OMRON

Machine Automation Controller

NX-series

Communications Interface Units

User's Manual

NX-CIF□□□

Communications Interface Units

SYSMAC
always in control

W540-E1-01

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Introduction

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

This manual contains information that is necessary to use the NX-series Communications Interface Units. Please read this manual and make sure you understand the functionality and performance of the NX-series Communications 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 products.

- NX-series Communications Interface Units

  NX-CIF□□□

Part of the specifications and restrictions for the CPU Units are given in other manuals. Refer to *Relevant Manuals* on page 6 and *Related Manuals* on page 26.

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Relevant Manuals

The table below provides the relevant manuals for the NX-series Communications Interface Units.

Read all of the manuals that are relevant to your system configuration and application to make the most of the NX-series Communications Interface Units.

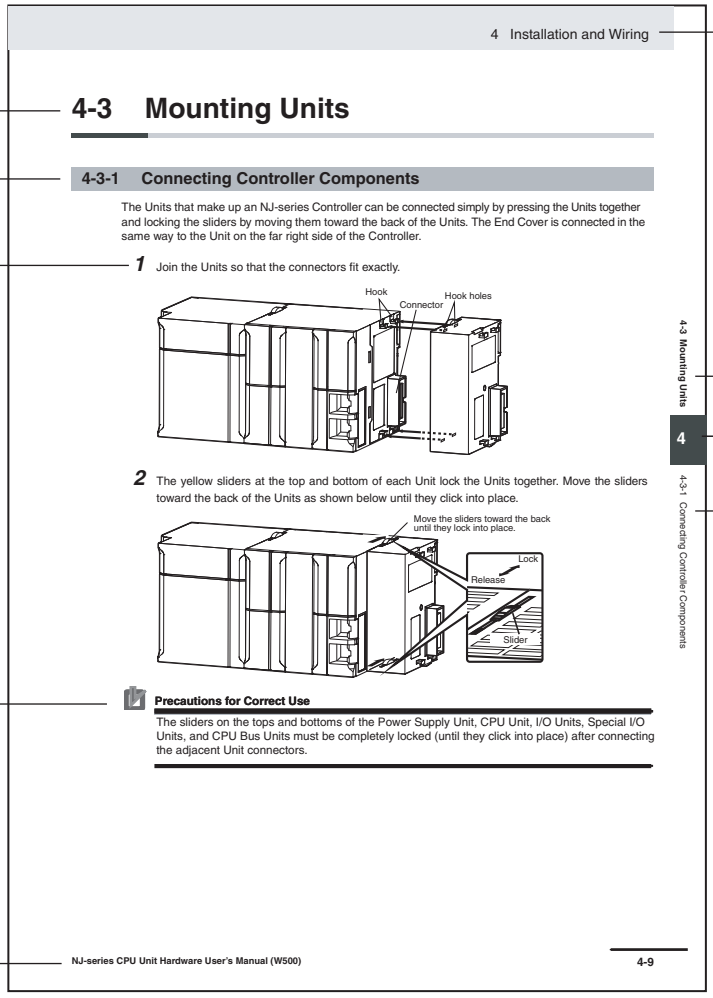
Other manuals, such as related product manuals, are necessary for specific system configurations and applications. Refer to *Related Manuals* on page 26 for the related manuals.

Manual name	Application
NX-series Communications Interface Units User's Manual	Learning how to use NX-series Communications 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.

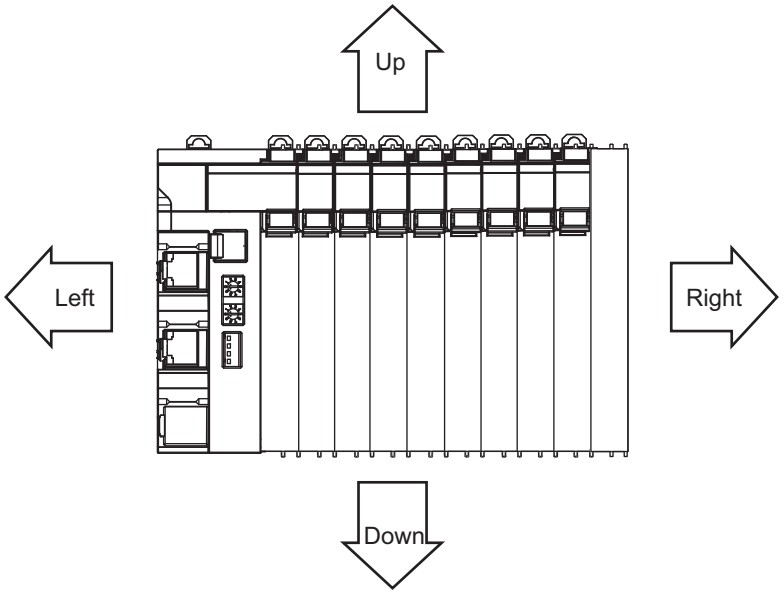
Version Information

Information on differences in specifications and functionality for CPU Units and Communications 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.

Precautions 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.



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Warranty, Limitations of Liability

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Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of an NX-series Communications 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.

Warning

⚠ WARNING

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.

Do not place heavy objects on top of the cables.

Doing so may break the cables.

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 controls 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.

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

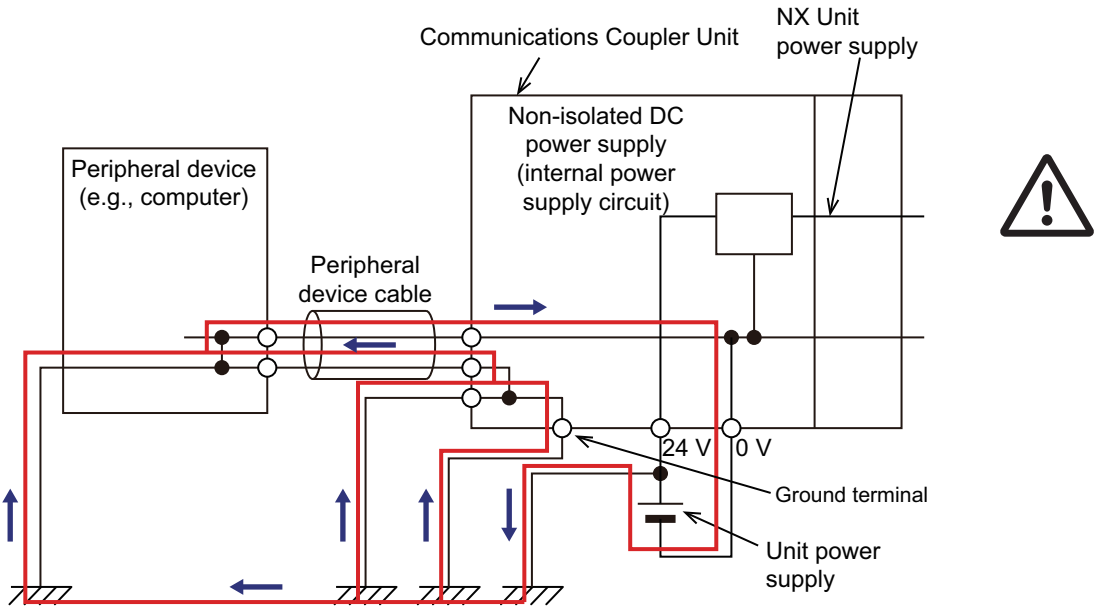
⚠ Caution

Wiring

When you connect a computer or other peripheral device to a Communications Coupler Unit or Communications Interface 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.



Tighten cable screws to the specified torque. Loose screws may result in fire or malfunction. Ask the cable manufacturer for the specified torque for the screws.

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

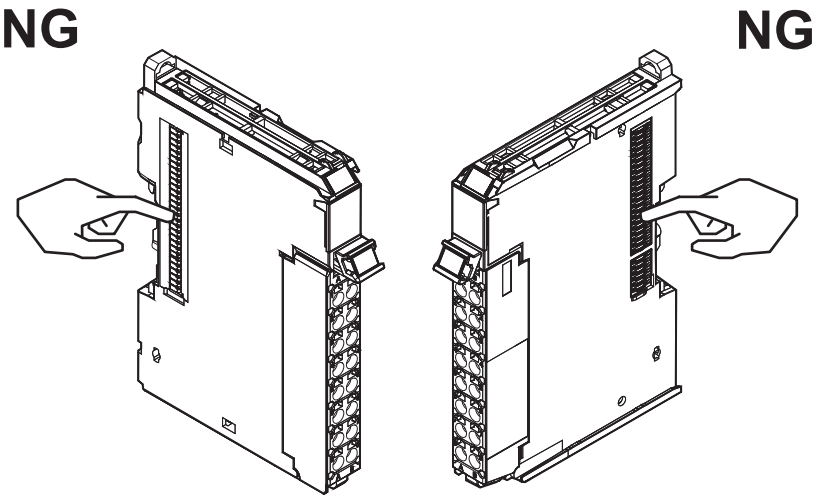
- When transporting any Unit, use the special packing box for it.
  Also, do not subject the Unit to excessive vibration or shock during transportation.
- Do not drop any Unit or subject it to abnormal vibration or shock.
  Doing so may result in Unit malfunction or burning.

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.

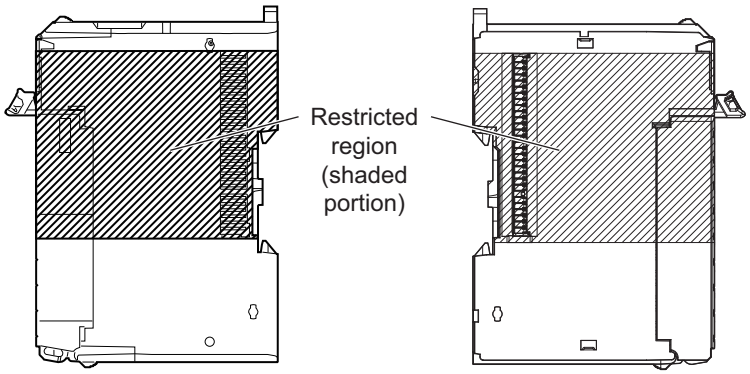
Installation

- Do not apply labels or tape to the Unit. When the Units are 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.

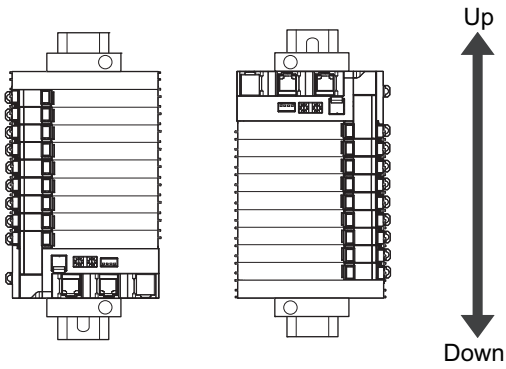


Example: NX Unit (12 mm width)

- 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

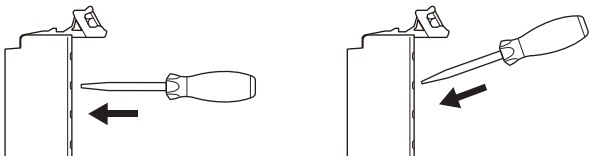
- Double-check all switches and other settings and double-check all wiring to make sure that they are correct before turning ON the power supply.

  Use the correct wiring parts and tools when you wire the system.
- Observe the following precautions when you wire communications cables. The communications cables may be broken or the Units may malfunction.
  a) Do not fold communications cables.
  b) Do not pull on communications cables with excessive force. Secure communications cables so that they are not pulled on excessively.
  c) Do not place heavy objects on top of communications cables.

  For a terminal block, cable ties can be used to secure the communications cable.
- When wiring or installing the Units, do not allow metal fragments to enter the Units.

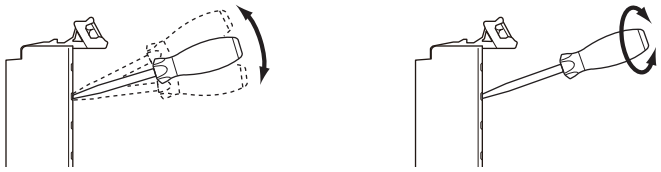
- Do not press the flat-blade screwdriver straight into the release holes on a screwless clamping terminal block. Doing so may break the terminal block.

NG **OK**



- 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.

NG **NG**



- If you use reed switches for the input contacts for AC Input Units, use switches with an allowable current of 1 A or greater. If the capacity of the reed switches is too low, inrush current may fuse the contacts.

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.
- Before you operate the controlled system with the user program, make sure that doing so will not adversely affect the controlled system.

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.

Disposal

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

Using Communications Interface Units

- Always check polarity before connecting RS-422A/485 cables. The polarity of the SDA/SDB and RDA/RDB terminals and signals are reversed for some remote devices.

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.
- Always mount an End Cover to the end of the EtherCAT Slave Terminal to protect the last NX Unit in the EtherCAT Slave Terminal. Not attaching the End Cover may result in malfunction or failure of the EtherCAT Slave Terminal.
- After you mount the Slave Terminal, always install an End Plate on each side of the Slave Terminal to secure the Slave Terminal. If you do not secure it, the Slave Terminal may be damaged or malfunction.
- Check the connector orientation and the socket and plug shapes before you connect the D-Sub connector. If the connector is not connected correctly, malfunctions may occur.
- If you use the RS-422A/485 port, check the polarity before you connect the cable. The polarity of the SDA/SDB and RDA/RDB terminals and signals are reversed for some remote devices. If the polarity is not correct, malfunctions may occur.
- If you use the RS-422A/485 port, use either two-wire or four-wire connections. Do not use both of them at the same time. If you use two-wire and four-wire connections at the same time, malfunctions may occur.
- If you use the RS-422A/485 port, ground the shield only at the CIF Unit. Do not ground it at the other end of the cable. If you ground both ends of the cable, a difference in electrical potential between the two grounds may damage the equipment.

Transferring Data

Before you transfer the communications settings to the Unit, confirm that the controlled system will not be adversely affected.

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.
- Do not exceed the NX Unit power supply capacity. If you exceed the NX Unit power supply capacity, failure or malfunction may occur.
- Use CPU Unit, Communications Coupler Unit, and Sysmac Studio versions that support the CIF Unit. If you use versions that do not support the CIF Unit, malfunctions may occur.

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.

Unit Replacement

- When removing an NX Unit, remove multiple Units together which include the one you want to remove. If you attempt to remove only one Unit, it is stuck and hard to pull out.

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.
- The SELV requirements must be satisfied 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 Communications 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 number
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

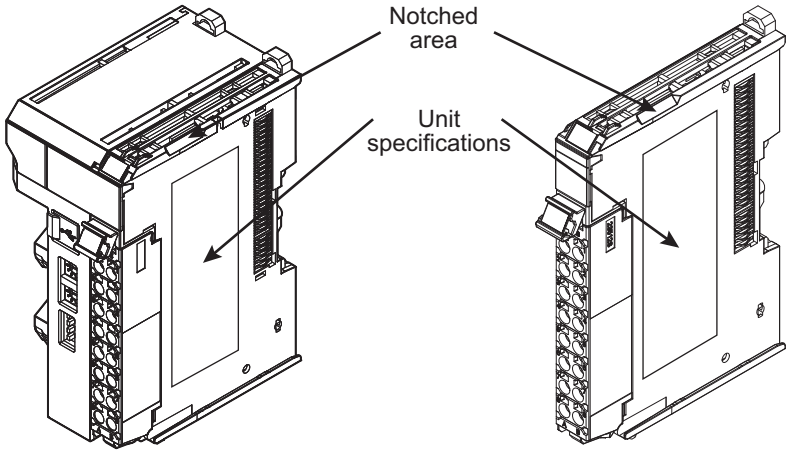
This section describes the notation that is used for unit versions, the confirmation method for unit versions, and the relationship between unit versions and Sysmac Studio versions.

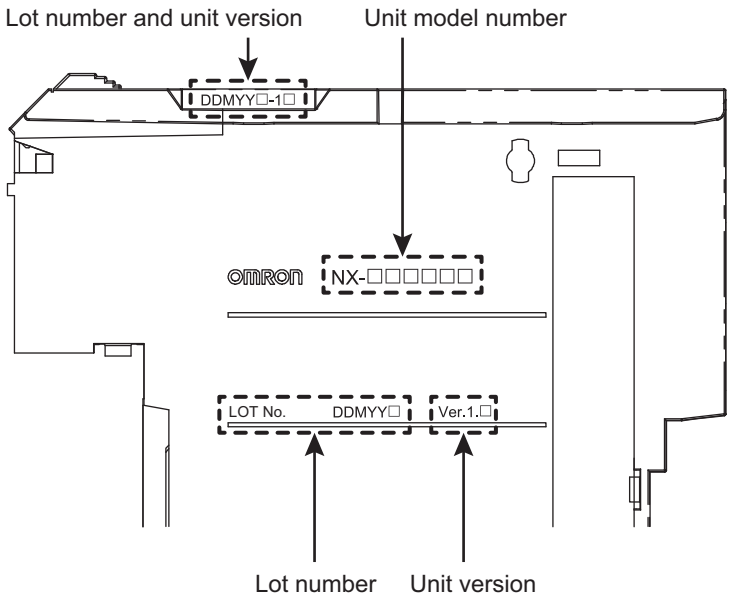
Unit Versions

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	Functions
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 ***Display Production Information*** menu command on the Sysmac Studio to check the unit versions of Communications Coupler Units 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.

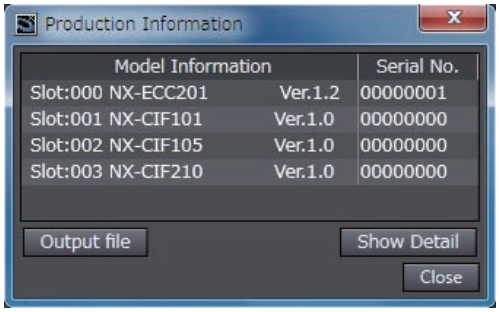
Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer, right-click the EtherCAT Coupler Unit in the EtherCAT tab page, and select ***Edit Slave Terminal Configuration***.

Or, select the EtherCAT Coupler Unit on the EtherCAT tab page and click the **Edit Slave Terminal Configuration** button.

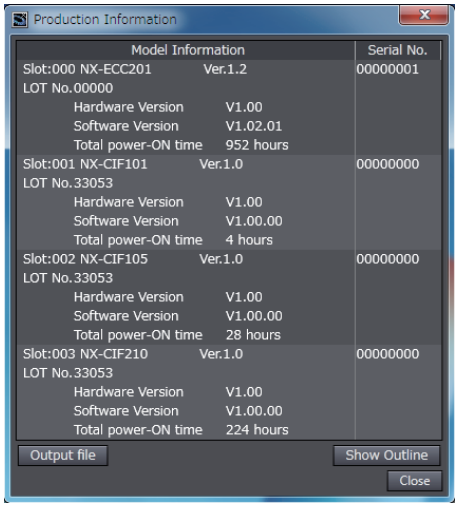
2 Go online.

3 Right-click the EtherCAT Coupler Unit on the Slave Terminal tab page 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 Communications Coupler Unit version upgrade. Refer to the user’s manual for the Communications Coupler Unit for the versions that support monitoring 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 required to use those functions.

Refer to *A-5 Version Information* on page A-42 for the functions that are supported by each unit version.

Related Manuals

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

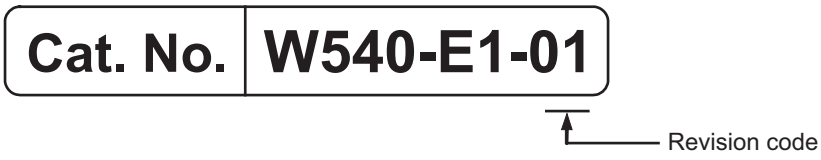
Manual name	Cat. No.	Model numbers	Application	Description
NX-series Communications Interface Units User's Manual	W540	NX-CIF□□□	Learning how to use NX-series Communications Interface Units	The hardware, setup methods, and functions of the NX-series Communications Interface Unit are described.
NX-series 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□□□□ NX-MD□□□□	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 Analog I/O Units User's Manual	W522	NX-AD□□□□ NX-DA□□□□ NX-TS□□□□	Learning how to use NX-series Analog I/O Units and Temperature Input Units	The hardware, setup methods, and functions of the NX-series Analog I/O Units and Temperature Input 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.
NX-series Position Interface Units User's Manual	W524	NX-EC0□□□ NX-ECS□□□ NX-PG0□□□	Learning how to use NX-series Position Interface Units	The hardware, setup methods, and functions of the NX-series Incremental Encoder Input Units, SSI Input Units, and Pulse Output Unit are described.
NX-series Safety Control Unit User's Manual	Z930	NX-SL□□□□ NX-SI□□□□ NX-SO□□□□	Learning how to use NX-series Safety Control Units	The hardware, setup methods, and functions of the NX-series Safety Control Unit are described.
NX-series Safety Control Unit Instruction Reference Manual	Z931	NX-SL□□□□	Learning about the specifications of instructions for the Safety CPU Unit.	The instructions for the Safety CPU Unit are described. When programming, use this manual together with the *NX-series Safety Control Units User's Manual* (Cat. No. Z930).
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.

Manual name	Cat. No.	Model numbers	Application	Description
NJ-series Troubleshooting Manual	W503	NJ501-□□□□ NJ301-□□□□	Learning about the errors that may be detected in an NJ-series Controller.	Concepts on managing errors that may be detected in an NJ-series Controller and information on individual errors are described. Use these manuals together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
NX-series EtherCAT® Coupler Unit User's Manual	W519	NX-ECC20□	Leaning 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-EIC202	Leaning 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.
NJ-series CPU Unit Hardware User's Manual	W500	NJ501-□□□□ NJ301-□□□□	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-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ-series CPU Unit Software User's Manual	W501	NJ501-□□□□ NJ301-□□□□	Learning how to program and set up an NJ-series CPU Unit. Mainly software information is provided.	The following information is provided on a Controller built with an NJ501 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).

Manual name	Cat. No.	Model numbers	Application	Description
NJ-series CPU Unit Built-in EtherCAT® Port User's Manual	W505	NJ501-□□□□ NJ301-□□□□	Using the built-in EtherCAT port on an NJ-series CPU Unit.	Information on the built-in EtherCAT port is provided. This manual provides an introduction and information on the configuration, features, and setup. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ-series CPU Unit Motion Control User's Manual	W507	NJ501-□□□□ NJ301-□□□□	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) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ-series Instructions Reference Manual	W502	NJ501-□□□□ NJ301-□□□□	Learning detailed specifications on the basic instructions of an NJ-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) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ-series Motion Control Instructions Reference Manual	W508	NJ501-□□□□ NJ301-□□□□	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), *NJ-series CPU Unit Software User's Manual* (Cat. No. W501) and *NJ-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

Revision History

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



Revision code	Date	Revised content
01	February 2015	Original production

Sections in this Manual

1 Features and System Configuration

2 Specifications and Application Procedures

3 Part Names and Functions

4 Installation and Wiring

5 I/O Data Specifications

6 Unit Settings

7 Serial Communications

8 Serial Line Monitor

9 Troubleshooting

10 Maintenance and Inspections

A Appendices

I Index

1

Features and System Configuration

This section describes the features of the Communications Interface Units and the system configuration in which the Communications Interface Units are used.

1-1 Features of Communications Interface Units 1-2

1-2 System Configuration 1-3

1-3 Unit Models, Functions, and Support Software 1-5

1-3-1 Unit Model Numbers 1-5

1-3-2 Functions 1-5

1-3-3 Support Software 1-5

1-1 Features of Communications Interface Units

The NX-series Communications Interface Units (hereafter called CIF Units) provide the following features.

Features as Sysmac Devices

The CIF Units are classified as Sysmac devices. Sysmac device is a generic name for EtherCAT slaves, EtherNet/IP slaves, and other OMRON control components that were designed with the same communications and user interface specifications. You can use Sysmac devices together with NJ-series Machine Automation Controllers and the Sysmac Studio Automation Software to achieve optimum functionality and ease of operation.

Features as NX Units

The CIF Units are classified as NX Units and are used in Slave Terminals.

A Slave Terminal is a building-block remote I/O slave that is created by mounting a group of NX Units to an NX-series Communications Coupler Unit.

The NX Units can be flexibly combined with an Communications Coupler Unit to achieve the optimum remote I/O slave for the application with less wiring, less work, and less space.

Features as Serial Communications Devices

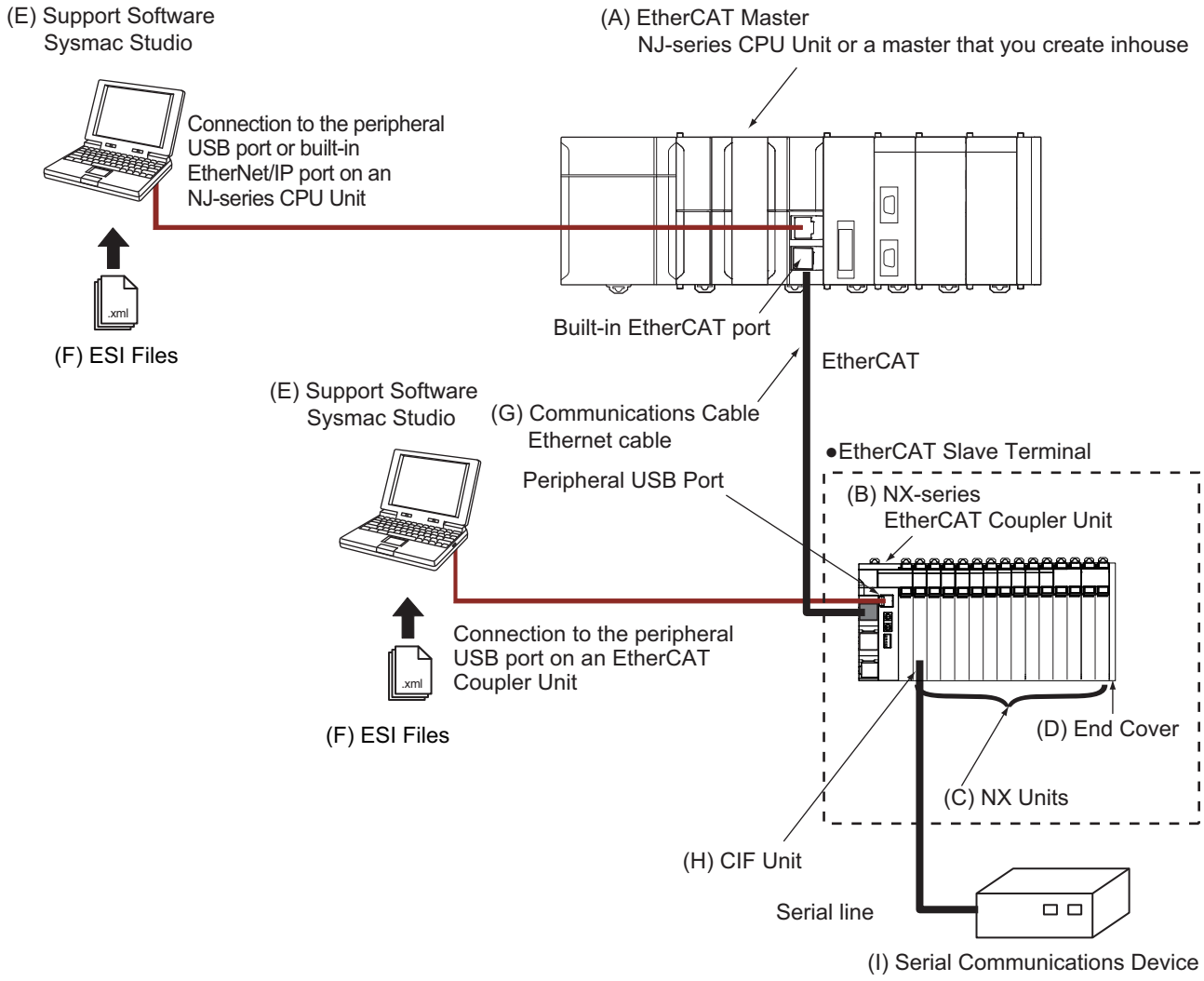
The CIF Units are also classified as serial communications devices. Both RS-232C and RS-422A/485 are supported as the serial interface. No-protocol communications are supported as the communications protocol.

Other convenient functions include logging send/receive data and a serial line monitor that you can use to display and save line data.

1-2 System Configuration

CIF Units are connected to EtherCAT Slave Terminals in EtherCAT networks.

You can use an NJ-series CPU Unit or a master that you create inhouse as the EtherCAT master. The elements in the system configuration are described in the following system configuration diagram.



Letter	Item	Description
(A)	EtherCAT master *1	The EtherCAT master manages the network, monitors the status of the slaves, and exchanges I/O data with the slaves.
(B)	EtherCAT Coupler Unit	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 (PDO 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. 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-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.
(F)	ESI (EtherCAT Slave Information) files	The ESI files contain information that is unique to the EtherCAT Slave Terminals in XML format. You can load an 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	Use double-shielded cables with aluminum tape and braiding of Ethernet category 5 (100BASE-TX) or higher, and use straight wiring.
(H)	CIF Unit	A CIF Unit is a type of NX Unit that performs serial communications with an external serial communications device.
(I)	Serial communications device	This external device performs serial communications for the application.

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

1-3 Unit Models, Functions, and Support Software

The following three models of CIF Units are available. They have different serial interfaces, connections, and numbers of serial ports.

1-3-1 Unit Model Numbers

The following three models of CIF Unit are available. They have different serial interfaces, connections, and numbers of serial ports.

Model number	Serial interface	External connection terminals	Number of serial ports
NX-CIF101	RS-232C	Screwless Clamping Terminal Block	1
NX-CIF105	RS-422A/485	Screwless Clamping Terminal Block	1
NX-CIF210	RS-232C	D-Sub	2

1-3-2 Functions

All models of the CIF Units provide the following functions.

Function	Description
No-protocol serial communications	Data is sent to and received from external serial communications devices without a specific protocol or data conversion.
Serial line monitor	You can display and save the log of the data that has been sent or received by the CIF Unit.

1-3-3 Support Software

The Sysmac Studio Support Software is used to make settings for the CIF Units. Refer to *A-5 Version Information* on page A-42 for details.

2

Specifications and Application Procedures

This section provides the general specifications and individual Unit specifications, and describes how to use the CIF Units.

2-1 Specifications 2-2
2-1-1 General Specifications 2-2
2-1-2 Specifications of Individual Units 2-3
2-2 Application Procedures 2-5

2-1 Specifications

This section gives the general specifications and individual Unit specifications of the CIF Units.

2-1-1 General Specifications

The following table gives the general specifications of the CIF Units.

Item		Specification
Enclosure		Mounted in a panel.
Grounding method		Ground of 100 Ω or less. If a conductive DIN Track is used, a CIF Unit is grounded through the DIN Track from the System Power Supply Unit. If a non-conductive DIN Track is used, a CIF Unit is grounded from the FG terminal.
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 with 3.5-mm amplitude, 8.4 to 150 Hz, Acceleration of 9.8 m/s^2, 100 min in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock resistance*1	Conforms to IEC 60068-2-27. 147 m/s^2, 3 times each in X, Y, and Z directions
	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.
Applicable standards*1		cULus: Listed (UL508), ANSI/ISA 12.12.01, EC: EN 61131-2, RCM, and KC: KC Registration

*1. Refer to the OMRON 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

The following table gives the specifications of individual CIF Units.

Item		NX-CIF101	NX-CIF105	NX-CIF210
Number of ports		1	1	2
Communications ports		RS-232C	RS-422A/485	RS-232C
Communications protocol		No-protocol		
Communi-cations specifica-tions	Communications method	Full duplex	Half duplex for two-wire connection, Full duplex for four-wire connection	Full duplex
	Signal lines*1	---	Two lines or four lines	---
	Baud rate [bps]*1	1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200, or 230,400		
	Data length [bits]*1	7 or 8		
	Parity*1	Even, odd, or none		
	Start bits [bits]	Always 1.		
	Stop bits [bits]*1	1 or 2		
	Flow control*1	None, RS/CS flow control,*2 or Xon/Xoff control		
	Flow control target*1	Send/receive, send only, or receive only		
	Initial RS signal value*1*3	ON or OFF		
	Number of characters to determine the end*1*4	0 to 10,000 (in increments of 0.1 character)) 0: The end is not detected.		
	Maximum communications distance [m]	15*5	1,200*6	15*5
	Connection configuration	1:1	1:N Maximum value of N is 32. You can change between two-wire and four-wire connections.	1:1
I/O refreshing method		Free-Run refreshing only		
PDO data size [bytes]*1		Inputs or outputs: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, or 80		
Transmission buffering enable/disable setting*1		Enabled or disabled		
Functions to back up data		Provided.*7		
Terminating resistance setting		---	Possible	--
Isolation method		No isolation	Power supply: transformer and photocoupler Signals: Digital isolators	No isolation
Power consumption		900 mW max.	1,450 mW max.	950 mW max.
Weight		66 g max.	69 g max.	91 g max.

*1. Setting is possible in the Unit operation settings of the Sysmac Studio.

