OMRON

Machine Automation Controller

NX-series

Position Interface Units

User's Manual

NX-EC0□□□
NX-ECS□□□
NX-PG0□□□

Incremental Encoder Input Units
SSI Input Units
Pulse Output Units

sysmac
always in control

W524-E1-05

Introduction

Thank you for purchasing an NX-series Position Interface Unit.

This manual contains information that is necessary to use the NX-series Position Interface Units. Please read this manual and make sure you understand the functionality and performance of the NX-series Position Interface Unit before you attempt to use it in a control system.

Keep this manual in a safe place where it will be available for reference during operation.

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.

- NX-series Position Interface Units

Unit name	Model
Incremental Encoder Input Units	NX-EC0112, NX-EC0122, NX-EC0132, NX-EC0142, NX-EC0212, and NX-EC0222
SSI Input Units	NX-ECS112 and NX-ECS212
Pulse Output Unit	NX-PG0112 and NX-PG0122

CONTENTS

Section 7 SSI Input Units

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Relevant Manuals

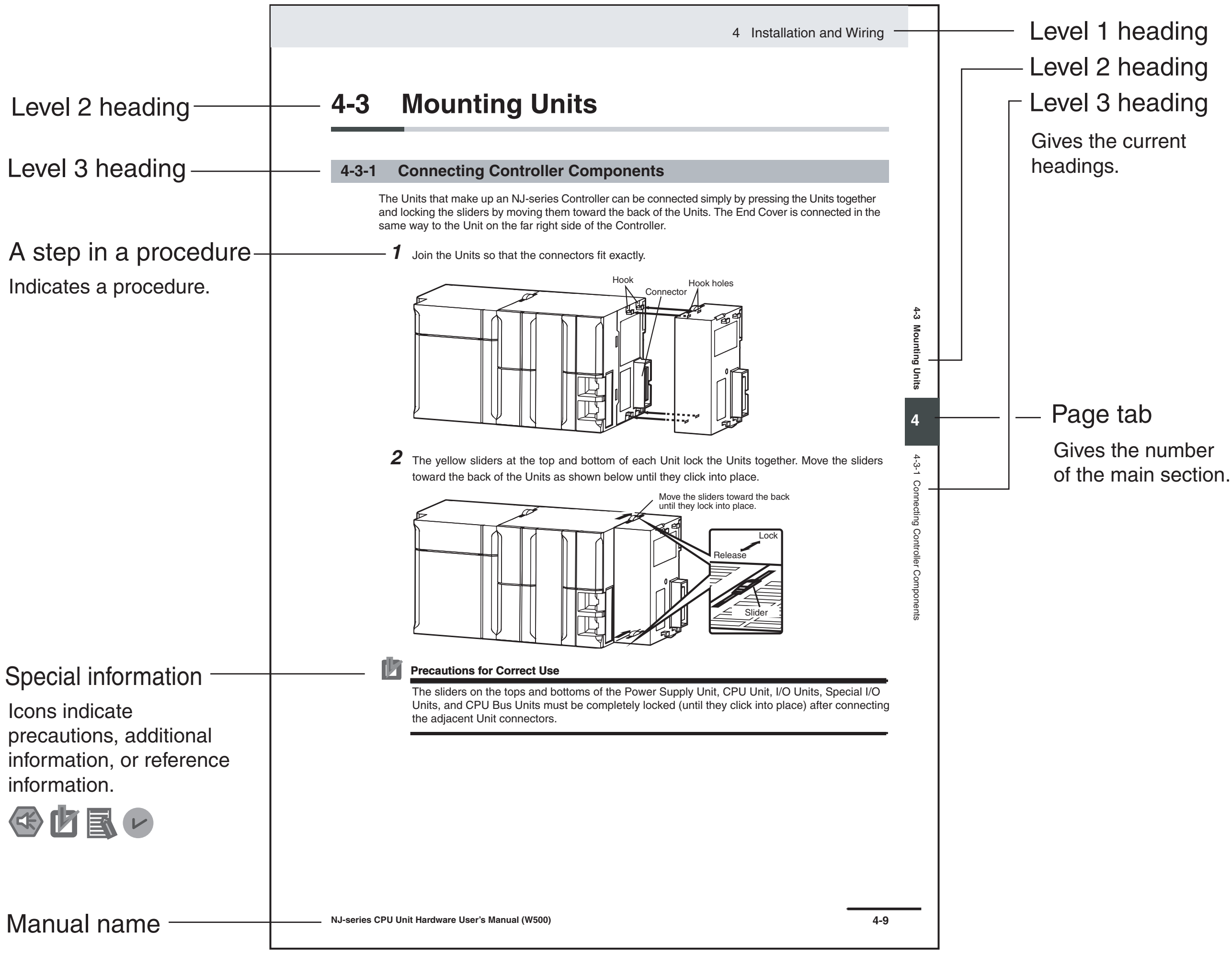
The table below provides the relevant manuals for the NX-series Position Interface Units.
Read all of the manuals that are relevant to your system configuration and application to make the most of the NX-series Position Interface Units.
Other manuals, such as related product manuals, are necessary for specific system configurations and applications. Refer to *Related Manuals* on page 27 for the related manuals.

Manual name	Application
NX-series Position Interface Units User's Manual	Learning how to use NX-series Position Interface Units
NX-series Data Reference Manual	Referencing lists of the data that is required to configure systems with NX-series Units

Manual Structure

Page Structure and Icons

The following page structure and icons are used in this manual.



Note This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

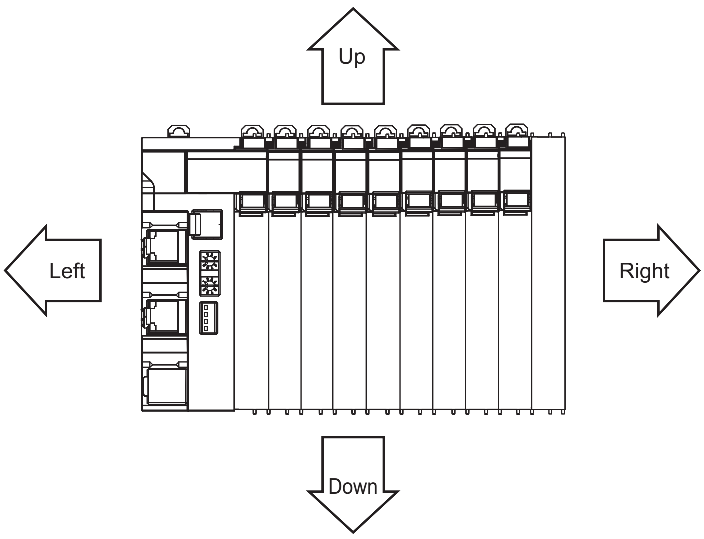
Version Information

Information on differences in specifications and functionality for CPU Units and EtherCAT Coupler Units with different unit versions and for different versions of the Sysmac Studio is given.

Note References are provided to more detailed or related information.

Precaution on Terminology

- In this manual, “download” refers to transferring data from the Sysmac Studio to the physical Controller and “upload” refers to transferring data from the physical Controller to the Sysmac Studio.
  For the Sysmac Studio, synchronization is used to both upload and download data. Here, “synchronize” means to automatically compare the data for the Sysmac Studio on the computer with the data in the physical Controller and transfer the data in the direction that is specified by the user.
- In this manual, the directions in relation to the Units are given in the following figure, which shows upright installation.



Terms and Conditions Agreement

Warranty, Limitations of Liability

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

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Safety Precautions

Definition of Precautionary Information

The following notation is used in this user's manual to provide precautions required to ensure safe usage of an NX-series Position Interface Unit.

The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.

The following notation is used.

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols

The circle and slash symbol indicates operations that you must not do.
The specific operation is shown in the circle and explained in text.
This example indicates prohibiting disassembly.

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a precaution for electric shock.

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a general precaution.

The filled circle symbol indicates operations that you must do.
The specific operation is shown in the circle and explained in text.
This example shows a general precaution for something that you must do.

Warnings

WARNING

Design

Interlock circuits, limit circuits, and other safety measures must be provided in external control circuits.

Not doing so may result in serious accidents due to incorrect operation.

Fail-safe Measures

Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the CPU Unit, other Units, or slaves or due to other external factors affecting operation.

Not doing so may result in serious accidents due to incorrect operation.

Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

The CPU Unit will turn OFF all outputs from Basic Output Units in the following cases. The remote I/O slaves will operate according to the settings in the slaves.

- If a power supply error occurs.
- If the power supply connection becomes faulty.
- If a CPU watchdog timer error or CPU reset occurs.
- If a Controller error in the major fault level occurs.
- While the CPU Unit is on standby until RUN mode is entered after the power is turned ON

External safety measures must be provided to ensure safe operation of the system in such cases.

The outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.

If external power supplies for slaves or other devices are overloaded or short-circuited, the voltage will drop, outputs will turn OFF, and the system may be unable to read inputs. Provide external safety measures in control with monitoring of external power supply voltage as required so that the system operates safely in such a case.

You must take fail-safe measures to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.

Not doing so may result in serious accidents due to incorrect operation.

During Power Supply

Do not touch the terminal section while power is ON.

Electric shock may occur.

Do not attempt to take any Unit apart.

In particular, high-voltage parts are present in Units that supply power while power is supplied or immediately after power is turned OFF. Touching any of these parts may result in electric shock. There are sharp parts inside the Unit that may cause injury.

Voltage and Current Inputs

Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges.

Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.

Transferring

Always confirm safety at the destination node before you transfer Unit configuration information, parameters, settings, or other data from tools such as the Sysmac Studio.

The devices or machines may operate unexpectedly, regardless of the operating mode of the Controller.

Cautions

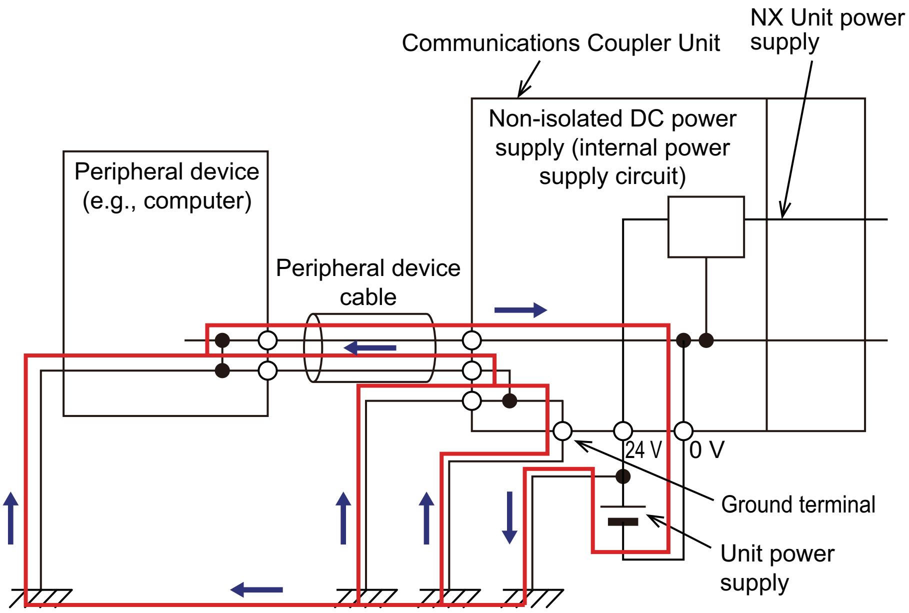
Caution

Wiring

When you connect a computer or other peripheral device to a Communications Coupler Unit that has a non-isolated DC power supply, either ground the 0-V side of the external power supply (i.e. Unit power supply) or do not ground it at all.

If the peripheral devices are grounded incorrectly, the external power supply (i.e. Unit power supply) may be short-circuited.

Never ground the 24-V side of the power supply, as shown in the following figure.



Be sure that all terminal screws and cable connector screws are tightened to the torque specified in the relevant manuals. The loose screws may result in fire or malfunction.

Online Editing

Execute online editing only after confirming that no adverse effects will be caused by deviations in the timing of I/O. If you perform online editing, the task execution time may exceed the task period, I/O may not be refreshed with external devices, input signals may not be read, and output timing may change.

Precautions for Safe Use

Transporting

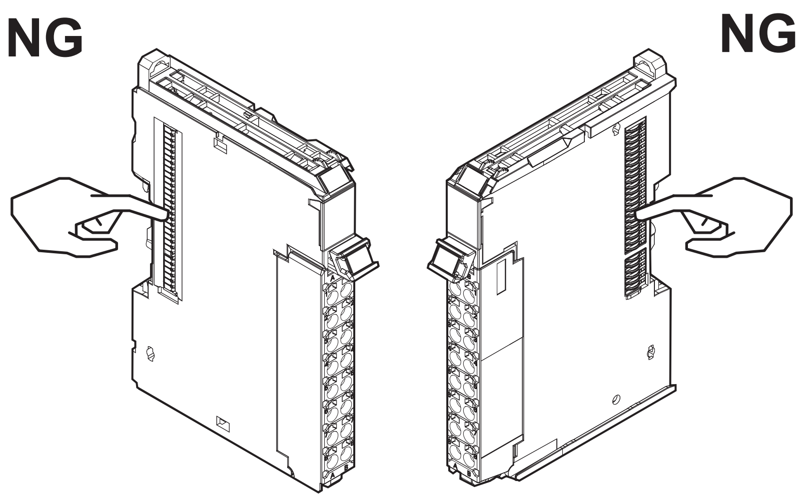
- When transporting any Unit, use the special packing box for it.
  Also, do not subject the Unit to excessive vibration or shock during transportation.
- Do not drop any Unit or subject it to abnormal vibration or shock.
  Doing so may result in Unit malfunction or burning.

Mounting

- Mount terminal blocks and connectors only after checking the mounting location carefully.
- Be sure that the terminal blocks, expansion cables, and other items with locking devices are properly locked into place.

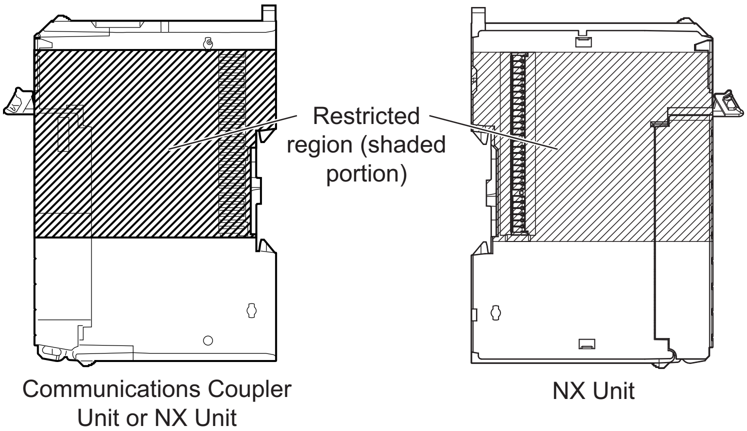
Installation

- Do not apply labels or tape to the Unit. When the Unit is installed or removed, adhesive or scraps may adhere to the pins in the NX bus connector, which may result in malfunctions.
- Do not touch the pins in the NX bus connector on the Unit. Dirt may adhere to the pins in the NX bus connector, which may result in malfunctions.

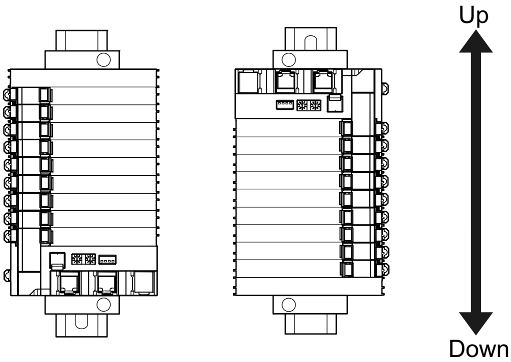


Example: NX Unit (12 mm width)

- Do not write on the Communications Coupler Unit or an NX Unit with ink within the restricted region that is shown in the following figure. Also do not get this area dirty. When the Unit is installed or removed, ink or dirt may adhere to the pins in the NX bus connector, which may result in malfunctions in the Slave Terminal.

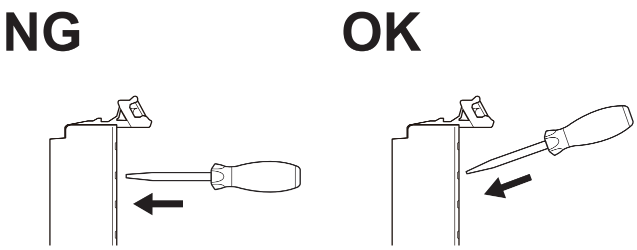


- For the installation orientations in the following figure, support the cables, e.g., with a duct, so that the End Plate on the bottom is not subjected to the weight of the cables. The weight of the cables may cause the bottom End Plate to slide downward so that the Slave Terminal is no longer secured to the DIN Track, which may result in malfunctions.



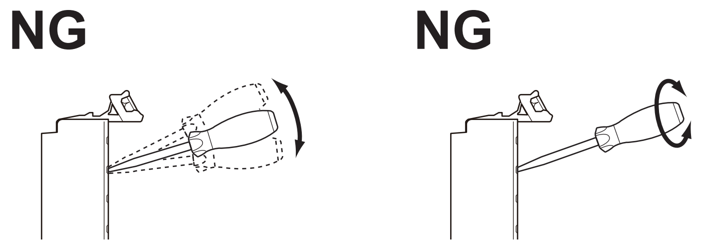
Wiring

- Double-check all switches and other settings and double-check all wiring to make sure that they are correct before turning ON the power supply.
  Use the correct wiring parts and tools when you wire the system.
- Do not pull on the cables or bend the cables beyond their natural limit. Also, do not place heavy objects on top of the cables or other wiring lines. Doing so may break the cable.
- When wiring or installing the Units, do not allow metal fragments to enter the Units.
- Do not press the flat-blade screwdriver straight into the release holes on a screwless clamping terminal block. Doing so may damage the terminal block.



- When you insert a flat-blade screwdriver into a release hole on a screwless clamping terminal block, press it down with a force of 30N or less. Applying excessive force may damage the terminal block.

- Do not incline or twist the flat-blade screwdriver while it is in a release hole on a screwless clamping terminal block. Doing so may damage the terminal block.



- Use crimp terminals for wiring the M3 screw terminal blocks. Do not connect bare stranded wires directly to the M3 screw terminal blocks.

Power Supply Design

- Use all Units within the I/O power supply ranges that are given in the specifications.
- Supply sufficient power according to the contents of this manual.
- Use the power supply voltage that is specified in this manual.
- Do not apply voltages that exceed the rated value to any Input Unit.
- Do not apply voltages or connect loads to the Output Units or slaves in excess of the maximum ratings.
- Inrush current occurs when the power supply is turned ON. When selecting fuses or breakers for external circuits, consider their fusing and detection characteristics as well as the above precautions and allow sufficient margin in shut-off performance.
- Install external breakers and take other safety measures against short-circuiting and overcurrents in external wiring.

Turning ON the Power Supply

- When you set the Operating Mode at Startup, confirm that no adverse effect will occur in the system.

Actual Operation

- Before you start operation, always register the NX Units that are connected to the Communications Coupler Unit in the host communications master as the Unit Configuration Information.
- Check the user program, data, and parameter settings for proper execution before you use them for actual operation.
- If you change the fail-soft operation setting, the output status when the error occurs may also change. Confirm safety before you change the fail-soft operation setting.
- If you use fail-soft operation, write programming to determine whether Unit I/O data is valid. Without such programming, the user program cannot distinguish between Units for which I/O refreshing is continued and Units for which I/O refreshing is stopped.

Turning OFF the Power Supply

- Do not disconnect the cable or turn OFF the power supply to the Controller or a Slave Terminal when downloading data or the user program from Sysmac Studio.
- Always turn OFF the external power supply to the Units before attempting any of the following.

  Mounting or removing an NX Unit, Communications Coupler Unit, or CPU Unit
  Assembling Units
  Setting DIP switches or rotary switches
  Connecting or wiring cables
  Attaching or removing terminal blocks or connectors

Units that supply power continue to supply power to the Units for up to several seconds after the power supply is turned OFF. The PWR indicator remains lit as long as power is supplied. Confirm that the PWR indicator is not lit before you perform any of the above.

Operation

- Confirm that the controlled system will not be adversely affected before you perform any of the following operations.

  Changing the operating mode of the CPU Unit (including changing the setting of the Operating Mode at Startup)
  Changing the user program or settings
  Changing set values or present values
  Forced refreshing
- Always sufficiently check the safety at the connected devices before you change the settings of a slave or Unit.

General Communications

- Do not exceed the ranges that are given in the specifications for the communications distance and number of connected Units.
- Refer to the user's manual for the Communications Coupler Unit for precautions for the safe use of communications with the connected Communications Coupler Unit.

Unit Replacement

- When you replace a Unit, start operation only after you transfer the settings and variables that are required for operation to the new Unit.

Disposal

- Dispose of the product according to local ordinances as they apply.

Precautions for Correct Use

Storage, Mounting, and Wiring

- Follow the instructions in this manual to correctly perform installation and wiring.
- Do not operate or store the Units in the following locations. Doing so may result in malfunction, in operation stopping, or in burning.

  Locations subject to direct sunlight
  Locations subject to temperatures or humidity outside the range specified in the specifications
  Locations subject to condensation as the result of severe changes in temperature
  Locations subject to corrosive or flammable gases
  Locations subject to dust (especially iron dust) or salts
  Locations subject to exposure to water, oil, or chemicals
  Locations subject to shock or vibration
- Take appropriate and sufficient countermeasures during installation in the following locations.

  Locations subject to strong, high-frequency noise
  Locations subject to static electricity or other forms of noise
  Locations subject to strong electromagnetic fields
  Locations subject to possible exposure to radioactivity
  Locations close to power lines
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.
- Use the rated power supply voltage for the Units that supply power. Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.
- Install the Units away from sources of heat and ensure proper ventilation. Not doing so may result in malfunction, in operation stopping, or in burning.
- Do not allow foreign matter to enter the openings in the Unit. Doing so may result in Unit burning, electric shock, or failure.

Actual Operation

- If you change the event level of an error, the output status when the error occurs may also change. Confirm safety before you change an event level.
- If you change the fail-soft operation setting, the output status when the error occurs may also change. Confirm safety before you change the fail-soft operation setting.

Turning OFF the Power Supply

- Do not turn OFF the power supply while data is being transferred.
- Do not turn OFF the power supply while parameters are being written to the Communications Coupler Unit or NX Units.

General Communications

- Refer to the user's manual for the Communications Coupler Unit for precautions for the correct use of communications with the connected Communications Coupler Unit.

Regulations and Standards

Conformance to EC Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards.*1

Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer. EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

*1. Applicable EMC (Electromagnetic Compatibility) standards are as follows:
EMS (Electromagnetic Susceptibility): EN 61131-2
EMI (Electromagnetic Interference): EN 61131-2 (Radiated emission: 10-m regulations).

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards. The applicable directive is EN 61131-2.

Conformance to EC Directives

The NX-series Units comply with EC Directives. To ensure that the machine or device in which the NX-series Units are used complies with EC Directives, the following precautions must be observed.

- The NX-series Units must be installed within a control panel.
- You must use reinforced insulation or double insulation for the DC power supplies that are connected as the Unit power supplies and I/O power supplies for the NX-series Units.

  We recommend that you use the OMRON S8JX-series Power Supplies. EMC standard compliance was confirmed for the recommended Power Supplies.
- NX-series Units that comply with EC Directives also conform to the Common Emission Standard (EN 61131-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions.

  You must therefore confirm that the overall machine or equipment in which the NX-series Units are used complies with EC Directives.
- You must use power supplies with an output hold time of 10 ms or longer for the DC power supplies that are connected as the Unit power supplies and I/O power supplies for the NX-series Units.
- This is a Class A product (for industrial environments). In a residential environment, it may cause radio interference. If radio interference occurs, the user may be required to take appropriate measures.

Conformance to UL and CSA Standards

Some NX-series products comply with UL and CSA standards. If you use an NX-series product that complies with UL or CSA standards and the machinery or system in which you use the NX-series product must also comply with the standards, refer to the *Instruction Sheet* that is provided with the product. The *Instruction Sheet* provides the application conditions for complying with the standards.

Conformance to Shipbuilding Standards

Some NX-series products comply with shipbuilding standards. If you use an NX-series product that complies with shipbuilding standards and the machinery or system in which you use the NX-series product must also comply with the standards, consult with your OMRON representative. Application conditions are defined according to the installation location. Application may not be possible for some installation locations.

Usage Conditions for NK and LR Shipbuilding Standards

- A Position Interface Unit must be installed within a control panel.
- Gaps in the door to the control panel must be completely filled or covered with gaskets or other material.
- The following noise filter must be connected to the power supply line.

Name	Manufacturer	Model
Noise filter	Cosel Co., Ltd.	TAH-06-683

Conformance to KC Standards

Observe the following precaution if you use NX-series Units in Korea.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A 급) 전자파적합기기로서 판매자
또는 사용자는 이 점을 주의하시기 바라며, 가정외의
지역에서 사용하는 것을 목적으로 합니다.

Class A Device (Broadcasting Communications Device for Office Use)

This device obtained EMC registration for office use (Class A), and it is intended to be used in places other than homes.

Sellers and/or users need to take note of this.

Software Licenses and Copyrights

This product incorporates certain third party software. The license and copyright information associated with this software is available at http://www.fa.omron.co.jp/nj_info_e/.

Unit Versions

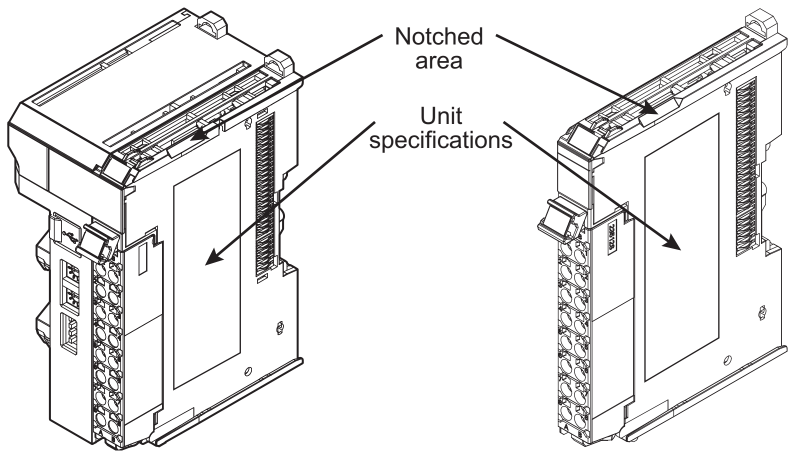
This section describes the notation that is used for unit versions, the confirmation method for unit versions, and the relationship between unit versions and Sysmac Studio versions.

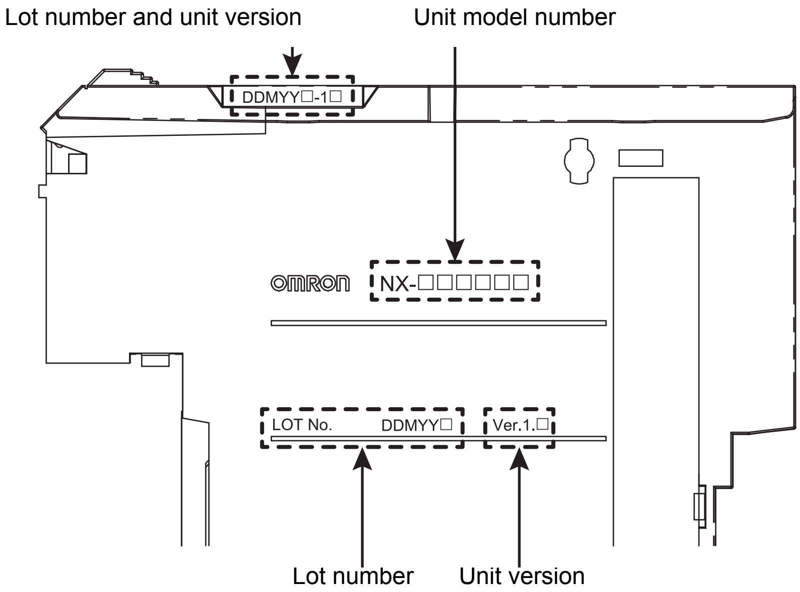
Unit Versions

A “unit version” has been introduced to manage the Units in the NX Series according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

The unit version is given with the Unit specifications on the side of the Unit or in the notched area.





The following information is provided in the Unit specifications on the Unit.

Name	Function
Unit model number	Gives the model of the Unit.
Unit version	Gives the unit version of the Unit.
Lot number	Gives the lot number of the Unit. DDMYY□: Lot number, □: Used by OMRON. “M” gives the month (1 to 9: January to September, X: October, Y: November, Z: December)

The following information is provided in the notched area on the Unit.

Name	Function
Lot number and unit version	Gives the lot number and unit version of the Unit. • DDMYY□: Lot number, □: Used by OMRON. "M" gives the month (1 to 9: January to September, X: October, Y: November, Z: December) • 1□: Unit version The decimal portion of the unit version is omitted. (It is provided in the Unit specifications.)

Confirming Unit Versions with the Sysmac Studio

You can use the Production Information on the Sysmac Studio to check the unit versions of the Communications Coupler Unit and NX Units.

An example for an EtherCAT Slave Terminal is given below.
Refer to the user's manual for the connected Communications Coupler Unit for the procedure to confirm the unit versions of the Units on any other type of Slave Terminal.

1 Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer, and then double-click the EtherCAT Coupler Unit. Or, right-click the EtherCAT Coupler Unit and select ***Edit*** from the menu.

The Slave Terminal Tab Page is displayed.

You can also display the Slave Terminal Tab Page with any of the following operations.

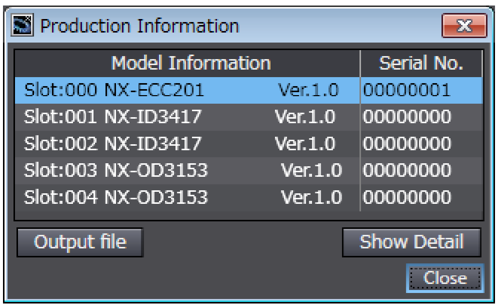
Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer, right-click the EtherCAT Coupler Unit in the EtherCAT Configuration Edit Tab Page, and select ***Edit Slave Terminal Configuration***.

Or, select the EtherCAT Coupler Unit on the EtherCAT Configuration Edit Tab Page click the **Edit Slave Terminal Configuration** Button.

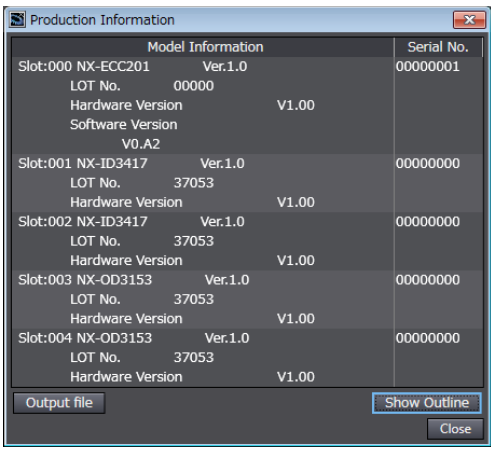
2 Go online.

3 Right-click the Position Interface Unit and select ***Display Production Information*** from the menu.

The Production Information Dialog Box is displayed.



Simple Display



Detailed Display

In this example, "Ver.1.0" is displayed next to the Unit model.

The following items are displayed.

- Slot number

- Unit model number
- Unit version
- Serial number
- Lot number
- Hardware version
- Software version
- Total power-ON time

The software version is displayed only for Units that contain software.

Version Information

The total power-ON time is provided by function to monitor the total power-ON time. The function to monitor the total power-ON time was added for a version upgrade. Refer to *Functions That Were Added or Changed for Each Unit Version* on page A-67 for the unit versions that support monitoring the total power-ON time.

Unit Versions and Sysmac Studio Versions

The functions that are supported depend on the unit version of the Unit. The version of Sysmac Studio that supports the functions that were added for an upgrade is also required to use those functions.

Refer to *A-5 Version Information* on page A-65 for the functions that are supported by each unit version.

Related Manuals

The following manuals are related. Use these manuals for reference.

Manual name	Cat. No.	Model numbers	Application	Description
NX-series Position Interface Units User's Manual (this manual)	W524	NX-EC0□□□ NX-ECS□□□ NX-PG0□□□	Learning how to use NX-series Position Interface Units	The hardware, setup, and functions for the NX-series Incremental Encoder Input Units, SSI Input Units, and Pulse Output Unit 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 Digital I/O Units User's Manual	W521	NX-ID□□□□ NX-IA□□□□ NX-OC□□□□ NX-OD□□□□	Learning how to use NX-series Digital I/O Units	The hardware, setup methods, and functions of the NX-series Digital I/O Units are described.
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.
NJ/NX-series Troubleshooting Manual	W503	NX701-□□□□ 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. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) or *NX-series CPU Unit Hardware User's Manual* (Cat. No. W535) and with the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501).
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.
NX-series EtherNet/IP™ Coupler Unit User's Manual	W536	NX-EIC□□□□	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 through EtherNet/IP.

Manual name	Cat. No.	Model numbers	Application	Description
NX-series CPU Unit Hardware User’s Manual	W535	NX701-□□□□	Learning the basic specifications of the NX-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX-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 Use this manual together with the *NJ/NX-series CPU Unit Software User’s Manual* (Cat. No. W501).
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 • Overview • Part names and functions • General specifications • Installation and wiring • Maintenance and Inspection Use this manual together with the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ/NX-series CPU Unit Software User's Manual	W501	NX701-□□□□ 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 an NJ/NX-series CPU Unit. • CPU Unit operation • CPU Unit features • Initial settings • Programming based on IEC 61131-3 language specifications Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NX-series CPU Unit Hardware User’s Manual* (Cat. No. W535).
NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual	W505	NX701-□□□□ 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. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) or *NX-series CPU Unit Hardware User’s Manual* (Cat. No. W535) and with the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501).

Manual name	Cat. No.	Model numbers	Application	Description
NJ/NX-series CPU Unit Motion Control User’s Manual	W507	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning about motion control settings and programming concepts.	The settings and operation of the CPU Unit and programming concepts for motion control are described. When programming, use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) or *NX-series CPU Unit Hardware User’s Manual* (Cat. No. W535) and with the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ/NX-series Instructions Reference Manual	W502	NX701-□□□□ 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. When programming, use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) or *NX-series CPU Unit Hardware User’s Manual* (Cat. No. W535) and with the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ/NX-series Motion Control Instructions Reference Manual	W508	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning about the specifications of the motion control instructions.	The motion control instructions are described. When programming, use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) or *NX-series CPU Unit Hardware User’s Manual* (Cat. No. W535) and with the *NJ/NX-series CPU Unit Motion Control User’s Manual* (Cat. No. W507)

Terminology

Term	Description
axis	A functional unit within the Motion Control Function Module. An axis is assigned to the drive mechanism in an external Servo Drive or the sensing mechanism in an external Encoder Input Slave Unit.
axis variable	A system-defined variable that is defined as a structure and provides status information and some of the axis parameters for an individual axis.
DC time	EtherCAT slaves that support distributed clock synchronization have a clock that is shared by all slaves in the network. The time on that clock is called the DC time.
device variable	A variable that is used to access a specific device through an I/O port.
I/O refreshing	Cyclic data exchange with external devices that is performed with predetermined memory addresses.
MC Test Run	A function to check motor operation and wiring from the Sysmac Studio.
Motion Control Function Module	A software component that executes motion control. The Motion Control Function Module performs motion control based on commands from the motion control instructions that are executed in the user program. (Abbreviation: MC Function Module)
motion control parameters	Parameters that define the operation of the Motion Control Function Module. The motion control parameters include the MC common parameters, axis parameters, and axes group parameters.
NX bus	The NX-series internal bus.
PDO communications	An acronym for process data communications.
SDO communications	One type of EtherCAT communications in which service data objects (SDOs) are used to transmit information whenever required.
Slave Terminal	A terminal that consists of a Communications Coupler Unit after which NX Units and an End Cover are mounted.
Sync0	A signal that gives the interrupt timing based on the distributed clock (DC) in EtherCAT communications. The slaves execute controls according to this interrupt timing.
time stamping	When you obtain position data from an Incremental Encoder Input Unit or SSI data from an SSI Input Unit and the position data has changed from the previously obtained position data, you can obtain the time when that change occurred along with the data. The obtained time data is called a time stamp.

Revision History

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

Cat. No. W524-E1-05

Revision code

Revision code	Date	Revised content
01	April 2013	Original production
02	June 2013	Added information on time stamping and corrected mistakes.
03	September 2013	Added precautions for connecting to NJ-series Controllers and added information on time stamping.
04	July 2014	Added the NX-EC0112, NX-EC0132, NX-EC0212, and NX-PG0112, and corrected mistakes.
05	April 2015	• Made changes accompanying the upgrade to unit version 1.2. • Made revisions accompanying the addition of NX-series NX701-□□□□ CPU Units. • Made revisions accompanying the addition of NX-EIC□□□ EtherNet/IP Coupler Units. • Corrected mistakes.

Sections in this Manual

1 10 2 11 3 A 4 I 5 6 7 8 9

1

Features and System Configuration

This section describes system configurations with Position Interface Units and the features and functions of Position Interface Units.

1-1 Features of Position Interface Units

“NX-series Position Interface Unit” is a generic name for any of a group of NX Units that perform I/O processing of position data to perform positioning.

The Position Interface Units use the Motion Control Function Module in an NJ/NX-series Controller (referred to as “MC Function Module”) to both perform pulse outputs and accept encoder inputs for motor control.

This section provides an introduction to the Position Interface Units and their operations and it describes the unique features of each Unit.

1-1-1 Introduction to Position Interface Units

Position Interface Units all share the following features.

Clamping Terminal Block Designed for Reduced Work

Position Interface Units use screwless clamping terminal blocks. Wiring is performed simply by inserting ferrules. This eliminates the need for tightening screws and greatly reduces the amount of work that is required for wiring.

Simple, High-precision Motion Control with the MC Function Module

You can use the MC Function Module in an NJ/NX-series CPU Unit to perform high-speed, high-precision control.

You can use motion control instructions to easily perform complex control tasks such as single-axis PTP positioning, interpolation control, synchronized control (e.g., of electronic cams), and velocity control with a minimal amount of programming.

1-1-2 Types and Features of Position Interface Units

The following table lists the different types of Position Interface Units.

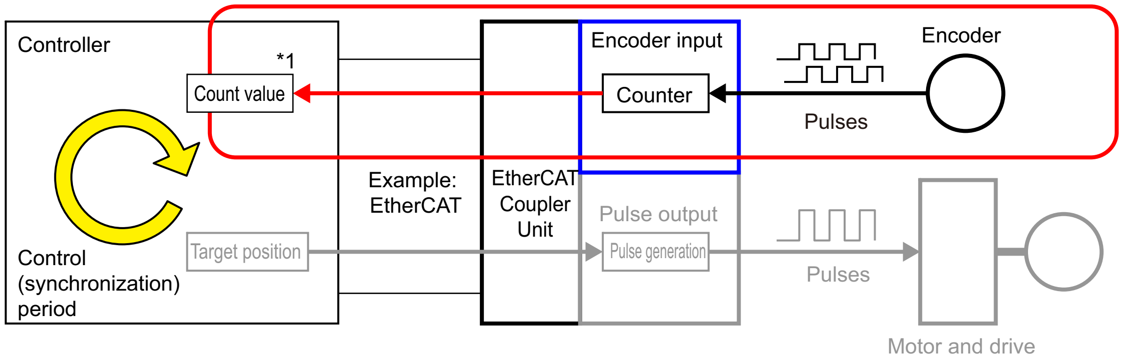
Type	Application
Incremental Encoder Input Unit	Converts pulse input signals from an incremental encoder and counts the number of pulses.
SSI Input Unit	Converts serial data from an SSI interface-compatible absolute encoder or linear encoder to obtain the absolute position.
Pulse Output Unit	Performs pulse output for positioning commands sent to a stepper motor drive or other pulse input motor drive.

Incremental Encoder Input Units

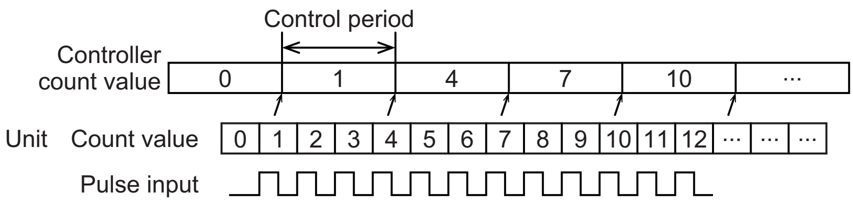
An Incremental Encoder Input Unit converts pulse input signals from an incremental encoder and counts the number of pulses.

Use an Incremental Encoder Input Unit to enable the Controller to identify control positions based on the number of encoder pulses. You can also latch the count value with an external input.

There are two types of Incremental Encoder Input Units, depending on the input specifications of the encoder pulses: Units that take a voltage input and Units that take a line receiver input.



*1. The count value of the encoder (pulses) is sent to the Controller every control period.



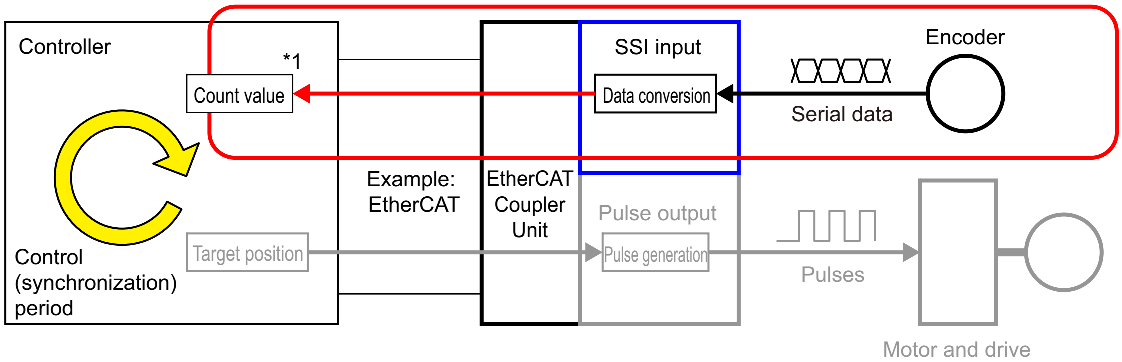
● Features

- One or two counters are provided in each Incremental Encoder Input Unit to count pulses in 32-bit ranges.
- The models with a voltage input can count at up to 500 kHz and the model with a line receiver input can count at up to 4 MHz.

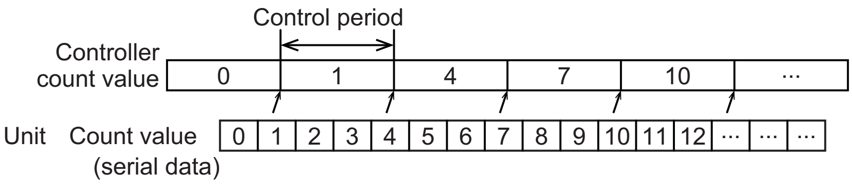
SSI Input Units

The SSI Input Units convert serial data from an SSI interface-compatible absolute encoder or linear encoder to obtain the absolute position.

Use an SSI Input Unit to enable the Controller to identify control positions based on the absolute position information obtained from the target device.



*1. The count value of the encoder (serial data) is sent to the Controller every control period.



● Features

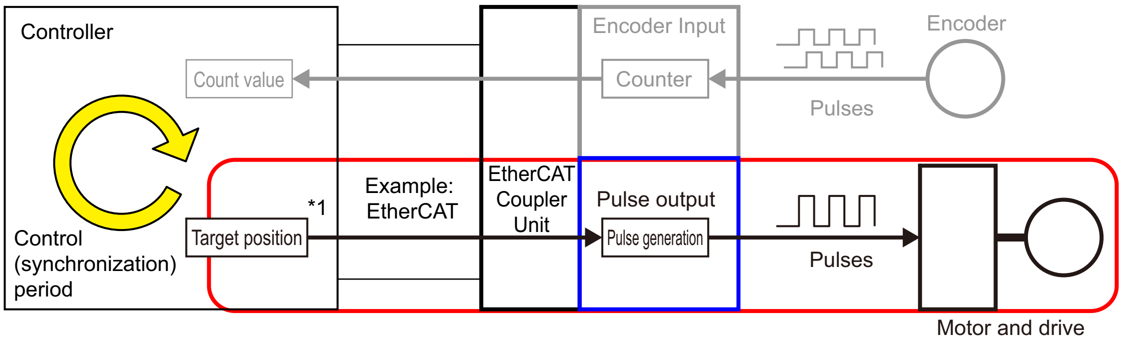
- You can connect to an absolute encoder with an SSI interface.
- A baud rate (synchronous clock of SSI communications) of up to 2.0 MHz is supported.
- Either one or two SSI input ports are provided. Each port can be set up with independent functionality.

Pulse Output Units

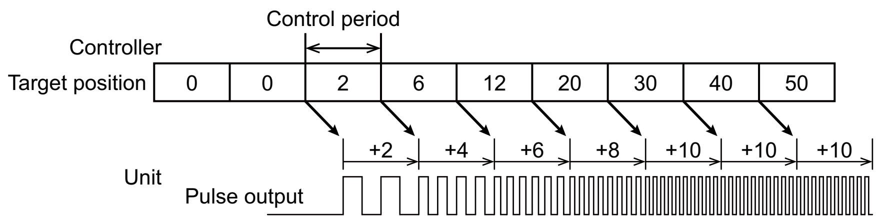
A Pulse Output Unit performs pulse output for positioning commands sent to a stepper motor drive or other pulse input motor drive.

Use a Pulse Output Unit to enable the Controller to perform positioning.

You can also latch the pulse output value with an external input.



*1. Pulse output is performed based on the synchronization commands (target positions) received from the Controller each control period.



The frequency is calculated based on the travel distance for the control period and the pulses are output.

The Pulse Output Unit is a simple output unit that performs pulse output based on periodically received target positions, as shown in the above figure.

Profile processing of the position (number of pulses) and velocity (pulse frequency) for motor control must be performed by the Controller that provides the target position information.

Therefore, the Unit synchronizes with the Controller at a fixed period.

NJ/NX-series Controllers are connected through an EtherCAT Coupler Unit and use EtherCAT in DC Mode.

● Features

- Pulses are output according to the position command information that is provided periodically.
- Control can interface with pulse input drives, such as stepper motor drives, through the pulse output.
- You can latch position information with an external input.

1-1-3 Operation of Position Interface Units

This section describes the operation of the Position Interface Units when you use them together with an NJ/NX-series Controller and the MC Function Module.

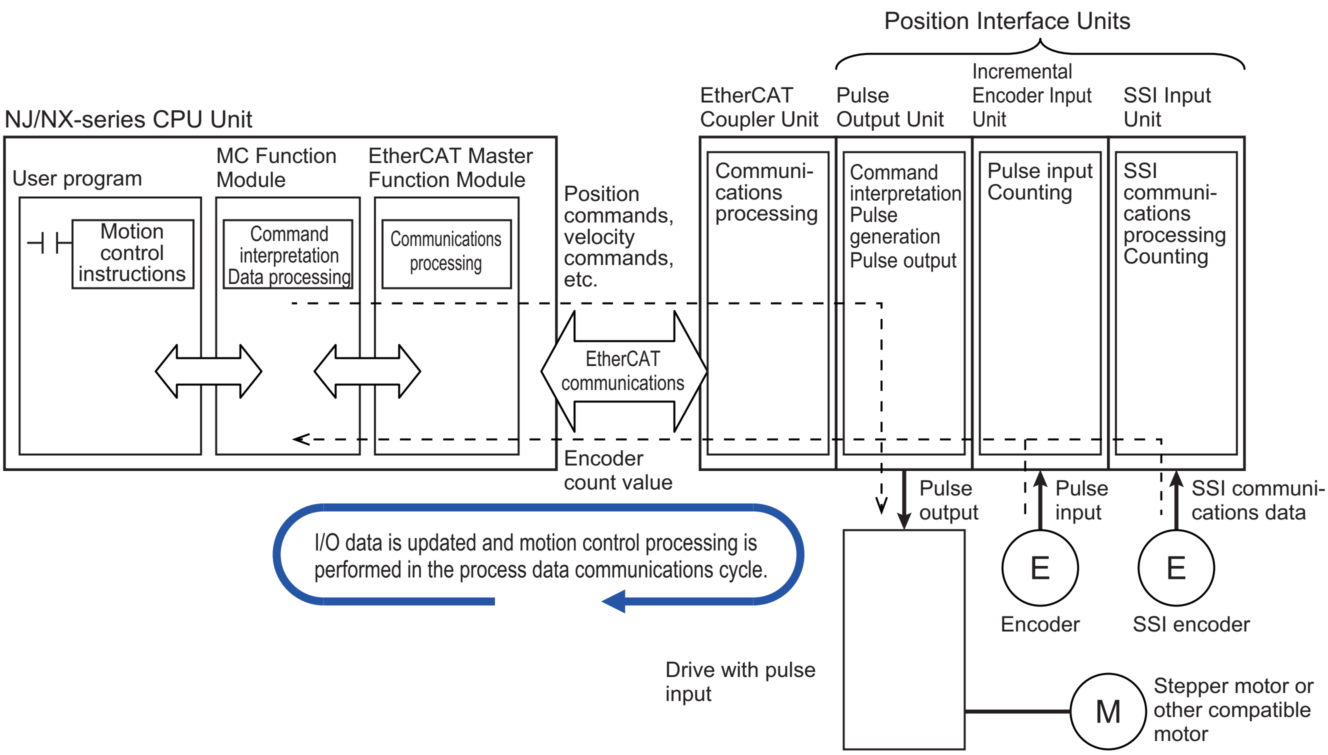
You can use the Position Interface Units together with an NJ/NX-series Controller and the MC Function Module to perform the following control operations.

- Positioning for motor drives with pulse inputs
- Motion control based on position information obtained from an encoder

The MC Function Module in the NJ/NX-series Controller is used to perform motion control for encoders or motor drives connected to the Position Interface Units.

You can connect the Position Interface Units through an EtherCAT Coupler Unit to the built-in EtherCAT port on an NJ/NX-series Controller to use the MC Function Module.

I/O control for the motion control functions that are executed by the MC Function Module is performed through cyclic communications with the NJ/NX-series Controller.



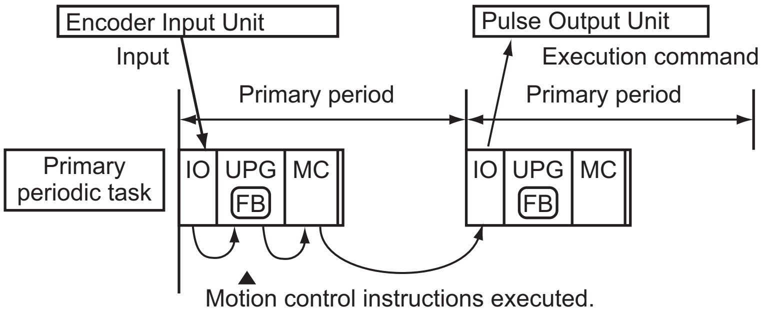
The operation is as follows:

- When motion control instructions are executed in the user program, the MC Function Module interprets the resulting commands.
- The MC Function Module then performs motion control processing at a fixed period based on the results of the command interpretation. It generates command values to send to the Pulse Output Unit.
- The EtherCAT Master Function Module sends the command values with PDO communications during each process data communications cycle of EtherCAT communications.
- The Pulse Output Unit outputs the appropriate number and frequency of pulses based on the command values received during each process data communications cycle of EtherCAT communications.
- The Incremental Encoder Unit and SSI Input Unit send the current count values of the encoders to the CPU Unit during each process data communications cycle of EtherCAT communications.

In the NJ/NX-series Controller, the I/O refreshing processing, user program processing, and MC Function Module processing between the Position Interface Units are executed in the primary periodic task and priority-5 periodic task.

Refer to *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for information on the primary periodic task and priority-5 periodic task.

The following figure shows an example of the task operation performed for I/O processing for the Position Interface Units in the primary periodic task. The same information applies when processing is performed in the priority-5 periodic task.



Abbreviation	Meaning
IO	I/O refreshing
UPG	User program execution
MC	Motion control
FB	Motion control instructions

The input information is obtained from the Position Interface Units every fixed period that the task is executed. Processing (user program execution and motion control processing) is then performed based on that information, and the information is sent as an output command.

1-1-4 Control Data for Position Interface Units

Some of the functions of the Position Interface Units are based on the CiA402 drive profile.

The I/O data definitions and operations for interaction with the Controller are based on functions in the CiA402 drive profile. However, the indexes and subindexes in the object dictionary are not the same.

Relationship between the Position Interface Unit Functions and the CiA402 Drive Profile

The following table describes the relationships between functions of the Units and the functions in the CiA402 drive profile.

Unit	Function of Position Interface Unit	CiA402 function	Description
Incremental Encoder Input Units	Latch function	Touch probe	The latch function and latch status that are used as I/O data for the Incremental Encoder Input Units both contain data definitions equivalent to the touch probe function and touch probe status. *1
SSI Input Units	---	---	These Units have no functions that are the same as the CiA402 drive profile.
Pulse Output Unit	Pulse output control	Control in Cyclic Synchronous Position Control Mode *2	The pulse output control from the Controller is the same as control in Cyclic Synchronous Position Control Mode of the CiA402 drive profile. The control commands that are sent to the Pulse Output Unit are sent with the Controlword and command position each control period. The control status is monitored through the Statusword. These are equivalent to the following data definitions in the CiA402 drive profile: Controlword, Target Position, and Statusword.
	Latch function	Touch probe	This is the same as for an Incremental Encoder Input Unit. *3

*1. Refer to *6-9-8 Latching* on page 6-59 for details on this operation.

*2. Refer to *8-3 Pulse Output Control* on page 8-5 for details.

*3. Refer to *8-10-5 Latching* on page 8-61 for details on this operation.

1-2 System Configuration

You can mount NX-series Position Interface Units after an EtherCAT Coupler Unit, the Communications Coupler Unit, in an EtherCAT Slave Terminal.

This allows you to connect to a controller that provides an EtherCAT master.

The system configuration and the functions of the Position Interface Units that you can use depend on the controller that you connect to and the EtherCAT master specifications.

This section describes differences in the system configuration.

Refer to the following sections for details on the differences in functions based on different controller specifications: *6-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 6-29, *7-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 7-21, and *8-7-4 Differences in I/O Refreshing Methods Based on the Controller* on page 8-28.

Refer to the *NX-series EtherNet/IP Coupler Units User's Manual* (Cat. No. W536) for information on connections to EtherNet/IP Coupler Units.

Additional Information

Slave Terminals

Slave Terminal is a generic name for a building block-type remote I/O terminal that contains a group of NX Units connected to a Communications Coupler Unit.

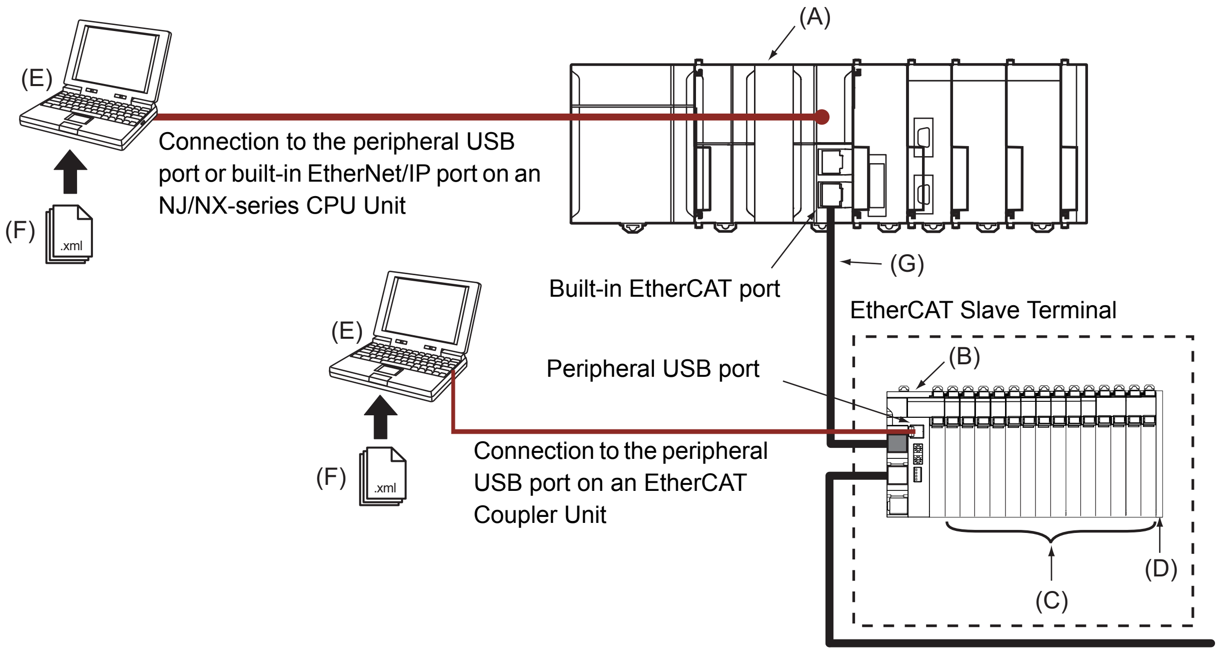
An EtherCAT Slave Terminal is the term when an EtherCAT Coupler Unit is used as the Communications Coupler Unit.

1-2-1 System Configuration When Connecting to an NJ/NX-series Controller

To use the Position Interface Units, mount them on an EtherCAT Slave Terminal and connect the Slave Terminal to the built-in EtherCAT port on an NJ/NX-series CPU Unit.

In this configuration, you can use the MC Function Module of the NJ/NX-series Controller to perform motion control.

For details on the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).



Letter	Item	Description
(A)	EtherCAT master [*1]	The EtherCAT master manages the EtherCAT network, monitors the status of the slaves, and exchanges I/O data with the slaves.
(B)	EtherCAT Coupler Unit (NX-ECC20☐)	The EtherCAT Coupler Unit is an interface that performs process data communications over an EtherCAT network between the NX Units and the EtherCAT master. The I/O data for the NX Units is accumulated in the EtherCAT Coupler Unit and then all of the data is exchanged with the EtherCAT master at the same time. The EtherCAT Coupler Unit can also perform message communications (SDO communications) with the EtherCAT master.
(C)	NX Units	The NX Units perform I/O processing with connected external devices. Process data communications with the EtherCAT master are performed through the EtherCAT Coupler Unit.
(D)	End Cover	The End Cover is attached to the end of the Slave Terminal.
(E)	Support Software (Sysmac Studio)	The Sysmac Studio runs on a personal computer and it is used to configure the EtherCAT network and EtherCAT Slave Terminals, and to program, monitor, and troubleshoot the Controller. You can connect the computer in which the Sysmac Studio is installed to the peripheral USB port or built-in EtherNet/IP port on an NJ/NX-series CPU Unit. Or you can connect it to the peripheral USB port on the EtherCAT Coupler Unit to set up the EtherCAT Slave Terminal.

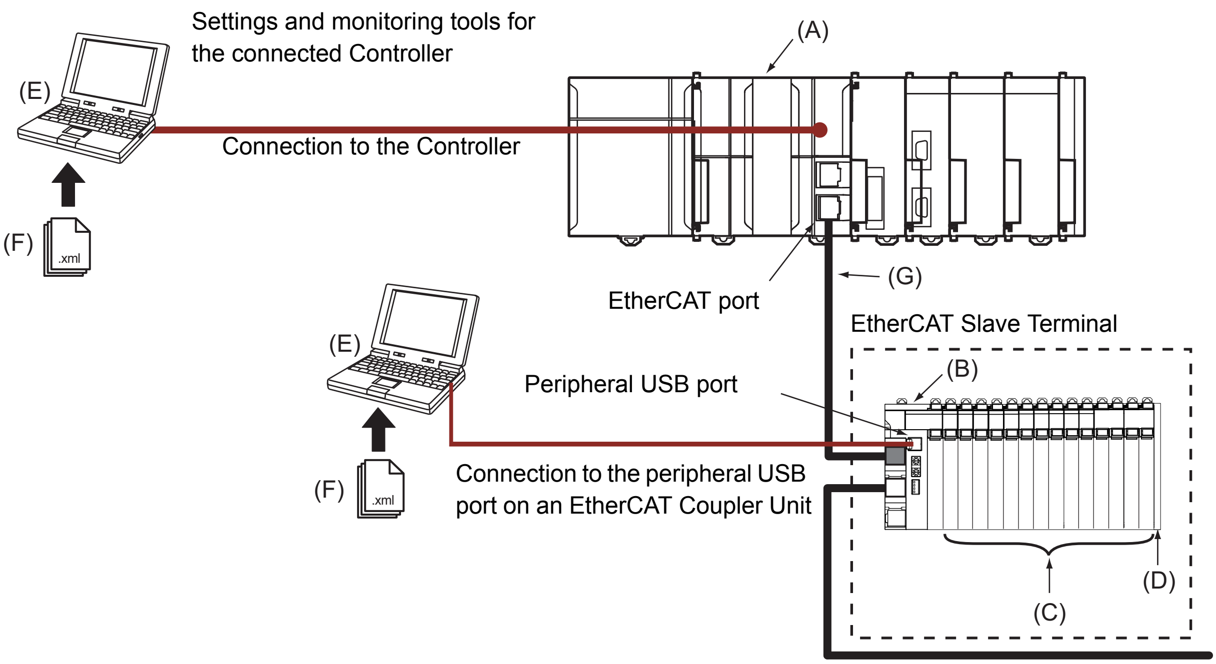
Letter	Item	Description
(F)	ESI (EtherCAT Slave Information) file	The ESI file contains information that is unique to the EtherCAT Slave Terminal in XML format. You can load the ESI file into the Sysmac Studio to easily allocate Slave Terminal process data and make other settings. The ESI files for OMRON EtherCAT slaves are installed in the Sysmac Studio. You can obtain the ESI files for the latest models through the Sysmac Studio's automatic update function.
(G)	Communications cable (Ethernet cable)	Use a double-shielded cable with aluminum tape and braiding of category 5 (100BASE-TX) or higher, and use straight wiring.

*1. An EtherCAT Slave Terminal cannot be connected to any of the OMRON CJ1W-NC[]81/[]82 Position Control Units even though they can operate as EtherCAT masters.

1-2-2 System Configuration When Connecting to a Controller Other Than the NJ/NX-series Controller

To use the Position Interface Units, mount them in an EtherCAT Slave Terminal and connect the Terminal to the EtherCAT master of the controller.

You can connect a Pulse Output Unit only to an NJ/NX-series Controller.



Letter	Item	Description
(A)	EtherCAT master	The EtherCAT master manages the EtherCAT network, monitors the status of the slaves, and exchanges I/O data with the slaves.
(B)	EtherCAT Coupler Unit (NX-ECC20☐)	The EtherCAT Coupler Unit is an interface that performs process data communications over an EtherCAT network between the NX Units and the EtherCAT master. The I/O data for the NX Units is accumulated in the EtherCAT Coupler Unit and then all of the data is exchanged with the EtherCAT master at the same time. The EtherCAT Coupler Unit can also perform message communications (SDO communications) with the EtherCAT master.
(C)	NX Units	The NX Units perform I/O processing with connected external devices. Process data communications with the EtherCAT master are performed through the EtherCAT Coupler Unit.
(D)	End Cover	The End Cover is attached to the end of the Slave Terminal.

Letter	Item	Description
(E)	Support Software (Sysmac Studio)	The Sysmac Studio runs on a personal computer and it is used to configure the EtherCAT network and EtherCAT Slave Terminals, and to program, monitor, and troubleshoot the Controller. Use this software to connect to the Controller and set up the EtherCAT Slave Terminal. Or if you use the Sysmac Studio, you can connect it to the peripheral USB port on the EtherCAT Coupler Unit to set up the EtherCAT Slave Terminal.
(F)	ESI (EtherCAT Slave Information) file	The ESI file contains information that is unique to the EtherCAT Slave Terminal in XML format. You can load the ESI file into the Controller or the Sysmac Studio to easily allocate Slave Terminal process data and make other settings. The ESI files for OMRON EtherCAT slaves are installed in the Sysmac Studio. You can obtain the ESI files for the latest models through the Sysmac Studio's automatic update function.
(G)	Communications cable (Ethernet cable)	Use a double-shielded cable with aluminum tape and braiding of category 5 (100BASE-TX) or higher, and use straight wiring.

1-3 Models

The model number of the Position Interface Unit tells you the Unit type, number of axes, I/O specifications, and other information.

1-3-1 Model Number Notation

The model numbers for Position Interface Units are in the following format:

NX-□□□□□□

NX Series

Unit Type
- EC0: Incremental Encoder Input Unit
- ECS: Serial Encoder Input Unit (SSI Input Unit)
- PG0: Pulse Output Unit

Number of Channels
- 1: 1 channel
- 2: 2 channels

I/O Specifications
- The I/O specifications depend on the Unit type.

Additional Functions
- 2: Supports synchronous refreshing

1-3-2 List of Incremental Encoder Input Units

The following table lists the different models of the Incremental Encoder Input Units.

Refer to *6-1 Interpreting Model Numbers* on page 6-3 for information on Incremental Encoder Input Units.

Model	Number of channels*1	External inputs	Fre-quency	I/O refreshing methods	Number of I/O entry mappings	Remarks
NX-EC0112	1 (NPN)	3 (NPN)	500 kHz	• Free-Run refreshing • Synchronous I/O refreshing • Task period prioritized refreshing*2	Inputs: 1, Outputs: 1	24-V voltage input
NX-EC0122	1 (PNP)	3 (PNP)				
NX-EC0132	1	3 (NPN)	4 MHz			Line receiver input
NX-EC0142		3 (PNP)				
NX-EC0212	2 (NPN)	None	500 kHz		Inputs: 2, Outputs: 2	24-V voltage input
NX-EC0222	2 (PNP)					

*1. This is the number of encoder input channels.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

1-3-3 List of SSI Input Units

The following table lists the different models of the SSI Input Units.

Refer to *7-1 Interpreting Model Numbers* on page 7-3 for information on SSI Input Units.

Model	Number of channels*1	External inputs	Maximum baud rate	I/O refreshing methods	Number of I/O entry mappings
NX-ECS112	1	None	2 MHz	• Free-Run refreshing • Synchronous I/O refreshing • Task period prioritized refreshing*2	Inputs: 1, Outputs: 0
NX-ECS212	2				Inputs: 2, Outputs: 0

*1. This is the number of SSI communications input channels.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

1-3-4 List of Pulse Output Units

The following table lists the different models of the Pulse Output Units.

Refer to *8-1 Interpreting Model Numbers* on page 8-3 for information on the Pulse Output Unit.

Model	Number of channels*1	External inputs	External outputs	Maximum pulse output speed	I/O refreshing methods	Number of I/O entry mappings	Remarks
NX-PG0112	1 (NPN)	2 (NPN)	1 (NPN)	500 kpps	• Synchronous I/O refreshing • Task period prioritized refreshing*2	Inputs: 1, Outputs: 1	Open collector output
NX-PG0122	1 (PNP)	2 (PNP)	1 (PNP)				

*1. This is the number of pulse output channels.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

1-4 Functions

Position Interface Units have a variety of functions that depend on the model. You can use these functions to use these different types of Units more efficiently.

1-4-1 Functions of Incremental Encoder Input Units

The following table lists the functions of the Incremental Encoder Input Units.

Refer to *6-9 Functions* on page 6-46 for details on these functions.

Function	Description
Counter type setting	Allows you to select the counter type for each counter. You can select a ring counter or linear counter.
Pulse input method setting	Allows you to select the pulse input method for each counter. You can select a phase differential pulse (multiplication ×2/4), pulse + direction, or up and down pulses.
Encoder count direction	Allows you to set the count direction of the connected encoder for each counter.
Gate control (counter enable)	Allows you to enable or disable counting for each counter. You can use counter operation commands or external inputs*1 for gate control.
Counter reset	Allows you to reset the counter value for each counter. You can use counter operation commands, external inputs *1, and phase-Z inputs to reset counters.
Counter preset	Allows you to preset the counter value for each counter with the counter operation command.
Latching	Allows you to latch the counter value for each counter. You can use counter operation commands, phase-Z input, and external inputs *1 to latch the counter values. You can use up to 3 latches (1 counter operation command, phase-Z input, and 2 external inputs) simultaneously.
External input function selection	Each counter has three external inputs *1. You can assign one of the following functions to each of these inputs: general input, latch input, reset input, or gate input. You can also set the logic for each input.
Pulse rate measurement	Measures the pulse rate*2 of input pulses for each counter. You can then use the measured pulse rate to calculate the frequency or rotation rate from a ladder diagram.
Pulse period measurement	Measures the input pulse period for each counter. You can measure the time between the falling edges, rising edges, or both edges of the phase-A pulse, regardless of the control period.
I/O refreshing method setting	Sets Free-Run refreshing, synchronous I/O refreshing,*3 or task period prioritized refreshing*3, *4 for the I/O refreshing*5 method. All counters use the same setting.
Time stamping*6	The time when the counter value changed is retained. You can use this function only when the I/O refreshing method is set to synchronous I/O refreshing.

*1. You can use external inputs only with the following single-counter-channel models: NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142. You cannot use external inputs with the NX-EC0212 or NX-EC0222 because it has 2 counter channels.

*2. This is the number of pulses per time window.

*3. You can select this option only when the Unit is used with a EtherCAT Coupler Unit with EtherCAT communications in DC Mode.

*4. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*5. This is the data exchange with the Controller.

*6. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

Refer to *Unit Models and Available Commands/Inputs* on page 1-16 and *Functions and Assignable Commands/Inputs* on page 1-16 for information on the relation between different Unit models and the commands/inputs that are supported and between functions and assignable commands.

Unit Models and Available Commands/Inputs

The commands and inputs that are supported depend on the model of the Unit.

Yes: Usable, ---: Not usable

Model	Usable commands and inputs					Remarks
	Counter operation commands	Phase-Z input	External input 1	External input 2	External input 3	
NX-EC0112	Yes	Yes	Yes	Yes	Yes	
NX-EC0122	Yes	Yes	Yes	Yes	Yes	
NX-EC0132	Yes	Yes	Yes	Yes	Yes	
NX-EC0142	Yes	Yes	Yes	Yes	Yes	
NX-EC0212	Yes	Yes	---	---	---	The EC0212 does not have external inputs.
NX-EC0222	Yes	Yes	---	---	---	The EC0222 does not have external inputs.

Functions and Assignable Commands/Inputs

The commands and inputs that you can assign depend on the function.

Yes: Usable, ---: Not usable

Function	Assignable commands and inputs					Remarks
	Counter operation commands	Phase-Z input	External input 1 *1	External input 2*1	External input 3*1	
Gate	Yes	---	Yes	Yes	Yes	Counting starts with a gate open operation initiated by either a command or input.
Resetting	Yes	Yes	Yes	Yes	Yes	The count value is reset with a reset operation initiated by either a command or input. You can enable or disable both the phase-Z input and external input with a counter operation command.
Internal latch	Yes	---	---	---	---	
Latch 1	---	Yes	Yes	Yes	Yes	The count value is latched with a latch input initiated by either a command or input.
Latch 2	---	Yes	Yes	Yes	Yes	

*1. You can select a different function for each input. An error occurs and external inputs are disabled if you assign the same function to more than one inputs.

1-4-2 Functions of SSI Input Units

The following table lists the functions of the SSI Input Units.

Refer to *7-9 Functions* on page 7-38 for details on these functions.

Function	Description
SSI data settings	Allows you to set the bit position and data length for each counter based on the format of the SSI data.
Coding method	Allows you to select whether to convert the received SSI data for each counter.
Encoder count direction	Allows you to set the counting direction for the SSI Input Unit to 0 (Not to invert the sign) or 1 (Invert the sign).
Bit shifting	If the number of error bits or location of the position data from the SSI encoder is incorrect, you can shift the first bit of the received frame to correct the problem.
Parity check	Performs a parity check on the SSI data.
Data refresh status	Allows you to check for updates to the SSI data.
Error data detection	Allows you to prevent refreshing and designate SSI data as error data when the code conversion result causes a change in position that exceeds the set value.
I/O refreshing method setting	Sets Free-Run refreshing, synchronous I/O refreshing,[*1] or task period prioritized refreshing[*1, *2] for the I/O refreshing[*3] method. All counters use the same setting.
Time stamping[*4]	The time when the counter value changed is retained. You can use this function only when the I/O refreshing method is set to synchronous I/O refreshing.

*1. You can select this option only when the Unit is used with a EtherCAT Coupler Unit with EtherCAT communications in DC Mode.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*3. This is the data exchange with the Controller.

*4. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

1-4-3 Functions of the Pulse Output Unit

The following table lists the functions of the Pulse Output Unit.

Refer to *8-10 Functions* on page 8-52 for details on these functions.

Function	Description
Pulse output method	Allows you to select either forward/reverse direction pulse outputs or pulse + direction outputs for the pulse output method.
Output mode selection	Allows you to select either position-synchronous pulse output or velocity-continuous pulse output for the pulse output mode selection.
External output	You can use one external output as a error counter reset output when the Unit is connected to a Servo Drive and used with the MC Function Module. You can also control whether the external output is ON or OFF as a general output if you want to manipulate a device variable directly without the MC Function Module.
Latching	You can latch the counter value of the pulse output. You can assign an external input as a latch input to use two latches at the same time.
External input function selection	Two external inputs are provided. You can assign them either of the following input functions: general input or latch input. You can also set the logic for each input.
Load rejection output setting	Allows you to select the pulse stopping method when an error occurs. You can select from the following two stopping methods: immediate stop or deceleration stop with set deceleration rate.
Interpolation control for missing synchronization command	When a command is missing, the target position is predicted based on previous commands to continue updating the target position.
Pulse direction change delay	When the Pulse Output Unit uses a velocity-continuous pulse output, this setting sets the wait time when the pulse output direction changes.
I/O refreshing method setting	Sets synchronous I/O refreshing[*1] or task period prioritized refreshing[*1, *2] for the I/O refreshing[*3] method.

*1. You can select this option only when the Unit is used with a EtherCAT Coupler Unit with EtherCAT communications in DC Mode.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*3. This is the data exchange with the Controller.

1-5 Support Software

Support Software is required to configure a system that uses NX-series Position Interface Units.

1-5-1 Applicable Support Software

The Support Software that you can use depends on the system configuration. Select the right Support Software for your system configuration.

System configuration		Applicable Support Software	
Controller	Communications Coupler Unit	Communications network settings	Slave Terminal settings*1
NJ/NX-series Controller	EtherCAT Coupler Unit	Sysmac Studio version 1.06 or higher	Sysmac Studio version 1.06 or higher
Controller other than an NJ/NX-series Controller	EtherCAT Coupler Unit	Support Software for the controller and the EtherCAT master	Sysmac Studio version 1.06 or higher

*1. Refer to *A-5 Version Information* on page A-65 for the Sysmac Studio versions for each Position Interface Unit model and unit version.

Additional Information

Refer to the *NX-series EtherNet/IP™ Coupler Units User's Manual* (Cat. No. W536) for information on EtherNet/IP Coupler Units.

1-5-2 Using Support Software with an NJ-series Controller

There are two possible configurations: connect the Sysmac Studio to the CPU Unit or to the EtherCAT Coupler Unit. Use Sysmac Studio version 1.06 or higher.

The functions that you can use in Sysmac Studio depend on whether you connect it to the CPU Unit or to the EtherCAT Coupler Unit. Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504-E1-12 or higher) for information on the functions that you can use.

Sysmac Studio Connection to the CPU Unit

Connect the Sysmac Studio to the NJ-series CPU Unit through a USB port or the EtherNet/IP network.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for connection procedures.

Sysmac Studio Connection to the EtherCAT Coupler Unit

Connect the Sysmac Studio to the EtherCAT Coupler Unit through the USB port.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on the connection methods.

1-5-3 Application Methods for Using Other Controllers

To set up any other controller, EtherCAT master, or Slave Terminal EtherCAT network, use the support software that is provided by the manufacturer. Refer to your product manuals for instructions.

To set up the Unit configuration information and NX Unit settings of the Slave Terminal, connect the Sysmac Studio to the EtherCAT Coupler Unit through the USB port. Use Sysmac Studio version 1.06 or higher.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on the functions that you can use.

Sysmac Studio Connection to the EtherCAT Coupler Unit

Connect the Sysmac Studio to the EtherCAT Coupler Unit through the USB port.

Refer to the *NX-series EtherCAT Coupler Unit User’s Manual* (Cat. No. W519) for information on the connection methods.

2

Specifications and Application Procedures

This section provides the specifications of the Position Interface Units and describes how to use the Position Interface Units.

2-1 Specifications

This section provides the specifications of the Position Interface Units.

2-1-1 General Specifications for the Position Interface Units

Item		Specification
Enclosure		Mounted in a panel
Grounding method		Ground to 100 Ω or less
Operating environment	Ambient operating temperature	0 to 55°C
	Ambient operating humidity	10% to 95% (with no condensation or icing)
	Atmosphere	Must be free from corrosive gases.
	Ambient storage temperature	–25 to 70°C (with no condensation or icing)
	Altitude	2,000 m max.
	Pollution degree	2 or less: Conforms to JIS B 3502 and IEC 61131-2.
	Noise immunity	2 kV on power supply line (Conforms to IEC 61000-4-4.)
	Overvoltage category	Category II: Conforms to JIS B 3502 and IEC 61131-2.
	EMC immunity level	Zone B
	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz, 3.5-mm amplitude, 8.4 to 150 Hz, acceleration: 9.8 m/s^2 100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock resistance	Conforms to IEC 60068-2-27. 147 m/s^2, 3 times each in X, Y, and Z directions
Applicable standards[*1]		cULus: Listed (UL 508), ANSI/ISA 12.12.01, EC: EN 61131-2, C-Tick, KC (KC Registration), NK, and LR

*1. Refer to the OMRON Industrial Automation website (http://www.ia.omron.com/) or consult your OMRON representative for the most recent applicable standards for each model.

2-1-2 Specifications of Individual Units

Refer to the following sections for the specifications of individual Units: Incremental Encoder Input Units: *6-10 Specifications* on page 6-77, SSI Input Units: *7-10 General Specifications* on page 7-58, and Pulse Output Unit: *8-11 Specifications* on page 8-73

2-2 Operating Procedures

The operating procedures for the Position Interface Units depend on the system configuration.

For example, even when you use an NJ/NX-series Controller, the operating procedures depend on whether the MC Function Module is also used.

This section describes the basic operating procedures that are required to use the Units.

2-2-1 Procedures When Using the Motion Control Function Module

This section describes the basic operating procedures that are required to use the MC Function Module in an NJ/NX-series Controller.

Additional Information

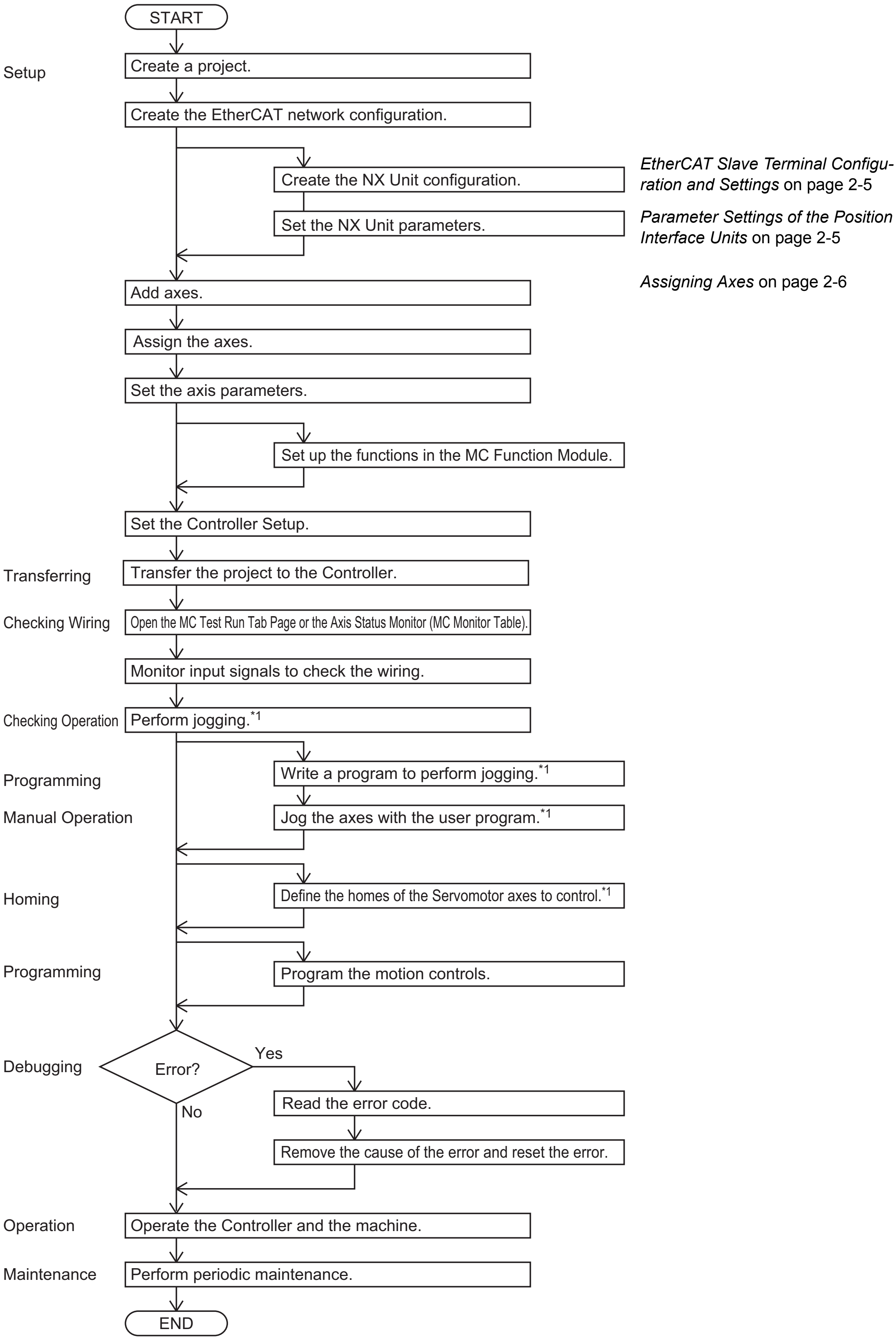
Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for the main operating methods.

However, the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) is written based on the assumption that a G5-series Servo Drive or Motor is used. Some of the material does not apply if you use a Pulse Output Unit.

Refer to *8-9-2 Precautions When Using the Pulse Output Unit* on page 8-42 for information on the differences between when a G5-series Servo Drive or Motor is used and when a Pulse Output Unit is used.

Basic Flow of Operation

The following figure shows the basic flow of operation:



*1. These steps are required if a Pulse Output Unit is used to control the motor drive.

Procedures When Using the MC Function Module

This section describes the procedures to use Position Interface Units with the MC Function Module.

For details on procedures for which references are not specified, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

● EtherCAT Slave Terminal Configuration and Settings

Mount the Position Interface Units after an EtherCAT Coupler Unit to configure an EtherCAT Slave Terminal.

To use the Position Interface Units, you must configure the EtherCAT network as well as configure and set the EtherCAT Slave Terminal.

Refer to the following sections for information on the I/O data assigned to the I/O entry mappings for Position Interface Units: *6-7 I/O Data Specifications* on page 6-34, *7-7 I/O Data Specifications* on page 7-30, and *8-8 I/O Data Specifications* on page 8-31.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to assign the I/O data of Position Interface Units.

Precautions for Correct Use

To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units. Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

● Parameter Settings of the Position Interface Units

Set the parameters for the Position Interface Units.

The settings are different for each model of Position Interface Unit.

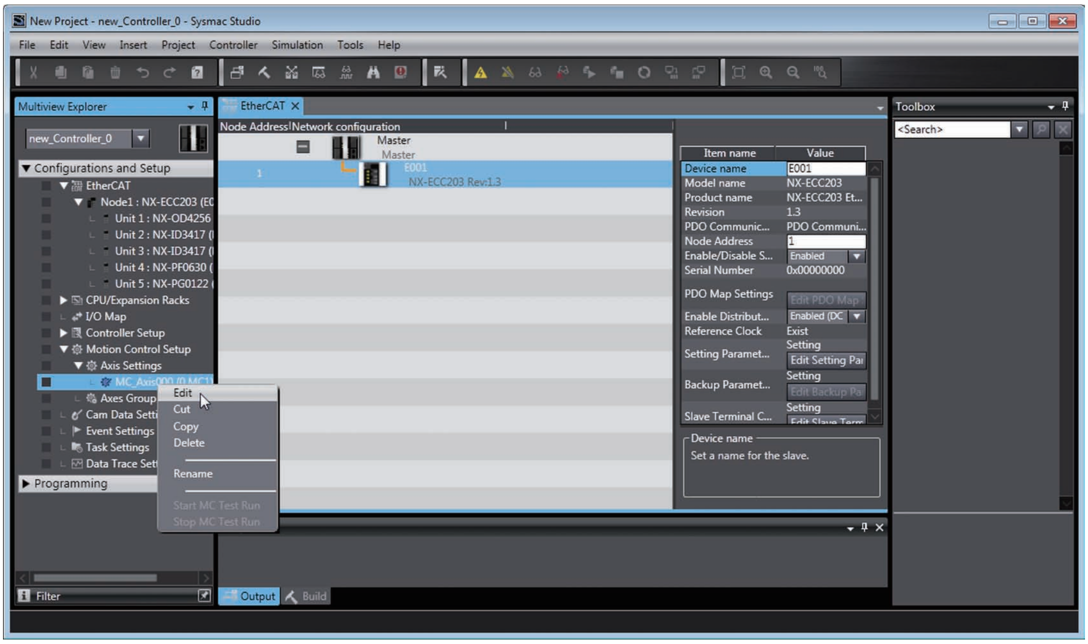
Refer to the following sections for details: *6-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 6-29, *7-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 7-21, and *8-7-4 Differences in I/O Refreshing Methods Based on the Controller* on page 8-28.

● Assigning Axes

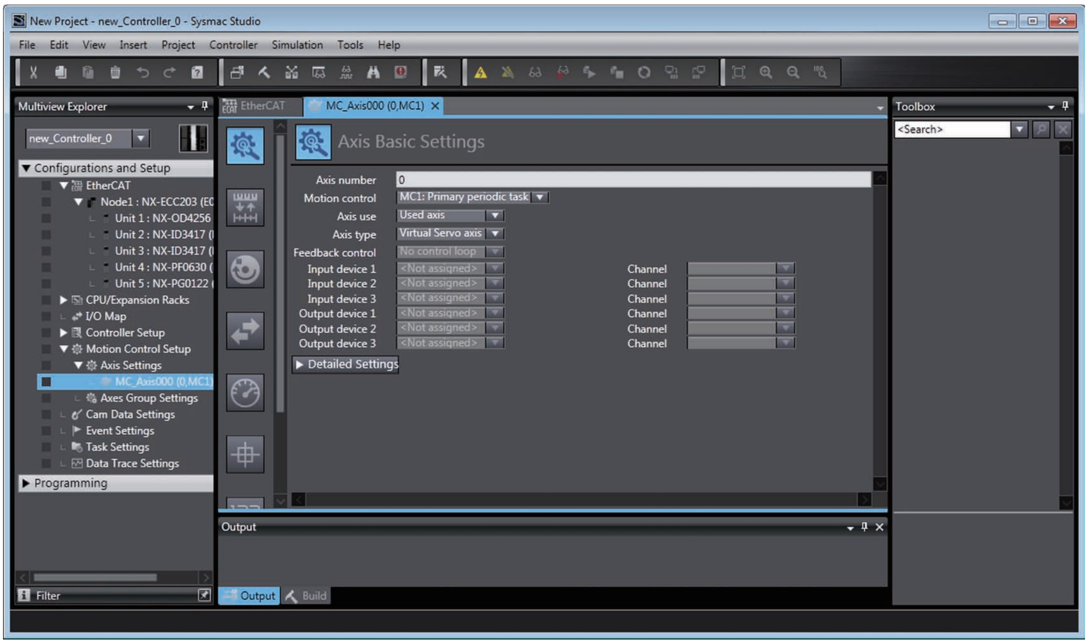
Assign the Position Interface Units to Axis Variables.

Use the following procedure to make the assignments.

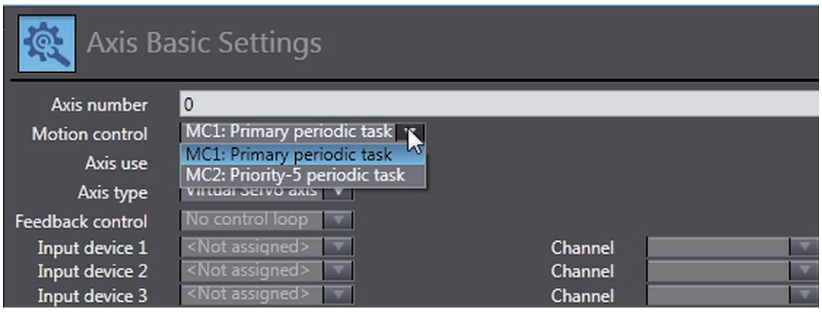
1 Right-click an axis in the Multiview Explorer and select ***Edit*** from the menu.



The Axis Basic Settings are displayed in the Axis Parameter Settings Tab Page.



2 Select **Motion Control**.

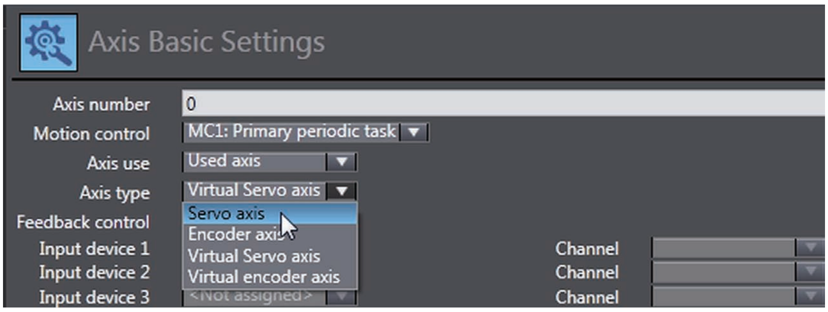


You can assign processing to either the primary periodic task or priority-5 periodic task.

Additional Information

This setting applies to an NX-series CPU Unit. NJ-series CPU Units do not have this setting.

3 Select the axis type.



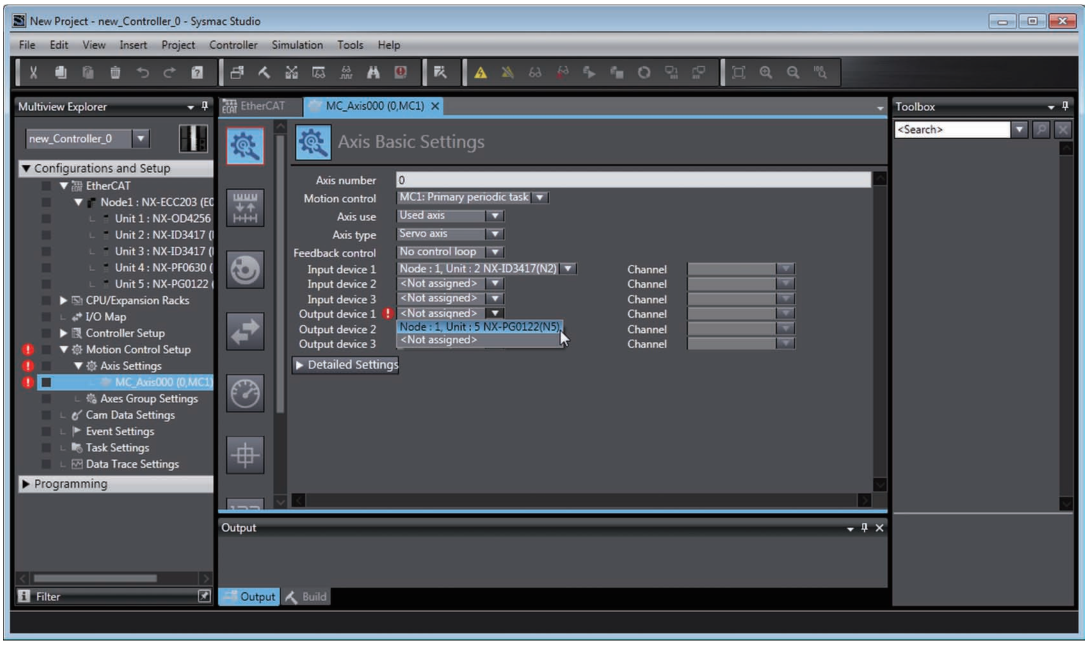
The following table lists the Position Interface Units and other NX Units that are required for each axis type.

Axis type	Required NX Units	
	Position Interface Units	Other NX Units
Encoder axis	Incremental Encoder Input Units	
	SSI Input Unit	
Servo axis for Servo-motor	Pulse Output Unit	Digital Input Unit
Servo axis for stepper motor	Pulse Output Unit	Digital Input Unit

Note If you use more than one NX Unit for the same axis, all of the NX Units for the axis must be in the same Slave Terminal.

4 Select the devices to use as the input and output devices.

This operation enables you to use an NX Unit as an axis.



The following table lists the NX Units that you can select for each device.

Axis type	Device type	Selectable NX Units
Encoder axis	Input device	• Incremental Encoder Input Unit • SSI Input Unit
Servo axis	Input device	Digital Input Unit
	Output device	Pulse Output Unit

● Function Settings of MC Function Module

For details on the function settings of the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Also refer to *8-9-2 Precautions When Using the Pulse Output Unit* on page 8-42.

Precautions for Correct Use

If you assign an NX Unit connected to an EtherCAT Coupler Unit as an I/O device for a MC Function Module axis, the MC Function Module manages refreshing of the I/O data. In this case, the MC Function Module manages refreshing of the I/O data for the entire Slave Terminal, including the EtherCAT Coupler Unit.

If any of the operations or errors in the following table occur, the MC Function Module discards the Slave Terminal I/O data at that time. Refreshing of I/O data resumes when valid data is obtained again.

Operation	Using EtherCAT slaves only	Using an EtherCAT Coupler Unit + NX Units
Intentional changes to EtherCAT network configuration elements	• Unintentional disconnection of an EtherCAT slave or an EtherCAT cable disconnection • Unintentional connection of an EtherCAT slave or an EtherCAT cable connection • EtherCAT slave power interruption	Same as at the left.
	• Disconnection of an EtherCAT slave due to a disconnect operation • Connection of an EtherCAT slave due to a connect operation	Same as at the left. • Restarting of EtherCAT Slave Terminal • Restarting after parameters were transferred to the Communications Coupler Unit
Unintentional changes to EtherCAT network configuration elements	None	Performing an error reset when the Slave Terminal is stopped due to an error

From several milliseconds to several tens of milliseconds is required to resume refreshing of I/O data, depending on the system configuration and the process data communications cycle.

You can include an NX Unit that is not assigned to an axis in a Slave Terminal that is managed by the MC Function Module, but keep in mind the above characteristics of the refreshing of I/O data when you do so.

If you want to avoid the effects of the refreshing of I/O data that is managed by the MC Function Module on NX Units that are not assigned to axes, place those NX Units on another Slave Terminal. To use different Slave Terminals, use different EtherCAT Coupler Units and configure the Slave Terminals so that one contains only NX Units that are assigned to axes and one contains only NX Units that are not assigned to axes.

2-2-2 Procedures When Not Using the Motion Control Function Module

This section describes the basic operating procedures that are required when you do not use the MC Function Module with an NJ/NX-series Controller.

If you do not want to use the MC Function Module, you can only use basic instructions in your programs, including those for position management.

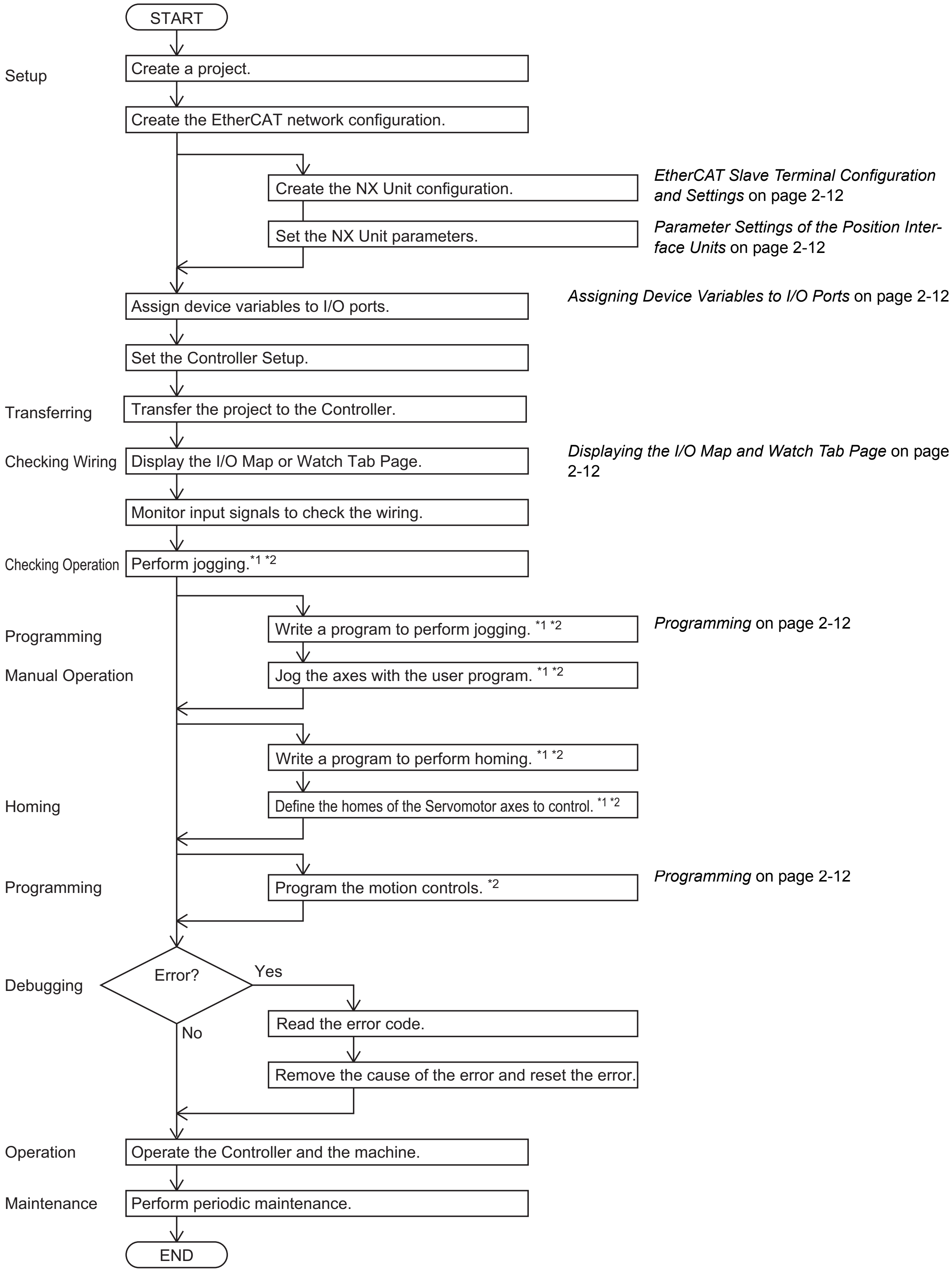
Additional Information

For Pulse Output Units, other tasks must be performed on the Controller in addition to position management, such as velocity profile generation and control status management.

If you want to use a pulse output, we recommend that you use the MC Function Module because it can automatically handle this control for you.

Basic Flow of Operation

The following figure shows the basic flow of operation:



*1. These steps are required if a Pulse Output Unit is used to control the motor drive.

*2. All control tasks must be performed in the user program, including position management.

Procedures When Not Using the MC Function Module

This section describes the procedures to use Position Interface Units without the MC Function Module.

- **EtherCAT Slave Terminal Configuration and Settings**

Mount the Position Interface Units after an EtherCAT Coupler Unit to configure an EtherCAT Slave Terminal.

To use the Position Interface Units, you must configure the EtherCAT network as well as configure and set the EtherCAT Slave Terminal.

Refer to the following sections for information on the I/O data assigned to the I/O entry mappings for Position Interface Units: *6-7 I/O Data Specifications* on page 6-34, *7-7 I/O Data Specifications* on page 7-30, and *8-8 I/O Data Specifications* on page 8-31.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to assign the I/O data of Position Interface Units.

- **Parameter Settings of the Position Interface Units**

Set the parameters for the Position Interface Units.

The settings are different for each model of Position Interface Unit.

Refer to the following sections for details: *6-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 6-29, *7-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 7-21, and *8-7-4 Differences in I/O Refreshing Methods Based on the Controller* on page 8-28.

- **Assigning Device Variables to I/O Ports**

Assign device variables to I/O ports.

You can then control the Position Interface Units through these device variables.

Refer to the following sections for a list of the I/O ports for the Position Interface Units: *6-7-1 Data Items for Allocation to I/O* on page 6-34, *7-7-1 Data Items for Allocation to I/O* on page 7-30, and *8-8-1 Data Items for Allocation to I/O* on page 8-31.

Refer to the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for the procedures to assign device variables to I/O ports.

- **Displaying the I/O Map and Watch Tab Page**

Open the I/O Map or Watch Tab Page to view the values of the device variables that you assigned to the I/O ports.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No W504-E1-06 or higher) for the procedures to display the I/O Map and Watch Tab Page.

- **Programming**

You cannot use motion control instructions to control the Position Interface Units if you do not use the MC Function Module. To perform motion control in the user program, write all motion control logic by reading and writing the device variables that are assigned to the I/O ports.

2-2-3 Using an EtherNet/IP Coupler Unit

Mount the Position Interface Units after an EtherNet/IP Coupler Unit to configure an EtherNet/IP Slave Terminal.
To use the Position Interface Units, you must configure the EtherNet/IP network and configure and set the EtherNet/IP Slave Terminal.

Refer to the following sections for information on the I/O data assigned to the I/O entry mappings for Position Interface Units: *6-7 I/O Data Specifications* on page 6-34 and *7-7 I/O Data Specifications* on page 7-30.

Refer to the *NX-series EtherNet/IP Coupler Unit User's Manual* (Cat. No. W536) for information on how to assign the I/O data of Position Interface Units.

Precautions for Correct Use

You cannot connect a Pulse Output Unit to an EtherNet/IP Coupler Unit.

● Parameter Settings of the Position Interface Units

Set the parameters for the Position Interface Units.

The settings are different for each model of Position Interface Unit.

Refer to *6-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 6-29 and *7-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 7-21 for details.

2-2-4 When Using Controllers from Other Manufacturers

Mount the Position Interface Units after a Communications Coupler Unit to configure a Slave Terminal.

To use the Position Interface Units, you must configure the communications network and configure and set the Slave Terminal.

Refer to the following sections for information on the I/O data assigned to the I/O entry mappings for Position Interface Units: *6-7 I/O Data Specifications* on page 6-34, *7-7 I/O Data Specifications* on page 7-30, and *8-8 I/O Data Specifications* on page 8-31.

Refer to the user's manual for the connected Communications Coupler Unit for information on how to assign the I/O data of Position Interface Units.

3

Part Names and Functions

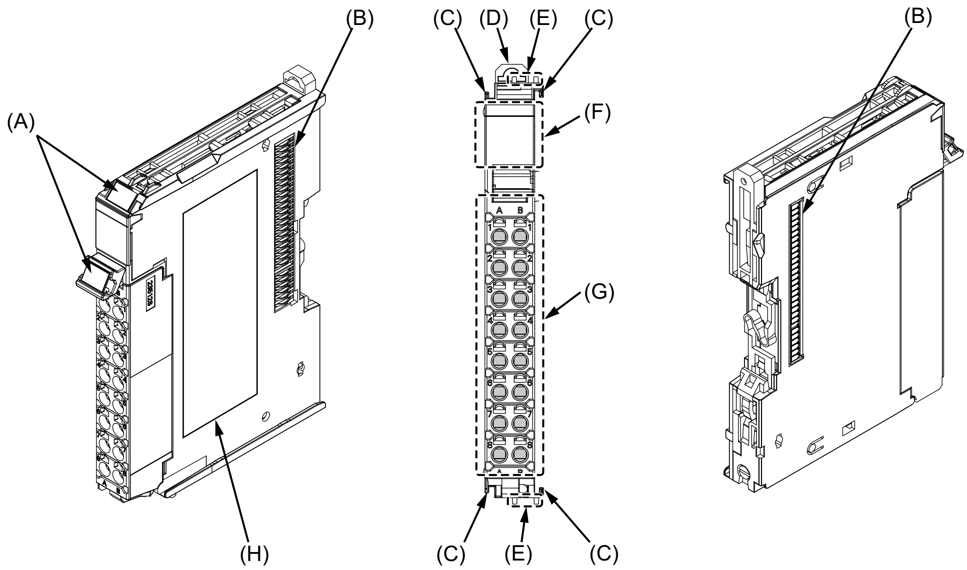
3

This section describes the names and functions of the parts of the Position Interface Units.

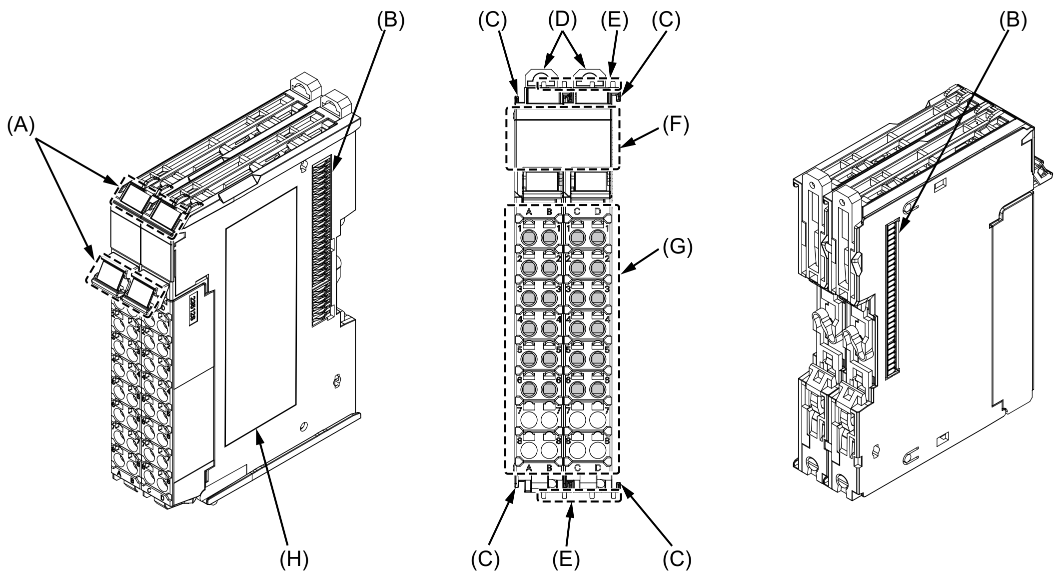
3-1 Parts and Names

This section describes the names and functions of the parts of the Position Interface Units.

- **NX-EC0112, NX-EC0122, NX-EC0212, NX-EC0222, NX-ECS112, NX-ECS212, NX-PG0112, and NX-PG0122**



- **NX-EC0132 and NX-EC0142**



Letter	Name	Function
(A)	Marker attachment locations	This is where the markers are attached. OMRON markers are pre-installed at the factory. You can also install commercially available markers.
(B)	NX bus connector	This connector is used to connect to another Unit.
(C)	Unit hookup guides	These guides are used to connect two Units to each other.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	These protrusions are to hold onto when you need to pull out the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit.
(G)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
(H)	Unit specifications	The specifications of the Unit are given here.

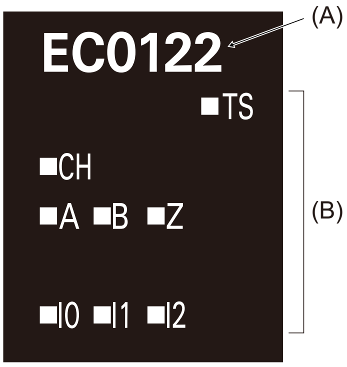
3-2 Indicators

This section provides information on the indicators that are provided on all Position Interface Units.

Refer to the following sections for indicator information specific to each Unit: *6-4-3 Indicators* on page 6-9, *7-4-3 Indicators* on page 7-9, and *8-5-3 Indicators* on page 8-13.

A Position Interface Unit has indicators that show information such as the current operating status of the Unit or signal I/O status details.

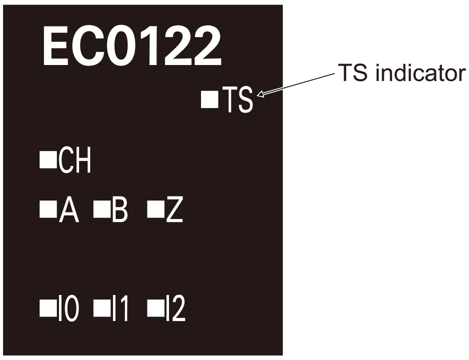
The NX-EC0122 Incremental Encoder Input Unit is used as an example to describe the layout of the indicators.



Letter	Name	Function
(A)	Model number indication	Gives the model number of the Unit, without the prefix. For example, "EC0122" is given for the NX-EC0122. The text is white.
(B)	Indicators	The indicators show the current operating status of the NX Unit and signal I/O status.

TS Indicator

This indicator shows information such as the current status of the Position Interface Unit or of the network.



The following table lists the possible states for this indicator and what they mean.

Color	Status		Description
Green		Lit	• The Unit is operating normally. • The Unit is ready for I/O refreshing. • I/O checking is in progress*1
		Flashing (at 2-s intervals)	• Initializing • Restarting is in progress for the Unit. • Downloading
		Flashing (at 0.5-s intervals)	A backup, restore, or compare operation is in progress from the Sysmac Studio or SD Memory Card.
Red		Lit	A hardware error, WDT error, or other critical error that is common to all Units occurred.
		Flashing (at 1-s intervals)	A communications error or other NX bus-related error that is common to all Units occurred.
---		Not lit	• There is insufficient or no Unit power supply. • Restarting is in progress for the Slave Terminal. • Waiting for initialization to start

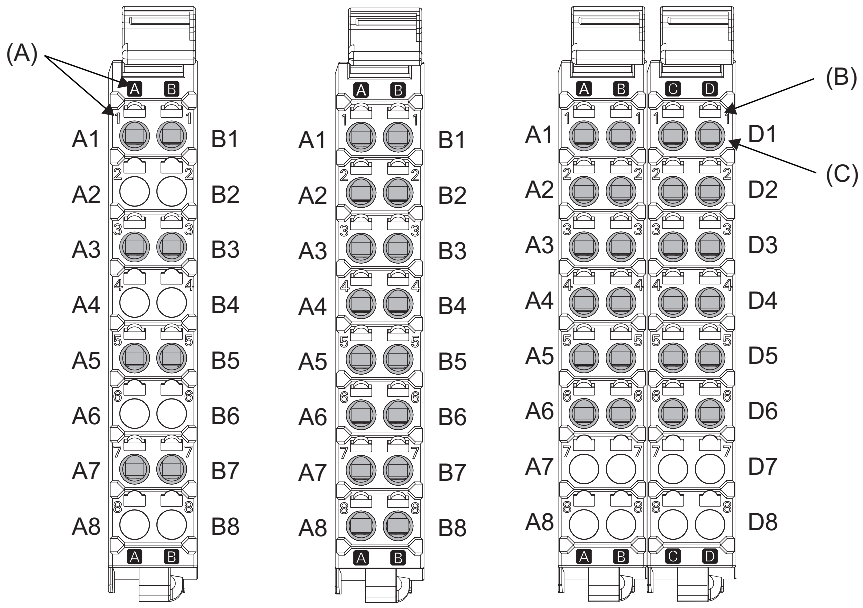
*1. Refer to the manual for the Communications Coupler Unit for the indicator status of the Communications Coupler Unit when I/O checking is in progress.

3-3 Terminal Blocks

Position Interface Units use screwless clamping terminal blocks for easy wiring and removal.

In terms of the number of terminals, there are three types of terminal blocks used on Position Interface Units: one with 12 terminals, one with 16 terminals, and one with 24 terminals (using 2 sets of 12-terminal terminal blocks), as shown below.

- **NX-TB□□□2**

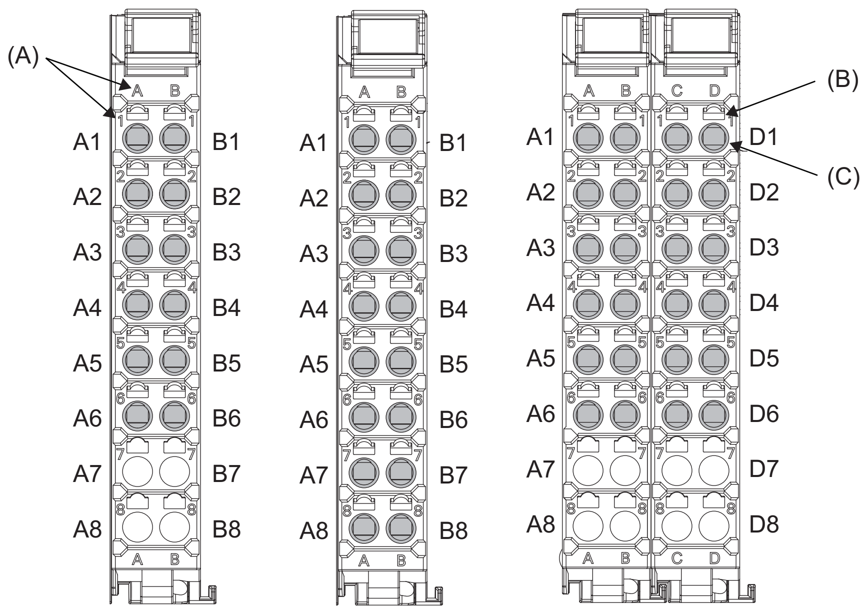


12 mm wide
12 terminals

12 mm wide
16 terminals

24 mm wide
12 terminals × 2

- **NX-TB□□□1**



12 mm wide
12 terminals

12 mm wide
16 terminals

24 mm wide
12 terminals × 2

Letter	Name	Function
(A)	Terminal number indication	The terminal number is identified by a column (A through D) and a row (1 through 8). Therefore, terminal numbers are written as a combination of columns and rows, A1 through A8 and B1 through B8. For a 24-mm-wide terminal block, the left side contains terminals A1 through A8 and B1 through B8. The right side contains terminals C1 through C8 and D1 through D8. The terminal number indication is the same regardless of the number of terminals on the terminal block, as shown above.
(B)	Release hole	A flat-blade screwdriver is inserted here to attach and remove the wiring.
(C)	Terminal hole	The wires are inserted into these holes.

To differentiate between the two models of Terminal Blocks, use the terminal number column indications. The Terminal Block with white letters on a dark background is the NX-TB□□□2.

Additional Information

- Each Position Interface Unit is compatible with only one of these three types of terminal blocks. You cannot use a terminal block that does not match the specifications for a particular Unit.
- The 12-mm-wide terminal block does not have terminal holes and release holes for terminal numbers A7, A8, B7, and B8.
- The 24-mm-wide terminal block does not have terminal holes and release holes for terminal numbers A7, A8, B7, B8, C7, C8, D7, and D8.

