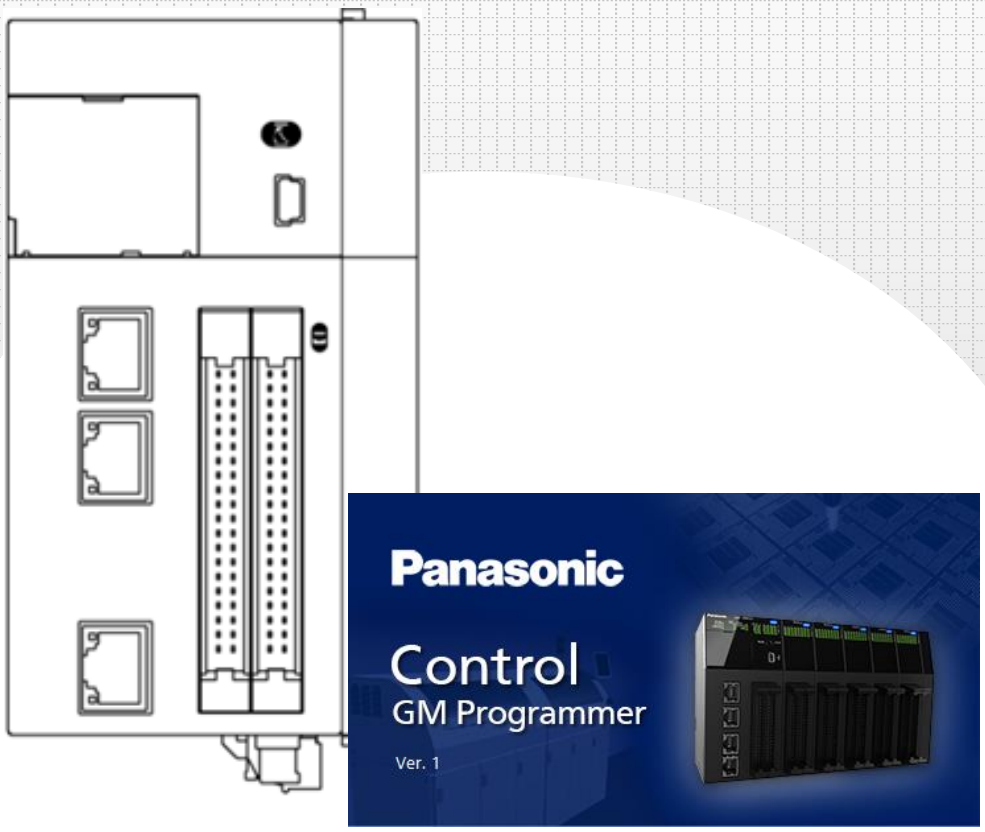
Panasonic

Hello! GM1 Controller Auxiliary Function Edition



memo

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Safety Precautions

This section explains important rules that must be observed to prevent personal injury and property damage.
・Injuries and damages that may occur as a result of incorrect use are classified into the following levels and safety precautions are explained according to the level.

⚠ WARNING　Indicates that there is a risk of death or serious injury
⚠ CAUTION　Indicates that there is a risk of minor injury or property damage


Indicates an action that is prohibited

Indicates an action that must be taken

⚠ WARNING


・Take safety measures outside this product to ensure the safety of the entire system even if this product fails or an error occurs due to external factors.

・Do not use this product in atmospheres that contain flammable gases. Doing so may result in explosion.

・Do not throw this product into the fire. Doing so may cause the batteries or other electronic parts to explode.

⚠ CAUTION


・To prevent abnormal heat generation or smoke generation, use this product with some leeway from the guaranteed characteristics and performance values of the product.

・Do not disassemble or modify this product. Doing so may result in abnormal heat generation or smoke generation.

・Do not touch any terminals while the power is on.

・Configure emergency stop and interlock circuits outside this product.

・Connect wires and connectors properly. Failure to do so may result in abnormal heat generation or smoke generation.

・Do not perform work (such as connection or removal) with the power turned on.

・If this product is used in any way that is not specified by Panasonic, its protection function may be impaired.

・This product has been developed and manufactured for factory use only.

GM1 Controller Auxiliary Function Edition

0 Preparation

Installing tool software

- GM Programmer

■ PWM Output

1 Basic Setup

1.1 Behavior Overview
1.2 Preparing and Wiring the Required Devices
1.3 IP Address Setting to Network Scanning

2 PWM Output Settings

2.1 IO_Configuration Settings
2.2 PWM_Configuration Settings

3 Programming

3.1 Adding New POU
3.2 Programming

4 System Operation Check

■ High-speed Counter (HSC)

1 Basic Setup

1.1 Behavior Overview
1.2 Preparing and Wiring the Required Devices

2 High-speed Counter Settings

2.1 IO_Configuration Settings
2.2 PWM_Configuration Settings

3 Programming

3.1 Adding New POU
3.2 Programming

4 System Operation Check

0 Preparation

Installing tool software

Install GM Programmer from the following website:
GM Programmer: https://industrial.panasonic.com/ac/j/motor/motion-controller/mc/gm1/index.jsp

INFO

When GM Programmer is installed, PANATERM Lite for GM, Gateway (CODESYS Gateway), and CodeMeter applications are installed at the same time.

- GM Programmer: This is a setup tool for the GM1 controller. Using GM Programmer makes it possible to set positioning data and various positioning parameters, and perform various monitoring operations.
- PANATERM Lite for GM1 (not used in this textbook): This is a setup support tool for the MINAS series servo amplifiers manufactured by Panasonic Corporation.
  When GM Programmer is installed, PANATERM Lite for GM is also installed at the same time.
  By using this tool, parameter setup within servo amplifiers, control status monitoring, setup support, machine analysis, and other operations can be executed on a PC.

Before installing GM Programmer on a PC, log on to the PC with Administrator privileges.
If other applications are running, be sure to close all the applications before installing GM Programmer.

In this textbook, one RTEX type GM1 controller and one EtherCAT type GM1 controller are used, but there is no difference in communication specifications between them.
Applicable models: AGM1CSRX16T, AGM1CSEC16T, and AGM1CSEC16P

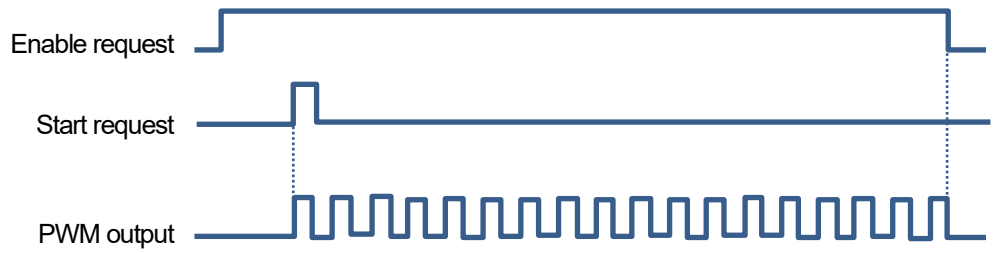
1 Basic Setup ■ PWM Output

The GM1 controller can use PWM output with the following specifications.

Item	Outline	Channel name
Number of output channels	Max. 4 channels	-
Output port number	Y4 to Y7	-
Output frequency	1 Hz to100 kHz (settable by 1 Hz)	Ch*_FrequencyValue
Output duty ratio	0% to 100% (settable by 0.1%)	Ch*_DutyValue
Control input	Start request	Ch*_PwmStartResister
	Enable request	Ch*_PwmEnableRequest

(* is replaced by a channel number)

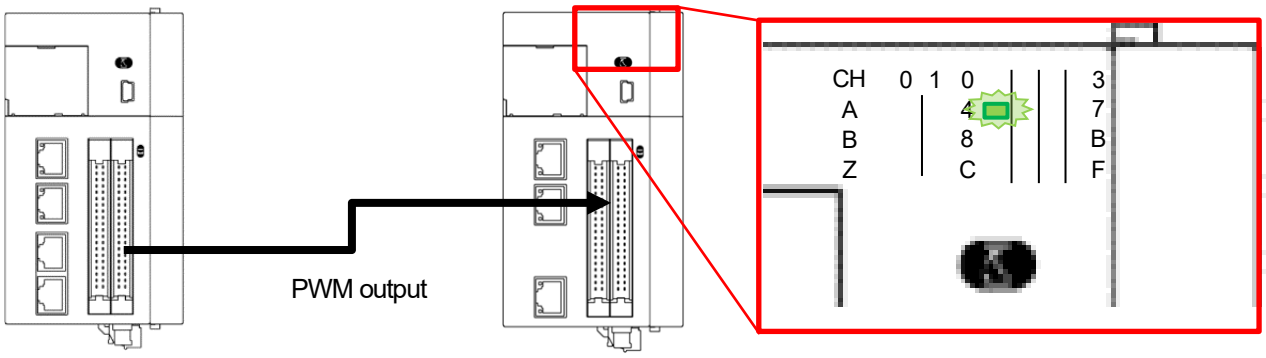
If the rising edge of the "Start request" bit is detected when the "Enable request" bit is ON, the output port will start PWM output.
If the "Enable request" bit is set to OFF, PWM output will stop.



To update "Output frequency" and "Output duty ratio" during PWM output, write the respective values of "Output frequency" and "Output duty ratio" and then change the state of the start request bit from OFF to ON.

1.1 Behavior Overview

In this textbook, PWM output is performed for one channel.
For the output destination, GM1 controller input (X4) is used to control the input LED indicators to substitute for LED light control which is often used for PWM output.



General-purpose I/O connectors Y4 to Y7 are assigned to the PWM output terminals on the GM1 controller.
In this textbook, Y4 of Ch0 (one of the four channels) is used.

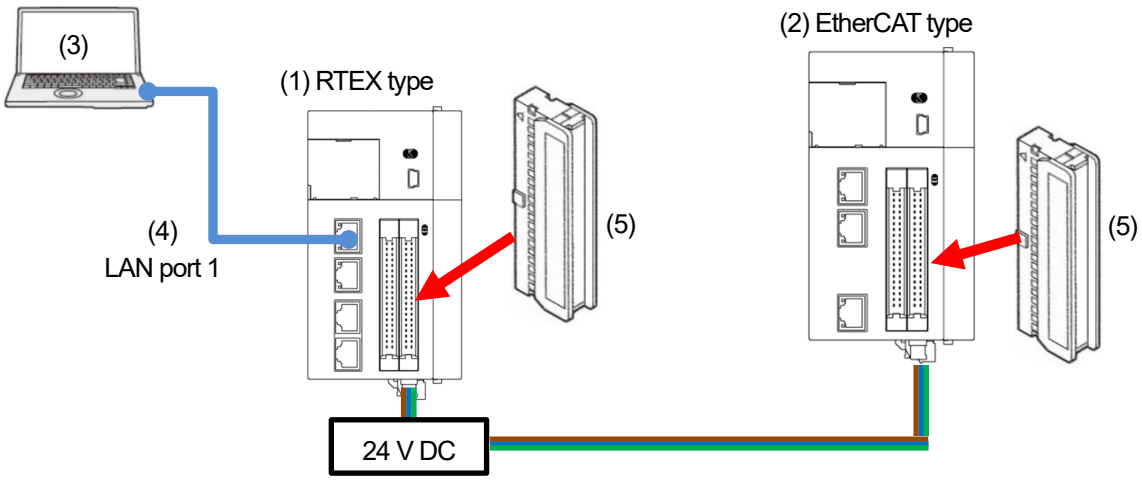
1.2 Preparing and Wiring the Required Devices

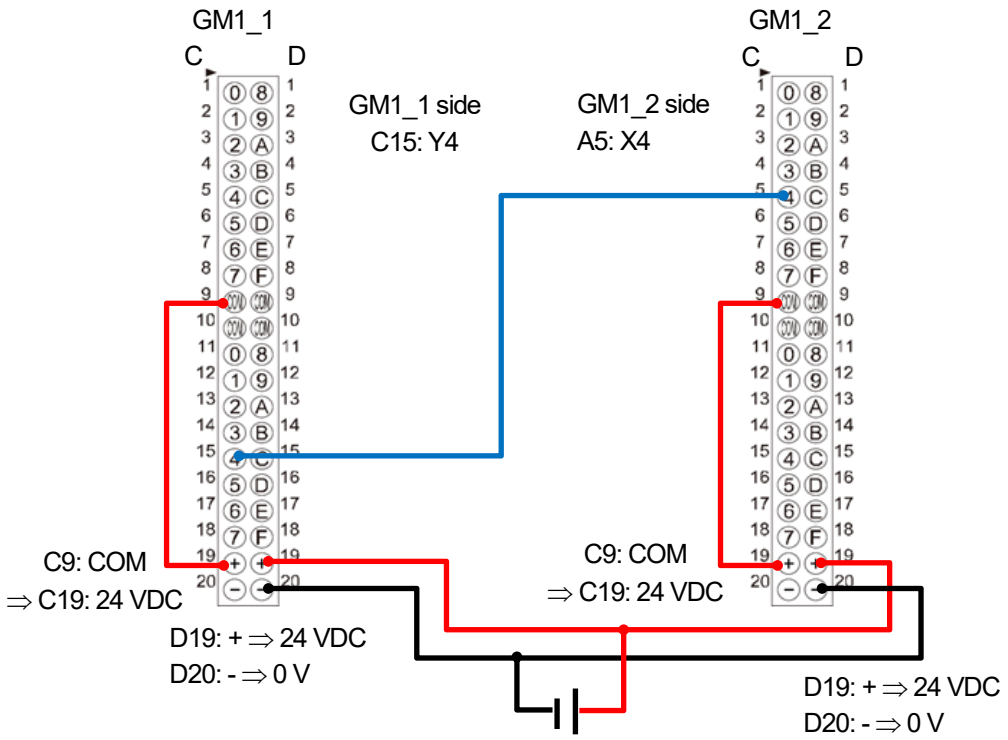
Prepare the following devices.

No.	Name	
(1)	GM1 controller (RTEX type) x 1: Master	(In this textbook, one RTEX type GM1 controller and one EtherCAT type GM1 controller are used.)
(2)	GM1 controller (EtherCAT type) x 1: Slave	
(3)	PC (with GM Programmer installed)	
(4)	LAN cable: x 2	
(5)	Discrete-wire connector: x 2	

* In this textbook, one RTEX type GM1 controller and one EtherCAT type GM1 controller are used, but there is no difference in general-purpose I/O specifications between them.

Wire each device as shown below.



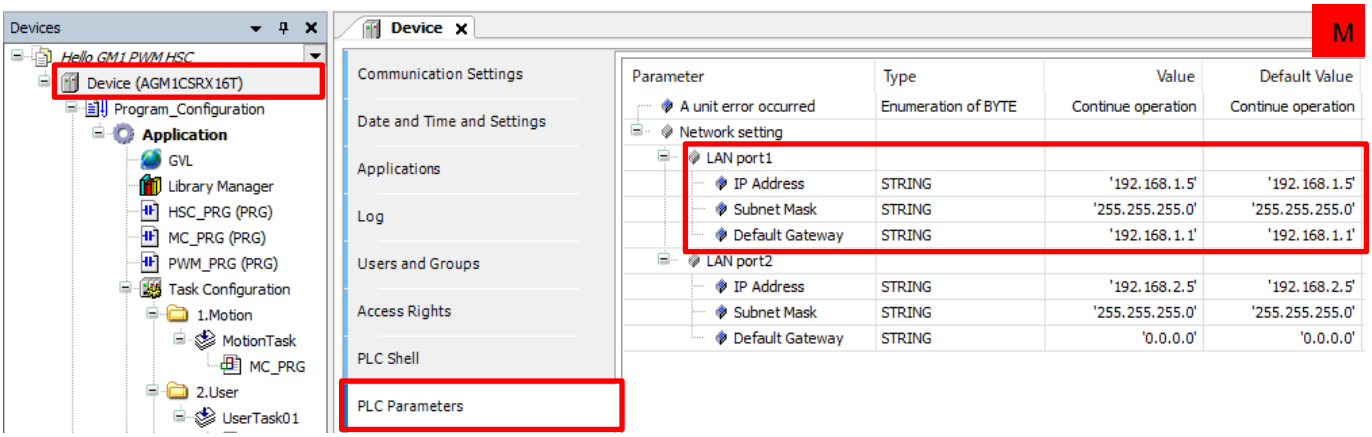


1.3 IP Address Setting to Network Scanning

Step 1

Open GM Programmer and double-click **Device**.

Select **PLC Parameters** and check the IP address of LAN port 1.