*2. You cannot set RS/CS flow control for the NX-CIF105.

*3. This is the value of the RS signal when the port enters the Operational state or immediately after the port is restarted. The initial value is disabled when RS/CS flow control is set. It is also disabled for the NX-CIF105.

*4. This setting is provided for communications protocols that assume the end of the data if data is not received for a specific period of time. For example, if the number of characters to determine the end is set to 35, the end of the data will be assumed if data is not received for the time required to receive 3.5 characters.

*5. If the baud rate is set to higher than 19,200 bps, refer to the manual for the remote communications device.

*6. The maximum total cable length for multidrop connections is 1,200 m.

*7. The settings that are backed up are saved in memory in the Communications Coupler Unit. The settings that are backed up are not saved in the CIF Unit.

2-2 Application Procedures

The following table gives the application procedures of the CIF Units.

Procedure	Item	Description	Reference
1	Creating the Unit Settings	The CIF Unit is registered on the Sysmac Studio. The Unit settings of the CIF Unit are made offline.	*Section 5 I/O Data Specifications*
2	Writing the User Program	The user program is created in the communications master. If the communications master is an NJ-series CPU Unit, the user program is created on the Sysmac Studio.	*NJ-series CPU Unit Software User's Manual* (Cat No. W501)
3	Installing Units	The CIF Unit is installed on the Slave Terminal	*Section 4 Installation and Wiring*
4	Wiring the Unit	The CIF Unit is wired.	*Section 4 Installation and Wiring*
5	Transferring Unit Settings and the User Program	The Unit settings that were created on the Sysmac Studio are transferred to the CIF Unit. If the communications master is an NJ-series CPU Unit, the user program is also transferred.	*Section 5 I/O Data Specifications*
6	Checking Operation	The serial line monitor is used to check the communications status with the external serial communications device.	*Section 7 Serial Communications*

3

Part Names and Functions

This section gives the names of the parts of the CIF Units and describes the functions of the parts.

3-1 Part Names 3-2
3-1-1 NX-CIF101 and NX-CIF105 3-2
3-1-2 NX-CIF210 3-4
3-2 Indicators 3-5
3-2-1 TS Indicator 3-5
3-2-2 Send/Receive Indicators 3-6

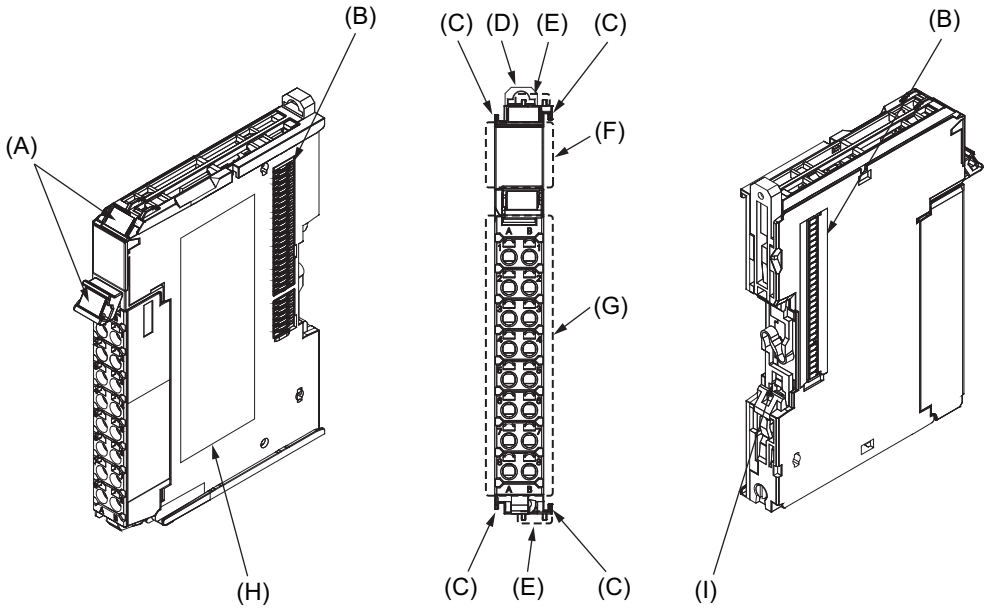
3-1 Part Names

This section gives the names of the parts of the CIF Units and describes the functions of the parts.

3-1-1 NX-CIF101 and NX-CIF105

This section gives the names of the parts of the NX-CIF101 and NX-CIF105, and describes the functions of the parts.

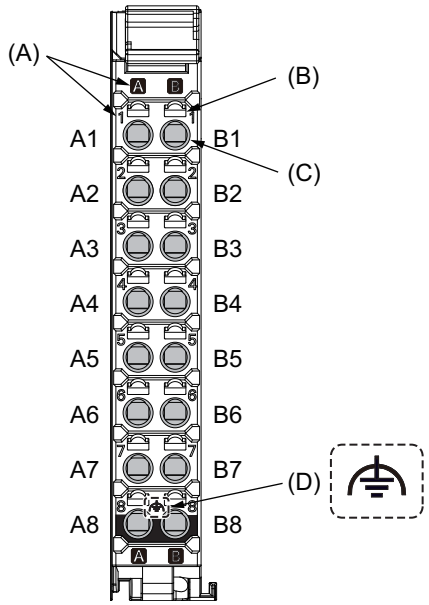
Unit Parts



Letter	Name	Description
(A)	Marker attachment location	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 each Unit.
(C)	Unit hookup guides	These guides are used to connect two Units.
(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. Refer to *3-2 Indicators* on page 3-5.
(G)	Terminal block	This terminal block is used to connect the external serial communications device.
(H)	Unit specifications	The specifications of the Unit are given here.
(I)	DIN Track contact plate	This plate is connected internally to the functional ground terminal on the terminal block.

Terminal Block

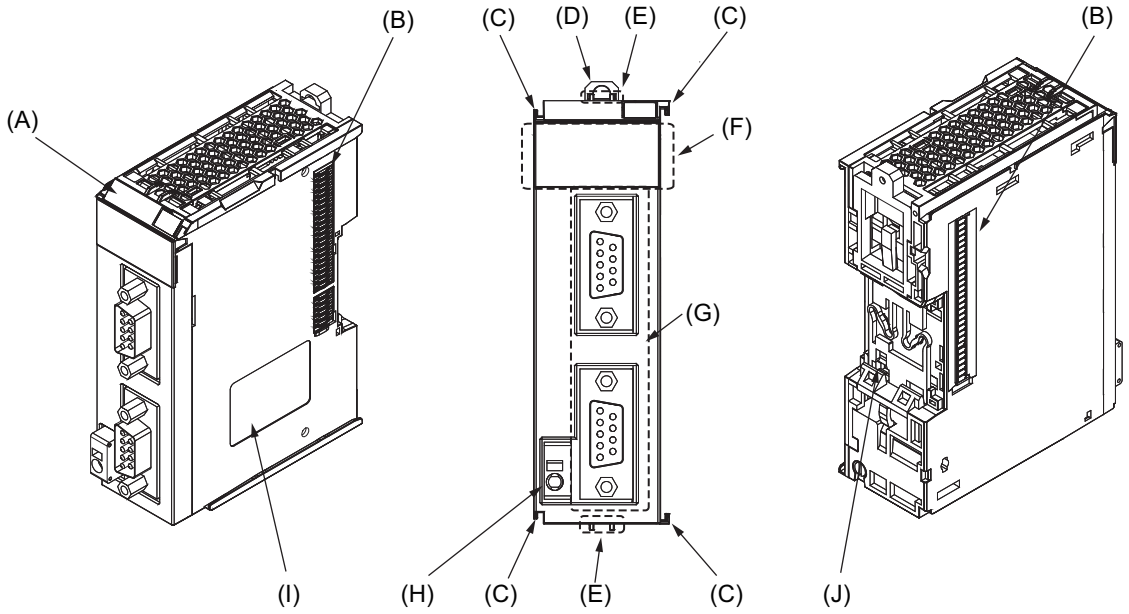
The model number of the Screwless Clamping Terminal Block is NX-TBC162.



Letter	Name	Description
(A)	Terminal number indication	The terminal numbers are given by column letters A and B, and row numbers 1 to 8. The combination of the column and row gives the terminal numbers from A1 to A8 and B1 to B8.
(B)	Release hole	Insert a flat-blade screwdriver into this hole to connect and remove the wire.
(C)	Terminal hole	The wire is inserted into this hole.
(D)	Ground terminal mark	This mark indicates the ground terminals.

3-1-2 NX-CIF210

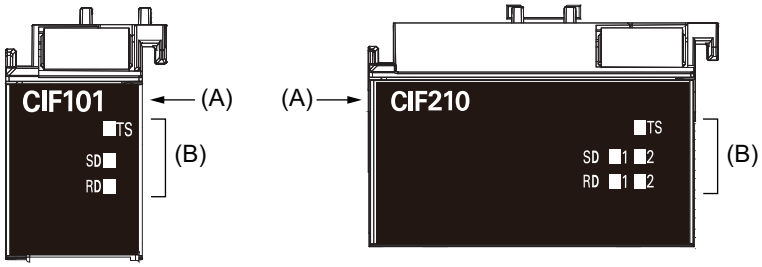
This section gives the names of the parts of the NX-CIF210, and describes the functions of the parts.



Letter	Name	Description
(A)	Marker attachment location	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 each Unit.
(C)	Unit hookup guides	These guides are used to connect two Units.
(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. Refer to *3-2 Indicators* on page 3-5.
(G)	D-Sub connector	This connector is used to connect the external serial communications device. This is the D-Sub connector plug.
(H)	FG terminal	This is the external ground connection terminal. It is a screwless clamping terminal.
(I)	Unit specifications	The specifications of the Unit are given here.
(J)	DIN Track contact plate	This plate is connected internally to the functional ground terminal on the terminal block.

3-2 Indicators

A CIF Unit has indicators that show information such as the current operating status of the Unit or signal I/O status. This section gives the names of the parts of the indicators, and describes the functions of the indicators.

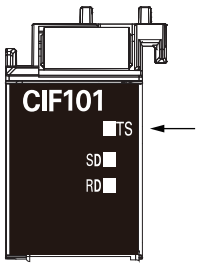


NX-CIF101
NX-CIF105

NX-CIF210

Letter	Name	Description
(A)	Model number indication	Gives the model number of the Unit, without the prefix. For example, “CIF210” is given for the NX-CIF210.
(B)	Indicators	The TS indicator shows the current operating status of the Unit. The other indicators show the send/receive status of the communications data.

3-2-1 TS Indicator

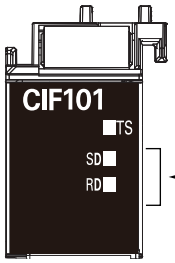


The TS indicator shows the current status of the CIF Unit and the communications status with the Communications Coupler Unit.

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

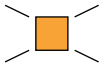
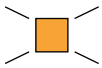
Color	Status		Description
Green		Lit	• The Unit is operating normally. • The Unit is ready for I/O refreshing.
		Flashing at 2-s intervals	Initializing
		Flashing at 0.5-s intervals	• Automatic creation of the Unit configuration is in progress. • I/O checking is in progress.
Red		Lit	A hardware error, 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. • Unit failure

3-2-2 Send/Receive Indicators



These indicators show the communications status with the serial communications device.

The following table lists the possible states for these indicators and what they mean.

Indicator*1	Color	Status		Send/receive status
SD	Yellow		Lit	Sending data
	---		Not lit	Waiting to send data
RD	Yellow		Lit	Receiving data
	---		Not lit	Waiting to receive data

*1. The NX-CIF210 has the following four indicators: SD1, RD1, SD2, and RD2. The SD1 and RD1 indicators show the send and receive status for port 1. The SD2 and RD2 indicators show the send and receive status for port 2.

4

Installation and Wiring

This section describes how to install the CIF Units, how to wire the power supplies used in the Slave Terminal, and how to wire the CIF Units.

4-1 Installing NX Units 4-2

4-2 Wiring the Power Supply and Ground to the Slave Terminal 4-3

4-3 Wiring the Terminals 4-4

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

4-3-2 Wiring the D-Sub Connector 4-5

4-4 Wiring Communications 4-6

4-4-1 Terminal Arrangement 4-6

4-4-2 Connecting to Serial Communications Devices 4-9

4-4-3 Examples of Recommended RS-232C and RS-422A/485 Wiring 4-13

4-1 Installing NX Units

Refer to the section on installation in the user's manual for the connected Communications Coupler Unit for information on installing NX Units, including CIF Units.

4-2 Wiring the Power Supply and Ground to the Slave Terminal

Refer to the section on wiring in the user's manual for the connected Communications Coupler Unit for information on wiring the power supply and ground to the Slave Terminal to which the CIF Unit is connected.

Additional Information

- An I/O power supply is not required for a CIF Unit. An I/O power supply is wired only when there is an NX Unit that requires an I/O power supply in the Slave Terminal.
- Normally, the FG terminal on a CIF Unit must be grounded. However, if the DIN Track to which the Slave Terminal is installed is conductive, the FG terminal on the CIF Unit will be electrically in contact with the DIN Track, so wiring the FG terminal is not necessary.

4-3 Wiring the Terminals

This section describes how to wire the terminals on the CIF 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.

Precautions for Safe Use

- 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.
- Turn ON the power after checking the connector wiring.
- Observe the following precautions when you wire communications cables. The communications cables may be broken or the Units may malfunction.

  Do not fold communications cables.

  Do not pull on communications cables with excessive force. Secure communications cables so that they are not pulled on excessively.

  Do not place heavy objects on top of communications cables.

  For a terminal block, cable ties can be used to secure the communications cable.

4-3-1 Wiring the Screwless Clamping Terminal Blocks

Refer to the user's manual for the connected Communications Coupler Unit for information on wiring the Screwless Clamping Terminal Block.

The following table gives the recommended ferrules and wires.

Unit model number	Wiring part	Specifications
NX-CIF101	Wires	Shielded twisted-pair cable Size: AWG28 to AWG16 (0.08 to 1.5 mm^2)
	Ferrules	Refer to the user's manual for the connected Communications Coupler Unit.
NX-CIF105	Wires	Shielded twisted-pair cable Size: AWG28 to AWG16 (0.08 to 1.5 mm^2) Characteristic impedance (1 MHz): 100 Ω standard Static capacity (1 kHz): 64 pF/m standard Attenuation (1 MHz): 30 dB/km max.
	Ferrules	Refer to the user's manual for the connected Communications Coupler Unit.

4-3-2 Wiring the D-Sub Connector

Connect the D-Sub connector to the external serial communications device with a Cable with a D-Sub Connector (socket).

Use #4-40UNC inch screws for the connector lock screws.

The following table gives the recommended wires and D-Sub connectors.

Wiring part	Specifications	Recommended products
Wires	Shielded twisted-pair cable Size: AWG28 to AWG22 (0.08 to 0.34 mm^2)	---
D-Sub connector	9-pin socket	OMRON Hood: XM2S-0913 (9-pin, inch screws) Socket: XM3D-0921 (9-pin)

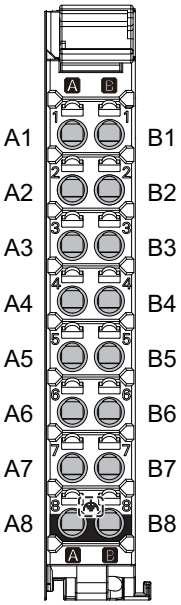
4-4 Wiring Communications

This section describes how to wire a CIF Unit to perform communications with an external serial communications device.

4-4-1 Terminal Arrangement

NX-CIF101 Terminal Arrangement

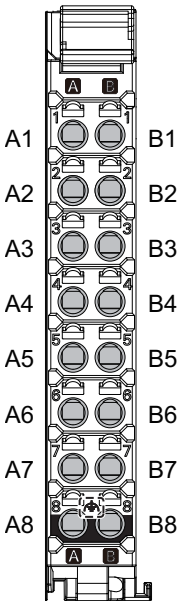
The terminal arrangement of the NX-CIF101 is given below.



Terminal No.	Abbrev.	Signal name	I/O	Terminal No.	Abbrev.	Signal name	I/O
A1	SD	Send data	Output	B1	RD	Receive data	Input
A2	RS	Request to send	Output	B2	CS	Clear to send	Input
A3	ER	Data terminal ready	Input	B3	DR	Data set ready	Output
A4	SG	Signal ground	--	B4	SG	Signal ground	---
A5	NC	Not used.	--	B5	NC	Not used.	---
A6	SHLD	Shield	--	B6	SHLD	Shield	---
A7	NC	Not used.	--	B7	NC	Not used.	---
A8	FG	Frame ground	--	B8	FG	Frame ground	---

NX-CIF105 Terminal Arrangement

The terminal arrangement of the NX-CIF105 is given below.



Terminal No.	Abbrev.	Signal name	I/O	Terminal No.	Abbrev.	Signal name	I/O
A1	SDA-	Send data -	Output	B1	SDB+	Send data +	Output
A2	SDA-	Send data -	Output	B2	SDB+	Send data +	Output
A3	TER SDA-	Terminal send data -*1	---	B3	TER SDB+	Terminal send data +*1	---
A4	RDA-	Receive data -	Input	B4	RDB+	Receive data +	Input
A5	RDA-	Receive data -	Input	B5	RDB+	Receive data +	Input
A6	TER RDA-	Terminal receive data -*2	---	B6	TER RDB+	Terminal receive data +*2	---
A7	SG	Signal ground*3	---	B7	SG	Signal ground	---
A8	FG	Frame ground	---	B8	FG	Frame ground	---

*1. For a two-wire connection, terminating resistance is turned ON when TERSDA- is connected to TERSDB+.

*2. For a four-wire connection, terminating resistance is turned ON when TERRDA- is connected to TERRDB+.

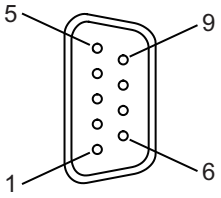
*3. The SG terminals are internally connected to the 0-V line inside the Unit. It is normally not necessary to connect the SG terminals. However, it may be possible to increase noise immunity by connecting the communications cables to the SG terminals.

Precautions for Correct Use

If you use the RS-422A/485 port, check the polarity before you connect the cable. The polarity of the SDA/SDB and RDA/RDB terminals and signals are reversed for some remote devices. If the polarity is not correct, malfunctions may occur.

Arrangement of D-sub Connector Pins on NX-CIF210

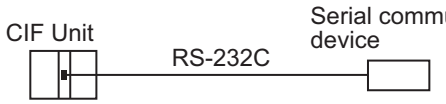
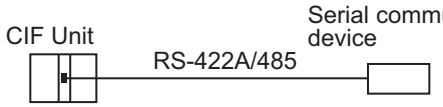
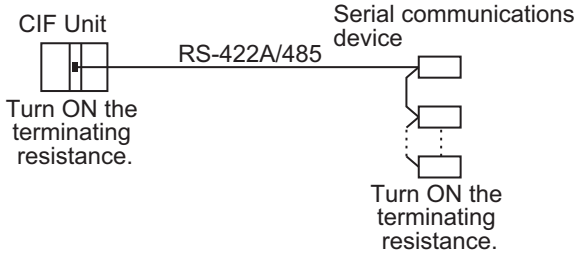
The arrangement of the D-sub connector pins on the NX-CIF210 are given in the following table.



Pin No.	Abbrev.	Signal name	I/O
1	---	Not used.	---
2	RD	Receive data	Input
3	SD	Send data	Output
4	ER	Data terminal ready	Output
5	SG	Signal ground	---
6	DR	Data set ready	Input
7	RS	Request to send	Output
8	CS	Clear to send	Input
9	---	Not used.	---
Shell	SHLD	Shield	---

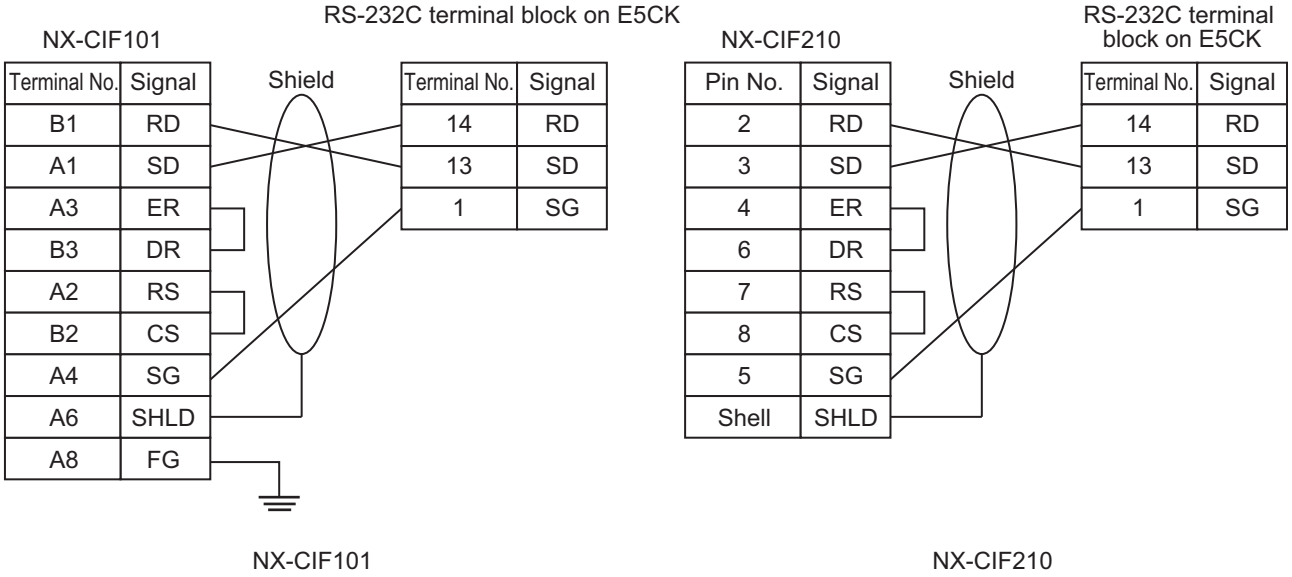
4-4-2 Connecting to Serial Communications Devices

You can use the following connection forms to connect a CIF Unit to one or more serial communications devices.

Model number	Connection form
NX-CIF101 or NX-CIF210	1:1 
NX-CIF105	1:1 
	1:N 

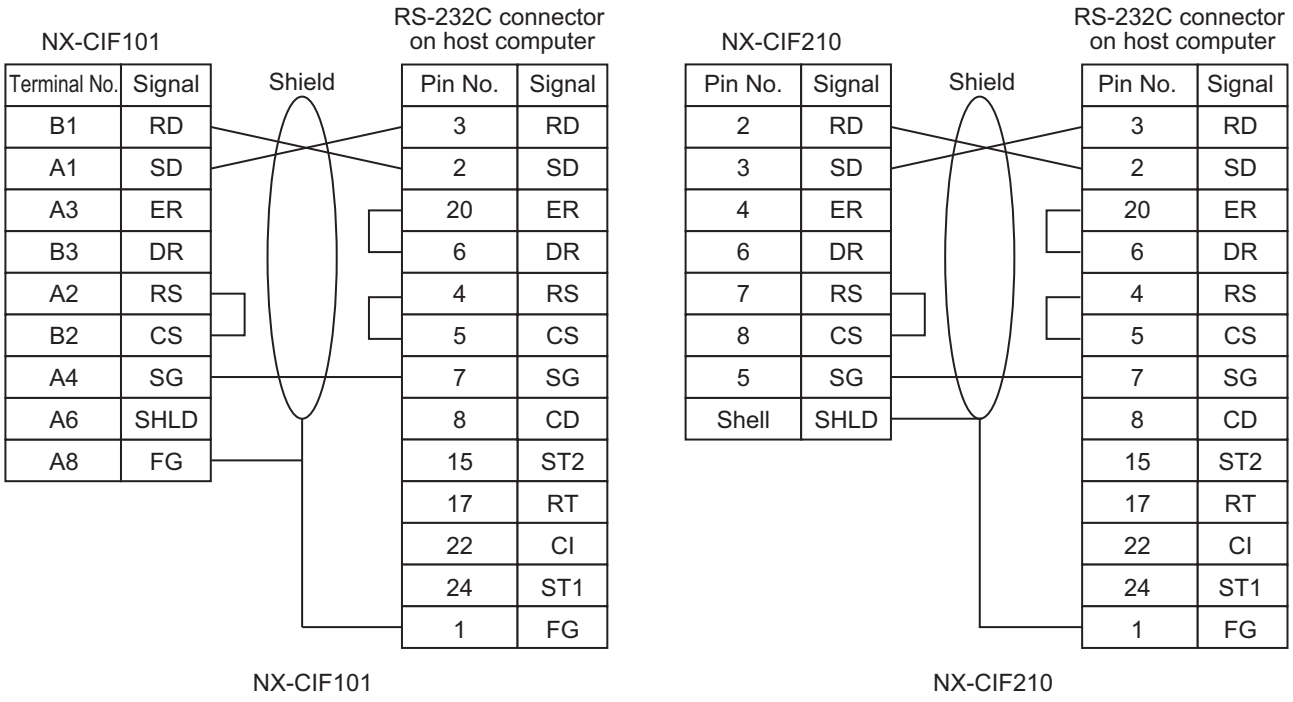
Examples of 1:1 Connections to an RS-232 Port

● Connection Examples for E5CK Digital Controllers

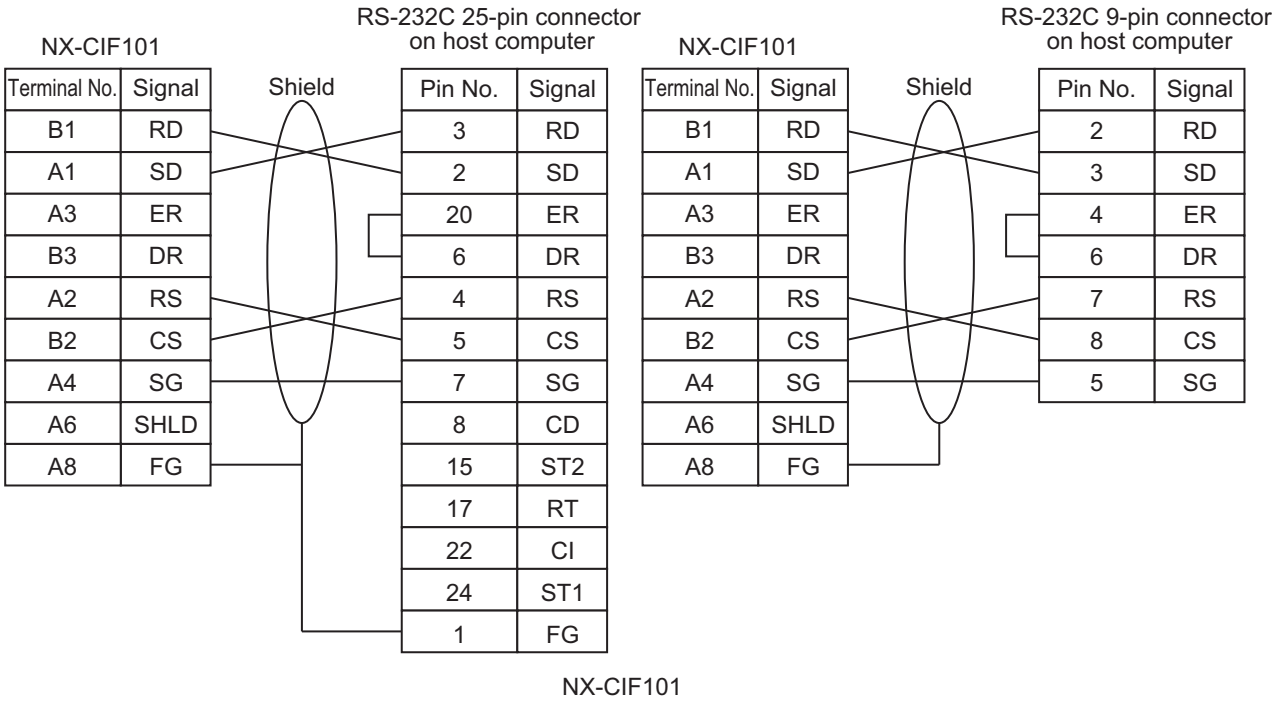


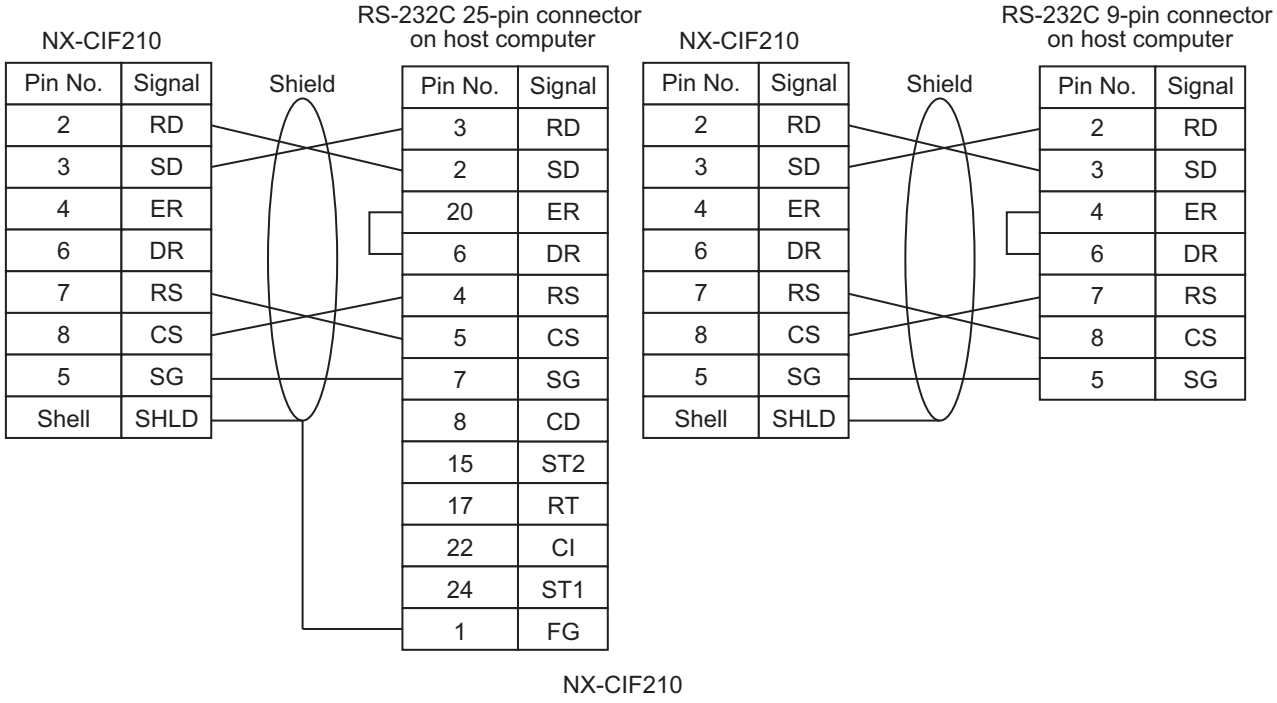
NX-CIF101 NX-CIF210

● Connection Examples to a Host Computer



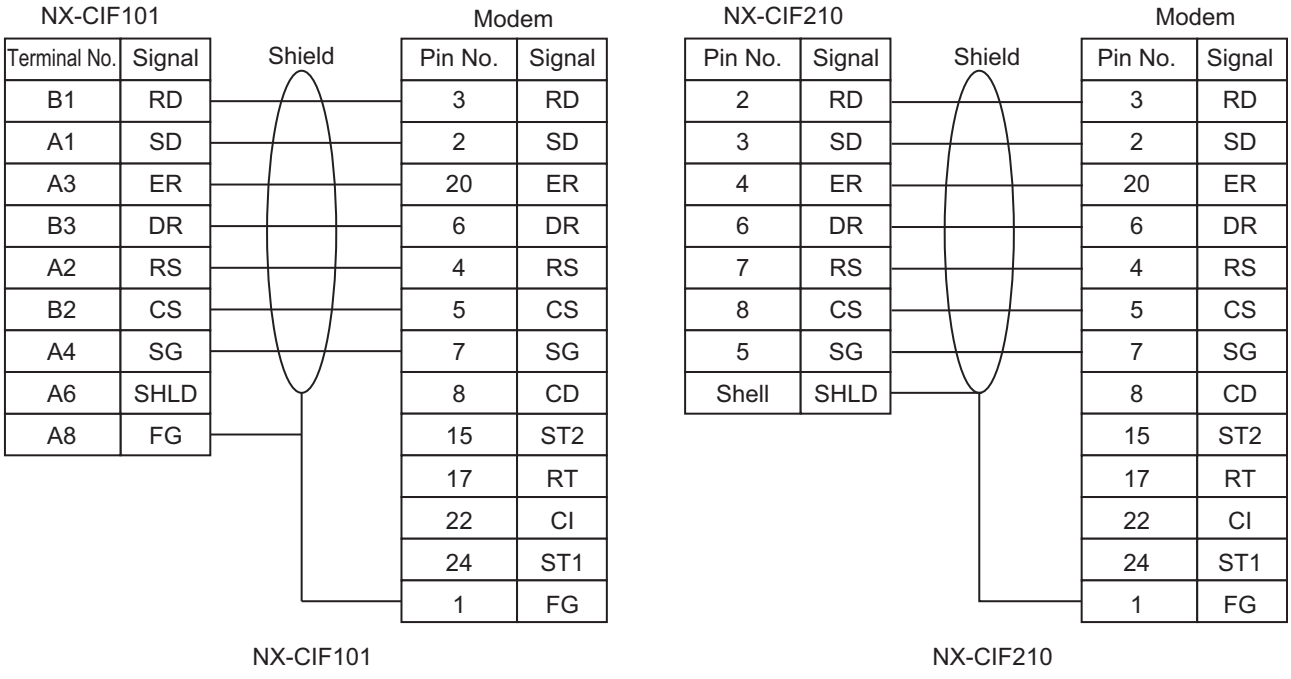
● Connection Examples to a Host Computer with RS-CS Flow Control