Applicable Terminal Blocks for Each Unit Model

The following table gives the Terminal Blocks that are applicable to each Unit.

Unit model number	Terminal Block			
	Terminal Block model number	No. of terminals	Ground terminal mark	Terminal current capacity
NX-EC0112	NX-TBA161	16	None	4 A
	NX-TBA162			10 A
NX-EC0122	NX-TBA161			4 A
	NX-TBA162			10 A
NX-EC0132	NX-TBA121 and NX-TBB121	12		4 A
	NX-TBA122 and NX-TBB122			10 A
NX-EC0142	NX-TBA121 and NX-TBB121			4 A
	NX-TBA122 and NX-TBB122			10 A
NX-EC0212	NX-TBA121			4 A
	NX-TBA122			10 A
NX-EC0222	NX-TBA121			4 A
	NX-TBA122			10 A
NX-ECS112	NX-TBA121			4 A
	NX-TBA122			10 A
NX-ECS212	NX-TBA121			4 A
	NX-TBA122			10 A
NX-PG0112	NX-TBA161	16		4 A
	NX-TBA162			10 A
NX-PG0122	NX-TBA161			4 A
	NX-TBA162			10 A

Precautions for Correct Use

You can mount an NX-TB□□□1 or NX-TB□□□2 Terminal Block to a Position Interface Unit.

Even if you mount an NX-TB□□□2 Terminal Block, which has a terminal current capacity of 10 A, the rated current does not change because the current capacity specification of the I/O power supply terminals on a Position Interface Unit is 4 A max.

Additional Information

Refer to *A-4 Terminal Block Model Numbers* on page A-64 for the model numbers of the Terminal Blocks.

4

Installation and Wiring

This section describes how to install and wire Position Interface Units.

4-1 Installing Units

This section describes how to install and remove NX Units, such as Position Interface Units, and how to attach markers.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on preparations for installation and installation in a control panel.

Precautions for Safe Use

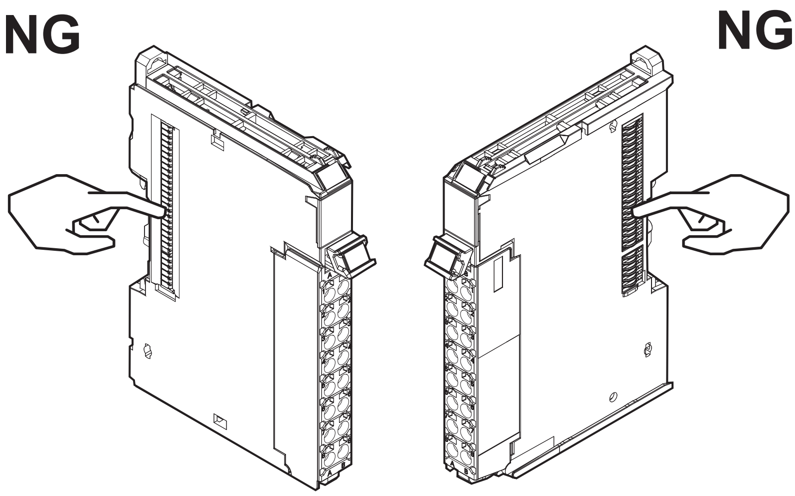
Always turn OFF the I/O power supply to an NX Unit before you attach or remove its terminal block.

4-1-1 Installing Position Interface Units

This section describes how to mount two NX Units (such as Position Interface Units) to each other.

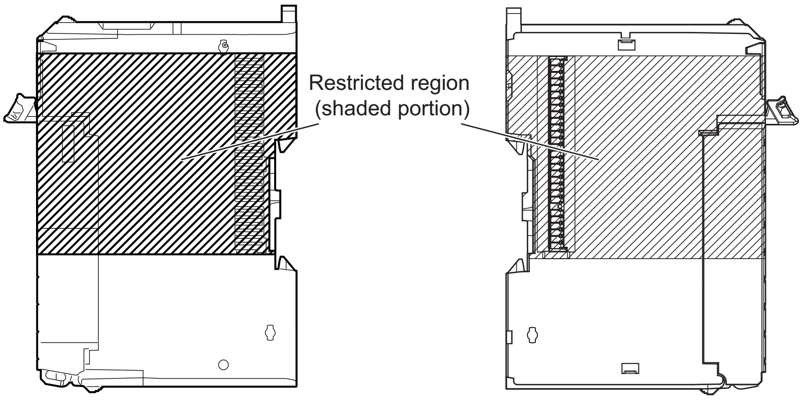
Precautions for Safe Use

- Do not apply labels or tape on the NX Units. When an NX Unit is installed or removed, adhesive or scraps may adhere to the NX bus connector, which may result in malfunctions.
- Do not touch the pins in the NX bus connector on the Unit. Dirt may adhere to the pins in the NX bus connector, which may result in malfunctions.



Example: NX Unit (12 mm width)

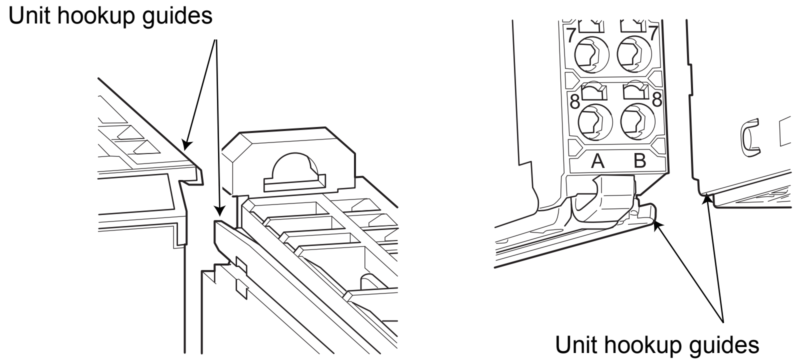
- Do not write anything with ink within the restricted region that is shown in the following figure. Also do not get this area dirty. When the Unit is installed or removed, ink or dirt may adhere to the pins in the NX bus connector, which may result in malfunctions in the Slave Terminal.



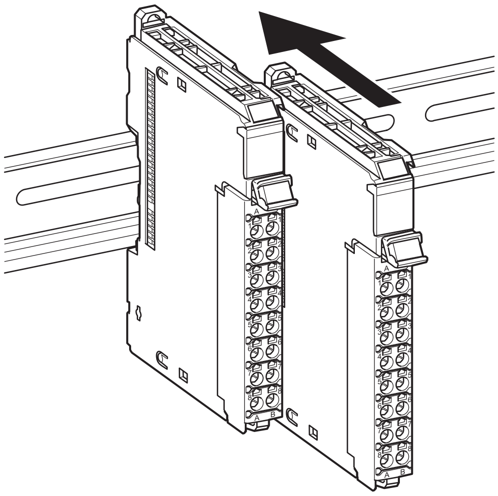
Precautions for Correct Use

- Mount only one NX Unit at a time on the DIN Track. If you attempt to mount multiple NX Units that are already connected together, the connections between the NX Units may break and they may fall to the ground.
- When you handle an NX Unit, be careful not to touch or bump the pins in the NX bus connector.
- When you handle an NX Unit, be careful not to apply stress to the pins in the NX bus connector. If the NX Unit is installed and the power supply is turned ON when the pins in the NX bus connector are deformed, contact failure may cause malfunctions.

1 From the front of the previously mounted NX Unit, engage the Unit hookup guides on a new Unit with the Unit hookup guides on the previously mounted NX Unit.



2 Slide the NX Unit in on the hookup guides.



3 Press the NX Unit with a certain amount of force against the DIN Track until you hear the DIN Track mounting hook lock into place.

It is not necessary to release the DIN Track mounting hook on the Position Interface Unit when you mount the Position Interface Unit.

After you mount the NX Unit, make sure that it is locked on the DIN Track.

Additional Information

- It is not normally necessary to unlock the DIN Track mounting hook when you mount the NX Unit. If you mount an NX Unit on a DIN Track that is not one of the recommended DIN Tracks, the DIN Track mounting hook may not lock into place. If that happens, unlock the DIN Track mounting hook at the start of the procedure, mount the NX Unit to the DIN Track, and then lock the DIN Track mounting hook.
- Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to mount the Communications Coupler Unit and how to mount the NX Units after the Communications Coupler Unit.

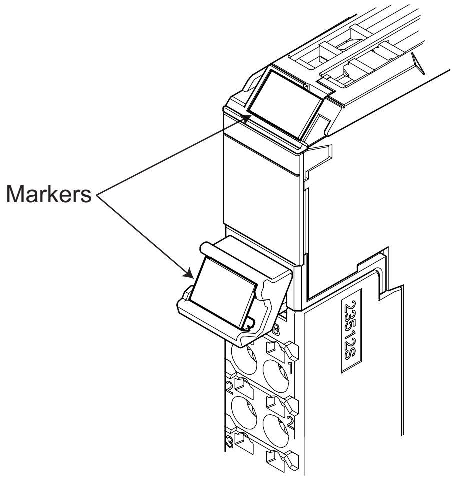
4-1-2 Attaching Markers

You can attach markers to NX Units and terminal blocks to identify them.

The plastic markers made by OMRON are installed for the factory setting. The ID information can be written on them.

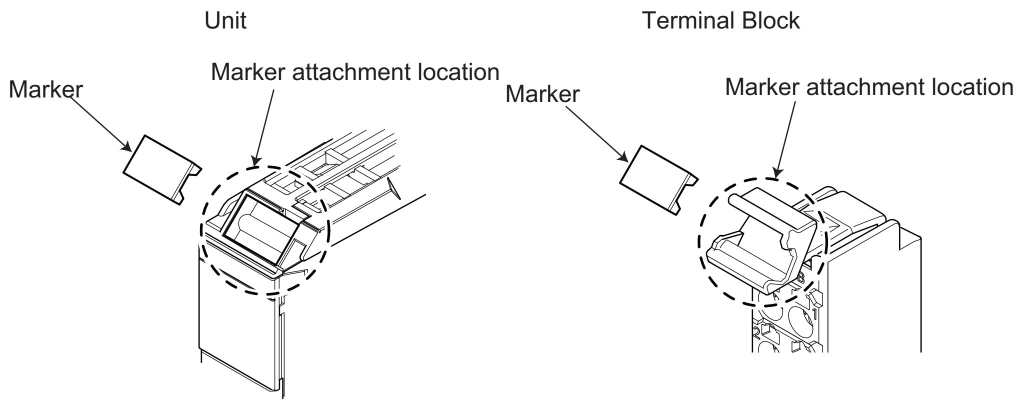
Commercially available markers can also be installed.

Replace the markers made by OMRON if you use commercially available markers now.



Marker Installation Method

Insert the protrusions on the markers into the marker attachment locations on the NX Units and the terminal blocks on NX Units.



Commercially Available Markers

Commercially available markers are made of plastic and can be printed on with a special printer.

To use commercially available markers, purchase the following products.

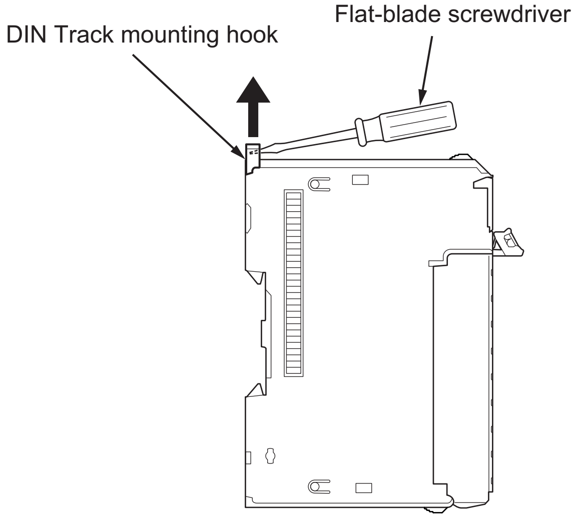
Product name	Model number	
	Made by Phoenix Contact	Made by Weidmueller
Markers	UC1-TMF8	DEK 5/8
Special marker printer	UM EN BLUEMARK X1	PrintJet PRO

The markers made by OMRON cannot be printed on with commercially available special printers.

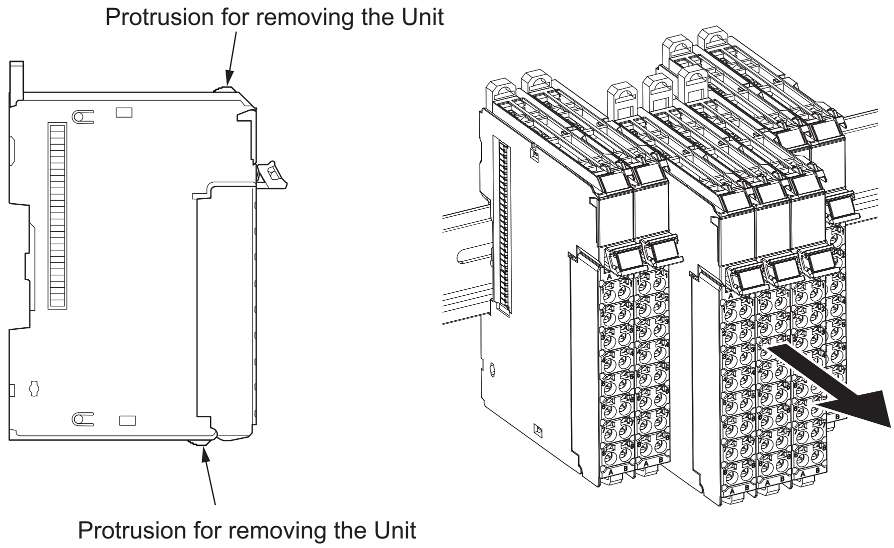
4-1-3 Removing Position Interface Units

This section describes how to remove NX Units, such as Position Interface Units.

1 Use a flat-blade screwdriver or similar tool to pull up the DIN Track mounting hook on the NX Unit to remove.



2 As shown in the following figure, place your fingers on the protrusions on more than one NX Unit, including the NX Unit to remove, and pull the NX Units straight forward.



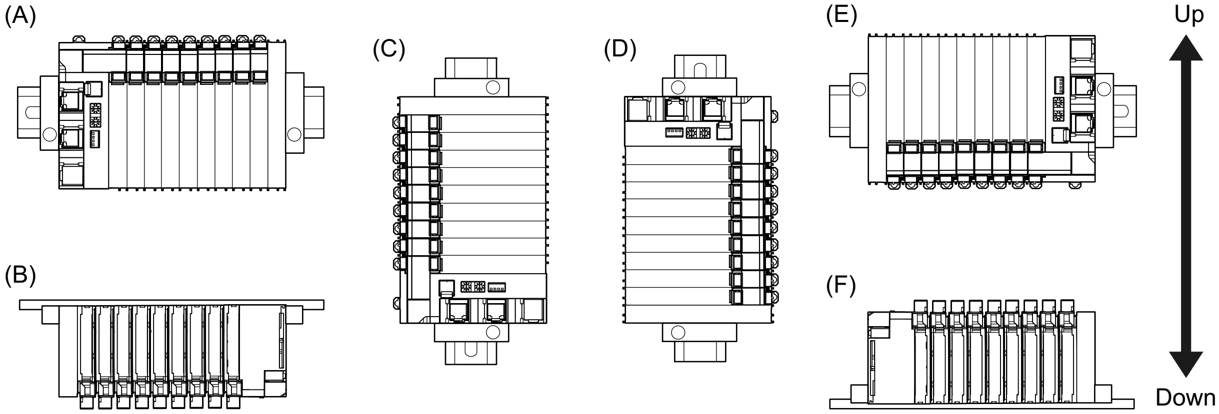
Precautions for Correct Use

- When you need to remove an NX Unit, always remove more than one NX Unit at a time, including the Unit you need to remove. It is sometimes very difficult to remove only one NX Unit by itself.
- Do not release the DIN Track mounting hooks on all of the NX Units at the same time. If you release the DIN Track mounting hooks on all of the Units at the same time, all of the Units will come off.

4-1-4 Installation Orientation

The Slave Terminal can be installed in any of the following six orientations.

(A) is the upright installation orientation and (B) to (F) are installation orientations other than upright.



However, there are restrictions on the installation orientation and restrictions to the specifications that can result from the Communications Coupler Units and NX Units that are used.

For detailed restrictions, refer to the user's manuals for the Communications Coupler Unit, NX Units, and NX-series System Units that you will use.

4-2 Connecting the Power Supply and Ground Wires

This section provides information on wiring the power supplies for Position Interface Units.

4-2-1 Power Supply Types

There are the following two types of power supplies that supply power to the Position Interface Units.

Power supply name	Description
Unit power supply	This power supply is required to generate the NX Unit power supply, which is necessary for the Slave Terminal to operate. This power supply is connected to the Unit power supply terminals on the Communications Coupler Unit or Additional NX Unit Power Supply Unit. The internal circuits of the Communications Coupler Unit and Position Interface Units operate on the power from the NX Unit power supply. The NX Unit power is supplied to the Position Interface Units in the Slave Terminal through the NX bus connectors.
I/O power supply	This power supply provides power to drive the I/O circuits of the Position Interface Units and it provides power to external devices. This power supply is connected to the I/O power supply terminals on the Communications Coupler Unit or Additional I/O Power Supply Unit. The I/O power supply provides power for connected external devices, such as external encoders or external sensors. The I/O power is supplied to the NX Units from the I/O power supply terminals and through the NX bus connectors.

Precautions for Correct Use

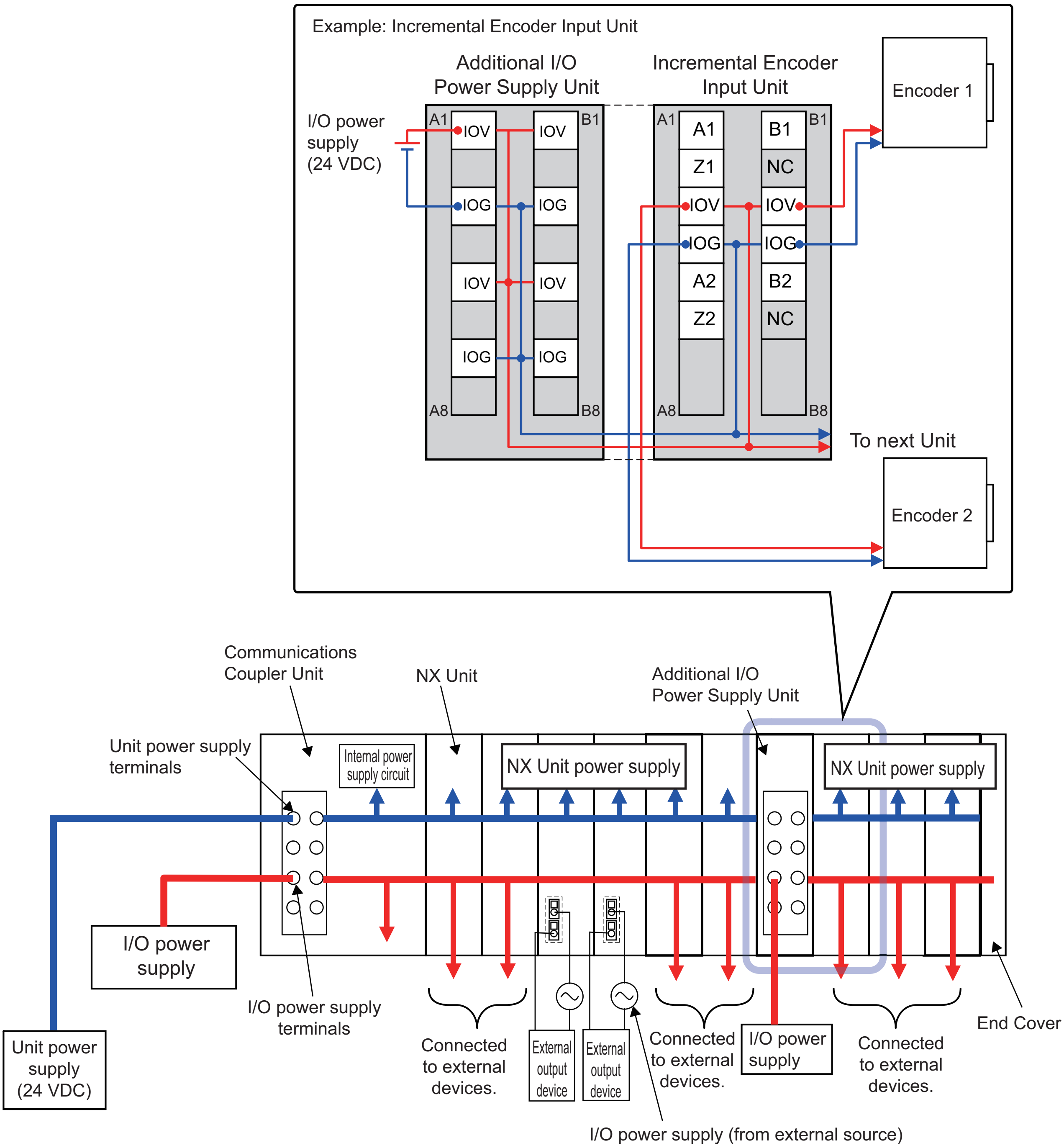
Always use separate power supplies for the Unit power supply and the I/O power supply. If you supply power from the same power supply, noise may cause malfunctions.

4-2-2 Power Supply Methods and Wiring

The following table describes how each power supply provides power to the Position Interface Units.

Power supply name	Description
NX Unit power supply	Power is supplied to the Position Interface Unit through the NX bus connectors by connecting a Unit power supply to the Unit power supply terminals on the Communications Coupler Unit or Additional NX Unit Power Supply Unit.
I/O power supply	Power is supplied to the Position Interface Unit through the NX bus connectors by connecting an I/O power supply to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

The following examples show the wiring for these power supplies.



Precautions for Correct Use

Always use separate power supplies for the Unit power supply and the I/O power supply. If you supply power from the same power supply, noise may cause malfunctions.

Additional Information

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on the power supply system design for Slave Terminals.

4-2-3 Calculating the Total Current Consumption from I/O Power Supply

The total current consumption from the I/O power supply from the NX bus must be less than the maximum I/O power supply current of the Communications Coupler Unit or Additional I/O Power Supply Unit.

To confirm this and to calculate the I/O power supply capacity, calculate the total current consumption of the I/O power supply from the NX bus.

The total I/O current consumption from the NX bus is the sum of the following: the current consumption from the I/O power supply for the NX Units that receive power from the I/O power supply from the NX bus, the current consumption of those I/O circuits, and the current consumption of connected external devices.

Calculate the total current consumption from the I/O power supply for the Position Interface Units as follows:

- Total Current Consumption for an Incremental Encoder Input Unit
  = (Current consumption from I/O power supply of Unit) + (Total input current for Unit voltage inputs) + (Total current consumption of connected external devices[*1])
- Total Current Consumption of an SSI Input Unit
  = (Current consumption from I/O power supply of Unit) + (Total current consumption of connected external devices)
- Total Current Consumption of a Pulse Output Unit
  = (Current consumption from I/O power supply of Unit) + (Total input current for Unit voltage inputs) + (Total load current of loads connected to Unit outputs) + (Total current consumption of connected external devices)

Refer to *A-1 Datasheets* on page A-2 for the current consumption from the I/O power supply for the individual Position Interface Units.

*1. If you use the 5-V power supply for an encoder, be sure to include that current too. Refer to *A-1 Datasheets* on page A-2 for the method to convert a 5-V power supply current consumption to a 24-V power supply current consumption.

4-2-4 NX-series Power Supply-related Units

The Communications Coupler Unit supplies the NX Unit power and I/O power to the NX Units in the Slave Terminal. The following three Units are related to power supply for the NX Series other than the Communications Coupler Units.

- Additional NX Unit Power Supply Unit
- Additional I/O Power Supply Unit
- I/O Power Supply Connection Units

Refer to the *NX-series System Unit User's Manual* (Cat. No. W523) for the specifications of these Units.

For a complete list of the latest power supply Units in the NX Series, refer to the product catalog or official website, or contact your OMRON sales representatives.

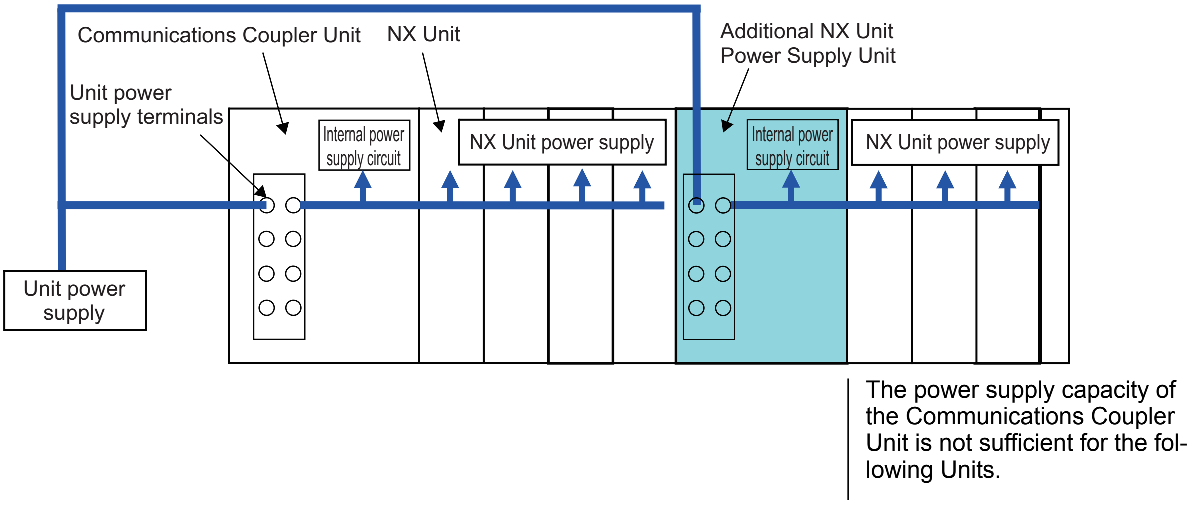
The following sections describe each of these Units.

Additional NX Unit Power Supply Unit

This NX Unit provides additional NX Unit power supply.

This NX Unit is used when the total power consumption of the NX Units in the Slave Terminal exceeds the NX Unit power supply capacity of the Communications Coupler Unit.

The NX Unit power supply provides power for the internal circuits in each NX Unit.



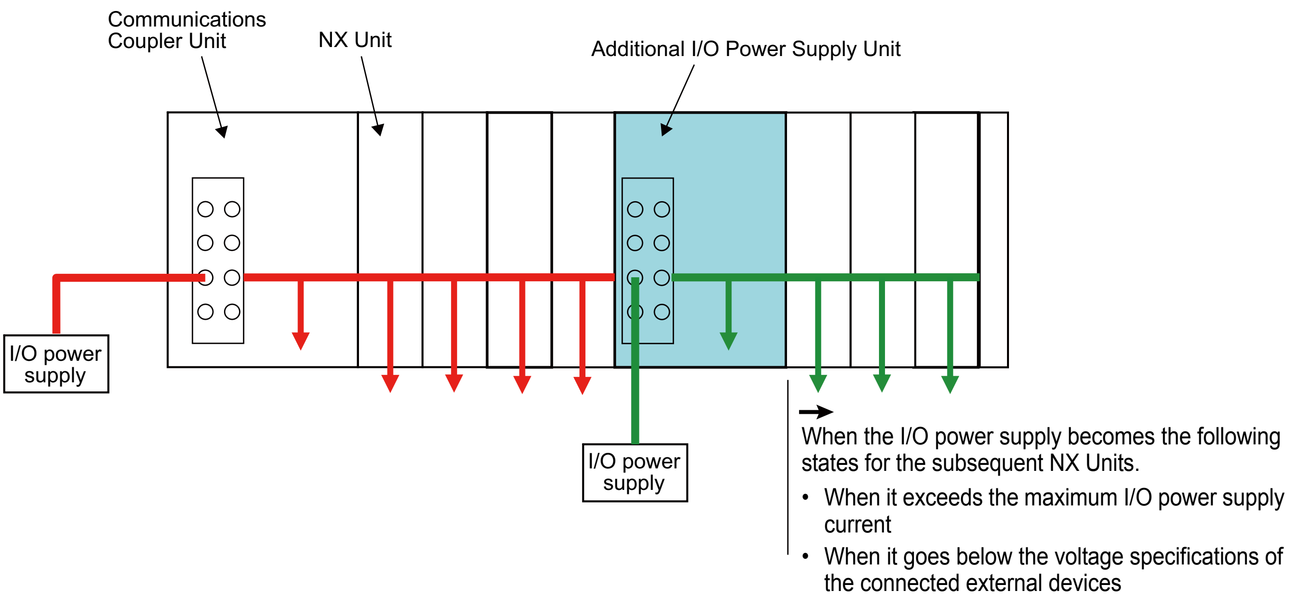
The I/O power supply for the Additional NX Unit Power Supply Unit is connected to the NX Unit on the left through the NX bus connector.

Additional I/O Power Supply Unit

This Unit supplies additional I/O power. It is used in the following two cases.

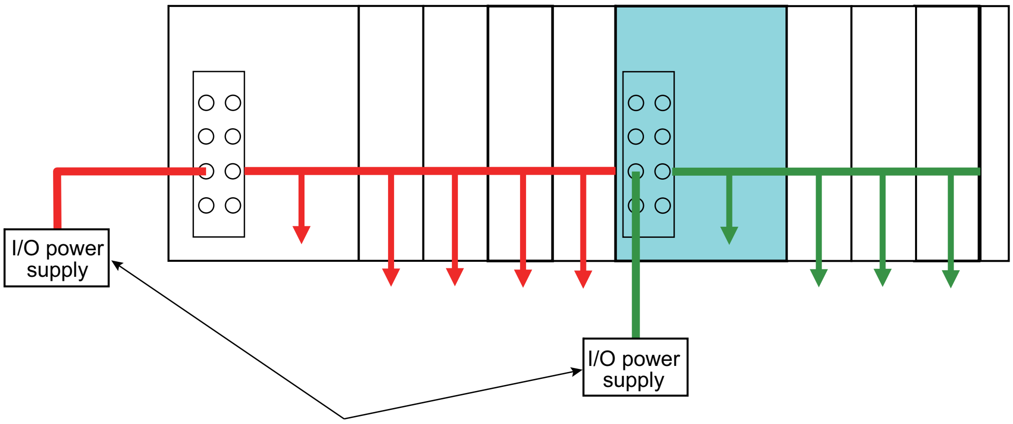
● Insufficient I/O Power Supply Capacity

- The Additional I/O Power Supply Unit is used when the total current consumption for the I/O power supply exceeds the maximum I/O power supply current of the Communications Coupler Unit.
- The Additional I/O Power Supply Unit is also used when voltage drop in the I/O power supply causes the voltage of the I/O power supply to go below the voltage specifications of the I/O circuits or connected external devices.



Separating the I/O Power Supply

- The Additional I/O Power Supply Unit is used when the connected external devices have different I/O power supply voltages.
- The Additional I/O Power Supply Unit is used to separate the power supply systems.

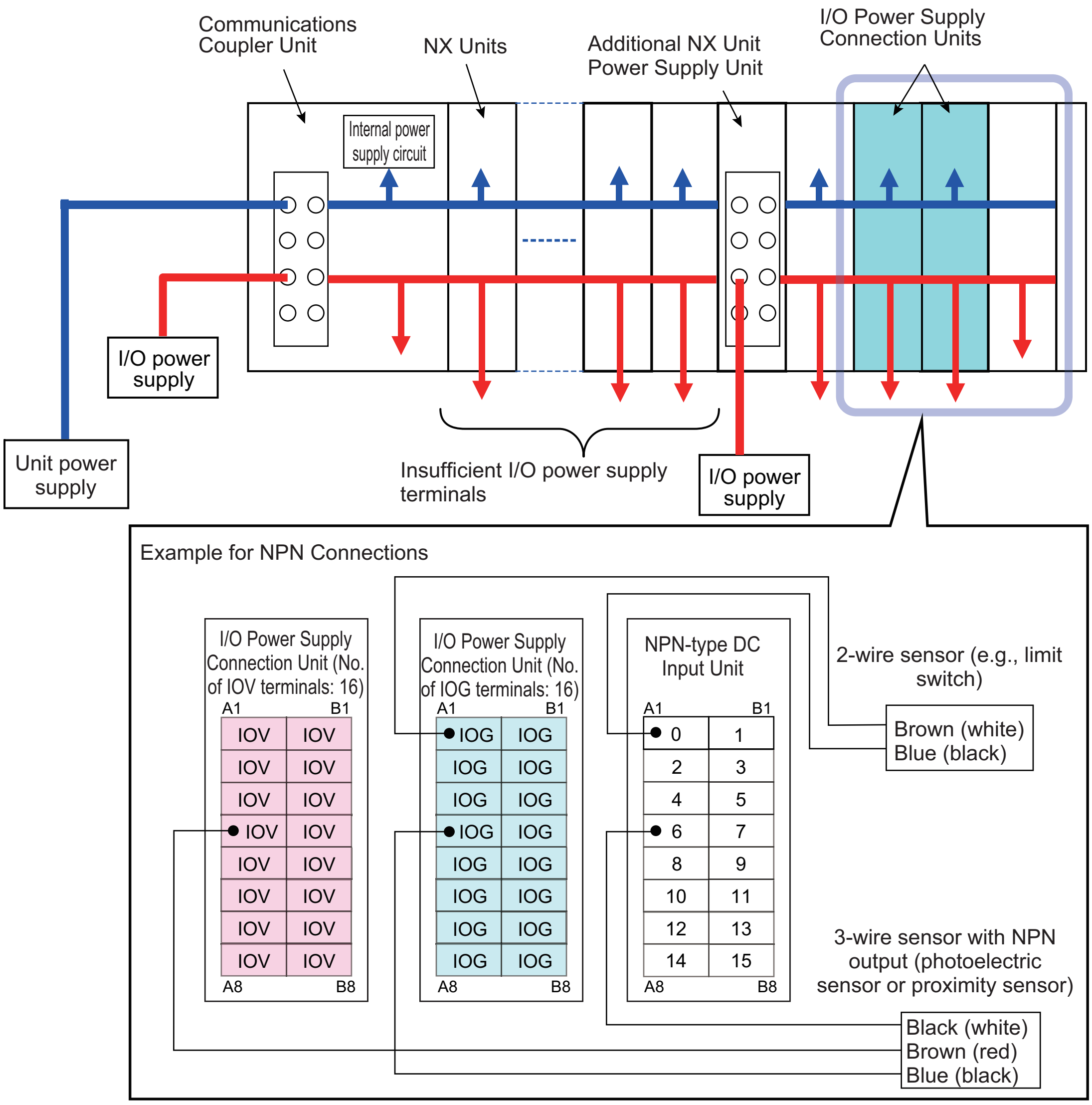


- When different I/O power supply voltages are used.
- To separate the power supply systems.

The NX Unit power supply of the Additional I/O Power Supply Unit is connected to the NX Unit on the left through the NX bus connector.

I/O Power Supply Connection Units

Use this Unit when you connect Position Interface Units or other NX Units to external devices and there are not enough I/O power supply terminals.



4-2-5 Wiring with Shielded Cables

This section describes how to wire shields to a Shield Connection Unit (NX-TBX01).

The shields are connected to the SHLD terminal.

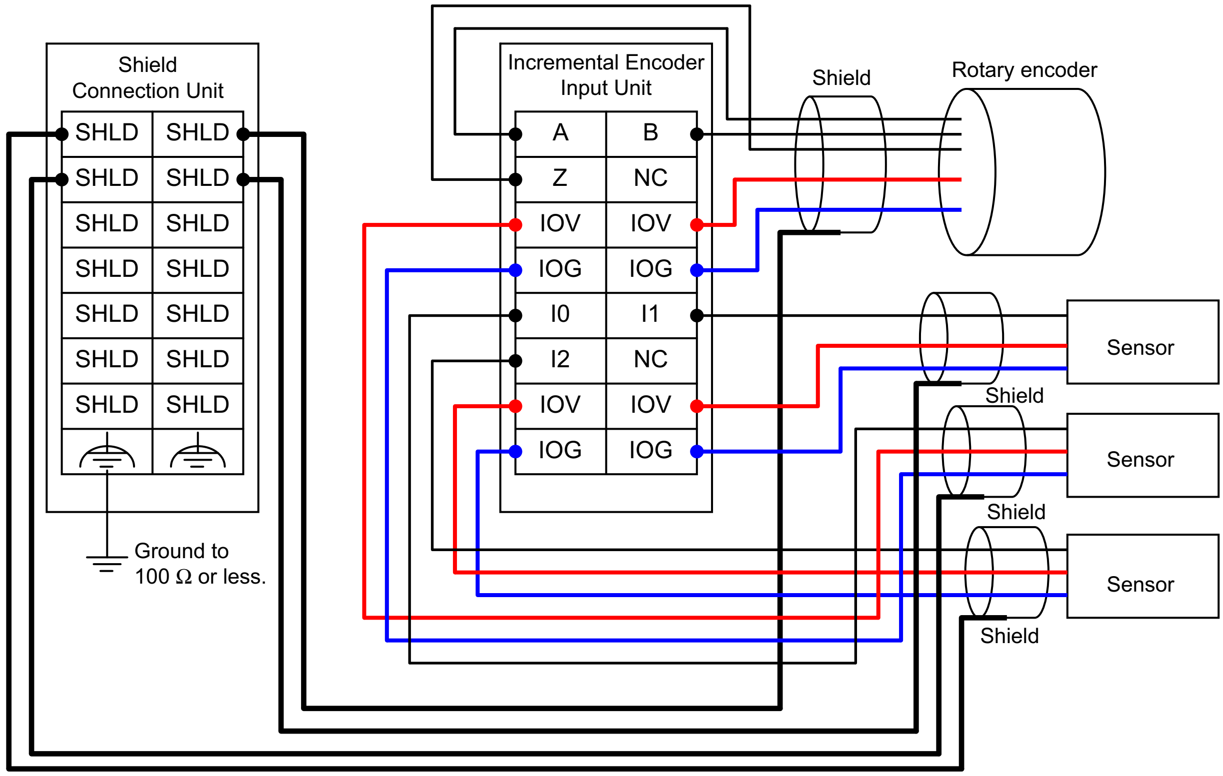
Wiring examples are provided for each Unit model.

As shown in the wiring examples, connect any shield that must be grounded to the Shield Connection Unit and then ground the ground terminals.

Wiring Examples for Incremental Encoder Input Units

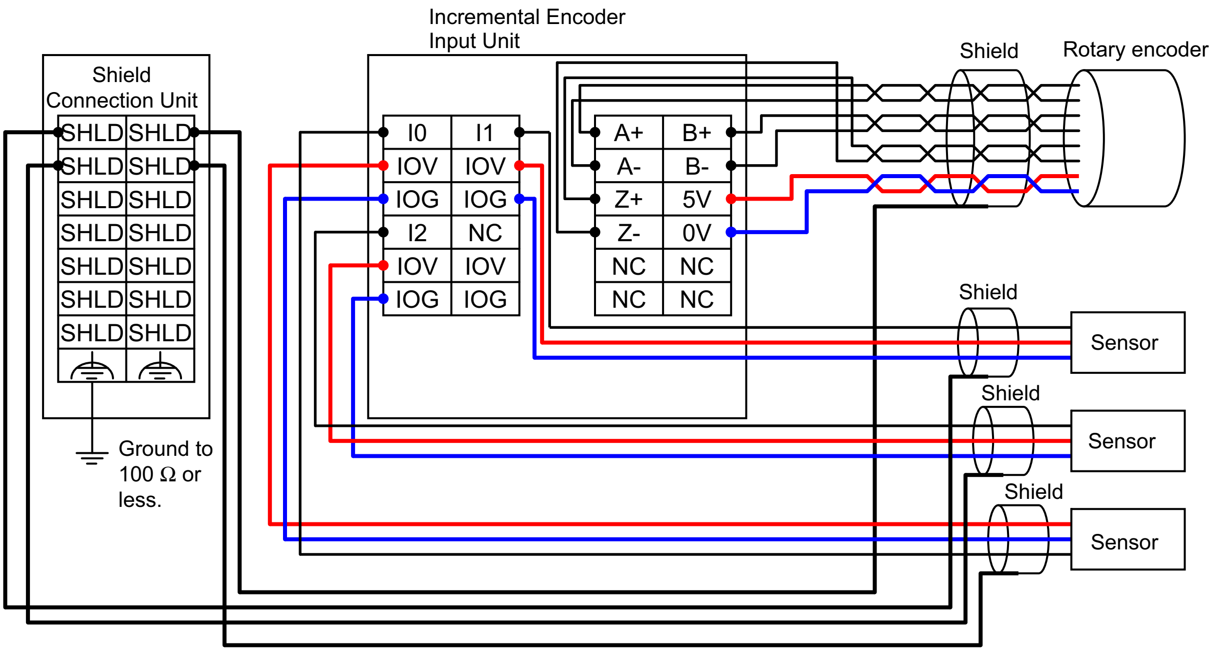
- **NX-EC0112 or NX-EC0122**

The following wiring example shows an NX-EC0112 or NX-EC0122 Incremental Encoder Input Unit wired to a rotary encoder with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



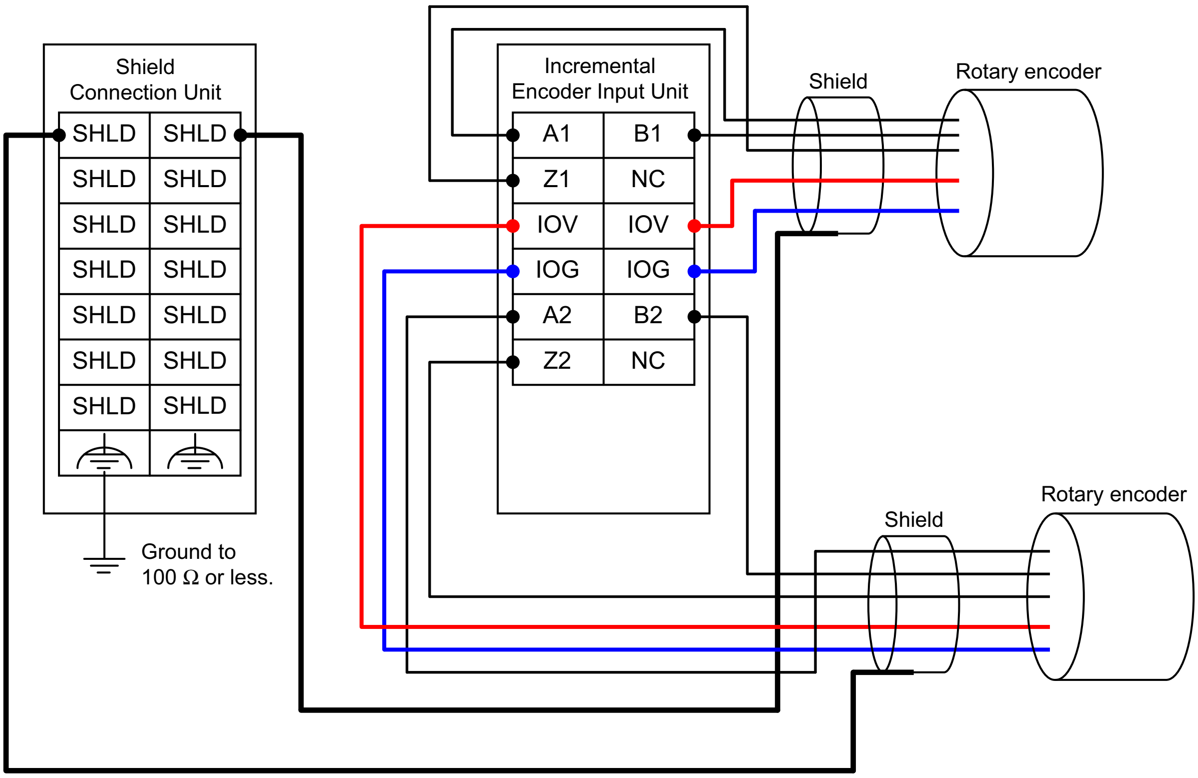
● NX-EC0132 or NX-EC0142

The following wiring example shows an NX-EC0132 or NX-EC0142 Incremental Encoder Input Unit wired to a rotary encoder with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



● NX-EC0212 or NX-EC0222

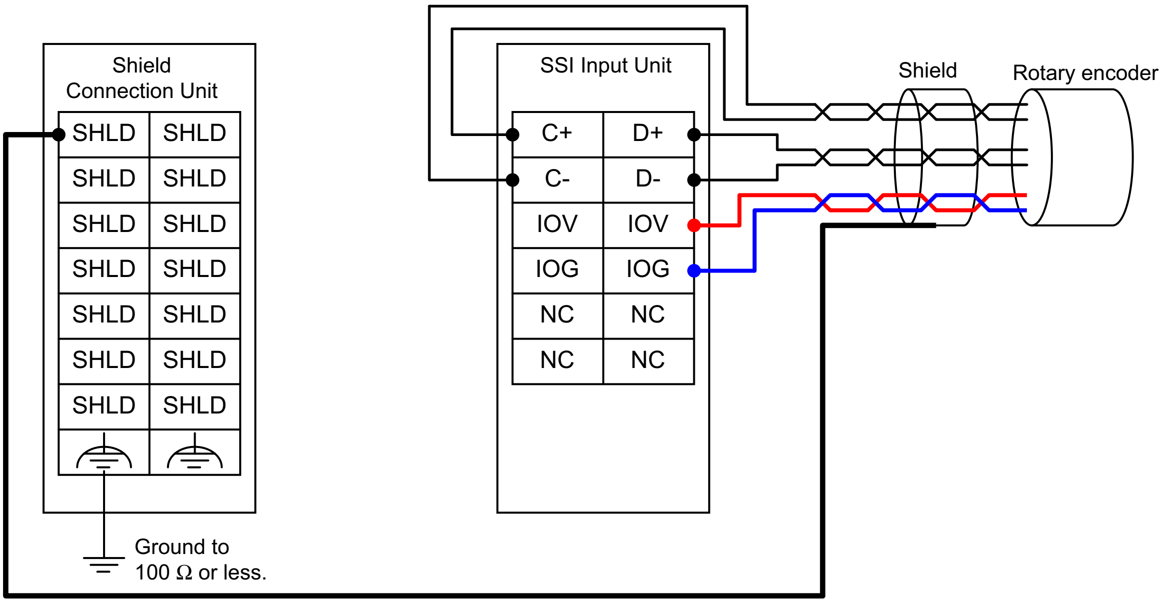
The following wiring example shows an NX-EC0212 or NX-EC0222 Incremental Encoder Input Unit wired to a rotary encoder with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



Wiring Examples for SSI Input Units

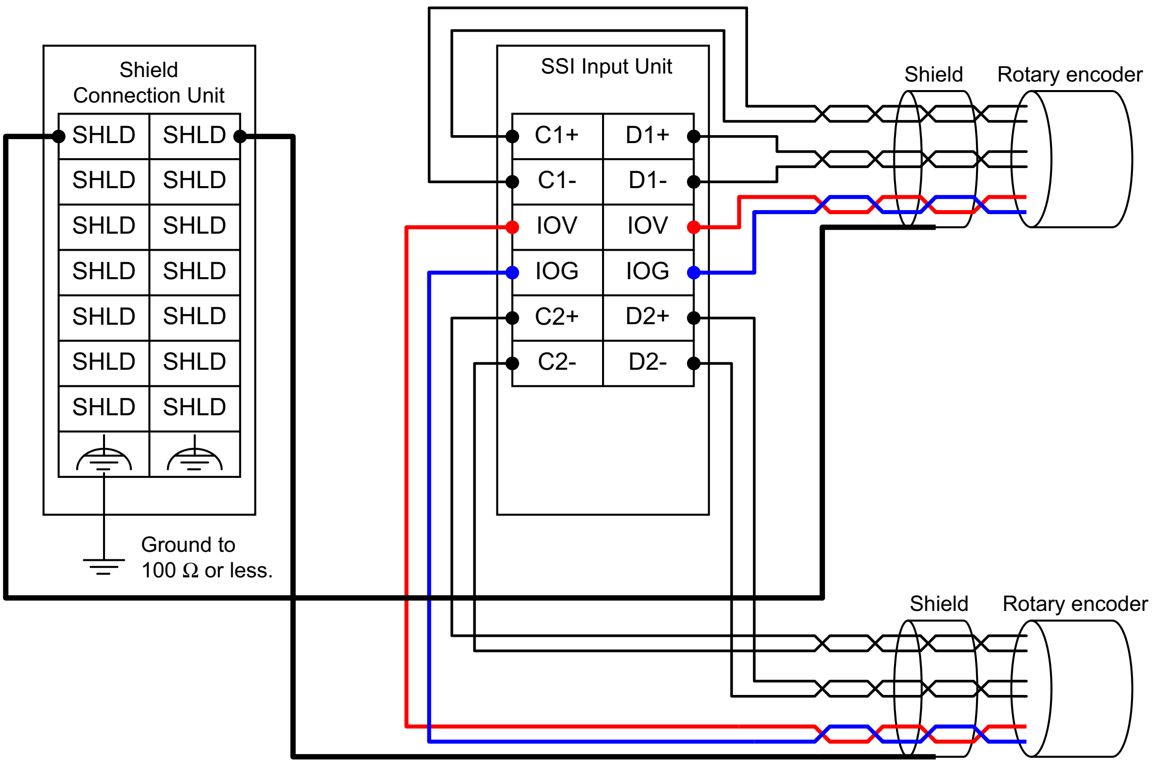
NX-ECS112

The following wiring example shows an NX-ECS112 SSI Input Unit wired to a rotary encoder with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



NX-ECS212

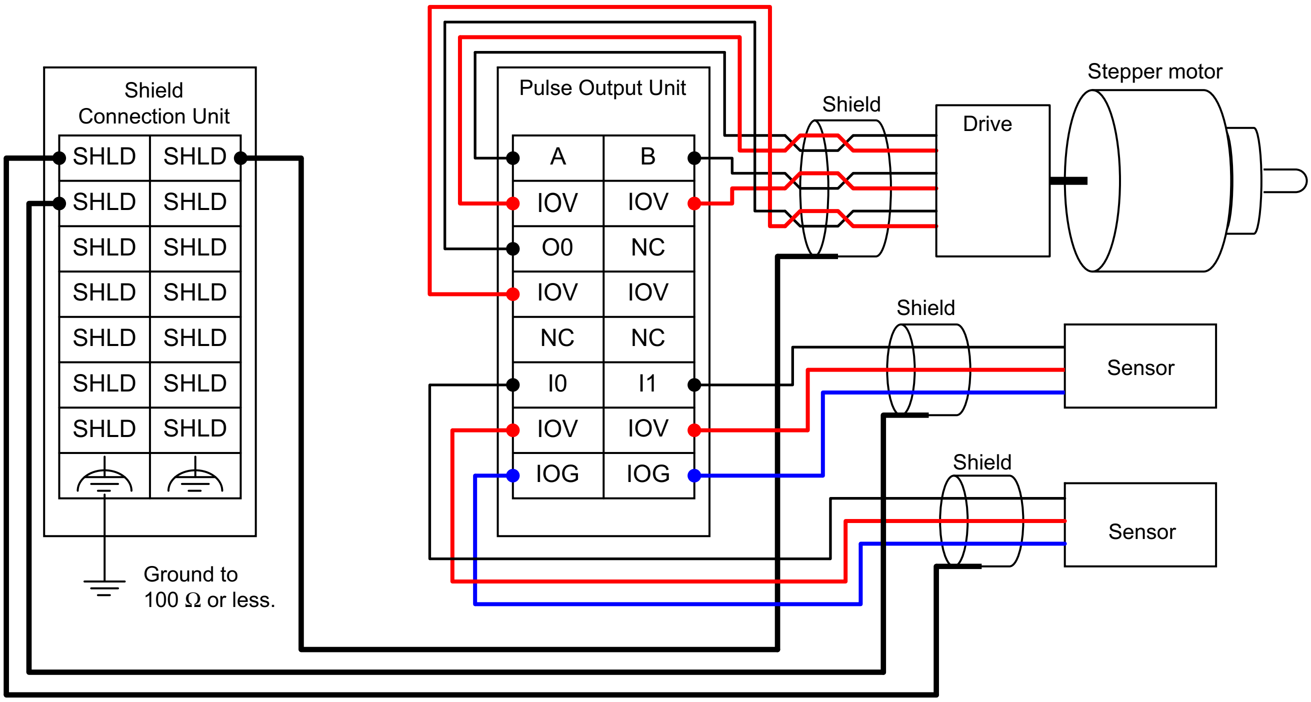
The following wiring example shows an NX-ECS212 SSI Input Unit wired to a rotary encoder with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



Wiring Example for Pulse Output Units

● NX-PG0112

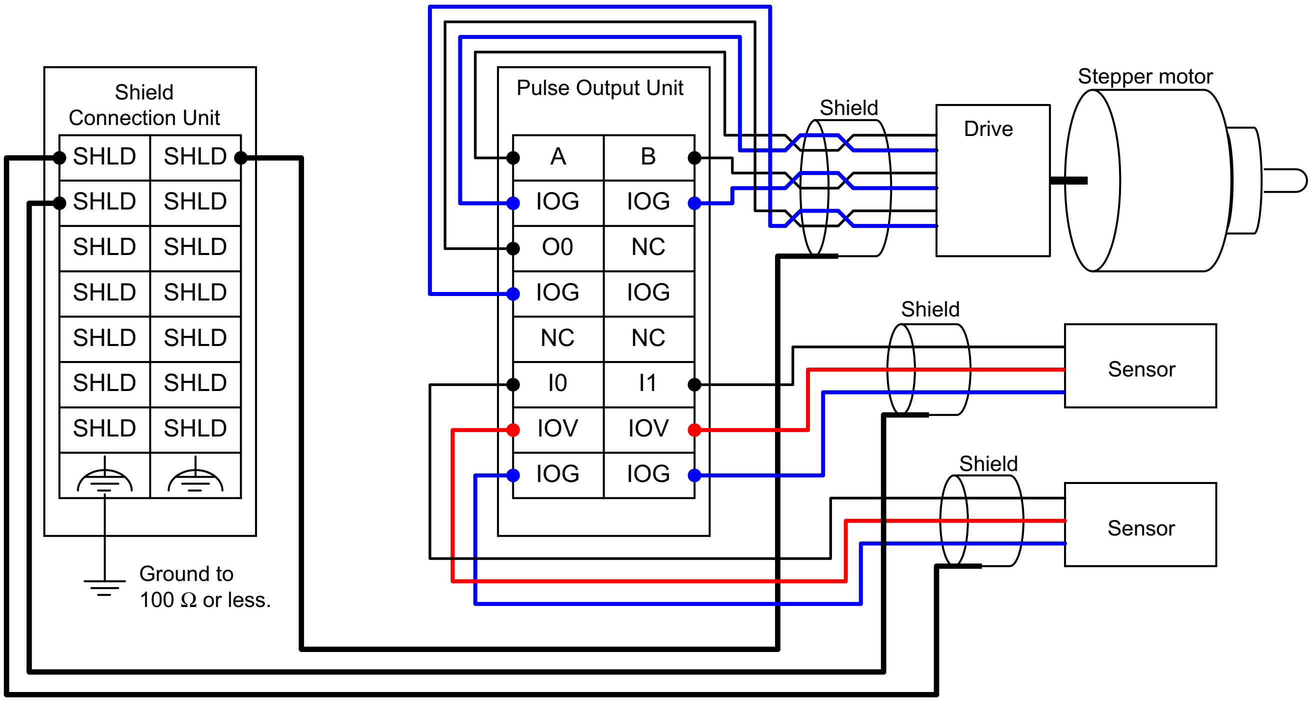
The following wiring example shows an NX-PG0112 Pulse Output Unit wired to a drive with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



Note The pulse output from an NX-PG0112 Pulse Output Unit is a 24-VDC NPN output. Refer to *8-6 Terminal Block Arrangement* on page 8-14 for information on wiring drives.

● NX-PG0122

The following wiring example shows an NX-PG0122 Pulse Output Unit wired to a drive with a shielded cable. The shield is connected to the Shield Connection Unit (NX-TBX01).



Note The pulse output from an NX-PG0122 Pulse Output Unit is a 24-VDC PNP output. Refer to *8-6 Terminal Block Arrangement* on page 8-14 for information on wiring drives.

4-3 Wiring the Terminals

This section provides information on wiring the terminals on Position Interface Units.

⚠ WARNING

Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges.

Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.

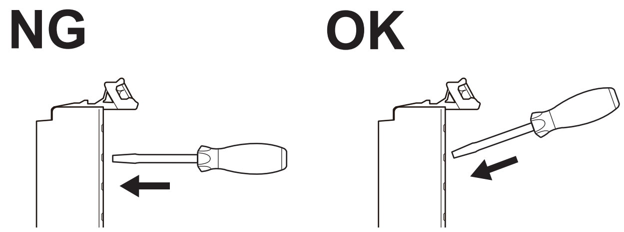
4-3-1 Wiring to the Screwless Clamping Terminal Blocks

This section describes wiring the screwless clamping terminal blocks, terminal block mounting and removal methods, and prevention of incorrect attachment.

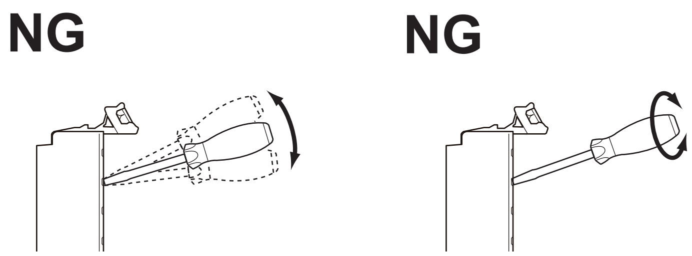
You can connect ferrules that are attached to twisted wires to the screwless clamping terminal block. You can also connect twisted wires or solid wires to the screwless clamping terminal block. If you connect ferrules, all you need to do to connect the wires is to insert the ferrules into the terminal holes.

Precautions for Safe Use

- Do not insert a flat-blade screwdriver straight into the release hole. Doing so may damage the terminal block.



- When you insert a flat-blade screwdriver into a release hole, press it down with a force of 30 N or less. Applying excessive force may damage the terminal block.
- Do not tilt or twist the flat-blade screwdriver while it is pressed into the release hole. Doing so may damage the terminal block.



- Double-check all wiring to make sure that it is correct before turning ON the power supply. Use the correct wiring parts and tools when you wire the system.
- Do not pull on the cables or bend the cables beyond their natural limit. Also, do not place heavy objects on top of the cables or other wiring lines. Doing so may break the cable.

Wiring Terminals

This section describes wiring for the following terminals:

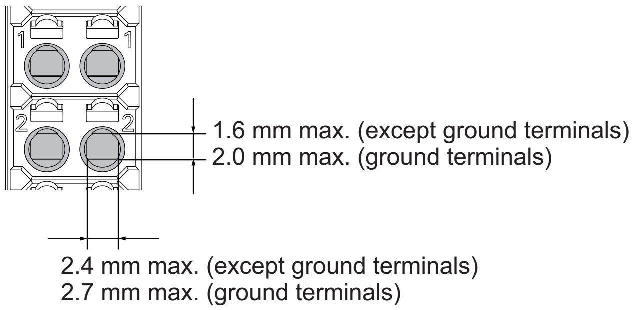
- I/O power supply terminals
- I/O terminals

Applicable Wires

You can connect twisted wires, solid wires, or ferrules attached to twisted wires to the screwless clamping terminal block. The applicable wire dimensions and preparation methods are given below.

● Dimensions of Wires Connected to the Terminal Block

The wire dimensions that you can insert into the wire holes on the screwless clamping terminal block are given in the following figure. Prepare wires with these dimensions that also meet the applicable wire specifications given below.



● Using Ferrules

If you use ferrules, attach the twisted wires to them.

Observe the application instructions for your ferrules for the wire stripping length when attaching ferrules.

Precautions for Correct Use

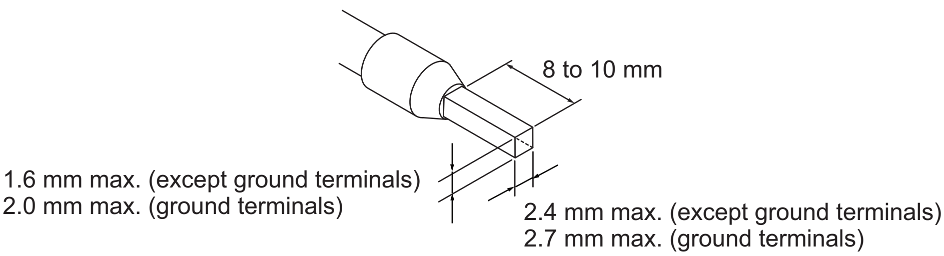
Always use plated one-pin ferrules. Do not use unplated ferrules or two-pin ferrules.

The applicable ferrules, wires, and crimping tool are given in the following table.

Terminal type	Manufacturer	Ferrule model number	Applicable wire (mm^2 (AWG))	Crimping tool
All terminals except ground terminals	Phoenix Contact	AI0,34-8	0.34 (#22)	Phoenix Contact (Applicable wire sizes are given in parentheses.) CRIMPFOX 6 (0.25 to 6 mm^2, AWG 24 to 10)
		AI0,5-8	0.5 (#20)	
		AI0,5-10		
		AI0,75-8	0.75 (#18)	
		AI0,75-10		
		AI1,0-8	1.0 (#18)	
		AI1,0-10		
		AI1,5-8	1.5 (#16)	
		AI1,5-10		
Ground terminals		AI2,5-10	2.0 *1	
All terminals except ground terminals	Weidmueller	H0.14/12	0.14 (#26)	Weidmueller (Applicable wire sizes are given in parentheses.) PZ6 Roto (0.14 to 6 mm^2, AWG 26 to 10)
		H0.25/12	0.25 (#24)	
		H0.34/12	0.34 (#22)	
		H0.5/14	0.5 (#20)	
		H0.5/16		
		H0.75/14	0.75 (#18)	
		H0.75/16		
		H1.0/14	1.0 (#18)	
		H1.0/16		
		H1.5/14	1.5 (#16)	
		H1.5/16		

*1. Some AWG 14 wires exceed 2.0 mm^2 and cannot be used in the screwless clamping terminal block.

If you use any ferrules other than those given in the above table, crimp them to twisted wires so that the following finished dimensions are achieved.

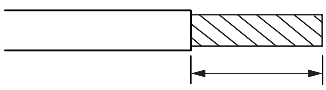


- **Using Twisted or Solid Wires**

If you use twisted wires or solid wires, use the following table to determine the correct wire specifications.

Terminals		Wire type		Wire plating		Wire size	Conductor length (stripping length)
Classification	**Current capacity**	**Twisted wires**	**Solid wire**	**Plated**	**Unplated**		
All terminals except ground terminals	2 A max.	Possible	Possible	Possible	Possible	0.08 to 1.5 mm^2 (AWG 28 to 16)	8 to 10 mm
	Greater than 2 A and 4 A or less				Not possible		
	Greater than 4 A		Not possible				
Ground terminals *1	---		Possible		Possible	2.0 mm^2	9 to 10 mm

*1. With the NX-TB□□□1 Terminal Block, use twisted wires to connect the ground terminal. Do not use a solid wire.

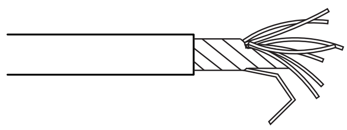


Conductor length (stripping length)

Precautions for Correct Use

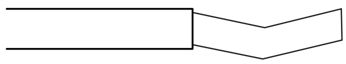
- Use cables with suitable wire sizes for the carrying current. There are also restrictions on the current due to the ambient temperature. Refer to the manuals for the cables and use the cables correctly for the operating environment.
- For twisted wires, strip the sheath and twist the conductor portion. Do not unravel or bend the conductor portion of twisted wires or solid wires.

NG



Unravel wires

NG



Bent wires

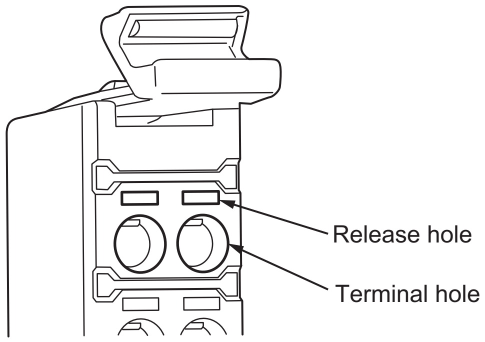
Additional Information

If more than 2 A will flow on the wires, use plated wires or use ferrules.

Connecting and Removing Wires

This section describes how to connect and remove wires.

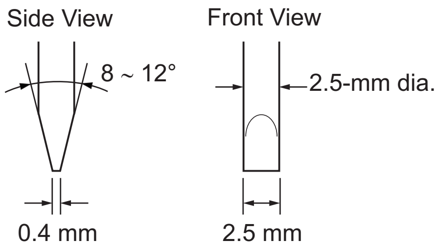
● Terminal Block Parts and Names



● Required Tools

A flat-blade screwdriver is used to connect and remove wires.

Use the following type of flat-blade screwdriver.



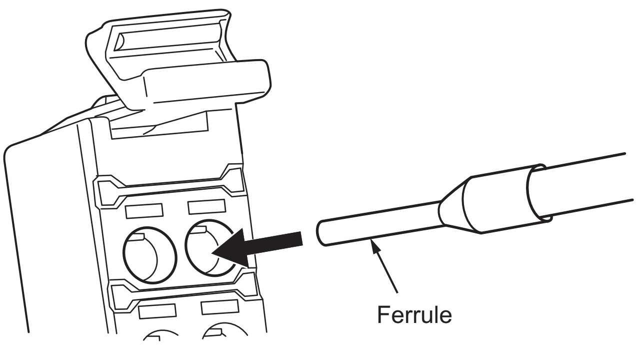
We recommend the following screwdriver.

Model	Manufacturer
SZF 0-0,4×2,5	Phoenix Contact

● Connecting Ferrules

Insert a ferrule straight into the terminal hole.

You do not need to insert a flat-blade screwdriver into the release hole.



After you make a connection, make sure that the ferrule is securely connected to the terminal block.

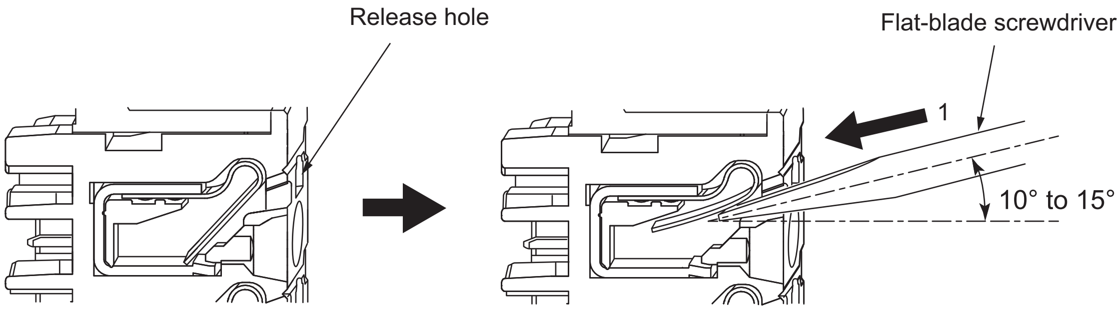
Connecting Twisted and Solid Wires

Use the following procedure to connect twisted and solid wires to the terminal block.

1 Press the flat-blade screwdriver diagonally into the release hole.

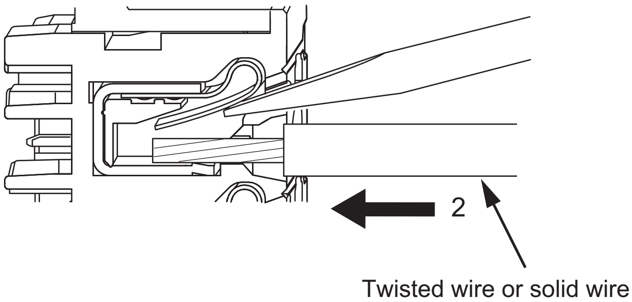
The optimal angle for insertion is between 10° to 15°.

If the screwdriver is inserted correctly, you should feel resistance from the spring inside the release hole.

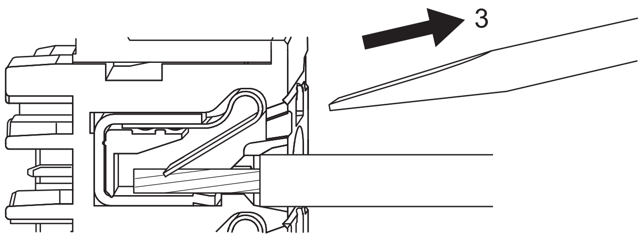


2 Leave the flat-blade screwdriver pressed into the release hole and insert the twisted wire or the solid wire into the terminal hole.

Insert the stripped portion of the wire all the way into the terminal hole to prevent shorting.



3 Remove the flat-blade screwdriver from the release hole.



After you make a connection, make sure that the twisted wire or the solid wire is securely connected to the terminal block.

Removing Wires

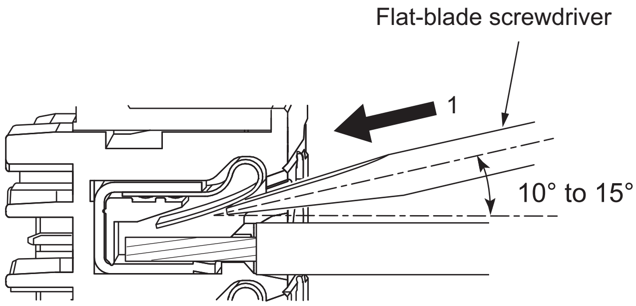
Use the following procedure to remove wires from the terminal block.

The removal process is the same for both ferrules and twisted/solid wires.

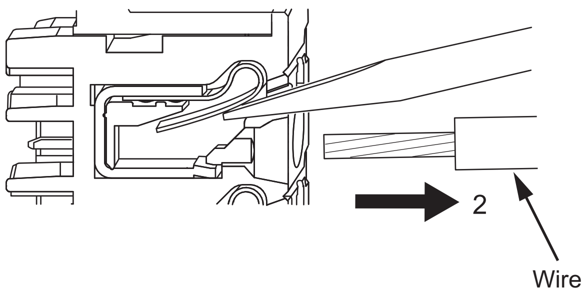
1 Press the flat-blade screwdriver diagonally into the release hole.

The optimal angle for insertion is between 10° to 15°.

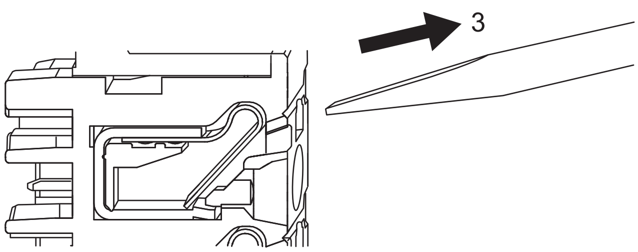
If the screwdriver is inserted correctly, you should feel resistance from the spring inside the release hole.



2 Insert a flat-blade screwdriver into the release hole and remove the wire from the terminal hole.

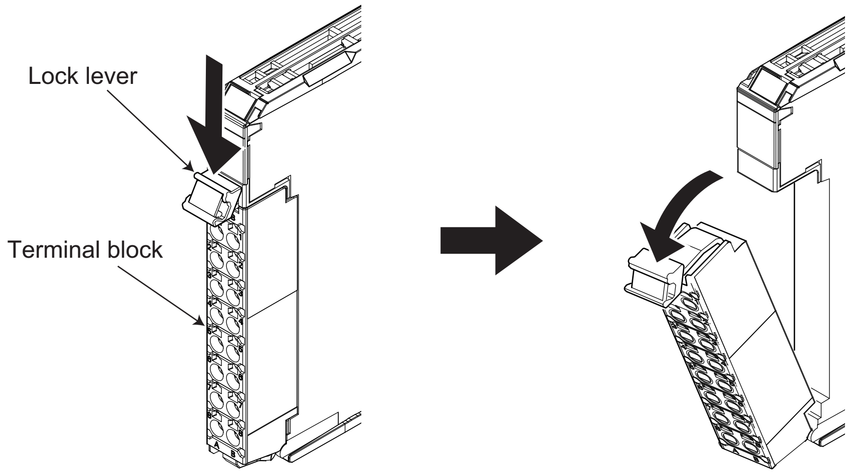


3 Remove the flat-blade screwdriver from the release hole.



Removing a Terminal Block

1 Press the lock lever on the terminal block and pull out the top of the terminal block to remove it.

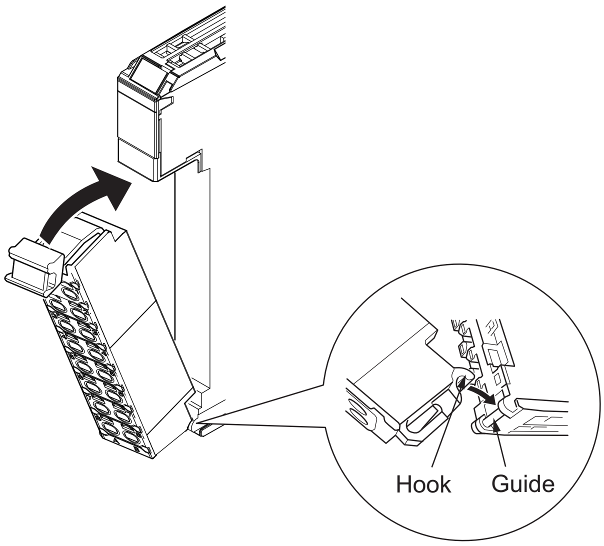


Attaching a Terminal Block

1 Mount the terminal block hook on the guide at the bottom of the NX Unit, lift up the terminal block, and press in on the top of the terminal block until you hear it engage.

The terminal block will click into place on the Unit.

After you mount the terminal block, make sure that it is locked to the Unit.



Precautions for Correct Use

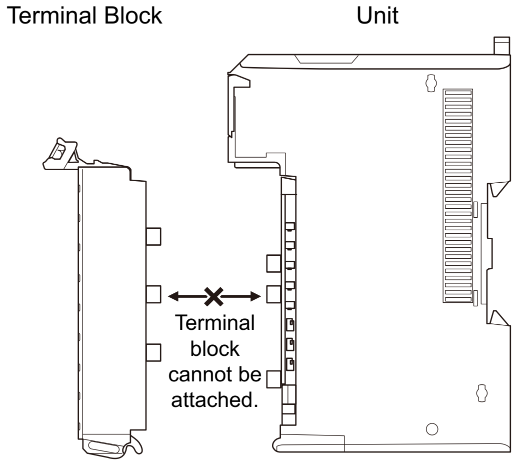
Mount a Terminal Block that is applicable to each Unit model. Refer to *3-3 Terminal Blocks* on page 3-5 for the applicable Terminal Blocks.

4-3-2 Preventing Incorrect Attachment of Terminal Blocks

You can limit the possible Position Interface Unit and terminal block combinations to prevent unintentionally connecting the wrong terminal block.

Insert three Coding Pins (NX-AUX02) into three of the six incorrect attachment prevention holes on the terminal block and the Position Interface Unit. Insert the pins so that they do not conflict with each other when the Position Interface Unit and terminal block are connected to each other.

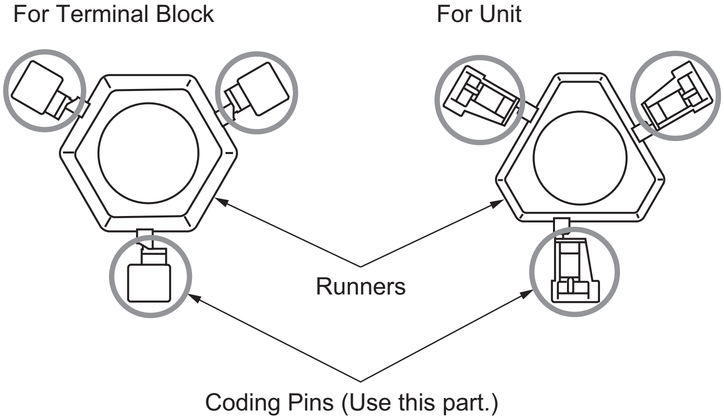
You can use these pins to create combinations in which the wrong terminal block cannot be attached because the pin patterns do not match.



● Types of Coding Pins

There are two types of Coding Pins, both with their own unique shape: one for terminal blocks and one for Units.

Three pins come with each runner.



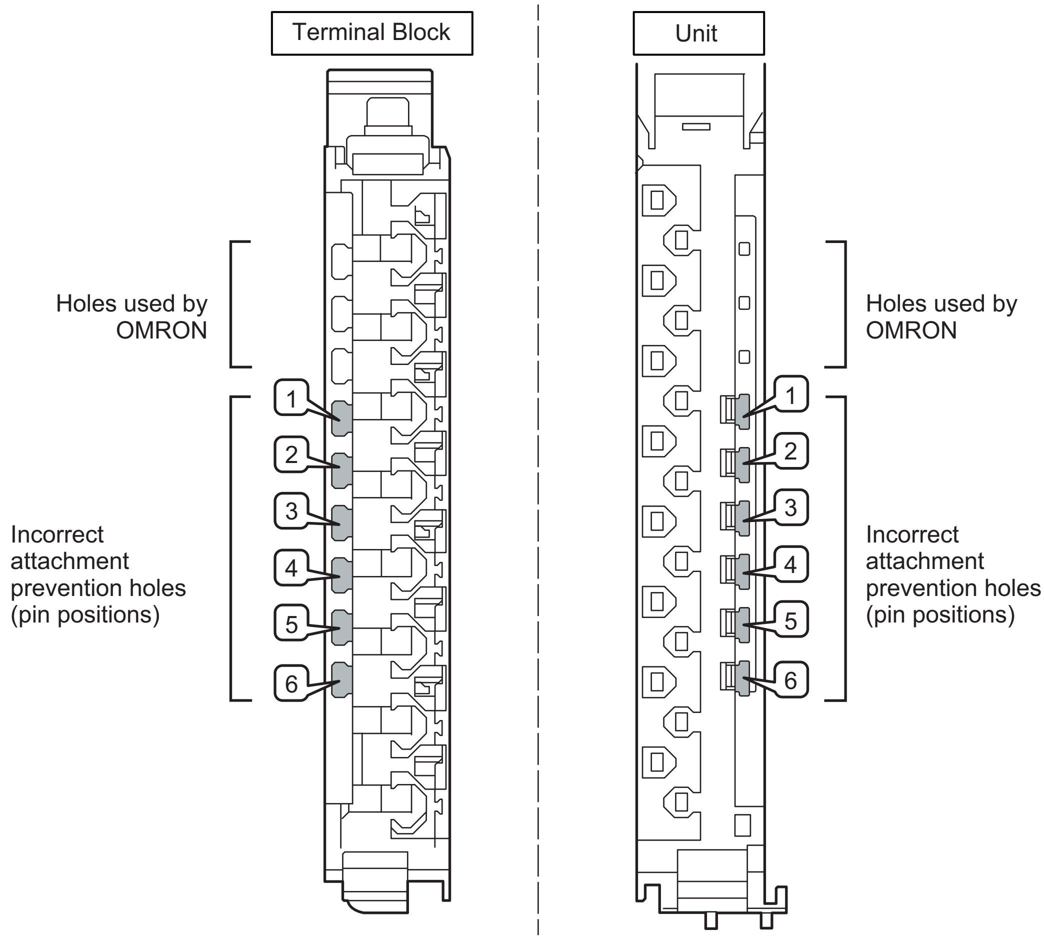
Use the following Coding Pins.

Name	Model	Specifications
Coding Pins	NX-AUX02	For 10 Units (Terminal Block: 30 pins, Unit: 30 pins)

● Insertion Locations and Patterns of Coding Pins

Insert three Coding Pins each on the terminal block and on the Unit at the positions designated by the numbers 1 through 6 in the figure below.

As shown in the following table, there are 20 unique pin patterns that you can use.



O: Insert pin

Pattern	Terminal block pin positions						Unit pin positions					
	1	2	3	4	5	6	1	2	3	4	5	6
No.1	O	O	O							O	O	O
No.2	O	O		O					O		O	O
No.3	O	O			O				O	O		O
No.4	O	O				O			O	O	O	
No.5	O		O	O				O			O	O
No.6	O		O		O			O		O		O
No.7	O		O			O		O		O	O	
No.8	O			O	O			O	O			O
No.9	O			O		O		O	O		O	
No.10	O				O	O		O	O	O		
No.11		O	O	O			O				O	O
No.12		O	O		O		O			O		O
No.13		O	O			O	O			O	O	
No.14		O		O	O		O		O			O
No.15		O		O		O	O		O		O	
No.16		O			O	O	O		O	O		
No.17			O	O	O		O	O				O
No.18			O	O		O	O	O			O	
No.19			O		O	O	O	O		O		
No.20				O	O	O	O	O	O			

Precautions for Correct Use

- The holes not designated by the numbers 1 through 6 in the above figure are used by OMRON. If you insert any Coding Pins into the holes reserved for use by OMRON, you will not be able to mount the terminal block to the Unit.
- Do not use Coding Pins that have been attached and then removed.

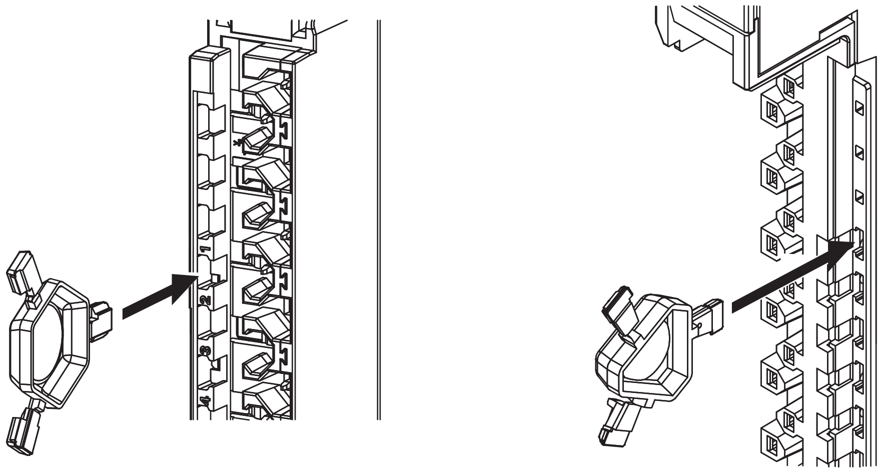
Additional Information

Two sets of NX-AUX02 Pins are required to make the maximum of 20 pin patterns.

● Inserting the Coding Pins

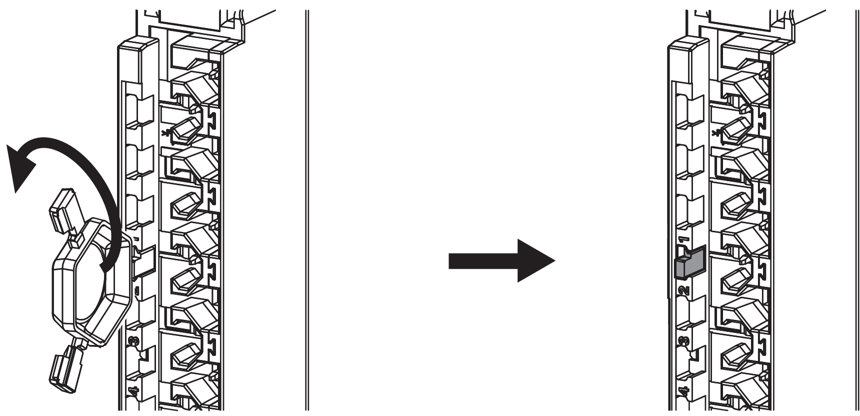
1 Hold the pins by the runner and insert a pin into one of the incorrect attachment prevention holes on the terminal block or on the Unit.

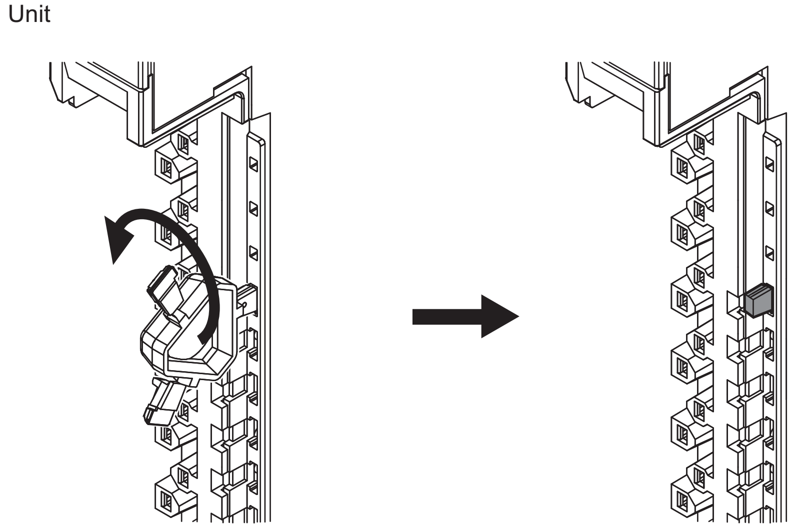
Terminal Block Unit



2 Rotate the runner to break off the Coding Pin.

Terminal Block




Unit

4-4 Wiring Precautions

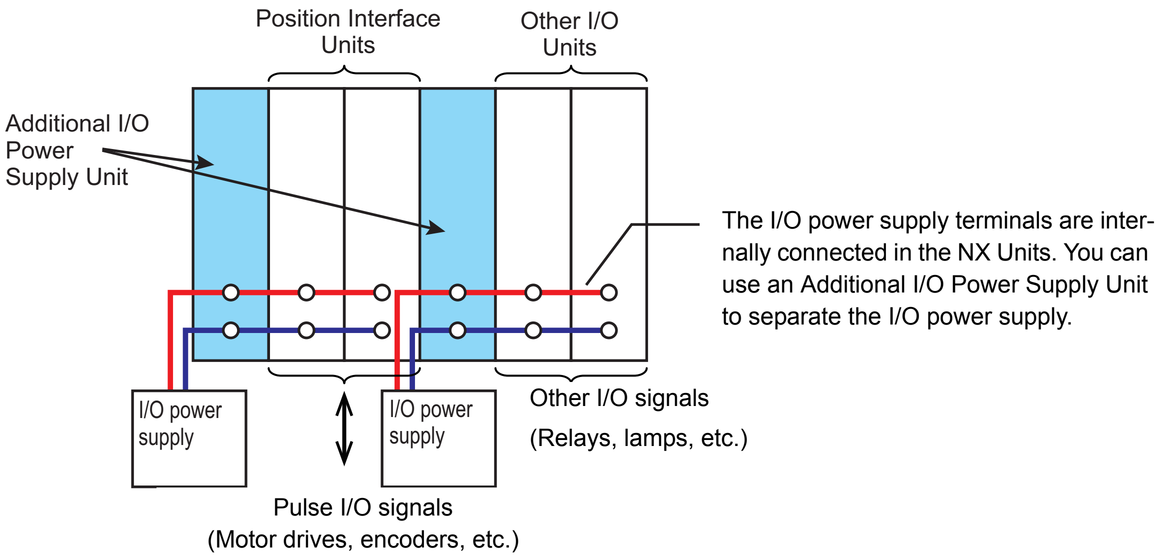
Electronic control equipment may malfunction due to noise from surrounding power supply lines and external loads.

Malfunctions due to noise are difficult to reproduce, and it can take some time to determine what the cause of the problem is. Observe the following precautions to prevent noise-related malfunctions and to increase the reliability of your system.

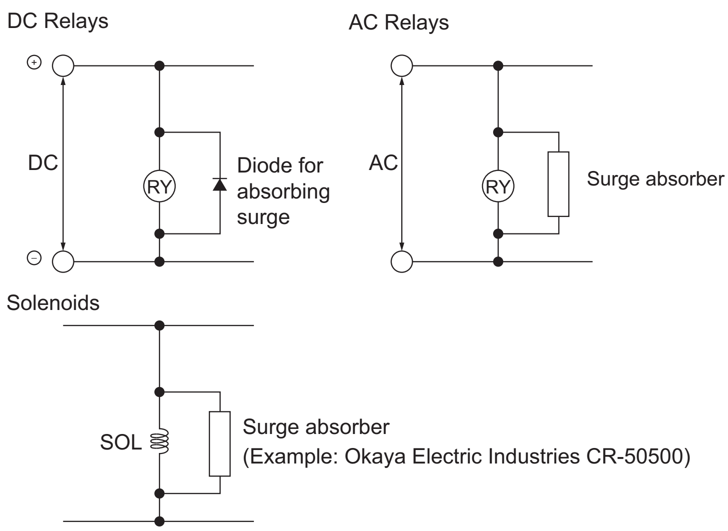
- Use the correct diameters of wires and cables according to the documentation for your motor drives, encoders, and other equipment.

  Wire power lines (AC power supply lines and motor power lines) separately from control lines (pulse I/O lines and external I/O signal lines). Never place these wires in the same duct or bundle them together.
- Do not share the power supply for the external I/O of a Position Interface Unit with I/O power supply for another Unit.

  The I/O power supply terminals on an NX Unit are connected to the I/O power supply terminals on the other NX Units in the Slave Terminal through the NX bus connectors. If a Slave Terminal contains one or more Position Interface Units together with one or more other Units, use an Additional I/O Power Supply Unit to separate the I/O power supply.



- Use sheathed shielded cables for control lines.
- Always install a surge absorber on an inductive load (relay or solenoid).



Additional Information

- Place the diode for absorbing surge or surge absorber next to the relay. Use a diode for absorbing surge that can withstand at least 5 times the circuit voltage.
- Noise on the power supply line may affect operation if you also use the same power supply to power an electrical welder or electric discharge machine, or if there is any source of high-frequency noise nearby. In this case, insert a noise filter into the power supply input section.
- Ground to 100 Ω or less and use as thick a wire as possible, larger than 1.25 mm^2.
- We recommend twisted-pair cables for power lines.

4-5 Checking Wiring

Use the functionality of the Sysmac Studio to check the wiring. The procedure depends on whether the MC Function Module is used.

Procedures When Using the MC Function Module

When the MC Function Module is used to control motion, use the MC Test Run and axis status monitor (MC monitor table) functions of the Sysmac Studio.
You can use these functions to monitor sensor signals and to check the wiring to external devices, such as motor drives and encoders, without any programming.

For details on the MC Test Run and axis status monitor (MC monitor table) functions, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) and to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

Precautions for Correct Use

If you assign an Incremental Encoder Input Unit to an encoder axis, you cannot monitor the external inputs with the Axis Status Monitor (MC Monitor Table).
To check the external inputs of the Incremental Encoder Input Unit, use the procedures in *Procedures When Not Using the MC Function Module* on page 4-33, below, before you assign the Unit to an encoder axis.

Procedures When Not Using the MC Function Module

If you do not use the MC Function Module, use the I/O Map and Watch Tab Page to check the wiring.

- For inputs, you can turn ON and OFF the input from the external device that is connected to the Unit you need to check and monitor the results. If the input device is an encoder, you can rotate the encoder to change the input value and monitor the results.
- For outputs, you can use forced refreshing to control the output to the Unit you need to check to confirm the operation of the connected external device.

If you use the I/O Map, you can conveniently monitor status or perform forced refreshing without defining variables or creating an algorithm to check the wiring.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the procedures to monitor status or perform forced refreshing.

Also, you can use the I/O checking function to check wiring by connecting the Sysmac Studio to the peripheral USB port on the EtherCAT Coupler Unit. This allows you to check wiring in the following cases.

- If you need to check the wiring when the CPU Unit is temporarily unavailable, such as when commissioning the system
- If you need to check the wiring when EtherCAT network wiring is not completed, such as when commissioning the system
- If you need to check wiring when the CPU Unit and EtherCAT Slave Terminal are not connected
- If it is necessary for more than one person to check the wiring when more than one EtherCAT Slave Terminal is used

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-03 or later) for information on I/O checking.

Precautions for Correct Use

A Pulse Output Unit outputs pulses in one control period equivalent to the deviation between the implemented command position and the command current position. For the Velocity-continuous Pulse Output Method, pulses are output according to the implemented command velocity. Therefore, observe the following precautions if you check the pulse output without using the MC Function Module.

- When you change the Pulse Output Unit to Operation Enabled status, pulses may be suddenly output if there is a difference between the command position and the command current position. That may cause the equipment or machine to operate unexpectedly. Make sure that there is no difference between the command position and the command current position before you change the status.
- When you output pulses, change the command position in small increments to avoid rapid movement.

If you use the MC Function Module, the MC Function Module controls these aspects. Therefore, when you check wiring with a Pulse Output Unit, we recommend that you use the MC Function Module.

Additional Information

If you check the wiring for a Pulse Output Unit without using the MC Function Module, perform the following operations.

Refer to *8-8 I/O Data Specifications* on page 8-31 for details on I/O data.

External Inputs

Monitor the corresponding bit for the external input status that is assigned as I/O data.

External Outputs

Manipulate the corresponding bit for the external output that is assigned as I/O data and check to see if the output turns ON and OFF.

Pulse Outputs

The operation to output pulses depends on the Output Mode Selection parameter.
As given below, change the status of the Pulse Output Unit with the Controlword and then manipulate the command values and check the pulse output.

- Manipulate the Controlword that is assigned as I/O data, implement the Shutdown, and then implement the SwitchON + Enable Operation commands. Then, place the Pulse Output Unit in Operation Enabled status.

  You can check the status of the Pulse Output Unit with the Statusword that is assigned as I/O data.
- Perform the following operation according to the Output Mode Selection to check the pulse output.

  Position-synchronous Pulse Output

  Change the command position that is assigned as I/O data and check the pulse output.

  Velocity-continuous Pulse Output

  Change the command position and command velocity that are assigned as I/O data and check the pulse output.

4-6 Wiring Examples

Refer to the following sections for terminal wiring examples for the Position Interface Units: *6-5 Terminal Block Arrangement* on page 6-11, *7-5 Terminal Block Arrangement* on page 7-10, and *8-6 Terminal Block Arrangement* on page 8-14.

5

I/O Refreshing Methods

This section describes the I/O refreshing methods and functions for Position Interface Units.

5-1 I/O Refreshing for Slave Terminals

This section first describes I/O refreshing for NX-series Slave Terminals.

It then describes operation when the built-in EtherCAT port on the NJ/NX-series CPU Unit is used for communications with an EtherCAT Slave Terminal.

I/O Refreshing from the CPU Unit to the Slave Terminals

The CPU Unit performs I/O refreshing cyclically with the Slave Terminals through the Communications Master Unit and the Communications Coupler Unit.

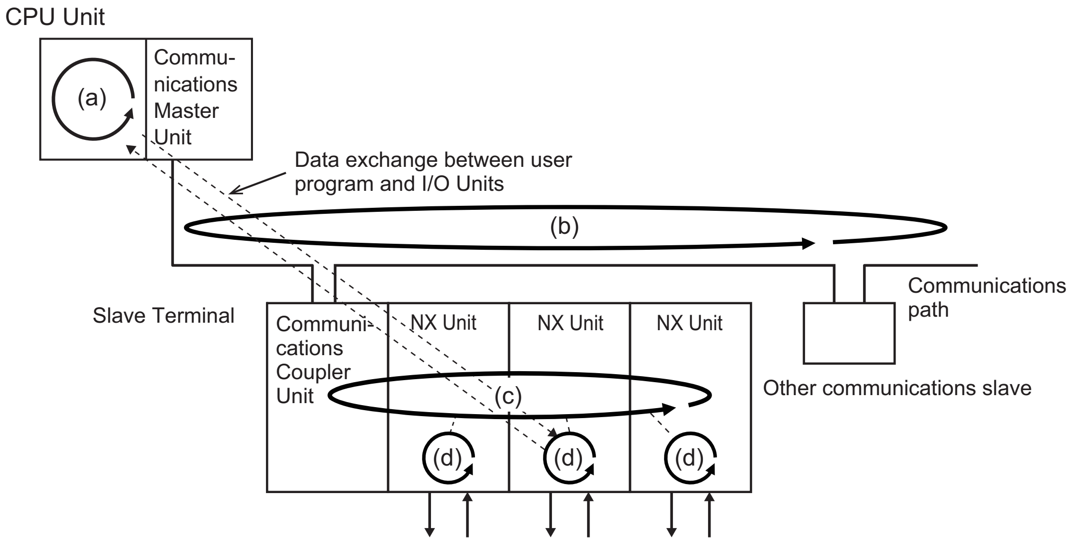
The following four cycles affect operation of the I/O refreshing between the CPU Unit and the NX Units in an Slave Terminal:

(a) CPU Unit cycle time

(b) Host network communications cycle

(c) Refresh cycle of the NX bus

(d) Refresh cycle of each NX Unit



The cycle time of the CPU Unit, the communications cycle of the host network, and the NX bus I/O refresh cycle are determined by the model of the CPU Unit and the type of communications.

NX-series CPU Units and I/O Refresh Operation

The operation of I/O refreshing is as follows when the built-in EtherCAT port on the NX-series CPU Unit is used for communications with an EtherCAT Slave Terminal.

- The (b) process data communications cycle and (c) refresh cycle of the NX bus in the above figure are automatically synchronized with the (a) task period of the primary periodic task or priority-5 periodic task in the CPU Unit if the distributed clock is enabled in the EtherCAT Coupler Unit.
- The (d) refresh cycles of the NX Units depend on the I/O refreshing methods, which are described later.

NJ-series CPU Units and I/O Refresh Operation

The operation of I/O refreshing is as follows when the built-in EtherCAT port on the NJ-series CPU Unit is used for communications with an EtherCAT Slave Terminal.

- The (b) process data communications cycle and (c) refresh cycle of the NX bus in the above figure are automatically synchronized with the (a) task period of the primary periodic task in the CPU Unit if the distributed clock is enabled in the EtherCAT Coupler Unit.
- The (d) refresh cycles of the NX Units depend on the I/O refreshing methods, which are described later.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for detailed information on I/O refreshing between the built-in EtherCAT port on an NJ/NX-series CPU Unit and EtherCAT Slave Terminals.

Additional Information

- You can use the priority-5 periodic task only on NX-series CPU Units.
- With an NX-series CPU Unit, you can perform process data communications in two tasks: the primary periodic task and the priority-5 periodic task.
- With an NJ-series CPU Unit, you can perform process data communications only in the primary periodic task.

5-2 I/O Refreshing Methods

This section describes I/O refreshing for Position Interface Units.

5-2-1 I/O Refreshing Methods

The I/O refreshing methods that you can use between the Communications Coupler Unit and the NX Units depend on the Communications Coupler Unit that you use.

EtherCAT Coupler Unit

The I/O refreshing methods that you can use between an EtherCAT Coupler Unit and the Position Interface Units when the EtherCAT Coupler Unit is connected to the built-in EtherCAT port on an NJ/NX-series CPU Unit are listed below.

I/O refreshing method	Outline of operation
Free-Run refreshing	With this I/O refreshing method, the refresh cycle of the NX bus and the I/O refresh cycles of the NX Units are asynchronous.
Synchronous I/O refreshing[*1]	With this I/O refreshing method, the timing to read inputs or to refresh outputs is synchronized on a fixed interval between more than one NX Unit on more than one Slave Terminal.
Task period prioritized refreshing[*1*2]	With this I/O refreshing method, shortening the task period is given priority over synchronizing the I/O timing with other NX Units. With this I/O refreshing method, the timing of I/O is not consistent with the timing of I/O for NX Units that use simultaneous I/O refreshing.

*1. This method is used when you use the MC Function Module in an NJ/NX-series Controller.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

With an EtherCAT Coupler Unit, you can use all of the I/O refreshing methods at the same time. Therefore, you can mix NX Units with different I/O refreshing methods on the same EtherCAT Slave Terminal.

Additional Information

The EtherCAT Slave Terminals with enabled distributed clocks and all EtherCAT slaves that support DC synchronization execute I/O processing based on Sync0, which is shared on the EtherCAT network. However, because the specifications and performance for the timing to read inputs or to refresh outputs for EtherCAT slaves and NX Units are different, the timing to read inputs or to refresh outputs is not simultaneous.

Refer to the manuals for the EtherCAT slaves for information on the timing to read inputs or to refresh outputs in EtherCAT slaves.

EtherNet/IP Coupler Unit

Free-Run refreshing is always used as the I/O refreshing method between the EtherNet/IP Coupler Unit and the NX Units.

5-2-2 Setting the I/O Refreshing Methods

This section describes the settings of the I/O refreshing method for each Communications Coupler Unit.

EtherCAT Coupler Unit

The I/O refreshing method between the EtherCAT Coupler Unit and the Position Interface Units depends on the *Enable Distributed Clock* setting in the EtherCAT Coupler Unit.

Enable Distributed Clock **setting in the EtherCAT Coupler Unit**	**Position Interface Units**
Enabled (DC for synchronization)	Operates with synchronous I/O refreshing
Enabled (DC with priority in cycle time)	Operates with task period prioritized refreshing.*1
Disabled (FreeRun)	Operates with Free-Run refreshing

*1. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required to use task period prioritized refreshing. If you use unit version 1.1 or earlier and an NX-ECC203 EtherCAT Coupler Unit, operation is performed with synchronous I/O refreshing.

EtherNet/IP Coupler Unit

Free-Run refreshing is always used as the I/O refreshing method between the EtherNet/IP Coupler Unit and the Position Interface Units. There is no setting for the I/O refreshing method.

5-2-3 I/O Refreshing Method Operation

This section describes the operation of the following I/O refreshing methods: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.

Operation of Free-Run Refreshing

With Free-Run refreshing, the refresh cycle of the NX bus and the I/O cycle of the NX Units operate asynchronously.

Additional Information

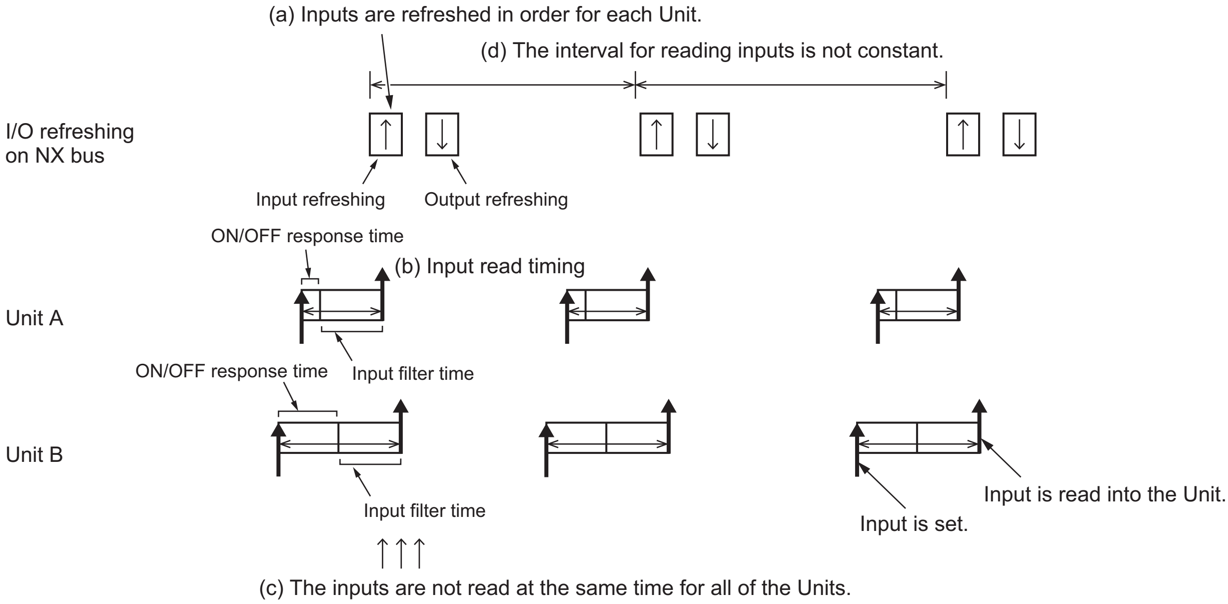
The Position Interface Unit cannot be assigned as an axis when Free-Run refreshing is used (distributed clock disabled).

Free-Run refreshing operates as follows:

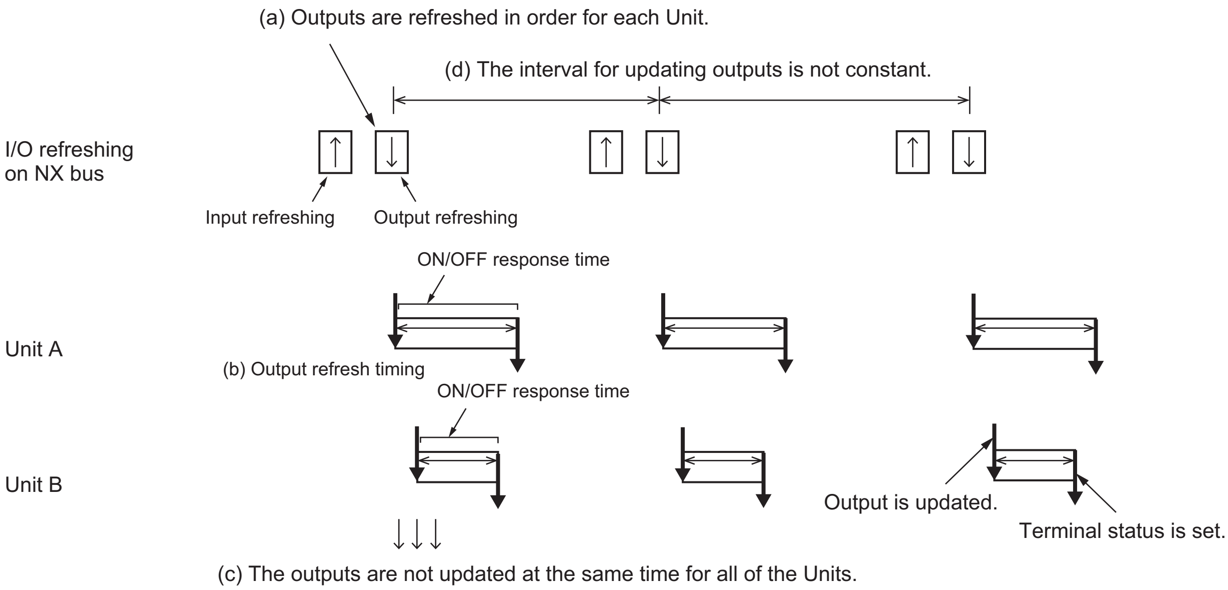
- The Communications Coupler Unit refreshes the I/O of the NX Units in order. (Refer to figure (a) in the diagram below.)
- When the I/O is refreshed, the NX Unit reads the inputs and updates the outputs. (See following figure (b).)
- When the I/O is refreshed, the Communications Coupler Unit reads the most recent input values and the NX Units control the outputs with the most recent output values. However, I/O is refreshed in order, so even within the same Slave Terminal, the timing of reading inputs and updating output is not the same for all of the NX Units. (See following figure (c).)
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit and host communications master. Therefore, the interval for reading inputs and updating outputs for NX Unit is not constant. (See following figure (d).)
- To read the correct input values, the input must be set before the input read timing of the NX Units for the total time of the ON/OFF response time and input filter time.

- The ON/OFF response time is required from when outputs are updated until the output status is set on the external terminals of the NX Units.

● Input Units



● Output Units



Operation of Synchronous I/O Refreshing

The NX Units that use synchronous I/O refreshing in an EtherCAT Slave Terminal receive inputs at a set fixed interval based on the synchronization timing. Outputs are also refreshed simultaneously, but at a separately set timing from inputs.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for information on the Slave Terminals that operate with the same timing when more than one Slave Terminal is placed on the same EtherCAT network.

The refresh cycle of the NX bus is automatically calculated by the Sysmac Studio based on the I/O refresh cycles of the NX Units when the Slave Terminal configuration is set.

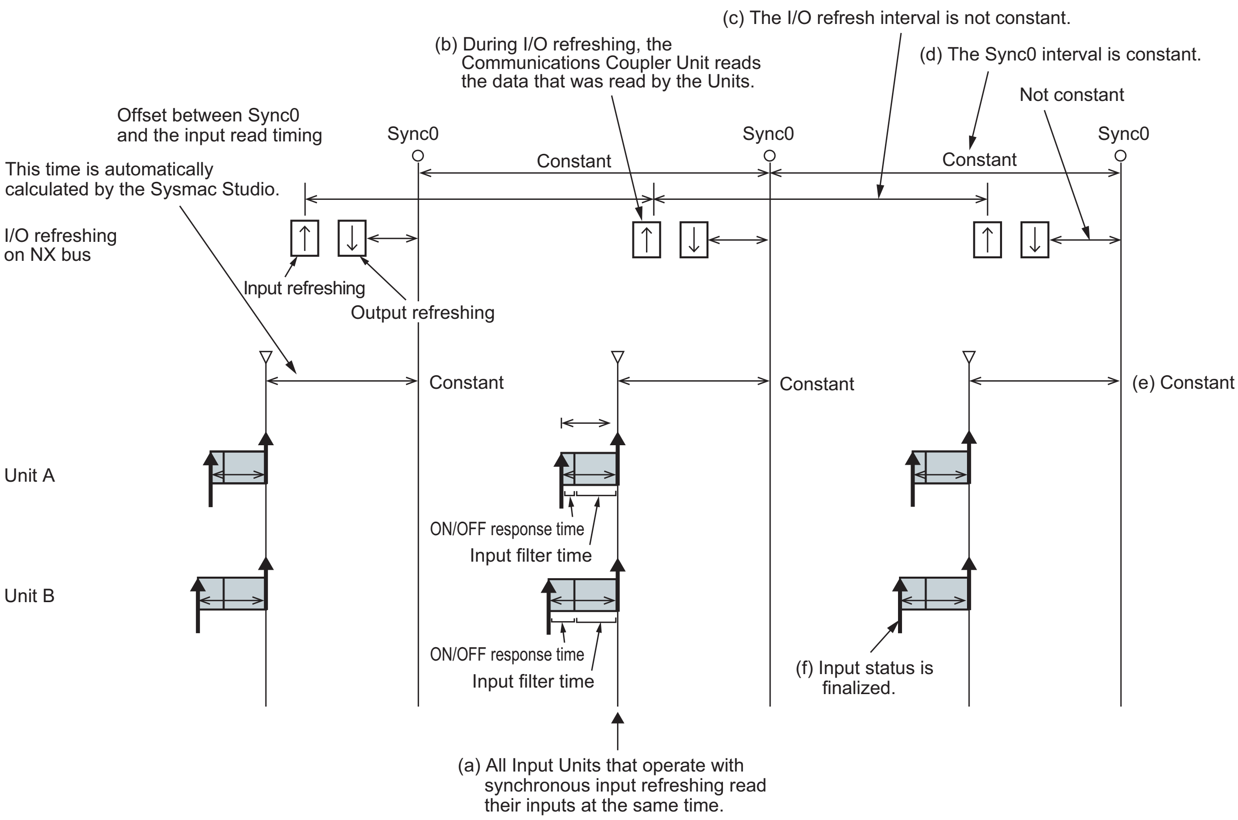
If an EtherCAT Slave Terminal is connected to the built-in EtherCAT port on an NX-series CPU Unit, the NX bus refresh cycle is automatically calculated by the Sysmac Studio for each periodic task. They are calculated for the primary periodic task and priority-5 periodic task.
For the built-in EtherCAT port on an NJ-series CPU Units, they are calculated for the primary periodic task.

Precautions for Correct Use

- The NX bus refresh cycle is automatically set to agree with the task period of the primary period task or priority-5 periodic task, but the task period is not set automatically. Set the task period to a value that is greater than the refresh cycle of the NX bus that is calculated by the Sysmac Studio.
  Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for information on setting the task periods of periodic tasks.
- The EtherCAT Slave Terminals with enabled distributed clocks and all EtherCAT slaves that support DC synchronization execute I/O processing based on Sync0, which is shared on the EtherCAT network. However, because the specifications and performance for the timing to read inputs or to refresh outputs for EtherCAT slaves and NX Units are different, the timing to read inputs or to refresh outputs is not simultaneous between the EtherCAT slaves and the NX Units.
  Refer to the manuals for the EtherCAT slaves for information on the timing to read inputs or to refresh outputs in EtherCAT slaves.

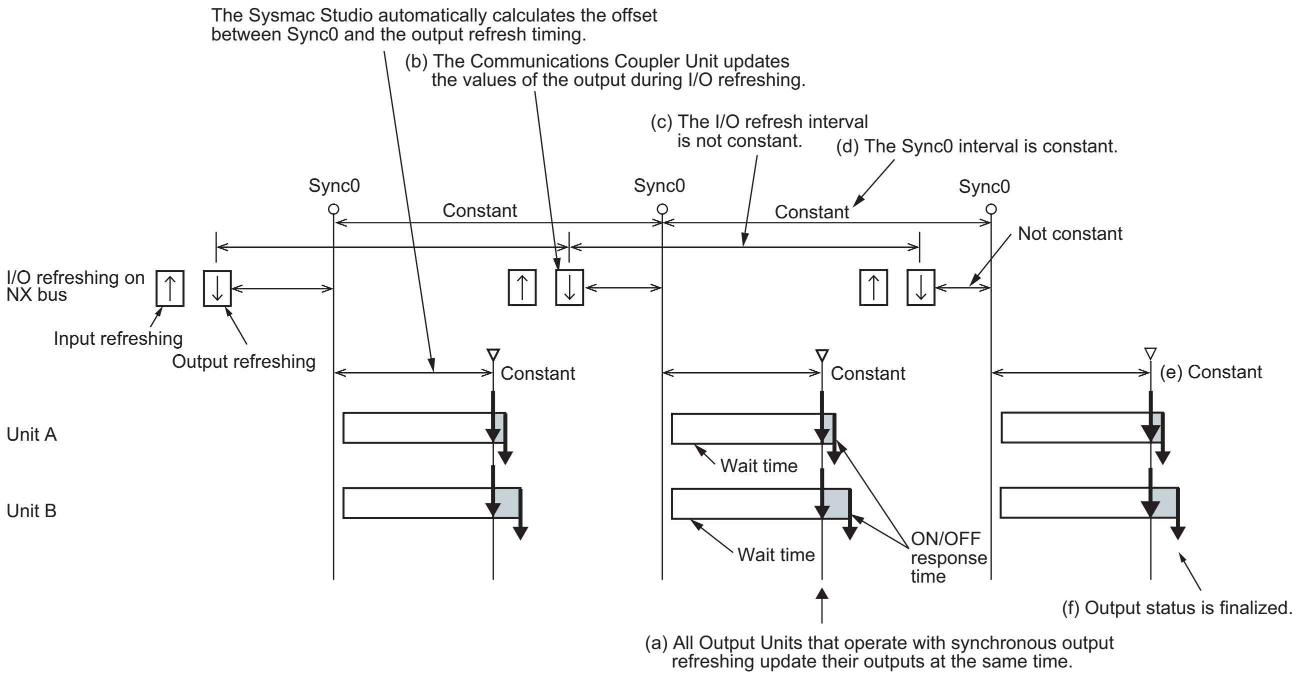
● Synchronous Input Refreshing

- The NX Units that operate with synchronous input refreshing in a Slave Terminal read inputs at a fixed interval based on Sync0. (Refer to figure (a) in the diagram below.)
  Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for information on the Slave Terminals that operate with the same timing when more than one Slave Terminal is placed on the same EtherCAT network.
- The Communications Coupler Unit reads the values that are read by the Units on the input read timing during the next I/O refresh. (See following figure (b).)
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit and host communications master (see following figure (c)), so the input read timing interval is constant. (See following figure (d), (e).)
- To read the correct input values, the input must be set before the input read timing of the NX Units for the total time of the ON/OFF response time and input filter time. (See following figure (f).)



