

Programmable Controller

**MELSEC iQ-F**  
series

MELSEC iQ-F  
FX5 PWM Function

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# 16 bit binary pulse width modulation

## PWM

**FX5UJ**

**FX5U**

**FX5UC**

This instruction outputs the pulse (in 16-bit data units) of the ON time (in 16-bit data units) specified by (s1) and the period specified by (s2) to the output destination specified by (d).

Ladder diagram	Structured text
	<pre>ENO:=PWM(EN,s1,s2,d);</pre>

FBD/LD

## Setting data

### ■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s1)	ON time or the device number storing the ON time	1 to 65535	16-bit unsigned binary	ANY16
(s2)	Period or the device number storing the period	1 to 65535	16-bit unsigned binary	ANY16
(d)	Channel number or device number from which pulses are to be output	—	Bit/16-bit unsigned binary	ANY_ELEMENTARY <sup>*1</sup>
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

<sup>\*1</sup> Digit specified bit type label cannot be used.

### ■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	\$	
(s1)	○	○	○	○	—	—	○	○	—	—	—
(s2)	○	○	○	○	—	—	○	○	—	—	—
(d)	○ <sup>*1</sup>	○ <sup>*2</sup>	○ <sup>*2</sup>	○ <sup>*2</sup>	—	—	○	○ <sup>*2</sup>	—	—	—

<sup>\*1</sup> Only Y can be used for a bit device.

When a bit device is specified, specify one of Y0 to Y7. The high-speed pulse input/output module bit device (Y) cannot be specified. If Y is specified, outputs are enabled when there is an unused channel number in the parameter setting and the specified Y number is not used.

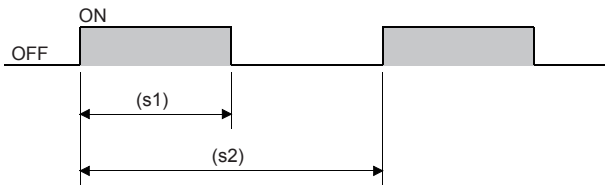
The nibble of a bit device cannot be specified.

<sup>\*2</sup> When a word device or constant is specified, specify one of the channel numbers.

Specify K1 to K4 (axis 1 to 4) for the CPU module, and K5 to K12 (axis 5 to 12) for the high-speed pulse input/output module.

## Processing details

- This instruction outputs the pulse of the ON time specified by (s1) and the period specified by (s2) to the output destination specified by (d).



- Time with a unit selected on the parameter setting screen ( $\mu$ s or ms) can be specified by (s1) and (s2).
- The pulse output destination channel number selected on the parameter setting screen can be specified by (d).
- This instruction store the number of pulses, pulse width, and period output from each channel to an SD device. The pulse width and period are stored in the units set by the parameters. When 0 is specified in the pulse output, pulses are output without any limitation.

Pulse output destination channel	Number of output pulses	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5301, SD5300	R/W	0	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed*1</li> <li>• When the PWM instruction is executed</li> <li>• END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5317, SD5316				
CH3	SD5333, SD5332				
CH4	SD5349, SD5348				
CH5	SD5365, SD5364				
CH6	SD5381, SD5380				
CH7	SD5397, SD5396				
CH8	SD5413, SD5412				
CH9	SD5429, SD5428				
CH10	SD5445, SD5444				
CH11	SD5461, SD5460				
CH12	SD5477, SD5476				

Pulse output destination channel	ON time	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5303, SD5302	R/W	0*2	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed*1</li> <li>• When this instruction is executed*3</li> <li>• END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5319, SD5318				
CH3	SD5335, SD5334				
CH4	SD5351, SD5350				
CH5	SD5367, SD5366				
CH6	SD5383, SD5382				
CH7	SD5399, SD5398				
CH8	SD5415, SD5414				
CH9	SD5431, SD5430				
CH10	SD5447, SD5446				
CH11	SD5463, SD5462				
CH12	SD5479, SD5478				

Pulse output destination channel	Period	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5305, SD5304	R/W	0 <sup>*2</sup>	<ul style="list-style-type: none"> <li>When the DHCMOV instruction is executed<sup>*1</sup></li> <li>When this instruction is executed<sup>*3</sup></li> <li>END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5321, SD5320				
CH3	SD5337, SD5336				
CH4	SD5353, SD5352				
CH5	SD5369, SD5368				
CH6	SD5385, SD5384				
CH7	SD5401, SD5400				
CH8	SD5417, SD5416				
CH9	SD5433, SD5432				
CH10	SD5449, SD5448				
CH11	SD5465, SD5464				
CH12	SD5481, SD5480				

\*1 When the DHCMOV instruction is used, the latest value can be read. A writable device can be updated immediately.

\*2 Parameter setting values are set to an SD device at STOP to RUN.

\*3 When this instruction is executed, the pulse width and period specified (s1) and (s2) are set to an SD device.

• After the pulse output is started from each channel, the pulse output monitor turns on.

Pulse output destination channel	Pulse output monitor	R/W	Initial value	ON timing	OFF timing
CH1	SM5300	R	OFF	<ul style="list-style-type: none"> <li>When the HIOEN instruction is executed</li> <li>When this instruction is executed</li> </ul>	<ul style="list-style-type: none"> <li>Power on</li> <li>Reset</li> <li>RUN→STOP/PAUSE</li> <li>When the specified number of pulses are output.</li> <li>The drive contact is turned off</li> </ul>
CH2	SM5301				
CH3	SM5302				
CH4	SM5303				
CH5	SM5304				
CH6	SM5305				
CH7	SM5306				
CH8	SM5307				
CH9	SM5308				
CH10	SM5309				
CH11	SM5310				
CH12	SM5311				

• This instruction stores the number of pulses output from each channel.

Pulse output destination channel	Monitoring the current number of output pulses	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5307, SD5306	R/W	0	<ul style="list-style-type: none"> <li>When the DHCMOV instruction is executed</li> <li>→ An SD device is updated</li> <li>When the PWM instruction is executed</li> <li>END processing</li> </ul>	<ul style="list-style-type: none"> <li>Power-on</li> <li>Reset</li> <li>STOP/PAUSE→RUN</li> </ul>
CH2	SD5323, SD5322				
CH3	SD5339, SD5338				
CH4	SD5355, SD5354				

- The number of output pulses set to an SD device is valid for this instruction as well. The setting values are always read and updated.
- When the specified number of output pulses is equal to or less than the number of pulses which have already been output, pulse output stops after outputting pulses which are being output.
- When the specified number of output pulses is larger than the number of pulses which have already been output, pulse output stops after outputting set number of pulses.
- When the number of output pulses is set from the no limitation output setting (number of output pulses is 0), the number of output pulses is not updated (because outputting pulses continues or stops in the no limitation output).
- The maximum number of output pulses which can be output when the PWM instruction is executed once (= maximum value which can be set to an SD device) is "2147483647".
- The ON time and period can be set during the pulse output. Setting values are always read and updated.
- When the number of output pulses is 0 (no limitation output setting), the monitor of the current number of output pulses is set to 0.

- When the number of output pulses is specified, the output pulses are monitored. When the PWM output is executed several times, the monitor of the number of output pulses is an integrated value.
- The monitor of the current number of output pulses can be changed during the pulse output.
- The monitor of the current number of output pulses is updated when the number of pulses is counted at the falling edge of pulses in the positive logic and at the rising edge of pulses in the negative logic.
- When the output always remains ON or OFF, the monitor of the current number of output pulses does not change.
- The maximum value of the monitor of the current number of output pulses is "FFFFFFFFH". After the current number of output pulses reaches the maximum value, the monitor of the current number of output pulses starts to count again from "0".

### Precautions

- Specify the ON time by (s1) and the period by (s2) so that [(s2)-(s1)] is equal to or larger than 3 μs.
- Specify the ON time by (s1) and the period by (s2) so that they are equal or larger than the following values.

