit)
	Per 1 CPU unit	Max. 64 programs (8 programs x 8 units)

9.1.2 Settings of High-speed Counter Unit

■ Switch setting of the unit

For using the interrupt program activation function, it is necessary to set the switch on the side of the unit. Refer to “2.1 Names and Functions of Parts”.

■ Configuration setting

Confirm if the comparison function has been set and the interrupt function has been set to "Enable" in the configuration menu.

9.1.3 Overview of Interrupt Program

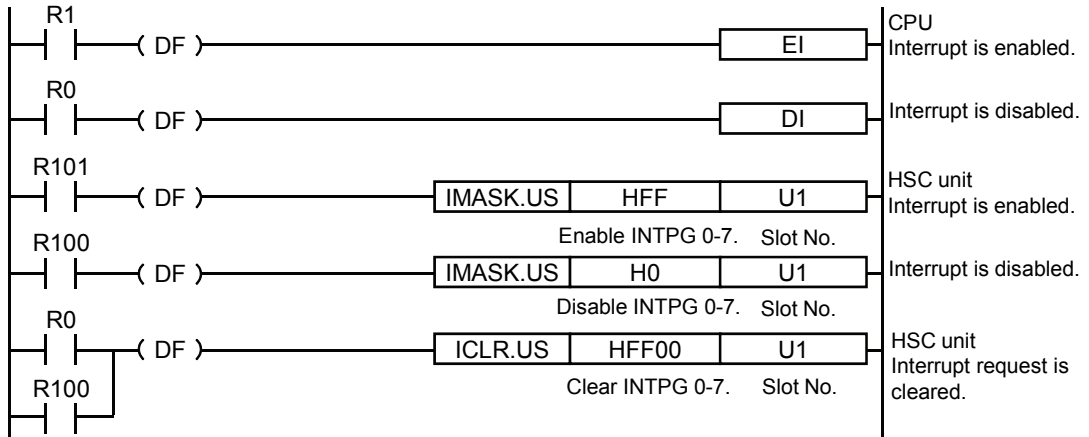
Use the following instructions to execute the interrupt program activation function.

■ Instructions used for interrupt program activation.

Described area	Instruction	Function
Main program	EI	Allows the interrupt process for the CPU.
	DI	Prohibits the interrupt process for the CPU.
	IMASK	Allows or prohibits the interrupt process of each unit.
	ICLR	Clears the interrupt activation request signal that has not been processed on the unit side when the interrupt program activation is prohibited by DI or IMASK instruction.
Interrupt program	INTPG	It is described at the beginning of the interrupt program.
	IRET	It is described at the end of the interrupt program.

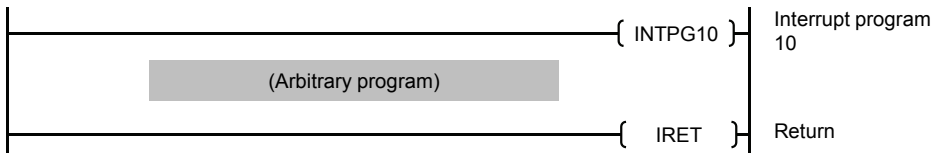
■ Programming method (Main program)

The interrupt for the CPU and the interrupt activation of the high-speed counter unit are allowed in the main program. If the interrupt becomes disabled, clear the interrupt activation request signal that is not processed in the unit as necessary.



■ Programming method (Interrupt program)

- Describe the program to be executed at the time of interrupt process in the interrupt program.



■ Corresponding interrupt program number

Interrupt program No.	Comparison match flag of high-speed counter unit	Designation of the first operand of IMASK and ICLR instructions
INTPG 10	CH0 Comparison match 0 flag	IMASK instruction bit no. 15 8 7 0
INTPG 11	CH0 Comparison match 1 flag	
INTPG 12	CH1 Comparison match 0 flag	
INTPG 13	CH1 Comparison match 1 flag	
INTPG 14	CH2 Comparison match 0 flag	ICLR instruction bit no. 15 8 7 0
INTPG 15	CH2 Comparison match 1 flag	
INTPG 16	CH3 Comparison match 0 flag	
INTPG 17	CH3 Comparison match 1 flag	

(Note 1): Interrupt program numbers are specified with slot numbers + (0 to 7). The numbers in the above table are for the slot 1.

Example) The interrupt program number corresponding to the CH1 comparison match 1 flag of the slot number 1 is INTPG103.

9.1.4 Precautions for Use

■ **Process when more than one interrupt activation request is made**

- If more than one interrupt activation request is made from the unit, the process will be carried out from the smallest slot number or the smallest interrupt program number.
- If the interrupt activation is requested on the completion of the process of interrupt program, a higher-priority program will be searched and the corresponding interrupt program will be executed.
- Interrupt activation request signals on the unit side will be held until the corresponding interrupt program is executed or ICLR instruction is executed.



◆ **NOTE**

- **If the interrupt program activation function is used a lot, the execution of the interrupt program will have a priority and the execution of the main program may not be complete.**

10

What to Do If an Error Occurs

10.1 Self-diagnostic Function

10.1.1 Errors Announced by High-speed Counter Unit

■ Operation monitor LEDs of high-speed counter

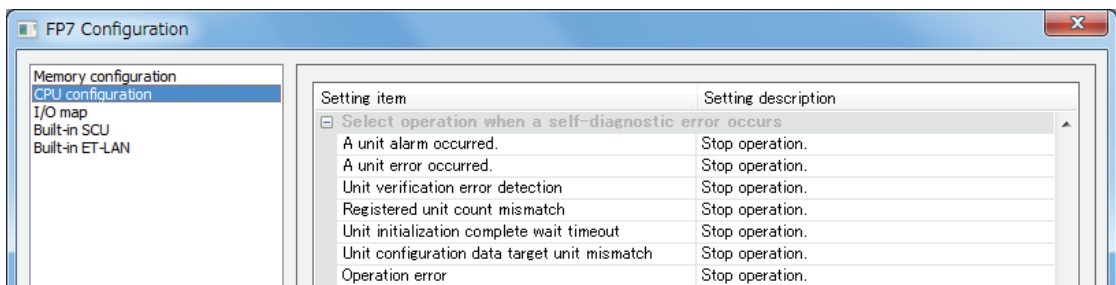
- When an error occurs in the high-speed counter unit, the ERR LED of the unit lights.
- The contents of errors can be confirmed from the error flags and error codes allocated to each channel.
- There are errors which occur at the time of start-up and errors which occur during operations.

