OMRON

Machine Automation Controller NX-series

Application Guide
High-speed Counter Units for Filling Control

NX-CT□□□□

SYSMAC always in control

P175-E1-02

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Introduction

The NX-series High-speed Counter Unit Application Guide for Filling Control (hereinafter referred to as *this guide*) describes the startup procedures and the operating procedures of the Sysmac Studio to use an NX-series High-speed Counter Unit in combination with an NX-series CPU Unit for the purpose of filling control. This guide uses a simple liquid filling system as an example.
By following the operating instructions in this guide, you can quickly learn the basic usage of the High-speed Counter Unit.
Please note that this guide does not include detailed information for use, including safety precautions. Be sure to obtain the manuals and documentation for each device used in this guide, and read and understand the detailed usage information before use, including precautions related to safety such as *Safety Precautions*, *Precautions for Safe Use*, and *Precautions for Correct Use*.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA systems.
- Personnel in charge of managing FA systems and facilities.

For programming, this manual is intended for personnel who understand the programming language specifications in international standard IEC 61131-3 or Japanese standard JIS B 3503.

Applicable Products

This manual covers the following product.

- Machine Automation Controller NX-series High-speed Counter Unit
  NX-CT□□□□
- Machine Automation Controller NX-series CPU Unit
  NX102-□□□□, NX502-□□□□
- Automation Software Sysmac Studio

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Related Manuals

The following table shows related manuals. Use these manuals for reference.

Manual name	Cat. No.	Model numbers	Application	Description
NX-series High-speed Counter Units User's Manual	W647	NX-CT□□□□	Learning how to use NX-series High-speed Counter Units.	The hardware, setup methods, and functions of the NX-series High-speed Counter Units are described.
NX-series Data Reference Manual	W525	NX-□□□□□□	Referencing lists of the data that is required to configure systems with NX-series Units.	Lists of the power consumptions, weights, and other NX Unit data that is required to configure systems with NX-series Units are provided.
NX-series System Units User's Manual	W523	NX-PD1□□□ NX-PF0□□□ NX-PC0□□□ NX-TBX01	Learning how to use NX-series System Units.	The hardware and functions of the NX-series System Units are described.
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC -SE2□□□	Learning about the operating procedures and functions of the Sysmac Studio.	Describes the operating procedures of the Sysmac Studio.
NX-IO Configurator Operation Manual	W585	CXONE-AL□□D-V4	Learning about the operating procedures and functions of the NX-IO Configurator.	Describes the operating procedures of the NX-IO Configurator.
NJ/NX-series Troubleshooting Manual	W503	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning about the errors that may be detected in an NJ/NX-series Controller.	Concepts on managing errors that may be detected in an NJ/NX-series Controller and information on individual errors are described.
NY-series Troubleshooting Manual	W564	NY532-□□□□ NY512-□□□□	Learning about the errors that may be detected in an NY-series Industrial PC.	Concepts on managing errors that may be detected in an NY-series Controller and information on individual errors are described.
NX-series EtherCAT® Coupler Unit User's Manual	W519	NX-ECC20□	Learning how to use an NX-series EtherCAT Coupler Unit and EtherCAT Slave Terminals.	The following items are described: the overall system and configuration methods of an EtherCAT Slave Terminal (which consists of an NX-series EtherCAT Coupler Unit and NX Units), and information on hardware, setup, and functions to set up, control, and monitor NX Units through EtherCAT.

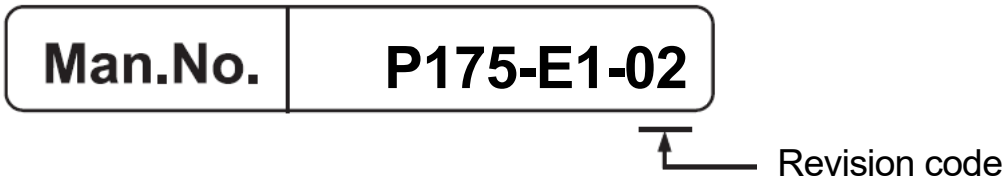
Manual name	Cat. No.	Model numbers	Application	Description
NX-series EtherNet/IP™ Coupler Unit User's Manual	W536	NX-EIC202	Learning how to use an NX-series EtherNet/IP Coupler Unit and EtherNet/IP Slave Terminals.	The following items are described: the overall system and configuration methods of an EtherNet/IP Slave Terminal (which consists of an NX-series EtherNet/IP Coupler Unit and NX Units), and information on hardware, setup, and functions to set up, control, and monitor NX Units.
NX-series CPU Unit Hardware User's Manual	W535	NX701-□□□□	Learning the basic specifications of the NX701 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX701 system is provided along with the following information on the CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NX-series NX502 CPU Unit Hardware User's Manual	W629	NX502-□□□□	Learning the basic specifications of the NX502 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX502 system is provided along with the following information on the CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NX-series NX102 CPU Unit Hardware User's Manual	W593	NX102-□□□□	Learning the basic specifications of the NX102 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX102 system is provided along with the following information on the CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NX-series NX1P2 CPU Unit Hardware User's Manual	W578	NX1P2-□□□□	Learning the basic specifications of the NX1P2 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX1P2 system is provided along with the following information on the CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection

Manual name	Cat. No.	Model numbers	Application	Description
NJ-series CPU Unit Hardware User's Manual	W500	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NJ-series system is provided along with the following information on the CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NY-series IPC Machine Controller Industrial Panel PC Hardware User's Manual	W557	NY532-□□□□	Learning the basic specifications of the NY-series Industrial Panel PCs, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NY-series system is provided along with the following information on the Industrial Panel PC. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NY-series IPC Machine Controller Industrial Box PC Hardware User's Manual	W556	NY512-□□□□	Learning the basic specifications of the NY-series Industrial Box PCs, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NY-series system is provided along with the following information on the Industrial Box PC. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NJ/NX-series CPU Unit Software User's Manual	W501	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning how to program and set up an NJ/NX-series CPU Unit. Mainly software information is provided.	The following information is provided on a Controller built with an NJ/NX-series CPU Unit. • CPU Unit operation • CPU Unit features • Initial settings • Programming based on IEC 61131-3 language specifications
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Software User's Manual	W558	NY532-□□□□ NY512-□□□□	Learning how to program and set up the Controller functions of an NY-series Industrial PC.	The following information is provided on the NY-series Controller functions. • Controller operation • Controller features • Controller settings • Programming based on IEC 61131-3 language specifications

Manual name	Cat. No.	Model numbers	Application	Description
NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual	W505	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Using the built-in EtherCAT port on an NJ/NX-series CPU Unit.	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup.
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Built-in EtherCAT® Port User's Manual	W562	NY532-□□□□ NY512-□□□□	Using the built-in EtherCAT port in an NY-series Industrial PC.	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup.
NJ/NX-series Instructions Reference Manual	W502	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning detailed specifications on the basic instructions of an NJ/NX-series CPU Unit.	The instructions in the instruction set (IEC 61131-3 specifications) are described.
NY-series Instructions Reference Manual	W560	NY532-□□□□ NY512-□□□□	Learning detailed specifications on the basic instructions of an NY-series Industrial PC.	The instructions in the instruction set (IEC 61131-3 specifications) are described.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of manual.



Revision code	Date	Revised content
01	December 2025	Original production
02	January 2026	Corrected mistakes.

1

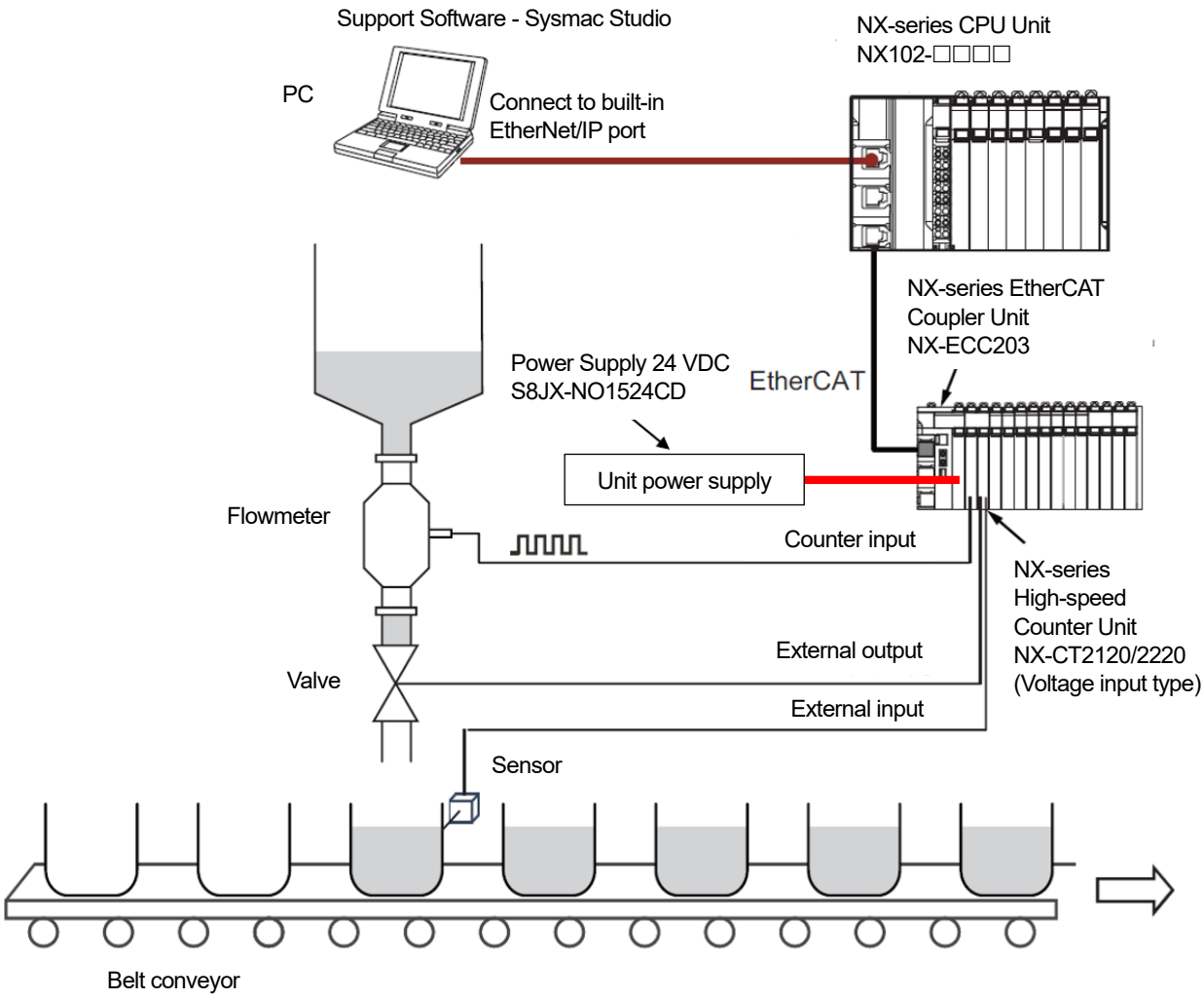
1. System Configuration and Devices Used

This section describes the system configuration and devices used in this guide.

1-1 System Configuration

The system configuration is shown below. Here, an example of a general-purpose filler machine is described.

The example below is an application for filling containers with a specified amount of liquid. When the sensor connected to an external input detects a container, the counter is reset. Then, the valve is opened by external output, allowing liquid to pass through the flowmeter and fill the container. The flowmeter outputs a number of pulses proportional to the liquid flow rate. By counting the number of pulses output, the filling amount of liquid is measured. When the target comparison function detects that the container has been filled with the specified amount of liquid, the valve is closed by external output.



1-2 Flowmeters That Can Be Connected

This section describes flowmeters that can be connected to the High-speed Counter Unit.
Here, a connection example of a voltage output flowmeter is shown. For the High-speed Counter Unit, use the NX-CT2120/2220 for voltage input.
The counter input specifications are shown in the tables below. Select a flowmeter that can be connected within the range of specifications shown in the tables.

NX-CT2120 Voltage input type (NPN)

Counter Input Specifications (Voltage input)			
Input voltage (24 V)	20.4 to 28.8 VDC (24 VDC +20%/−15%)	**Input voltage (5 V)**	4.5 to 5.5 VDC
ON voltage/ON current (24 V)	18.6 VDC min./3 mA min.	**ON voltage/ON current (5 V)**	4.5 VDC min./3 mA min.
OFF voltage/OFF current (24 V)	4.0 VDC max./1 mA max.	**OFF voltage/OFF current (5 V)**	1.5 VDC max./1 mA max.
Input current (24 V)	5.6 mA typical (24 VDC)	**Input current (5 V)**	5.3 mA typical (5 VDC)
Maximum response frequency	In 2ch Mode: A- and B-phase: Single-phase 250 kHz (phase differential pulse input at multiplication x4: 1 MHz), Z-phase: 250 kHz In 6ch Mode: Single-phase 100 kHz		
Internal I/O common processing	NPN		
I/O power supply method	Supply from the NX Bus		
External power supply output (5 V)	Output voltage: 4.9 to 5.25 VDC (5 VDC +5%/-2%) Output current: 500 mA/channel min., 1 A/unit min.		

NX-CT2220 Voltage input type (PNP)

Counter Input Specifications (Voltage input)			
Input voltage (24 V)	20.4 to 28.8 VDC (24 VDC +20%/−15%)	**Input voltage (5 V)**	4.5 to 5.5 VDC
ON voltage/ON current (24 V)	18.6 VDC min./3 mA min.	**ON voltage/ON current (5 V)**	4.5 VDC min./3 mA min.
OFF voltage/OFF current (24 V)	4.0 VDC max./1 mA max.	**OFF voltage/OFF current (5 V)**	1.5 VDC max./1 mA max.
Input current (24 V)	5.6 mA typical (24 VDC)	**Input current (5 V)**	5.3 mA typical (5 VDC)
Maximum response frequency	In 2ch Mode: A- and B-phase: Single-phase 250 kHz (phase differential pulse input at multiplication x4: 1 MHz), Z-phase: 250 kHz In 6ch Mode: Single-phase 100 kHz		
Internal I/O common processing	PNP		
I/O power supply method	Supply from the NX Bus		
External power supply output (5 V)	Output voltage: 4.9 to 5.25 VDC (5 VDC +5%/-2%) Output current: 500 mA/channel min., 1 A/unit min.		

Example of a Flowmeter That Can Be Connected
The filling amount and filling speed are detected from the pulse count value received by the counter input of the NX-CT2120/2220.
Analog output flowmeters cannot be connected directly.
Model: EGM5500C
Manufacturer: TOKYO KEISO CO., LTD.
Power supply voltage: 24 V ±25%
Output specification: Open collector pulse output
Load rating: 30 VDC, 20 mA max.
Pulse rate: 10,000 Hz max./full scale
Pulse width: 50% duty cycle

1-3 Valves That Can Be Connected

This section describes valves that can be connected to the High-speed Counter Unit.
The external output specifications of the High-speed Counter Unit are shown in the tables below.
Select a valve that can be connected within the range of specifications shown in the tables.

NX-CT2120 Voltage input type (NPN)

External Output Specifications			
Rated voltage	5 to 24 VDC		
Load voltage range	4.75 to 28.8 VDC	**Residual voltage**	0.6 V max.
Maximum value of load current	0.5 A/point, 1.8 A/Unit	**Leakage current**	0.1 mA max.
ON/OFF response time	1 µs max./3 µs max. (at load current 7 to 500 mA)		
Internal I/O common processing	NPN	**Load Short-circuit Protection**	None
I/O power supply method	External supply, 4.75 to 28.8 VDC		
Current consumption from I/O power supply	20 mA max.		

NX-CT2220 Voltage input type (PNP)

External Output Specifications			
Rated voltage	5 to 24 VDC		
Load voltage range	4.75 to 28.8 VDC	Residual voltage	0.6 V max.
Maximum value of load current	0.5 A/point, 1.8 A/Unit	Leakage current	0.1 mA max.
ON/OFF response time	1 µs max./3 µs max. (at load current 7 to 500 mA)		
Internal I/O common processing	PNP	Load Short-circuit Protection	None
I/O power supply method	External supply, 4.75 to 28.8 VDC		
Current consumption from I/O power supply	30 mA max.		

■

Example of a Valve That Can Be Connected

The opening and closing of the valve is controlled by the external output (ON/OFF) of the NX-CT.

Product name: Direct Operated 2 Port Solenoid Valve

Model: VX232GG

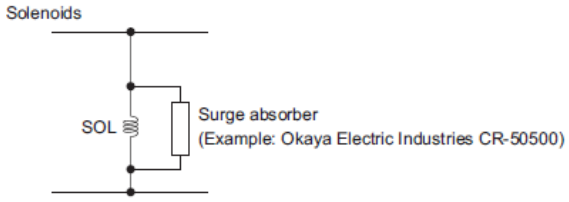
Manufacturer: SMC Corporation

Valve specification: Normally Closed (N.C.)