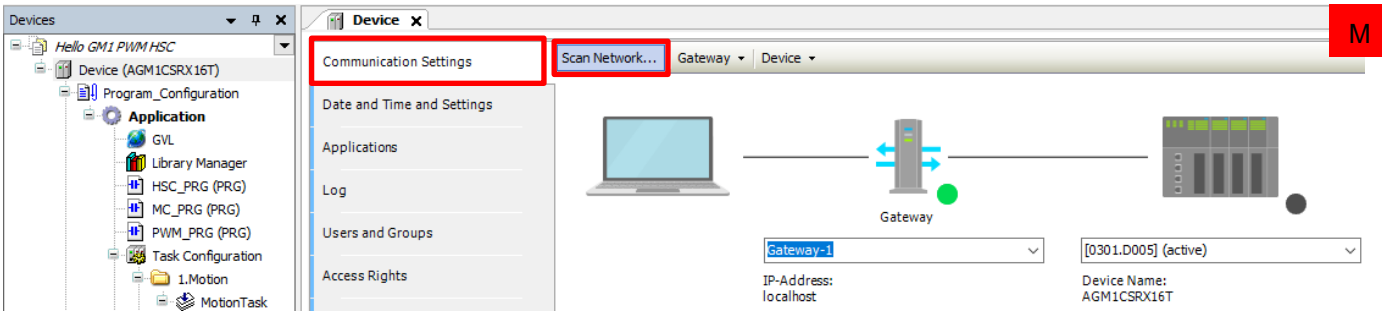


LAN port 1 (default value)

IP address	192.168.1.5
Subnet mask	255.255.255.0
Default gateway	192.168.1.1

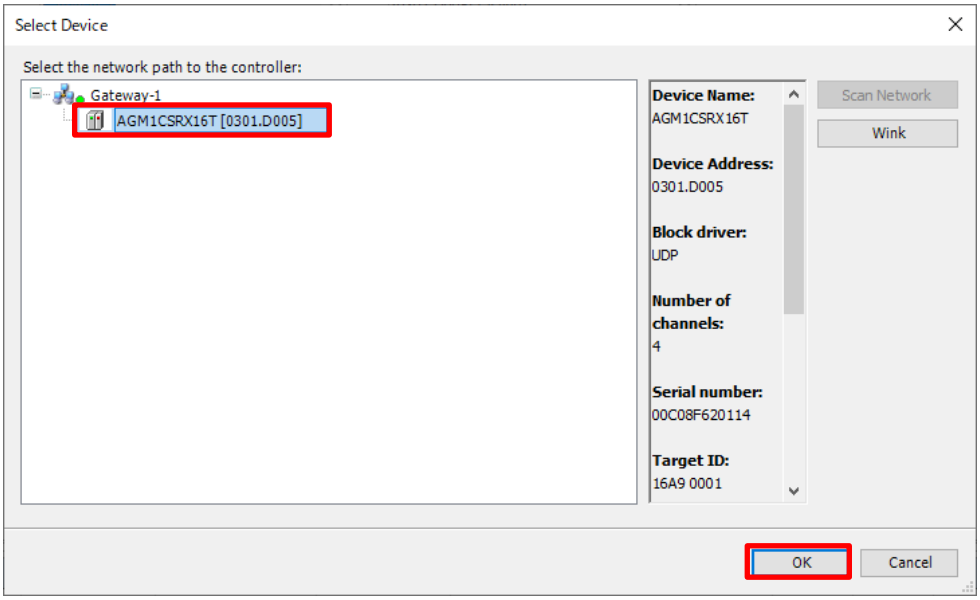
Step 2

Select **Communication Settings** and click **Scan Network**.



Step 3

Select a device to be connected and click **OK**.



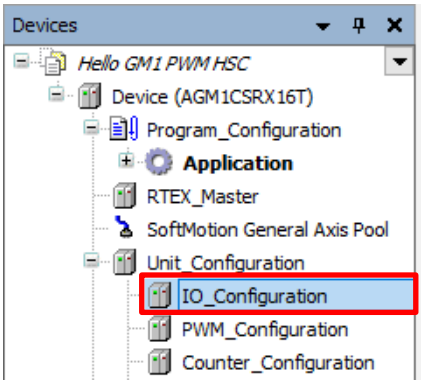
2 PWM Output Settings

2.1 IO_Configuration Settings

By default, general-purpose I/O connectors for the GM1 controller are allocated to normal I/O. Therefore, change the settings.

Step 1

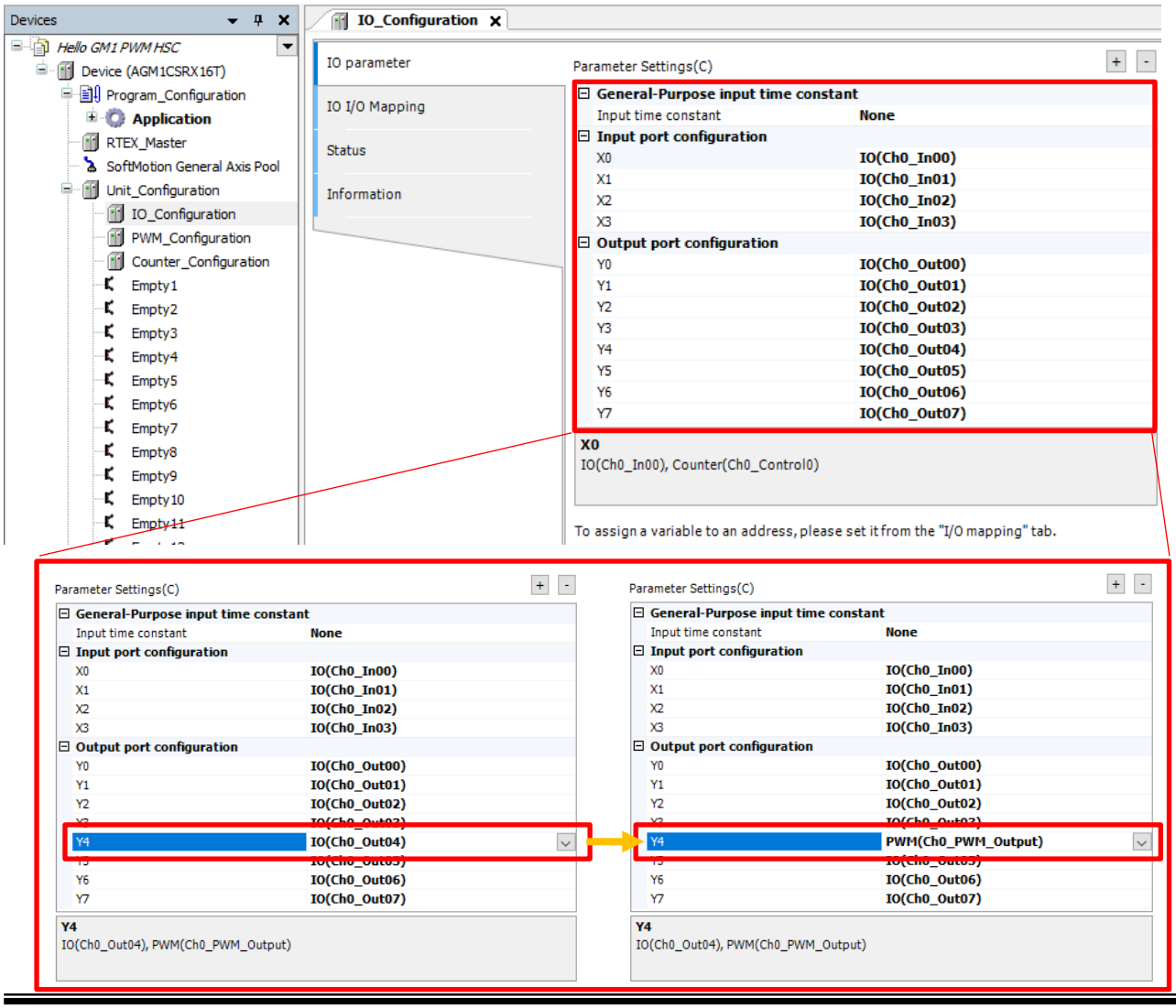
Double-click **Device**, **Unit_Configuration**, and then **IO_Configuration**.



Step 2

Select **IO parameter** and change the setting of **Y4** in **Output port configuration**.

Click **Y4** and change the setting from **IO(Ch0_Out04)** to **PWM(Ch0_PWM_Output)**.

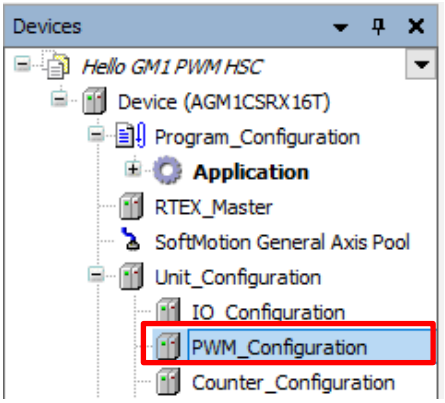


2.2 PWM_Configuration Settings

Register the items required for PWM control as variables.

Step 1

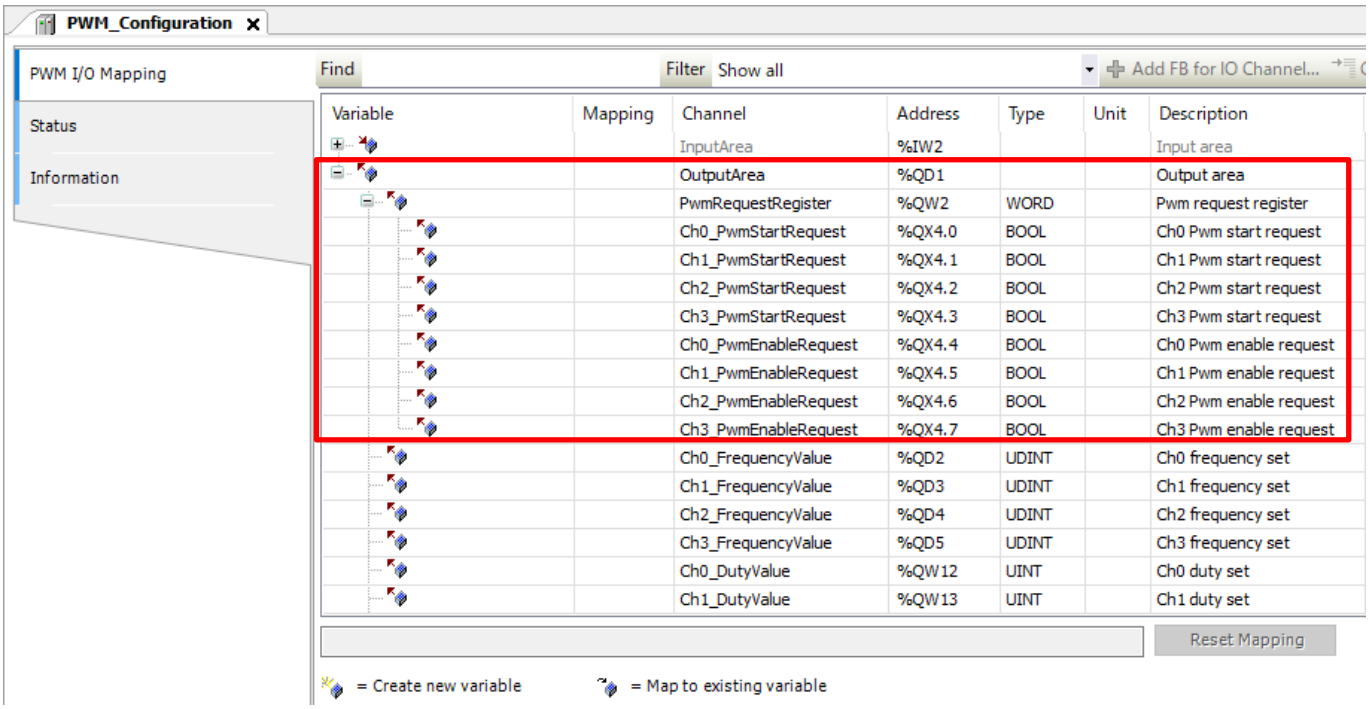
Double-click **Device**, **Unit_Configuration**, and then **PWM_Configuration**.



Step 2

Register variables in the **PWM I/O Mapping** pane.

Click **OutputArea** and then **PwmRequestRegister** to display the **OutputArea** registration pane as shown below.



Step 3

Register variables in the **PWM I/O Mapping** pane, as below.

Variable	Channel	Description
xPwmStart	Ch0_PwmStartRegister	Ch0 start request
xPwmEnable	Ch0_PwmEnableRequest	Ch0 enable request
udiFrequency	Ch0_FrequencyValue	Ch0 frequency set value
uiDuty	Ch0_DutyValue	Ch0 duty ratio set value

Variable	Mapping	Channel	Address	Type	Unit	Description
		InputArea	%IW2			Input area
		OutputArea	%QD1			Output area
		PwmRequestRegister	%QW2	WORD		Pwm request register
xPwmStart		Ch0_PwmStartRequest	%QX4.0	BOOL		Ch0 Pwm start request
		Ch1_PwmStartRequest	%QX4.1	BOOL		Ch1 Pwm start request
		Ch2_PwmStartRequest	%QX4.2	BOOL		Ch2 Pwm start request
		Ch3_PwmStartRequest	%QX4.3	BOOL		Ch3 Pwm start request
xPwmEnable		Ch0_PwmEnableRequest	%QX4.4	BOOL		Ch0 Pwm enable request
		Ch1_PwmEnableRequest	%QX4.5	BOOL		Ch1 Pwm enable request
		Ch2_PwmEnableRequest	%QX4.6	BOOL		Ch2 Pwm enable request
		Ch3_PwmEnableRequest	%QX4.7	BOOL		Ch3 Pwm enable request
udiFrequency		Ch0_FrequencyValue	%QD2	UDINT		Ch0 frequency set
		Ch1_FrequencyValue	%QD3	UDINT		Ch1 frequency set
		Ch2_FrequencyValue	%QD4	UDINT		Ch2 frequency set
		Ch3_FrequencyValue	%QD5	UDINT		Ch3 frequency set
uiDuty		Ch0_DutyValue	%QW12	UINT		Ch0 duty set
		Ch1_DutyValue	%QW13	UINT		Ch1 duty set
		Ch2_DutyValue	%QW14	UINT		Ch2 duty set
		Ch3_DutyValue	%QW15	UINT		Ch3 duty set

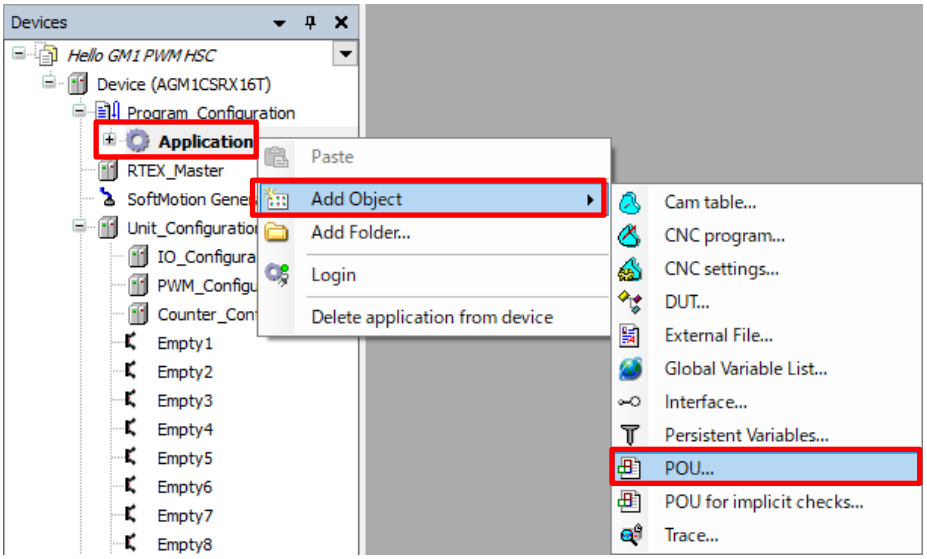
3 Programming

3.1 Adding New POU

Step 1

Create a program for PWM control.

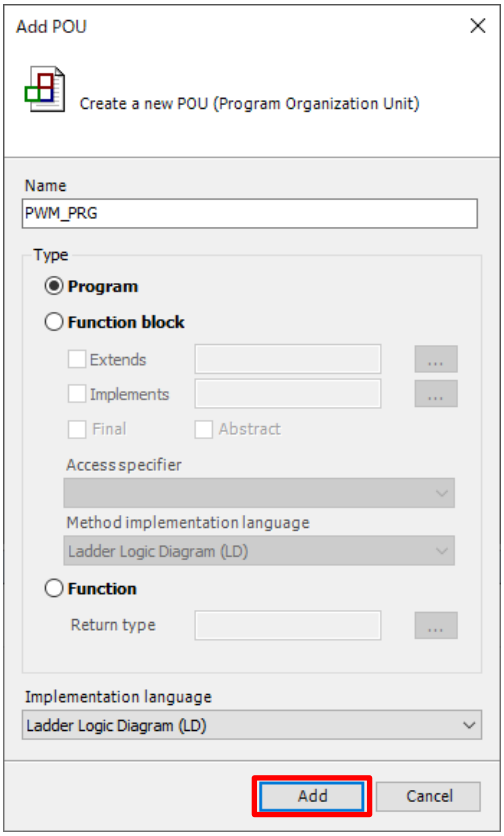
Right-click **Application** and select **Add Object** and then **POU** to create a new POU.



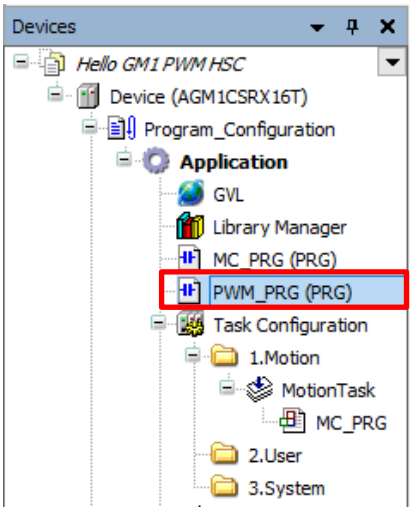
Step 2

In the **Add POU** dialog box, specify settings as below and click **Add**.