■ CPU operation when an error occurs in the high-speed counter unit

- If an error occurs in the high-speed counter unit, it will give the information to the CPU as "Unit error".
- If a "Unit error" occurs, the CPU will stop the operation.
- In the programming tool, the error code (81) unit error is displayed.

■ Operation mode of the CPU when a unit error occurs

- The operation mode of the CPU at the time a unit error occurs can be changed using the configuration menu of programming tool FPWIN GR7.



10.1.2 Confirming Error Code

■ Confirmation of error information

- Error codes are stored in unit memories (UM) for each channel.
- Error codes are read by the device monitor function of programming tool FPWIN GR7.

■ Allocation of I/O signals and unit memories

Signal name	CH0	CH1	CH2	CH3
Overflow annunciation	X10D	X12D	X14D	X16D
Underflow annunciation	X10E	X12E	X14E	X16E
Error annunciation	X10F	X12F	X14F	X16F
Error code storage area	UM00025	UM00026	UM00027	UM00028

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

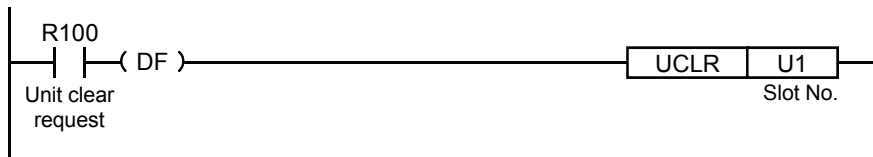
10.1.3 Clearing Errors Using User Programs

- Each error can be cleared by user programs.
- Refer to error codes, correct error factors, and clears the errors.

■ Clearing all channels by UCLR instruction

- Executing the dedicated instruction UCLR (error) clears errors occurred in the high-speed counter unit.

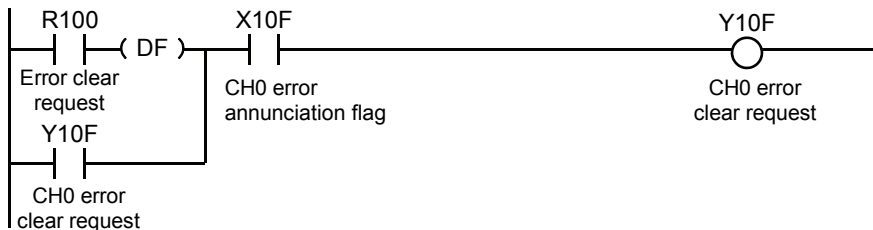
Example) Program to clear errors of the high-speed counter unit installed in the slot No. 1



■ Clearing each channel separately by I/O signals

- Turning on the error clear request flag allocated to the I/O area clears errors in each channel separately. The program below shows the error clear of channel 0.
- The overflow or underflow annunciation flag can be cleared by each clear signal, reset or preset operation. However, error states are not cleared.

Example) Program to request for clearing errors of CH0 of the high-speed counter unit installed in the slot No. 1



■ Allocation of I/O signals

Signal name	CH0	CH1	CH2	CH3
Overflow clear	Y10D	Y11D	Y12D	Y13D
Underflow clear	Y10E	Y11E	Y12E	Y13E
Error clear	Y10F	Y11F	Y12F	Y13F
Overflow annunciation	X10D	X12D	X14D	X16D
Underflow annunciation	X10E	X12E	X14E	X16E
Error annunciation	X10F	X12F	X14F	X16F

(Note 1): The above I/O numbers are those for the slot number 1 and the starting word number 10. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

10.2 List of Error Codes

10.2.1 Errors in Operation Ready Request (0100H to 0633H)

- These are errors occurred when the operation ready is requested. If these errors occur, the unit will not be ready for operations and the functions set in the unit will not be activated.
- Check if the setting values in the configuration menu or unit memories (UM) are correct.

■ List of error codes (0100H ~ 0153H)

Error code	Channel No.	Error name	Corresponding unit memory No.
0100H	CH0	Counter type setting error	UM 00050
0101H	CH1		UM 00120
0102H	CH2		UM 001F0
0103H	CH3		UM 002C0
0110H	CH0	Enable/Disable Overflow/underflow setting error	UM 00051
0111H	CH1		UM 00121
0112H	CH2		UM 001F1
0113H	CH3		UM 002C1
0120H	CH0	Counter upper and lower limits setting error	Upper limit UM 00052-UM 00053
			Lower limit UM 00054-UM 00055
0121H	CH1		Upper limit UM 00122-UM 00123
			Lower limit UM 00124-UM 00125
0122H	CH2		Upper limit UM 001F2-UM 001F3
			Lower limit UM 001F4-UM 001F5
0123H	CH3		Upper limit UM 002C2-UM 002C3
			Lower limit UM 002C4-UM 002C5
0130H	CH0	Count direction setting error	UM 00056
0131H	CH1		UM 00126
0132H	CH2		UM 001F6
0133H	CH3		UM 002C6
0140H	CH0	Count input setting error	UM 00057
0141H	CH1		UM 00127
0142H	CH2		UM 001F7
0143H	CH3		UM 002C7
0150H	CH0	Count method setting error	UM 00058
0151H	CH1		UM 00128
0152H	CH2		UM 001F8
0153H	CH3		UM 002C8

■ List of error codes (0160H ~ 0313H)

Error code	Channel No.	Error name	Corresponding unit memory No.
0160H	CH0	Input Z signal function setting error	UM 00059
0161H	CH1		UM 00129
0162H	CH2		UM 001F9
0163H	CH3		UM 002C9
0170H	CH0	Control 0 signal function setting error	UM 0005A
0171H	CH1		UM 0012A
0172H	CH2		UM 001FA
0173H	CH3		UM 002CA
0180H	CH0	Control 1 signal function setting error	UM 0005B
0181H	CH1		UM 0012B
0182H	CH2		UM 001FB
0183H	CH3		UM 002CB
0190H	CH0	Default value setting error	UM 00060-UM 00061
0191H	CH1		UM 00130-UM 00131
0192H	CH2		UM 00200-UM 00201
0193H	CH3		UM 002D0-UM 002D1
01A0H	CH0	Input A signal/Input B signal input time constant setting error	UM 00068
01A1H	CH1		UM 00138
01A2H	CH2		UM 00208
01A3H	CH3		UM 002D8
01B0H	CH0	Input Z signal input time constant setting error	UM 00069
01B1H	CH1		UM 00139
01B2H	CH2		UM 00209
01B3H	CH3		UM 002D9
01C0H	CH0	Control signal input time constant setting error	UM 0006A
01C1H	CH1		UM 0013A
01C2H	CH2		UM 0020A
01C3H	CH3		UM 002DA
0300H	CH0	Measurement function selection setting error	UM 00070
0301H	CH1		UM 00140
0302H	CH2		UM 00210
0303H	CH3		UM 002E0
0310H	CH0	Pulse number per rotation setting error	UM 00071-UM 00072
0311H	CH1		UM 00141-UM 00142
0312H	CH2		UM 00211-UM 00212
0313H	CH3		UM 002E1-UM 002E2