Input specification: 24 VDC ±10%

Precautions for Correct Use

• If you connect an inductive load (solenoid) to external output, be sure to install a surge absorber.
The surge absorber must be installed in close proximity to the relay.



1-4 Sensors That Can Be Connected

This section describes sensors that can be connected to the High-speed Counter Unit.
The external input specifications of the High-speed Counter Unit are shown in the tables below.
Select a sensor that can be connected within the range of specifications shown in the tables.

NX-CT2120 Voltage input type (NPN)

External Input Specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/-15%)	ON voltage/ON current	15 VDC min./3 mA min.
Input current	3.3 mA typical (24 VDC)	OFF voltage/OFF current	5.0 VDC max./1 mA max.
ON/OFF response time	1 µs max./1 µs max.		
Internal I/O common processing	NPN		
I/O power supply method	Supply from the NX Bus		

NX-CT2220 Voltage input type (PNP)

External Input Specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/-15%)	ON voltage/ON current	15 VDC min./3 mA min.
Input current	3.3 mA typical (24 VDC)	OFF voltage/OFF current	5.0 VDC max./1 mA max.
ON/OFF response time	1 µs max./1 µs max.		
Internal I/O common processing	PNP		
I/O power supply method	Supply from the NX Bus		

■ Example of a Sensor That Can Be Connected

Here, we assume that a reflective photoelectric sensor is used.
The sensor distinguishes the state of workpieces (containers to be filled, such as PET bottles) by light-receiving state: when a workpiece is carried to the filling position, the sensor turns ON; when no workpiece is present at the filling position, the sensor is OFF.

Model: E3AS-HL□□□M□
Manufacturer: OMRON Corporation
Control output Load power supply voltage: 30 VDC max. (Class 2),
Load current: 100 mA max. for a total of 2 outputs
(Residual voltage: 1 V max. for load current of less than 10 mA, 2 V max. for load current of 10 to less than 100 mA)
Open collector output (NPN/PNP output depending on model)
NO (Normally Open)/NC (Normally Closed) switchable

2

2. Preparation

This section describes the preparation that you must complete before starting up the filling control system.

2-1 Wiring and Software Installation

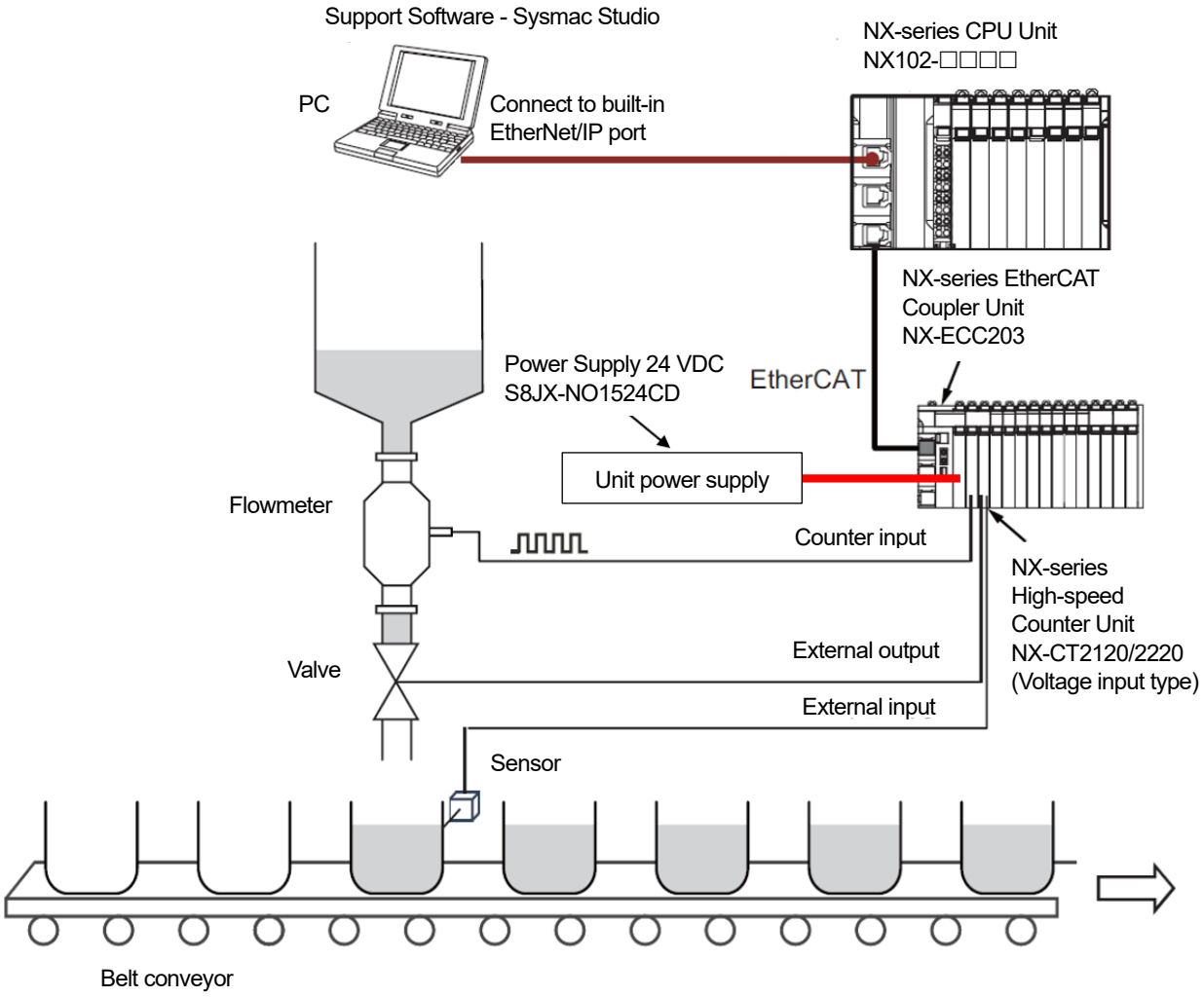
Wire the devices as described in *1-1 System Configuration and Device Used* and install the Sysmac Studio on the PC.

Additional Information

• For the wiring of the High-speed Counter Unit to the flowmeter, valve, and sensor, refer to *3.2 Wiring for the Flowmeter, Valve, and Sensor*.

• For the wiring and usage of the NX-series CPU Unit, NX-series EtherCAT Coupler Unit, and Programmable Terminal, refer to the manuals for each device. Refer to *Related Manuals* for information on the manuals for each device.

• Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the installation of the Sysmac Studio.



3

3. Startup of the Filling Control System

This section describes the procedure for starting up the filling control system.

3-1 Procedures for Starting Up the Filling Control System

Follow the procedures below to start up the filling control system.

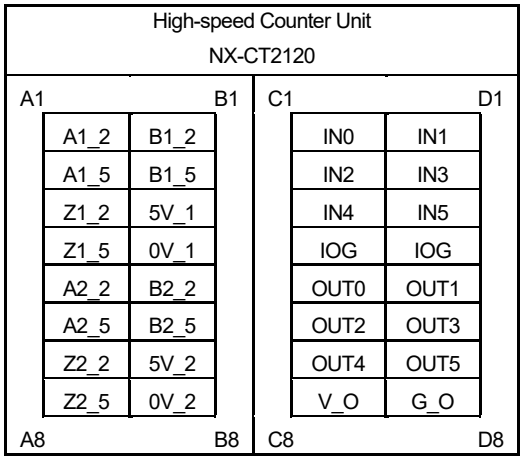
3-2	Wiring for the Flowmeter, Valve, and Sensor	Wire the High-speed Counter Unit to the flowmeter, valve, and sensor.
	▼	
3-3	Slave Terminal Setup	Establish a connection with the slave terminal and perform the initial setup.
	▼	
3-4	High-speed Counter Unit Setup	Select the functions to use on the High-speed Counter Unit and configure its parameters.
	▼	
3-5	Operation Checks	Check if the external I/O devices operate according to the function selection and parameter settings configured on the High-speed Counter Unit.
	▼	
3-6	Programming	Create a program for enabling and initializing the I/O data required to operate the filler machine control, using the ST language as an example.
	▼	
3-7	Advance Time Adjustment	Optimize the filling amount. Set the advance time to minimize excess filling.

3-2 Wiring for the Flowmeter, Valve, and Sensor

This section shows wiring examples for connecting the flowmeter, valve, and sensor to the High-speed Counter Unit.

3-2-1 NX-CT2120

● **Terminal Block Arrangement In 2ch Mode**



Pin No.	Symbol	I/O	Name
A1	A1_24	I	Counter 1 input A-phase (24 V)
A2	A1_5	I	Counter 1 input A-phase (5 V)
A3	Z1_24	I	Counter 1 input Z-phase (24 V)
A4	Z1_5	I	Counter 1 input Z-phase (5 V)
A5	A2_24	I	Counter 2 input A-phase (24 V)
A6	A2_5	I	Counter 2 input A-phase (5 V)
A7	Z2_24	I	Counter 2 input Z-phase (24 V)
A8	Z2_5	I	Counter 2 input Z-phase (5 V)

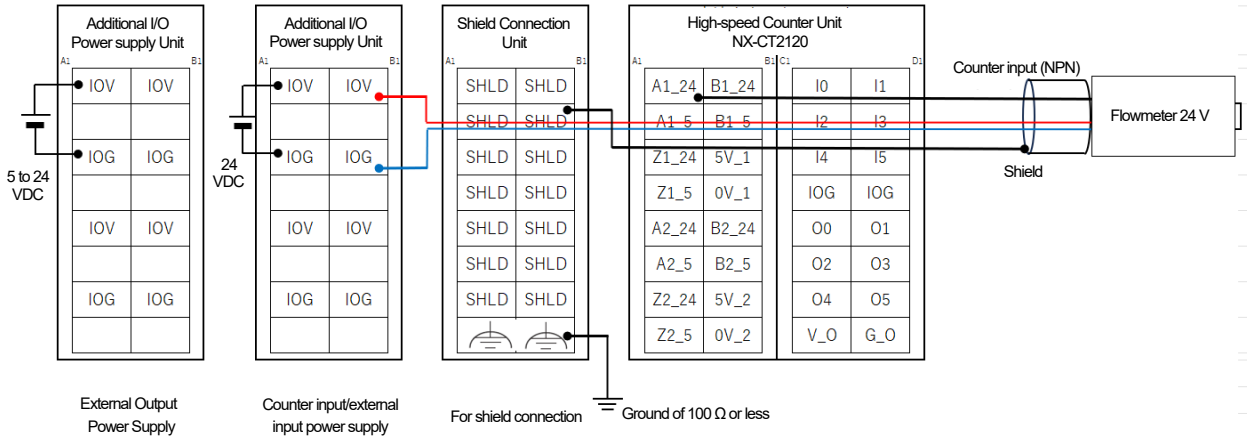
Pin No.	Symbol	I/O	Name
B1	B1_24	I	Counter 1 input B-phase (24 V)
B2	B1_5	I	Counter 1 input B-phase (5 V)
B3	5V_1	O	Encoder power supply output 1, 5
B4	0V_1	O	Encoder power supply output 1, 0
B5	B2_24	I	Counter 2 input B-phase (24 V)
B6	B2_5	I	Counter 2 input B-phase (5 V)
B7	5V_2	O	Encoder power supply output 2, 5
B8	0V_2	O	Encoder power supply output 2, 0

Pin No.	Symbol	I/O	Name
C1	IN0	I	External Input0
C2	IN2	I	External Input2
C3	IN4	I	External Input4
C4	IOG	—	I/O power supply -
C5	OUT0	O	External Output0
C6	OUT2	O	External Output2
C7	OUT4	O	External Output4
C8	V_O	I	External Output Power Supply

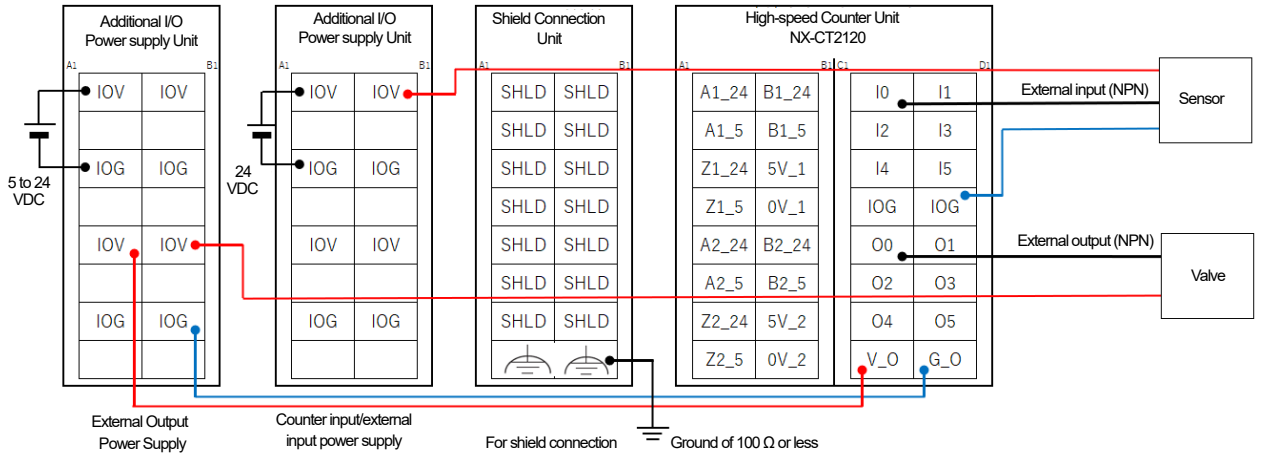
Pin No.	Symbol	I/O	Name
D1	IN1	I	External Input1
D2	IN3	I	External Input3
D3	IN5	I	External Input5
D4	IOG	—	I/O power supply -
D5	OUT1	O	External Output1
D6	OUT3	O	External Output3
D7	OUT5	O	External Output5
D8	G_O	I	External Output Power Supply

● **Wiring Example for the Flowmeter (Counter Input)**

For the flowmeter shown as an example in *1-2 Flowmeters That Can Be Connected*, connect only A-phase since it has single-phase output. B-phase and Z-phase for count input are not used. When connecting counter input (A-phase) wiring, use a shielded cable and connect the shield to a ground of 100 Ω or less.

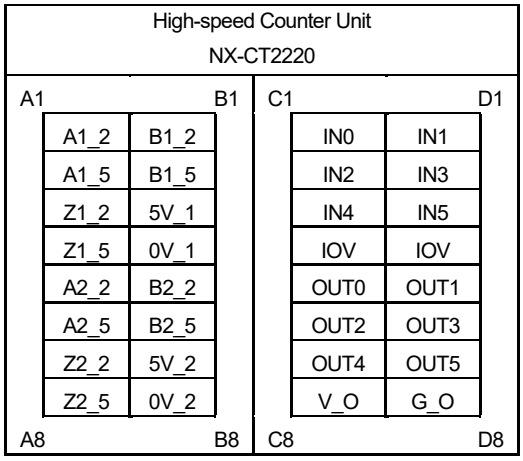


● **Wiring Example for the Valve (External Output) and Sensor (External Input)**



3-2-2 NX-CT2220

● **Terminal Block Arrangement In 2ch Mode**



Pin No.	Symbol	I/O	Name
A1	A1_24	I	Counter 1 input A-phase (24 V)
A2	A1_5	I	Counter 1 input A-phase (5 V)
A3	Z1_24	I	Counter 1 input Z-phase (24 V)
A4	Z1_5	I	Counter 1 input Z-phase (5 V)
A5	A2_24	I	Counter 2 input A-phase (24 V)
A6	A2_5	I	Counter 2 input A-phase (5 V)
A7	Z2_24	I	Counter 2 input Z-phase (24 V)
A8	Z2_5	I	Counter 2 input Z-phase (5 V)