Name	PWM_PRG
Type	Program
Implementation language	Ladder Logic Diagram (LD)

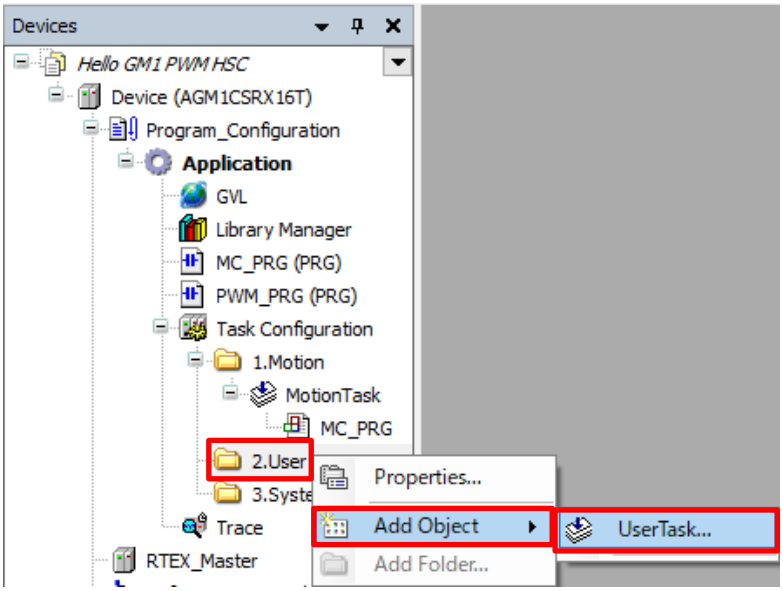


PWM_PRG (PRG) will be added to **Application**.



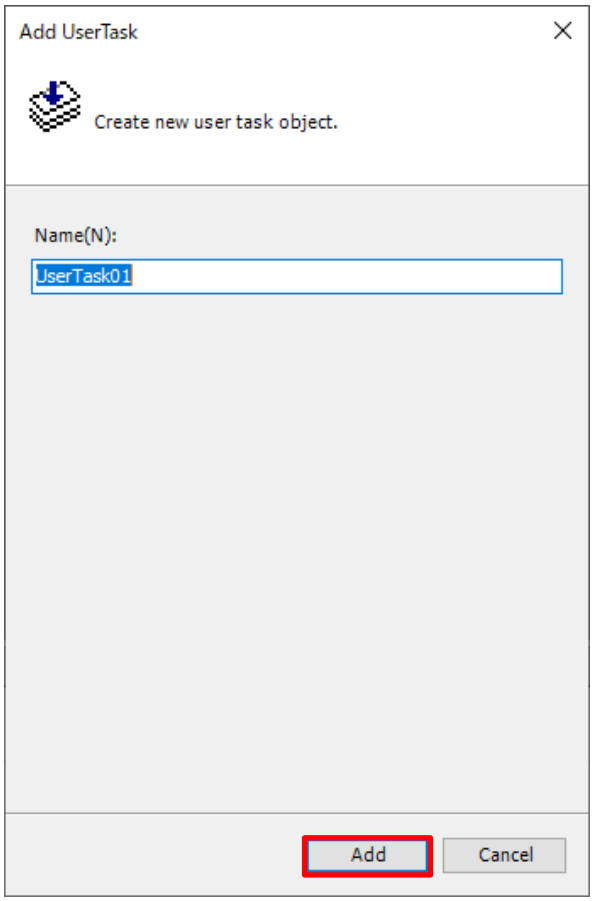
Step 3

Right-click **2.User** and select **Add Object** and then **UserTask**.

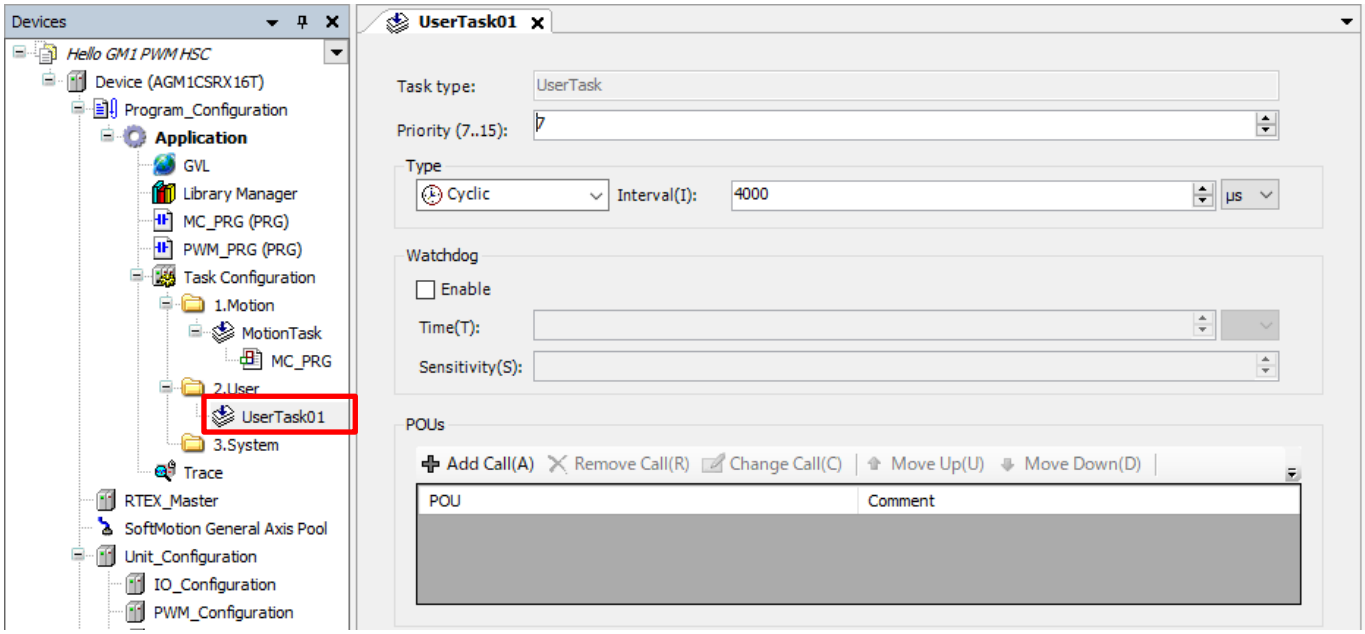


Step 4

The **Add UserTask** dialog box will be displayed. Leave **UserTask01** (default) unchanged in the **Name(N)** field and click **Add**.

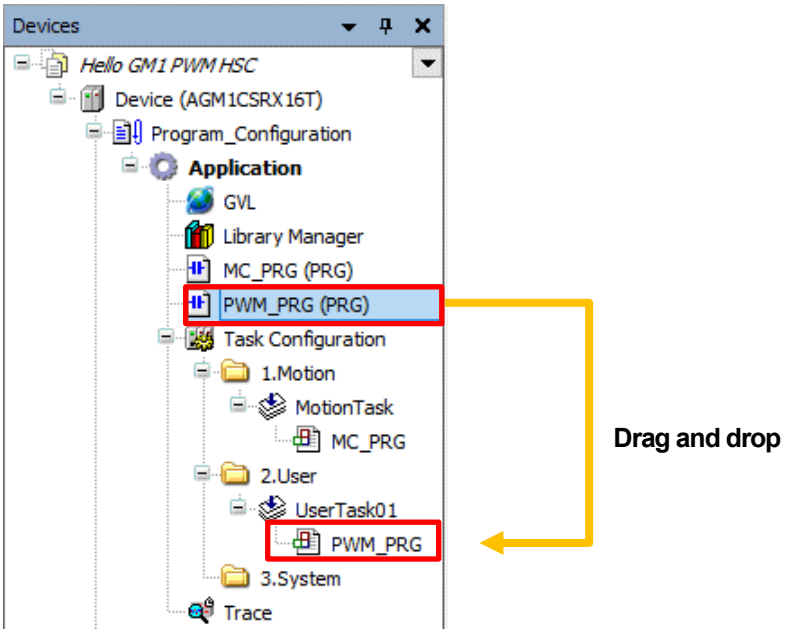


UserTask01 will be added.



Step 5

Drag and drop **PWM_PRG (PRG)** into the **UserTask01** object, which has been added, to add it to the task.



Column (6): Tasks

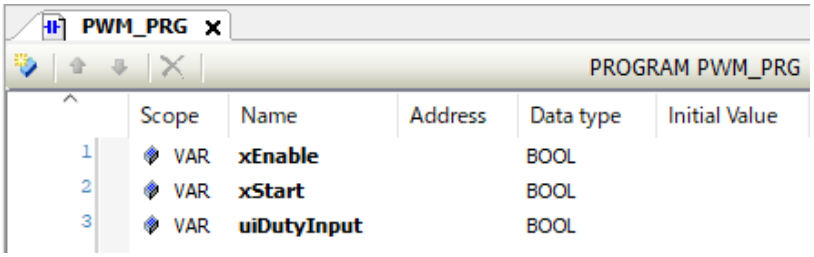
Task	Description
MotionTask	This is a user program task to perform motion control. It is given the highest priority. Only one MotionTask is allowed for each project.
UserTask	This is a user program task to perform control other than motion control. The user can set the level of priority. Up to 50 tasks can be registered in a single project.
SystemTask	This is a task that is used by the system and cannot be added by user programs. It is processed while other tasks are inactive.

3.2 Programming

Step 1

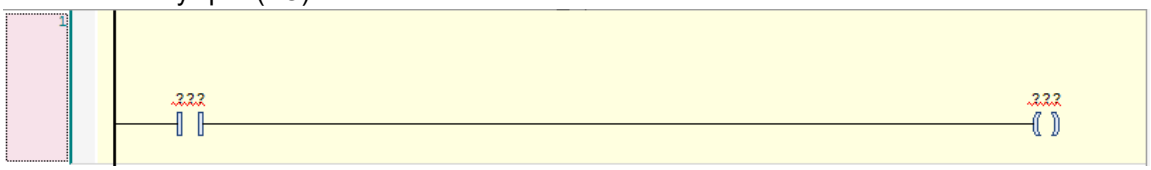
Open PWM_PRG and add local variables as below.

Name	Data type
xEnable	BOOL
xStart	BOOL
uiDutyInput	UINT



Step 2

Add a normally open (NO) contact and coil to Network 1.



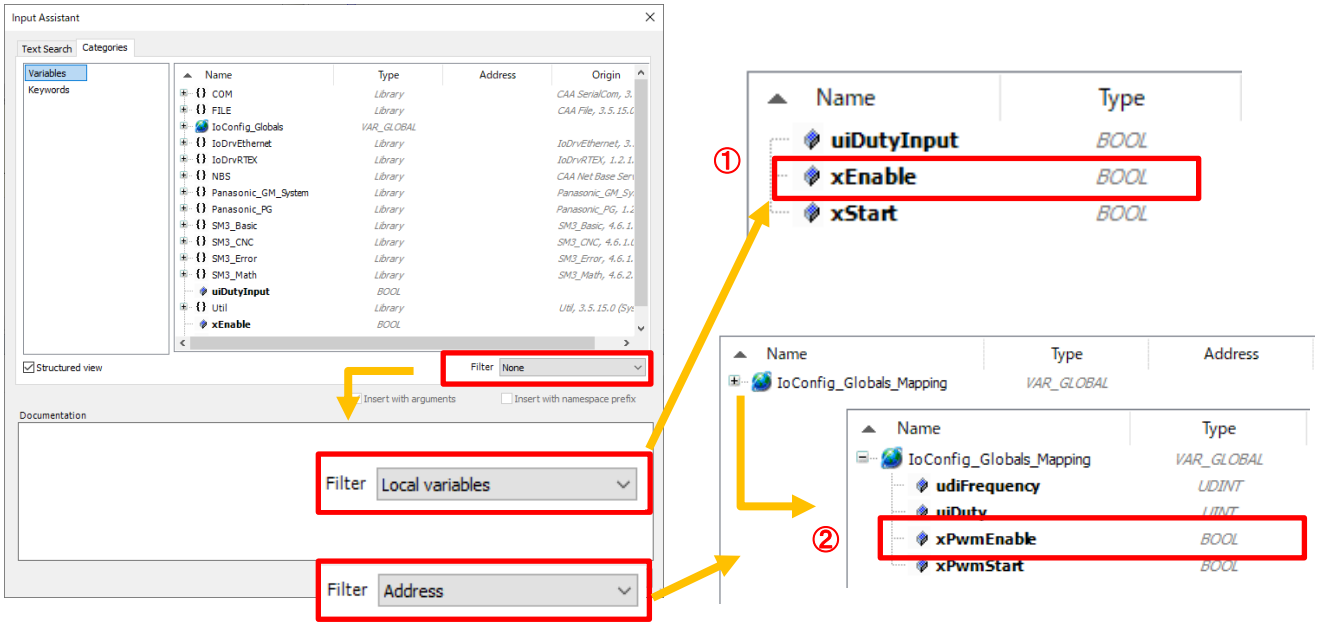
Procedure:

Use the **Input Assistant** dialog box to enter variables for an NO contact and coil.

Click **???** and select . . . . The **Input Assistant** dialog box will open.

NO contact: In the **Filter** drop-down list, select **Local variables** and then select **xEnable** in the **Name** column.

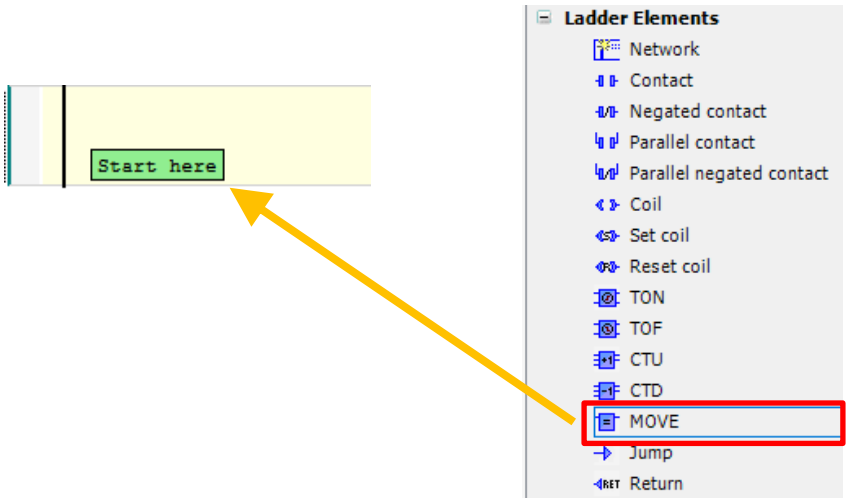
Coil: In the **Filter** drop-down list, select **Address** and then select **IoConfig_Globals_Mapping** and then **xPwmEnable** in the **Name** column.



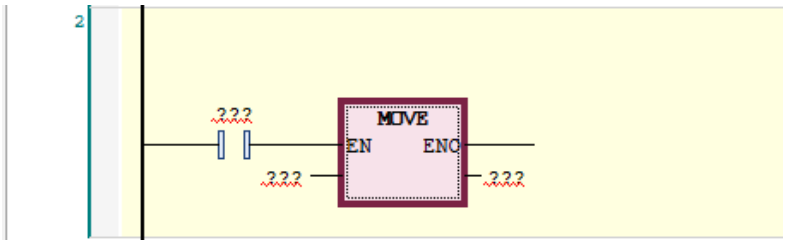
This completes the circuit for Enable input to Ch0.

Step 3

Insert a new network and then insert **MOVE** from **Ladder Elements** in Toolbox.
MOVE can be added by dragging and dropping it into the **Start here** box.

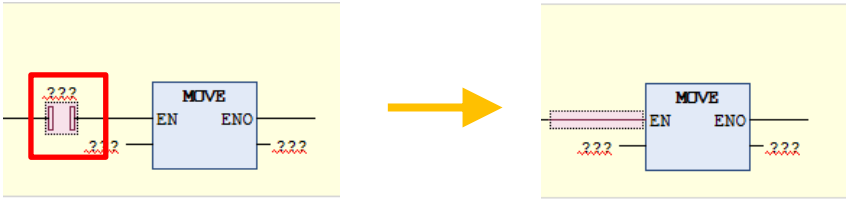


MOVE will be added.



Step 4

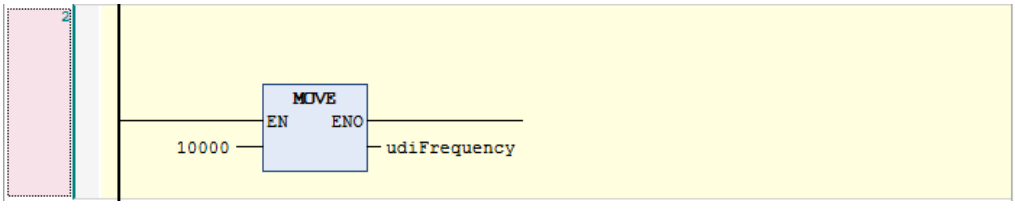
Delete the NO contact on the left side of **MOVE** which has been inserted.



Step 5

Enter fixed value 10000 for input and udiFrequency for output as shown in the figure below.

Input	10000
Output	udiFrequency



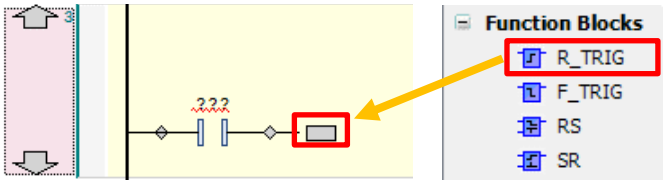
This completes the circuit for writing the set value of Ch0 output frequency.
Because frequency is set in increments of 1 Hz, 10 kHz is set as 10000 Hz.