[FX5UJ CPU module]

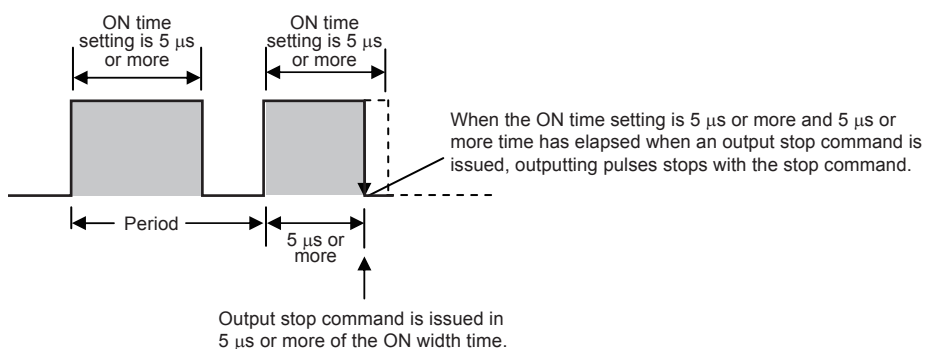
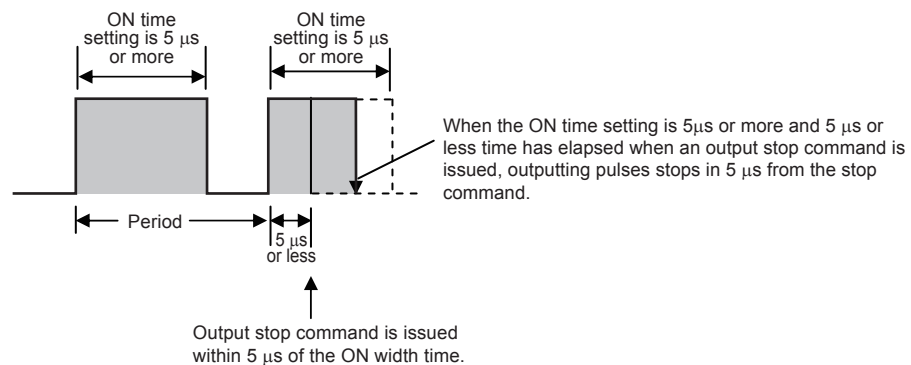
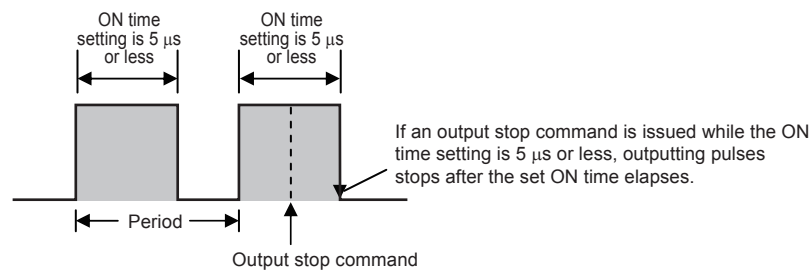
Output number	(s1) ON time	(s2) Period
<b>CPU module</b>		
Y0 to Y2	2 μs more	5 μs more
Y3 to Y7	200 μs more	400 μs more

[FX5U/FX5UC CPU module and high-speed pulse input/output module]

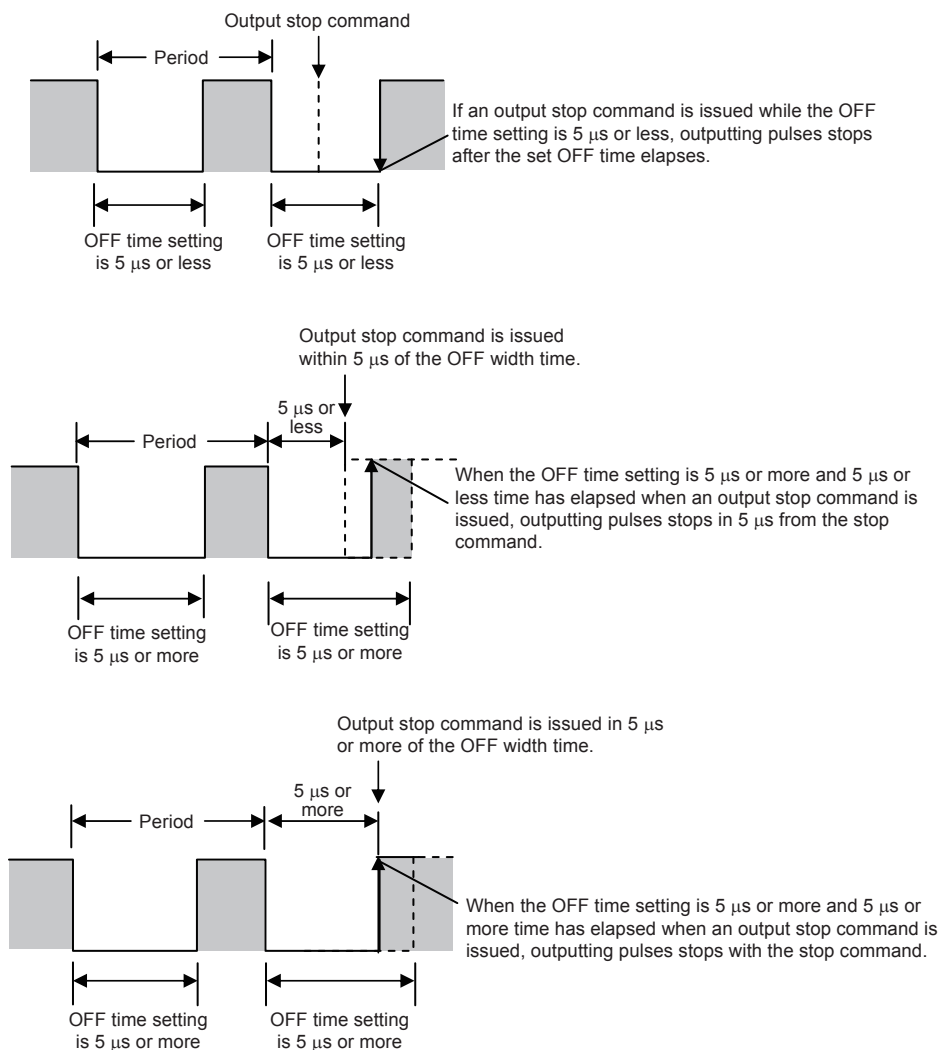
Output number		(s1) ON time	(s2) Period
<b>CPU module</b>	<b>High-speed pulse input/output module</b>		
Y0 to Y3	Y0 to Y2	2 μs more	5 μs more
Y4 to Y7	—	200 μs more	400 μs more

- When a channel number that is not selected for the PWM output in the parameter setting is specified for (d), this instruction is not executed. An operation error occurs.
- Do not specify the channel numbers of the high-speed pulse input/output module (5 to 12) in a program with interrupt priority set to "1".

- Operations when the PWM output is stopped (while the output pulse is on)



- Operations when the PWM output is stopped (while the output pulse is off)

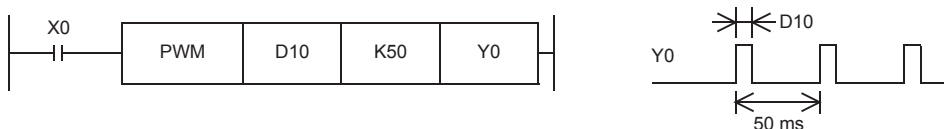


- The PWM output stops when SM8034 is on, and starts when SM8034 is off.
- PWM output does not stop, even if a pulse stop command for positioning is driven.
- When specifying the number of output pulses, executing the PWM instruction, and then outputting pulses again after the pulse output stops due to the completion of output of the specified number of pulses, turn OFF the contact which drove the PWM instruction. When driving PWM output by the HIOEN instruction, use the HIOEN instruction to turn PWM output off.
- When the period setting is equivalent to the ON time setting, the output always remains ON. The output ON state continues even after "Period x Number of output pulses" is finished in this condition.

## Program example

When the contents of D10 are changed ranging from "0" to "50" in the program example shown below, the average output from Y0 will be ranging from 0 to 100%.

An error will occur if the contents of D10 exceed K50.



## Operation error

Error code (SD0/SD8067)	Description
1810H	The output destination specified by (d) is already used by another instruction (positioning instruction). (The PWM output is not executed.)
	A Y device is specified as the output destination specified by (d), and there is no unused channel number in the parameter setting.
2221H	The parameter set value is out of range.
3405H	Y10 or later is specified as the output destination specified by (d). (The PWM output stops.)
3580H	An instruction that cannot be used in an interrupt program is used
3600H	A channel number that is not selected in the parameter setting are specified for the output destination specified by (d). (The PWM output is not executed.)
3611H(CH1)	The ON time specified by (s1) is larger than the period specified by (s2). (The PWM output stops.)
3612H(CH2)	
3613H(CH3)	The ON time or period is less than "1".
3614H(CH4)	
3615H(CH5)	The SD device specified for the number of output pulses stores a value outside the available range (0 to 2147483647).
3616H(CH6)	
3617H(CH7)	
3618H(CH8)	
3619H(CH9)	
361AH(CH10)	
361BH(CH11)	
361CH(CH12)	



# 32 bit binary pulse width modulation

## DPWM

**FX5UJ**

**FX5U**

**FX5UC**

This instruction outputs the pulse (in 32-bit data units) of the ON time (in 32-bit data units) specified by (s1) and the period specified by (s2) to the output destination specified by (d).

Ladder diagram	Structured text
	<pre>ENO:=DPWM(EN,s1,s2,d);</pre>

FBD/LD

## Setting data

### ■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s1)	ON time or the device number storing the ON time	1 to 2147483647	32-bit unsigned binary	ANY32
(s2)	Period or the device number storing the period	1 to 2147483647	32-bit unsigned binary	ANY32
(d)	Channel number or device number from which pulses are to be output	—	Bit/16-bit unsigned binary	ANY_ELEMENTARY <sup>*1</sup>
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

\*1 Digit specified bit type label cannot be used.