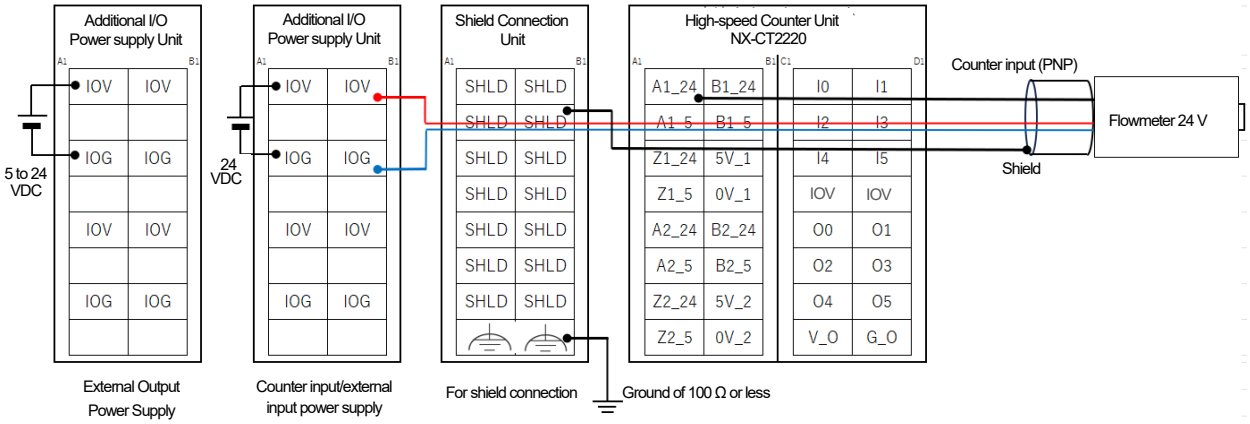
Pin No.	Symbol	I/O	Name
B1	B1_24	I	Counter 1 input B-phase (24 V)
B2	B1_5	I	Counter 1 input B-phase (5 V)
B3	5V_1	O	Encoder power supply output 1, 5
B4	0V_1	O	Encoder power supply output 1, 0
B5	B2_24	I	Counter 2 input B-phase (24 V)
B6	B2_5	I	Counter 2 input B-phase (5 V)
B7	5V_2	O	Encoder power supply output 2, 5
B8	0V_2	O	Encoder power supply output 2, 0

Pin No.	Symbol	I/O	Name
C1	IN0	I	External Input0
C2	IN2	I	External Input2
C3	IN4	I	External Input4
C4	IOV	—	I/O power supply +
C5	OUT0	O	External Output0
C6	OUT2	O	External Output2
C7	OUT4	O	External Output4
C8	V_O	I	External Output Power Supply

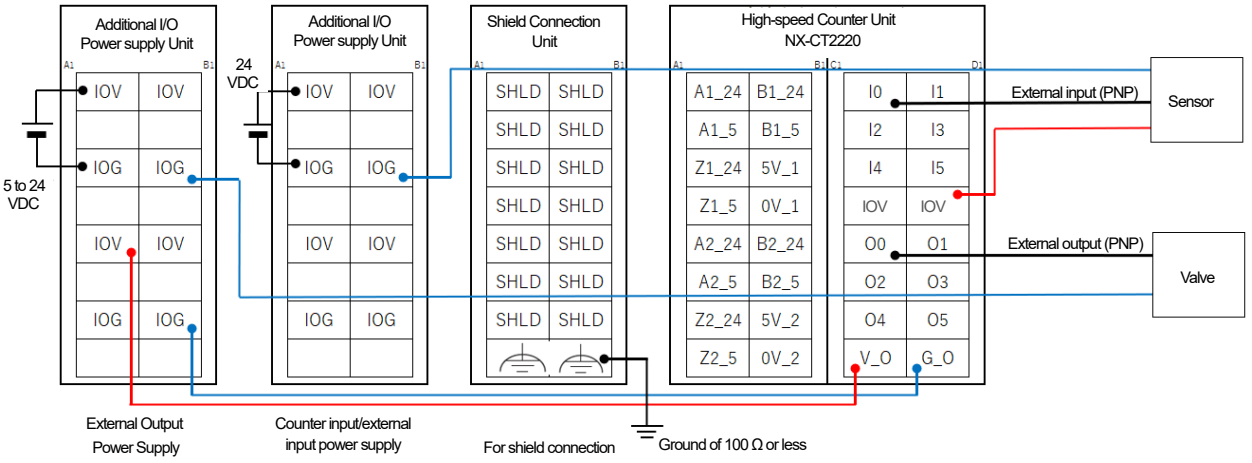
Pin No.	Symbol	I/O	Name
D1	IN1	I	External Input1
D2	IN3	I	External Input3
D3	IN5	I	External Input5
D4	IOV	—	I/O power supply +
D5	OUT1	O	External Output1
D6	OUT3	O	External Output3
D7	OUT5	O	External Output5
D8	G_O	I	External Output Power Supply

● **Wiring Example for Counter Input**

For the flowmeter shown as an example in *1-2 Flowmeters That Can Be Connected*, connect only A-phase since it has single-phase output. B-phase and Z-phase for count input are not used. When connecting counter input (A-phase) wiring, use a shielded cable and connect the shield to a ground of 100 Ω or less.



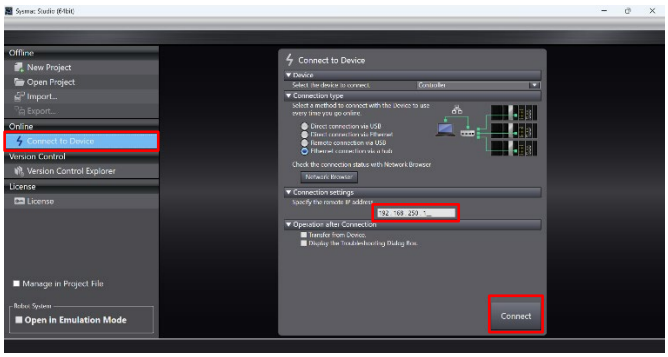
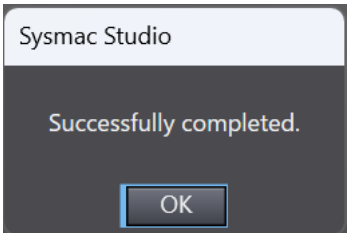
● **Wiring Example for the Valve (External Output) and Sensor (External Input)**



3-3 Slave Terminal Setup

3-3-1 Connection to the CPU Unit

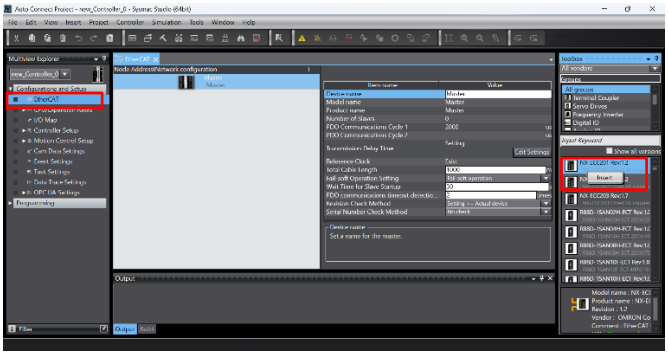
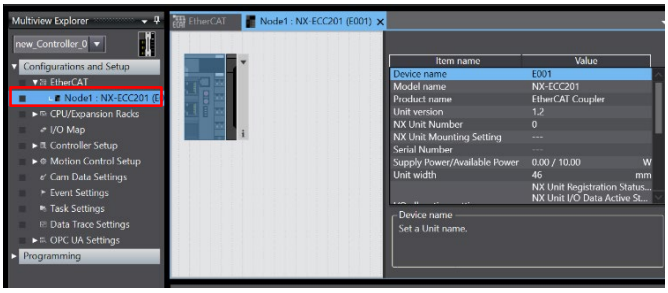
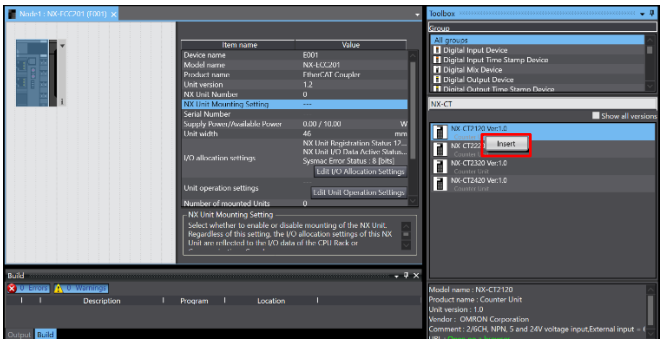
Follow the steps below to connect the CPU Unit to the PC.

1	Connect the CPU Unit and the PC using an Ethernet cable.	
2	Turn ON the power supply to the CPU Unit.	
3	Start the Sysmac Studio.	
4	Click **Connect to Device (C)**, set the IP address of the connected device, and then click the **Connect** Button. • The default IP address of the CPU Unit is *192.168.250.1*. • If necessary, change the IP address of the Windows PC to *192.168.250.X*.	
5	When the connection is completed, a message dialog box as shown on the right appears.	

*The above is an example of connecting the PC to the CPU Unit (NX102-□□□□) using the Direct connection via Ethernet connection type.
Select a connection type appropriate for your environment and the CPU Unit to connect.

3-3-2 Connection to the EtherCAT Coupler Unit or NX-CT Unit

This section describes the procedure for connecting an NX-series High-speed Counter Unit via an EtherCAT Coupler Unit in a system using EtherCAT communications.

1	With the Sysmac Studio and the CPU Unit offline, double-click **EtherCAT** in the Multiview Explorer to open the EtherCAT Tab Page. In the Toolbox Pane, right-click the EtherCAT Coupler Unit (NX-ECC2□□) and select **Insert** from the pop-up menu.	
2	Double-click the EtherCAT Coupler Unit (NX-ECC2□□) in the Multiview Explorer to open the Slave Terminal Configuration Tab Page.	
3	In the Toolbox Pane, right-click the High-speed Counter Unit (NX-CT2□20) and select **Insert** from the pop-up menu.	

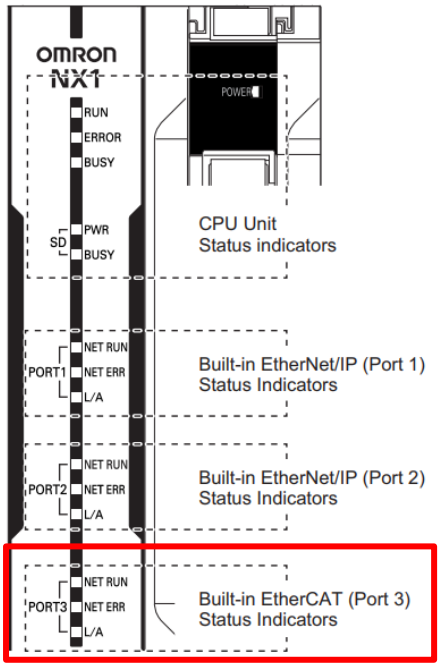
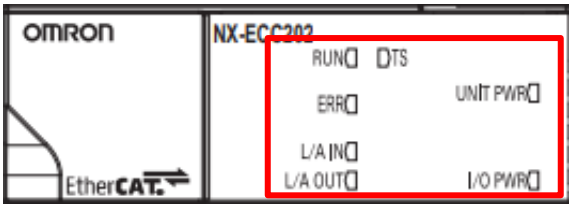
3-3-3 Setting Up as an EtherCAT Slave

Configure the EtherCAT settings (enable distributed clock, node address, etc.) according to your environment.

Refer to *9-2-2 Settings as an EtherCAT Slave* in the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

3-3-4 Checking for EtherCAT Communications

Check the EtherCAT communications between the CPU Unit and the EtherCAT Coupler Unit.

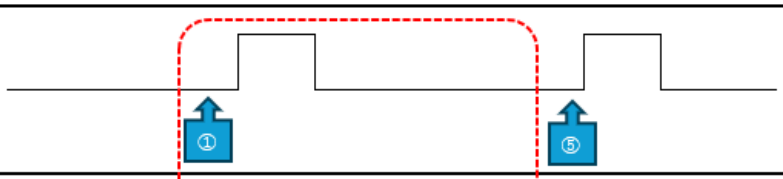
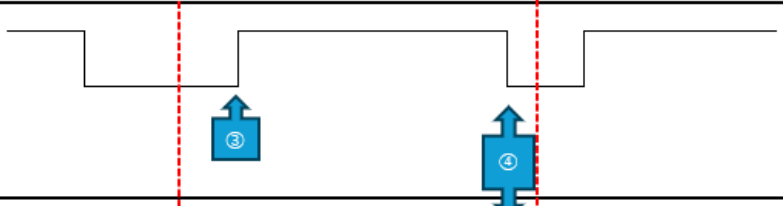
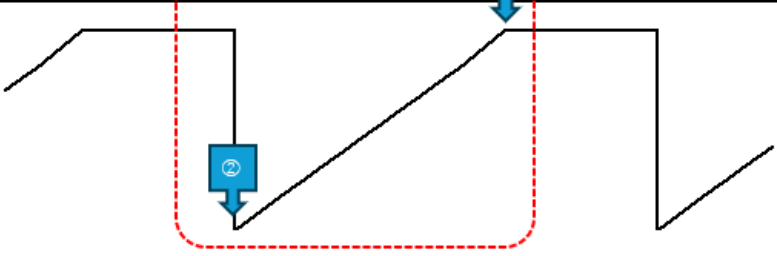
1	Check the EtherCAT communications status with the indicators on the CPU Unit. The indicator status during normal operation is as follows. NET RUN: Lit green NET ERR: Not lit LINK/ACT: Flashing yellow	
2	Check the indicators on the EtherCAT Coupler Unit. The indicator status during normal operation is as follows. RUN: Lit green TS: Lit green ERR: Not lit L/A IN: Flashing green UNIT PWR: Lit green For the meaning of errors that each indicator shows and the troubleshooting procedure when the indicator display differs, refer to the following manual. Reference: *13-2 Checking for Errors and Troubleshooting with the Indicators* in the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519)	

3-4 High-speed Counter Unit Setup

This section describes the timing chart for the sensor, valve, and flowmeter, which you should understand before setting up the High-speed Counter Unit. It covers the processing highlighted in red frame, from detecting a workpiece on the conveyor belt by sensor input to stopping the flowmeter counter. The processing to feed the workpiece onto the conveyor belt is excluded.

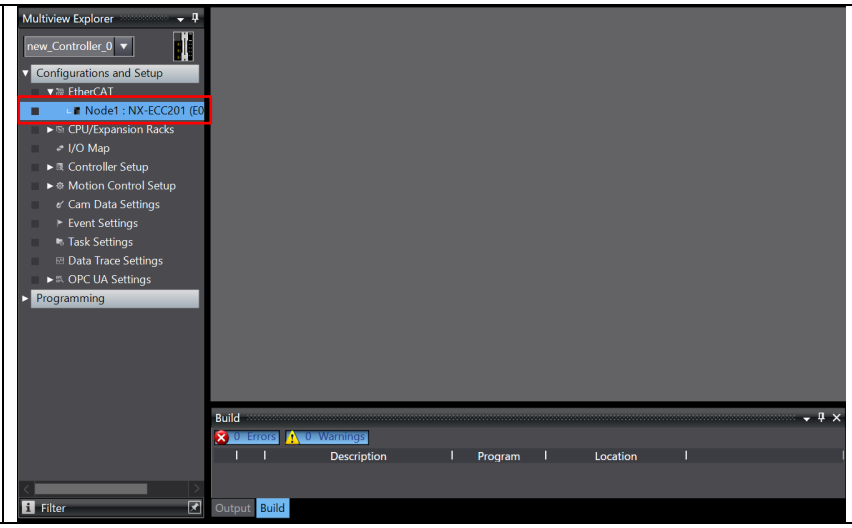
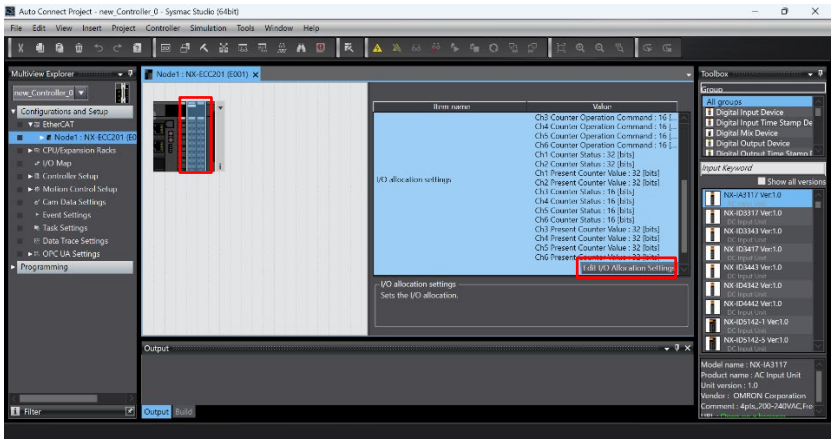
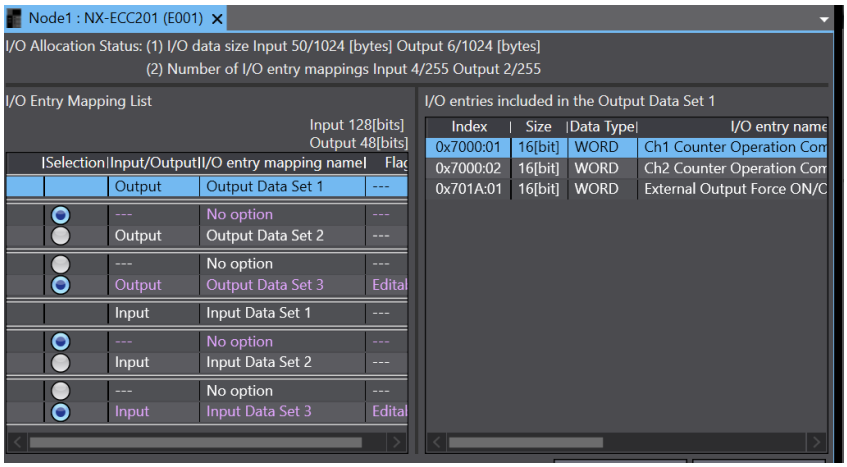
● Timing Chart