NX-CIF210

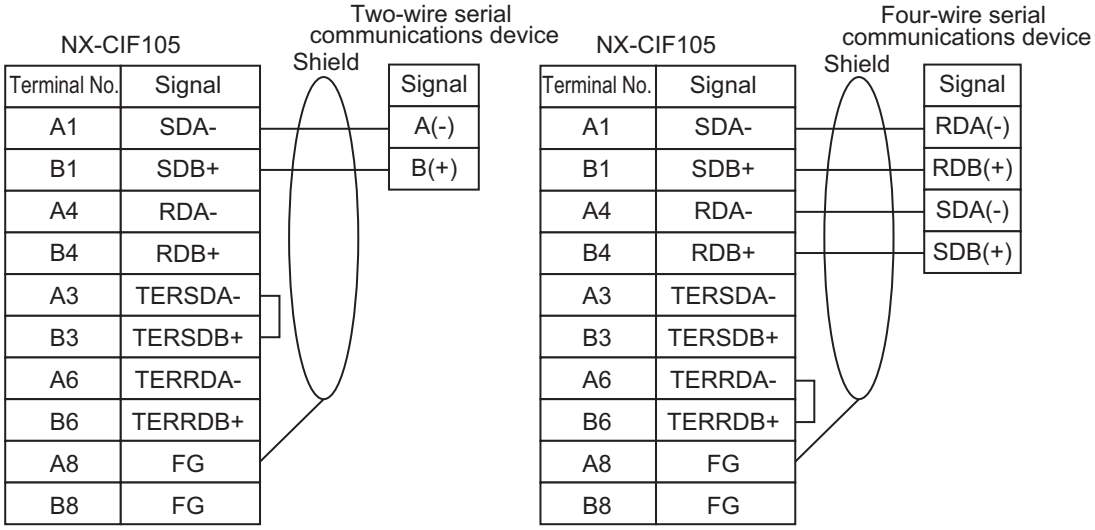
● Connection Examples to Modems



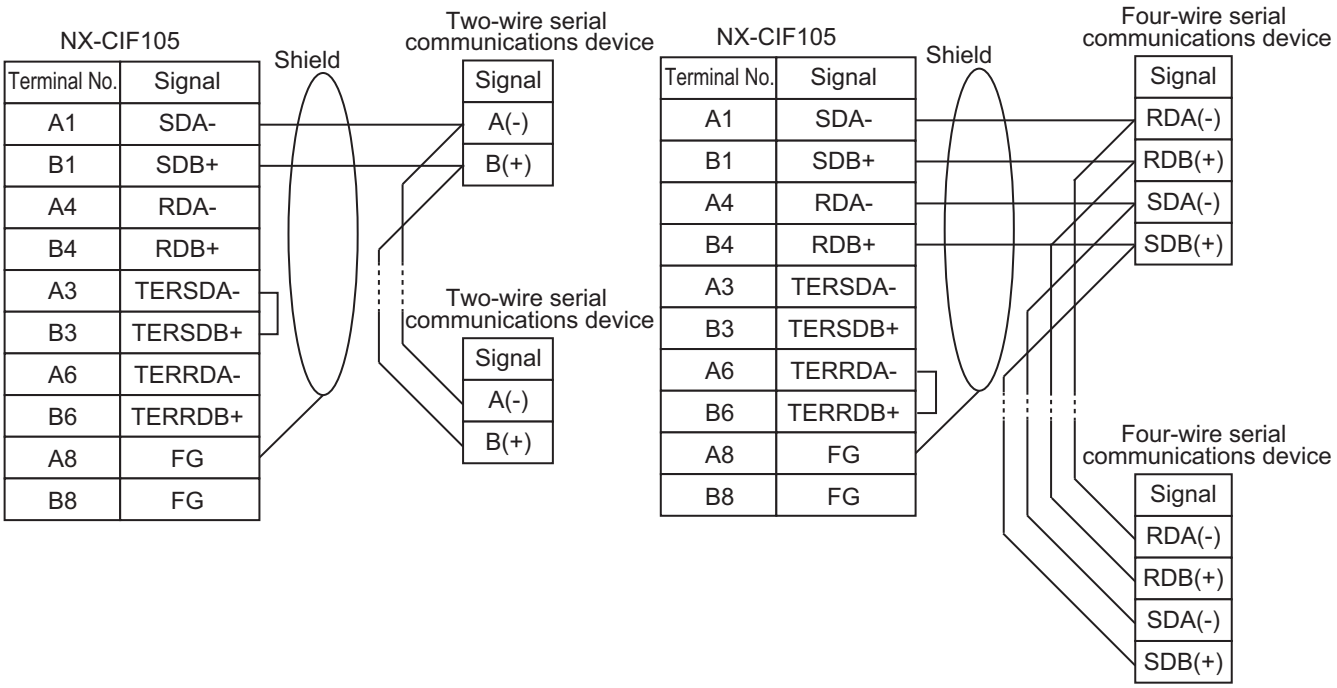
NX-CIF101

NX-CIF210

Examples of 1:1 Connections to an RS-422A/485 Port



Examples of 1:N Connections to an RS-422A/485 Port



4-4-3 Examples of Recommended RS-232C and RS-422A/485 Wiring

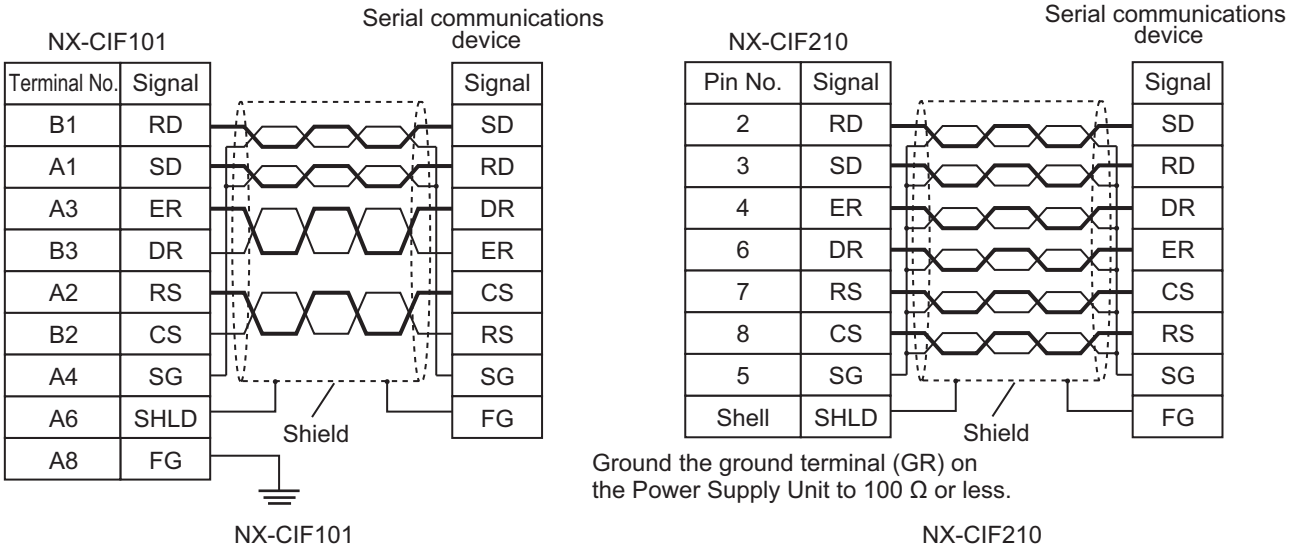
This section provides examples of the recommended RS-232C and RS-422A/485 wiring.

Examples of Recommended RS-232C Wiring

We recommend the following wiring for RS-232C communications, particularly in environments where noise is common.

- Use shielded, twisted-pair cable for the communications cable.
- Pair the SD (send data) line with the SG (signal ground) line as one twisted pair and the RD (receive data) line with the SG (signal ground) line as a separate twisted pair.
- For the NX-CIF210, connect the shield on the communications cable to the shell (SHLD) on the D-Sub connector on the NX-CIF210. Also, ground the ground terminal (GR) on the Power Supply Unit to 100 Ω or less.
- For the NX-CIF101, connect the shield on the communications cable to A6 (SHLD) on the NX-CIF101. Also, ground the A8 (FG) on the NX-CIF101 to 100 Ω or less.

Connection examples are given in the following figure.



Examples of Recommended RS-422A/485 Wiring

For RS-422A/485, we recommended that you use the following wiring method to ensure transmission quality.

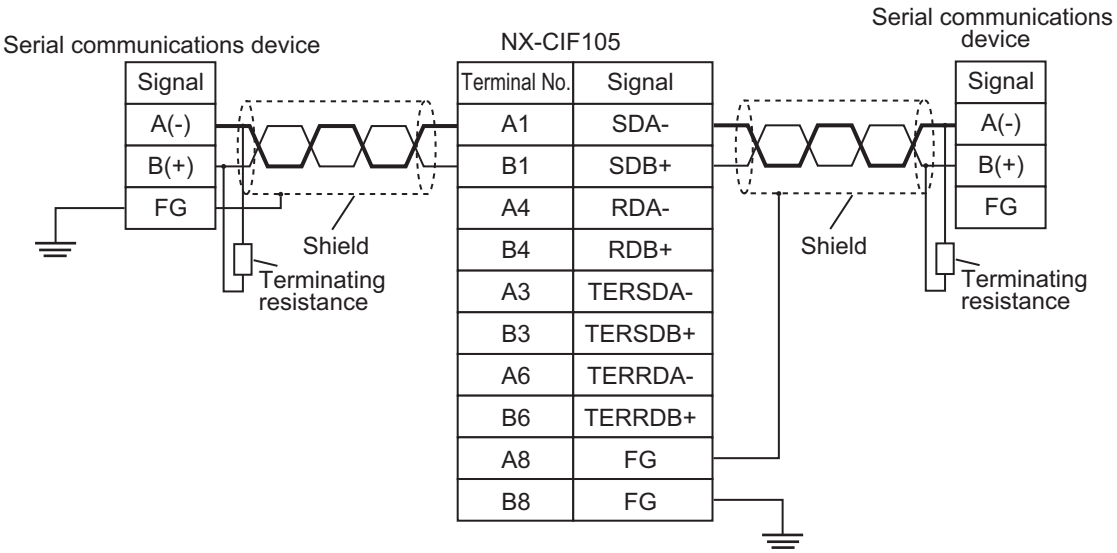
- Use shielded, twisted-pair cable for the communications cable.
- Connect the shield on the communications cable to A8 or B8 (FG) on the NX-CIF105. Also, ground the A8 or B8 (FG) on the NX-CIF101 to 100 Ω or less.
- Always turn ON the terminating resistance at the end nodes for RS-422A/485 communications. To turn ON the terminating resistance, connect TERSDA- and TERSDB+ for a two-wire connection and connect TERRDA- and TERRDB+ for a four-wire connection.

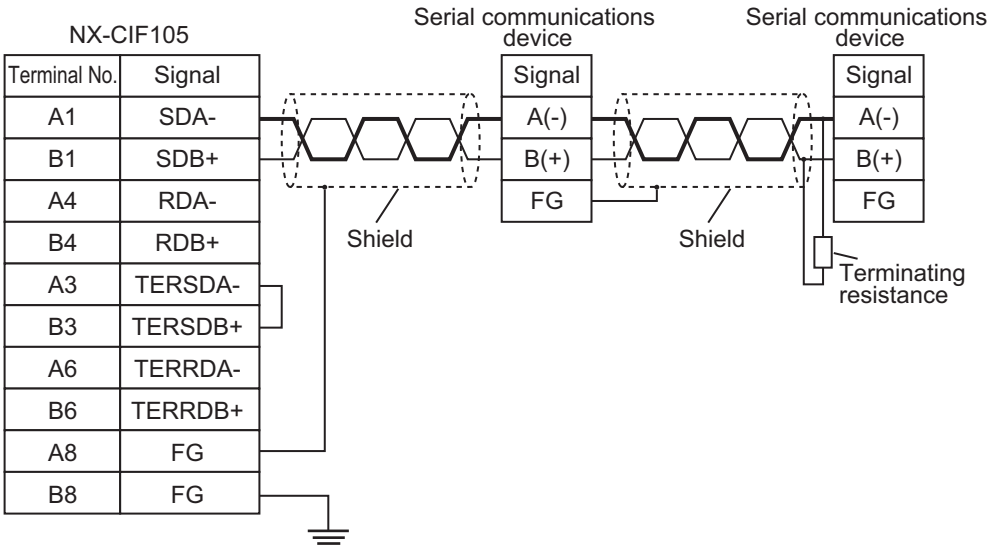
Precautions for Correct Use

Ground the shield only at the CIF Unit. Do not ground it at the other end of the cable. If you ground both ends of the cable, a difference in electrical potential between the two grounds may damage the equipment.

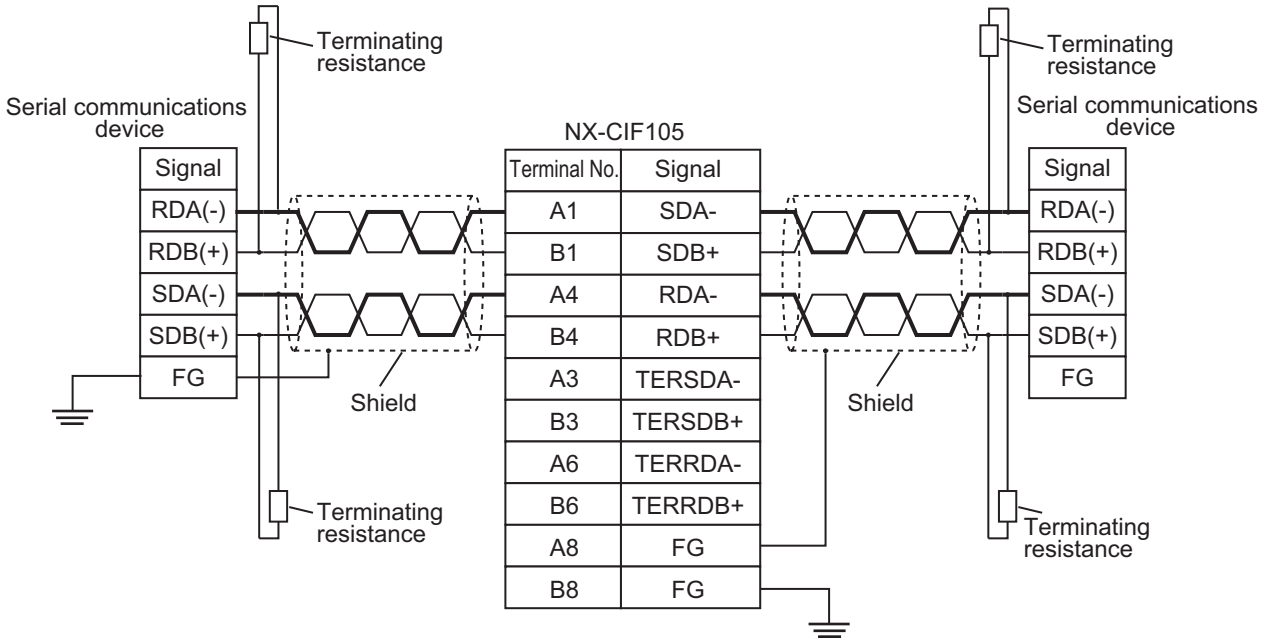
Connection examples are given in the following figures.

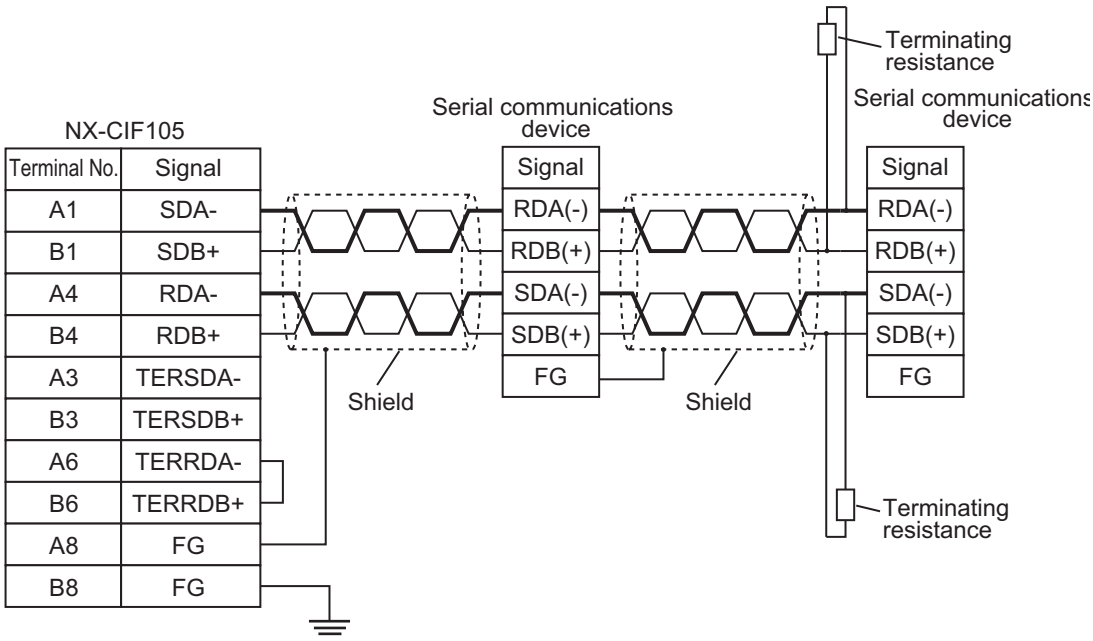
● Two-wire Connections





● Four-wire Connections with One Transmitting Node and N Receiving Nodes





5

I/O Data Specifications

This section describes the data that you can set for I/O allocations.

5-1 I/O Data Specifications for NX-CIF101 and NX-CIF105 5-2

5-2 I/O Data Specifications for NX-CIF210 5-3

5-1 I/O Data Specifications for NX-CIF101 and NX-CIF105

All of the data that you can set for the I/O allocations of the NX-CIF101 and NX-CIF105 on the Sysmac Studio correspond to NX objects. The following table shows the correspondence between I/O entry names and NX object names. Refer to *I/O Allocation Objects* on page A-7 for details on the NX objects. Refer to the user's manual for the connected Communications Coupler Unit for details on setting I/O allocations from the Sysmac Studio.

Index (hex)	Subindex (hex)	I/O entry name	NX object name
6000	01	Ch1 Port Status	Port Status
	02	Ch1 Input SID	Input SID
	03	Ch1 Output SID Response	Output SID Response
	04	Ch1 Input Data Type	Input Data Type
	05	Ch1 Input Sub Info	Input Sub Info
	06	Ch1 Input Data Length	Input Data Length
	07 to 1A	Ch1 Input Data 1 to 20	Input Data 01 to 20
7000	01	Ch1 Output SID	Output SID
	02	Ch1 Input SID Response	Input SID Response
	03	Ch1 Output Data Type	Output Data Type
	04	Ch1 Output Sub Info	Output Sub Info
	05	Ch1 Output Data Length	Output Data Length
	06 to 19	Ch1 Output Data 1 to 20	Output Data 01 to 20

5-2 I/O Data Specifications for NX-CIF210

All of the data that you can set for the I/O allocations of the NX-CIF201 on the Sysmac Studio correspond to NX objects. The following table shows the correspondence between I/O entry names and NX object names. Refer to *I/O Allocation Objects* on page A-7 for details on the NX objects. Refer to the user's manual for the connected Communications Coupler Unit for details on setting I/O allocations from the Sysmac Studio.

Index (hex)	Subindex (hex)	I/O entry name	NX object name
6000	01	Ch1 Port Status	Port Status
	02	Ch1 Input SID	Input SID
	03	Ch1 Output SID Response	Output SID Response
	04	Ch1 Input Data Type	Input Data Type
	05	Ch1 Input Sub Info	Input Sub Info
	06	Ch1 Input Data Length	Input Data Length
	07 to 1A	Ch1 Input Data 1 to 20	Input Data 01 to 20
6001	01	Ch2 Port Status	Port Status
	02	Ch2 Input SID	Input SID
	03	Ch2 Output SID Response	Output SID Response
	04	Ch2 Input Data Type	Input Data Type
	05	Ch2 Input Sub Info	Input Sub Info
	06	Ch2 Input Data Length	Input Data Length
	07 to 1A	Ch2 Input Data 1 to 20	Input Data 01 to 20
7000	01	Ch1 Output SID	Output SID
	02	Ch1 Input SID Response	Input SID Response
	03	Ch1 Output Data Type	Output Data Type
	04	Ch1 Output Sub Info	Output Sub Info
	05	Ch1 Output Data Length	Output Data Length
	06 to 19	Ch1 Output Data 1 to 20	Output Data 01 to 20
7001	01	Ch2 Output SID	Output SID
	02	Ch2 Input SID Response	Input SID Response
	03	Ch2 Output Data Type	Output Data Type
	04	Ch2 Output Sub Info	Output Sub Info
	05	Ch2 Output Data Length	Output Data Length
	06 to 19	Ch2 Output Data 1 to 20	Output Data 01 to 20

6

Unit Settings

This section describes the Unit operation settings and how to set PDO sizes for CIF Units.

6-1 Unit Operation Settings 6-2
6-1-1 Communications Specifications 6-2
6-1-2 Transmission Buffering 6-2
6-1-3 Event Levels 6-4
6-2 Unit Operation Setting Procedure 6-5
6-3 Setting the PDO Sizes 6-6

6-1 Unit Operation Settings

The following operation settings are made for a CIF Unit from the Sysmac Studio.

- Communications specifications
- Transmission buffering
- Event levels

6-1-1 Communications Specifications

You must set the communications specifications for the ports on the CIF Units. Refer to *2-1-2 Specifications of Individual Units* on page 2-3 for the items to set and the setting ranges.

6-1-2 Transmission Buffering

The send data from the communications master to a CIF Unit may sometimes be divided into pieces and sent over multiple PDO communications cycles. With transmission buffering, CIF Unit first stores the divided send data in a send buffer inside the CIF Unit. When all of the send data has been received, the CIF Unit sends all of it at the same time on the serial line.

When transmission buffering is not used, each piece of the send data sent separately from the communications master to the CIF Unit is immediately sent to the serial line. Therefore, in this case, the data sent from the CIF Unit to the serial line may also be divided into pieces.

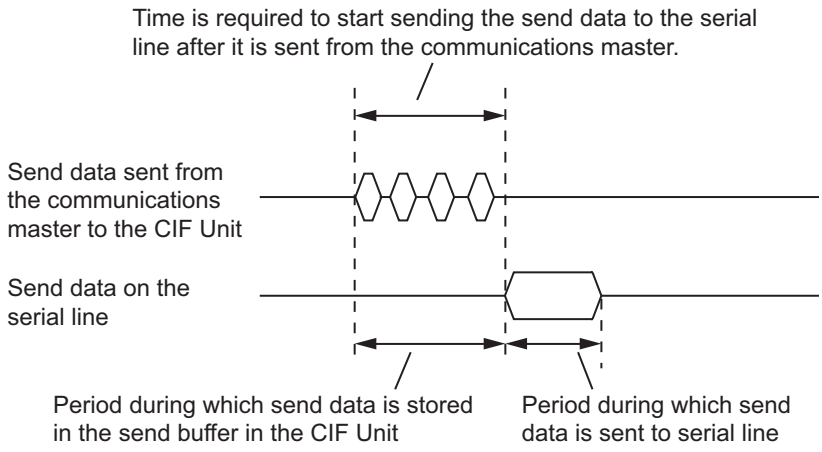
You can enable or disable transmission buffering with a setting on the Sysmac Studio.

Differences between When Transmission Buffering Is Enabled and Disabled

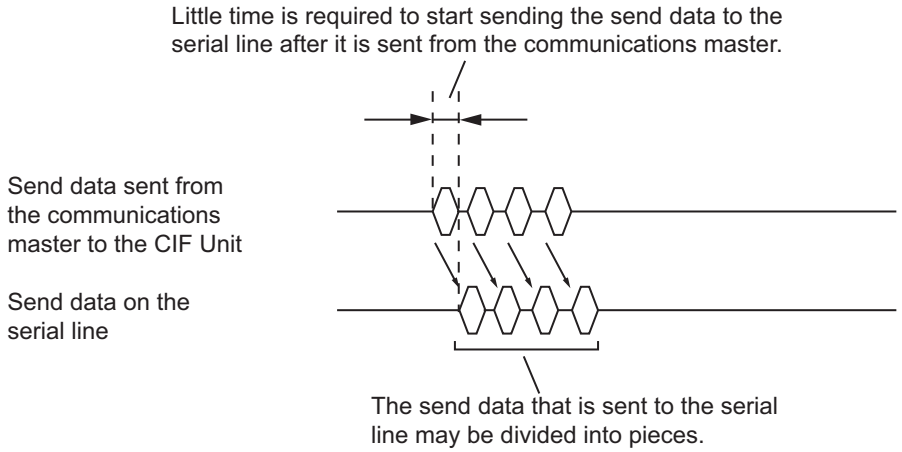
The differences in how send data is sent with and without transmission buffering are described in the following table.

Transmission buffering	Features
Enabled (default)	• The send data that is sent to the serial line is never divided into pieces. • Time is required to start sending the send data to the serial line after it is sent from the communications master.
Disabled	• The send data that is sent to the serial line may be divided into pieces. • Little time is required to start sending the send data to the serial line after it is sent from the communications master.

● Timing Chart When Transmission Buffering Is Enabled



● Timing Chart When Transmission Buffering Is Disabled



Detecting the Final Data When Transmission Buffering Is Enabled

When transmission buffering is enabled, the communications master must tell the CIF Unit when all of the send data is stored in the send buffer. The Output Data Type in the output notification data that is sent from the communications master to the CIF Unit is used for this purpose. The meanings of bits 12 to 15 in the Output Data Type are given in the following table.

Bits 12 to 15 in the Output Data Type	Description
0 hex	There is no send data.
1 hex	There is send data that is not the final send data.
2 hex	There is send data that is the final send data.

If the value of bits 12 to 15 of the Output Data Type is 2 hex, the CIF Unit knows that all of the send data is stored in the send buffer. It sends all of the send data together to the serial line.

For details on the Output Data Type, refer to *7-3-3 Input Data Type and Output Data Type* on page 7-9 or to *A-3 List of NX Objects* on page A-5.

Precautions for Correct Use

Even if transmission buffering is enabled, all of the data in the send buffer is sent to the serial line if the amount of send data in the send buffer exceeds 4,096 bytes, even if all of the send data is not yet in the send buffer.

6-1-3 Event Levels

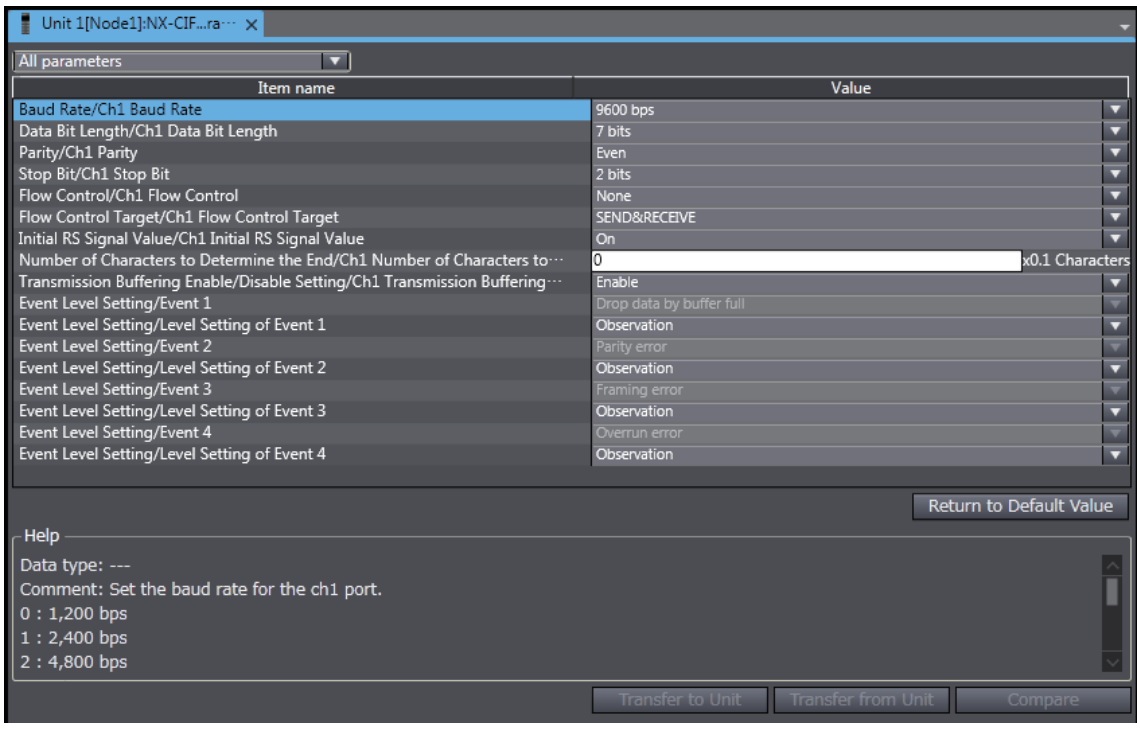
You can set the event levels for errors that occur in the CIF Units.

6-2 Unit Operation Setting Procedure

Use the following procedure from the Sysmac Studio to set the Unit operation settings.

1 Double-click the CIF Unit in the Multiview Explorer.

The following pane is displayed. The following screen capture is for the NX-CIF101.



2 Make all of the required settings.

3 Transfer the Unit operation settings to the Controller.

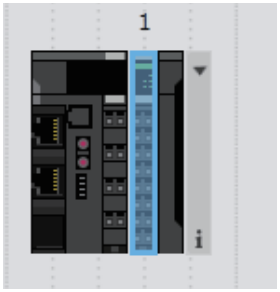
Refer to *Transferring the Slave Terminal Configuration Information* in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the procedure to transfer the Unit operation settings to the Controller.

6-3 Setting the PDO Sizes

You can set the PDO sizes for PDO communications between the communications master and CIF Unit. You can edit the I/O allocation settings on the Sysmac Studio to set the PDO sizes to between 4 and 80 bytes for both inputs and outputs. You can adjust the PDO sizes to improve communications performance. Refer to *7-8-2 Adjusting PDO Sizes to Improve Communications Performance* on page 7-34 for information on improving communications performance.

Use the following procedure to set the PDO output data size.

1 Click the CIF Unit on the Slave Terminal tab page.

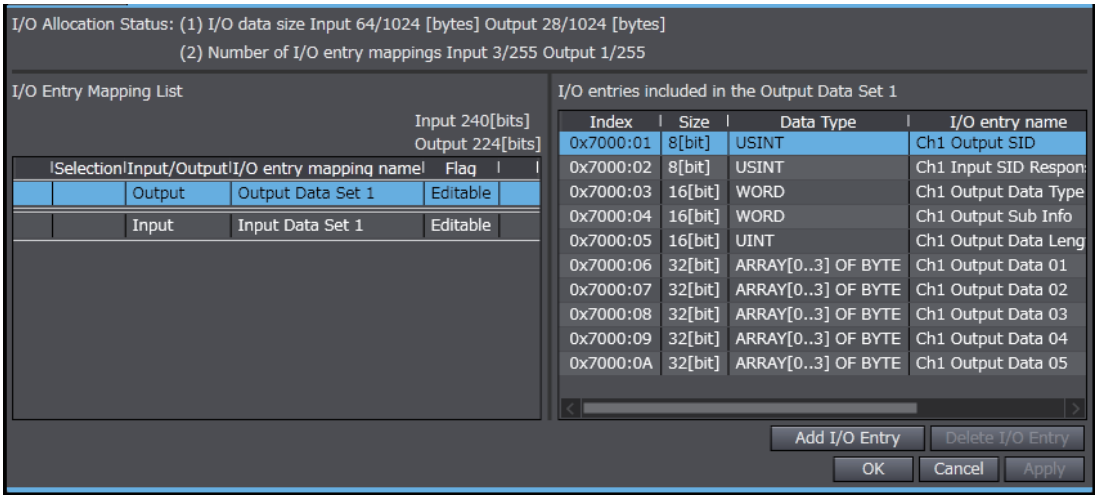


The following pane is displayed. The following screen capture is for the NX-CIF101.