■ List of error codes (0320H ~ 0533H)

Error code	Channel No.	Error name	Corresponding unit memory No.
0320H	CH0	Average number of frequency measurement processes setting error	UM 00073
0321H	CH1		UM 00143
0322H	CH2		UM 00213
0323H	CH3		UM 002E3
0330H	CH0	Average number of rotation speed measurement processes setting error	UM 00074
0331H	CH1		UM 00144
0332H	CH2		UM 00214
0333H	CH3		UM 002E4
0400H	CH0	Comparison function selection setting error	UM 00078
0401H	CH1		UM 00148
0402H	CH2		UM 00218
0403H	CH3		UM 002E8
0410H	CH0	Comparison input selection setting error	UM 00079
0411H	CH1		UM 00149
0412H	CH2		UM 00219
0413H	CH3		UM 002E9
0430H	CH0	Number of comparison data setting error	UM 0007B
0431H	CH1		UM 0014B
0432H	CH2		UM 0021B
0433H	CH3		UM 002EB
0500H	CH0	External output 0 signal setting error	UM 00100
0501H	CH1		UM 001D0
0502H	CH2		UM 002A0
0503H	CH3		UM 00370
0510H	CH0	External output 0 signal output hold setting error	UM 00101
0511H	CH1		UM 001D1
0512H	CH2		UM 002A1
0513H	CH3		UM 00371
0520H	CH0	External output 0 signal ON timing delay setting error	UM 00102
0521H	CH1		UM 001D2
0522H	CH2		UM 002A2
0523H	CH3		UM 00372
0530H	CH0	External output 0 signal ON hold time setting error	UM 00103
0531H	CH1		UM 001D3
0532H	CH2		UM 002A3
0533H	CH3		UM 00373

■ List of error codes (0540H ~ 0633H)

Error code	Channel No.	Error name	Corresponding unit memory No.
0540H	CH0	External output 1 signal setting error	UM 00104
0541H	CH1		UM 001D4
0542H	CH2		UM 002A4
0543H	CH3		UM 00374
0550H	CH0	External output 1 signal output hold setting error	UM 00105
0551H	CH1		UM 001D5
0552H	CH2		UM 002A5
0553H	CH3		UM 00375
0560H	CH0	External output 1 signal ON timing delay setting error	UM 00106
0561H	CH1		UM 001D6
0562H	CH2		UM 002A6
0563H	CH3		UM 00376
0570H	CH0	External output 1 signal ON hold time setting error	UM 00107
0571H	CH1		UM 001D7
0572H	CH2		UM 002A7
0573H	CH3		UM 00377
0600H	CH0	Capture 0 setting error	UM 00110
0601H	CH1		UM 001E0
0602H	CH2		UM 002B0
0603H	CH3		UM 00380
0610H	CH0	Capture 1 setting error	UM 00111
0611H	CH1		UM 001E1
0612H	CH2		UM 002B1
0613H	CH3		UM 00381
0620H	CH0	Sampling capture function operation setting error	UM 00112
0621H	CH1		UM 001E2
0622H	CH2		UM 002B2
0623H	CH3		UM 00382
0630H	CH0	Sampling time setting error	UM 00113
0631H	CH1		UM 001E3
0632H	CH2		UM 002B3
0633H	CH3		UM 00383

10.2.2 Errors Occurred in Operations (1000H to 1043H)

- These are errors occurred in operations.
- Take steps according to the contents in the table below.

■ List of error codes

Error code	Channel No.	Error name	Content	Operation	Countermeasures
1000H	CH0	Overflow error	The count value exceeds the upper limit.	Announces the overflow error. Holds the count value.	Performs the reset or preset operation to make the count value be in the range of upper and lower limits.
1001H	CH1				
1002H	CH2				
1003H	CH3				
1010H	CH0	Underflow error	The count value exceeds the lower limit.	Announces the underflow error. Holds the count value.	Performs the reset or preset operation to make the count value be in the range of upper and lower limits.
1011H	CH1				
1012H	CH2				
1013H	CH3				
1020H	CH0	Reset error	The count value becomes 0 under the reset condition, and it is outside the range of upper and lower limits.	Does not reset. Continues the count operation.	Confirm the settings of the upper and lower limits of counter. If 0 does not exist in the range of the upper and lower limits, make the preset request.
1021H	CH1				
1022H	CH2				
1023H	CH3				
1030H	CH0	Preset error	The count value is outside the range of upper and lower limits under the preset condition.	Does not preset. Continues the count operation.	Confirm if the specified preset value is in the range of upper and lower limits.
1031H	CH1				
1032H	CH2				
1033H	CH3				
1040H	CH0	Current value change error	The count value is outside the range of upper and lower limits when the current value is changed.	Does not change the current value. Continues the count operation.	Confirm if the current value changed value is in the range of upper and lower limits.
1041H	CH1				
1042H	CH2				
1043H	CH3				