● Synchronous Output Refreshing

- The NX Units that operate with synchronous output refreshing in a Slave Terminal update outputs at a fixed interval based on Sync0. (Refer to figure (a) in the diagram below.)
  Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for information on the Slave Terminals that operate with the same timing when more than one Slave Terminal is placed on the same EtherCAT network.
- The Communications Coupler Unit updates the values of the output during I/O refreshing. (See following figure (b).)
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit and host communications master (see following figure (c)), so the output refresh interval is constant. (See following figure (d), (e).)
- The ON/OFF response time is required from when outputs are updated until the output status is set on the external terminals of the NX Units. (See following figure (f).)



Additional Information

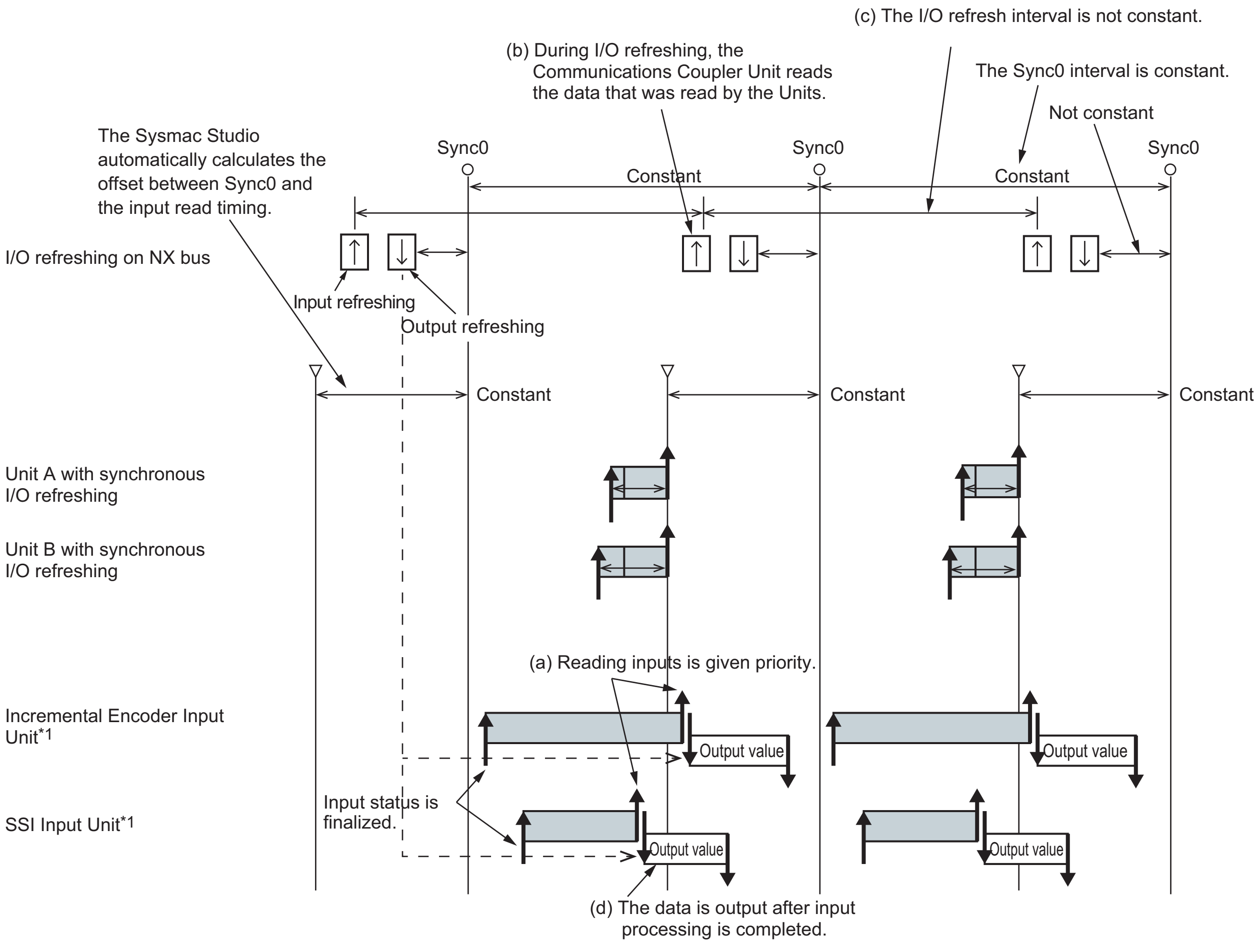
Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details on the operation of I/O refreshing with connections that do not use the built-in EtherCAT port on the NJ/NX-series CPU Unit.

Operation for Task Period Prioritized Refreshing

With task period prioritized refreshing, shortening the task period is given priority over synchronizing the I/O timing with other NX Units that use synchronous I/O refreshing.

● Input Prioritized Refreshing

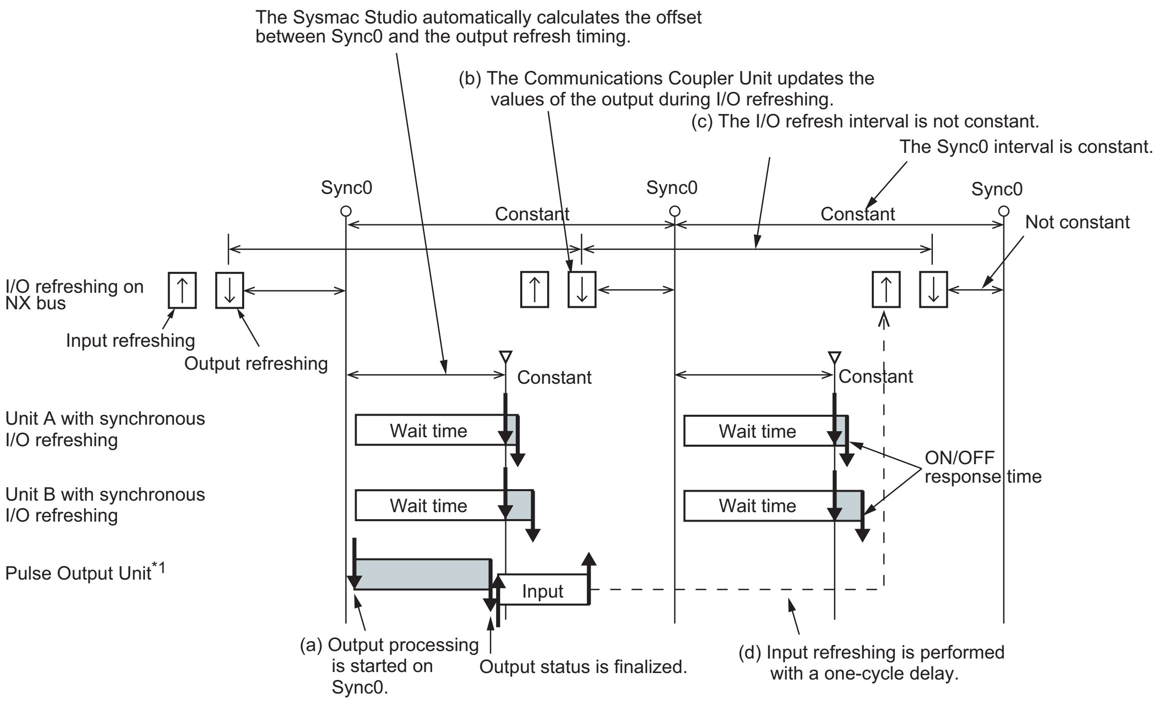
- The Communications Coupler Unit performs I/O processing so that the input values of NX Units are read during the next I/O refresh. (See following figure (a).)
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit and host communications master (see following figure (c)), so the inputs are read at the next I/O refresh. (See following figure (b).)
- Because input processing is given priority, output processing is performed after input processing is completed. (See following figure (d).)



*1. The timing of I/O is given as an example. The actual timing will vary.

Output Prioritized Refreshing

- Output processing is started on Sync0. (See following figure (a).)
- The Communications Coupler Unit updates the values of the output during I/O refreshing. (See following figure (b).)
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit and host communications master (see following figure (c)). Output processing is started on Sync0. (See following figure (a).)
- Because output processing is given priority, input processing is performed after output processing is completed. Therefore, input refreshing for the data that results from input processing is performed by the Communications Coupler Unit in the next cycle after the cycle in which output processing is performed. (See following figure (d).)



*1. The timing of I/O is given as an example. The actual timing will vary.

Additional Information

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later) for details on the operation of I/O refreshing with connections that do not use the built-in EtherCAT port on the NJ/NX-series CPU Unit.

6

Incremental Encoder Input Units

This section describes the functions of the Incremental Encoder Input Units.

6-1 Interpreting Model Numbers

The model number of an Incremental Encoder Input Unit tells you the Unit type, number of axes, I/O specifications, and other information.

NX-EC0 1 2 2

NX Series

Unit Type
- EC0: Incremental Encoder Input Unit

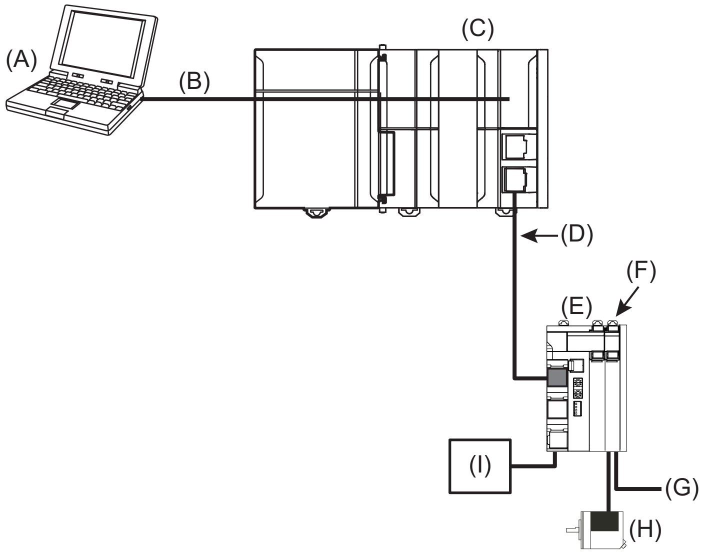
Number of Channels
- 1: 1 channel
- 2: 2 channels

Encoder Input Specification and Voltage Input Polarity
- 1: Voltage input, NPN
- 2: Voltage input, PNP
- 3: Line receiver, NPN
- 4: Line receiver, PNP

Additional Functions
- 2: Supports synchronous refreshing

6-2 System Configuration

The following figure shows the system configuration of an Incremental Encoder Input Unit.



Symbol	Description
(A)	Support Software (Sysmac Studio)
(B)	Connection to the peripheral USB port or built-in EtherNet I/P port on an NJ/NX-series CPU Unit
(C)	EtherCAT master (NJ/NX-series CPU Unit)
(D)	EtherCAT communications cable
(E)	EtherCAT Coupler Unit
(F)	Incremental Encoder Input Unit
(G)	External input*1 (latch input 1, latch input 2, gate input, or reset input)
(H)	Incremental encoder
(I)	I/O power supply

*1. You can specify functions for up to two external inputs to a One-input Incremental Encoder Input Unit. You cannot use external inputs for a Two-input Unit.

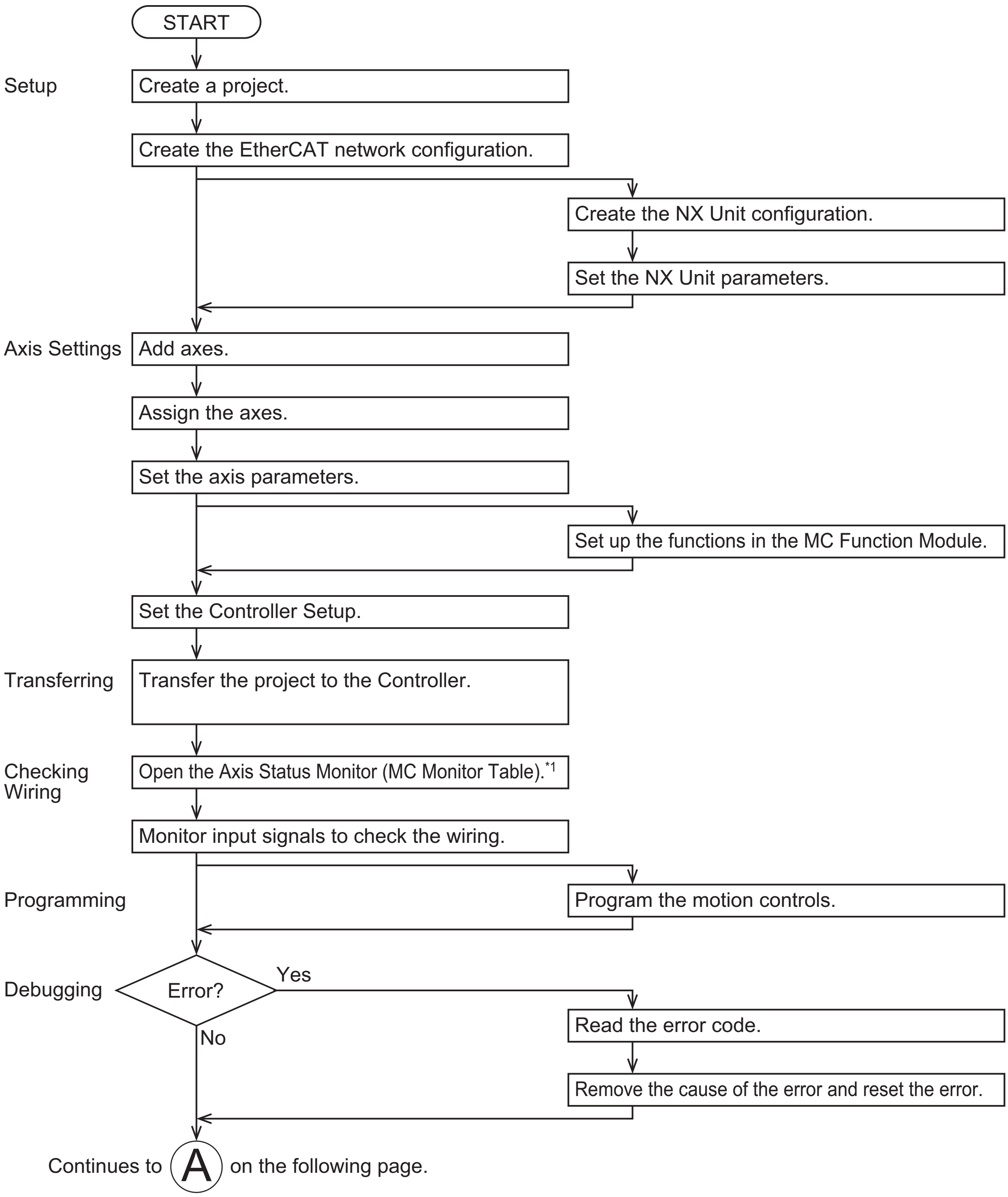
6-3 Basic Application Procedures

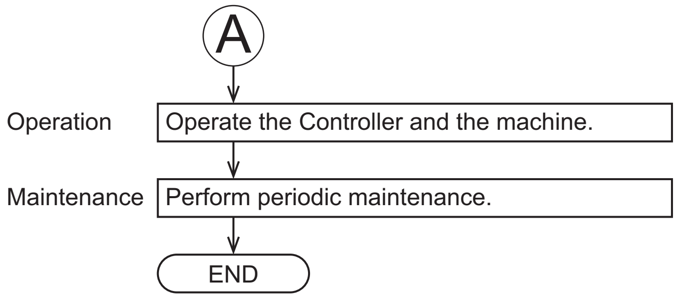
This section describes the basic procedures to use an Incremental Encoder Input Unit.

The procedure depends on whether the MC Function Module is used.

6-3-1 Procedures When Using the Motion Control Function Module

The process flow to use an Incremental Encoder Input Unit with the MC Function Module is shown below.

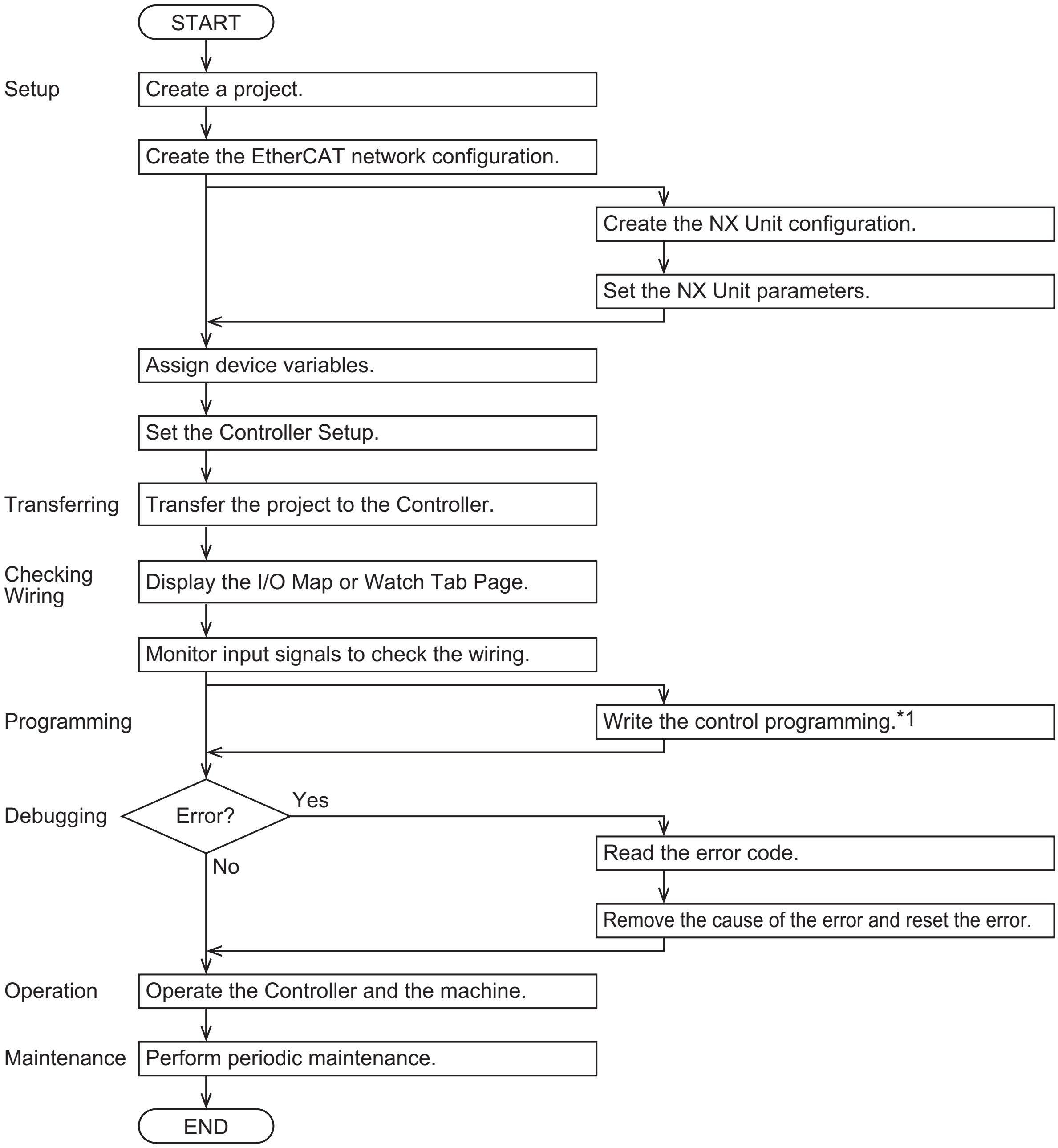




*1. Refer to *4-5 Checking Wiring* on page 4-33 for the checking procedures.

6-3-2 Procedures When Not Using the Motion Control Function Module

The process flow to use an Incremental Encoder Input Unit without the MC Function Module is shown below.



*1. If the MC Function Module is not used, all control tasks must be performed in the user program, including position management.

6-4 Part Names and Functions

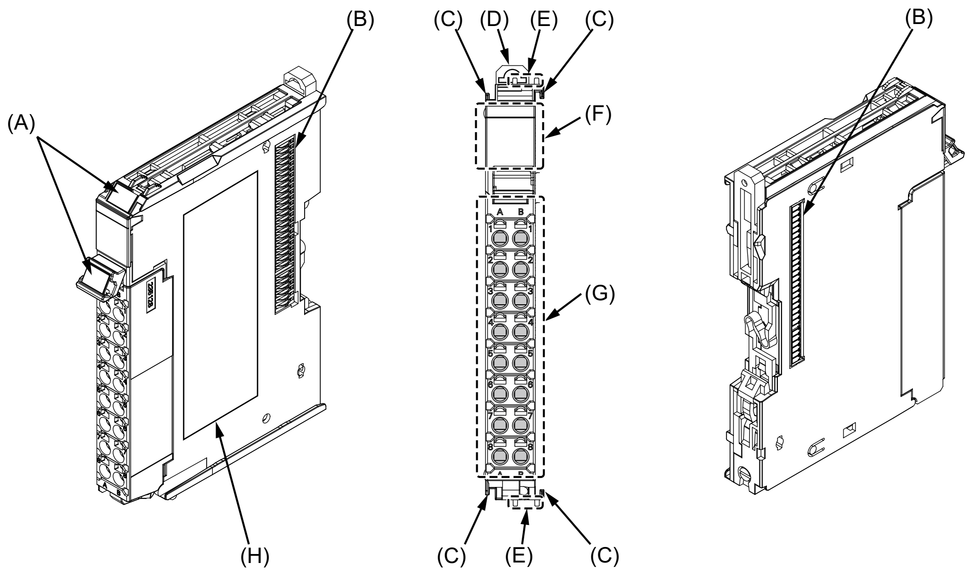
This section describes the names and functions of the parts of the Incremental Encoder Input Units.

6-4-1 Parts and Names

Units with voltage inputs and Units with line receiver inputs have different shapes.

Units with Voltage Inputs

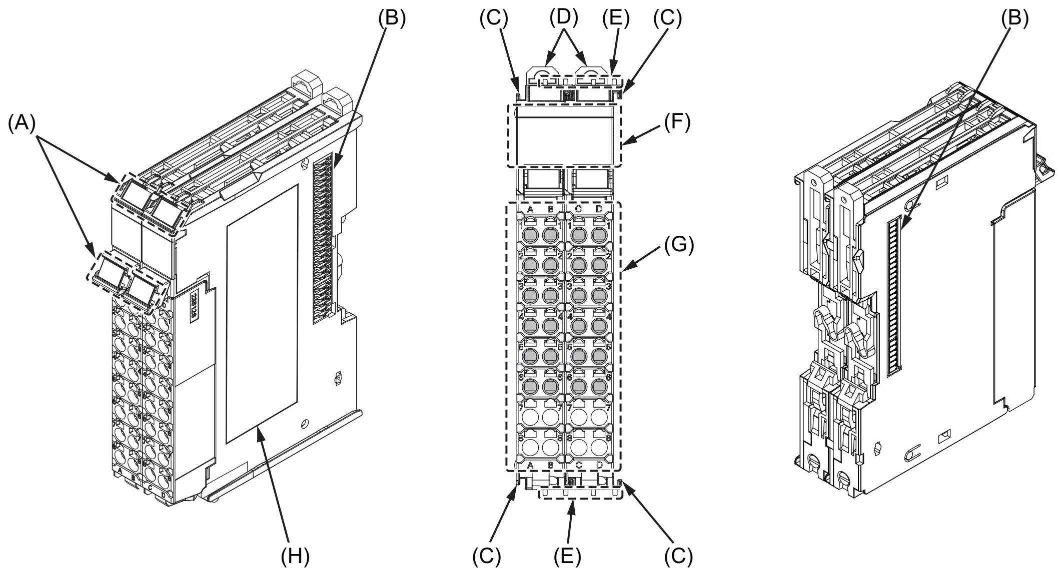
The names of the parts of the NX-EC0112, NX-EC0122, NX-EC0212,and NX-EC0222 are shown in the following figure.



Symbol	Name	Function
(A)	Marker attachment locations	This is where the markers are attached. OMRON markers are pre-installed at the factory. You can also install commercially available markers.
(B)	NX bus connector	This connector is used to connect to another Unit.
(C)	Unit hookup guides	These guides are used to connect two Units to each other.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	These protrusions are to hold onto when you need to pull out the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit.
(G)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
(H)	Unit specifications	The specifications of the Unit are given here.

Units with Line Receiver Inputs

The names of the parts of the NX-EC0132 and NX-EC0142 are shown in the following figure.



Symbol	Name	Function
(A)	Marker attachment locations	This is where the markers are attached. OMRON markers are pre-installed at the factory. You can also install commercially available markers.
(B)	NX bus connector	This connector is used to connect to another Unit.
(C)	Unit hookup guides	These guides are used to connect two Units to each other.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	These protrusions are to hold onto when you need to pull out the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit.
(G)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
(H)	Unit specifications	The specifications of the Unit are given here.

6-4-2 Functions of the Parts

The functions of the parts of the Incremental Encoder Input Unit are described below.

Unit Hookup Guides

Use the guides to connect the Units to each other.

Indicators

The indicators show the Unit status, counter operation status, external input status, and other information.

Terminal Block

The terminal block is used to connect the external I/O signals.

NX Bus Connector

The bus connectors connect the Units to each other.

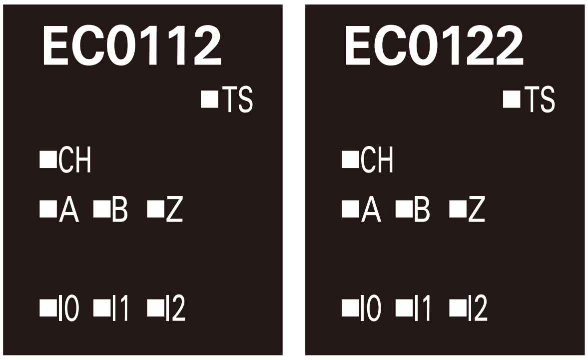
6-4-3 Indicators

This section describes the indicators on the Incremental Encoder Input Units.

Refer to *3-2 Indicators* on page 3-3 for information on the indicators that are provided on all Position Interface Units.

NX-EC0112 and NX-EC0122

The indicators for a One-input Unit with a voltage input are described in the following table.



Indicator	Name	Color	Status	Description
CH	Counter operation status indicator	Green	Lit	The counter is enabled.
			Not lit	The counter is disabled.
A, B, and Z	Counter input status indicator	Yellow	Lit	The phase-A, phase-B, or phase-Z input is active.
			Not lit	The phase-A, phase-B, or phase-Z input is not active.
I0, I1, and I2	External input status indicator	Yellow	Lit	The corresponding external input is ON.
			Not lit	The corresponding external input is OFF.

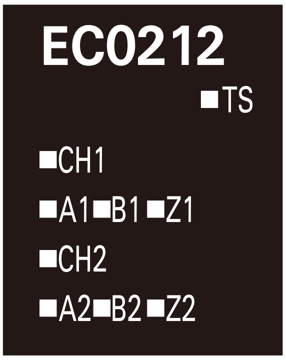
NX-EC0132 and NX-EC0142

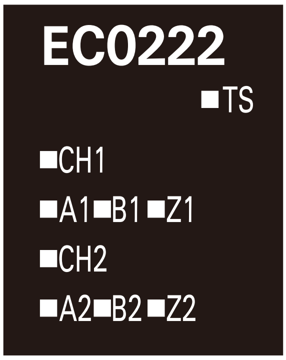
The indicator for a One-input Unit with a line receiver input is described in the following table.

Indicator	Name	Color	Status	Description
CH	Counter operation status indicator	Green	Lit	The counter is enabled.
			Not lit	The counter is disabled.
A, B, and Z	Counter input status indicator	Yellow	Lit	The phase-A, phase-B, or phase-Z input is active.
			Not lit	The phase-A, phase-B, or phase-Z input is not active.
I0, I1, and I2	External input status indicator	Yellow	Lit	The corresponding external input is ON.
			Not lit	The corresponding external input is OFF.

NX-EC0212 and NX-EC0222

The indicators for a Two-input Unit with a voltage input are described in the following table.





Indicator	Name	Color	Status	Description
CH1	Counter operation status indicator	Green	Lit	The CH1 counter is enabled.
			Not lit	The CH1 counter is disabled.
CH2	Counter operation status indicator	Green	Lit	The CH2 counter is enabled.
			Not lit	The CH2 counter is disabled.
A1, B1, and Z1	Counter input status indicator	Yellow	Lit	The phase-A, phase-B, or phase-Z input for CH1 is active.
			Not lit	The phase-A, phase-B, or phase-Z input for CH1 is not active.
A2, B2, and Z2	Counter input status indicator	Yellow	Lit	The phase-A, phase-B, or phase-Z input for CH2 is active.
			Not lit	The phase-A, phase-B, or phase-Z input for CH2 is not active.

6-5 Terminal Block Arrangement

Incremental Encoder Input Units use screwless clamping terminal blocks.

This section describes the terminal block arrangements of the Units.

6-5-1 NX-EC0112

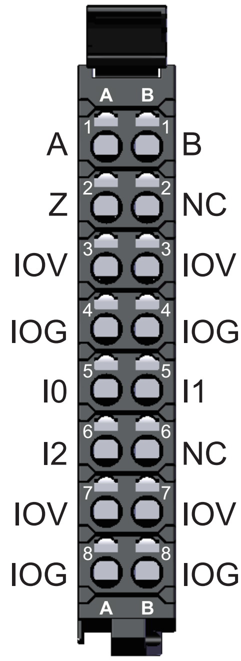
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0112. It also provides a wiring example.

Terminal Block Arrangement

A 16-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A	I	Counter input A
A2	Z	I	Counter input Z
A3	IOV	O	Encoder power supply output, 24 V
A4	IOG	O	Encoder power supply output, 0 V
A5	I0	I	External input 0
A6	I2	I	External input 2
A7	IOV	O	Encoder power supply output, 24 V
A8	IOG	O	Encoder power supply output, 0 V

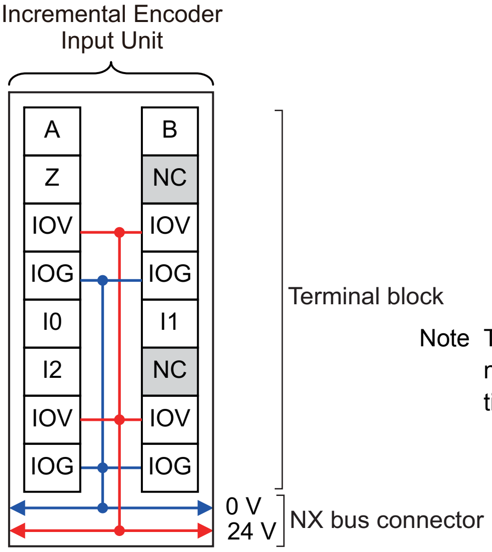
Terminal No.	Symbol	I/O	Name
B1	B	I	Counter input B
B2	NC	---	Not used.
B3	IOV	O	Encoder power supply output, 24 V
B4	IOG	O	Encoder power supply output, 0 V
B5	I1	I	External input 1
B6	NC	---	Not used.
B7	IOV	O	Encoder power supply output, 24 V
B8	IOG	O	Encoder power supply output, 0 V



Note The encoder power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

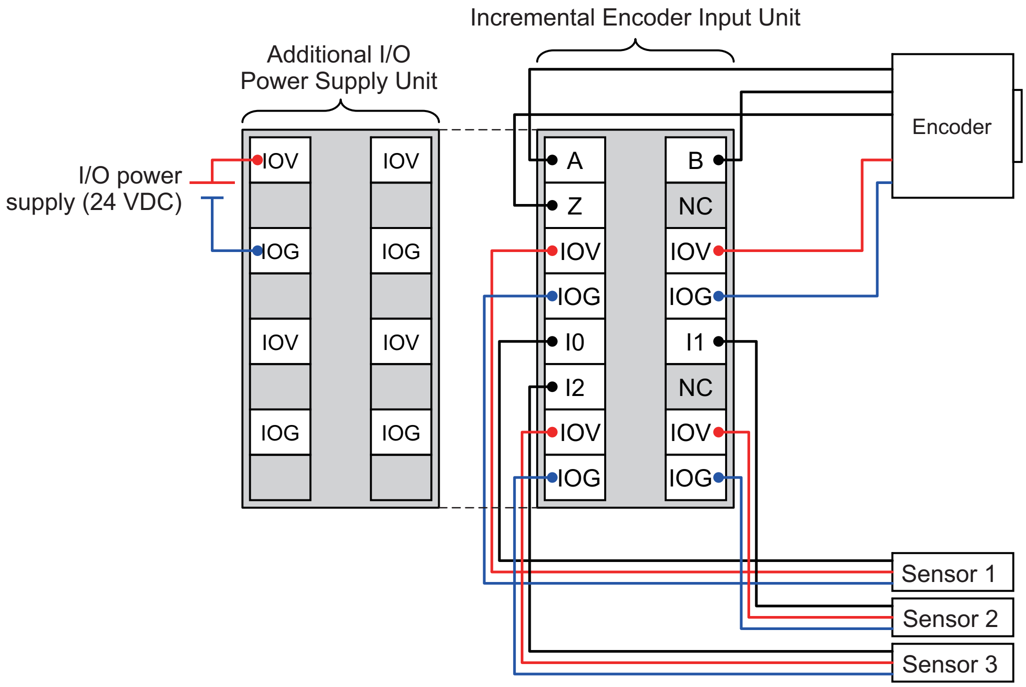
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note 1. The encoder and external inputs on Units with voltage inputs are NPN connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

6-5-2 NX-EC0122

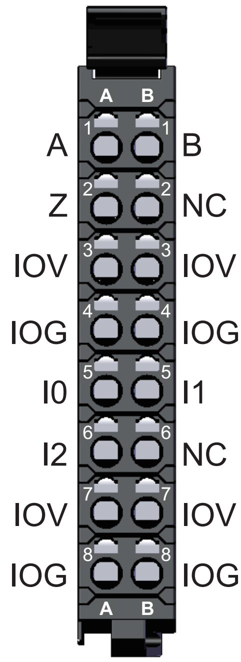
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0122. It also provides a wiring example.

Terminal Block Arrangement

A 16-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A	I	Counter input A
A2	Z	I	Counter input Z
A3	IOV	O	Encoder power supply output, 24 V
A4	IOG	O	Encoder power supply output, 0 V
A5	I0	I	External input 0
A6	I2	I	External input 2
A7	IOV	O	Encoder power supply output, 24 V
A8	IOG	O	Encoder power supply output, 0 V

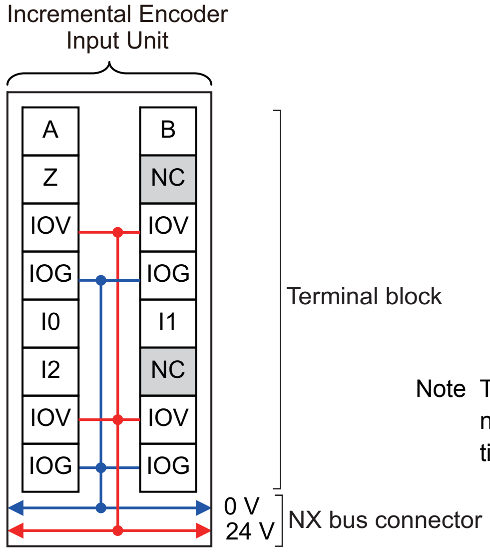
Terminal No.	Symbol	I/O	Name
B1	B	I	Counter input B
B2	NC	---	Not used.
B3	IOV	O	Encoder power supply output, 24 V
B4	IOG	O	Encoder power supply output, 0 V
B5	I1	I	External input 1
B6	NC	---	Not used.
B7	IOV	O	Encoder power supply output, 24 V
B8	IOG	O	Encoder power supply output, 0 V



Note The encoder power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

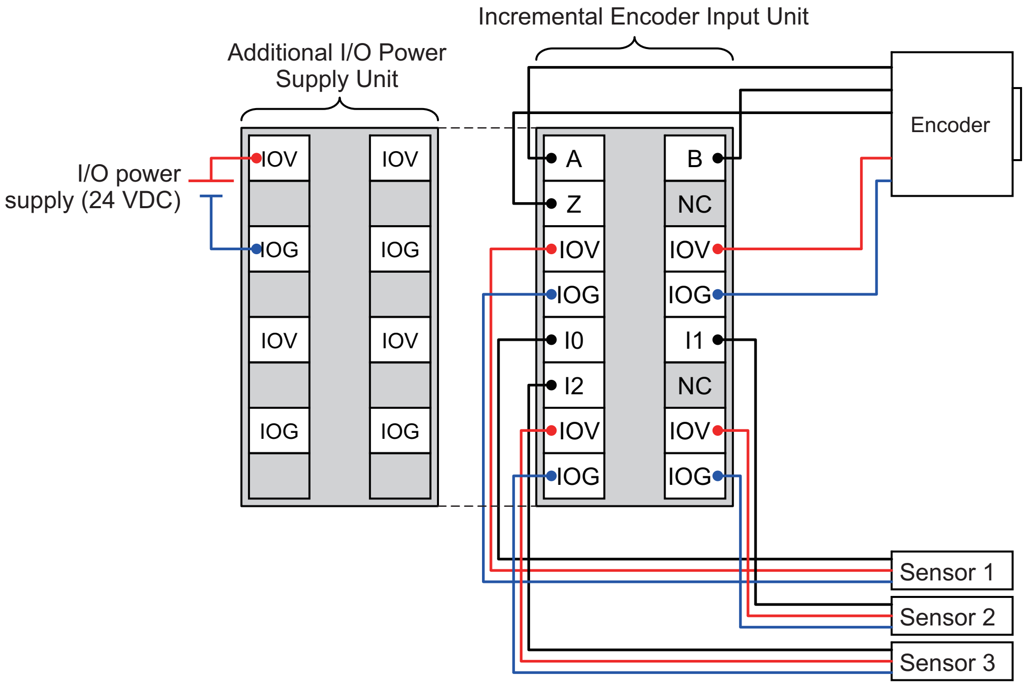
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note 1. The encoder and external inputs on Units with voltage inputs are PNP connections.

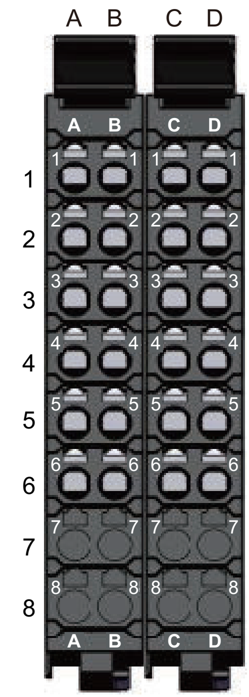
2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

6-5-3 NX-EC0132

This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0132. It also provides a wiring example.

Terminal Block Arrangement

Two 12-terminal terminal blocks are used.



Terminal No.	Symbol	I/O	Name
A1	I0	I	External input 0
A2	IOV	O	Sensor power supply output, 24 V
A3	IOG	O	Sensor power supply output, 0 V
A4	I2	I	External input 2
A5	IOV	O	Sensor power supply output, 24 V
A6	IOG	O	Sensor power supply output, 0 V
A7	---	---	---
A8	---	---	---

Terminal No.	Symbol	I/O	Name
B1	I1	I	External input 1
B2	IOV	O	Sensor power supply output, 24 V
B3	IOG	O	Sensor power supply output, 0 V
B4	NC	---	Not used.
B5	NC	---	Not used.
B6	NC	---	Not used.
B7	---	---	---
B8	---	---	---

Terminal No.	Symbol	I/O	Name
C1	A+	I	Counter input A+ side
C2	A–	I	Counter input A- side
C3	Z+	I	Counter input Z+ side
C4	Z–	I	Counter input Z- side
C5	NC	---	Not used.
C6	NC	---	Not used.
C7	---	---	---
C8	---	---	---

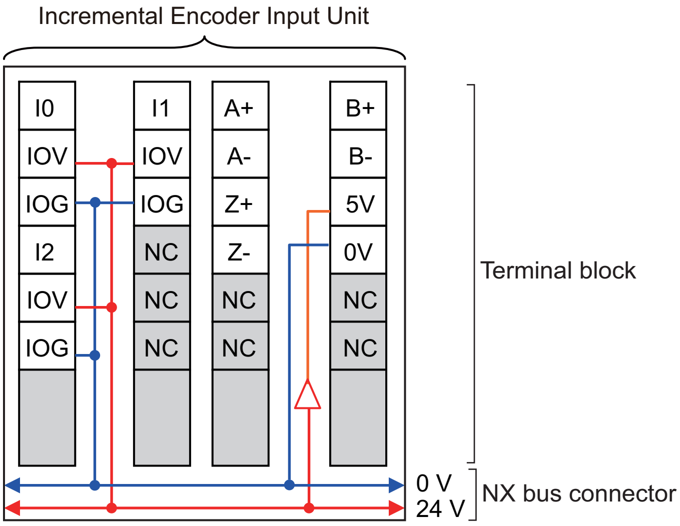
Terminal No.	Symbol	I/O	Name
D1	B+	I	Counter input B+ side
D2	B–	I	Counter input B- side
D3	5V	O	Encoder power supply output, 5 V
D4	0V	O	Encoder power supply output, 0 V
D5	NC	---	Not used.
D6	NC	---	Not used.
D7	---	---	---
D8	---	---	---

Note 1. The sensor power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

2. The power supply output for encoders (5 V and 0 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

Internal Power Supply Wiring Diagram

The following diagram shows the internal power supply wiring.

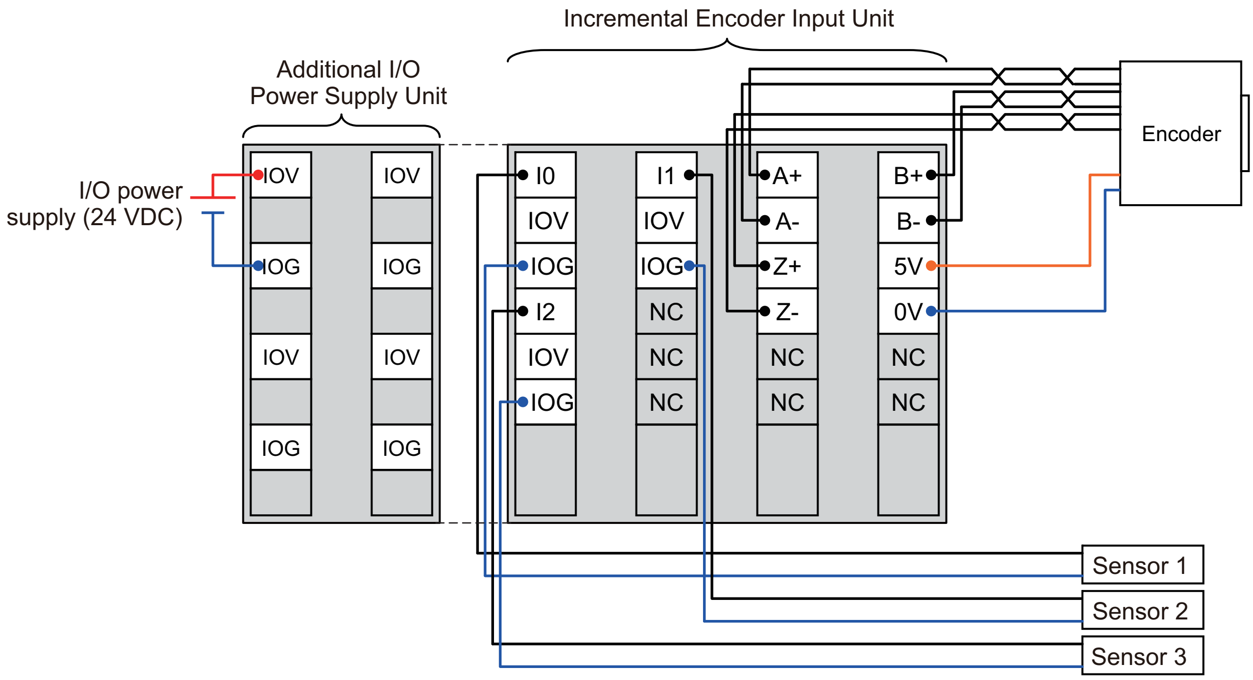


Note 1. The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

2. The power supply output for encoders (5 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

Wiring Example

The following is a wiring example.



Note 1. The external inputs for the Units with line receiver inputs are NPN connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

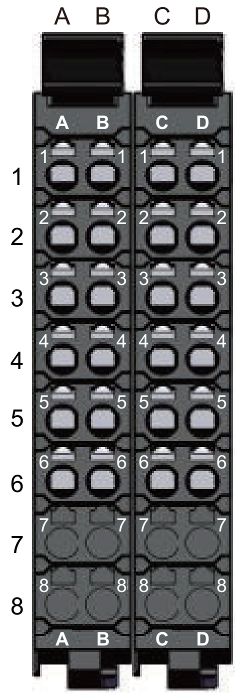
3. The power supply output for encoders (5 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

6-5-4 NX-EC0142

This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0142. It also provides a wiring example.

Terminal Block Arrangement

Two 12-terminal terminal blocks are used.



Terminal No.	Symbol	I/O	Name
A1	I0	I	External input 0
A2	IOV	O	Sensor power supply output, 24 V
A3	IOG	O	Sensor power supply output, 0 V
A4	I2	I	External input 2
A5	IOV	O	Sensor power supply output, 24 V
A6	IOG	O	Sensor power supply output, 0 V
A7	---	---	---
A8	---	---	---

Terminal No.	Symbol	I/O	Name
B1	I1	I	External input 1
B2	IOV	O	Sensor power supply output, 24 V
B3	IOG	O	Sensor power supply output, 0 V
B4	NC	---	Not used.
B5	NC	---	Not used.
B6	NC	---	Not used.
B7	---	---	---
B8	---	---	---

Terminal No.	Symbol	I/O	Name
C1	A+	I	Counter input A+ side
C2	A–	I	Counter input A– side
C3	Z+	I	Counter input Z+side
C4	Z–	I	Counter input Z–side
C5	NC	---	Not used.
C6	NC	---	Not used.
C7	---	---	---
C8	---	---	---

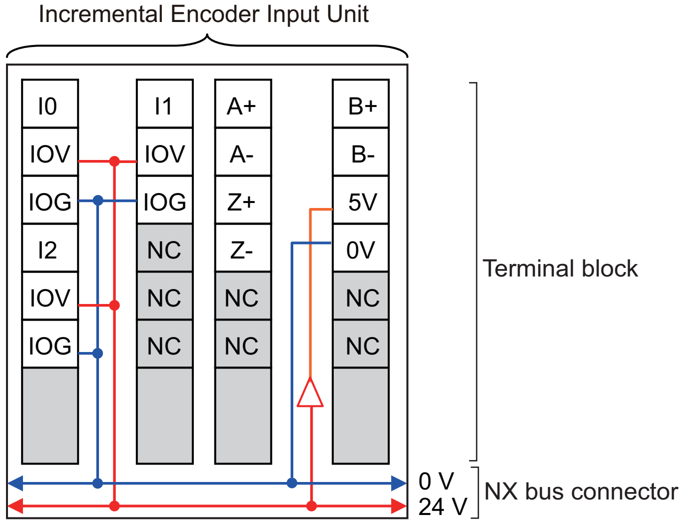
Terminal No.	Symbol	I/O	Name
D1	B+	I	Counter input B+ side
D2	B–	I	Counter input B– side
D3	5V	O	Encoder power supply output, 5 V
D4	0V	O	Encoder power supply output, 0 V
D5	NC	---	Not used.
D6	NC	---	Not used.
D7	---	---	---
D8	---	---	---

Note 1. The sensor power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

2. The power supply output for encoders (5 V and 0 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

Internal Power Supply Wiring Diagram

The following diagram shows the internal power supply wiring.

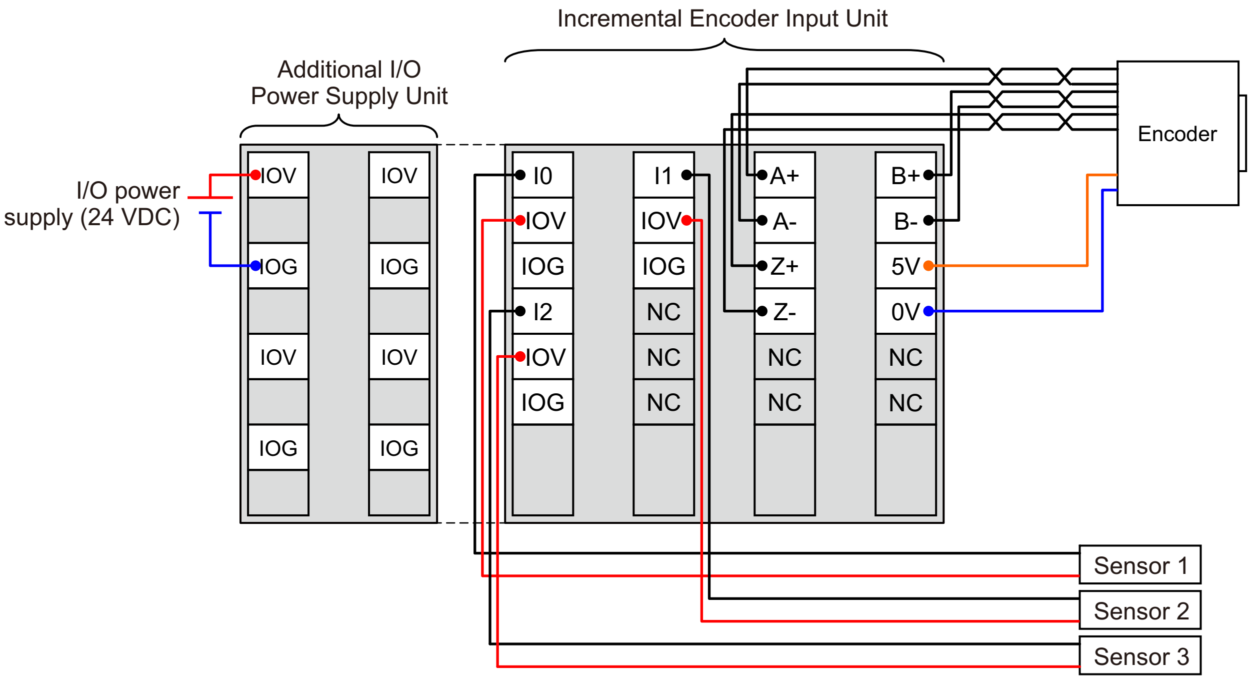


Note 1. The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

2. The power supply output for encoders (5 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

Wiring Example

The following is a wiring example.



Note 1. The external inputs for the Units with line receiver inputs are PNP connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

3. The power supply output for encoders (5 V) is converted from the 24-VDC I/O power supply to 5 VDC inside the Incremental Encoder Input Unit.

6-5-5 NX-EC0212

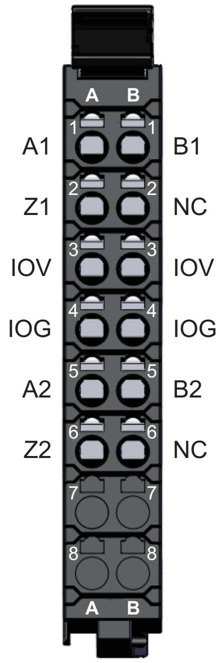
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0212. It also provides a wiring example.

Terminal Block Arrangement

A 12-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A1	I	Counter 1 input A
A2	Z1	I	Counter 1 input Z
A3	IOV	O	Encoder power supply output, 24 V
A4	IOG	O	Encoder power supply output, 0 V
A5	A2	I	Counter 2 input A
A6	Z2	I	Counter 2 input Z
A7	---	---	---
A8	---	---	---

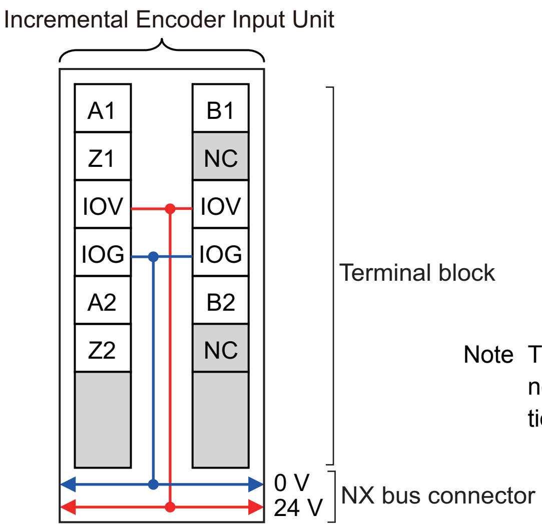
Terminal No.	Symbol	I/O	Name
B1	B1	I	Counter 1 input B
B2	NC	---	Not used.
B3	IOV	O	Encoder power supply output, 24 V
B4	IOG	O	Encoder power supply output, 0 V
B5	B2	I	Counter 2 input B
B6	NC	---	Not used.
B7	---	---	---
B8	---	---	---



Note The encoder power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

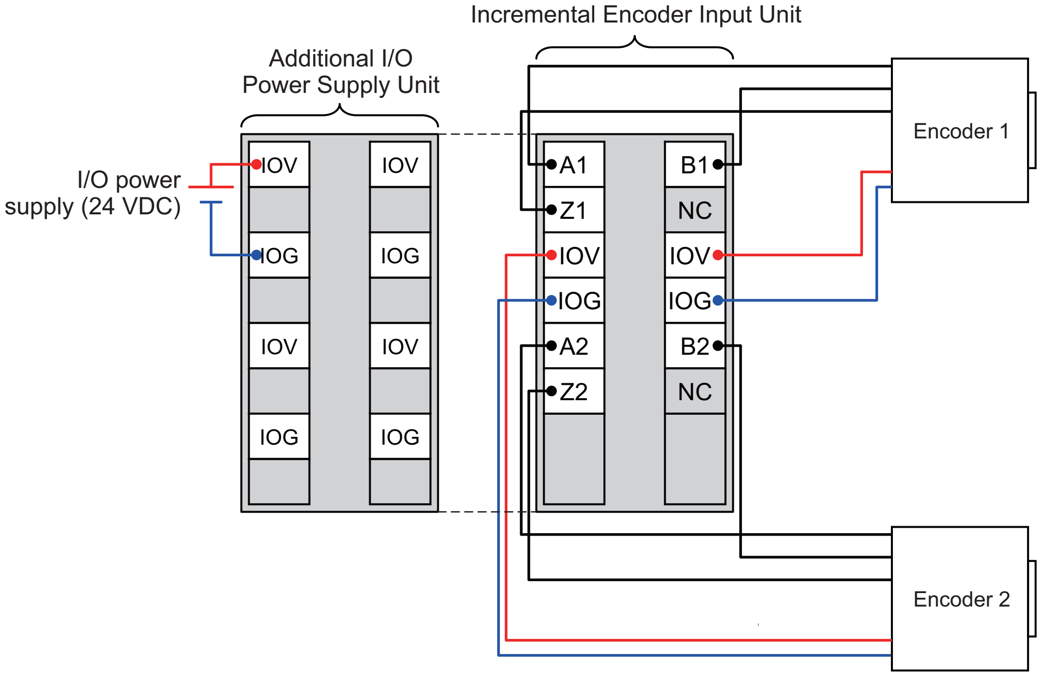
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note 1. The encoder inputs on Units with voltage inputs are NPN connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

6-5-6 NX-EC0222

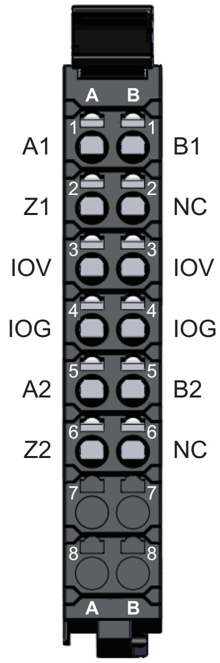
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-EC0222. It also provides a wiring example.

Terminal Block Arrangement

A 12-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A1	I	Counter 1 input A
A2	Z1	I	Counter 1 input Z
A3	IOV	O	Encoder power supply output, 24 V
A4	IOG	O	Encoder power supply output, 0 V
A5	A2	I	Counter 2 input A
A6	Z2	I	Counter 2 input Z
A7	---	---	---
A8	---	---	---

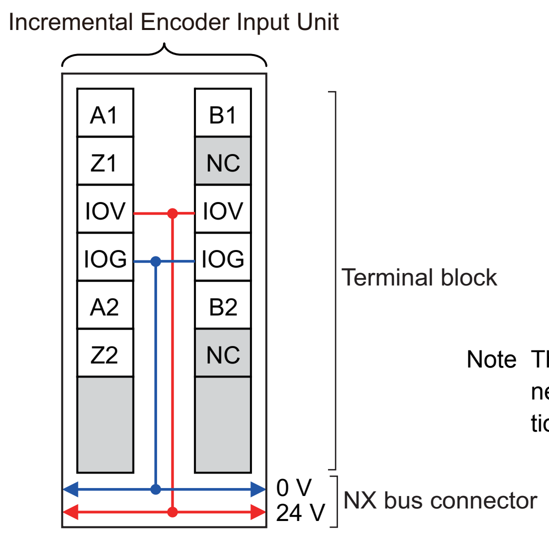
Terminal No.	Symbol	I/O	Name
B1	B1	I	Counter 1 input B
B2	NC	---	Not used.
B3	IOV	O	Encoder power supply output, 24 V
B4	IOG	O	Encoder power supply output, 0 V
B5	B2	I	Counter 2 input B
B6	NC	---	Not used.
B7	---	---	---
B8	---	---	---



Note The encoder power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

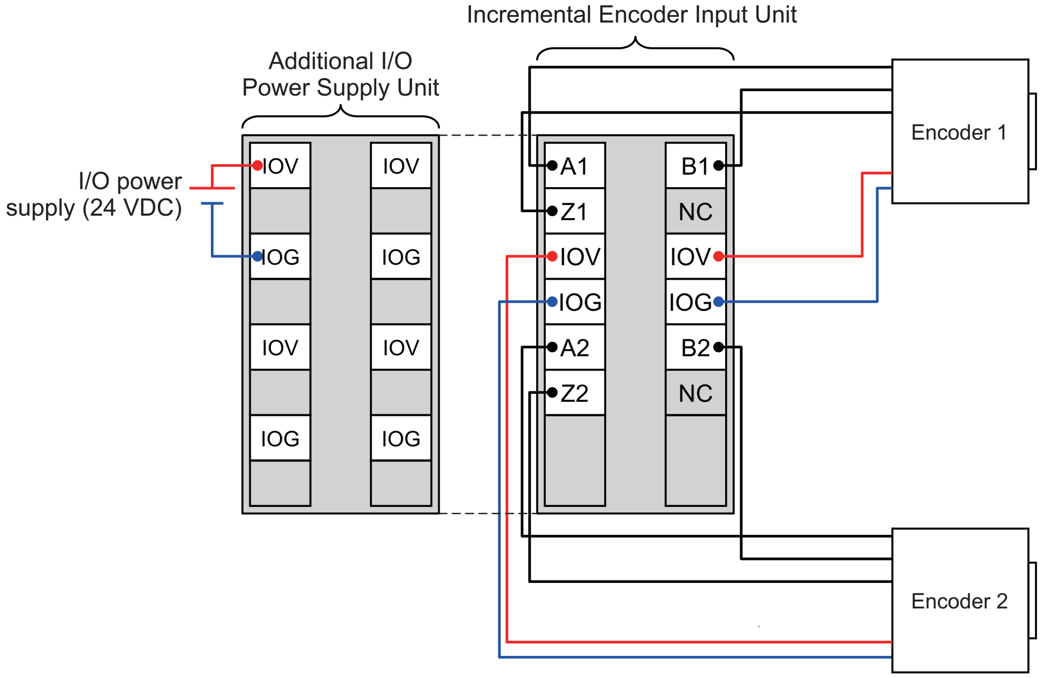
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note 1. The encoder inputs on Units with voltage inputs are PNP connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Incremental Encoder Input Unit.

6-6 I/O Refreshing Method Setting

There are the following methods to exchange data between Incremental Encoder Input Units and the Controller: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.

This section describes how to set the I/O refreshing method for Incremental Encoder Input Units, the I/O refreshing methods, and the differences in I/O refreshing methods for different Controllers.

6-6-1 Setting the I/O Refreshing Methods

This section describes the settings of the I/O refreshing method for each Communications Coupler Unit.

● EtherCAT Coupler Unit

When an Incremental Encoder Input Unit is connected to an EtherCAT Coupler Unit, the I/O refreshing method depends on the *Enable Distributed Clock* setting.

The following table lists the possible combinations.

DC enabled/disabled	I/O refreshing method
Enabled (DC for synchronization)	Synchronous I/O refreshing
Enabled (DC with priority in cycle time)	Task period prioritized refreshing
Disabled (FreeRun)	Free-Run refreshing

Version Information

Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required to use task period prioritized refreshing. If you use unit version 1.1 or earlier and an NX-ECC203 EtherCAT Coupler Unit, operation is performed with synchronous I/O refreshing.

● EtherNet/IP Coupler Unit

When an Incremental Encoder Input Unit is connected to an EtherNet/IP Coupler Unit, you can use only Free-Run refreshing. There is no setting.

Refresh Cycle

The following table lists the refresh cycles for Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.

I/O refreshing method	Refresh cycle
Free-Run refreshing	Always 125 μs*1
Synchronous I/O refreshing*2	250 μs to 10 ms*3
Task period prioritized refreshing*2	125 μs to 10 ms*4

*1. The value is always 250 μs for unit version 1.1 or earlier.

*2. The refresh cycle depends on the specifications of the EtherCAT master and EtherCAT Coupler Unit. It also depends on the Unit configuration.

*3. The range is 250 μs to 4 ms for unit version 1.1 or earlier. The range is also 250 μs to 4 ms for unit version 1.2 or later if you use the NX-ECC201/202 EtherCAT Coupler Unit.

*4. The range for the NX-EC02□2 is 250 μs to 10 ms.

Precautions for Correct Use

- If you use a Position Interface Unit and EtherCAT Coupler Unit together and you use Free-Run refreshing, set the task period to a value that is greater than or equal to the refresh cycle of the Position Interface Unit.
- If you use synchronous I/O refreshing or task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.
- If you set task period prioritized refreshing for the NX-EC02□2 and operate at 125 μs, a WDT error will occur in the Incremental Encoder Input Unit and the TS indicator will light red. An NX Unit Minor Fault error event will occur in the Communications Coupler Unit at the same time.

For the communications cycle specifications of the built-in EtherCAT port on an NJ/NX-series CPU Unit, refer to the *NJ/NX-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505). For the communications cycle specifications of the EtherCAT Coupler Unit, refer to the *NX-series EtherCAT Coupler Unit User’s Manual* (Cat. No. W519-E1-05 or later).

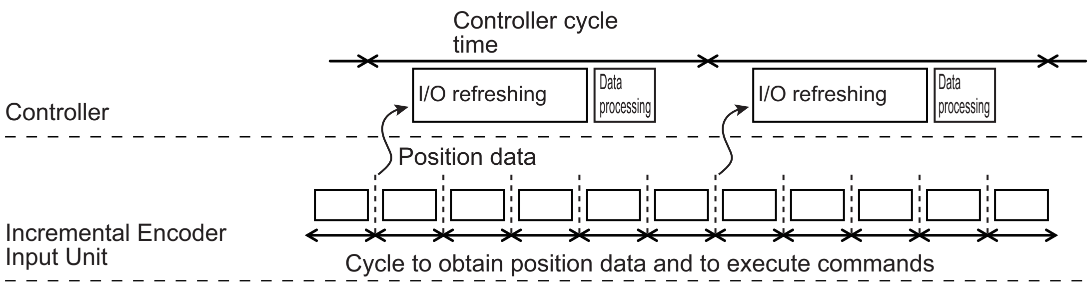
6-6-2 Free-Run Refreshing

Use Free-Run refreshing to exchange data without worrying about the timing of when the Incremental Encoder Input Unit obtains the position data.

Position data is obtained according to the Unit’s cycle, regardless of the Controller’s processing interval.

Data is exchanged with the Controller based on the I/O refreshing timing of the Controller.

The data that is exchanged is the position data that was obtained in the last Unit cycle when I/O refreshing is performed.



Precautions for Correct Use

If you use a Position Interface Unit and EtherCAT Coupler Unit together and you use Free-Run refreshing, set the task period to a value that is greater than or equal to the refresh cycle of the Position Interface Unit.

Version Information

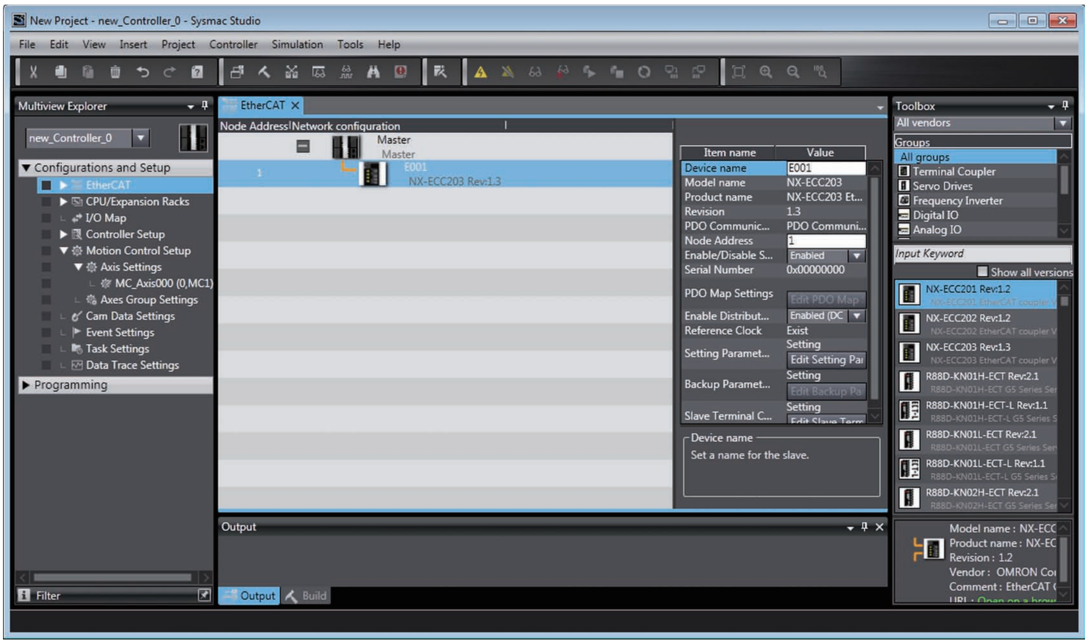
The refresh cycle is always 125 μs for unit version 1.2 or later.
The refresh cycle is always 250 μs for unit version 1.1 or earlier.

Setting with the Sysmac Studio

Use the following procedure to select *Disabled (FreeRun)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use Free-Run refreshing for Incremental Encoder Input Units connected to an EtherCAT Coupler Unit.

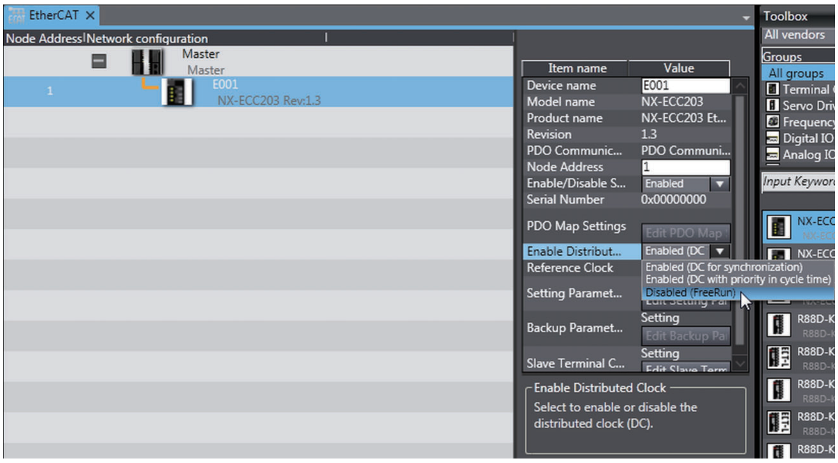
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

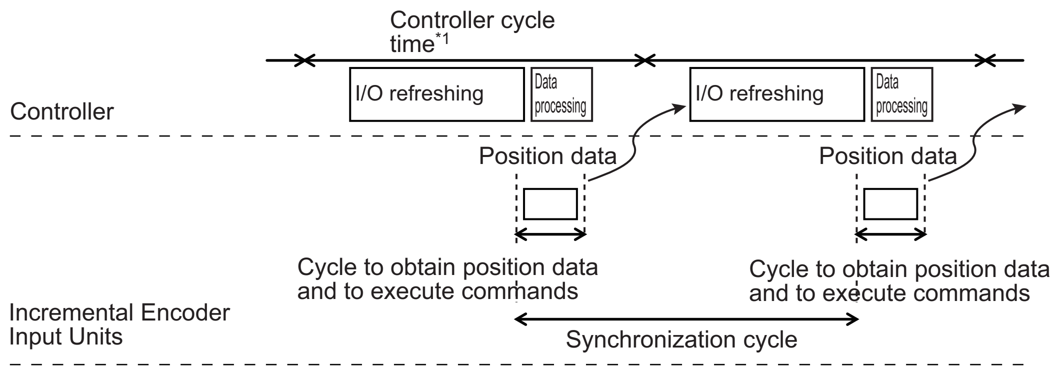
Change the *Enable Distributed Clock* setting to *Disabled (FreeRun)*.



As a result, Free-Run refreshing is used.

6-6-3 Synchronous I/O Refreshing

With synchronous I/O refreshing, the status of workpieces in multiple locations is monitored. Use this method to synchronize Controller processing with the timing of when position data is obtained by more than one Incremental Encoder Input Unit.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation of Synchronous I/O Refreshing* on page 5-7 for details.

Precautions for Correct Use

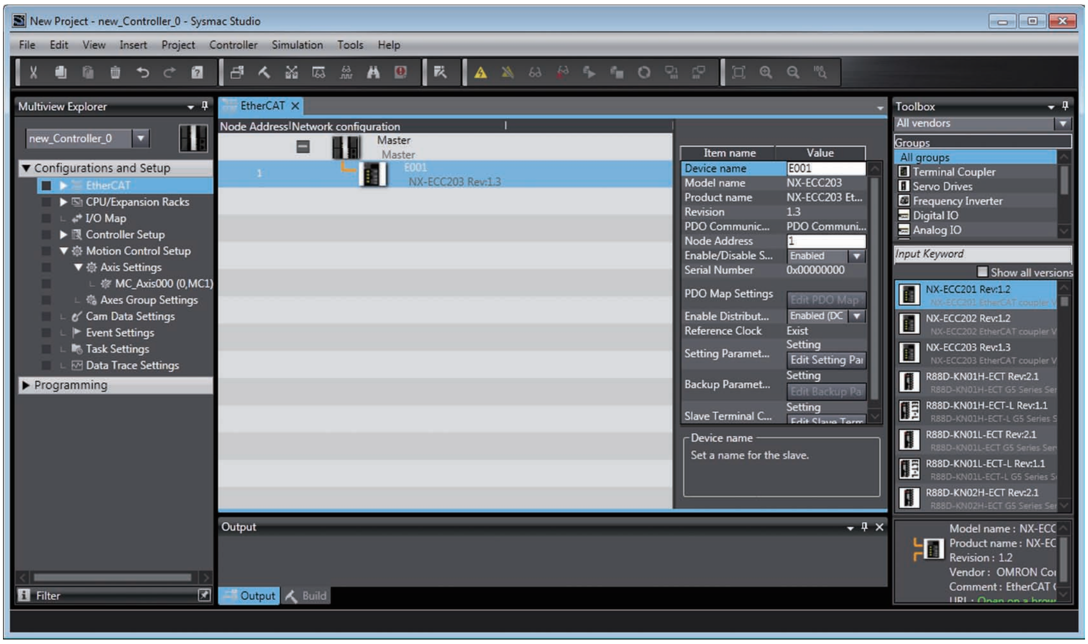
If you use synchronous I/O refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC for synchronization)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use synchronous I/O refreshing for Incremental Encoder Input Units connected to an EtherCAT Coupler Unit.

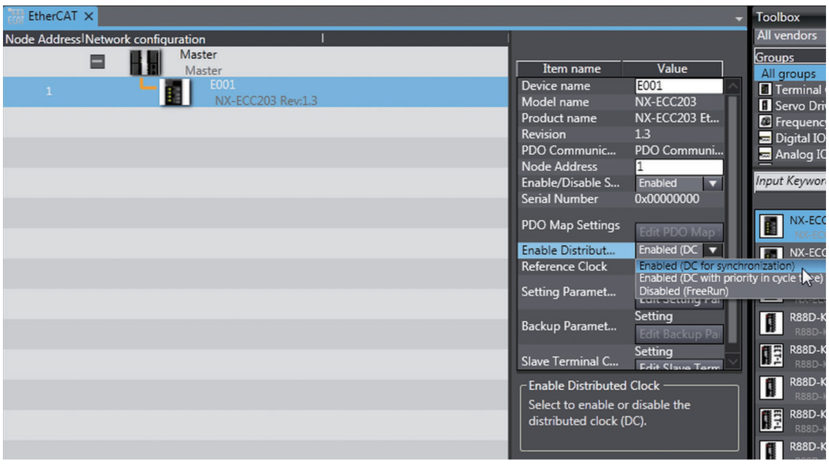
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

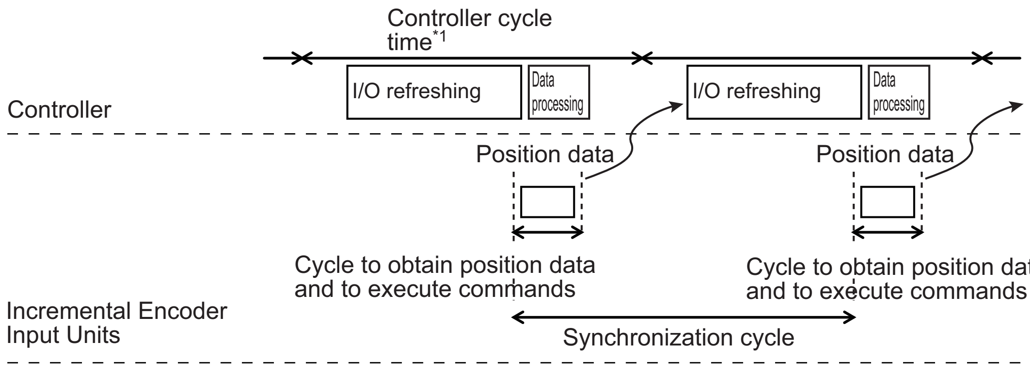
Change the *Enable Distributed Clock* setting to *Enabled (DC for synchronization)*.



As a result, synchronous I/O refreshing is used.

6-6-4 Task Period Prioritized Refreshing

With this I/O refreshing method, shortening the task period is given priority over synchronizing the I/O timing with other NX Units. With this I/O refreshing method, the timing of I/O is not consistent with the timing of I/O for NX Units that use simultaneous I/O refreshing.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation for Task Period Prioritized Refreshing* on page 5-10 for details.

Precautions for Correct Use

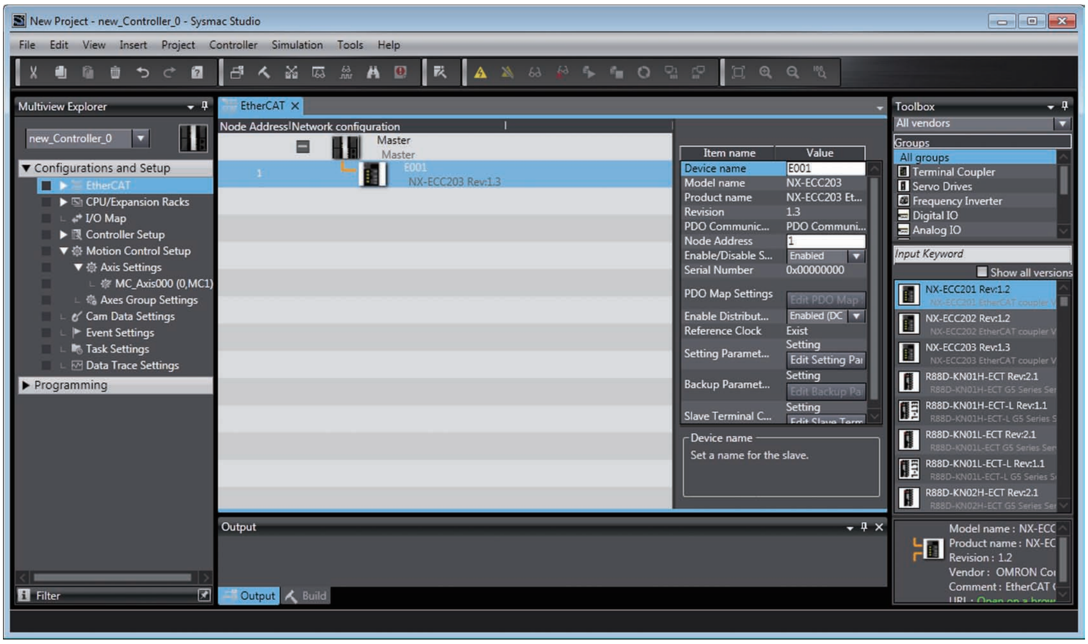
- If you use task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.
- If you use task period prioritized refreshing for the NX-EC02☐2, the refresh cycle is 250 µs to 10 ms. If you operate the NX-EC02☐2 at 125 µs, a WDT error will occur in the Incremental Encoder Input Unit and the TS indicator will light red. An NX Unit Minor Fault error event will occur in the Communications Coupler Unit at the same time.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC with priority in cycle time)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use task period prioritized refreshing for Incremental Encoder Input Units connected to an EtherCAT Coupler Unit.

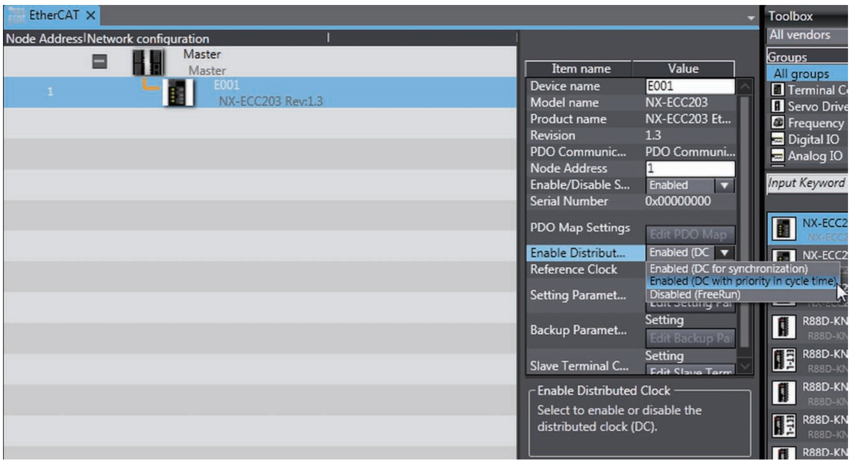
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Enabled (DC with priority in cycle time)*.



As a result, task period prioritized refreshing is used.

6-6-5 Differences in I/O Refreshing Methods Based on the Controller

The type of controller that is connected affects the I/O refreshing method, parameter settings, data access methods, and supported functions.

This section describes this information for various controllers.

Using an NJ/NX-series Controller with the MC Function Module

When you use an NJ/NX-series Controller with the MC Function Module, you must set the Unit as an encoder axis. Set the axis parameter settings and assign an axis variable from the Sysmac Studio.

Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for detailed setting procedures.

Observe the following precautions when you use an Incremental Encoder Input Unit with the MC Function Module.

- Connect the Incremental Encoder Input Unit after an EtherCAT Coupler Unit.
- The Unit is treated as an axis (encoder axis) from the user program, so you cannot handle the I/O data from the Incremental Encoder Input Unit directly. Use motion control instructions and an axis variable to manipulate this data.
- For an NX-series CPU Unit, you can execute motion control in the primary periodic task and priority-5 periodic task.
- Some functions are fixed and no selections are available. For example, gate control requires that you always enable the counter. Counter reset and preset operations are calculated in the MC Function Module and therefore do not change any data in the Incremental Encoder Input Unit.

Yes: Can be used, Partial: Can be used with restrictions, No: Cannot be used

Function	EtherCAT Coupler Unit		
	Free-Run refreshing *1	Synchronous I/O refreshing	Task period prioritized refreshing*2
Counter type setting	No	Partial *3	Partial *3
Pulse input method setting	No	Yes	Yes
Encoder count direction	No	Yes	Yes
Gate control	No	No *4	No *4
Counter reset	No	No *5	No *5
Counter preset	No	No *5	No *5
Latching	No	Partial *6	Partial *6
External input function selection	No	Partial *7	Partial *7
Pulse rate measurement	No	No	No
Pulse period measurement	No	No	No
I/O refreshing method setting	No	Partial *1	Partial *1
Time stamping*8	No	Yes	Yes

*1. If you use the Unit as an axis in the MC Function Module, either synchronous I/O refreshing or task period prioritized refreshing is used as the I/O refreshing method.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*3. Select a ring counter if you use the Incremental Encoder Input Unit as an axis in the MC Function Module.

*4. The gate requires that you always enable the counter. The counter is enabled by default for an Incremental Encoder Input Unit, so you do not need to change this setting.

*5. This is performed in the MC Function Module data. It will not function in the Unit.

*6. You can use latching for external inputs and phase-Z inputs only. You cannot perform latching with an encoder counter operation command.

*7. When you use the Unit as an axis in the MC Function Module, select either a general input or latch input for the external input. Select a latch input to use latching. Otherwise, select a general input.

*8. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

You can control latching for an encoder axis with the following motion control instructions.

Motion control instructions	Function
MC_TouchProbe	Enabling external latches
MC_AbortTrigger	Disabling external latches

Refer to the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508) for details on the motion control instructions.

Precautions for Correct Use

- If you assign an NX Unit connected to an EtherCAT Coupler Unit as an I/O device for a MC Function Module axis, the MC Function Module manages refreshing of the I/O data. In this case, the MC Function Module manages refreshing of the I/O data for the entire Slave Terminal, including the EtherCAT Coupler Unit.

  If any of the operations or errors in the following table occur, the MC Function Module discards the Slave Terminal I/O data at that time. Refreshing of I/O data resumes when valid data is obtained again.

Operation	Using EtherCAT slaves only	Using an EtherCAT Coupler Unit + NX Units
Intentional changes to EtherCAT network configuration elements	• Unintentional disconnection of an EtherCAT slave or an EtherCAT cable disconnection • Unintentional connection of an EtherCAT slave or an EtherCAT cable connection • EtherCAT slave power interruption	Same as at the left.
Intentional changes to EtherCAT network configuration elements	• Disconnection of an EtherCAT slave due to a disconnect operation • Connection of an EtherCAT slave due to a connect operation	Same as at the left. • Restarting of EtherCAT Slave Terminal • Restarting after parameters were transferred to the Communications Coupler Unit
Unintentional changes to EtherCAT network configuration elements	None	Performing an error reset when the Slave Terminal is stopped due to an error

  From several milliseconds to several tens of milliseconds is required to resume refreshing of I/O data, depending on the system configuration and the process data communications cycle.

  You can include an NX Unit that is not assigned to an axis in a Slave Terminal that is managed by the MC Function Module, but keep in mind the above characteristics of the refreshing of I/O data when you do so.

- If you want to avoid the effects of the refreshing of I/O data that is managed by the MC Function Module on NX Units that are not assigned to axes, place those NX Units on another Slave Terminal. To use different Slave Terminals, use different EtherCAT Coupler Units and configure the Slave Terminals so that one contains only NX Units that are assigned to axes and one contains only NX Units that are not assigned to axes.
- To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units.

  Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

Using an NJ/NX-series Controller without the MC Function Module

Set the parameters and assign I/O data for the user program from the Sysmac Studio.

Assign the I/O data in the NJ/NX-series Controller as device variables for the Unit.

Refer to the *NJ/NX-series CPU Unit Software Users Manual* (Cat. No. W501) for details.

The following table lists the usage restrictions for functions based on their combination with the EtherCAT Coupler Unit.

Yes: Usable, No: Not usable

Function	EtherCAT Coupler Unit		
	Free-Run refreshing	Synchronous I/O refreshing	Task period prioritized refreshing*1
Counter type setting	Yes	Yes	Yes
Pulse input method setting	Yes	Yes	Yes
Encoder count direction	Yes	Yes	Yes
Gate control	Yes	Yes	Yes
Counter reset	Yes	Yes	Yes
Counter preset	Yes	Yes	Yes
Latching	Yes	Yes	Yes
External input function selection	Yes	Yes	Yes
Pulse rate measurement	Yes	Yes	Yes
Pulse period measurement	Yes	Yes	Yes
I/O refreshing method setting *2	Yes	Yes	Yes
Time stamping*3	No	Yes	Yes

*1. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*2. This setting determines the I/O refreshing method.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

Other Controllers

The procedure to set parameters and assign data for the user program depends on the system. Manipulate the Position Interface Unit device parameters through the I/O and message communications provided by the Controller.

Refer to *A-2 Object Lists* on page A-28 for details.

The following table lists the usage restrictions for functions based on their combination with the Communications Coupler Unit.

Yes: Usable, No: Not usable

Function	EtherCAT Coupler Unit			EtherNet/IP Coupler Unit
	Free-Run refreshing	Synchronous I/O refreshing	Task period prioritized refreshing*1	Free-Run refreshing
Counter type setting	Yes	Yes	Yes	Yes
Pulse input method setting	Yes	Yes	Yes	Yes
Encoder count direction	Yes	Yes	Yes	Yes
Gate control	Yes	Yes	Yes	Yes
Counter reset	Yes	Yes	Yes	Yes
Counter preset	Yes	Yes	Yes	Yes
Latching	Yes	Yes	Yes	Yes
External input function selection	Yes	Yes	Yes	Yes
Pulse rate measurement	Yes	Yes	Yes	Yes
Pulse period measurement	Yes	Yes	Yes	Yes
I/O refreshing method setting	Yes	Yes	Yes	No
Time stamping*2	No	Yes	Yes	No

*1. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*2. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

6-7 I/O Data Specifications

This section describes the data items that you can allocate to I/O, the data configurations, and the axis settings.

6-7-1 Data Items for Allocation to I/O

You can allocate the following 15 data items to the I/O for an Incremental Encoder Input Unit.

The data items are described in the following sections.

Additional Information

- If you use an EtherCAT Coupler Unit, you can use the Read NX Unit Object instruction or the Write NX Unit Object instruction to access data that is not assigned as I/O. Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for details on the Read NX Unit Object instruction or the Write NX Unit Object instruction.
  For the index numbers, refer to *A-2-2 Incremental Encoder Input Units* on page A-29.
- If you use an EtherNet/IP Coupler Unit, you cannot access data that is not assigned to I/O.

NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142

The data items that you can allocate to I/O for a One-input Unit are listed in the following table.

Area	Data item	Size (bytes)	Data type	Default *1	MC Function Module PDO *2
Input	Encoder Counter Status	1	BYTE	Yes	
	Reset/External Input Status	1	BYTE	Yes	
	Encoder Present Position	4	DINT	Yes	Yes
	Pulse Period Measurement Status	1	BYTE	Yes	
	Latch Status	2	WORD	Yes	Yes
	Latch Input 1 Data	4	DINT	Yes	Yes
	Latch Input 2 Data	4	DINT	Yes	Yes
	Internal Latch Data	4	DINT		
	Pulse Rate	4	UDINT		
	Pulse Period Measured Value	4	UDINT		
	Time Stamp*3	8	ULINT		
Output	Encoder Counter Operation Command	2	WORD		
	Pulse Period Measurement Function	2	WORD	Yes	
	Latch Function	2	WORD	Yes	Yes
	Preset Command Value	4	DINT		

*1. The *Default* column shows the data item that are set when the Unit is shipped from the factory. You can allocate other data items.

*2. These PDOs are required to use the MC Function Module.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

NX-EC0212 and NX-EC0222

The data items that you can allocate to I/O for a Two-input Unit are listed in the following table.

Area	Data item	Size (bytes)	Data type	Default *1	MC Function Module PDO *2
Input	Encoder Counter Status 1	1	BYTE	Yes	
	Reset Status 1	1	BYTE	Yes	
	Encoder Present Position 1	4	DINT	Yes	Yes
	Pulse Period Measurement Status 1	1	BYTE	Yes	
	Latch Status 1	2	WORD	Yes	Yes
	Latch Input 1 Data 1	4	DINT	Yes	Yes
	Latch Input 2 Data 1	4	DINT	Yes	Yes
	Internal Latch Data 1	4	DINT		
	Pulse Rate 1	4	UDINT		
	Pulse Period Measured Value 1	4	UDINT		
	Time Stamp 1*3	8	ULINT		
	Encoder Counter Status 2	1	BYTE	Yes	
	Reset Status 2	1	BYTE	Yes	
	Encoder Present Position 2	4	DINT	Yes	Yes
	Pulse Period Measurement Status 2	1	BYTE	Yes	
	Latch Status 2	2	WORD	Yes	Yes
	Latch Input 1 Data 2	4	DINT	Yes	Yes
	Latch Input 2 Data 2	4	DINT	Yes	Yes
	Internal Latch Data 2	4	DINT		
	Pulse Rate 2	4	UDINT		
	Pulse Period Measured Value 2	4	UDINT		
	Time Stamp 2*3	8	ULINT		
Output	Encoder Counter Operation Command 1	2	WORD		
	Pulse Period Measurement Function 1	2	WORD	Yes	
	Latch Function 1	2	WORD	Yes	Yes
	Preset Command Value 1	4	DINT		
	Encoder Counter Operation Command 2	2	WORD		
	Pulse Period Measurement Function 2	2	WORD	Yes	
	Latch Function 2	2	WORD	Yes	Yes
	Preset Command Value 2	4	DINT		

*1. The *Default* column shows the data item that are set when the Unit is shipped from the factory. You can allocate other data items.

*2. These PDOs are required to use the MC Function Module.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

6-7-2 Data Details

This section describes the data configuration for each of the 15 data items for I/O allocation.

Encoder Counter Status

The bit configuration of the Encoder Counter Status parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	DIRn	OFERn	UFERn	PRERn	PACKn	LACKn	RACKn	CRUNn

Abbr.	Data	Description
CRUNn	Counter Enabled	1: Counter operating. 0: Counter stopped.
RACKn	Internal Reset Completed	This is the completion flag for the Internal Reset Execution bit of the Encoder Counter Operation Command parameter. 0 to 1: Reset execution completed. 1 to 0: The Internal Reset Execution bit in the Encoder Counter Operation Command parameter is set to 0.
LACKn	Internal Latch Completed	This is the completion flag for the Internal Latch Execution bit of the Encoder Counter Operation Command parameter. 0 to 1: Latch execution completed. 1 to 0: The Internal Latch Execution bit in the Encoder Counter Operation Command parameter is set to 0.
PACKn	Preset Completed	This is the completion flag for the Preset Execution bit of the Encoder Counter Operation Command parameter. 0 to 1: Preset execution completed. 1 to 0: The Preset Execution bit in the Encoder Counter Operation Command parameter is set to 0.
PRERn	Preset Command Value Invalid Flag	1: Setting error occurred. 0: No setting errors occurred.
UFERn	Counter Underflow Flag	1: Counter underflow error occurred. 0: Counter underflow error did not occur.
OFERn	Counter Overflow Flag	1: Counter overflow error occurred. 0: Counter overflow error did not occur.
DIRn	Count Direction Flag	This bit indicates the count direction based on the last pulse input. *1 1: Reverse direction 0: Forward direction

*1. The indicated count direction is based on the setting of the Encoder Count Direction parameter. Because this is the count direction for the last pulse input, the direction given by the Count Direction bit and the difference between the previous and current values of the Encoder Present Position parameter may not agree if there is oscillation in the pulse input from the encoder.

Reset/External Input Status

The bit configuration of the Reset/External Input Status parameter is given in the following table.

● One-input Input Unit

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ZSFLG	ERFLG	ZSEND	EREND	EXTEN	EXT2	EXT1	EXT0

Abbr.	Data	Description
EXT0	External Input 0 Status	1: External input 0 ON. 0: External input 0 OFF.
EXT1	External Input 1 Status	1: External input 1 ON. 0: External input 1 OFF.
EXT2	External Input 2 Status	1: External input 2 ON. 0: External input 2 OFF.
EXTEN	External Input Enabled *1	1: External input enabled. 0: External input disabled.
EREND	External Reset Enabled	1: Reset for external reset enabled. 0: Reset for external reset disabled.
ZSEND	Phase Z Reset Enabled	1: Reset for phase-Z signal enabled. 0: Reset for phase-Z signal disabled.
ERFLG	External Reset Completed Flag	1: Reset for external reset occurred. 0: Reset for external reset did not occur.
ZSFLG	Phase Z Reset Completed Flag	1: Reset for phase-Z signal occurred. 0: Reset for phase-Z signal did not occur.

*1. The external input is enabled if the External Input Function Selection parameter is set correctly and the external input is enabled. If the External Input Function Selection parameter is set more than once for the same input, the external input is disabled.

● Two-input Input Unit

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ZSFLGn	---	ZSENDn	---	---	---	---	---

Abbr.	Data	Description
ZSENDn	Phase Z Reset Enabled	1: Reset for phase-Z signal enabled. 0: Reset for phase-Z signal disabled.
ZSFLGn	Phase Z Reset Completed Flag	1: Reset for phase-Z signal occurred. 0: Reset for phase-Z signal did not occur.

Encoder Present Position

The bit configuration of the Encoder Present Position parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CVn (Chn Encoder Present Position LL)							
+1	CVn (Chn Encoder Present Position LH)							
+2	CVn (Chn Encoder Present Position HL)							
+3	CVn (Chn Encoder Present Position HH)							

Abbr.	Data	Description
CVn	Chn Encoder Present Position	This contains the present position of the encoder for channel n.

Pulse Period Measurement Status

The bit configuration of the Pulse Period Measurement Status parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	PPOFn	PPCAKn	PPENFn

Abbr.	Data	Description
PPENFn	Pulse Period Measurement Enabled	1: Pulse period measurement enabled. 0: Pulse period measurement disabled.
PPCAKn	Pulse Period Measurement Value Clear Completed	1: Pulse period measurement value clear completed. 0: Pulse period measurement value clear bit is 0.
PPOFn	Pulse Period Measurement Value Overflow Flag	1: Pulse period measurement value overflow occurred. 0: Pulse period measurement value overflow did not occur.

Latch Status

The bit configuration of the Latch Status parameter is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	---	L1FLG	L1EN
+1	---	---	---	---	---	---	L2FLG	L2EN

Abbr.	Data	Description
L1EN	Latch Input 1 Enabled *1	1: Latch input 1 enabled. 0: Latch input 1 disabled.
L1FLG	Latch Input 1 Completed Flag *2	1: Data was latched for latch input 1. 0: No data was latched for latch input 1.
L2EN	Latch Input 2 Enabled *3	1: Latch input 2 enabled. 0: Latch input 2 disabled.
L2FLG	Latch Input 2 Completed Flag *4	1: Data was latched for latch input 2. 0: No data was latched for latch input 2.

*1. This bit changes according to the setting of the Latch Input 1 Enable bit for latching. Refer to *Latch Function* on page 6-41 for information on latching.

*2. This bit is cleared when the Latch Input 1 Enable bit changes from 1 to 0.

*3. This bit changes according to the setting of the Latch Input 2 Enable bit for latching. Refer to *Latch Function* on page 6-41 for information on latching.

*4. This bit is cleared when the Latch Input 2 Enable bit changes from 1 to 0.

Latch Input 1 Data

The bit configuration of the Latch Input 1 Data parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ELV1n (Chn Latch Input 1 Data LL)							
+1	ELV1n (Chn Latch Input 1 Data LH)							
+2	ELV1n (Chn Latch Input 1 Data HL)							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+3	ELV1n (Chn Latch Input 1 Data HH)							

Abbr.	Data	Description
ELV1n	Chn Latch Input 1 Data	This contains the latch 1 data for channel n.

Latch Input 2 Data

The bit configuration of the Latch Input 2 Data parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ELV2n (Chn Latch Input 2 Data LL)							
+1	ELV2n (Chn Latch Input 2 Data LH)							
+2	ELV2n (Chn Latch Input 2 Data HL)							
+3	ELV2n (Chn Latch Input 2 Data HH)							

Abbr.	Data	Description
ELV2n	Chn Latch Input 2 Data	This contains the latch 2 data for channel n.

Internal Latch Data

The bit configuration of the Internal Latch Data parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ILVn (Chn Internal Latch Data LL)							
+1	ILVn (Chn Internal Latch Data LH)							
+2	ILVn (Chn Internal Latch Data HL)							
+3	ILVn (Chn Internal Latch Data HH)							

Abbr.	Data	Description
ILVn	Chn Internal Latch Data	This contains the internal latch data for channel n. The time is 64-bit TIME data. (Unit: ns)

Pulse Rate

The bit configuration of the Pulse Rate parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PRn (Chn Pulse Rate LL)							
+1	PRn (Chn Pulse Rate LH)							
+2	PRn (Chn Pulse Rate HL)							
+3	PRn (Chn Pulse Rate HH)							

Abbr.	Data	Description
PRn	Chn Pulse Rate	This contains the pulse rate for channel n.

Pulse Period Measured Value

The bit configuration of the Pulse Period Measured Value parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PPVn (Chn Pulse Period Measured Value LL)							
+1	PPVn (Chn Pulse Period Measured Value LH)							
+2	PPVn (Chn Pulse Period Measured Value HL)							
+3	PPVn (Chn Pulse Period Measured Value HH)							

Abbr.	Data	Description
PPVn	Chn Pulse Period Measured Value	This contains the pulse period measured value for channel n.

Time Stamp

The bit configuration of the Time Stamp parameter is given in the following table.

Refer to *6-9-12 Time Stamping* on page 6-75 for details on time stamps.

Note An EtherCAT Coupler Unit with unit version 1.1 or later is required.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 01	Bit 0
0	TMSn (Chn Time Stamp, 1st byte)							
+1	TMSn (Chn Time Stamp, 2nd byte)							
+2	TMSn (Chn Time Stamp, 3rd byte)							
+3	TMSn (Chn Time Stamp, 4th byte)							
+4	TMSn (Chn Time Stamp, 5th byte)							
+5	TMSn (Chn Time Stamp, 6th byte)							
+6	TMSn (Chn Time Stamp, 7th byte)							
+7	TMSn (Chn Time Stamp, 8th byte)							

Abbr.	Data	Description
TMSn	Chn Time Stamp	Contains the time stamp for when Chn changed. It stores the DC time. (Unit: ns)

Encoder Counter Operation Command

The bit configuration of the Encoder Counter Operation Command parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ZSCRn	ERCRn	ZSENn	ERENn	PSETn	INLAn	INRSn	CENn
1	---	---	---	---	---	---	---	---

Abbr.	Data	Description
CENn	Counter Enable	1: Enable counter command. 0: Disable counter command.
INRSn	Internal Reset Execution	0 to 1: Reset of present value started.
INLAn	Internal Latch Execution	0 to 1: Internal latch started.
PSETn	Preset Execution	0 to 1: Preset of present value started.

Abbr.	Data	Description
ERENn	External Reset Enable	1: Reset for external reset enabled. 0: Reset for external reset disabled.
ZSENn	Phase Z Reset Enable	1: Reset for phase-Z signal enabled. 0: Reset for phase-Z signal disabled.
ERCRn	External Reset Completed Flag Clear	0 to 1: External Reset Completed Flag cleared.
ZSCRn	Phase Z Reset Completed Flag Clear	0 to 1: Phase Z Reset Completed Flag cleared.

Precautions for Correct Use

The Encoder Counter Operation Command parameter is normally used by assigning it as I/O data. However, do not assign this parameter as I/O data when you assign it to an MC Function Module axis.

When you assign the parameter to an MC Function Module axis, manipulate the parameter through the MC Function Module axis and not in the parameter itself.

Pulse Period Measurement Function

The bit configuration of the Pulse Period Measurement Function parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	PPOFRn	PPVCRn	PPENn
1	---	---	---	---	---	---	---	---

Abbr.	Data	Description
PPENn	Pulse Period Measurement Enable *1	1: Pulse period measurement enabled. 0: Pulse period measurement disabled.
PPVCRn	Pulse Period Measurement Value Clear *2	0 to 1: Pulse period measured value and pulse period measurement counter are cleared.
PPOFRn	Pulse Period Measurement Value Overflow Flag Clear*2	0 to 1: Pulse period measurement value overflow flag is cleared.

*1. If the Edge Detection Method parameter is set to 0, the function is disabled regardless of the status of this bit.

*2. This can be performed only when pulse period measurement is enabled.

Latch Function

The bit configuration for the Latch Function parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	LSEL1n	LTRG1n	LEN1n
+1	---	---	---	---	---	LSEL2n	LTRG2n	LEN2n

Abbr.	Data	Description
LEN1n	Latch Input 1 Enable	1: Enable the latch input 1. 0: Disable the latch input 1.
LTRG1n	Latch Input 1 Trigger Condition*1	0: One-shot Mode 1: Continuous Mode

Abbr.	Data	Description
LSEL1n	Latch Input 1 Trigger Selection*1	0: External input 1: Phase-Z input
LEN2n	Latch Input 2 Enable	1: Enable the latch input 2. 0: Disable the latch input 2.
LTRG2n	Latch Input 2 Trigger Condition*2	0: One-shot Mode 1: Continuous Mode
LSEL2n	Latch Input 2 Trigger Selection*2	0: External input 1: Phase-Z input

*1. The setting is enabled when the Latch Input 1 Enable bit changes from 0 to 1.

*2. The setting is enabled when the Latch Input 2 Enable bit changes from 0 to 1.

Preset Command Value

The big configuration of the Preset Command Value parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PSVn (Chn Preset Command Value LL)							
+1	PSVn (Chn Preset Command Value LH)							
+2	PSVn (Chn Preset Command Value HL)							
+3	PSVn (Chn Preset Command Value HH)							

Abbr.	Data	Description
PSVn	Chn Preset Command Value	This contains the preset command value for channel n.

6-7-3 Axis Settings

Use the Incremental Encoder Input Unit as an encoder axis when you use the MC Function Module in an NJ/NX-series Controller.

For information on axis parameters and how to assign axis variables, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

6-8 Setting Methods

This section describes the setting methods for the Incremental Encoder Input Units.

You can use an Incremental Encoder Input Unit as an encoder axis input device if you also use the MC Function Module.

This section describes the settings for using an NJ/NX-series Controller and the MC Function Module to control Incremental Encoder Input Units.

For details on the functions of the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Precautions for Correct Use

To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units. Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

6-8-1 Building and Wiring the System

Incremental Encoder Input Units are mounted after an EtherCAT Coupler Unit to build an NX Unit Slave Terminal. The Slave Terminal is connected through EtherCAT communications.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to build NX Unit systems.

Refer to *6-5 Terminal Block Arrangement* on page 6-11 for information on wiring external devices to an Incremental Encoder Input Unit, such as encoders or external sensors for latching.

6-8-2 Counter Specifications

The functional specifications of the Incremental Encoder Input Unit are given below.

Function	Specifications
Counter range	80000000 to 7FFFFFFF hex
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction, or up and down pulses
Counting speed	Voltage input: 500 kHz Line receiver input: 4 MHz
Gate control (counter enabled/disabled)	Encoder counter operation command or external input
Resetting	Encoder counter operation command, external input, or phase-Z input
Preset	Encoder counter operation command
Latching	Encoder counter operation command, external input, or phase-Z input

6-8-3 Setting Examples

This section describes the minimum parameter settings that are required to use Incremental Encoder Input Units with the MC Function Module.

Refer to *6-9-1 Parameters* on page 6-46 for information on the parameters of the Incremental Encoder Input Units.

Counter Type Selection

Select the counting operation for the encoder with the Counter Type parameter. For this example, select a ring counter.

The default for the Incremental Encoder Input Unit is a ring counter, so do not change the setting.

Refer to *6-9-2 Counter Type* on page 6-47 for information on the counter types.

Maximum Counter Value and Minimum Counter Value Settings

Use the Maximum Counter Value and Minimum Counter Value parameters to set the counting range for the encoder.

The default range for the Incremental Encoder Input Unit is –2,147,483,648 to 2,147,483,647.

Leave these parameters at their default settings.

Refer to *Ring Counter* on page 6-48 for information on the maximum counter value and minimum counter value.

Precautions for Correct Use

To use an Incremental Encoder Input Unit with the MC Function Module, select a ring counter (default) for the Counter Type parameter. Also, leave the Maximum Counter Value and Minimum Counter Value parameters at their default settings for a range of −2,147,483,648 to 2,147,483,647. The MC Function Module may not perform control normally and unintended operations may occur if you change the default settings.

Pulse Input Method Selection

Set the Pulse Input Method parameter according to the output specifications of the connected encoder. There are three pulse input methods: phase differential pulse x2/4, pulse + direction inputs, or up and down pulses.

The default setting for the Incremental Encoder Input Unit is for a phase differential pulse multiplication x4.

Refer to *6-9-3 Pulse Input Method* on page 6-50 for information on selecting the pulse input method.

Encoder Count Direction Settings

Use the Encoder Count Direction parameter to specify how to increment and decrement the count value according to the rotational direction of the encoder.

The default setting for the Incremental Encoder Input Unit is a positive direction of phase A advancement.

Refer to *6-9-4 Encoder Count Direction* on page 6-53 for information on the encoder direction setting.

External Input Signal Settings

Set the External Input Function Selection and External Input Logic Selection parameters.

The NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142 each have three external inputs. The NX-EC0212 and NX-EC0222 do not have any external inputs.

The default settings for the above parameters are for a general input and N.O. (normally open), respectively.

Change the input function and input logic settings to use latching with the MC Function Module or in other cases.

Refer to *6-9-9 External Input Function Selection* on page 6-62 for information on external input signals.

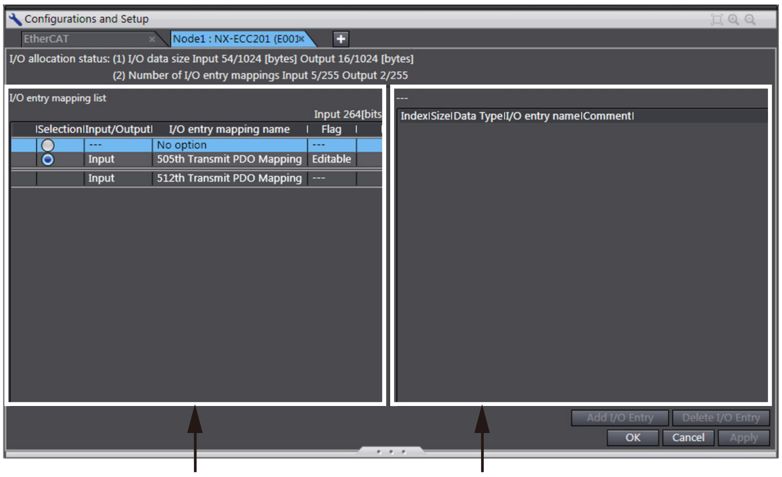
I/O Entry Mappings

This section describes I/O entry mapping to control encoder axes from the MC Function Module.

You must map the objects that are required for the motion control functions that you will use to process data communications.

The I/O entry mapping is a list of required objects that is prepared in advance.

You select the I/O entry mappings to use in the Edit I/O Allocation Settings area of the Slave Terminal Tab Page in the Sysmac Studio.



I/O entry mapping list

I/O entries

The following I/O entry mappings are selected by default in the Sysmac Studio.

RxPDO	Latch Input
TxPDO	Encoder Counter Status, Reset/External Input Status, Encoder Present Position, Latch Status, Latch Input 1 Data, and Latch Input 2 Data

Refer to *A-2 Object Lists* on page A-28 for details on each object.

Use the default Sysmac Studio I/O entry mappings to use the Incremental Encoder Input Unit with the MC Function Module.

Relationships between MC Function Module and Process Data

The functions of the MC Function Module are related to the information in the process data objects.

Use the Sysmac Studio defaults to use the Incremental Encoder Input Unit with the MC Function Module.

6-9 Functions

This section describes the types of counters, pulse input methods, encoder count direction, and other functions.

Precautions for Correct Use

Functions are restricted by the selected I/O refreshing method and Controller. Refer to *6-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 6-29 for details.

6-9-1 Parameters

The following table lists the parameters that are used in the Incremental Encoder Input Unit.

Parameter name	Function	Setting range	Unit	Default	Reference
External Input 0 Function Selection	External Input 0 Function Selection 0: General input 1: Latch input 1 2: Latch input 2 3: Gate input 4: Reset input	0 to 4	---	0	P. 6-62
External Input 1 Function Selection	External Input 1 Function Selection 0: General input 1: Latch input 1 2: Latch input 2 3: Gate input 4: Reset input	0 to 4	---	0	P. 6-62
External Input 2 Function Selection	External Input 2 Function Selection 0: General input 1: Latch input 1 2: Latch input 2 3: Gate input 4: Reset input	0 to 4	---	0	P. 6-62
External Input 0 Logic Selection	External Input 0 Logic Selection 0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 6-62
External Input 1 Logic Selection	External Input 1 Logic Selection 0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 6-62

Parameter name	Function	Setting range	Unit	Default	Reference
External Input 2 Logic Selection	External Input 2 Logic Selection 0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 6-62
Counter Type	0: Ring counter 1: Linear counter	0 or 1	---	0	P. 6-47
Maximum Counter Value	The maximum value of the counter.	1 to 2,147,483,647	Pulses	2,147,483,647	P. 6-48 P. 6-49
Minimum Counter Value	The minimum value of the counter.	–2,147,483,648 to 0	Pulses	–2,147,483,648	P. 6-48 P. 6-49
Pulse Input Method	0: Not Supported 1: Phase differential pulse x2 2: Phase differential pulse x4 3: Pulse + direction 4: Up and down pulses	1 to 4	---	2	P. 6-50
Encoder Count Direction	0: Positive direction of phase A 1: Positive direction of phase B	0 or 1	---	0	P. 6-53
Time Window	This is the time window for pulse rate measurement.	0 to 65,535	ms	0 *1	P. 6-64
Average Processing Times	This is the average processing times for pulse rate measurement.	0 to 100	Times	0 *2	P. 6-64
Edge Detection Method	This is the edge detection method for pulse period measurement. 0: Disable the function. 1: Measure every rising edge. 2: Measure every falling edge. 3: Measure every rising and falling edge.	0 to 3	---	0	P. 6-72

*1. Set this parameter to 0 to disable pulse rate measurement.

*2. Set this parameter to 0 to disable average processing.

6-9-2 Counter Type

You can use a counter as a ring counter or linear counter.

Use the Counter Type parameter to change the counter mode.

Parameter name	Setting	Default	Remarks
Counter Type	0: Ring counter 1: Linear counter	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Precautions for Correct Use

- When an Incremental Encoder Input Unit is used as an MC Function Module axis (encoder axis) and the counter type is set to a linear counter, counting for the encoder axis stops when the count value reaches the maximum or minimum value. At this point, the correct position of the encoder can no longer be obtained, so the position must not be used.
- Set the encoder type to a ring counter to use the encoder as an MC Function Module encoder axis.

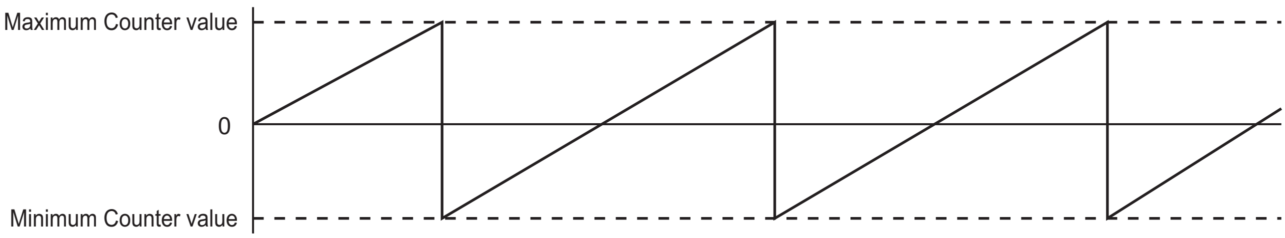
MC Function Module setting	Ring counter	Linear counter
Use as an axis.	Applicable	Do not use.
Do not use as an axis.	Applicable	Applicable

Ring Counter

This counter counts up and down between a maximum counter value and a minimum counter value. The following table shows the allowed range for the maximum and minimum counter values.

Parameter name	Setting	Default	Remarks
Maximum Counter Value	1 to 2,147,483,647 (00000001 to 7FFFFFFF hex)	2,147,483,647 (7FFFFFFF hex)	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted. The unit is pulses.
Minimum Counter Value	–2,147,483,648 to 0 (80000000 to 00000000 hex)	–2,147,483,648 (80000000 hex)	

If the counter value exceeds the maximum counter value, the counter value returns to the minimum counter value to continue the counting operation. If the counter value exceeds the minimum counter value, the counter value returns to the maximum counter value to continue the counting operation.



Precautions for Correct Use

To use the encoder as an MC Function Module axis, set the maximum counter value to 2,147,483,647 (7FFFFFFF hex) and set the minimum counter value to –2,147,483,648 (80000000 hex).

Linear Counter

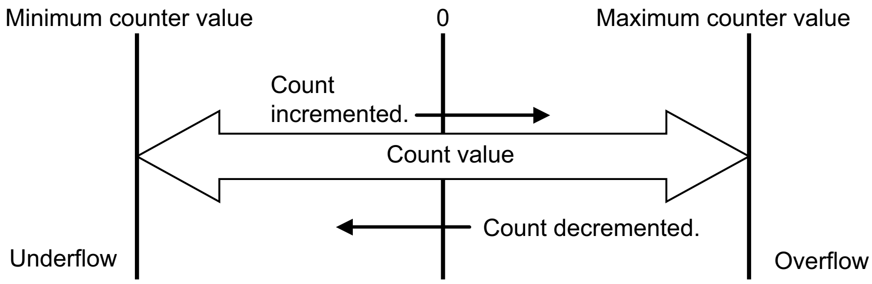
This counter counts up and down between a maximum counter value and a minimum counter value. The following table shows the allowed range for the maximum and minimum counter values.

Parameter name	Setting	Default	Remarks
Maximum Counter Value	1 to 2,147,483,647 (00000001 to 7FFFFFFF hex)	2,147,483,647 (7FFFFFFF hex)	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted. The unit is pulses.
Minimum Counter Value	–2,147,483,648 to 0 (80000000 to 00000000 hex)	–2,147,483,648 (80000000 hex)	

If the counter value exceeds the maximum counter value, the Counter Overflow Flag turns ON. If the counter falls below the minimum counter value, the Counter Underflow Flag turns ON.

You can preset or reset the Counter Overflow Flag and Counter Underflow Flag to clear them.