Item name	Value
Device name	N1
Model name	NX-CIF101
Product name	Communication Interface Unit
Unit version	1.0
NX Unit Number	1
NX Unit Mounting Setting	Enabled
Serial Number	0x00000000
Power consumption	0.90 W
Unit width	12 mm
I/O allocation settings	Ch1 Output SID : 8 [bits] Ch1 Input SID Response : 8 [bits] Ch1 Output Data Type : 16 [bits] Ch1 Output Sub Info : 16 [bits] Ch1 Output Data Length : 16 [bits] Ch1 Output Data 01 : 32 [bits] Ch1 Output Data 02 : 32 [bits] Ch1 Output Data 03 : 32 [bits] Ch1 Output Data 04 : 32 [bits] Ch1 Output Data 05 : 32 [bits] Ch1 Port Status : 16 [bits] Ch1 Input SID : 8 [bits] Ch1 Output SID Response : 8 [bits] Ch1 Input Data Type : 16 [bits] Ch1 Input Sub Info : 16 [bits] Ch1 Input Data Length : 16 [bits] Ch1 Input Data 01 : 32 [bits] Ch1 Input Data 02 : 32 [bits] Ch1 Input Data 03 : 32 [bits] Ch1 Input Data 04 : 32 [bits] Ch1 Input Data 05 : 32 [bits] Edit I/O Allocation Settings
Unit operation settings	--- Edit Unit Operation Settings

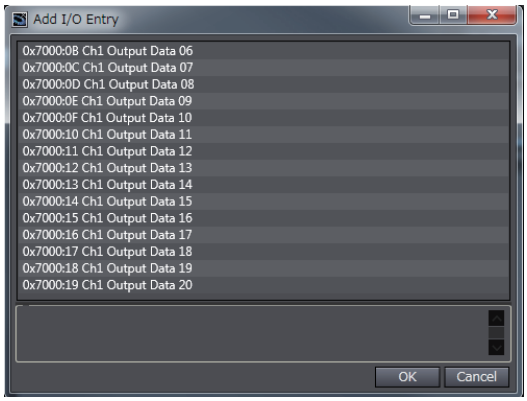
2 Click the **Edit I/O Allocation Settings** button.

The following tab page is displayed.



3 Select *Output Data Set* n in the *I/O entry mapping name* column and click the **Add I/O Entry** button.

The following dialog box is displayed.



4 Select the I/O entry to add and click the **OK** button.

The I/O entry is added.

5 Click the **OK** button or **Apply** button in the Edit I/O Allocation Settings pane.

The I/O entries will be added to the CIF Unit settings.

6 Transfer the Unit operation settings to the Controller.

Refer to *Transferring the Slave Terminal Configuration Information* in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the procedure to transfer the Unit operation settings to the Controller.

Each I/O entry for the output data has a size of 4 bytes. If you add I/O entries for Output Data 01 to Output Data 20, the PDO output data size will be 80 bytes.

You can use the same procedure to select *Input Data Set n* in the *I/O Entry Mapping Name* column to add I/O entries and change the PDO input data size.

7

Serial Communications

The CIF Units support no-protocol communications as the communications protocol. This section describes the communications protocol and the serial communications specifications.

7-1 No-protocol Communications 7-3

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7-1 No-protocol Communications

With no-protocol communications, data is sent and received without any conversions. Communications protocols to perform retry processing, data type conversion processing, branch processing according to the receive data, and other processing are not used.

You can use no-protocol communications to send data to and receive data from serial communications devices that have an RS-232C or RS-422A/485 port.

For example, you can use it for simple no-protocol data transfers, such as inputting data from a barcode reader or outputting data to a printer.

Controlling the RS and CS signals and other control signals is also possible.

Precautions for Correct Use

Precaution for EtherCAT Communications State

EtherCAT communications must be in the Operational state to perform PDO communications between the communications master and CIF Units. Confirm that EtherCAT communications are in the Operational state before you perform serial communications.

7-2 How Data Is Sent and Received

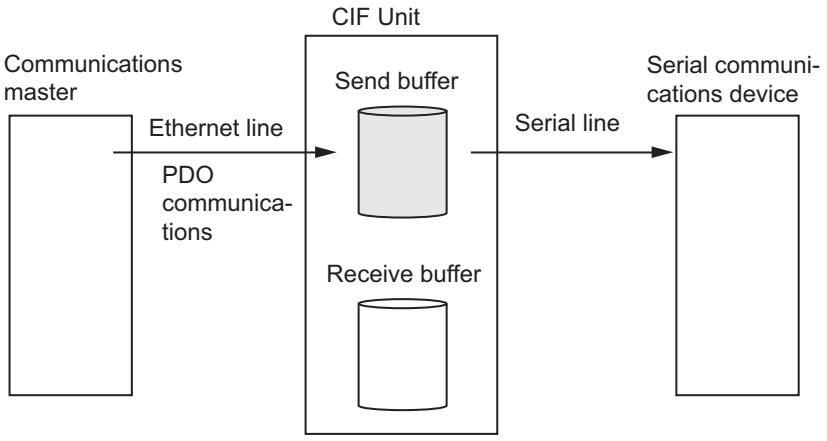
This section describes how the send and receive buffers in a CIF Unit are used to send and receive data.

The definitions of the terms used for sending and receiving data are described in the following table.

Term	Meaning
Sending data	Sending data from the Controller to the serial line. Although data is sent and received between the communications master and CIF Unit within a Controller, the device sending the data, such as the communications master or CIF Unit, is specified in that case and the wording “data is sent” is used.
Receiving data	Receiving data from the serial line at the Controller. Although data is sent and received between the communications master and a CIF Unit within a Controller, the device receiving the data, such as the communications master or CIF Unit, is specified in that case and the wording “data is received” is used.
Send data	The data that is sent from the Controller to the serial line. Although data is sent and received between the communications master and a CIF Unit within a Controller, “send data” is used only for the data that is finally sent from the Controller to the serial line.
Receive data	The data that is received by the Controller from the serial line. Although data is sent and received between the communications master and a CIF Unit within a Controller, “receive data” is used only for the data that is initially received by the Controller from the serial line.

7-2-1 How Data Is Sent

When data is sent, the send data is first stored in the send buffer in the CIF Unit, as shown in the following figure, before the data is sent to the serial line. The send buffer size is 5,120 bytes per port.



The following procedure is used to send data.

1. In each process data communications cycle, the send data from the communications master is sent in order to the send buffer in the CIF Unit.

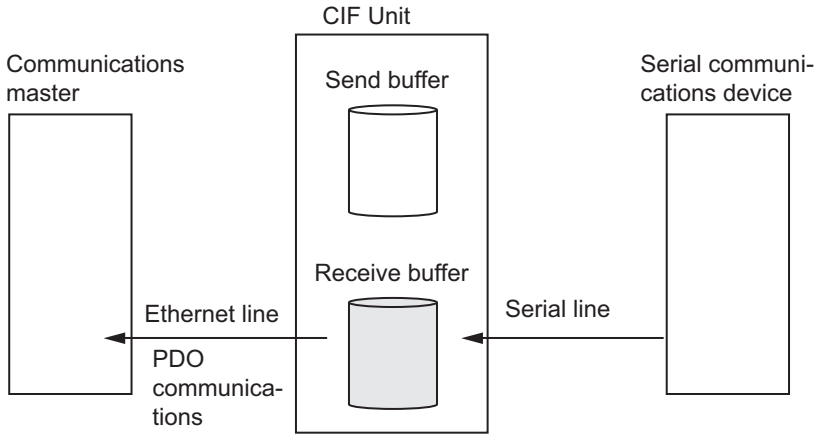
   The size of send data that is transferred each time depends on the PDO settings. You can change the PDO size to between 4 and 80 bytes. The default setting is 20 bytes.

2. The send data in the send buffer in the CIF Unit is sent to the serial line.

   You can change the baud rate in the Unit operation settings for the CIF Unit.

7-2-2 How Data Is Received

When data is received, the receive data is first stored in the receive buffer in the CIF Unit, as shown in the following figure, before the data is sent to the communications master. The receive buffer size is 5,120 bytes per port.



The following procedure is used to receive data.

1. The receive data on the serial line is stored in the receive buffer in the CIF Unit.
2. In each process data communications cycle, the receive data in the receive buffer in the CIF Unit is sent in order to the communications master.

   The size of receive data that is transferred each time depends on the PDO settings. You can change the PDO size to between 4 and 80 bytes. The default setting is 20 bytes.

Precautions for Correct Use

The CIF Unit may not store receive data that is on the serial line in the receive buffer when the Controller power supply is turned ON or during initialization processing immediately after the CIF Unit is restarted. A parity or framing error may occur.

7-3 Data Used in PDO Communications

This section describes the data that is used in PDO communications between the communications master and a CIF Unit.

7-3-1 Input Notification Data and Output Notification Data

The data that is sent from a CIF Unit to the communications master is called the input notification data. The data that is sent from the communications master to a CIF Unit is called the output notification data.

All of the input notification data and output notification data can be set in the I/O allocations on the Sysmac Studio. Refer to *Section 5 I/O Data Specifications* for details on the data that you can set in the I/O allocations.

The following table gives the data indices for I/O allocation of the input notification and output notification data.

Data	Index (hex)
Input Notification Data	6000 and 6001
Output Notification Data	7000 and 7001

In each process data communications cycle, the communications master and CIF Unit exchange input notification data and output notification data.

7-3-2 SIDs and SID Responses

It is necessary to confirm that the input notification data and output notification data that are sent between the communications master and CIF Unit are received normally. The following data is used for that purpose: Input SID and Output SID Response in the input notification data and Output SID and Input SID Response in the output notification data. The default values for all of these is 00 hex.

Input SID and Input SID Response

The Input SID and Input SID Response are used as described in the following table when the CIF Unit inputs receive data to the communications master.

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>1</td><td>No data reception</td><td>• The communications master receives the input notification data given on the right.
• The Input SID is 00 hex, so the master knows that there is no input data included in the input notification data that was received.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit sets the Input SID to 00 hex to tell the communications master that no input data is included in the input notification data.
<table><tr><td>Port Status</td><td>-</td></tr><tr><td>Input SID</td><td>00 hex</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>None</td></tr></table></td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>2</td><td>Input response when there is no input data</td><td>• The communications master outputs the following output notification data.
• The communications master has not yet received input data, so the Input SID Response remains at 00 hex.
<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>00 hex</td></tr><tr><td>Output Data Type</td><td>-</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>-</td></tr></table></td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>3</td><td>Data reception</td><td>---</td><td></td><td>The CIF Unit receives data from the serial line.</td></tr>
<tr><td>4</td><td>Inputting the first data</td><td>• The communications master receives the input notification data given on the right.
• The Input SID is 01 hex, so the master knows that the first input data is included in the input notification data that was received.
• The input data is stored in the receive buffer.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit sets the Input SID to 01 hex to tell the communications master that the first input data is included in the input notification data.
<table><tr><td>Port Status</td><td>-</td></tr><tr><td>Input SID</td><td>01 hex</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>The first data received from the serial line</td></tr></table></td></tr>
<tr><td>5</td><td>First input response</td><td>• The communications master outputs the following output notification data.
• The communications master sets the Input SID Response to the value of the Input SID (01 hex) to tell the CIF Unit that the communications master has normally received the first input data.
<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>01 hex</td></tr><tr><td>Output Data Type</td><td>-</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>-</td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that the communications master has normally received the first input data because the Input SID Response in the output notification data is 01 hex.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>6</td><td>Inputting the second data</td><td>• The communications master receives the input notification data given on the right.
• The communications master checks the Input SID.
• The Input SID is 02 hex, so the master knows that the second input data is included in the input notification data that was received.
• The input data is stored in the receive buffer.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit sets the Input SID to 02 hex to tell the communications master that the second input data is included in the input notification data.<table><tr><td>Port Status</td><td>-</td></tr><tr><td>Input SID</td><td>02 hex</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>The second data received from the serial line</td></tr></table></td></tr>
<tr><td>7</td><td>Second input response</td><td>• The communications master outputs the following output notification data.
• The communications master sets the Input SID Response to the value of the Input SID (02 hex) to tell the CIF Unit that the communications master has normally received the second input data.<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>02 hex</td></tr><tr><td>Output Data Type</td><td>-</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>-</td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that the communications master has normally received the second input data because the Input SID Response in the output notification data is 02 hex.</td></tr>
<tr><td>8</td><td>Completion of data input</td><td>• The communications master receives the input notification data given on the right.
• The communications master checks the Input SID.
• The Input SID is still 02 hex, so the master knows that there is no new input data included in the input notification data that was received.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit leaves the Input SID set to 02 hex to tell the communications master that no input data is included in the input notification data.<table><tr><td>Port Status</td><td>-</td></tr><tr><td>Input SID</td><td>02 hex</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>None</td></tr></table></td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

Output SID and Output SID Response

The Output SID and Output SID Response are used when the communications master outputs send data to the CIF Unit. They are used in the same way as the Input SID and Input SID Response.

7-3-3 Input Data Type and Output Data Type

If the send data size is larger than the PDO size, the send data is separated into more than one PDO and sent from the communications master to the CIF Unit. If the receive data size is larger than the PDO size, the receive data is separated into more than one PDO and sent from the CIF Unit to the communications master.

It is therefore necessary for the communications master to tell the CIF Unit whether the sent output data is final or if other data will follow. The same thing is true when the CIF Unit sends input data to the communications master. The following data is used for that purpose: Input Data Type in the input notification data and Output Data Type in the output notification data.

The following table gives the meanings of bits 12 to 14 of the Input Data Type and bits 12 to 15 of the Output Data Type.

Data	Description
Bits 12 to 14 in the Input Data Type	Presence of receive data received by the CIF Unit from the serial line 0 hex: No data received, and the end not detected. 1 hex: Data received, and the end not detected. 2 hex: The end detected. Whether there is data received depends on cases. *1*2
Bits 12 to 15 in the Output Data Type	Presence of send data sent by the CIF Unit to the serial line 0 hex: No data sent. 1 hex: Data sent but not the last. 2 hex: Last data sent.

*1. The value will be 2 hex only when the Number of Characters to Determine the End is set to a value other than 0. If the Number of Characters to Determine the End is set to 0 and there is receive data, the value will be 1 hex.

*2. If the Number of Characters to Determine the End is not set to 0, the value will be 1 hex when the last data is received. The value will then change to 2 hex when the end is detected.

7-3-4 Send Completed Toggle Bit

The send data that the communications master sends to the CIF Unit is then sent to the serial line. The Send Completed Toggle Bit in the Port Status in the input notification data tells whether the final send data has been sent to the serial line.

The Send Completed Toggle Bit changes between TRUE and FALSE each time the send data is sent to the serial line until the final data is sent. The default value of the Send Completed Toggle Bit is FALSE.

The following table gives an operation example for the Send Completed Toggle Bit.

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>1</td><td>Outputting send data that is not the final send data</td><td>• The communications master outputs the following output notification data to pass the send data that is not the final send data to the CIF Unit.
<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>-</td></tr><tr><td>Output Data Type</td><td>1000 hex</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>Send data that is not the final send data</td></tr></table>There is send data that is not the final send data.</td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>2</td><td>Output response for send data that is not the final send data</td><td>The communications master receives the input notification data given on the right.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit changes the Send Data Exist in the Port Status to TRUE (there is data in the send buffer).
<table><tr><td>Port Status</td><td>0011 hex</td></tr><tr><td>Input SID</td><td>-</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>-</td></tr></table>There is data in the send buffer.</td></tr>
<tr><td>3</td><td>Sending send data that is not the final send data</td><td>---</td><td></td><td>The CIF Unit sends send data that is not the final send data to the serial line. *2</td></tr>
<tr><td>4</td><td>Outputting the final send data</td><td>The communications master outputs the following output notification data to pass the final send data to the CIF Unit.
<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>-</td></tr><tr><td>Output Data Type</td><td>2000 hex</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>Final send data</td></tr></table>Final send data</td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>5</td><td>Output response for the final send data</td><td>The communications master receives the input notification data given on the right.</td><td>←</td><td>• The CIF Unit inputs the following input notification data.
• The CIF Unit tells the communications master that the final send data was received normally.
<table><tr><td>Port Status</td><td>0011 hex</td></tr><tr><td>Input SID</td><td>-</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>-</td></tr></table>There is data in the send buffer.</td></tr>
<tr><td>6</td><td>Sending the final send data</td><td>---</td><td></td><td>The CIF Unit sends the final send data to the serial line.</td></tr>
<tr><td>7</td><td>---</td><td>• The communications master outputs the following output notification data.
• There is no new output data.
<table><tr><td>Output SID</td><td>-</td></tr><tr><td>Input SID Response</td><td>-</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>-</td></tr><tr><td>Output Data Length</td><td>-</td></tr><tr><td>Output Data</td><td>None</td></tr></table>There is no send data.</td><td>→</td><td>---</td></tr>
<tr><td>8</td><td>Checking sending of the final send data</td><td>• The communications master receives the input notification data given on the right.
• The Send Completed Toggle Bit in the Port Status in the input notification data changed, so the communications master knows that the CIF Unit sent the final send data to the serial line.</td><td>←</td><td>• The CIF Unit inputs the following input notification data and tells the communications master that the final send data was sent to the serial line.
• The CIF Unit changes the Send Completed Toggle Bit in the Port Status.
<table><tr><td>Port Status</td><td>0012 hex</td></tr><tr><td>Input SID</td><td>-</td></tr><tr><td>Output SID Response</td><td>-</td></tr><tr><td>Input Data Type</td><td>-</td></tr><tr><td>Input Sub Info</td><td>-</td></tr><tr><td>Input Data Length</td><td>-</td></tr><tr><td>Input Data</td><td>-</td></tr></table>The Send Completed Toggle Bit changed.</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

*2. The CIF Unit sends the output data to the serial line immediately after receiving it from the communications master only when transmission buffering is disabled. If transmission buffering is enabled, all of the output data is sent at the same time after it has been received.

7-4 PDO Communications Examples

This section gives some examples of PDO communications between a communications master and CIF Unit.

7-4-1 Example of Sending Data

In this example, the following 26-byte text string is sent: ABCDEFGHIJKLMNOPQRSTUVWXYZ.

The text string is separated into the first 20 bytes (ABCDEFGHIJKLMNOPQRST) and the remaining 6 bytes (UVWXYZ) to output it from the communications master to the CIF Unit.

For a programming sample for this example, refer to *A-4-3 Programming Sample 2: Sending Data* on page A-35.

Here, we will assume that the input notification data and output notification data are in the following default status before the data is sent. The default status will exist immediately after the power supply to the Controller is turned ON or the CIF Unit is restarted.

● Input Notification Data

NX object name	Value
Port Status	Depends on port status.
Input SID	00 hex
Output SID Response	00 hex
Input Data Type	0000 hex
Input Sub Info	0000 hex
Input Data Length	0000 hex
Input Data 01	00 hex, 00 hex, 00 hex, 00 hex

● Output Notification Data

NX object name	Value
Output SID	00 hex
Input SID Response	00 hex
Output Data Type	0000 hex
Output Sub Info	0000 hex
Output Data Length	0000 hex
Output Data 01 to 05	00 hex, 00 hex ...

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>1</td><td>Outputting string from A to T</td><td>• The communications master outputs the output notification data given below to pass the following part of the text string to the CIF Unit: ABCDEFGHIJKLMNOPQRST.
<table><tr><td>Output SID</td><td>01 hex</td><td>Incremented.</td></tr><tr><td>Input SID Response</td><td>00 hex</td><td rowspan="2">There is send data that is not the final.</td></tr><tr><td>Output Data Type</td><td>1000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td><td rowspan="2"></td></tr><tr><td>Output Data Length</td><td>0014 hex</td><td>20 bytes</td></tr><tr><td>Output Data 01 to 05</td><td>41 hex,
42 hex,
:
53 hex,
54 hex</td><td>A to T</td></tr></table>• The above output notification data is held until the CIF Unit sends the input notification data in which the Output SID Response is 01 hex.</td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>2</td><td>Output response for A to T</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that ABCDEFGHIJKLMNOPQRST was normally received by the CIF Unit because the Output SID Response in the input notification data is 01 hex.</td><td>←</td><td>The CIF Unit inputs the following input notification data to tell the communications master that ABCDEFGHIJKLMNOPQRST was received normally.
<table><tr><td>Port Status</td><td>0011 hex</td><td>There is data in the send buffer.</td></tr><tr><td>Input SID</td><td>00 hex</td><td rowspan="2"></td></tr><tr><td>Output SID Response</td><td>01 hex</td><td>Set the Output SID.</td></tr><tr><td>Input Data Type</td><td>0000 hex</td><td></td></tr><tr><td>Input Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Input Data Length</td><td>0000 hex</td><td></td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td><td></td></tr></table></td></tr>
<tr><td>3</td><td>Sending A to T</td><td>---</td><td></td><td>The CIF Unit sends ABCDEFGHIJKLMNOPQRST to the serial line. *2</td></tr>
<tr><td>4</td><td>Outputting UVWXYZ</td><td>The communications master outputs the output notification data given below to pass the following part of the text string to the CIF Unit: UVWXYZ.
<table><tr><td>Output SID</td><td>02 hex</td><td>Incremented.</td></tr><tr><td>Input SID Response</td><td>00 hex</td><td></td></tr><tr><td>Output Data Type</td><td>2000 hex</td><td>This is the final send data.</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Output Data Length</td><td>0006 hex</td><td>6 bytes</td></tr><tr><td>Output Data 01 to 05</td><td>55 hex,
56 hex,
57 hex,
58 hex,
59 hex,
5A hex,
00 hex,
:</td><td>UVWXYZ</td></tr></table></td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>5</td><td>Output response for UVWXYZ</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that UVWXYZ was normally received by the CIF Unit because the Output SID Response in the input notification data is 01 hex.</td><td>←</td><td>The CIF Unit inputs the following input notification data to tell the communications master that UVWXYZ was received normally.
<table><tr><td>Port Status</td><td>0011 hex</td></tr><tr><td>Input SID</td><td>00 hex</td></tr><tr><td>Output SID Response</td><td>02 hex</td></tr><tr><td>Input Data Type</td><td>0000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>There is data in the send buffer.
Set the Output SID.</td></tr>
<tr><td>6</td><td>Sending UVWXYZ</td><td>---</td><td></td><td>The CIF Unit sends UVWXYZ to the serial line.</td></tr>
<tr><td>7</td><td>---</td><td>• The communications master outputs the following output notification data.
• There is no new output data.
<table><tr><td>Output SID</td><td>02 hex</td></tr><tr><td>Input SID Response</td><td>00 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Not incremented.
There is no send data.</td><td>→</td><td>---</td></tr>
<tr><td>8</td><td>Confirming sending of UVWXYZ</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the CIF Unit sent UVWXYZ to the serial line because the Send Completed Toggle Bit in the Port Status in the input notification data changed.</td><td>←</td><td>The CIF Unit inputs the following input notification data and tells the communications master that UVWXYZ was sent to the serial line.
<table><tr><td>Port Status</td><td>0012 hex</td></tr><tr><td>Input SID</td><td>00 hex</td></tr><tr><td>Output SID Response</td><td>02 hex</td></tr><tr><td>Input Data Type</td><td>0000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>The Send Completed Toggle Bit changes.
No change</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

*2. The CIF Unit sends the output data to the serial line immediately after receiving it from the communications master only when transmission buffering is disabled. If transmission buffering is enabled, all of the output data is sent at the same time after it has been received.

7-4-2 Example of Receiving Data

In this example, the following 26-byte text string is received: ABCDEFGHIJKLMNOPQRSTUVWXYZ.

The text string is separated into the first 20 bytes (ABCDEFGHIJKLMNOPQRST) and the remaining 6 bytes (UVWXYZ) to send it from the CIF Unit to the communications master.

It is assumed that the Number of Characters to Determine the End is set as the condition to determine the reception completion.

For a programming sample for this example, refer to *A-4-4 Programming Sample 3: Receiving Data* on page A-38.

Here, we will assume that the input notification data and output notification data are in the following status before the data is received.

● Input Notification Data

NX object name	Value
Port Status	0010 hex
Input SID	00 hex
Output SID Response	02 hex
Input Data Type	0000 hex
Input Sub Info	0000 hex
Input Data Length	0000 hex
Input Data 01 to 05	00 hex, 00 hex ...

● Output Notification Data

NX object name	Value
Output SID	02 hex
Input SID Response	00 hex
Output Data Type	0000 hex
Output Sub Info	0000 hex
Output Data Length	0000 hex
Output Data 01	00 hex, 00 hex, 00 hex, 00 hex

Step	Process	Communications master processing	Communications direction*1	CIF Unit processing
1	Receiving A to Z	---		The CIF Unit receives ABCDEFGHIJKLMNOPQRSTUVWXYZ from the serial line.

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>2</td><td>Inputting string from A to T</td><td>The communications master receives the input notification data given on the right.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to pass ABCDEFGHIJKLMNOPQRST to the communications master.
<table><tr><td>Port Status</td><td>0010 hex</td><td rowspan="7">Incremented.
There is receive data that is not the final receive data.
20 bytes
A to T</td></tr><tr><td>Input SID</td><td>01 hex</td></tr><tr><td>Output SID Response</td><td>02 hex</td></tr><tr><td>Input Data Type</td><td>1000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0014 hex</td></tr><tr><td>Input Data 01 to 05</td><td>41 hex,
42 hex,
:
53 hex,
54 hex</td></tr></table>• The above input notification data is held until the communications master sends output notification data in which the Input SID Response is 01 hex.</td></tr>
<tr><td>3</td><td>Input response for A to T</td><td>The communications master outputs the following output notification data to tell the CIF Unit that ABCDEFGHIJKLMNOPQRST was received normally.
<table><tr><td>Output SID</td><td>02 hex</td><td rowspan="6">Set the Input SID.</td></tr><tr><td>Input SID Response</td><td>01 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that ABCDEFGHIJKLMNOPQRST was normally received by the communications master because the Input SID Response in the output notification data is 01 hex.</td></tr>
<tr><td>4</td><td>• Inputting string UVWXYZ
• Notification of end detection</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the CIF Unit detected the end of the receive data because the End Detected in the Port Status in the input notification data is TRUE.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to pass UVWXYZ to the communications master.
• At the same time, the CIF Unit tells the communications master that the end of the receive data was detected.
<table><tr><td>Port Status</td><td>8010 hex</td><td>End was detected.</td></tr><tr><td>Input SID</td><td>02 hex</td><td rowspan="2">Incremented.</td></tr><tr><td>Output SID Response</td><td>02 hex</td></tr><tr><td>Input Data Type</td><td>2000 hex</td><td rowspan="5">This is the final receive data.
6 bytes
"UVWXYZ"</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0006 hex</td></tr><tr><td>Input Data 01 to 05</td><td>55 hex,
56 hex,
57 hex,
58 hex,
59 hex,
5A hex,
00 hex
:</td></tr></table></td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>5</td><td>Input response for UVWXYZ</td><td>The communications master outputs the following output notification data to tell the CIF Unit that UVWXYZ was received normally.
<table><tr><td>Output SID</td><td>02 hex</td><td rowspan="7">Set the Input SID.</td></tr><tr><td>Input SID Response</td><td>02 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that UVWXYZ was normally received by the communications master because the Input SID Response in the output notification data is 02 hex.</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

7-4-3 Simultaneously Sending and Receiving Data

In this example, a 4-byte text string (ABCD) is sent and a 4-byte text string (1234) is received at the same time.

It is assumed that the Number of Characters to Determine the End is set.

Here, we will assume that the input notification data and output notification data are in the following status before the data is sent and received.

● Input Notification Data

NX object name	Value
Port Status	8010 hex
Input SID	02 hex
Output SID Response	02 hex
Input Data Type	2000 hex
Input Sub Info	0000 hex
Input Data Length	0006 hex
Input Data 01	55 hex, 56 hex, 57 hex, 58 hex

● Output Notification Data

NX object name	Value
Output SID	02 hex
Input SID Response	02 hex
Output Data Type	0000 hex
Output Sub Info	0000 hex
Output Data Length	0000 hex
Output Data 01	00 hex, 00 hex, 00 hex, 00 hex

Step	Process	Communications master processing	Communications direction*1	CIF Unit processing
1	Outputting ABCD	• The communications master outputs the following output notification data to pass ABCD to the CIF Unit. Output SID: 03 hex (Incremented.) Input SID Response: 02 hex Output Data Type: 2000 hex (This is the final send data.) Output Sub Info: 0000 hex Output Data Length: 0004 hex (4 bytes) Output Data 01: 41 hex, 42 hex, 43 hex, 44 hex (ABCD) • The above output notification data is held until the CIF Unit sends input notification data in which the Output SID Response is 03 hex.	→	The CIF Unit receives the output notification data given on the left.
2	Receiving 1234	---		The CIF Unit receives 1234 from the serial line. *2

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>3</td><td>• Output response for ABCD
• Inputting 1234</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that ABCD was normally received by the CIF Unit because the Output SID Response in the input notification data is 03 hex.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to tell the communications master that ABCD was received normally.
• At the same time, it passes 1234 to the communications master.
<table><tr><td>Port Status</td><td>0010 hex</td><td>Incremented.</td></tr><tr><td>Input SID</td><td>03 hex</td><td rowspan="2">Set the Output SID.
There is receive data that is not the final receive data.</td></tr><tr><td>Output SID Response</td><td>03 hex</td></tr><tr><td>Input Data Type</td><td>1000 hex</td><td></td></tr><tr><td>Input Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Input Data Length</td><td>0004 hex</td><td>4 bytes</td></tr><tr><td>Input Data 01</td><td>31 hex,
32 hex,
33 hex,
34 hex</td><td>1234</td></tr></table></td></tr>
<tr><td>4</td><td>Sending ABCD</td><td>---</td><td></td><td>The CIF Unit sends ABCD to the serial line.</td></tr>
<tr><td>5</td><td>Input response for 1234</td><td>• The communications master outputs the following output notification data to tell the CIF Unit that 1234 was received normally.
<table><tr><td>Output SID</td><td>03 hex</td><td rowspan="2">Set the Input SID.</td></tr><tr><td>Input SID Response</td><td>03 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td><td></td></tr><tr><td>Output Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Output Data Length</td><td>0000 hex</td><td></td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td><td></td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that 1234 was normally received by the communications master because the Input SID Response in the output notification data is 03 hex.</td></tr>
<tr><td>6</td><td>Detecting the end of the receive data</td><td>---</td><td></td><td>The CIF Unit detects the end of the receive data.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>7</td><td>• Confirming sending of ABCD
• Notification of end detection</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the CIF Unit sent ABCD to the serial line because the Send Completed Toggle Bit in the Port Status in the input notification data changed.
• The communications master knows that the CIF Unit detected the end of the receive data because the End Detected in the Port Status in the input notification data is TRUE.</td><td>←</td><td>• The CIF Unit inputs the following input notification data and tells the communications master that ABCD was sent to the serial line.
• At the same time, the CIF Unit tells the communications master that the end of the receive data was detected.
<table><tr><td>Port Status</td><td>8012 hex</td><td>The Send Completed Toggle Bit changed.
End was detected.</td></tr><tr><td>Input SID</td><td>04 hex</td><td>Incremented.</td></tr><tr><td>Output SID Response</td><td>03 hex</td><td></td></tr><tr><td>Input Data Type</td><td>2000 hex</td><td>This is the final receive data.</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Input Data Length</td><td>0000 hex</td><td>0 bytes</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td><td></td></tr></table></td></tr>
<tr><td>8</td><td>Input response for end detection</td><td>The communications master outputs the following output notification data to tell the CIF Unit that notification of the detection of the end of the receive data was received normally.
<table><tr><td>Output SID</td><td>03 hex</td><td rowspan="7">Set the Input SID.</td></tr><tr><td>Input SID Response</td><td>04 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that the communications master has normally received the notification of the detection of the end of the receive data because the Input SID Response in the output notification data is 04 hex.</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

*2. In this example, the end is not detected when the CIF Unit receives ABCD.

7-4-4 Example for a Parity Error during Data Reception

This section gives an example of a parity error in the third character when a 6-byte string (123456) was received.

Here, we will assume that the input notification data and output notification data are in the following status before the data is received.