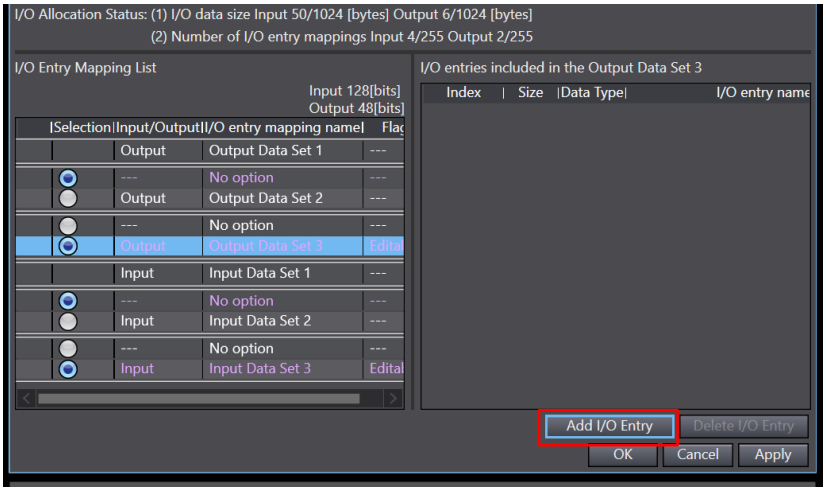
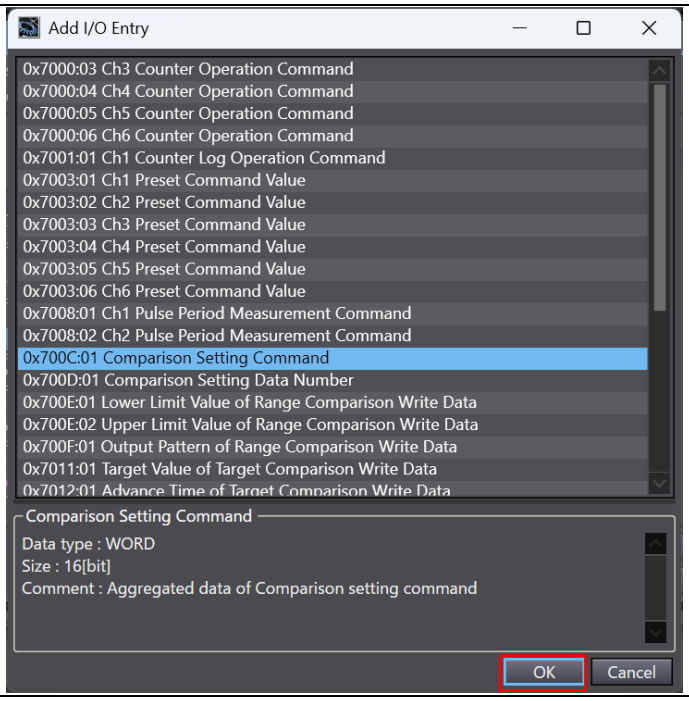
1. The High-speed Counter Unit waits until a workpiece is set in the specified position (①).
2. The High-speed Counter Unit detects via sensor input that the workpiece is set in the specified position and resets the flowmeter counter value by the program.
3. The High-speed Counter Unit opens the valve (③) in conjunction with the counter reset (②).
   • While the valve is open, the High-speed Counter Unit performs edge processing using the selected output pattern as part of the counter reset operation.
4. The High-speed Counter Unit injects the specified amount of liquid using the target comparison function and closes the valve (④).
   • To inject the specified amount of liquid, you can use the advance time correction function to optimize the filling amount. While the valve closed, the High-speed Counter Unit performs edge processing using the selected output pattern as part of the target comparison operation.
5. Then, after the belt conveyor moves and the next workpiece is set in the specified position, the High-speed Counter Unit repeats the sequence from step 1 .

Devices	Connection to the counter unit	Status	Timing chart
Sensor	External input 0	ON OFF	
Valve	External output 0	ON OFF	
Flowmeter	Counter Ch1	Filling volume 0	

3-4-1 I/O Data Allocation

To use the counter, target comparison, and advance time functions, allocate the following I/O data in the I/O allocation settings.

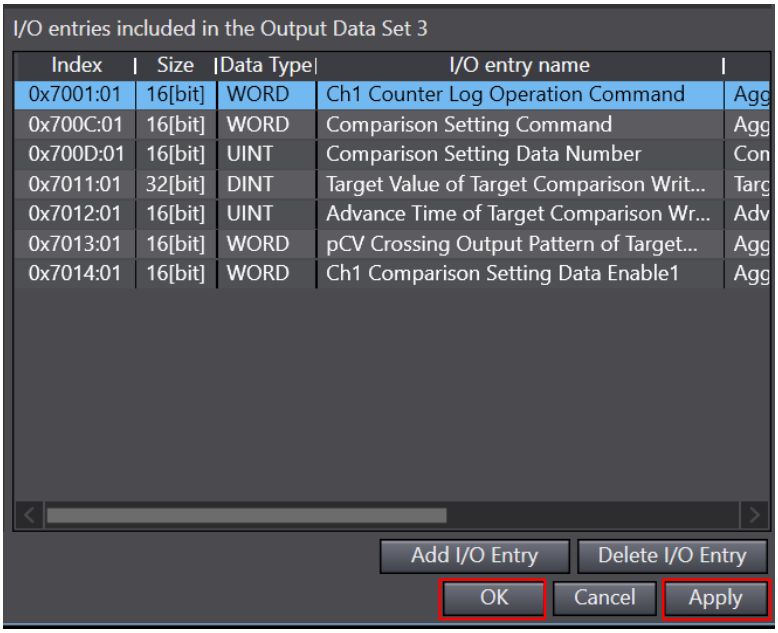
1	With the Sysmac Studio and the CPU Unit offline, double-click the EtherCAT Coupler Unit (NX-ECC2□□) in the Multiview Explorer.	
2	Click the target High-speed Counter Unit in the Slave Terminal Configuration Tab Page. Click the **Edit I/O Allocation Settings** Button.	
3	Change the I/O entries in the I/O Entry Mapping List. **Output Data Set 2** → No option **Output Data Set 3** → Output **Input Data Set 2** → No option **Input Data Set 3** → Input	

4	In the I/O Entry Mapping List, select the data whose I/O entry mapping name is **Output Data Set 3** and click the **Add I/O Entry** Button.	
5	Select **0x700C:01 Comparison Setting Command** and click the **OK** Button.	
6	Similarly, add the following I/O data to register to **Output Data Set 3**. The I/O data required for executing the functions that you will configure in the subsequent sections. List of I/O data to register in **Output Data Set 3**	

I/O port name	**Comment**
Ch1 Counter Log Operation Command	Ch1 counter log operation command
Comparison Setting Command	Comparison setting command
Comparison Setting Data Number	Comparison setting data number
pCV Crossing Output Pattern of Target Comparison Write Data	Target comparison pCV crossing output pattern write data
Target Value of Target Comparison Write Data	Target comparison target value write data
Output Pattern at Ch1 Counter Reset/Preset of Target Comparison	Target comparison output pattern at Ch1 counter reset/preset
Ch1 Comparison Setting Data Enable1	Ch1 comparison setting data enable setting 1

7

Click the **Apply** Button on the right and then click the **OK** Button on the left.



8

Next, add the input data in the same manner.

In the I/O Entry Mapping List, select the data whose I/O entry mapping name is **Input Data Set 3** and click the **Add I/O Entry** Button.

Select and add the following I/O data.

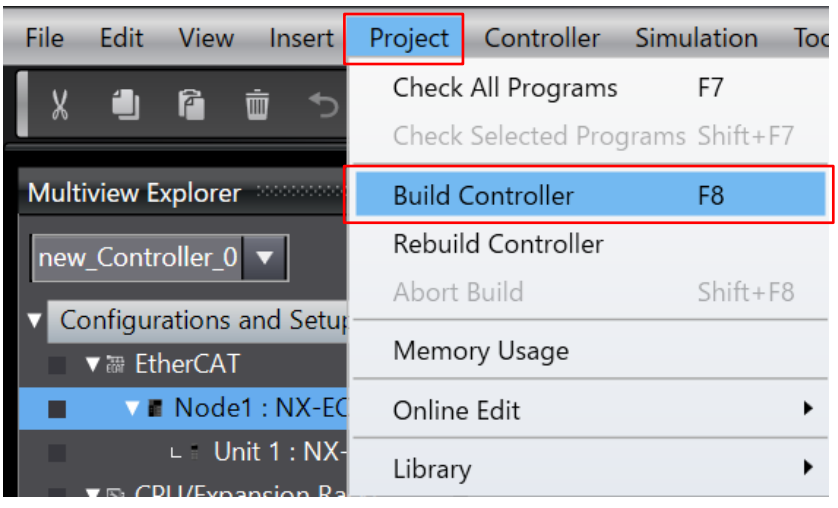
List of I/O data to register in **Input Data Set 3**

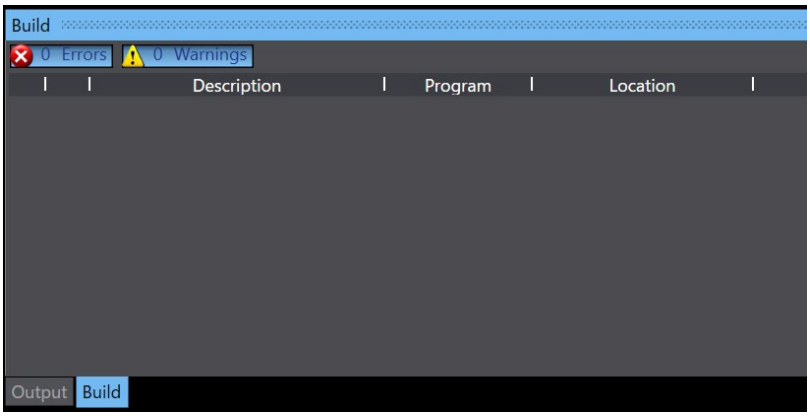
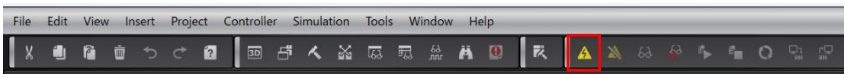
I/O port name	**Comment**
pCV Crossing Output Pattern of Target Comparison Read Data	Target comparison pCV crossing output pattern read data
Comparison Setting Status	Comparison setting status
External Input Status	External input status

9

After you finish adding the I/O entries, build the project.

In the Sysmac Studio, select **Build Controller** from the **Project** Menu.

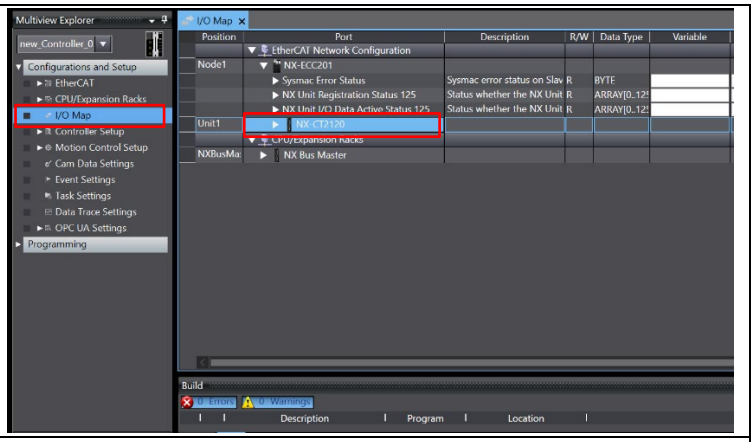
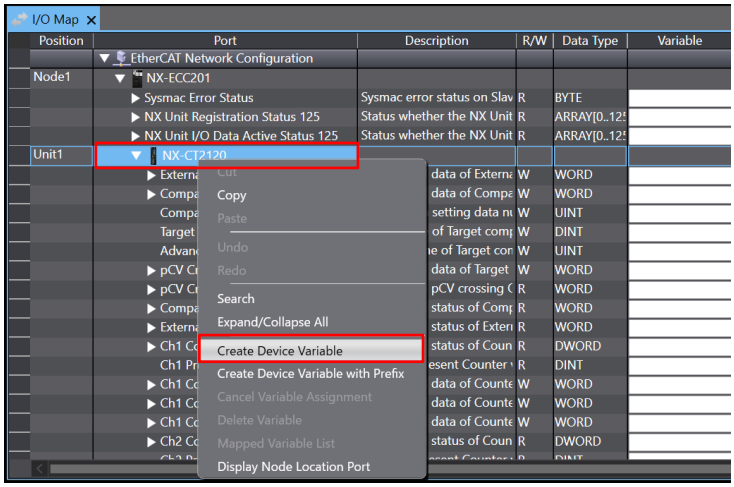
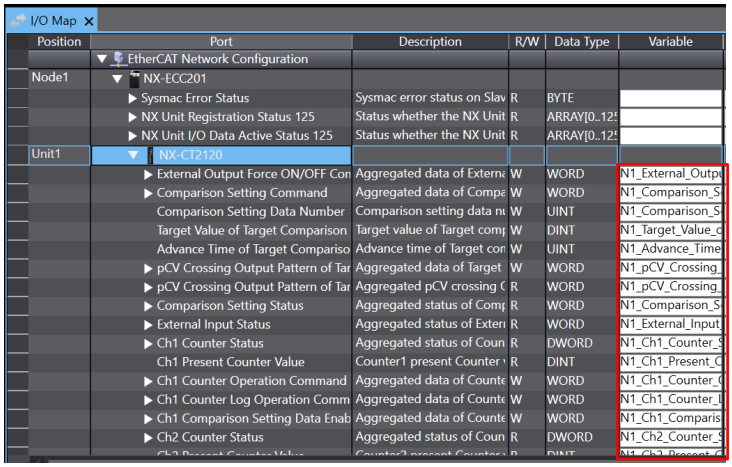


10	Check the Build Tab Page to confirm that no build errors or warnings have occurred.	
11	Click the **Online** Button to place the Sysmac Studio and the CPU Unit online.	
12	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	

3-4-2 Device Variable Setting

Set device variables so that the CPU Unit can handle signals from the I/O Unit.

This section describes the procedure for automatically generating device variable names, as an example.

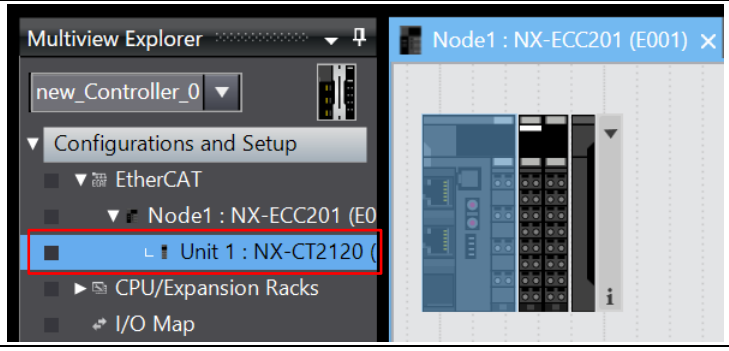
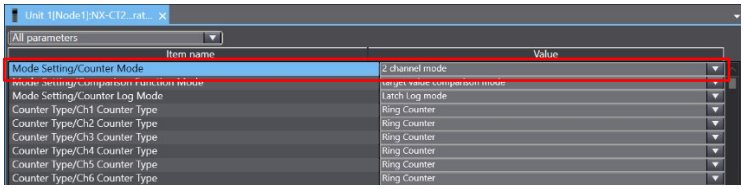
1	With the Sysmac Studio and the CPU Unit offline, click **I/O Map** in the Multiview Explorer and select the EtherCAT Coupler Unit (NX-ECC2□□) under **Port**.	
2	Right-click the High-speed Counter Unit (NX-CT2□20) under **Port** and select **Create Device Variables (V)** from the pop-up menu.	
3	Device variables are allocated automatically.	

3-4-3 Channel Mode Selection

The procedure for selecting the channel mode is described below.

• 2ch mode: 2-channel up-down counter mode

For the filling control system, select 2ch mode to use the advance time and counter log functions.

1	With the Sysmac Studio and the CPU unit offline, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	
2	Confirm that **Mode Setting/Counter Mode** is set to **2 channel mode**.	

3-4-4 Pulse Input Method and Command Setting

This section describes the procedure for setting the pulse input method. Incorrect settings may cause the count function to malfunction. Ensure that the setting matches your environment.

Refer to *7-3-2 Pulse Input Method* in the *NX-series High-speed Counter Units User's Manual* (Cat. No. W647) for more detailed procedures and descriptions.