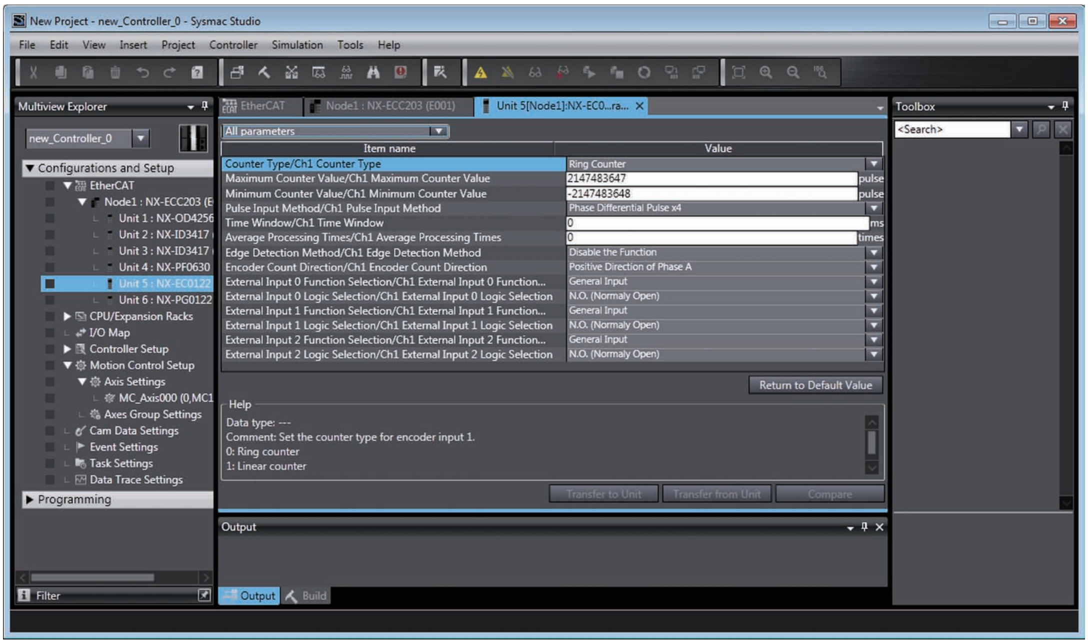
If the count value exceeds the maximum counter value or falls below the minimum counter value, the counter value will stay fixed at the maximum and minimum counter value. However, counting continues internally so the count value can be updated again if it falls back within the valid range.



Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Counter Type, Maximum Counter Value, and Minimum Counter Value.

6-9-3 Pulse Input Method

There are the following three pulse input methods for counters:

- Phase differential pulse input multiplication x2/4
- Pulse + direction inputs
- Up and down pulses

Use the Pulse Input Method parameter to change the input method.

Parameter name	Setting	Default	Remarks
Pulse Input Method	0: Not Supported 1: Phase differential pulse x2 2: Phase differential pulse x4 3: Pulse + direction 4: Up and down pulses	2	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Phase Differential Pulse Input Multiplication (x2/4)

There are two multiplications for the phase differential pulse inputs: x2 and x4.

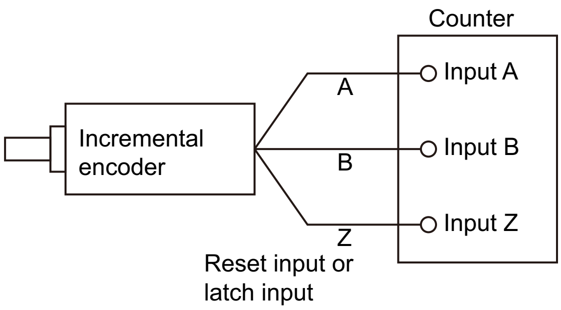
The default setting is for x4 multiplication.

Connect the phase-A and phase-B2 phase differential pulse inputs to inputs A and B on the encoder.

Connect the reset input or latch input to input Z.

Change the Encoder Count Direction parameter in the Unit operation settings to change the count direction.

Refer to *6-9-4 Encoder Count Direction* on page 6-53 for information on changing the count direction.



● x2 Multiplication

The counter operation is performed on the rising and falling edges of the phase-A signal.

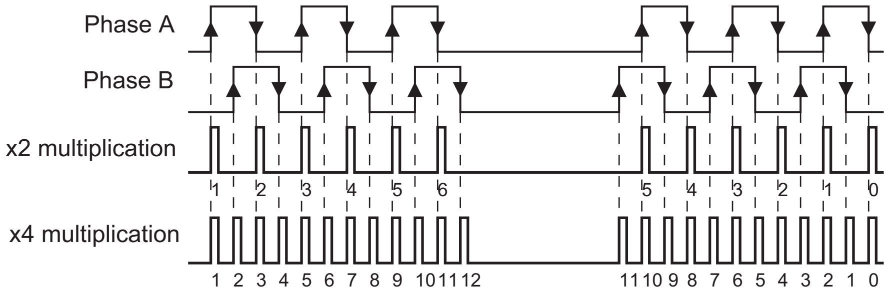
The count is incremented if phase A is advanced from phase B and decremented if phase A is delayed from phase B.

● x4 Multiplication

This setting is used to increase the resolution of encoder input compared with multiplication x2.

The counter operation is performed on the rising and falling edges of the phase-A and phase-B signals.

The count is incremented if phase A is advanced from phase B and decremented if phase A is delayed from phase B.



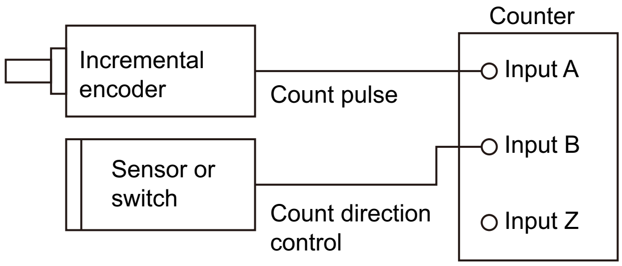
Pulse + Direction Inputs

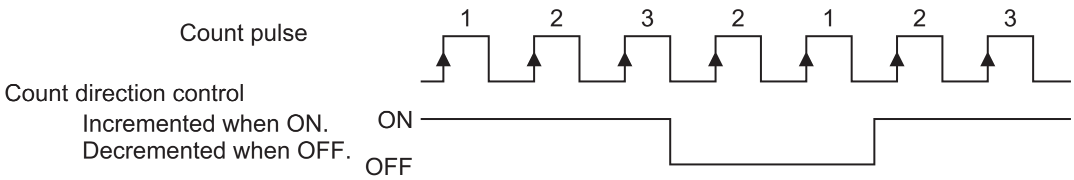
Input A is the count pulse input and input B is the count direction control input.

The count is incremented on the rising edge of the phase A when input B is ON and decremented on the rising edge of the phase A when input B is OFF.

Change the Encoder Count Direction parameter in the Unit operation settings to change the count direction.

Refer to *6-9-4 Encoder Count Direction* on page 6-53 for information on changing the count direction.



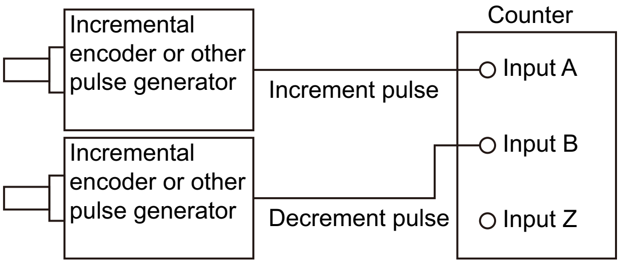


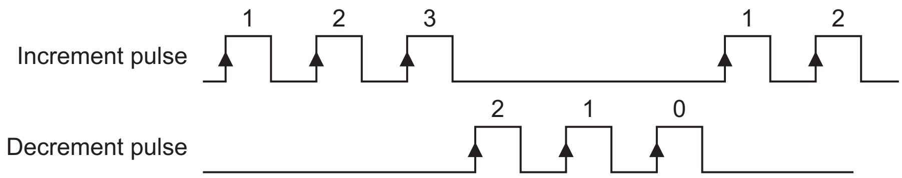
Up and Down Pulses

For up and down pulses, the count is incremented on the rising edge of the input A pulse and decremented on the rising edge of the input B pulse.

Change the Encoder Count Direction parameter in the Unit operation settings to change the count direction.

Refer to *6-9-4 Encoder Count Direction* on page 6-53 for information on changing the count direction.

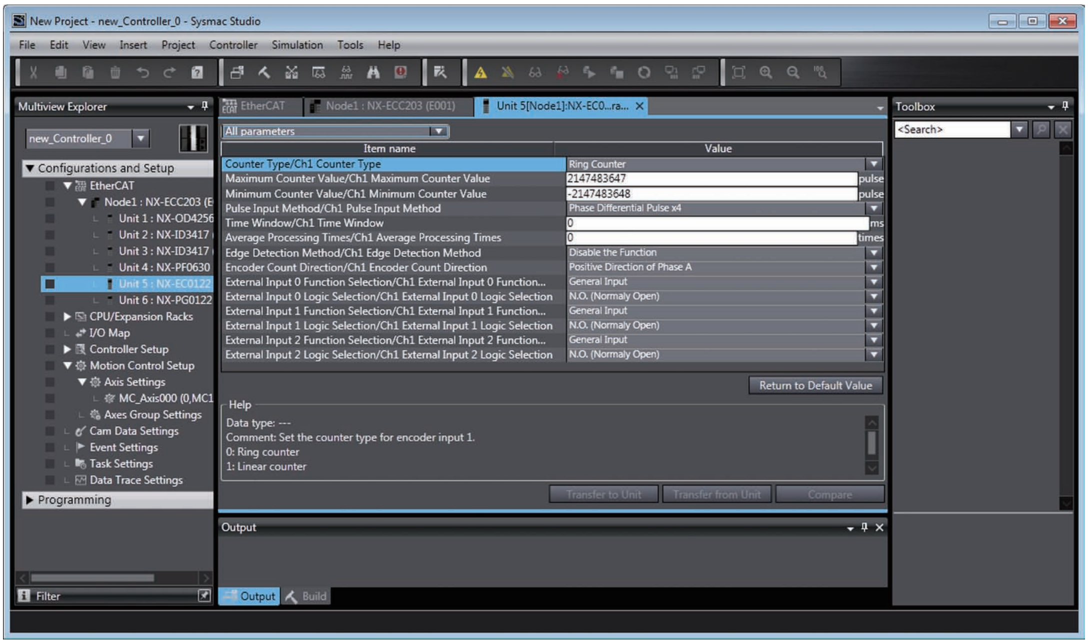




Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Pulse Input Method.

6-9-4 Encoder Count Direction

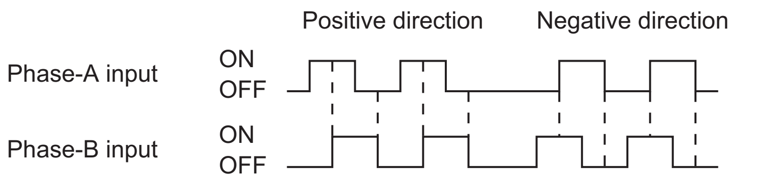
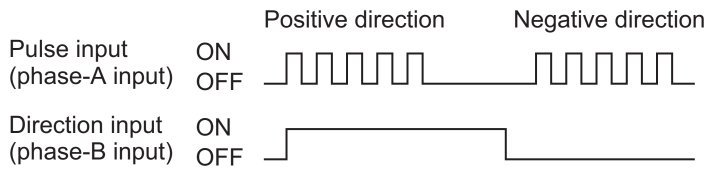
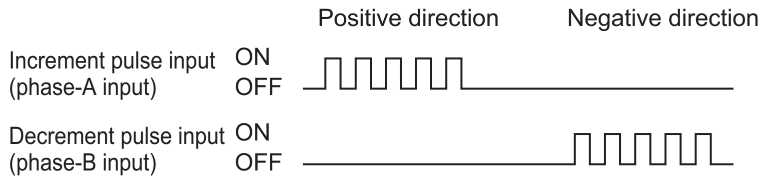
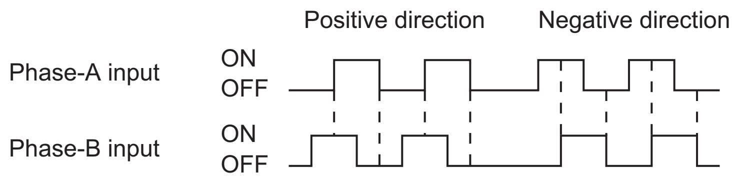
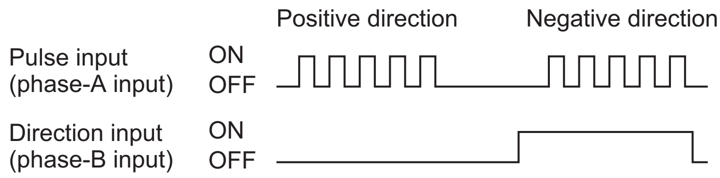
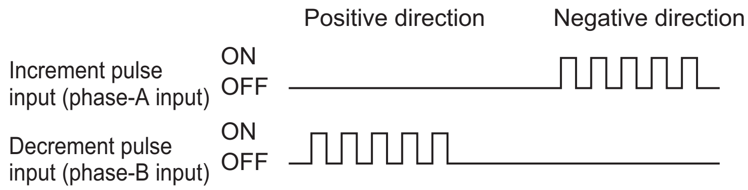
You can set the encoder direction for each counter.

Set the Encoder Count Direction parameter to change the encoder direction.

Parameter name	Setting	Default	Remarks
Encoder Count Direction	0: Positive direction of phase A 1: Positive direction of phase B	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Counter Operation

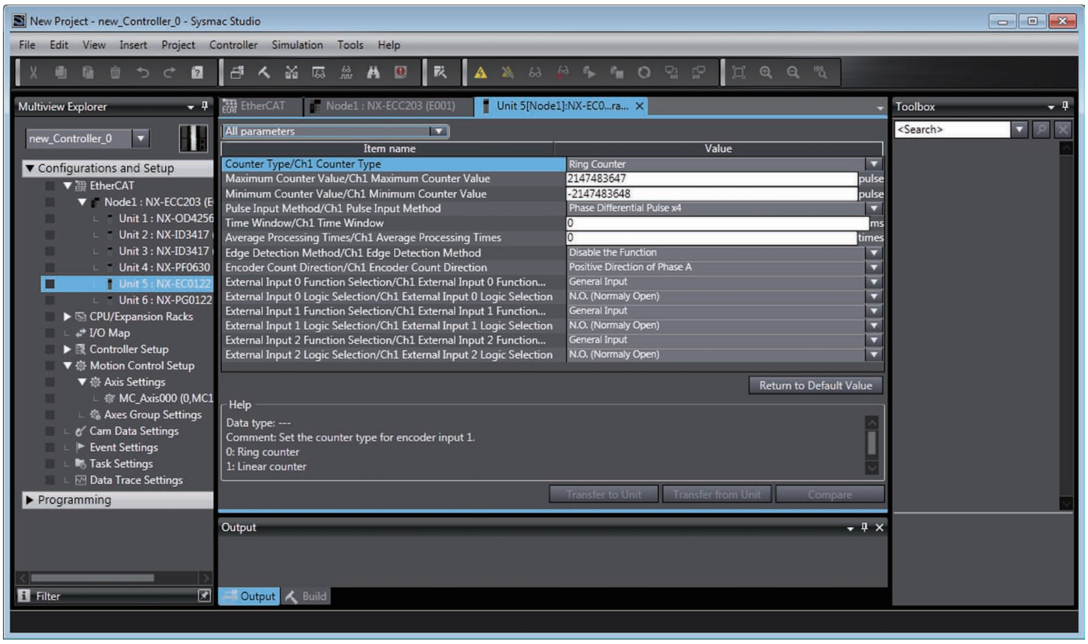
The following table shows the counter operation according to the pulse input method and encoder count direction.

Encoder direction setting	Input type	Counter Operation
Positive direction of phase A	Phase differential pulse x2/4	
	Pulse + direction inputs	
	Up and down pulses	
Positive direction of phase B	Phase differential pulse x2/4	
	Pulse + direction inputs	
Positive direction of phase B	Up and down pulses	

Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Encoder Counter Direction.

6-9-5 Gate Control

You can specify gate control for each counter.

Gate control is used to perform counting when the gate is open and stop counting when the gate is closed.

Encoder counter operation commands, including gate control, cannot be allocated as I/O data. Therefore, the default setting leaves the gate open (counting is enabled).

Refer to *Encoder Counter Operation Command* on page 6-40 for information on enabling the counter.

Precautions for Correct Use

Always set the gate to open to use an Incremental Encoder Unit assigned to an MC Function Module axis variable.

Therefore, you cannot perform gate control through encoder counter operation commands or external inputs when you use an Incremental Encoder Unit with the MC Function Module.

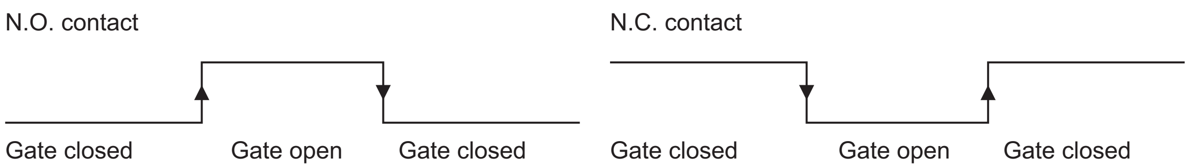
External Inputs

Set the I0, I1, or I2 external input as a gate input to enable or disable the counter through that external input.

When the gate is open, the counter will count the pulses. When the gate is closed, the counter does not count any pulses.

If you set the External Input Logic Selection parameter to specify an N.O. contact, the gate will be open when the external input signal is ON.

If you set the External Input Logic Selection parameter to specify an N.C. contact, the gate will be open when the external input signal is OFF.



Precautions for Correct Use

If you set an external input to a gate input, the response time from the gate input until the gate opens or closes is 250 μs maximum.

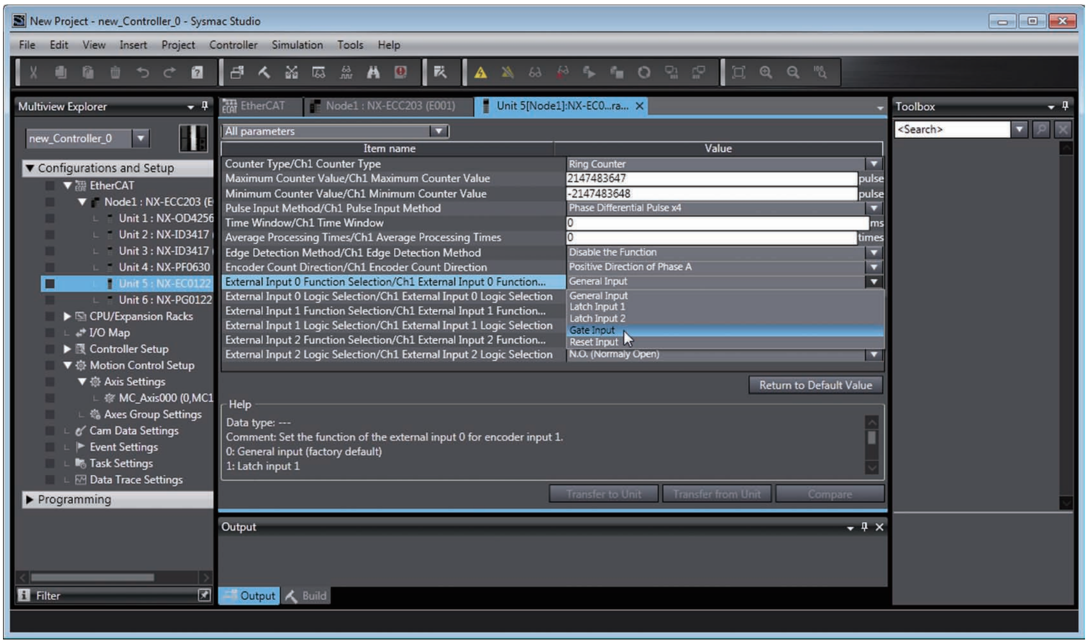
Additional Information

The NX-EC0212 and NX-EC0222 do not have any external inputs.

Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the External Input 0 Function Selection, External Input 1 Function Selection, or External Input 2 Function Selection to a gate input.

Also set the logic for the external input you selected.

Additional Information

The NX-EC0212 and NX-EC0222 do not have any external inputs.

6-9-6 Counter Reset

You can reset the counter value for each counter.

There are the following three reset methods:

- Reset for internal reset
- Reset for external input
- Reset for phase-Z input

Internal Reset Execution

Change the Internal Reset Execution bit in the Encoder Counter Operation Command parameter from 0 to 1 to reset the counter to 0.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the Internal Reset Execution bit.

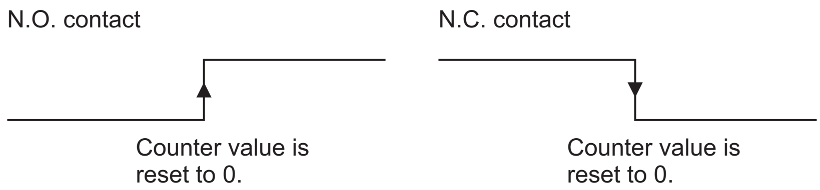
External Inputs

If you set the External Input Logic Selection parameter for the external input to specify an N.O. contact, the counter will reset to 0 on the rising edge of the external input.

If you set the External Input Logic Selection parameter for the external input to specify an N.C. contact, the counter will reset to 0 on the falling edge of the external input.

To enable resetting, set the External Reset Enable bit of the Encoder Counter Operation Command parameter to 1.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the External Reset Enable bit.



Precautions for Correct Use

If you reset a counter with an external input or the phase-Z input, a delay of up to 250 µs will occur between the input and reset processing. The reset completed flag will turn ON the first time input data is refreshed after processing is completed.

Additional Information

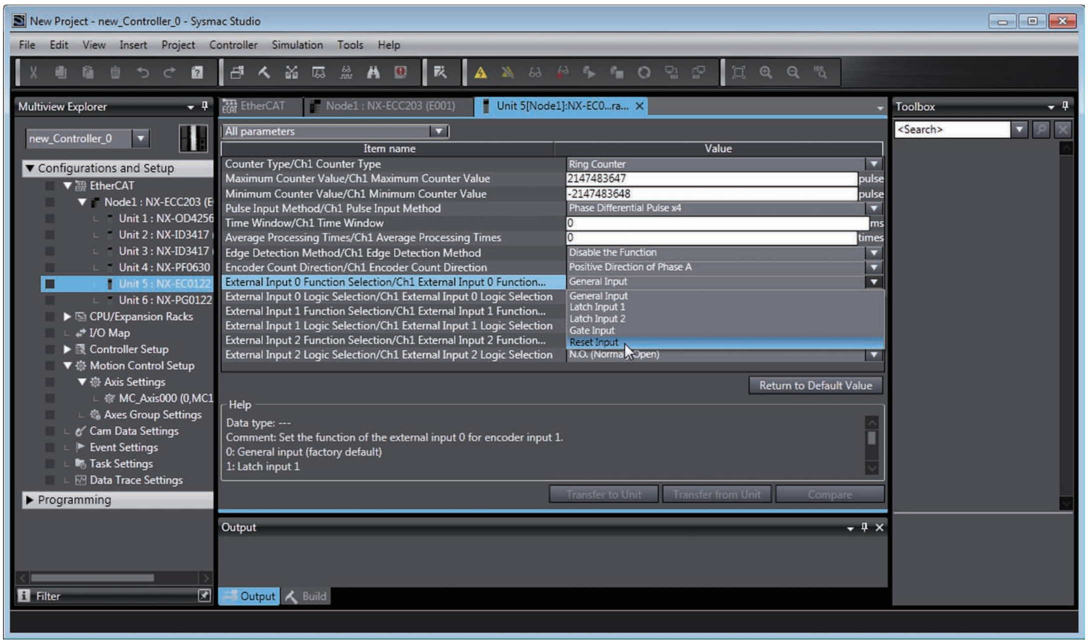
The NX-EC0212 and NX-EC0222 do not have any external inputs.

● Setting with the Sysmac Studio

Use the following procedure to perform a reset via external input.

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the External Input 0 Function Selection, External Input 1 Function Selection, or External Input 2 Function Selection to a reset input.

Also set the logic for the external input you selected.

Phase-Z Input

The counter is reset to 0 on the rising edge of the phase-Z input.

To enable resetting, set the Phase Z Reset Enable bit of the Encoder Counter Operation Command parameter to 1.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the Phase Z Reset Enable bit.

Clearing the Reset Completed Flag

When the Unit is reset with an external input or phase-Z input, the Phase Z Reset Completed Flag or External Reset Completed Flag turns ON. When you change the Phase Z Reset Completed Flag Clear bit or External Reset Completed Flag Clear Flag from 0 to 1, the Phase Z Reset Completed Flag or External Reset Completed Flag is cleared and resetting is enabled for the next external input or phase-Z input.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the Phase Z Reset Completed Flag and External Reset Completed Flag.

Precautions for Correct Use

Wait at least 1 ms after the reset completed flag turns ON before you clear it.

6-9-7 Counter Preset

You can preset a value in the Preset Command Value parameter for each channel and change the Preset Execution bit in the Encoder Counter Operation Command parameter from 0 to 1 to preset the counter value.

When this is performed, the counter value is overwritten with the value in the Preset Command Value parameter.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the Preset Execution bit.

If the Preset Command Value parameter is allocated in the output area, enter the command value directly in that area.

If the Preset Command Value parameter is not allocated in the output area, use message communications to write the value to the Unit. If the Preset Command Value parameter is not allocated in the output area, the default for it is 0.

Refer to *Preset Command Value* on page 6-42 for details on the Preset Command Value parameter.

If you set a value for the Preset Command Value that is outside of the valid counter value range and attempt to preset the counter to that value, the value of the counter will not change and the Preset Command Value Invalid Flag in the Encoder Counter Status parameter will change to 1. To reset the Preset Command Value Invalid Flag to 0, set a value that is within the valid counter value range in the Preset Command Value parameter and preset the counter again or reset the counter.

6-9-8 Latching

You can latch the counter value for each counter.

There are the following two latch methods:

- Latching with the Internal Latch Execution bit
- Latching with an external input

Latching with the Internal Latch Execution Bit

Change the Internal Latch Execution bit in the Encoder Counter Operation Command parameter from 0 to 1 to latch the counter. You can allocate the latch data in an I/O data input area.

Refer to *Encoder Counter Operation Command* on page 6-40 for information on the Internal Latch Execution bit.

Latching with an External Input

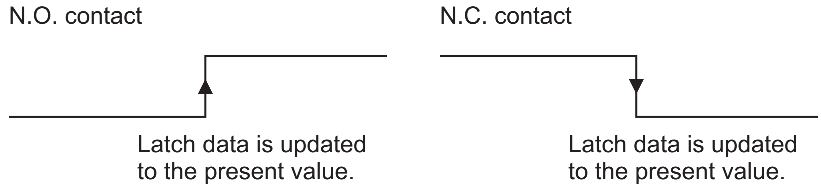
You can select the external input latch trigger from the external inputs (I0, I1, and I2) and the encoder's phase-Z signal.

Latching with an external input (I0, I1, or I2) is supported only by the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

Refer to *Latch Function* on page 6-41 for information on latching for an external input.

Refer to *6-9-9 External Input Function Selection* on page 6-62 for information on the external inputs (I0, I1, and I2).

When you set the External Input Logic Selection parameter for the external input (I0, I1, or I2) to specify an N.O. contact, the counter is latched on the rising edge of the selected external input. When you set the External Input Logic Selection parameter for the external input to specify an N.C. contact, the counter is latched on the falling edge of the external input. The latch value is updated every time the counter value is latched.



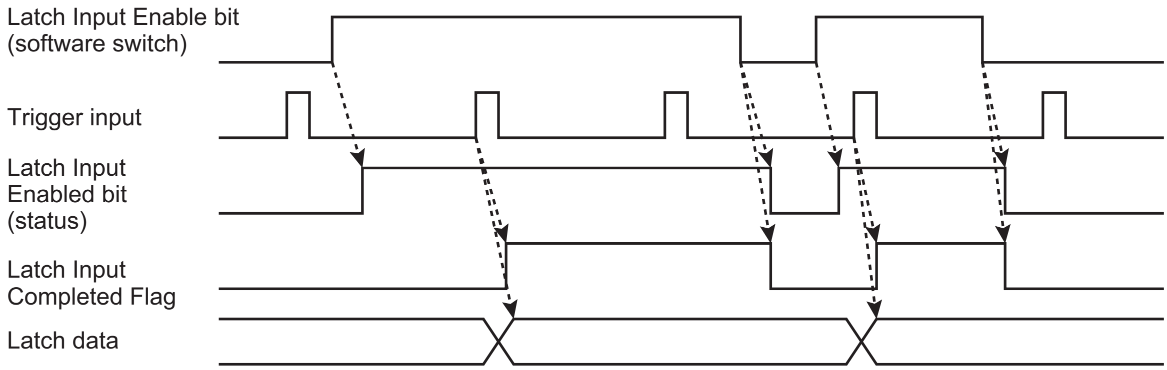
You can assign up to two external inputs as latch inputs, each with an I/O data input area allocation.

● Trigger Conditions

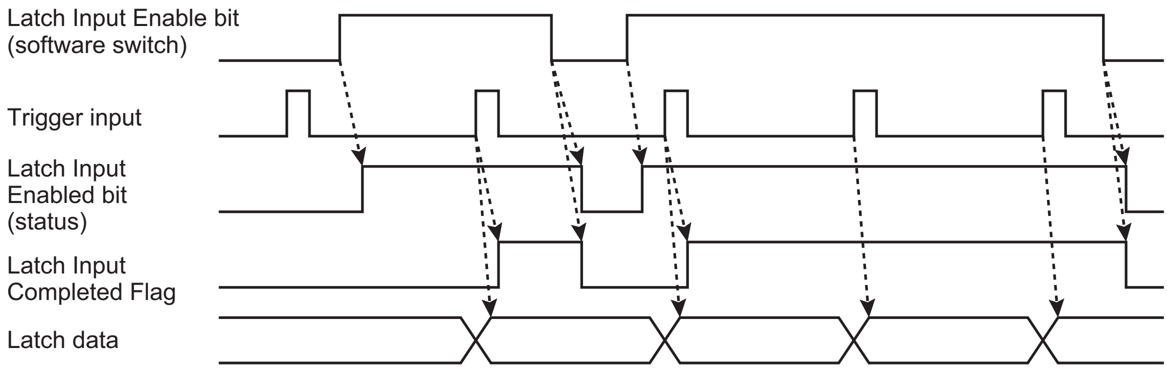
There are the following two input trigger conditions for latching:

Input trigger condition	Description
One-shot Mode	After you change Latch Input 1 Enable or Latch Input 2 Enable bit from 0 to 1, the present position of the encoder is latched for the first detected latch input. No more latching is performed for this latch input until you change the Latch Input 1 Enable or Latch Input 2 Enable bit to 0 and then back to 1 again.
Continuous Mode	While the Latch Input 1 Enable or Latch Input 2 Enable bit is 1, the present position of the encoder is latched and the latch value is updated every time a latch input is detected.

The following timing chart shows the operation in One-shot Mode.



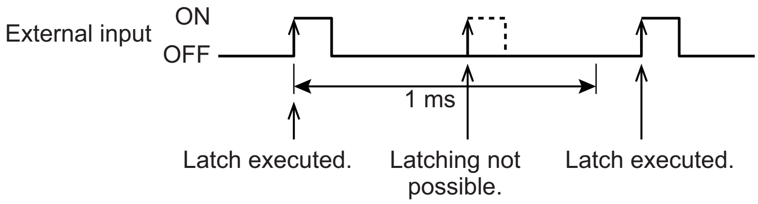
The following timing chart shows the operation in Continuous Mode.



Precautions for Correct Use

Restrictions in Continuous Mode

- When you perform latching with an external input, a latch cannot be detected for 1 ms after the previous latch was detected, even when the latch input is enabled.



Restrictions on Latch Inputs, Resetting, and Counter Presetting

- Do not use a latch input that uses an external input at the same time as a reset (i.e., a phase-Z reset, a reset with an external input, or an internal reset). If you do, the value of the latch data is unpredictable.
- Also, do not use a counter preset at the same time as a latch input that uses an external input. If you do, the value of the latch data is unpredictable.
- A delay of up to 250 µs will occur between when the latch input is received and when the latch data is processed. The latch data and latch completed flags will turn ON the first time input data is refreshed after processing is completed.

● Clearing the External Latch Input Completed Flag

When the latch input is enabled and a trigger input occurs for an external input, the Latch Input 1 Completed or Latch Input 2 Completed Flag turns ON. Change the Latch Input 1 Enable or Latch 2 Enable bit from 1 to 0 to reset the Latch Input 1 Completed or Latch Input 2 Completed Flag.

Then, when the latch input is enabled and a trigger input occurs for an external input, the Latch Input 1 Completed or Latch Input 2 Completed Flag will turn ON again.

Refer to *Latch Status* on page 6-38 for information on the Latch Input Completed Flag and *Latch Function* on page 6-41 for information on the Latch Input Enable bit.

6-9-9 External Input Function Selection

The NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142 each have three external inputs: I0, I1, and I2. You can use these inputs for general input, gate, reset, or latch inputs.

You can check the input status in the Reset/External Input Status parameter.

Refer to *Reset/External Input Status* on page 6-37 for information on the external input status.

<table>
<tr><th>Parameter name</th><th>Setting</th><th>Default</th><th>Remarks</th></tr>
<tr><td>External Input 0 Logic Selection</td><td>External Input 0 Logic Selection
0: N.O. (Normally open)
1: N.C. (Normally close)</td><td rowspan="3">0</td><td rowspan="3">Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.</td></tr>
<tr><td>External Input 1 Logic Selection</td><td>External Input 1 Logic Selection
0: N.O. (Normally open)
1: N.C. (Normally close)</td></tr>
<tr><td>External Input 2 Logic Selection</td><td>External Input 2 Logic Selection
0: N.O. (Normally open)
1: N.C. (Normally close)</td></tr>
<tr><td>External Input 0 Function Selection</td><td>External Input 0 Function Selection
0: General input
1: Latch input 1
2: Latch input 2
3: Gate input
4: Reset input</td><td rowspan="3">0</td><td rowspan="3">• Except for the general input setting, you cannot set more than one of the external inputs I0 through I2 to the same setting. If the same setting is used for more than one external input, all external inputs I0 through I2 are disabled and an External Input Setting Error event will occur.
• Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.</td></tr>
<tr><td>External Input 1 Function Selection</td><td>External Input 1 Function Selection
0: General input
1: Latch input 1
2: Latch input 2
3: Gate input
4: Reset input</td></tr>
<tr><td>External Input 2 Function Selection</td><td>External Input 2 Function Selection
0: General input
1: Latch input 1
2: Latch input 2
3: Gate input
4: Reset input</td></tr>
</table>

You can set up to two external inputs as latch inputs, but you can designate only one external input as a gate or reset external input. For example, you can use external inputs 0 and 1 both as latch inputs. However, you cannot use external inputs 0 and 1 both as reset inputs.

However, you cannot set both external inputs 0 or 1 to the same latch input, i.e., Latch input 1 or Latch input 2. Make sure they are set to different latch inputs.

The NX-EC0212 and NX-EC0222 do not have external inputs.

Additional Information

You can use the Z phase at the same time for latch input 1, latch input 2, and the reset.

If you use it for both a latch input and the reset, the latch input and reset are input simultaneously. In this case, the reset is performed first and then the value is latched.

Digital Filtering of External Inputs

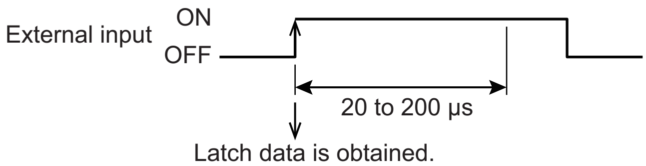
To use an external input as a gate input, latch input (1 or 2), or reset input, digital filtering is performed for 20 to 200 µs when the external input turns ON (i.e., when the internal logic is TRUE after applying the selected logic).

The input latch itself is a hardware latch on the first edge, so any data variation results from the characteristics of the hardware input. However, software processing is applied to the data confirmation processing that is performed after that. Therefore, you must set a signal width of at least 200 µs for external inputs.

For latch and reset operations, digital filtering is determined according to the input that is detected up to 200 µs after the present position input was detected.

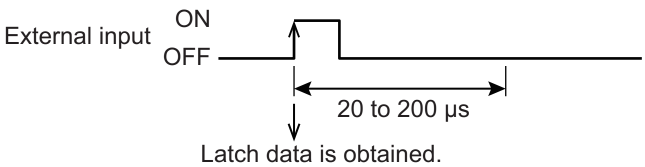
● Signal Width Greater Than 200 µs

If the signal width is greater than 200 µs, the input is detected when it turns ON and the input is valid. Therefore, processing is based on the obtained latch data.



● Signal Width Less Than the Detected Width

If the signal width is less than the detected width, the input is not detected when it turns ON and the input is not valid. Therefore, the obtained latch data is discarded and no processing is performed.



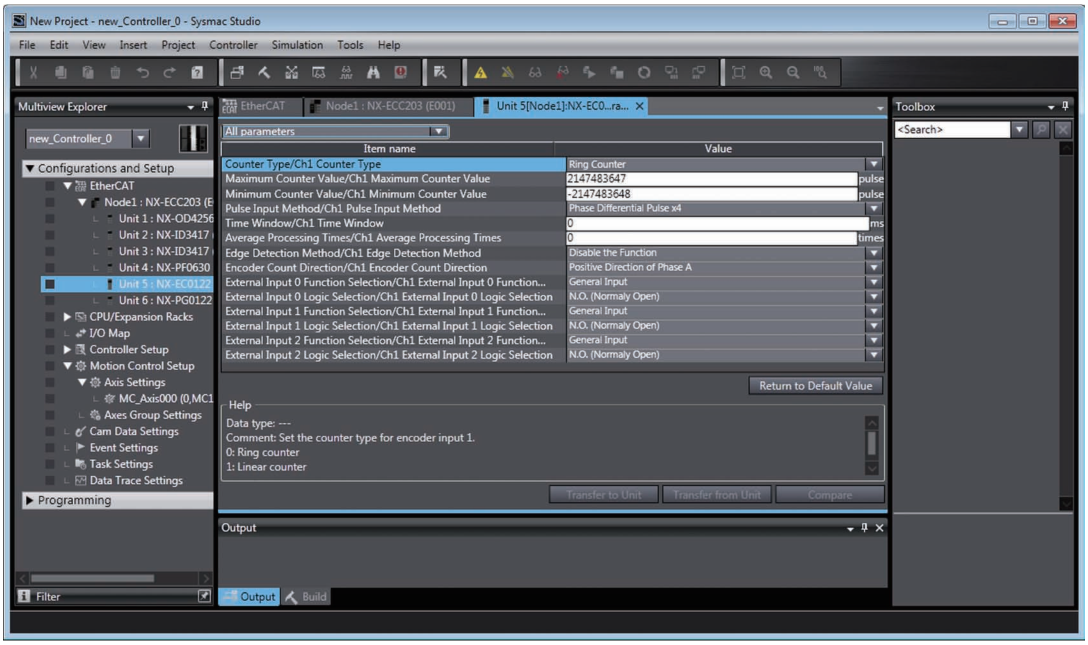
Precautions for Correct Use

Digital filtering is performed for 20 to 200 µs for external inputs. Therefore signals with signal widths of less than 200 µs may not be detected. If you use a sensor with a short response time, set an OFF delay timer for the output from the sensor or use another method to ensure a signal width of at least 200 µs for the external input.

Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the parameters.

6-9-10 Pulse Rate Measurement

You can measure the number of input pulses in the specified time window for each counter.

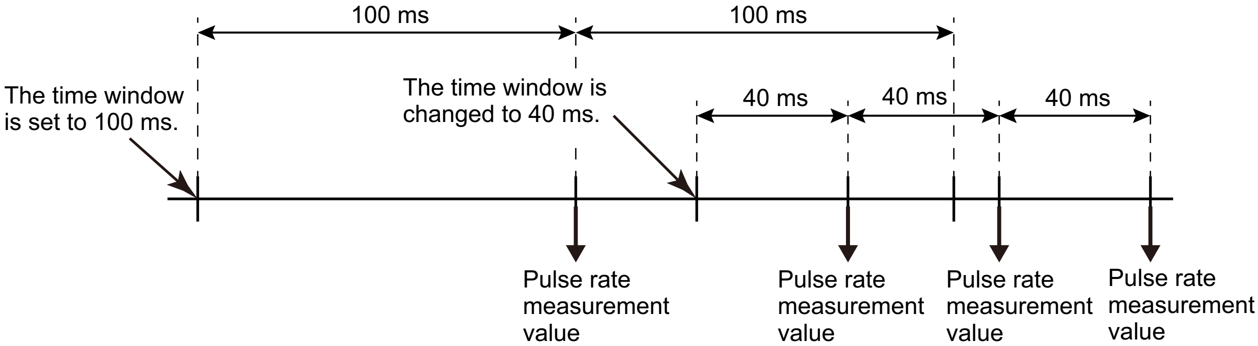
You can use this information to calculate the pulse frequency and rotation rate in the user program.

Parameter name	Setting	Default	Remarks
Time Window	0 to 65,535 (ms) The setting unit is milli-seconds.	0 *1	You can change the value of this parameter at any time.
Average Processing Times	0 to 100 times	0 *2	

*1. Pulse rate measurement is disabled (0) by default.

*2. Average processing is disabled (0) by default.

The time window for pulse rate measurement starts from the set value that is written and it starts when the set value is written.



Precautions for Correct Use

The time that is set for the time window for pulse rate measurement varies within a range of ±250 μs. The range of variation is constant. It does not depend on the value set for the time window.

To reduce the variation, set the average processing times and perform moving average processing.

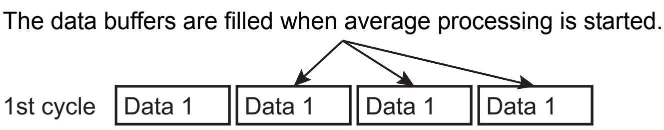
Additional Information

The time window is not synchronized when the NX bus I/O is refreshed.

When refreshing is performed for the NX bus I/O, the pulse rate measurement value that was measured in the most recent time window is returned.

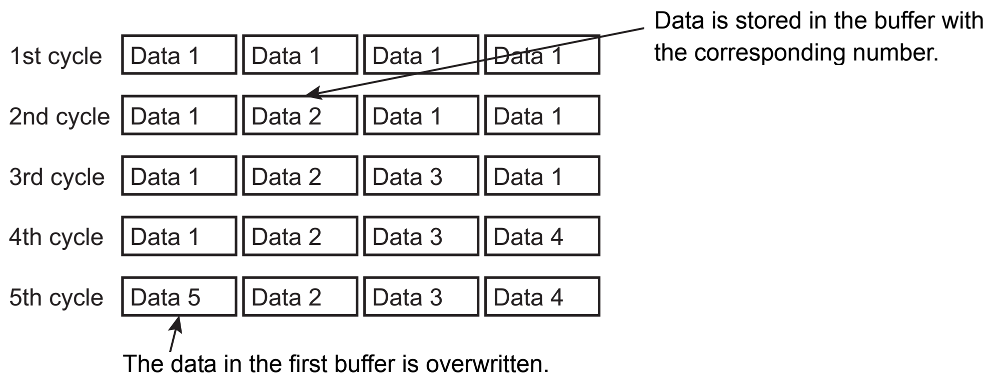
Average processing for the average processing times also starts from the set value that is written and it starts when the set value is written.

When processing begins, the data that is obtained at that point is used to fill the average processing times buffers.



Data is stored in the corresponding buffer from the 2nd cycle onward and the average value is calculated. When the buffers are full, the buffer with the oldest data is overwritten with the latest data.

If a new value is written to the Average Processing Times parameter during an average processing operation, the average processing data up to that point is discarded and average processing is started again from the time when the set value is written.


Data is stored in the buffer with the corresponding number.
1st cycle
Data 1
Data 1
Data 1
Data 1
2nd cycle
Data 1
Data 2
Data 1
Data 1
3rd cycle
Data 1
Data 2
Data 3
Data 1
4th cycle
Data 1
Data 2
Data 3
Data 4
5th cycle
Data 5
Data 2
Data 3
Data 4
The data in the first buffer is overwritten.

Measuring the Frequency

You can use the pulse rate value that is read in the user program to calculate the pulse frequency.

Use the following formula to calculate the input pulse frequency.

$$\text{Frequency (kHz)} = \frac{\text{Pulse rate value}}{\text{Time window (ms)}}$$

The time window is set in milliseconds. The unit of the frequency that is found with the above formula is in kHz. Convert the value to the required unit.

Measuring the Rotation Rate

You can use the pulse rate value that was read in the user program to calculate the rotation rate (r/min).

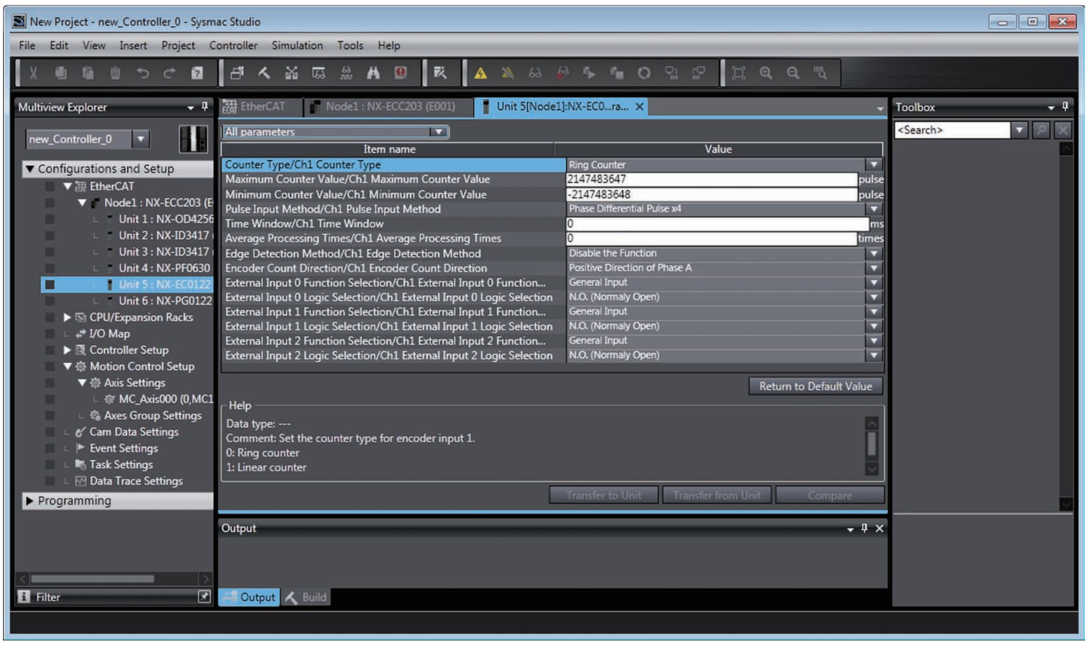
The rotation rate is the number of motor rotations per minute. Use the following formula to calculate the rotation rate.

$$\text{Rotation rate (r/min)} = \frac{\text{Pulse rate value}}{\text{Encoder resolution (pulses/rotation)}} \times \frac{60{,}000}{\text{Time window (ms)}}$$

Setting with the Sysmac Studio

1 Double-click the Incremental Encoder Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Time Window and Average Processing Times.

Sample Programming

This section provides two ladder diagram examples. One does not assign the pulse rate value to a PDO and reads the value from the Unit every time. The other assigns the pulse rate value to a PDO.

● Reading the Pulse Rate Value from the Unit Each Time

Use the following procedure.

1 Starting and Reading the Pulse Rate Value

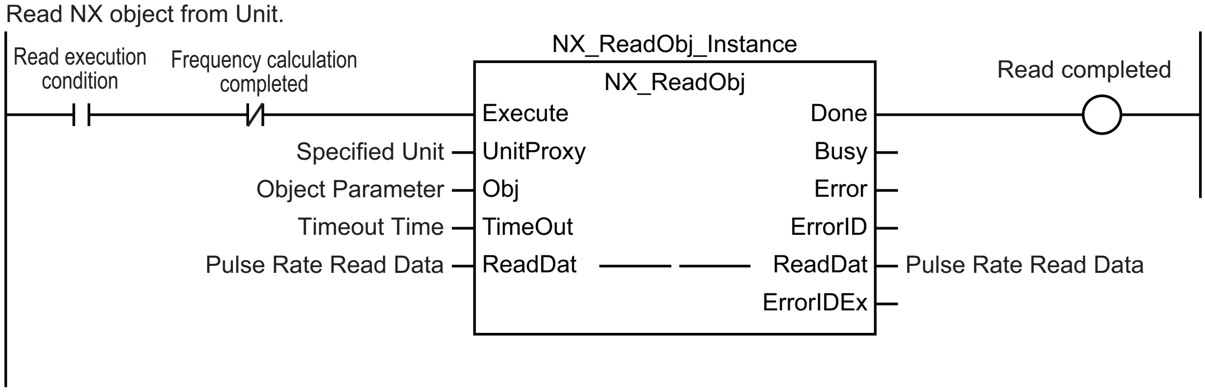
Change the read execution condition to TRUE and use the Read NX Unit Object instruction to read the pulse rate value from the target Unit.

2 Processing the Data

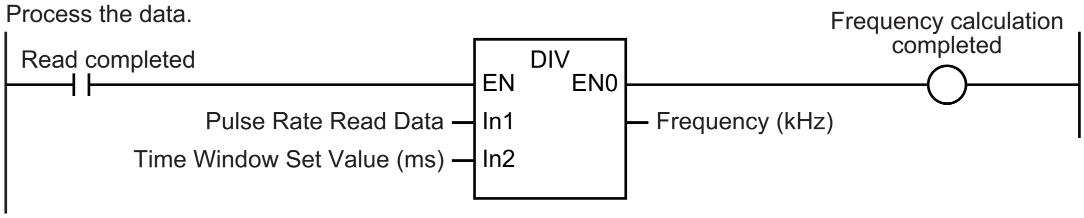
When the read is completed (i.e., Done in the Read NX Unit Object instruction), calculate the data from the pulse rate value that was read in step 1.

In this example, we will calculate the frequency.

Read NX object from Unit.



Process the data.



In this example, the time window set value (unit: ms) in the Incremental Encoder Input Unit is used as it is in the frequency calculation. The unit of the calculated frequency is therefore kHz.

The value that is automatically set for the target Unit when the variable is assigned in the Sysmac Studio is used for the Specified Unit input variable to the Read NX Unit Object instruction (NX_ReadObj).

The Object Parameter (Obj) is a structure with the following data type.

Variable	Name	Description	Data type	Valid range	Unit	Default
Obj	Object Parameter	Object parameters.	_sNXOBJ_ACCESS	---	---	---
Index	Index	Index.	UINT	Depends on data type.	---	0
Subindex	Subindex	Subindex.	USINT			

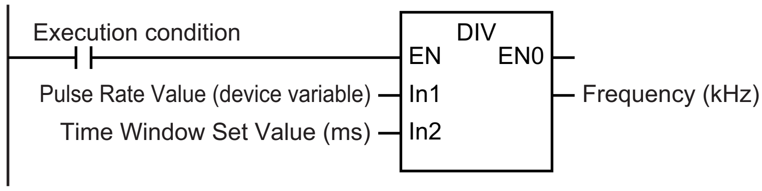
To read the pulse rate of the Incremental Encoder Input Unit, set the index to UINT#16#6003 and set the subindex to USINT#1 for the pulse rate for channel 1 and to USINT#2 for the pulse rate for channel 2.

Only the items that are necessary to read the frequency are given for the execution condition for the Read NX Unit Object instruction. For details on the variables, using the variables, and the Read NX Unit Object instruction, refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502).

● Allocating the Pulse Rate to a PDO

In this example, you can change the execution condition to TRUE to calculate the data for the pulse rate value that has been allocated to a device variable. In this example, we will calculate the frequency.

Process the data.



6-9-11 Pulse Period Measurement

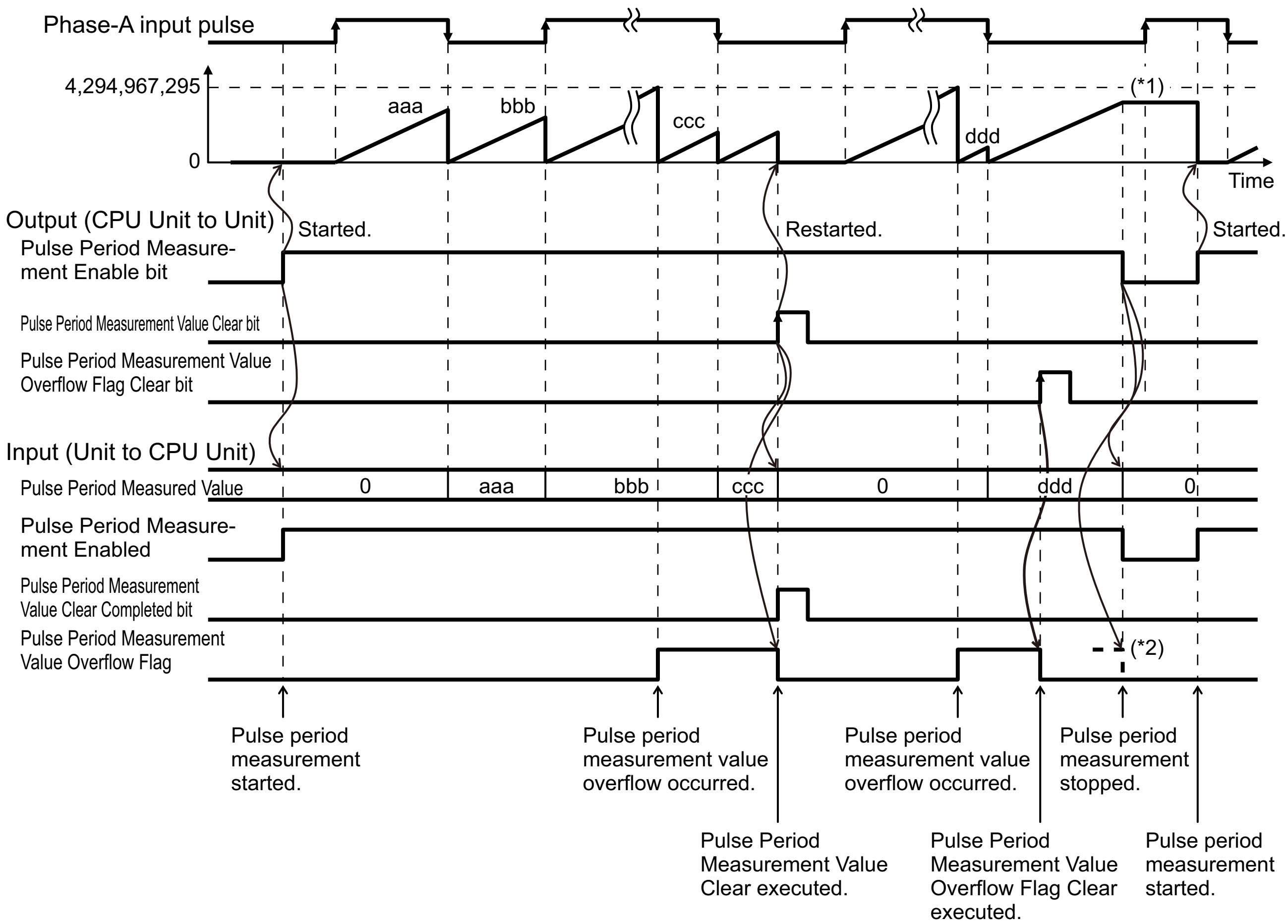
You can measure the period between the rising edges or falling edges of the input pulse.

For phase-A input pulses, the rate of change of the specified edge is measured and the most recent measurement result for the latest NX bus I/O refresh is returned.

This measurement is not performed in sync with the NX bus synchronization cycle.

Item	Specifications	Remarks
Measurement target	Phase-A input pulse	Measures the pulse frequency according to the specifications listed in the column to the left, regardless of the pulse input method, counting direction, or multiplier.
Detection method	• Between rising edges • Between falling edges • Between both edges	
Measurable range	1 to 4,294,967,295 (× 100 ns) (100 ns to 429.4967295 s)	The data type is UDINT. However, frequency measurements that exceed the maximum response frequency may not be accurate. If the maximum measurable value is exceeded, the value returns to zero.
Measurement resolution (minimum measurement unit)	100 ns	Times below 100 ns are rounded up.

● Example Operation for Measuring Both Edges



*1. The pulse period measurement counter retains the most recent value while the function is disabled.

*2. The operation is reset if the Overflow Flag is ON when the function is disabled.

If pulse period measurement is enabled, measurement of the period measurement value is started from the first detected edge.

After measurement is started, the period measurement value is updated every time a target edge is detected.

The internal Unit counter for the pulse period measured value is a ring counter. When the upper limit value for the counter (2,147,483,647) is reached, an overflow flag is set and the count value returns to 0 before its counting is continued.

If pulse period measurement is disabled when the power is turned ON or when the Unit is restarted, the pulse period measured value will be 0.

Setting Flags and Parameters

The following three bits are used to control pulse period measurement

Refer to *Pulse Period Measurement Function* on page 6-41 for information on the bit configuration of the Pulse Period Measurement Function parameter.

Flag name	Function	Operation
Pulse Period Measurement Enable	Enables or disables pulse period measurement. *1 0: Disable 1: Enable	When Enabled (0 to 1) • The Pulse Period Measurement Enabled bit is set. • The Pulse Period Measured Value is reset to 0. • The Pulse Period Measurement Value Overflow Flag is reset. When Disabled (0) • The Pulse Period Measurement Enabled bit is reset. • The Pulse Period Measured Value is set to 0. • The Pulse Period Measurement Value Overflow Flag is reset.
Pulse Period Measurement Value Clear	Clears the Pulse Period Measured Value. 0 to 1: Value cleared. *2	When Enabled (0 to 1) • The Pulse Period Measured Value is reset to 0. • The Pulse Period Measurement Value Overflow Flag is reset. • When the above processing is completed, the Pulse Period Measurement Value Clear Completed bit is set. *3
Pulse Period Measurement Value Overflow Flag Clear	Resets the Pulse Period Measurement Value Overflow Flag. 0 to 1: Flag reset.*2	When Enabled (0 to 1) • The Pulse Period Measurement Value Overflow Flag is reset.

*1. If the Edge Detection Method parameter is set to disable (0) pulse period measurement, the function is disabled regardless of the setting of this bit.

*2. This bit is valid when the Pulse Period Measurement Function is enabled.

*3. Reset this bit to reset the Pulse Period Measurement Value Clear Completed bit.

The parameter that is used to set up pulse period measurement is given in the following table.

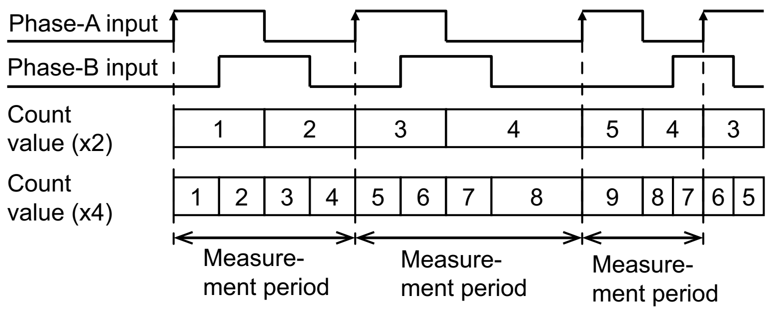
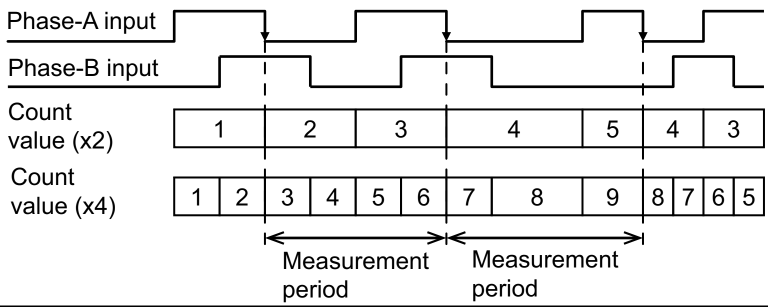
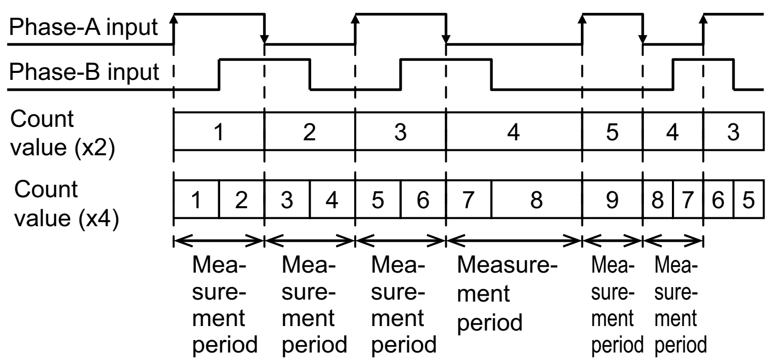
Parameter name	Setting	Default	Remarks
Edge Detection Method	0: Disable the function. 1: Measure every rising edge. 2: Measure every falling edge. 3: Measure every rising and falling edge.	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Edge Detection Method by Input Type

This section describes the edge detection methods based on the differences between the input types: phase differential pulse input multiplication x2/4, pulse + direction inputs, and up and down pulses.

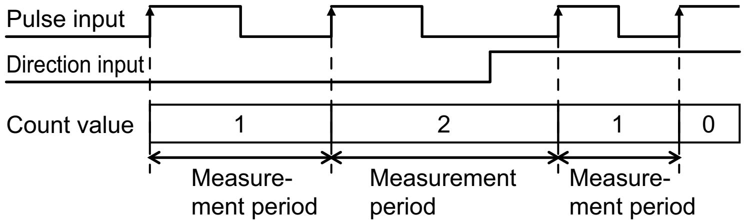
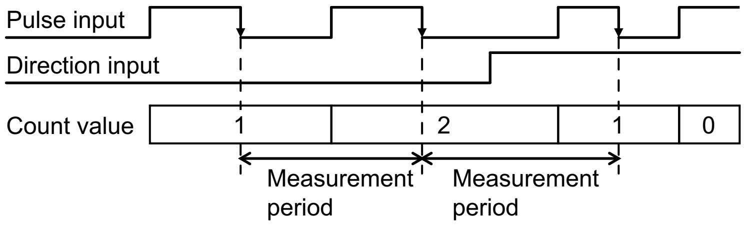
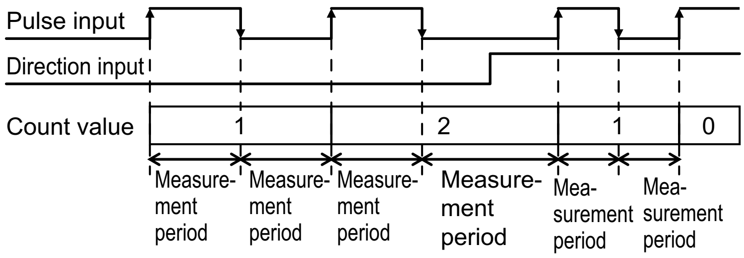
● Phase Differential Input (Multiplication x2/4)

The period between phase-A input edges is measured regardless of the multiplier and count direction settings.

Edge detection method	Measurement period
Measure every rising edge	
Measure every falling edge	
Measure every rising and falling edge	

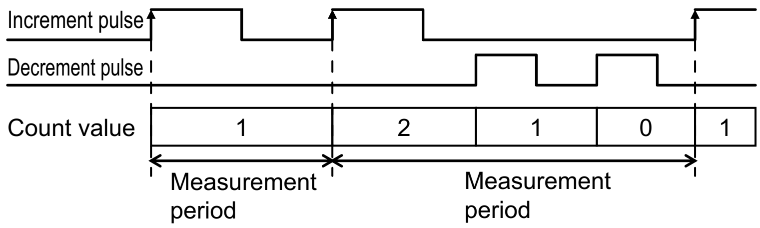
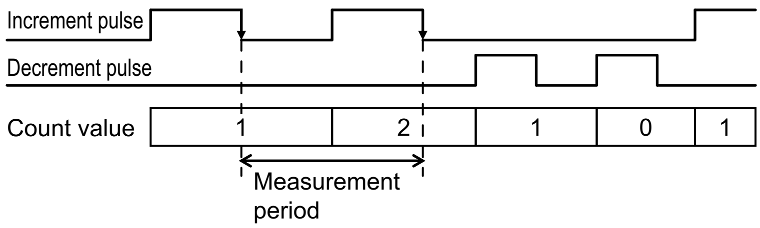
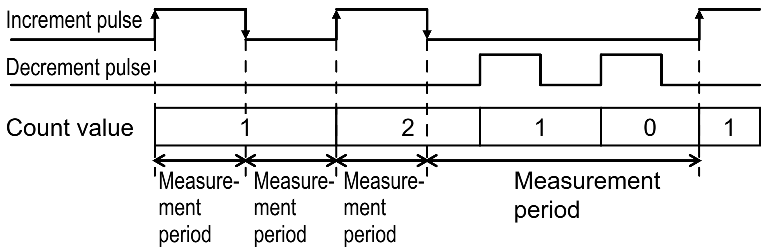
● Pulse + Direction Inputs

The period between pulse input edges is measured regardless of the count direction.

Edge detection method	Measurement period
Measure every rising edge	
Measure every falling edge	
Measure every rising and fall-ing edge	

Up and Down Pulses

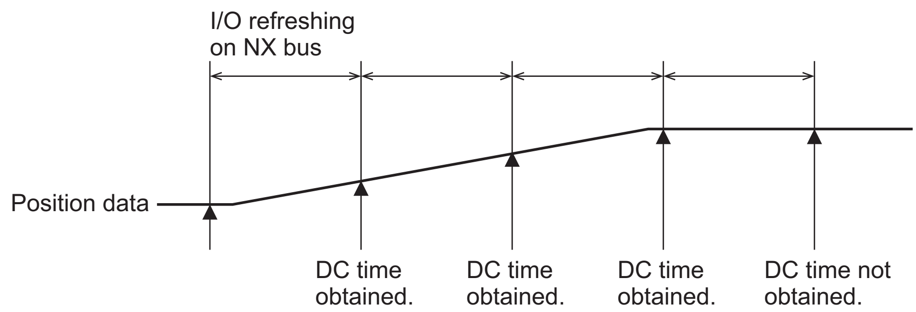
You can measure the period between incremental pulse input edges.

Edge detection method	Measurement period
Measure every rising edge	
Measure every falling edge	
Measure every rising and fall-ing edge	

6-9-12 Time Stamping

When you obtain position data from an Incremental Encoder Input Unit and the position data has changed from the previously obtained position data, you can obtain the DC time when that change occurred along with the data.

Position data is obtained when NX bus I/O is refreshed.



The obtained position data and DC time are input to the Controller.

The obtained DC time is called a time stamp.

If there was no change in the position data, the time stamp is not updated and so the previous time stamp is retained.

Refer to *6-7-1 Data Items for Allocation to I/O* on page 6-34 for information and *Time Stamp* on page 6-40 for details on time stamps.

If you use time stamping, you must assign a time stamp to I/O in the Incremental Encoder Input Unit.

Time stamps are not assigned by default.

Add a time stamp to the I/O entries in the I/O entry mapping using the I/O assignments of the Incremental Encoder Input Unit.

Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

Refer to *Operation of Synchronous I/O Refreshing* on page 5-7 for information on refreshing of NX bus I/O.

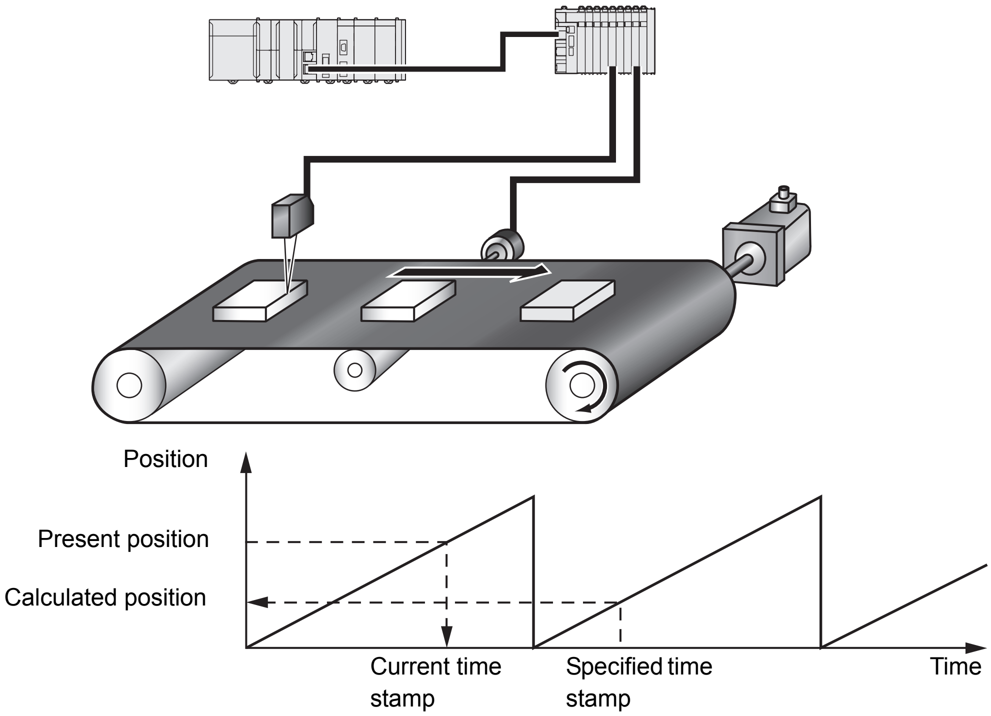
Precautions for Correct Use

- An EtherCAT Coupler Unit with unit version 1.1 or later is required.
- Time stamping is supported only when synchronous I/O refreshing is used. When Free-Run refreshing is used, the data will always be 0.

Application Example

Time stamping allows you to perform I/O controls based on time stamps when the Unit is used in combination with the motion control instructions in the NJ/NX-series CPU Unit. You can estimate positions according to workpiece travel times to achieve time-based controls that are not dependent on the task periods in the CPU Unit.

For example, if you use sensors to detect workpieces moving on a conveyor, you can use time stamps to estimate the positions of the workpieces based on elapsed times.



The following instructions are examples of the motion instructions that use time stamping.

- MC_DigitalCamSwitch
- MC_TimeStampToPos

Refer to the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508) for details on the instructions.

6-10 Specifications

This section provides the general specifications, pulse input specifications, and external input specifications of the Incremental Encoder Input Units.

6-10-1 General Specifications

The general specifications of the Incremental Encoder Input Unit are given below.

Item	Specifications	
I/O interface	Push-in	
Number of encoder input channels	NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142	: 1 channel
	NX-EC0212 or NX-EC0222	: 2 channels
Input signals	Encoder inputs	: Phases A, B, and Z
	External Inputs	: 3 *1
Input form	NX-EC0112, NX-EC0122, NX-EC0212, or NX-EC0222	: Voltage input (24 VDC)
	NX-EC0132 or NX-EC0142	: Line receiver input
NX Unit power consumption	NX-EC0112	: 0.85 W max.
	NX-EC0122	: 0.95 W max.
	NX-EC0132	: 0.95 W max.
	NX-EC0142	: 1.05 W max.
	NX-EC0212	: 0.85 W max.
	NX-EC0222	: 0.95 W max.
I/O power supply voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)	
Current consumption from I/O power supply	NX-EC0112 or NX-EC0122	: No consumption
	NX-EC0132 or NX-EC0142	: 30 mA max.*2
	NX-EC0212 or NX-EC0222	: No consumption
I/O power supply method	NX bus	
Weight	NX-EC0112 or NX-EC0122	: 70 g max.
	NX-EC0132 or NX-EC0142	: 130 g max.
	NX-EC0212 or NX-EC0222	: 70 g max.
Dimensions (Width × Height × Depth)	NX-EC0112, NX-EC0122, NX-EC0212, or NX-EC0222	: 12 × 100 × 71 mm
	NX-EC0132 or NX-EC0142	: 24 × 100 × 71 mm
I/O data size*3	NX-EC0112 or NX-EC0122	: Inputs: 18 bytes, Outputs: 4 bytes
	NX-EC0132 or NX-EC0142	: Inputs: 18 bytes, Outputs: 4 bytes
	NX-EC0212 or NX-EC0222	: Inputs: 36 bytes, Outputs: 8 bytes
Number of I/O entry mappings*3	NX-EC0112 or NX-EC0122	: Inputs: 1, Outputs: 1
	NX-EC0132 or NX-EC0142	: Inputs: 1, Outputs: 1
	NX-EC0212 or NX-EC0222	: Inputs: 2, Outputs: 2

*1. The NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142 each have three external inputs. You can select from the following external input types: gate (1), latch (2), and reset (1). Refer to *6-10-3 External Input Specifications* on page 6-80 for the external input specifications.

*2. If you use the 5-V power supply for an encoder, be sure to include that current too. Refer to *A-1 Datasheets* on page A-2 for the method to convert a 5-V power supply current consumption to a 24-V power supply current consumption.

*3. This is the default set value.

6-10-2 Pulse Input Specifications

There are two types of pulse inputs: voltage input and line receiver input.

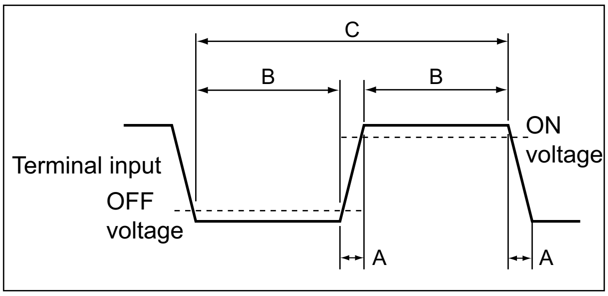
Voltage Input Specifications

The following table shows the pulse input specifications for Units with voltage inputs (NX-EC0112, NX-EC0122, NX-EC0212, and NX-EC0222).

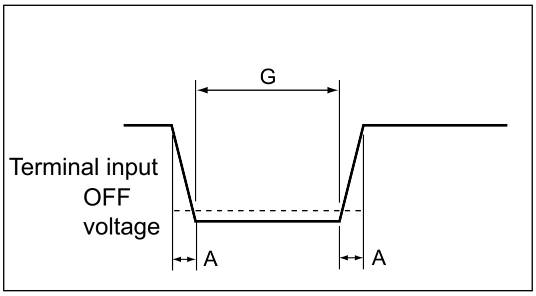
Item	Specifications	
	Phases A and B	Phase Z
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/−15%)	
Input current	4.2 mA typical (24 VDC)	
Minimum ON voltage	19.6 VDC min./3 mA min.	
Maximum OFF voltage	4.0 VDC max./1 mA max.	
Maximum response frequency	Single-phase 500 kHz (Phase differential pulse input, x4 multiplication: 125 kHz)	125 kHz

● Pulse Input Timing Specifications

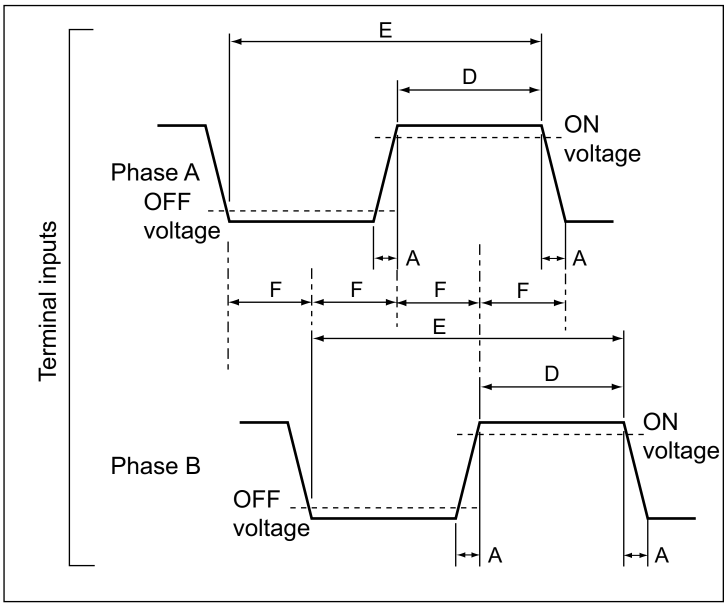
Counter Input (Phases A and B)
Input pulse duty = 50%



Counter Input Phase Z



Relationship between Phase A and Phase B on Phase Differential Pulse Inputs



Timing conditions						
A	B	C	D	E	F	G
< 0.3 µs	> 1 µs	> 2 µs	> 4 µs	> 8 µs	> 2 µs	> 4 µs

Precautions for Correct Use

To satisfy the specifications for counter input, the type of output drive from the encoder that you use, the encoder cable length, and the count pulse frequency must all be taken into consideration.

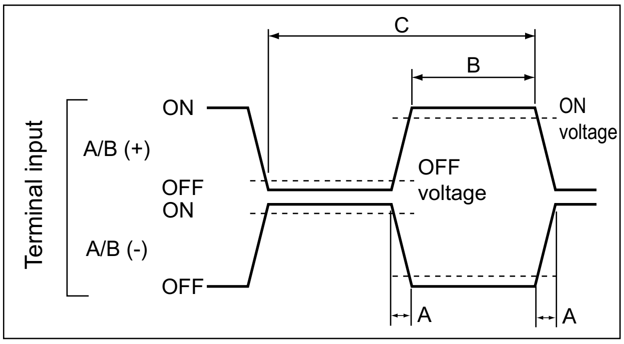
Line Receiver Input Specifications

The following table shows the pulse input specifications for the Units with line receiver inputs (NX-EC0132 and NX-EC0142).

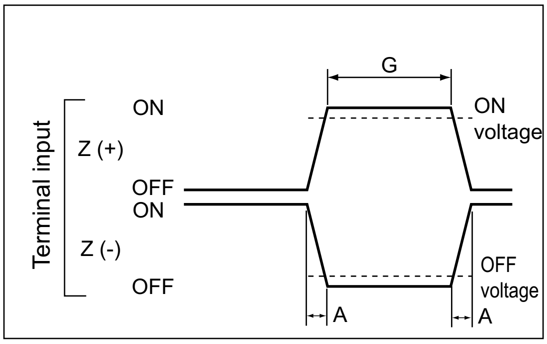
Item		Specifications	
		Phases A and B	Phase Z
Input voltage		EIA standard RS-422-A line driver levels	
Input impedance		120 Ω ±5%	
High level input voltage		VIT+ : 0.1 V min.	
Low level input voltage		VIT− : −0.1 V max.	
Hysteresis voltage		Vhys (VIT+ − VIT-) : 60 mV	
Maximum response frequency		Single-phase 4 MHz (Phase differential pulse input, x4 multiplication: 1 MHz)	1 MHz
Encoder 5-V power supply	Output voltage	5 VDC ±5%	
	Output current	500 mA max.	

● Pulse Input Timing Specifications

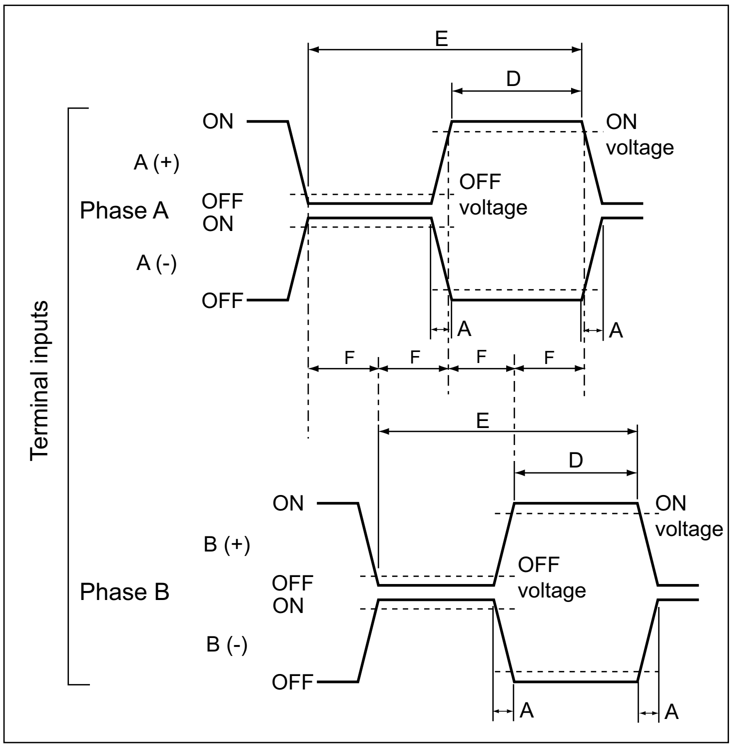
Counter Input (Phases A and B)
Input pulse duty = 50%



Counter Input Phase Z



Relationship between Phase A and Phase B on Phase Differential Pulse Inputs



Timing conditions						
A	**B**	**C**	**D**	**E**	**F**	**G**
< 25 ns	> 125 ns	> 250 ns	> 0.5 μs	> 1 μs	> 0.25 μs	> 0.5 μs

Precautions for Correct Use

To satisfy the specifications for counter input, the type of output drive from the encoder that you use, the encoder cable length, and the count pulse frequency must all be taken into consideration.

6-10-3 External Input Specifications

The following table gives the external input specifications.

Item	Specifications
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)
Input current	NX-EC0112 or NX-EC0122: 4.6 mA typical (24 VDC) NX-EC0132 or NX-EC0142: 3.5 mA typical (24 VDC)
ON voltage/ON current	15 VDC min./3 mA min.
OFF voltage/OFF current	NX-EC0112 or NX-EC0122: 4.0 VDC max./1 mA max. NX-EC0132 or NX-EC0142: 5.0 VDC max./1 mA max.
ON response time	1 μs max.
OFF response time	NX-EC0112 or NX-EC0122: 2 μs max. NX-EC0132 or NX-EC0142: 1 μs max.

7

SSI Input Units

This section describes the functions of the SSI Input Units.

7-1 Interpreting Model Numbers

The model number of the SSI Input Unit tells you the Unit type, number of axes, I/O specifications, and other information.

NX-ECS 1 1 2

NX Series

Unit Type
ECS: Serial Encoder Input Unit

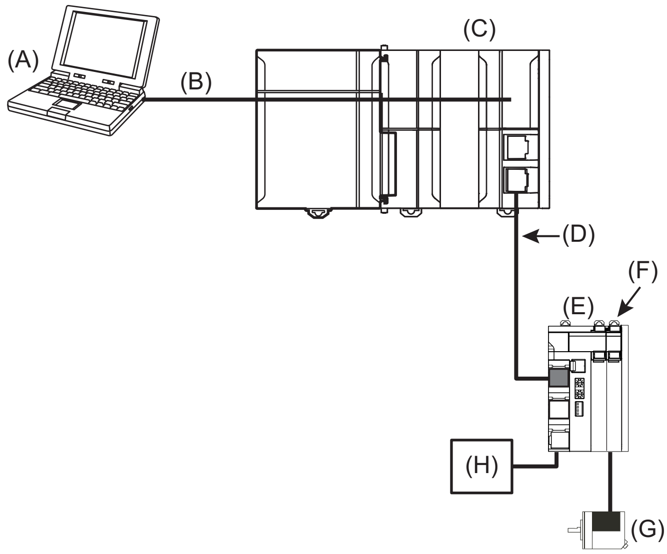
Number of Channels
1: 1 channel
2: 2 channels

Input Specifications
1: SSI inputs

Additional Functions
2: Supports synchronous refreshing

7-2 System Configuration

The following figure shows the system configuration of an SSI Input Unit.



Symbol	Description
(A)	Support Software (Sysmac Studio)
(B)	Connection to the peripheral USB port or built-in EtherNet I/P port on an NJ/NX-series CPU Unit
(C)	EtherCAT master (NJ/NX-series CPU Unit)
(D)	EtherCAT communications cable
(E)	EtherCAT Coupler Unit
(F)	SSI Input Unit
(G)	SSI encoder[*1]
(H)	I/O power supply

*1. The SSI encoder is supplied with 24-VDC power from the SSI Input Unit.

Precautions for Correct Use

SSI Input Units provide only I/O interface functions for a synchronized serial interface. For errors related to communications data, checks are made for communications errors and parity errors (if there is parity), but error correction and other communications protocol processing are not supported.

Therefore, you must check for data errors and perform any error processing on input data, such as the present value or status data, in the Controller.

SSI Input Units have an auxiliary function that you can use to separate error data based on the amount of change in the present value since the last value. Refer to *7-9-8 Error Data Detection* on page 7-55 for information on this auxiliary function.

Use this auxiliary function or other methods to handle communications data errors when you use SSI Input Units together with the MC Control Module in an NJ/NX-series Controller.

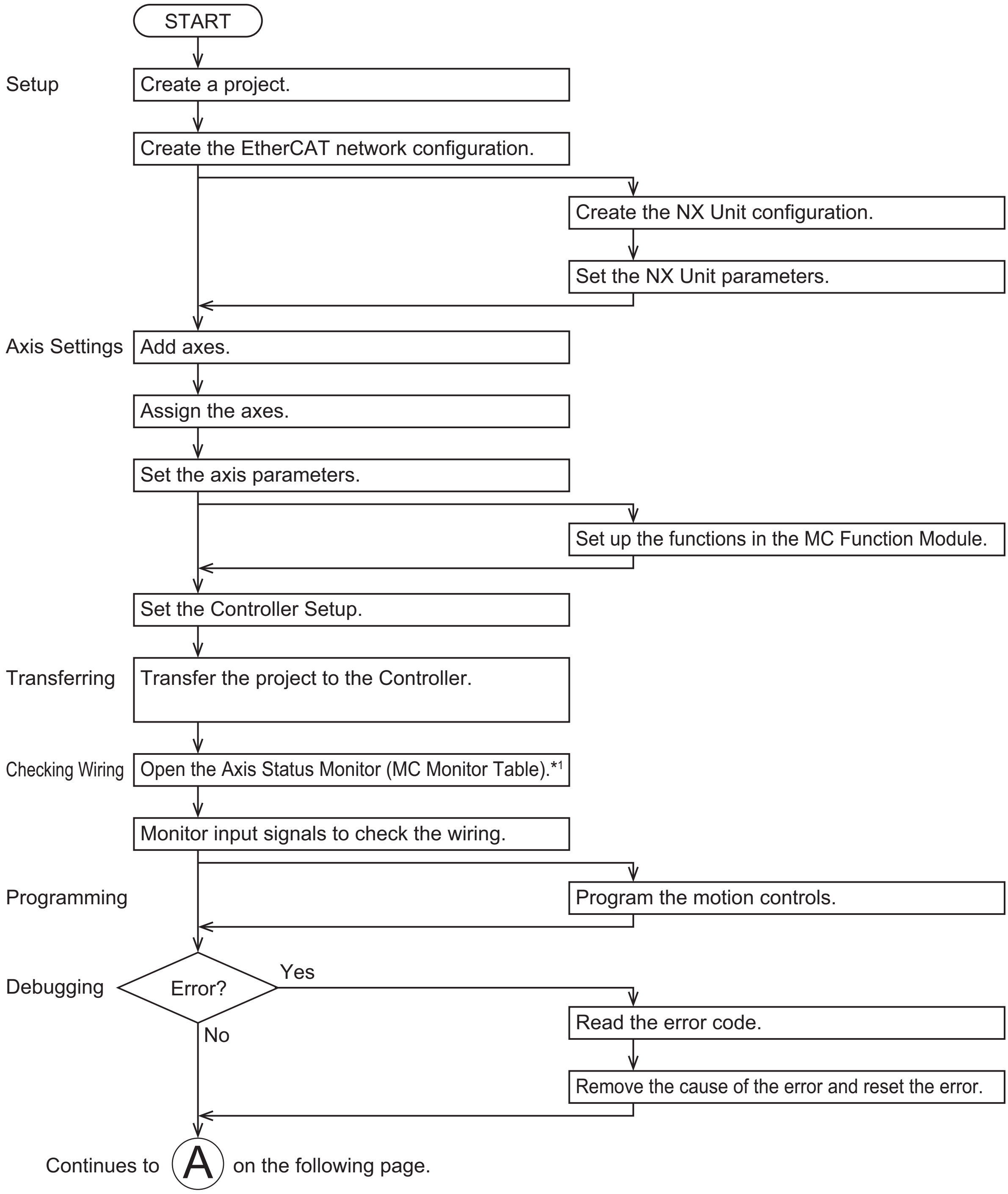
7-3 Basic Application Procedures

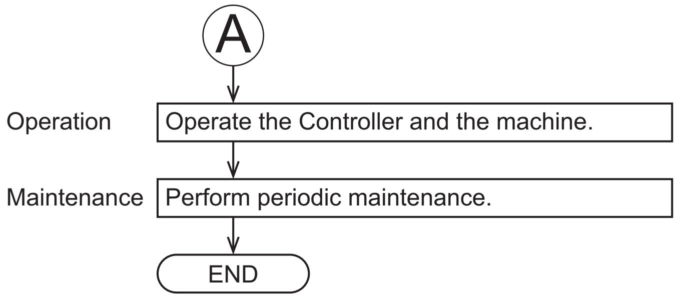
This section describes the basic procedures to use an SSI Input Unit.

The procedure depends on whether the MC Function Module is used.

7-3-1 Procedures When Using the Motion Control Function Module

The process flow to use an SSI Input Unit with the MC Function Module is shown below.

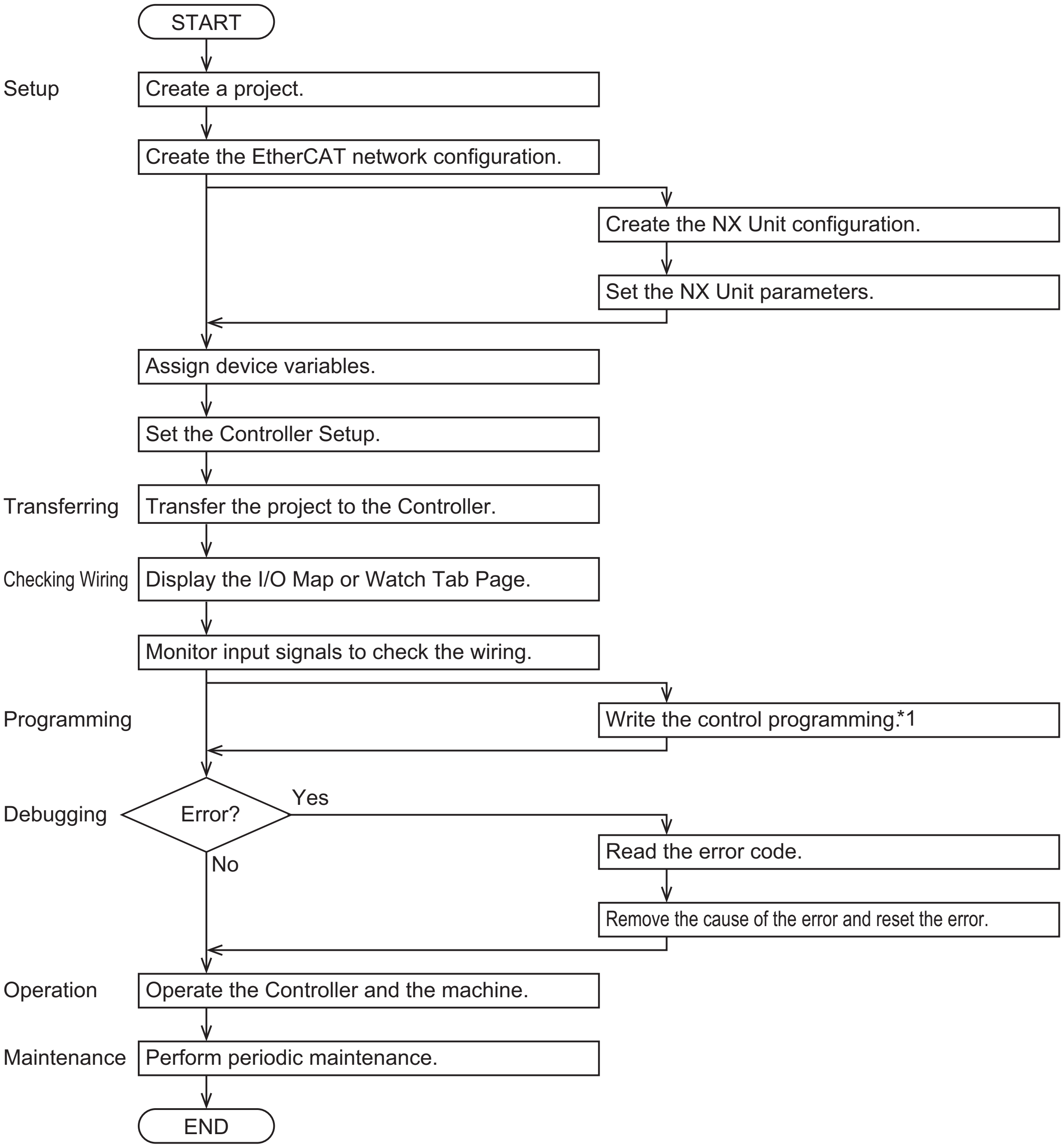




*1. Refer to *4-5 Checking Wiring* on page 4-33 for the checking procedures.

7-3-2 Procedures When Not Using the Motion Control Function Module

The process flow to use an SSI Input Unit without the MC Function Module is shown below.



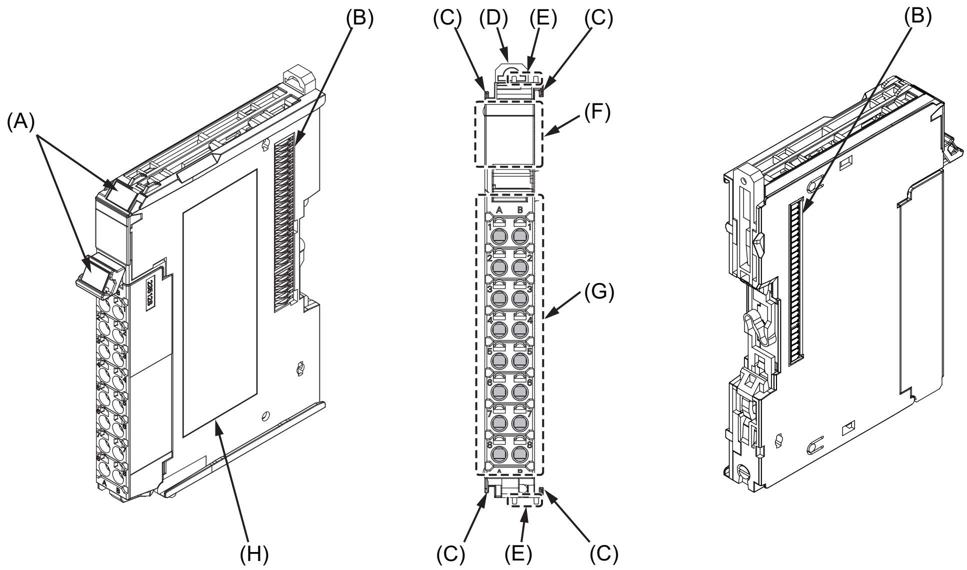
*1. If the MC Function Module is not used, all control tasks must be performed in the user program, including position management.

7-4 Part Names and Functions

This section describes the names and functions of the parts of the SSI Input Units.

7-4-1 Parts and Names

The names of the parts of the NX-ECS112 and NX-ECS212 are shown in the following figure.



Symbol	Name	Function
(A)	Marker attachment locations	This is where the markers are attached. OMRON markers are pre-installed at the factory. You can also install commercially available markers.
(B)	NX bus connector	This connector is used to connect to another Unit.
(C)	Unit hookup guides	These guides are used to connect two Units to each other.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	These protrusions are to hold onto when you need to pull out the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit.
(G)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
(H)	Unit specifications	The specifications of the Unit are given here.

7-4-2 Functions of the Parts

The functions of the parts of the SSI Input Unit are described below.

Unit Hookup Guides

Use the guides to connect the Units to each other.

Indicators

The indicators show the Unit status, counter operation status, external input status, and other information.

Terminal Block

The terminal block is used to connect the external I/O signals.

NX Bus Connector

The bus connectors connect the Units to each other.

7-4-3 Indicators

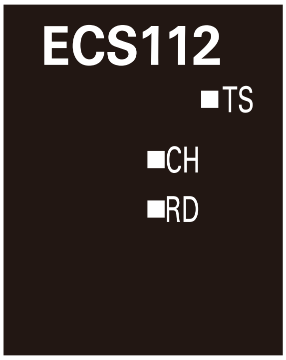
This section describes the indicators on the SSI Input Units.

Refer to *3-2 Indicators* on page 3-3 for information on the indicators that are provided on all Position Interface Units.

NX-ECS112

The indicators for a One-input Unit are described in the following table.

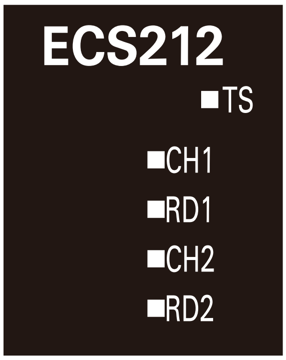
Indicator	Name	Color	Status	Description
CH	SSI operating status indicator	Green	Lit	The counter is enabled.
			Not lit	The counter is disabled.
RD	SSI communications status indicator	Yellow	Lit	SSI communications are in progress.
			Not lit	SSI communications are not in progress.



NX-ECS212

The indicators for a Two-input Unit are described in the following table.

Indicator	Name	Color	Status	Description
CH1 and CH2	SSI operating status indicators	Green	Lit	The counter is enabled.
			Not lit	The counter is disabled.
RD1 and RD2	SSI communications status indicators	Yellow	Lit	SSI communications are in progress.
			Not lit	SSI communications are not in progress.



7-5 Terminal Block Arrangement

SSI Input Units use screwless clamping terminal blocks.

This section describes the terminal block arrangements of the Units.

7-5-1 NX-ECS112

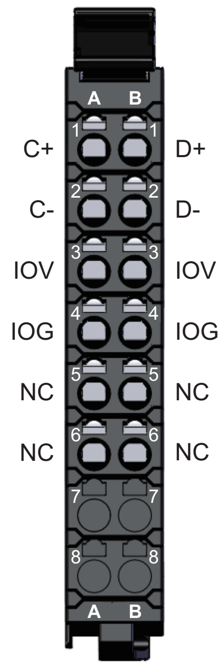
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the One-input Unit. It also provides a wiring example.

Terminal Block Arrangement

A 12-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	C+	O	Synchronous clock output + side
A2	C–	O	Synchronous clock output – side
A3	IOV	O	SSI power supply output, 24 VDC
A4	IOG	O	SSI power supply output, 0 VDC
A5	NC	---	Not used.
A6	NC	---	Not used.
A7	---	---	---
A8	---	---	---

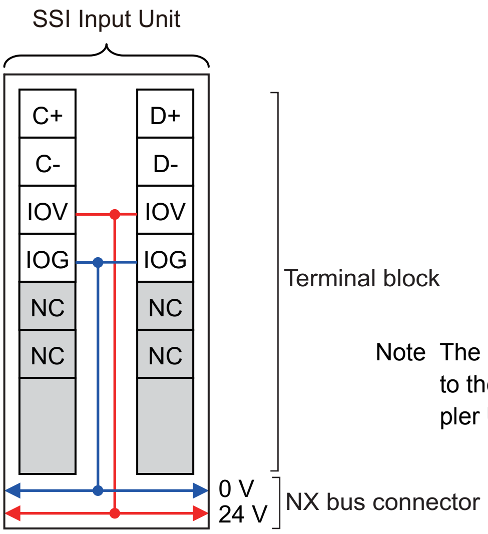
Terminal No.	Symbol	I/O	Name
B1	D+	I	SSI data input + side
B2	D–	I	SSI data input – side
B3	IOV	O	SSI power supply output, 24 VDC
B4	IOG	O	SSI power supply output, 0 VDC
B5	NC	---	Not used.
B6	NC	---	Not used.
B7	---	---	---
B8	---	---	---



Note The SSI power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

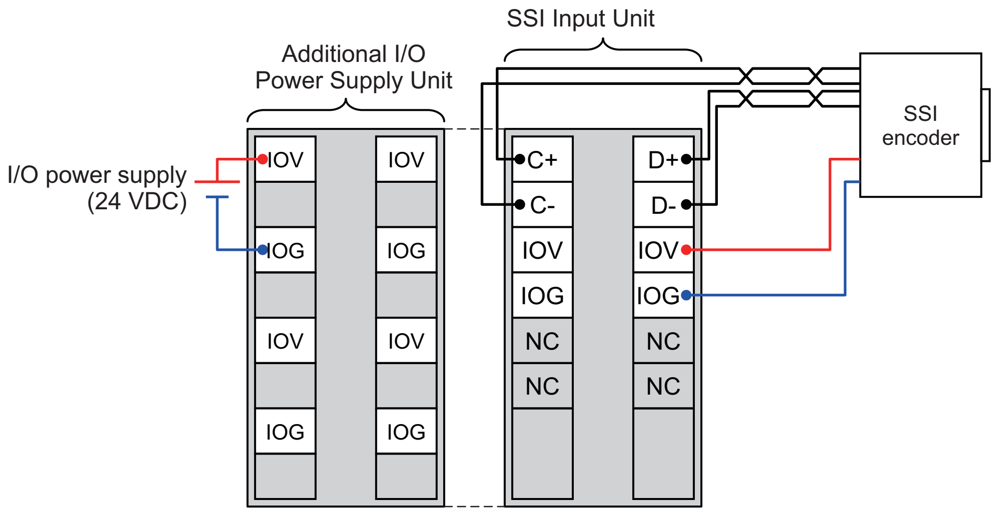
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the SSI Input Unit.

7-5-2 NX-ECS212

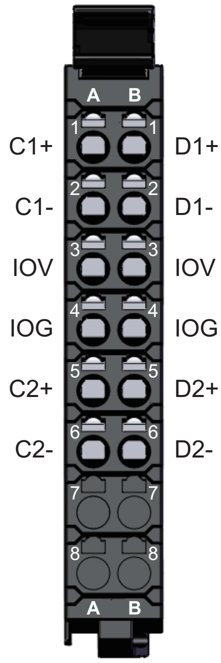
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the Two-input Unit. It also provides a wiring example.

Terminal Block Arrangement

A 12-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	C1+	O	Synchronous clock 1 output + side
A2	C1–	O	Synchronous clock 1 output – side
A3	IOV	O	SSI power supply output, 24 VDC
A4	IOG	O	SSI power supply output, 0 VDC
A5	C2+	O	Synchronous clock 2 output + side
A6	C2–	O	Synchronous clock 2 output – side
A7	---	---	---
A8	---	---	---

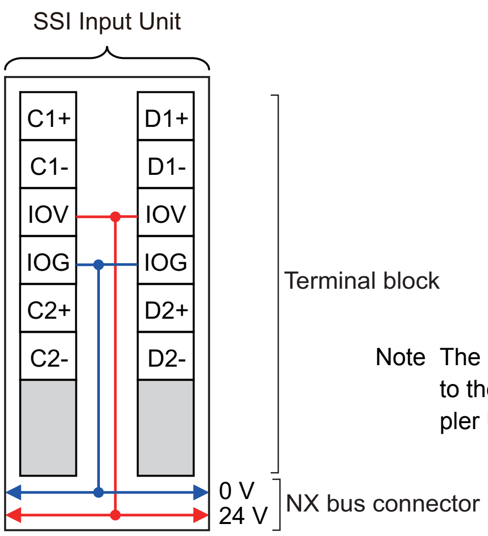
Terminal No.	Symbol	I/O	Name
B1	D1+	I	SSI data input 1 + side
B2	D1–	I	SSI data input 1 – side
B3	IOV	O	SSI power supply output, 24 VDC
B4	IOG	O	SSI power supply output, 0 VDC
B5	D2+	I	SSI data input 2 + side
B6	D2–	I	SSI data input 2 – side
B7	---	---	---
B8	---	---	---



Note The SSI power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

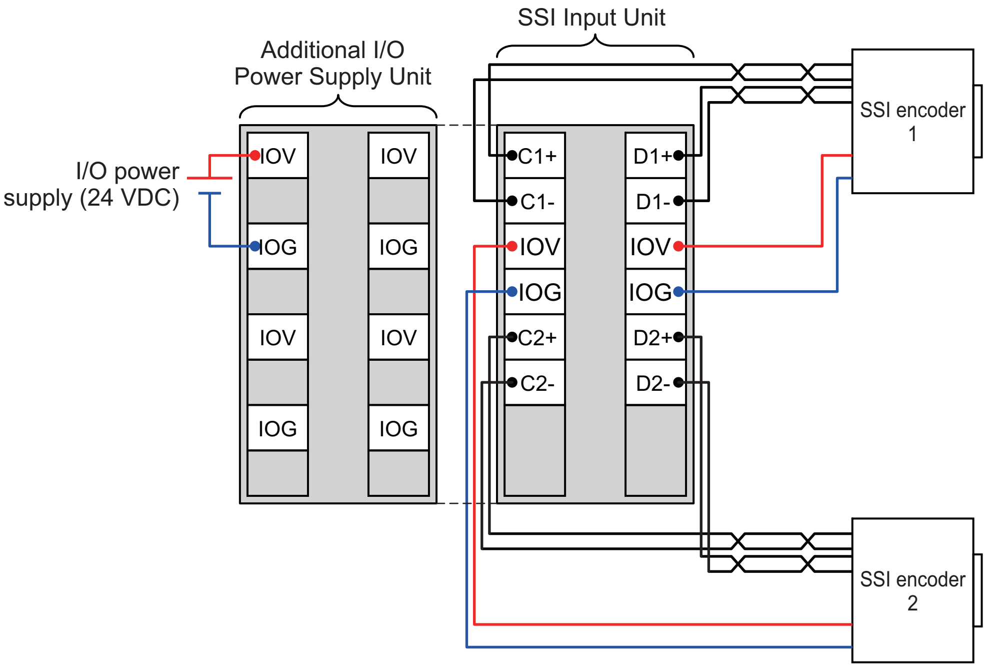
The following diagram shows the internal power supply wiring.



Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

The following is a wiring example.



Note To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the SSI Input Unit.

7-6 I/O Refreshing Method Setting

There are the following methods to exchange data between SSI Input Units and the Controller: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.

This section describes how to set the I/O refreshing method for SSI Units, the I/O refreshing methods, and the differences in I/O refreshing methods for different Controllers.

7-6-1 Setting the I/O Refreshing Methods

This section describes the settings of the I/O refreshing method for each Communications Coupler Unit.

● EtherCAT Coupler Unit

When an SSI Input Unit is connected to an EtherCAT Coupler Unit, the I/O refreshing method depends on the *Enable Distributed Clock* setting.

The following table lists the possible combinations.

DC enabled/disabled	I/O refreshing method
Enabled (DC for synchronization)	Synchronous I/O refreshing
Enabled (DC with priority in cycle time)	Task period prioritized refreshing
Disabled (FreeRun)	Free-Run refreshing

Version Information

Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required to use task period prioritized refreshing. If you use unit version 1.1 or earlier and an NX-ECC203 EtherCAT Coupler Unit, operation is performed with synchronous I/O refreshing.

● EtherNet/IP Coupler Unit

When an SSI Input Unit is connected to an EtherNet/IP Coupler Unit, you can use only Free-Run refreshing. There is no setting.

Refresh Cycle

The following table lists the refresh cycles for Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.

I/O refreshing method	Refresh cycle
Free-Run refreshing	Always 125 μs*1
Synchronous I/O refreshing*2	250 μs to 10 ms*3
Task period prioritized refreshing*2	125 μs to 10 ms

*1. The value is always 250 μs for unit version 1.1 or earlier.

*2. The refresh cycle depends on the specifications of the EtherCAT master and EtherCAT Coupler Unit. It also depends on the Unit configuration.

*3. The range is 250 μs to 4 ms for unit version 1.1 or earlier. The range is also 250 μs to 4 ms for unit version 1.2 or later if you use the NX-ECC201/202 EtherCAT Coupler Unit.

Precautions for Correct Use

- If you use a Position Interface Unit and EtherCAT Coupler Unit together and you use Free-Run refreshing, set the task period to a value that is greater than or equal to the refresh cycle of the Position Interface Unit.
- If you use synchronous I/O refreshing or task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

For the communications cycle specifications of the built-in EtherCAT port on an NJ/NX-series CPU Unit, refer to the *NJ/NX-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505). For the communications cycle specifications of the EtherCAT Coupler Unit, refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-05 or later).

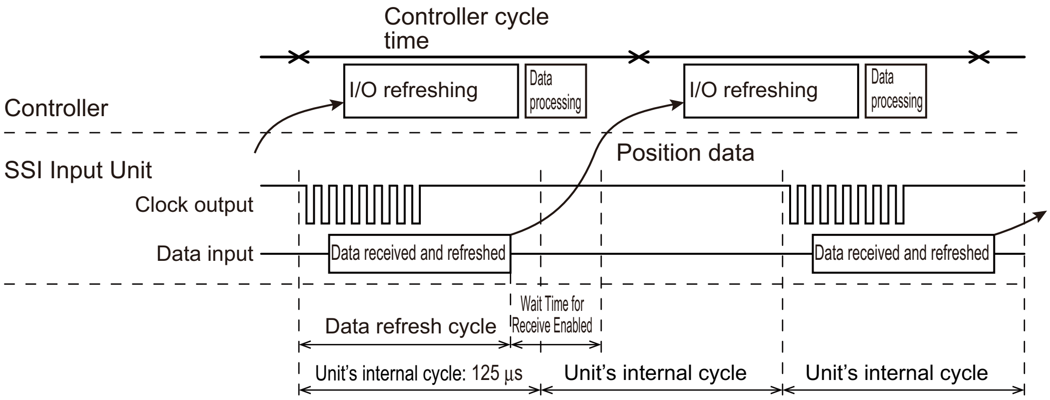
7-6-2 Free-Run Refreshing

Use Free-Run refreshing to ignore the data refresh time of the SSI Input Unit and simply exchange data with the Controller.

The SSI Input Unit will refresh data through SSI communications asynchronously with the Controller processing cycle.

Data is exchanged with the Controller based on the I/O refreshing timing of the Controller.

The data that is exchanged is based on the SSI data that was obtained in the last I/O refresh.



For this method, the SSI Input Unit sends a clock signal to the encoder that is timed to the internal cycle of the Unit and receives data from the encoder.

After the data is received, the updated data is written to memory for I/O refreshing.

For Free-Run refreshing, the Unit's internal cycle is always 125 µs. The cycle for receiving and refreshing data through SSI communications depends on the SSI baud rate and the data length.

The timing of refreshing the data that is exchanged with the Controller depends on the data refresh cycle of the SSI communications.

Use the following equations to calculate the data refresh cycle.

Data refresh cycle = Conversion wait time + (Number of leading bits + Valid data length) × Clock period + Monoflop time + Unit processing time

You can use data traces on the Sysmac Studio to check the data update timing. Assign the Encoder Present Position Refresh Count to an output and check the timing when the value changes in the data trace.

You can find the clock period from the Baud Rate parameter in the SSI Input Unit as shown in the following table.

Baud rate setting	Clock period (μs)
0: 100 kHz	10
1: 200 kHz	5
2: 300 kHz	3.3
3: 400 kHz	2.5
4: 500 kHz	2
5: 1.0 MHz	1
6: 1.5 MHz	0.67
7: 2.0 MHz	0.5

Each Unit has its own processing time, as shown in the following table.

Model	Unit processing time
NX-ECS112	36 to 146 μs
NX-ECS212	36 to 254 μs

The Unit processing time varies as shown in the above table according to the length of the data refresh period and the processing status of the SSI Input Unit.

If the Wait Time for Receive Enabled parameter is set, SSI communications processing is started again at the next synchronization cycle after the value set for the Wait Time for Receive Enabled parameter elapses from when the data is refreshed.

The following are SSI Input Unit setting parameters: Baud Rate, Wait Time for Receive Enabled, Monoflop Time, Conversion Wait Time, Valid Data Length, and Leading Bits.

Refer to *7-9-2 SSI Data Settings* on page 7-40 and *7-9-5 Bit Shifting* on page 7-51 for details.

Precautions for Correct Use

If you use a Position Interface Unit and EtherCAT Coupler Unit together and you use Free-Run refreshing, set the task period to a value that is greater than or equal to the refresh cycle of the Position Interface Unit.

Version Information

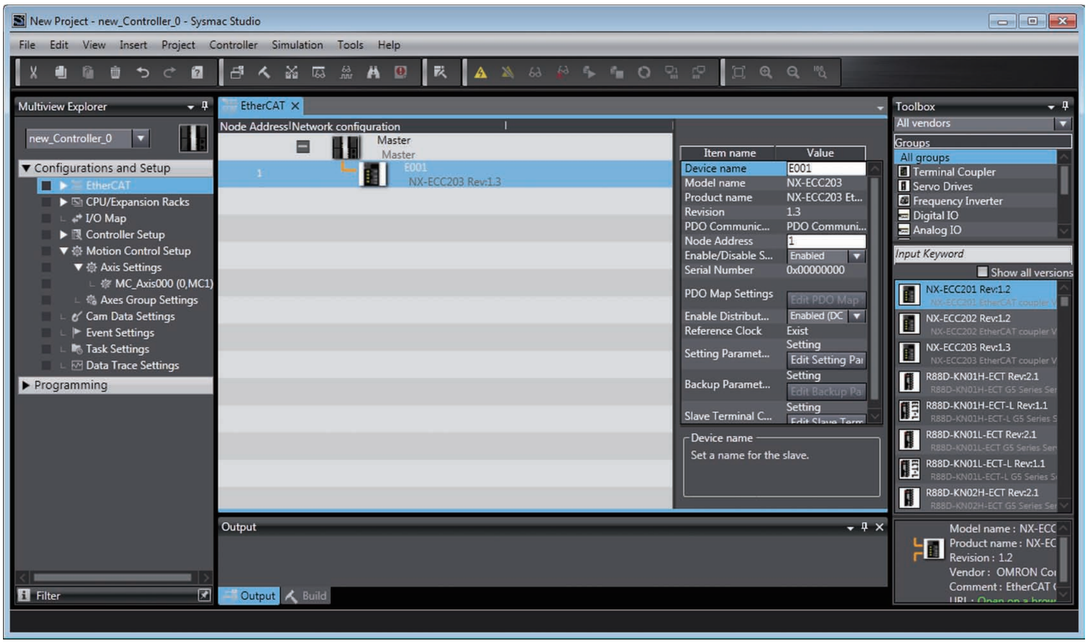
The refresh cycle is always 125 μs for unit version 1.2 or later.
The refresh cycle is always 250 μs for unit version 1.1 or earlier.

Setting with the Sysmac Studio

Use the following procedure to select *Disabled (FreeRun)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use Free-Run refreshing for SSI Input Units that are connected to an EtherCAT Coupler Unit.

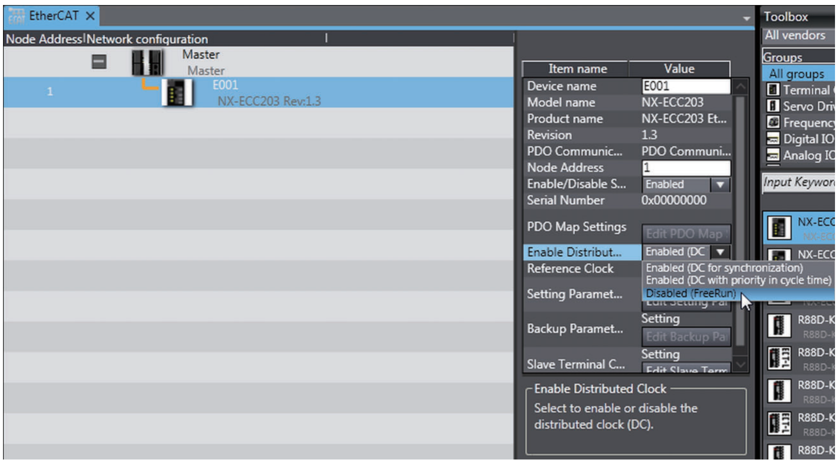
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Disabled (FreeRun)*.