Step 6

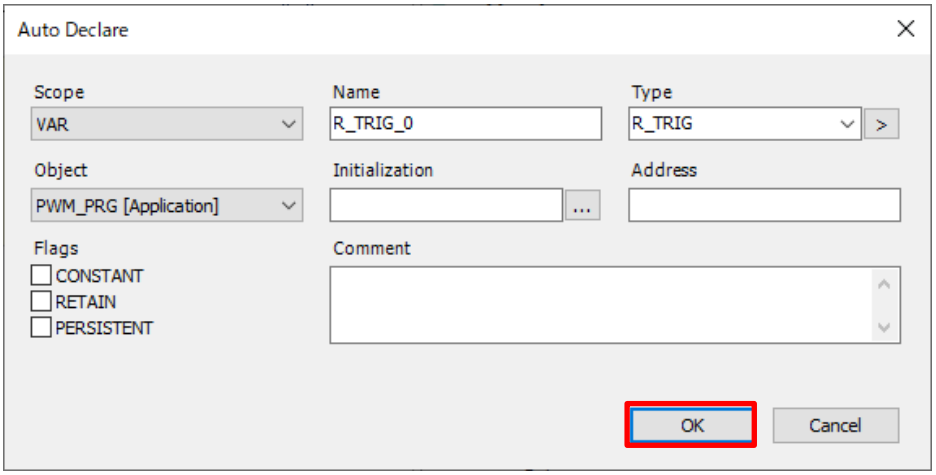
Insert a new network and an NO contact.

Step 7

Drag and drop **R_TRIG** from **Function Blocks** in Toolbox to insert it into — ▭ .



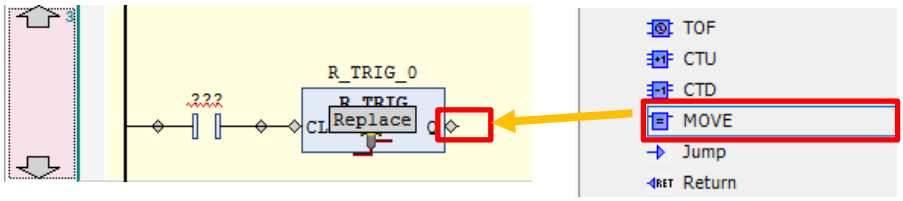
The **Auto Declare** dialog box will be displayed. Click **OK**.



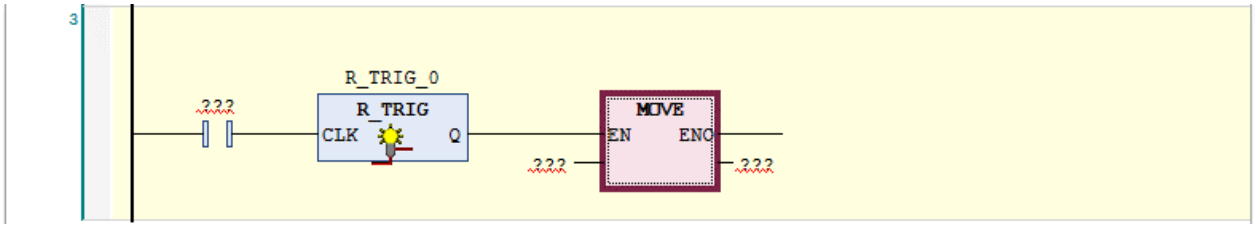
R_TRIG will be inserted.

Procedure:

Drag and drop **MOVE** from **Ladder Elements** in Toolbox to insert it into Q ◇ .

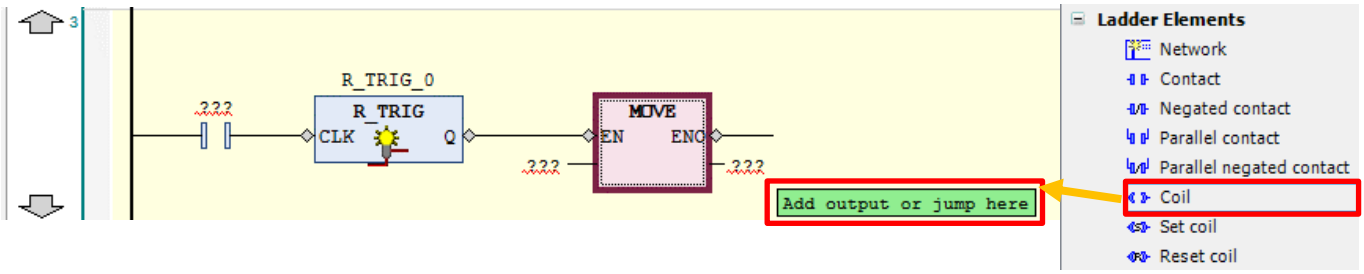


MOVE will be inserted.

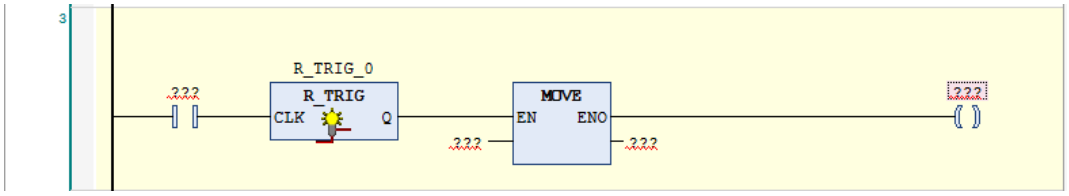


Step 8

Drag and drop **Coil** from **Ladder Elements** in Toolbox to insert it into `Add output or jump here`.



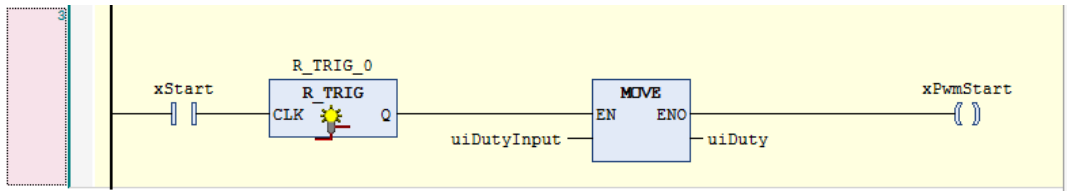
A coil will be inserted.



Step 9

Insert variables as shown in the figure below.

NO contact	xStart
MOVE input	uiDutyInput
MOVE output	uiDuty
Coil	xPwmStart



This completes the circuit for updating the set value of Ch0 output duty ratio and starting PWM output.
By transferring the value entered with "uiDutyInput" to the "uiDuty" storage area of the duty ratio set value and setting the "xPwmStart" start request bit to ON, a PWM output start request is output at the specified duty ratio.

Step 10

This completes PWM output setup and programming.
Execute build in GM Programmer and make sure that no error occurs.
Perform a download on the GM1 controller and switch the operation mode to RUN.

4 System Operation Check

Step 1

Check PWM output operation.

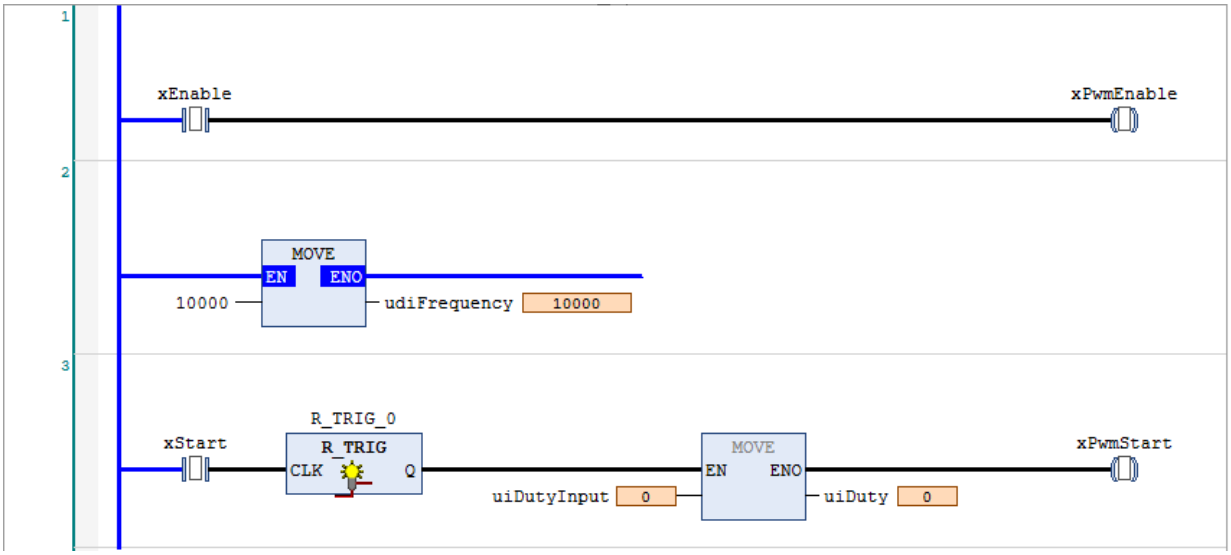
Check that one GM1 controller is in a run state and GM Programmer is in a login state.

Check that the other GM1 controller is on.

Step 2

When opening PWM_PRG in POU using GM Programmer, check that monitoring is performed as shown in the figure below.

Because **MOVE** in Network 2 is continuously executed, 10 kHz is written as the PWM frequency setting.



Step 3

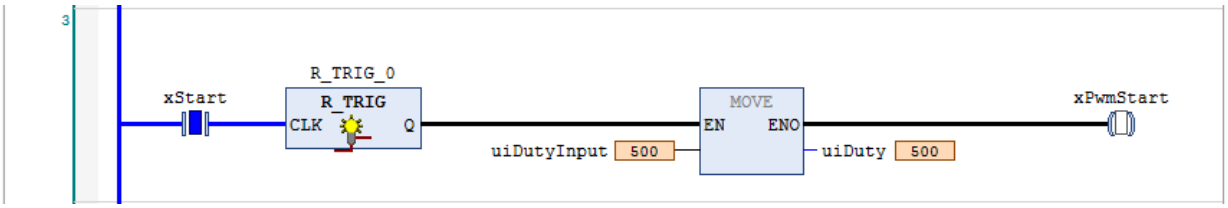
By setting **xEnable** in Network 1 to TRUE, the Ch0 enable request bit is set to ON.

At this time, PWM output has not been performed yet.

Step 4

Let's actually perform PWM output.

Enter 500 in **uiDutyInput** in Network 3 and set **xStart** to TRUE.



The duty ratio will be set to 50% and a start request will be accepted when xPwmStart (Ch0 start request bit) is set to ON during a single scan.

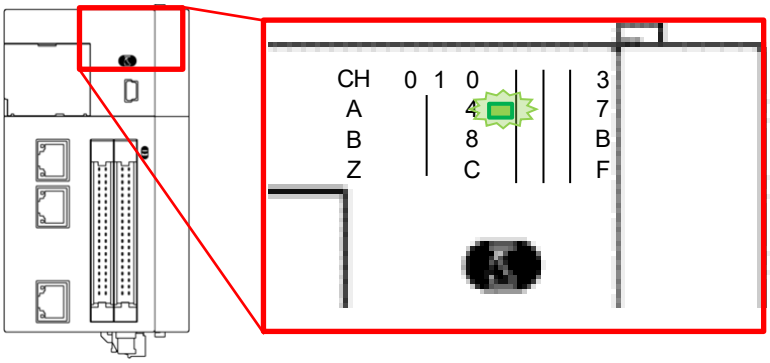
* Because the duty ratio is set in increments of 0.1%, entered value "1" is equivalent to duty ratio "0.1%".

Step 5

PWM output will be started.

Check the input LED indicator "X4" on the GM1_2 controller.

It is difficult to see the status at this time, but the LED indicator is lit with light controlled at a duty ratio of 50%.

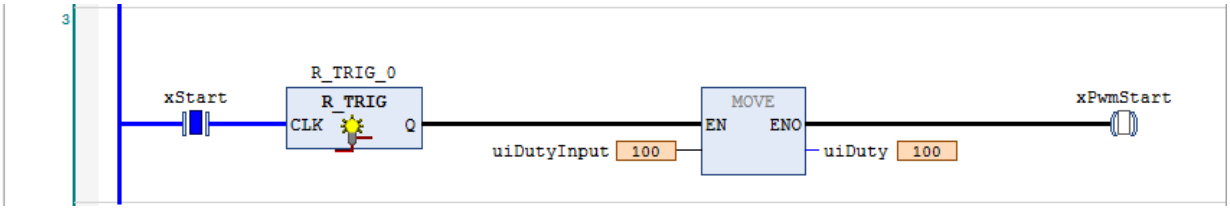


Step 6

Adjust the light intensity of the input LED indicator by changing the duty ratio.

Set **xStart** to FALSE.

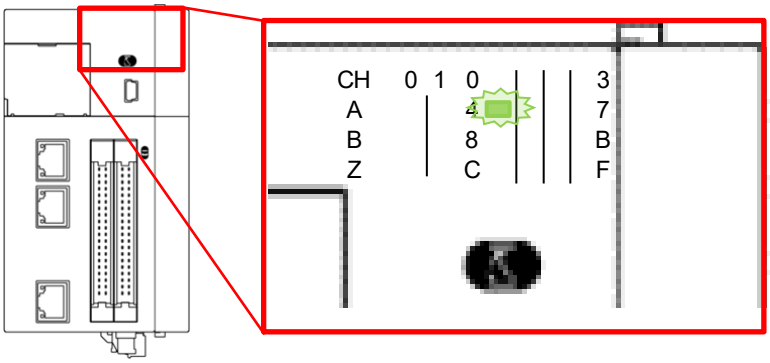
Then, enter 100 in **uiDutyInput** and set **xStart** to TRUE again.



Check the input LED indicator "X4" on the GM1_2 controller.

The LED indicator is lit with light controlled at a duty ratio of 10%.

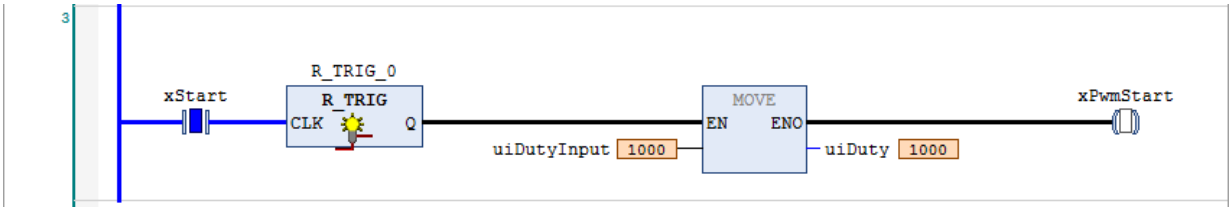
The LED indicator is lit dimly, compared to the previous one lit at a duty ratio of 50%.



Step 7

Set **xStart** to FALSE.

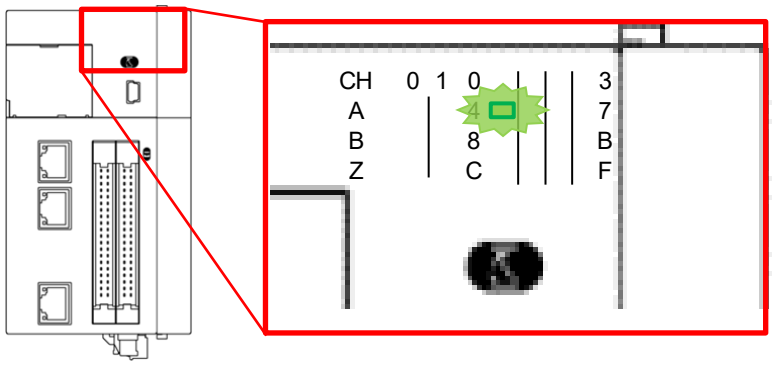
Then, enter 1000 in **uiDutyInput** and set **xStart** to TRUE again.



Check the input LED indicator "X4" on the GM1_2 controller.

The LED indicator is lit with light controlled at a duty ratio of 100%.

The LED indicator is lit brightly, compared to the previous one lit at a duty ratio of 10% or 50%.



Step 8

Stop PWM output.

Set **xEnable** in Network 1 to FALSE.

The enable request bit will be set to OFF and PWM output will be stopped.

The input LED indicator on the GM1_2 controller will also go out.

1 Basic Setup ■ High-speed Counter (HSC)

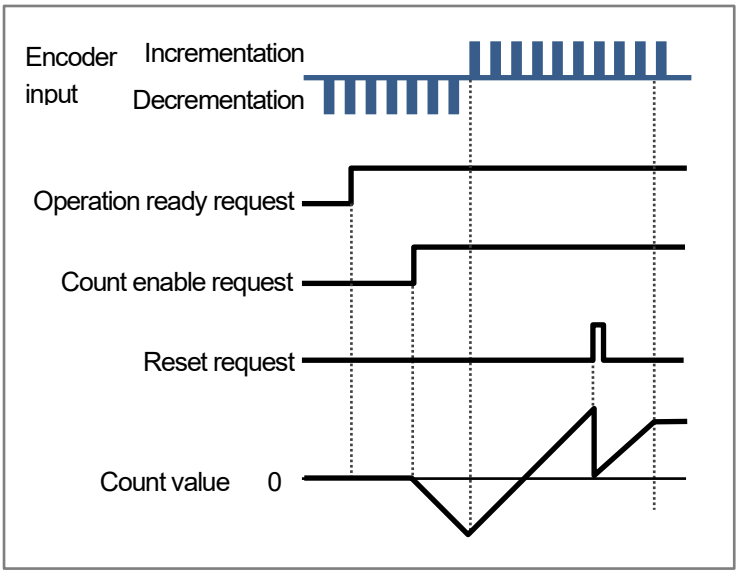
In this textbook, a line driver encoder is used to perform high-speed counter input for a single channel.

The following flags are used.

Operation ready request	Enables operation preparation for the count function
Count enable request	Enables count operation
Reset request	Resets the count value
Count value	Indicates a count value

1.1 Behavior Overview

Use the above flags to check behaviors of the high-speed counter as shown below.