### ■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	\$	
(s1)	○	○	○	○	○	○	○	○	—	—	—
(s2)	○	○	○	○	○	○	○	○	—	—	—
(d)	○ <sup>*1</sup>	○ <sup>*2</sup>	○ <sup>*2</sup>	○ <sup>*2</sup>	—	—	○	○ <sup>*2</sup>	—	—	—

\*1 Only Y can be used for a bit device.

When a bit device is specified, specify one of Y0 to Y7. The high-speed pulse input/output module bit device (Y) cannot be specified. If Y is specified, outputs are enabled when there is an unused channel number in the parameter setting and the specified Y number is not used.

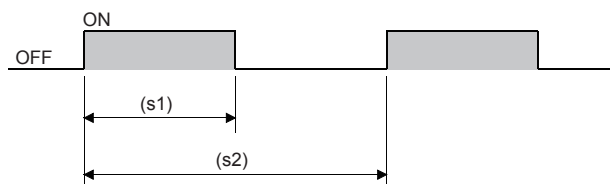
The nibble of a bit device cannot be specified.

\*2 When a word device or constant is specified, specify one of the CH numbers.

Specify K1 to K4 (axis 1 to 4) for the CPU module, and K5 to K12 (axis 5 to 12) for the high-speed pulse input/output module.

## Processing details

- This instruction outputs the pulse of the ON time specified by (s1) and the period specified by (s2) to the output destination specified by (d).



- Time with a unit selected on the parameter setting screen ( $\mu$ s or ms) can be specified by (s1) and (s2).
- The pulse output destination channel number selected on the parameter setting screen can be specified by (d).
- This instruction stores the number of pulses, pulse width, and period output from each channel to an SD device. The pulse width and period are stored in the units set by the parameters. When 0 is specified in the pulse output, pulses are output without any limitation.

Pulse output destination channel	Number of output pulses	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5301, SD5300	R/W	0	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed<sup>*1</sup></li> <li>• When the PWM instruction is executed</li> <li>• END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5317, SD5316				
CH3	SD5333, SD5332				
CH4	SD5349, SD5348				
CH5	SD5365, SD5364				
CH6	SD5381, SD5380				
CH7	SD5397, SD5396				
CH8	SD5413, SD5412				
CH9	SD5429, SD5428				
CH10	SD5445, SD5444				
CH11	SD5461, SD5460				
CH12	SD5477, SD5476				

Pulse output destination channel	ON time	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5303, SD5302	R/W	0 <sup>*2</sup>	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed<sup>*1</sup></li> <li>• When this instruction is executed<sup>*3</sup></li> <li>• END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5319, SD5318				
CH3	SD5335, SD5334				
CH4	SD5351, SD5350				
CH5	SD5367, SD5366				
CH6	SD5383, SD5382				
CH7	SD5399, SD5398				
CH8	SD5415, SD5414				
CH9	SD5431, SD5430				
CH10	SD5447, SD5446				
CH11	SD5463, SD5462				
CH12	SD5479, SD5478				

Pulse output destination channel	Period	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5305, SD5304	R/W	0 <sup>*2</sup>	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed<sup>*1</sup></li> <li>• When this instruction is executed<sup>*3</sup></li> <li>• END processing</li> </ul>	STOP/PAUSE→RUN
CH2	SD5321, SD5320				
CH3	SD5337, SD5336				
CH4	SD5353, SD5352				
CH5	SD5369, SD5368				
CH6	SD5385, SD5384				
CH7	SD5401, SD5400				
CH8	SD5417, SD5416				
CH9	SD5433, SD5432				
CH10	SD5449, SD5448				
CH11	SD5465, SD5464				
CH12	SD5481, SD5480				

\*1 When the DHCMOV instruction is used, the latest value can be read. A writable device can be updated immediately.

\*2 Parameter setting values are set to an SD device at STOP to RUN.

\*3 When this instruction is executed, the pulse width and period specified (s1) and (s2) are set to an SD device.

- After the pulse output is started from each channel, the pulse output monitor turns on.

Pulse output destination channel	Pulse output monitor	R/W	Initial value	ON timing	OFF timing
CH1	SM5300	R	OFF	<ul style="list-style-type: none"> <li>• When the HIOEN instruction is executed</li> <li>• When this instruction is executed</li> </ul>	<ul style="list-style-type: none"> <li>• Power on</li> <li>• Reset</li> <li>• RUN→STOP/PAUSE</li> <li>• When the specified number of pulses are output.</li> <li>• The drive contact is turned off</li> </ul>
CH2	SM5301				
CH3	SM5302				
CH4	SM5303				
CH5	SM5304				
CH6	SM5305				
CH7	SM5306				
CH8	SM5307				
CH9	SM5308				
CH10	SM5309				
CH11	SM5310				
CH12	SM5311				

- This instruction stores the number of pulses output from each channel.

Pulse output destination channel	Monitoring the current number of output pulses	R/W	Initial value	Timing of reflection on operation	Timing of clearing to initial value
CH1	SD5307, SD5306	R/W	0	<ul style="list-style-type: none"> <li>• When the DHCMOV instruction is executed → An SD device is updated</li> <li>• When the DPWM instruction is executed</li> <li>• END processing</li> </ul>	<ul style="list-style-type: none"> <li>• Power-on</li> <li>• Reset</li> <li>• STOP/PAUSE→RUN</li> </ul>
CH2	SD5323, SD5322				
CH3	SD5339, SD5338				
CH4	SD5355, SD5354				

- The number of output pulses set to an SD device is valid for this instruction as well. The setting values are always read and updated.
- When the specified number of output pulses is equal to or less than the number of pulses which have already been output, pulse output stops after outputting pulses which are being output.
- When the specified number of output pulses is larger than the number of pulses which have already been output, pulse output stops after outputting set number of pulses.
- When the number of output pulses is set from the no limitation output setting (number of output pulses is 0), the number of output pulses is not updated (because outputting pulses continues or stops in the no limitation output).
- The maximum number of output pulses which can be output when the DPWM instruction is executed once (= maximum value which can be set to an SD device) is "2147483647"
- The ON time and period can be set during the pulse output. Setting values are always read and updated.
- When the number of output pulses is 0 (no limitation output setting), the monitor of the current number of output pulses is set to 0.
- When the number of output pulses is specified, the output pulses are monitored. When the DPWM output is executed several times, the monitor of the number of output pulses is an integrated value.
- The monitor of the current number of output pulses can be changed during the pulse output.
- The monitor of the current number of output pulses is updated when the number of pulses is counted at the falling edge of pulses in the positive logic and at the rising edge of pulses in the negative logic.
- When the output always remains ON or OFF, the monitor of the current number of output pulses does not change.
- The maximum value of the monitor of the current number of output pulses is "FFFFFFFFH". After the current number of output pulses reaches the maximum value, the monitor of the current number of output pulses starts to count again from "0".

## Precautions

- Specify the ON time by (s1) and the period by (s2) so that  $[(s2)-(s1)]$  is equal to or larger than 3  $\mu\text{s}$ .
- When a negative value is specified for the ON time by (s1) and the period by (s2), an operation error occurs. (In 16-bit instruction PWM, no error occurs.)
- Specify the ON time by (s1) and the period by (s2) so that they are equal or larger than the following values.

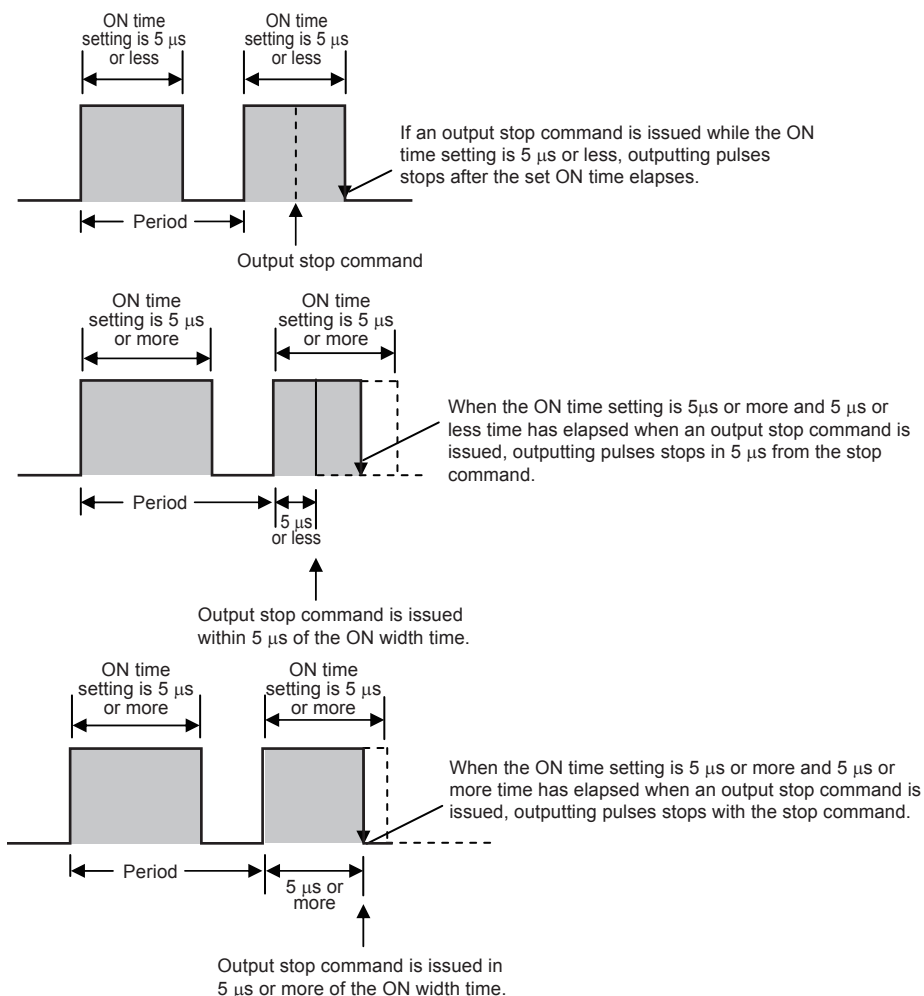
[FX5UJ CPU module]