• Pulse Input Method

Select the pulse input method for the High-speed Counter Unit according to the pulse output of the flowmeter.

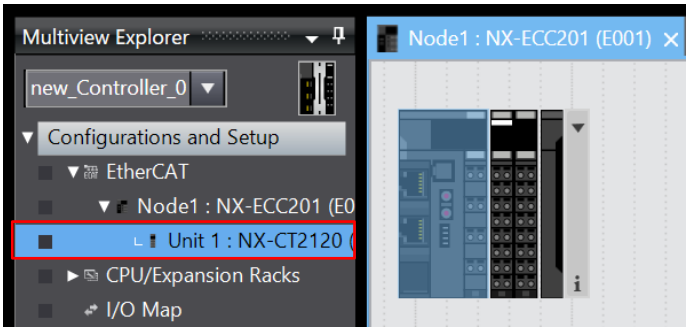
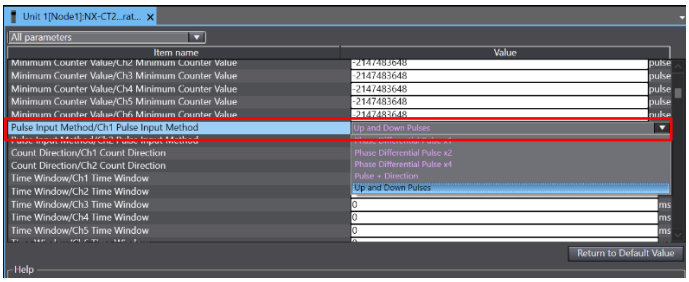
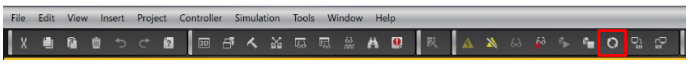
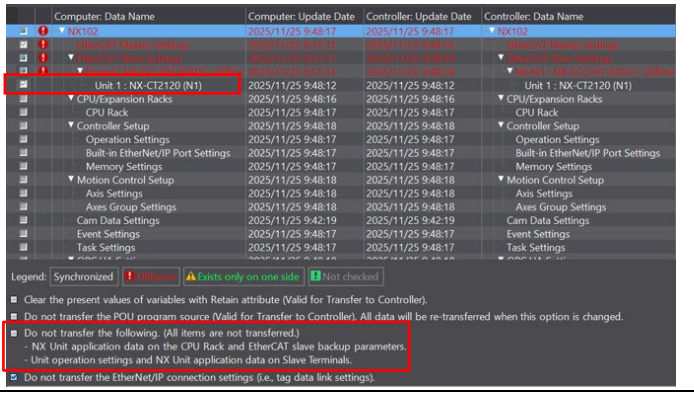
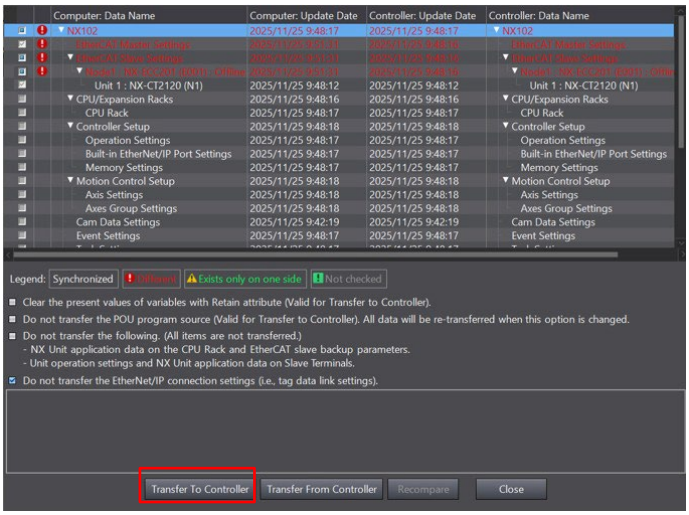
There are the following three pulse input methods for counters in 2ch mode:

• Phase Differential Input (multiplication x1, x2, or x4)

• Pulse + Direction

• Up and Down Pulses

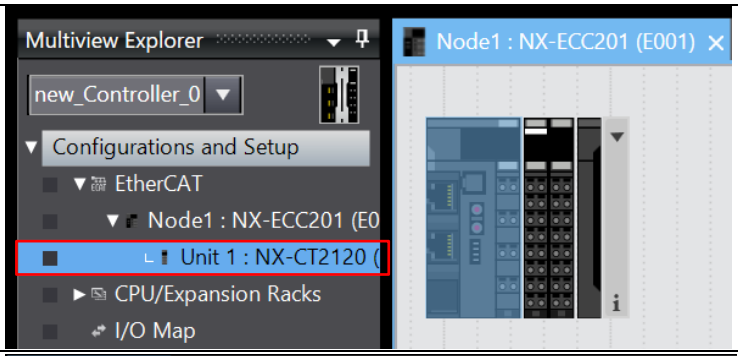
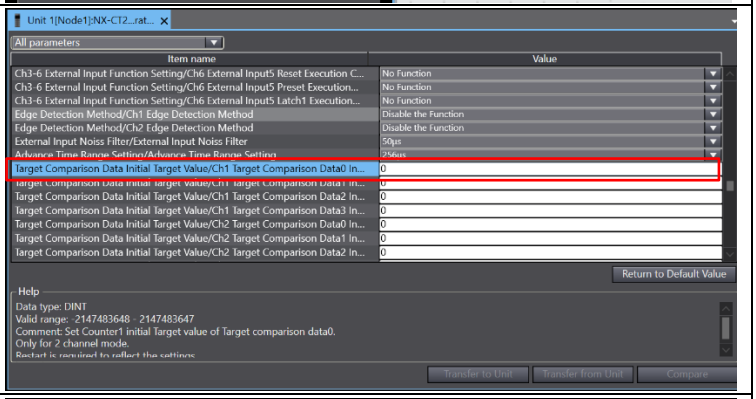
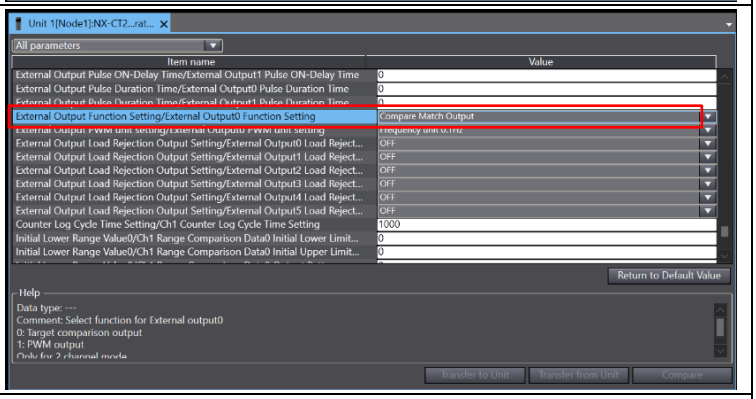
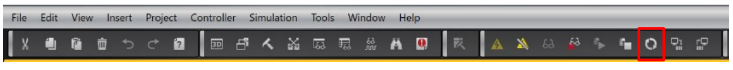
Here, we assume that you are using the flowmeter mentioned in *Example of a Flowmeter That Can Be Connected* in *1-2 Flowmeters That Can Be Connected* and set the **Up and Down Pulses** pulse input method.

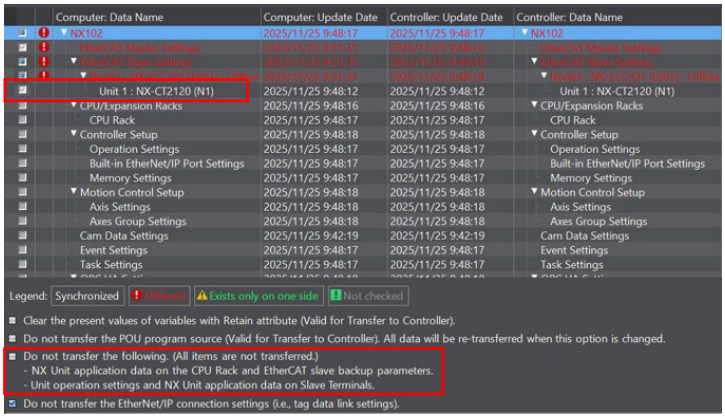
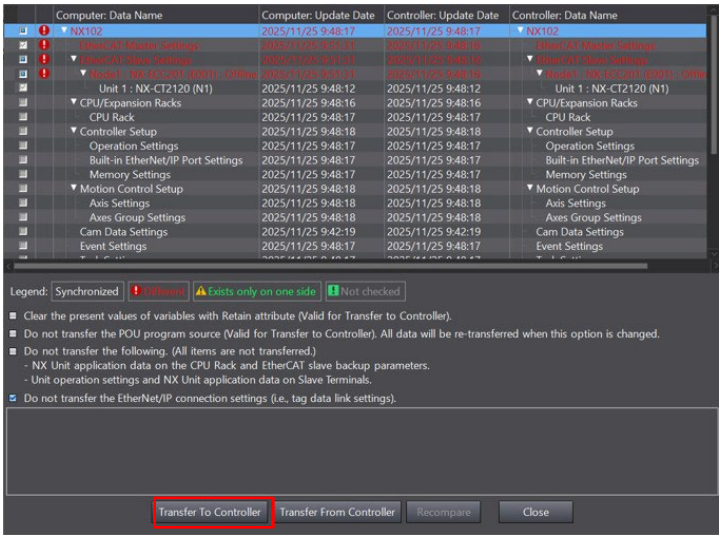
1	With the Sysmac Studio and the CPU unit offline, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	
2	Set **Pulse Input Method/Ch1 Pulse Input Method** to **Up and Down Pulses**.	
3	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	
4	Select the check box for the High-speed Counter Unit (NX-CT2□20) that you have set up. Clear the **Do not transfer the following. (All items are not transferred)** Check Box. This enables the transfer of the Unit operation settings on the Slave Terminal.	
5	Click the **Transfer To Controller** Button. The settings are transferred from the Sysmac Studio to the NX Unit.	

3-4-5 External Output Setting Using the Target Comparison Output Function

Using the target comparison output function, set the external output so that it automatically turns ON/OFF to close the valve when the set target value is reached.

Here, an example of setting **Target Comparison Data Initial Target Value** to the default value is described.

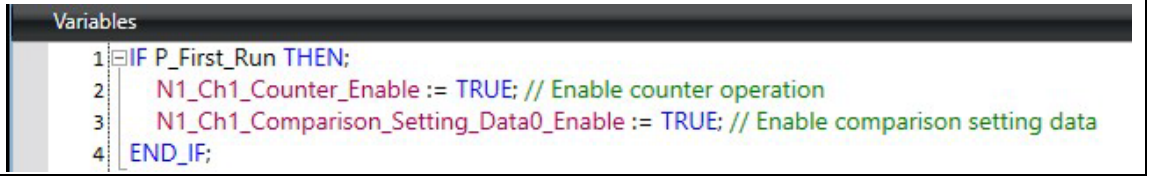
1	With the Sysmac Studio and the CPU Unit online, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	
2	Set the value of **Target Comparison Data Initial Target Value**. In this example, set the default value.	
3	Set the value of **External Output Function Setting**. In this example, set **Compare Match Output**.	
4	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	

5	Select the check box for the High-speed Counter Unit (NX-CT2□20) that you have set up. Clear the **Do not transfer the following. (All items are not transferred)** Check Box. This enables the transfer of the Unit operation settings on the Slave Terminal.	
6	Click the **Transfer To Controller** Button. The settings are transferred from the Sysmac Studio to the NX Unit.	

3-4-6 Counter Resetting by External Input and External Output Control

This section shows programs for resetting the counter value by external input (for example, sensor detection) and for automatically turning ON/OFF external output (for example, the valve) when the counter is reset or when the target value is matched.

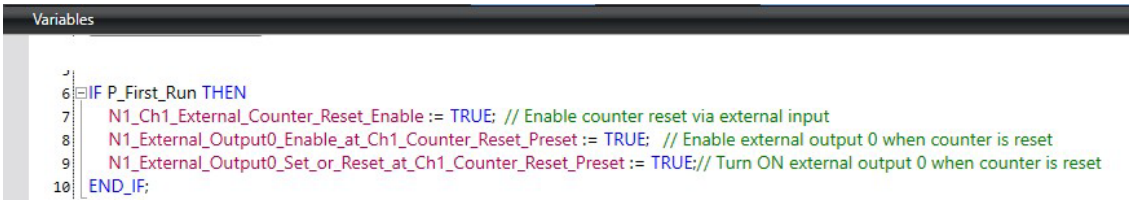
*Refer to *3-6 Programming* for how to create and configure an ST program.

1	To enable counter functions and the target comparison function, add the following program.
	
	IF P_First_Run THEN;
	N1_Ch1_Counter_Enable := TRUE; // Enable counter operation
	N1_Ch1_Comparison_Setting_Data0_Enable := TRUE; // Enable comparison setting data
	END_IF;
	 

2

Here is a programming example for resetting the counter by external input and enabling external output 0 when the counter is reset.

```
IF P_First_Run THEN
    N1_Ch1_External_Counter_Reset_Enable := TRUE; // Enable counter reset via external input
    N1_External_Output0_Enable_at_Ch1_Counter_Reset_Preset := TRUE;// Enable external output 0 when counter is reset
    N1_External_Output0_Set_or_Reset_at_Ch1_Counter_Reset_Preset := TRUE;// Turn ON external output 0 when counter is reset
END_IF;
```



3

Here is a programming example for executing counter reset on external input.

Register the variables shown below as internal variables.

Name	Data type	Initial value	AT	Retain	Constant	Comment
Stage	UINT	0	—	—	—	Internal status of program

```
CASE Stage OF
  0: // External Input 0 is OFF
    IF N1_External_Input0_Status THEN
      N1_Ch1_Internal_Counter_Reset_Execution := TRUE; // Execute counter reset on external input
    END_IF;
    IF N1_Ch1_Internal_Counter_Reset_Completed THEN// If internal counter reset completed flag is TRUE
      N1_Ch1_Internal_Counter_Reset_Execution := FALSE; // Change internal counter reset execution flag to FALSE
      Stage := 10;
    END_IF;

  10: // External Input 0 is ON
    IF NOT N1_External_Input0_Status THEN // Reset Stage to 0 when external input is OFF
      Stage := 0;
    END_IF;
END_CASE;
```

Variables

Namespace - Using

Internals
Externals

Name	Data Type	Initial Value	AT	Retain	Constant	Comment
Stage	UINT	0		☐	☐	Internal status of program

```
CASE Stage OF
    0: // External Input 0 is OFF
        IF N1_External_Input0_Status THEN
            N1_Ch1_Internal_Counter_Reset_Execution := TRUE; // Execute counter reset on external input
        END_IF;
        IF N1_Ch1_Internal_Counter_Reset_Completed THEN// If internal counter reset completed flag is TRUE
            N1_Ch1_Internal_Counter_Reset_Execution := FALSE;// Change internal counter reset execution flag to FALSE
            Stage := 10;
        END_IF;

    10: // External Input 0 is ON
        IF NOT N1_External_Input0_Status THEN // Reset Stage to 0 when external input is OFF
            Stage := 0;
        END_IF;
END_CASE;
```

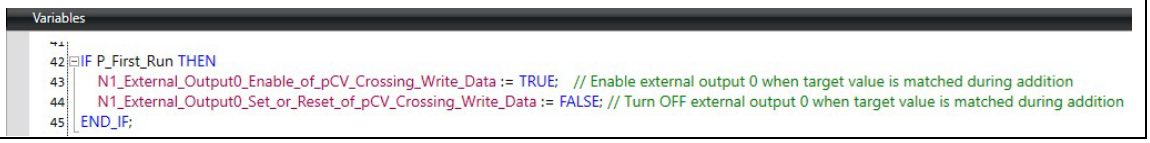
4

Here is a programming example for enabling I/O data required to write a target value and then writing the target value.

```
IF P_First_Run THEN
    N1_Ch1_Comparison_Setting_Data_Request := TRUE; // Enable comparison setting data request
    N1_Ch1_Comparison_Setting_Data0_Enable := TRUE; // Enable comparison setting data 0
    N1_Target_Value_of_Target_Comparison_Write_Data := 5000;// Write 5000 to target value
    N1_Comparison_Setting_Data_Read_or_Write := TRUE; // Write comparison data setting
     // To write the advance time setting calculated in 3-7 Advance Time Adjustment,
     // add the following program. Refer to 3-7 Advance Time Adjustment for the set value.
     // N1_Advance_Time_of_Target_Comparison_Write_Data := 23500    // Advance time setting
     // Add Advance_Time_of_Target_Comparison_Write_Data to
     // I/O Entry Mapping List as Output Data Set 3

END_IF;
```

Variables

```
IF P_First_Run THEN
    N1_Ch1_Comparison_Setting_Data_Request :=  TRUE;   // Enable comparison setting data request
    N1_Ch1_Comparison_Setting_Data0_Enable := TRUE;    // Enable comparison setting data 0
    N1_Target_Value_of_Target_Comparison_Write_Data := 5000;   // Write 5000 to target value
    N1_Comparison_Setting_Data_Read_or_Write := TRUE; // Write comparison data setting

    // To write the advance time setting calculated in 3-7 Advance Time Adjustment,
    // add the following program. Refer to 3-7 Advance Time Adjustment for the set value.
    // N1_Advance_Time_of_Target_Comparison_Write_Data := 23500  // Advance time setting
    // Add Advance_Time_of_Target_Comparison_Write_Data to
    // I/O Entry Mapping List as Output Data Set 3

END_IF;
```

5	Here is a programming example for closing the valve by turning OFF the external output when the target value is matched.
	