11

Specifications

11.1 Specifications

11.1.1 General Specifications

Items	Description
Operating ambient temperature	0°C to +55°C
Storage ambient temperature	-40°C to +70°C
Operating ambient humidity	10% to 95%RH (at 25°C with no-condensing)
Storage ambient humidity	10% to 95%RH (at 25°C with no-condensing)
Breakdown voltage	Between I/O terminals and CPU power supply terminal/function earth Between input terminal and output terminals 500 VAC for 1 min. (Cutoff current: 10 mA, factory default setting)
Insulation resistance	Between I/O terminals and CPU power supply terminal/function earth Between input terminal and output terminals 100 MΩ or more (with 500 VDC megohmmeter)
Vibration resistance	Conforming to JISB3502 and IEC61131-2. 5 to 8.4 Hz, 3.5-mm single amplitude 8.4 to 150 Hz, acceleration of 9.8 m/s ² 10 sweeps each in X, Y, and Z directions (1 octave/min)
Shock resistance	Conforming to JISB3502 and IEC61131-2. 147 m/s ² or more in X, Y, and Z directions three times each
Noise resistance	1,000 V [P-P] with pulse width of 1 μs or 50 ns (based on in-house measurements)
Environment	Free from corrosive gases and excessive dust
EU Directive applicable standard	EMC Directive: EN61131-2
Overvoltage category	Category II
Pollution degree	Pollution level 2
Internal current consumption	65 mA or less
Weight	Approx. 130 g

11.1.2 Function Specifications

Items		Description	
Count function	Product No.	AFP7HSC2T	AFP7HSC4T
	No. of counters	2-ch type	4-ch type
	Counter type	Linear counter, Ring counter	
	Counting range	Signed 32-bit (-2,147,483,648 to +2,147,483,647)	
	Max. input frequency	4MHz/8MHz for individual input (phases A and B) (Duty ratio 50±10%) 4MHz/8MHz for direction detection input (Duty ratio 50%±10%) 4MHz/8MHz for 2-phase input (Duty ratio 50±10%, Phase shifting below 5%)	
	Input signal	Phases A, B and Z	
	External I/O	- Control signal input: 4 points (2 points/ch) - External output: 4 points (2 points/ch)	- Control signal input: 8 points (2 points/ch) - External output: 8 points (2 points/ch)
	Input type	- 2-phase input (Phase difference input) 1 multiple, 2 multiple, 4 multiple - Individual input 1 multiple, 2 multiple - Direction detection input 1 multiple, 2 multiple	
Count operation function	<p>Count operation can be controlled by input signals in combination with three functions.</p> <ul style="list-style-type: none"> - Enable function (Control signal/Output Y relay) - Preset function (Input Z signal/Output Y relay) - Preset function (Input Z signal/Output Y relay) <p>Only for control signals, the enable function and reset function or preset function can be combined. The count operation is set by selecting from the following operations.</p> <ul style="list-style-type: none"> - Reset operation at rising edge - Reset operation at trailing edge - Positive logic reset operation - Negative logic reset operation - Preset operation at rising edge - Preset operation at trailing edge - Positive logic preset operation - Negative logic preset operation - Positive logic enable operation - Negative logic enable operation - Positive logic enable operation and reset operation at rising edge - Negative logic enable operation and reset operation at trailing edge - Positive logic enable operation and preset operation at rising edge - Negative logic enable operation and preset operation at trailing edge 		
Measurement function	Frequency measurement function	Measures the intervals between the changes in the count value, and calculates the frequency.	
	Rotation speed measurement A function	Measures the intervals between the changes in the count value, and automatically calculates the rotation speed.	
	Rotation speed measurement B function	Measures the time for the number of counts equivalent to one rotation. Sets the time to reach the specified number of pulses per one rotation, and calculates the rotation speed from the time required for one rotation.	

Items		Description
Comparison function	No. of comparison data	Max. 16 data/ch (Comparison data 0 to Comparison data 15)
	Comparison match flag	Max. 16 points/ch (Comparison match 0 flag to Comparison match F flag) Read as input relays (X) by user programs. Multiple comparison match flags can be set for one comparison data.
	Target value match function	Depending on the count direction, sets or resets the output when the count value reaches the target value.
	Band comparison function	Turns on/off the output when the count value reaches the area of the target value.
External output function	No. of external outputs	2 points/ch Comparison match 0 flag and comparison match 1 flag can be allocated to external outputs.
	Comparison result output function	When using the band comparison function, the ON timing characteristics of external output relays can be changed. ON timing delay ON hold time ON timing delay and ON hold time
	Forced output function	Output can be forcibly set or reset by the monitor function of programming tool.
Other Functions	Capture function	Acquires the current count value from the edges of input signals, and stores it in the capture 0 register or capture 1 register. The value of the specified capture register will be overwritten by a new value and the old value will be discarded every time a count value is captured.
	Interrupt function	Available (2 points/ch, Max. 8 points/unit) (Note 1)
	Initial value of counter	The count value overwrites the initial value when the power turns on.
	Input time constant	Input time constant (noise filter) can be set to reduce noises of input signal lines of each counter.

(Note 1) The interrupt input function can be used for 8 points per unit and for a maximum of 8 units (max. 64 points) in the whole system. However, the entire scan time slows down as more interrupt programs are used. Minimize the use of interrupt programs.

(Note 2): The priority order for interrupt inputs is as follows; In a unit, from the smallest interrupt bit. In the whole system, from the smallest unit number.

11.2 Allocation of I/O Numbers

■ Input relays

I/O number					Name	Description
CH0	CH1	CH2	CH3			
WX0	X0	X20	X40	X60	Operation ready done	Flag to indicate the counter operation is ready.
	X1	X21	X41	X61	Counter enable	Flag to indicate the counter operation is enabled.
	X2	X22	X42	X62	Count direction	Flag to indicate a count direction. ON: Forward (Addition) OFF: Reverse (Subtraction)
	X3	X23	X43	X63	—	—
	X4	X24	X44	X64	Capture 0 done flag	Flag to acquire the count value, save it in capture 0 register, and announce the completion.
	X5	X25	X45	X65	Capture 1 done flag	Flag to acquire the count value, save it in capture 1 register, and announce the completion.
	X6	X26	X46	X66	External output 0 signal monitor	Monitors the output state of external output 0 signal.
	X7	X27	X47	X67	External output 1 signal monitor	Monitors the output state of external output 1 signal.
	X8	X28	X48	X68	Input A signal monitor	Monitors the input state of input A signal.
	X9	X29	X49	X69	Input B signal monitor	Monitors the input state of input B signal.
	XA	X2A	X4A	X6A	Input Z signal monitor	Monitors the input state of input Z signal.
	XB	X2B	X4B	X6B	Control 0 signal monitor	Monitors the output state of control 0 signal.
	XC	X2C	X4C	X6C	Control 1 signal monitor	Monitors the output state of control 1 signal.
	XD	X2D	X4D	X6D	Overflow annunciation	Flag to announce the occurrence of overflow (Enabled for the linear counter only.)
	XE	X2E	X4E	X6E	Underflow annunciation	Flag to announce the occurrence of underflow (Enabled for the linear counter only.)
	XF	X2F	X4F	X6F	Error annunciation	Flag to announce the occurrence of an error.
WX1	X10 ~ X19	X30 ~ X39	X50 ~ X59	X70 ~ X79	Comparison match 0 flag to Comparison match 9 flag	Flag to reflect the results of the band comparison function or target value match function.
	X1A ~ X1F	X3A ~ X3F	X5A ~ X5F	X7A ~ X7F	Comparison match A flag to Comparison match F flag	

(Note 1): The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.
Example) When the starting word number for the unit is "10", the operation ready done flag for CH0 is X100.