Output number	(s1) ON time	(s2) Period
<b>CPU module</b>		
Y0 to Y2	2 $\mu\text{s}$ more	5 $\mu\text{s}$ more
Y3 to Y7	200 $\mu\text{s}$ more	400 $\mu\text{s}$ more

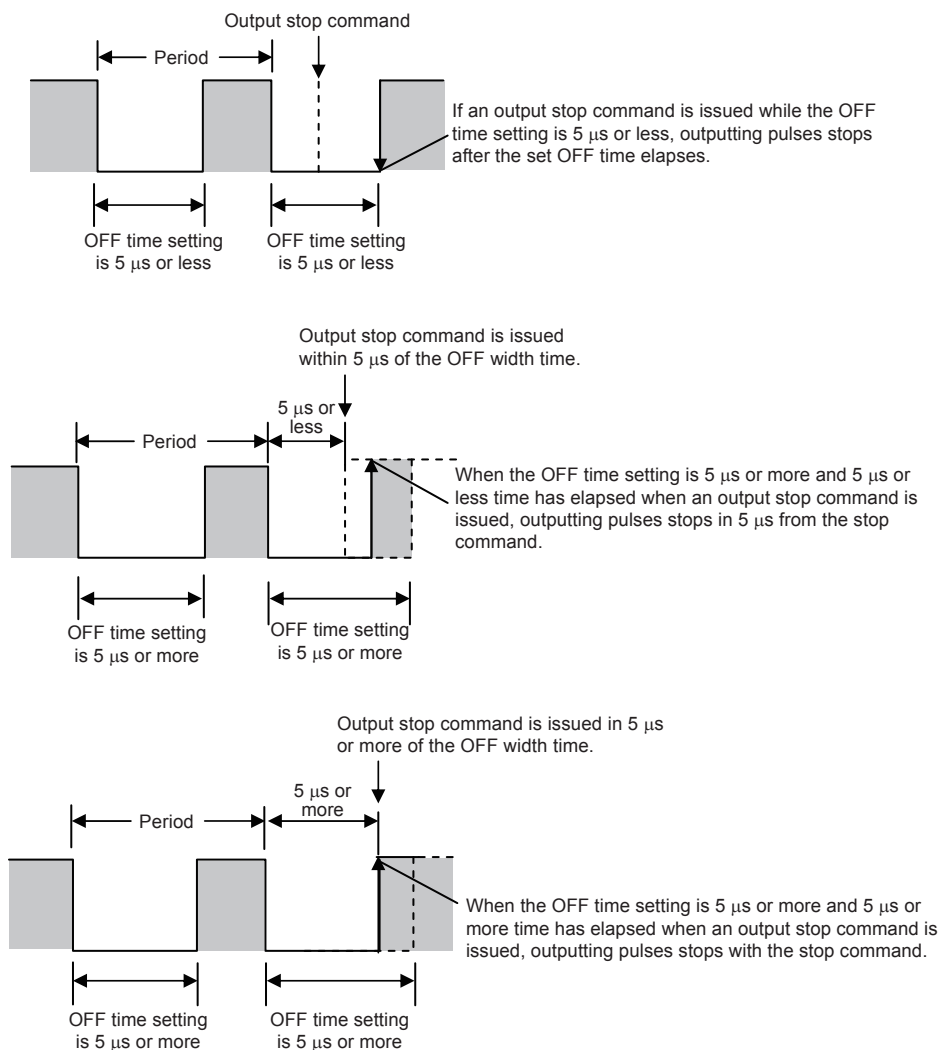
[FX5U/FX5UC CPU module and high-speed pulse input/output module]

Output number		(s1) ON time	(s2) Period
<b>CPU module</b>	<b>High-speed pulse input/output module</b>		
Y0 to Y3	Y0 to Y2	2 $\mu\text{s}$ more	5 $\mu\text{s}$ more
Y4 to Y7	—	200 $\mu\text{s}$ more	400 $\mu\text{s}$ more

- When a channel number that is not selected for the DPWM output in the parameter setting is specified for (d), this instruction is not executed. An operation error occurs.
- Do not specify the channel numbers of the high-speed pulse input/output module (5 to 12) in a program with interrupt priority set to "1".
- Operations when the DPWM output is stopped (while the output pulse is on)



- Operations when the PWM output is stopped (while the output pulse is off)



- The PWM output stops when SM8034 is on, and starts when SM8034 is off.
- PWM output does not stop, even if a pulse stop command for positioning is driven.
- When specifying the number of output pulses, executing the PWM instruction, and then outputting pulses again after the pulse output stops due to the completion of output of the specified number of pulses, turn OFF the contact which drove the PWM instruction. When driving PWM output by the DHIOEN instruction, use the DHIOEN instruction to turn PWM output off.
- When the period setting is equivalent to the ON time setting, the output always remains ON. The output ON state continues even after "Period x Number of output pulses" is finished in this condition.

## Operation error

Error code (SD0/SD8067)	Description
1810H	The output destination specified by (d) is already used by another instruction (positioning instruction). (The PWM output is not executed.)
	A Y device is specified as the output destination specified by (d), and there is no unused channel number in the parameter setting
2221H	The parameter set value is out of range.
3405H	Y10 or later is specified as the output destination specified by (d). (The PWM output stops.)
3580H	An instruction that cannot be used in an interrupt program is used.
3600H	A channel number that is not selected in the parameter setting are specified for the output destination specified by (d). (The PWM output is not executed.)
3611H(CH1) 3612H(CH2) 3613H(CH3) 3614H(CH4) 3615H(CH5) 3616H(CH6) 3617H(CH7) 3618H(CH8) 3619H(CH9) 361AH(CH10) 361BH(CH11) 361CH(CH12)	The ON time specified by (s1) is larger than the period specified by (s2). (The PWM output stops.)
	In (s1) and (s2), a negative value is specified. (The PWM output stops.)
	Values of an SD device for setting pulse width and period of this instruction are incorrect. (The PWM output stops.)
	The ON time or period is less than "1".
	The SD device specified for the number of output pulses stores a value outside the available range (0 to 2147483647).

## 26.7 PWM Function

This chapter explains the PWM function.

### Outline of PWM output

The CPU module and the high-speed pulse input/output module allow PWM output on up to 12 channels.

For PWM output, the output channel assignment, pulse/cycle units, output pulse logic, pulse width, cycle, etc. are set using parameters, and the HIOEN/DHIOEN instruction is used to start/stop pulse output.

Also, the regular PWM/DPWM instruction can be used.

### PWM output specifications

The PWM output specifications are explained below.

#### Number of output channels

Up to 12 channels (CPU module 4CH + high-speed pulse input/output module 2CH × 4 units) can be used for PWM output. The output device assignment is as follows.

CPU module				High-speed pulse input/output module*1							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
Y0 to Y7 (Any device can be set.)				Y□+1	Y□+5	Y□+1	Y□+5	Y□+1	Y□+5	Y□+1	Y□+5

\*1 □: Head output number for each high-speed pulse input/output module



Outputs (Y) assigned for PWM output in parameter settings cannot be used by the positioning function.

#### Setting range of period and pulse width

The setting values that can be set for cycle and pulse width are shown below.

Output number		Period	Pulse width
CPU module	High-speed pulse input/output module*1		
Y0 to Y3	Y□+1, Y□+5	5 μs more	2 μs more
Y4 to Y7	—	400 μs more	200 μs more

\*1 □: Head output number for each high-speed pulse input/output module

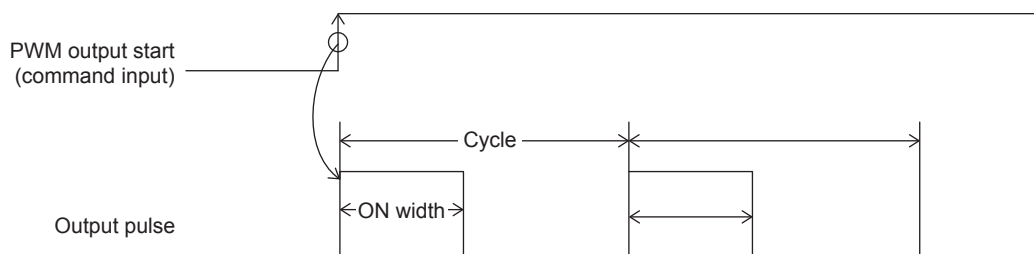
The response time for actual output varies depending on the connected load. Check the output specifications of the module that uses PWM outputs. For the output specifications, refer to the manual of each module.