	IF P_First_Run THEN
	N1_External_Output0_Enable_of_pCV_Crossing_Write_Data := TRUE;// Enable external output 0 when target value is matched during addition
	N1_External_Output0_Set_or_Reset_of_pCV_Crossing_Write_Data := FALSE; // Turn OFF external output 0 when target value is matched during addition
	END_IF;
	
	 

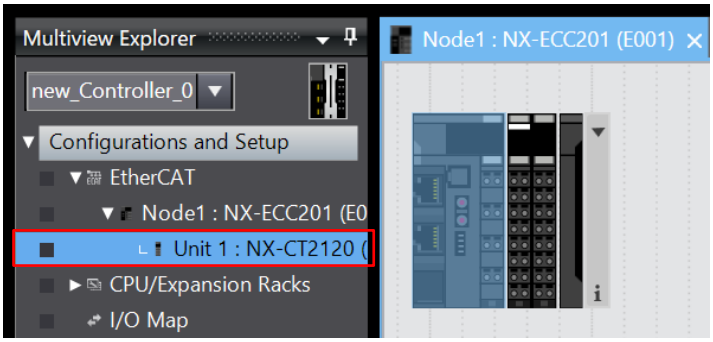
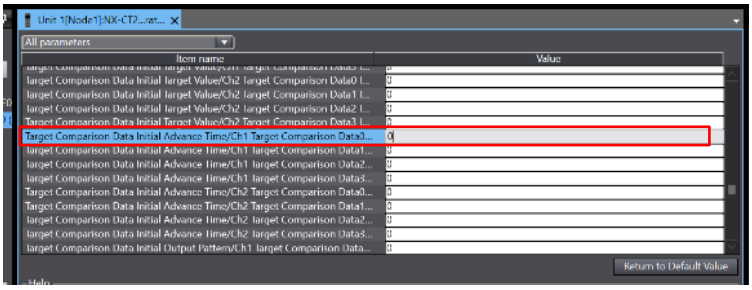
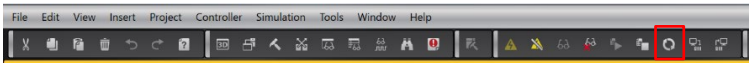
3-4-7 Advance Time Function Setting

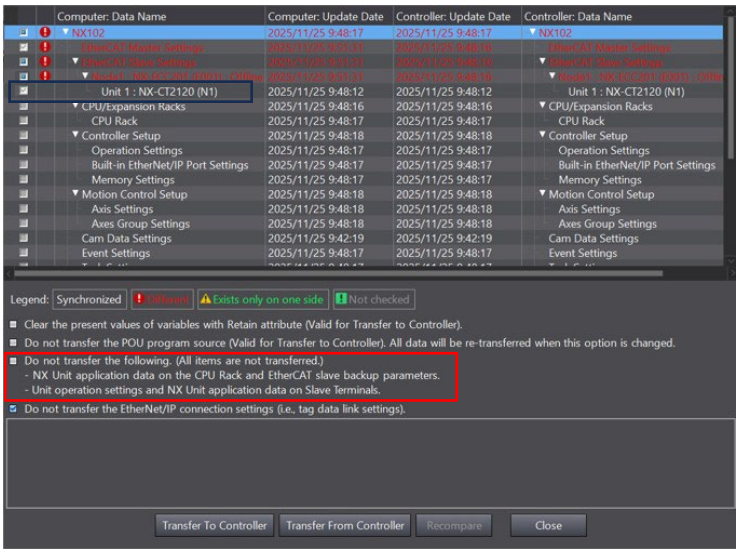
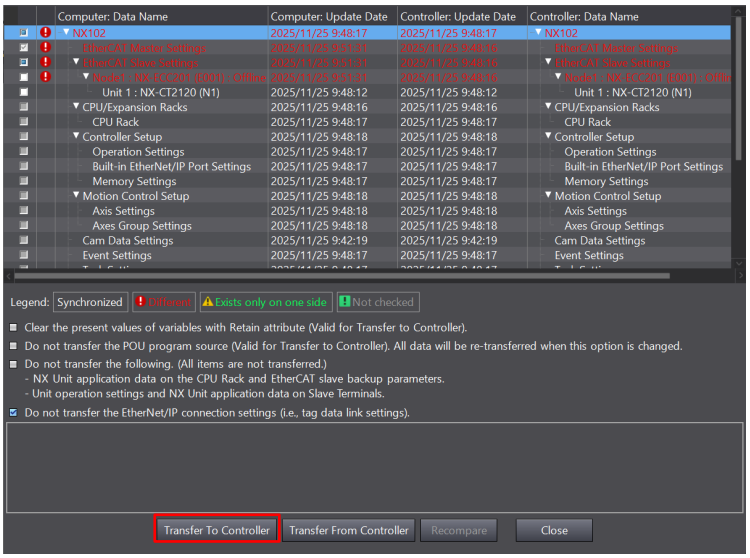
The procedure for setting the advance time function is described below.

Calculate the specific set value for the advance time according to *3-7 Advance Time Adjustment* and write it to the High-speed Counter Unit.

• Advance Time Function

You can use this function to output signals earlier than the set time for each target value matched, considering delays in external devices such as actuators.

1	With the Sysmac Studio and the CPU Unit online, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	
2	Determine the set value for **Target Comparison Data Initial Advance Time**.	
3	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	

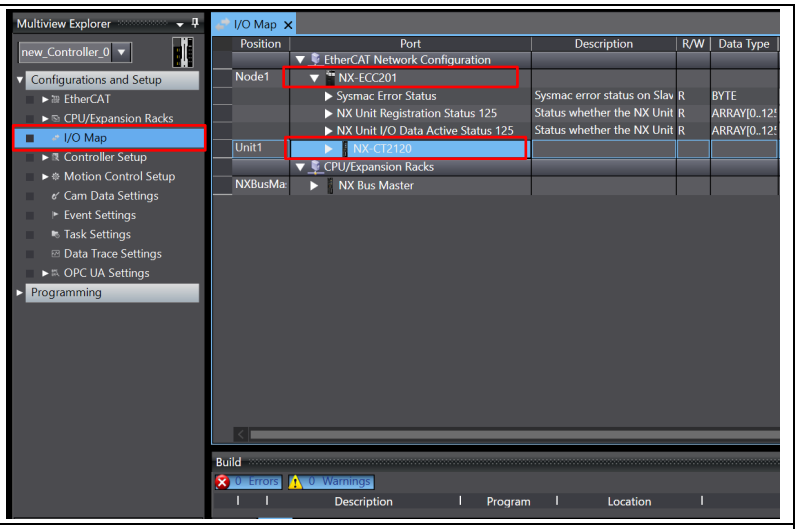
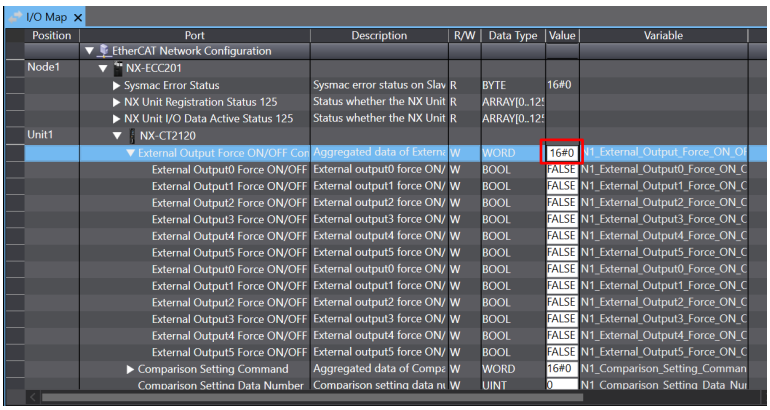
4	Select the check box for the High-speed Counter Unit (NX-CT2□20) that you have set up. Clear the **Do not transfer the following. (All items are not transferred)** Check Box. This enables the transfer of the Unit operation settings on the Slave Terminal.	
5	Click the **Transfer To Controller** Button. The settings are transferred from the Sysmac Studio to the NX Unit.	

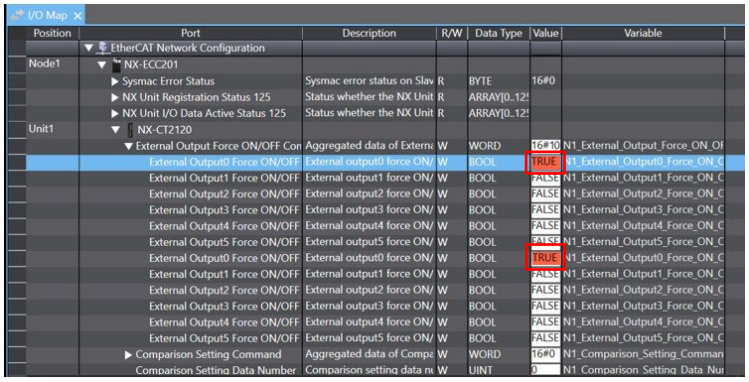
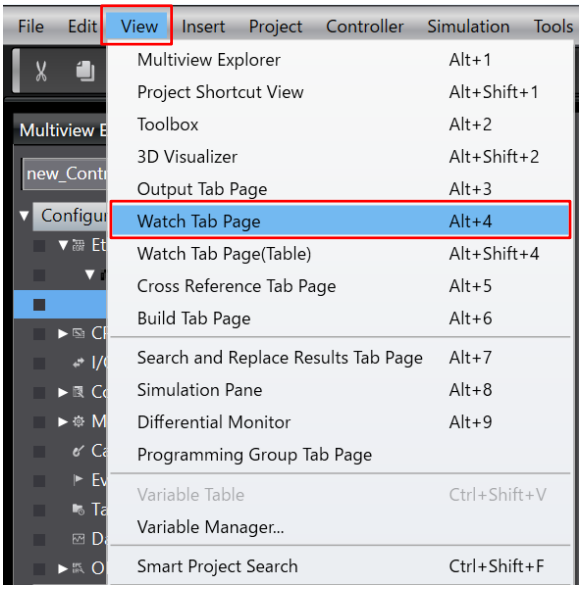
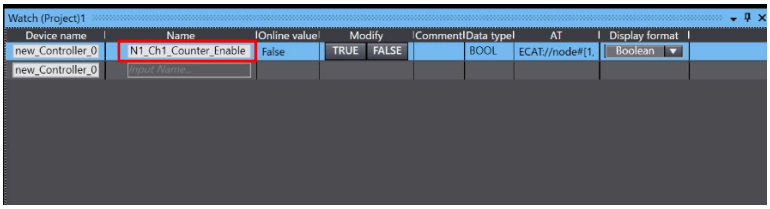
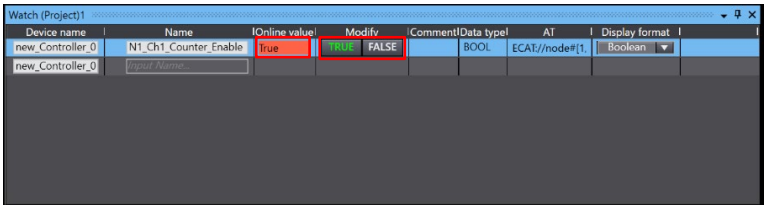
3-5 Operation Checks

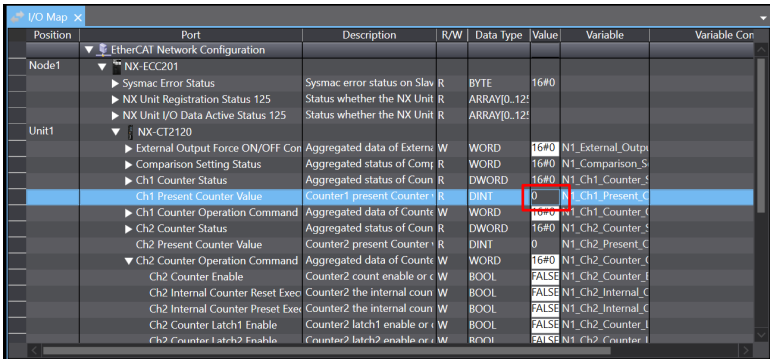
This section describes how to check that the equipment to control operates according to the settings configured in sections up to *3-4 High-speed Counter Unit Setup*.

3-5-1 Flowmeter and Valve Operation Checks

Check that the High-speed Counter Unit can count pulses from the flowmeter and control the valve connected to the external I/O. To do this, check and change values in the I/O Map.

1	With the Sysmac Studio and the CPU Unit online, double-click the I/O Map in the Multiview Explorer, click the EtherCAT Coupler Unit (NX-ECC2□□), and then click the High-speed Counter Unit (NX-CT2□20).	
2	First, check external output 0 to the valve. Change the value of the port name **External Output Force ON/OFF Command** from **16#0** to **16#101**. This check is done by changing **External Output0 Enables Force ON/OFF** (bit 0) and **External Output0 Force ON/OFF Setting** (bit 8) of the port name **External Output Force ON/OFF Command** to 1 **TRUE**.	

3	By changing the value, the values of the port names **External Output0 Force ON/OFF Enable** and **External Output0 Force ON/OFF Setting** change to **TRUE**. You can also right-click the value of **External Output0 Force ON/OFF Setting** and select **Set/Reset (S)** from the pop-up menu to change the value. Check if the valve is opened by the external output.	
4	Check if the High-speed Counter Unit can count the pulses output by the flowmeter. The following describes an example of checking in the Watch Tab Page. In the Sysmac Studio, select **Watch Tab Page** from the **View** Menu.	
5	In the Watch Tab Page displayed, enter **N1_Ch1_Counter_Enable** in the **Name** field to add it.	
6	In the Watch Tab Page, click the **TRUE** Button in the **Modify** field and check that the **Online value** has changed to True. Alternatively, you can also check this by right-clicking **N1_Ch1_Counter_Enable** on the IO Map and selecting **Set/Reset (S)** from the pop-up menu.	

7	Let the flowmeter operate with liquid flowing through it. The pulses output by the flowmeter are reflected as the present counter value in the **Value** field for **Ch1 Present Counter Value** in the **Port** column, as shown in the figure on the right. Confirm that the present counter value has changed.	

3-5-2 I/O Check Function (EtherCAT Coupler Unit)

In situations such as startup of equipment where the CPU Unit is temporarily unavailable or EtherCAT network wiring is not completed, you can use the EtherCAT Coupler Unit alone to perform wiring checks between the NX Unit and I/O devices as described in *3-6-1 Flowmeter and Valve Operation Checks*.

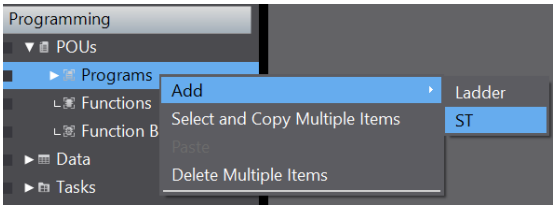
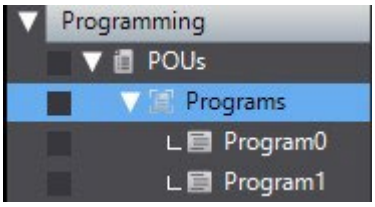
Refer to *11-10 I/O Checking* in the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details on how to perform I/O checks.

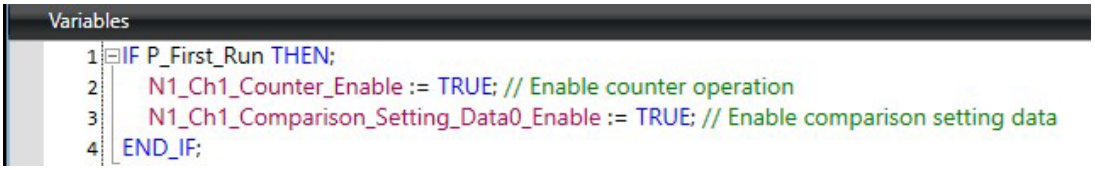
3-6 Programming

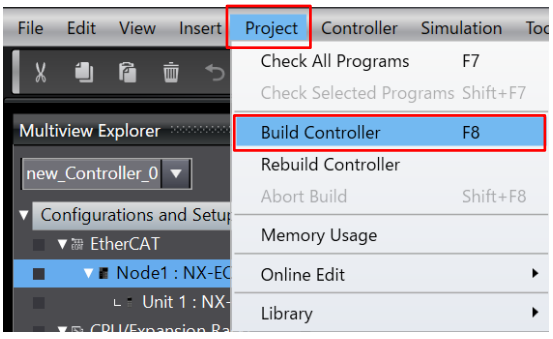
This section describes programming for initializing I/O data required to the filling control system.