● Input Notification Data

NX object name	Value
Port Status	8012 hex
Input SID	04 hex
Output SID Response	03 hex
Input Data Type	2000 hex
Input Sub Info	0000 hex

NX object name	Value
Input Data Length	0000 hex
Input Data 01	00 hex, 00 hex, 00 hex, 00 hex

● Output Notification Data

NX object name	Value
Output SID	03 hex
Input SID Response	04 hex
Output Data Type	0000 hex
Output Sub Info	0000 hex
Output Data Length	0000 hex
Output Data 01	00 hex, 00 hex, 00 hex, 00 hex

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>1</td><td>Receiving 123456</td><td>--</td><td></td><td>• The CIF Unit receives 123456 from the serial line.
• A parity error is detected.</td></tr>
<tr><td>2</td><td>• Inputting 12
• Discarding 12</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that there is a parity error because the Parity Error in the Port Status in the input notification data is TRUE.
• The communications master discards 12.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to pass 12 to the communications master.
• At the same time, the CIF Unit tells the communications master that there is a parity error.
<table><tr><td>Port Status</td><td>1012 hex</td></tr><tr><td>Input SID</td><td>05 hex</td></tr><tr><td>Output SID Response</td><td>03 hex</td></tr><tr><td>Input Data Type</td><td>9000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0002 hex</td></tr><tr><td>Input Data 01</td><td>31 hex,
32 hex,
00 hex,
00 hex</td></tr></table>There is a parity error. Incremented.
There is an error in the receive data.
2 bytes
12
• The above input notification data is held until the communications master sends output notification data in which the Input SID Response is 05 hex.</td></tr>
<tr><td>3</td><td>Input response for 12</td><td>The communications master outputs the following output notification data to tell the CIF Unit that 12 was received normally.
<table><tr><td>Output SID</td><td>03 hex</td></tr><tr><td>Input SID Response</td><td>05 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Set the Input SID.</td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that 12 was normally received by the communications master because the Input SID Response in the output notification data is 05 hex.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>4</td><td>• Inputting 456
• Discarding 456</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the CIF Unit detected the end of the receive data because the End Detected in the Port Status in the input notification data is TRUE.
• The communications master discards 456 because it is part of the receive data for which a parity error occurred.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to pass 456 to the communications master.
• At the same time, the CIF Unit tells the communications master that the end of the receive data was detected.
<table><tr><td>Port Status</td><td>8012 hex</td><td>End was detected.</td></tr><tr><td>Input SID</td><td>06 hex</td><td>Incremented.</td></tr><tr><td>Output SID Response</td><td>03 hex</td><td></td></tr><tr><td>Input Data Type</td><td>2000 hex</td><td>This is the final receive data.</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Input Data Length</td><td>0003 hex</td><td>3 bytes</td></tr><tr><td>Input Data 01</td><td>34 hex,
35 hex,
36 hex,
00 hex</td><td>456</td></tr></table></td></tr>
<tr><td>5</td><td>Input response for 456</td><td>The communications master outputs the following output notification data to tell the CIF Unit that 456 was received normally.
<table><tr><td>Output SID</td><td>03 hex</td><td rowspan="2">Set the Input SID.</td></tr><tr><td>Input SID Response</td><td>06 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td><td></td></tr><tr><td>Output Sub Info</td><td>0000 hex</td><td></td></tr><tr><td>Output Data Length</td><td>0000 hex</td><td></td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td><td></td></tr></table></td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that 456 was normally received by the communications master because the Input SID Response in the output notification data is 06 hex.</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

7-4-5 Example of Control Command Execution

This example executes a control command to restart a port.

When the port is restarted, the value of the Input SID is initialized to 00 hex. In response to this, the communications master must initialize the value of the Output SID.

In this example, the value of the Output SID is initialized before the Restart Port control command is executed in case an unexpected error, such as a communications error, occurs.

For a programming sample for this example, refer to *A-4-2 Programming Sample 1: Restarting CIF Unit Ports* on page A-32.

Here, we will assume that the input notification data and output notification data are in the following status before the control command is executed.

● Input Notification Data

NX object name	Value
Port Status	0010 hex
Input SID	05 hex
Output SID Response	03 hex
Input Data Type	2000 hex

NX object name	Value
Input Sub Info	0000 hex
Input Data Length	0000 hex
Input Data 01	00 hex, 00 hex, 00 hex, 00 hex

● Output Notification Data

NX object name	Value
Output SID	03 hex
Input SID Response	05 hex
Output Data Type	0000 hex
Output Sub Info	0000 hex
Output Data Length	0000 hex
Output Data 01	00 hex, 00 hex, 00 hex, 00 hex

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>1</td><td>Output SID initial-ization</td><td>• The communications master initializes the value of the Output SID to 00 hex and outputs the following output notifi-cation data.
<table><tr><td>Output SID</td><td>00 hex</td></tr><tr><td>Input SID Response</td><td>05 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Initialization
• The above output notification data is held until the CIF Unit sends the input notification data in which the Output SID Response is 00 hex.</td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>2</td><td>Response to initial-ized Out-put SID</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that initialized Output SID was nor-mally received by the CIF Unit because the Output SID Response in the input notification data is 00 hex.</td><td>←</td><td>The CIF Unit inputs the following input notifi-cation data to tell the communications mas-ter that the initialized Output SID was received normally.
<table><tr><td>Port Status</td><td>0010 hex</td></tr><tr><td>Input SID</td><td>05 hex</td></tr><tr><td>Output SID Response</td><td>00 hex</td></tr><tr><td>Input Data Type</td><td>2000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Set the Output SID.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communi-cations direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>3</td><td>Request to restart the port</td><td>The communications master outputs the following output notification data to execute the Restart Port control command.
<table><tr><td>Output SID</td><td>01 hex</td></tr><tr><td>Input SID Response</td><td>05 hex</td></tr><tr><td>Output Data Type</td><td>0101 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Incremented.
Restart Port</td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>4</td><td>Confirmation of reception of the port restart request</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the control command was normally received by the CIF Unit because the Output SID Response in the input notification data is 01 hex.</td><td>←</td><td>• The CIF Unit restarts the port.
• The value of the Input SID is initialized to 00 hex.
<table><tr><td>Port Status</td><td>0010 hex</td></tr><tr><td>Input SID</td><td>00 hex</td></tr><tr><td>Output SID Response</td><td>01 hex</td></tr><tr><td>Input Data Type</td><td>0000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Initialization
Set the Output SID.</td></tr>
<tr><td>5</td><td>---</td><td>The communications master outputs the following empty output notification data.
<table><tr><td>Output SID</td><td>01 hex</td></tr><tr><td>Input SID Response</td><td>00 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Not incremented.</td><td>→</td><td>The CIF Unit receives the output notification data given on the left.</td></tr>
<tr><td>6</td><td>Response reception</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that the port was restarted normally because the Input Data Type in the input notification data is 0201 hex.</td><td>←</td><td>• The CIF Unit inputs the following input notification data to notify the communications master of the response.
<table><tr><td>Port Status</td><td>0010 hex</td></tr><tr><td>Input SID</td><td>01 hex</td></tr><tr><td>Output SID Response</td><td>01 hex</td></tr><tr><td>Input Data Type</td><td>0201 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Incremented.
Set the Output SID.
Response</td></tr>
</table>

<table>
<tr><th>Step</th><th>Process</th><th>Communications master processing</th><th>Communications direction*1</th><th>CIF Unit processing</th></tr>
<tr><td>7</td><td>Checking response reception</td><td>• The communications master outputs the following output notification data to notify the CIF Unit that the response was received.
• When the port is restarted, the value of the Output SID is initialized to 00 hex.
<table><tr><td>Output SID</td><td>00 hex</td></tr><tr><td>Input SID Response</td><td>01 hex</td></tr><tr><td>Output Data Type</td><td>0000 hex</td></tr><tr><td>Output Sub Info</td><td>0000 hex</td></tr><tr><td>Output Data Length</td><td>0000 hex</td></tr><tr><td>Output Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Initialization
Set the Input SID.</td><td>→</td><td>• The CIF Unit receives the output notification data given on the left.
• The CIF Unit knows that the response was normally received by the communications master because the Input SID Response in the output notification data is 01 hex.</td></tr>
<tr><td>8</td><td>Response to initialized Output SID</td><td>• The communications master receives the input notification data given on the right.
• The communications master knows that initialized Output SID was normally received by the CIF Unit because the Output SID Response in the input notification data is 00 hex.</td><td>←</td><td>The CIF Unit inputs the following input notification data to tell the communications master that the initialized Output SID was received normally.
<table><tr><td>Port Status</td><td>0010 hex</td></tr><tr><td>Input SID</td><td>05 hex</td></tr><tr><td>Output SID Response</td><td>00 hex</td></tr><tr><td>Input Data Type</td><td>2000 hex</td></tr><tr><td>Input Sub Info</td><td>0000 hex</td></tr><tr><td>Input Data Length</td><td>0000 hex</td></tr><tr><td>Input Data 01</td><td>00 hex,
00 hex,
00 hex,
00 hex</td></tr></table>Set the Output SID.</td></tr>
</table>

*1. →: Output notification data is output from communications master to CIF Unit.
←: Input notification data is input from CIF Unit to communications master.

7-5 User Programming to Send Data

To send data, user programming in the communications master must include the following processing.

7-5-1 Creating and Outputting Output Notification Data

The output notification data is created using the send data as the output data and the output notification data is output to the CIF Unit. If the send data size is larger than the PDO size, the send data must be divided into pieces and multiple output notification data must be created.

7-5-2 Checking Input Notification Data

User programming must check the contents of the input notification data that is input from the CIF Unit to confirm that the output notification data was correctly received by the CIF Unit.

7-5-3 Processing Send Data

Depending on the communications protocol of the serial communications device that is the destination of the send data, it may be necessary to perform the following processing on the send data.

- Adding the start code
- Adding the end code
- Adding a CRC

For a programming sample to send data, refer to *A-4-3 Programming Sample 2: Sending Data* on page A-35.

7-6 User Programming to Receive Data

To receive data, user programming in the communications master must include the following processing.

7-6-1 Checking Input Notification Data

User programming must check the contents of the input notification data that was input from the CIF Unit. If there is input data, the user programming must store it in the receive buffer.

If the receive data size is larger than the PDO size, the receive data is divided into pieces and sent in multiple input data. In that case, the multiple input data must be rejoined to restore the receive data.

You can also use the input notification data to see if a communications error has occurred.

7-6-2 Creating and Outputting Output Notification Data

User programming must create the output notification data and output it to the CIF Unit. By outputting the output notification data, the communications master tells the CIF Unit whether it received the input notification data normally.

7-6-3 Determining Conditions to Start Reception and Conditions for the Completion of the Reception

Depending on the communications protocol of the serial communications device that is the source of the receive data, there may be settings made for the reception start condition and reception completion condition for the receive data.

The user programming in the communications master must interpret the contents of the receive data and determine when the reception start condition and reception completion condition are met.

However, if Number of Characters to Determine the End is set as the reception completion condition, you can check the End Detected in the Port Status in the input notification data to see if the reception completion condition is met.

For protocols in which the receive data contains a CRC or other check code, the user programming must perform processing to confirm the check codes.

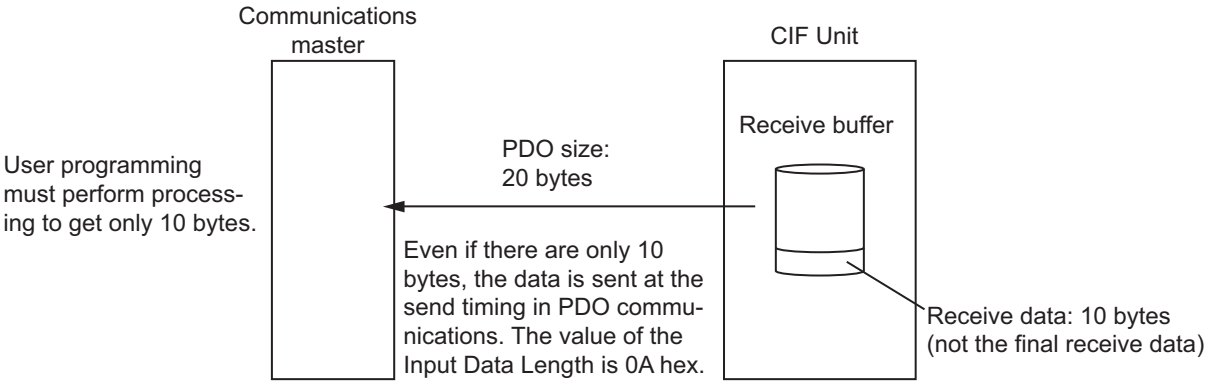
7-6-4 Precautions for Writing User Programming to Receive Data

Observe the following precautions when you write the user programming to receive data from the serial line.

Operation When the Size of Receive Data in the Receive Buffer Is Less Than the PDO Size

In each PDO communications cycle, the CIF Unit sends the receive data in the receive buffer to the communications master. Therefore, even if the size of receive data in the receive buffer is less than the PDO size, the receive data is sent to the communications master at the send timing in PDO communications.

For example, if the PDO size is 20 bytes, there are 10 bytes of receive data in the receive buffer, and the data is not the final receive data, the 10 bytes of receive data in the receive buffer is sent to the communications master as input data at the send timing in PDO communications. In this case, the user programming would have to get the 10 bytes of input data from the 20-byte PDO that was received. You can determine the size of the input data from the Input Data Length given in the input notification data.

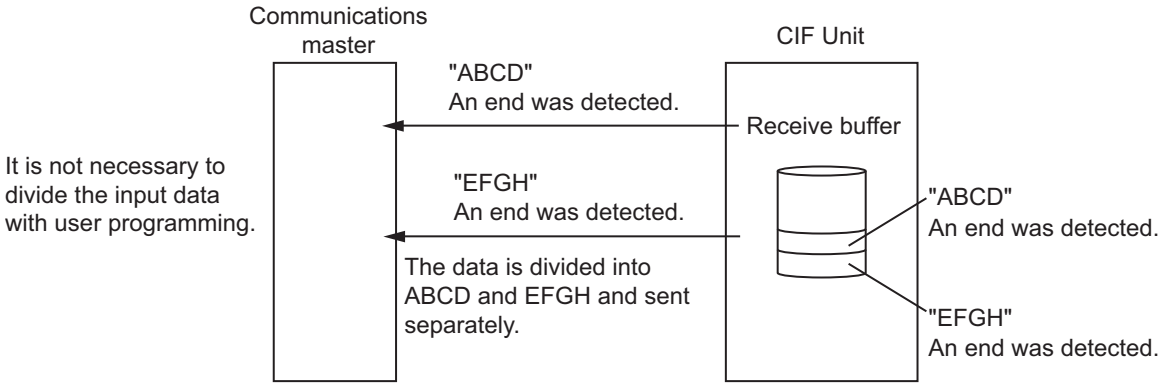


Operation When More Than One End Is Detected in the Receive Data in the Receive Buffer

If the Number of Characters to Determine the End is set and more than one end is detected in the receive data in the receive buffer, the receive data is separated into the different sets of input data and sent to the communications master.

For example, if the receive data in the receive buffer is ABCDEFGH and ends are detected between D and E and after H, the receive data is divided into ABCD and EFGH input data and sent to the communications master separately.

Therefore, if you set the Number of Characters to Determine the End, it is not necessary to divide input data with user programming.



For a programming sample to receive data, refer to *A-4-4 Programming Sample 3: Receiving Data* on page A-38.

7-7 User Programming to Restart a Port

The communications master and CIF Unit exchange input notification data and output notification data in each PDO communications cycle. The Input SID in the input notification data and the Output SID in the output notification data must match. Refer to *7-3-2 SIDs and SID Responses* on page 7-6 for detailed specifications for the Input SID and Output SID.

If the values of the Input SID and Output SID do not match, the port on the CIF Unit must be restarted to initialize the values so that they match again. Place processing to restart the CIF Unit port in the user programming that is executed in the communications master.

7-7-1 Mismatched Values for the Input SID and Output SID

The values for the Input SID and Output SID may become mismatched in the following cases.

- A power interruption occurs only in the communications master.
- A power interruption occurs only in the Slave Terminal or CIF Unit.
- An EtherCAT error occurs and is then reset.

7-7-2 User Program Processing

Use the NX Unit I/O Data Active Status in the I/O data of the Communications Coupler Unit to detect when the values of the Input SID and Output SID do not match. The value of NX Unit I/O Data Active Status changes to TRUE when the values become unmatched.

Therefore, assign a variable to NX Unit I/O Data Active Status in the I/O map as shown below. In this example, the Communications Coupler Unit is the NX-ECC201 and NX Unit I/O Data Active Status 125 is used as the port.

Unit	Port	Description	Name
NX-ECC201	NX Unit I/O Data Active Status 125	NX Unit I/O Data Active Status	E001_NX_Unit_IO_Data_Active_Status_125

When you detect a change to TRUE in the NX Unit I/O Data Active Status, execute the Restart Port control command. When restarting the port is completed, execute the user programing to send and receive data.

For a programming sample for restarting a port, refer to *A-4-2 Programming Sample 1: Restarting CIF Unit Ports* on page A-32.

7-8 Communications Performance

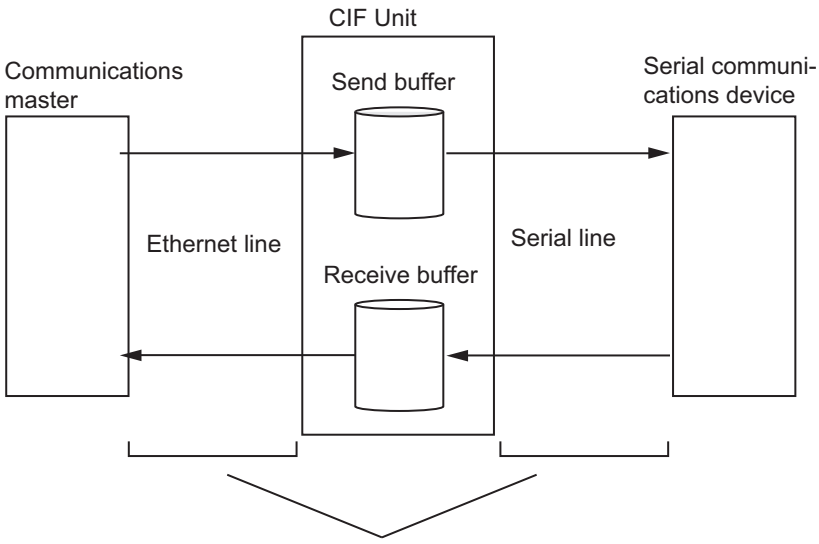
This section describes how to calculate the communications performance of the CIF Unit. You can adjust the PDO sizes to improve communications performance.

7-8-1 Calculating the Communications Performance

The communications performance is determined by the transfer time between the communications master and CIF Unit and the transfer time between the CIF Unit and serial line.

The calculation formulas for the transfer time between the communications master and CIF Unit and the transfer time between the CIF Unit and serial line are given for the following three cases.

- Data send times when transmission buffering is enabled
- Data send times when transmission buffering is disabled
- Data reception time



The communications performance is determined by these two transfer times.

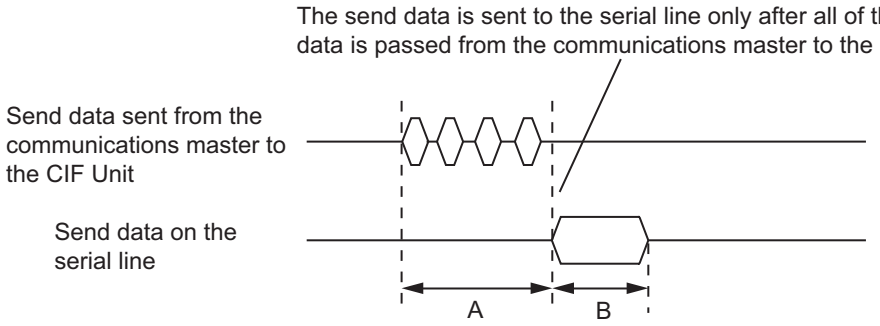
Precautions for Correct Use

The values found with the calculation formulas for the communications performance are only guidelines. Actual transfer times will vary. Always test performance with the actual equipment before you use the system.

Data Send Times When Transmission Buffering Is Enabled

If transmission buffering is enabled, the send data is sent to the serial line only after all of the send data is passed from the communications master to the CIF Unit.

Therefore, the data send time will be the total of time A and time B in the following diagram.



Letter	Definition
A	The time from when the communications master starts sending the data to the CIF Unit until the CIF Unit starts sending the data to the serial line
B	The time from when the CIF Unit starts sending the data to the serial line until sending is completed

$$\text{Data send time [ms]} = \text{A [ms]} + \text{B [ms]}$$

$$\text{A [ms]} = \frac{\text{Process data communications cycle [ms]} \times \text{Number of I/O refreshes} \times \text{Output data size [bytes]}}{\text{PDO size [bytes]}}$$

$$\text{B [ms]} = \frac{\text{Bits per character}}{\text{Baud rate [bps]}} \times \text{Number of characters} \times 1{,}000$$

For example, the data send times for various baud rate and process data communications cycles are given in the following table for these parameter values.

Parameter	Value
Number of I/O refreshes	Always 3
Bits per character	10
Output data size [bytes]	256
PDO size [bytes]*1	20

*1. Refer to *6-3 Setting the PDO Sizes* on page 6-6 for the procedure to set PDO sizes.

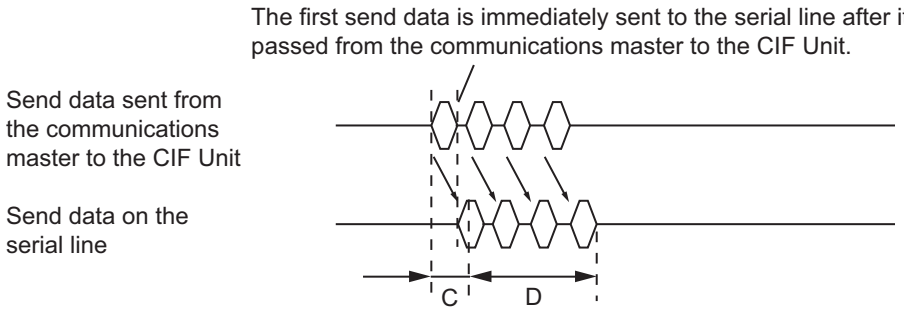
Data Send Times [ms]

Baud rate [bps]	Process data communications cycle [ms]			
	0.5	1	2	4
1,200	2,153	2,172	2,211	2,287
2,400	1,086	1,106	1,144	1,221
4,800	553	572	611	687
9,600	286	306	344	421
19,200	153	172	211	287
38,400	86	106	144	221
57,600	64	83	122	199
115,200	42	61	100	176
230,400	31	50	88	165

Data Send Times When Transmission Buffering Is Disabled

If transmission buffering is disabled, the first send data is immediately sent to the serial line after it is passed from the communications master to the CIF Unit.

Therefore, the data send time will be the total of time C and time D in the following diagram.



Letter	Definition
C	The time from when the communications master starts sending the data to the CIF Unit until the CIF Unit starts sending the data to the serial line
D	The time from when the CIF Unit starts sending the data to the serial line until sending is completed

Data send time [ms] = C [ms] + D [ms]

C [ms] = Process data communications cycle [ms] × Number of I/O refreshes

$$D\ [ms] = \frac{\text{Bits per character}}{\text{Baud rate [bps]}} \times \text{Number of characters} \times 1{,}000$$

For example, the data send times for various baud rate and process data communications cycles are given in the following table for these parameter values.

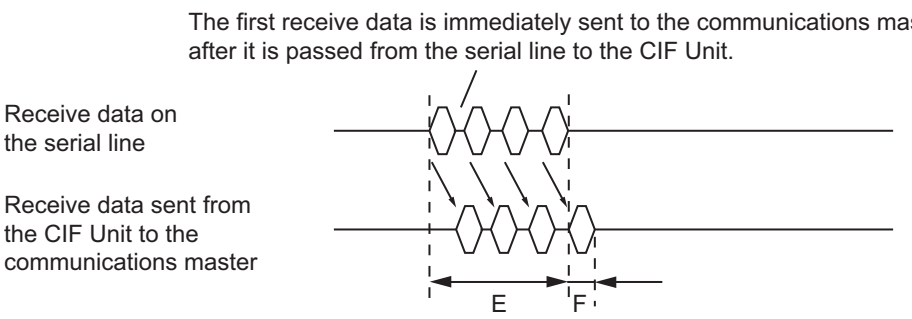
Parameter	Value
Number of I/O refreshes	Always 3
Bits per character	10
Output data size [bytes]	256

Data Send Times [ms]

Baud rate [bps]	Process data communications cycle [ms]			
	0.5	1	2	4
1,200	2,135	2,137	2,140	2,146
2,400	1,069	1,070	1,073	1,079
4,800	535	537	540	546
9,600	269	270	273	279
19,200	135	137	140	146
38,400	69	70	73	79
57,600	46	48	51	57
115,200	24	26	29	35
230,400	13	15	18	24

Data Reception Times

The data reception time is the total of time E and time F in the following diagram.



Letter	Definition
E	The time from when the CIF Unit starts receiving data from the serial line until receiving is completed
F	The time from when the CIF Unit finishes receiving data from the serial line until transferring the data to the communications master is completed

Data reception time [ms] = E [ms] + F [ms]

$$E\ [ms] = \frac{\text{Bits per character}}{\text{Baud rate [bps]}} \times \text{Number of characters} \times 1{,}000$$

F [ms] = Process data communications cycle [ms] × Number of I/O refreshes

The data reception times are the same as the data send times when transmission buffering is disabled.

For example, the data reception times for various baud rates and process data communications cycles are given in the following table for these parameter values.

Parameter	Value
Number of I/O refreshes	2
Bits per character	10
Input data size [bytes]	256

Data Reception Times [ms]

Baud rate [bps]	Process data communications cycle [ms]			
	0.5	1	2	4
1,200	2,135	2,136	2,138	2,141
2,400	1,068	1,069	1,071	1,075
4,800	535	536	538	542
9,600	268	269	271	275
19,200	135	136	138	142
38,400	68	69	71	75
57,600	46	47	49	53
115,200	24	25	27	31
230,400	13	14	16	20

7-8-2 Adjusting PDO Sizes to Improve Communications Performance

The communications performance is determined by the transfer time between the communications master and CIF Unit and the transfer time between the CIF Unit and serial line.

Therefore, you can achieve efficient communications if you optimize the PDO sizes for the process data communications cycle between the communications master and CIF Unit and the baud rate between the CIF Unit and serial line.

You can use the following formula to calculate the optimum PDO size.

$$\text{Optimum PDO sizes [bytes]} = \frac{\text{Baud rate [bps]}}{\text{Bits per character} \times 1{,}000} \times \text{Process data communications cycle [ms]} \times \text{Number of I/O refreshes}$$

However, the PDO sizes must be set in increments of 4 bytes, so use the next higher multiple of 4 bytes from the value found with the above formula.

Also, the smallest PDO size that you can set is 4 bytes, so if the result of the above formula is less than 4 bytes, set the PDO size to 4 bytes. Also, the largest PDO size that you can set is 80 bytes, so if the result of the above formula is greater than 80 bytes, set the PDO size to 80 bytes.

For example, the data send times for various baud rates and process data communications cycles are given in the following table for these parameter values.

Parameter	Value
Number of I/O refreshes	3
Bits per character	10

Optimum PDO Sizes [bytes]

Baud rate [bps]	Process data communications cycle [ms]			
	0.5	1	2	4
1,200	4	4	4	4
2,400	4	4	4	4
4,800	4	4	4	8
9,600	4	4	8	12
19,200	4	8	12	24
38,400	8	12	24	48
57,600	12	20	36	72
115,200	20	36	72	80
230,400	36	72	80	80

Precautions for Correct Use

PDO Size Limits for EtherCAT

The following restrictions apply to the PDO sizes when you use EtherCAT. When you adjust the PDO sizes to improve communications performance, consider these restrictions as well.

Item	Specification [bytes]
Maximum total PDO size that you can use for EtherCAT	5,736
Maximum total PDO size that you can use for PDO communications for one EtherCAT slave	1,024

Additional Information

Optimizing PDO Sizes When Transmission Buffering Is Enabled

If transmission buffering is enabled, the send data is sent to the serial line only after all of the send data is passed from the communications master to the CIF Unit. Therefore, to improve communications performance, you can adjust the PDO sizes to minimize divisions of send data that is sent from the communications master to the CIF Unit.

The optimum PDO size is determined by the send data size as given in the following table.

Send data size	Optimum PDO size
80 bytes or more	80 bytes
Less than 80 bytes	A size that is larger than the send data size

7-8-3 Processing When the Send Buffer or Receive Buffer Becomes Full

If the transfer time from the communications master to the CIF Unit is shorter than the transfer time from the CIF Unit to the serial line when data is sent, the send data may accumulate in the send buffer.

If the transfer time from the serial line to the CIF Unit is shorter than the transfer time from the CIF Unit to the communications master when data is received, the receive data may accumulate in the receive buffer.

The send buffer and receive buffer each has a capacity of 5,120 bytes. The CIF Unit performs the following processing if the send buffer or receive buffer becomes full.

Problem	Processing
Send buffer becomes full.	• Any new send data from the communications master is discarded until the data in the send buffer goes below 5,120 bytes. • When send data is discarded, a Data Discarded Due to Full Internal Buffer event (event code 85400000 hex) is recorded in the event log.
Receive buffer becomes full.	• Any new receive data from the serial line is discarded until the data in the receive buffer goes below 5,120 bytes. • When receive data is discarded, a Data Discarded Due to Full Internal Buffer event (event code 85400000 hex) is recorded in the event log.

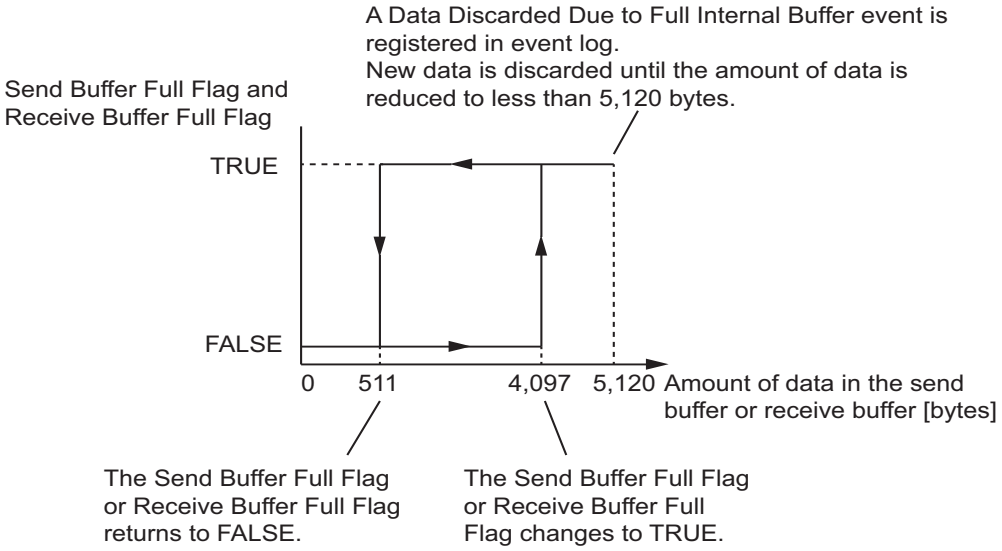
Send Buffer Full Flag and Receive Buffer Full Flag

If more than 4,097 bytes accumulate in the send or receive buffer (capacity of 5,120 bytes each) when data is sent or received, the Send Buffer Full Flag or the Receive Buffer Full Flag in the Port Status for the relevant port changes to TRUE. Monitor the Send Buffer Full Flag and Receive Buffer Full Flag in user programming and do not allow the buffers to become full. Or, adjust the PDO sizes so that the buffers do not become full.

After the Send Buffer Full Flag or Receive Buffer Full Flag changes to TRUE, it will return to FALSE when the amount of data in the send or receive buffer declines to 511 bytes or less.

Refer to *A-3 List of NX Objects* on page A-5 for details on the Send Buffer Full Flag and Receive Buffer Full Flag.

The following figure illustrates the relationship between the amount of data in the send buffer or receive buffer and the value of the Send Buffer Full Flag or Receive Buffer Full Flag.



8

Serial Line Monitor

With the serial line monitor, you can display and save the log of the data that has been sent or received by the CIF Unit. This section describes the serial line monitor in detail.

8-1 How the Serial Line Monitor Works 8-2
8-1-1 Monitor Data Contents 8-2
8-1-2 CIF Serial Line Monitor Tab Page 8-3
8-1-3 Processing When a Buffer Becomes Full 8-4
8-1-4 Importing and Exporting Monitor Data 8-4
8-1-5 Searching for Text Strings in Monitor Data 8-4
8-1-6 Creating CSV Files of Monitor Data 8-5
8-1-7 Processing for Multiple Units and Ports 8-5
8-2 Operation with the Sysmac Studio 8-6
8-2-1 Displaying the CIF Serial Line Monitor Tab Page 8-6
8-2-2 Starting and Stopping Monitoring and Displaying Monitor Data 8-8

8-1 How the Serial Line Monitor Works

"Monitor" in the serial line monitor means to store a log of the data that is sent and received by the CIF Unit in a buffer inside the CIF Unit. The data stored in this buffer is called the monitor data.

You can check the monitor data to see when and which data was sent and received. You can use this to confirm whether data is sent and received according to the system design.

You can use the serial line monitor to start and stop monitoring and to display monitor data on the Sysmac Studio.

There is a different buffer for each port. You can therefore monitor the line data and display the monitor data for a specific port.

8-1-1 Monitor Data Contents

The contents of the monitor data are given in the following table.