## Relationship between cycle and pulse width

The relationship between period and pulse width is shown below.

### ■When positive logic is set

The relationship between the period and pulse width when the output pulse logic at start of pulse output is set to "positive logic" is shown below. (The pulse width is called the "ON width".)

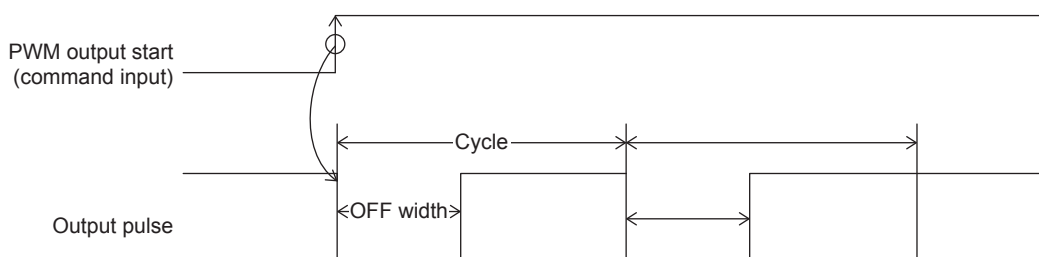


#### Point

- When positive logic is set, PWM output begins from output ON.)
- Pulse output is stopped at the specified number of pulses.
- Pulse output stops in the output (Y) status of before PWM output was started.

### ■When negative logic is set

The relationship between the period and pulse width when the output pulse logic at start of pulse output is set to "negative logic" is shown below. (The pulse width is called the "OFF width".)



#### Point

- When negative logic is set, PWM output begins when the output pulse turns OFF.
- Pulse output is stopped at the specified number of pulses.
- Pulse output stops in the output (Y) status of before PWM output was started.

## PWM driving method

PWM output is driven by either of the following methods.

### ■Driven by HIOEN/DHIOEN instruction

The logical settings like output destination, cycle, pulse width, output pulse logic, etc. are set in parameters, and the HIOEN/DHIOEN instruction is used to execute pulse output. For parameters, refer to Page 295 PWM output parameters. For the HIOEN/DHIOEN instruction, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Driven by PWM/DPWM instruction

The PWM/DPWM instruction is used to execute pulse output.

For the PWM/DPWM instruction, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).




## PWM output function execution procedure

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The procedure for executing the PWM output function is explained below.


**1.** Check the specifications of PWM output.

Check specifications such as pulse output performance of PWM output. (  Page 292 PWM output specifications)


**2.** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

 MELSEC iQ-F FX5U User's Manual (Hardware)

 MELSEC iQ-F FX5UC User's Manual (Hardware)

**3.** Set the parameters.

Set the output destination, cycle, pulse width, output pulse logic, etc. of the PWM in parameters, (  Page 295 PWM output parameters)

**4.** Create the program.

Create the program for using PWM output.

**5.** Run the program.

## PWM output parameters

This section explains the PWM output parameters.

Set the PWM output parameters in GX Works3.

### Outline of parameters

PWM output parameters are output destination, pulse width/cycle unit, output pulse logic, pulse width, and period.

### Parameter setting

This section explains how to set the PWM output parameters.

Set the output destination, pulse width/cycle unit, output pulse logic, pulse width, period, etc. of the channel to be used.

#### ■CPU module

Navigation window ⇒ [Parameter] ⇒ [FX5UCPU] ⇒ [Module Parameter] ⇒ [High Speed I/O] ⇒ "Output Function" ⇒ "PWM" ⇒ "Detail Setting"

#### Window

Item	CH1	CH2	CH3	CH4
<b>Use PWM Output</b>	<b>Set whether to use PWM output or not.</b>			
Use/Not Use	Enable	Enable	Disable	Enable
<b>Output Signal</b>	<b>Set the output destination device.</b>			
Output Signal	Y0	Y1	Y0	Y3
<b>Pulse Width/Cycle Unit</b>	<b>Set pulse width/cycle unit.</b>			
Pulse Width/Cycle Unit	1ms	1micro-s	1ms	1ms
<b>Output Pulse Logic</b>	<b>Set output pulse logic.</b>			
Output Pulse Logic	Positive Logic	Positive Logic	Positive Logic	Negative Logic
<b>Pulse Width</b>	<b>Set pulse width.</b>			
Pulse Width	10 ms	100 micro-s	1 ms	200 ms
<b>Cycle</b>	<b>Set cycle.</b>			
Cycle	20 ms	500 micro-s	1 ms	300 ms

#### Displayed items

Item	Description	Setting range	Default
Use PWM Output	Set whether to use PWM output or not.	<ul style="list-style-type: none"> <li>Disable</li> <li>Enable</li> </ul>	Disable
Output Signal	Set the output destination device of output signal.	Y0 to Y7	—
Pulse Width/Cycle Unit	Set pulse width/cycle unit.	<ul style="list-style-type: none"> <li>1ms</li> <li>1micro-s (μs)</li> </ul>	—
Output Pulse Logic	Sets output pulse logic.	<ul style="list-style-type: none"> <li>Positive Logic</li> <li>Negative Logic</li> </ul>	—
Pulse Width	Sets the ON/OFF width of the pulse.	<ul style="list-style-type: none"> <li>When pulse width/period unit is set to 1 ms 1 to 2147483 ms</li> <li>When pulse width/period unit is set to 1 micro-s (μs) 1 to 2147483647 micro-s (μs)</li> </ul>	—
Cycle	Sets cycle.	<ul style="list-style-type: none"> <li>When pulse width/cycle unit is set to 1 ms 1 to 2147483 ms</li> <li>When pulse width/cycle unit is set to 1 micro-s (μs) 1 to 2147483647 micro-s (μs)</li> </ul>	—

## ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

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

After adding the high-speed pulse input/output module, make settings on the the screen displayed from the following operation.

Navigation window ⇒ [Parameter] ⇒ [Module Information] ⇒ [1 to 16 (high-speed pulse input/output module)] ⇒ [Module Parameter] ⇒ "Output Function" ⇒ "PWM" ⇒ "Detail Setting"

### Window

Item	CH5	CH6
<b>Use PWM Output</b>	<b>Set whether to use PWM output or not .</b>	
Use/Not Use	Enable	Enable
<b>Output Signal</b>	<b>Set the output destination device.</b>	
Output Signal	Y21	Y25
<b>Pulse Width/Cycle Unit</b>	<b>Set pulse width/cycle unit.</b>	
Pulse Width/Cycle Unit	1ms	1micro-s
<b>Output Pulse Logic</b>	<b>Set output pulse logic.</b>	
Output Pulse Logic	Positive Logic	Negative Logic
<b>Pulse Width</b>	<b>Set pulse width.</b>	
Pulse Width	100 ms	300 micro-s
<b>Cycle</b>	<b>Set cycle.</b>	
Cycle	500 ms	1000 micro-s

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

### Displayed items

Item	Description	Setting range	Default
Use PWM Output	Set whether to use PWM output or not.	<ul style="list-style-type: none"> <li>Disable</li> <li>Enable</li> </ul>	Disable
Output Signal	The output destination device of output signal.The output number is fixed for each channel.	<ul style="list-style-type: none"> <li>CH□: Y■+1<sup>*1</sup></li> <li>CH□+1: Y■+5<sup>*1</sup></li> </ul>	—
Pulse Width/Cycle Unit	Set pulse width/cycle unit.	<ul style="list-style-type: none"> <li>1ms</li> <li>1micro-s (μs)</li> </ul>	—
Output Pulse Logic	Sets output pulse logic.	<ul style="list-style-type: none"> <li>Positive Logic</li> <li>Negative Logic</li> </ul>	—
Pulse Width	Sets the ON/OFF width of the pulse.	<ul style="list-style-type: none"> <li>When pulse width/period unit is set to 1 ms</li> <li>1 to 2147483 ms</li> <li>When pulse width/period unit is set to 1 micro-s (μs)</li> <li>1 to 2147483647 micro-s (μs)</li> </ul>	—
Cycle	Sets cycle.	<ul style="list-style-type: none"> <li>When pulse width/cycle unit is set to 1 ms</li> <li>1 to 2147483 ms</li> <li>When pulse width/cycle unit is set to 1 micro-s (μs)</li> <li>1 to 2147483647 micro-s (μs)</li> </ul>	—

\*1 The number in □ is first module: 5, second module: 7, third module: 9, fourth module: 11.  
The number in ■ is the head output number for each high-speed pulse input/output module.