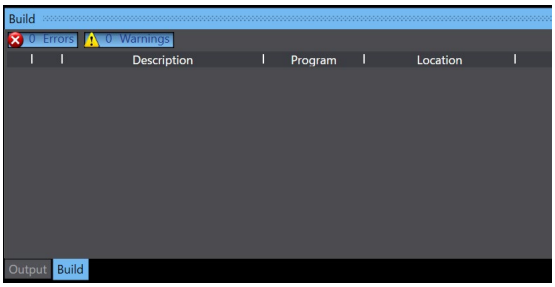
3-6-1 ST Program Creation

To express algorithms within POUs (programs, function blocks, and functions), there are two available programming languages: ladder diagram (LD) and ST (Structured Text).
This section describes the input procedure using ST language as an example.

1	With the Sysmac Studio and the CPU Unit offline, select **Programing** – **POUs** – **Programs** in the Multiview Explorer. Right-click **Programs** and select **Add** – **ST** to create a new ST program file.	
2	The ST program file is added under Programs. Program0 for ladder diagram language has been registered in advance. Modify or delete it as needed.	

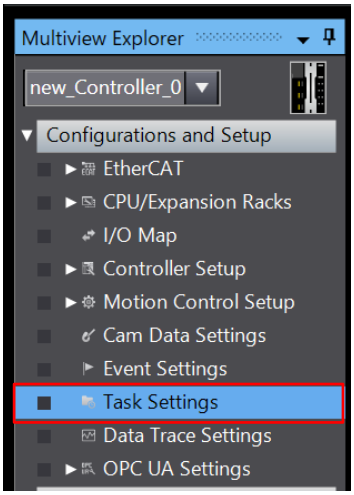
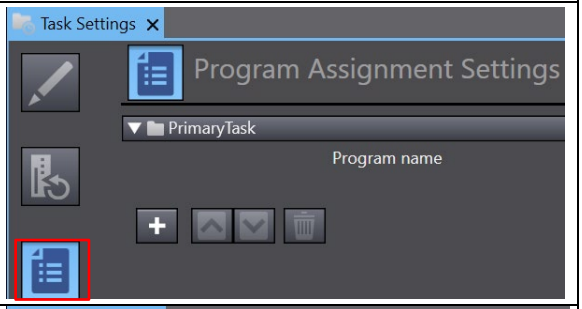
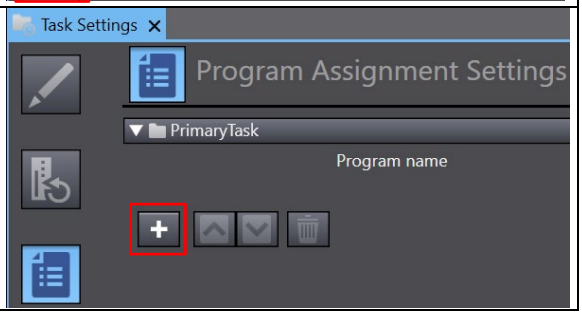
3	Double-click the added ST program. Or right-click it and select **Edit** from the pop-up menu.
	A variable table and the ST Editor are displayed in the Edit Pane, allowing you to create an ST program.
	As an example, add the following program to enable counter functions and the target comparison function.
	
	IF P_First_Run THEN;
	N1_Ch1_Counter_Enable := TRUE; // Enable counter operation
	N1_Ch1_Comparison_Setting_Data0_Enable := TRUE; // Enable comparison setting data
	END_IF;
	 	

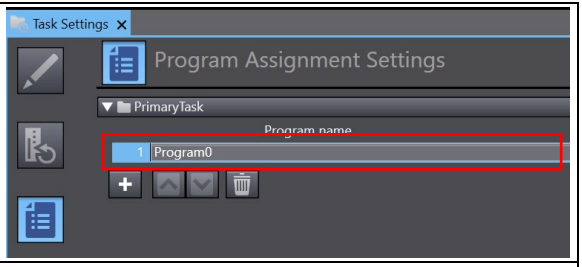
4	After you finish adding the program, select **Build Controller** from the **Project** Menu.	

5	Check the Build Tab Page to confirm that no build errors or warnings have occurred.	

3-6-2 ST Program Configuration

Configure the allocation settings for the ST program that you created in *3-6-1 ST Program Creation*.

1	In the Multiview Explorer, select **Configurations and Setup** – **Task Settings**.	
2	In the Task Settings Tab Page displayed in the Edit Pane, click the **Program Assignment Settings** Button.	
3	Click the **+** button highlighted in red frame.	

4	Select and add the ST program that you created in step 2 of *3-6-1 ST Program Creation*.	
5	Click the **Online** Button to place the Sysmac Studio and the CPU Unit online.	
6	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	

*Refer to *4-6 ST Programming* in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for details on how to create an ST program.

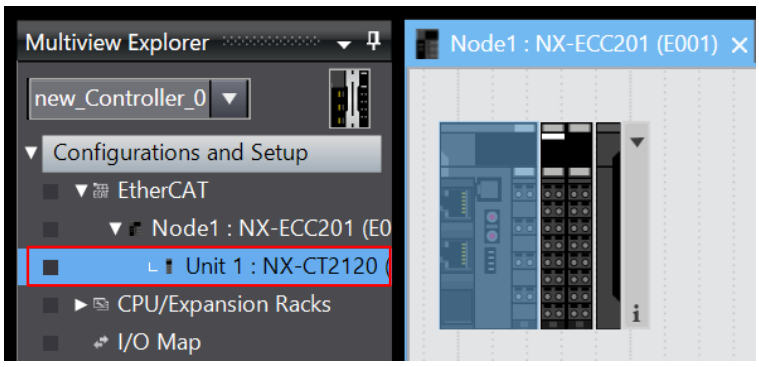
3-7 Advance Time Adjustment

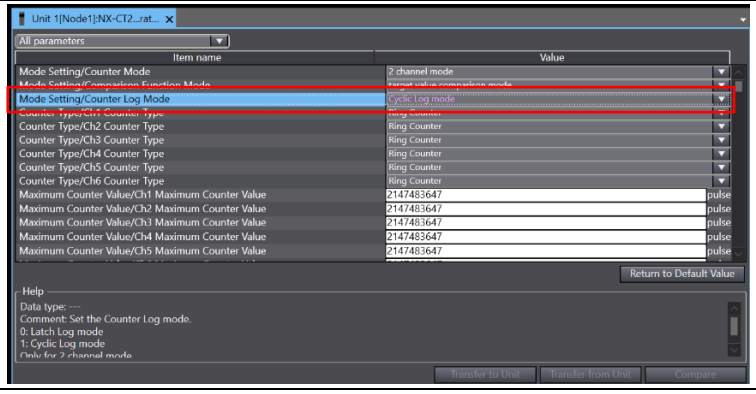
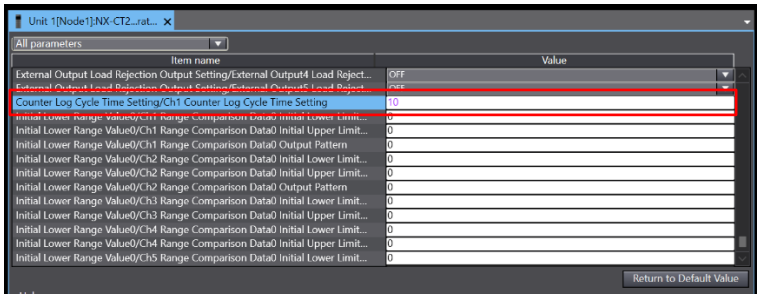
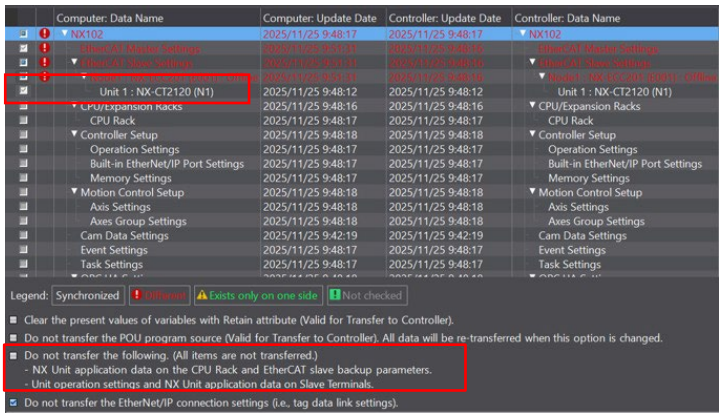
This section describes how to set the advance time using counter log data.
For the counter log function, you can select from two modes: Latch Log Mode and Cyclic Log Mode.
This section explains the procedures for Cyclic Log Mode.
Using Cyclic Log Mode enables you to acquire the transition of the present counter value from external output OFF due to target comparison until the valve is closed and the counter stops counting. By analyzing the transition of the present counter value, you can predict and set the advance time value.
Since Cyclic Log Mode acquires the present counter value at a set fixed cycle and continuously records time-series data during valve operation, it is suitable for calculating advance time.

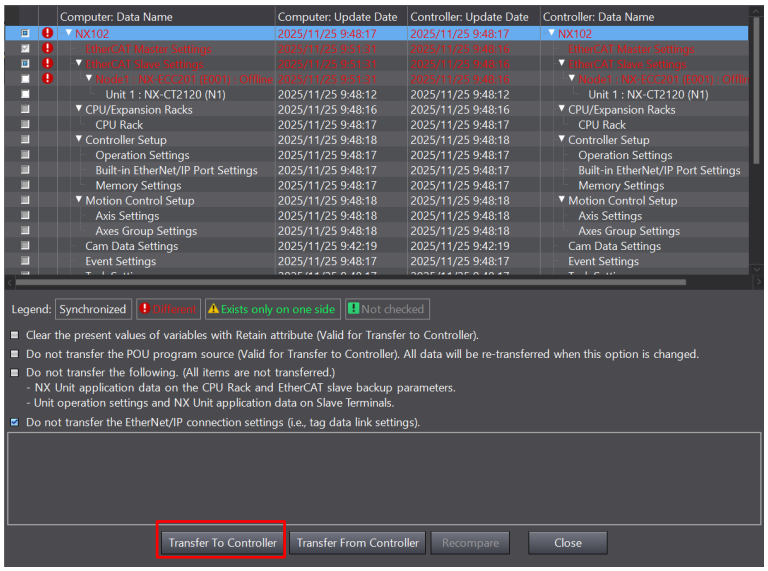
3-7-1 Cyclic Log Mode Setting

• Cyclic Log Mode
This function captures the present counter value at a set time cycle and stores it inside the High-speed Counter Unit as log data with up to 4,096 items.

You can use it for analyzing speed changes and other applications by recording the present counter value at a fixed cycle.
Refer to *7-3-9 Counter Log Function* in the *NX-series High-speed Counter Units User's Manual* (Cat. No. W647) for details on Cyclic Log Mode.

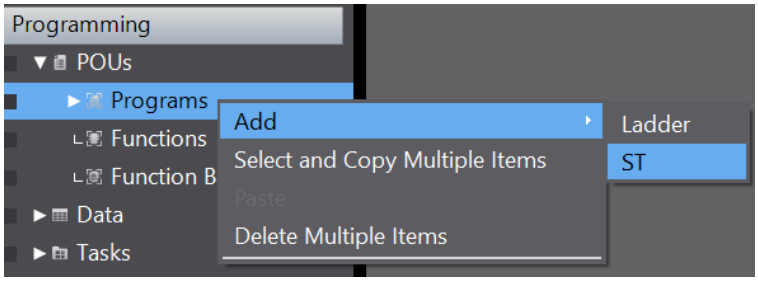
1	With the Sysmac Studio and the CPU Unit online, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	

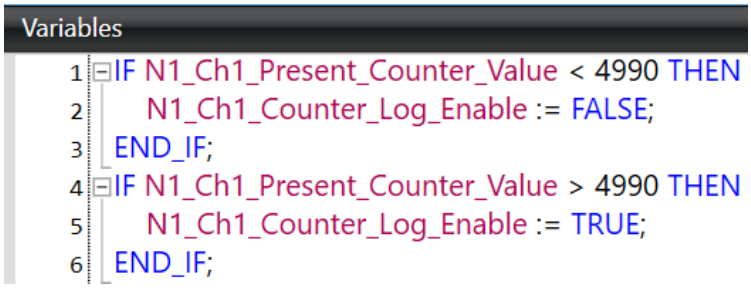
2	Change the set value of **Mode Setting/Counter Log Mode** to **Cyclic log mode**.	
3	Set the counter log data acquisition cycle. To do so, set **Counter Log Cycle Time Setting** to **10**. *If you cannot acquire counter logs properly near the target value, adjust the counter log data acquisition cycle.	
4	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	
5	Select the check box for the High-speed Counter Unit (NX-CT2□20) that you have set up. Clear the **Do not transfer the following. (All items are not transferred)** Check Box. This enables the transfer of the Unit operation settings on the Slave Terminal.	

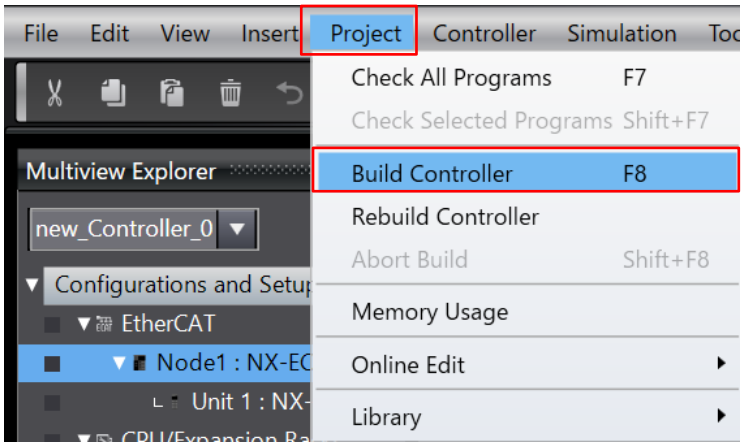
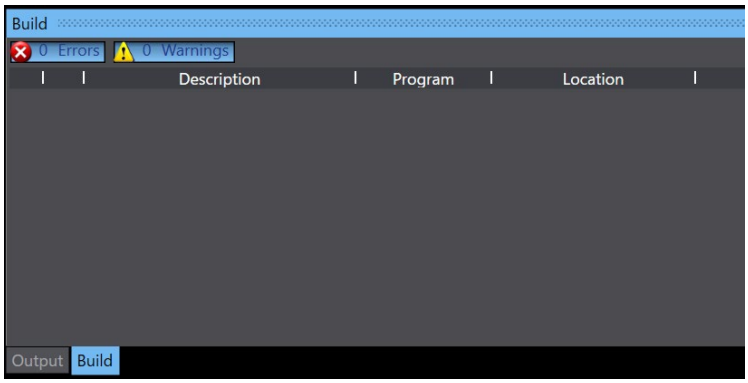
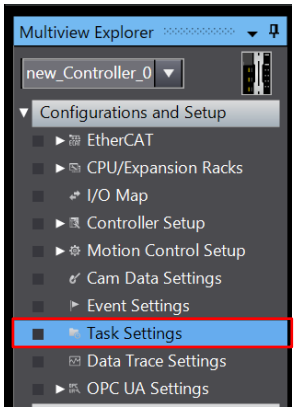
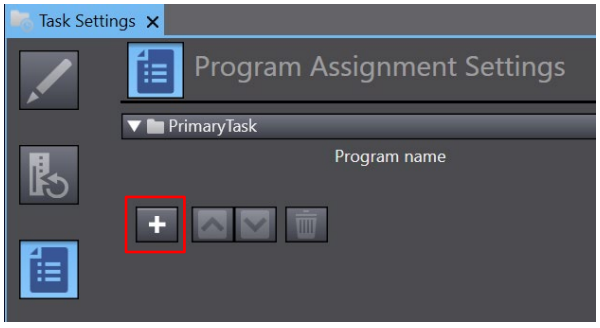
6	Click the **Transfer To Controller** Button. The settings are transferred from the Sysmac Studio to the NX Unit.	