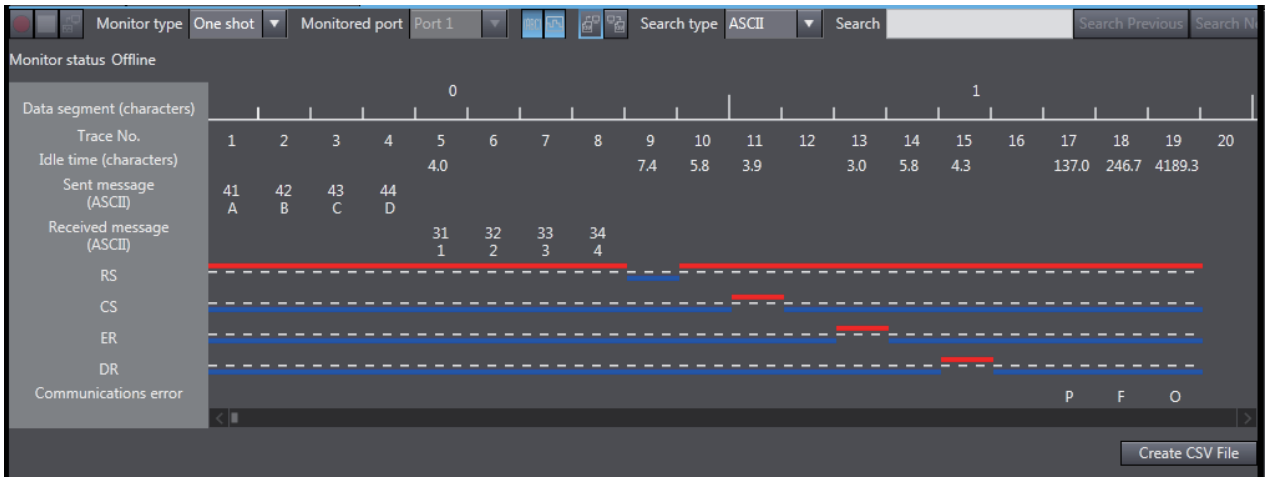
Category	Data	Description
Sent or received messages	SD	Sent message
	RD	Received message
Control signals	RS	Request to send
	CS	Clear to send
	ER	Data terminal ready
	DR	Data set ready
Communications error flags	Parity Error Flag	These flags indicate when errors occur.
	Framing Error Flag	
	Overrun Error Flag	

Precautions for Correct Use

The monitor data is not included in the Sysmac Studio project. To save the monitor data, use the monitor data export operation and save it in a separate file from the Sysmac Studio project file.

8-1-2 CIF Serial Line Monitor Tab Page

On the Sysmac Studio, the monitor data is displayed in the CIF Serial Line Monitor tab page. The configuration of the CIF Serial Line Monitor tab page is shown below. The data values are shown from left to right along a time scale. The left edge is the starting point of the monitor.



Display item	Description
Data segment (characters)	A serial number is given for each segment of 10 trace numbers.
Trace No.	Trace numbers are assigned to sent or received messages by character.
Idle time (characters)	The idle time is the number of characters between two sent or received messages when nothing is sent or received for more than the time required for two characters. The maximum value is 6,553.5 characters.
Sent message (ASCII)	The top row gives the sent messages in hexadecimal. The bottom row gives the sent messages in ASCII characters. Periods are displayed when the actual characters cannot be displayed, such as for control characters. *1
Received message (ASCII)	The top row gives the received messages in hexadecimal. The bottom row gives the received messages in ASCII characters. Periods are displayed when the actual characters cannot be displayed, such as for control characters. *1
RS, CS, ER, and DR*2	The ON/OFF values of the RS, CS, ER, and DR control signals are displayed. ON: A red line is displayed above the base line. OFF: A blue line is displayed below the base line.
Comm error*2	Abbreviations are displayed for communications errors that occur. *3 P: Parity error F: Framing error O: Overrun error

*1. You can show or hide the characters with the **Display the characters** button in the CIF Serial Line Monitor tab page.

*2. You can show or hide the signals with the **Display the details** button in the CIF Serial Line Monitor tab page.

*3. If more than one type of communications error occur at the same time, the priority of the error display from the highest priority is as follows: parity error, framing error, and overrun error.

Precautions for Correct Use

The control signals are recorded from when one character of a message is sent or received. Therefore, changes in the control signals are not shown in the CIF Serial Line Monitor tab page even when they change unless a message is sent or received. Also, changes in the control signals may not be shown in the CIF Serial Line Monitor tab page if the signals change for periods shorter than the time to send or receive one character.

8-1-3 Processing When a Buffer Becomes Full

The buffer size for each port is 4,096 characters.

The processing that is performed when a buffer becomes full depends on the monitor type, as described in the following table. The monitor type is set with the **Monitor type** button in the CIF Serial Line Monitor tab page.

Monitor type	Processing
Continuous	After the buffer becomes full, the data is discarded from the oldest and monitoring continues.
One shot	Monitoring automatically stops when the buffer becomes full.

8-1-4 Importing and Exporting Monitor Data

You can export the monitor data that is displayed in the CIF Serial Line Monitor tab page to a binary file on your computer. You can also import monitor data and display it in the CIF Serial Line Monitor tab page.

However, importing and exporting monitor data is not possible while monitoring is in progress. Also, exporting monitor data is not possible unless the monitor data is displayed in the CIF Serial Line Monitor tab page.

Use the **Import** button and **Export** button in the CIF Serial Line Monitor tab page to import and export monitor data.

Precautions for Correct Use

You cannot import or export monitor data when the CIF Unit is monitoring data or reading monitor data from the buffer.

However, if more than one CIF Unit is connected, you can import or export monitor data for a CIF Unit that is not monitoring data or reading monitor data even when another CIF Unit is monitoring data or reading monitor data.

8-1-5 Searching for Text Strings in Monitor Data

You can search for a specified text string in the monitor data that is currently displayed in the CIF Serial Line Monitor tab page. If the text string is found, it is highlighted in blue. The search string can contain up to 16 characters.

You can set any of the following three search types. The search type is set with the **Search type** button in the CIF Serial Line Monitor tab page.

Search type	Processing
ASCII	The ASCII characters that are displayed for the sent or received messages are searched for the text string that you specified for the search string. *1
HEX	The hexadecimal values that are displayed for the sent/received messages are searched for the hexadecimal conversion of the text string that you specified for the search string.
Comm error	The communications errors are searched for the characters that you specify for the search string. *2 The following letters are used to indicate the communications errors. P: Parity error F: Framing error O: Overrun error

*1. The characters must be displayed in the CIF Serial Line Monitor tab page with the **Display the characters** button to perform this type of search.

*2. The hexadecimal values must be displayed in the CIF Serial Line Monitor tab page with the **Display the details** button to perform this type of search.

8-1-6 Creating CSV Files of Monitor Data

You can save the monitor data that is displayed in the CIF Serial Line Monitor tab page to a CSV file on your computer.

However, you cannot save the monitor data if monitoring is in progress or if the monitor data is not displayed in the CIF Serial Line Monitor tab page.

Use the **Create CSV File** button in the CIF Serial Line Monitor tab page to create a CSV file of the monitor data.

The format of the CSV file that is created follows the display in the CIF Serial Line Monitor tab page as shown below. The values for each item are separated with commas for individual trace numbers.

```
Trace No.,1,2,3,4,5
Idle time (characters),20.5,,,,
Sent message,31,32,,,
(ASCII),A,B,,,
Received message,,,,33,
(ASCII),,,,C,
RS,0,0,1,1,1
CS,0,0,0,0,0
ER,0,0,0,0,0
DR,0,0,0,0,0
Communications error,,,,,P
```

Precautions for Correct Use

The CSV file cannot be read by the Sysmac Studio. If you must read the monitor data that you save on the computer with the Sysmac Studio, import and export binary monitor data.

8-1-7 Processing for Multiple Units and Ports

The following table describes the CIF Serial Line Monitor tab page and starting and stopping monitoring when more than one CIF Unit is connected or when more than one port is used on the NX-CIF210.

Application conditions	Processing	
	CIF Serial Line Monitor tab page	Starting or stopping monitoring
Multiple CIF Units connected	You can display a different tab page for each Unit.	You can start and stop monitoring for each Unit separately.
Using multiple ports on one CIF Unit	You cannot display the CIF Serial Line Monitor tab page for more than one port at the same time. You must change the *Monitored port* setting to display the CIF Serial Line Monitor tab page for the port.	You can start and stop monitoring for each port separately. To stop or start monitoring, do so after displaying the CIF Serial Line Monitor tab page for the port you want to start or stop monitoring.

Precautions for Correct Use

If you change the monitored port, the monitor data for the port that is not displayed is cleared from the buffer. If you must save the monitor data, export the monitor data before you change the monitored port.

8-2 Operation with the Sysmac Studio

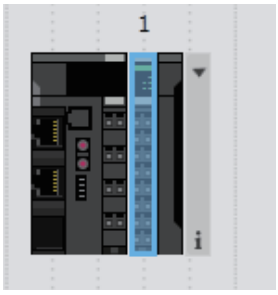
This section describes how to use the serial line monitoring on the Sysmac Studio in the following two parts.

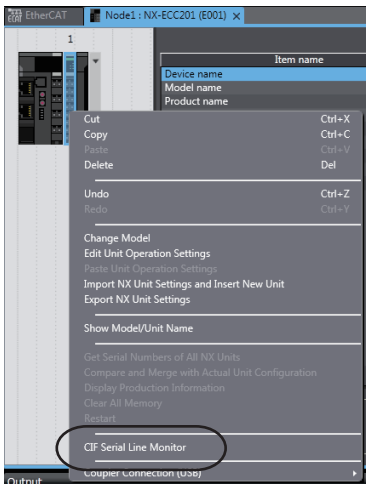
- Displaying the CIF Serial Line Monitor tab page
- Starting and stopping monitoring and displaying monitor data

8-2-1 Displaying the CIF Serial Line Monitor Tab Page

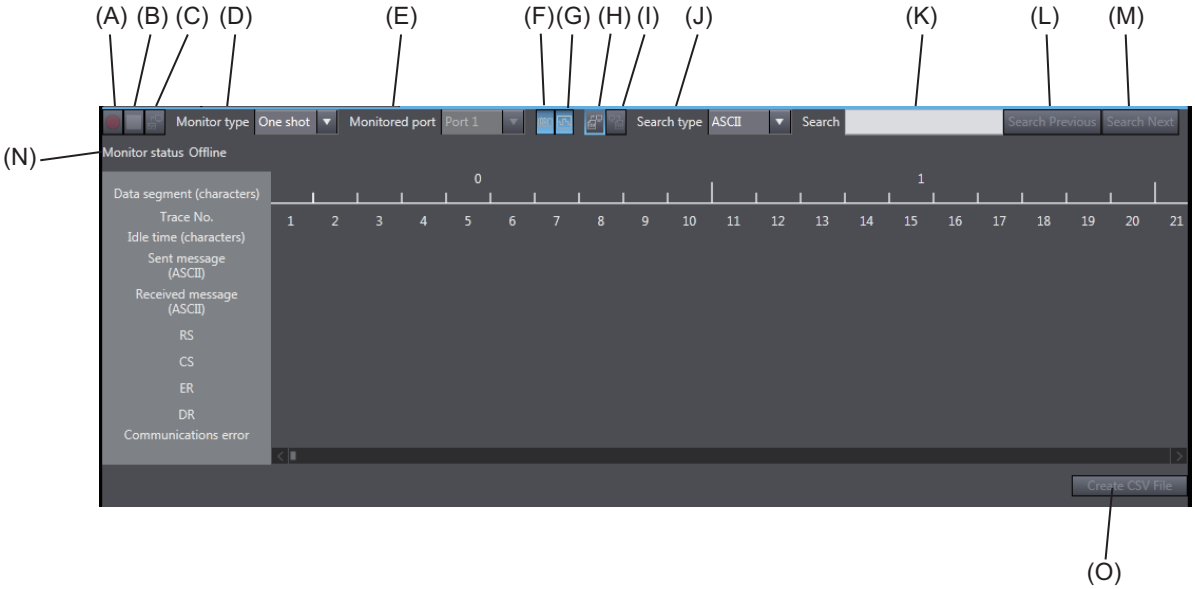
You can display the CIF Serial Line Monitor tab page. Use the following procedure.

1 Right-click the target CIF Unit on the Slave Terminal tab page and select ***CIF Serial Line Monitor***.





The CIF Serial Line Monitor tab page is displayed.



The buttons and boxes on the CIF Serial Line Monitor tab page are described in the following table.

Letter	Item	Description
(A)	Start monitoring	Starts monitoring.
(B)	Stop monitoring	Stops monitoring.
(C)	Read the monitor data	Reads the monitor data from the buffer and displays it.*1
(D)	Monitor type	Sets the monitor type.
(E)	Monitored port	Sets the number of the port to monitor. This button is enabled for the NX-CIF210.
(F)	Display the characters	Shows and hides the characters for the sent and received messages.
(G)	Display the details	Shows and hides the control signals and communications errors.
(H)	Import	Imports monitor data that was saved on the computer and displays it.
(I)	Export	Exports the monitor data that is displayed in the tab page to the computer.
(J)	Search type	Sets the search type.
(K)	Search string	Enter a search string.
(L)	Search Previous	Displays the previous search result.
(M)	Search Next	Displays the next search result.
(N)	Monitor status	Displays the monitoring status of the specified port on the CIF Unit. Offline: Offline Executing: Monitoring is in progress. Stopped: Monitoring is stopped.
(O)	Create CSV File	Exports the monitor data that is displayed in the tab page to a CSV file on the computer.

*1. If you click the **Read the monitor data** button when there is no monitor data in the buffer, no monitor data is displayed and an error message is also not displayed.

The CIF Serial Line Monitor tab page closes when you click the tab close button or when you right-click the tab and select ***Close*** from the menu.

8-2-2 Starting and Stopping Monitoring and Displaying Monitor Data

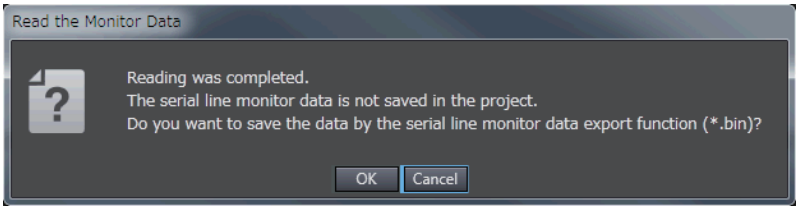
You can start monitoring, stop monitoring, and display monitor data for any CIF Unit port. Use the following procedure.

1. Make the following settings in the CIF Serial Line Monitor tab page.
   - Monitor type
   - Monitored port
2. Click the **Start monitoring** button.

   Monitoring will start.
3. Click the **Stop monitoring** button at any time.

   Monitoring stops.
   If the monitor type is set to **One shot**, monitoring will automatically stop when the buffer becomes full even if you do not click the **Stop monitoring** button.
4. Click the **Read the monitor data** button.

   The monitor data is displayed. Also, the following dialog box is displayed.



5. Click the **OK** button to export the monitor data. Click the **Cancel** button to not export the monitor data and only display the monitor data.

9

Troubleshooting

This section describes the error information and corrections for errors that can occur when the CIF Units are used.

9-1 How to Check for Errors 9-2

9-2 Checking for Errors with the Indicators 9-3

9-3 Checking for Errors and Troubleshooting on the Sysmac Studio 9-4

9-3-1 Checking for Errors from the Sysmac Studio 9-4

9-3-2 Event Codes for Errors and Troubleshooting Procedures 9-5

9-4 Resetting Errors 9-18

9-5 Troubleshooting Flow 9-19

9-1 How to Check for Errors

Use one of the following error checking methods.

- Checking the indicators.
- Troubleshooting with the Sysmac Studio.

9-2 Checking for Errors with the Indicators

You can use the TS indicators on the CIF Units to check the CIF Unit status and level of 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.

Abbrev.	Indicator status
Lit	Lit.
Not Lit	Not lit.
FS( )	Flashing. The numeric value in parentheses is the flashing interval.
---	Undefined.

The TS indicator can light either in green or red. The indicator status, CIF Unit status, and corrections are given in the following table.

Indicator status		CIF Unit status	Correction
Green	Red		
Lit	Not Lit	• The Unit is operating normally. • The Unit is ready for I/O refreshing.	---
FS (2 s)	Not Lit	Initializing	This status does not indicate an error. Wait until processing is completed.
FS (0.5 s)	Not Lit	• Automatic creation of the Unit configuration is in progress. • I/O checking is in progress.	This status does not indicate an error. Wait until processing is completed.
Not Lit	Not Lit	There is insufficient or no Unit power supply.	Check the following items and make sure that power is correctly supplied from the Unit 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.
		• Restarting is in progress for the Slave Terminal. • Waiting for initialization to start.	This status does not indicate an error. Wait until processing is completed.
		Unit failure	Replace the Unit.
Not Lit	Lit	A hardware error, WDT error, or other critical error that is common to all Units	Replace the Unit.
Not Lit	FS (1 s)	Communications error or other NX bus-related error that is common to all Units	Refer to the following event on *NX Unit I/O Communications Error* on page 9-11.

9-3 Checking for Errors and Troubleshooting on the Sysmac Studio

Error management on the NX Series is based on the methods used for the NJ-series Controllers. This allows you to use the Sysmac Studio to check the meanings of errors and troubleshooting procedures.

9-3-1 Checking for Errors from the Sysmac Studio

When an error occurs, you can place the Sysmac Studio online with the Controller or the Communications Coupler Unit to check current errors and the log of past 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 observation level are not displayed on this tab page.

Log of Past Errors

Open the Sysmac Studio's Controller Event Log tab page to check the following information on past errors: times, levels, sources, source details, event names, event codes, details, attached information 1 through 4, and corrections.

Refer to the *NJ-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 *9-3-2 Event Codes for Errors and Troubleshooting Procedures* on page 9-5 for details on event codes.

9-3-2 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 Communications Interface Units are given on the following pages. The following abbreviations are used in the *Level* column.

Abbreviation	Meaning
Maj	Major fault level
Prt	Partial fault level
Min	Minor fault level
Obs	Observation
Info	Information

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-series Troubleshooting Manual* (Cat. No. W503) for all NJ-series event codes.

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
00200000 hex	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	• Non-volatile memory failure			S			P. 9-8
10410000 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. 9-9
40200000 hex	NX Unit Processing Error	A fatal error occurred in an NX Unit.	• An error occurred in the software.			S			P. 9-10

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
80200000 hex	NX Unit I/O Communications Error	An I/O communications error occurred between the Communications Coupler Unit and the NX Unit.	• An 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. 9-11
80240000 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. 9-12
85400000 hex	Data Discarded Due to Full Internal Buffer	The internal buffer is full. The input data is discarded.	• If the internal buffer for received data is full, the task period was too short to read the received data. If the internal buffer for transmission data is full, the transmission data was too large or there are too many send requests.			S	U		P. 9-13
80220000 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. 9-14
85410000 hex	Parity Error	A parity error occurred.	• The communications settings and baud rate setting do not agree with those of the remote device. • Noise			U	S		P. 9-15
85420000 hex	Framing Error	A framing error occurred.	• The communications settings and baud rate setting do not agree with those of the remote device. • Noise			U	S		P. 9-15
85430000 hex	Overrun Error	An overrun error occurred.	• The next data was received during processing of received data because the baud rate is too high.			U	S		P. 9-16
90400000 hex	Event Log Cleared	The event log was cleared.	• The event log was cleared by the user.					S	P. 9-17

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 rowspan="2">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="2">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>Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="5">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>Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="5">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-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><td>Event name</td><td colspan="3">Control Parameter Error in Master</td><td>Event code</td><td colspan="2">10410000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An error occurred in the control parameters that are saved in the master.</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 rowspan="2">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, 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><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">I/O refreshing for the NX Unit stops.</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">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.</td><td colspan="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">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 is in progress.</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>

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	Restart 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	NX Unit I/O Communications Error			Event code	80200000 hex	
Meaning	An I/O communications error occurred between the Communications Coupler Unit and the 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	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.	Log category	System
Effects	User program	Continues.	Operation	The NX Unit will continue to operate. Input data: Inputs are stopped. Output data: Outputs are stopped.		

System-defined variables	Variable	Data type	Name
	None	---	---

Cause and correction	Assumed cause	Correction	Prevention
	The NX Unit is not mounted properly.	Mount the NX Units and End Cover securely and secure them with End Plates.	Mount the NX Units and End Cover securely and secure them with End Plates.
	The power cable for the Unit power supply is disconnected. Or, the wiring from the Unit power supply to the NX Units is incorrect.	Correctly wire the Unit power supply to the NX Units.	Correctly wire the Unit power supply to the NX Units.
	The power cable for the Unit power supply is broken.	Replace the power cable between the Unit power supply and the NX Units.	None
	The voltage of the Unit power supply is outside the specified range. Or, the capacity of the Unit power supply is insufficient.	Correctly configure the power supply system according to the power supply design methods.	Correctly configure the power supply system according to the power supply design methods.
	There is a hardware error in the NX Unit.	If the error occurs again even after you make the above correction, replace the NX Unit.	None

Attached information	None
Precautions/ Remarks	None

<table>
<tr><td>Event name</td><td colspan="2">NX Unit Clock Not Synchronized Error</td><td>Event code</td><td colspan="2">80240000 hex</td></tr>
<tr><td>Meaning</td><td colspan="5">An error occurred in the clock information between the EtherCAT 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>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 NX Unit will continue to operate.
Input data: Inputs are stopped.
Output data: Outputs are stopped.</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">There is a hardware error in the NX Unit.
There is a hardware error in the EtherCAT Coupler Unit.</td><td colspan="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">None</td></tr>
<tr><td>Attached information</td><td colspan="5">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="5">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="2">Data Discarded Due to Full Internal Buffer</td><td>Event code</td><td colspan="2">85400000 hex</td></tr>
<tr><td>Meaning</td><td colspan="5">An internal buffer is full. The input data is discarded.</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 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.
If the internal buffer for received data is full, the received data is discarded.
If the internal buffer for transmission data is full, the transmission data is discarded.</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">If the internal buffer for received data is full, the task period was too short to read the received data.
If the internal buffer for transmission data is full, the transmission data was too large or there are too many send requests.</td><td colspan="2">Reduce the amount of data sent and received with serial devices or increase the number of bytes assigned to the PDOs.</td><td colspan="2">Reduce the amount of data sent and received with serial devices or increase the number of bytes assigned to the PDOs.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: Port where error occurred
0001 hex: Port 1
0010 hex: Port 2
Attached information 2: Buffer where error occurred
0001 hex: Internal buffer for transmission data
0010 hex: Internal buffer for received data</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">You can change the event level to the observation level.</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="2">NX Message Communications Error</td><td>Event code</td><td colspan="2">80220000 hex</td></tr>
<tr><td>Meaning</td><td colspan="5">An error was detected in message communications and the message frame was discarded.</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>During NX message communications</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Observation</td><td>Recovery</td><td>---</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">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="4">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 message communications load is high.</td><td colspan="2">Reduce the number of times that instructions are used to send NX messages.
Refer to the appendix of the NJ-series Instructions Reference Manual (Cat. No. W502) for information on the instructions that send messages.</td><td colspan="2">Reduce the number of times that instructions are used to send NX messages.</td></tr>
<tr><td colspan="2">The communications cable is disconnected or broken.
This cause does not apply if attached information 2 is 0 (NX bus).</td><td colspan="2">Connect the communications cable securely.</td><td colspan="2">Connect the communications cable securely.</td></tr>
<tr><td colspan="2">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.</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td>Attached information</td><td colspan="5">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)</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="5">None</td></tr>
</table>

Event name	Parity Error			Event code	85410000 hex	
Meaning	A parity error occurred.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The NX Unit will continue to operate. The received data may not be correct.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The communications settings and baud rate setting do not agree with those of the remote device.		Use the same communications settings and baud rate setting for the remote device.		Use the same communications settings and baud rate setting for the remote device.	
	Noise		Implement noise countermeasures.		Implement noise countermeasures.	
Attached information	Attached information 1: Port where error occurred 0001 hex: Port 1 0010 hex: Port 2					
Precautions/ Remarks	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 NX Unit.”					

Event name	Framing Error			Event code	85420000 hex	
Meaning	A framing error occurred.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The NX Unit will continue to operate. The received data may not be correct.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The communications settings and baud rate setting do not agree with those of the remote device.		Use the same communications settings and baud rate setting for the remote device.		Use the same communications settings and baud rate setting for the remote device.	
	Noise		Implement noise countermeasures.		Implement noise countermeasures.	
Attached information	Attached information 1: Port where error occurred 0001 hex: Port 1 0010 hex: Port 2					
Precautions/ Remarks	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 NX Unit.”					

<table>
<tr><td>Event name</td><td colspan="2">Overrun Error</td><td>Event code</td><td colspan="2">85430000 hex</td></tr>
<tr><td>Meaning</td><td colspan="5">An overrun error occurred.</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>Observation</td><td>Recovery</td><td>---</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. The received data may not be correct.</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 next data was received during processing of received data because the baud rate is too high.</td><td colspan="2">Reduce the baud rate.</td><td colspan="2">Reduce the baud rate.</td></tr>
<tr><td>Attached information</td><td colspan="5">Attached information 1: Port where error occurred
0001 hex: Port 1
0010 hex: Port 2</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="5">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 NX Unit.”</td></tr>
</table>

Event name	Event Log Cleared			Event code	90400000 hex	
Meaning	The event log was cleared.					
Source	Depends on where the Sysmac Studio is connected and the system configuration.		Source details	NX Unit	Detection timing	When commanded from user
Error attributes	Level	Information	Recovery	---	Log category	Access
Effects	User program	Continues.	Operation	Not affected.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The event log was cleared by the user.		---		---	
Attached information	Attached information 1: Events that were cleared 1: The system event log was cleared. 2: The access event log was cleared.					
Precautions/ Remarks	None					

9-4 Resetting Errors

Refer to the user's manual for the connected Communications Coupler Unit for information on resetting errors.

9-5 Troubleshooting Flow

Refer to the user's manual for the connected Communications Coupler Unit for the standard flow for troubleshooting.

10

Maintenance and Inspections

This section describes how to clean, inspect, and maintain the CIF Units.

10-1 Cleaning and Inspections 10-2
10-1-1 Cleaning 10-2
10-1-2 Periodic Inspection 10-2
10-2 Maintenance Procedures 10-5

10-1 Cleaning and Inspections

This section describes daily maintenance and the cleaning and inspection methods.

Inspect the CIF Unit daily or periodically in order to keep it in optimal operating condition.

10-1-1 Cleaning

Clean the CIF Unit regularly as described below in order to keep it in optimal operating condition.

- Wipe the CIF Unit 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 NX Units 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.

10-1-2 Periodic Inspection

Although the major components in NX Units have an extremely long life time, they can deteriorate under improper environmental conditions. Periodic inspections are thus required to ensure that the required conditions are being maintained.

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	Correction
1	External power supplies	Measure the power supply voltage at the terminal blocks, and make sure that they are 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 power supply voltage range.
2	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 CIF Unit is not in direct sunlight.	Not in direct sunlight	Protect the CIF Unit if necessary.
		Check for accumulation of dirt, dust, salt, or metal powder.	No accumulation	Clean and protect the CIF Unit if necessary.
		Check for water, oil, or chemical sprays hitting the CIF Unit.	No spray	Clean and protect the CIF Unit if necessary.
		Check for corrosive or flammable gases in the area of the CIF Unit.	No corrosive or flammable gases	Check by smell or use a gas sensor.
		Check that the CIF 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 CIF Unit.	No significant noise sources	Either separate the CIF Unit and noise source or protect the CIF Unit.
3	Installation and wiring	Check that the DIN Track mounting hooks on all NX Units are securely locked.	No looseness	Securely lock all DIN Track mounting hooks.
		Check that cable connectors are fully inserted and locked.	No looseness	Correct any improperly installed connectors.
		Check that the screws on the End Plates (PFP-M) are tight.	No looseness	Tighten loose screws with a Phillips screwdriver.
		Check that each NX Unit is connected along the hookup guides, and fully inserted until it contacts the DIN Track.	The NX Units must be connected and securely in place on the DIN Track.	Connect each NX Unit along the hookup guides, and insert each NX Unit until it contacts the DIN Track.
		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

10-2 Maintenance Procedures

Refer to the section on maintenance and inspection in the user's manual for the connected Communications Coupler Unit for the data backup procedures and replacement procedures for CIF Units.

A

Appendices

The appendices provide additional information for CIF Units, such as dimensions and object lists.

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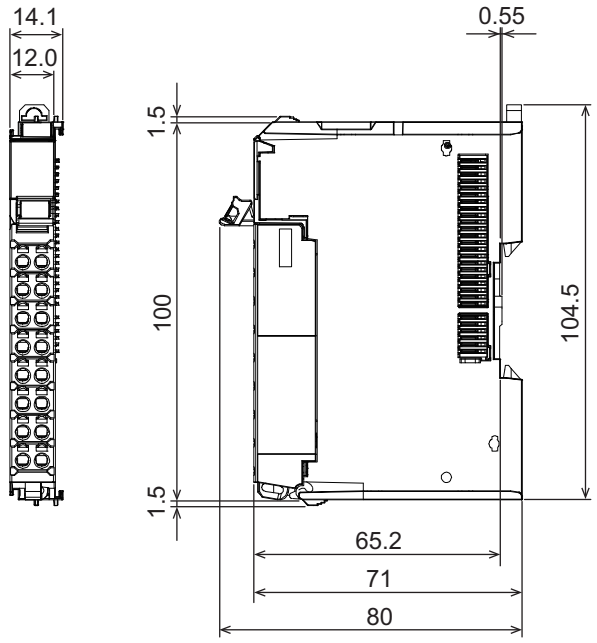
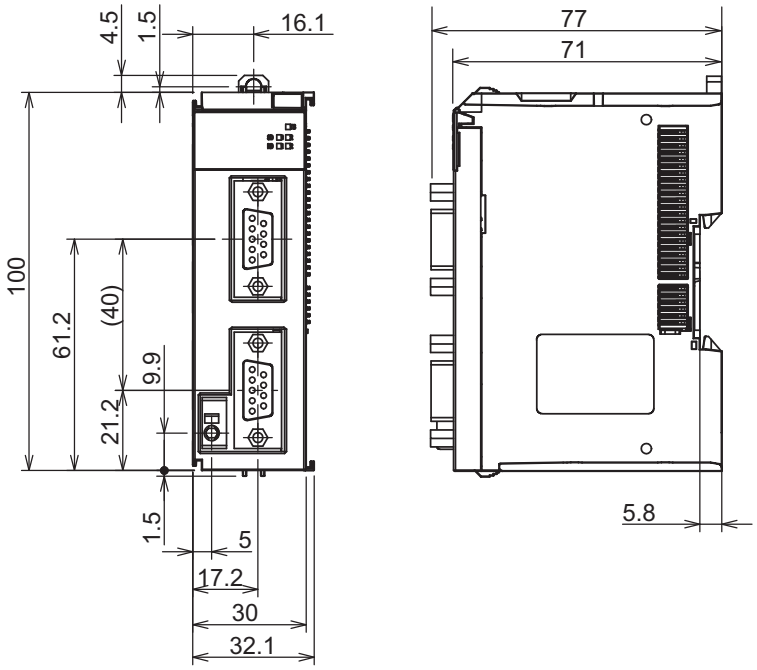
A-1 Dimensions

A-1-1 NX-CIF101 and NX-CIF105



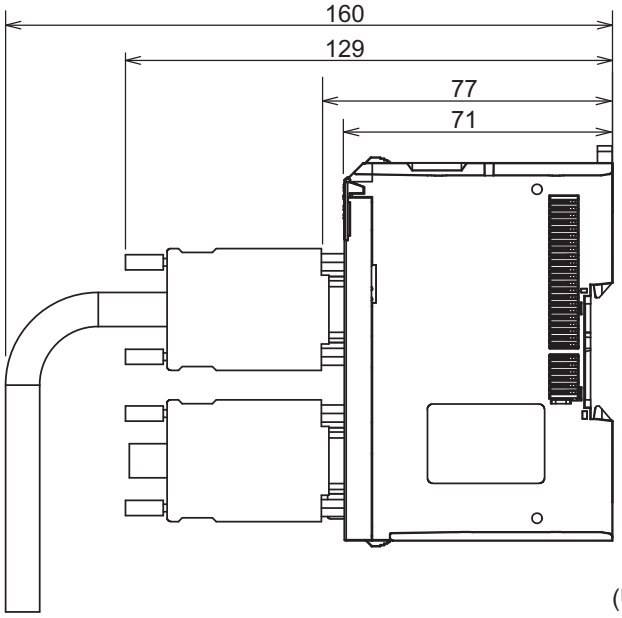
(Unit: mm)

A-1-2 NX-CIF210



(Unit: mm)

Installation Heights



(Unit: mm)

A-2 Changing NX Objects from a User Program

If an NJ-series CPU Unit is used as the communications master, you can change the NX objects of a CIF Unit from a user program.