As a result, Free-Run refreshing is used.

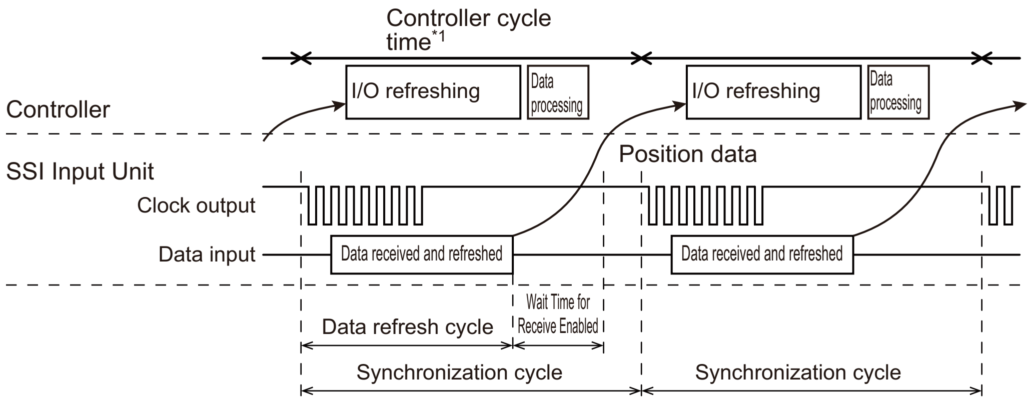
7-6-3 Synchronous I/O Refreshing

Use synchronous I/O refreshing to synchronize the timing of SSI communications data (i.e., the timing of obtaining the data) for one or more SSI Input Units with the processing of the Controller.

The SSI Input Unit will refresh data through SSI communications synchronously with the Controller processing cycle.

Data is exchanged with the Controller based on the I/O refreshing timing of the Controller.

The data that is exchanged is based on the SSI data that was obtained in the last I/O refresh.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation of Synchronous I/O Refreshing* on page 5-7 for details.

For this method, the SSI Input Unit sends a clock signal to the encoder based on the synchronization cycle and receives data from the encoder.

After the data is received, the updated data is written to memory for I/O refreshing.

The period for receiving and refreshing data through SSI communications depends on the SSI baud rate and data length, just as it does for Free-Run refreshing.

The calculation method for the data refresh cycle is the same as for Free-Run refreshing. The timing of refreshing the data that is exchanged with the Controller depends on the data refresh cycle of the SSI communications.

You can use data traces on the Sysmac Studio to check the data update timing. Use a data trace to check the timing when the value of the Data Refresh Status bit in the SSI Status changes. Or, assign the Encoder Present Position Refresh Count to an output and check the timing when the value changes in the data trace.

Refer to *7-6-2 Free-Run Refreshing* on page 7-15 for details.

If the Wait Time for Receive Enabled parameter is set, SSI communications processing is started again at the next synchronization cycle after the value set for the Wait Time for Receive Enabled parameter elapses from when the data is refreshed.

Precautions for Correct Use

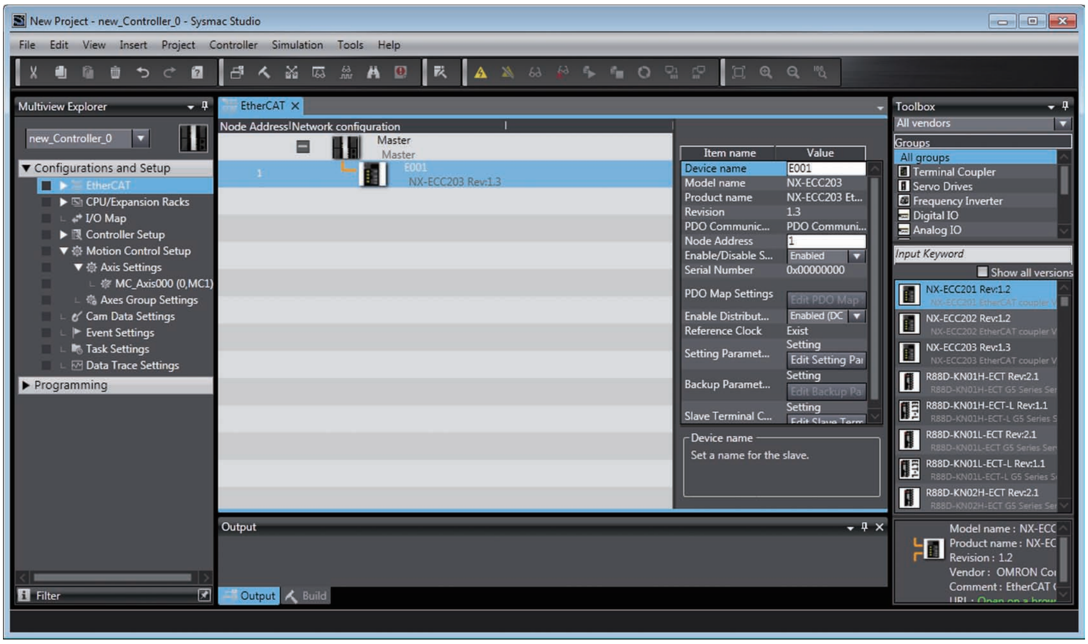
If you use synchronous I/O refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC for synchronization)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use synchronous I/O refreshing for SSI Input Units that are connected to an EtherCAT Coupler Unit.

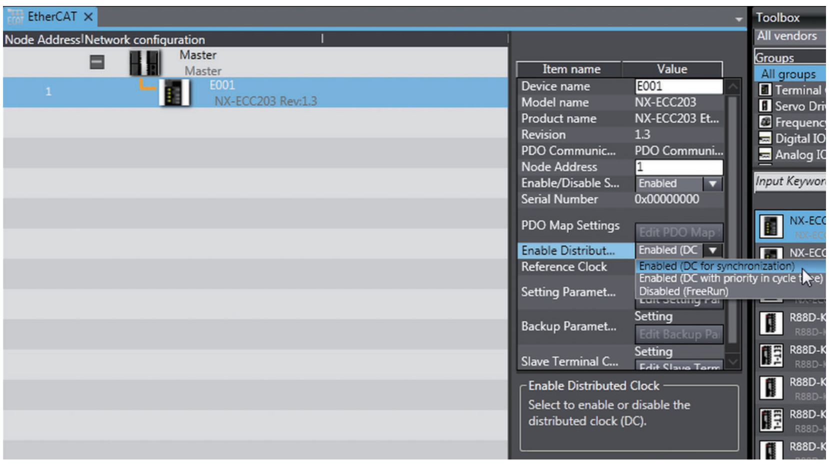
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Enabled (DC for synchronization)*.

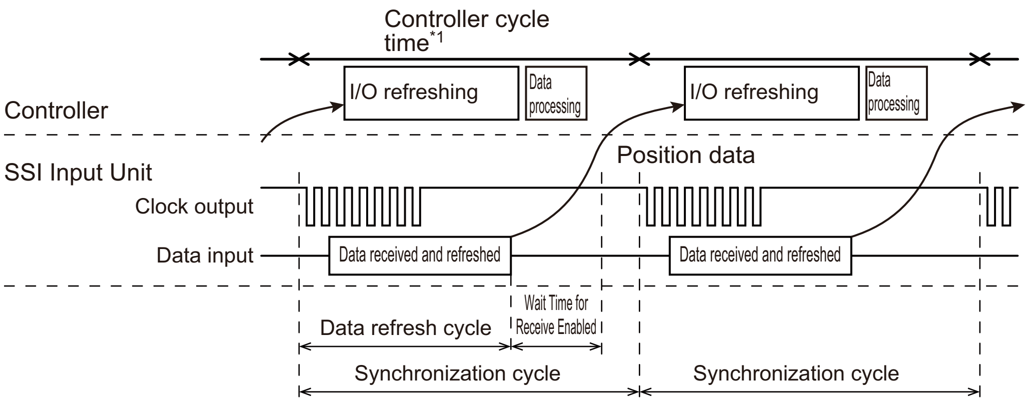


As a result, synchronous I/O refreshing is used.

7-6-4 Task Period Prioritized Refreshing

With this I/O refreshing method, shortening the task period is given priority over synchronizing the I/O timing with other NX Units.

With this I/O refreshing method, the timing of I/O is not consistent with the timing of I/O for NX Units that use simultaneous I/O refreshing.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation for Task Period Prioritized Refreshing* on page 5-10 for details.

Precautions for Correct Use

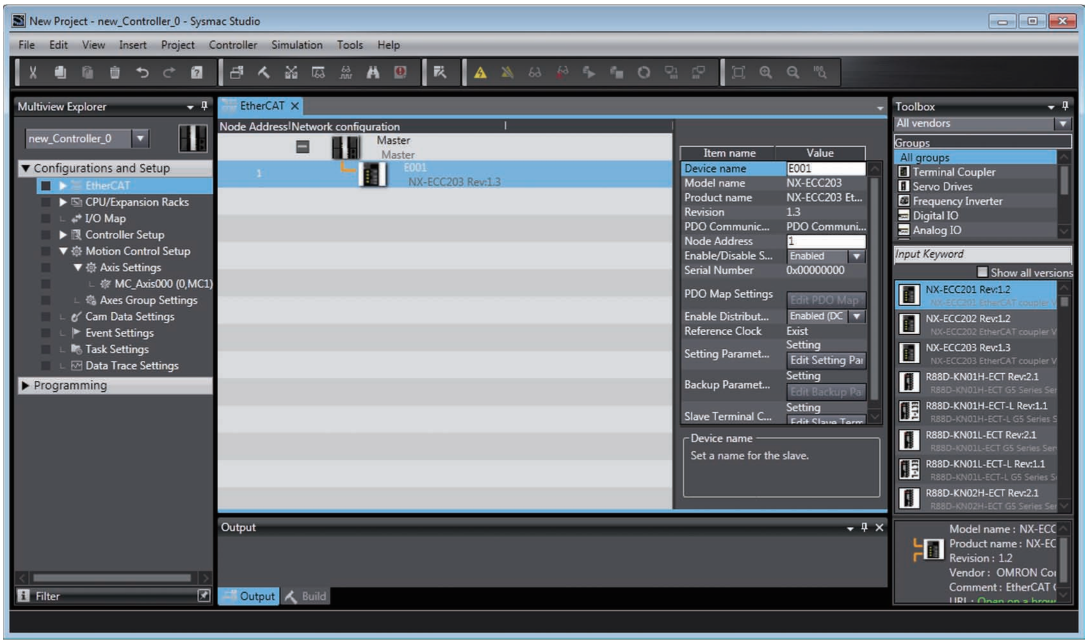
If you use task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC with priority in cycle time)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use task period prioritized refreshing for SSI Units connected to an EtherCAT Coupler Unit.

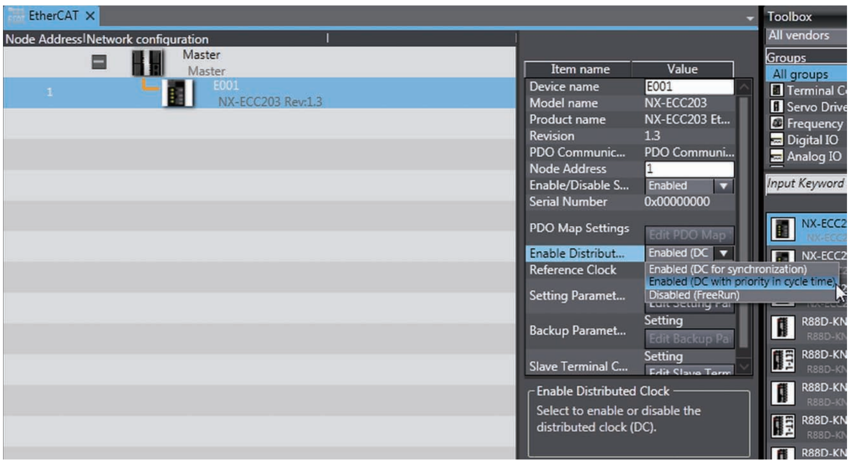
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Enabled (DC with priority in cycle time)*.



As a result, task period prioritized refreshing is used.

7-6-5 Differences in I/O Refreshing Methods Based on the Controller

The type of controller that is connected affects the I/O refreshing method, parameter settings, data access methods, and supported functions.

This section describes this information for various controllers.

Using an NJ/NX-series Controller with the MC Function Module

When you use an NJ/NX-series Controller with the MC Function Module, you must set the Unit as an encoder axis. Set the axis parameter settings and assign an axis variable from the Sysmac Studio.

Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for detailed setting procedures.

Observe the following precautions when you use an SSI Input Unit with the MC Function Module.

- Connect the SSI Input Unit after an EtherCAT Coupler Unit.
- Set the coding method to present value conversion to use an SSI Input Unit as an incremental encoder with a 32-bit counting range, regardless of the SSI encoder resolution. In this case, change the setting as shown below according to the output data from the SSI encoder.

SSI encoder	Setting
Binary code output	Change binary codes to present values.
Gray code output	Change gray codes to present values.

The present position of the encoder axis is obtained based on the encoder type setting in the axis parameters of the MC Function Module, as described in the following table.

Encoder type	Present position
Incremental encoder	The present position of the encoder axis is 0 when the power is turned ON to the Controller or when the Controller is restarted (i.e., when data starts being exchanged with the Unit).
Absolute encoder	The present position of the Unit is treated as the present position of the encoder axis when the power is turned ON to the Controller or when the Controller is restarted (i.e., when data starts being exchanged with the Unit).

- The Unit is treated as an axis (encoder axis) from the user program, so you cannot handle the I/O data from the SSI Input Unit directly. The Unit is handled as an axis variable.
- SSI communications must always be enabled to use an SSI Input Unit with the MC Function Module. Do not assign the SSI Operation Command parameter to I/O data. SSI communications are enabled by default if you do not assign the SSI Operation Command parameter to I/O data.
- For an NX-series CPU Unit, you can execute motion control in the primary periodic task and priority-5 periodic task.
- You cannot use motion control instructions to perform control operations.

Precautions for Correct Use

- The MC Function Module cannot directly manipulate SSI encoder absolute value data if the coding method is set to present value conversion. In this case, you cannot use an encoder axis as an infinite-length axis absolute encoder.
- When you use an SSI Input Unit with the MC Function Module, the MC Function Module monitors the bit that corresponds to the SSI Input Unit in the Process Data Communications Status. You can assign the Process Data Communications Status as an EtherCAT Coupler Unit device variable. The MC Function Module calculates the initial position of the encoder axis when this bit is first set. If there is an error in the SSI Input Unit at this time, the initial position of the encoder axis is not set correctly.

  Refer to the precautions in *7-6-6 Process Data Communications Status* on page 7-26 and write the user program.

Yes: Can be used, Partial: Can be used with restrictions, No: Cannot be used

Function	EtherCAT Coupler Unit		
	Free-Run refreshing *1	Synchronous I/O refreshing	Task period prioritized refreshing*2
SSI data settings	No	Yes	Yes
Coding method	No	Yes	Yes
Encoder count direction	No	Yes	Yes
Bit shifting	No	Yes	Yes
Parity check	No	Yes	Yes
Data refresh status	No	Yes	Yes
Error data detection	No	Yes	Yes
I/O refreshing method setting	No	Partial *1	Partial *1
Time stamping *3	No	Yes	Yes

*1. If you use the Unit as an axis in the MC Function Module, either synchronous I/O refreshing or task period prioritized refreshing is used as the I/O refreshing method.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

Precautions for Correct Use

- If you assign an NX Unit connected to an EtherCAT Coupler Unit as an I/O device for a MC Function Module axis, the MC Function Module manages refreshing of the I/O data. In this case, the MC Function Module manages refreshing of the I/O data for the entire Slave Terminal, including the EtherCAT Coupler Unit.

  If any of the operations or errors in the following table occur, the MC Function Module discards the Slave Terminal I/O data at that time. Refreshing of I/O data resumes when valid data is obtained again.

Operation	Using EtherCAT slaves only	Using an EtherCAT Coupler Unit + NX Units
Intentional changes to EtherCAT network configuration elements	• Unintentional disconnection of an EtherCAT slave or an EtherCAT cable disconnection • Unintentional connection of an EtherCAT slave or an EtherCAT cable connection • EtherCAT slave power interruption	Same as at the left.
	• Disconnection of an EtherCAT slave due to a disconnect operation • Connection of an EtherCAT slave due to a connect operation	Same as at the left. • Restarting of EtherCAT Slave Terminal • Restarting after parameters were transferred to the Communications Coupler Unit
Unintentional changes to EtherCAT network configuration elements	None	Performing an error reset when the Slave Terminal is stopped due to an error

  From several milliseconds to several tens of milliseconds is required to resume refreshing of I/O data, depending on the system configuration and the process data communications cycle.

  You can include an NX Unit that is not assigned to an axis in a Slave Terminal that is managed by the MC Function Module, but keep in mind the above characteristics of the refreshing of I/O data when you do so.
- If you want to avoid the effects of the refreshing of I/O data that is managed by the MC Function Module on NX Units that are not assigned to axes, place those NX Units on another Slave Terminal. To use different Slave Terminals, use different EtherCAT Coupler Units and configure the Slave Terminals so that one contains only NX Units that are assigned to axes and one contains only NX Units that are not assigned to axes.
- To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□"with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units.

  Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

Using an NJ/NX-series Controller without the MC Function Module

Set the parameters and assign I/O data for the user program from the Sysmac Studio.

Assign the I/O data in the NJ/NX-series Controller as device variables for the Unit.

Refer to the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for details.

The following table lists the usage restrictions for functions based on their combination with the EtherCAT Coupler Unit.

Yes: Usable, No: Not usable

Function	EtherCAT Coupler Unit		
	Free-Run refreshing	Synchronous I/O refreshing	Task period prioritized refreshing*1
SSI data settings	Yes	Yes	Yes
Coding method	Yes	Yes	Yes
Encoder count direction	Yes	Yes	Yes
Bit shifting	Yes	Yes	Yes
Parity check	Yes	Yes	Yes
Data refresh status	Yes	Yes	Yes
Error data detection	Yes	Yes	Yes
I/O refreshing method setting *2	Yes	Yes	Yes
Time stamping *3	---	Yes	Yes

*1. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*2. This setting determines the I/O refreshing method.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

Other Controllers

The procedure to set parameters and assign data for the user program depends on the system. Manipulate the Position Interface Unit device parameters through the I/O and message communications provided by the Controller.

Refer to *A-2 Object Lists* on page A-28 for details.

The following table lists the usage restrictions for functions based on their combination with the Communications Coupler Unit.

Yes: Usable, No: Not usable

Function	EtherCAT Coupler Unit			EtherNet/IP Coupler Unit
	Free-Run refreshing	Synchronous I/O refreshing	Task period prioritized refreshing*1	Free-Run refreshing
SSI data settings	Yes	Yes	Yes	Yes
Coding method	Yes	Yes	Yes	Yes
Encoder count direction	Yes	Yes	Yes	Yes
Bit shifting	Yes	Yes	Yes	Yes
Parity check	Yes	Yes	Yes	Yes
Data refresh status	Yes	Yes	Yes	Yes
Error data detection	Yes	Yes	Yes	Yes
I/O refreshing method setting	Yes	Yes	Yes	No
Time stamping *2	No	Yes	Yes	No

*1. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*2. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

7-6-6 Process Data Communications Status

SSI Input Units can exchange I/O data (i.e., perform I/O refreshing) with the Controller through the EtherCAT Coupler Unit.

The status of the data between the Controller and the SSI Input Unit is indicated in the Process Data Communications Status.

You can assign the Process Data Communications Status as an EtherCAT Coupler Unit device variable.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details on the Process Data Communications Status.

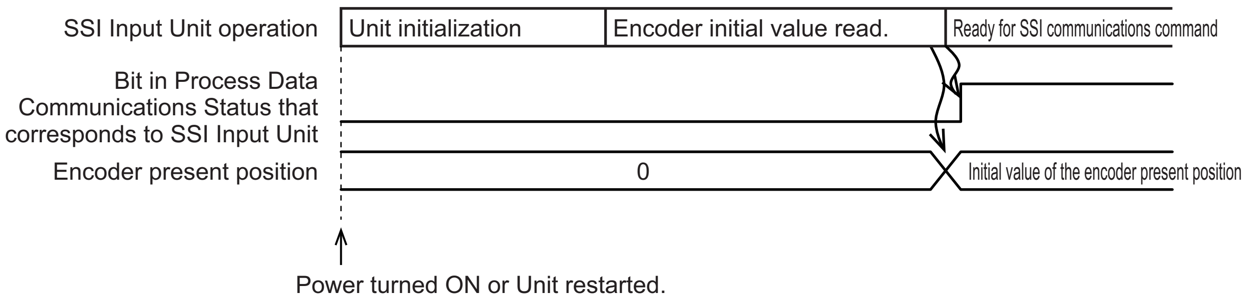
The Process Data Communications Status of the SSI Input Unit operates as described below based on the communications status of the connected SSI encoder.

When Initial Communications with the SSI Encoder Started Normally

After an SSI Input Unit starts, it automatically reads the value from the connected SSI encoder and sets that value as the initial value for the encoder present position.

If communications were successfully performed with the SSI encoder, the SSI Input Unit reads the initial value and sets the Encoder Present Position. After the value is set, the bit that corresponds to the SSI Input Unit in the Process Data Communications Status is set.

Then, SSI communications start when the appropriate command is received.

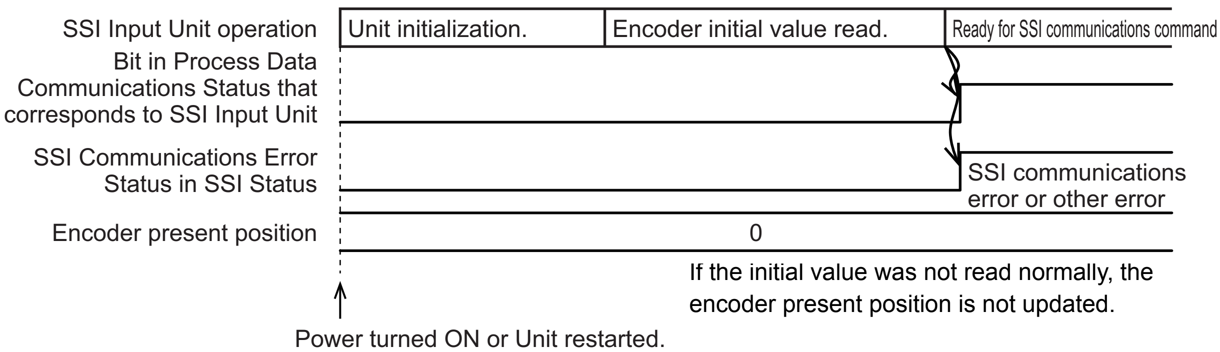


When Initial Communications with the SSI Encoder Did Not Start Normally

If it was not possible to read the initial value from the SSI encoder because the SSI encoder was not connected, the power supply to the encoder is not turned ON, or for any other reason, an SSI communications error occurs in the SSI Input Unit.

When the SSI communications error is detected, the bit that corresponds to the SSI Input Unit in the Process Data Communications Status is set along with the SSI Communications Error Status in the SSI Status. In this case, the initial value of the encoder present position is not set and the initial state of the Unit remains at 0.

However, you can start SSI communications with a command after the bit in the Process Data Communications Status is set. If SSI communications start normally, the SSI Communications Error Status is reset and the read value is set as the encoder present position.

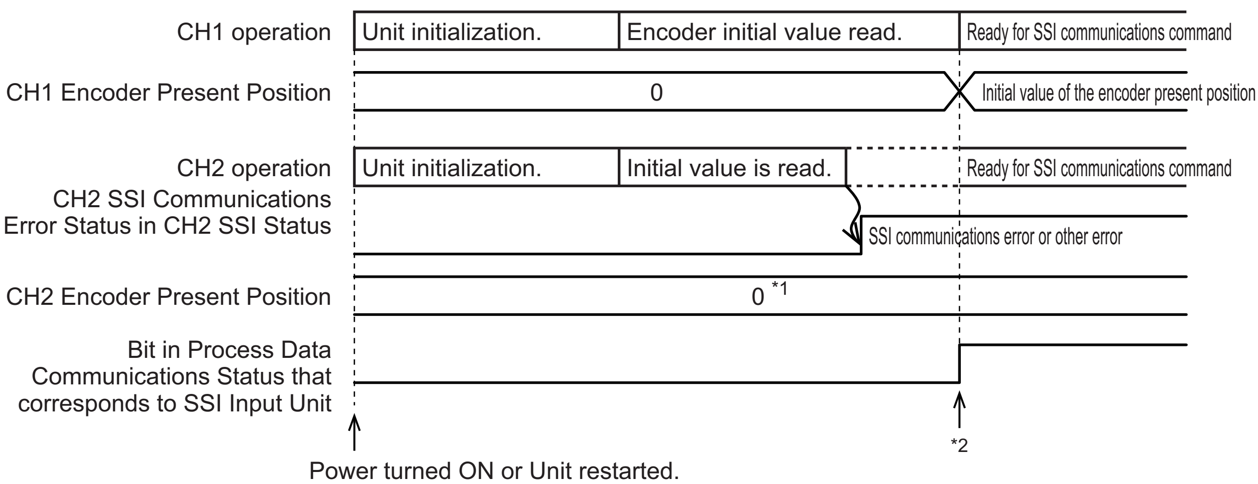


Two-channel Units

There is one bit for each Unit in the Process Data Communications Status.

For a Two-channel Unit, bit in the Process Data Communications Status is set when both channels are ready to start SSI communications based on the results of the initial communications performed for each channel.

The following figure shows an example of a Two-channel Unit where channel 1 completed initial communications normally, but an error occurred for channel 2.



*1. An error occurred for CH2 when the initial value was read, so the present value is not updated.

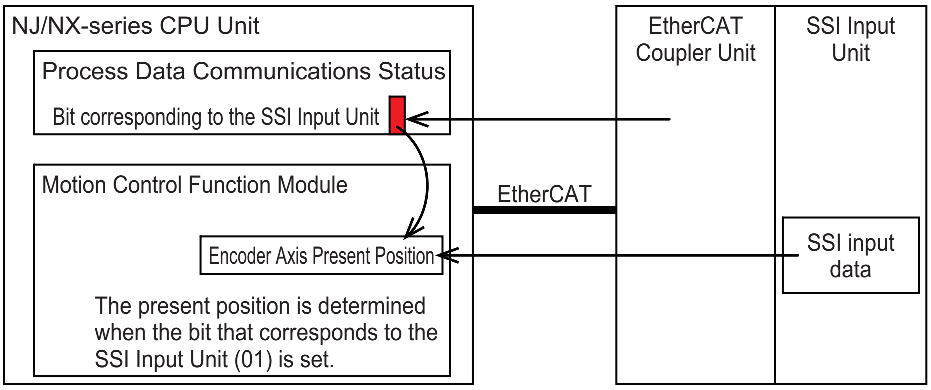
*2. The bit in the Process Data Communications Status is set when both channels are ready to perform SSI communications for a command.

Precautions When Assigning an SSI Input Unit to an MC Function Module Axis

When you assign the SSI Input Unit to an encoder axis in the MC Function Module, the MC Function Module monitors the bit that corresponds to the SSI Input Unit in the Process Data Communications Status.

You can assign the Process Data Communications Status as an EtherCAT Coupler Unit device variable.

This allows the MC Function Module to perform error processing if valid input data is not passed to the Controller during operation of the SSI Input Unit. The MC Function Module also uses this to set the present position of the encoder axis when the initial encoder value is read after the SSI Input Unit starts.



However, if reading the initial value is not possible, the SSI Input Unit cannot begin operation normally and the SSI Input Unit sets the bit in the SSI Communications Error Status in the SSI Status.

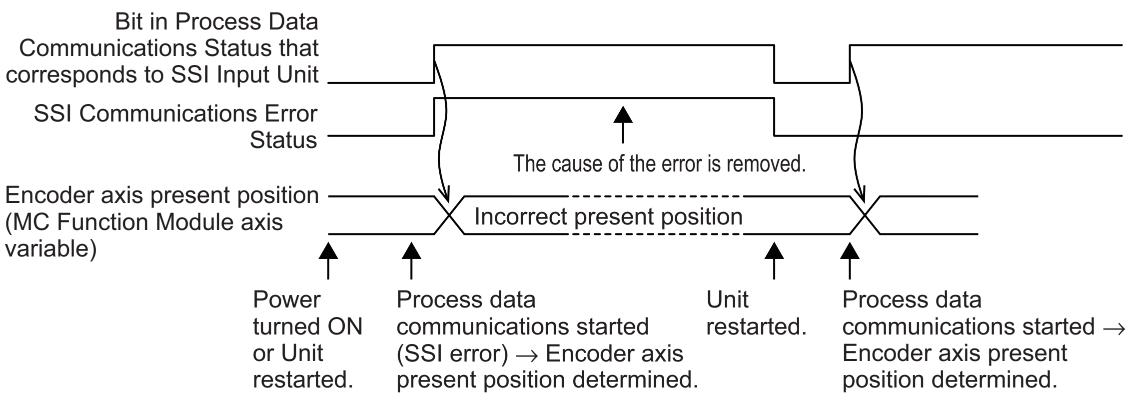
The bit in the Process Data Communications Status is also set at this time.

Because the encoder present position is still set to the default value of 0 at this time, the MC Function Module cannot set the initial position of the encoder axis to the correct value.

Therefore, when you assign an SSI Input Unit to an MC Function Module encoder axis, always check to confirm that the bit in the SSI Communications Error Status in the SSI Status was reset when the bit in the Process Data Communications Status for the SSI Input Unit is set before you use the encoder axis.

If the bit in the SSI Communications Error Status is still set when bit in the Process Data Communications Status for the SSI Input Unit is set, the initial position of the encoder axis will not be set correctly. If this occurs, correct the problem that caused the SSI communications error and restart the NX Unit so that the SSI Input Unit beings operation correctly.

You can access the SSI Status and SSI Communications Error Code as device variables of the SSI Input Unit, even if the Unit is assigned and used as an encoder axis.



Additional Information

The following are possible causes for a failure to read the initial value: I/O power is not supplied, the SSI encoder is not connected, or the wiring is incorrect.

7-7 I/O Data Specifications

This section describes the data items that you can allocate to I/O, the data configurations, and the axis settings.

7-7-1 Data Items for Allocation to I/O

You can assign the following 7 data items to the I/O for an SSI Input Unit.

The data items are described in the following sections.

Additional Information

You can use the Read NX Unit Object instruction or the Write NX Unit Object instruction to access data that is not assigned as I/O. You use index numbers with these instructions.
Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the Read NX Unit Object instruction or the Write NX Unit Object instruction.
For the index numbers, refer to *A-2-3 SSI Input Units* on page A-43.

NX-ECS112

The data items that you can allocate to I/O for a One-input Unit are listed in the following table.

Area	Data item	Size (bytes)	Data type	Default *1	MC Function Module PDO *2
Input	SSI Status	1	BYTE	Yes	
	SSI Communications Error Code	1	BYTE	Yes	
	Encoder Present Position	4	DINT	Yes	Yes
	Status Data	4	DWORD	Yes	
	Encoder Present Position Refresh Count	2	UINT		
	Time Stamp *3	8	ULINT		
Output	SSI Operation Command	2	WORD		

*1. The *Default* column shows the data item that are set when the Unit is shipped from the factory. You can allocate other data items.

*2. These PDOs are required to use the MC Function Module.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

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The data items that you can allocate to I/O for a Two-input Unit are listed in the following table.

Area	Data item	Size (bytes)	Data type	Default *1	MC Function Module PDO *2
Input	SSI Status 1	1	BYTE	Yes	
	SSI Communications Error Code 1	1	BYTE	Yes	
	Encoder Present Position 1	4	DINT	Yes	Yes
	Status Data 1	4	DWORD	Yes	
	Encoder Present Position Refresh Count 1	2	UINT		
	Time Stamp 1 *3	8	ULINT		
	SSI Status 2	1	BYTE	Yes	
	SSI Communications Error Code 2	1	BYTE	Yes	
	Encoder Present Position 2	4	DINT	Yes	Yes
	Status Data 2	4	DWORD	Yes	
	Encoder Present Position Refresh Count 2	2	UINT		
	Time Stamp 2 *3	8	ULINT		
Output	SSI Operation Command 1	2	WORD		
	SSI Operation Command 2	2	WORD		

*1. The *Default* column shows the data item that are set when the Unit is shipped from the factory. You can allocate other data items.

*2. These PDOs are required to use the MC Function Module.

*3. An EtherCAT Coupler Unit with unit version 1.1 or later is required.

7-7-2 Data Details

This section describes the data configuration for each of the 7 data items for I/O allocation.

SSI Status

The bit configuration of the SSI Status parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	CRUNn	ERRn	REFn

Abbr.	Data	Description
REFn	Data Refresh Status	This indicates when the position data changes from its previous value. This bit toggles between 0 and 1 every time the data changes.
ERRn	SSI Communications Error Status	1: Error occurred. 0: No errors occurred.
CRUNn	SSI Communications Enabled *1	1: SSI communications enabled. 0: SSI communications disabled.

*1. The status of this bit depends on the value of the SSI Communications Enable bit in the SSI Operation Command parameter. Refer to *SSI Operation Command* on page 7-35 for information on the SSI Operation Command parameter.

Additional Information

- The error status in the SSI Status parameter and the SSI Communications Error Code parameter are both set to 0 when the data is received without an error.
- When you use the SSI Input Unit in combination with an NJ/NX-series Controller, notification of SSI communications errors is provided in the SSI Communications Error Code in the SSI Status of the SSI Input Unit. Also, the Controller detects an error event and manages it. Error events for which notification is provided in the Controller are not automatically reset even when the SSI Input Unit normally receives data. Reset the error event with an error reset method of the Controller.

SSI Communications Error Code

The bit configuration of the SSI Communications Error Code parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	ERROR CODEn			

Abbr.	Data	Description
ERROR CODEn	SSI Communications Error Code	This contains the detailed error code for ERRn. 0: No error 1: Communications Preparation Incomplete 2: Frame Error 3: Parity Error 4: Communications Timeout 5: Out of range for position difference

Additional Information

- The error status in the SSI Status parameter and the SSI Communications Error Code parameter are both set to 0 when the data is received without an error.
- When you use the SSI Input Unit in combination with an NJ/NX-series Controller, notification of SSI communications errors is provided in the SSI Communications Error Code in the SSI Status of the SSI Input Unit. Also, the Controller detects an error event and manages it. Error events for which notification is provided in the Controller are not automatically reset even when the SSI Input Unit normally receives data. Reset the error event with an error reset method of the Controller.

Error description	Detection details	Assumed cause	Possible correction
Communications Preparation Incomplete	This error occurs when an SSI data input is not at high level before the SSI clock signal is sent.	• I/O power is not being supplied. • The SSI data input (D+ and D-) is connected with reversed polarity. • There is an encoder or Unit malfunction.	• Check the I/O power supply. • Check the SSI data input wiring. • Replace the encoder or Unit.

Error description	Detection details	Assumed cause	Possible correction
Frame Error	This error occurs when an SSI data input is not at low level*1 in the next clock cycle after the final bit of SSI data is received.	• The SSI settings are incorrect. • An SSI communications line (clock output or data input) is disconnected. Or, the clock output (C+ and C-) is connected with reversed polarity. • There is noise on an SSI communications line. • There is an encoder or Unit malfunction.	• Set the correct SSI settings for the connected encoder. • Check the wiring to the SSI encoder. • Remove the sources of any noise around the SSI communications lines. • Replace the encoder or Unit.
Parity Error	This error occurs if the results of a parity check performed on received data detects an error.	• There is a problem with the parity check settings. • There is noise on an SSI communications line. • There is an encoder or Unit malfunction.	• Set the correct SSI settings for the connected encoder. • Remove the sources of any noise around the SSI communications lines. • Replace the encoder or Unit.
Communications Timeout	This error occurs if the SSI data input is not at high level after the monoflop time elapses and the SSI data is received.	• The SSI settings are incorrect. • The SSI communications line for clock output was disconnected during communications. • There is noise on an SSI communications line. • There is an encoder or Unit malfunction.	• Set the correct SSI settings for the connected encoder. • Check the wiring to the SSI encoder. • Remove the sources of any noise around the SSI communications lines. • Replace the encoder or Unit.
Out of range for position difference	If error data detection is enabled, this error occurs when a change that exceeds the position variation limit is detected in SSI data.	• There is noise on an SSI communications line. • There is an encoder or Unit malfunction.	• Remove the sources of any noise around the SSI communications lines. • Replace the encoder or Unit.

*1. The low level is the state when the SSI data frame ends in 0.

Encoder Present Position

The bit configuration of the Encoder Present Position parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CVn (Chn Encoder Present Position LL)							
+1	CVn (Chn Encoder Present Position LH)							
+2	CVn (Chn Encoder Present Position HL)							
+3	CVn (Chn Encoder Present Position HH)							

Abbr.	Data	Description
CVn	Chn Encoder Present Position	This contains the present position of the encoder for channel n.

Status Data

The bit configuration of the Status Data parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	STDn (Chn Status Data LL)							
+1	STDn (Chn Status Data LH)							
+2	STDn (Chn Status Data HL)							
+3	STDn (Chn Status Data HH)							

Abbr.	Data	Description
STDn	Chn Status Data	This contains the status data obtained from the encoder for channel n.

Encoder Present Position Refresh Count

The bit configuration of the Encoder Present Position Refresh Count parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CVRn (Chn Encoder Present Position Refresh Count L)							
+1	CVRn (Chn Encoder Present Position Refresh Count H)							

Abbr.	Data	Description
CVRn	Chn Encoder Present Position Refresh Count	This bit is incremented by 1 every time the present value of channel n is refreshed. The value returns to 0 after it exceeds 65,535.

Time Stamp

The bit configuration of the Time Stamp parameter is given in the following table.

Refer to *7-9-9 Time Stamping* on page 7-56 for details on time stamps.

Note An EtherCAT Coupler Unit with unit version 1.1 or later is required.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	TMSn (Chn Time Stamp, 1st byte)							
+1	TMSn (Chn Time Stamp, 2nd byte)							
+2	TMSn (Chn Time Stamp, 3rd byte)							
+3	TMSn (Chn Time Stamp, 4th byte)							
+4	TMSn (Chn Time Stamp, 5th byte)							
+5	TMSn (Chn Time Stamp, 6th byte)							
+6	TMSn (Chn Time Stamp, 7th byte)							
+7	TMSn (Chn Time Stamp, 8th byte)							

Abbr.	Data	Description
TMSn	Chn Time Stamp	Contains the time stamp for when Chn changed. It stores the DC time. (Unit: ns)

SSI Operation Command

The big configuration of the SSI Operation Command parameter is given in the following table.

n: Channel number

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	---	---	CENn
1	---	---	---	---	---	---	---	---

Abbr.	Data	Description
CENn	SSI Communications Enable	1: Enables SSI communications. 0: Disables SSI communications.

Precautions for Correct Use

The SSI Operation Command parameter is used by assigning it to I/O data. However, do not assign this variable to I/O data when you assign it to an MC Function Module axis.

When you assign the variable to an MC Function Module axis, manipulate the variable through the MC Function Module axis and not in the variable itself.

7-7-3 Axis Settings

Use the SSI Input Unit as an encoder axis when you use the MC Function Module in an NJ/NX-series Controller.

For information on axis parameters and how to assign axis variables, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

7-8 Setting Methods

This section describes the setting methods for the SSI Input Units.

You can use an SSI Input Unit as an encoder axis input device if you also use the MC Function Module.

This section describes the settings for using an NJ/NX-series Controller and the MC Function Module to control SSI Input Units.

For details on the functions of the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Precautions for Correct Use

To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units. Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

7-8-1 Building and Wiring the System

SSI Input Units are mounted after an EtherCAT Coupler Unit to build an NX Unit Slave Terminal. The Slave Terminal is connected through EtherCAT communications.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to build NX Unit systems.

Refer to *7-5 Terminal Block Arrangement* on page 7-10 for information on wiring SSI Input Units to external devices, such as SSI encoders.

7-8-2 Setting Examples

This section describes the minimum parameter settings that are required to use SSI Input Units with the MC Function Module.

Refer to *7-9-1 Parameters* on page 7-38 for information on SSI Input Unit parameters.

Setting Up SSI Communications

You can set SSI Input Unit parameters for a variety of SSI encoder communications data formats, timings, coding methods, and other settings.

Set the parameters based on the communications specifications of the connected SSI encoder.

Refer to *7-9-2 SSI Data Settings* on page 7-40 for information on SSI communications settings.

Count Direction Setting

Use the Encoder Count Direction parameter to specify the incrementing/decrementing direction in the Unit in comparison to the incrementing/decrementing direction of the SSI Encoder.

You can reverse the count direction from the Unit for SSI encoders that provide the absolute position in the communications data.

The default setting for the SSI Input Unit is 0 (Not to invert the sign).

Refer to *7-9-4 Encoder Count Direction* on page 7-50 for information on setting the count direction.

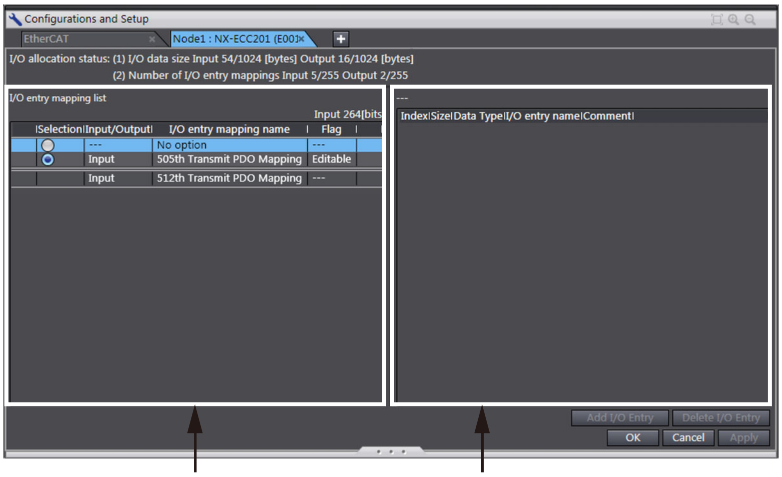
I/O Entry Mappings

This section describes I/O entry mapping to control encoder axes from the MC Function Module.

You must map the objects that are required for the motion control functions that you will use to process data communications.

The I/O entry mapping is a list of required objects that is prepared in advance.

You select the I/O entry mappings to use in the Edit I/O Allocation Settings area of the Slave Terminal Tab Page in the Sysmac Studio.



The following I/O entry mappings are selected by default in the Sysmac Studio.

RxPDO	No assignments
TxPDO	SSI Status, SSI Communications Error Code, Encoder Present Position, and Status Data

Refer to *A-2 Object Lists* on page A-28 for details on each object.

Use the default Sysmac Studio I/O entry mappings to use the SSI Encoder Input Unit with the MC Function Module.

Relationships between MC Function Module and Process Data

The functions of the MC Function Module are related to the information in the process data objects.

Use the default Sysmac Studio settings to use the SSI Input Unit with the MC Function Module.

7-9 Functions

This section describes the SSI data settings and other functions, such as the coding methods and bit shifting.

Precautions for Correct Use

Functions are restricted by the selected I/O refreshing method and Controller. Refer to *7-6-5 Differences in I/O Refreshing Methods Based on the Controller* on page 7-21 for details.

7-9-1 Parameters

The following table lists the parameters that are used in the SSI Input Units.

Parameter name	Function	Setting range	Unit	Default	Reference
Baud Rate	0: 100 kHz 1: 200 kHz 2: 300 kHz 3: 400 kHz 4: 500 kHz 5: 1.0 MHz 6: 1.5 MHz 7: 2.0 MHz	0 to 7	---	4	P. 7-41
SSI Communications Start-Up Time	0: 2,000 ms 1: 1,050 ms 2: 500 ms 3: No delay	0 to 3		0	P. 7-41
Wait Time for Receive Enabled	This is the wait time until the next frame can be sent.	0 to 9999	10 μs	0	P. 7-41
Monoflop Time	This is the duration from when the last block is sent until the high level is confirmed on the data line.	1 to 9999	10 μs	4	P. 7-41
Conversion Wait Time	This is the wait time from the falling edge of the first clock signal to the rising edge.	0 to 64	---	0	P. 7-41
Valid Data Length	This is the valid bit length of the SSI data.	1 to 32	Bits	25	P. 7-41
Single-turn Data Start Bit	This is the start bit position for single-turn data.	0 to 31	Bits	12	P. 7-41
Single-turn Data Length	This is the data length of single-turn data.	0 to 32	Bits	13	P. 7-41
Multi-turn Data Start Bit	This is the start bit position for multi-turn data.	0 to 31	Bits	0	P. 7-42
Multi-turn Data Length	This is the data length of multi-turn data.	0 to 32	Bits	12	P. 7-42
Status Data Start Bit	This is the start bit position for status data.	0 to 31	Bits	0	P. 7-42

Parameter name	Function	Setting range	Unit	Default	Reference
Status Data Length	This is the data length of the status data.	0 to 32	Bits	0	P. 7-42
Leading Bits	This is the number of leading bits for the SSI data.	0 to 31	Bits	0	P. 7-52
Parity Check	0: No check 1: Even parity check 2: Odd parity check	0 to 2	---	0	P. 7-53
Encoder Resolution	This is the resolution for single-turn data.	0 to 4294967295	---	0	P. 7-42
Coding Method	0: No change 1: Output binary codes. 2: Change gray codes to binary codes. 3: Change binary codes to present values. 4: Change gray codes to present values.	0 to 4	---	3	P. 7-44
Position Variation Limit	This is the limit to the change in the position from the previous position data.	0 to 2147483647	---	0	P. 7-55
Encoder Count Direction	0: Not to invert the sign 1: Invert the sign	0 or 1	---	0	P. 7-50

7-9-2 SSI Data Settings

You can connect an SSI Input Unit to the following types of encoders.

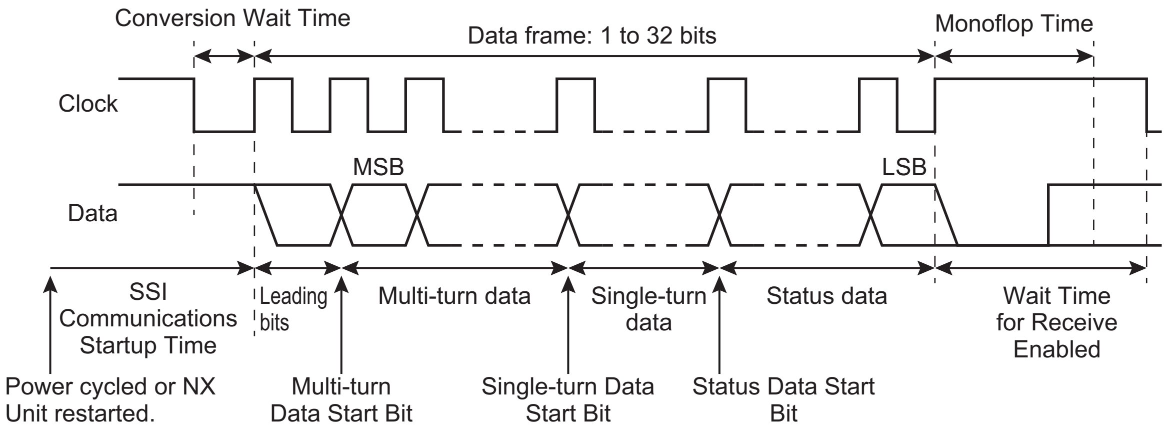
- A single-turn encoder that performs single-turn position detection
- A multi-turn encoder that can count the number of rotations
- An encoder that reports the position data and status data

The encoder's position data and status data are synchronized with the clock signal and transferred over the data line.

You can set the bit positions and bit lengths for multi-turn data, single-turn data, and status data. You can also set the start bit position data for position data and status data.

This enables you to support a variety of encoders with different status data positions or when additional information is added in front of or behind the position data.

However, the total bit length of all the data must not exceed 32 bits. The bit position plus data length of any data must not exceed 32 bits.



Use the following equation to calculate the actual present position to send to the Controller.

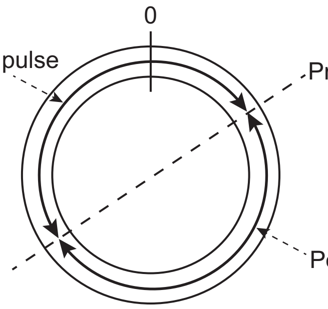
- Actual present position = Previous present position + Travel distance

However, the calculation method depends on the code conversion that you used. Refer to *7-9-3 Coding Method* on page 7-44 for information on code conversion.

The travel distance is calculated according to the direction of rotation.

The direction of rotation is determined to be in the Forward/reverse direction pulse based on where the present value is in the range of ±resolution/2 of the previous value, as shown in the figure below.

The travel distance is considered positive if the direction of rotation is positive, and it is considered negative if the direction of rotation is negative.



Settings

The following table gives the meanings and default values of the parameter settings.

Changes to the following parameter settings are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Parameter name	Setting	Default	Remarks
SSI Communications Start-Up Time	0: 2,000 ms 1: 1,050 ms 2: 500 ms 3: No delay	0	Set this parameter to the wait time until SSI communications are started from the time that power is supplied to the SSI Encoder Unit after the power supply is turned ON or after the NX Unit is restarted.
Wait Time for Receive Enabled*1	0 to 9999 × 10 µs	0	Set the wait time until the next frame can be received.
Monoflop Time	1 to 9999 × 10 µs	4	Set this parameter to the duration from when the last clock is sent until the high level is confirmed on the data line.
Conversion Wait Time	0 to 64 × Transmission clock cycle	0	• Set the wait time from the falling edge of the first clock signal to the rising edge. • The wait time is the clock cycle multiplied by the set value. A setting of 0 is equal to a half of the clock cycle.
Baud Rate	0: 100 kHz 1: 200 kHz 2: 300 kHz 3: 400 kHz 4: 500 kHz 5: 1.0 MHz 6: 1.5 MHz 7: 2.0 MHz	4	Set the frequency of the transmission clock signal for SSI communications.
Valid Data Length*2*3*4	1 to 32 (bits)	25	Set the valid bit length for SSI data.
Single-turn Data Start Bit*2	0 to 31 (bits)	12	Set the start bit position for single-turn data.
Single-turn Data Length*2*5	0 to 32 (bits)	13	Set the data length for single-turn data.

Parameter name	Setting	Default	Remarks
Multi-turn Data Start Bit*3	0 to 31 (bit)	0	Set the start bit position for multi-turn data.
Multi-turn Data Length*3*5	0 to 32 (bits)	12	Set the data length for multi-turn data.
Status Data Start Bit*4	0 to 31 (bit)	0	Set the start bit position for status data.
Status Data Length*4*5	0 to 32 (bits)	0	Set the data length for status data.
Encoder Resolution*6	0 to 4294967295	0	Set the single-turn resolution. If this parameter is set to 0, the resolution is the maximum setting value for single-turn data + 1.

*1. Set the time that is required for the SSI encoder to output data again. This time depends on the SSI encoder. Set it according to the specifications of the SSI encoder that is connected.

*2. If the sum of the values set for the Single-turn Data Start Bit and the Single-turn Data Length parameters is greater than the Valid Data Length parameter, SSI communications are disabled and an SSI Data Setting Error event occurs.

*3. If the sum of the values set for the Multi-turn Data Start Bit and the Multi-turn Data Length parameters is greater than the Valid Data Length parameter, SSI communications are disabled and an SSI Data Setting Error event occurs.

*4. If the sum of the values set for the Status Data Start Bit and the Status Data Length parameters is greater than the Valid Data Length parameter, SSI communications are disabled and the SSI Data Setting Error event occurs.

*5. If the sum of the values set for the Multi-turn Data Length, Single-turn Data Length, and Status Data Length parameters is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

*6. If the resolution is greater than the range represented by the value set for the Single-turn Data Length parameter, SSI communications are disabled and an SSI Data Setting Error event occurs.

Encoder Setting Examples

This section provides setting examples for four different encoder formats.

● Single-turn 13-bit Data

Received frame bit positions												
0: MSB	1	2	3	4	5	6	7	8	9	10	11	12
S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0

Note S0, S1, etc., are the data bits that give the absolute position during a single rotation.

Valid data length	Single-turn data start bit	Single-turn data length	Multi-turn data start bit	Multi-turn data length	Status data start bit	Status data length
13	0	13	0	0	0	0

● Multi-turn 25-bit, Multi-turn 12-bit, and Single-turn 13-bit Data

Received frame bit positions																
0: MSB	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	S12	S11	S10	S9	S8

Received frame bit positions							
17	18	19	20	21	22	23	24
S7	S6	S5	S4	S3	S2	S1	S0

Note 1. M0, M1, etc., are the data bits that give the number of rotations.
2. S0, S1, etc., are the data bits that give the absolute position during a single rotation.

Valid data length	Single-turn data start bit	Single-turn data length	Multi-turn data start bit	Multi-turn data length	Status data start bit	Status data length
25	12	13	0	12	0	0

● Single-turn 9-bit Data and Alarm Bit

Received frame bit positions												
0: MSB	1	2	3	4	5	6	7	8	9	10	11	12
S8	S7	S6	S5	S4	S3	S2	S1	S0	0	0	A	0

Note 1. S0, S1, etc., are the data bits that give the number of rotations.
2. A is a bit that indicates an error.

Valid data length	Single-turn data start bit	Single-turn data length	Multi-turn data start bit	Multi-turn data length	Status data start bit	Status data length
13	0	9	0	0	11	1

● Tannen Baum Multi-turn 9-bit and Single-turn 12-bit Data

Received frame bit positions																
0: MSB	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0	0	M8	M7	M6	M5	M4	M3	M2	M1	M0	S11	S10	S9	S8	S7

Received frame bit positions								
17	18	19	20	21	22	23	24	25
S6	S5	S4	S3	S2	S1	S0	0	0

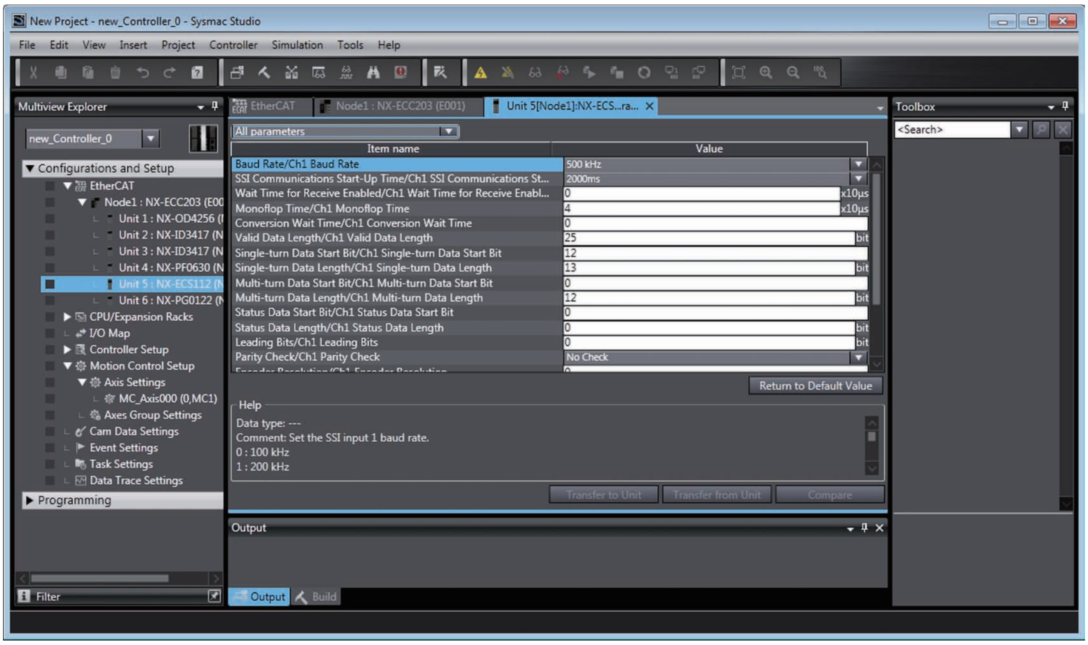
Note 1. M0, M1, etc., are the data bits that give the number of rotations.
2. S0, S1, etc., are the data bits that give the absolute position during a single rotation.

Valid data length	Single-turn data start bit	Single-turn data length	Multi-turn data start bit	Multi-turn data length	Status data start bit	Status data length
26	3	12	12	9	0	0

Setting with the Sysmac Studio

1 Double-click the SSI Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the parameters.

7-9-3 Coding Method

You can convert received SSI data into different formats.

Use the Code Method Setting parameter to change the format conversion method.

Parameter name	Setting	Default	Remarks
Coding Method	0: No change 1: Output binary codes. 2: Change gray codes to binary codes. 3: Change binary codes to present values. 4: Change gray codes to present values.	3	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

No Change

This method passes SSI data to the input area exactly as it is received. Select this method to perform all protocol interpretation in the user program.

Valid SSI data (data after the bits are shifted)

↓ No change

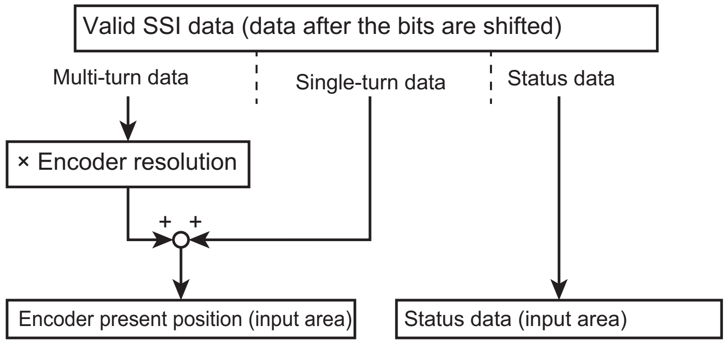
Encoder present position (input area)

Additional Information

The status data in the input area is not used when *No change* is selected. This data will always be 0.

Output Binary Codes

This method divides SSI data up into multi-turn data, single-turn data, and status data. Then, the encoder present position is calculated from the multi-turn data and single-turn data based on the encoder resolution and sent to the input area along with the status data.



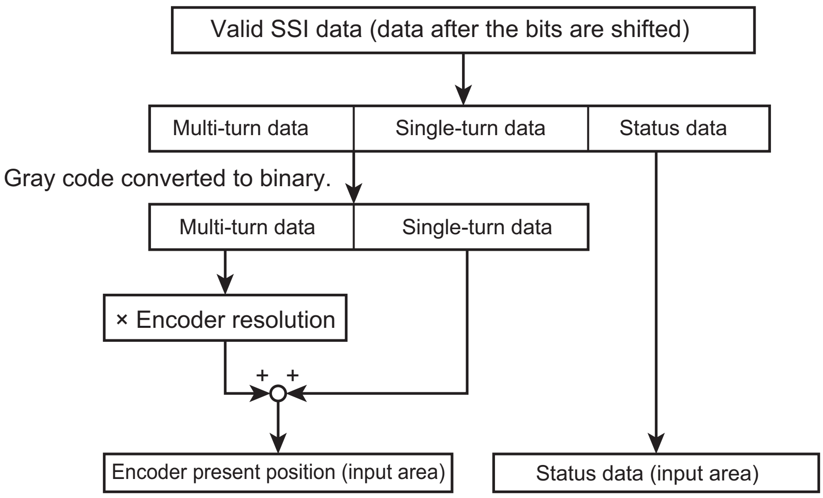
Additional Information

If the set value of the Encoder Resolution parameter is 0, the resolution is calculated as the maximum value of the single-turn data plus 1.

Changing Gray Codes to Binary Codes

Select this method when the data format from the encoder is gray code.

Received SSI data is converted to binary and processed in the same way as for binary code output, and then the encoder present position and status data are sent to the input area.



Additional Information

For a multi-turn encoder, the SSI Input Unit will perform gray code conversion treating the multi-turn data and single-turn data as continuous data. In this case, always set the Encoder Resolution parameter to 0. If you set the Encoder Resolution parameter to any value other than 0, the encoder present position will not be calculated correctly.

● Corresponding Gray Codes and Binary

The following table lists the gray codes and their equivalent values in binary.

Hex	Gray code	Binary
0	0000	0000
1	0001	0001
2	0011	0010
3	0010	0011
4	0110	0100
5	0111	0101
6	0101	0110
7	0100	0111
8	1100	1000
9	1101	1001
A	1111	1010
B	1110	1011
C	1010	1100
D	1011	1101
E	1001	1110
F	1000	1111

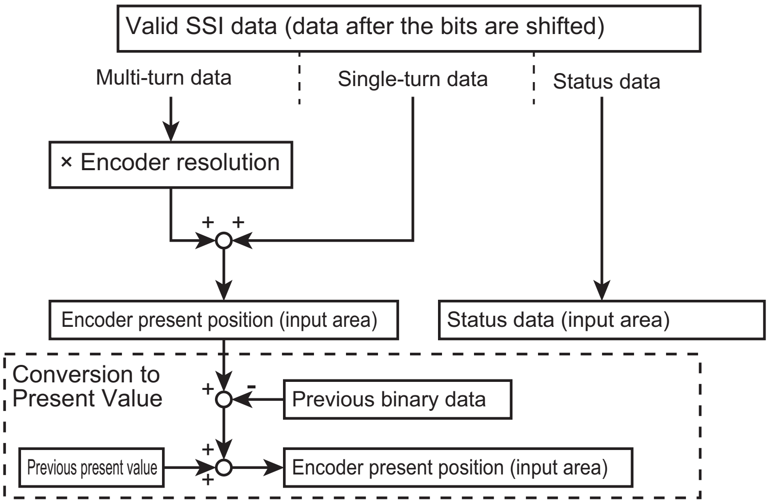
● Remainder Gray Code

For single-turn encoders, if the set resolution is not a power of 2, remainder gray codes are used for calculations.

Changing Binary Codes to Present Values

Select this method when the data format from the encoder is binary.

This method divides SSI data up into multi-turn data, single-turn data, and status data. The present value of the encoder is then expanded to signed, 32-bit present value data from the multi-turn and single-turn data according to the encoder resolution. This encoder present position and status data are then both sent to the input area.



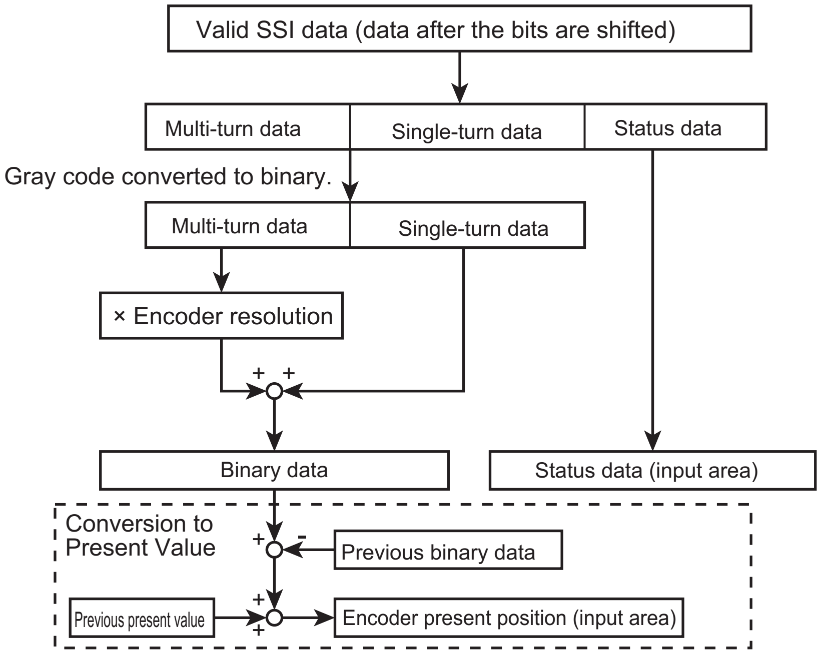
Additional Information

If the set value of the Encoder Resolution parameter is 0, the resolution is calculated as the maximum value of the single-turn data plus 1.

Changing Gray Codes to Present Values

Select this method when the data format from the encoder is gray code.

Received SSI data is converted to binary and processed in the same way as for when the Coding Method parameter is set to *Change binary code to present value*, and then the encoder present position and status data are sent to the input area.

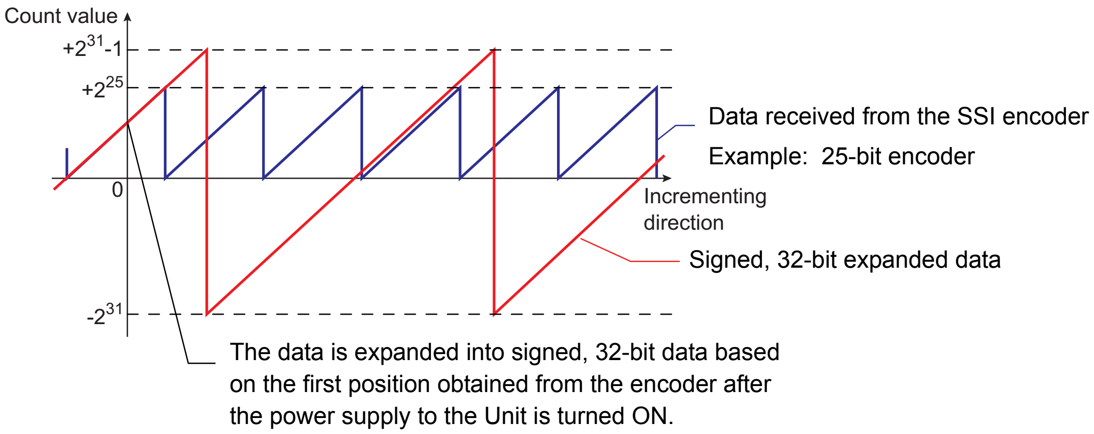


Additional Information

For a multi-turn encoder, the SSI Input Unit will perform gray code conversion treating the multi-turn data and single-turn data as continuous data. In this case, always set the Encoder Resolution parameter to 0. If you set the Encoder Resolution parameter to any value other than 0, the encoder present position will not be calculated correctly.

Present Value Conversion for SSI Input Units

When you change binary code to the present value or gray code to the present value to convert the code, the present value is expanded to signed, 32-bit data according to the position information obtained from the SSI encoder. The first position for the absolute value data from the SSI encoder is the first data read after the power supply to the SSI Unit is turned ON or the Unit is restarted. Counting is then performed based on the relative increment in the same way as an incremental encoder.



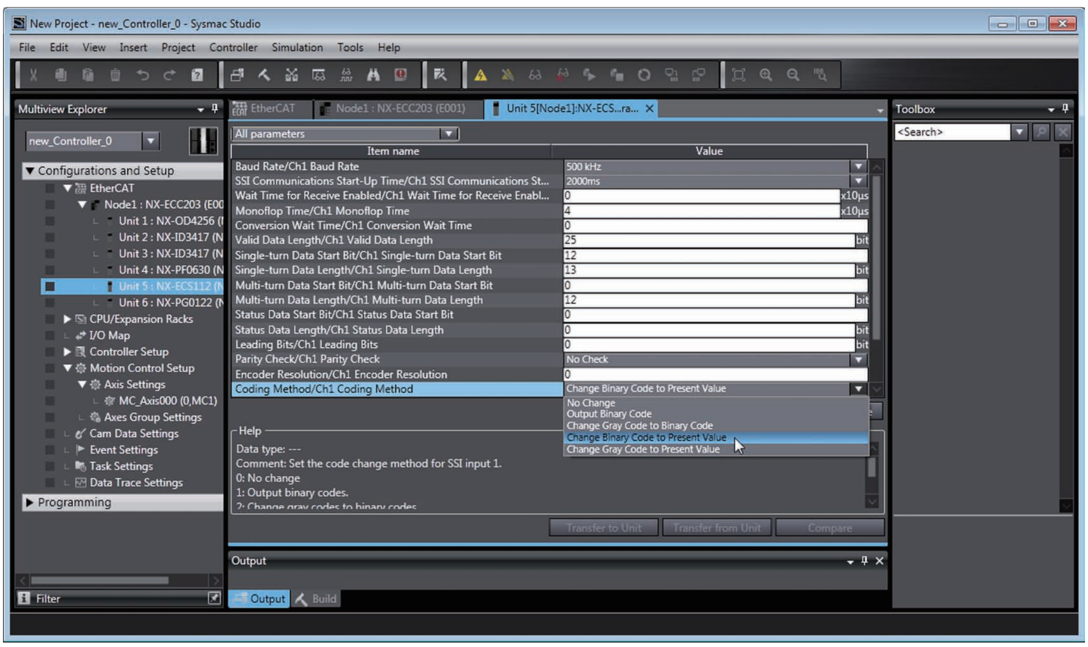
If you use present value conversion with an SSI encoder that supports a resolution other than 32 bits, the reference point (home position) changes from the signed, 32-bit data after one rotation of absolute value data from the encoder.

For continuously repeating encoder absolute value data rotations, the absolute value data converted from the present value cannot be retained. In this case, set the Coding Method parameter to *No change* or to *Change gray codes to binary codes* to perform position control from the Controller.

Setting with the Sysmac Studio

1 Double-click the SSI Input Unit in the Multiview Explorer.

The following tab page is displayed.



7-9 Functions

7

7-9-3 Coding Method

2 Set the Coding Method parameter.

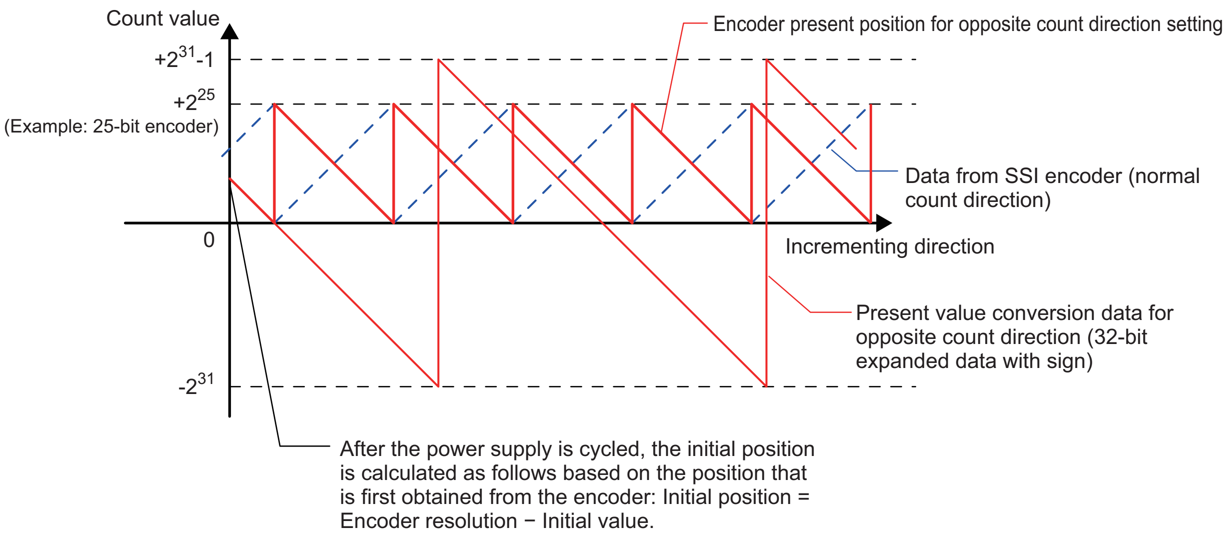
7-9-4 Encoder Count Direction

You can change the count direction of data that is received from the encoder.

Set the Encoder Count Direction parameter to change the count direction.

Parameter name	Setting	Default	Remarks
Encoder Count Direction	0: Not to invert the sign 1: Invert the sign	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

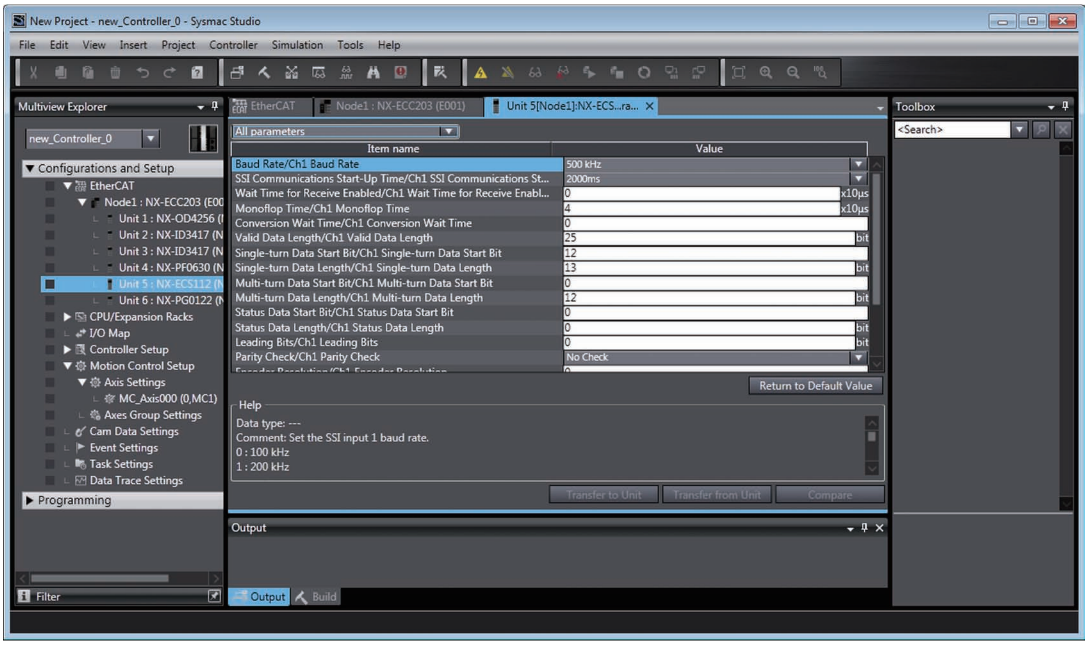
If you set the parameter to use the opposite encoder count direction, the encoder present position is calculated as shown below.



Setting with the Sysmac Studio

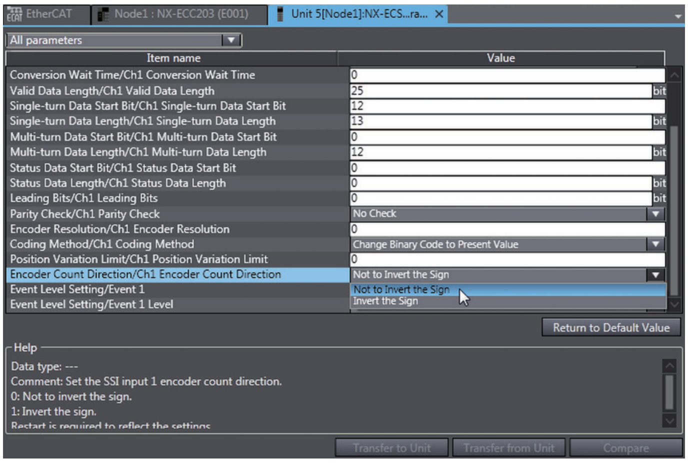
1 Double-click the SSI Input Unit in the Multiview Explorer.

The following tab page is displayed.



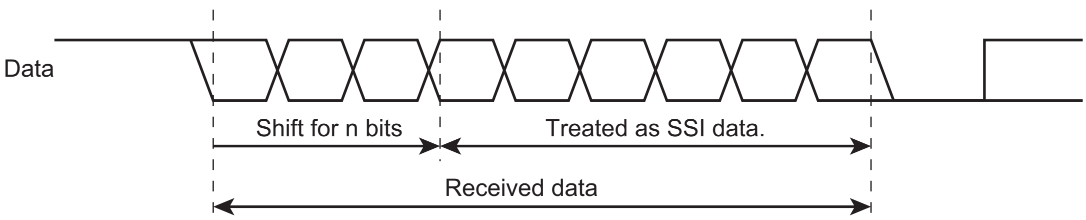
2 Scroll down the Configurations and Setup Tab Page.

Set the Encoder Count Direction parameter.



7-9-5 Bit Shifting

The number of error bits and the location of position data depend on the encoder that you use. You can shift the first bit in received frames to specify the first position of the received SSI data.



Parameter name	Setting	Default	Remarks
Leading Bits	0 to 31 (bits)	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

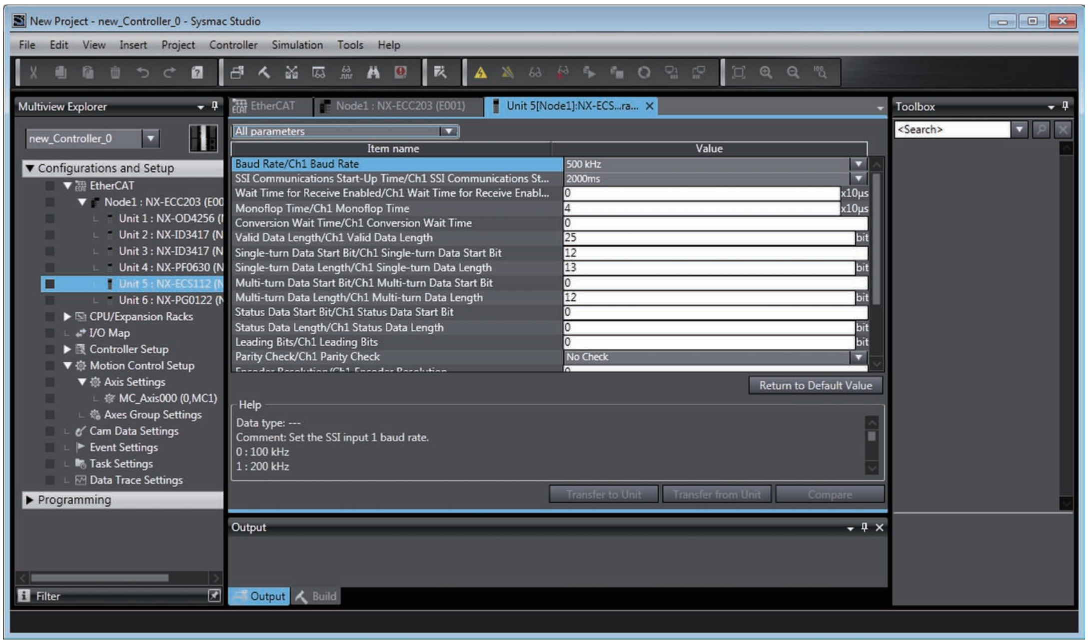
Precautions for Correct Use

If the sum of the values set for the Valid Data Length parameter and the Leading Bits parameter is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Setting with the Sysmac Studio

1 Double-click the SSI Input Unit in the Multiview Explorer.

The following tab page is displayed.

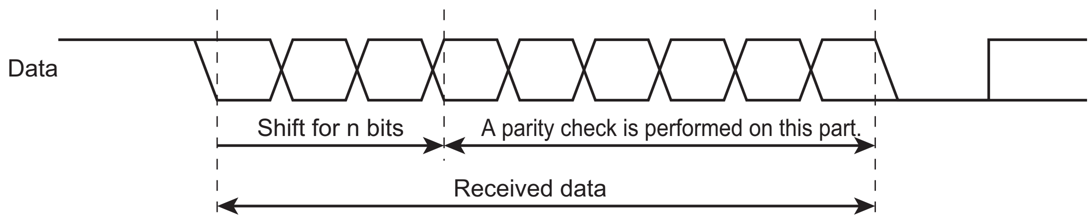


2 Set the Leading Bits parameter.

7-9-6 Parity Check

A parity check is performed on all bits after the bits of SSI data are shifted.

If a parity error is detected, it is reflected in the error code in the SSI Status parameter.

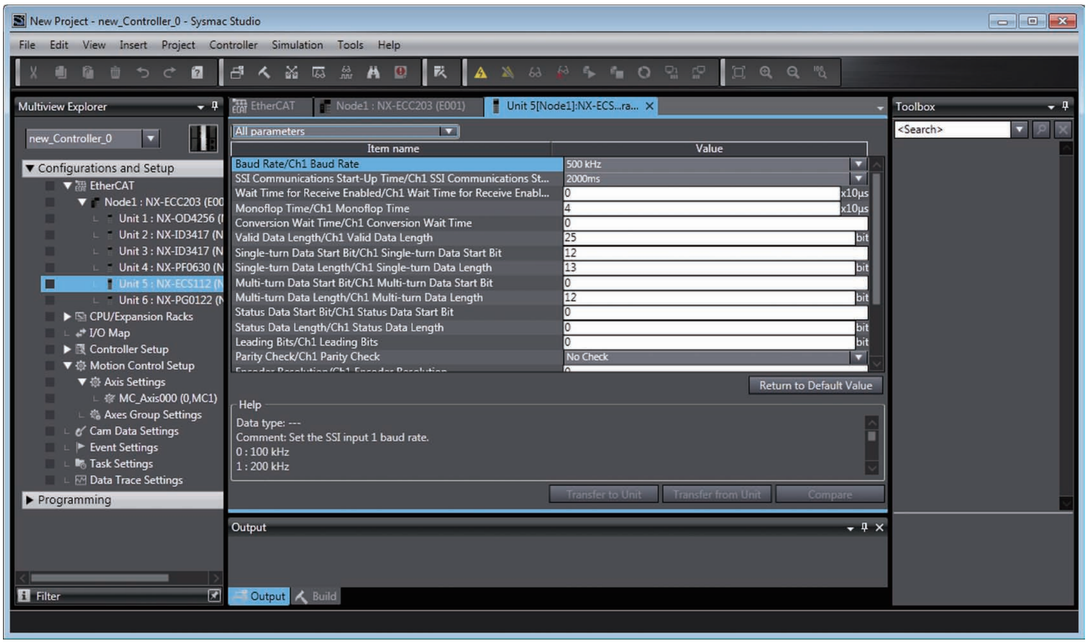


Parameter name	Setting	Default	Remarks
Parity Check	0: No check 1: Even parity check 2: Odd parity check	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Setting with the Sysmac Studio

1 Double-click the SSI Input Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Parity Check parameter.

7-9-7 Data Refresh Status

Data is refreshed in SSI data communications according to the Baud Rate parameter on a cycle that is longer than the Controller's I/O refresh cycle. SSI Input Units have the following two methods to check whether the data was refreshed in the Controller.

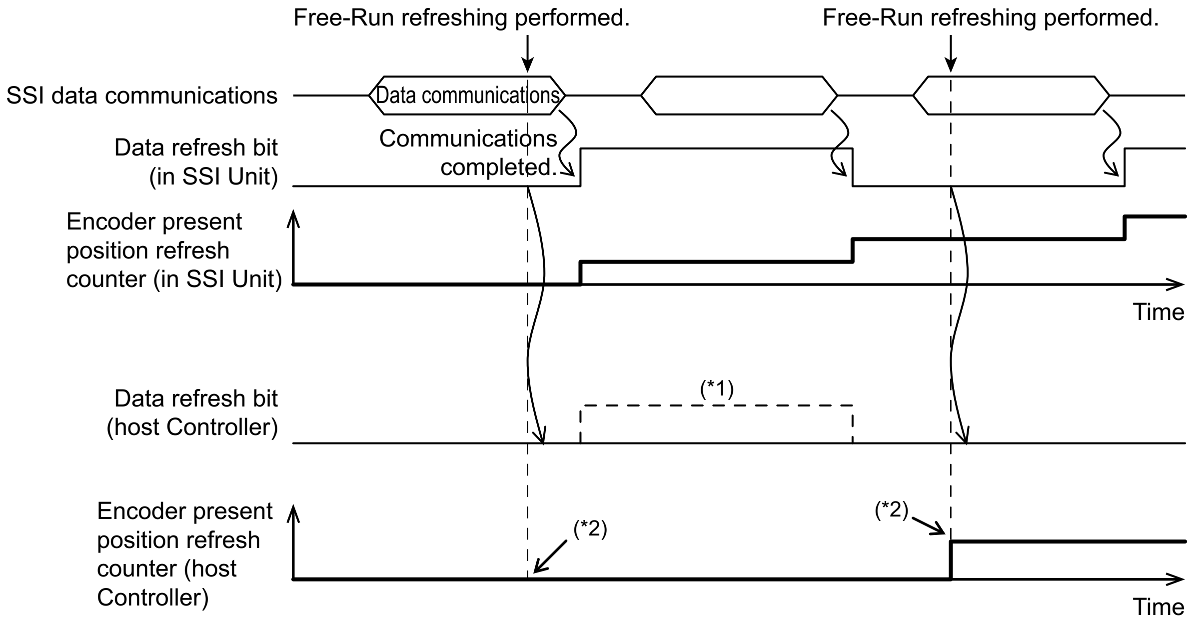
Function	Description	Remarks
Data Refresh Status bit (SSI Status)	This bit is toggled between 0 and 1 every time the position data is refreshed through SSI data communications.	You can use this bit only when the I/O refreshing method is set to synchronous I/O refreshing.
Encoder Present Position Refresh Count	A counter with a range from 0 to 65,535 is incremented by 1 every time the position data is refreshed through SSI data communications. The value returns to 0 after it exceeds 65,535.	You can use this variable when the I/O refreshing method is set to Free-Run refreshing or synchronous I/O refreshing.

- The Data Refresh Status bit is toggled every time SSI data communications are performed. Therefore, you can use it only with synchronous I/O refreshing, i.e., when SSI communications are synchronized with the I/O refreshing operation of the Controller.
  With Free-Run refreshing, SSI communications are sometimes performed more than once during the Controller's I/O refresh cycle, and therefore the value of this bit is not dependable.
- Use the Encoder Present Position Refresh Count parameter to determine if the data has been refreshed when you use Free-Run refreshing.

Timing Charts

The following timing charts show the timing for both Free-Run refreshing and synchronous I/O refreshing.

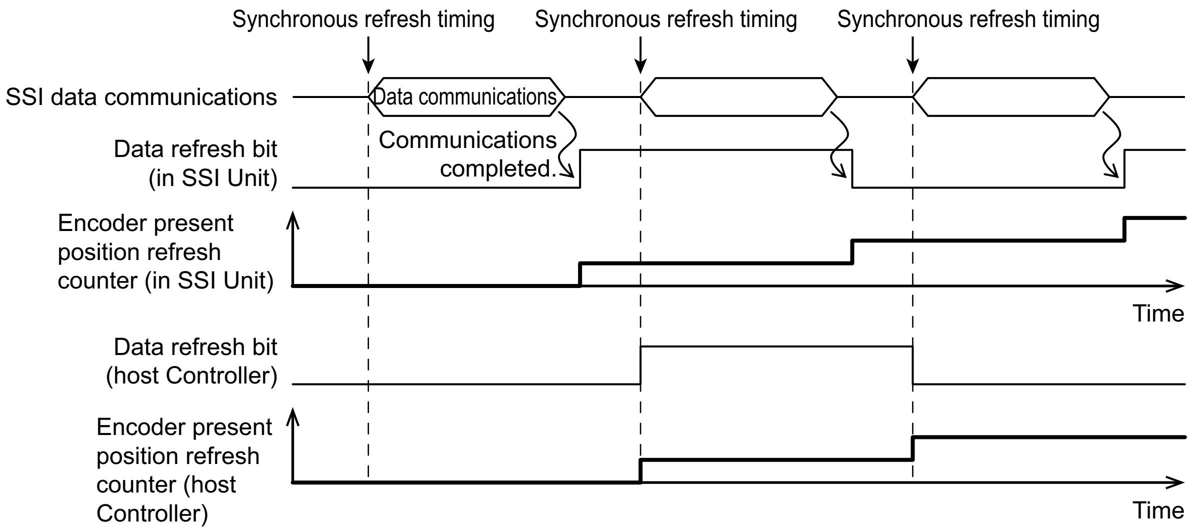
● Free-Run Refreshing



*1. Bit changes are not always detected depending on the I/O refresh cycle and timing when you use Free-Run refreshing.

*2. You can compare the values of the Encoder Present Position Refresh Count parameter to check if the data has been refreshed when you use Free-Run refreshing.

● Synchronous I/O Refreshing



7-9-8 Error Data Detection

You can separate out error data based on the difference between the previous and current present values.

Data is treated as error data if the difference between the previous and current present values is greater than the value set for the Position Variation Limit parameter.

Error data is discarded and the present position of the encoder is not refreshed.

The following data is also not refreshed:

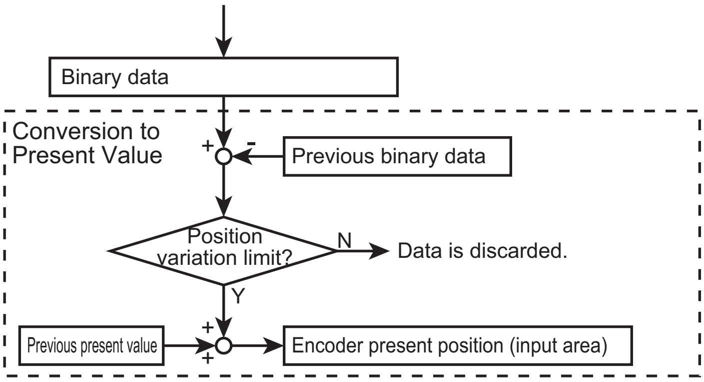
- Data Refresh Status bit
- Encoder Present Position Refresh Count
- Time Stamp

Any time error data is detected with this function, the error code in the SSI Status parameter is updated.

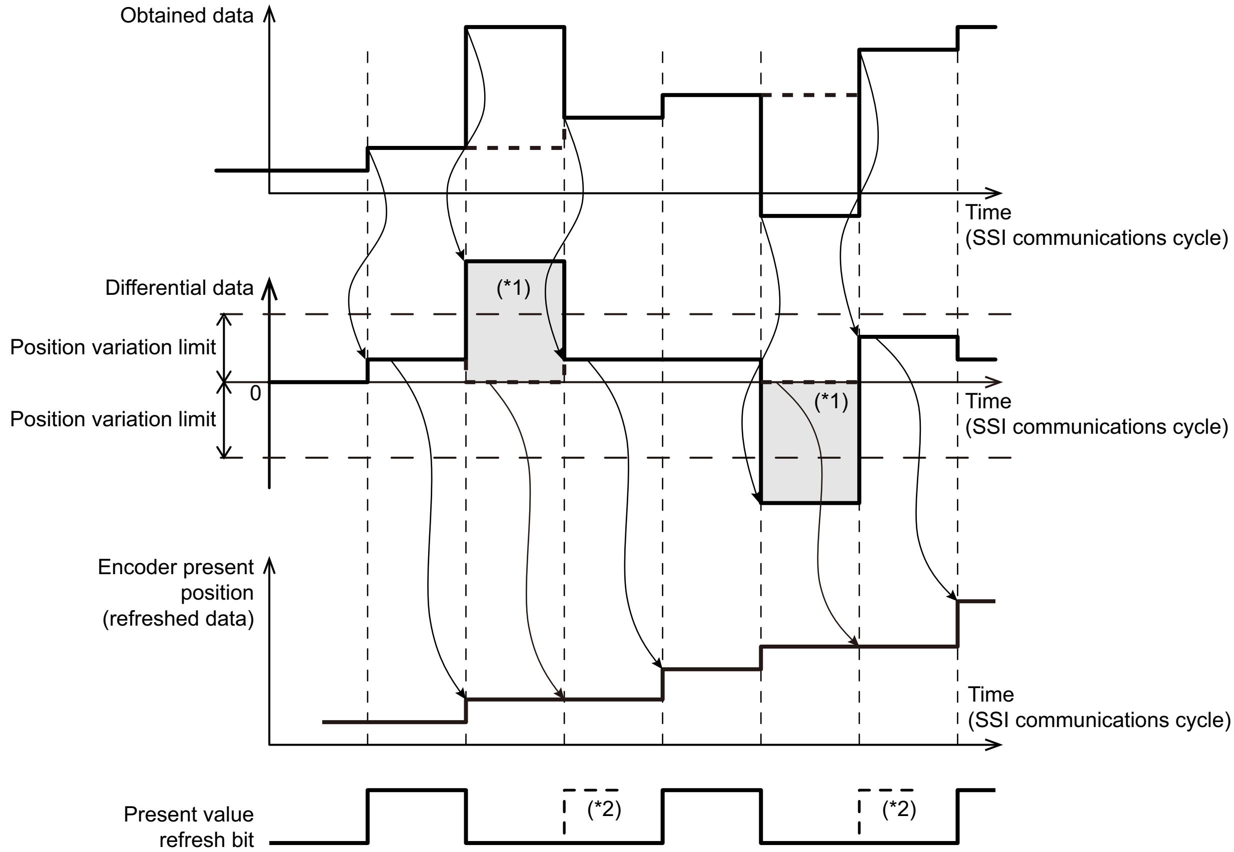
Parameter name	Setting	Default	Remarks
Position Variation Limit	0 to 2147483647	0	• Set this parameter to 0 to disable the function. • Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Precautions for Correct Use

Error data detection is possible only when the coding method is set to change binary codes to present values or change gray codes to present values. Otherwise, this function is disabled.



Timing Charts



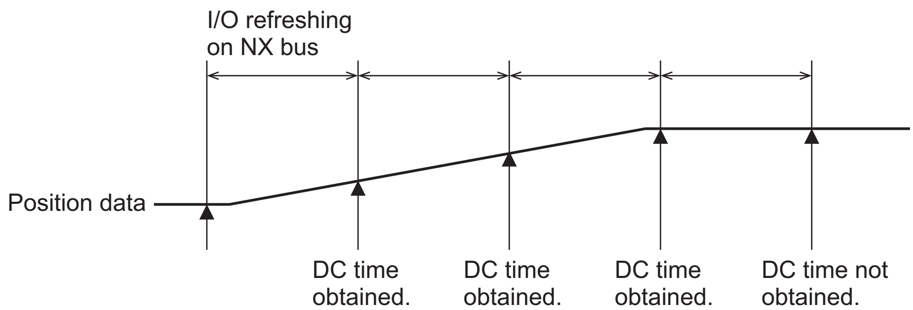
*1. The difference is greater than the limit, so the obtained data is discarded and the current data is not refreshed. The difference is then set to 0.

*2. If the present position of the encoder is not refreshed because of the discarded data, the present position refresh bit is also not toggled. The Encoder Present Position Refresh Count and Time Stamp parameters are also not refreshed.

7-9-9 Time Stamping

When you obtain SSI data from an SSI Input Unit and the position data has changed from the previously obtained position data, you can obtain the DC time when that change occurred along with the data.

Position data is obtained when NX bus I/O is refreshed.



The obtained position data and DC time are input to the Controller.

The obtained DC time is called a time stamp.

If there was no change in the position data, the time stamp is not updated and so the previous time stamp is retained.

Refer to *7-7-1 Data Items for Allocation to I/O* on page 7-30 for information and *Time Stamp* on page 7-34 for details on time stamps.

If you use time stamping, you must assign a time stamp to I/O in the SSI Input Unit.

Time stamps are not assigned by default.

Add a time stamp to the I/O entries in the I/O entry mapping using the I/O assignments of the SSI Input Unit.

Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

Refer to *Operation of Synchronous I/O Refreshing* on page 5-7 for information on refreshing of NX bus I/O.

Precautions for Correct Use

- An EtherCAT Coupler Unit with unit version 1.1 or later is required.
- Time stamping is supported only when synchronous I/O refreshing is used. When Free-Run refreshing is used, the data will always be 0.

Application Example

Refer to *6-9-12 Time Stamping* on page 6-75 for a time stamp application example.

7-10 General Specifications

The general specifications of the SSI Input Units are given below.

Item	Specification	
I/O interface	Push-in	
Number of SSI communications input channels	NX-ECS112: 1 channel	
	NX-ECS212: 2 channels	
I/O signals	Data input (D+, D–)	
	Clock output (C+, C–)	
Clock output	EIA standard RS-422-A line driver levels	
Data input	EIA standard RS-422-A line driver levels	
Maximum data length	32 bits (The single-turn, multi-turn, and status data length can be set.)	
Coding method	0: No change, binary code, or gray code	
Baud rate	100 kHz, 200 kHz, 300 kHz, 400 kHz, 500 kHz, 1.0 MHz, 1.5 MHz, or 2.0 MHz	
NX Unit power consumption	NX-ECS112	: 0.85 W max.
	NX-ECS212	: 0.9 W max.
I/O power supply voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)	
Current consumption from I/O power supply	NX-ECS112	: 20 mA max.
	NX-ECS212	: 30 mA max.
I/O power supply method	NX bus	
Weight	NX-ECS112	: 65 g max.
	NX-ECS212	: 65 g max.
Dimensions (Width × Height × Depth)	NX-ECS112 or NX-ECS212: 12 × 100 × 71 mm	
I/O data size[*1]	NX-ECS112	: Inputs: 10 bytes, Outputs: 0 bytes
	NX-ECS212	: Inputs: 20 bytes, Outputs: 0 bytes
Number of I/O entry mappings[*1]	NX-ECS112	: Inputs: 1, Outputs: 0
	NX-ECS212	: Inputs: 2, Outputs: 0

*1. This is the default set value.

8

Pulse Output Units

This section describes the functions of the Pulse Output Unit.

8-1 Interpreting Model Numbers

The model number of the Pulse Output Unit tells you the Unit type, number of axes, I/O specifications, and other information.

NX-PG0 1 2 2

NX Series

Unit Type
PG0: Pulse Output Unit

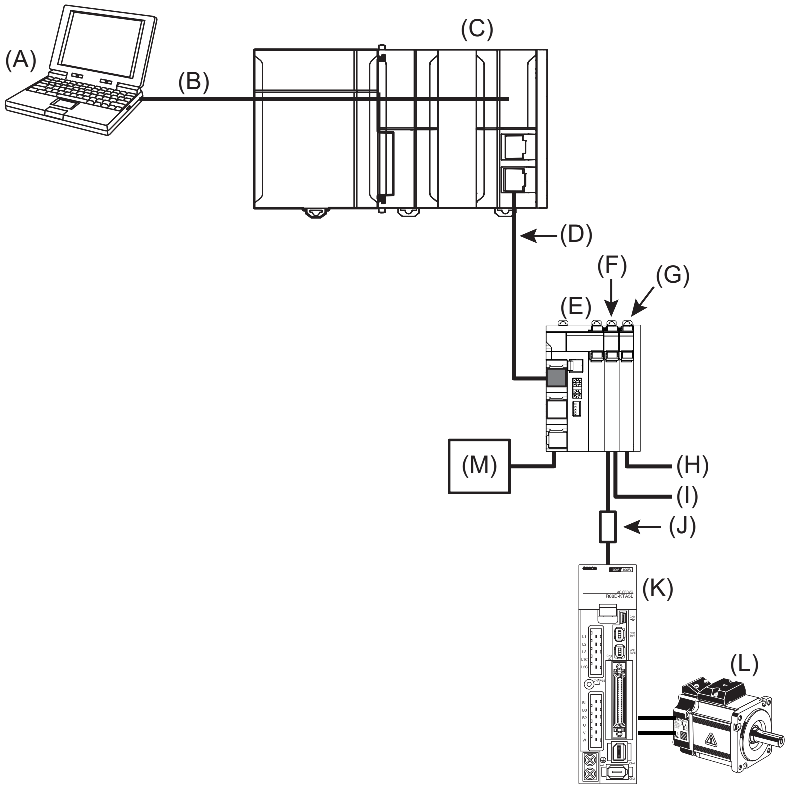
Number of Channels
1: 1 channel

Pulse Output Specification and I/O Polarity
1: Open collector output, NPN
2: Open collector output, PNP

Additional Functions
2: Supports synchronous refreshing

8-2 System Configuration

The following figure shows the system configuration of a Pulse Output Unit.



Symbol	Description
(A)	Support Software (Sysmac Studio)
(B)	Connection to the peripheral USB port or built-in EtherNet I/P port on an NJ/NX-series CPU Unit
(C)	EtherCAT master (NJ/NX-series CPU Unit)
(D)	EtherCAT communications cable
(E)	EtherCAT Coupler Unit
(F)	Pulse Output Unit
(G)	Digital Input Unit
(H)	External inputs*1 (positive limit input, negative limit input, home proximity input, and immediate stop input)
(I)	Latch inputs (Latch input 1 and latch input 2)
(J)	Current-limiting resistor*2
(K)	Drive with pulse string input
(L)	Motor
(M)	I/O power supply

*1. When the Unit is connected to an NJ/NX-series CPU, you can use these inputs by adding a Digital Input Unit and assigning MC Function Module functions. For information on Digital Input Units, refer to the *NX-series Digital I/O Units User’s Manual* (Cat. No. W521).

*2. The pulse output from a Pulse Output Unit is a 24-VDC open collector output. Connect an external current-limiting resistor according to the input specifications of the connected motor drive.
Example: For a G5-series Servo Drive, connect a 2-kΩ (1/2-W) resistor in series.

8-3 Pulse Output Control

The pulse output control from the Controller is the same as control in Cyclic Synchronous Position Control Mode of the CiA402 drive profile.

The control commands that are sent to the Pulse Output Unit are sent with the Controlword and command position each control period. The control status is monitored through the Statusword.

These are equivalent to the following data definitions in the CiA402 drive profile: Controlword, Target Position, and Statusword.

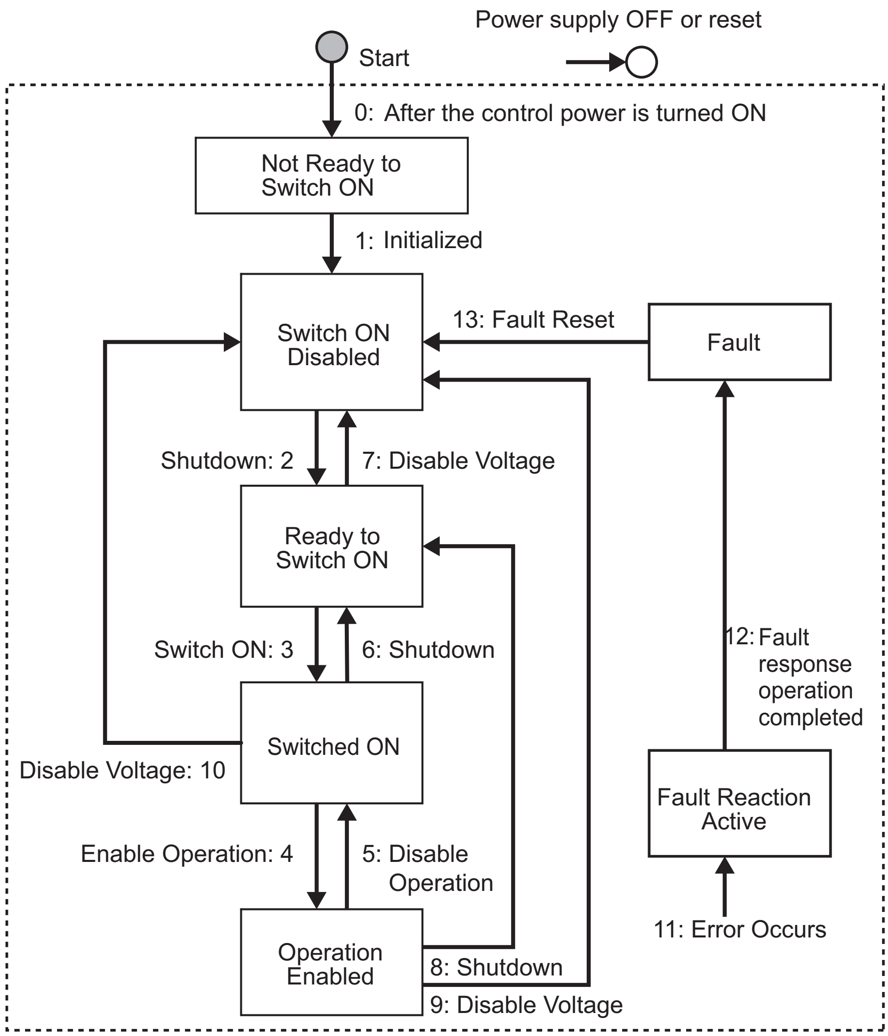
This section describes the control status and Cyclic Synchronous Position Control Mode for the Pulse Output Unit.

8-3-1 Control State

Pulse Operation Unit operations are controlled through a Controlword and the results of those operations are returned in a Statusword.

Control operations are defined by different states and transitions between these states, as shown in the following figure. The control status changes according to the Controlword. The current status is indicated in the Statusword.

A Pulse Output Unit can output pulses in Cyclic Synchronous Position Control Mode when the Servo is turned ON (Operation Enabled).



Controlword

Command	Controlword bits					Number in transition diagram
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
	Fault Reset	Enable Operation	Quick Stop Done	Enable Voltage	Switch ON	
Shutdown	---	---	1	1	0	2, 6, or 8
Switch ON	---	0	1	1	1	3
Switch ON + Enable Operation	---	1	1	1	1	3 + 4 *1
Disable Voltage	---	---	---	0	---	7, 9, or 10
Quick Stop Done	---	---	0	1	---	Not supported. *2
Disable Operation	---	0	1	1	1	5
Enable Operation	---	1	1	1	1	4
Fault Reset	0 to 1 *3	---	---	---	---	13

*1. When the Servo is ready (Switched ON) the Servo is automatically turned ON (Operation Enabled).

*2. The Quick Stop Done command is not supported. Even if a Quick Stop Done command is received, it will be ignored.

*3. This is the operation when bit 7 (Fault Reset) turns ON.

Fault state	• When the error is reset, the Switch ON Disabled state is entered.
Not Fault state	• The state will change according to command bits 0 to 3.

When a Fault Reset is executed with bit 7, set the bit back to 0 before giving the next command.

Refer to *Controlword* on page 8-35 for details on the Controlword.

Statusword

Status	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Switch ON Disabled	Quick Stop Done	Voltage Enabled	Fault	Operation Enabled	Switched ON	Ready to Switch ON
Not Ready to Switch ON	0	0	*1	0	0	0	0
Switch ON Disabled	1	1	*1	0	0	0	0
Ready to Switch ON	0	1	*1	0	0	0	1
Switched ON	0	1	*1	0	0	1	1
Operation Enabled	0	1	*1	0	1	1	1
Fault Reaction Active	0	1	*1	1	1	1	1
Fault	0	1	*1	1	0	0	0

*1. This signal monitors the ON/OFF status of the main power supply circuit, but this signal is always ON for the Pulse Output Unit.

Status	Operation	Number in transition diagram
Start → Not Ready to Switch ON	This is the uninitialized state after the power supply to the Unit is turned ON or after the Unit is reset.	0
Not Ready to Switch ON → Switch ON Disabled	This state is automatically entered from the Not Ready to Switch ON state. The Unit enters this state automatically when the Unit initialization and self-testing processes finish normally.	1
Switch ON Disabled → Ready to Switch ON	Set the Controlword to Shutdown to enter this state.	2
Ready to Switch ON → Switched ON	Set the Controlword to Switch ON to enter this state. Check that the Unit is ready to perform pulse output, and change the state if it is ready.	3
Switched ON → Operation Enabled	Set the Controlword to Operation Enabled to enter this state.	4
Operation Enabled → Switched ON	Set the Controlword to Disable Operation to enter this state. This stops pulse output. *1	5
Switched ON → Ready to Switch ON	Set the Controlword to Shutdown to enter this state.	6
Ready to Switch ON → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state.	7
Operation Enabled → Ready to Switch ON	Set the Controlword to Shutdown to enter this state. This stops pulse output. *1	8
Operation Enabled → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state. This stops pulse output. *1	9
Switched ON → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state.	10
Fault Reaction Active	The Unit enters this state when an error occurs that stops the output. The Statusword is changed to notify the host when the Unit enters the Fault Reaction Active state. The pulse output is stopped when the Unit enters this state. *1	11
Fault	When an error occurs, the Unit outputs an error code and then enters this state.	12
Fault Reset	When bit 7 of the Controlword turns ON, check for the cause of the error. After the cause of the error is determined and removed, the Unit enters the Switch ON Disabled state. Or, if the cause of the error is not removed, the Unit enters the Fault state.	13
Ready to Switch ON → Operation Enabled	Set the Controlword to Enable Operation to enter this state. The Unit checks to see if the conditions*2 for changing to the Switch ON state are met, and automatically changes to the Operation Enabled state when ready.	3 + 4

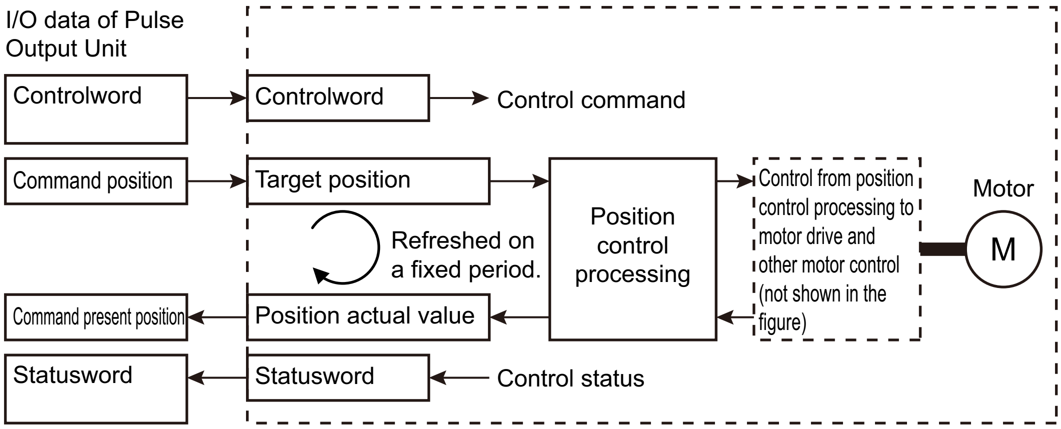
*1. When the Unit enters the Operation Enabled state from another state, the Pulse Output Unit stops the pulse output according to the Load Rejection Output Setting.
When the Unit is in the Operation Enabled state and the NX bus changes from Operational to any other state, an Illegal State Transition error event occurs in the Pulse Output Unit. The state then changes to Fault Reaction Active and pulse output is stopped according to the Load Rejection Output Setting.

*2. The condition for changing to the Switch ON state is whether the Unit is ready to perform pulse output.

Refer to *Statusword* on page 8-32 for details on the Statusword.

8-3-2 Cyclic Synchronous Position Control Mode

The following figure shows an outline of motor control performed in Cyclic Synchronous Position Control Mode.



In Cyclic Synchronous Position Control Mode, motor position control is performed by sending the motor target position on a fixed synchronization cycle. The result of that operation is monitored as the position actual value.

The Controlword, Statusword, Command Position, and Command Present Position that are used as I/O data by the Pulse Output Unit correspond to the following control data used in control execution: Controlword, Statusword, Target Position, and Position Actual Value.

Additional Information

The Pulse Output Unit uses a control method equivalent to the Cyclic Synchronous Position Control Mode in the CiA402 drive profile, but it only controls pulse output. The Unit cannot perform processing to control the main power or turn ON the Servo as is the case for Servo Drives that use the complete CiA402 drive profile.

To enable pulse output, you must turn ON the Servo and enter the Operation Enabled state from the user program.

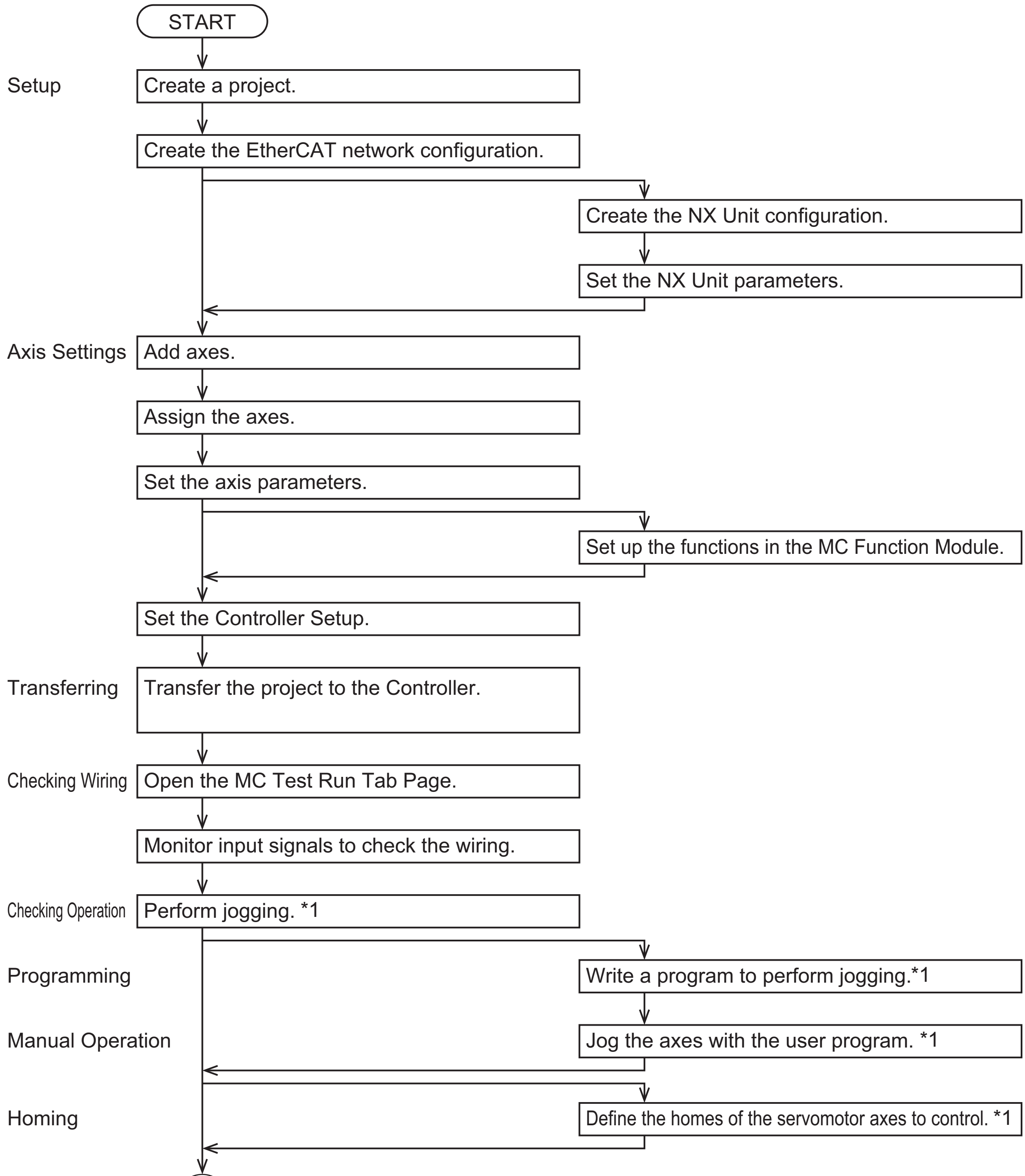
8-4 Basic Application Procedures

This section describes the basic procedures to use a Pulse Output Unit.