■ Output relays

I/O number				Name	Effective condition	Description				
CH0	CH1	CH2	CH3							
WY0	WY1	WY2	WY3	Y0	Y10	Y20	Y30	Operation ready request	Level	Relay to recalculate the setting parameter of counter.
				Y1	Y11	Y21	Y31	Enable request	Level	Relay to start the counter operation.
				Y2	Y12	Y22	Y32	Reset request	ON edge	Relay to reset count values.
				Y3	Y13	Y23	Y33	Preset request	ON edge	Relay to preset count values.
				Y4	Y14	Y24	Y34	Reset enable request	Level	Relay to enable the reset by the control signal and input Z signal.
				Y5	Y15	Y25	Y35	Current value change request	ON edge	Relay to request for changing the current value of counter.
				Y6	Y16	Y26	Y36	Preset value change request	ON edge	Relay to request for changing preset values.
				Y7	Y17	Y27	Y37	Sampling capture request	Level	Relay to enable the sampling capture function.
				Y8	Y18	Y28	Y38	—	—	—
				Y9	Y19	Y29	Y39	External output 0 forced ON	Level	Relay to forcibly turn on the external output 0.
				YA	Y1A	Y2A	Y3A	External output 0 forced OFF	Level	Relay to forcibly turn off the external output 0.
				YB	Y1B	Y2B	Y3B	External output 1 forced ON	Level	Relay to forcibly turn on the external output 1.
				YC	Y1C	Y2C	Y3C	External output 1 forced OFF	Level	Relay to forcibly turn off the external output 1.
				YD	Y1D	Y2D	Y3D	Overflow clear	ON edge	Relay to clear the overflow annunciation flag.
				YE	Y1E	Y2E	Y3E	Underflow clear	ON edge	Relay to clear the underflow annunciation flag.
				YF	Y1F	Y2F	Y3F	Error clear	ON edge	Relay to clear errors.

(Note 1): The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.

Example) When the starting word number for the unit is "10", the operation ready request flag for CH0 is Y100.

11.3 List of Unit Memories

■ Check list of unit memories

Setting monitor item		Unit memory (UM) number			
		CH0	CH1	CH2	CH3
Common setting area	Error code	UM 00025	UM 00026	UM 00027	UM 00028
Individual setting area	Count function setting area	UM 00050 -	UM 00120 -	UM 001F0 -	UM 002C0 -
		UM 0006F	UM 0013F	UM 0020F	UM 002DF
	Measurement function setting area	UM 00070 -	UM 00140 -	UM 00210 -	UM 002E0 -
		UM 00077	UM 00147	UM 00217	UM 002E7
	Comparison function setting area	UM 00078 -	UM 00148 -	UM 00218 -	UM 002E8 -
		UM 000FF	UM 001CF	UM 0029F	UM 0036F
External output function setting area	UM 00100 -	UM 001D0 -	UM 002A0 -	UM 00370 -	
	UM 0010F	UM 001DF	UM 002AF	UM 0037F	
Capture function setting area	UM 00110 -	UM 001E0 -	UM 002B0 -	UM 00380 -	
	UM 00117	UM 001E7	UM 002B7	UM 00387	
Interrupt function setting area	UM00118 -	UM001E8 -	UM002B8 -	UM00388 -	
	UM0011F	UM 001EF	UM 002BF	UM 0038F	
Monitor area	Count value	UM003A0 -	UM003B0 -	UM003C0 -	UM003D0 -
		UM003A1	UM003B1	UM003C1	UM003D1
	Capture 0 register	UM003A2 -	UM003B2 -	UM003C2 -	UM003D2 -
		UM003A3	UM003B3	UM003C3	UM003D3
	Capture 1 register	UM003A4 -	UM003B4 -	UM003C4 -	UM003D4 -
		UM003A5	UM003B5	UM003C5	UM003D5
Capture register difference value	UM003A6 -	UM003B6 -	UM003C6 -	UM003D6 -	
	UM003A7	UM003B7	UM003C7	UM003D7	
Frequency measurement (Averaging)	UM003A8 -	UM003B8 -	UM003C8 -	UM003D8 -	
	UM003A9	UM003B9	UM003C9	UM003D9	
Rotation speed measurement (Averaging)	UM003AA -	UM003BA -	UM003CA -	UM003DA -	
	UM003AB	UM003BB	UM003CB	UM003DB	

(Note 1): For information on the memory numbers actually used, refer to each items of "11.4 Unit Memory Detailed Specifications". The above list includes empty areas which are reserved in the system. Do not read empty areas or write into empty areas.

11.4 Unit Memory Detailed Specifications

11.4.1 Common Setting Area

■ Error code

Unit memory No. (Hex)	Name	Default	Setting range and description
UM 00025	ch0 Error code	H0	Stores error code for each channel. Refer to the error code list.
UM 00026	ch1 Error code	H0	
UM 00027	ch2 Error code	H0	
UM 00028	ch3 Error code	H0	