A-2-1 NX Objects That You Can Change

Only writable NX objects for a CIF Unit can be changed from the user program.

Refer to *A-3-2 NX Objects for the NX-CIF101 and NX-CIF105* on page A-6 for details on NX objects for CIF Units. Writable NX objects are indicated in the NX object lists by “RW” in the *Access* column.

A-2-2 Procedure to Change NX Objects

Use the following procedure to change an NX object.

1. Use the NX_ChangeWriteMode (Change to NX Unit Write Mode) instruction to change the specified CIF Unit to the mode that enables writing NX objects.
2. Use the NX_WriteObj (Write NX Unit Object) instruction to change the value of the NX object.
3. Use the NX_SaveParam (Save NX Unit Parameters) instruction to save the values of the NX objects of the CIF Unit.
4. Use the RestartNXUnit (Restart NX Unit) instruction to restart the specified CIF Unit.

A-3 List of NX Objects

This section describes the NX objects of the CIF Units.

A-3-1 Format of NX Object Descriptions

In this manual, NX objects are described with the following format.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute

Index (hex)	:	This is the index of the NX object that is expressed as a four-digit hexadecimal number.
Subindex (hex)	:	This is the subindex of the NX object expressed by a two-digit hexadecimal number.
Object name	:	This is the name of the object. For a subindex, this is the name of the subindex.
Default	:	This is the value that is set by default.
Data range	:	For a read-only (RO) NX object, this is the range of the data you can read. For a read-write (RW) NX object, this is the setting range of the data.
Unit	:	The physical unit of the object.
Data type	:	This is the data type of the object.
Access	:	This data tells if the object is read-only or read/write. RO: Read only RW: Read/write
I/O allocation	:	This tells whether I/O allocation is allowed.
Data attribute	:	This is the timing when changes to writable NX objects are enabled. Y: Enabled by restarting N: Enabled at all times ---: Write-prohibited

A-3-2 NX Objects for the NX-CIF101 and NX-CIF105

Unit Information Object

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	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	No	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	No	---
	04	Product Code	*2	---	---	UDINT	RO	No	---
	05	Vendor Code	00000001 hex *3	---	---	UDINT	RO	No	---
	06	Unit Version	*4	---	---	UDINT	RO	No	---
	07	Serial Number	*5	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---
1001	---	Production Info	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	No	---
	01	Lot Number	*6	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---
	02	Hardware Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	No	---
	03	Software Version	*7	---	---	ARRAY [0..19] OF BYTE	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. The product codes are assigned for each product model.
Bits 0 to 31: Product code

*3. OMRON's vendor code.

*4. 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
Example for version 1.0: 0100□□□□ hex

*5. The unique serial number of the product is given.
Bits 0 to 31: Serial number

*6. The date of manufacture is given for the lot number.
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

*7. The version is returned in ASCII. It is given as follows: "V" ($56), integer part of version, period ($2E), decimal part of version. If all 20 bytes are not required, the remaining bytes are filled with spaces ($20).
Example for version 1.00: $56$31$2E$30$30$20$20$20$20$20$20$20$20$20$20$20$20$20

I/O Allocation Objects

The following table lists the objects that you can set for the I/O allocations.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6000	---	Ch1 Input Data	---	---	---	---	---	---	---
	00	Ch1 Number of Entries	7	1 to 16	---	USINT	RO	No	---
	01	Ch1 Port Status (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	02	Ch1 Input SID*1	00 hex	---	---	USINT	RO	Yes	---
	03	Ch1 Output SID Response*2	00 hex	---	---	USINT	RO	Yes	---
	04	Ch1 Input Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	05	Ch1 Input Sub Info (See below for details.)	0000 hex	---	---	WORD	RO	Yes	---
	06	Ch1 Input Data Length [bytes]	0	---	---	UINT	RO	Yes	---
	07-1A	Ch1 Input Data 01 to 20*3	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RO	Yes	---

*1. The Input SID is incremented each process data communications cycle from 01 hex to FF hex. It returns to 01 hex after FF hex. If the Input SID is not changed from the previous transmission, it means there is no change to the input data or that there is no input data.
The Input SID immediately after the Restart Port control command is executed is 00 hex. The Input SID after the first PDO reception is then 01 hex, and the Input SID after the second PDO reception is 02 hex.

*2. This is the operating status of the CIF Unit.
00 hex: Not ready to receive.
Not 00 hex: Ready to receive. The value is the Output SID of the PDO that the CIF Unit received last.

*3. This is the response from the CIF Unit for the receive data that the CIF Unit received from the serial line or a control command that the CIF Unit received from the communications master.
You can change the number of input data in the I/O entry on the Sysmac Studio.

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- The following table shows the Port Status. You can access this data as WORD data or BOOL data.

Bit	Status name	Condition to change to TRUE	Condition to change to FALSE
0	Ch1 Send Data Exist	Send buffer contains one or more bytes of data.	Send buffer contains 0 bytes of data.
1	Ch1 Send Completed Toggle Bit	The value alternates between TRUE and FALSE each time a transmission is completed.	
2	Ch1 Send Buffer Full Flag	Send buffer contains 4,097 or more bytes of data.	Send buffer contains 511 or fewer bytes of data.
3	Ch1 Receive Buffer Full Flag	Receive buffer contains 4,097 or more bytes of data.	Receive buffer contains 511 or fewer bytes of data.
4	Ch1 RS Signal	Receive buffer contains 4,097 or more bytes of data. Or, the RS Signal ON command is executed.	Receive buffer contains 511 or fewer bytes of data. Or, the RS Signal OFF command is executed.
5	Ch1 CS Signal	The remote node is busy.	The remote node is waiting to receive data.
6	Ch1 ER Signal	The ER Signal ON command is executed.	The ER Signal OFF command is executed.
7	Ch1 DR Signal	The remote node turns ON the DR signal.	The remote node turns OFF the DR signal.
8	Ch1 Remote Unit Communications Status*1	The remote node is busy.	The remote node is waiting to receive data.
9	Ch1 Local Unit Communications Status	Receive buffer contains 4,097 or more bytes of data.	Receive buffer contains 511 or fewer bytes of data.
10	Ch1 Line Monitoring Flag	The serial line monitor is operating.	The serial line monitor is stopped.
11	Ch1 Receive Data Exist	Receive buffer contains 1 or more bytes of data.	Receive buffer contains 0 bytes of data.
12	Ch1 Parity Error	A parity error occurs.	The parity error is cleared.
13	Ch1 Framing Error	A framing error occurs.	The framing error is cleared.
14	Ch1 Overrun Error	An overrun error occurs.	The overrun error is cleared.
15	Ch1 End Detected	An end is detected.	An end is not detected.

*1. This status bit is valid when RS/CS or Xon/Xoff flow control is performed.

- The following table shows the Input Data Type. You can access this data as WORD data or BOOL data.

Bits	Description
15	Indicates whether there is an error in the receive data.*1 0 hex: There are no errors. 1 hex: There is an error
12 to 14	Indicates whether there is data received by the CIF Unit from the serial line. 0 hex: No data received, and the end not detected. 1 hex: Data received, and the end not detected. 2 hex: The end detected. Whether there is data received depends on cases. *2*3
08 to 11	Indicates whether there is a response from the CIF Unit to the control command sent from the communications master to the CIF Unit.*4 0 hex: No response 2 hex: Response
00 to 07*5	Indicates the command code of the control command that the communications master sent to the CIF Unit.

*1. This bit indicates a parity error, framing error, or overrun error that occurred when data was received from the serial communications device.

*2. The value will be 2 hex only when the Number of Characters to Determine the End is set to a value other than 0. If the Number of Characters to Determine the End is set to 0 and there is receive data, the value will be 1 hex.

*3. If the Number of Characters to Determine the End is not set to 0, the value will be 1 hex when the final receive data is received. The value will then change to 2 hex when the end is detected.

*4. Both data reception and a command response may occur at the same time.

*5. You cannot read this data as BOOL data. To read the command code of a control command, access the data as WORD data.

- The following table shows the Input Sub Info. If the Input Data Type indicates a control command response, the result of the control command is stored in the Input Sub Info.

Value (hex)	Execution result of control command	Description
0000	Normal end	Normal end
0001	Execution is not possible because an operation is in progress.	• The RS Signal ON or RS Signal OFF control command was executed when the flow control method was set to RS/CS flow control. • One of the following control commands was executed for the NX-CIF105: RS Signal ON, RS Signal OFF, ER Signal ON, or ER Signal OFF • The Clear Serial Line Monitor Buffer control command was executed when serial line monitoring was in progress.
0002	Undefined command	An undefined control command was specified and therefore it cannot be executed.
0003	Setting out-of-range error	• The Change Number of Characters to Determine the End or Change Communications Setup control command was executed and the value of the Output Sub Info was out of range. • The Flow Control Method in the Output Sub Info for the NX-CIF105 was set to RS/CS flow control.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	Ch1 Output Data	---	---	---	---	---	---	---
	00	Ch1 Number of Entries	6	1 to 15	---	USINT	RO	No	---
	01	Ch1 Output SID*1	00 hex	---	---	USINT	RW	Yes	---
	02	Ch1 Input SID Response*2	00 hex	---	---	USINT	RW	Yes	---
	03	Ch1 Output Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RW	Yes	---
	04	Ch1 Output Sub Info (See below for details.)	0000 hex	---	---	WORD	RW	Yes	---
	05	Ch1 Output Data Length [bytes]*3	0	---	---	UINT	RW	Yes	---
	06 to 19	Ch1 Output Data 01 to 20*4	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RW	Yes	---

*1. The Output SID is incremented each process data communications cycle from 01 hex to FF hex. It returns to 01 hex after FF hex. If the Output SID is not changed from the previous transmission, it means there is no change to the output data or that there is no output data.

*2. This is the operating status of the communications master.
00 hex: Not ready to receive.
Not 00 hex: Ready to receive. The value is the Output SID of the PDO that the communications master received last.

*3. If the set value exceeds 80, a setting of 80 bytes will be used.

*4. This is the send data that the CIF Unit sent to the serial line or the control command for the CIF Unit.
You can change the number of output data in the I/O entry on the Sysmac Studio.

Precautions for Correct Use

Output SID Specifications

The send buffer in the CIF Unit is cleared if the Output SID is 00 hex.

No send data is stored in the send buffer in the CIF Unit until an Output SID with a value of 01 hex is received. In this case, an error does not occur.

The send data is also not stored in the send buffer in the CIF Unit if the value of the Output SID is not one higher than the value of the last received SID. In this case, an error does not occur.

- The following table shows the Output Data Type. You can access this data as WORD data or BOOL data.

Bits	Description
12 to 15	Indicates presence of send data sent by the CIF Unit to the serial line*1 0 hex: No data sent. 1 hex: Data sent but not the last. 2 hex: Last send data.
08 to 11	Indicates presence of control command for CIF Unit*1*2 0 hex: There is no control command. 1 hex: There is a control command.
00 to 07*3	Indicates command code of control command (See below for details.)

*1. The CIF Unit will not perform any processing if the set value is out of range.

*2. Both send data and a control command can be sent at the same time.

*3. You cannot read or write this data as BOOL data. To issue a control command, access the data as WORD data.

- The following table shows the command code of the control command. If the set value is out of range, 0002 hex (undefined command) is returned in the Input Sub Info from the CIF Unit.

Command code (hex)	Command name	Description
01	Restart Port	Restarts the port.
04	Clear Receive Buffer	Clears the receive buffer in the CIF Unit.
05	Clear Send Buffer	Clears the send buffer in the CIF Unit.
06	Clear Send and Receive Buffers	Clears the send and receive buffers in the CIF Unit.
11	ER Signal ON*1	Turns ON the ER signal.
12	ER Signal OFF*1	Turns OFF the ER signal.
13	RS Signal ON*1*2	Turns ON the RS signal.
14	RS Signal OFF*1, *2	Turns OFF the RS signal.
21	Change Number of Characters to Determine the End	Changes the Number of Characters to Determine the End to the value specified in the Output Sub Info. *3
22	Change Communications Setup	Changes the communications setup to the values specified in the Output Sub Info. *2

Command code (hex)	Command name	Description
31	Start One-shot Monitoring*4	Sets the monitor type of the serial line monitor to one-shot monitoring and starts data monitoring.
32	Start Continuous Monitoring*3	Sets the monitor type of the serial line monitor to continuous monitoring and starts data monitoring.
33	Stop Monitoring*5	Stops serial line monitoring.
34	Clear Serial Line Monitor Buffer*6	Clears the buffer for the serial line monitor.

*1. If you attempt to execute this command for the NX-CIF105, execution is not possible and the command ends in an error.

*2. These commands are valid only when the flow control setting is not set to RS/CS flow control. If you attempt to execute this command when the flow control setting is set to RS/CS flow control, execution is not possible and the command ends in an error.

*3. The new value is applied after the port is restarted.

*4. If this command is executed while monitoring is in progress, monitoring is continued and the command ends normally.

*5. If this command is executed while monitoring is stopped, monitoring remains stopped and the command ends normally.

*6. This command is valid only while monitoring is stopped. If you attempt to execute this command while monitoring is in progress, execution is not possible and the command ends in an error.

- The meaning of the Output Sub Info is different between when the Change Number of Characters to Determine the End control command is specified in the Output Data Type and when the Change Communications Setup control command is specified..

  a) The following table gives the Output Sub Info when the Change Number of Characters to Determine the End control command is specified.

Bit	Item name	Description
00 to 15	Number of Characters to Determine the End	The value specified for the number of characters to determine the end.*1 Setting range: 0000 to 2710 hex (0 to 10,000 decimal) The number of characters to determine the end is not set if 0000 hex is specified. Unit: 0.1 character

*1. For example, if 0064 hex (100 decimal) is specified, the number of characters to determine the end is 10.

  b) The following table gives the Output Sub Info when the Change Communications Setup control command is specified. If any of the set values is out of range, 0003 hex (setting out-of-range error) is returned in the Input Sub Info from the CIF Unit.

Bit	Item name	Description
00 to 03	Baud Rate [bps]	0 hex: No change 1 hex: 1,200 2 hex: 2,400 3 hex: 4,800 4 hex: 9,600 5 hex: 19,200 6 hex: 38,400 7 hex: 57,600 8 hex: 115,200 9 hex: 230,400
04 to 05	Data Length [bits]	0 hex: No change 1 hex: 7 2 hex: 8
06 to 07	Parity	0 hex: No change 1 hex: No parity 2 hex: Even 3 hex: Odd
08 to 09	Stop Bits [bits]	0 hex: No change 1 hex: 2 2 hex: 1
10 to 11	Flow Control Method	0 hex: No change 1 hex: No flow control 2 hex: RS/CS flow control*1 3 hex: Xon/Xoff control
12 to 13	Flow Control Target*2	0 hex: No change 1 hex: Send/receive 2 hex: Send only 3 hex: Receive only
14 to 15	Initial RS Signal Value*3	0 hex: No change 1 hex: ON 2 hex: OFF

*1. The NX-CIF105 port is RS-422A/485. You cannot use RS/CS flow control. If you specify RS/CS flow control for the NX-CIF105, a setting out-of-range error (0003 hex) will occur.

*2. This item is not valid when no flow control is set.

*3. This is the value of the RS signal when EtherCAT communications are in the Operational state or immediately after restarting the port. This item is invalid when the flow control method is set to RS/CS flow control, and the initial RS signal value will always be ON. If the Initial RS Signal Value is set to OFF, use the RS Signal ON control command to turn ON the RS signal.

Other Objects

This section lists other objects.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Transmission Buffering Enable/Disable Setting	---	---	---	---	---	---	---
	01	Ch1 Transmission Buffering Enable/Disable Setting	1	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Transmission Buffering Enable/Disable Setting.

Set value	Description
0	Disabled
1	Enabled

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Baud Rate	---	---	---	---	---	---	---
	01	Ch1 Baud Rate	3	0 to 8	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Baud Rate.

Set value	Description
0	1,200 bps
1	2,400 bps
2	4,800 bps
3	9,600 bps
4	19,200 bps
5	38,400 bps
6	57,600 bps
7	115,200 bps
8	230,400 bps

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Signal Wire	---	---	---	---	---	---	---
	01	Ch1 Signal Wire*1	1	0 or 1	---	USINT	RW	No	Y

*1. Only the NX-CIF105, which has an RS-422A/485 port, has this object. This object does not exist in the NX-CIF101.

- The following table gives the meanings of the set values for the Ch1 Signal Wire.

Set value	Description
0	2-wire
1	4-wire

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5003	---	Data Bit Length	---	---	---	---	---	---	---
	01	Ch1 Data Bit Length	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Data Bit Length.

Set value	Description
0	7 bits
1	8 bits

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Parity	---	---	---	---	---	---	---
	01	Ch1 Parity	1	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Parity.

Set value	Description
0	None
1	Even
2	Odd

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Stop Bits	---	---	---	---	---	---	---
	01	Ch1 Stop Bits	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values of the Ch1 Stop Bits.

Set value	Description
0	2 bits
1	1 bit

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5006	---	Flow Control	---	---	---	---	---	---	---
	01	Ch1 Flow Control	0	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Flow Control.

Set value	Description
0	None
1	RS/CS flow control
2	Xon/Xoff control

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5007	---	Flow Control Target	---	---	---	---	---	---	---
	01	Ch1 Flow Control Target	0	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Flow Control Target.

Set value	Description
0	Transmission and reception
1	Transmission
2	Reception

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500A	---	Number of Characters to Determine the End*1	---	---	---	---	---	---	---
	01	Ch1 Number of Characters to Determine the End	0	0 to 10,000	0.1 character	UINT	RW	No	Y

*1. This object is valid when the reception completion condition is set to the number of characters to determine the end.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500B	---	Initial RS Signal Value	---	---	---	---	---	---	---
	01	Ch1 Initial RS Signal Value	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Initial RS Signal Value.

Set value	Description
0	OFF
1	ON

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5011	---	Start Serial Line Monitor	---	---	---	---	---	---	---
	01	Ch1 Start Serial Line Monitor	---	0 to 2*1	---	BYTE	RW	No	---

*1. You can write 1 or 2 as the set value. If you read the value, a value of 0 is always read.

- The following table gives the meanings of the set values for the Ch1 Start Serial Line Monitor.

Set value	Description
1	Set continuous monitor mode and start monitoring.
2	Set one-shot monitor mode and start monitoring.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5012	---	Stop Serial Line Monitor	---	---	---	---	---	---	---
	01	Ch1 Stop Serial Line Monitor	---	0 or 1*1	---	BYTE	RW	No	---

*1. You can write only 1 as the set value. If you read the value, a value of 0 is always read.

- The following table gives the meanings of the set values for the Ch1 Stop Serial Line Monitor.

Set value	Description
1	Stop monitoring.

A-3-3 NX Objects for the NX-CIF210

Unit Information Object

This object gives the 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	---
	04	Product Code	*2	---	---	UDINT	RO	No	---
	05	Vendor Code	00000001 hex *3	---	---	UDINT	RO	No	---
	06	Unit Version	*4	---	---	UDINT	RO	No	---
	07	Serial Number	*5	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---
1001	---	Production Info	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	No	---
	01	Lot Number	*6	00000000 to FFFFFFFF hex	---	UDINT	RO	No	---
	02	Hardware Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	No	---
	03	Software Version	*7	---	---	ARRAY [0..19] OF BYTE	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. The product codes are assigned for each product model.
Bits 0 to 31: Product code

*3. OMRON's vendor code.

*4. 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
Example for version 1.0: 0100□□□□ hex

*5. The unique serial number of the product is given.
Bits 0 to 31: Serial number

*6. The date of manufacture is given for the lot number.
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

*7. The version is returned in ASCII. It is given as follows: "V" ($56), integer part of version, period ($2E), decimal part of version. If all 20 bytes are not required, the remaining bytes are filled with spaces ($20).
Example for version 1.00: $56$31$2E$30$30$20$20$20$20$20$20$20$20$20$20$20$20$20$20

I/O Allocation Objects

The following table lists the objects that you can set for the I/O allocations.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6000	---	Ch1 Input Data	---	---	---	---	---	---	---
	00	Ch1 Number of Entries	7	1 to 16	---	USINT	RO	No	---
	01	Ch1 Port Status (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	02	Ch1 Input SID*1	00 hex	---	---	USINT	RO	Yes	---
	03	Ch1 Output SID Response*2	00 hex	---	---	USINT	RO	Yes	---
	04	Ch1 Input Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	05	Ch1 Input Sub Info (See below for details.)	0000 hex	---	---	WORD	RO	Yes	---
	06	Ch1 Input Data Length [bytes]	0	---	---	UINT	RO	Yes	---
	07 to 1A	Ch1 Input Data 01 to 20*3	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RO	Yes	---
6001	---	Ch2 Input Data	---	---	---	---	---	---	---
	00	Ch2 Number of Entries	7	1 to 16	---	USINT	RO	No	---
	01	Ch2 Port Status (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	02	Ch2 Input SID*1	00 hex	---	---	USINT	RO	Yes	---
	03	Ch2 Output SID Response*2	00 hex	---	---	USINT	RO	Yes	---
	04	Ch2 Input Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RO	Yes	---
	05	Ch2 Input Sub Info (See below for details.)	0000 hex	---	---	WORD	RO	Yes	---
	06	Ch2 Input Data Length [bytes]	0	---	---	UINT	RO	Yes	---
	07 to 1A	Ch2 Input Data 01 to 20*3	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RO	Yes	---

*1. The Input SID is incremented each process data communications cycle from 01 hex to FF hex. It returns to 01 hex after FF hex. If the Input SID is not changed from the previous transmission, it means there is no change to the input data or that there is no input data.
The Input SID immediately after the port is restarted is 00 hex. The Input SID after the first PDO reception is then 01 hex, and the Input SID after the second PDO reception is 02 hex.

*2. This is the operating status of the CIF Unit.
00 hex: Not ready to receive.
Not 00 hex: Ready to receive. The value is the Output SID of the PDO that the CIF Unit received last.

*3. This is the response from the CIF Unit for the receive data that the CIF Unit received from the serial line or a control command that the CIF Unit received from the communications master.
You can change the number of input data in the I/O entry on the Sysmac Studio.

- The following table shows the Port Status. You can access this data as WORD data or BOOL data.

Bit	Status name*1	Condition to change to TRUE	Condition to change to FALSE
0	Chn Send Data Exist	Send buffer contains one or more bytes of data.	Send buffer contains 0 bytes of data.
1	Chn Send Completed Toggle Bit	The value alternates between TRUE and FALSE each time a transmission is completed.	
2	Chn Send Buffer Full Flag	Send buffer contains 4,097 or more bytes of data.	Send buffer contains 511 or fewer bytes of data.
3	Chn Receive Buffer Full Flag	Receive buffer contains 4,097 or more bytes of data.	Receive buffer contains 511 or fewer bytes of data.
4	Chn RS Signal	Receive buffer contains 4,097 or more bytes of data. Or, the RS Signal ON command is executed.	Receive buffer contains 511 or fewer bytes of data. Or, the RS Signal OFF command is executed.
5	Chn CS Signal	The remote node is busy.	The remote node is waiting to receive data.
6	Chn ER Signal	The ER Signal ON command is executed.	The ER Signal OFF command is executed.
7	Chn DR Signal	The remote node turned ON the DR signal.	The remote node turned OFF the DR signal.
8	Chn Remote Unit Communications Status*2	The remote node is busy.	The remote node is waiting to receive data.
9	Chn Local Unit Communications Status	Receive buffer contains 4,097 or more bytes of data.	Receive buffer contains 511 or fewer bytes of data.
10	Chn Line Monitoring Flag	The serial line monitor is operating.	The serial line monitor is stopped.
11	Chn Receive Data Exist	Receive buffer contains 1 or more bytes of data.	Receive buffer contains 0 bytes of data.
12	Chn Parity Error	A parity error occurs.	The parity error is cleared.
13	Chn Framing Error	A framing error occurs.	The framing error is cleared.
14	Chn Overrun Error	An overrun error occurs.	The overrun error is cleared.
15	Chn End Detected	An end is detected.	An end is not detected.

*1. “n” in “Chn” is the port number.

*2. This status bit is valid when RS/CS or Xon/Xoff flow control is performed.

- The following table shows the Input Data Type. You can access this data as WORD data or BOOL data.

Bits	Description
15	Indicates whether there is an error in the receive data.*1 0 hex: There are no errors. 1 hex: There is an error
12 to 14	Indicates whether there is data received by the CIF Unit from the serial line. 0 hex: No data received, and the end not detected. 1 hex: Data received, and the end not detected. 2 hex: The end detected. Whether there is data received depends on cases. *2*3
08 to 11	Indicates whether there is a response from the CIF Unit to the control command sent from the communications master to the CIF Unit.*4 0 hex: No response 2 hex: Response
00 to 07*5	Indicates the command code of the control command that the communications master sent to the CIF Unit.

*1. This bit indicates a parity error, framing error, or overrun error that occurred when data was received from the serial communications device.

*2. The value will be 2 hex only when the Number of Characters to Determine the End is set to a value other than 0. If the Number of Characters to Determine the End is set to 0 and there is receive data, the value will be 1 hex.

*3. If the Number of Characters to Determine the End is not set to 0, the value will be 1 hex when the final receive data is received. The value will then change to 2 hex when the end is detected.

*4. Both data reception and a command response may occur at the same time.

*5. You cannot read this data as BOOL data. To read the command code of a control command, access the data as WORD data.

- The following table shows the Input Sub Info. If the Input Data Type indicates a control command response, the result of the control command is stored in the Input Sub Info.

Value (hex)	Execution result of control command	Description
0000	Normal end	Normal end
0001	Execution is not possible because an operation is in progress.	• The RS Signal ON or RS Signal OFF control command was executed when the flow control method was set to RS/CS flow control. • The Clear Serial Line Monitor Buffer control command was executed when serial line monitoring was in progress.
0002	Undefined command	An undefined control command was specified and therefore it cannot be executed.
0003	Setting out-of-range error	• The Change Number of Characters to Determine the End or Change Communications Setup control command was executed and the value of the Output Sub Info was out of range. • The Flow Control Method in the Output Sub Info for the NX-CIF105 was set to RS/CS flow control.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	Ch1 Output Data	---	---	---	---	---	---	---
	00	Ch1 Number of Entries	6	1 to 15	---	USINT	RO	No	---
	01	Ch1 Output SID*1	00 hex	---	---	USINT	RW	Yes	---
	02	Ch1 Input SID Response*2	00 hex	---	---	USINT	RW	Yes	---
	03	Ch1 Output Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RW	Yes	---
	04	Ch1 Output Sub Info (See below for details.)	0000 hex	---	---	WORD	RW	Yes	---
	05	Ch1 Output Data Length [bytes]*3	0	---	---	UINT	RW	Yes	---
	06 to 19	Ch1 Output Data 01 to 20*4	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RW	Yes	---

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7001	---	Ch2 Output Data	---	---	---	---	---	---	---
	00	Ch2 Number of Entries	6	1 to 15	---	USINT	RO	No	---
	01	Ch2 Output SID*1	00 hex	---	---	USINT	RW	Yes	---
	02	Ch2 Input SID Response*2	00 hex	---	---	USINT	RW	Yes	---
	03	Ch2 Output Data Type (See below for details.)	0000 hex	---	---	WORD and BOOL	RW	Yes	---
	04	Ch2 Output Sub Info (See below for details.)	0000 hex	---	---	WORD	RW	Yes	---
	05	Ch2 Output Data Length [bytes]*3	0	---	---	UINT	RW	Yes	---
	06 to 19	Ch2 Output Data 01 to 20*4	00 hex ×4×20	---	---	ARRAY [0..3] OF BYTE	RW	Yes	---

*1. The Output SID is incremented each process data communications cycle from 01 hex to FF hex. It returns to 01 hex after FF hex. If the Output SID is not changed from the previous transmission, it means there is no change to the output data or that there is no output data.

*2. This is the operating status of the communications master.
00 hex: Not ready to receive.
Not 00 hex: Ready to receive. The value is the Output SID of the PDO that the communications master received last.

*3. If the set value exceeds 80, a setting of 80 bytes will be used.

*4. This is the send data that the CIF Unit sent to the serial line or the control command for the CIF Unit.
You can change the number of output data in the I/O entry on the Sysmac Studio.

Precautions for Correct Use

Output SID Specifications

The send buffer in the CIF Unit is cleared if the Output SID is 00 hex.

No send data is stored in the send buffer in the CIF Unit until an Output SID with a value of 01 hex is received. In this case, an error does not occur.

The send data is also not stored in the send buffer in the CIF Unit if the value of the Output SID is not one higher than the value of the last received SID. In this case, an error does not occur.

- The following table shows the Output Data Type. You can access this data as WORD data or BOOL data.

Bits	Description
12 to 15	Indicates presence of send data sent by the CIF Unit to the serial line*1 0 hex: No data sent. 1 hex: Data sent but not the last. 2 hex: Last data sent.
08 to 11	Indicates presence of control command for CIF Unit*1*2 0 hex: There is no control command. 1 hex: There is a control command.
00 to 07*3	Indicates command code of control command (See below for details.)

*1. The CIF Unit will not perform any processing if the set value is out of range.

*2. Both send data and a control command can be sent at the same time.

*3. You cannot read or write this data as BOOL data. To issue a control command, access the data as WORD data.

- The following table shows the command code of the control command. If the set value is out of range, 0002 hex (undefined command) is returned in the Input Sub Info from the CIF Unit.

Command code (hex)	Command name	Description
01	Restart Port	Restarts the port.
04	Clear Receive Buffer command	Clears the receive buffer in the CIF Unit.
05	Clear Send Buffer	Clears the send buffer in the CIF Unit.
06	Clear Send and Receive Buffers	Clears the send and receive buffers in the CIF Unit.
11	ER Signal ON	Turns ON the ER signal.
12	ER Signal OFF	Turns OFF the ER signal.
13	RS Signal ON*1	Turns ON the RS signal.
14	RS Signal OFF*1	Turns OFF the RS signal.
21	Change Number of Characters to Determine the End	Changes the Number of Characters to Determine the End to the value specified in the Output Sub Info. *2
22	Change Communications Setup	Changes the communications setup to the values specified in the Output Sub Info. *2
31	Start One-shot Monitoring*3	Sets the monitor type of the serial line monitor to one-shot monitoring and starts data monitoring.
32	Start Continuous Monitoring*3	Sets the monitor type of the serial line monitor to continuous monitoring and starts data monitoring.
33	Stop Monitoring*4	Stops serial line monitoring.
34	Clear Serial Line Monitor Buffer*5	Clears the buffer for the serial line monitor.

*1. These commands are valid only when the flow control setting is not set to RS/CS flow control. If you attempt to execute this command when the flow control setting is set to RS/CS flow control, execution is not possible and the command ends in an error.

*2. The new value is applied after the port is restarted.

*3. If this command is executed while monitoring is in progress, monitoring is continued and the command ends normally.

*4. If this command is executed while monitoring is stopped, monitoring remains stopped and the command ends normally.

*5. This command is valid only while monitoring is stopped. If you attempt to execute this command while monitoring is in progress, execution is not possible and the command ends in an error.

- The meaning of the Output Sub Info is different between when the Change Number of Characters to Determine the End control command is specified in the Output Data Type and when the Change Communications Setup control command is specified.

a) The following table gives the Output Sub Info when the Change Number of Characters to Determine the End control command is specified.

Bit	Item name	Description
00 to 15	Number of Characters to Determine the End	The value specified for the number of characters to determine the end.*1 Setting range: 0000 to 2710 hex (0 to 10,000 decimal) The number of characters to determine the end is not set if 0000 hex is specified. Unit: 0.1 character

*1. For example, if 0064 hex (100 decimal) is specified, the number of characters to determine the end is 10.

b) The following table gives the Output Sub Info when the Change Communications Setup control command is specified. If any of the set values is out of range, 0003 hex (setting out-of-range error) is returned in the Input Sub Info from the CIF Unit.

Bit	Item name	Description
00 to 03	Baud Rate [bps]	0 hex: No change 1 hex: 1,200 2 hex: 2,400 3 hex: 4,800 4 hex: 9,600 5 hex: 19,200 6 hex: 38,400 7 hex: 57,600 8 hex: 115,200 9 hex: 230,400
04 to 05	Data Length [bits]	0 hex: No change 1 hex: 7 2 hex: 8
06 to 07	Parity	0 hex: No change 1 hex: No parity 2 hex: Even 3 hex: Odd
08 to 09	Stop Bits [bits]	0 hex: No change 1 hex: 2 2 hex: 1
10 to 11	Flow Control Method	0 hex: No change 1 hex: No flow control 2 hex: RS/CS flow control 3 hex: Xon/Xoff control
12 to 13	Flow Control Target*1	0 hex: No change 1 hex: Send/receive 2 hex: Send only 3 hex: Receive only
14 to 15	Initial RS Signal Value*2	0 hex: No change 1 hex: ON 2 hex: OFF

*1. This item is not valid when no flow control is set.

*2. This is the value of the RS signal when EtherCAT communications are in the Operational state or immediately after restarting the port. This item is invalid when the flow control method is set to RS/CS flow control, and the initial RS signal value will always be ON. If the Initial RS Signal Value is set to OFF, use the RS Signal ON control command to turn ON the RS signal.