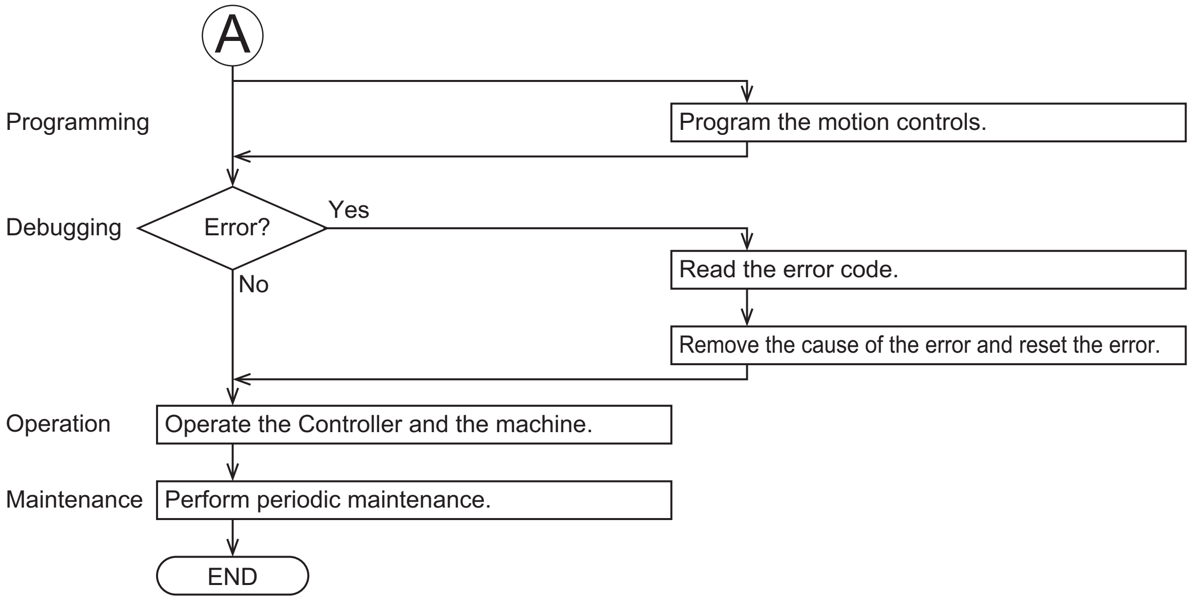
The procedure depends on whether the MC Function Module is used.

8-4-1 Procedures When Using the Motion Control Function Module

The process flow to use a Pulse Output Unit with the MC Function Module is shown below.



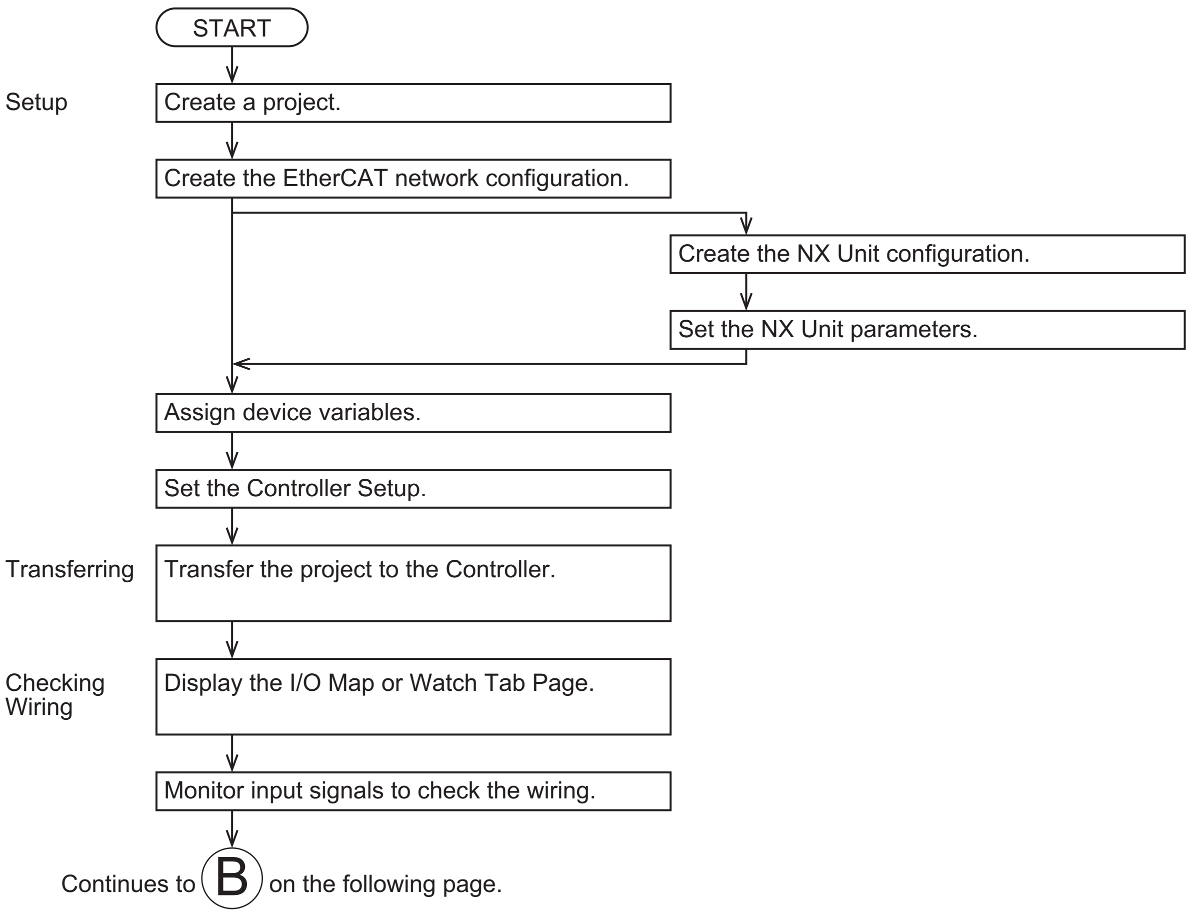
Continues to A on the following page.

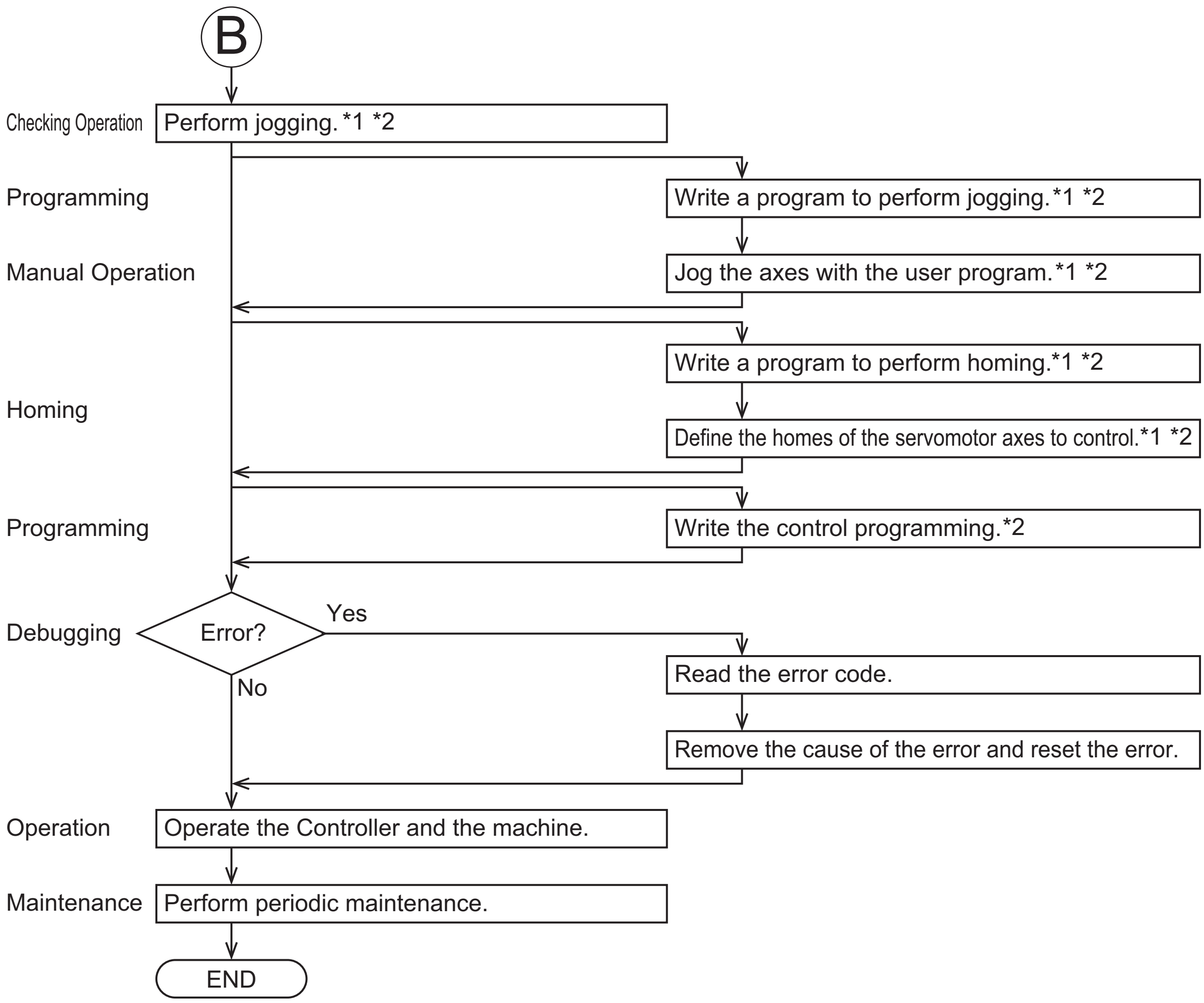


*1. These steps are required if a Pulse Output Unit is used to control the motor drive.

8-4-2 Procedures When Not Using the Motion Control Function Module

The process flow to use a Pulse Output Unit without the MC Function Module is shown below.





*1. These steps are required if a Pulse Output Unit is used to control the motor drive.

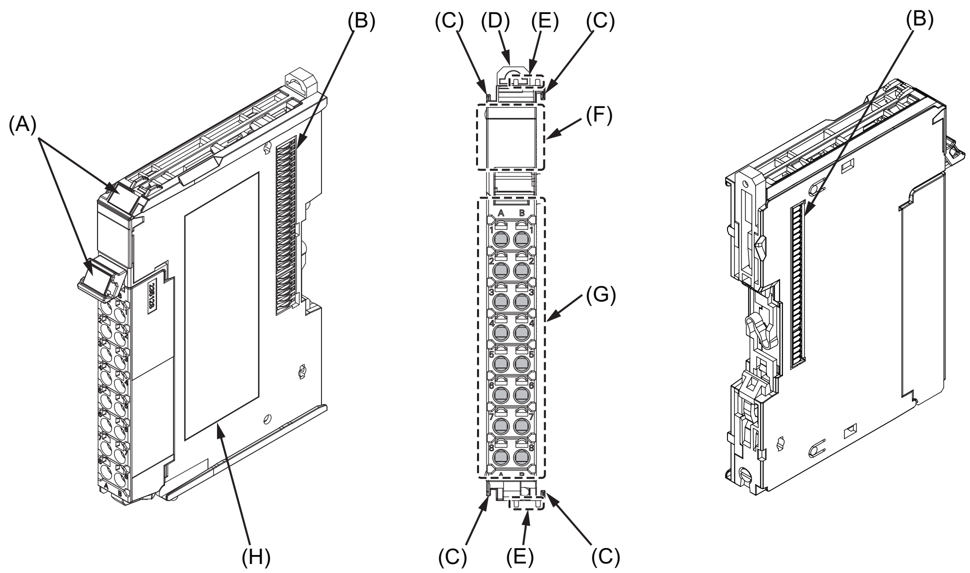
*2. If the MC Function Module is not used, all control tasks must be performed in the user program, including position management.

8-5 Part Names and Functions

This section describes the names and functions of the parts of the Pulse Output Unit.

8-5-1 Parts and Names

The names of the parts of the NX-PG0112 and NX-PG0122 are shown in the following figure.



Symbol	Name	Function
(A)	Marker attachment locations	This is where the markers are attached. OMRON markers are pre-installed at the factory. You can also install commercially available markers.
(B)	NX bus connector	This connector is used to connect to another Unit.
(C)	Unit hookup guides	These guides are used to connect two Units to each other.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	These protrusions are to hold onto when you need to pull out the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit.
(G)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
(H)	Unit specifications	The specifications of the Unit are given here.

8-5-2 Functions of the Parts

The functions of the parts of the Pulse Output Unit are described below.

Unit Hookup Guides

Use the guides to connect the Units to each other.

Indicators

The indicators show the Unit status, pulse output operation status, external I/O status, and other information.

Terminal Block

The terminal block is used to connect the external I/O signals.

NX Bus Connector

The bus connectors connect the Units to each other.

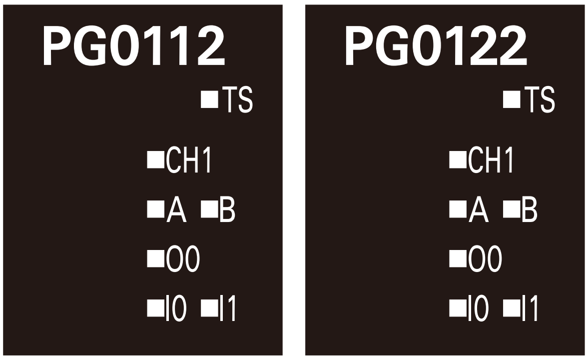
8-5-3 Indicators

This section describes the indicators on the Pulse Output Unit.

Refer to *3-2 Indicators* on page 3-3 for information on the indicators that are provided on all Position Interface Units.

NX-PG0112 and NX-PG0122

The indicators for a One-input Unit are described in the following table.



Indicator	Name	Color	Status	Description
CH	Pulse output status indicator	Green	Lit	Ready for pulse output.
			Not lit	Not ready for pulse output.
A and B	Pulse output indicators	Yellow	Lit	Phase-A or phase-B output is active.
			Not lit	Phase-A or phase-B output is not active.
I0 and I1	External input status indicators	Yellow	Lit	The corresponding external input is ON.
			Not lit	The corresponding external input is OFF.
O0	External output status indicator	Yellow	Lit	The external output is ON.
			Not lit	The external output is OFF.

8-6 Terminal Block Arrangement

The Pulse Output Unit uses screwless clamping terminal blocks.

This section describes the terminal block arrangements of the Unit.

8-6-1 NX-PG0112

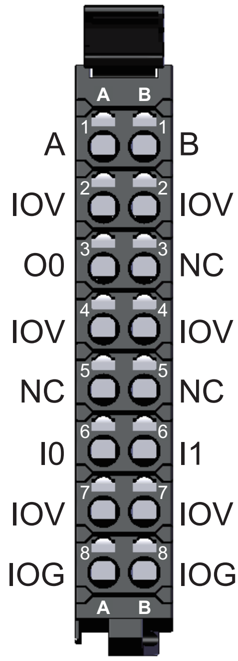
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-PG0112. It also provides a wiring example.

Terminal Block Arrangement

A 16-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A	O	Pulse output A (CW/PLS)
A2	IOV	O	Pulse output, 24 V
A3	O0	O	External output 0
A4	IOV	O	External output, 24 V
A5	NC	---	Not used.
A6	I0	I	External input 0
A7	IOV	O	Sensor power supply output, 24 V
A8	IOG	O	Sensor power supply output, 0 V

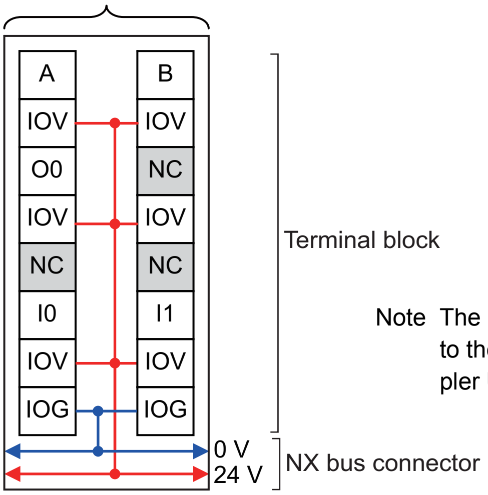
Terminal No.	Symbol	I/O	Name
B1	B	O	Pulse output B (CW/DIR)
B2	IOV	O	Pulse output, 24 V
B3	NC	---	Not used.
B4	IOV	O	External output, 24 V
B5	NC	---	Not used.
B6	I1	I	External input 1
B7	IOV	O	Sensor power supply output, 24 V
B8	IOG	O	Sensor power supply output, 0 V



Note The sensor power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

The following diagram shows the internal power supply wiring.

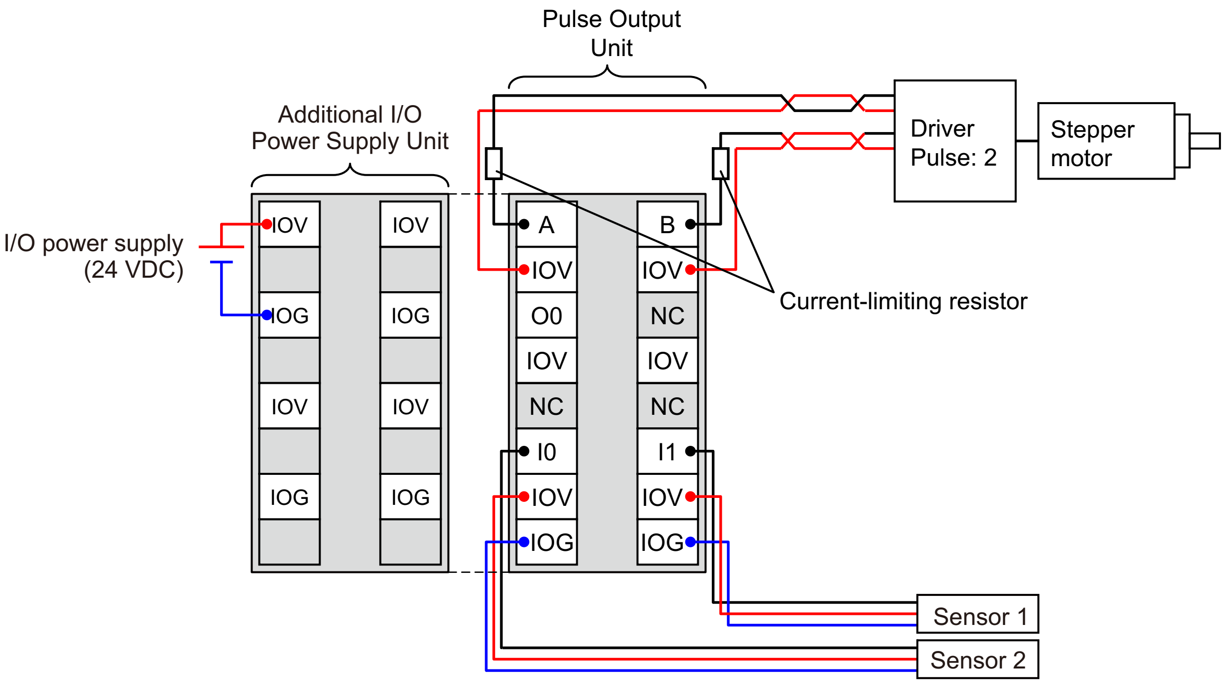


Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Examples

This section provides examples of how to wire the Unit to stepper motor drives and servo drives.

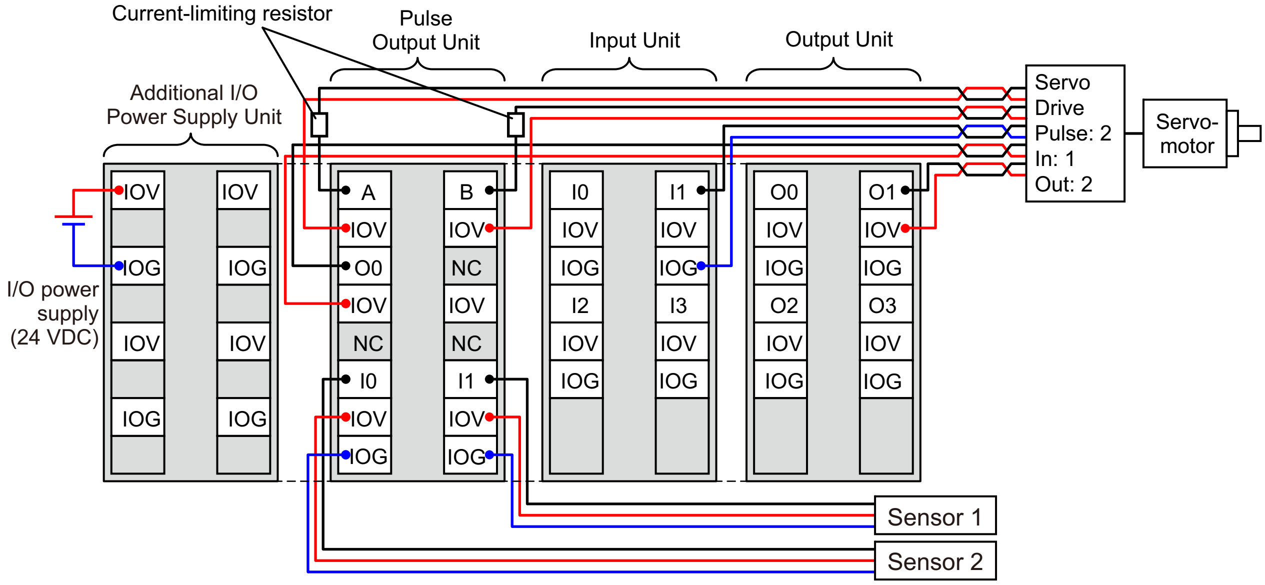
● Wiring Example for Stepper Motor Drives



Note 1. The pulse output, external output, and external inputs are all NPN connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Pulse Output Unit.

● Wiring Example for Servo Drives



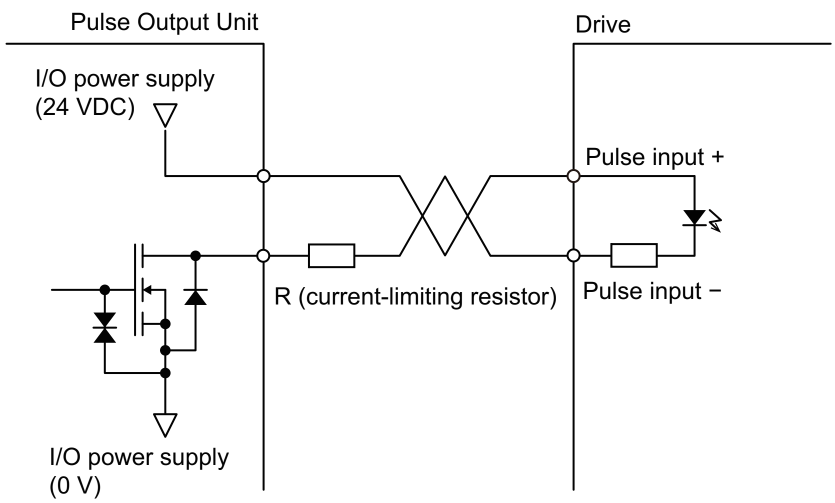
Note 1. The pulse output, external output, and external inputs are all NPN connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Pulse Output Unit.

Additional Information

The pulse output from an NX-PG0112 Pulse Output Unit is an NPN output. The common side (0 VDC) is internally connected to 0 VDC of the I/O power supply. Refer to *A-1 Datasheets* on page A-2 and *A-1-4 Pulse Output Units* on page A-22 for details.

When you connect a Pulse Output Unit to a Servo Drive, use a 24-VDC input for the pulse input on the Servo Drive. If there is no 24-VDC pulse input, connect an external current-limiting resistor so that the current matches the input specifications of the Servo Drive.

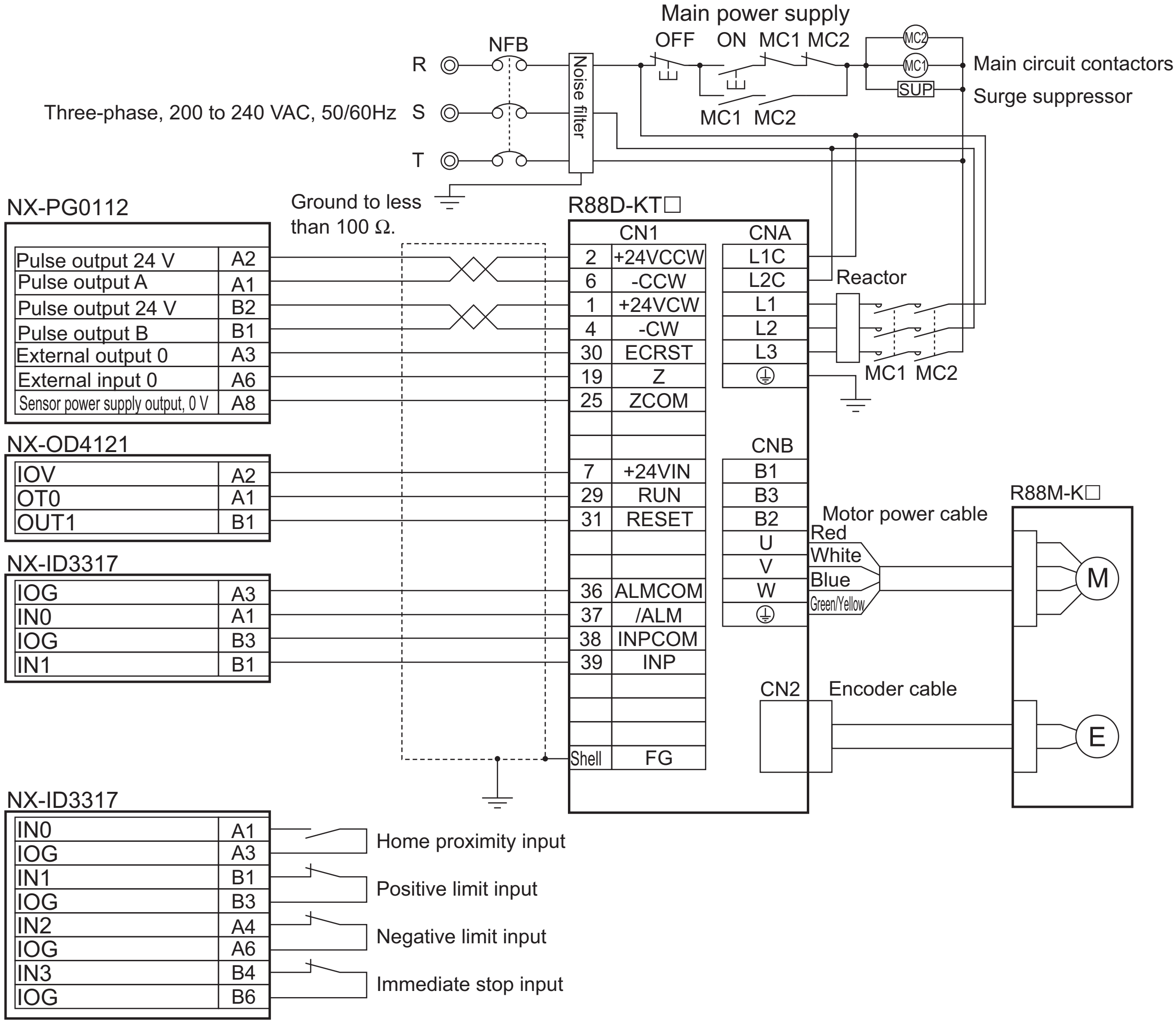


- **OMRON G5-series Servomotor/Servo Drive Wiring Example**

This section provides wiring examples for limit inputs and other control I/O in addition to the NX-PG0112 Pulse Output Unit.

The way these signals are handled depends on the system configuration of the Controller that you use.

Refer to *8-9 Setting Methods* on page 8-39 and *Section 9 Application Example* for information on using the MC Function Module in an NJ/NX-series Controller.



Precautions for Correct Use

- The external output 0 (O0) from the NX-PG0112 Pulse Output Unit is an NPN output. In this example, it is used as a following error reset output.
- To connect to the following error counter reset input (ECRST) of the Servo Drive, connect to the input common (+24 VIN) of the Servo Drive to the IOV (I/O power 24 V) of the NX Unit. The Servo Drive supports both PNP and NPN inputs.
- If you use the phase-Z input signal, connect it to external input 0 on the Pulse Output Unit. Also, set the External Input 0 Function Selection parameter to Latch Input 1. Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on external input signals.
- Also connect the operation command input (RUN) and error reset input (RESET) (which have the same common) to an NPN Output Unit.
- If all of the Units are mounted to the same Slave Terminal and an Additional I/O Power Supply Unit is not used, the I/O power supply is shared by the entire Slave Terminal.
- Wiring mistakes or mixing PNP and NPN outputs may cause damage or malfunctions.
- The above example shows only the major signals that are required to control the Servo Drive. You need to add operation commands for errors, cutoff circuits for the main power supply, and any other circuits that are required for safety.

8-6-2 NX-PG0122

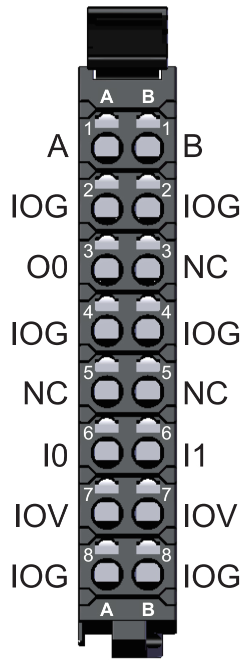
This section provides diagrams of the terminal block arrangement and internal power supply wiring of the NX-PG0122. It also provides a wiring example.

Terminal Block Arrangement

A 16-terminal terminal block is used.

Terminal No.	Symbol	I/O	Name
A1	A	O	Pulse output A (CW/PLS)
A2	IOG	O	Pulse output, 0 V
A3	O0	O	External output 0
A4	IOG	O	External output, 0 V
A5	NC	---	Not used.
A6	I0	I	External input 0
A7	IOV	O	Sensor power supply output, 24 V
A8	IOG	O	Sensor power supply output, 0 V

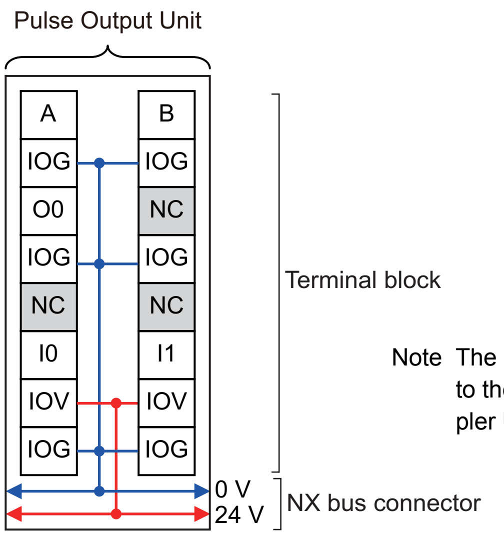
Terminal No.	Symbol	I/O	Name
B1	B	O	Pulse output B (CW/DIR)
B2	IOG	O	Pulse output, 0 V
B3	NC	---	Not used.
B4	IOG	O	External output, 0 V
B5	NC	---	Not used.
B6	I1	I	External input 1
B7	IOV	O	Sensor power supply output, 24 V
B8	IOG	O	Sensor power supply output, 0 V



Note The sensor power supply output (24 V and 0 V) is provided power from the I/O power supply connected to the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Internal Power Supply Wiring Diagram

The following diagram shows the internal power supply wiring.

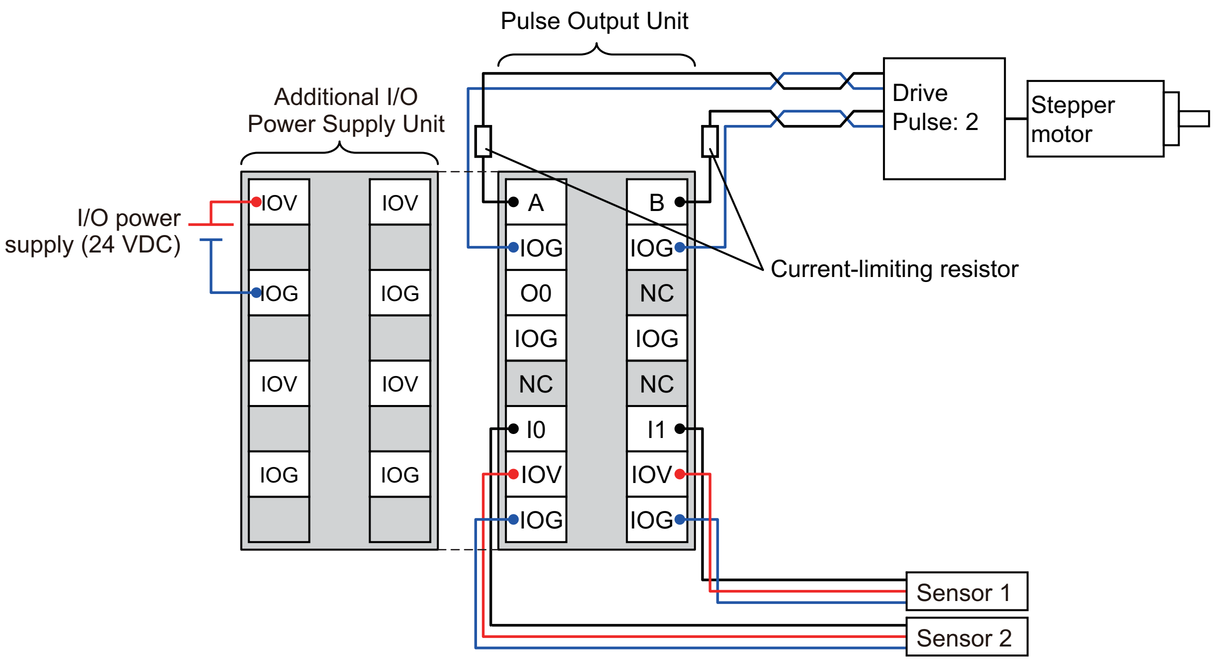


Note The I/O power is supplied from the I/O power supply connected to the I/O power supply terminals on the Communications Coupler Unit or an Additional I/O Power Supply Unit.

Wiring Example

This section provides examples of how to wire the Unit to stepper motor drives and servo drives.

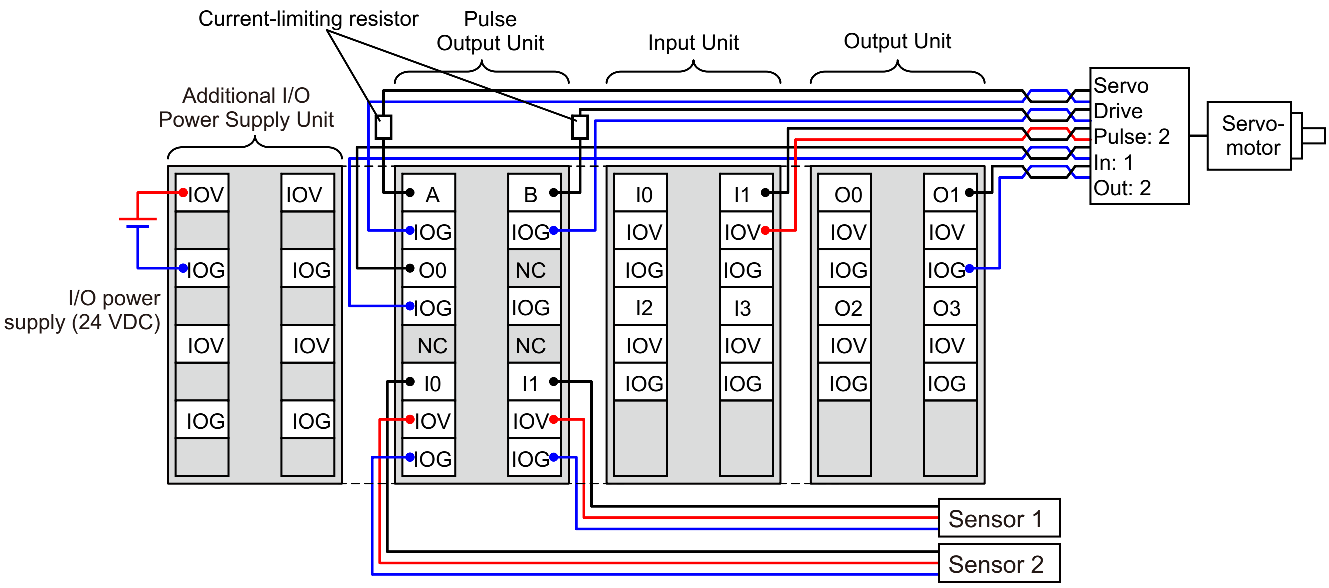
● Wiring Example for Stepper Motor Drives



Note 1. The pulse output, external output, and external inputs are all PNP connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Pulse Output Unit.

● Wiring Example for Servo Drives



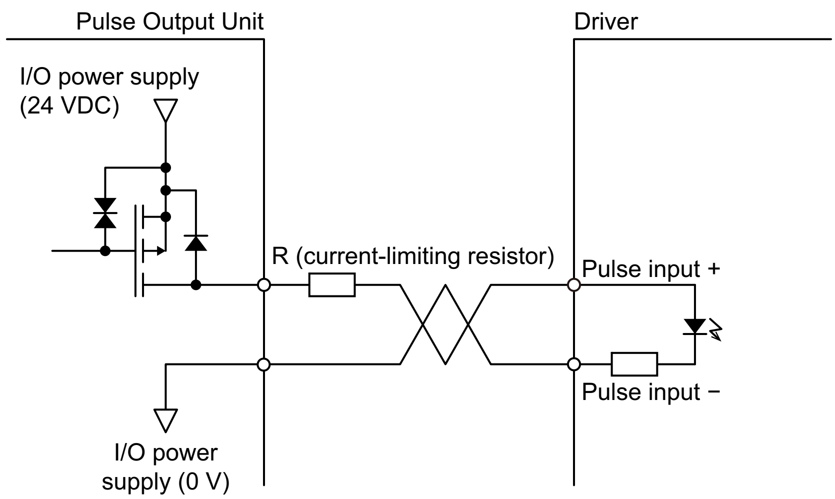
Note 1. The pulse output, external output, and external inputs are all PNP connections.

2. To supply power to connected external devices, connect an 24-VDC I/O power supply to the Communications Coupler Unit or an Additional I/O Power Supply Unit to supply power to the Pulse Output Unit.

Additional Information

The pulse output from an NX-PG0122 Pulse Output Unit is a PNP output. The common side (24 VDC) is internally connected to 24 VDC of the I/O power supply. Refer to *A-1 Datasheets* on page A-2 and *A-1-4 Pulse Output Units* on page A-22 for details.

When you connect a Pulse Output Unit to a Servo Drive, use a 24-VDC input for the pulse input on the Servo Drive. If there is no 24-VDC pulse input, connect an external current-limiting resistor so that the current matches the input specifications of the Servo Drive.

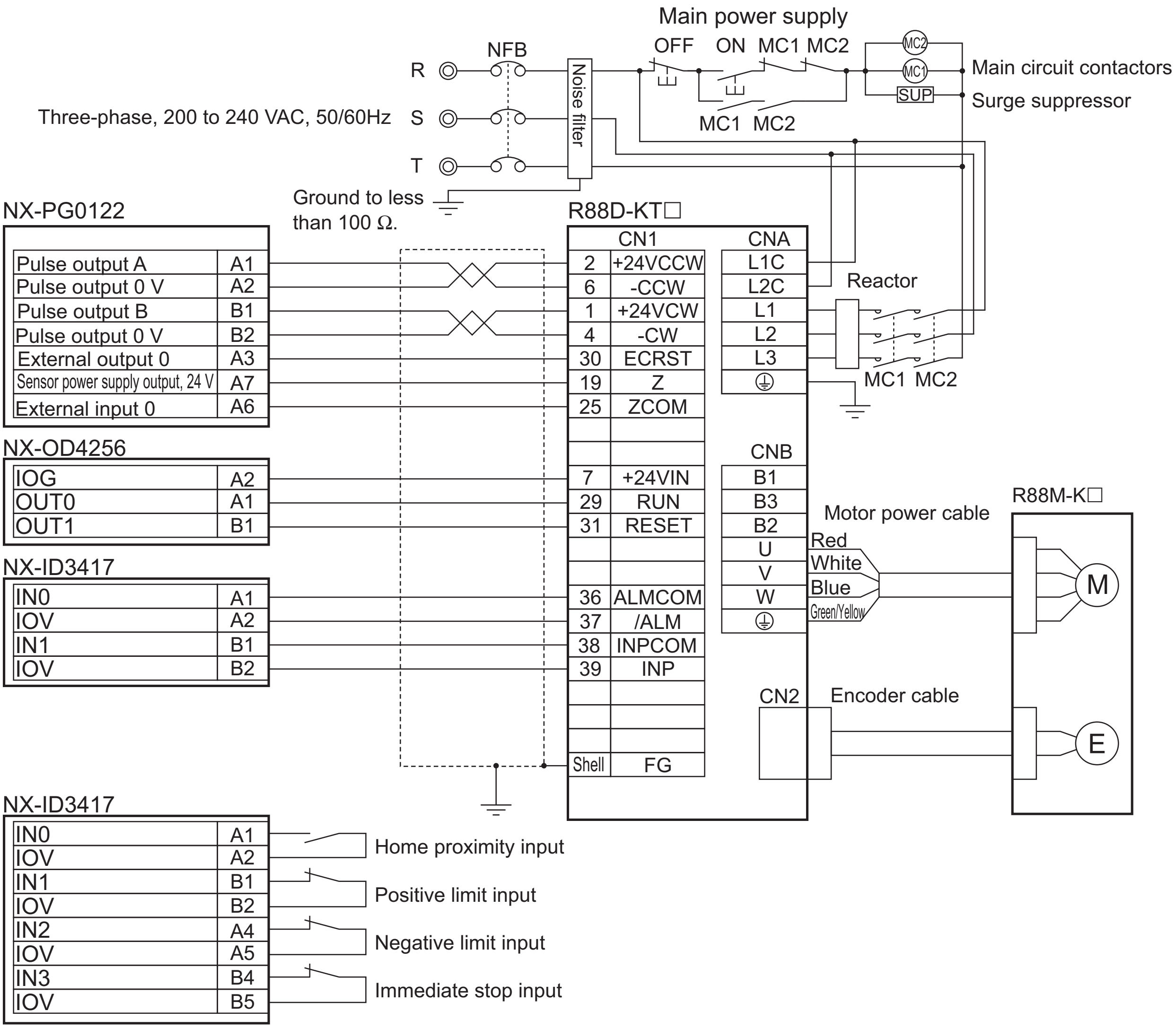


● OMRON G5-series Servomotor/Servo Drive Wiring Example

This section provides wiring examples for limit inputs and other control I/O in addition to the NX-PG0122 Pulse Output Unit.

The way these signals are handled depends on the system configuration of the Controller that you use.

Refer to *8-9 Setting Methods* on page 8-39 and *Section 9 Application Example* for information on using the MC Function Module in an NJ/NX-series Controller.



Precautions for Correct Use

- The external output 0 (O0) from the NX-PG0122 Pulse Output Unit is a PNP output. In this example, it is used as a following error reset output.
- To connect to the following error counter reset input (ECRST) of the Servo Drive, connect to the input common (+24 VIN) of the Servo Drive to the IOG (I/O power GND) of the NX Unit. The Servo Drive supports both PNP and NPN inputs.
- If you use the phase-Z input signal, connect it to external input 0 on the Pulse Output Unit. Also, set the External Input 0 Function Selection parameter to Latch Input 1. Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on external input signals.
- Also connect the operation command input (RUN) and error reset input (RESET) (which have the same common) to a PNP Output Unit.
- If all of the Units are mounted to the same Slave Terminal and an Additional I/O Power Supply Unit is not used, the I/O power supply is shared by the entire Slave Terminal.
- Wiring mistakes or mixing PNP and NPN outputs may cause damage or malfunctions.
- The above example shows only the major signals that are required to control the Servo Drive. You need to add operation commands for errors, cutoff circuits for the main power supply, and any other circuits that are required for safety.

8-7 I/O Refreshing Method Setting

Data is exchanged between the Pulse Output Unit and the Controller through synchronous I/O refreshing or task period prioritized refreshing.

You cannot use Free-Run refreshing.

You cannot use a Pulse Output Unit with a Communications Coupler Unit that does not support synchronous I/O refreshing or task period prioritized refreshing.

This section describes how to set the I/O refreshing method for Pulse Output Units, the I/O refreshing methods, and the differences in I/O refreshing methods for different Controllers.

Precautions for Correct Use

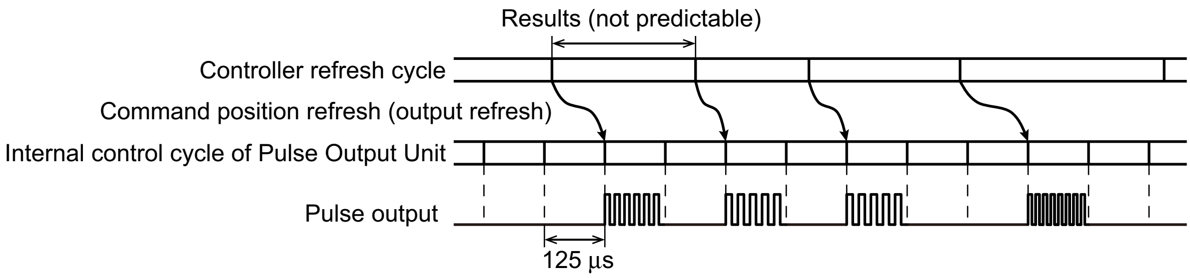
The Pulse Output Unit receives cyclic command positions or cyclic command positions and command velocities from the Controller and uses them to control the pulse output in each cycle. Therefore, synchronous I/O refreshing or task period prioritized refreshing is used as the I/O refreshing method. If you incorrectly set the I/O Refresh Method to Free-Run refreshing, this could result in unintended operation. Be sure to set the I/O Refresh Method correctly.

Example: Position-synchronous Pulse Output (for Servomotor Control)

When a position-synchronous pulse output is used, the Pulse Output Unit outputs a number of pulses based on the command position that is received from the Controller at the speed that is required to output all of the pulses within the synchronous refresh cycle.

If the I/O Refresh Method is set to Free-Run refreshing, the Pulse Output Unit will continuously output pulses on an irregular cycle. This happens because the cycle when the command position is received from the Controller and the cycle for Pulse Output Unit processing do not match.

Refer to *8-10-3 Output Mode Selection* on page 8-55 for details on a position-synchronous pulse output.



8-7-1 Setting the I/O Refreshing Methods

When a Pulse Output Unit is connected to an EtherCAT Coupler Unit, the I/O refreshing method depends on the *Enable Distributed Clock* setting.

The following table lists the possible combinations.

DC enabled/disabled	I/O refreshing method
Enabled (DC for synchronization)	Synchronous I/O refreshing
Enabled (DC with priority in cycle time)	Task period prioritized refreshing
Disabled (FreeRun)	Cannot be used.

Version Information

Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required to use task period prioritized refreshing. If you use unit version 1.1 or earlier and an NX-ECC203 EtherCAT Coupler Unit, operation is performed with synchronous I/O refreshing.

Refresh Cycle

The following table lists the refresh cycles for synchronous I/O refreshing and task period prioritized refreshing.

I/O refreshing method	Refresh cycle
Synchronous I/O refreshing*1	250 μs to 10 ms *2
Task period prioritized refreshing*1	125 μs to 10 ms

*1. The refresh cycle depends on the specifications of the EtherCAT master and EtherCAT Coupler Unit. It also depends on the Unit configuration.

*2. The range is 250 μs to 4 ms for unit version 1.1 or earlier. The range is also 250 μs to 4 ms for unit version 1.2 or later if you use the NX-ECC201/202 EtherCAT Coupler Unit.

Precautions for Correct Use

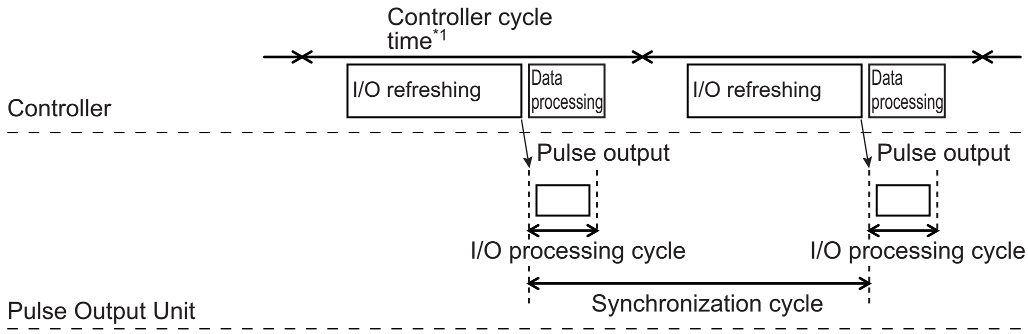
If you use synchronous I/O refreshing or task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

For the communications cycle specifications of the built-in EtherCAT port on an NJ/NX-series CPU Unit, refer to the *NJ/NX-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505). For the communications cycle specifications of the EtherCAT Coupler Unit, refer to the *NX-series EtherCAT Coupler Unit User’s Manual* (Cat. No. W519-E1-05 or later).

8-7-2 Synchronous I/O Refreshing

With synchronous I/O refreshing, you can match the timing for the processing that is performed by the Controller and the Unit's pulse output.

You can use synchronous I/O refreshing with more than one Unit to operate more than one stepper motor or Servomotor at the same time.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation of Synchronous I/O Refreshing* on page 5-7 for details.

Precautions for Correct Use

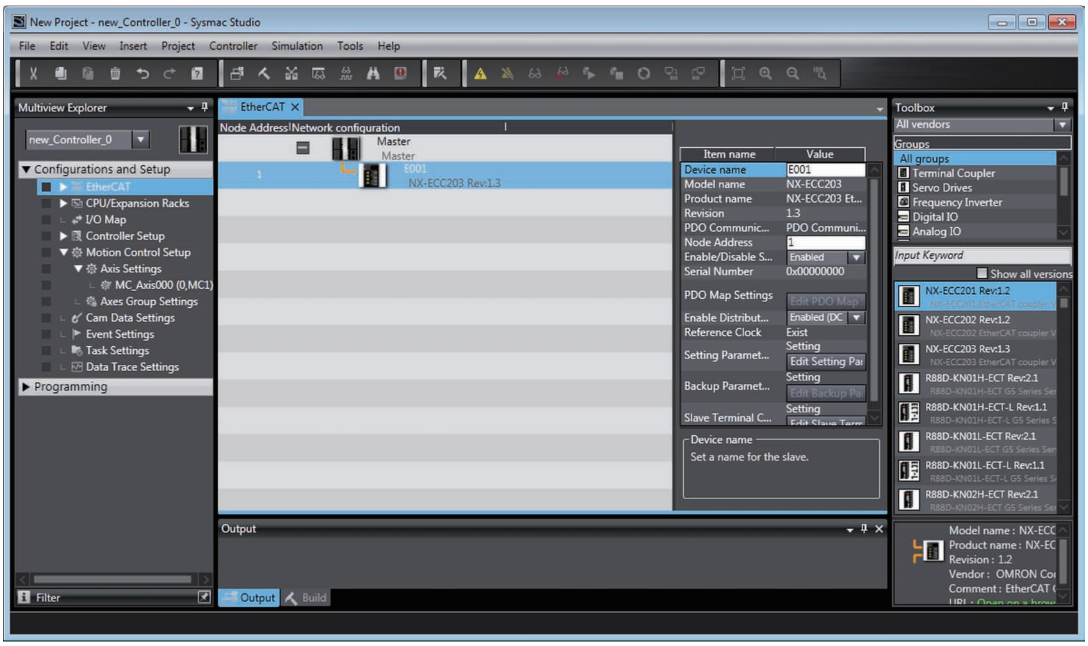
If you use synchronous I/O refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC for synchronization)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use synchronous I/O refreshing for Pulse Output Input Units that are connected to an EtherCAT Coupler Unit.

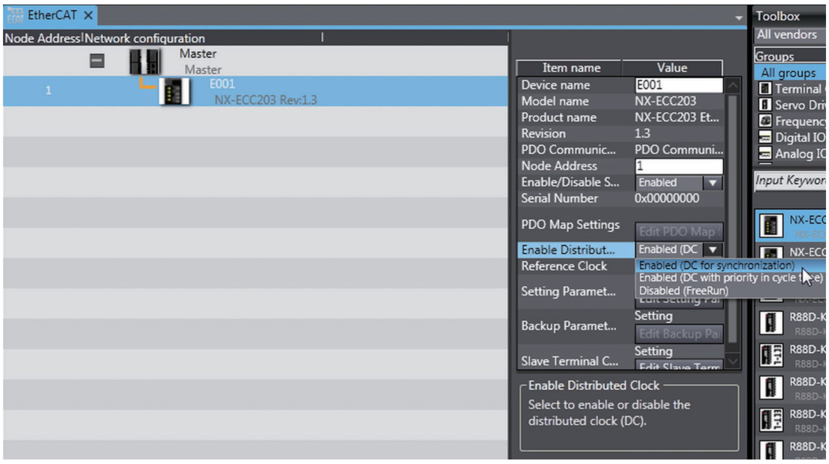
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Enabled (DC for synchronization)*.

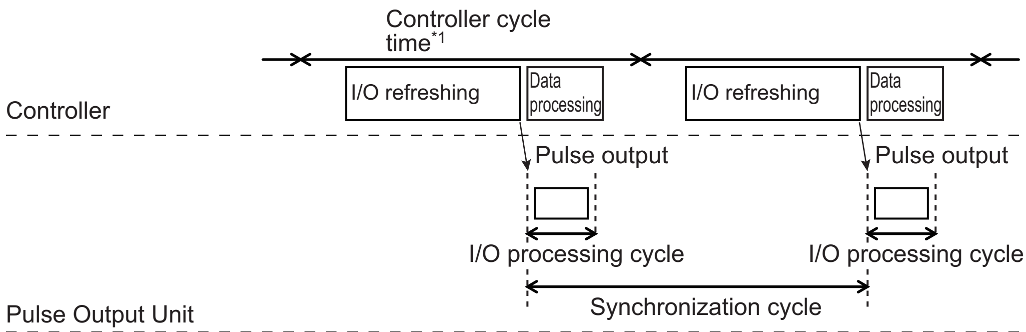


As a result, synchronous I/O refreshing is used.

8-7-3 Task Period Prioritized Refreshing

With this I/O refreshing method, shortening the task period is given priority over synchronizing the I/O timing with other NX Units.

With this I/O refreshing method, the timing of I/O is not consistent with the timing of I/O for NX Units that use simultaneous I/O refreshing.



*1. For an NX-series CPU Unit, the task period of the primary periodic task or priority-5 periodic task is applicable. For an NJ-series CPU Unit, only the task period of the primary periodic task is applicable.

Note Refer to *Operation for Task Period Prioritized Refreshing* on page 5-10 for details.

Precautions for Correct Use

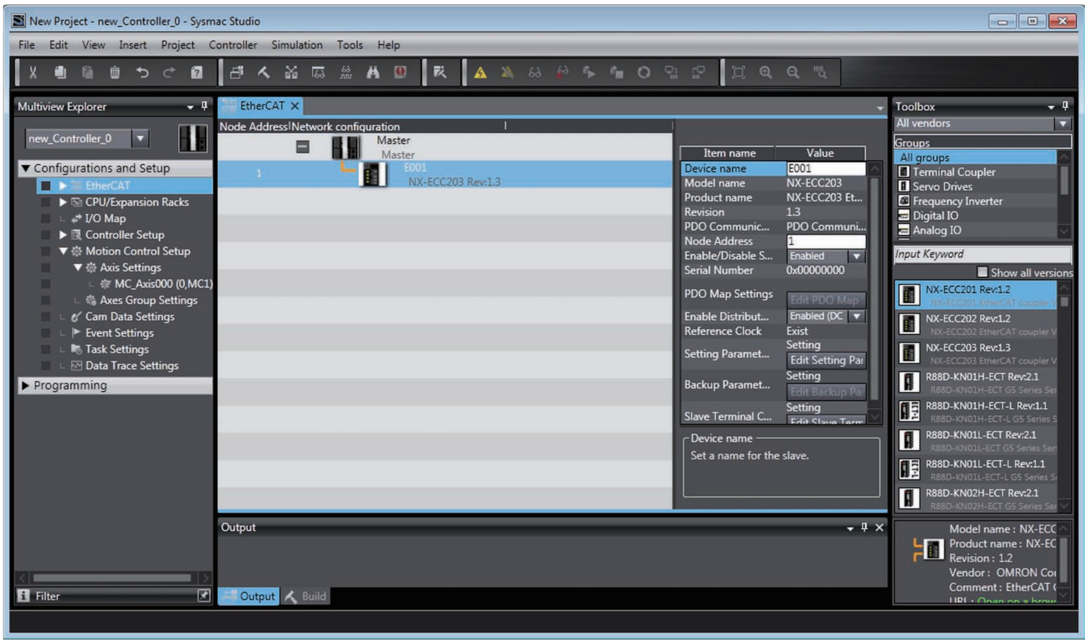
If you use task period prioritized refreshing, set the task period to a value within the specified refresh cycle range of the Position Interface Unit.

Setting with the Sysmac Studio

Use the following procedure to select *Enabled (DC with priority in cycle time)* from the *Enable Distributed Clock* setting for the EtherCAT Coupler Unit and use task period prioritized refreshing for Pulse Output Units connected to an EtherCAT Coupler Unit.

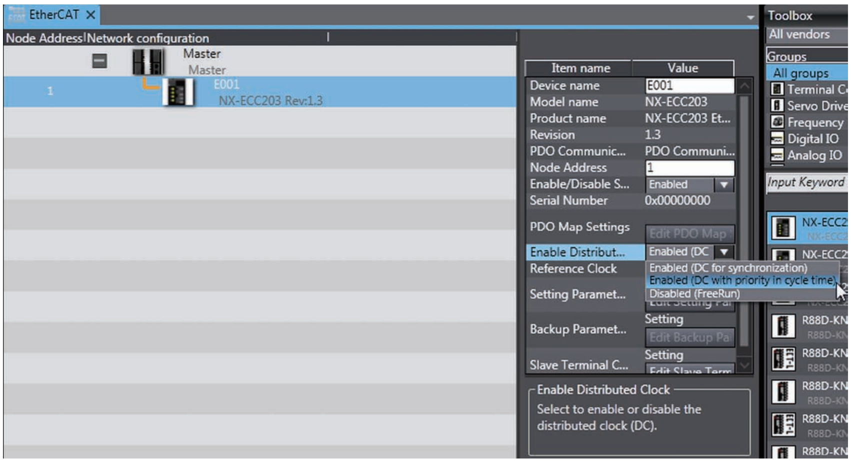
1 Double-click ***EtherCAT*** in the Multiview Explorer.

The following tab page is displayed.



2 Click the EtherCAT Coupler Unit under **Configurations and Setup**.

Change the *Enable Distributed Clock* setting to *Enabled (DC with priority in cycle time)*.



As a result, task period prioritized refreshing is used.

8-7-4 Differences in I/O Refreshing Methods Based on the Controller

The type of controller that is connected affects the I/O refreshing method, parameter settings, data access methods, and supported functions.

This section describes this information for various controllers.

Using an NJ/NX-series Controller with the MC Function Module

When you use an NJ/NX-series Controller with the MC Function Module, you must set the Unit as an servo axis. Set the axis parameter settings and assign an axis variable from the Sysmac Studio.

Even though the setting is for a servo axis, you can also use it for a stepper motor.

Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for detailed setting procedures.

Observe the following precautions when you use a Pulse Output Unit with the MC Function Module.

- Connect the Pulse Output Unit after an EtherCAT Coupler Unit.
- The Unit is treated as an axis (servo axis) from the user program, so you cannot handle the I/O data from the Pulse Output Unit directly. The Unit is handled as an axis variable.
- For an NX-series CPU Unit, you can execute motion control in the primary periodic task and priority-5 periodic task.
- You cannot control the error inputs, positioning completion inputs, RUN outputs, and error reset outputs with instructions for the MC Function Module, such as the MC_Power or MC_Reset instructions. Set these inputs and outputs as I/O Unit signals and control operations to save inputs, output sequencing, and other operations from the user program.

Yes: Can be used, Partial: Can be used with restrictions, No: Cannot be used

Function	EtherCAT Coupler Unit		
	Free-Run refreshing *1	Synchronous I/O refreshing	Task period prioritized refreshing*2
Pulse output method	No	Yes	Yes
Output mode selection	No	Yes	Yes
External output	No	Partial *3	Partial *3
Latching	No	Yes	Yes
External input function selection	No	Partial *4	Partial *4
Load rejection output setting	No	Yes	Yes
I/O refreshing method setting	No	Partial *1	Partial *1

*1. If you use the Unit as an axis in the MC Function Module, either synchronous I/O refreshing or task period prioritized refreshing is used as the I/O refreshing method.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

*3. If the Unit is used as an MC Function Module axis, only automatic output of the error counter reset output based on the latch function can be performed.

*4. There are restrictions in the use of the Unit as an axis for the MC Function Module. These restrictions include that you must set the External Input Function Selection parameter for external input 0 to latch input 1 and you must connect external input 0 to the home input signal for homing. Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on external input signals.

Precautions for Correct Use

- If you assign an NX Unit connected to an EtherCAT Coupler Unit as an I/O device for a MC Function Module axis, the MC Function Module manages refreshing of the I/O data. In this case, the MC Function Module manages refreshing of the I/O data for the entire Slave Terminal, including the EtherCAT Coupler Unit.

  If any of the operations or errors in the following table occur, the MC Function Module discards the Slave Terminal I/O data at that time. Refreshing of I/O data resumes when valid data is obtained again.

Operation	Using EtherCAT slaves only	Using an EtherCAT Coupler Unit + NX Units
Intentional changes to EtherCAT network configuration elements	• Unintentional disconnection of an EtherCAT slave or an EtherCAT cable disconnection • Unintentional connection of an EtherCAT slave or an EtherCAT cable connection • EtherCAT slave power interruption	Same as at the left.
	• Disconnection of an EtherCAT slave due to a disconnect operation • Connection of an EtherCAT slave due to a connect operation	Same as at the left. • Restarting of EtherCAT Slave Terminal • Restarting after parameters were transferred to the Communications Coupler Unit
Unintentional changes to EtherCAT network configuration elements	None	Performing an error reset when the Slave Terminal is stopped due to an error

  From several milliseconds to several tens of milliseconds is required to resume refreshing of I/O data, depending on the system configuration and the process data communications cycle.

  You can include an NX Unit that is not assigned to an axis in a Slave Terminal that is managed by the MC Function Module, but keep in mind the above characteristics of the refreshing of I/O data when you do so.
- If you want to avoid the effects of the refreshing of I/O data that is managed by the MC Function Module on NX Units that are not assigned to axes, place those NX Units on another Slave Terminal. To use different Slave Terminals, use different EtherCAT Coupler Units and configure the Slave Terminals so that one contains only NX Units that are assigned to axes and one contains only NX Units that are not assigned to axes.
- To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units.

  Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

Using an NJ/NX-series Controller without the MC Function Module

Set the parameters and assign I/O data for the user program from the Sysmac Studio.

Assign the I/O data in the NJ/NX-series Controller as device variables for the Unit.

Refer to the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for details.

Connect the Unit after the EtherCAT Coupler Unit, even if you do not use the MC Function Module.

The following table lists the usage restrictions for functions based on their combination with the EtherCAT Coupler Unit.

Yes: Can be used, Partial: Can be used with restrictions, No: Cannot be used

Function	EtherCAT Coupler Unit		
	Free-Run refreshing *1	Synchronous I/O refreshing	Task period prioritized refreshing*2
Pulse output method	No	Yes	Yes
Output mode selection	No	Yes	Yes
External output	No	Yes	Yes
Latching	No	Yes	Yes
External input function selection	No	Yes	Yes
Load rejection output setting	No	Yes	Yes
I/O refreshing method setting	No	Partial *1	Partial *1

*1. Synchronous I/O refreshing or task period prioritized refreshing is used as the I/O refreshing method.

*2. Unit version 1.2 or later and an NX-ECC203 EtherCAT Coupler Unit are required.

Precautions for Correct Use

- Connect the Unit after the EtherCAT Coupler Unit, even if you do not use the MC Function Module.
- If you do not use the MC Function Module, operations related to the Position Interface Units, such as latching, must be performed from the user program.

Additional Information

For Pulse Output Units, other tasks must be performed on the Controller in addition to position management, such as velocity profile generation and control status management.

If you want to use a pulse output, we recommend that you use the MC Function Module because it can automatically handle this control for you.

Other Controllers

The Pulse Output Unit cannot be connected to other controllers.

8-8 I/O Data Specifications

This section describes the data items that you can allocate to I/O, the data configurations, and the axis settings.

8-8-1 Data Items for Allocation to I/O

You can assign the following 11 data items to the I/O for a Pulse Output Unit.

The data items are described in the following sections.

Additional Information

You can use the Read NX Unit Object instruction or the Write NX Unit Object instruction to access data that is not assigned as I/O. You use index numbers with these instructions.
Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the Read NX Unit Object instruction or the Write NX Unit Object instruction.
For the index numbers, refer to *A-2-4 Pulse Output Units* on page A-54.

Area	Data item	Size (bytes)	Data type	Default *1	MC Function Module PDO *2
Input	Statusword	2	WORD	Yes	Yes
	External Input Status	1	BYTE	Yes	
	Command Present Position	4	DINT	Yes	Yes
	Latch Status	2	WORD	Yes	Yes
	Latch Input 1 Data	4	DINT	Yes	Yes
	Latch Input 2 Data	4	DINT	Yes	Yes
Output	Controlword	2	WORD	Yes	Yes
	External Output	1	BYTE	Yes	
	Command Position	4	DINT	Yes	Yes
	Command Velocity	4	DINT	Yes	Yes
	Latch Function	2	WORD	Yes	Yes

*1. The *Default* column shows the data item that are set when the Unit is shipped from the factory. You can allocate other data items.

*2. These PDOs are required to use the MC Function Module.

8-8-2 Data Details

This section describes the data configuration for each of the 11 data items for I/O allocation.

Statusword

Refer to *Controlword* on page 8-35 for information on the Controlword.

The bit configuration of the Statusword is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	sod *1	qs *2	ve *3	f *4	oe *5	so *6	rtso *7
+1	---	---	---	---	---	---	---	---

*1. “sod” is an abbreviation for Switch ON Disabled.

*2. “qs” is an abbreviation for Quick Stop Done.

*3. “ve” is an abbreviation for Voltage Enabled.

*4. “f” is an abbreviation for Fault.

*5. “oe” is an abbreviation for Operation Enabled.

*6. “so” is an abbreviation for Switched ON.

*7. “rtso” is an abbreviation for Ready to Switch ON.

● Statusword Status Indications

The status is indicated by the combination of the bits in the Statusword, as shown in the following table.

State	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Switch ON Disabled	Quick Stop Done	Voltage Enabled	Fault	Operation Enabled	Switched ON	Ready to Switch ON
Not Ready to Switch ON	0	0	*1	0	0	0	0
Switch ON Disabled	1	1	*1	0	0	0	0
Ready to Switch ON	0	1	*1	0	0	0	1
Switched ON	0	1	*1	0	0	1	1
Operation Enabled	0	1	*1	0	1	1	1
Fault Reaction Active	0	1	*1	1	1	1	1
Fault	0	1	*1	1	0	0	0

*1. This signal monitors the ON/OFF status of the main power supply circuit, but this signal is always ON for the Pulse Output Unit.

Status	Operation	Number in transition diagram *1
Start → Not Ready to Switch ON	This is the uninitialized state after the power supply to the Unit is turned ON or after the Unit is reset.	0
Not Ready to Switch ON → Switch ON Disabled	This state is automatically entered from the Not Ready to Switch ON state. The Unit enters this state automatically when the Unit initialization and self-testing processes finish normally.	1
Switch ON Disabled → Ready to Switch ON	Set the Controlword to Shutdown to enter this state.	2
Ready to Switch ON → Switched ON	Set the Controlword to Switch ON to enter this state. Check that the Unit is ready to perform pulse output, and change the state if it is ready.	3
Switched ON → Operation Enabled	Set the Controlword to Operation Enabled to enter this state.	4
Operation Enabled → Switched ON	Set the Controlword to Disable Operation to enter this state. This stops pulse output. *2	5
Switched ON → Ready to Switch ON	Set the Controlword to Shutdown to enter this state.	6
Ready to Switch ON → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state.	7
Operation Enabled → Ready to Switch ON	Set the Controlword to Shutdown to enter this state. This stops pulse output. *2	8
Operation Enabled → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state. This stops pulse output. *2	9
Switched ON → Switch ON Disabled	Set the Controlword to Disable Voltage to enter this state.	10
Fault Reaction Active	The Unit enters this state when an error occurs that stops the output. The Statusword is changed to notify the host when the Unit enters the Fault Reaction Active state. The pulse output is stopped when the Unit enters this state. *2	11
Fault	When an error occurs, the Unit outputs an error code and then enters this state.	12
Fault Reset	When bit 7 of the Controlword turns ON, check for the cause of the error. After the cause of the error is determined and removed, the Unit enters the Switch ON Disabled state. Or, if the cause of the error is not removed, the Unit enters the Fault state.	13
Ready to Switch ON → Operation Enabled	Set the Controlword to Enable Operation to enter this state. The Unit checks to see if the conditions*3 for changing to the Switch ON state are met, and automatically changes to the Operation Enabled state when ready.	3 + 4

*1. Refer to *8-3-1 Control State* on page 8-5 for the transition diagram.

*2. When the Unit enters the Operation Enabled state from another state, the Pulse Output Unit stops the pulse output according to the Load Rejection Output Setting.

*3. The condition for changing to the Switch ON state is whether the Unit is ready to perform pulse output.

External Input Status

The bit configuration of the External Input Status variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	---	EXT1	EXT0

Abbr.	Data	Description
EXT0	External Input 0 Status	1: External input 0 ON. 0: External input 0 OFF.
EXT1	External Input 1 Status	1: External input 1 ON. 0: External input 1 OFF.

Note You can use the External Input Status variable to monitor the ON/OFF status, regardless of the device setting of the external input.

Command Present Position

The bit configuration of the Command Present Position variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	CVn (Command Present Position LL)							
+1	CVn (Command Present Position LH)							
+2	CVn (Command Present Position HL)							
+3	CVn (Command Present Position HH)							

Abbr.	Data	Description
CVn	Command Present Position	This contains the present value of the number of output pulses.

Latch Status

The bit configuration of the Latch Status variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	---	L1FLG	L1EN
+1	---	---	---	---	---	---	L2FLG	L2EN

Abbr.	Data	Description
L1EN	Latch Input 1 Enabled *1	1: Latch input 1 enabled. 0: Latch input 1 disabled.
L1FLG	Latch Input 1 Completed Flag *2	1: Data was latched for latch input 1. 0: No data was latched for latch input 1.
L2EN	Latch Input 2 Enabled *3	1: Latch input 2 enabled. 0: Latch input 2 disabled.
L2FLG	Latch Input 2 Completed Flag *4	1: Data was latched for latch input 2. 0: No data was latched for latch input 2.

*1. This bit changes according to the setting of the Latch Input 1 Enable bit for latching. Refer to *Latch Function* on page 8-38 for information on latching.

*2. This bit is cleared when the Latch Input 1 Enable bit changes from 1 to 0.

*3. This bit changes according to the setting of the Latch Input 2 Enable bit for latching. Refer to *Latch Function* on page 8-38 for information on latching.

*4. This bit is cleared when the Latch Input 2 Enable bit changes from 1 to 0.

Latch Input 1 Data

The bit configuration of the Latch Input 1 Data variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ELV1 (Latch Input 1 Data LL)							
+1	ELV1 (Latch Input 1 Data LH)							
+2	ELV1 (Latch Input 1 Data HL)							
+3	ELV1 (Latch Input 1 Data HH)							

Abbr.	Data	Description
ELV1	Latch Input 1 Data	This contains the latch 1 data.

Latch Input 2 Data

The bit configuration of the Latch Input 2 Data variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ELV2 (Latch Input 2 Data LL)							
+1	ELV2 (Latch Input 2 Data LH)							
+2	ELV2 (Latch Input 2 Data HL)							
+3	ELV2 (Latch Input 2 Data HH)							

Abbr.	Data	Description
ELV2	Latch Input 2 Data	This contains the latch 2 data.

Controlword

The bit configuration of the Controlword is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	fr *1	---	---	---	eo *2	qs *3	ev *4	so *5
+1	---	---	---	---	---	---	---	---

*1. “fr” is an abbreviation for Fault Reset.
*2. “eo” is an abbreviation of Enable Operation.
*3. “qs” is an abbreviation for Quick Stop Done.
*4. “ev” is an abbreviation of Enable Voltage.
*5. “so” is an abbreviation of Switch ON.

● Controlword Status

Command	Controlword bits					Number in transition diagram *1
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
	Fault Reset	Enable Operation	Quick Stop Done	Enable Voltage	Switch ON	
Shutdown	---	---	1	1	0	2, 6, or 8
Switch ON	---	0	1	1	1	3
Switch ON + Enable Operation	---	1	1	1	1	3 + 4 *2
Disable Voltage	---	---	---	0	---	7, 9, or 10
Quick Stop Done	---	---	0	1	---	Not supported. *3
Disable Operation	---	0	1	1	1	5
Enable Operation	---	1	1	1	1	4
Fault Reset	0 to 1 *4	---	---	---	---	13

*1. Refer to *8-3-1 Control State* on page 8-5 for the transition diagram.

*2. When the Servo is ready (Switched ON), the Servo is automatically turned ON (Operation Enabled).

*3. The Quick Stop Done command is not supported. Even if a Quick Stop Done command is received, it will be ignored.

*4. This is the operation when bit 7 (Fault Reset) turns ON.

Fault state	• When the error is reset, the Switch ON Disabled state is entered. • This state is reset when bit 7 (Warning) in the Statusword (6041 hex) turns ON.
Not Fault state	• This state is reset when bit 7 (Warning) in the Statusword (6041 hex) turns ON. • The state will change according to command bits 0 to 3.

When a Fault Reset is executed with bit 7, set the bit back to 0 before giving the next command.

External Output

The bit configuration of the External Output variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	---	---	---	---	---	---	EXO0

Abbr.	Data	Description
EXO0	External Output	1: Output ON 0: Output OFF

Note You can assign the External Output object to I/O data to control its ON/OFF state. However, when the Unit is assigned to an MC Function Module axis and the External Output 0 Function Selection parameter is set to Error counter reset, the external output is controlled automatically through the latch function. You cannot turn it ON and OFF directly.

Command Position

The bit configuration of the Command Position variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	POP (Command Position LL)							
+1	POP (Command Position LH)							
+2	POP (Command Position HL)							
+3	POP (Command Position HH)							

Abbr.	Data	Description
POP	Command Position	This contains the command position.

Command Velocity

The bit configuration of the Command Velocity variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	POV (Command Velocity LL)							
+1	POV (Command Velocity LH)							
+2	POV (Command Velocity HL)							
+3	POV (Command Velocity HH)							

Abbr.	Data	Description
POV	Command Velocity	This contains the command velocity.

Additional Information

The command velocity is only used when the Output Mode Selection parameter is set to a velocity-continuous pulse output.

For position-synchronous pulse output, the set value for the Command Velocity parameter is ignored.

The command velocity for velocity-continuous pulse output is signed 32-bit (DINT) data. However, the set value itself is handled as an absolute value, regardless of the sign. The pulse output direction is determined by the sign of the command position.

Latch Function

The bit configuration for the Latch Function variable is given in the following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	---	LSTP1	---	---	---	LSEL1	LTRG1	LENB1
+1	---	LSTP2	---	---	---	LSEL2	LTRG2	LENB2

Abbr.	Data	Description
LENB1	Latch Input 1 Enable	1: Enable the latch input 1. 0: Disable the latch input 1.
LTRG1	Latch Input 1 Trigger Condition*1	0: One-shot Mode 1: Continuous Mode
LSEL1	Latch Input 1 Trigger Selection*1	0: External input 1: Phase-Z input *2
LSTP1	Latch Input 1 Motion Stop Enable*1	0: No stop 1: Immediate stop
LENB2	Latch Input 2 Enable	1: Enable the latch input 2. 0: Disable the latch input 2.
LTRG2	Latch Input 2 Trigger Condition*3	0: One-shot Mode 1: Continuous Mode
LSEL2	Latch Input 2 Trigger Selection*3	0: External input 1: Phase-Z input.*2
LSTP2	Latch Input 2 Motion Stop Enable*3	0: No stop 1: Immediate stop

*1. The setting is enabled when the Latch Input 1 Enable bit changes from 0 to 1.

*2. The Pulse Output Unit does not have a phase-Z input. If you use the latch function, set the Latch Input 1 Trigger Selection and Latch Input 2 Trigger Selection bits to 0. Latch inputs are not detected if you set these bits to 1.

*3. The setting is enabled when the Latch Input 2 Enable bit changes from 0 to 1.

8-8-3 Axis Settings

Use the Pulse Output Unit as a servo axis when you use the MC Function Module in an NJ/NX-series Controller.

For information on axis parameters and how to assign axis variables, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

8-9 Setting Methods

This section describes the setting methods for the Pulse Output Unit.

You can use a Pulse Output Unit as an servo axis output device if you also use the MC Function Module.

This section describes the settings for using an NJ/NX-series Controller and the MC Function Module to control the Pulse Output Unit.

For details on the functions of the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Precautions for Correct Use

To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units. Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

8-9-1 Building and Wiring the System

Pulse Output Units are mounted after an EtherCAT Coupler Unit to build an NX Unit Slave Terminal. The Slave Terminal is connected through EtherCAT communications.

Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on how to build NX Unit systems.

To construct a motor control system with a Pulse Output Unit, Digital Input Units are also required to use external sensor inputs, such as limit sensor inputs.

Connect the Digital Input Units after the EtherCAT Coupler Unit just like the Pulse Output Unit.

For information on Digital Input Units, refer to the *NX-series Digital I/O Units User's Manual* (Cat. No. W521).

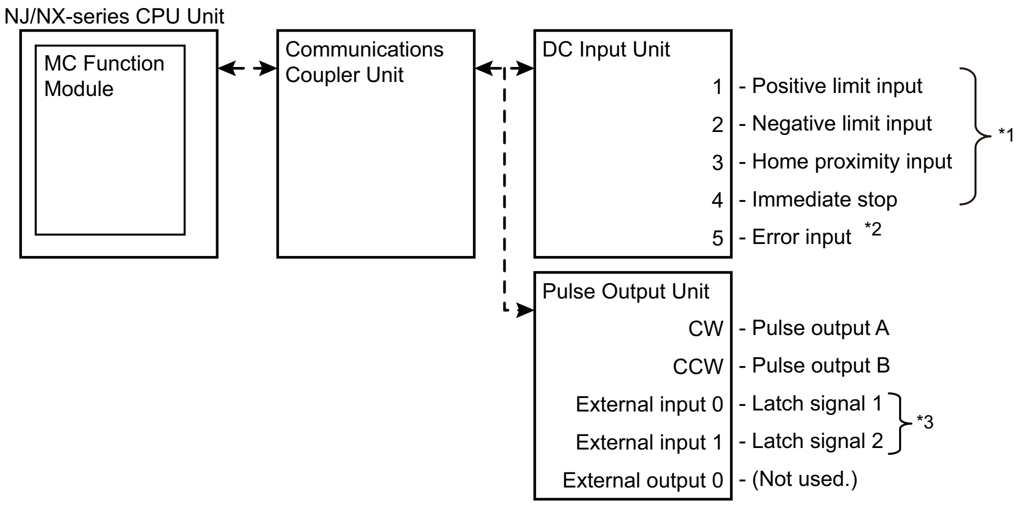
Refer to *8-6 Terminal Block Arrangement* on page 8-14 and *Section 9 Application Example* for information on wiring external devices, such as motor drives and external sensors, to Pulse Output Units and Digital Input Units.

Precautions for Correct Use

If you use external sensor inputs, such as limit sensors, the Pulse Output Unit and Digital Input Units must be in the same Slave Terminal.

Connection Configuration Example for Stepper Motor Drives

The following is a configuration example for a system that controls a stepper motor drive.



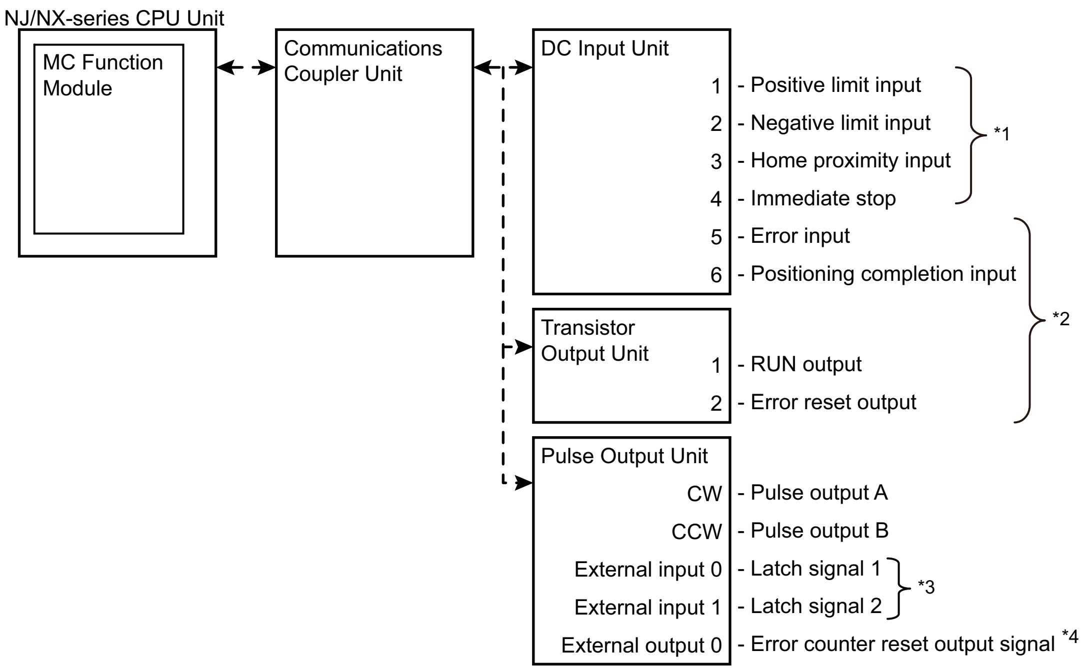
*1. Assign these signals to the MC Function Module axis in the basic axis motion control settings.

*2. Error inputs cannot be controlled from the MC Function Module. Handle error inputs as input signal device variables and control operations to save inputs, output sequencing, and other operations from the user program. You cannot use instructions such as the MC_Power and MC_Reset instructions for control.

*3. These signals are used for instructions that use the latch function. External input 0 (latch input 1) is also used for the home input during homing. Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on using the home input signal. If you use the MC Function Module but do not use the home input signal, set the homing method of the Home (MC_Home) instruction to 11 (Limit inputs only) or 14 (Zero position preset).

Servo Drive Connection Configuration Example

The following is a configuration example for a system that controls a Servo Drive.



*1. Assign these signals to the MC Function Module axis in the basic axis motion control settings.

*2. You cannot control the error inputs, positioning completion inputs, RUN outputs, and error reset outputs from the MC Function Module. Handle these I/O signals as I/O signal device variables and control operations to save inputs, output sequencing, and other operations from the user program. You cannot use instructions such as the MC_Power and MC_Reset instructions for control.

*3. These signals are used for instructions that use the latch function. They are also used for the home input during homing. Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on using the home input signal.

*4. When the external output is set to *Error counter reset output*, this signal is automatically controlled when execution of the homing operation is completed.

Precautions for Correct Use

- The MC Function Module will restrict operation in the relative direction depending on the status of the positive limit input signal and negative limit input signal. If the dog width for the limit input is short or if for any other reason the signal is not input for positions that are beyond the limit, an operational restriction is not applied after the error is reset and the machine will move beyond the limit. To restrict the range of operation of the machine with the limit inputs, set the signal detection method or detection width so that the limit input is always detected at any position beyond the limits.
- When you use the Pulse Output Unit with the MC Function Module, input signals from a Digital Input Unit are used for the positive limit input, negative limit input, immediate stop input, and home proximity input. Always make sure that the signal widths for all of these input signals are longer than the task period where the MC Function Module is executed. If the input signal widths are shorter than the task period, the MC Function Module may not be able to detect the input signals, resulting in incorrect operation.

8-9-2 Precautions When Using the Pulse Output Unit

The NJ/NX-series CPU Unit Motion Control User's Manual (Cat. No. W507) is written based on the assumption that a G5-series Servo Drive or Motor is used. Some functions are not the same as when a Pulse Output Unit is used.

When you refer to the above manual, keep in mind the following differences between when a G5-series Servo Drive or Motor is used and when a Pulse Output Unit is used.

Function		When using a G5-series Servo Drive	When Using a Pulse Output Unit
Control mode		• Position control • Velocity control • Torque control	Position control
Positions that can be managed	Command position	This is the command position for the Servomotor.	Command value for pulse output
	Actual current position [*1]	This is the present rotation position of the Servomotor. [*2] This is the position that results from subtracting the following error accumulated in the Servo Drive from the command position.	This is the number of output pulses (output count value). This is the pulse output count value for the command value, so the actual current position equals the command position. The actual current position is delayed in respect to the command position because the pulse count that is actually output by the Pulse Output Unit is returned. The unit is pulses, so the decimal portion of the actual current position is truncated. However, these values may not match depending on pulse unit rounding error in the MC Function Module or when Pulse Output Unit processing is stopped during a command.
Single-axis position control	Interrupt feeding	This function performs position control in Position Control Mode and uses the interrupt input (latch input) that is built into the Servo Drive to perform feeding.	This function performs position control in Position Control Mode and uses the interrupt input (latch input) that is built into the Pulse Output Unit to perform feeding.
Single-axis velocity control	Cyclic synchronous velocity control	This outputs velocity commands in Velocity Control Mode.	Cannot be used.
Single-axis torque control	Torque control	This controls the motor torque in Torque Control Mode.	Cannot be used.
Single-axis manual operation	Powering the Servo (Servo ON/OFF)	This turns the power to the Servomotor ON or OFF.	This enables or disables pulse output. You cannot use the MC Function Module to control the power to the motor drive that is connected to a Pulse Output Unit. Use a separate digital output and perform this type of control from the user program.

Function		When using a G5-series Servo Drive	When Using a Pulse Output Unit
Auxiliary function for single-axis control	Resetting axis errors *3	Clears the Drive error status for all Drive errors that are resettable. When a Servo Drive error occurs, you can use the MC Function Module to detect the error and report it as an axis error.	Clears the error status for all Pulse Output Unit errors that are resettable. This function cannot clear the error status of the motor drive that is connected to a Pulse Output Unit. You also cannot use the MC Function Module to detect errors that occur in the Servo Drive. Instead, use a separate digital input and output for the error output and error reset input on the Servo Drive, and perform this control from the user program.
	Homing	The input that is built into the Servo Drive is used to perform homing based on the positions of the signals. You can also use holding to perform homing.	A Digital Input Unit is added and axis functions are assigned to perform homing based on the positions of the signals. For the home input, you must select to use an external home input in the motion control parameters. You cannot also use holding to perform homing.
	Enabling external latches	The Servo Drive's latch function and the interrupt input (latch input) that is built into the Servo Drive are used to latch the present position.	The Pulse Output Unit's latch function and the interrupt input (latch input) that is built into the Unit are used to latch the present position.
	Monitoring axis following error	The processing for this function is performed by the MC Function Module.	Same as at the left. However, this function is not effective in the Pulse Output Unit because the command position equals the actual current position.
	Following error counter reset	The accumulated following error in the Servo Drive is reset. *4	The following status is reset: when the command current position in the Pulse Output Unit does not match the actual current position when an operation is stopped during Pulse Output Unit processing or due to pulse unit rounding error. This function cannot reset the accumulated following error in the motor drive that is connected to a Pulse Output Unit.
	Torque limit	The specified torque limit is set.	Cannot be used.
Auxiliary functions for multi-axes coordinated control	Resetting axes group errors	Refer to *Resetting axis errors* under *Auxiliary function for single-axis control.*	Refer to *Resetting axis errors* under *Auxiliary function for single-axis control.*
In-position check *5		An in-position check is performed on the motor position based on the command position and position actual value.	You cannot perform an in-position check for the motor drive that is connected to a Pulse Output Unit. Use a separate Digital Input Unit to receive the in-position output from the Servo Drive and perform an in-position check of the motor position in the user program.
Stopping mode selection		In addition to immediately stopping the command value, you can also select to reset the following error counter and turn OFF the Servo.	Only an immediate stop of the command value is performed. You cannot reset the following error counter or turn OFF the Servo for the motor drive that is connected to a Pulse Output Unit.

Function		When using a G5-series Servo Drive	When Using a Pulse Output Unit
Monitoring functions	Following error	You can monitor the following error in the Servo Drive.	You cannot monitor the following error in the motor drive that is connected to a Pulse Output Unit.
Absolute encoder (eliminates the need to perform homing when the power is turned ON)		You can use an absolute encoder if you use an OMRON G5-series Motor with an Absolute Encoder.	Cannot be used.
Backlash compensation		The compensation provided by the Servo Drive is used.	Cannot be used.
Signal inputs	Home input	The phase-Z input or external latch input to the Servo Drive is used.	The latch input on the Pulse Output Unit is used.
	Home proximity input	The home proximity input on the Servo Drive is used.	A Digital Input Unit is used. Axis assignment settings are also required.
	Positive limit input	The positive drive prohibit input to the Servo Drive is used.	A Digital Input Unit is used. Axis assignment settings are also required.
	Negative limit input	The negative drive prohibit input to the Servo Drive is used.	A Digital Input Unit is used. Axis assignment settings are also required.
	Immediate stop input	The immediate stop input to the Servo Drive is used.	A Digital Input Unit is used. Axis assignment settings are also required.
	Interrupt input	The external latch input to the Servo Drive is used.	The latch input on the Pulse Output Unit is used.

*1. Refer to *Differences in Processing to Obtain the Actual Current Position* on page 8-45 for information on the actual current position.

*2. This indicates the position that is based on the actual count value from the encoder.

*3. Refer to *Differences in Reset Axis Error Processing* on page 8-45 for information on resetting axis errors.

*4. This resets the following error through a command operation.

*5. Refer to *Differences in In-position Check Processing* on page 8-46 for information on in-position checking.

Additional Information

You can use external inputs 0 and 1 on the Pulse Output Unit as external latch inputs 1 and 2 by setting the External Input Function Selection parameters. If you perform homing with the MC Function Module, external latch 1 (external input 0) is used as the home input. If you do not use external latch 2 (external input 1) for latching, select a general input for the External Input Function Selection parameter. If you select a general input, you can use the external input as a limit input or other input.

Application Example

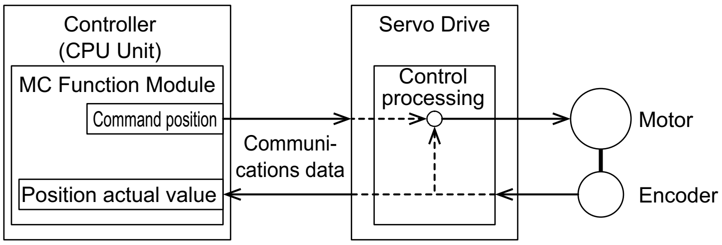
If you use the MC Function Module and the latching function of the Pulse Output Unit only for homing, set the external input 0 of the Pulse Output Unit as the external latch input 1 and use it as the home input. You can set external input 1 as a general input and use it as the home proximity input or another input. In this case, you can change the settings of the digital inputs of the MC Function Module to assign the input bits.

Refer to *8-10-6 External Input Function Selection* on page 8-65 for the External Input Function Selection parameters of the Pulse Output Unit. For the digital input settings of the MC Function Module, refer to the setting examples in *8-9-3 Setting Examples* on page 8-47 and *9-3-3 I/O Assignments and Settings* on page 9-9.

Differences in Processing to Obtain the Actual Current Position

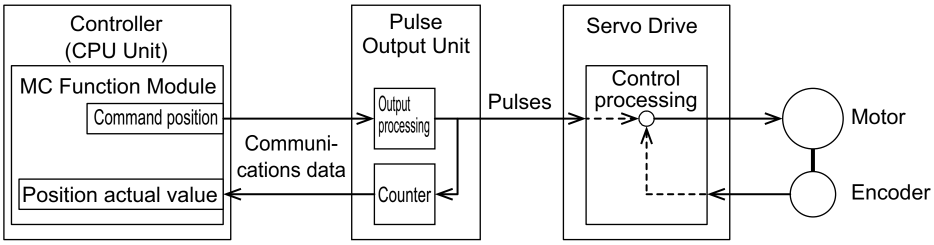
● When using a G5-series Servo Drive

You can return the feedback signal from the encoder to the CPU Unit if you use a G5-series Servo Drive with built-in EtherCAT communications.



● When Using a Pulse Output Unit

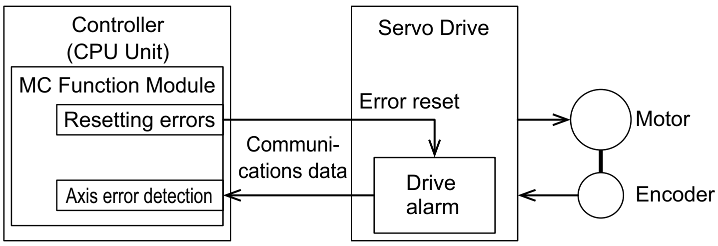
A Pulse Output Unit is the same as a Servo Drive with a pulse string input. The pulses that are output from the Pulse Output Unit are therefore returned to the CPU Unit.



Differences in Reset Axis Error Processing

● When using a G5-series Servo Drive

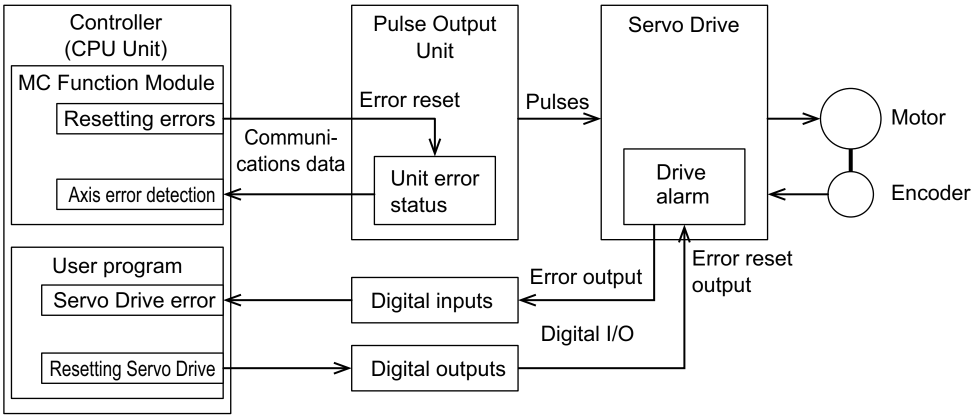
You can detect Servo Drive errors in the CPU Unit if you use a G5-series Servo Drive with built-in EtherCAT communications.



- **When Using a Pulse Output Unit**

You can detect errors that occur in a Pulse Output Unit from the CPU Unit.

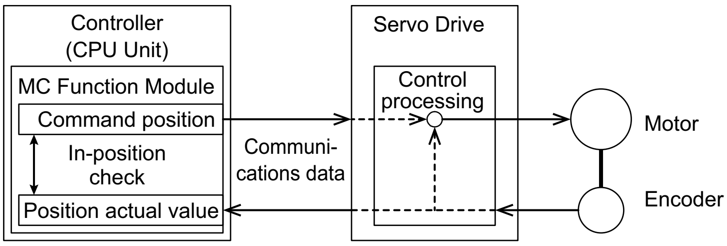
However, you must use Digital I/O Units and write the user program to monitor and reset Servo Drive errors.



Differences in In-position Check Processing

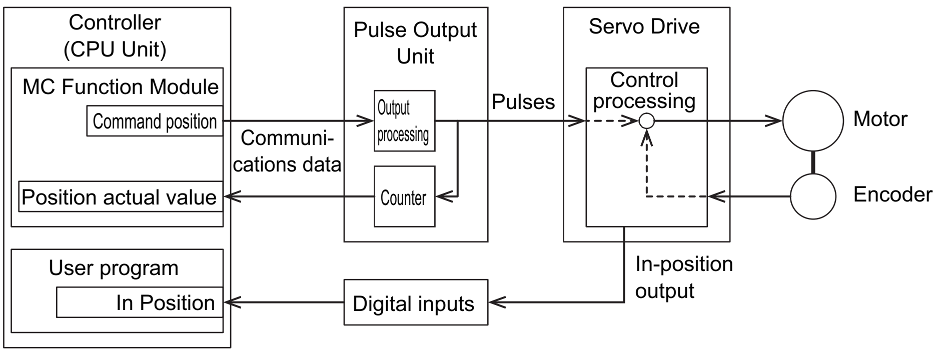
- **When using a G5-series Servo Drive**

If you use a G5-series Servo Drive with built-in EtherCAT communications, compare the position actual value and the command position in the CPU Unit to perform an in-position check.



- **When Using a Pulse Output Unit**

For the Pulse Output Unit, use a Digital Input Unit to monitor the in-position output from the Servo Drive with the user program.



Applicable Motion Control Instructions

You can use some motion control instructions and cannot use others.
Refer to *A-6 Applicable Motion Control Instructions* on page A-69 for the instruction applicability.

8-9-3 Setting Examples

This section describes the minimum parameter settings that are required to use a Pulse Output Unit with the MC Function Module.

Refer to *8-10-1 Parameters* on page 8-52 for information on Pulse Output Unit parameters.

Pulse Output Method Selection

Set the Pulse Output Method parameter, to either *Forward/reverse direction pulse* or *Pulse + direction* according to the pulse input specifications of the connected motor drive.

The default setting for the Pulse Output Unit parameter is *Forward/reverse direction pulse*.

Refer to *8-10-2 Pulse Output Method* on page 8-53 for information on the pulse output method.

Output Mode Selection

In the Output Mode Selection parameter setting, select one of the following output modes according to the connected motor drive and control application.

- Position-synchronous pulse output (for servomotor control)
- Velocity-continuous pulse output (for stepping motor control)

The default setting for the Pulse Output Unit is for a position-synchronous pulse output.

Refer to *8-10-3 Output Mode Selection* on page 8-55 for information on the pulse output methods.

External Input Signal Settings

Set the External Input Function Selection and External Input Logic Selection parameters.

The Pulse Output Unit has two inputs.

Leave the input functions at their default settings to use the Unit with the MC Function Module.

The default settings set the inputs to *Latch Input 1* and *Latch Input 2* and set both to *N.O. (Normally open)*.

Refer to *8-10-6 External Input Function Selection* on page 8-65 for information on external input signals.

External Output Signal Settings

Set the External Output 0 Function Selection and External Output 0 Logic Selection parameters.

The Pulse Output Unit has one output.

You can select between *General output* and *Error counter reset output* for the output function.

Select *Error counter reset output* to use the Pulse Output Unit with the MC Function Module.

When you use the MC Function Module and select *Error counter reset output* as the output function, ON/OFF control for this output signal is performed automatically when the home position is detected (latch 1 input).

This automatically resets the following error counter for homing when a Servo Drive is connected.

If you do not want to reset the Servo Drive’s following error counter or if a stepper motor drive is connected, set the output function to *General output*.

The default setting is for *General output* set to *N.O. (Normally open)*.

Refer to *8-10-4 External Output* on page 8-59 for information on external output signals.

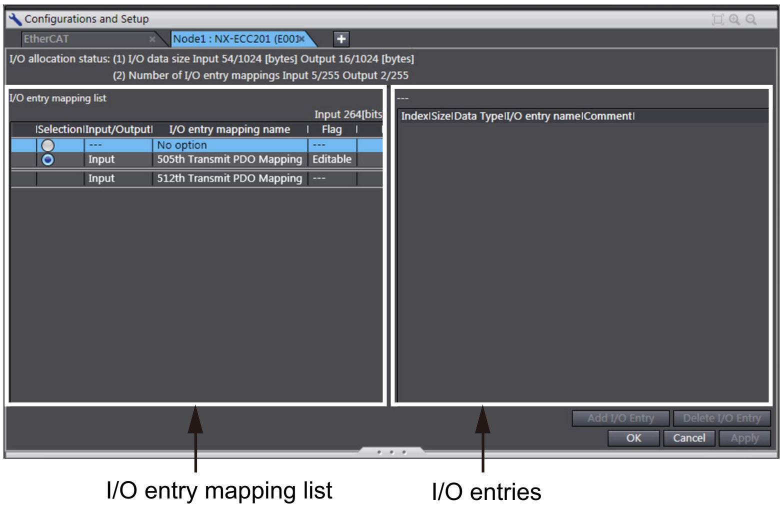
I/O Entry Mappings

This section describes I/O entry mappings to control servo axes from the MC Function Module.

You must map the objects that are required for the motion control functions that you will use to process data communications.

The I/O entry mapping is a list of required objects that is prepared in advance.

You select the I/O entry mappings to use in the Edit I/O Allocation Settings area of the Slave Terminal Tab Page in the Sysmac Studio.



The following I/O entry mappings are selected by default in the Sysmac Studio.

RxPDO	Controlword, Command Position, Command Velocity, and Latch Input
TxPDO	Statusword, External Input Status, Command Current Position, Latch Status, Latch Input 1 Data, and Latch Input 2 Data

Refer to *A-2 Object Lists* on page A-28 for details on each object.

These object mappings are set automatically by the Sysmac Studio based on the recommended usage.

You can normally use the default settings for the Sysmac Studio.

Relationships between MC Function Module and Process Data

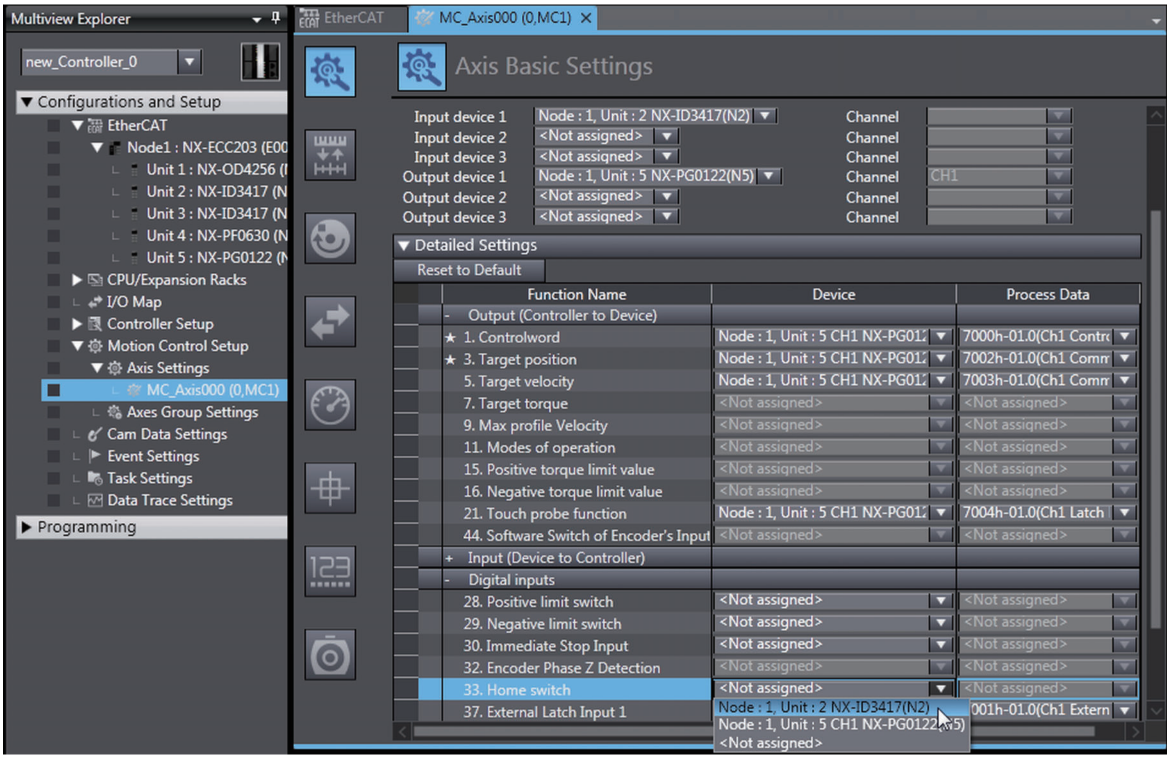
The functions of the MC Function Module are related to the information in the process data objects.

To construct a motor control system with a Pulse Output Unit, Digital Input Units are required to use limit sensor inputs and other external sensor inputs.

For information on Digital Input Units, refer to the *NX-series Digital I/O Units User's Manual* (Cat. No. W521).

You must change some settings to associate the inputs from the Digital Input Unit with MC Function Module limit detection and other functions.

Click the **Detailed Settings** Button on the Axis Basic Settings Display in the Sysmac Studio. The settings will be displayed.



● **Output Settings (Controller to Device)**

The output settings apply to the command data that is sent from the MC Function Module to the Pulse Output Unit.

Refer to *OMRON G5-series Servomotor/Servo Drive Wiring Example* on page 8-17 for details on the functions of the MC Function Module.

You can normally use the default Sysmac Studio settings for the Pulse Output Unit connections.

● **Input Settings (Device to Controller)**

This is the status data from the Pulse Output Unit to the MC Function Module.

Refer to *OMRON G5-series Servomotor/Servo Drive Wiring Example* on page 8-17 for details on the functions of the MC Function Module.

You can normally use the default Sysmac Studio settings for the Pulse Output Unit connections.

● **Digital Input Settings**

The following table lists the external inputs that are used by the MC Function Module.

Function	Description
Positive drive prohibit input	This signal is used for the positive limit input. Set the PDO of the corresponding input bit of the Digital Input Unit.
Negative drive prohibit input	This signal is used for the negative limit input. Set the PDO of the corresponding input bit of the Digital Input Unit.
Immediate stop input	This signal is used for the immediate stop input. Set the PDO of the corresponding input bit of the Digital Input Unit.
Encoder phase-Z input	This input gives the detected status of the phase-Z input. This input is not used with the Pulse Output Unit. Set it to *No assignment*. With a Pulse Output Unit, external latch input 1 is used as the home input signal. Use an external home sensor or the encoder phase-Z signal for the home input signal. Connect the home input signal to external input 0 on the Pulse Output Unit and set the External Input 0 Function Selection parameter to latch input 1. *1
Home proximity input	This signal is used for the home proximity input. Set the PDO of the corresponding input bit of the Digital Input Unit.
External latch input 1	This input gives the status of the signal that is used for external latch input 1. Set it to the latch 1 input of the Pulse Output Unit. This is the default Sysmac Studio setting.
External latch input 2	This input gives the status of the signal that is used for external latch input 2. Set it to the latch 2 input of the Pulse Output Unit. This is the default Sysmac Studio setting.

*1. Refer to *8-10-6 External Input Function Selection* on page 8-65 for details and to *9-3 Setting Examples* on page 9-7 for setting examples.

Precautions for Correct Use

- Be careful of the wiring and settings that are required when you assign a positive drive prohibit input, negative drive prohibit input, immediate stop input, or home proximity input to an input bit of a Digital Input Unit. Conform that the target signal turns ON and OFF correctly before you turn ON the power to the motor.
- You can select the input logic for the positive drive prohibit, negative drive prohibit, immediate stop, and home proximity inputs in the axis parameter settings of the MC Function Module. For the Pulse Output Unit, leave the positive drive prohibit, negative drive prohibit, and immediate stop inputs at their Sysmac Studio default settings for N.O. contacts.
  Consider the operation when the input signal is disconnected for these inputs and set the input logic accordingly.
- Input signals that use a Digital Input Unit are detected by the MC Function Module. Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

Additional Information

You can use external inputs 0 and 1 on the Pulse Output Unit as external latch inputs 1 and 2 by setting the External Input Function Selection parameters. If you perform homing with the MC Function Module, external latch 1 (external input 0) is used as the home input. If you do not use external latch 2 (external input 1) for latching, select a general input for the External Input Function Selection parameter. If you select a general input, you can use the external input as a limit input or other input.

Setting Examples

If you use the MC Function Module and the latching function of the Pulse Output Unit only for homing, set the external input 0 of the Pulse Output Unit as the external latch input 1 and use it as the home input. You can set external input 1 as a general input and use it as the home proximity input or another input. In this case, you can change the settings of the digital inputs of the MC Function Module to assign the input bits.

Refer to *8-10-6 External Input Function Selection* on page 8-65 for the External Input Function Selection parameters of the Pulse Output Unit. For the digital input settings of the MC Function Module, *9-3-3 I/O Assignments and Settings* on page 9-9.

8-10 Functions

This section describes the pulse output methods, output mode selections, latch inputs, and other functions of the Pulse Output Unit.

Precautions for Correct Use

Functions are restricted by the selected I/O refreshing method and Controller. Refer to *8-7-4 Differences in I/O Refreshing Methods Based on the Controller* on page 8-28 for details.

8-10-1 Parameters

The following table lists the parameters that are used in the Pulse Output Unit.

Parameter name	Function	Setting range	Unit	Default	Reference
Pulse Output Method	0: Forward/reverse direction pulse 1: Pulse + direction	0 or 1	---	0	P. 8-53
Output Mode Selection	0: Position-synchronous pulse output 1: Velocity-continuous pulse output	0 or 1	---	0	P. 8-55
External Input 0 Function Selection	0: General input 1: Latch input 1	0 or 1	---	1	P. 8-65
External Input 1 Function Selection	0: General input 1: Latch input 2	0 or 1	---	1	P. 8-65
External Input 0 Logic Selection	0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 8-65
External Input 1 Logic Selection	0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 8-65
External Output 0 Function Selection	0: General output 1: Error counter reset output	0 or 1	---	0	P. 8-59
External Output 0 Logic Selection	0: N.O. (Normally open) 1: N.C. (Normally close)	0 or 1	---	0	P. 8-59
Load Rejection Output Setting	0: Immediate stop 1: Deceleration stop with set deceleration rate	0 or 1	---	0	P. 8-67
Deceleration at Load Rejection	This is the amount to reduce the velocity each control period.	0 to 500,000,000	ms	0	P. 8-67
Number of Synchronization Command Interpolations	This is the maximum number of interpolations for missing synchronization commands.	0 to 16	interpolations	2	P. 8-69
Pulse Direction Change Delay	This is the pulse direction change delay.	5 to 4,000	µs	5	P. 8-71

8-10-2 Pulse Output Method

The Pulse Output Unit has two pulse output methods that you can select based on the motor that you use.

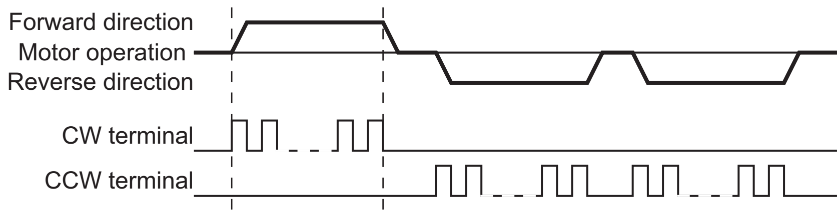
Use the Pulse Output Method parameter to change the pulse output.

The number of pulses that are output is counted inside the Pulse Output Unit. This value can be monitored by the Controller as the command current position. The command current position is counted by a signed, 32-bit ring counter.

Parameter name	Setting	Default	Remarks
Pulse Output Method	0: Forward/reverse direction pulse 1: Pulse + direction	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

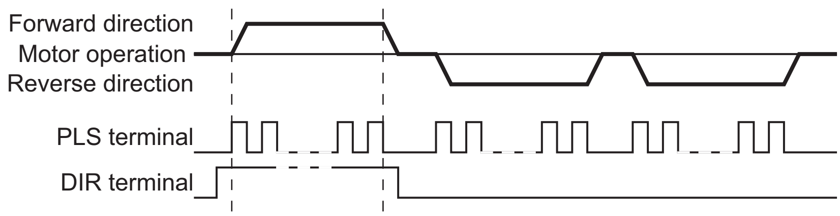
Forward/Reverse Direction Pulse

To rotate the motor forward, pulses are output from the CW terminal (pulse output A). To rotate the motor in reverse, pulses are output from the CCW terminal (pulse output B).



Pulse + Direction

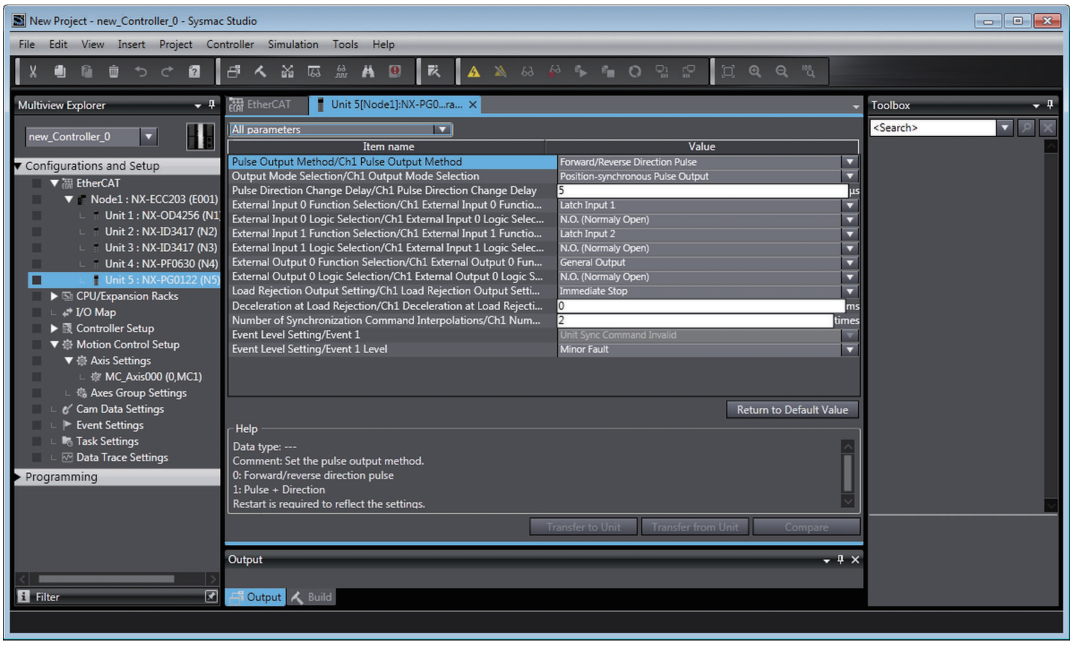
To rotate the motor in the forward direction, pulses are output from the PLS terminal (pulse output A) while the DIR output terminal (pulse output B) is ON. To rotate the motor in the reverse direction, pulses are output from the PLS terminal (pulse output A) while the DIR output terminal (pulse output B) is turned OFF.



Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Pulse Output Method parameter.

8-10-3 Output Mode Selection

The Pulse Output Unit has two pulse output selections.