11.4.2 Individual Setting Area

■ Count function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00050 UM 00120 UM 001F0 UM 002C0	Counter type	H0	Set the type of counter. H0: Linear counter H1: Ring counter	—
UM 00051 UM 00121 UM 001F1 UM 002C1	Enable/Disable overflow/underflow	H0	Set whether to enable or disable the overflow/underflow judgement. H0: Disable, H1: Enable Annunciation using overflow and underflow flags of each channel and error codes. However, when it is set to disable, the upper and lower limits are disregarded and counting continues.	—
UM 00052 UM 00053	Counter upper limit	U 2,147,483,647	Set the upper limit of counter. Setting range: -2,147,483,647 (8000 0001H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 00122 UM 00123			However, the upper limit should be larger than the lower limit. A setting error occurs when the upper limit is equal to the lower limit or smaller than the lower limit.	
UM 001F2 UM 001F3				
UM 002C2 UM 002C3				
UM 00054 UM 00055	Counter lower limit	U -2,147,483,648	Set the lower limit of counter. Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,646 (7FFF FFFE H) Signed 32-bit	Pulse
UM 00124 UM 00125			However, the upper limit should be larger than the lower limit. A setting error occurs when the upper limit is equal to the lower limit or smaller than the lower limit.	
UM 001F4 UM 001F5				
UM 002C4 UM 002C5				

Specifications

■ Count function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00056 UM 00126 UM 001F6 UM 002C6	Specify count direction	H0	Set the direction of count. H0: Count in normal direction H1: Count in reverse direction	—
UM 00057 UM 00127 UM 001F7 UM 002C7	Select count input	H0	Select a signal for counting from the count signal, internal clock or internal control signal. H0: Count signal H1: Internal clock 0.25 us (4 MHz) H2: Internal clock 1.00 us (1 MHz) H3: Internal clock 10 us (100 kHz) H4: Internal clock 100 us (10 kHz) H7: Internal control signal	—
UM 00058 UM 00128 UM 001F8 UM 002C8	Count method	H0	Set the count method. H0: 2-phase input 1 multiple H1: 2-phase input 2 multiple H2: 2-phase input 4 multiple H3: Individual input 1 multiple H4: Individual input 2 multiple H5: Direction detection input 1 multiple H6: Direction detection input 2 multiple	—
UM 00059 UM 00129 UM 001F9 UM 002C9	Input Z signal function setting	H0	Set counter operations by the input Z signal. H0: Not used H1: Reset operation at rising edge H2: Reset operation at trailing edge H3: Positive logic reset operation H4: Negative logic reset operation H5: Preset operation at rising edge H6: Preset operation at trailing edge H7: Positive logic preset operation H8: Negative logic preset operation	—
UM 0005A UM 0012A UM 001FA UM 002CA	Control 0 signal function setting	H0	Set counter operations by the control 0 signal. H0: Not used H1: Positive logic enable operation H2: Negative logic enable operation H3: Positive logic enable operation, reset operation at rising edge H4: Negative logic enable operation and reset operation at trailing edge H5: Positive logic enable operation and preset operation at rising edge H6: Negative logic enable operation and preset operation at trailing edge	—
UM 0005B UM 0012B UM 001FB UM 002CB	Control 1 signal function setting	H0	Set counter operations by the control 1 signal. H0: Not used H1: Positive logic enable operation H2: Negative logic enable operation	—

■ Count function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 0005C UM 0012C UM 001FC UM 002CC	Comparison match leading edge reset	H0	<p>Set to reset the counter when the comparison match flag rises.</p>	—
UM 0005D UM 0012D UM 001FD UM 002CD	Comparison match trailing edge reset	H0	<p>Set to reset the counter when the comparison match flag falls.</p>	—
UM 00060 UM 00061 UM 00130 UM 00131 UM 00200 UM 00201 UM 002D0 UM 002D1	Default	U0	<p>Set the default value used when the power turns on.</p> <p>Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit</p>	Pulse
UM 00062 UM 00063 UM 00132 UM 00133 UM 00202 UM 00203 UM 002D2 UM 002D3	Preset value	U0	<p>Set the preset value.</p> <p>Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit</p>	Pulse
UM 00064 UM 00065 UM 00134 UM 00135 UM 00204 UM 00205 UM 002D4 UM 002D5	Current value changed value	U0	<p>Set the current value changed value to change the current count value of counter.</p> <p>Setting range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit</p>	Pulse

Specifications

■ Count function0

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00068 UM 00138 UM 00208 UM 002D8	Input A signal/Input B signal input time constant	H5	Set the input time constants of input A signal and input B signal. H0: No input time constant H1: 0.1 us(2 MHz) H2: 0.2 us(1 MHz) H3: 0.5 us(500 kHz) H4: 1.0 us(250 kHz) H5: 2.0 us(100 kHz) H6:10.0 us(10 kHz) H7: Disable (No input time constant)	—
UM 00069 UM 00139 UM 00209 UM 002D9	Input Z signal input time constant	H5	Set the input time constant of input Z signal. H0: No input time constant H1: 0.1 us(2 MHz) H2: 0.2 us(1 MHz) H3: 0.5 us(500 kHz) H4: 1.0 us(250 kHz) H5: 2.0 us(100 kHz) H6:10.0 us(10 kHz) H7: Disable (No input time constant)	—
UM 0006A UM 0013A UM 0020A UM 002DA	Control signal input time constant	H9	Set the input time constant of control signal. H0: No input time constant H1: 2 us H2: 5 us H3: 10 us H4: 20 us H5: 50 us H6: 100 us H7: 500 us H8: 1.0 ms H9: 2.0 ms HA: 5.0 ms HB: 10.0 ms HC: Disable (No input time constant) HD: Disable (No input time constant) HE: Disable (No input time constant) HF: Disable (No input time constant)	—

■ Measurement function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00070 UM 00140 UM 00210 UM 002E0	Select measurement function	H0	Select a measurement function from frequency measurement, rotation speed measurement A or rotation speed measurement B. H0: Not use measurement function H1: Frequency measurement H2: Frequency measurement and rotation speed measurement A H3: Frequency measurement and rotation speed measurement B	—
UM 00071 UM 00072 UM 00141 UM 00142 UM 00211 UM 00212 UM 002E1 UM 002E2	Pulse number per rotation	U1	Set the pulse number for one rotation of the encoder. Setting range: 1 to 1,048,575 (The values out of the setting range are invalid.)	Pulse
UM 00073 UM 00143 UM 00213 UM 002E3	Set average number of frequency measurement processes	H0	Set the number of averaging of frequency measurement values. H0: No averaging H1: 2 times H2: 4 times H3: 8 times H4: 16 times H5: 32 times H6: 64 times H7: 128 times	Times
UM 00074 UM 00144 UM 00214 UM 002E4	Set average number of rotation speed measurement processes	H0	Set the number of averaging of rotation speed measurement values. H0: No averaging H1: 2 times H2: 4 times H3: 8 times H4: 16 times H5: 32 times H6: 64 times H7: 128 times	Times