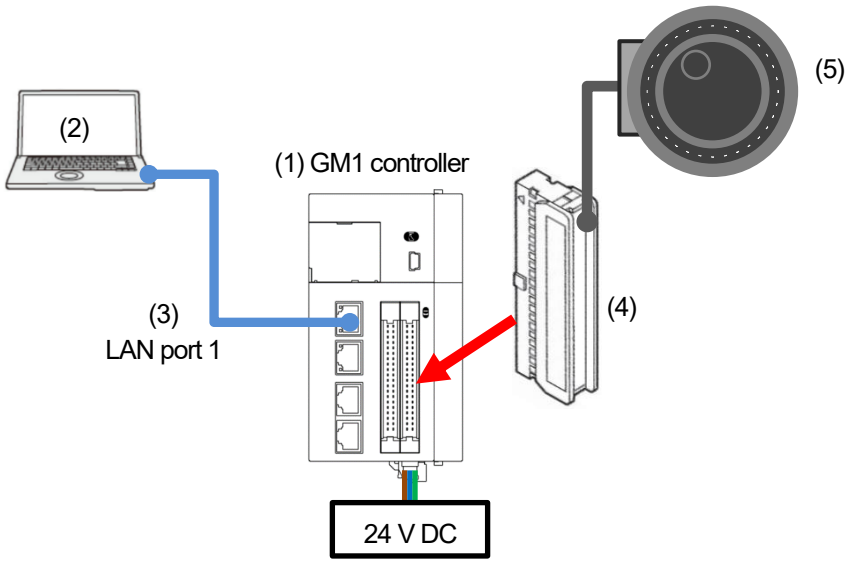
1.2 Preparing and Wiring the Required Devices

Prepare the following devices.

No.	Name
(1)	GM1 controller
(2)	PC (with GM Programmer installed)
(3)	LAN cable
(4)	Discrete-wire connector
(5)	Encoder

* In this textbook, an EtherCAT type GM1 controller is used, but there is no difference in high-speed counter input specifications between EtherCAT type and RTEX type GM1 controllers.

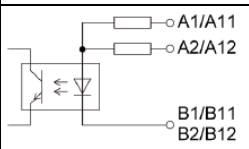
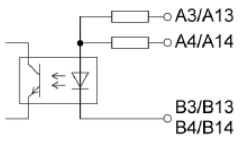
Wire each device as shown below.



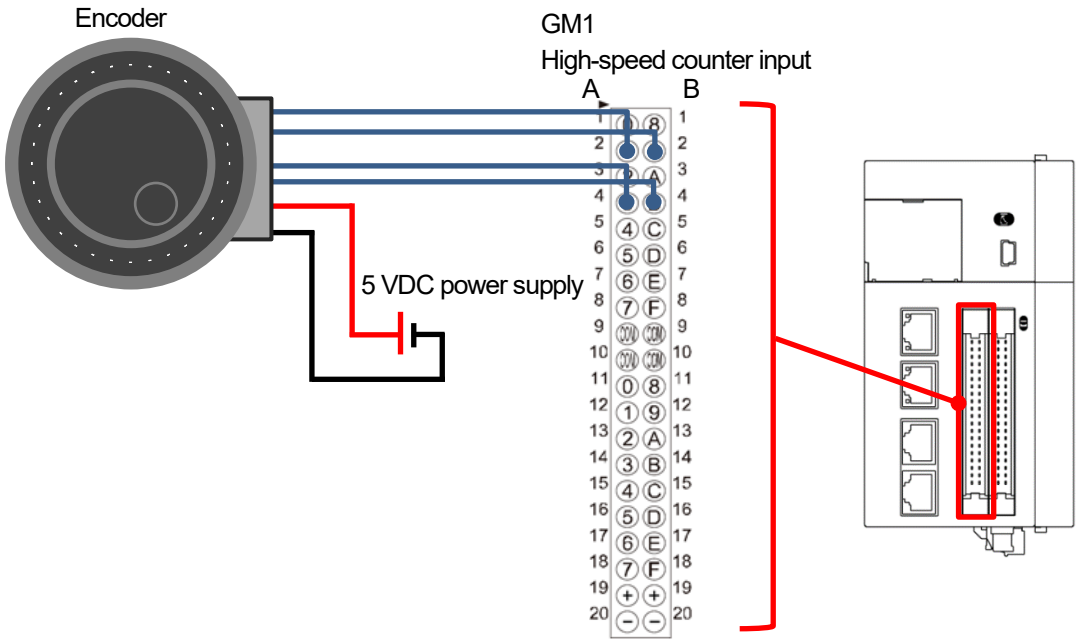
The GM1 controller uses high-speed counter input terminals to receive inputs from the high-speed counter.
The line driver requires 5 VDC power supply. (Reference: The 5 V power supply of the FP0H CMO0 terminal can be used.)

The high-speed counter input terminals for the encoder and GM1 controller are wired as below.

Encoder wire allocation	
Encoder A (positive phase)	A2 terminal
Encoder A (negative phase)	B2 terminal
Encoder B (positive phase)	A4 terminal
Encoder B (negative phase)	B4 terminal
Encoder 5 V	FP0H COM0 terminal 5 V
Encoder 0 V	FP0H COM0 terminal 0 V

Pin No.			
Ch0	Ch1		
A1	A11		Input A: 24 V DC (12 to 24 V DC)
A2	A12		**Input A: 5 V DC (3.5 to 5 V DC)**
B1	B11		Input A: COM
B2	B12		**Input A: COM**
A3	A13		Input B: 24 V DC (12 to 24 V DC)
A4	A14		**Input B: 5 V DC (3.5 to 5 V DC)**
B3	B13		Input B: COM
B4	B14		**Input B: COM**

■ Wiring diagram example

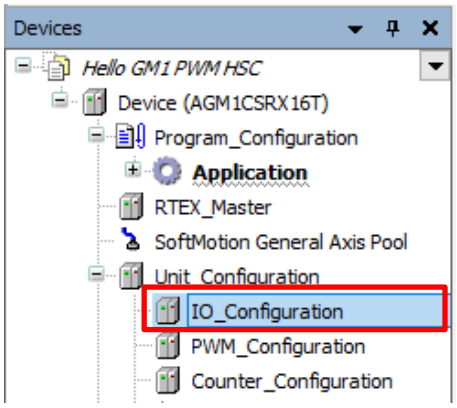


2 High-speed Counter Settings

2.1 IO_Configuration Settings

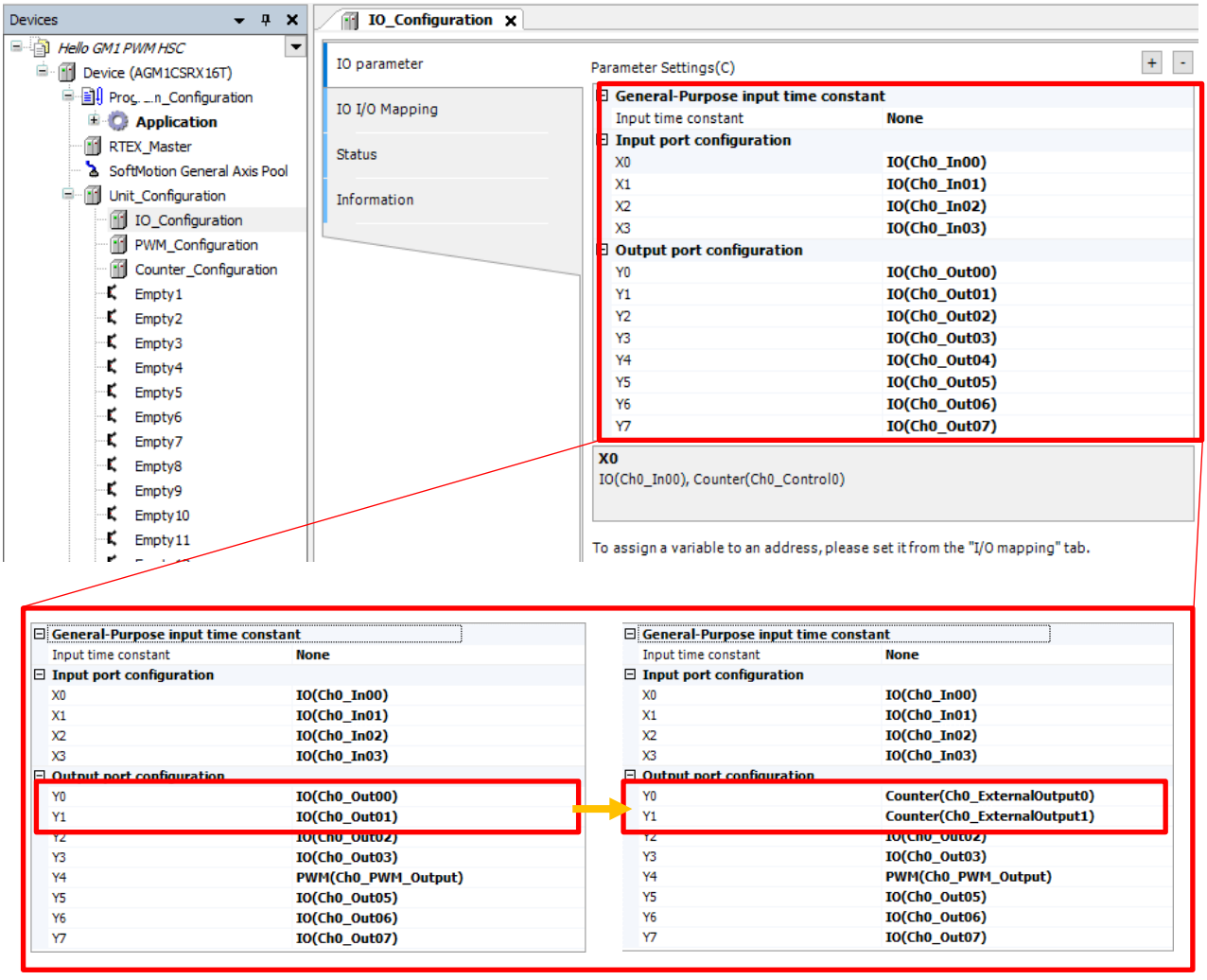
Step 1

By default, general-purpose I/O connectors for the GM1 controller are allocated to normal I/O. Therefore, change the settings.
Double-click **Device**, **Unit_Configuration**, and then **IO_Configuration**.



Step 2

In the **IO parameter** tab, change settings in **Output port configuration**.
Click **Y0** and change the setting from **IO(Ch0_Out00)** to **Counter(Ch0_ExternalOutput0)**.
Click **Y1** and change the setting from **IO(Ch0_Out01)** to **Counter(Ch0_ExternalOutput1)**.

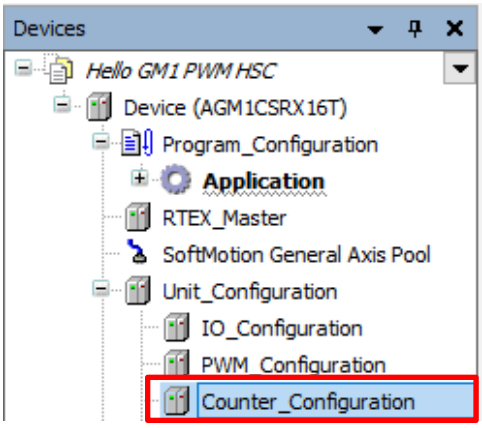


2.2 Counter_Configuration Settings

Step 1

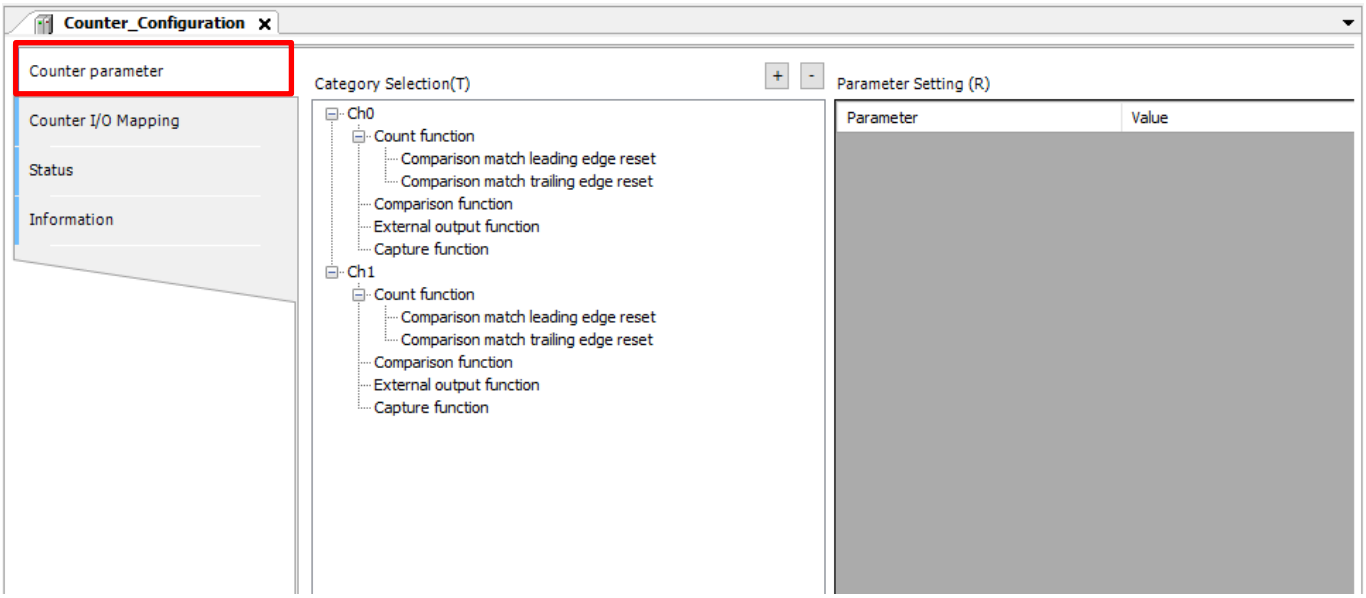
Configure advanced settings for the high-speed counter.

Double-click **Device**, **Unit_Configuration**, and then **Counter_Configuration**.



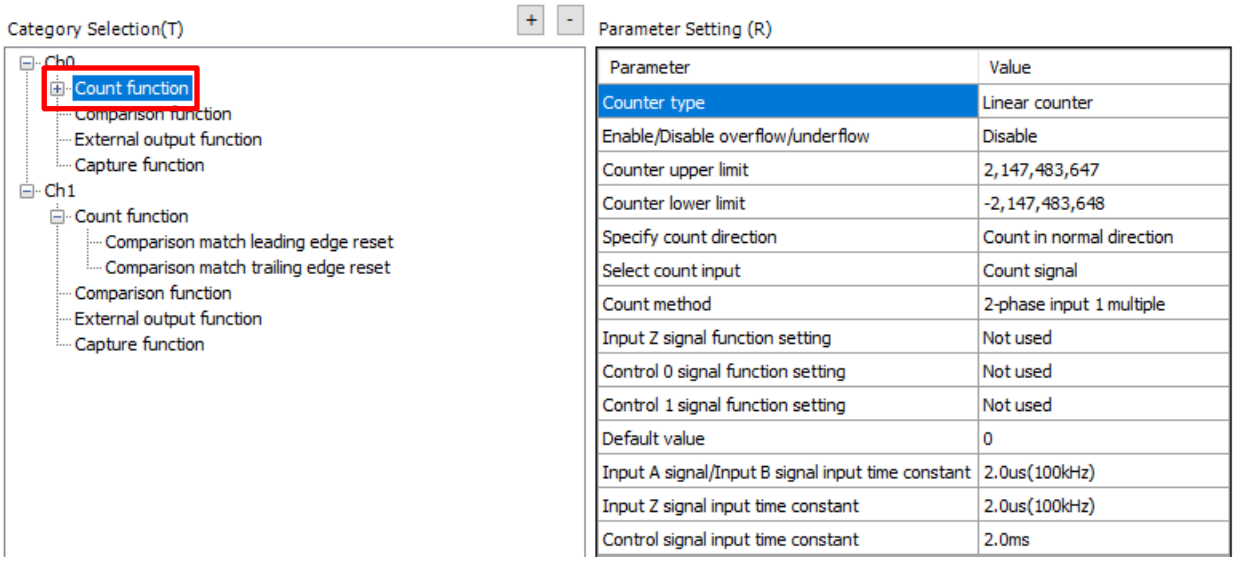
Step 2

The **Counter_Configuration** window will open. Select the **Counter parameter** tab.



Step 3

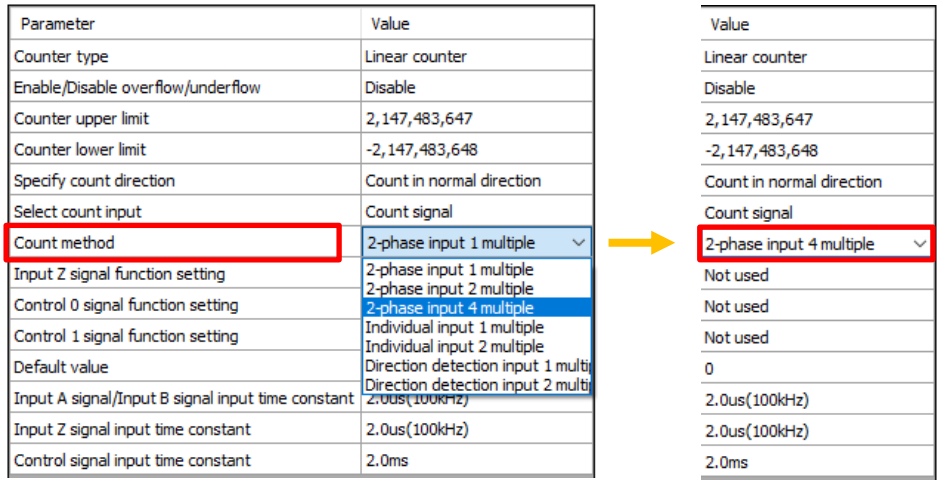
Select **Ch0** and then **Count function** to open the **Parameter Setting** pane shown below.