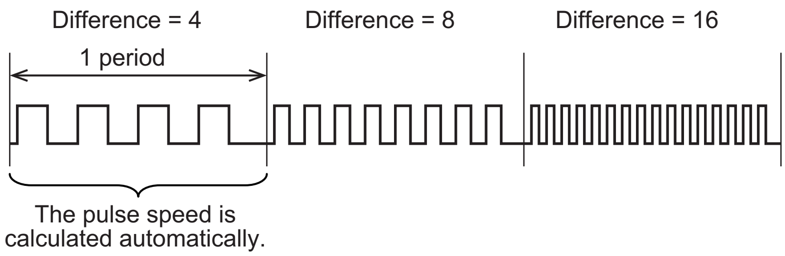
Use the Output Mode Selection parameter to change the pulse output.

Parameter name	Setting	Default	Remarks
Output Mode Selection	0: Position-synchronous pulse output 1: Velocity-continuous pulse output	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Position-synchronous Pulse Output (for Servomotor Control)

This method calculates the difference between the position output by the Controller each cycle and the present position, automatically calculates the velocity required to distribute that difference, and then outputs the pulses.

The pulse output interval depends on the control period, but because the number of pulses up to the command position are output within a specific amount of time, the Unit is best used as a servo axis.



Velocity-continuous Pulse Output (for Stepping Motor Control)

This method outputs pulses to maintain the specified velocity for the position and command velocity from the Controller and prioritizes a continuous velocity.

This method outputs pulses to maintain the specified velocity. You can use it to prevent abrupt changes in velocity due to changes in the control period.

Use this mode for constant velocity feed control or for stepper motors that can lose steps if there are any sudden changes in the velocity.

Precautions for Correct Use

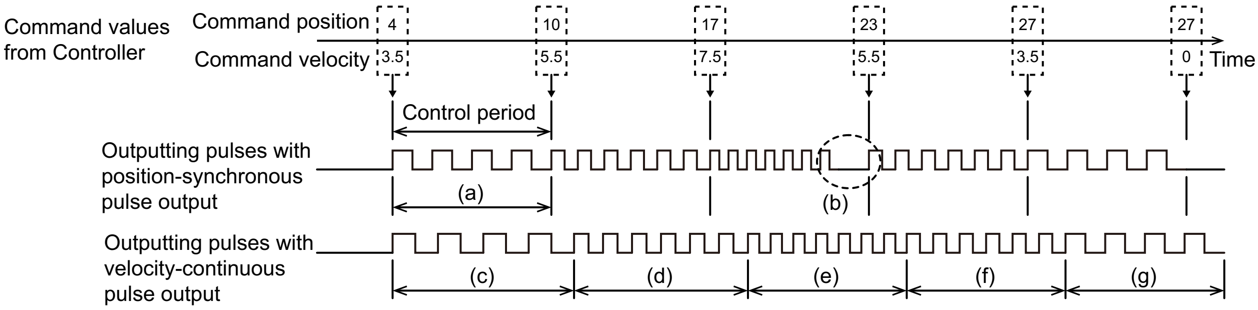
Error of ±0.005% occurs due to internal processing in the Unit between the set speed (frequency) and the speed (frequency) that is actually output from the Unit. The error in the speed does not affect positioning accuracy.

Differences between Position-synchronous Pulse Output and Velocity-continuous Pulse Output

The position-synchronous pulse output method outputs all the pulses for the command position within each control period. The velocity-continuous pulse output method outputs pulses to maintain the specified command velocity by specifying a command velocity that corresponds to the command position. Therefore, the actual pulse output depends on the output method used.

● Conceptual Description of Pulse Output

The following figure serves as an example. The pulse output will depend on the actual command position and command velocity.



Letter	Description
(a)	The differential travel distance for the command position is output in the control period. The command velocity has no effect.
(b)	Depending on the resolution of the velocity, the velocity may not be continuous.
(c)	Pulses are output for the differential travel distance for the command position based on the velocity command (3.5). The travel distance is 4.
(d)	Pulses are output for the differential travel distance for the command position based on the velocity command (5.5). The travel distance is 6.
(e)	Pulses are output for the differential travel distance for the command position based on the velocity command (7.5). The travel distance is 7.
(f)	Pulses are output for the differential travel distance for the command position based on the velocity command (5.5). The travel distance is 6.
(g)	Pulses are output for the differential travel distance for the command position based on the velocity command (3.5). The travel distance is 4.

Precautions for Correct Use

For the velocity-continuous pulse output method, you must specify a command velocity to go along with the command position that is given every control period. If you specify a command velocity that is not compatible with the command position, this may result in sudden changes in the pulse output, pulse output across more than one control period, or other unintended output.

Use the MC Function Module in an NJ/NX-series Controller to automatically calculate the command velocity when you use the velocity-continuous pulse output method.

Low Velocity Command Operation for Velocity-continuous Pulse Output

The velocity-continuous pulse output method is used to output pulses so that the specified velocity is maintained.

However, at low velocities the response to changes in host commands is slower if the command velocity is strictly retained. For example, if a command velocity of 1 pps is given and retained strictly, the time required to output one pulse would be one second, and during that time there will be no response even if the command value changes.

You must also consider cases when a position command is given with a command velocity of 0 pps (i.e., any speed less than 1 pps) according to the results of a deceleration command, such as when positioning is stopped.

Therefore, when velocity-continuous pulse output is used, the command velocity has the characteristics that are shown in the following table.

Travel distance*1	Command velocity	Pulse output operation
0	---	No pulse output.
1	250 pps max.	Pulses are output at 250 pps.
	251 pps min.	Pulses are output at the command velocity.
2 or higher	0	Pulses are output at the previous command velocity.*2
	1 pps min.	Pulses are output at the command velocity, with a maximum velocity of 500 kpps.

*1. The travel distance is expressed as the amount of change from the previous command position.

*2. If the previous command velocity was 0, pulses are output at 1 pps.

Precautions for Correct Use

If the command velocity is greater than 500 kpps, pulse output is performed at 500 kpps.

Monitoring the Following Error

The command position for a Pulse Output Unit is given as signed, 32-bit data that expresses the absolute position. It is the shortest distance in relation to the present position with a travel distance expressed by up to 31 bits.

The maximum output velocity is 500 kpps, so pulse output is limited to a maximum of 500 kpps even if a higher velocity is specified.

Therefore, depending on the commands that are received, the following error between the command position and the present position can increase to a point where the following error exceeds 31 bits and the operation begins to run in the reverse direction.

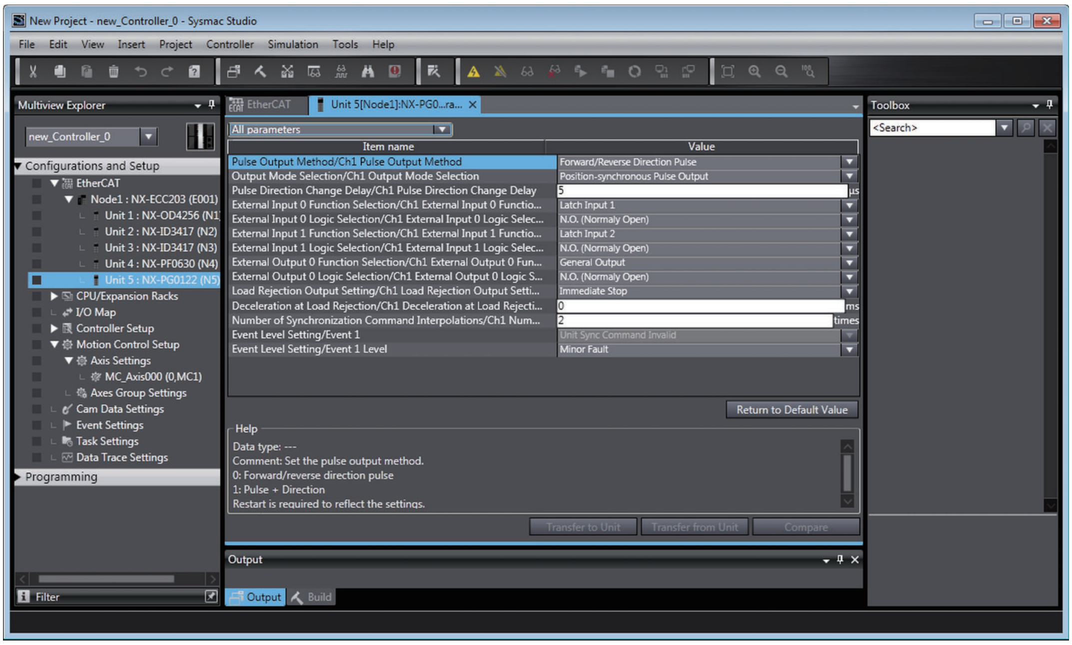
To avoid this, the following error between the command position and the present position is monitored and an Illegal Following Error error event occurs if it exceeds 30 bits.

If an Illegal Following Error occurs during axis operation, the control state changes from Fault Reaction Active to Fault. Pulse output is also stopped according to the Load Rejection Output Setting.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Output Mode Selection parameter.

8-10-4 External Output

The Pulse Output Unit has one output port for an external output.

If you use this output port with the MC Function Module, you can use it as an error counter reset output when the homing operation is completed.

Otherwise, this output is used as a general output.

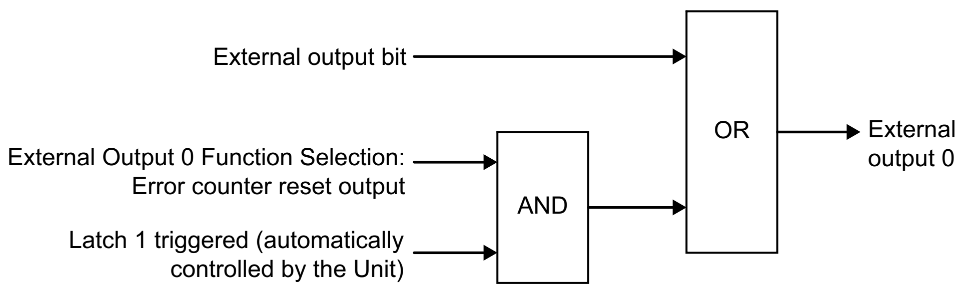
When the external output is set as a general output, you can manipulate the bit for the external output that was assigned as a device variable to turn that external output ON or OFF.

Parameter name	Setting	Default	Remarks
External Output 0 Function Selection	0: General output 1: Error counter reset output	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.
External Output 0 Logic Selection	0: N.O. (Normally open) 1: N.C. (Normally close)	0	

Error Counter Reset Output

When the External Output 0 Function Selection parameter is set for an error counter reset output, the Pulse Output Unit will automatically turn ON external output 0 (O0) when latch 1 is triggered. The output stays ON for 20 ms.

When you connect a Pulse Output Unit to a Servo Drive, you can use this function to reset the Servo Drive's error counter reset output when the home input of the homing operation of the MC Function Module is detected.



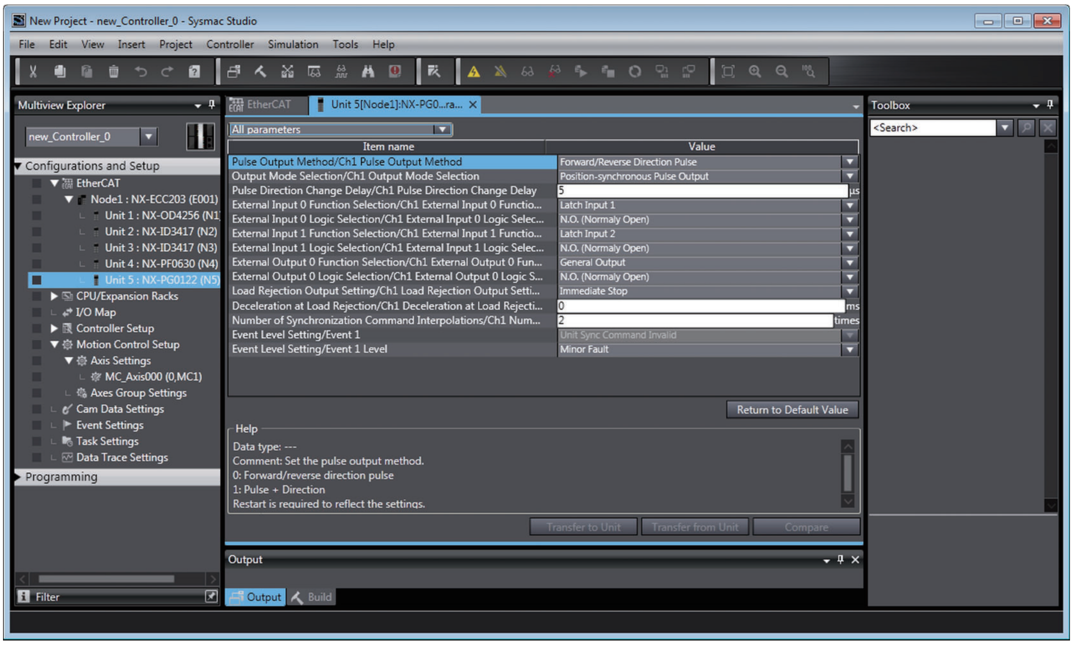
Precautions for Correct Use

- If the error counter reset output is set for the external output function, the output turns ON automatically when the latch 1 of the current value latch is triggered. This function is designed for homing when the Unit is used with the MC Function Module. For all other purposes or if you do not want to reset the following error counter, set the external output function for a general output and do not use the error counter reset output.
- If you use the error counter reset output, you cannot use latch 1 for a standard latch function. Latch 1 is used for the homing operation. Use latch 2 if you need a standard latch.
- The response time from the latch 1 input signal until the error counter reset output is 250 μs maximum.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the External Output 0 Function Selection and External Output 0 Logic Selection parameters.

8-10-5 Latching

You can use an external input to latch the present position.

The data that is obtained with the Pulse Output Unit's latch function is the command current position, which is represented by the internal output pulse count value.

You can select either a ring or linear counter to obtain the present position with the latch.

Precautions for Correct Use

If you use the error counter reset output, you cannot use latch 1 for a standard latch function. Latch 1 is used for the homing operation. To use both the following error count reset output and a standard latch, use latch 2.

Latching with an External Input

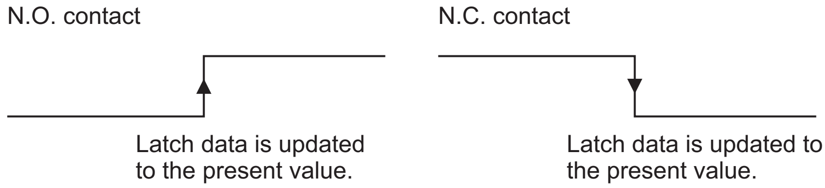
You can select either external input 0 (I0) or external input 1 (I1) as the external input latch trigger.

You can use external input 0 (I0) as Latch Input 1 and external input 1 (I1) as Latch Input 2.

Refer to *Latch Function* on page 8-38 for information on latching for an external input.

Refer to *External Input Function Selection* on page 8-65 for information on the external inputs (I0 and I1).

When you select an N.O. contact for the external input logic, the present value is latched on the rising edge of the selected external input (I0 or I1). When you select N.C. contact for the external input logic, the present value is latched on the falling edge of the external input. The latch value is updated every time the present value is latched.



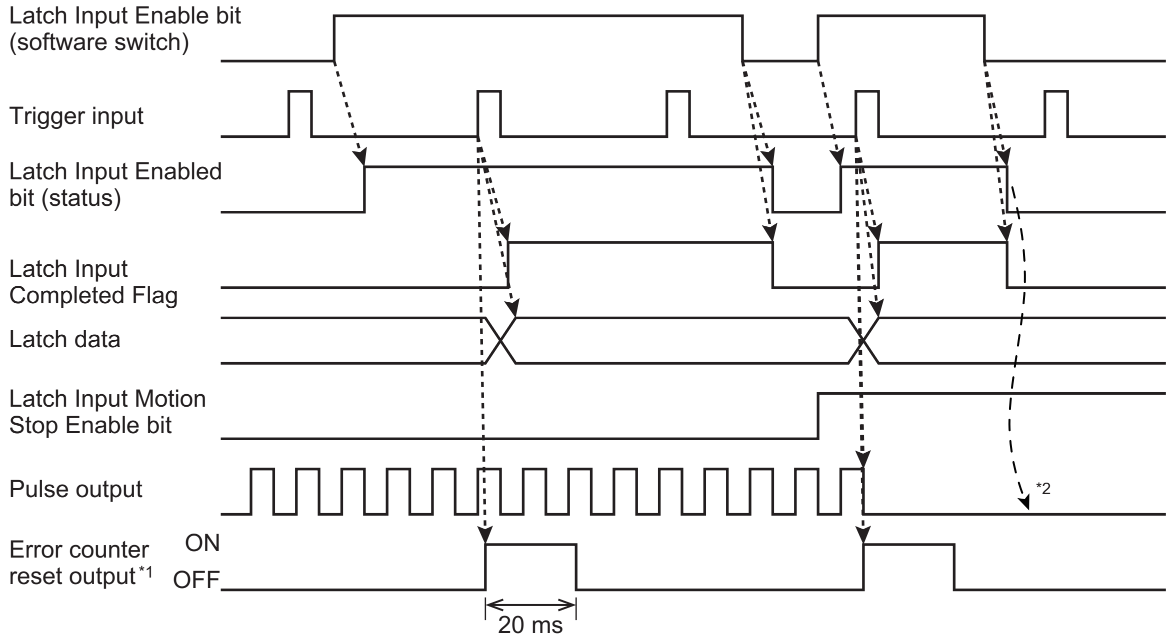
You can assign up to two external inputs as latch inputs, each with an I/O data input area allocation.

● Trigger Conditions

There are the following two input trigger conditions for latching.

Input trigger condition	Description
One-shot Mode	After you change Latch Input 1 Enable or Latch Input 2 Enable bit from 0 to 1, the present position of the encoder is latched for the first detected latch input. No more latching is performed for this latch input until you change the Latch Input 1 Enable or Latch Input 2 Enable bit to 0 and then back to 1 again.
Continuous Mode	While the Latch Input 1 Enable or Latch Input 2 Enable bit is 1, the present position of the encoder is latched and the latch value is updated every time a latch input is detected.

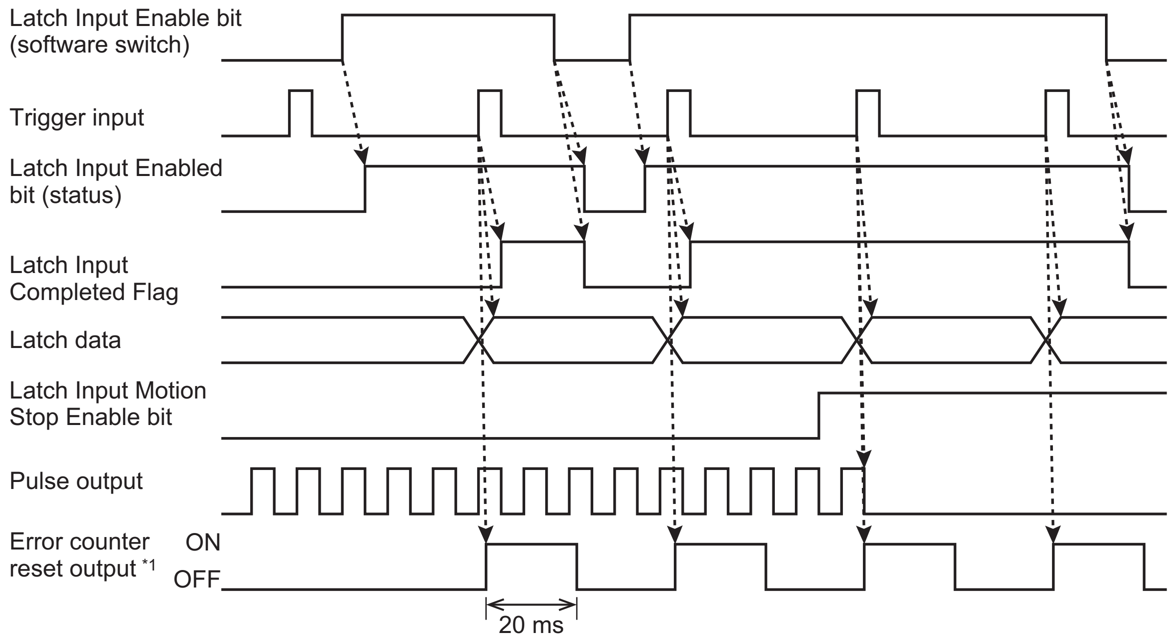
The following timing chart shows the operation in One-shot Mode.



*1. This turns ON for latch 1 only.

*2. If the pulse output is stopped due to the Latch Input Motion Stop Enable bit, latching is temporarily disabled and the pulse output command is enabled.

The following timing chart shows the operation in Continuous Mode.



*1. This turns ON for latch 1 only.

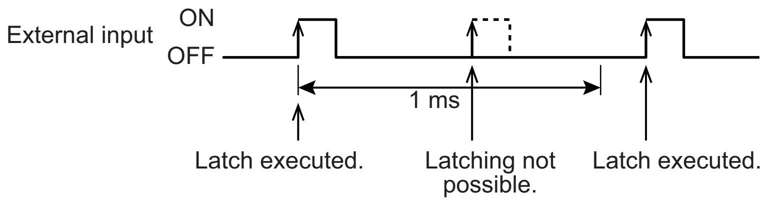
Precautions for Correct Use

Limits on Latch Inputs

- A delay of up to 250 µs will occur between when the latch input is received and when the latch data is processed. The latch data and latch completed flags will turn ON the first time input data is refreshed after processing is completed.

Restrictions in Continuous Mode

- When you perform latching with an external input, a latch cannot be detected for 1 ms after the previous latch was detected, even when the latch input is enabled.



Immediate Stop during Latching

Set the Latch Input 1 Motion Stop Enable or Latch Input 2 Motion Stop Enable variable to 1 to immediately stop pulse output when the corresponding latch is triggered.

After the latch is triggered and the output stops, the Latch Input 1 Enable or Latch Input 2 Enable bit is set to disable the latch. Pulse output is then started when a command position is received.

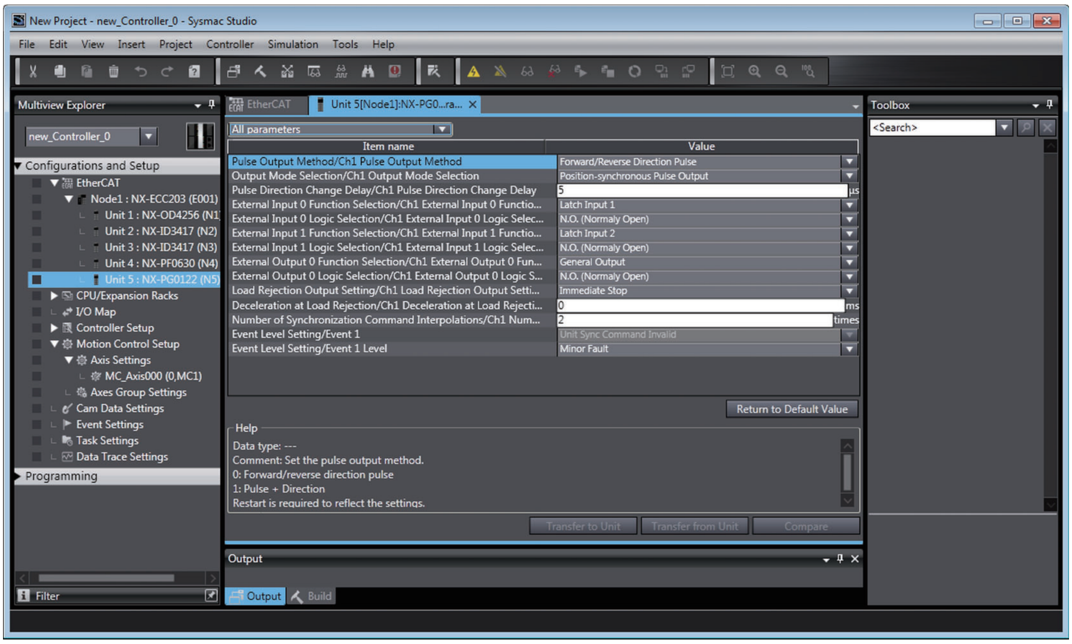
Precautions for Correct Use

The response time from when the latch is triggered until the pulses are stopped is 250 µs maximum.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the External Input 0 Function Selection and External Input 1 Function Selection parameters.

8-10-6 External Input Function Selection

The Pulse Output Unit has two input ports for external sensor input signals.

You can use these two input ports as latch inputs.

You can use these inputs as trigger inputs for instructions that control latching when you use the MC Function Module.

If you perform homing with the MC Function Module, external latch input 1 on the Pulse Output Unit is used as the home input signal. Use an external home sensor or the encoder phase-Z signal for the home input signal.

Connect the home input signal to external input 0 on the Pulse Output Unit and set the External Input 0 Function Selection parameter to latch input 1.

Refer to *OMRON G5-series Servomotor/Servo Drive Wiring Example* on page 8-17 for a wiring example.

You can also use the external inputs as general inputs by setting the function selection parameters.

If you set an external input as a general input, you can use it for the home proximity input or another input when you also use the MC Function Module. In this case, you can change the settings of the digital inputs of the MC Function Module to assign the input bits.

When you do not use the MC Function Module, you can check the input status through the corresponding device variable.

The default settings for these inputs are Latch Input 1 and Latch Input 2.

Refer to *8-10-5 Latching* on page 8-61 for information on latching.

Parameter name	Setting	Default	Remarks
External Input 0 Function Selection	Select the function for external input 0. 0: General input 1: Latch input 1	1	• To use the Latch Function, you must set the Latch Input 1 Trigger Selection or Latch Input 2 Trigger Selection bit to 0 (external input). • When a latch input is selected as the function, you can set bit 6 (Latch Input Motion Stop Enable) of the Latch variable to 1 to stop pulse output when a latch operation is triggered. • Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.
External Input 1 Function Selection	Select the function for external input 1. 0: General input 1: Latch input 2	1	
External Input 0 Logic Selection	Select the logic for external input 0. 0: N.O. (Normally open) 1: N.C. (Normally close)	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.
External Input 1 Logic Selection	Select the logic for external input 1. 0: N.O. (Normally open) 1: N.C. (Normally close)	0	

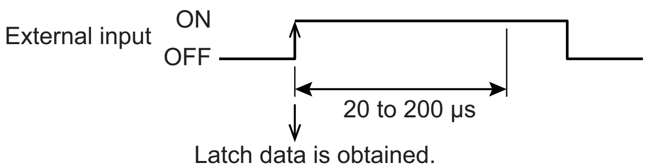
Digital Filtering of External Inputs

To use an external input as a latch input (1 or 2), digital filtering is performed for 20 to 200 µs when the external input turns ON (i.e., when the internal logic is TRUE after applying the selected logic). The input latch itself is a hardware latch on the first edge, so any data variation results from the characteristics of the hardware input. However, software processing is applied to the data confirmation processing that is performed after that. Therefore, you must set a signal width of at least 200 µs for external inputs.

For latch and reset operations, digital filtering is determined according to the input that is detected up to 200 µs after the present position input was detected.

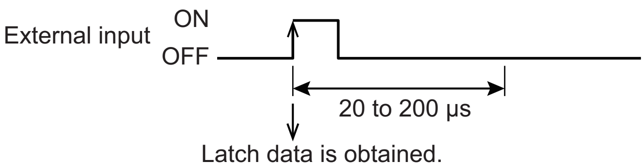
● Signal Width Greater Than 200 μs

If the signal width is greater than 200 μs, the input is detected when it turns ON and the input is valid. Therefore, processing is based on the obtained latch data.



● Signal Width Less Than the Detected Width

If the signal width is less than the detected width, the input is not detected when it turns ON and the input is not valid. Therefore, the obtained latch data is discarded and no processing is performed.



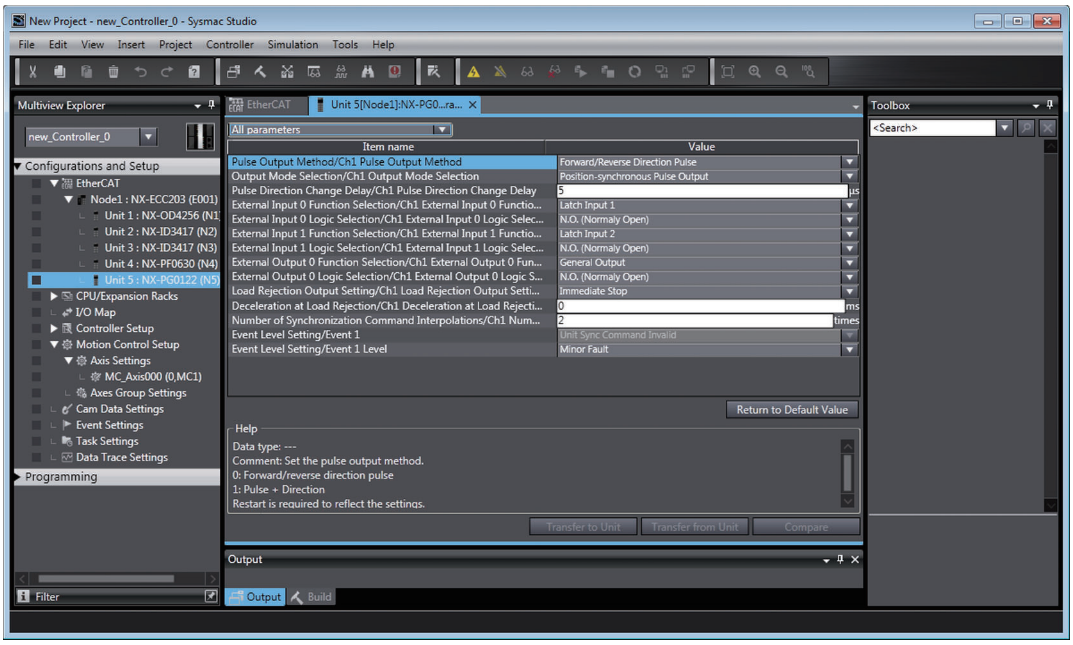
Precautions for Correct Use

Digital filtering is performed for 20 to 200 μs for external inputs. Therefore signals with signal widths of less than 200 μs may not be detected. If you use a sensor with a short response time, set an OFF delay timer for the output from the sensor or use another method to ensure a signal width of at least 200 μs for the external input.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the External Input 0 Function Selection, External Input 1 Function Selection, External Input 0 Logic Selection, and External Input 1 Logic Selection parameters.

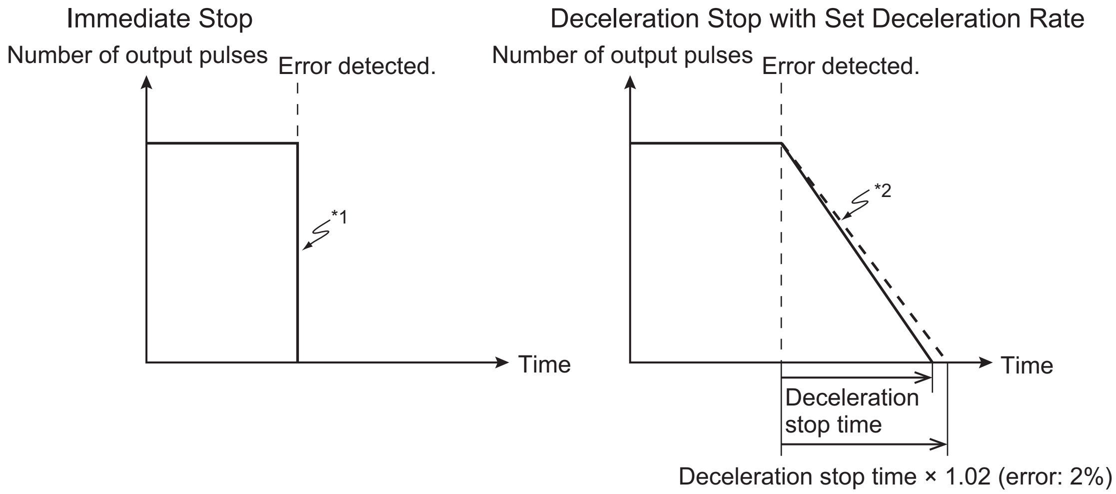
8-10-7 Load Rejection Output Setting

You can stop the output by a pre-specified operation when the Unit enters a state that stops pulse output during axis operation or when an error occurs.

You can select from the following two output stop methods: immediate stop or deceleration stop with set deceleration rate.

Parameter name	Setting	Default	Remarks
Load Rejection Output Setting	0: Immediate stop 1: Deceleration stop with set deceleration rate.	0	Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.
Deceleration at Load Rejection	0 to 500,000,000 (ms)	0	• Sets the time required to decelerate from the maximum pulse output velocity (500 kpps). • Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

- Immediate stop will stop pulse output immediately.
- Deceleration stop with set deceleration rate will decelerate the pulse output every control period by the value that is set for the Deceleration at Load Rejection parameter until the velocity reaches 0.



*1. Pulse output is stopped immediately if an error is detected.

*2. The pulse output decelerates to a stop at the set deceleration rate. In addition to the deceleration rate calculated from the value of the Deceleration at Load Rejection, there will be a delay of up to 2% between when the error is detected and the pulse output is stopped.

The load rejection output setting is used for the following conditions.

- When the communications state of the Unit changes from the Operational state to the Safe-Operational or Init state
- When the communications state of the Unit changes to the Error Safe-Operational state when a time-out is detected
- When the status of the Statusword changes to any other state from the Operation Enabled state.

When the Unit communications status is Operational for a general output, the output turns ON and OFF according to the external output that is assigned to the I/O data. If the communications status is not Operational, the output is turned OFF according to the setting of the External Input 0 Logic Selection parameter regardless of the status of the external output bit.

Precautions for Correct Use

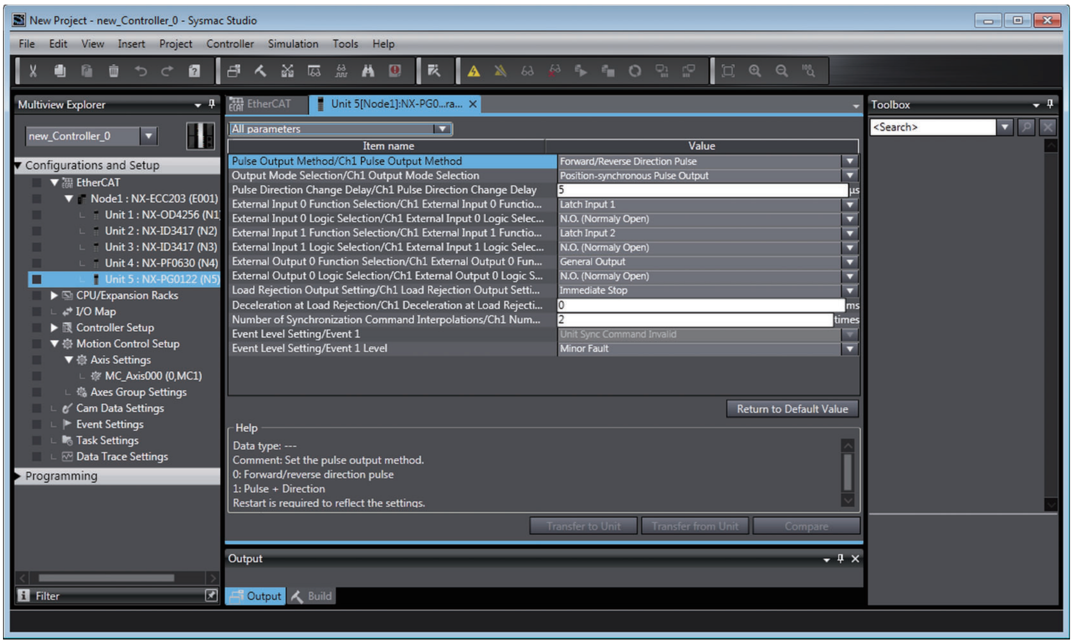
When a deceleration stop with set deceleration rate is selected, pulse output automatically decelerates to a stop at the set deceleration rate based on the velocity when the error is detected. Therefore, the stop position cannot be controlled.

Furthermore, if the motion command from the Controller must be interrupted due to the velocity at this time, the operation may change when the error is detected.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Load Rejection Output Setting and Deceleration at Load Rejection parameters.

8-10-8 Interpolation Control for Missing Synchronization Command

The Pulse Output Unit outputs pulses in sync with the command position that is received each fixed period.

If synchronized communications falls out of sync or if the cycle is broken for any other reason and a command is lost, the command position for that period is not updated.

In this case, the Unit will receive the same command position as before, which will result in a travel distance of 0 or in an immediate stop (velocity 0).

Therefore, refreshing synchronized commands is monitored to prevent the machine from stopping abruptly or to prevent the stepper motor from step loss.

If the command position cannot be obtained at the expected time, the command position is predicted based on the previous two command positions so that operation continues.

Parameter name	Setting	Default	Remarks
Number of Synchronization Command Interpolations	0 to 16 (interpolations)	2	• This parameter sets the maximum number of interpolations for missing synchronization commands. • Set this parameter to 0 to disable the function. • Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Additional Information

If the number of consecutive missing synchronization commands exceeds the value that is set for the Number of Synchronization Command Interpolations parameter, an Incorrect Synchronization Command error occurs.

Interpolation for Velocity-continuous Pulse Output

When the Output Mode Selection parameter is set to velocity-continuous pulse output, interpolation is performed as follows when a synchronous command is missing:

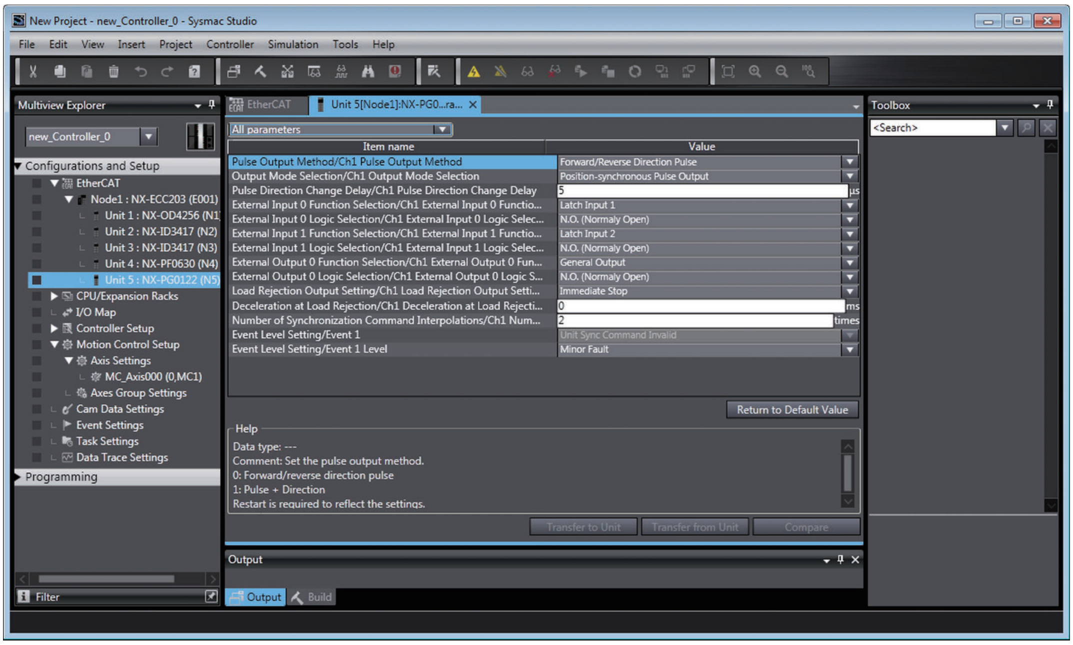
- Command position: Command position is presumed based on the previous two commands (primary interpolation)
- Command velocity: The previous command velocity is retained.

If a normal command is received so that the value set for the Number of Synchronization Command Interpolations parameter is not exceeded and the Unit recovers from the interpolation control state, the return operation for that command is performed with position-synchronous pulse output.

Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Number of Synchronization Command Interpolations parameter.

8-10-9 Pulse Direction Change Delay

Use the pulse direction change delay to specify a wait time for the expected time when reverse direction pulse signals cannot be received due to the responsiveness of the motor drive when you change pulse output to a reverse operation.

Set this wait time when you use the Pulse Output Unit with a velocity-continuous pulse output.

Set the wait time according to the specifications for the connected Servo Drive.

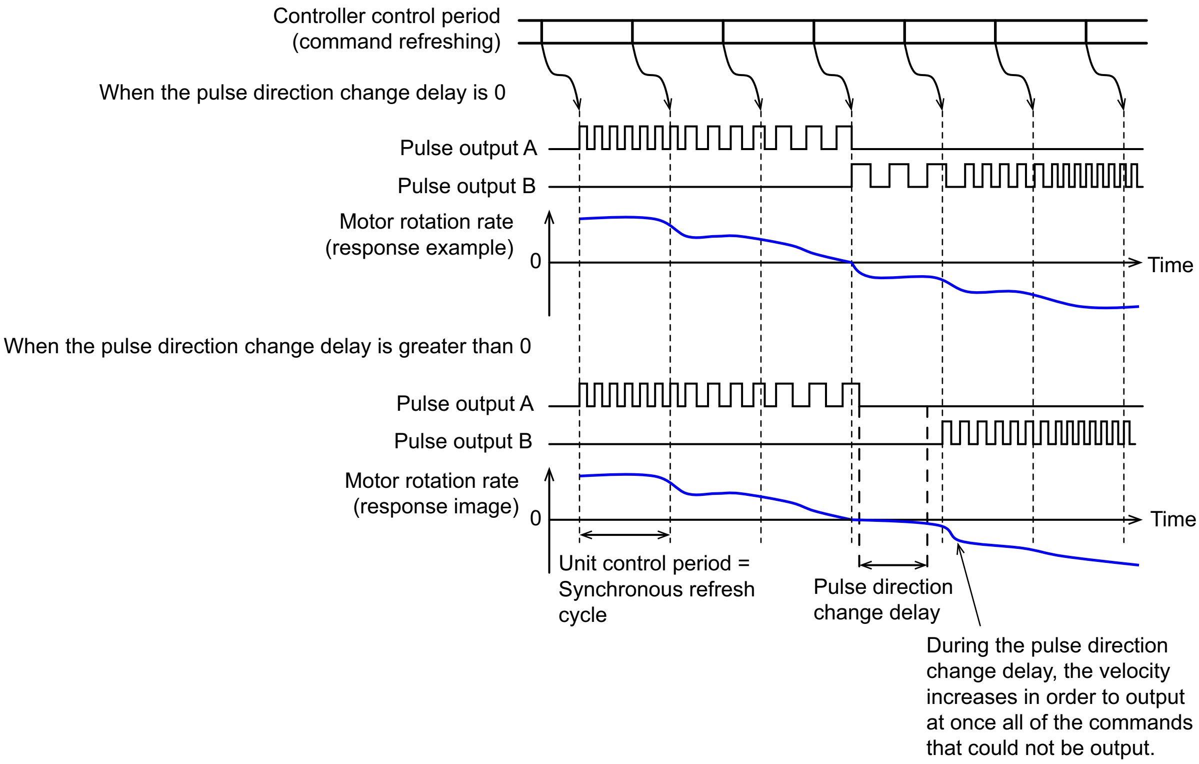
Refer to *8-10-3 Output Mode Selection* on page 8-55 for information on the output modes.

Parameter name	Setting	Default	Remarks
Pulse Direction Change Delay	5 to 4,000 (µs)	5	• This parameter is valid for velocity-continuous pulse output only. • Changes are applied when the power supply to the NX Unit is turned ON or the NX Unit is restarted.

Precautions for Correct Use

- This function is executed by the Pulse Output Unit regardless of any commands from the Controller. Therefore, the machine may move abruptly upon reversal if you select a setting that does not match the specifications of the connected Servo Drive.

Operation for Reversing Velocity-continuous Pulse Output (for Stepping Motor Control)

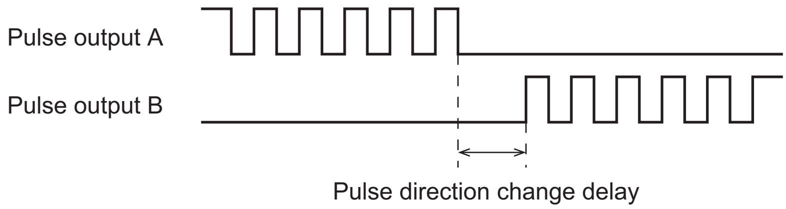


- The Pulse Direction Change Delay may require up to 121 µs longer than the set value.

  Delay time (15 µs max.) + Jitter due to I/O refreshing (106 µs max.)

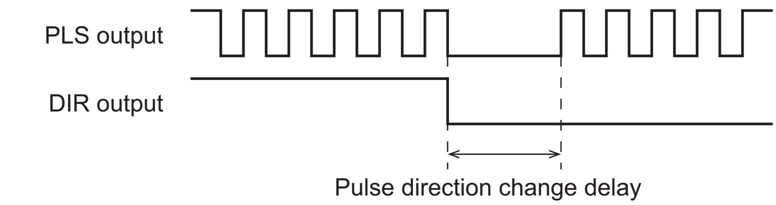
Wait Time for Forward/Reverse Direction Pulse Outputs

Set the pulse direction change delay as shown below when the Pulse Output Method parameter is set to *Forward/reverse direction pulse*.



Wait Time for Pulse + Direction Outputs

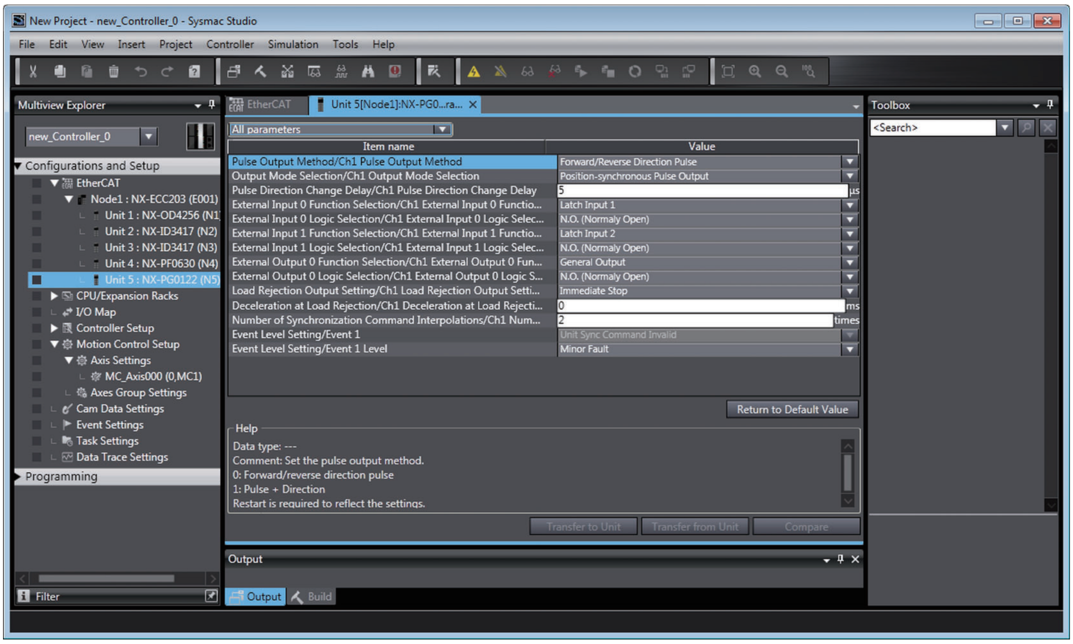
Set the pulse direction change delay as shown below when the Pulse Output Method parameter is set to *Pulse + direction*.



Setting with the Sysmac Studio

1 Double-click the Pulse Output Unit in the Multiview Explorer.

The following tab page is displayed.



2 Set the Pulse Direction Change Delay parameter.

8-11 Specifications

This section provides the general specifications, external I/O specifications, and performance specifications for the Pulse Output Unit.

8-11-1 General Specifications

The general specifications of the Pulse Output Unit are given below.

Item		Specification
Number of pulse output channels		1
Pulse output interface		Open collector output
Maximum pulse output speed		500 kpps
Pulse output method		Forward/reverse direction pulse outputs or Pulse + direction outputs
Control unit		Pulses
Position control range		–2,147,483,648 to 2,147,483,647 pulses
Velocity control range		1 to 500,000pps
Control I/O	Output signals	3 The outputs are forward direction pulse output, reverse direction pulse output, and external output.*1
	Input signals	2 The inputs are external inputs. *2
NX Unit power consumption		NX-PG0112: 0.80 W max. NX-PG0122: 0.90 W max.
I/O power supply voltage		20.4 to 28.8 VDC (24 VDC +20%/–15%)
Current consumption from I/O power supply		NX-PG0112/-PG0122: 20 mA max.
I/O power supply method		NX bus
Weight		NX-PG0112/-PG0122: 70 g max.
Dimensions (Width × Height × Depth)		NX-PG0112/-PG0122: 12 × 100 × 71 mm
I/O data size*3		NX-PG0112/-PG0122: Inputs: 18 bytes, Outputs: 14 bytes
Number of I/O entry mappings*3		NX-PG0112/-PG0122: Inputs: 1, Outputs: 1
Cable length		NX-PG0112/-PG0122: 3 m max.

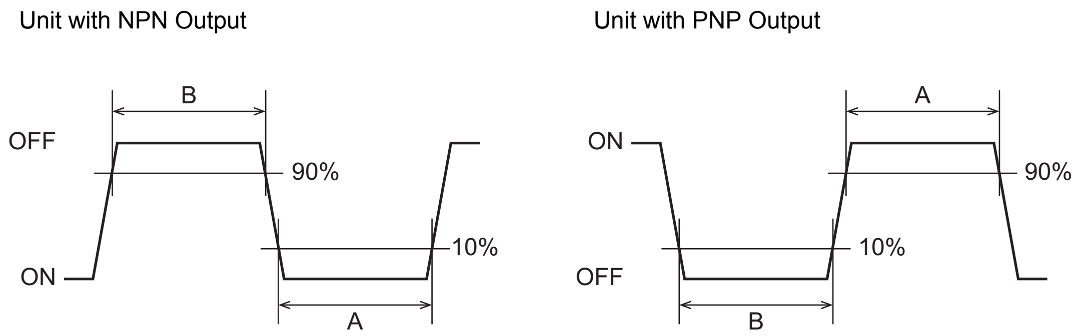
*1. You can use the external output as an error counter reset output.

*2. You can use the inputs as latch inputs.

*3. This is the default set value.

8-11-2 Pulse Output Specifications

The specifications of the pulse outputs and the pulse output waveforms of the Pulse Output Unit are given below.



- The ON width is width A in the above figure.
- The OFF width is width B in the above figure.
- The rising width and falling width are not specified.

Pulse output speed	Output current	ON width	OFF width
200 kpps	7 mA	2.4 μs max.	1.7 μs max.
	16 mA	2.4 μs max.	2.1 μs max.
500 kpps	7 mA	0.9 μs max.	0.2 μs min.
	16 mA	0.9 μs max.	0.6 μs min.

Precautions for Correct Use

- The pulse widths during actual usage may be smaller than the specified values due to pulse waveform distortion caused by the impedance of the connecting cable.
- If the output current is too small when the pulse output speed is high, a sufficient signal width may not be provided for the input specifications of the motor drive or other input device. If that occurs, connect bypass resistance or take other steps to increase the output current and obtain a sufficient signal width.

8-11-3 External I/O Specifications

The specifications for the external inputs and outputs of the Pulse Output Unit are given below.

External Input Specifications

Item	Specification
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)
Input current	4.6 mA typical (at 24 VDC)
ON voltage/ON current	15 VDC min./3 mA min.
OFF voltage/OFF current	4.0 VDC max./1 mA max.
ON response time	1 µs max.
OFF response time	2 µs max.

External Output Specifications

Item	Specification
Rated voltage	24 VDC
Load voltage range	15 to 28.8 VDC
Maximum load current	30 mA
Leakage current	0.1 mA max.
Residual voltage	1.0 V max.
ON response time	5 µs max.
OFF response time	5 µs max.

9

Application Example

This section provides an application example for the Position Interface Units.

9-1 Assumed System Configuration

This section gives the system configuration, setting, and programming examples for one possible case scenario.

The following table gives the details for the assumed configuration.

Item	Description
Control type	Single-axis absolute positioning
Control method	Open-loop control
Outputs to Servo Drive	• Pulses can be output to the Servo Drive. • The Servo Drive following error counter can be reset. • The Servo can be turned ON and OFF. • Servo Drive errors can be reset.
Inputs from Servo Drive	• The number of pulses can be latched through an input from the Servo Drive. • Servo drive errors can be detected. • Completion of positioning by the Servo Drive can be detected.
External sensor inputs	• Operation can be stopped through positive and negative limit inputs. • An immediate stop input can be used to stop operation immediately. • The home proximity input can be detected.

Note This example shows only the major I/O signals required to control the Servo Drive. For an actual system configuration, you need to add operation commands for errors, cutoff circuits for the main power supply, and any other circuits that are required for safety.

9-2 Configuration Example

This section describes the system configuration and provides a wiring example to the Servo Drive.

9-2-1 System Configuration

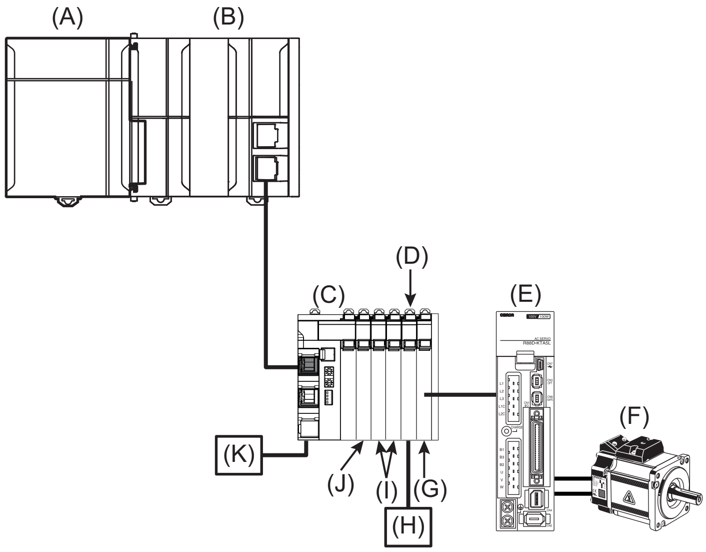
This section describes the example system configuration to implement the control described in the previous section with an NJ-series Controller, EtherCAT Coupler Unit, and Position Interface Units.

To construct a motor control system with a Pulse Output Unit, Digital Input Units are required to use external sensors, such as for limit sensor inputs and error inputs.

A Digital Output Unit is used for a RUN output and an error reset output.

The Digital I/O Units are connected after the EtherCAT Coupler Unit in the same way as the Pulse Output Unit.

The following diagram shows the example Unit configuration for the Controller.

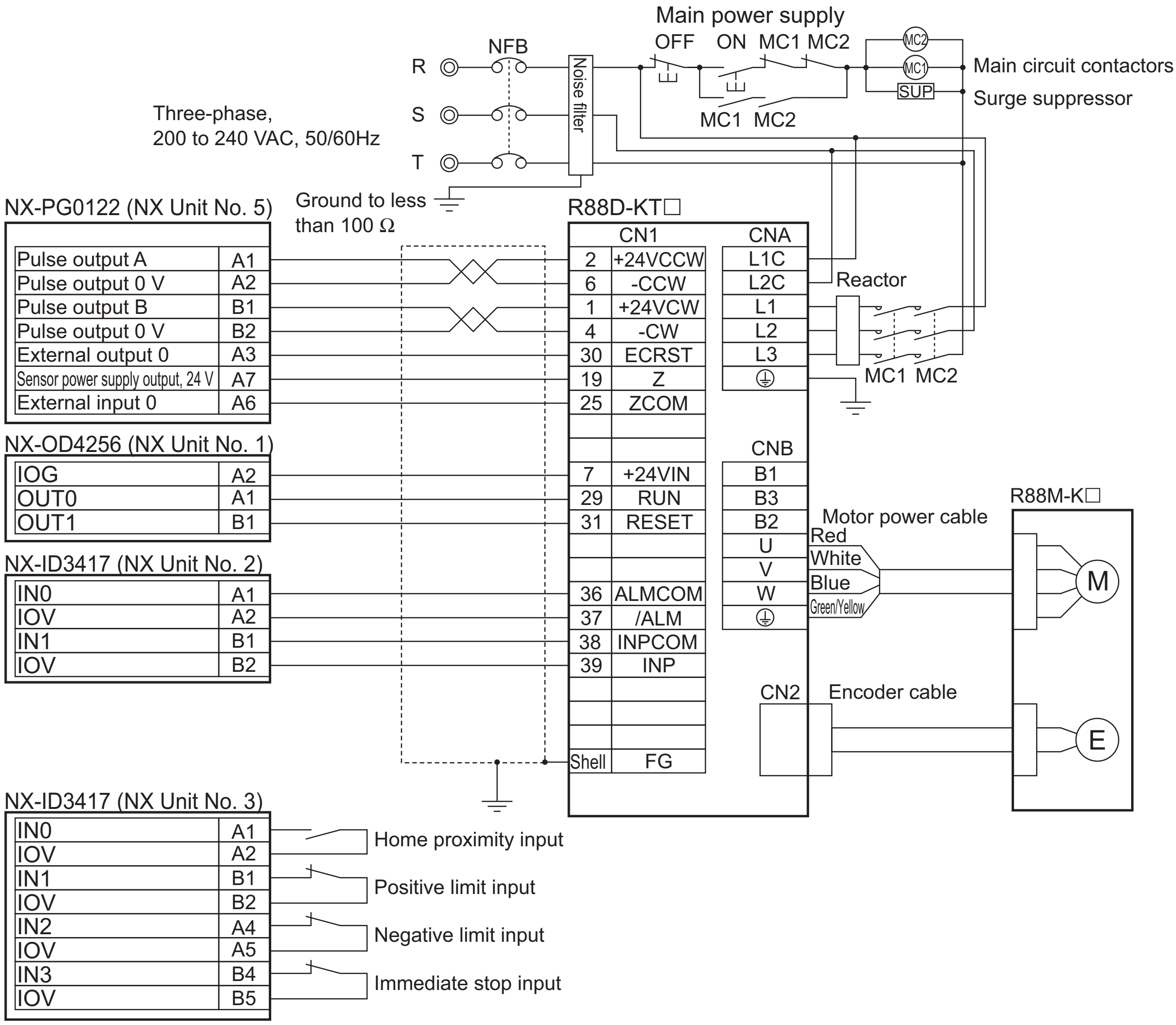


Symbol	Description
(A)	Power Supply Unit
(B)	NJ-series CPU Unit
(C)	EtherCAT Coupler Unit
(D)	Additional I/O Power Supply Unit
(E)	Servo Drive with a pulse string input
(F)	Servomotor
(G)	Pulse Output Unit
(H)	I/O power supply
(I)	Digital Input Units
(J)	Digital Output Unit
(K)	Unit power supply and I/O power supply

Unit classification	Model	Application	Remarks
Power Supply Unit	NJ-PA3001	Supplies power to the CPU Unit.	
CPU Unit	NJ501-1500	Controller	
EtherCAT Coupler Unit	NX-ECC201	Connects Position Interface Units to the CPU Unit.	
Digital Output Unit	NX-OD4256 (8-point Transistor Output Unit, 24 VDC, PNP)	Outputs to Servo Drive. • RUN output • Error reset output	NX Unit No. 1
Digital Input Unit	NX-ID3417 (4-point DC Input Unit, 12 to 24 VDC, PNP)	Inputs from Servo Drive. • Error input • Positioning completion input	NX Unit No. 2
Digital Input Unit	NX-ID3417 (4-point DC Input Unit, 12 to 24 VDC, PNP)	External Sensor Inputs • Positive limit input • Negative limit input • Immediate stop input • Home proximity input	NX Unit No. 3
Additional I/O Power Supply Unit	NX-PF0630	Separates the power supplies for the Pulse Output and Digital I/O Units.	NX Unit No. 4 This Unit separates the I/O power supplies for the Position Interface Units and the other NX Units to prevent noise.
Pulse Output Unit	NX-PG0122 (PNP)	Outputs to Servo Drive. • Pulse output • Latch input for the number of pulses • Error counter reset output	NX Unit No. 5

9-2-2 Servo Drive Wiring Example

The following wiring example shows the wiring when an OMRON G5-series Servo Drive and Servomotor (R88D-KT☐ or R88M-K☐) are used.



The external output 0 (O0) from the NX-PG0122 Pulse Output Unit is a PNP output. In this example, it is used as an error counter reset output.

To connect to the following error counter reset input (ECRST) of the Servo Drive, connect to the input common (+24 VIN) of the Servo Drive to the IOG (I/O power GND) of the NX Unit. The Servo Drive supports both PNP and NPN inputs.

Also connect the operation command input (RUN) and error reset input (RESET) (which have the same common) to a PNP Output Unit.

When connected in the same Slave Terminal, the I/O power supply is shared by the entire Slave Terminal if an Additional I/O Power Supply is not used.

Wiring errors or mixing PNP and NPN outputs may cause damages or malfunctions.

Precautions for Correct Use

The MC Function Module will restrict operation in the relative direction depending on the status of the positive limit input signal and negative limit input signal. If the dog width for the limit input is short or if for any other reason the signal is not input for positions that are beyond the limit, an operational restriction is not applied after the error is reset and the machine will move beyond the limit. To restrict the range of operation of the machine with the limit inputs, set the signal detection method or detection width so that the limit input is always detected at any position beyond the limits.

9-3 Setting Examples

This section describes the settings that are required to build the example system.

9-3-1 EtherCAT Network and Slave Terminal Configuration

This section describes how to create a new project in the Sysmac Studio and build the EtherCAT network and EtherCAT Slave Terminal configuration.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) and the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for information on the configuration method.

9-3-2 Parameter Settings for the Pulse Output Unit

For this configuration we will use the MC Function Module in the NJ-series Controller.

This section describes the minimum parameter settings that are required for the Pulse Output Unit.

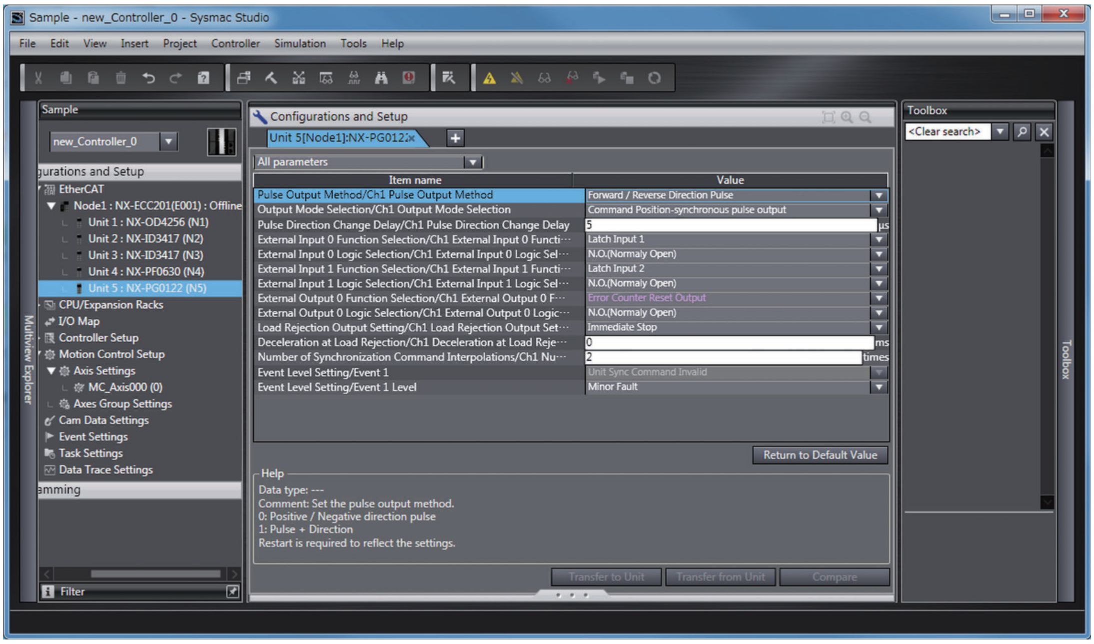
This example uses the parameter settings in the following table.

Parameter	Setting used	Remarks
Pulse Output Method	Forward/reverse direction pulse	Select from the following: • Forward/reverse direction pulse (default) • Pulse + direction
Output Mode Selection	Position-synchronous pulse output	Select from the following: • Position-synchronous pulse output (default) • Velocity-continuous pulse output
External Input Signals	External input 0 is an N.O. contact latch input. External input 1 is an N.O. contact latch input.	Select from the following external input functions: • Latch input (default) • General input Select from the following external input contact forms: • N.O. (Normally open) (default) • N.C. (Normally close) Leave this setting on its default setting to use the MC Function Module.
External Output Signals	External input 0 is an N.O., error counter reset output.	Select from the following external output functions: • General output (default) • Error counter reset output Select from the following output logic options: • N.O. (Normally open) (default) • N.C. (Normally close) Use the error counter reset output with the MC Function Module.

Precautions for Correct Use

- When you use the Pulse Output Unit with the MC Function Module, input signals from a Digital Input Unit are used for the positive limit input, negative limit input, immediate stop input, and home proximity input. Always make sure that the signal widths for all of these input signals are longer than the task period where the MC Function Module is executed. If the input signal widths are shorter than the task period, the MC Function Module may not be able to detect the input signals, resulting in incorrect operation.
- To assign a Position Interface Unit to an axis in the MC Function Module, you must assign *NX Unit I/O Data Active Status* □□□ in the EtherCAT Coupler Unit. Replace "□□□" with 15, 31, 63, or 125 according to the highest NX Unit number of the EtherCAT Coupler Units. Refer to the N*X-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

● Software Interface

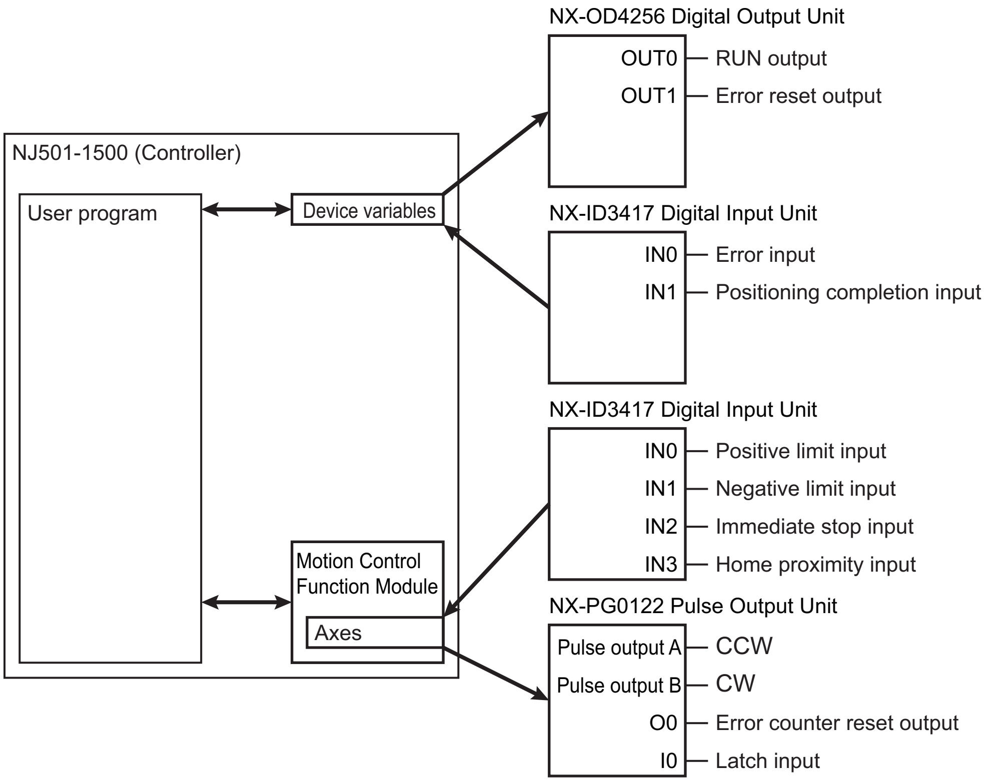


9-3-3 I/O Assignments and Settings

This section describes the axis settings and device variable settings that are required for the previous example system configuration.

For this example, we will assign some inputs from the Pulse Output Unit, which has I/O, and Digital I/O Units to MC Function Module axes.

Inputs and outputs that are not assigned to axes are assigned to device variables through I/O ports.



Precautions for Correct Use

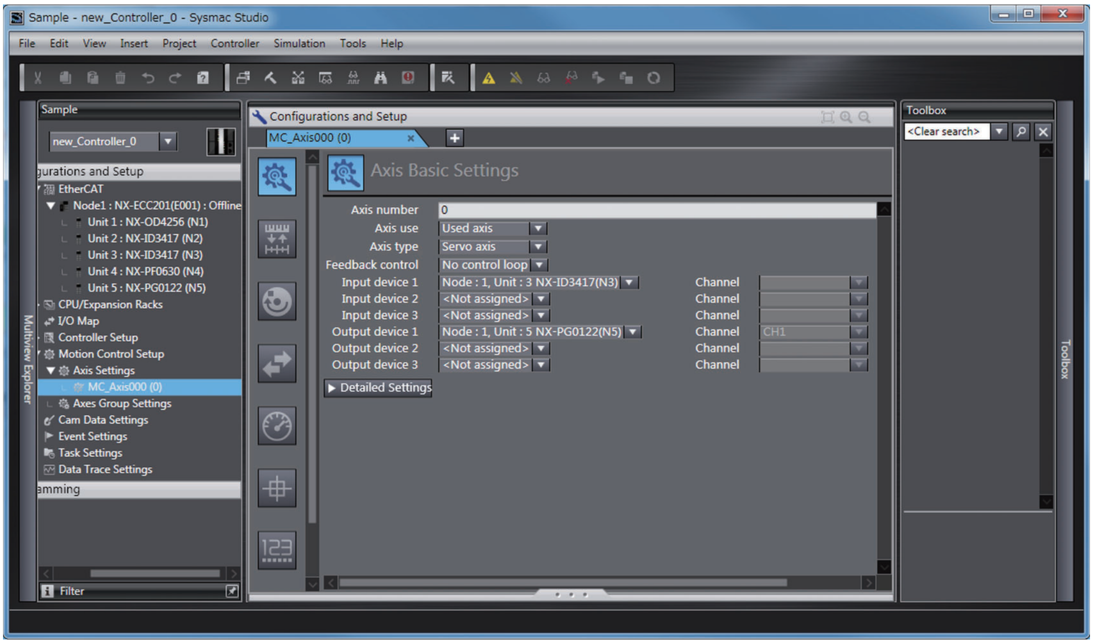
- The MC Function Module in the NJ/NX-series Controller does not support a RUN output or alarm reset output to the Servo Drive or the detection of alarm and positioning completion inputs from the Servo Drive. These inputs and outputs must be handled in the user program through the use of device variables that correspond to the connected inputs and outputs.
- The Servo Drive alarm status requires some time to recover after the alarm reset output is turned ON (i.e., when the reset input on the Servo Drive is turned ON). When you work with the alarm reset output in the user program, consider the time required to clear the alarm in the Servo Drive and build an output-holding circuit.

Axis Assignments and Settings

For this example we will assign the Pulse Output Unit and Digital Input Units to axis 1.

Perform the following settings on the Axis Basic Settings Display in the Sysmac Studio.

Parameter	Setting	Remarks
Axis Number	0	Assigns axis 0.
Axis Use	Used Axis	
Axis Type	Servo axis	
Feedback Control	No control loop	
Input Device 1	NX Unit No. 3: NX-ID3417 Digital Input Unit	Select the Digital Input Unit to assign to the axis.
Input Device 2	---	
Input Device 3	---	
Output Device 1	NX Unit No. 5: NX-PG0122 Pulse Output Unit	Select the Pulse Output Unit.
Output Device 2	---	
Output Device 3	---	



The following default I/O entry mappings are set as the process data assignments for the Pulse Output Unit and the process data is automatically assigned to the appropriate axis functions.

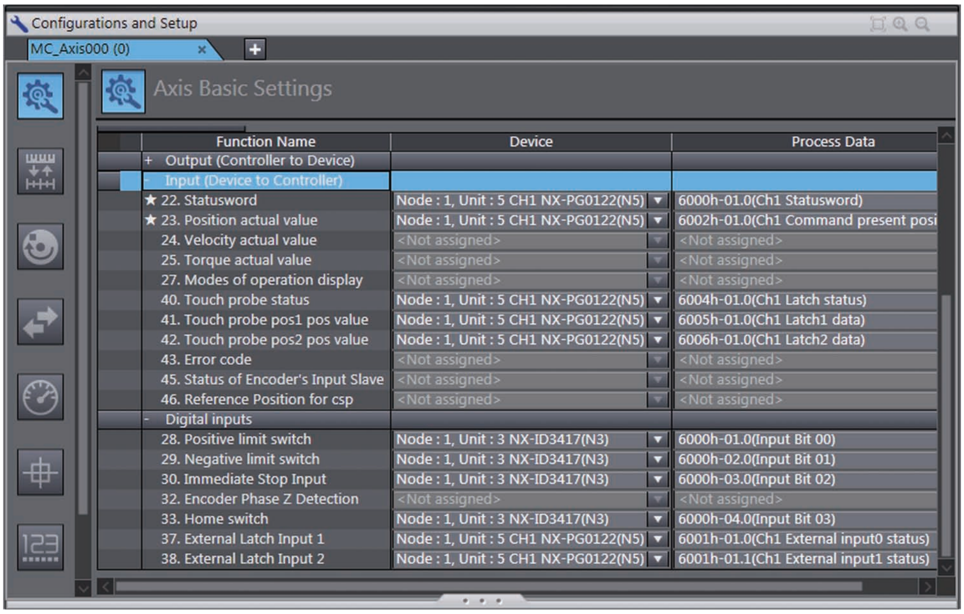
Leave these settings on their default settings to use the MC Function Module.

I/O entry mapping	Function
Inputs (RxPDO)	Controlword, Command Position, Command Velocity, and Latch Input
Outputs (TxPDO)	Statusword, External Input Status, Command Current Position, Latch Status, Latch Input 1 Data, and Latch Input 2 Data

Assign the process data for the Digital Input Units to the axis functions as shown below in the detailed settings on the Axis Basic Settings Display.

Function	Device	Process data	Remarks
Positive drive prohibit input	NX Unit No. 3: NX-ID3417 (Digital Input Unit)	6000 hex-01 hex (digital inputs)	Specifies the positive limit input (IN0).
Negative drive pro-hibit input	NX Unit No. 3: NX-ID3417 (Digital Input Unit)	6000 hex-02 hex (digital inputs)	Specifies the negative limit input (IN1).
Immediate stop input	NX Unit No. 3: NX-ID3417 (Digital Input Unit)	6000 hex-03 hex (digital inputs)	Specifies the immediate stop input (IN2).
Home proximity input	NX Unit No. 3: NX-ID3417 (Digital Input Unit)	6000 hex-04 hex (digital inputs)	Specifies the home proximity input (IN3).

You can review the Pulse Output Unit process data that was automatically assigned in the detailed settings on the Axis Basic Settings Display.



Additional Information

You can use external inputs 0 and 1 on the Pulse Output Unit as external latch inputs 1 and 2 by setting the External Input Function Selection parameters. If you perform homing with the MC Function Module, external latch 1 (external input 0) is used as the home input. If you do not use external latch 2 (external input 1) for latching, select a general input for the External Input Function Selection parameter. If you select a general input, you can use the external input as a limit input or other input.

Application Example

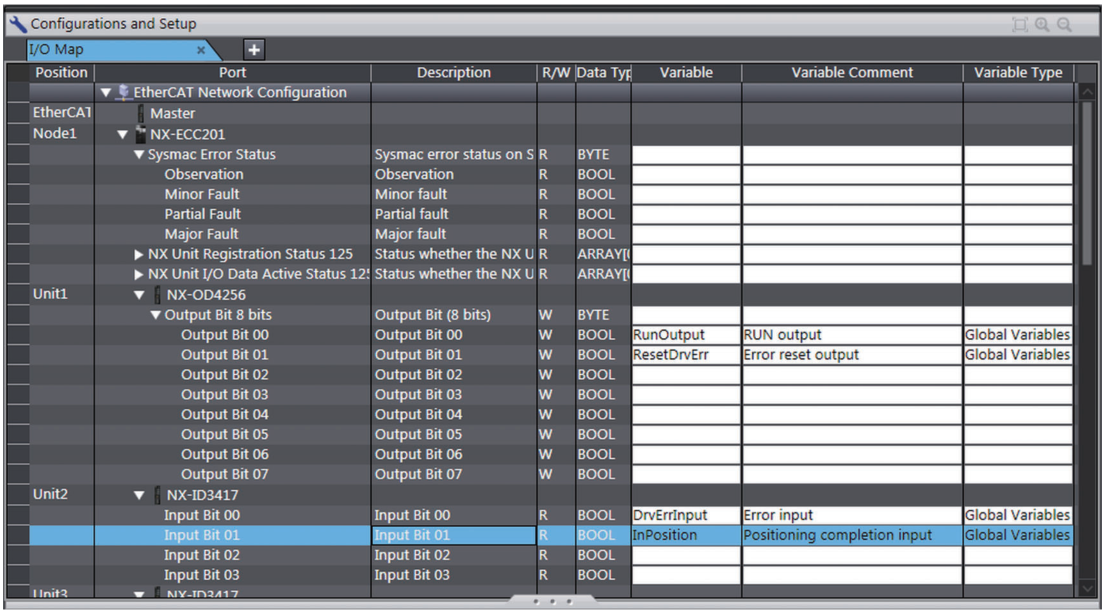
If you use the MC Function Module and use and the latching function of the Pulse Output Unit only for homing, set the external input 0 of the Pulse Output Unit as the external latch input 1 and use it as the home input. You can set external input 1 as a general input and use it as the home proximity input or another input. In this case, you can change the settings of the digital inputs of the MC Function Module to assign the input bits.

Refer to *External Input Function Selection* on page 8-65 for the External Input Function Selection parameters of the Pulse Output Unit. For the digital input settings of the MC Function Module, *I/O Assignments and Settings* on page 9-9.

Device Variable Assignments and Settings

Assign device variables to the inputs and outputs that you did not assign to an axis as shown below.

I/O port		Description	Device variables	Remarks
NX-OD4256 (NX Unit No. 1)	OutBit00	OUT0	RunOutput	RUN output
	OutBit01	OUT1	ResetDrvErr	Error reset output
NX-ID3417 (NX Unit No. 2)	INBit00	IN0	DrvErrInput	Error input
	INBit01	IN1	InPosition	Positioning completion input



Additional Information

I/O Data Assignments When Not Using the MC Function Module

When you do not use the MC Function Module, assign all data to device variables.

9-3-4 Setting Up the Motion Control Function Module

Set the MC Function Module functions as required for the type of control you need to perform.

For details on the function settings of the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

For further setup and operation confirmation procedures, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

9-4 Programming Examples

This example shows the basic programming for relative positioning.

Interlocks with other devices and programming are omitted from this example.

For other sample programming for the MC Function Module, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

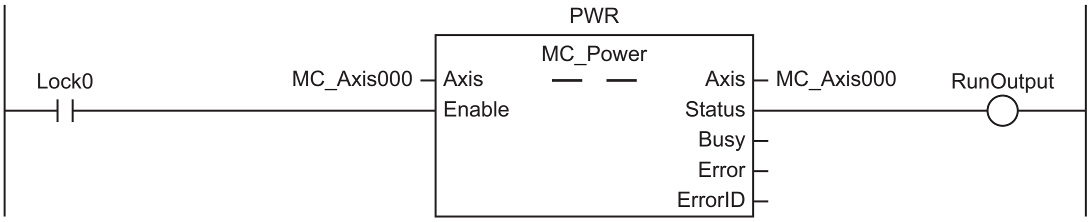
9-4-1 Main Variables Used in Programming Example

Name	Data type	Default	Comments
MC_Axis000	_sAXIS_REF	---	Axis variable for axis 0.
MC_Axis000.Cfg.NodeAddress	UINT	---	This is the node address of the EtherCAT Coupler Unit under which the Position Interface Unit that is assigned to axis 0 is connected.
_EC_PDSlavTbl[N]	BOOL	FALSE	TRUE when EtherCAT process data communications for node address N are enabled (Operational).
_EC_CommErrTbl[N]	BOOL	FALSE	TRUE when a communications error has occurred in the slave with node address N.
StartPg	BOOL	FALSE	When this variable is TRUE, the Servo is turned ON if EtherCAT process data communications are active and normal.
MoveStart	BOOL	FALSE	This is the command to execute relative positioning. If this variable changes to TRUE when the Servo is ON, the execution condition (*Start0*) for the MC_MoveRelative instruction changes to TRUE.
RunOutput	BOOL	FALSE	This is the Run output device variable to the Servo Drive. In this example, this variable is connected to the *Status* output from the PWR instance of the MC_Power instruction. It changes to TRUE when the Servo turns ON.
ResetOn	BOOL	FALSE	This variable gives the status of the external button that is used to reset errors. If this variable is TRUE, the error reset output (ResetDrvErr) to the Servo Drive turns ON and the error in the MC Function Module is reset by the MC_Reset instruction.
InPosition	BOOL	FALSE	This is the positioning completion input device variable from the Servo Drive.
DrvErrInput	BOOL	FALSE	This is the error input device variable from the Servo Drive. When this variable is TRUE, an immediate stop is performed by the MC_ImmediateStop instruction.
ResetDrvErr	BOOL	FALSE	This is the error reset output device variable to the Servo Drive.

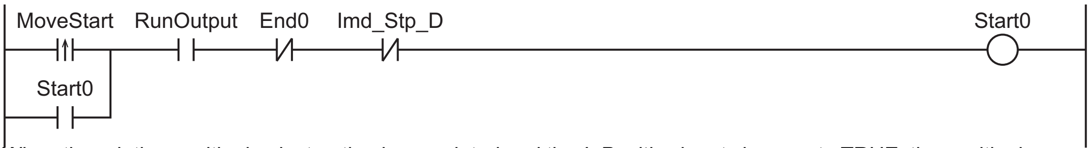
9-4-2 Ladder Programming

If the *StartPg* input is TRUE, the status of process data communications is checked to see if communications are active and normal.

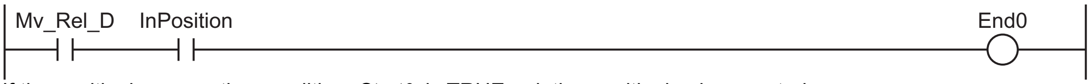
If process data communications are active and normal, the Servo for axis 0 is turned ON and the *RunOutput* output is turned ON.



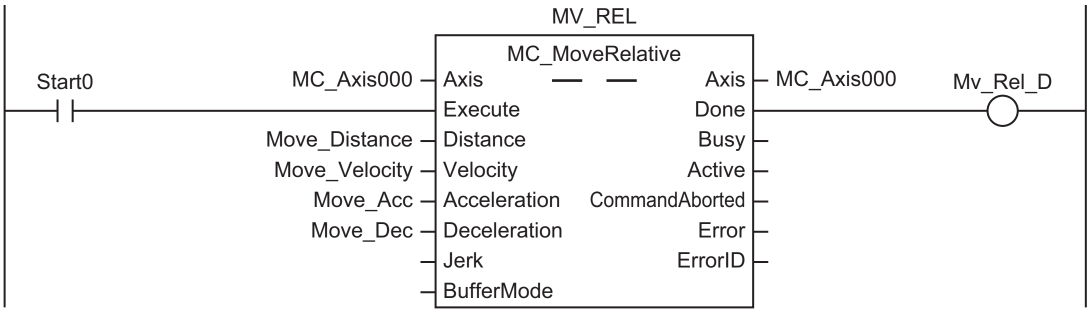
If the *MoveStart* input changes to TRUE, the positioning execution condition, *Start0*, changes to TRUE.



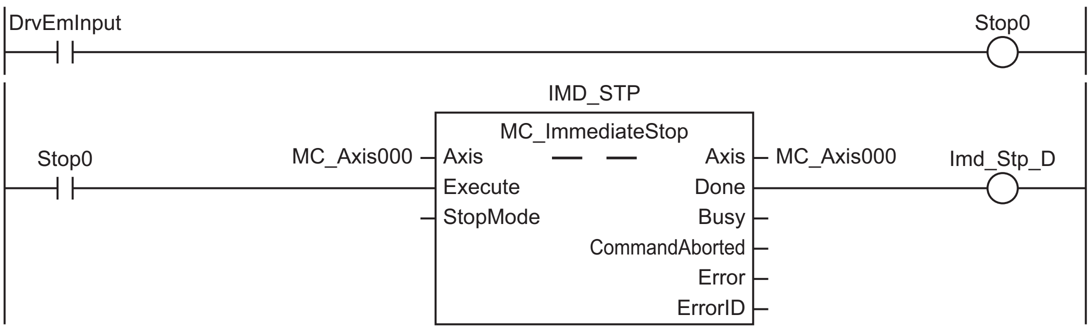
When the relative positioning instruction is completed and the *InPosition* input changes to TRUE, the positioning completion condition, *End0*,



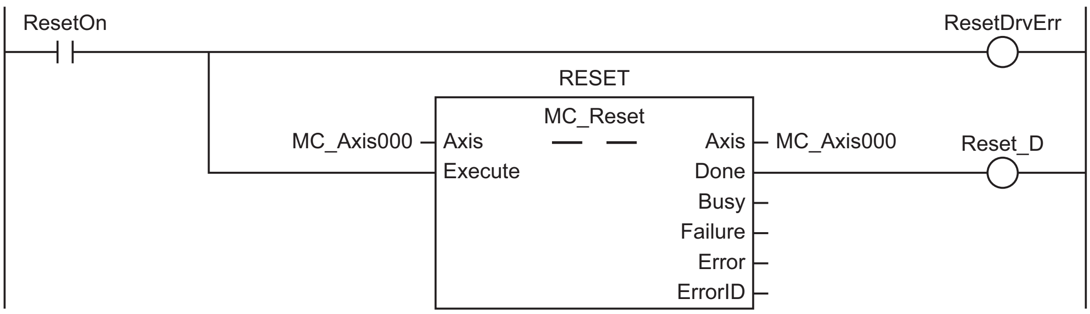
If the positioning execution condition, *Start0*, is TRUE, relative positioning is executed.



If the *DrvEmInput* input is TRUE, the Immediate Stop (MC_ImmediateStop) instruction is executed and positioning is stopped immediately.



If the *ResetOn* input is TRUE, the *ResetDrvErr* output changes to TRUE and the error in the MC Function Module is reset.



10

Troubleshooting

There are several different ways to check for errors in the Position Interface Units. When an error occurs, refer to this section for detailed information on errors and how to correct them.

10-1 Checking for Errors

Use one of the following error checking methods.

- Checking the indicators
- Troubleshooting with the Sysmac Studio

Refer to the user's manual for the connected Communications Coupler Unit for information on checking errors with the troubleshooting functions of the Sysmac Studio.

10-2 Checking for Errors with the Indicators

You can use the TS indicators on the NX Units to check the NX Unit status and errors.

This section describes the meanings of errors that the TS indicator shows and the troubleshooting procedures for them.

In this section, the status of the indicator is indicated with the following abbreviations.

Abbreviation	Indicator status
Lit	Lit.
Not Lit	Not lit.
FS ( )	Flashing. The numeric value in parentheses is the flashing interval.
---	Undefined

Main Errors and Corrections

TS Indicator		Cause	Correction
Green	Red		
Lit	Not Lit	---	Status is normal.
FS (2 s)	Not Lit	• Initializing • Restarting is in progress for the Unit. • Downloading	Status is normal. Wait until processing is completed.
FS (0.5 s)	Not Lit	A backup, restore, or compare operation is in progress from the Sysmac Studio or SD Memory Card.	Status is normal. Wait until processing is completed.
Lit	Lit	---	This status does not exist.
Not Lit	Not Lit	Power is currently not supplied from the Unit power supply.	Check the following items and make sure that power is correctly supplied from the Unit power supply. Checks Related to the Power Supply • Make sure that the power supply cable is wired properly. • Make sure that there are no breaks in the power supply cable. • Make sure that the power supply voltage is within the specified range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed. If you cannot resolve the problem after you check the above items and cycle the Slave Terminal power supply, the Unit may have a hardware failure. In that case, replace the Unit.
		• Waiting for initialization to start • Restarting is in progress for the Slave Terminal.	Status is normal. Wait until processing is completed.

TS Indicator		Cause	Correction
Green	Red		
Not Lit	Lit	Non-volatile Memory Hardware Error	Refer to *Non-volatile Memory Hardware Error* on page 10-11.
Not Lit	Lit	Control Parameter Error in Master	Refer to *Control Parameter Error in Master* on page 10-12.
Not Lit	Lit	NX Unit Clock Not Synchronized Error	Refer to *NX Unit Clock Not Synchronized Error* on page 10-20.
Not Lit	FS (1 s)	NX Unit I/O Communications Error	Refer to *NX Unit I/O Communications Error* on page 10-18.
Not Lit	FS (1 s)	NX Unit Output Synchronization Error	Refer to *NX Unit Output Synchronization Error* on page 10-19.
---	---	External Input Setting Error	Refer to *External Input Setting Error* on page 10-13.
---	---	SSI Data Setting Error	Refer to *SSI Data Setting Error* on page 10-14.
---	---	SSI Communications Error	Refer to *SSI Communications Error* on page 10-22.
---	---	Incorrect Synchronization Command	Refer to *Incorrect Synchronization Command* on page 10-15.
---	---	NX Message Communications Error	Refer to *NX Message Communications Error* on page 10-21.
---	---	Illegal Following Error	Refer to *Illegal Following Error* on page 10-16.
---	---	Illegal State Transition	Refer to *Illegal State Transition* on page 10-17.
---	---	Event Log Cleared	Refer to *Event Log Cleared* on page 10-23.

10-3 Checking for Errors and Trouble-shooting on the Sysmac Studio

Error management on the NX Series is based on the methods used for the NJ/NX-series Controllers.

This allows you to use the Sysmac Studio to check the meanings of errors and troubleshooting procedures.

10-3-1 Checking for Errors from the Sysmac Studio

When an error occurs, you can place the Sysmac Studio online to the Controller or the EtherCAT Coupler Unit to check current Controller errors and the log of past Controller errors.

Refer to the user's manual for the connected Communications Coupler Unit for information on checking errors.

Current Errors

Open the Sysmac Studio's Controller Error Tab Page to check the current error's level, source, source details, event name, event codes, details, attached information 1 to 4, and correction.
Errors in the observation level are not displayed.

Additional Information

Number of Current Errors

The following table gives the number of errors that are reported simultaneously as current errors in each Unit.

Unit	Number of simultaneous errors
Position Interface Unit	15

If the number of errors exceeds the maximum number of reportable current errors, errors are reported with a priority given to the oldest and highest-level errors. The errors that occur beyond this limit are not reported.

Errors that are not reported are still shown in the error status.

Log of Past Errors

You can check the following information on past errors on the Controller Event Log Tab Page in the Sysmac Studio: times, levels, sources, source details, event names, event codes, details, attached information 1 through 4, and corrections.

Additional Information

Number of Events in Log of Past Errors

The following table gives the number of events that each event log can record. The oldest events are overwritten if there are more than 15 events in the system event log or two events in the access event log.

Refer to the *NJ/NX-series Troubleshooting Manual* (Cat. No. W503) and the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on the items you can check and for how to check for errors.

Refer to *10-3-2 Event Codes for Errors and Troubleshooting Procedures* on page 10-6 for information on event codes.

10-3-2 Event Codes for Errors and Troubleshooting Procedures

This section describes the errors (events) that can occur and how to troubleshoot them.

Error Table

The errors (i.e., events) that can occur in the Position Interface Units are given on the following pages.

The following abbreviations are used in the *Level* column.

Abbr.	Name
Maj	Major fault level
Prt	Partial fault level
Min	Minor fault level
Obs	Observation level
Info	Information level

Symbol	Meaning
S	Event levels that are defined by the system.
U	Event levels that can be changed by the user.*1

*1. This symbol appears only for events for which the user can change the event level.

Refer to the *NJ/NX-series Troubleshooting Manual* (Cat. No. W503) for a list of all NJ/NX-series event codes.

Event code	Event name	Meaning	Assumed cause	Level					Refer-ence
				Maj	Prt	Min	Obs	Info	
0020 0000 hex	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	• Non-volatile memory failure			S			P. 10-11
1041 0000 hex	Control Parameter Error in Master	An error occurred in the control parameters that are saved in the master.	• There is an error in the area of the non-volatile memory in the Communications Coupler Unit in which the Unit operation settings for the NX Unit are saved. • The power supply to the NX Unit was turned OFF or Sysmac Studio communications were disconnected while writing the Unit operation settings was in progress.			S			P. 10-12

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
35100000 hex	External Input Setting Error	A setting for an external input is not correct.	• The same function (other than a general-purpose input) is assigned to more than one of the external inputs (I0 to I2).			S			P. 10-13
35110000 hex	SSI Data Setting Error	There is an error in the SSI data settings.	• The sum of the values set for the Valid Data Length and the Leading Bits parameters exceeds 32. • The sum of the values set for the Multi-turn Data Length, Single-turn Data Length, and the Status Data Length parameters exceeds 32. • The sum of the value set for the start bit position and the data length of the SSI data exceeds the value set for the Valid Data Length parameter. • The value set for the Encoder Resolution parameter exceeds the range expressed by the data length set for the Single-turn Data Length parameter.			S			P. 10-14
40200000 hex	NX Unit Processing Error	A fatal error occurred in an NX Unit.	• An error occurred in the software.			S			P. 10-15
743D0000 hex	Incorrect Synchronization Command	Updating the target position data in the synchronization refresh failed consecutively for more than the specified number of times.	• The communications cable connected to the Communications Coupler Unit is broken or the connection is faulty. • Noise			S	U		P. 10-15

Event code	Event name	Meaning	Assumed cause	Level					Refer-ence
				Maj	Prt	Min	Obs	Info	
743E0000 hex	Illegal Following Error	The difference between the command position and actual position exceeds the range expressed by 29 bits.	• A command that exceeded the maximum velocity (500 kpps) was output continuously, so the following error for the actual output, which is restricted by the maximum velocity, has increased. • A command velocity that does not correspond to the command position was specified when a velocity-continuous pulse output was used, so the number of pulses that were actually output for the updated command position has increased.			S			P. 10-16
743F0000 hex	Illegal State Transition	The EtherCAT master or EtherCAT Coupler Unit executed a command to change the communications status when the Pulse Output Unit is in the Operation Enabled status.	• A communications command to change the current communications status was received from the communications master while the Unit is in the Operation Enabled status.			S			P. 10-17
80200000 hex	NX Unit I/O Communications Error	A communications error occurred between the Communications Coupler Unit and the NX Unit.	• The NX Unit is not mounted properly. • The power cable for the Unit power supply is disconnected. Or, the wiring from the Unit power supply to the NX Units is incorrect. • The power cable for the Unit power supply is broken. • The voltage of the Unit power supply is outside the specified range. Or, the capacity of the Unit power supply is insufficient. • There is a hardware error in the NX Unit.			S			P. 10-18
80210000 hex	NX Unit Output Synchronization Error	An output synchronization error occurred in the NX Unit.	• The communications cable connected to the Communications Coupler Unit is broken or the connection is faulty. • Noise			S			P. 10-19

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
8024 0000 hex	NX Unit Clock Not Synchronized Error	An error occurred in the clock information between the EtherCAT Coupler Unit and the NX Unit.	• There is a hardware error in the NX Unit. • There is a hardware error in the EtherCAT Coupler Unit.			S			P. 10-20
8022 0000 hex	NX Message Communications Error	An error was detected in message communications and the message frame was discarded.	• The message communications load is high. • The communications cable is disconnected or broken. • Message communications were cut off as the result of executing a synchronization or restoration operation on the Sysmac Studio or as the result of disconnecting an EtherCAT slave.				S		P. 10-21
84D0 0000 hex	SSI Communications Error	An error occurred in SSI communications.	• The SSI data settings do not agree with the SSI communications settings in the connected device. • The wiring between the NX Unit and the connected device is not correct or disconnected. • Noise			U	S		P. 10-22
9040 0000 hex	Event Log Cleared	The event log was cleared.	• The event log was cleared by the user.					S	P. 10-23

Error Descriptions

This section describes the information that is given for individual errors.

● Controller Error Descriptions

The items that are used to describe individual errors (events) are described in the following copy of an error table.

<table>
<tr><td>Event name</td><td colspan="3">Gives the name of the error.</td><td>Event code</td><td colspan="2">Gives the code of the error.</td></tr>
<tr><td>Meaning</td><td colspan="6">Gives a short description of the error.</td></tr>
<tr><td>Source</td><td colspan="2">Gives the source of the error.</td><td>Source details</td><td>Gives details on the source of the error.</td><td>Detection timing</td><td>Tells when the error is detected.</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Tells the level of influence on control. *1</td><td>Recovery</td><td>Gives the recovery method. *2</td><td>Log category</td><td>Tells which log the error is saved in. *3</td></tr>
<tr><td>Effects</td><td>User program</td><td>Tells what will happen to execution of the user program. *4</td><td>Operation</td><td colspan="3">Provides special information on the operation that results from the error.</td></tr>
<tr><td>Indicators</td><td colspan="6">Gives the status of the built-in EtherNet/IP port and built-in EtherCAT port indicators. Indicator status is given only for errors in the EtherCAT Master Function Module and the EtherNet/IP Function Module.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="6">Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">Lists the possible causes, corrections, and preventive measures for the error.</td></tr>
<tr><td>Attached information</td><td colspan="6">This is the attached information that is displayed by the Sysmac Studio or an HMI.*5, *6</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">Provides precautions, restrictions, and supplemental information. If the user can set the event level, the event levels that can be set, the recovery method, operational information, and other information are also provided.</td></tr>
</table>

*1. One of the following:
Major fault: Major fault level
Partial fault: Partial fault level
Minor fault: Minor fault level
Observation
Information

*2. One of the following
Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
Error reset: Normal status is restored when the error is reset after the cause of the error is removed.
Cycle the power supply: Normal status is restored when the power supply to the Controller is turned OFF and then back ON after the cause of the error is removed.
Controller reset: Normal status is restored when the Controller is reset after the cause of the error is removed.
Depends on cause: The recovery method depends on the cause of the error.

*3. One of the following
System: System event log
Access: Access event log

*4. One of the following
Continues: Execution of the user program will continue.
Stops: Execution of the user program stops.
Starts: Execution of the user program starts.

*5. “System information” indicates internal system information that is used by OMRON.

*6. Refer to the appendices of the *NJ/NX-series Troubleshooting Manual* (Cat. No. W503) for the applicable range of the HMI Troubleshooter.

● Error Descriptions

Event name	Non-volatile Memory Hardware Error			**Event code**	00200000 hex	
Meaning	An error occurred in non-volatile memory.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		**Source details**	NX Unit	**Detection timing**	When power is turned ON to the NX Unit
Error attributes	**Level**	Minor fault	**Recovery**	Restart the Slave Terminal and then reset all errors in Controller.	**Log category**	System
Effects	**User program**	Continues.	**Operation**	Writing to non-volatile memory will not be possible.		
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	Non-volatile memory failure		Replace the NX Unit.		None	
Attached information	None					
Precautions/ Remarks	None					

<table>
<tr><th>Event name</th><td colspan="3">Control Parameter Error in Master</td><th>Event code</th><td colspan="2">10410000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">An error occurred in the control parameters that are saved in the master.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>When power is turned ON to the NX Unit</td></tr>
<tr><th>Error attributes</th><th>Level</th><td>Minor fault</td><th>Recovery</td><td>When the fail-soft operation for the Communications Coupler Unit is set to stop, restart the NX Unit and then reset all errors in Controller.
When the fail-soft operation for the Communications Coupler Unit is set to fail-soft, restart the NX Unit and then reset errors in Communications Coupler Unit.</td><th>Log category</th><td>System</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">I/O refreshing for the NX Unit stops.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="3">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">There is an error in the area of the non-volatile memory in the Communications Coupler Unit in which the Unit operation settings for the NX Unit are saved.</td><td colspan="2" rowspan="2">Download the Unit operation settings of the NX Unit again and restart the Communications Coupler Unit.
If the error occurs again even after you make the above correction, replace the Communications Coupler Unit.</td><td colspan="2" rowspan="2">Do not turn OFF the power supply to the NX Unit or disconnect Sysmac Studio communications while transfer of the Unit operation settings for the NX Unit or execution of the NX_SaveParam instruction is in progress.</td></tr>
<tr><td colspan="2">The power supply to the NX Unit was turned OFF or Sysmac Studio communications were disconnected while writing the Unit operation settings was in progress.</td></tr>
<tr><th>Attached information</th><td colspan="6">None</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">External Input Setting Error</td><td>Event code</td><td colspan="2">35100000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">A setting for an external input is not correct.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>When power is turned ON to the NX Unit</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>Restart the NX Unit.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">External inputs are disabled.
The following bit changes to FALSE: Ch□ External Input Enabled bit in the Reset/External Input Status.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The same function (other than a general-purpose input) is assigned to more than one of the external inputs (I0 to I2).</td><td colspan="2">Except for general-purpose inputs, do not assign the same function to more than one external input.</td><td colspan="2">Except for general-purpose inputs, do not assign the same function to more than one external input.</td></tr>
<tr><td>Attached information</td><td colspan="6">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">SSI Data Setting Error</td><td>Event code</td><td colspan="2">3511 0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">There is an error in the SSI data settings.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>When power is turned ON to the NX Unit</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>Restart the NX Unit.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The present value data changes to 0.
The following bit changes to FALSE: Ch☐ SSI Communications Enabled bit in the SSI Status.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="5">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The sum of the values set for the Valid Data Length and the Leading Bits parameters exceeds 32.</td><td colspan="2" rowspan="3">Check that there are no mistakes in the SSI data settings and correct any that are found.</td><td colspan="2" rowspan="3">Set the SSI data correctly.</td></tr>
<tr><td colspan="2">The sum of the values set for the Multi-turn Data Length, Single-turn Data Length, and the Status Data Length parameters exceeds 32.</td></tr>
<tr><td colspan="2">The sum of the value set for the start bit position and the data length of the SSI data exceeds the value set for the Valid Data Length parameter.</td></tr>
<tr><td colspan="2">The value set for the Encoder Resolution parameter exceeds the range expressed by the data length set for the Single-turn Data Length parameter.</td><td colspan="2">Check that there are no mistakes in the resolution settings and correct any that are found.</td><td colspan="2">Set the resolution correctly.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: Error channel
1: Channel 1
2: Channel 2</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

Event name	NX Unit Processing Error			**Event code**	40200000 hex	
Meaning	A fatal error occurred in an NX Unit.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		**Source details**	NX Unit	**Detection timing**	Continuously
Error attributes	**Level**	Minor fault	**Recovery**	Cycle the power supply to the NX Unit.	**Log category**	System
Effects	**User program**	Continues.	**Operation**	I/O refreshing for the NX Unit stops. Messages cannot be sent to the NX Unit.		
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	An error occurred in the software.		Contact your OMRON representative.		None	
Attached information	Attached information 1: System information Attached information 2: System information Attached information 3: System information Attached information 4: System information					
Precautions/ Remarks	None					

Event name	Incorrect Synchronization Command			**Event code**	743D0000 hex	
Meaning	Updating the target position data in the synchronization refresh failed consecutively for more than the specified number of times.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		**Source details**	NX Unit	**Detection timing**	Continuously
Error attributes	**Level**	Minor fault	**Recovery**	Reset error in the NX Unit.	**Log category**	System
Effects	**User program**	Continues.	**Operation**	The NX Unit will continue to operate. Output data: The pulse output value depends on the Load Rejection Output Setting.		
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	The communications cable connected to the Communications Coupler Unit is broken or the connection is faulty.		Replace the communications cable or wire the cable correctly.		Wire the communications cable correctly.	
	Noise		Set the Number of Synchronization Command Interpolations parameter to a suitable value that will not cause problems in operation. Implement noise countermeasures if there is excessive noise.		Implement noise countermeasures if there is excessive noise.	
Attached information	None					
Precautions/ Remarks	You can change the event level to the observation level.					

<table>
<tr><td>Event name</td><td colspan="3">Illegal Following Error</td><td>Event code</td><td colspan="2">743E0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">The difference between the command position and actual position exceeds the range expressed by 29 bits.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>Reset error in the NX Unit.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Output data: The pulse output value depends on the Load Rejection Output Setting.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="3">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">A command that exceeded the maximum velocity (500 kpps) was output continuously, so the following error for the actual output, which is restricted by the maximum velocity, has increased.</td><td colspan="2">Correct the program or correct the electronic gear ratio in the Motion Control Function Module so that the maximum velocity (500 kpps) is not exceeded.</td><td colspan="2">Set the program or correct the electronic gear ratio in the Motion Control Function Module so that the maximum velocity (500 kpps) is not exceeded.</td></tr>
<tr><td colspan="2">A command velocity that does not correspond to the command position was specified when a velocity-continuous pulse output was used, so the number of pulses that were actually output for the updated command position has increased.
If the Motion Control Function Module is used, this cause does not occur because the command velocity is calculated automatically.</td><td colspan="2">Correct the program so that the command velocity corresponds to a command position.</td><td colspan="2">Write the program so that the command velocity corresponds to a command position. Or, use the Motion Control Function Module.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: Error channel
1: Channel 1
2: Channel 2</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">Illegal State Transition</td><td>Event code</td><td colspan="2">743F0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">The EtherCAT master or EtherCAT Coupler Unit executed a command to change the communications status when the Pulse Output Unit is in the Operation Enabled status.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>Reset error in the NX Unit.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: The operation depends on the new communications status.
Output data: The external outputs are turned OFF. The pulse output value depends on the Load Rejection Output Setting.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">A communications command to change the current communications status was received from the communications master while the Unit is in the Operation Enabled status.</td><td colspan="2">Correct the program so that there are no incorrect changes in the communications status. Or, add interlocked rungs to the program to leave the Operation Enabled state before you change the communications status.</td><td colspan="2">Write the program so that there are no incorrect changes in the communications status. Or, create interlocked rungs in the program to leave the Operation Enabled state before you change the communications status.</td></tr>
<tr><td>Attached information</td><td colspan="6">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">NX Unit I/O Communications Error</td><td>Event code</td><td colspan="2">80200000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">A communications error occurred between the Communications Coupler Unit and the NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>When the fail-soft operation for the Communications Coupler Unit is set to stop, reset all errors in Controller.
When the fail-soft operation for the Communications Coupler Unit is set to fail-soft, reset errors in Communications Coupler Unit and NX Unit.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.
Output data: The external outputs are turned OFF. The pulse output value depends on the Load Rejection Output Setting.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="6">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The NX Unit is not mounted properly.</td><td colspan="2">Mount the NX Units and End Cover securely and secure them with End Plates.</td><td colspan="2">Mount the NX Units and End Cover securely and secure them with End Plates.</td></tr>
<tr><td colspan="2">The power cable for the Unit power supply is disconnected. Or, the wiring from the Unit power supply to the NX Units is incorrect.</td><td colspan="2">Correctly wire the Unit power supply to the NX Units.</td><td colspan="2">Correctly wire the Unit power supply to the NX Units.</td></tr>
<tr><td colspan="2">The power cable for the Unit power supply is broken.</td><td colspan="2">Replace the power cable between the Unit power supply and the NX Units.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">The voltage of the Unit power supply is outside the specified range. Or, the capacity of the Unit power supply is insufficient.</td><td colspan="2">Correctly configure the power supply system according to the power supply design methods.</td><td colspan="2">Correctly configure the power supply system according to the power supply design methods.</td></tr>
<tr><td colspan="2">There is a hardware error in the NX Unit.</td><td colspan="2">If the error occurs again even after you make the above correction, replace the NX Unit.</td><td colspan="2">None</td></tr>
<tr><td>Attached information</td><td colspan="6">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">NX Unit Output Synchronization Error</td><td>Event code</td><td colspan="2">80210000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An output synchronization error occurred in the NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Minor fault</td><td>Recovery</td><td>Reset all errors in Controller.</td><td>Log category</td><td>System</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.
Output data: The external outputs are turned OFF. The pulse output value depends on the Load Rejection Output Setting.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="3">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The communications cable connected to the Communications Coupler Unit is broken or the connection is faulty.</td><td colspan="2">Replace the communications cable or wire the cable correctly.</td><td colspan="2">Wire the communications cable correctly.</td></tr>
<tr><td colspan="2">Noise</td><td colspan="2">Set the Consecutive Communications Error Detection Count parameter for the Communications Coupler Unit to a suitable value that will not cause problems in operation.
Implement noise countermeasures if there is excessive noise.</td><td colspan="2">Implement noise countermeasures if there is excessive noise.</td></tr>
<tr><td>Attached information</td><td colspan="6">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><th>Event name</th><td colspan="3">NX Unit Clock Not Synchronized Error</td><th>Event code</th><td colspan="2">80240000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">An error occurred in the clock information between the EtherCAT Coupler Unit and the NX Unit.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>Continuously</td></tr>
<tr><th>Error attributes</th><th>Level</th><td>Minor fault</td><th>Recovery</th><td>Restart the NX Unit.</td><th>Log category</th><td>System</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.
Output data: The external outputs are turned OFF. The pulse output value depends on the Load Rejection Output Setting.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="3">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">There is a hardware error in the NX Unit.</td><td colspan="2" rowspan="2">If the error occurred in only a specific NX Unit in the Slave Terminal, replace the NX Unit.
If the error occurred in all of the NX Units on the Slave Terminal except for the System Units, replace the EtherCAT Coupler Unit.</td><td colspan="2" rowspan="2">None</td></tr>
<tr><td colspan="2">There is a hardware error in the EtherCAT Coupler Unit.</td></tr>
<tr><th>Attached information</th><td colspan="6">None</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">None</td></tr>
</table>

Event name	NX Message Communications Error			**Event code**	80220000 hex	
Meaning	An error was detected in message communications and the message frame was discarded.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		**Source details**	NX Unit	**Detection timing**	During NX message communications
Error attributes	**Level**	Observation	**Recovery**	---	**Log category**	System
Effects	**User program**	Continues.	**Operation**	Not affected.		
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	The message communications load is high.		Reduce the number of times that instructions are used to send NX messages. Refer to the appendix of the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the instructions that send messages.		Reduce the number of times that instructions are used to send NX messages.	
	The communications cable is disconnected or broken. This cause does not apply if attached information 2 is 0 (NX bus).		Connect the communications cable securely.		Connect the communications cable securely.	
	Message communications were cut off as the result of executing a synchronization or restoration operation on the Sysmac Studio or as the result of disconnecting an EtherCAT slave.		---		---	
Attached information	Attached information 1: System information Attached information 2: Type of communications where error occurred 0: NX bus 1: EtherCAT 2: Serial communications (USB) 3: EtherNet/IP 65535: Internal Unit communications (routing)					
Precautions/ Remarks	None					

<table>
<tr><th>Event name</th><td colspan="3">SSI Communications Error</td><th>Event code</th><td colspan="2">84D00000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">An error occurred in SSI communications.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>Continuously</td></tr>
<tr><th>Error attributes</th><th>Level</th><td>Observation</td><th>Recovery</th><td>Restart the NX Unit.</td><th>Log category</th><td>System</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">The previous value is retained as the present value data and the data is not updated.
The following bit changes to TRUE: Ch☐ SSI Communications Error Status bit in the SSI Status.
This bit returns to FALSE the next time normal SSI communications are performed.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="4">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">The SSI data settings do not agree with the SSI communications settings in the connected device.</td><td colspan="2">Make the settings so that the SSI data settings and the SSI communications settings agree.</td><td colspan="2">Make the settings so that the SSI data settings and the SSI communications settings agree.</td></tr>
<tr><td colspan="2">The wiring between the NX Unit and the connected device is not correct or disconnected.</td><td colspan="2">Check the wiring between the NX Unit and the connected device and correct any problems that are found.</td><td colspan="2">Make sure that the wiring between the NX Unit and the connected device is correct.</td></tr>
<tr><td colspan="2">Noise</td><td colspan="2">Implement noise countermeasures if there is excessive noise.</td><td colspan="2">Implement noise countermeasures if there is excessive noise.</td></tr>
<tr><th>Attached information</th><td colspan="6">Attached information 1: Error channel
1: Channel 1
2: Channel 2
Attached information 2: Error details
1: Preparations for communications are not completed.
2: Frame error
3: Parity error
4: Communications timeout
5: Out of range for position difference</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">You can change the event level to the minor fault level. If you change the level to the minor fault level, the Recovery column above will be changed to “Reset error in the NX Unit.”</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">Event Log Cleared</td><td>Event code</td><td colspan="2">9040 0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">The event log was cleared.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Sysmac Studio is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td>When commanded from user</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Information</td><td>Recovery</td><td>---</td><td>Log category</td><td>Access</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Not affected.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The event log was cleared by the user.</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information: Events that were cleared
1: The system event log was cleared.
2: The access event log was cleared.</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

10-4 Resetting Errors

Refer to the user’s manual for the connected Communications Coupler Unit for information on resetting errors.

10-5 Unit-specific Troubleshooting

This section describes errors and corrections for individual Units.

10-5-1 Incremental Encoder Input Units

The following table shows the errors and corrections for Incremental Encoder Input Units.

Error	Cause	Possible correction
No count pulses are detected.	The input wiring is not correct.	Check the wiring to the connected device.
	I/O power is not being supplied.	Check to see if the I/O power is supplied.
	The I/O power supply voltage is outside of the rated voltage range.	Set the I/O power supply voltage so that it is within the rated voltage range.
	The setting of the Pulse Input Method Setting is not correct.	Check the wiring to the connected device.
	The Counter Enable bit in the Encoder Counter Operation Command parameter is set to 0 (counter disabled).	Set the Counter Enable bit in the Encoder Counter Operation Command parameter to 1 (counter enabled).
	The gate control for the external input is set to close the gate.	Change the gate control signal for the external input to open the gate.
	The wiring to the connected device is disconnected.	Check the wiring to the connected device.
	There is a problem with the connected device.	Replace the connected device.
Pulses are not counted correctly.	The input pulse frequency exceeds the maximum frequency in the Unit specifications.	Set the input pulse frequency to within the allowed range in the Unit specifications or within the maximum value for the mode.
The counter value is not reset even when an external input or phase-Z reset input is received.	The input wiring is not correct.	Check the wiring of the input.
	The External Reset Enable bit in the Encoder Counter Operation Command parameter is set to 0 (disabled).	Set the External Reset Enable bit in the Encoder Counter Operation Command parameter to 1 (enabled).
	The Phase Z Reset Enable bit in the Encoder Counter Operation Command parameter is set to 0 (disabled).	Set the Phase Z Reset Enable bit in the Encoder Counter Operation Command parameter to 1 (enabled).
	The external input function is not set to resetting.	Set the external input function to resetting.
	Two or more functions other than a general input were selected for the external input function selections.	Set only one of the external inputs to a function other than a general input.
	The external input logic is not correct.	Check to see if the external input logic is correct.