Specifications

■ Comparison function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00078 UM 00148 UM 00218 UM 002E8	Select comparison function	H0	Select a method of the comparison function from band comparison or target value match comparison. H0: Not use H1: Band comparison H2: Target value match comparison	—
UM 00079 UM 00149 UM 00219 UM 002E9	Select comparison input	H0	Select a target of the comparison function from count value or measurement value. H0: Count value H1: Measurement value (Frequency) H2: Measurement value (Rotation speed)	—
UM 0007B UM 0014B UM 0021B UM 002EB	Set number of comparison data	U16	Set the judgement value for the comparison function. Setting range: 1 to 16 (The values out of the setting range are invalid.)	Times
UM 00080 UM 00150 UM 00220 UM 002F0	Comparison data 0	H0	<p>- Areas in which the output patterns of comparison data and comparison match flags are stored.</p> <p>- The formats of storage areas differ between the target value match comparison and the band comparison.</p> <p>- Each item occupies 8-word area. The unit memory numbers (UM) indicate starting addresses.</p> <p>- For details of the format of target value match comparison, refer to 7.1.2 Target Value Match Comparison and Band Comparison.</p> <p>- For details of the format of band comparison, refer to 7.3.3 Configuration of Band Comparison.</p>	—
UM 00088 UM 00158 UM 00228 UM 002F8	Comparison data 1	H0		—
UM 00090 UM 00160 UM 00230 UM 00300	Comparison data 2	H0		—
UM 00098 UM 00168 UM 00238 UM 00308	Comparison data 3	H0		—
UM 000A0 UM 00170 UM 00240 UM 00310	Comparison data 4	H0		—
UM 000A8 UM 00178 UM 00248 UM 00318	Comparison data 5	H0		—
UM 000B0 UM 00180 UM 00250 UM 00320	Comparison data 6	H0		—

■ Comparison function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 000B8 UM 00188 UM 00258 UM 00328	Comparison data 7	H0	- Set the data for band comparison or target value match comparison. - The formats to be set differ between the band comparison and the target value match comparison. - Each item occupies 8-word area. The unit memory numbers (UM) indicate starting addresses. - For details of the format of target value match comparison, refer to 7.1.2 Target Value Match Comparison and Band Comparison. - For details of the format of band comparison, refer to 7.3.3 Configuration of Band Comparison.	—
UM 000C0 UM 00190 UM 00260 UM 00330	Comparison data 8	H0		—
UM 000C8 UM 00198 UM 00268 UM 00338	Comparison data 9	H0		—
UM 000D0 UM 001A0 UM 00270 UM 00340	Comparison data 10	H0		—
UM 000D8 UM 001A8 UM 00278 UM 00348	Comparison data 11	H0		—
UM 000E0 UM 001B0 UM 00280 UM 00350	Comparison data 12	H0		—
UM 000E8 UM 001B8 UM 00288 UM 00358	Comparison data 13	H0		—
UM 000F0 UM 001C0 UM 00290 UM 00360	Comparison data 14	H0		—
UM 000F8 UM 001C8 UM 00298 UM 00368	Comparison data 15	H0		—

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

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■ External output function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00100 UM 001D0 UM 002A0 UM 00370	External output 0 signal setting	H0	Set whether or not to output the comparison match 0 flag to the external output 0 signal. H0: Not output H1: Output	—
UM 00101 UM 001D1 UM 002A1 UM 00371	External output 0 signal output hold setting	H0	Set whether or not to hold the output signal in the program mode when an error occurs. H0: Not hold H1: Hold	—
UM 00102 UM 001D2 UM 002A2 UM 00372	External output 0 signal ON timing delay	U0	Set the ON timing delay of external output 0 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms
UM 00103 UM 001D3 UM 002A3 UM 00373	External output 0 signal ON hold time	U0	Set the ON hold time of external output 0 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms
UM 00104 UM 001D4 UM 002A4 UM 00374	External output 1 signal setting	H0	Set whether or not to output the comparison match 1 flag to the external output 1 signal. H0: Not output H1: Output	—
UM 00105 UM 001D5 UM 002A5 UM 00375	External output 1 signal output hold setting	H0	Set whether or not to hold the output signal in the program mode when an error occurs. H0: Not hold H1: Hold	—
UM 00106 UM 001D6 UM 002A6 UM 00376	External output 1 signal ON timing delay	U0	Set the ON timing delay of external output 1 signal. Setting range: 0 to 1,000 (The values out of the setting range are invalid.)	ms
UM 00107 UM 001D7 UM 002A7 UM 00377	External output 1 signal ON hold time	U0	Set the ON hold time of external output 1 signal. Setting range: 0 to 1,000(The values out of the setting range are invalid.)	ms

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

■ Capture function / Sampling capture function

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 00110 UM 001E0 UM 002B0 UM 00380	Capture 0 setting	H0	Set the capture function or sampling capture function by the control 0 signal or control 1 signal. H0: Not use capture 0 function H1: Capture function at rising edge of control 0 signal H2: Capture function at trailing edge of control 0 signal H3: Capture function at rising edge of control 1 signal H4: Capture function at trailing edge of control 1 signal H5: Control 0 signal positive logic sampling capture function H6: Control 0 signal negative logic sampling capture function H7: Control 1 signal positive logic sampling capture function H8: Control 1 signal negative logic sampling capture function H9: Output relay (Y relay) sampling capture function The capture 1 setting area is invalid when the sampling capture function (H5 to H9) is selected in the capture 0 setting.	—
UM 00111 UM 001E1 UM 002B1 UM 00381	Capture 1 setting	H0	Set the capture function or sampling capture function by the control 0 signal or control 1 signal. H0: Not use capture 1 function H1: Capture function at rising edge of control 0 signal H2: Capture function at trailing edge of control 0 signal H3: Capture function at rising edge of control 1 signal H4: Capture function at trailing edge of control 1 signal However, this setting area is invalid when the sampling capture function (H5 to H9) is selected in the capture 0 setting.	—
UM 00112 UM 001E2 UM 002B2 UM 00382	Sampling capture function operation setting	H0	Set the operation of the sampling capture function. H0: One operation H1: Continuous operation	—
UM 00113 UM 001E3 UM 002B3 UM 00383	Sampling time	U1	Set a sampling time. Setting range: 1 to 65,535 (The values out of the setting range are invalid.)	ms