### Point

The items specified in the parameters are stored in special devices when the CPU module is set from STOP to RUN.

## List of Special relays/special registers

The list of special relays/special registers used in PWM output is shown below.

R/W: Read or write

R: Read only

Special relays/ special registers	Function	Description	Default	R/W
SM5300	Operation monitor (CH1)	The operation/stopped status of PWM output on the target channel can be checked. OFF: Stopped ON: In operation	OFF	R
SM5301	Operation monitor (CH2)			
SM5302	Operation monitor (CH3)			
SM5303	Operation monitor (CH4)			
SM5304	Operation monitor (CH5)			
SM5305	Operation monitor (CH6)			
SM5306	Operation monitor (CH7)			
SM5307	Operation monitor (CH8)			
SM5308	Operation monitor (CH9)			
SM5309	Operation monitor (CH10)			
SM5310	Operation monitor (CH11)			
SM5311	Operation monitor (CH12)			
SM5316	PWM output complete flag (CH1)	The end status of PWM output on the target channel can be checked. OFF: Other than normally end ON: Normally end	OFF	R/W
SM5317	PWM output complete flag (CH2)			
SM5318	PWM output complete flag (CH3)			
SM5319	PWM output complete flag (CH4)			
SM5320	PWM output complete flag (CH5)			
SM5321	PWM output complete flag (CH6)			
SM5322	PWM output complete flag (CH7)			
SM5323	PWM output complete flag (CH8)			
SM5324	PWM output complete flag (CH9)			
SM5325	PWM output complete flag (CH10)			
SM5326	PWM output complete flag (CH11)			
SM5327	PWM output complete flag (CH12)			
SM5332	PWM output abnormal end flag (CH1)	The end status of PWM output on the target channel can be checked. OFF: No error ON: Abnormal end	OFF	R/W
SM5333	PWM output abnormal end flag (CH2)			
SM5334	PWM output abnormal end flag (CH3)			
SM5335	PWM output abnormal end flag (CH4)			
SM5336	PWM output abnormal end flag (CH5)			
SM5337	PWM output abnormal end flag (CH6)			
SM5338	PWM output abnormal end flag (CH7)			
SM5339	PWM output abnormal end flag (CH8)			
SM5340	PWM output abnormal end flag (CH9)			
SM5341	PWM output abnormal end flag (CH10)			
SM5342	PWM output abnormal end flag (CH11)			
SM5343	PWM output abnormal end flag (CH12)			
SD5301, SD5300	CH1 number of output pulses	The number of pulses to output are stored.	0	R/W

Special relays/ special registers	Function	Description	Default	R/W
SD5303, SD5302	CH1 pulse width	The pulse width is stored.	0	R/W
SD5305, SD5304	CH1 period	The period is stored.	0	R/W
SD5307, SD5306	CH1 Number of output pulses current value monitor	The current value of the number of output pulses is stored.	0	R
SD5317, SD5316	CH2 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5319, SD5318	CH2 pulse width	The pulse width is stored.	0	R/W
SD5321, SD5320	CH2 period	The period is stored.	0	R/W
SD5323, SD5322	CH2 Number of output pulses current value monitor	The current value of the number of output pulses is stored.	0	R
SD5333, SD5332	CH3 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5335, SD5334	CH3 pulse width	The pulse width is stored.	0	R/W
SD5337, SD5336	CH3 period	The period is stored.	0	R/W
SD5339, SD5338	CH3 Number of output pulses current value monitor	The current value of the number of output pulses is stored.	0	R
SD5349, SD5348	CH4 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5351, SD5350	CH4 pulse width	The pulse width is stored.	0	R/W
SD5353, SD5352	CH4 period	The period is stored.	0	R/W
SD5355, SD5354	CH4 Number of output pulses current value monitor	The current value of the number of output pulses is stored.	0	R
SD5365, SD5364	CH5 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5367, SD5366	CH5 pulse width	The pulse width is stored.	0	R/W
SD5369, SD5368	CH5 period	The period is stored.	0	R/W
SD5381, SD5380	CH6 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5383, SD5382	CH6 pulse width	The pulse width is stored.	0	R/W
SD5385, SD5384	CH6 period	The period is stored.	0	R/W
SD5397, SD5396	CH7 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5399, SD5398	CH7 pulse width	The pulse width is stored.	0	R/W
SD5401, SD5400	CH7 period	The period is stored.	0	R/W
SD5413, SD5412	CH8 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5415, SD5414	CH8 pulse width	The pulse width is stored.	0	R/W
SD5417, SD5416	CH8 period	The period is stored.	0	R/W
SD5429, SD5428	CH9 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5431, SD5430	CH9 pulse width	The pulse width is stored.	0	R/W
SD5433, SD5432	CH9 period	The period is stored.	0	R/W
SD5445, SD5444	CH10 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5447, SD5446	CH10 pulse width	The pulse width is stored.	0	R/W
SD5449, SD5448	CH10 period	The period is stored.	0	R/W
SD5461, SD5460	CH11 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5463, SD5462	CH11 pulse width	The pulse width is stored.	0	R/W
SD5465, SD5464	CH11 period	The period is stored.	0	R/W
SD5477, SD5476	CH12 number of output pulses	The number of pulses to output are stored.	0	R/W
SD5479, SD5478	CH12 pulse width	The pulse width is stored.	0	R/W
SD5481, SD5480	CH12 period	The period is stored.	0	R/W

## Details of special relays/special registers

Details of special relays/special registers used in PWM output are explained below.

### Operation monitor

This device is for monitoring the operation/stopped status of PWM output.

#### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SM5300	SM5301	SM5302	SM5303	SM5304	SM5305	SM5306	SM5307	SM5308	SM5309	SM5310	SM5311

#### ■Update timing

The timing of device update is as follows.

ON	OFF
<ul style="list-style-type: none"> <li>• PWM output driven by HIOEN/DHIOEN instruction</li> <li>• PWM/DPWM instruction ON execution</li> </ul>	<ul style="list-style-type: none"> <li>• PWM output stopped by HIOEN/DHIOEN instruction</li> <li>• After end of output of the specified number of pulses</li> <li>• PWM/DPWM instruction OFF execution</li> <li>• Activation contact turned OFF</li> <li>• Power OFF→ON, reset, RUN→STOP/PAUSE</li> </ul>

### PWM output complete flag

This device is for monitoring the completion status (normal completion) of PWM output.

#### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SM5316	SM5317	SM5318	SM5319	SM5320	SM5321	SM5322	SM5323	SM5324	SM5325	SM5326	SM5327

#### ■Update timing

The timing of device update is as follows.

ON	OFF
<ul style="list-style-type: none"> <li>• At execution of the PWM/DPWM, HIOEN/DHIOEN instruction or the END processing after the output of the specified pulse count is output</li> </ul>	<ul style="list-style-type: none"> <li>• Power OFF→ON, reset, STOP/PAUSE→RUN</li> <li>• When pulse output starts</li> <li>• When turned OFF by the user</li> </ul>



If the number of output pulses is set to "0" (unlimited output), PWM output complete flag is not turned ON.

## PWM output abnormal end flag

This device is for monitoring the end status (abnormal end) of PWM output.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SM5332	SM5333	SM5334	SM5335	SM5336	SM5337	SM5338	SM5339	SM5340	SM5341	SM5342	SM5343

### ■Update timing

The timing of device update is as follows.

ON	OFF
<ul style="list-style-type: none"><li>• At stop of pulse output due to an error in the setting value of the pulse width, period, or output pulse count</li><li>• At stop of pulse output due to the relation of pulse width &gt; period</li><li>• In the case of forced stop with SM8034 (all output disable) or output cannot be started</li></ul>	<ul style="list-style-type: none"><li>• Power OFF→ON, reset, STOP/PAUSE→RUN</li><li>• When pulse output starts</li><li>• When turned OFF by the user</li><li>• After forced stop by SM8034 (all output disable), SM8034 is turned off, and PWM output resumes (only when unlimited output)</li></ul>

#### Point

The ON timing of the PWM output abnormal end flag includes startup of the PWM/DPWM, HIOEN/ DHIOEN instruction.

## Number of output pulses

The number of output pulses of PWM output is stored.

When "0" is set, output is continued without any limitation.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SD5301, SD5300	SD5317, SD5316	SD5333, SD5332	SD5349, SD5348	SD5365, SD5364	SD5381, SD5380	SD5397, SD5396	SD5413, SD5412	SD5429, SD5428	SD5445, SD5444	SD5461, SD5460	SD5477, SD5476

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

#### Point

- If the number of output pulses written is equal to or smaller than the number of pulses that have already been output, pulse output is stopped after the pulses being currently output are completed.
- If the number of output pulses written is greater than the number of pulses that have already been output, pulse output is stopped after the specified number of pulses are output.
- If the number of output pulses is set to "0" (output without any limitation), the value cannot be changed while pulses are being output.
- The number of output pulses cannot be changed to "0" (output without any limitation) while pulses are being output.