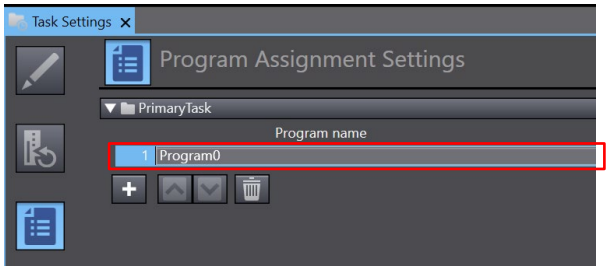
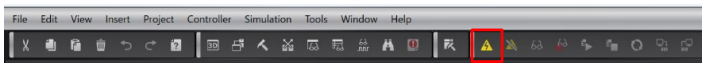
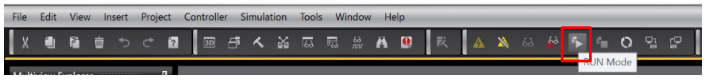
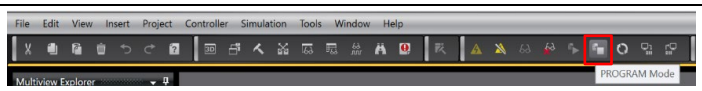
3-7-2 Counter Log Acquisition (Cyclic Log Mode)

This section describes how to acquire counter log data by operating the flowmeter and valve. It also provides an example program in ST for enabling the counter log function near the target value.

1	With the Sysmac Studio and the CPU Unit offline, select **Programing** – **POUs** – **Programs** in the Multiview Explorer. Then, right-click **Programs** and select **Add** – **ST** from the pop-up menu to create a new ST program file.	

2	Add the code as shown on the right to the ST program.
	This example code acquires the present counter value and enables the counter log function when it exceeds **4990**.
	
	*Refer to *3-6 Programming* for how to create and configure an ST program.
		IF N1_Ch1_Present_Counter_Value < 4990 THEN
		  N1_Ch1_Counter_Log_Enable := FALSE;
		END_IF;
		IF N1_Ch1_Present_Counter_Value > 4990 THEN
		  N1_Ch1_Counter_Log_Enable := TRUE;
		END_IF;
		
		 

3	Select **Build Controller** from the **Project** Menu.	
4	Check the Build Tab Page. Confirm that no build errors or warnings have occurred.	
5	In the Multiview Explorer, double-click **Task Settings**.	
6	Select **Program Assignment Settings** and click the **+** button highlighted in red frame.	

7	Assign the ST program file that you created in step 2 to PrimaryTask.	
8	Click the **Online** Button to place the Sysmac Studio and the CPU Unit online.	
9	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	
10	After you finish transferring the settings, start the CPU Unit in RUN mode.	
11	The High-speed Counter Unit waits until the workpiece is set in the specified position.	
12	The High-speed Counter Unit detects via sensor input that the workpiece is set in the specified position and resets the flowmeter counter value using the ST program.	
13	The High-speed Counter Unit opens the valve in conjunction with the counter reset.	
14	When the specified amount of liquid is reached, the target value matching function turns ON the external output signal to close the valve.	
15	Change the CPU Unit to PROGRAM mode to stop the operation.	

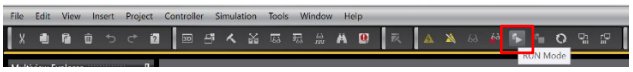
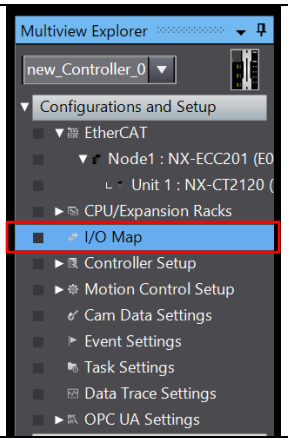
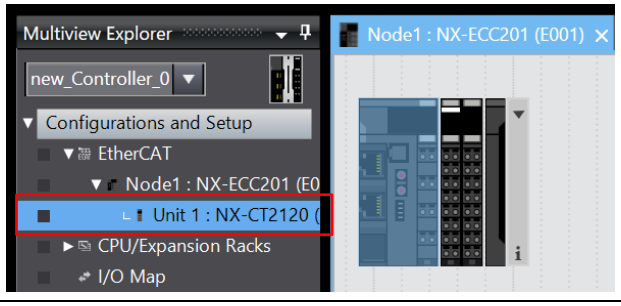
3-7-3 Counter Log Check and Advance Time Setting

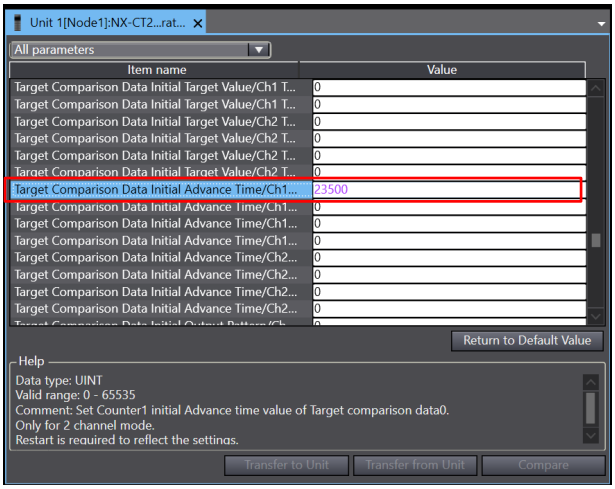
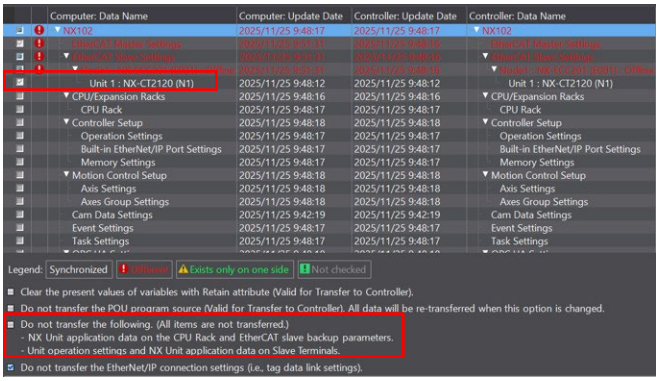
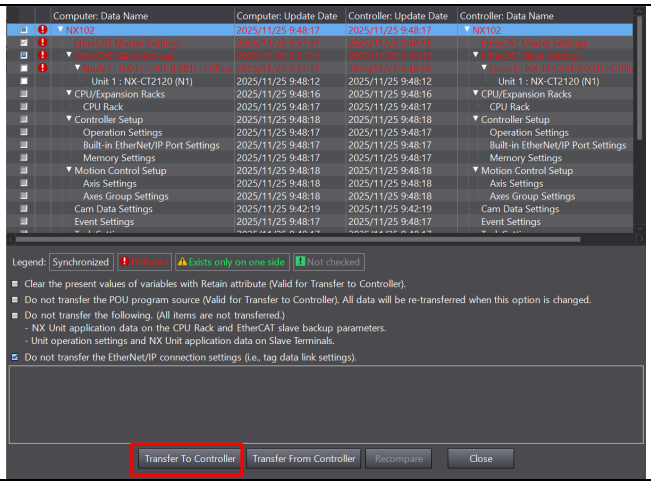
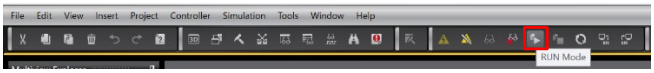
Check the counter log and set the advance time.

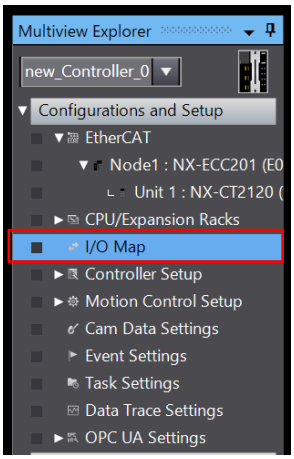
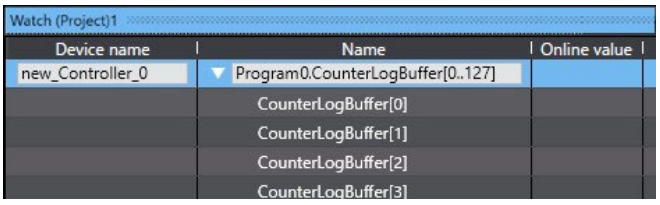
By reading and checking the counter log data stored inside the counter that you acquired in *3-7-2 Counter Log Acquisition (Cyclic Log Mode)*, estimate the delay time from external output OFF due to target comparison until the valve is closed and the counter stops counting. Then, set the advance time by the amount of the delay time.

*This section describes reading counter log data.

Refer to *A-4-1 Counter Log Data Read* in the *NX-series High-speed Counter Units User's Manual* (Cat. No. W647) for details on reading counter log data.

1	With the Sysmac Studio and the CPU Unit online, start the CPU Unit in RUN mode.	
2	In the Multiview Explorer, double-click **I/O Map**.	
3	Display the I/O Map for the High-speed Counter Unit and acquire counter log data (Ch1 Counter Log Data1 to Ch1 Counter Log Data16).	
4	Analyze the acquired counter log data and calculate the advance time. Refer to *4-2 How to Calculate the Advance Time* for the specific setting procedure.	
5	With the Sysmac Studio and the CPU Unit online, double-click the High-speed Counter Unit (NX-CT2□20) in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.	

6	Set the value of **Target Comparison Data Initial Advance Time/Ch1 Target Comparison Data0 initial Advance Time**. *Set the advance time value calculated from the counter log data. This is an example of setting default values for both the target value and the advance time in the target comparison data. Refer to *3-4-6 Counter Resetting by External Input and External Output Control* for the program for writing set values.	
7	Click the **Online** Button to place the Sysmac Studio and the CPU Unit online.	
8	Click the **Synchronize** Button to transfer the settings from the PC to the CPU Unit.	
9	Select the check box for the High-speed Counter Unit (NX-CT2□20) that you have set up. Clear the **Do not transfer the following. (All items are not transferred)** Check Box. This enables the transfer of the Unit operation settings on the Slave Terminal.	
10	Click the **Transfer To Controller** Button. The settings are transferred from the Sysmac Studio to the NX Unit.	
11	With the Sysmac Studio and the CPU Unit online, start the CPU Unit in RUN mode.	

12	In the Multiview Explorer, double-click **I/O Map**.	
13	Display the I/O Map for the High-speed Counter Unit and acquire counter log data (Ch1 Counter Log Data1 to Ch1 Counter Log Data16). *1 If the counter log is not updated, check the buffer full flag. If the buffer is full, the counter log cycle time may be too short relative to the cycle time for retrieving the counter log data (for example, the task period). *2 The sample program provided in *A-4-1 Counter Log Data Read in the NX-series High-speed Counter Units User's Manual* (Cat. No. W647) acquires four data items at a time using I/O data (Ch1 Counter Log Data1 to Ch1 Counter Log Data4). Using I/O data (Ch1 Counter Log Data1 to Ch1 Counter Log Data16), you can transfer up to 16 data items at a time.	
14	The sample program provided in *A-4-1 Counter Log Data Read in the NX-series High-speed Counter Units User's Manual* (Cat. No. W647) copies 128 log data items into the CounterLogBuffer array variable. You can monitor the array variable in the Watch Tab Page, or save it as data to acquire the counter log data. *The internal buffer of the High-speed Counter Unit can store up to 4,096 data items. The	

	above sample program stores the 129th and subsequent data items again starting from CounterLogBuffer[0]. Change the array variable as appropriate based on the number of log data items to acquire, or stop storing data.	
15	Check the acquired counter log data and confirm that the measured values are around **5000** pulses, compared to the target value of **5000**. Then, calculate the advance time by graphing the results or by other means. Calculate the advance time by referring to *4-2 How to Calculate the Advance Time*. It is also evident that setting the advance time resulted in earlier output of the external output signal. This means that the valve opening and closing timing becomes closer to the target value, leading to reduced delay time for the valve. *If there is a significant difference between the target value and the checked result, go back to *3-7-2 Counter Log Acquisition (Cyclic Log Mode)* and check the counter log data before performing the procedure again.	

4

4. Appendices

4-1 Functions for Stable Measurement

To ensure stable measurement, the High-speed Counter Unit provides the following functions. Use them as needed.

● **Counter Noise Filter**

This function eliminates the noise contained in counter input signal wires.
The use of the counter noise filter eliminates electrical noise contained in counter input signals and prevents miscounting.

Refer to *7-3-1 Counter Noise Filter* in the *NX-series High-speed Counter Units User's Manual* (Cat. No. W647) for details on the counter noise filter.

● **External Input Noise Filter**

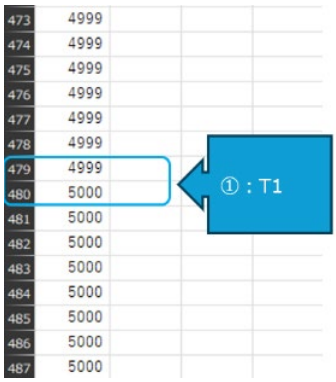
This function prevents data changes and stabilizes data when external input signal contact status is unstable due to the influence of chattering or noise.

Refer to *7-4-1 External Input Noise Filter* in the *NX-series High-speed Counter Units User's Manual* (Cat. No. W647) for details on the counter noise filter.

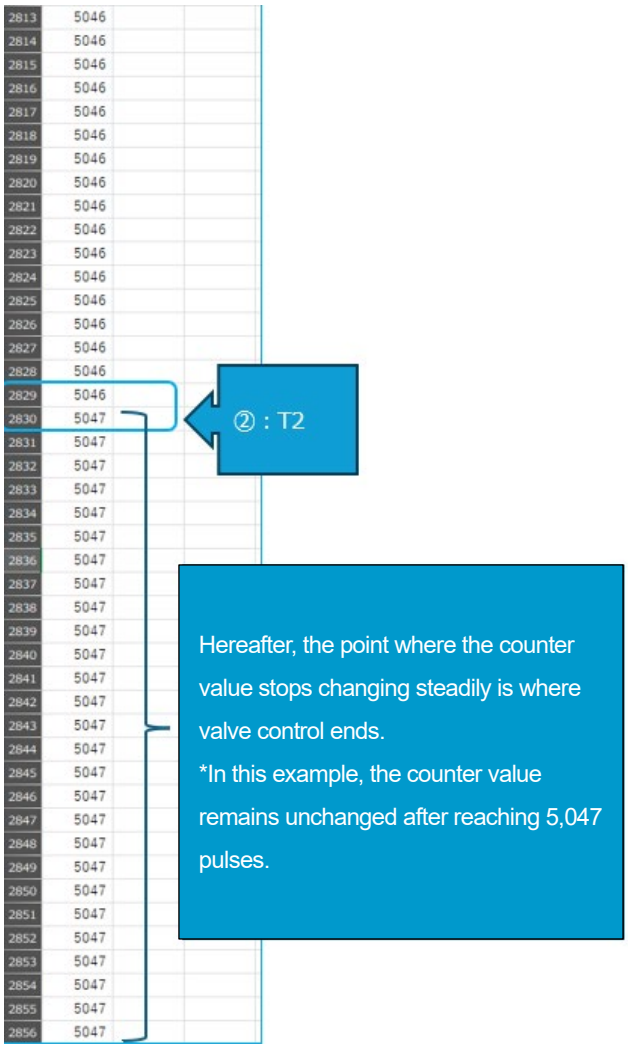
4-2 How to Calculate the Advance Time

This section describes how to calculate the advance time from the acquired counter log data.

1. Retrieve the counter log data from the High-speed Counter Unit and organize it into a table.
2. Locate the point from the counter log data where the specified filling amount is exceeded. ((1) in the figure below)
   This example assumes that the specified amount is 5,000 pulses.
3. Next, locate the point where the valve was fully closed. ((2) in the figure below)
   The point where the valve was closed corresponds to where the counter value stopped changing steadily.
4. Based on steps 1 and 2, calculate the time (T) required to close the valve.
   In this example, the time (T) required to close the valve is the advance time.
   Since T1 is at the 480th cycle and T2 is at the 2,830th cycle, T is calculated as follows:
   T (μs) = (T2 - T1) × Log period = (2,830 - 480) × 10 (μs) = 23,500 (μs)


473 4999
474 4999
475 4999
476 4999
477 4999
478 4999
479 4999
480 5000
481 5000
482 5000
483 5000
484 5000
485 5000
486 5000
487 5000
① : T1

(Omitted)


2813 5046
2814 5046
2815 5046
2816 5046
2817 5046
2818 5046
2819 5046
2820 5046
2821 5046
2822 5046
2823 5046
2824 5046
2825 5046
2826 5046
2827 5046
2828 5046
2829 5046
2830 5047
2831 5047
2832 5047
2833 5047
2834 5047
2835 5047
2836 5047
2837 5047
2838 5047
2839 5047
2840 5047
2841 5047
2842 5047
2843 5047
2844 5047
2845 5047
2846 5047
2847 5047
2848 5047
2849 5047
2850 5047
2851 5047
2852 5047
2853 5047
2854 5047
2855 5047
2856 5047
② : T2
Hereafter, the point where the counter value stops changing steadily is where valve control ends.
*In this example, the counter value remains unchanged after reaching 5,047 pulses.

Note: Do not use this document to operate the Unit.

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