Parameter	Value
Counter type	Linear counter
Enable/Disable overflow/underflow	Disable
Counter upper limit	2,147,483,647
Counter lower limit	-2,147,483,648
Specify count direction	Count in normal direction
Select count input	Count signal
Count method	2-phase input 1 multiple
Input Z signal function setting	Not used
Control 0 signal function setting	Not used
Control 1 signal function setting	Not used
Default value	0
Input A signal/Input B signal input time constant	2.0us(100kHz)
Input Z signal input time constant	2.0us(100kHz)
Control signal input time constant	2.0ms

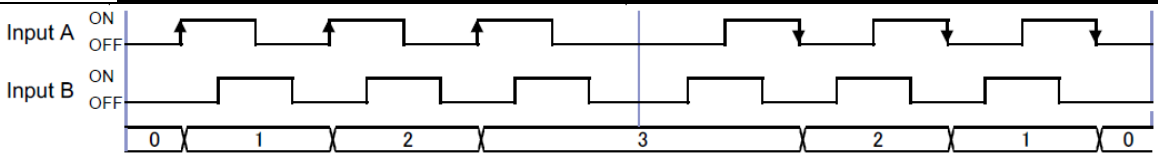
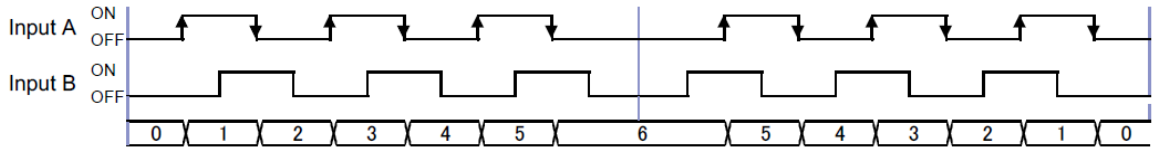
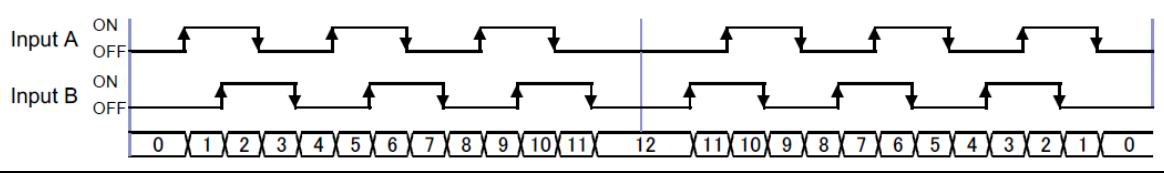
Step 4

Change the value of **Count method** in the **Parameter** column to **2-phase input 4 multiple**.



INFO

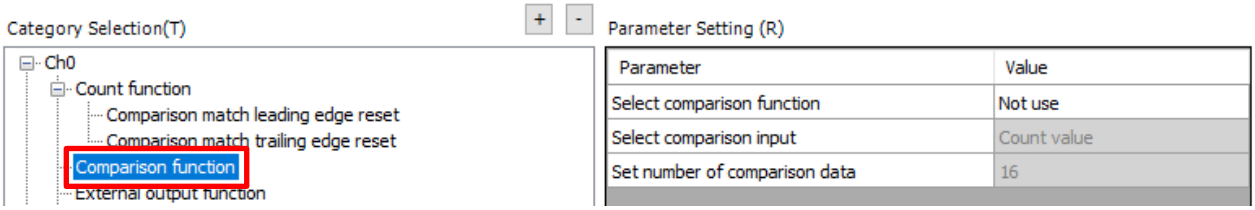
■ Count operation of 2-phase input (phase difference input)

Multiplication	Timing chart
Multiply by 1	
Multiply by 2	
Multiply by 4	

Step 5

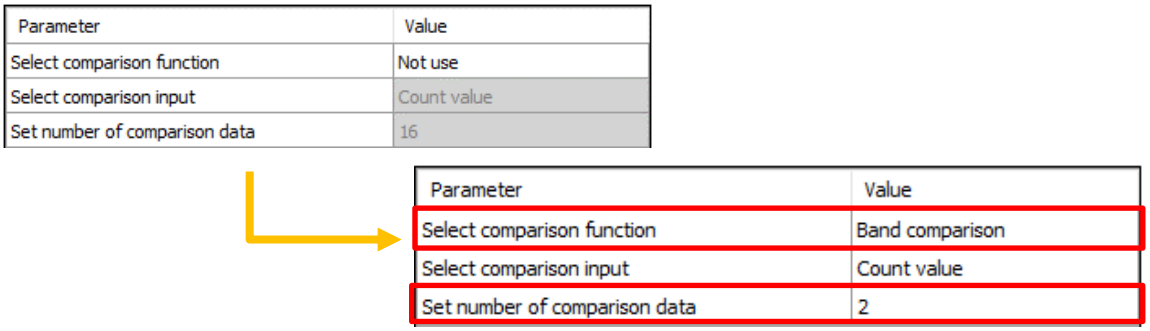
Configure settings to use the comparison function of the high-speed counter.
In this textbook, configure settings to set the comparison match output 1 flag to ON when the count value is between 100 and 200 and to set the comparison match output 2 flag to ON when the count value is between 300 and 400.

Select **Ch0** and then **Comparison function** to open the **Parameter Setting** pane shown below.
Here, configure basic settings for the comparison function.

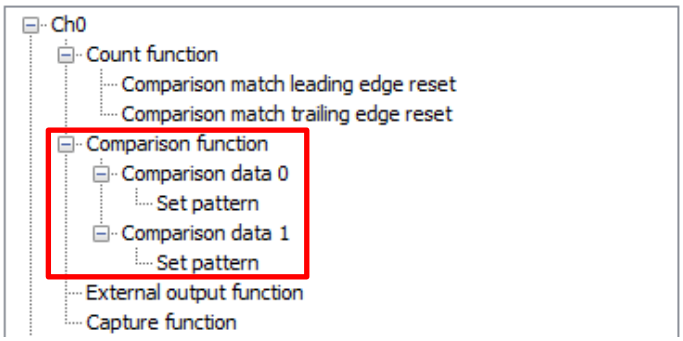


Step 6

Select **Band comparison** for **Select comparison function**.
Enter 2 for **Set number of comparison data**.

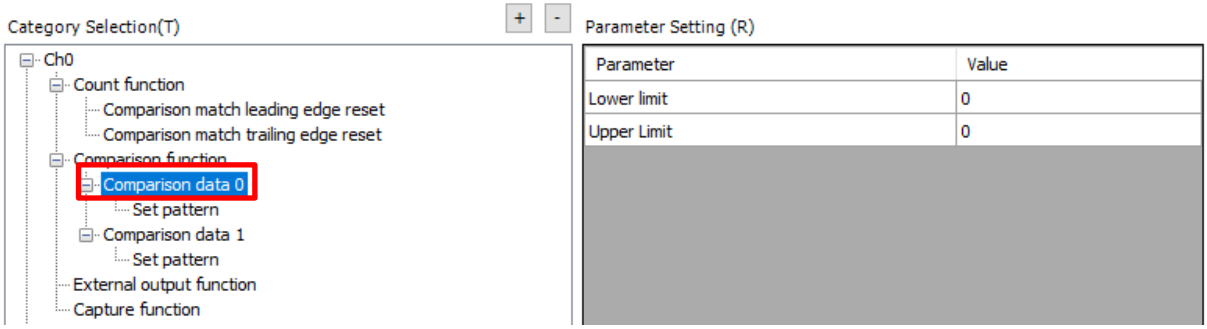


In **Comparison function**, setting items for the value entered in **Set number of comparison data** will be added.
Here, two setting items "Comparison data 0" and "Comparison data 1" will be added.



Step 7

Configure settings for each comparison data item.
Select **Ch0**, **Comparison function**, and then **Comparison data 0** to open the **Parameter Setting** pane shown below.
Here, configure settings for band comparison.



Step 8

Enter 100 for **Lower limit** and 200 for **Upper limit**.

Parameter	Value
Lower limit	100
Upper Limit	200

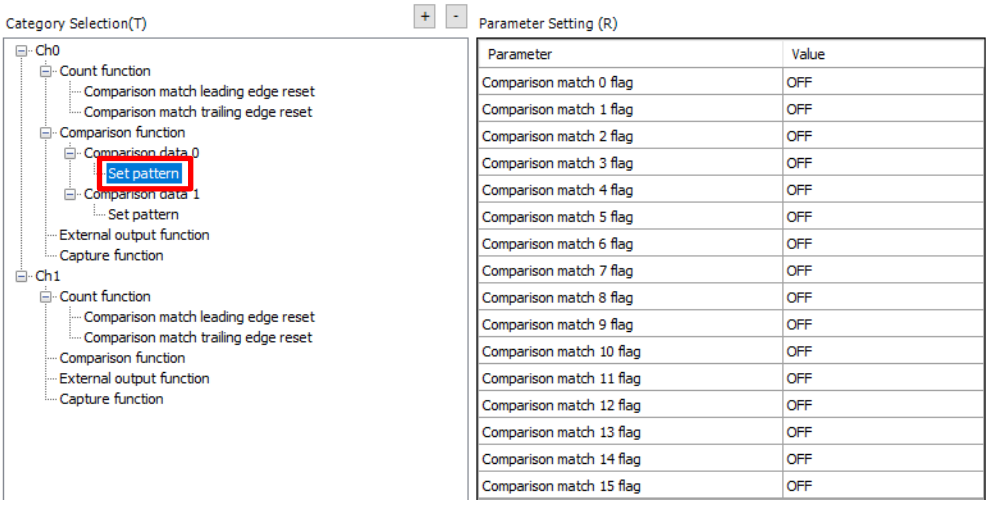
* If a lower limit value and upper limit value are entered in this order, a warning mark will be displayed as shown below. However, if a lower limit value is entered again or the **Counter_Configuration** window is temporarily closed, the mark will disappear automatically.

Parameter	Value
Lower limit	100
Upper Limit	200

Step 9

Set up comparison match flags.

Select **Ch0**, **Comparison function**, **Comparison data 0**, and then **Set pattern** to open the **Parameter Setting** pane shown below.



Parameter	Value
Comparison match 0 flag	OFF
Comparison match 1 flag	OFF
Comparison match 2 flag	OFF
Comparison match 3 flag	OFF
Comparison match 4 flag	OFF
Comparison match 5 flag	OFF
Comparison match 6 flag	OFF
Comparison match 7 flag	OFF
Comparison match 8 flag	OFF
Comparison match 9 flag	OFF
Comparison match 10 flag	OFF
Comparison match 11 flag	OFF
Comparison match 12 flag	OFF
Comparison match 13 flag	OFF
Comparison match 14 flag	OFF
Comparison match 15 flag	OFF

Step 10

Of comparison match flags that can be selected, only "Comparison match 0 flag" and "Comparison match 1 flag" can be used for external output.

"Comparison match 0 flag" is assigned to output "Y0" and "Comparison match 1 flag" is assigned to output "Y1".

Set "Comparison match 0 flag" to ON.

Parameter	Value
Comparison match 0 flag	ON
Comparison match 1 flag	OFF

Step 11

For "Comparison data 1", configure settings in the same way as above.

Select **Ch0**, **Comparison function**, and then **Comparison data 1** and specify a lower limit value and upper limit value.

Enter 300 for **Lower limit** and 400 for **Upper limit**.

Parameter	Value
Lower limit	300
Upper Limit	400

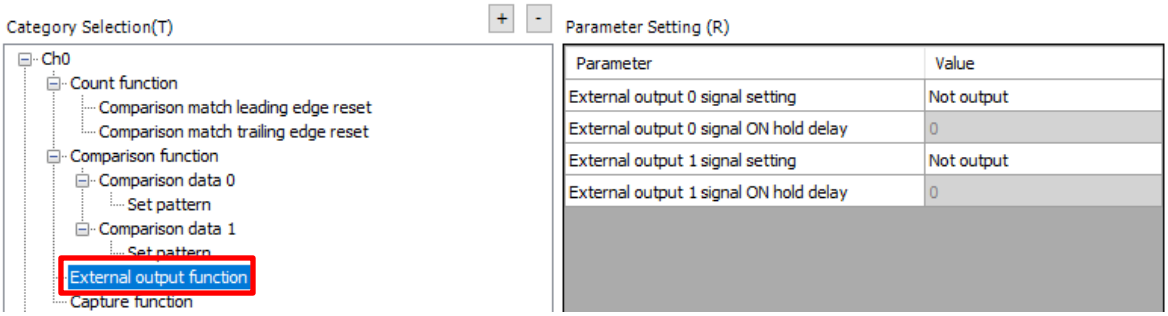
Select **Ch0**, **Comparison function**, **Comparison data 1**, and then **Set pattern** and select "Comparison match 1 flag".

Set "Comparison match 1 flag" to ON.

Parameter	Value
Comparison match 0 flag	OFF
Comparison match 1 flag	ON

Step 12

Select **Ch0** and then **External output function** to open the **Parameter Setting** pane shown below.



Step 13

Set **External output 0 signal setting** to **Output**.

Set **External output 1 signal setting** to **Output**.

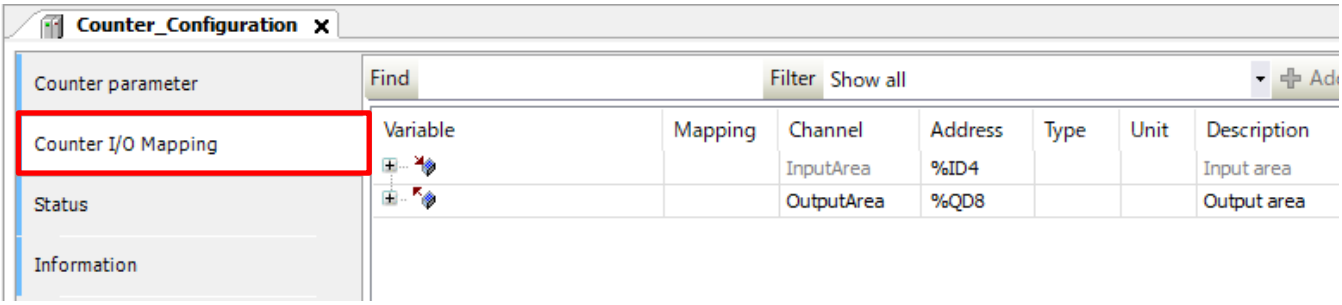
Parameter	Value
External output 0 signal setting	Output
External output 0 signal ON hold delay	0
External output 1 signal setting	Output
External output 1 signal ON hold delay	0

By setting **External output 0 signal ON hold delay** or **External output 1 signal ON hold delay** to **0**, the external output signal is left ON while the comparison match conditions are satisfied.

Step 14

Register variables required for high-speed counter input control.

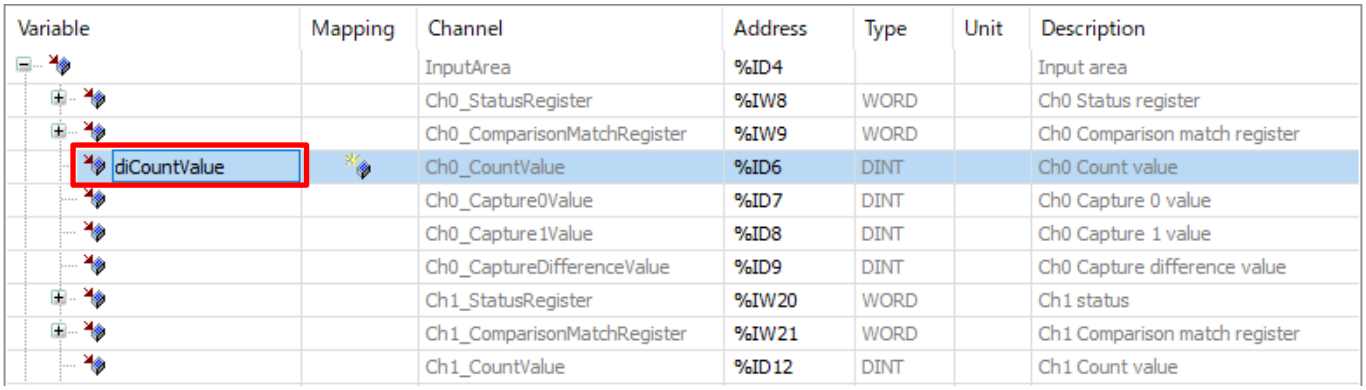
In the **Counter_Configuration** window, select the **Counter I/O Mapping** tab.



Step 15

Register the following variable in the input area.