## Pulse width

The pulse width of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SD5303, SD5302	SD5319, SD5318	SD5335, SD5334	SD5351, SD5350	SD5367, SD5366	SD5383, SD5382	SD5399, SD5398	SD5415, SD5414	SD5431, SD5430	SD5447, SD5446	SD5463, SD5462	SD5479, SD5478

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

#### Point

- The pulse width and cycle can be changed even while pulses are being output.
- The pulse width and cycle are stored in the unit specified by the parameter (ms or  $\mu$ s).

## Period

The period of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CPU module				High-speed pulse input/output module							
				First module		Second module		Third module		Fourth module	
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
SD5305, SD5304	SD5321, SD5320	SD5337, SD5336	SD5353, SD5352	SD5369, SD5368	SD5385, SD5384	SD5401, SD5400	SD5417, SD5416	SD5433, SD5432	SD5449, SD5448	SD5465, SD5464	SD5481, SD5480

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

#### Point

- The pulse width and cycle can be changed even while pulses are being output.
- The pulse width and cycle are stored in the unit specified by the parameter (ms or  $\mu$ s).



## Number of output pulses current value monitor

The current value of the number of output pulses of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

CH1	CH2	CH3	CH4
SD5307, SD5306	SD5323, SD5322	SD5339, SD5338	SD5355, SD5354

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing


The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN

#### Point

- If the number of output pulses is set to "0" (output without any limitation), the number of output pulse current value monitor is fixed at "0".
- The number of output pulse current value monitor can be changed even while pulses are being output.

## Cautions when using the PWM function

- Set the pulse width to a value 2  $\mu$ s more and period to a value 5  $\mu$ s more.
- Set the value so that pulse width  $\leq$  period.
- The PWM/DPWM instruction is not executed when a channel number not selected for PWM output in parameters setting is specified by the PWM/DPWM instruction.
- If the all output disable flag (SM8034) is turned ON while PWM is output, PWM output is stopped. However, when the number of output pulses is "0" (unlimited output), the operation restarts when SM8034 is turned OFF.
- In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with the following devices cannot be executed.
  - Number of output pulses
  - Pulse width
  - Period
- For functions that share outputs with the PWM function, refer to  Page 254 Functions that share inputs and outputs.

# Start/stop of the 16-bit data high-speed I/O function

## HIOEN(P)

These instructions control the start and stop operations of a high-speed I/O function.

Ladder diagram	Structured text
	<pre>ENO:=HIOEN(EN,s1,s2,s3); ENO:=HIOENP(EN,s1,s2,s3);</pre>

FBD/LD

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## Setting data

### ■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s1)	Function number to be started or stopped	Refer to Function number ( Page 825)	16-bit signed binary	ANY16
(s2)	Set the bit of the channel number where the function is started.	-32768 to +32767	16-bit signed binary	ANY16
(s3)	Set the bit of the channel number where the function is stopped.	-32768 to +32767	16-bit signed binary	ANY16
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

### ■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	\$	
(s1)	○	○	○	○	—	—	○	○	—	—	—
(s2)	○	○	○	○	—	—	○	○	—	—	—
(s3)	○	○	○	○	—	—	○	○	—	—	—

## Processing details

Specify the number of the function to be started or stopped in (s1), the bit of the channel to be started in (s2), and the bit of the channel to be stopped in (s3).

The following table shows the function numbers which can be specified in (s1).

### ■Function number

Function number	Function name
K0	High-speed counter
K10 <sup>*1</sup>	Pulse density/rotation speed measurement
K20 <sup>*1</sup>	High-speed comparison table (CPU module)
K21 <sup>*1</sup>	High-speed comparison table (first high-speed pulse input/output module)
K22 <sup>*1</sup>	High-speed comparison table (second high-speed pulse input/output module)
K23 <sup>*1</sup>	High-speed comparison table (third high-speed pulse input/output module)
K24 <sup>*1</sup>	High-speed comparison table (fourth high-speed pulse input/output module)
K30 <sup>*1*2</sup>	Multi-output high-speed comparison table
K40	Pulse width measurement

Function number	Function name
K50	PWM

\*1 When high-speed counter (function number: K0) is stopped during function operation, the function continues to operate, but nothing will be processed.

\*2 When multi-output high-speed comparison table (function number: K30) is stopped, high-speed counter of the same ch is also stopped. The following table shows the values which can be specified in (s2) and (s3) for each function number.

- Function number K0

The counting start and stop of a high-speed counter can be controlled for each channel of high-speed counter.

CH1 to CH8 are for the CPU module, and CH9 to CH16 are for the high-speed pulse input/output module.

Bit position															
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH16	CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

**Ex.**

To start CH3, set 04H in (s2). To stop it, set 04H in (s3).

To start CH1, CH4, and CH5, set 19H in (s2). To stop them, set 19H in (s3).

To start CH1 and CH4 and to stop CH5, set 09H in (s2) and set 10H in (s3).

- Function number K10

The measuring start and stop of the pulse density (rotation speed measurement) can be controlled for each channel of the high-speed counter.

Bit position															
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
—								CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

- Function number K20 to K24

Set the value to turn on the bit of the high-speed comparison table number which is to be started or stopped.

In the case of the CPU module (K20), b0 to b15 can be used.

In the case of the high-speed pulse input/output module (K21 to K24), b0 to b14 can be used.

Bit position															
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

- Function number K30

For the multi-output high-speed comparison table, specification of a channel is not required. To start the multi-output high-speed comparison table, set 01H in (s2). To stop it, set 01H in (s3).

Bit position															
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
—															Valid


- Function numbers K40 and K50

The measuring start and stop of pulse width measurement and PWM can be controlled for each channel.

CH1 to CH4 are for the CPU module, and CH5 to CH12 are for the high-speed pulse input/output module.

Bit position															
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
—				CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

## Precautions

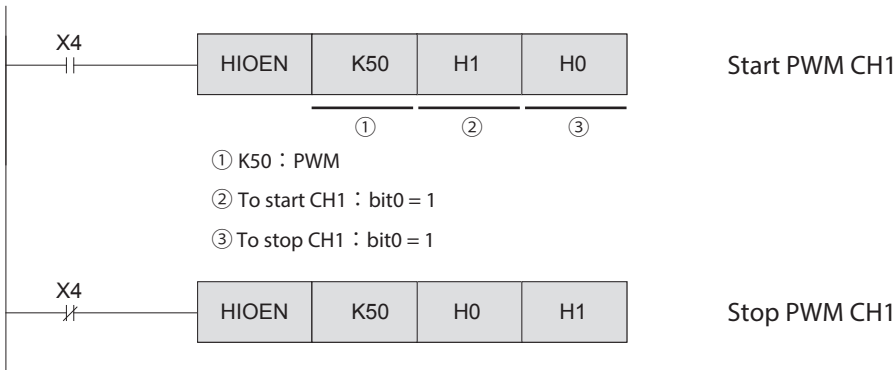
- Do not specify channel numbers of the high-speed pulse input/output module in a program with interrupt priority set to "1".
- When values that turn on the same channel are set for start and stop, the stop operation is prioritized.
- If there is a channel where an error occurs (error code: 3781H) when the high-speed counter (function number: K0) is executed by the HIOEN instruction, the counter can no longer be started/stopped for the applicable channel and subsequent channels.
- When the high-speed comparison table (function number: K20) is used with the HIOEN instruction, the total number of high-speed comparisons, including the DHSCS instruction, DHSCR instruction, DHSZ instruction, and interrupt input of built-in positioning, must be 32 or less.
- When using the high-speed comparison table (function numbers: K21 to K24) with the HIOEN instruction, set the number of high-speed comparisons used within the same high-speed pulse input/output module to 15 times or less.
- For the high-speed comparison table numbers and total number of high-speed comparisons, refer to  Page 1146 Added and Changed Functions.
- To start the high-speed comparison table (function numbers: K20 to K24) or the multi-output high-speed comparison table (function number: K30), the high-speed counter must be started using the HIOEN instruction in advance.
- The high-speed input/output instructions operate according to the following parameters.