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

■ Interrupt function

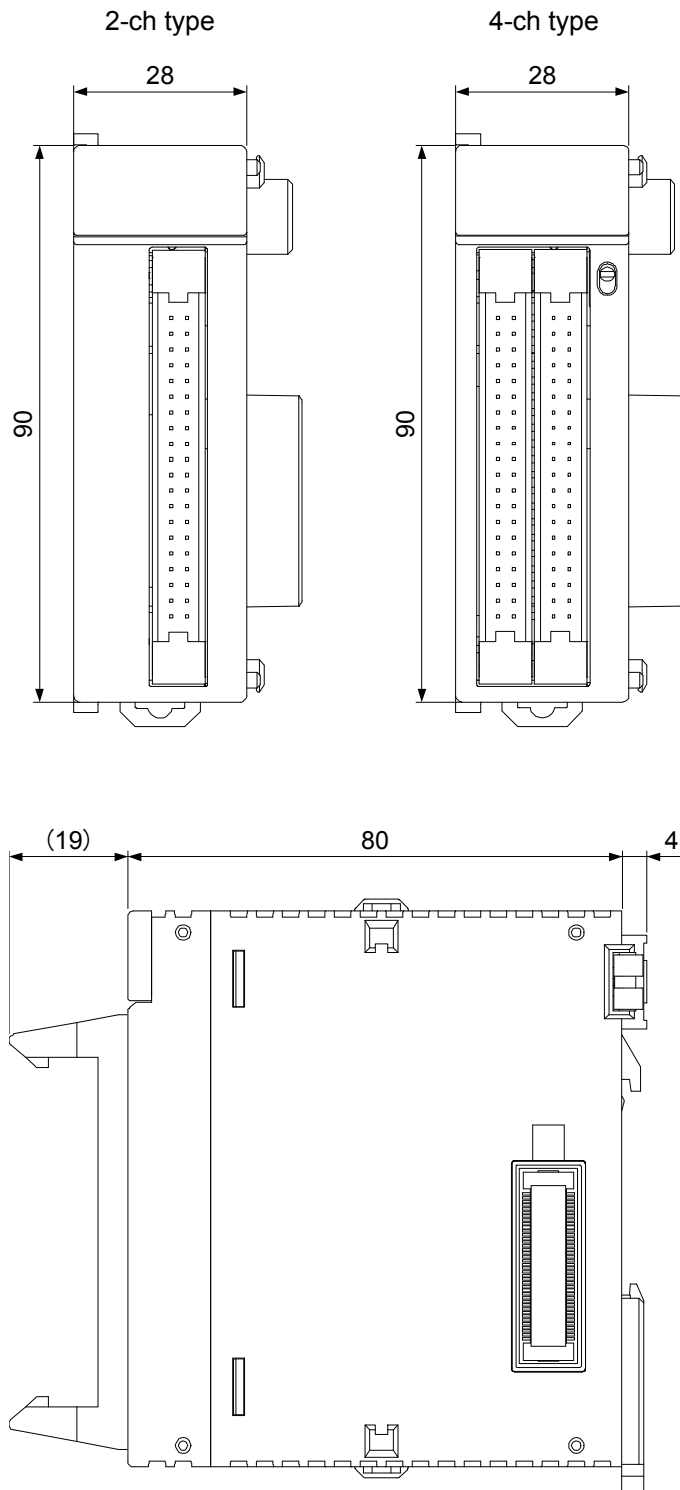
Unit memory No. (Hex)	Name	Default	Setting range and description	Unit																
UM 00118 UM 001E8 UM 002B8 UM 00388	Interrupt function enable/disable setting	H3	Make the settings for the interrupt operation at the time of comparison match. <table border="1"> <thead> <tr> <th>bit</th> <th>Default</th> <th>Description</th> <th>Setting</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Comparison match 0 flag</td> <td>0: Disable 1: Enable</td> </tr> <tr> <td>1</td> <td>1</td> <td>Comparison match 1 flag</td> <td></td> </tr> <tr> <td>15-2</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	bit	Default	Description	Setting	0	1	Comparison match 0 flag	0: Disable 1: Enable	1	1	Comparison match 1 flag		15-2	-	-	-	—
bit	Default	Description	Setting																	
0	1	Comparison match 0 flag	0: Disable 1: Enable																	
1	1	Comparison match 1 flag																		
15-2	-	-	-																	

11.4.3 Monitor Display Area

Unit memory No. (Hex)	Name	Default	Setting range and description	Unit
UM 003A0 - UM 003A1 UM 003B0 - UM 003B1 UM 003C0 - UM 003C1 UM 003D0 - UM 003D1	Count value	U0	Current count value of counter Range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003A2 - UM 003A3 UM 003B2 - UM 003B3 UM 003C2 - UM 003C3 UM 003D2 - UM 003D3	Capture 0 register	U0	Value of capture 0 register. Range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003A4 - UM 003A5 UM 003B4 - UM 003B5 UM 003C4 - UM 003C5 UM 003D4 - UM 003D5	Capture 1 register	U0	Value of capture 1 register. Range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003A6 - UM 003A7 UM 003B6 - UM 003B7 UM 003C6 - UM 003C7 UM 003D6 - UM 003D7	Capture register difference value	U0	Calculated difference between the capture registers (Capture register 1 - Capture register 0) Range: -2,147,483,648 (8000 0000H) to 2,147,483,647 (7FFF FFFFH) Signed 32-bit	Pulse
UM 003A8 - UM 003A9 UM 003B8 - UM 003B9 UM 003C8 - UM 003C9 UM 003D8 - UM 003D9	Frequency measurement (Averaging)	U0	Frequency measurement value after averaging procedure. Range: 0 to 20,000,000 Signed 32-bit	Hz
UM 003AA -UM 003AB UM 003BA -UM 003BB UM 003CA - UM 003CB UM 003DA - UM 003DB	Rotation speed measurement (Averaging)	U0	Rotation speed measurement value after averaging procedure Range: -1,200,000,000 to +1,200,000,000 Signed 32-bit	rpm

(Note) The unit memory numbers in the above table are for CH0, CH1, CH2 and CH3 from the top.

11.5 Dimensions



Record of changes

Manual No.	Date	Record of Changes
WUME-FP7HSC-01	Oct.2013	First Edition

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