Variable	Channel	Description
diCountValue	Ch0_CountValue	Ch0 count value

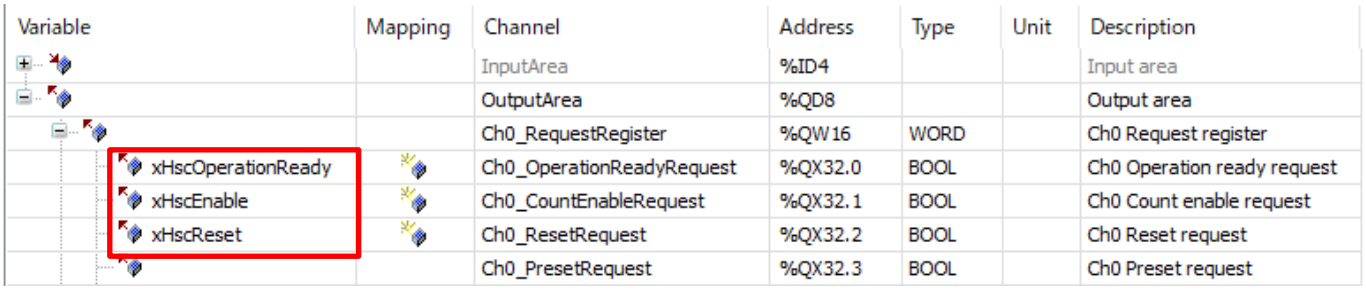


Variable	Mapping	Channel	Address	Type	Unit	Description
		InputArea	%ID4			Input area
		Ch0_StatusRegister	%IW8	WORD		Ch0 Status register
		Ch0_ComparisonMatchRegister	%IW9	WORD		Ch0 Comparison match register
diCountValue		Ch0_CountValue	%ID6	DINT		Ch0 Count value
		Ch0_Capture0Value	%ID7	DINT		Ch0 Capture 0 value
		Ch0_Capture1Value	%ID8	DINT		Ch0 Capture 1 value
		Ch0_CaptureDifferenceValue	%ID9	DINT		Ch0 Capture difference value
		Ch1_StatusRegister	%IW20	WORD		Ch1 status
		Ch1_ComparisonMatchRegister	%IW21	WORD		Ch1 Comparison match register
		Ch1_CountValue	%ID12	DINT		Ch1 Count value

Step 16

Register the following variables in the output area.

Variable	Channel	Description
xHscOperationReady	Ch0_OperationReadyRequest	Ch0 operation ready request
xHscEnable	Ch0_CountEnableRequest	Ch0 count enable request
xHscReset	Ch0_ResetRequest	Ch0 reset request



Variable	Mapping	Channel	Address	Type	Unit	Description
		InputArea	%ID4			Input area
		OutputArea	%QD8			Output area
		Ch0_RequestRegister	%QW16	WORD		Ch0 Request register
xHscOperationReady		Ch0_OperationReadyRequest	%QX32.0	BOOL		Ch0 Operation ready request
xHscEnable		Ch0_CountEnableRequest	%QX32.1	BOOL		Ch0 Count enable request
xHscReset		Ch0_ResetRequest	%QX32.2	BOOL		Ch0 Reset request
		Ch0_PresetRequest	%QX32.3	BOOL		Ch0 Preset request

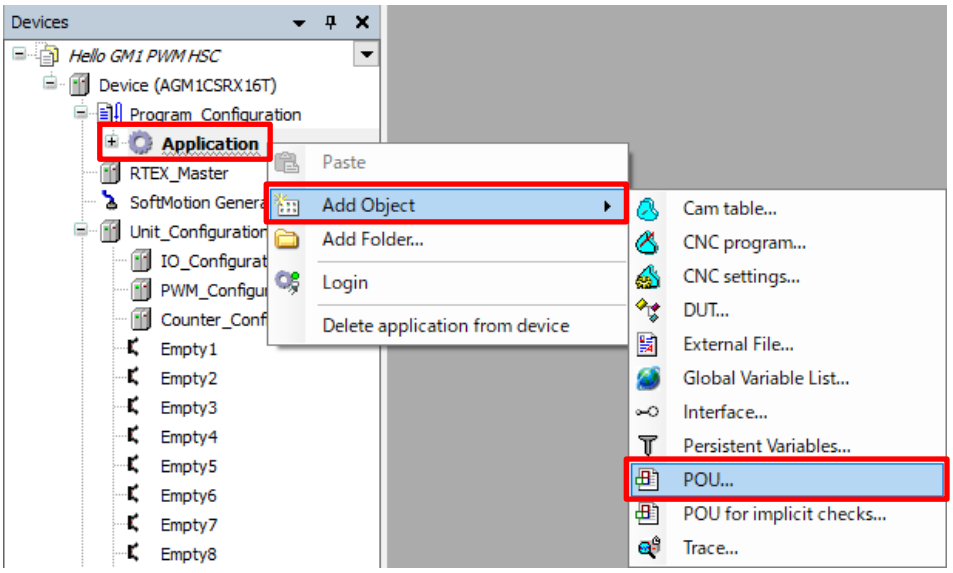
3 Programming

3.1 Adding New POU

Step 1

Create a program for high-speed counter control.

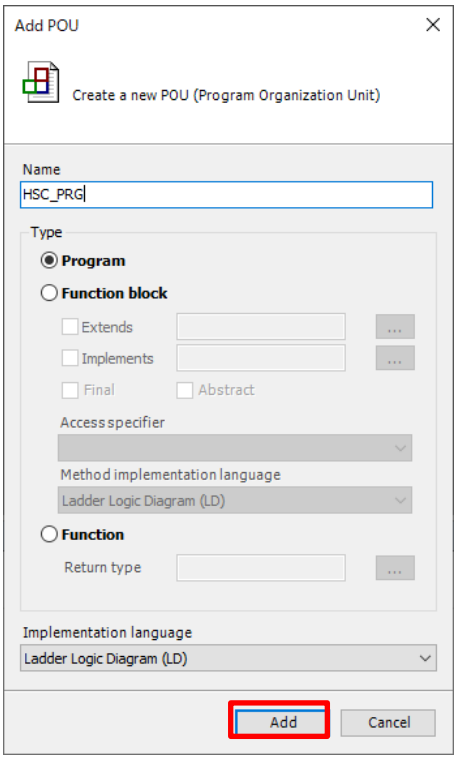
Right-click **Application** and select **Add Object** and then **POU** to create a new POU.



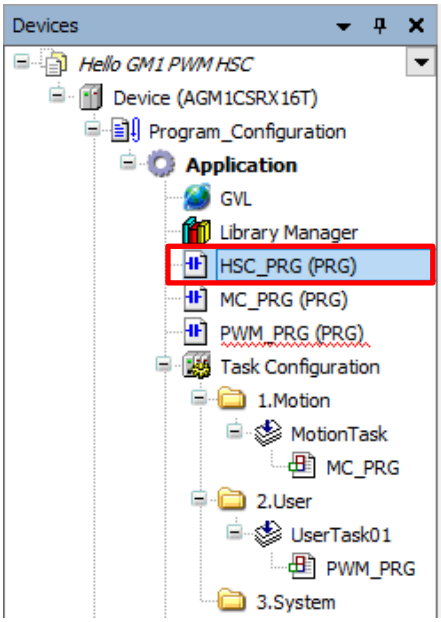
Step 2

In the **Add POU** dialog box, specify settings as below and click **Add**.

Name	HSC_PRG
Type	Program
Implementation language	Ladder Logic Diagram (LD)

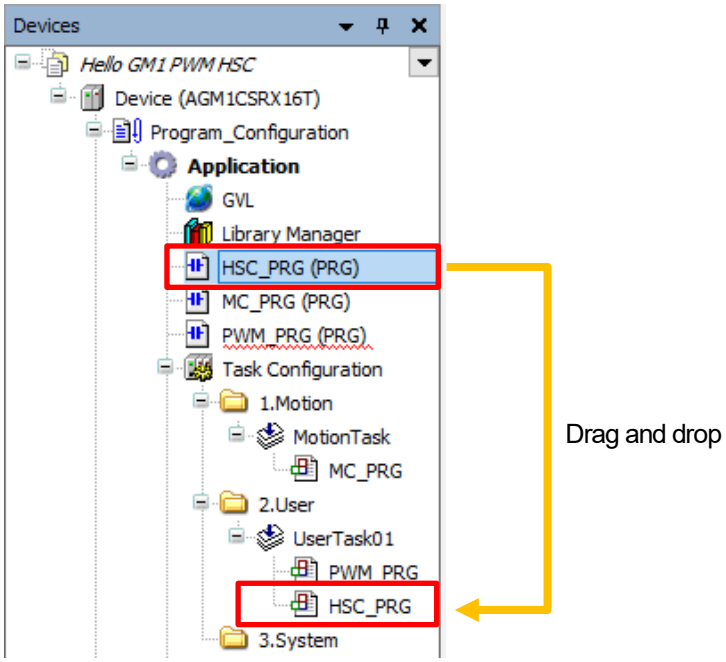


HSC_PRG (PRG) will be added to **Application**.



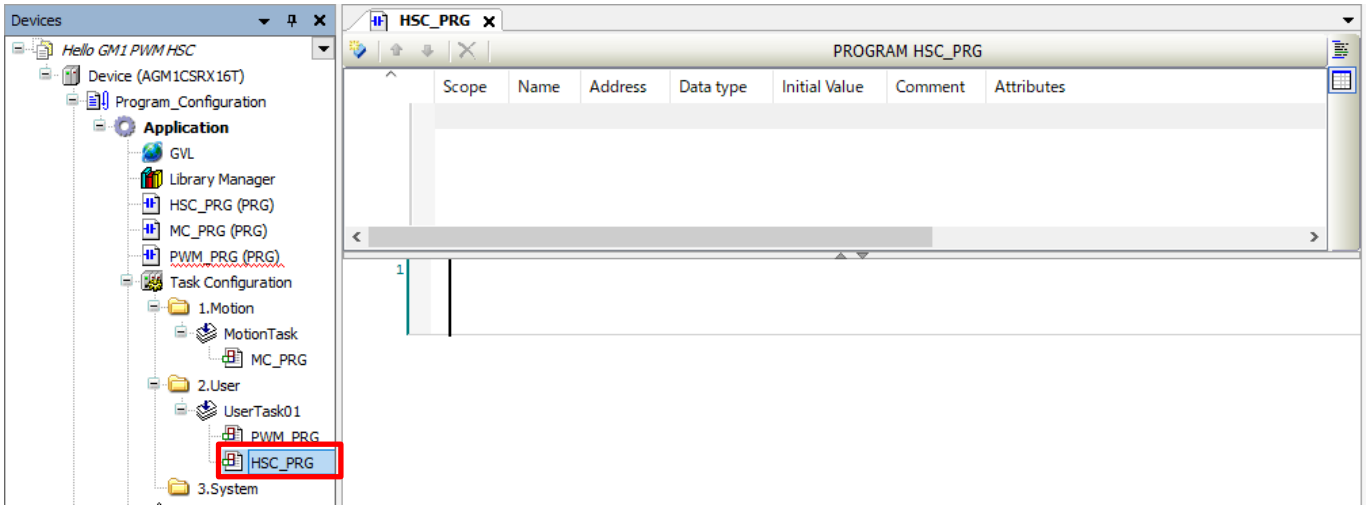
Step 3

Drag and drop the **HSC_PRG (PRG)** object added in Step 2 into **2.User** in **Task_Configuration** to add it to the task.



Step 4

Double-click **HSC_PRG** to open the program pane.

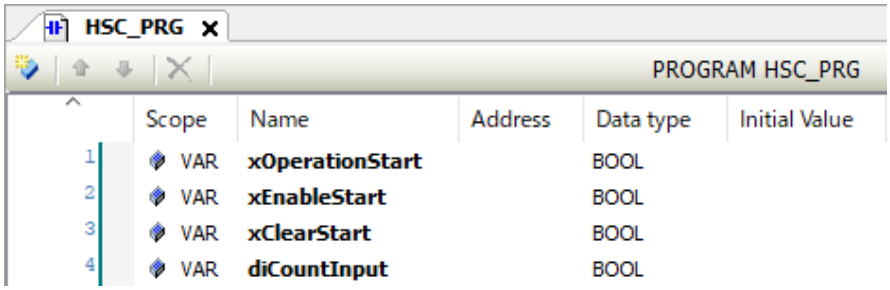


3.2 Programming

Step 1

Add local variables.

Name	Data type
xOperationStart	BOOL
xEnableStart	BOOL
xClearStart	BOOL
diCountInput	DINT



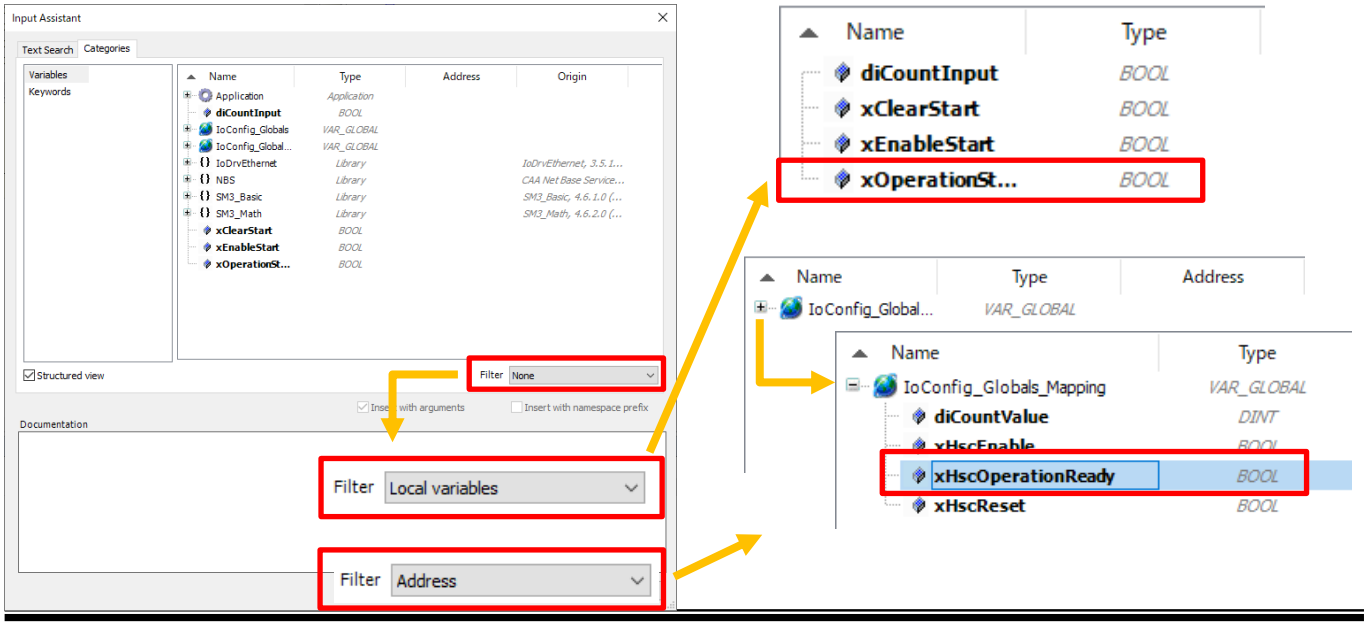
Step 2

Insert a normally open (NO) contact and coil into Network 1.

Step 3

Use the **Input Assistant** dialog box to enter "xOperationStart" into the "**???**" position representing an NO contact.
Use the **Input Assistant** dialog box to enter "xHscOperationReady" into the "**???**" position representing a coil.

This completes the circuit for outputting an operation request to Ch0.



Step 4

Insert Network 2 and then insert an NO contact and coil.

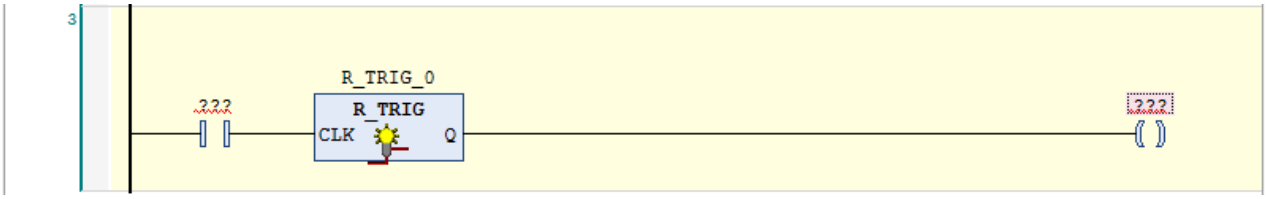
Step 5

Use the **Input Assistant** dialog box to enter "xEnableStart" into the "**???**" position representing an NO contact.
Use the **Input Assistant** dialog box to enter "xHscEnable" into the "**???**" position representing a coil.

This completes the circuit for outputting an enable request to Ch0.

Step 6

Insert Network 3 and then insert an NO contact, coil and R_TRIG.
The variable name of R_TRIG is the default name in the **Auto Declare** dialog box.



Step 7

Use the **Input Assistant** dialog box to enter "xClearStart" into the "**???**" position representing an NO contact.
Use the **Input Assistant** dialog box to enter "xHscReset" into the "**???**" position representing a coil.

This completes the circuit for outputting a clear request to Ch0.

Step 8

Insert Network 4 and then insert **MOVE**.

Step 9

Delete the NO contact.

Use the **Input Assistant** dialog box to enter "diCountValue" into the "**???**" position representing an input.

Use the **Input Assistant** dialog box to enter "diCountInput" into the "**???**" position representing an output.

This completes the circuit for reading a count value from Ch0.

Step 10

This completes high-speed counter setup and programming.

Execute build in GM Programmer and make sure that no error occurs.