Function number	Function specified by the HIOEN instruction	Parameter setting
K0	High-speed counter	Channel setting of the high-speed counter
K10	Pulse density (rotation speed measurement)	Channel setting of the pulse density/rotation speed measurement High-speed counter
K20	High-speed comparison table (CPU module)	Output setting of the high-speed counter
K21	High-speed comparison table (first high-speed pulse input/output module)	Output setting of the high-speed counter
K22	High-speed comparison table (second high-speed pulse input/output module)	Output setting of the high-speed counter
K23	High-speed comparison table (third high-speed pulse input/output module)	Output setting of the high-speed counter
K24	High-speed comparison table (fourth high-speed pulse input/output module)	Output setting of the high-speed counter
K30	Multi-output high-speed comparison table	Output setting of the high-speed counter
K40	Pulse width measurement	Channel setting of the pulse width measurement
K50	PWM	Channel setting of PWM

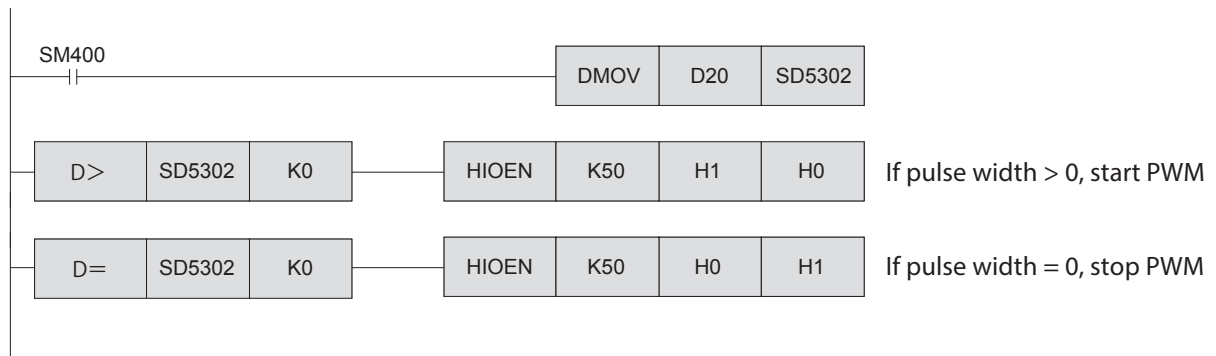
## Operation error

Error code (SD0/SD8067)	Description
1810H	A channel number which is used in another instruction is specified.
2801H	The channel number of a module that does not exist is specified.
3056H	Timeout occurred while communicating with the target modules during execution of the instruction.
3060H	Signal error was detected while accessing the target modules during execution of the instruction.
3405H	An invalid function number is specified in (s).
3580H	An instruction that cannot be used in an interrupt program is used.
3600H	A channel number which is not selected in the parameter setting is executed.
3781H	Ring length $\leq$ preset value is specified and executed in channel for which ring length is set and preset input is enabled.

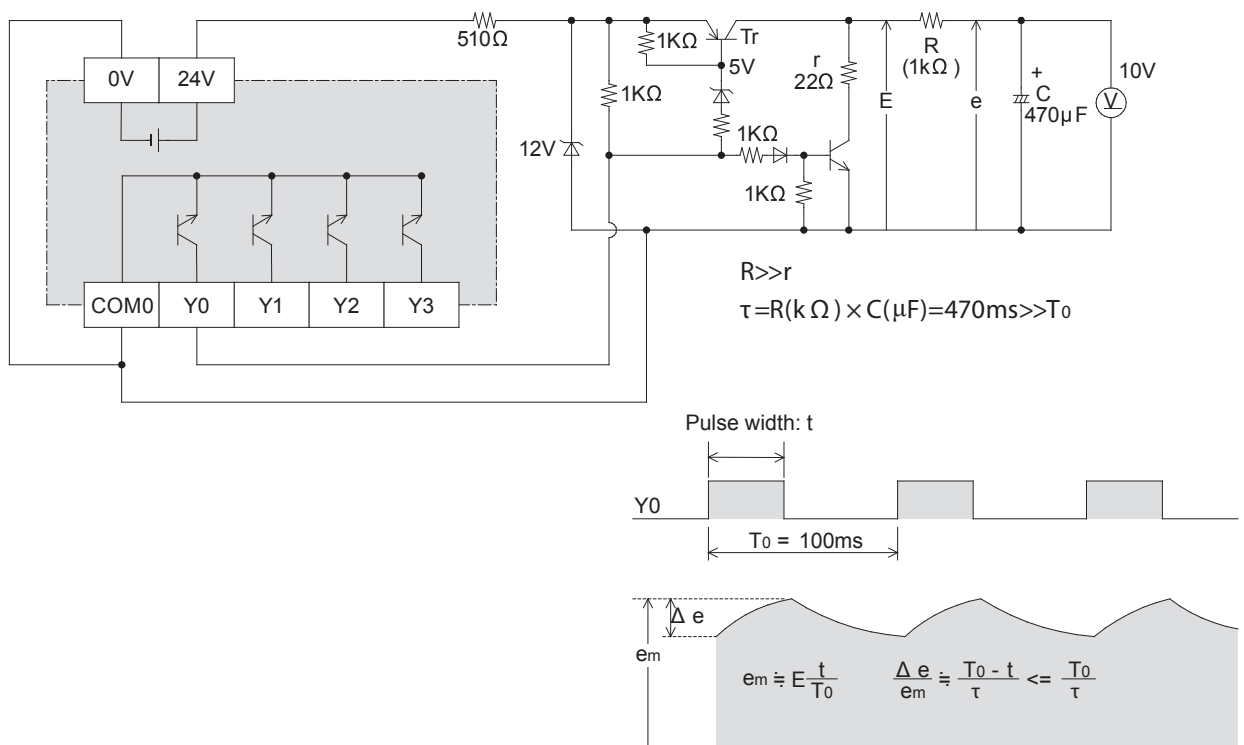
## Program example



To change pulse width of CH1, change special register SD5302 in 32-bit data unit.



### Example filter circuit



## High-speed current value transfer of 32-bit data

### DHCMOV(P)

These instructions read and write (updates) special register for high-speed counter, pulse width measurement, PWM, and positioning.

Ladder diagram	Structured text
	<pre>ENO:=DHCMOV(EN,s,n,d); ENO:=DHCMOVP(EN,s,n,d);</pre>
FBD/LD	

### Setting data

#### ■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s)	Transfer source device number	—	Bit/32-bit signed binary	ANY_ELEMENTARY
(d)	Transfer source device number	—	Bit/32-bit signed binary	ANY_ELEMENTARY
(n)	Specification to clear the device value of the transfer source after the transfer	K0, K1	16-bit unsigned binary	ANY16_U
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

#### ■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	\$	
(s)	○	○	○	○	○	○	○	○	—	—	—
(d)	○	○	○	○	○	○	○	—	—	—	—
(n)	○	○	○	○	—	—	○	○	—	—	—

### Processing details

These instructions transfer the data in the device specified by (s) to the device specified by (d). At this time, if the value of (n) is K0, the value of (s) is not cleared. If the value of (n) is K1, the value of (s) is cleared to "0" after the transfer. The value is cleared only for SD devices for the current value of high-speed counters or LC devices used as a high-speed counter when using the FX3 compatible high-speed counter.

#### Point

When (s) is a device supporting high-speed transfer

- When the DHCMOV instruction is executed, the latest value is acquired such as the current value of a high-speed counter and transferred to (d).

When (d) is a device supporting high-speed transfer

- When the DHCMOV instruction is executed, value such as the current value of a high-speed counter is changed.

## ■Effect of DHCMOV instruction

- By using both input interrupt and DHCMOV instruction, the current value of a high-speed counter can be received at the rising edge or falling edge of an external input.
- When DHCMOV instruction is used just before a comparison instruction (DCMP, DZCP or comparison contact instruction), the latest value of the high-speed counter is used in comparison.

## Precautions

- When it is necessary to execute comparison and outputting as soon as the current value of a high-speed counter changes, use the high-speed comparison table, multi-output high-speed comparison table, or one of the DHSCS, DHSCR, and DHSZ instructions.
- Do not overwrite the current value of a high-speed counter using the DHCMOV instruction while executing the pulse density (rotation speed measurement) or the DSPD instruction.
- Transfer is not possible between an SM supporting high-speed transfer and an SD supporting high-speed transfer.
- When the device supporting high-speed transfer is set as the transfer source (s) by the DHCMOV instruction while the high-speed I/O function is stopped, the previous value before stop is read out. However, if the function is not executed even once, the initial value is read out.

### Ex.

When SD5303, SD5302 (PWM pulse width) is set as the transfer source (s), the operation is executed as follows.

When the PWM function is not executed	"0" is read out. (This is not the value of the parameter that is set by GX Works3.)
When the PWM function was executed but it is currently stopped	The value when the PWM function was stopped is read out.
When the PWM function is executed	The latest value that is currently operating is read out.

- When a high-speed counter SD device (current value, maximum value, minimum value) is read out individually, only the read SD device will be updated. Thus, there may be cases when the high-speed counter's SD device does not satisfy the relation of minimum value  $\leq$  current value  $\leq$  maximum value temporarily. Refer to the MELSEC iQ-F FX5 User's Manual (Application) for details on the timing that the high-speed counter's SD device is updated.

## Point

The DHCMOV instruction is mainly used to read the current value of the high-speed counter/pulse width measurement and change the current address (in the user units) or the current address (in the pulse unit) of positioning.

## Operation error

Error code (SD0/SD8067)	Description
2801H	The channel number of a module that does not exist is specified.
2821H	Operands that execute transmission between an SM supporting high-speed transfer and an SD supporting high-speed transfer is designated.
3056H	Timeout occurred while communicating with the target modules during execution of the instruction.
3060H	Signal error was detected while accessing the target modules during execution of the instruction.
3405H	A value outside the data range is set in (n).
3580H	An instruction that cannot be used in an interrupt program is used.