Error	Cause	Possible correction
The External Reset Enable bit in the Encoder Counter Operation Command parameter is set to 1 (enabled), but the counter value does not reset even when the signal is input.	After the counter value is externally reset, the External Reset Completed Flag changes to 1 and another external reset cannot be performed until this flag is cleared.	Change the External Reset Completed Flag Clear bit of the Encoder Counter Operation Command parameter to 1. When the bit changes to 1, the External Reset Completed Flag changes to 0 and an external reset can again be performed.
	The external input function is not set to resetting.	Set the external input function to resetting.
	Two or more functions other than a general input were selected for the external input function selections.	Set only one of the external inputs to a function other than a general input.
	The external input logic is not correct.	Check to see if the external input logic is correct.
The counter value cannot be latched even when a latch input signal is received.	The Latch Input 1 Enable or Latch Input 2 Enable parameter is set to 0 (disabled).	Set the Latch1 Enable or Latch2 Enable parameter to 1 (enabled).
	No external input function has been selected.	Set the external input function selection to *Latch Input 1* or *Latch Input 2*.
	Two or more functions other than a general input were selected for the external input function selections.	Set only one of the external inputs to a function other than a general input.
	The external input logic is not correct.	Check the external input logic.
The Latch Input 1 Enable or Latch Input 2 Enable bit is set to 1, but the counter value will not latch even when the signal is input.	After the counter value is latched, Latch Input 1 Completed Flag or Latch Input 2 Completed Flag changes to 1. Until this flag is cleared, you cannot perform another latch.	Change Latch Input 1 Enable or Latch Input 2 Enable bit to 0. When one of these bits changes to 0, the Latch Input 1 Completed Flag or Latch Input 2 Completed Flag will also change to 0 and the system is again ready for latching.
	No external input function has been selected.	Set the external input function selection to *Latch Input 1* or *Latch Input 2*.
	Two or more functions other than a general input were selected for the external input function selections.	Set only one of the external inputs to a function other than a general input.
	The external input logic is not correct.	Check the direction setting of the external input contacts.
When preset execution is performed, the Preset Completed bit does not turn ON and the Actual Value Preset Set Value Error bit turns ON.	An attempt was made to preset a count value that was greater than the allowed ring or linear counter range.	Set the Preset Command Value parameter to a value that is within the range from the minimum counter value to the maximum counter value, and execute the preset again. Or, the Preset Command Value Invalid Flag bit will also turn OFF when you perform an internal reset of the actual value or when an external reset occurs

10-5-2 SSI Input Units

The following table shows the errors and corrections for the SSI Input Units.

Error	Cause	Possible correction
The actual value data is not refreshed.	The input wiring is not correct.	Check the wiring to the connected device.
	I/O power is not being supplied.	Check to see if the I/O power is supplied.
	The I/O power supply voltage is outside of the rated voltage range.	Set the I/O power supply voltage so that it is within the rated voltage range.
	The wiring to the connected device is disconnected.	Check the wiring to the connected device.
	There is a problem with the connected device.	Replace the connected device.
	The SSI data settings are not correct.	Check the SSI data settings.
	The setting of the Wait Time for Receive Enabled parameter does not match the connected device.	Check the specifications of the connected device and set the correct waiting time.
	The setting of the Monoflop Time parameter does not match the connected device.	Check the specifications of the connected device and set the correct monoflop time.
	The parity check setting does not match the connected device.	Check the specifications of the connected device and make the correct parity check setting.
	The SSI Communications Enabled bit in the SSI Operation Command parameter is set to 0 (SSI communications disabled).	Set the SSI Communications Enabled bit in the SSI Operation Command parameter to 1 (SSI communications enabled).
The actual value data is not correctly refreshed.	The setting of the Baud Rate parameter does not match the connected device.	Check the specifications of the connected device and set the correct baud rate.
	The SSI data settings do not match the connected device.	Check the specifications of the connected device and set the correct valid data length, start bit position, data length, and resolution.
	The setting of the Encoder Count Direction parameter is not correct.	Set the correct encoder count direction to match the application specifications.
	The setting of the Coding Method does not match the SSI data specifications of the connected device.	Check the data specifications of the connected device and set the correct coding method.

10-5-3 Pulse Output Unit

The following table shows the errors and corrections for the Pulse Output Unit.

Error	Cause	Possible correction
There is no pulse output.	The output wiring is not correct.	Check the wiring to the connected device.
	I/O power is not being supplied.	Check to see if the I/O power is supplied.
	The I/O power supply voltage is outside of the rated voltage range.	Set the I/O power supply voltage so that it is within the rated voltage range.
	The wiring to the connected device is disconnected.	Check the wiring to the connected device.
	There is a problem with the connected device.	Replace the connected device.
	The Statusword does not indicate that the Servo is ON.	Set the Controlword parameter and set the status to Servo ON.
Pulses are not output correctly.	The setting of Pulse Output Method does not match the connected device.	Check the specifications of the connected device and set the correct pulse output method.
	The Statusword status has changed from the Servo ON to the Load Rejection Output state.	Set the Controlword parameter and set the status to Servo ON.
	The output mode is not correct.	Review the Output Mode Selection and set the correct output mode.
There is no external output.	The output wiring is not correct.	Check the wiring to the connected device.
	The wiring to the connected device is disconnected.	Check the wiring to the connected device.
	The external output function selection is not correct.	Review the setting for External Output 0 Function Selection parameter.
	The external output logic is not correct.	Review the setting for External Output 0 Logic Selection parameter.
Even when a signal is input to an external input, it is not shown in the external input status.	The input wiring is not correct.	Check the wiring to the connected device.
	The wiring to the connected device is disconnected.	Check the wiring to the connected device.
	The external input logic is not correct.	Check the direction of the external input contacts.
The counter value cannot be latched even when a latch input signal is received.	The Latch Input 1 Enable or Latch Input 2 Enable parameter is set to 0 (disabled).	Set the Latch1 Enable or Latch2 Enable parameter to 1 (enabled).
	No external input function has been selected.	Set the external input function selection to *Latch Input 1* or *Latch Input 2*.
	The external input logic is not correct.	Review the setting for External Input Logic Selection parameter.

Error	Cause	Possible correction
Latch Input 1 Enable or Latch Input 2 Enable bit is set to 1, but the counter value will not latch even when the signal is input.	After the counter value is latched, Latch Input 1 Completed Flag or Latch Input 2 Completed Flag changes to 1. Until this flag is cleared, you cannot perform another latch.	Change Latch Input 1 Enable or Latch Input 2 Enable bit to 0. When one of these bits changes to 0, the Latch Input 1 Completed Flag or Latch Input 2 Completed Flag will also change to 0 and the system is again ready for latching.
	No external input function has been selected.	Set the external input function selection to *Latch Input 1* or *Latch Input 2*.
	The external input logic is not correct.	Review the setting for External Input Logic Selection parameter.

10-6 Troubleshooting Flow

Refer to the user's manual for the connected Communications Coupler Unit for the standard flow for troubleshooting.

11

Maintenance and Inspection

This section describes the procedures for cleaning, inspecting, and replacing Position Interface Units.

11-1 Cleaning and Maintenance

This section describes daily maintenance and the cleaning and inspection methods.

Inspect the Position Interface Units daily or periodically in order to keep it in optimal operating condition.

11-1-1 Cleaning

Clean the Position Interface Units regularly as described below in order to keep it in optimal operating condition.

- Wipe the Units over with a soft, dry cloth when doing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe over with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- A smudge may remain on the Unit from gum, vinyl, or tape that was left on for a long time. Remove the smudge when cleaning.

Precautions for Correct Use

- Never use volatile solvents, such as paint thinner, benzene, or chemical wipes.
- Do not touch the NX bus connector.

11-1-2 Periodic Inspections

Although the major components in Position Interface Units have an extremely long life time, they can deteriorate under improper environmental conditions. Periodic inspections are thus required

Inspection is recommended at least once every six months to a year, but more frequent inspections will be necessary in adverse environments

Take immediate steps to correct the situation if any of the conditions in the following table are not met.

Periodic Inspection Items

No.	Item	Inspection	Criteria	Action
1	Power supplies	Measure the power supply voltage at the terminal blocks, and make sure that the voltage fluctuation is within the criteria voltage.	The voltage must be within the power supply voltage range.	Use a voltage tester to check the power supply at the terminals. Take necessary steps to bring voltage of the supplied power to within the allowable voltage fluctuation range.
2	I/O power supplies	Measure the power supply voltages at the input and output terminal blocks, and make sure that the voltage fluctuation is within the criteria voltage.	The voltages must be within the I/O specifications for each NX Unit.	Use a voltage tester to check the power supply at the terminals. Take necessary steps to bring voltage of the I/O power supplies to within the I/O specifications of each Unit.

No.	Item	Inspection	Criteria	Action
3	Ambient environment	Check that the ambient operating temperature is within the criteria.	0 to 55°C	Use a thermometer to check the temperature and ensure that the ambient temperature remains within the allowed range of 0 to 55°C.
		Check that the ambient operating humidity is within the criteria.	10 to 95% With no condensation.	Use a hygrometer to check the humidity and ensure that the ambient humidity remains between 10% and 95%. Make sure that condensation does not occur due to rapid changes in temperature.
		Check that the Controller is not in direct sunlight.	Not in direct sunlight	Protect the Position Interface Unit if necessary.
		Check for accumulation of dirt, dust, salt, or metal powder.	No accumulation	Clean and protect the Position Interface Unit if necessary.
		Check for water, oil, or chemical sprays hitting the Position Interface Unit.	No spray	Clean and protect the Position Interface Unit if necessary.
		Check for corrosive or flammable gases in the area of the Position Interface Unit.	No corrosive or flammable gases	Check by smell or use a gas sensor.
		Check that the Position Interface Unit is not subject to direct vibration or shock.	Vibration and shock must be within specifications.	Install cushioning or shock absorbing equipment if necessary.
		Check for noise sources nearby the Position Interface Unit.	No significant noise sources	Either separate the Position Interface Unit and noise source or protect the Position Interface Unit.
4	Installation and wiring	Check that the DIN Track mounting hooks on all Units are mounted securely and locked.	No looseness	Securely lock all DIN Track mounting hooks.
		Check that cable connectors are fully inserted and locked.	No looseness	Properly insert and lock all cables securely
		Check for loose screws in external wiring.	No looseness	Tighten loose screws with a Phillips-head screwdriver.
		Check that crimp terminals are adequately spaced in external wiring.	Adequate spacing	Check visually and adjust if necessary.
		Check for damaged external wiring cables.	No visible damage	Check visually and replace cables if necessary.

Tools Required for Inspections

● Required Tools

- Phillips screwdriver
- Flat-blade screwdriver
- Voltage tester or digital voltmeter
- Industrial alcohol and clean cotton cloth

● Tools Required Occasionally

- Oscilloscope
- Thermometer and hygrometer

11-2 Maintenance Procedures

To replace a Position Interface Unit, follow the procedure in the user's manual for the connected Communications Coupler Unit.

A

Appendices

A

The appendices provides the specifications, device object lists, and dimensional diagrams for all Units.

A-1 Datasheets

This section provides the specifications of the Units.

A-1-1 Models

Incremental Encoder Input Units

Model	Number of channels*1	External inputs	Maximum response frequency	I/O refreshing method	Number of I/O entry mappings	Remarks	Page
NX-EC0112	1 (NPN)	3 (NPN)	500 kHz	• Free-Run refreshing • Synchronous I/O refreshing • Task period prioritized refreshing	Inputs: 1, Outputs: 1	24-V voltage input	P. A-5
NX-EC0122	1 (PNP)	3 (PNP)					P. A-7
NX-EC0132	1	3 (NPN)	4 MHz			Line receiver input	P. A-9
NX-EC0142		3 (PNP)					P. A-11
NX-EC0212	2 (NPN)	None	500 kHz		Inputs: 2, Outputs: 2	24-V voltage input	P. A-13
NX-EC0222	2 (PNP)						P. A-15

*1. This is the number of encoder input channels.

SSI Input Units

Model	Number of channels*1	External inputs	Maximum baud rate	I/O refreshing method	Number of I/O entry mappings	Page
NX-ECS112	1	None	2 MHz	• Free-Run refreshing • Synchronous I/O refreshing • Task period prioritized refreshing	Inputs: 1, Outputs: 0	P. A-18
NX-ECS212	2				Inputs: 2, Outputs: 0	P. A-20

*1. This is the number of SSI communications input channels.

Pulse Output Units

Model	Number of channels*1	External inputs	External outputs	Maximum pulse output speed	I/O refreshing method	Number of I/O entry mappings	Remarks	Page
NX-PG0112	1 (NPN)	2 (NPN)	1 (NPN)	500 kpps	• Synchronous I/O refreshing • Task period prioritized refreshing	Inputs: 1, Outputs: 1	Open collector output	P. A-24
NX-PG0122	1 (PNP)	2 (PNP)	1 (PNP)					P. A-26

*1. This is the number of pulse output channels.

A-1-2 Incremental Encoder Input Units

Interpreting Datasheets

The following table describes how to interpret the datasheets for Incremental Encoder Input Units.

Unit name	The name of the Unit.	**Model**	The model of the Unit.
Number of channels	The encoder input capacity of the Unit.	**Type of external connections**	The type of wiring for the Unit, i.e., terminal block or connector. For a screwless clamping terminal block, the number of terminals on the terminal block is also given.
I/O refreshing method	The I/O refreshing method of the Unit. The following refreshing methods are supported: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.		
Indicators	The indicators on the Units and their layout.	**Input signals**	The input signals.
Input form	The form of encoder input.		
Counting unit	The unit of counting		
Pulse input method	The usable pulse input method.		
Counter range	The usable counting range. You can also set minimum and maximum values.		
Counter functions	The usable counter functions.		
Voltage input specifications: These are the encoder input specifications for models with voltage inputs.			
Input voltage	The rated input voltage and voltage range.	**ON voltage**	The input voltage at which the input turns ON and the input current at that time.
Input current	The input current at the rated voltage.	**OFF voltage**	The input voltage at which the input turns OFF and the input current at that time.
Maximum response frequency	The maximum frequency of the encoder input.		
Internal I/O common processing	The polarity of the connected input device. There are models with NPN and PNP connections.		
Line driver specifications: These are the encoder input specifications for models with a line receiver input.			
Input voltage	The rated input voltage and voltage range.	**High level input voltage**	The high level input voltage.
Input impedance	The input impedance.	**Low level input voltage**	The low level input voltage.
Hysteresis voltage	The hysteresis voltage.		
Maximum response frequency	The maximum frequency of the encoder input.		
5-V power supply for encoder	The output voltage and output current of the 5-V power supply for the encoder.		
External input specifications: These are the input specifications for the external inputs.			
Input voltage	The rated input voltage and voltage range.	**ON voltage/ON current**	The input voltage at which the input turns ON and the input current at that time.
Input current	The input current at the rated voltage.	**OFF voltage/OFF current**	The input voltage at which the input turns OFF and the input current at that time.
ON/OFF response time	The delay time in a change in the state of an input terminal reaching the internal circuit. The ON delay time is given first followed by the OFF delay time.		
Internal I/O common processing	The polarity of the connected input device. There are models with NPN and PNP connections.		

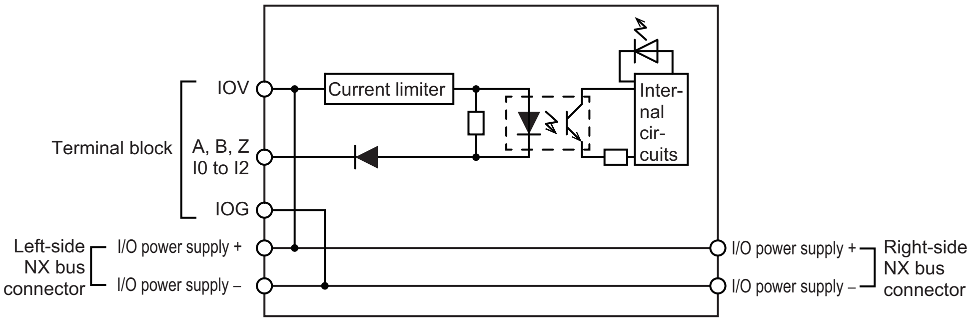
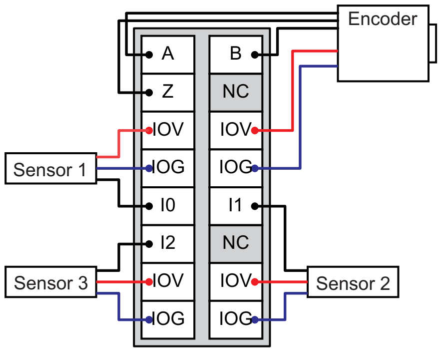
Dimensions	The external dimensions of the Unit. Dimensions are given in the following form: W × H × D. The unit is mm.	**Isolation method**	The isolation method between the input circuits and the internal circuits in the Unit.
Insulation resistance	The insulation resistance between the input circuits and the internal circuits in the Unit.	**Dielectric strength**	The dielectric strength between the input circuits and the internal circuits in the Unit.
I/O power supply method	The method that is used to supply I/O power to the Unit. The supply method is determined for each Unit. Power is supplied either from the NX bus or from an external source.	**Current capacity of I/O power supply terminals**	The current capacity of the I/O power supply terminals (IOV/IOG) on the Unit. You cannot exceed this value when you supply I/O power to external devices that are connected to the Unit.
NX Unit power consumption	The power consumption of the Unit from the NX Unit power supply.	**Current consumption from I/O power supply**	The current consumption of the Unit from the I/O power supply. The above input current and the current consumption of connected external devices are not included.
Weight	The weight of the Unit.		
Circuit layout	The circuit layout of the input circuits to the Unit.		
Installation orientation and restrictions	The installation orientation of a Slave Terminal that includes this Unit. Any restrictions to specifications that result from the installation orientation are also given.		
Terminal connection diagram	The connection diagram between the Unit and external devices. Any I/O Power Supply Connection Units or Shield Connection Units that are required to connect the external devices are also shown.		
Failure detection	The failure detection functions of the Unit.	**Protection**	The protection functions of the Unit.

Terminal Connection Diagrams

- I/O terminals in the terminal connection diagrams are shown as viewed from the front of the Unit.

NX-EC0112

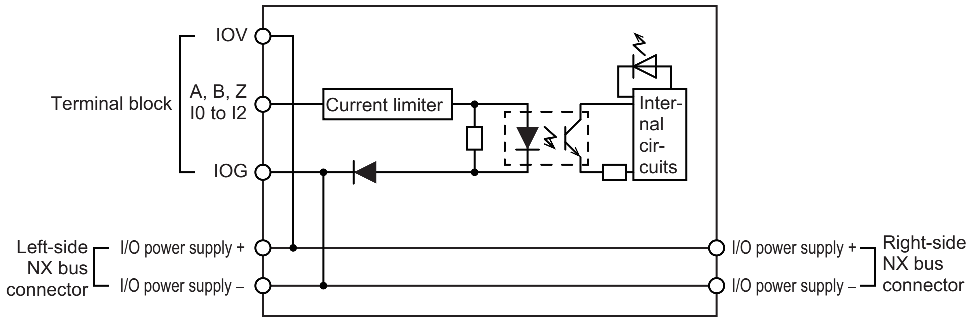
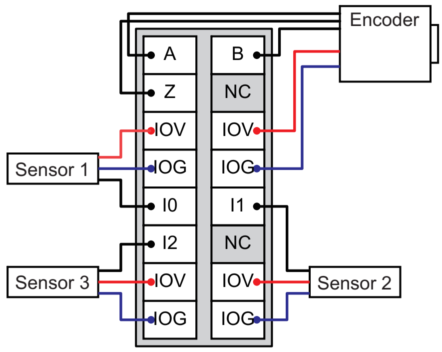
Unit name	Incremental Encoder Input Units	**Model**	NX-EC0112
Number of channels	1 channel	**Type of external connections**	Screwless clamping terminal block (16 terminals)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0112 and NX-EC0122* on page 6-9.	**Input signals**	Counter: Phases A, B, and Z External Inputs: 3
Input form	Voltage input (24 V)		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Voltage input specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)	**ON voltage**	19.6 VDC min./3 mA min.
Input current	4.2 mA typical (24 VDC)	**OFF voltage**	4.0 VDC max./1 mA max.
Maximum response frequency	Phases A and B: Single-phase 500 kHz (phase differential pulse input x4: 125 kHz), Phase Z: 125 kHz		
Internal I/O common processing	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	4.6 mA typical (24 VDC)	**OFF voltage/OFF current**	4.0 VDC max./1 mA max.
ON/OFF response time	1 µs max./2 µs max.		
Internal I/O common processing	NPN		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Photocoupler isolation
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.3 A max. per terminal for encoder supply section and 0.1 A max. per terminal for other sections IOG: 0.3 A max. per terminal for encoder supply section and 0.1 A max. per terminal for other sections
NX Unit power consumption	0.85 W max.	**Current consumption from I/O power supply**	None
Weight	70 g max.		

Circuit layout	Encoder Input and External Inputs 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

NX-EC0122

Unit name	Incremental Encoder Input Units	**Model**	NX-EC0122
Number of channels	1 channel	**Type of external connections**	Screwless clamping terminal block (16 terminals)
I/O refreshing method[*1]	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0112 and NX-EC0122* on page 6-9.	**Input signals**	Counter: Phases A, B, and Z External Inputs: 3
Input form	Voltage input (24 V)		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Voltage input specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%/–15%)	**ON voltage**	19.6 VDC min./3 mA min.
Input current	4.2 mA typical (24 VDC)	**OFF voltage**	4.0 VDC max./1 mA max.
Maximum response frequency	Phases A and B: Single-phase 500 kHz (phase differential pulse input x4: 125 kHz), Phase Z: 125 kHz		
Internal I/O common processing	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	4.6 mA typical (24 VDC)	**OFF voltage/OFF current**	4.0 VDC max./1 mA max.
ON/OFF response time	1 µs max./2 µs max.		
Internal I/O common processing	PNP		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Photocoupler isolation
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.3 A max. per terminal for encoder supply section and 0.1 A max. per terminal for other sections IOG: 0.3 A max. per terminal for encoder supply section and 0.1 A max. per terminal for other sections
NX Unit power consumption	0.95 W max.	**Current consumption from I/O power supply**	None
Weight	70 g max.		

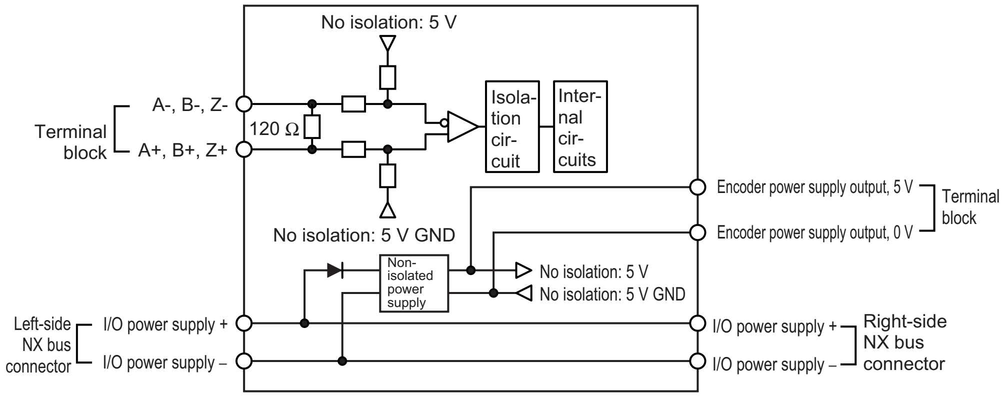
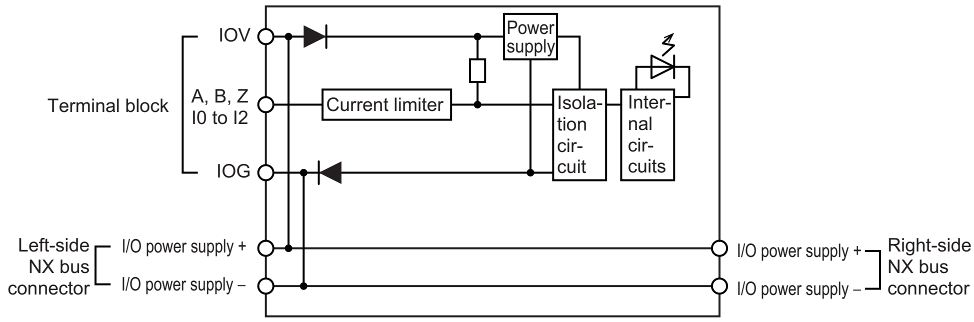
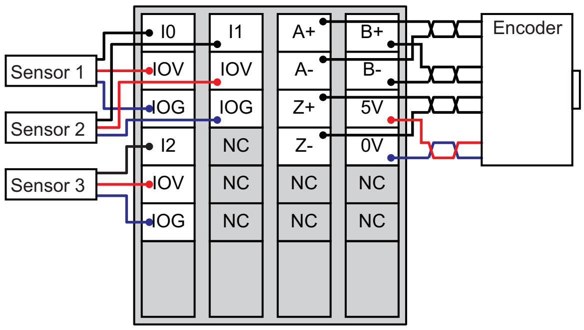
Circuit layout	Encoder Input and External Inputs 
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.
Terminal connection diagram	

Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

NX-EC0132

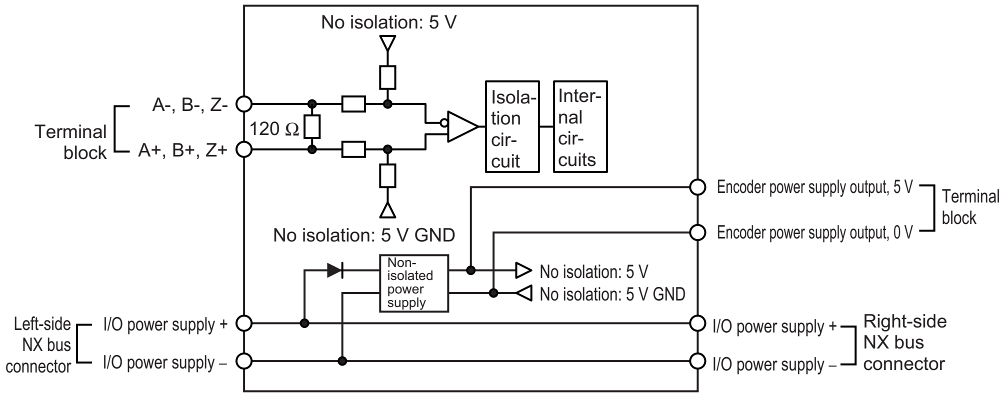
Unit name	Incremental Encoder Input Units	**Model**	NX-EC0132
Number of channels	1 channel	**Type of external connections**	Screwless clamping terminal block (12 terminals × 2)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0132 and NX-EC0142* on page 6-10.	**Input signals**	Counter: Phases A, B, and Z External Inputs: 3
Input form	Line receiver input		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Line driver specifications			
Input voltage	EIA standard RS-422-A line driver levels	**High level input voltage**	V_{IT+}: 0.1 V min.
Input impedance	120 Ω ± 5%	**Low level input voltage**	V_{IT-}: –0.1 V min.
Hysteresis voltage	Vhys (V_{IT+} – V_{IT-}): 60 mV		
Maximum response frequency	Phases A and B: Single-phase 4 MHz (phase differential pulse input x4: 1 MHz), Phase Z: 1 MHz		
5-V power supply for encoder	Output voltage: 5 VDC ±5% Output current: 500 mA max.		
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	3.5 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		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.1 A max. per terminal IOG: 0.1 A max. per terminal
NX Unit power consumption	0.95 W max.	**Current consumption from I/O power supply**	Unit current consumption: 30 mA max. Consumption from encoder 5-V power supply: Encoder current consumption *0.28 mA
Weight	130 g max.		

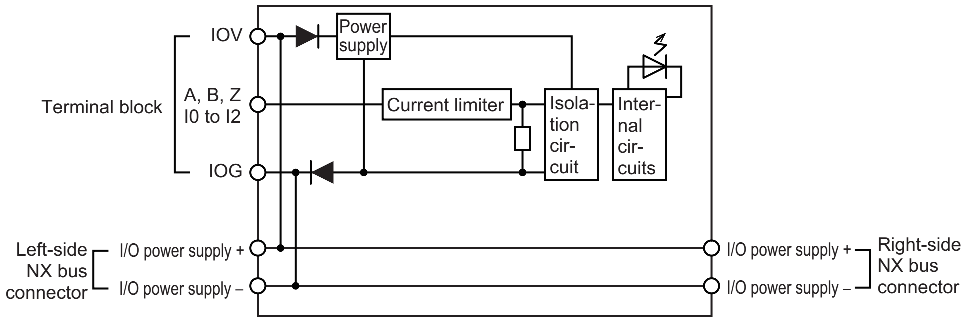
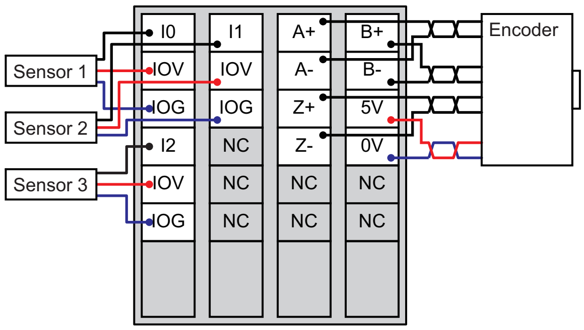
Circuit layout	Encoder Input  External Inputs 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

NX-EC0142

Unit name	Incremental Encoder Input Units	Model	NX-EC0142
Number of channels	1 channel	Type of external connections	Screwless clamping terminal block (12 terminals × 2)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0132 and NX-EC0142* on page 6-10.	Input signals	Counter: Phases A, B, and Z External Inputs: 3
Input form	Line receiver input		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Line driver specifications			
Input voltage	EIA standard RS-422-A line driver levels	High level input voltage	V_{IT+}: 0.1 V min.
Input impedance	120 Ω ± 5%	Low level input voltage	V_{IT-}: –0.1 V min.
Hysteresis voltage	Vhys ($V_{IT+} - V_{IT-}$): 60 mV		
Maximum response frequency	Phases A and B: Single-phase 4 MHz (phase differential pulse input x4: 1 MHz), Phase Z: 1 MHz		
5-V power supply for encoder	Output voltage: 5 VDC ±5% Output current: 500 mA max.		
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	3.5 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		
Dimensions	12 × 100 × 71 mm (W×H×D)	Isolation method	Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	Dielectric strength	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	Current capacity of I/O power supply terminals	IOV: 0.1 A max. per terminal IOG: 0.1 A max. per terminal
NX Unit power consumption	1.05 W max.	Current consumption from I/O power supply	Unit current consumption: 30 mA max. Consumption from encoder 5-V power supply: Encoder current consumption *0.28 mA
Weight	130 g max.		

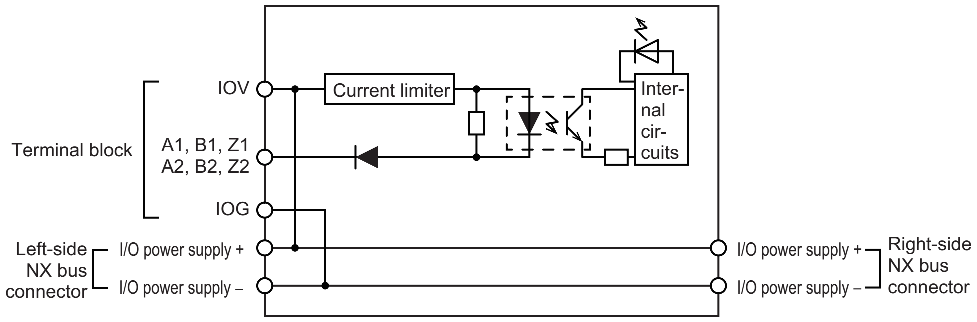
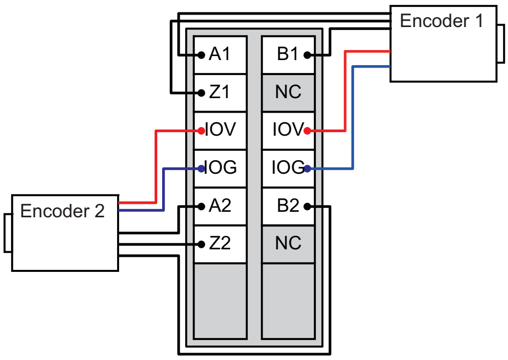
<table>
<tr><td rowspan="1">Circuit layout</td><td colspan="3">Encoder Input


External Inputs

</td></tr>
<tr><td>Installation orientation and restrictions</td><td colspan="3">Installation orientation: 6 possible orientations
Restrictions: There are no restrictions.</td></tr>
<tr><td>Terminal connection diagram</td><td colspan="3">
</td></tr>
<tr><td>Failure detection</td><td>None</td><td>Protection</td><td>None</td></tr>
</table>

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

NX-EC0212

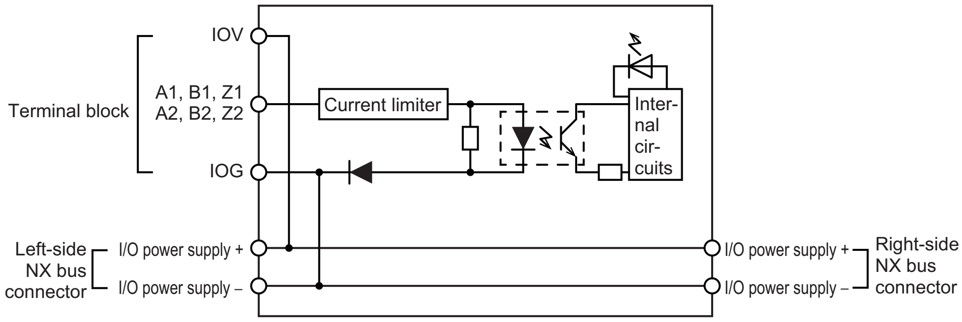
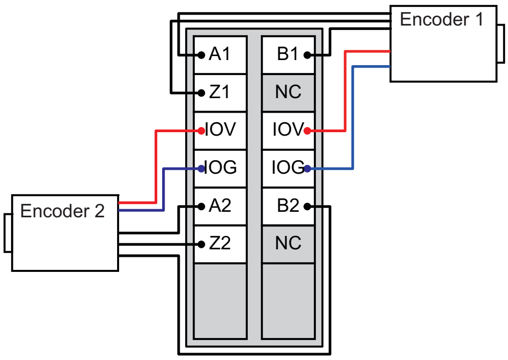
Unit name	Incremental Encoder Input Units	Model	NX-EC0212
Number of channels	2 channels	Type of external connections	Screwless clamping terminal block (12 terminals)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0212 and NX-EC0222* on page 6-10.	Input signals	Counter: Phases A, B, and Z External Inputs: None
Input form	Voltage input (24 V)		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Voltage input specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%, –15%)	ON voltage	19.6 VDC min./3 mA min.
Input current	4.2 mA typical (24 VDC)	OFF voltage	4.0 VDC max./1 mA max.
Maximum response frequency	Phases A and B: Single-phase 500 kHz (phase differential pulse input x4: 125 kHz), Phase Z: 125 kHz		
Internal I/O common processing	NPN		
External input specifications			
Input voltage	---	ON voltage/ON current	---
Input current	---	OFF voltage/OFF current	---
ON/OFF response time	---		
Internal I/O common processing	---		
Dimensions	12 × 100 × 71 mm (W×H×D)	Isolation method	Photocoupler isolation
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	Dielectric strength	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	Current capacity of I/O power supply terminals	IOV: 0.3 A max. per terminal IOG: 0.3 A max. per terminal
NX Unit power consumption	0.85 W max.	Current consumption from I/O power supply	None
Weight	70 g max.		

Circuit layout	Encoder Input 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

NX-EC0222

Unit name	Incremental Encoder Input Units	**Model**	NX-EC0222
Number of channels	2 channels	**Type of external connections**	Screwless clamping terminal block (12 terminals)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-EC0212 and NX-EC0222* on page 6-10.	**Input signals**	Counter: Phases A, B, and Z External Inputs: None
Input form	Voltage input (24 V)		
Counting unit	Pulses		
Pulse input method	Phase differential pulse (multiplication x2/4), pulse + direction inputs, or up and down pulse inputs		
Counter range	–2,147,483,648 to 2,147,483,647 pulses		
Counter functions			
Counter type	Ring counter or linear counter		
Counter controls	Gate control, counter reset, and counter preset		
Latch function	Two external input latches and one internal latch		
Measurements	Pulse rate measurement and pulse period measurement		
Voltage input specifications			
Input voltage	20.4 to 28.8 VDC (24 VDC +20%, –15%)	**ON voltage**	19.6 VDC min./3 mA min.
Input current	4.2 mA typical (24 VDC)	**OFF voltage**	4.0 VDC max./1 mA max.
Maximum response frequency	Phases A and B: Single-phase 500 kHz (phase differential pulse input x4: 125 kHz), Phase Z: 125 kHz		
Internal I/O common processing	PNP		
External input specifications			
Input voltage	---	**ON voltage/ON current**	---
Input current	---	**OFF voltage/OFF current**	---
ON/OFF response time	---		
Internal I/O common processing	---		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Photocoupler isolation
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.3 A max. per terminal IOG: 0.3 A max. per terminal
NX Unit power consumption	0.95 W max.	**Current consumption from I/O power supply**	None
Weight	70 g max.		

Circuit layout	Encoder Input  		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram	 		
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

A-1-3 SSI Input Units

Interpreting Datasheets

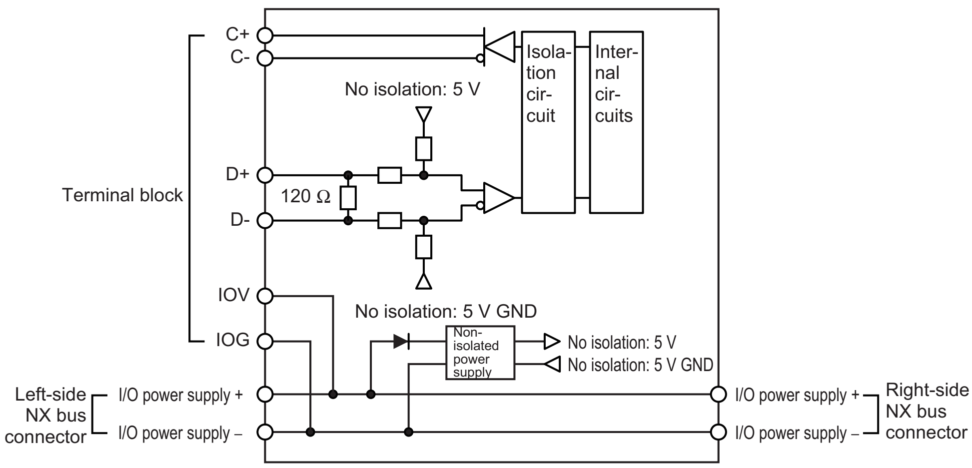
The following table describes how to interpret the datasheets for SSI Input Units.

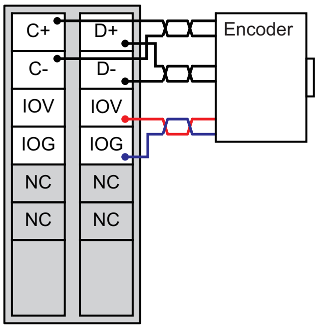
Unit name	The name of the Unit.	**Model**	The model of the Unit.
Number of channels	The SSI communications input capacity of the Unit.	**Type of external connections**	The type of wiring for the Unit, i.e., terminal block or connector. For a screwless clamping terminal block, the number of terminals on the terminal block is also given.
I/O refreshing method	The I/O refreshing method of the Unit. The following refreshing methods are supported: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.		
Indicators	The indicators on the Units and their layout.	**I/O signals**	The I/O signals.
I/O interface	The specifications of the applicable serial interface.		
Clock output	The specifications of the CLK line.		
Data input	The specifications of the data line.		
Maximum data length	The valid data length.		
Coding method	The format of the SSI data that can be received.		
Baud Rate	The baud rate that you can use for SSI communications.		
Dimensions	The external dimensions of the Unit. Dimensions are given in the following form: W × H × D. The unit is mm.	**Isolation method**	The isolation method between the input circuits and the internal circuits in the Unit.
Insulation resistance	The insulation resistance between the input circuits and the internal circuits in the Unit.	**Dielectric strength**	The dielectric strength between the input circuits and the internal circuits in the Unit.
I/O power supply method	The method that is used to supply I/O power to the Unit. The supply method is determined for each Unit. Power is supplied either from the NX bus or from an external source.	**Current capacity of I/O power supply terminals**	The current capacity of the I/O power supply terminals (IOV/IOG) on the Unit. You cannot exceed this value when you supply I/O power to external devices that are connected to the Unit.
NX Unit power consumption	The power consumption of the Unit from the NX Unit power supply.	**Current consumption from I/O power supply**	The current consumption of the Unit from the I/O power supply. The above input current and the current consumption of connected external devices are not included.
Maximum transmission distance	The maximum SSI communications transmission distance for the Unit.		
Weight	The weight of the Unit.		
Circuit layout	The circuit layout of the input circuits to the Unit.		
Installation orientation and restrictions	The installation orientation of a Slave Terminal that includes this Unit. Any restrictions to specifications that result from the installation orientation are also given.		
Terminal connection diagram	The connection diagram between the Unit and external devices. Any I/O Power Supply Connection Units or Shield Connection Units that are required to connect the external devices are also shown.		
Failure detection	The failure detection functions of the Unit.	**Protection**	The protection functions of the Unit.

Terminal Connection Diagrams

- I/O terminals in the terminal connection diagrams are shown as viewed from the front of the Unit.

NX-ECS112

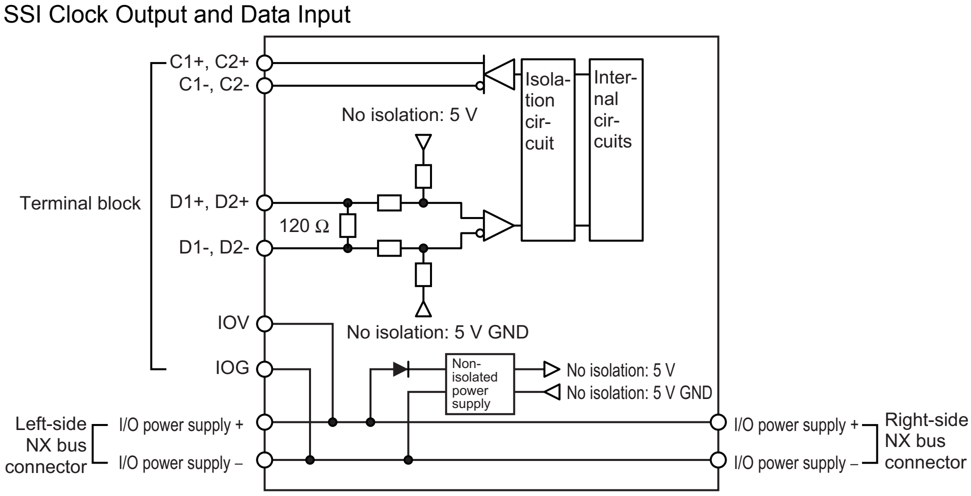
Unit name	SSI Input Units	**Model**	NX-ECS112
Number of channels	1 channel	**Type of external connections**	Screwless clamping terminal block (12 terminals)
I/O refreshing method[*1]	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-ECS112* on page 7-9.	**I/O signals**	SSI inputs: 2, Data input (D+, D-) SSI outputs: 2, Clock output (C+, C-)
I/O interface	Synchronized serial interface (SSI)		
Clock output	EIA standard RS-422-A line driver levels		
Data input	EIA standard RS-422-A line receiver levels		
Maximum data length	32 bits (The single-turn, multi-turn, and status data length can be set.)		
Coding method	No conversion, binary code, or gray code		
Baud Rate	100 kHz, 200 kHz, 300 kHz, 400 kHz, 500 kHz, 1.0 MHz, 1.5 MHz, or 2.0 MHz		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, −15%)	**Current capacity of I/O power supply terminals**	IOV: 0.3 A max. per terminal IOG: 0.3 A max. per terminal
NX Unit power consumption	0.85 W max.	**Current consumption from I/O power supply**	20 mA max.
Maximum transmission distance [*2]	**Baud Rate**	**Maximum transmission distance**	
	100 kHz	400 m	
	200 kHz	190 m	
	300 kHz	120 m	
	400 kHz	80 m	
	500 kHz	60 m	
	1.0 MHz	25 m	
	1.5 MHz	10 m	
	2.0 MHz	5 m	
Weight	65 g max.		
Circuit layout	SSI Clock Output and Data Input 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		

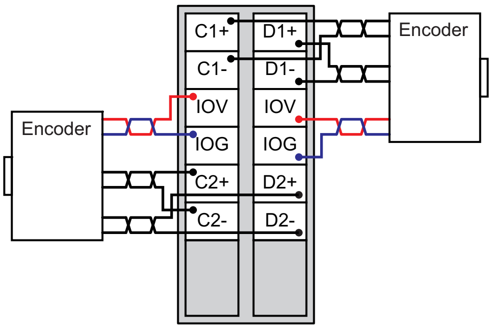
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

*2. The maximum transmission distance for an SSI Input Unit depends on the baud rate due to the delay that can result from the responsiveness of the connected encoder and cable impedance. The maximum transmission distance is only a guideline. Review the specifications for the cables and encoders in the system and evaluate the operation of the actual equipment before use.

NX-ECS212

Unit name	SSI Input Units	**Model**	NX-ECS212
Number of channels	2 channels	**Type of external connections**	Screwless clamping terminal block (12 terminals)
I/O refreshing method *1	Free-Run refreshing, synchronous I/O refreshing, or task period prioritized refreshing		
Indicators	Refer to *NX-ECS212* on page 7-9.	**I/O signals**	SSI inputs: 4, Data input (D+, D-, D2+, D2-) SSI outputs: 4, Clock output (C+, C-, C2+, C2-)
I/O interface	Synchronized serial interface (SSI)		
Clock output	EIA standard RS-422-A line driver levels		
Data input	EIA standard RS-422-A line receiver levels		
Maximum data length	32 bits (The single-turn, multi-turn, and status data length can be set.)		
Coding method	No conversion, binary code, or gray code		
Baud Rate	100 kHz, 200 kHz, 300 kHz, 400 kHz, 500 kHz, 1.0 MHz, 1.5 MHz, or 2.0 MHz		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, −15%)	**Current capacity of I/O power supply terminals**	IOV: 0.3 A max. per terminal IOG: 0.3 A max. per terminal
NX Unit power consumption	0.9 W max.	**Current consumption from I/O power supply**	30 mA max.
Maximum transmission distance *2	**Baud Rate**	**Maximum transmission distance**	
	100 kHz	400 m	
	200 kHz	190 m	
	300 kHz	120 m	
	400 kHz	80 m	
	500 kHz	60 m	
	1.0 MHz	25 m	
	1.5 MHz	10 m	
	2.0 MHz	5 m	
Weight	65 g max.		
Circuit layout	SSI Clock Output and Data Input  		

Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram	 		
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

*2. The maximum transmission distance for an SSI Input Unit depends on the baud rate due to the delay that can result from the responsiveness of the connected encoder and cable impedance. The maximum transmission distance is only a guideline. Review the specifications for the cables and encoders in the system and evaluate the operation of the actual equipment before use.

A-1-4 Pulse Output Units

Interpreting Datasheets

The following table describes how to interpret the datasheets for Pulse Output Units.

Unit name	The name of the Unit.	**Model**	The model of the Unit.
Number of axes	The pulse output capacity of the Unit.	**Type of external connections**	The type of wiring for the Unit, i.e., terminal block or connector. For a screwless clamping terminal block, the number of terminals on the terminal block is also given.
I/O refreshing method	The I/O refreshing method of the Unit. The following refreshing methods are supported: Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing.		
Indicators	The indicators on the Units and their layout.	**I/O signals**	The I/O signals.
Control method	The control method used during positioning.		
Controlled drive	The motor drive that is controlled.		
Pulse output form	The form of the pulse output.		
Unit of control	The unit of control.		
Maximum pulse output speed	The maximum pulse output speed.		
Pulse output method	The pulse output method.		
Position control range	The range of the number of pulse outputs for position control.		
Velocity control range	The range of the velocity of pulse outputs for velocity control.		
Positioning	The usable positioning functions.		
External input specifications: These are the specifications of the external inputs.			
Input voltage	The rated input voltage and voltage range.	**ON voltage/ON current**	The input voltage at which the input turns ON and the input current at that time.
Input current	The input current at the rated voltage.	**OFF voltage/OFF current**	The input voltage at which the input turns OFF and the input current at that time.
ON/OFF response time	The delay time in a change in the state of an input terminal reaching the internal circuit. The ON delay time is given first followed by the OFF delay time.		
Internal I/O common processing	The polarity of the connected input device. There are models with NPN and PNP connections.		
Pulse output and external output specifications: These are the specifications of the external outputs.			
Rated voltage	The rated output voltage.		
Load voltage range	The range of the load voltage that is supported.	**Residual voltage**	The residual voltage.
Maximum load current	The maximum load current that is supported.	**Leakage current**	The leakage current.
ON/OFF response time	The delay time in a change in the state of an internal circuit reaching the output terminal. The ON delay time is given first followed by the OFF delay time.		
Internal I/O common processing	The polarity of the connected output device. There are models with NPN and PNP connections.		
Dimensions	The external dimensions of the Unit. Dimensions are given in the following form: W × H × D. The unit is mm.	**Isolation method**	The isolation method between the input circuits and the internal circuits in the Unit.
Insulation resistance	The insulation resistance between the input circuits and the internal circuits in the Unit.	**Dielectric strength**	The dielectric strength between the input circuits and the internal circuits in the Unit.

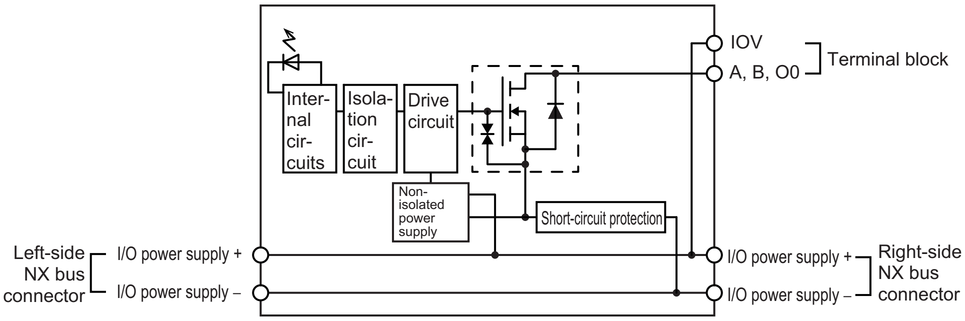
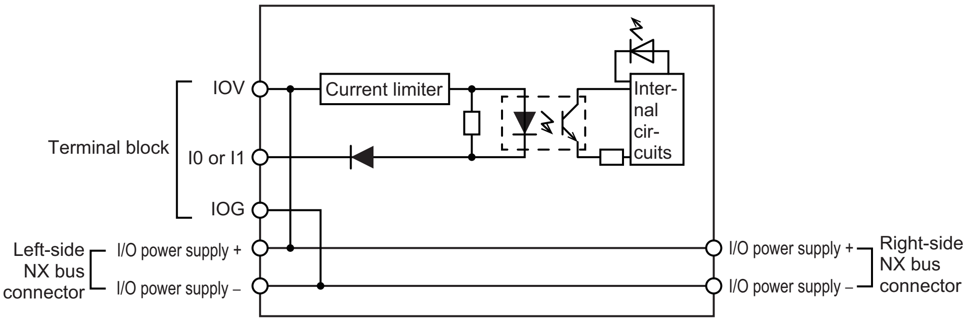
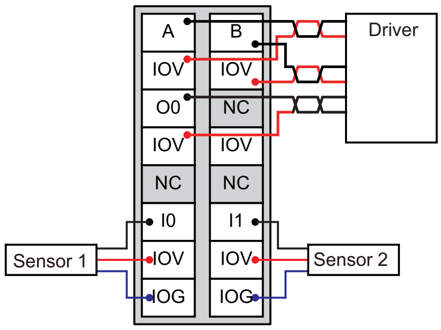
I/O power supply method	The method that is used to supply I/O power to the Unit. The supply method is determined for each Unit. Power is supplied either from the NX bus or from an external source.	**Current capacity of I/O power supply terminals**	The current capacity of the I/O power supply terminals (IOV/IOG) on the Unit. You cannot exceed this value when you supply I/O power to external devices that are connected to the Unit.
NX Unit power consumption	The power consumption of the Unit from the NX Unit power supply.	**Current consumption from I/O power supply**	The current consumption of the Unit from the I/O power supply. The above input current and the current consumption of connected external devices are not included.
Weight	The weight of the Unit.	**Cable length**	The usable range of cable length that is connected to the Unit.
Circuit layout	The circuit layout of the input circuits to the Unit.		
Installation orientation and restrictions	The installation orientation of a Slave Terminal that includes this Unit. Any restrictions to specifications that result from the installation orientation are also given.		
Terminal connection diagram	The connection diagram between the Unit and external devices. Any I/O Power Supply Connection Units or Shield Connection Units that are required to connect the external devices are also shown.		
Failure detection	The failure detection functions of the Unit.	**Protection**	The protection functions of the Unit.

Terminal Connection Diagrams

- I/O terminals in the terminal connection diagrams are shown as viewed from the front of the Unit.

NX-PG0112

Unit name	Pulse Output Units	**Model**	NX-PG0112
Number of axes	1	**Type of external connections**	Screwless clamping terminal block (16 terminals)
I/O refreshing method[*1]	Synchronous I/O refreshing or task period prioritized refreshing		
Indicators	Refer to *NX-PG0112 and NX-PG0122* on page 8-13.	**I/O signals**	Inputs: 2, External inputs Outputs: 3, The outputs are the forward direction pulse output, reverse direction pulse output, and external output (one of each output).
Control method	Open-loop control through pulse string output		
Controlled drive	Servo drive with a pulse string input or a stepper motor drive		
Pulse output form	Open collector output		
Unit of control	Pulses		
Maximum pulse output speed	500 kpps		
Pulse output method	Forward/reverse direction outputs or Pulse + direction outputs		
Position control range	–2,147,483,648 to 2,147,483,647 pulses		
Velocity control range	1 to 500,000 pps		
Positioning[*2]			
Single-axis position control	Absolute positioning, relative positioning, and interrupt feeding		
Single-axis velocity control	Velocity control (velocity feeding in Position Control Mode)		
Single-axis synchronized control	Cam operation and gear operation		
Single-axis manual operation	Jogging		
Auxiliary function for single-axis control	Homing, stopping, and override changes		
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	4.6 mA typical (24 VDC)	**OFF voltage/OFF current**	4.0 VDC max./1 mA max.
ON/OFF response time	1 μs max./2 μs max.		
Internal I/O common processing	NPN		
Pulse output and external output specifications			
Rated voltage	24 VDC		
Load voltage range	15 to 28.8 VDC	**Residual voltage**	1.0 V max.
Maximum load current	30 mA	**Leakage current**	0.1 mA max.
ON/OFF response time	Pulse output: Refer to *8-11-2 Pulse Output Specifications* on page 8-74. External output: 5 μs max./5 μs max.		
Internal I/O common processing	NPN		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	External inputs: Photocoupler isolation External outputs: Digital isolator

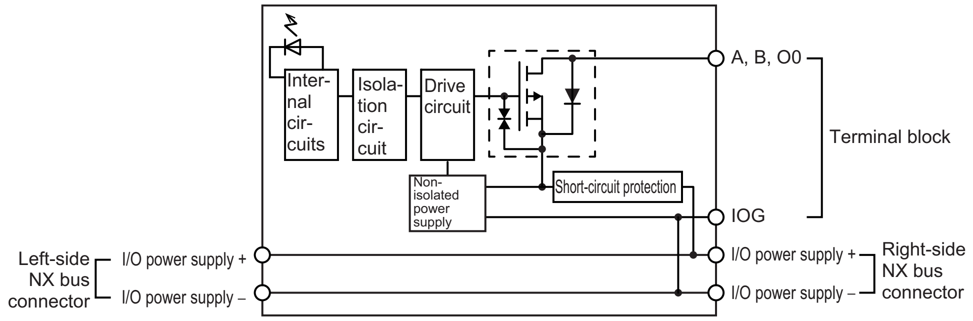
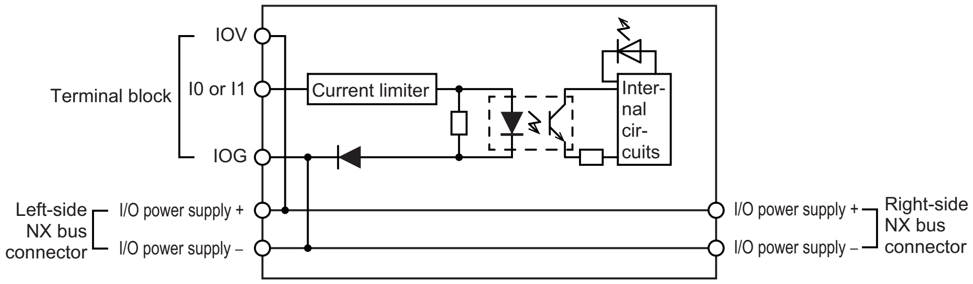
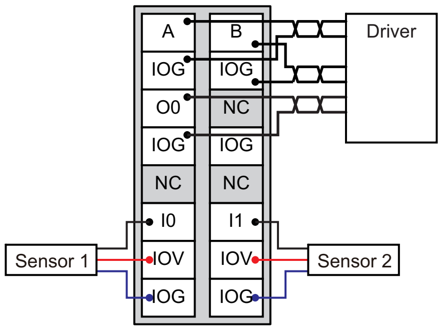
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.1 A max. per terminal IOG: 0.1 A max. per terminal
NX Unit power consumption	0.80 W max.	**Current consumption from I/O power supply**	20 mA max.
Weight	70 g max.	**Cable length**	3 m max.
Circuit layout	Pulse Output and External Output  External Inputs 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

*2. These functions are supported when you also use the MC Function Module in the NJ/NX-series CPU Unit.
Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for details.
A Pulse Output Unit only outputs pulses during the control period based on commands received at a fixed period.
Target position calculations (distribution calculations) for acceleration/deceleration control or for each control period must be performed on the Controller that is connected as the host.

NX-PG0122

Unit name	Pulse Output Units	**Model**	NX-PG0122
Number of axes	1	**Type of external connections**	Screwless clamping terminal block (16 terminals)
I/O refreshing method *1	Synchronous I/O refreshing or task period prioritized refreshing		
Indicators	Refer to *NX-PG0112 and NX-PG0122* on page 8-13.	**I/O signals**	Inputs: 2, External inputs Outputs: 3, The outputs are the forward direction pulse output, reverse direction pulse output, and external output (one of each output).
Control method	Open-loop control through pulse string output		
Controlled drive	Servo drive with a pulse string input or a stepper motor drive		
Pulse output form	Open collector output		
Unit of control	Pulses		
Maximum pulse output speed	500 kpps		
Pulse output method	Forward/reverse direction outputs or Pulse + direction outputs		
Position control range	–2,147,483,648 to 2,147,483,647 pulses		
Velocity control range	1 to 500,000 pps		
Positioning *2			
Single-axis position control	Absolute positioning, relative positioning, and interrupt feeding		
Single-axis velocity control	Velocity control (velocity feeding in Position Control Mode)		
Single-axis synchronized control	Cam operation and gear operation		
Single-axis manual operation	Jogging		
Auxiliary function for single-axis control	Homing, stopping, and override changes		
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	4.6 mA typical (24 VDC)	**OFF voltage/OFF current**	4.0 VDC max./1 mA max.
ON/OFF response time	1 μs max./2 μs max.		
Internal I/O common processing	PNP		
Pulse output and external output specifications			
Rated voltage	24 VDC		
Load voltage range	15 to 28.8 VDC	**Residual voltage**	1.0 V max.
Maximum load current	30 mA	**Leakage current**	0.1 mA max.
ON/OFF response time	Pulse output: Refer to *8-11-2 Pulse Output Specifications* on page 8-74. External output: 5 μs max./5 μs max.		
Internal I/O common processing	PNP		
Dimensions	12 × 100 × 71 mm (W×H×D)	**Isolation method**	External inputs: Photocoupler isolation External outputs: Digital isolator

Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.
I/O power supply method	Supplied from the NX bus. 20.4 to 28.8 VDC (24 VDC +20%, –15%)	**Current capacity of I/O power supply terminals**	IOV: 0.1 A max. per terminal IOG: 0.1 A max. per terminal
NX Unit power consumption	0.90 W max.	**Current consumption from I/O power supply**	20 mA max.
Weight	70 g max.	**Cable length**	3 m max.
Circuit layout	Pulse Output and External Output  External Inputs 		
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: There are no restrictions.		
Terminal connection diagram			
Failure detection	None	**Protection**	None

*1. The I/O refreshing method is automatically set according to the connected Communications Coupler Unit and CPU Unit.

*2. These functions are supported when you also use the MC Function Module in the NJ/NX-series CPU Unit.
Refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) for details.
A Pulse Output Unit only outputs pulses during the control period based on commands received at a fixed period.
Target position calculations (distribution calculations) for acceleration/deceleration control or for each control period must be performed on the Controller that is connected as the host.

A-2 Object Lists

This section describes the objects for Incremental Encoder Input Units, SSI Input Units, and Pulse Output Units.

A-2-1 Object Description Format

The following format is used to describe objects.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute

Name	Description
Index (hex)	The index of the NX object expressed by a 4-digit hexadecimal number.
Subindex (hex)	The subindex of the NX object expressed by a 2-digit hexadecimal number.
Object name	The name of the object. For a subindex, this is the subindex name.
Default	The default setting.
Data range	For read-only data (RO), the displayable data range. For read/write data (RW), the valid data range that you can set.
Unit	The physical unit of the object.
Data type	The data type of the object.
Access	RO: Read only RW: Read/write
I/O allocation	Whether I/O allocation is allowed.
Data attribute	The timing at which any changes made to a writable NX object take effect. Y: Effective after restart N: Effective immediately ---: Not writable

A-2-2 Incremental Encoder Input Units

This section describes the product information objects, I/O allocation objects, and message communications objects for Incremental Encoder Input Units.

Unit Information Objects

These objects are related to product information.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
1000	---	NX Bus Identity information	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	No	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	No	---
	06	Unit Version	*2	---	---	UDINT	RO	No	---
1001	---	Production Info	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	No	---
	01	Lot Number	*3	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---

*1. This returns the model of the Unit in ASCII. If all 12 bytes are not required, the remaining bytes are filled with spaces ($20).

*2. Bits 24 to 31: Integer part of the unit version
Bits 16 to 23: Decimal part of the unit version
Bits 0 to 15: Reserved

*3. Bits 24 to 31: Day of month of manufacture
Bits 16 to 23: Month of manufacture
Bits 8 to 15: Year of manufacture
Bits 0 to 7: Reserved

I/O Allocation Objects

The following objects are assigned to I/O or used in message communications.

If you assign any of the objects that are described below to I/O, you can no longer access those objects with the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6000	---	Encoder Counter Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Counter Status	00 hex	00 to FF hex	---	BYTE	RO	Yes	---
	02	Ch2 Encoder Counter Status *2	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Encoder Counter Status object.

Bit	Status name	Description
0	Counter Enabled	0: Counter operating. 1: Counter stopped.
1	Internal Reset Completed	This is the completion flag for the Internal Reset Execution bit of the Encoder Counter Operation Command variable. 0 to 1: Reset execution completed. 1 to 0: The Internal Reset Execution bit in the Encoder Counter Operation Command variable is set to 0.
2	Internal Latch Completed	This is the completion flag for the Internal Latch Execution bit of the Encoder Counter Operation Command variable. 0 to 1: Latch execution completed. 1 to 0: The Internal Latch Execution bit in the Encoder Counter Operation Command variable is set to 0.
3	Preset Completed	This is the completion flag for the Preset Execution bit of the Encoder Counter Operation Command variable. 0 to 1: Preset execution completed. 1 to 0: The Preset Execution bit in the Encoder Counter Operation Command variable is set to 0.
4	Preset Command Value Invalid Flag	1: Setting error occurred. 0: No setting errors occurred.
5	Counter Underflow Flag	1: Counter underflow error occurred. 0: Counter underflow error did not occur.
6	Counter Overflow Flag	1: Counter overflow error occurred. 0: Counter overflow error did not occur.
7	Count Direction Flag	This bit indicates the count direction based on the last pulse input.*1 1: Negative direction 0: Positive direction

*1. The indicated count direction is based on the setting of the Encoder Count Direction parameter. Because this is the count direction for the latest pulse input, the direction given by the Count Direction Flag and the difference between the previous and current values of the Encoder Present Position parameter may not agree if there is oscillation in the pulse input from the encoder.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6001	---	Reset/External Input Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Reset/External Input Status	*2	00 to FF hex	---	BYTE	RO	Yes	---
	02	Ch2 Reset/External Input Status *3	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 08 hex. The values for the NX-EC0212 or NX-EC0222 are 00 hex.

*3. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Reset/External Input Status object.
- Only bits 5 and 7 are valid for the NX-EC0212 and NX-EC0222.

Bit	Status name	Description
0	External Input 0 Status	1: External input 0 ON. 0: External input 0 OFF.
1	External Input 1 Status	1: External input 1 ON. 0: External input 1 OFF.
2	External Input 2 Status	1: External input 2 ON. 0: External input 2 OFF.
3	External Input Enabled*1	1: External input enabled. 0: External input disabled.
4	External Reset Enabled	1: Reset for external reset enabled. 0: Reset for external reset disabled.
5	Phase Z Reset Enabled	1: Reset for phase-Z signal enabled. 0: Reset for phase-Z signal disabled.
6	External Reset Completed Flag	1: Reset for external reset occurred. 0: Reset for external reset did not occur.
7	Phase Z Reset Completed Flag	1: Reset for phase-Z signal occurred. 0: Reset for phase-Z signal did not occur.

*1. The external input is enabled if the External Input Function Selection parameter is set correctly and the external input is enabled. If the External Input Function Selection parameter is set more than once for the same input, the external input is disabled.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6002	---	Encoder Present Position	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Present Position	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---
	02	Ch2 Encoder Present Position *2	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6003	---	Pulse Rate	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	CH1 Pulse Rate	0	0 to 4,294,967,295	---	UDINT	RO	Yes	---
	02	CH2 Pulse Rate *2	0	0 to 4,294,967,295	---	UDINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6004	---	Latch Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Latch Status	0000 hex	0000 to FFFF hex	---	WORD	RO	Yes	---
	02	Ch2 Latch Status *2	0000 hex	0000 to FFFF hex	---	WORD	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Latch Status object.

Bit	Status name	Description
0	Latch Input 1 Enabled*1	1: Latch Input 1 enabled. 0: Latch Input 1 disabled.
1	Latch Input 1 Completed Flag*2	1: Data was latched for Latch Input 1. 0: No data was latched for Latch Input 1
8	Latch Input 2 Enabled*3	1: Latch Input 2 enabled. 0: Latch Input 2 disabled.
9	Latch Input 2 Completed Flag*4	1: Data was latched for Latch Input 2. 0: No data was latched for Latch Input 2

*1. This bit changes according to the setting of the Latch Input 1 Enable bit for latching. Refer to *Latch Function* on page 6-41 for information on latching.

*2. This bit is cleared when the Latch Input 1 Enable bit changes from 1 to 0.

*3. This bit changes according to the setting of the Latch Input 2 Enable bit for latching. Refer to *Latch Function* on page 6-41 for information on latching.

*4. This bit is cleared when the Latch Input 2 Enable bit changes from 1 to 0.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6005	---	Latch Input 1 Data	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Latch Input 1 Data	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---
	02	Ch2 Latch Input 1 Data *2	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The value latched by latch input 1 through an external input or phase-Z signal is displayed.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6006	---	Latch Input 2 Data	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Latch Input 2 Data	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---
	02	Ch2 Latch Input 2 Data *2	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The value latched by latch input 2 through an external input or phase-Z signal is displayed.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6007	---	Internal Latch Data	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Internal Latch Data	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---
	02	Ch2 Internal Latch Data *2	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The value latched by the internal latch is displayed.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6008	---	Pulse Period Measurement Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Pulse Period Measurement Status	00 hex	00 to FF hex	---	BYTE	RO	Yes	---
	02	Ch2 Pulse Period Measurement Status *2	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Pulse Period Measurement Status object.

Bit	Status name	Description
0	Pulse Period Measurement Enabled	1: Pulse period measurement enabled. 0: Pulse period measurement disabled.
1	Pulse Period Measurement Value Clear Completed	1: Pulse period measurement value clear completed. 0: Pulse period measurement value clear bit is 0.
2	Pulse Period Measurement Value Overflow Flag	1: Pulse period measurement value overflow occurred. 0: Pulse period measurement value overflow did not occur.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6009	---	Pulse Period Measured Value	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Pulse Period Measured Value	0	1 to 4,294,967,295	100 ns	UDINT	RO	Yes	---
	02	Ch2 Pulse Period Measured Value *2	0	1 to 4,294,967,295	100 ns	UDINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The setting range is 100 ns to 429.4967295 s.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6010	---	Time Stamp	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	CH1 Time Stamp	0	0000000000000000 to FFFFFFFFFFFFFFFF hex	---	ULINT	RO	Yes	---
	02	CH2 Time Stamp *2	0	0000000000000000 to FFFFFFFFFFFFFFFF hex	---	ULINT	RO	Yes	---

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- This displays the time when the present value data was changed.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	Encoder Counter Operation Command	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Counter Operation Command	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N
	02	Ch2 Encoder Counter Operation Command *2	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Encoder Counter Operation Command object.

Bit	Data name	Description
0	Counter Enable	1: Enable counter command. 0: Disable counter command.
1	Internal Reset Execution	0 to 1: Reset of present value started.
2	Internal Latch Execution	0 to 1: Internal latch started.
3	Preset Execution	0 to 1: Preset of present value started.
4	External Reset Enable	1: Reset for external reset enabled. 0: Reset for external reset disabled.
5	Phase Z Reset Enable	1: Reset for phase-Z signal enabled. 0: Reset for phase-Z signal disabled.
6	External Reset Completed Flag Clear	0 to 1: Reset Completed Flag cleared for external reset.
7	Phase Z Reset Completed Flag Clear	0 to 1: Reset Completed Flag cleared for phase Z.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7002	---	Preset Command Value	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Preset Command Value	0	–2147483648 to 2147483647	pulse	DINT	RW	Yes	N
	02	Ch2 Preset Command Value *2	0	–2147483648 to 2147483647	pulse	DINT	RW	Yes	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the preset command value for the counter.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7004	---	Latch Function	No	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Latch Function	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N
	02	Ch2 Latch Function *2	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the settings of the Latch Function object.

Bit	Data name	Setting
0	Latch Input 1 Enable	0: Disable the latch input 1. 1: Enable the latch input 1.
1	Latch Input 1 Trigger Condition	0: One-shot Mode 1: Continuous Mode
2	Latch Input 1 Trigger Selection	0: External input 1: Phase-Z input
8	Latch Input 2 Enable	0: Disable the latch input 2. 1: Enable the latch input 2.
9	Latch Input 2 Trigger Condition	0: One-shot Mode 1: Continuous Mode
10	Latch Input 2 Trigger Selection	0: External input 1: Phase-Z input

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7008	---	Pulse Period Measurement Function	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Pulse Period Measurement Function	0000 hex	0000 to 0007 hex	---	WORD	RW	Yes	N
	02	Ch2 Pulse Period Measurement Function *2	0000 hex	0000 to 0007 hex	---	WORD	RW	Yes	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the bit configuration of the Pulse Period Measurement object.

Bit	Data name	Description
0	Pulse Period Measurement Enable*1	1: Pulse period measurement enabled. 0: Pulse period measurement disabled.
1	Pulse Period Measurement Value Clear*2	0 to 1: Pulse period measured value and pulse period measurement counter are cleared.
2	Pulse Period Measurement Value Overflow Flag Clear*2	0 to 1: Pulse period measurement value overflow flag is cleared.

*1. If the Edge Detection Method parameter is set to 0, the function is disabled regardless of the status of this bit.

*2. This can be performed only when pulse period measurement is enabled.

Other Objects

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Counter Type	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Counter Type	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Counter Type *2	0	0 or 1	---	USINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the counter type.
- The following table shows the settings for the Counter Type object.

Set value	Description
0	Ring counter
1	Linear counter

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Maximum Counter Value	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Maximum Counter Value	2147483647	1 to 2147483647	pulse	DINT	RW	No	Y
	02	Ch2 Maximum Counter Value *2	2147483647	1 to 2147483647	pulse	DINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the maximum value of the counter.
- The maximum value is the same for either a ring counter or linear counter.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Minimum Counter Value	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Minimum Counter Value	–2147483648	–2147483648 to 0	pulse	DINT	RW	No	Y
	02	Ch2 Minimum Counter Value *2	–2147483648	–2147483648 to 0	pulse	DINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the minimum value of the counter.
- The maximum value is the same for either a ring counter or linear counter.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5003	---	Pulse Input Method	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Pulse Input Method	2	1 to 4	---	USINT	RW	No	Y
	02	Ch2 Pulse Input Method *2	2	1 to 4	---	USINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the settings for the Pulse Input Method object.

Set value	Description
0	Not Supported
1	Phase differential pulse (x2)
2	Phase differential pulse (x4)
3	Pulse + Direction
4	Up and Down pulses

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Time Window	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Time Window	0	0 to 65535	ms	UINT	RW	No	N
	02	Ch2 Time Window *2	0	0 to 65535	ms	UINT	RW	No	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the time window for pulse rate measurement.
- Set this parameter to 0 to disable pulse rate measurement.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Average Processing Times	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Average Processing Times	0	0 to 100	Times	USINT	RW	No	N
	02	Ch2 Average Processing Times *2	0	0 to 100	Times	USINT	RW	No	N

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- Set this object to the average processing times for pulse rate measurement.
- Set this object to 0 to disable average processing.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5006	---	Edge Detection Method	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Edge Detection Method	0	0 to 3	---	USINT	RW	No	Y
	02	Ch2 Edge Detection Method *2	0	0 to 3	---	USINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the settings for the Edge Detection Method object.

Set value	Description
0	Disable the function.
1	Measure every rising edge.
2	Measure every falling edge.
3	Measure every rising and falling edge.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5011	---	Encoder Count Direction	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Count Direction	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Encoder Count Direction *2	0	0 or 1	---	USINT	RW	No	Y

*1. The values for the NX-EC0112, NX-EC0122, NX-EC0132, or NX-EC0142 are 1. The values for the NX-EC0212 or NX-EC0222 are 2.

*2. This object does not exist on the NX-EC0112, NX-EC0122, NX-EC0132, and NX-EC0142.

- The following table shows the settings of the Encoder Counter Direction object.

Set value	Description
0	Positive direction of phase A
1	Positive direction of phase B

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5012	---	External Input 0 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 0 Function Selection	0	0 to 4	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the settings for the External Input 0 object.

Set value	Description
0	General input (factory default)
1	Latch input 1
2	Latch input 2
3	Gate input
4	Reset input

Precautions for Correct Use

Except for the general input setting, you cannot set more than one of the external inputs 0 through 2 to the same setting. If the same setting is used for more than one external input, all external inputs 0 through 2 are disabled and an External Input Setting Error event will occur.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5013	---	External Input 0 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 0 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the logic settings for the External Input 0 object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5014	---	External Input 1 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 1 Function Selection	0	0 to 4	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the settings for the External Input 1 object.

Set value	Description
0	General input (factory default)
1	Latch input 1
2	Latch input 2
3	Gate input
4	Reset input

Precautions for Correct Use

Except for the general input setting, you cannot set more than one of the external inputs 0 through 2 to the same setting. If the same setting is used for more than one external input, all external inputs 0 through 2 are disabled and an External Input Setting Error event will occur.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5015	---	External Input 1 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 1 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the logic settings for the External Input 1 object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5016	---	External Input 2 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 2 Function Selection	0	0 to 4	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the settings for the External Input 2 object.

Set value	Description
0	General input (factory default)
1	Latch input 1
2	Latch input 2
3	Gate input
4	Reset input

Precautions for Correct Use

Except for the general input setting, you cannot set more than one of the external inputs 0 through 2 to the same setting. If the same setting is used for more than one external input, all external inputs 0 through 2 are disabled and an External Input Setting Error event will occur.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5017	---	External Input 2 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1 *1	1 *1	---	USINT	RO	No	---
	01	Ch1 External Input 2 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

*1. Setting is not possible for the NX-EC0212 and NX-EC0222.

- The following table shows the logic settings for the External Input 2 object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

A-2-3 SSI Input Units

This section describes the product information objects, I/O allocation objects, and message communications objects for SSI Input Units.

Unit Information Objects

These objects are related to product information.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
1000	---	NX Bus Identity information	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	No	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	No	---
	06	Unit Version	*2	---	---	UDINT	RO	No	---
1001	---	Production Info							
	00	Number of Entries	4	4	---	USINT	RO	No	---
	01	Lot Number	*3	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---

*1. This returns the model of the Unit in ASCII. If all 12 bytes are not required, the remaining bytes are filled with spaces ($20).

*2. Bits 24 to 31: Integer part of the unit version
Bits 16 to 23: Decimal part of the unit version
Bits 0 to 15: Reserved

*3. Bits 24 to 31: Day of month of manufacture
Bits 16 to 23: Month of manufacture
Bits 8 to 15: Year of manufacture
Bits 0 to 7: Reserved

I/O Allocation Objects

The following objects are assigned to I/O or used in message communications.

If you assign any of the objects that are described below to I/O, you can no longer access those objects with the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O alloca-tion	Data attri-bute
6000	---	SSI Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 SSI Status	00 hex	00 to FF hex	---	BYTE	RO	Yes	---
	02	Ch2 SSI Status *2	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the bit configuration of the SSI Status object.

Bit	Status name	Description
0	Data Refresh Status	This bit indicates when the position data changes from its previous value. This bit toggles between 0 and 1 every time the data changes.
1	SSI Communications Error Status	1: Error occurred. 0: No errors occurred.
2	SSI Communications Enabled*1	1: SSI communications enabled. 0: SSI communications disabled.

*1. The status of this bit depends on the value of the SSI Communications Enable bit in the SSI Operation Command object. Refer to *SSI Operation Command* on page 7-35 for information on the SSI Operation Command object.

Additional Information

The error status in the SSI Status object and the SSI Communications Error Code object are both set to 0 when the data is received without an error.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6002	---	Encoder Present Position	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Present Position	0	–2147483648 to 2,147,483,647	---	DINT	RO	Yes	---
	02	Ch2 Encoder Present Position *2	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6008	---	SSI Communications Error Code	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 SSI Communications Error Code	00 hex	00 to FF hex	---	BYTE	RO	Yes	---
	02	Ch2 SSI Communications Error Code *2	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The error code shows the communications status in each cycle. A value of 0 is returned on success, or the error code is returned on failure.
  An SSI Communications Error event occurs when there is an SSI communications error, so you can check the error code in the attached information.
- The following table shows the bit configuration of the SSI Communications Error Code object.

Bit	Status name
0	No error
1	Communications preparation incomplete
2	Frame Error
3	Parity Error
4	Communications timeout
5	Out of range for position difference

Additional Information

The error status in the SSI Status object and the SSI Communications Error Code object are both set to 0 when the data is received without an error.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6009	---	Status Data	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Status Data	00000000 hex	00000000 to FFFFFFFF hex	---	DWORD	RO	Yes	---
	02	Ch2 Status Data *2	00000000 hex	00000000 to FFFFFFFF hex	---	DWORD	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
600A	---	Encoder Present Position Refresh Count	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Present Position Refresh Count	0	0 to 65535	---	UINT	RO	Yes	---
	02	Ch2 Encoder Present Position Refresh Count *2	0	0 to 65535	---	UINT	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- This bit is incremented by 1 every time the present value is refreshed. The value returns to 0 after it exceeds 65,535.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6010	---	Time Stamp	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	CH1 Time Stamp	0	0000000000000000 to FFFFFFFFFFFFFFFF hex	---	ULINT	RO	Yes	---
	02	CH2 Time Stamp *2	0	0000000000000000 to FFFFFFFFFFFFFFFF hex	---	ULINT	RO	Yes	---

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- This object gives the times when the present value data was changed.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	SSI Operation Command	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 SSI Operation Command	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N
	02	Ch2 SSI Operation Command *2	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the bit configuration of the SSI Operation Command object.

Bit	Data name	Description
0	SSI Communications Enable	1: SSI communications enabled. 0: SSI communications disabled.

Other Objects

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Baud Rate	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Baud Rate	4	0 to 7	---	USINT	RW	No	Y
	02	Ch2 Baud Rate *2	4	0 to 7	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the settings of the Baud Rate object.

Set value	Description
0	100 kHz
1	200 kHz
2	300 kHz
3	400 kHz
4	500 kHz
5	1.0 MHz
6	1.5 MHz
7	2.0 MHz

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	SSI Communications Start-UP Time	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 SSI Communications Startup Time	0	0 to 3	---	USINT	RW	No	Y
	02	Ch2 SSI Communications Startup Time *2	0	0 to 3	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the wait time until SSI communications are started from the time that I/O power is supplied to the SSI Encoder Unit after the power supply is turned ON or after the NX Unit is restarted after the SSI Input Unit starts operation.
- The following table shows the settings for the SSI Communications Start-up Time object.

Set value	Description
0	2,000 ms
1	1,050 ms
2	500 ms
3	No delay

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Wait Time for Receive Enabled	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Wait Time for Receive Enabled	0	0 to 9999	10 μs	UINT	RW	No	Y
	02	Ch2 Wait Time for Receive Enabled *2	0	0 to 9999	10 μs	UINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the wait time until the next frame can be sent.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5003	---	Monoflop Time	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Monoflop Time	4	1 to 9999	10 μs	UINT	RW	No	Y
	02	Ch2 Monoflop Time *2	4	1 to 9999	10 μs	UINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the duration from when the last clock is sent until the high level is confirmed on the data line.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Conversion Wait Time	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Conversion Wait Time	0	0 to 64	---	USINT	RW	No	Y
	02	Ch2 Conversion Wait Time *2	0	0 to 64	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the wait time from the falling edge of the first clock signal to the rising edge.
  Wait time = Clock period × Set value
- If the object is set to 0, the wait time is half of the clock period.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Valid Data Length	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Valid Data Length	25	1 to 32	Bit	USINT	RW	No	Y
	02	Ch2 Valid Data Length *2	25	1 to 32	Bit	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the valid data length for SSI data.
- If the sum of the valid data length and the leading bits is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5006	---	Single-turn Data Start Bit	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Single-turn Data Start Bit	12	0 to 31	---	USINT	RW	No	Y
	02	Ch2 Single-turn Data Start Bit *2	12	0 to 31	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the start bit position for single-turn data.
- If the sum of the values set for the Single-turn Data Start Bit and the Single-turn Data Length objects is greater than the Valid Data Length object, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5007	---	Single-turn Data Length	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Single-turn Data Length	13	0 to 32	Bit	USINT	RW	No	Y
	02	Ch2 Single-turn Data Length *2	13	0 to 32	Bit	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the data length for single-turn data.
- If the sum of the values set for the Multi-turn Data Length, Single-turn Data Length, and Status Data Length objects is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5008	---	Multi-turn Data Start Bit	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Multi-turn Data Start Bit	0	0 to 31	---	USINT	RW	No	Y
	02	Ch2 Multi-turn Data Start Bit *2	0	0 to 31	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set the start bit position for multi-turn data.
- If the sum of the values set for the Multi-turn Data Start Bit and the Multi-turn Data Length objects is greater than the Valid Data Length object, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5009	---	Multi-turn Data Length	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Multi-turn Data Length	12	0 to 32	Bit	USINT	RW	No	Y
	02	Ch2 Multi-turn Data Length *2	12	0 to 32	Bit	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the data length for multi-turn data.
- If the sum of the values set for the Multi-turn Data Length, Single-turn Data Length, and Status Data Length objects is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500A	---	Status Data Start Bit	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Status Data Start Bit	0	0 to 31	---	USINT	RW	No	Y
	02	Ch2 Status Data Start Bit *2	0	0 to 31	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the start bit position for status data.
- If the sum of the values set for the Status Data Start Bit and the Status Data Length objects is greater than the Valid Data Length object, SSI communications are disabled and the SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500B	---	Status Data Length	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Status Data Length	0	0 to 32	Bit	USINT	RW	No	Y
	02	Ch2 Status Data Length *2	0	0 to 32	Bit	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the data length for status data.
- If the sum of the multi-turn data length, single-turn data length, and status data length is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500C	---	Leading Bits	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Leading Bits	0	0 to 31	Bit	USINT	RW	No	Y
	02	Ch2 Leading Bits *2	0	0 to 31	Bit	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the leading bits for SSI data.
- If the sum of the valid data length and the leading bits is greater than 32, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500D	---	Parity Check	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Parity Check	0	0 to 2	---	USINT	RW	No	Y
	02	Ch2 Parity Check *2	0	0 to 2	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the settings for the Parity Check object.

Set value	Description
0	No check
1	Even parity check
2	Odd parity check

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500E	---	Encoder Resolution	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Resolution	0	0 to 4,294,967,295	---	UDINT	RW	No	Y
	02	Ch2 Encoder Resolution *2	0	0 to 4,294,967,295	---	UDINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the resolution for single-turn data.
- If this object is set to 0, the resolution is the maximum setting value for single-turn data + 1.
- If the resolution is greater than the range represented by the value set for the Single-turn Data Length object, SSI communications are disabled and an SSI Data Setting Error event occurs.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500F	---	Coding Method	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Coding Method	3	0 to 4	---	USINT	RW	No	Y
	02	Ch2 Coding Method *2	3	0 to 4	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the settings for the Coding Method Setting object.

Set value	Description
0	No change
1	Output binary codes.
2	Change gray codes to binary codes.
3	Change binary codes to present values.
4	Change gray codes to present values.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5010	---	Position Variation Limit	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Position Variation Limit	0	0 to 2147483647	---	DINT	RW	No	Y
	02	Ch2 Position Variation Limit *2	0	0 to 2147483647	---	DINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- Set this object to the limit to the change in position from the previous position data.
- Set this object to 0 to disable the function.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5011	---	Encoder Count Direction	No	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	No	---
	01	Ch1 Encoder Count Direction	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Encoder Count Direction *2	0	0 or 1	---	USINT	RW	No	Y

*1. The values for the NX-ECS112 are 1. The values for the NX-ECS212 are 2.

*2. This object does not exist on the NX-ECS112.

- The following table shows the settings of the Encoder Counter Direction Setting object.

Set value	Description
0	Not to invert the sign.
1	Invert the sign.

A-2-4 Pulse Output Units

This section describes the product information objects, I/O allocation objects, and message communications objects for the Pulse Output Unit.

Unit Information Objects

These objects are related to product information.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
1000	---	NX Bus Identity information	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	No	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	No	---
	06	Unit Version	*2	---	---	UDINT	RO	No	---
1001	---	Production Info							
	00	Number of Entries	4	4	---	USINT	RO	No	---
	01	Lot Number	*3	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---

*1. This returns the model of the Unit in ASCII. If all 12 bytes are not required, the remaining bytes are filled with spaces ($20).

*2. Bits 24 to 31: Integer part of the unit version
Bits 16 to 23: Decimal part of the unit version
Bits 0 to 15: Reserved

*3. Bits 24 to 31: Day of month of manufacture
Bits 16 to 23: Month of manufacture
Bits 8 to 15: Year of manufacture
Bits 0 to 7: Reserved

I/O Allocation Objects

The following objects are assigned to I/O or used in message communications.

If you assign any of the objects that are described below to I/O, you can no longer access those objects with the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on the Read NX Unit Object instruction or the Write NX Unit Object instruction.

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6000	---	Statusword	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Statusword	0070 hex	0000 to 00FF hex	---	WORD	RO	Yes	---

- The following table shows the bit configuration of the Encoder Counter Status object.

Bit	Status name
0	Ready to Switch ON
1	Switched ON
2	Operation Enabled
3	Fault
4	Voltage Enabled
5	Quick Stop Done
6	Switch ON Disabled

Index (hex)	Subin-dex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allo-cat-ion	Data attri-bute
6001	---	External Input Status	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Input Status	00 hex	00 to FF hex	---	BYTE	RO	Yes	---

- The following table shows the bit configuration of the External Input Status object.

Bit	Status name	Description
0	External Input 0 Status	1: External input 0 ON. 0: External input 0 OFF.
1	External Input 1 Status	1: External input 1 ON. 0: External input 1 OFF.

Note You can use the External Input Status object to monitor the ON/OFF status, regardless of the device setting of the external input.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6002	---	Command Present Position	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Command Present Position	0000 hex	0000 to 00FF hex	---	DINT	RO	Yes	---

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6004	---	Latch Status	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Latch Status	0000 hex	0000 to FFFF hex	---	WORD	RO	Yes	---

- The following table shows the bit configuration of the Latch Status object.

Bit	Status name	Description
0	Latch Input 1 Enabled*1	1: Latch Input 1 enabled. 0: Latch Input 1 disabled.
1	Latch Input 1 Completed Flag*2	1: Data was latched for Latch Input 1. 0: No data was latched for Latch Input 1
8	Latch Input 2 Enabled*3	1: Latch Input 2 enabled. 0: Latch Input 2 disabled.
9	Latch Input 2 Completed Flag*4	1: Data was latched for Latch Input 2. 0: No data was latched for Latch Input 2

*1. This bit changes according to the setting of the Latch Input 1 Enable bit for latching. Refer to *Latch Function* on page 8-38 for information on latching.

*2. This bit is cleared when the Latch Input 1 Enable bit changes from 1 to 0.

*3. This bit changes according to the setting of the Latch Input 2 Enable bit for latching. Refer to *Latch Function* on page 8-38 for information on latching.

*4. This bit is cleared when the Latch Input 2 Enable bit changes from 1 to 0.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6005	---	Latch Input 1 Data	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Latch Input 1 Data	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

- The value latched by Latch Input 1 from external input 0 is displayed.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6006	---	Latch Input 2 Data	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Latch Input 2 Data	0	–2147483648 to 2147483647	---	DINT	RO	Yes	---

• The value latched by latch input 2 from external input 1 is displayed.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	Controlword	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Controlword	0000 hex	0000 to 00FF hex	---	WORD	RW	Yes	N

• The following table shows the bit configuration of the Controlword object.

Bit	Data name
0	Switch ON
1	Enable Voltage
2	Quick Stop Done
3	Enable Operation
7	Fault Reset

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7001	---	External Output	No	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Output	00 hex	00 to 01 hex	---	BYTE	RW	Yes	N

• The following table shows the settings of the External Output object.

Bit	Data name	Description
0	External output	1: Output ON 0: Output OFF

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7002	---	Command Position	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Command Position	0	–2147483648 to 2147483647	---	DINT	RW	Yes	N

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7003	---	Command Velocity	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Command Velocity	0	−2147483648 to 2147483647	pps	DINT	RW	Yes	N

Additional Information

The command velocity is only used when the Output Mode Selection parameter is set to a velocity-continuous pulse output.

For position-synchronous pulse output, the set value for the Command Velocity object is ignored.

The command velocity for velocity-continuous pulse output is signed 32-bit (DINT) data. However, the set value itself is handled as an absolute value, regardless of the sign. The pulse output direction is determined by the sign of the command position.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7004	---	Latch Function	No	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Latch Function	0000 hex	0000 to FFFF hex	---	WORD	RW	Yes	N

- If a latch has not been assigned to an external input, no latch operation is performed.
- The following table shows the settings of the Latch Function object.

Bit	Data name	Description
0	Latch Input 1 Enable	1: Enable the latch input 1. 0: Disable the latch input 1.
1	Latch Input 1 Trigger Condition	0: One-shot Mode 1: Continuous Mode
2	Latch Input 1 Trigger Selection	0: External input 1: Phase-Z input.*1
6	Latch Input 1 Motion Stop Enable	0: No stop 1: Immediate stop
8	Latch Input 2 Enable	1: Enable the latch input 2. 0: Disable the latch input 2.
9	Latch Input 2 Trigger Condition	0: One-shot Mode 1: Continuous Mode
10	Latch Input 2 Trigger Selection	0: External input 1: Phase-Z input.*1
14	Latch Input 2 Motion Stop Enable	0: No stop 1: Immediate stop

*1. The Pulse Output Unit does not have a phase-Z input. If you use the latch function, set the Latch Input 1 Trigger Selection and Latch Input 2 Trigger Selection bits to 0. Latch inputs are not detected if you set these bits to 1.

Other Objects

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Pulse Output Method	No	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Pulse Output Method	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the Pulse Output Method object.

Set value	Description
0	Forward/reverse direction pulse
1	Pulse + Direction

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Output Mode Selection	No	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Output Mode Selection	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the Output Mode Selection object.

Set value	Description
0	Position-synchronous pulse output (for servomotor control)
1	Velocity-continuous pulse output (for stepping motor control)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Pulse Direction Change Delay	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Pulse Direction Change Delay	5	5 to 4,000	μs	UINT	RW	No	Y

- Set this object to the pulse direction change delay.
- This setting is valid only for velocity-continuous pulse output.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5012	---	External Input 0 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Input 0 Function Selection	1	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Input 0 Function Selection object.

Set value	Description
0	General input
1	Latch input 1

- To use the latch, you must set the Latch Input 2 Trigger Selection bit to 0 (external input).

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5013	---	External Input 0 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Input 0 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Input 1 Logic Selection object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5014	---	External Input 1 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Input 1 Function Selection	1	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Input 1 Function Selection object.

Set value	Description
0	General input
1	Latch input 2

- To use the latch, you must set the Latch Input 2 Trigger Selection bit to 0 (external input).

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5015	---	External Input 1 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Input 1 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Input 1 Logic Selection object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5018	---	External Output 0 Function Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Output 0 Function Selection	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Output 0 Function Selection object.

Set value	Description
0	General output
1	Error counter reset output

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5019	---	External Output 0 Logic Selection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 External Output 0 Logic Selection	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the External Output 0 Logic Selection object.

Set value	Description
0	N.O. (Normally open)
1	N.C. (Normally close)

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5020	---	Load Rejection Output Setting	No	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Load Rejection Output Setting	0	0 or 1	---	USINT	RW	No	Y

- The following table shows the settings for the Load Rejection Output Setting object.

Set value	Description
0	Immediate stop
1	Deceleration stop with set deceleration rate

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5021	---	Deceleration at Load Rejection	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Deceleration at Load Rejection	0	0 to 500,000,000	ms	UDINT	RW	No	Y

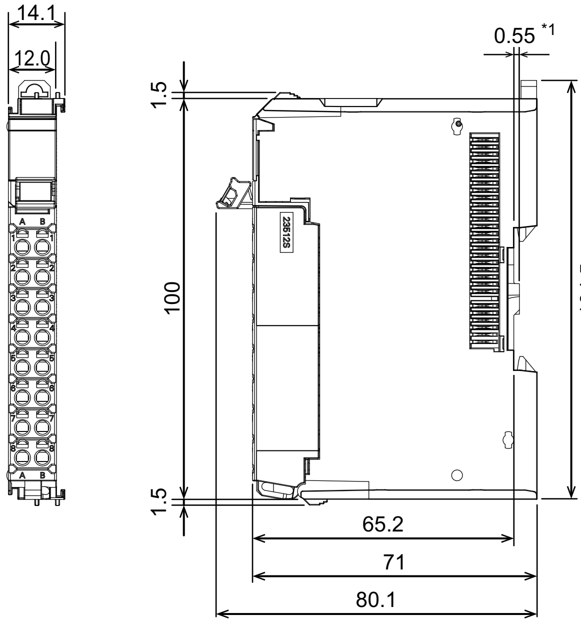
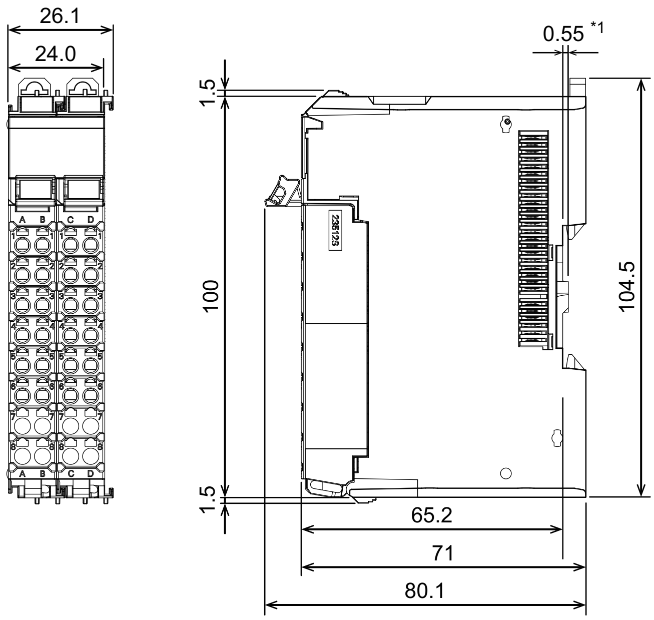
- This object sets the deceleration rate used when the Load Rejection Output Setting object is set to *Deceleration stop with set deceleration rate*.
- The deceleration rate sets the time for deceleration from the pulse output maximum velocity (500 kpps).

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5022	---	Number of Synchronization Command Interpolations	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	No	---
	01	Ch1 Number of Synchronization Command Interpolations	2	0 to 16	Interpolations	UINT	RW	No	Y

- This object sets the maximum number of interpolations for missing synchronization commands.
- Set this object to 0 to disable the function.

A-3 Dimensions

This section gives the dimensions of the Position Interface Units.

Unit width	Model	Dimensions (mm)
12 mm	NX-EC0112 NX-EC0122 NX-EC0212 NX-EC0222 NX-ECS112 NX-ECS212 NX-PG0112 NX-PG0122	
24 mm	NX-EC0132 NX-EC0142	

*1. The dimension is 1.35 mm for Units with lot numbers through December 2014.

A-4 Terminal Block Model Numbers

This appendix describes how to interpret Terminal Block model numbers and the Terminal Block models that are applicable to each Unit.

A-4-1 Model Number Notation

The Terminal Block model numbers are assigned based on the following rules.

NX-TB□□□□

Product Type
TB: Terminal block

Terminal Specification
A: Column number indications A and B, no functional ground terminals
B: Column number indications C and D, no functional ground terminals
C: Column number indications A and B, functional ground terminals

Number of Terminals
08: 8 terminals
12: 12 terminals
16: 16 terminals

Other Specification
1: Terminal current capacity of 4 A
2: Terminal current capacity of 10 A

A-4-2 Model Number Table

The following table lists the Terminal Blocks

Terminal Block model number	No. of terminals	Ground terminal mark	Terminal current capacity
NX-TBA081	8	None	4 A
NX-TBA121	12	None	4 A
NX-TBA161	16	None	4 A
NX-TBB121	12	None	4 A
NX-TBB161	16	None	4 A
NX-TBA082	8	None	10 A
NX-TBA122	12	None	10 A
NX-TBA162	16	None	10 A
NX-TBB122	12	None	10 A
NX-TBB162	16	None	10 A
NX-TBC082	8	Provided	10 A
NX-TBC162	16	Provided	10 A

Note When you purchase a Terminal Block, purchase an NX-TB○○○2.

A-5 Version Information

This section describes the compatibility between the versions of the Position Interface Units, Communications Coupler Units, CPU Units, and Sysmac Studio, and it provides information on specification changes for each unit version.

Compatibility for the Unit Versions of the Position Interface Units

This section describes the relationships between the versions of the Position Interface Units, and the versions of the Communications Coupler Units, CPU Units, and Sysmac Studio.

Interpreting the Version Combination Tables

The items that are used in the version combination tables are given below.

NX Units		Corresponding versions				
		EtherCAT			EtherNet/IP	
Model	Unit version	Communications Coupler Unit	CPU Unit	Sysmac Studio	Communications Coupler Unit	Sysmac Studio
This is the model number of the NX Unit.	This is the unit version of the NX Unit.	This is the unit version of the EtherCAT Coupler Unit that supports the NX Units.	This is the unit version of the NJ/NX-series CPU Units that support the EtherCAT Coupler Unit.	This is the version of the Sysmac Studio that supports the NX Units, EtherCAT Coupler Unit, and CPU Unit.	This is the unit version of the EtherNet/IP Coupler Unit that supports the NX Units.	This is the version of the Sysmac Studio that supports the NX Units and EtherNet/IP Coupler Unit.

Version Combination Tables

- If you use any of the combinations of versions in the following table, you can use all of the functions that are supported by that unit version of the Position Interface Unit. Use the versions (or later/higher versions) that correspond to the models and unit versions of the NX Units that you will use. You cannot use the specifications that were added or changed for the relevant NX Unit models and the unit versions unless you use the corresponding versions or later/higher versions.
- If you use the corresponding versions given in the following table or later/higher versions, refer to version information on the Communications Coupler Unit and CPU Unit.

Refer to *Functions That Were Added or Changed for Each Unit Version* on page A-67 for the functions that are supported by each unit version of the Communications Coupler Units and Position Interface Units.

NX Units		Corresponding versions[*1]				
		EtherCAT			EtherNet/IP	
Model	Unit version	Communica-tions Coupler Unit	CPU Unit	Sysmac Studio	Communi-cations Coupler Unit	Sysmac Studio
NX-EC0112	Ver.1.1	Ver.1.1 [*2]	Ver.1.06 [*2]	Ver.1.10	Ver.1.0	Ver.1.10
	Ver.1.2			Ver.1.12		
NX-EC0122	Ver.1.0			Ver.1.07		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		
NX-EC0132	Ver.1.1			Ver.1.10		
	Ver.1.2			Ver.1.12		
NX-EC0142	Ver.1.0			Ver.1.07		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		
NX-EC0212	Ver.1.1			Ver.1.10		
	Ver.1.2			Ver.1.12		
NX-EC0222	Ver.1.0			Ver.1.07		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		
NX-ECS112	Ver.1.0			Ver.1.07		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		
NX-ECS212	Ver.1.0			Ver.1.07		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		
NX-PG0112	Ver.1.1	Ver.1.0	Ver.1.05	Ver.1.10	---	---
	Ver.1.2			Ver.1.12		
NX-PG0122	Ver.1.0			Ver.1.06		
	Ver.1.1			Ver.1.08		
	Ver.1.2			Ver.1.12		

*1. Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

*2. You can use the following versions if time stamp refreshing is not used.
EtherCAT Coupler Unit: Version 1.0
NJ-series CPU Unit: Version 1.05

Functions That Were Added or Changed for Each Unit Version

- The following table shows the relationships between the unit versions/version of the NX Units, Communications Coupler Units, CPU Units, and Sysmac Studio for changes in or additions to the functions.
- You can use the added or changed functions with the versions given in the table or with later/higher versions.
- If you use the corresponding versions given in the following table or later/higher versions, refer to version information on the Communications Coupler Unit and CPU Unit.
- Refer to *Interpreting the Version Combination Tables* on page A-65 for information on interpreting the table.

Function	Change or addition	NX Units		Corresponding versions[*1]				
				EtherCAT			EtherNet/IP	
		Model	Unit version	Communications Coupler Unit	CPU Unit	Sysmac Studio	Communications Coupler Unit	Sysmac Studio
Task period prioritized refreshing	Addition	NX-EC0112 NX-EC0122 NX-EC0132 NX-EC0142 NX-EC0212 NX-EC0222 NX-ECS112 NX-ECS212 NX-PG0112 NX-PG0122	Ver.1.2	Ver.1.3	Ver.1.05	Ver.1.13	---	---
Restarting a specified NX Unit[*2]	Addition	NX-EC0122 NX-EC0142 NX-EC0222 NX-ECS112 NX-ECS212	Ver.1.1	Ver.1.2	Ver.1.07 *3	Ver.1.08	Ver. 1.0	Ver. 1.10
		NX-PG0122					---	---
		NX-EC0112 NX-EC0132 NX-EC0212				Ver.1.10	Ver. 1.0	Ver. 1.10
		NX-PG0112					---	---
Monitoring total power-ON time[*4]	Addition	NX-EC0122 NX-EC0142 NX-EC0222 NX-ECS112 NX-ECS212	Ver.1.1	Ver.1.2	Ver.1.05	Ver.1.08	Ver.1.0	Ver.1.10
		NX-PG0122					---	---
		NX-EC0112 NX-EC0132 NX-EC0212				Ver.1.10	Ver.1.0	Ver.1.10
		NX-PG0112					---	---

*1. Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

*2. Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-03 or later) for information on how to restart a specified NX Unit.

*3. A CPU Unit with unit version 1.07 or later is required to specify an NX Unit for the restart instruction. If you do not specify an NX Unit for the restart instruction, you can use version 1.05. Refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502) for information on specifying an NX Unit for the restart instruction.

*4. Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519-E1-03 or later) for information on monitoring the total power-ON time.

A-6 Applicable Motion Control Instructions

Some motion control instructions can be used together with a Pulse Output Unit and some cannot.

Some motion control instructions can be used regardless of whether you use a Pulse Output Unit.

A-6-1 Format

The following format is used to describe the motion control instructions.

Instruction name	Instruction	Outline of instruction	Attributes	Applicability

Name	Description
Instruction name	The name of the motion control instruction.
Instruction	The motion control instruction.
Outline of instruction	A brief description of the instruction.
Attributes	Whether the instruction is related to the presence of a Pulse Output Unit. A: Related to a Pulse Output Unit. ---: Not related to a Pulse Output Unit.
Applicability	Whether the instruction can be used together with a Pulse Output Unit. Yes: Can be used. No: Cannot be used.

A-6-2 Common Commands

Common commands are commands that are implemented by instructions that are not related to the presence of a Pulse Output Unit.

Instruction name	Instruction	Outline of instruction	Attributes	Applicability
Set Cam Table Properties	MC_SetCamTableProperty	The MC_SetCamTableProperty instruction updates the end point index of the cam table that is specified in an input parameter.	---	Yes
Save Cam Table	MC_SaveCamTable	The MC_SaveCamTable instruction saves the cam table specified with the input parameter to non-volatile memory.	---	Yes
Writing MC Setting	MC_Write	The MC_Write instruction writes parts of the motion control parameters.	---	Yes
Generate Cam Table	MC_GenerateCamTable	The MC_GenerateCamTable instruction creates a cam table for the cam properties and cam nodes specified in the I/O parameters.	---	Yes
Write Axis Parameters	MC_WriteAxisParameter	The MC_WriteAxisParameter instruction writes axis parameter settings.	---	Yes
Read Axis Parameters	MC_ReadAxisParameter	The MC_ReadAxisParameter instruction reads axis parameter settings.	---	Yes

A-6-3 Instructions for Axis Commands

The instructions for axis commands are given in the following table.

Instruction name	Instruction	Outline of instruction	Attri-butes	Applica-bility
Power Servo	MC_Power	The MC_Power instruction makes a Servo Drive ready to operate.	A	Yes *1
Jog	MC_MoveJog	The MC_MoveJog instruction jogs an axis according to the specified target velocity.	A	Yes
Home	MC_Home	The MC_Home instruction operates the motor to determine home. It uses the limit signals, home proximity signal, and home signal.	A	Yes*2
Home with Parameters	MC_HomeWithParameter	The MC_HomeWithParameter instruction sets the homing parameter and operates the motor to determine home. It uses the limit signals, home proximity signal, and home signal.	A	Yes
Positioning	MC_Move	The MC_Move instruction performs absolute positioning or relative positioning.	A	Yes
Absolute Positioning	MC_MoveAbsolute	The MC_MoveAbsolute instruction performs positioning to a specified absolute target position.	A	Yes
Relative Positioning	MC_MoveRelative	The MC_MoveRelative instruction performs positioning for the specified travel distance from the command current position.	A	Yes
Velocity Control	MC_MoveVelocity	The MC_MoveVelocity instruction performs velocity control with the Position Control Mode of the Servo Drive.	A	Yes
High-speed Home	MC_MoveZeroPosition	The MC_MoveZeroPosition instruction performs positioning with an absolute position of 0 as the target position to return to home.	A	Yes
Interrupt Feeding	MC_MoveFeed	The MC_MoveFeed instruction performs positioning for the specified travel distance from the position where an external device triggers an interrupt input.	A	Yes
Stop	MC_Stop	The MC_Stop instruction decelerates an axis to a stop.	A	Yes
Immediate Stop	MC_ImmediateStop	The MC_ImmediateStop instruction stops an axis according to the stopping mode that is set with the *StopMode* (Stopping Mode Selection) input variable regardless of the status of the axis.	A	Yes
Set Position	MC_SetPosition	The MC_SetPosition instruction changes the command current position or the actual current position of an axis as required.	A	Yes
Set Override Factors	MC_SetOverride	The MC_SetOverride instruction changes the target velocity for an axis.	A	Yes

Instruction name	Instruction	Outline of instruction	Attri-butes	Applica-bility
Reset Following Error	MC_ResetFollowingError	The MC_ResetFollowingError instruction resets the following error between the command position and the actual position.	A	Yes *3
Start Cam Operation	MC_CamIn	The MC_CamIn instruction starts a cam operation by using a specified cam table.	A	Yes
End Cam Operation	MC_CamOut	The MC_CamOut instruction ends the cam operation for the axis specified with the input parameter.	A	Yes
Start Gear Operation	MC_GearIn	The MC_GearInPos instruction sets the gear ratio between the master axis and the slave axis and performs electronic gear operation.	A	Yes
Positioning Gear Operation	MC_GearInPos	The MC_GearInPos instruction performs electronic gear operation for the specified gear ratio between the master axis and the slave axis. The positions at which to start synchronizing the master axis and slave axis are specified.	A	Yes
End Gear Operation	MC_GearOut	The MC_GearOut instruction stops execution of the MC_GearIn and MC_GearInPos instructions.	A	Yes
Synchronous Positioning	MC_MoveLink	The MC_MoveLink instruction performs positioning in sync with the specified master axis.	A	Yes
Combine Axes	MC_CombineAxes	The MC_CombineAxes instruction outputs the sum or difference of the command positions of two axes.	A	Yes
Shift Master Axis	MC_Phasing	The MC_Phasing instruction shifts the phase of the master axis currently in synchronized control.	A	Yes
Torque Control	MC_TorqueControl	The MC_TorqueControl instruction uses the Torque Control Mode of the Servo Drive to control the torque.	---	No *4
Set Torque Limit	MC_SetTorqueLimit	The MC_SetTorqueLimit instruction limits the torque output from the Servo Drive through the torque limit function of the Servo Drive.	---	No *4
Zone Monitor	MC_ZoneSwitch	The MC_ZoneSwitch instruction determines if the command position or actual current position of an axis is within a specified zone.	---	Yes
Enable External Latch	MC_TouchProbe	The MC_TouchProbe instruction records the position of an axis when a trigger signal occurs.	A	Yes
Disable External Latch	MC_AbortTrigger	The MC_AbortTrigger instruction aborts a current latch operation.	A	Yes
Monitor Axis Following Error	MC_AxesObserve	The MC_AxesObserve instruction monitors the deviation of the command position or actual position for the specified axis to see if it exceeds the allowed value.	A	Yes
Cyclic Synchronous Velocity Control	MC_SyncMoveVelocity	The MC_SyncMoveVelocity instruction outputs the value set for the target velocity every task period to the Servo Drive in Cyclic Synchronous Velocity Mode.	---	No *4

Instruction name	Instruction	Outline of instruction	Attri-butes	Applica-bility
Cyclic Synchronous Absolute Positioning	MC_SyncMoveAbsolute	The MC_SyncMoveAbsolute instruction cyclically outputs the specified target position for the axis.	A	Yes
Reset Axis Error	MC_Reset	The MC_Reset instruction clears axis errors.	A	Yes *5
Change Axis Use	MC_ChangeAxisUse	The MC_ChangeAxisUse instruction temporarily changes the Axis Use axis parameter.	---	Yes
Enable Digital Cam Switch	MC_DigitalCamSwitch	The MC_DigitalCamSwitch instruction turns a digital output ON or OFF according to the axis position.	A	Yes
Time Stamp to Axis Position Calculation	MC_TimeStampToPos	The MC_TimeStampToPos instruction calculates the position of the axis for the specified time stamp.	A	Yes
Periodic Axis Variable Synchronization between Tasks	MC_PeriodicSyncVariables	The MC_PeriodicSyncVariables instruction periodically synchronizes Axes Variables between tasks.	---	Yes

*1. This instruction functions to enable and disable axis control (i.e., pulse output) for a Pulse Output Unit. It does not turn the power ON and OFF to the motor that is connected to the motor drive that in turn is connected to the Pulse Output Unit.

*2. When you combine a Pulse Output Unit and the MC Function Module to perform homing, set the Home Input Signal parameter in the Homing Settings in the MC Function Module to 1 (Use external home input). Also, connect the home input signal to external input 0 on the Pulse Output Unit and set the External Input 0 Function Selection parameter to latch input 1. Use an external home sensor or the encoder phase-Z signal for the external input signal. Refer to *External Input Function Selection* on page 8-65 for details.

*3. This instruction adjusts the command position according to the actual position. It does not manipulate the error counter reset output from the Pulse Output Unit. This instruction does not reset the accumulated following error in the motor drive that is connected to a Pulse Output Unit.

*4. This instruction cannot be used together with a Pulse Output Unit. If you execute it, a Process Data Object Setting Missing error occurs.

*5. This instruction resets an error condition between the MC Function Module and the Pulse Output Unit. It does not reset the error in the motor drive that is connected to a Pulse Output Unit.

A-6-4 Instructions for Axes Group Commands

The instructions for axes group commands are given in the following table.

Instruction name	Instruction	Outline of instruction	Attri-butes	Appli-cability
Enable Axes Group	MC_GroupEnable	The MC_GroupEnable instruction enables an axes group.	---	Yes
Disable Axes Group	MC_GroupDisable	The MC_GroupDisable instruction disables an axes group.	---	Yes
Linear Interpolation	MC_MoveLinear	The MC_MoveLinear instruction performs linear interpolation.	A	Yes
Absolute Linear Interpolation	MC_MoveLinearAbsolute	The MC_MoveLinearAbsolute instruction performs linear interpolation for a specified absolute position.	A	Yes
Relative Linear Interpolation	MC_MoveLInearRelative	The MC_MoveLinearRelative instruction performs linear interpolation for a specified relative position.	A	Yes
Circular 2D Interpolation	MC_MoveCircular2D	The MC_MoveCircular2D instruction performs circular interpolation for two axes.	A	Yes
Group Stop	MC_GroupStop	The MC_GroupStop instruction decelerates all of the axes in an interpolated motion to a stop.	A	Yes
Axes Group Immediate Stop	MC_GroupImmediateStop	The MC_GroupImmediateStop instruction immediately stops all axes in an interpolated motion with the method that is specified in the axis parameters.	A	Yes
Set Group Overrides	MC_GroupSetOverride	The MC_GroupSetOverride instruction changes the blended target velocity during an interpolated motion.	A	Yes
Group Reset	MC_GroupReset	The MC_GroupReset instruction clears axes group errors and axis errors.	A	Yes *1
Axes Group Cyclic Synchronous Absolute Positioning	MC_GroupSyncMoveAbsolute	The MC_GroupSyncMoveAbsolute instruction outputs the target positions in the axis coordinate system (ACS) every task period to the Servo Drive in Cyclic Synchronous Position (CSP) Control Mode.	A	Yes
Read Axes Group Position	MC_GroupReadPosition	The MC_GroupReadPosition instruction gets the command current positions and the actual current positions of an axes group.	A	Yes
Change Axes in Group	MC_ChangeAxesInGroup	The MC_ChangeAxesInGroup instruction overwrites the axes group composition axes in the axes group parameters of the MC Function Module.	---	Yes

*1. This instruction resets an error condition between the MC Function Module and the Pulse Output Unit. It does not reset the error in the motor drive that is connected to a Pulse Output Unit.

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