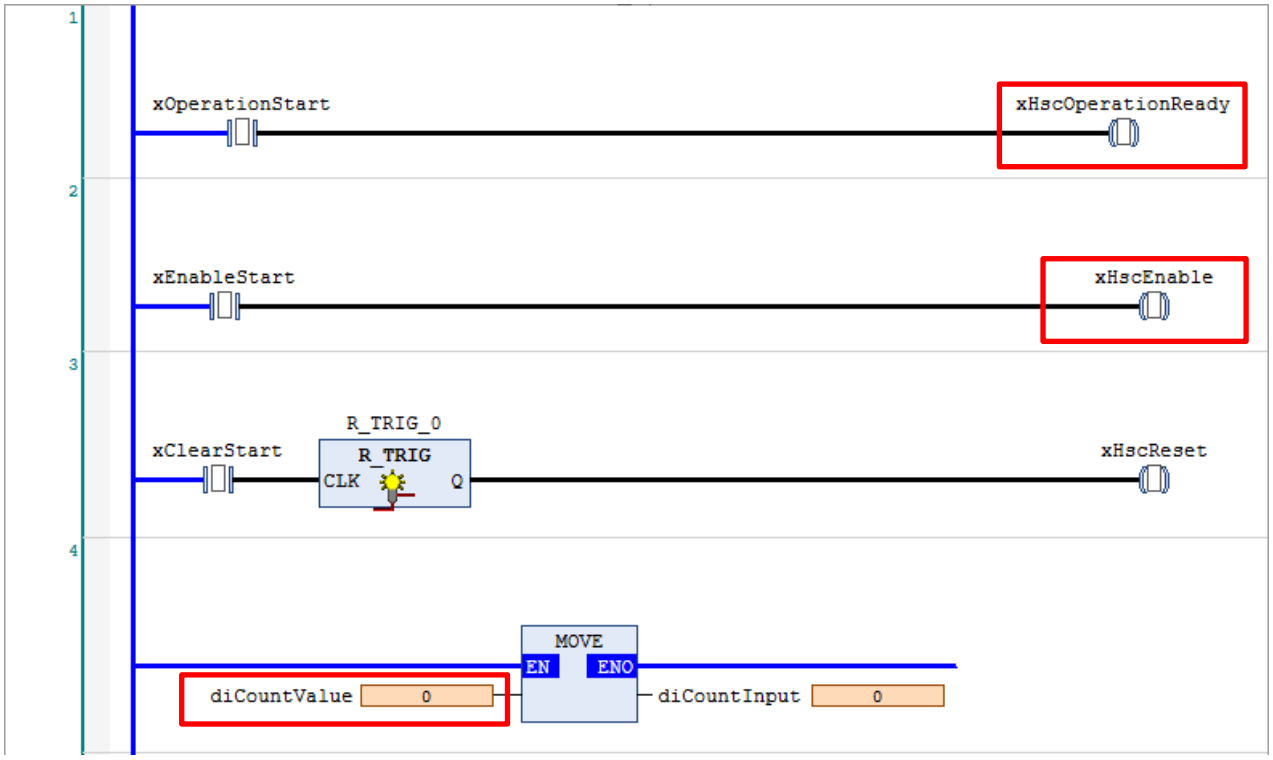
Perform a download on the GM1 controller and switch the operation mode to RUN.

4 System Operation Check

Step 1

Check that the GM1 controller is in a run state and GM Programmer is in a login state.

When opening HSC_PRG in POU using GM Programmer, check that monitoring is performed as shown in the figure below. Because MOVE in Network 4 is continuously executed, count values are continuously read. However, in the figure below, the values are set to 0 because count operation has not started.



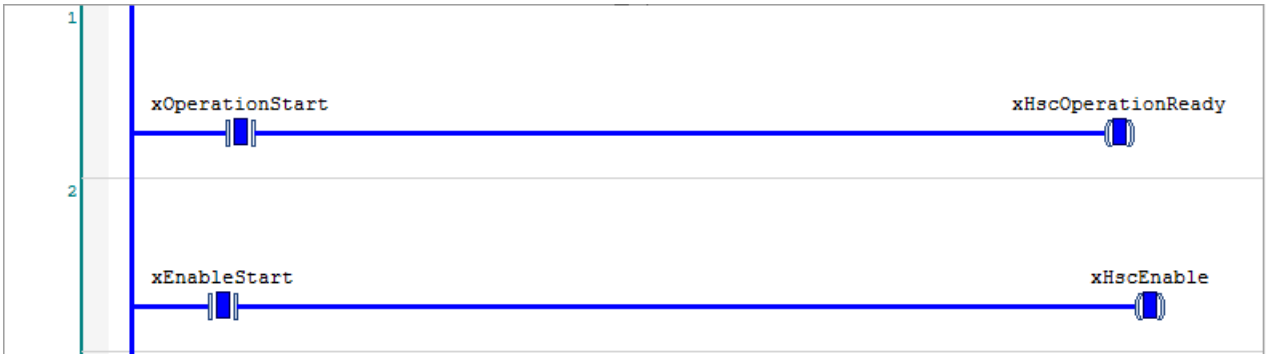
Even if the encoder is rotated in this situation, because the "Operation ready request" bit and "Count enable request" bit are set to OFF, any input from the encoder will not be accepted and the count values will not change.

Step 2

Set **xOperationStart** and **xEnableStart** to TRUE.

Setting **xOperationStart** in Network 1 to TRUE sets the Ch0 operation request bit to ON, making the count function ready for operation. At this time, the count function does not accept any inputs from the encoder.

Setting **xEnableStart** in Network 2 to TRUE sets the Ch0 count enable input bit to ON, making the count function ready for operation and accept inputs from the encoder.



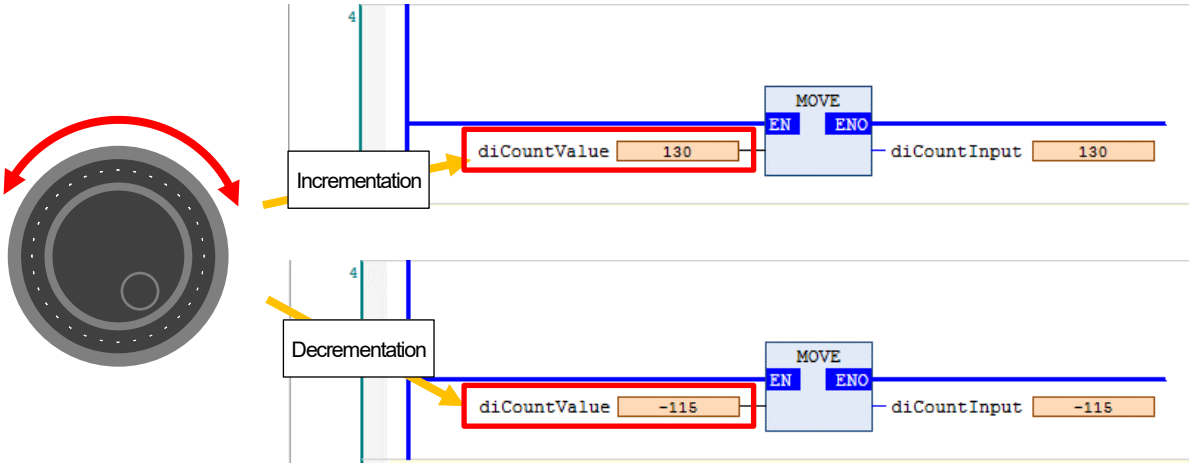
Step 3

Let's actually rotate the encoder and check high-speed counter operation.

◆Checking count operation

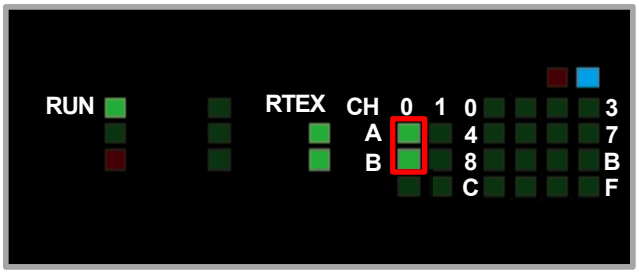
You can check that the count value increments and decrements by rotating the encoder counterclockwise and clockwise, respectively.

Let's actually check the count value (the value of **diCountValue**).



◆Checking the phase-A and phase-B indicators on GM1 controller

Check that LEDs A and B on the GM1 controller turn ON and OFF by rotating the encoder counterclockwise and clockwise, respectively.



Because "2-phase input 4 multiple" is set, check that count operation is performed as below.

1 count when phase-A indicator turns ON

1 count when phase-B indicator turns ON

1 count when phase-A indicator turns OFF

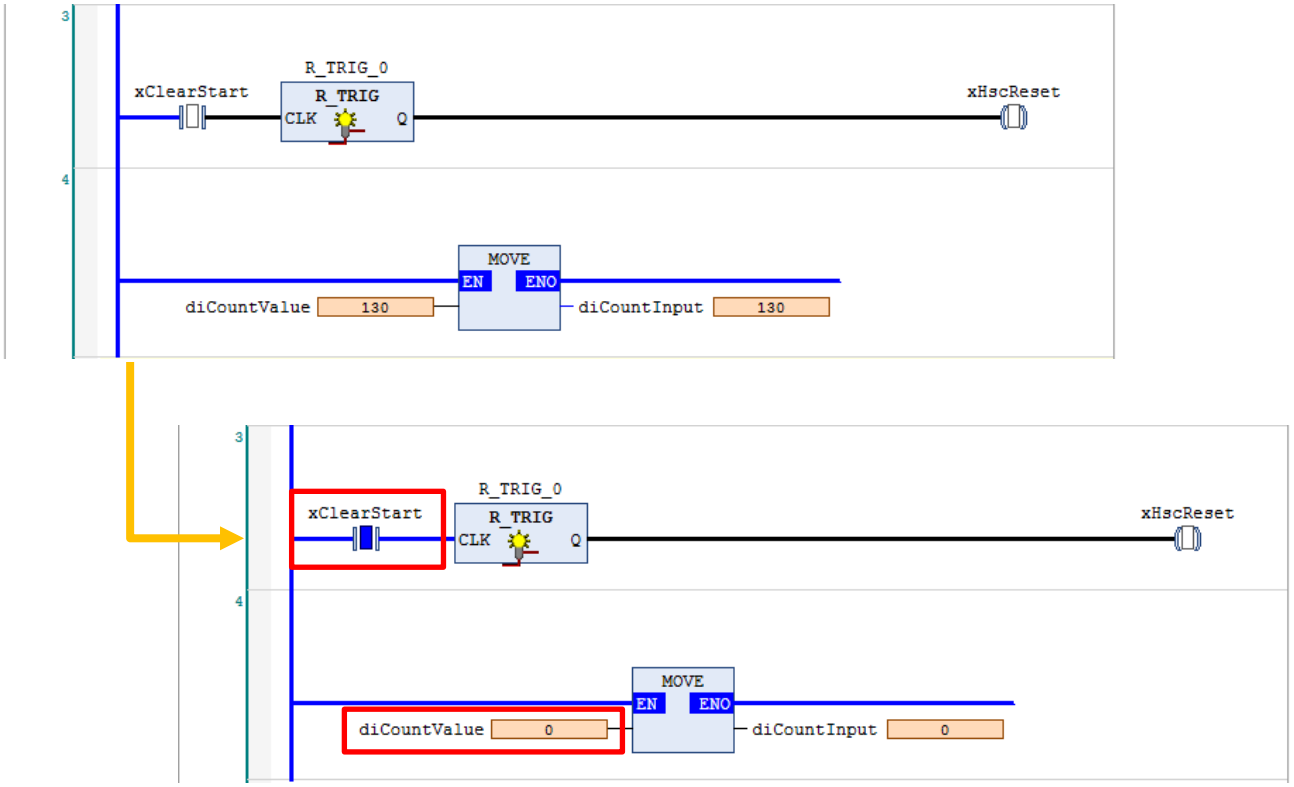
1 count when phase-B indicator turns OFF

Step 4

◆Checking reset operation

A request to clear the count value can be issued by setting **xClearStart** in Network 3 to TRUE.

Let's check the count value by setting **xClearStart** to TRUE.



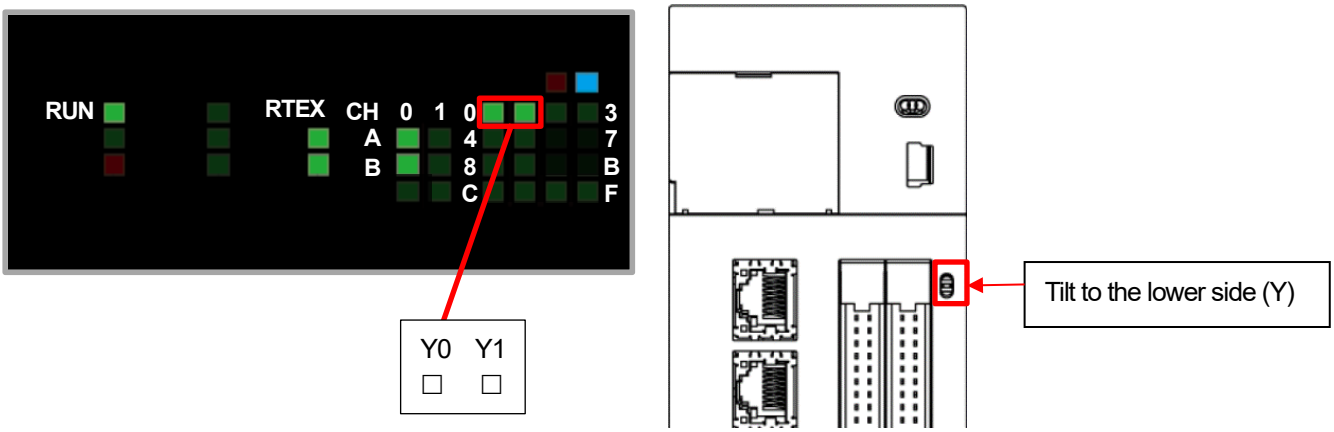
After checking is complete, set **xClearStart** to FALSE.

Step 5

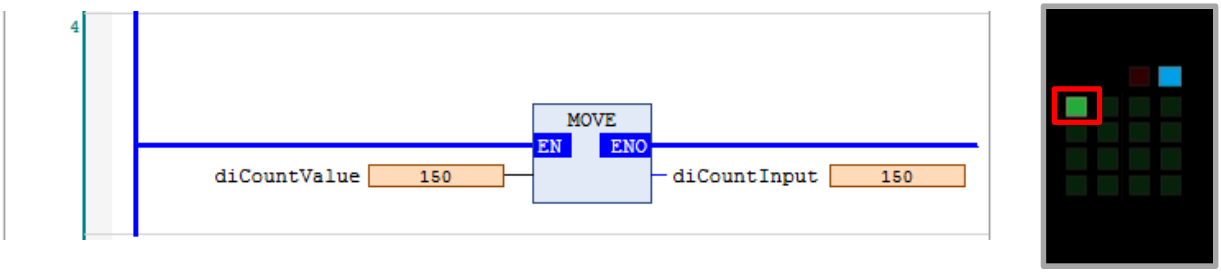
◆Checking comparison match output

Check that Y0 turns ON as comparison match output 1 when the count value is between 100 and 200 and Y1 turns ON as comparison match output 2 when the count value is between 300 and 400.

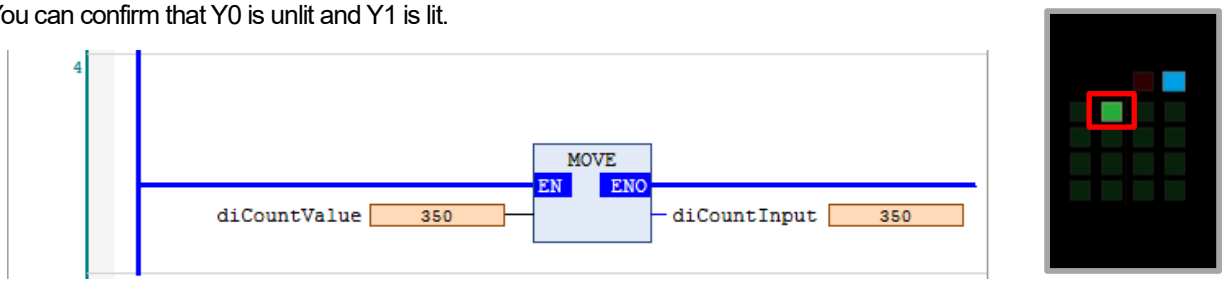
Use the status LED indicators to check the ON/OFF status of Y0 and Y1.
Switch the setting of the LED display changeover switch and make sure that it is set to output display mode.



Rotate the encoder and check the status LED indicator when the count value is between 100 and 200.
You can confirm that Y0 is lit.



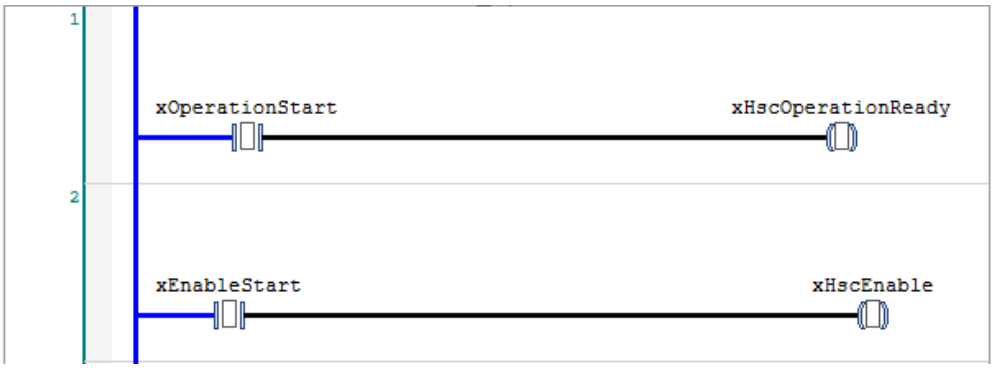
Rotate the encoder and check the status LED indicator when the count value is between 300 and 400.
You can confirm that Y0 is unlit and Y1 is lit.



Step 6

Stop the counter.

Set **xOperationStart** in Network 1 and **xEnableStart** in Network 2 to FALSE.



The operation request and enable request bits will be set to OFF and counter operation will be stopped.

Then, even if the encoder is rotated, the count value will not be updated.

Memo

Revision History

Date of issue	Manual code	Revision details
April 2022	AIM0012_01	First edition

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