Other Objects

This section lists other objects.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Transmission Buffering Enable/Disable Setting	---	---	---	---	---	---	---
	01	Ch1 Transmission Buffering Enable/Disable Setting	1	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Transmission Buffering Enable/Disable Setting	1	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Transmission Buffering Enable/Disable Setting and Ch2 Transmission Buffering Enable/Disable Setting.

Set value	Description
0	Disabled
1	Enabled

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Baud Rate	---	---	---	---	---	---	---
	01	Ch1 Baud Rate	3	0 to 8	---	USINT	RW	No	Y
	02	Ch2 Baud Rate	3	0 to 8	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Baud Rate and Ch2 Baud Rate.

Set value	Description
0	1,200 bps
1	2,400 bps
2	4,800 bps
3	9,600 bps
4	19,200 bps
5	38,400 bps
6	57,600 bps
7	115,200 bps
8	230,400 bps

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5003	---	Data Bit Length	---	---	---	---	---	---	---
	01	Ch1 Data Bit Length	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Data Bit Length	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Data Bit Length and Ch2 Data Bit Length.

Set value	Description
0	7 bits
1	8 bits

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Parity	---	---	---	---	---	---	---
	01	Ch1 Parity	1	0 to 2	---	USINT	RW	No	Y
	02	Ch2 Parity	1	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Parity and Ch2 Parity.

Set value	Description
0	None
1	Even
2	Odd

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Stop Bits	---	---	---	---	---	---	---
	01	Ch1 Stop Bits	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Stop Bits	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Stop Bits and Ch2 Stop Bits.

Set value	Description
0	2 bits
1	1 bit

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5006	---	Flow Control	---	---	---	---	---	---	---
	01	Ch1 Flow Control	0	0 to 2	---	USINT	RW	No	Y
	02	Ch2 Flow Control	0	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Flow Control and Ch2 Flow Control.

Set value	Description
0	None
1	RS/CS flow control
2	Xon/Xoff control

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5007	---	Flow Control Target	---	---	---	---	---	---	---
	01	Ch1 Flow Control Target	0	0 to 2	---	USINT	RW	No	Y
	02	Ch2 Flow Control Target	0	0 to 2	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Flow Control Target and Ch2 Flow Control Target.

Set value	Description
0	Transmission and reception
1	Transmission
2	Reception

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500A	---	Number of characters to determine the end*1	---	---	---	---	---	---	---
	01	Ch1 Number of Characters to Determine the End	0	0 to 10,000	0.1 character	UINT	RW	No	Y
	02	Ch2 Number of Characters to Determine the End	0	0 to 10,000	0.1 character	UINT	RW	No	Y

*1. This object is valid when the reception completion condition is set to the number of characters to determine the end.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500B	---	Initial RS Signal Value	---	---	---	---	---	---	---
	01	Ch1 Initial RS Signal Value	0	0 or 1	---	USINT	RW	No	Y
	02	Ch2 Initial RS Signal Value	0	0 or 1	---	USINT	RW	No	Y

- The following table gives the meanings of the set values for the Ch1 Initial RS Signal Value and Ch2 Initial RS Signal Value.

Set value	Description
0	OFF
1	ON

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5011	---	Start Serial Line Monitor	---	---	---	---	---	---	---
	01	Ch1 Start Serial Line Monitor	---	0 to 2*1	---	BYTE	RW	No	---
	02	Ch2 Start Serial Line Monitor	---	0 to 2*1	---	BYTE	RW	No	---

*1. You can write 1 or 2 as the set value. If you read the value, a value of 0 is always read.

- The following table gives the meanings of the set values for the Ch1 Start Serial Line Monitor and Ch2 Start Serial Line Monitor.

Set value	Description
1	Set continuous monitor mode and start monitoring.
2	Set one-shot monitor mode and start monitoring.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5012	---	Stop Serial Line Monitor	---	---	---	---	---	---	---
	01	Ch1 Stop Serial Line Monitor	---	0 or 1*1	---	BYTE	RW	No	---
	02	Ch2 Stop Serial Line Monitor	---	0 or 1*1	---	BYTE	RW	No	---

*1. You can write only 1 as the set value. If you read the value, a value of 0 is always read.

- The following table gives the meanings of the set values for the Ch1 Stop Serial Line Monitor and Ch2 Stop Serial Line Monitor.

Set value	Description
1	Stop monitoring.

A-4 Programming Samples

This appendix provides programming samples in the ST language for the communications master to use a CIF Unit to perform communications with a serial communications device.

These samples assume that an NJ-series CPU Unit is used for the communications master.

The following three programming samples are provided.

- Restarting CIF Unit Ports
- Sending Data
- Receiving Data

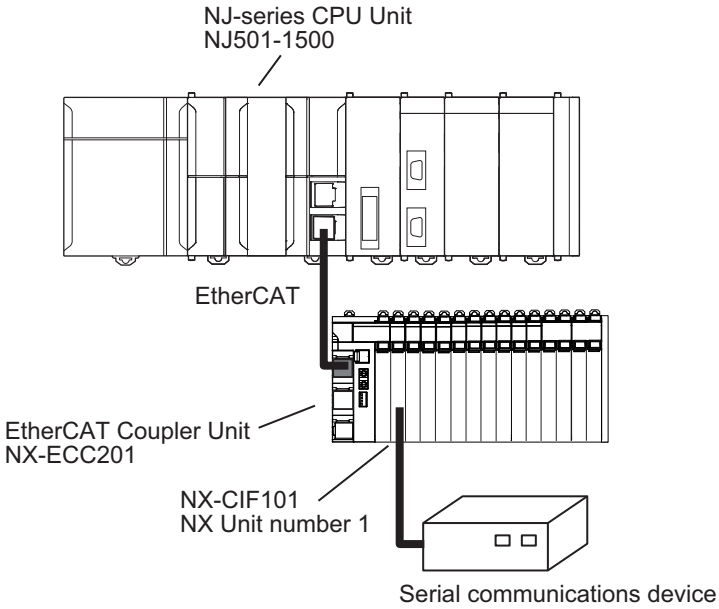
A-4-1 Items Common to all Programming Samples

This section describes the items that are the same in all three programming samples.

System Configuration

The following system configuration is used.

Item	Specification
Communications master	NJ501-1500
Communications Coupler Unit	NX-ECC201
CIF Unit	NX-CIF101
NX Unit number of CIF Unit	1



Unit Operation Settings for the CIF Unit

The following Unit operation settings are made for the CIF Unit from the Sysmac Studio. Refer to *Section 6 Unit Settings* for the meanings of the settings and the setting procedures.

Item	Setting
Baud Rate [bps]	9,600
Data Bit Length [bits]	7
Parity	Even
Stop Bits [bits]	2
Initial RS Signal Value	On
Flow Control	None
Flow Control Target	Send/receive
Number of Characters to Determine the End	35
Transmission Buffering Enable/Disable Setting	Enabled
Event Level Settings	All events set to observations.

Setting the PDO Sizes

The following PDO sizes are set from the Sysmac Studio as the default values. Refer to *6-3 Setting the PDO Sizes* on page 6-6 for a detailed setting procedure.

Data	I/O entry name	Size [bytes]
Input data	Ch1 Input Data 01 to 05	20
Output data	Ch1 Output Data 01 to 05	20

I/O Map

The following I/O map settings are made from the Sysmac Studio.

Unit	I/O port	Description	Name
NX-ECC201	NX Unit I/O Data Active Status 125	NX Unit I/O Data Active Status	E001_NX_Unit_IO_Data_Active_Status_125
NX-CIF101	Ch1 Output SID	Ch1 Output SID	N1_Ch1_Output_SID
	Ch1 Input SID Response	Ch1 Input SID Response	N1_Ch1_Input_SID_Response
	Ch1 Output Data Type	Ch1 Output Data Type	N1_Ch1_Output_Data_Type
	Ch1 Send Command Flag	Ch1 Send Command Flag	N1_Ch1_Send_Command_Flag
	Ch1 Send Data Flag	Ch1 Send Data Flag	N1_Ch1_Send_Data_Flag
	Ch1 Send Last Data Flag	Ch1 Send Last Data Flag	N1_Ch1_Send_Last_Data_Flag
	Ch1 Output Data Length	Ch1 Output Data Length	N1_Ch1_Output_Data_Length
	Ch1 Output Data 01	Ch1 Output Data 01	N1_Ch1_Output_Data_01
	Ch1 Output Data 02	Ch1 Output Data 02	N1_Ch1_Output_Data_02
	Ch1 Output Data 03	Ch1 Output Data 03	N1_Ch1_Output_Data_03
	Ch1 Output Data 04	Ch1 Output Data 04	N1_Ch1_Output_Data_04
	Ch1 Output Data 05	Ch1 Output Data 05	N1_Ch1_Output_Data_05
	Ch1 Send Completed Toggle Bit	Ch1 Send Completed Toggle Bit	N1_Ch1_Send_Completed_Toggle_Bit
	Ch1 Input SID	Ch1 Input SID	N1_Ch1_Input_SID
	Ch1 Output SID Response	Ch1 Output SID Response	N1_Ch1_Output_SID_Response
	Ch1 Input Data Type	Ch1 Input Data Type	N1_Ch1_Input_Data_Type
	Ch1 Receive Command Flag	Ch1 Receive Command Flag	N1_Ch1_Receive_Command_Flag
	Ch1 Receive Data Flag	Ch1 Receive Data Flag	N1_Ch1_Receive_Data_Flag
	Ch1 Receive Last Data Flag	Ch1 Receive Last Data Flag	N1_Ch1_Receive_Last_Data_Flag
	Ch1 Receive Data Error Flag	Ch1 Receive Data Error Flag	N1_Ch1_Receive_Data_Error_Flag
	Ch1 Input Sub Info	Ch1 Input Sub Info	N1_Ch1_Input_Sub_Info
	Ch1 Input Data Length	Ch1 Input Data Length	N1_Ch1_Input_Data_Length
	Ch1 Input Data 01	Ch1 Input Data 01	N1_Ch1_Input_Data_01
	Ch1 Input Data 02	Ch1 Input Data 02	N1_Ch1_Input_Data_02
	Ch1 Input Data 03	Ch1 Input Data 03	N1_Ch1_Input_Data_03
	Ch1 Input Data 04	Ch1 Input Data 04	N1_Ch1_Input_Data_04
	Ch1 Input Data 05	Ch1 Input Data 05	N1_Ch1_Input_Data_05

A-4-2 Programming Sample 1: Restarting CIF Unit Ports

The port on the CIF Unit is restarted to prepare to send or receive data. You use the Restart Port control command in the Output Data Type object to restart a port. Refer to *A-3 List of NX Objects* on page A-5 for details on each object.

Procedure

This programming sample is for the example given in *7-4-5 Example of Control Command Execution* on page 7-22. The processes in the table in *7-4-5 Example of Control Command Execution* on page 7-22 correspond to the CASE statements in the ST program as follows:

Step number in control command execution example	Process	CASE statement
---	Idle	CASE 0
1	Output SID initialization	CASE 1
2	Response to initialized Output SID	
3	Request to restart the port	CASE 2
4	Confirmation of reception of the port restart request	CASE 3
5	---	---
6	Response reception	CASE 4
7	Checking response reception	
8	Response to initialized Output SID	CASE 5

Variable Table

The following variable table is set from the Sysmac Studio. All of the variables that you registered in the I/O map are registered as global variables.

● Internal Variables

Name	Data type	Initial value	Comment
InitialPortRestartRequestTrigger	BOOL	FALSE	Execution condition to restart port
InitialPortRestartRequestTrigger_R_TRIG_instance	R_TRIG		Instance of R_TRIG instruction
CIFCmdCode	WORD	WORD#16#0	Command code
CmdStage	INT	INT#0	State transition
ExpectedOutputSIDResponse	USINT	USINT#0	Expected value of Output SID Response

● External Variables

Name	Data type	Comment
N1_Ch1_Input_SID_Response	USINT	Ch1 Input SID Response
N1_Ch1_Input_SID	USINT	Ch1 Input SID
N1_Ch1_Output_SID	USINT	Ch1 Output SID
N1_Ch1_Output_SID_Response	USINT	Ch1 Output SID Response
N1_Ch1_Input_Sub_Info	WORD	Ch1 Input Sub Info
N1_Ch1_Output_Data_Type	WORD	Ch1 Output Data Type
N1_Ch1_Input_Data_Type	WORD	Ch1 Input Data Type
N1_Ch1_Send_Command_Flag	BOOL	Ch1 Send Command Flag
N1_Ch1_Receive_Command_Flag	BOOL	Ch1 Receive Command Flag
E001_NX_Unit_IO_Data_Active_Status_125	ARRAY[0..125] OF BOOL	NX Unit I/O Data Active Status

ST Program

```
// If I/O data communications are possible for CIF Unit at program execution,
// restart port.
InitialPortRestartRequestTrigger_R_TRIG_instance(
    E001_NX_Unit_I_O_Data_Active_Status_125[1],
    InitialPortRestartRequestTrigger);
IF( InitialPortRestartRequestTrigger = TRUE ) THEN
    //Set the CIF command code.
    CIFCmdCode := WORD#16#0001;//0x0001:Restart port.
    CmdStage:=INT#1;//Transition (to Restart Port request)
END_IF;

CASE CmdStage OF
    0://Idle
      ;
    1: // Clear Output SID.
      ExpectedOutputSIDResponse := 0;
      N1_Ch1_Output_SID:=ExpectedOutputSIDResponse;

      CmdStage := INT#2;//Transition (confirm completion of Restart Port request)
    2: // Request to restart the port.
      IF (ExpectedOutputSIDResponse = N1_Ch1_Output_SID_Response) THEN
        // Set Output Data Type.
        N1_Ch1_Output_Data_Type:= (N1_Ch1_Output_Data_Type AND WORD#16#FF00 )
        OR CIFCmdCode;
        N1_Ch1_Send_Command_Flag:=TRUE;

        // Set Output SID.
        ExpectedOutputSIDResponse:=N1_Ch1_Output_SID + 1;
        IF (ExpectedOutputSIDResponse=USINT#0) THEN
          ExpectedOutputSIDResponse:=USINT#1; //If Output SID is 0, set 1.
        END_IF;

        N1_Ch1_Output_SID:=ExpectedOutputSIDResponse;

        CmdStage := INT#3;//Transition (confirm completion of Restart Port request)
      END_IF;

   3: //Confirm completion of Restart Port request.
      IF (ExpectedOutputSIDResponse = N1_Ch1_Output_SID_Response) THEN
        //Clear Output Data Type.
        N1_Ch1_Send_Command_Flag:=FALSE;

       CmdStage := INT#4;//Transition (to confirmation of reception of Restart Port
       response)
      END_IF;

    4: //Confirm reception of Restart Port response.
      //Confirm update of Input SID.
      IF (N1_Ch1_Input_SID_Response <> N1_Ch1_Input_SID) THEN

       // Check for command response.
        IF ( N1_Ch1_Receive_Command_Flag = TRUE ) THEN
          //Check command response code.
          IF (N1_Ch1_Input_Sub_Info=WORD#16#0000) THEN
            //Clear Output SID after normal completion to Restart Port.
            ExpectedOutputSIDResponse := 0;
            N1_Ch1_Output_SID:=ExpectedOutputSIDResponse;

           CmdStage := INT#5;//Transition (to confirmation of completion of clearing
           Output SID)
          ELSE
            // Error end
```

```
            CmdStage := INT#10;//Transition (to error end)
          END_IF;
        END_IF;

        //Set the Input SID Response.
         N1_Ch1_Input_SID_Response := N1_Ch1_Input_SID;
      END_IF;

    5: //Confirm completion of clearing Output SID.
      IF (ExpectedOutputSIDResponse = N1_Ch1_Output_SID_Response) THEN
        //Normal end
        CmdStage := INT#0;//Transition (return to initial status)
      END_IF;

    10: //Error end
      ;
END_CASE;
```

A-4-3 Programming Sample 2: Sending Data

This sample sends the following 26-bytes text string to the serial line: ABCDEFGHIJKLMNOPQRSTU-VWXYZ.

Procedure

This programming sample is for the example given in *7-4-1 Example of Sending Data* on page 7-12.

The processes in the table in *7-4-1 Example of Sending Data* on page 7-12 correspond to the CASE statements in the ST program as follows:

Step number in example of sending data	Process	CASE statement
---	Idle	CASE 0
1	Outputting string from A to T	CASE 1
2	Output response for A to T	CASE 2
3	Sending A to T	---
4	Outputting UVWXYZ	CASE 1
5	Output response for UVWXYZ	CASE 2
6	Sending UVWXYZ	---
7	---	CASE 3
8	Confirming sending of UVWXYZ	CASE 3

Variable Table

The following variable table is set from the Sysmac Studio. All of the variables that you registered in the I/O map are registered as global variables.

● Internal Variables

Name	Data type	Initial value	Comment
SendSize	UINT	UINT#0	Total size of the send data in bytes
SendDat	ARRAY[0..39] OF BYTE	[40(16#0)]*1	Send data
TestDat	STRING[27]	""	Text string to send
SendDatOffset	UINT	UINT#0	Send data offset
LastDatFlag	BOOL	FALSE	Final data flag
OutputDataLength	UINT	UINT#0	Output data size
SendRequest	BOOL	FALSE	Send request flag
SendRequest_R_TRIG_instance	R_TRIG		Instance of R_TRIG instruction
InitialRequestTrigger	BOOL	FALSE	Condition to establish communications
InitialRequestTrigger_R_TRIG_instance	R_TRIG		Instance of R_TRIG instruction
SendRequestTrigger	BOOL	FALSE	Send execution condition
SendStage	INT	INT#0	Current state
ExpectedOutputSID	USINT	USINT#0	Expected value of Output SID Response
PreSendCompletedToggle	BOOL	FALSE	Send Completed Toggle Bit before sending data

*1. Set the size of the *SendDat* array to the following size or larger: Number of divisions of send data × Output PDO size [bytes].
In this sample, the send data is divided into two divisions (A to T and U to Z) and the output PDO size is 20 bytes, so the array size is 40.

● External Variables

Name	Data type	Comment
N1_Ch1_Output_Data_01	ARRAY[0..3] OF BYTE	Ch1 Output Data 01
N1_Ch1_Output_Data_02	ARRAY[0..3] OF BYTE	Ch1 Output Data 02
N1_Ch1_Output_Data_03	ARRAY[0..3] OF BYTE	Ch1 Output Data 03
N1_Ch1_Output_Data_04	ARRAY[0..3] OF BYTE	Ch1 Output Data 04
N1_Ch1_Output_Data_05	ARRAY[0..3] OF BYTE	Ch1 Output Data 05
N1_Ch1_Output_Data_Length	UINT	Ch1 Output Data Length
N1_Ch1_Output_SID	USINT	Ch1 Output SID
N1_Ch1_Output_SID_Response	USINT	Ch1 Output SID Response
N1_Ch1_Output_Data_Type	WORD	Ch1 Output Data Type
N1_Ch1_Send_Completed_Toggle_Bit	BOOL	Ch1 Send Completed Toggle Bit
N1_Ch1_Send_Data_Flag	BOOL	Ch1 Send Data Flag
N1_Ch1_Send_Last_Data_Flag	BOOL	Ch1 Send Last Data Flag
E001_NX_Unit_IO_Data_Active_Status_125	ARRAY[0..125] OF BOOL	NX Unit I/O Data Active Status

ST Program

```
// Restore default program status using establishing communications as the trigger.
InitialRequestTrigger_R_TRIG_instance(
    E001_NX_Unit_I_O_Data_Active_Status_125[1],
    InitialRequestTrigger);
IF( InitialRequestTrigger = TRUE ) THEN
    SendStage:=INT#0;// Initialize.
END_IF;

// If send processing is not in progress and
//SendRequest is TRUE, request send.
SendRequest_R_TRIG_instance(
 SendRequest,
 SendRequestTrigger);
IF((SendRequestTrigger = TRUE)
    AND (E001_NX_Unit_I_O_Data_Active_Status_125[1] = TRUE )
    AND (SendStage = INT#0) ) THEN
    //Set the text string to send.
    TestDat:='ABCDEFGHIJKLMNOPQRSTUVWXYZ';
    //Set the send data and send data size.
    SendSize:=StringToAry( TestDat, SendDat[0] );
    SendDatOffset:=0;
    SendStage:=INT#1;//Transition (to send request)
END_IF;

CASE SendStage OF
    0: //Idle
      ;
    1://Send request to CIF Unit.
      //Total output data size (20: Size of data sent to CIF Unit in one send)
      IF( (SendSize - SendDatOffset) > 20 ) THEN
        OutputDataLength := 20;
        LastDatFlag:=FALSE;//Not final data
      ELSE
        OutputDataLength := (SendSize - SendDatOffset);
        LastDatFlag := TRUE;//Final data
      END_IF;
```

```
        //Set Output Data Length.
        N1_Ch1_Output_Data_Length:=OutputDataLength;

        //Set output data.
        //Set the SendDat array to the following size: Number of divisions of send
        //data * Output PDO size [bytes]
        AryMove(SendDat[SendDatOffset], N1_Ch1_Output_Data_01[0], UINT#4);
        AryMove(SendDat[SendDatOffset+4], N1_Ch1_Output_Data_02[0], UINT#4);
        AryMove(SendDat[SendDatOffset+8], N1_Ch1_Output_Data_03[0], UINT#4);
        AryMove(SendDat[SendDatOffset+12], N1_Ch1_Output_Data_04[0], UINT#4);
        AryMove(SendDat[SendDatOffset+16], N1_Ch1_Output_Data_05[0], UINT#4);
        SendDatOffset:= SendDatOffset + OutputDataLength;

        //Set Output Data Type.
        IF( LastDatFlag = TRUE ) THEN
          N1_Ch1_Send_Data_Flag := FALSE;
          N1_Ch1_Send_Last_Data_Flag:=TRUE;
        ELSE
          N1_Ch1_Send_Data_Flag := TRUE;
          N1_Ch1_Send_Last_Data_Flag:=FALSE;
        END_IF;

       //Get current Send Completed Toggle Bit status (before sending data).
       PreSendCompletedToggle:=N1_Ch1_Send_Completed_Toggle_Bit;

        // Set Output SID.
        ExpectedOutputSID:=N1_Ch1_Output_SID + 1;
        IF (ExpectedOutputSID=USINT#0) THEN
          ExpectedOutputSID:=USINT#1; //If Output SID is 0, set 1.
        END_IF;

       N1_Ch1_Output_SID:=ExpectedOutputSID;

       SendStage := INT#2;//Transition (to confirmation of send request completion)

      2: //Confirm completion of send request from CIF Unit.
       //Confirm Output SID Response.
       IF (ExpectedOutputSID = N1_Ch1_Output_SID_Response) THEN
         // Clear Output Data Type.
         N1_Ch1_Send_Data_Flag:=FALSE;
         N1_Ch1_Send_Last_Data_Flag:=FALSE;

         IF( LastDatFlag = TRUE ) THEN
           SendStage := INT#3;//Transition (to confirmation of send completion)
         ELSE
           SendStage := INT#1;//Transition (to send request)
         END_IF;

       END_IF;

      3://Confirm completion of sending data on the serial line.
       //Check Send Completed Toggle Bit.
       IF (N1_Ch1_Send_Completed_Toggle_Bit <> PreSendCompletedToggle) THEN
         SendStage:=INT#0; //Transition (return to initial status)
       END_IF;
END_CASE;
```

A-4-4 Programming Sample 3: Receiving Data

This sample receives data that was sent from the serial communications device.

Procedure

This programming sample is for the example given in *7-4-2 Example of Receiving Data* on page 7-15.

The processes in the table in *7-4-2 Example of Receiving Data* on page 7-15 correspond to the comment process numbers in the ST program as follows:

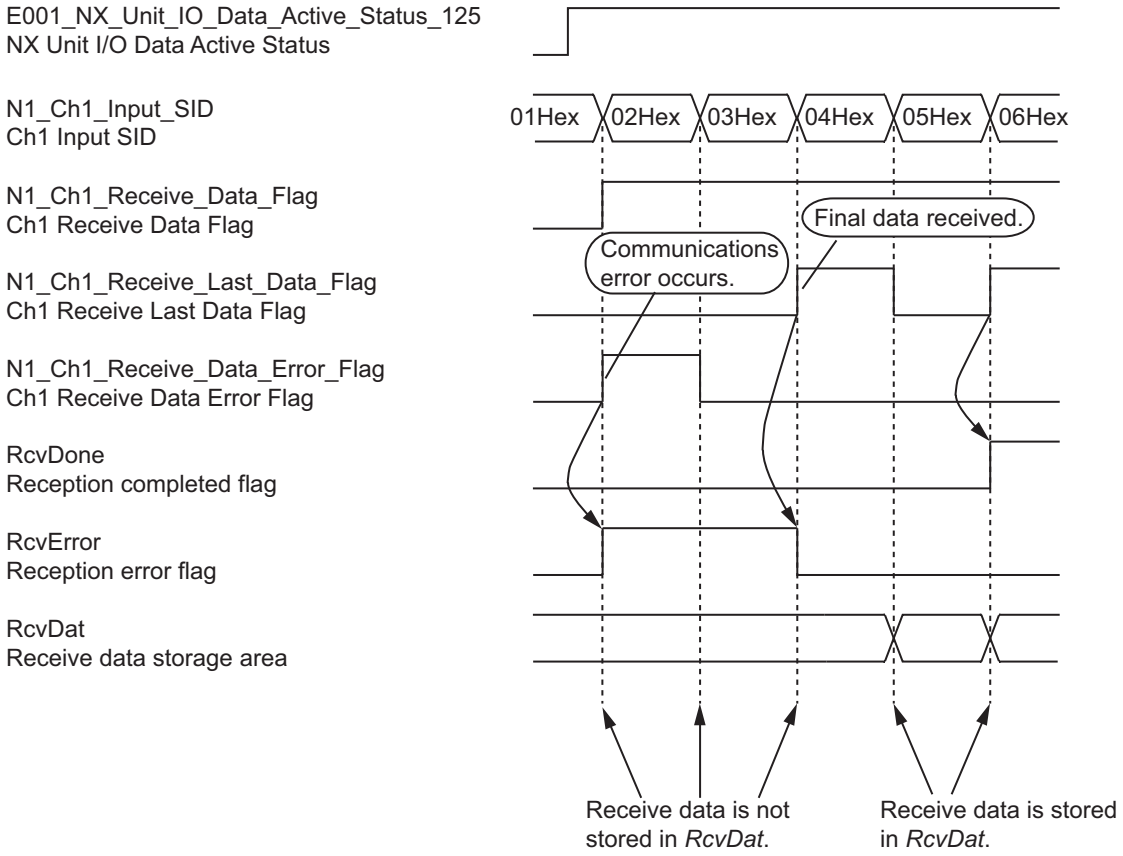
Step number in example of receiving data	Process	Comment process number in ST program
---	Skipping reading receive data when a reception error occurs.	(1)
1	Receiving A to Z	---
2	Inputting string from A to T	(2)
3	Input response for A to T	(2)
4	Inputting string UVWXYZ	(2)
	Notification of end detection	(3)
5	Input response for UVWXYZ	(2)

Timing Chart

The following figure shows a timing chart for the main variables.

Each time the Input SID is incremented and input data is received from the CIF Unit, the input data is stored in *RcvDat* (receive data storage area).

If a parity error or other communications error occurs and the value of *N1_Ch1_Receive_Data_Error_Flag* changes to TRUE, the receive data is assumed to be incorrect until the value of *N1_Ch1_Receive_Last_Data_Flag* changes to TRUE. The incorrect received data is not stored in *RcvDat*.



Variable Table

The following variable table is set from the Sysmac Studio. All of the variables that you registered in the I/O map are registered as global variables.

● Internal Variables

Name	Data type	Initial value	Comment
RcvSize	UINT	UINT#0	Size of the received data in bytes
RcvInitialize	BOOL	FALSE	Initial processing execution flag for reception processing
RcvError	BOOL	FALSE	Reception error flag
RcvDone	BOOL	FALSE	Reception completed flag
InitialRequestTrigger	BOOL	FALSE	Condition to establish communications
InitialRequestTrigger_R_TRIG_instance	R_TRIG		Instance of R_TRIG instruction
RcvDat	ARRAY[0..45] OF BYTE	[46(16#0)]*1	Receive data storage area

*1. Set the size of the *RcvDat* array to the following size or larger: Maximum receive data size [bytes] + Input PDO size [bytes].
In this sample, the maximum receive data size is 26 (assuming A to Z is received) and the input PDO size is 20 bytes, so the array size is 46.

● External Variables

Name	Data type	Comment
N1_Ch1_Input_Data_01	ARRAY[0..3] OF BYTE	Ch1 Input Data 01
N1_Ch1_Input_Data_02	ARRAY[0..3] OF BYTE	Ch1 Input Data 02
N1_Ch1_Input_Data_03	ARRAY[0..3] OF BYTE	Ch1 Input Data 03
N1_Ch1_Input_Data_04	ARRAY[0..3] OF BYTE	Ch1 Input Data 04
N1_Ch1_Input_Data_05	ARRAY[0..3] OF BYTE	Ch1 Input Data 05
N1_Ch1_Input_SID	USINT	Ch1 Input SID
N1_Ch1_Input_SID_Response	USINT	Ch1 Input SID Response
N1_Ch1_Input_Data_Length	UINT	Ch1 Input Data Length
N1_Ch1_Input_Data_Type	WORD	Ch1 Input Data Type
N1_Ch1_Receive_Data_Flag	BOOL	Ch1 Receive Data Flag
N1_Ch1_Receive_Last_Data_Flag	BOOL	Ch1 Receive Last Data Flag
N1_Ch1_Receive_Data_Error_Flag	BOOL	Ch1 Receive Data Error Flag
E001_NX_Unit_IO_Data_Active_Status_125	ARRAY[0..125] OF BOOL	NX Unit I/O Data Active Status

ST Program

```
// Initialize program status using establishing communications as the trigger.
InitialRequestTrigger_R_TRIG_instance(
    E001_NX_Unit_I_O_Data_Active_Status_125[1],
    InitialRequestTrigger);
IF( InitialRequestTrigger = TRUE ) THEN
    RcvInitialize := FALSE;//Initialize.
END_IF;

//See if I/O communications are enabled and if Input SID was updated.
IF ( ( E001_NX_Unit_I_O_Data_Active_Status_125[1] = TRUE )
    AND ( N1_Ch1_Input_SID_Response <> N1_Ch1_Input_SID) ) THEN

    IF ((N1_Ch1_Receive_Data_Error_Flag = TRUE )             //Process (1)
         OR (RcvError = TRUE))THEN
        //If a receive data error is detected,
        //skip the receive data until the end of the serial data is detected.
        RcvSize := UINT#0;
        RcvError := TRUE;

       //Set the Input SID Response.
       N1_Ch1_Input_SID_Response := N1_Ch1_Input_SID;

     ELSIF ((N1_Ch1_Receive_Data_Flag = TRUE ) OR             // Process (2)
          (N1_Ch1_Receive_Last_Data_Flag = TRUE )) THEN
          //When there is no receive data error and there is input data

        IF( RcvInitialize=FALSE) THEN
           //Initialize reception process.
           RcvSize := UINT#0;
           RcvInitialize := TRUE;
           RcvDone:=FALSE;
        END_IF;

        //Get receive data.
        //Set the RcvDat array to the following size: Maximum receive data
        //size [bytes] + Input PDO size [bytes]
        AryMove(N1_Ch1_Input_Data_01[0], RcvDat[RcvSize], UINT#4);
        AryMove(N1_Ch1_Input_Data_02[0], RcvDat[RcvSize+4], UINT#4);
        AryMove(N1_Ch1_Input_Data_03[0], RcvDat[RcvSize+8], UINT#4);
        AryMove(N1_Ch1_Input_Data_04[0], RcvDat[RcvSize+12], UINT#4);
        AryMove(N1_Ch1_Input_Data_05[0], RcvDat[RcvSize+16], UINT#4);
        RcvSize:=RcvSize+N1_Ch1_Input_Data_Length;

       //Set the Input SID Response.
       N1_Ch1_Input_SID_Response := N1_Ch1_Input_SID;

    END_IF;

    // Check for final data.                                 // Process (3)
    IF (N1_Ch1_Receive_Last_Data_Flag = TRUE ) THEN
        IF( RcvError = FALSE ) THEN
          //If there is no reception error and the final data is obtained
          RcvDone:=TRUE; //End reception.
        END_IF;
        RcvError := FALSE;
        RcvInitialize := FALSE;
    END_IF;
END_IF;
```

A-5 Version Information

This section describes the compatibility between the versions of the CIF Units, Communications Coupler Units, CPU Units, and Sysmac Studio, and it provides information on the functions supported for each unit version.

If you use any of the combinations of versions in the following table or later/higher versions, you can use all of the functions that are supported by that unit version of the CIF Units.

CIF Unit		Corresponding version*1		
Model number	Unit version	EtherCAT Coupler Unit NX-ECC201 or NX-ECC202	NJ-series CPU Unit NJ501-□□□□ or NJ301-□□□□	Sysmac Studio
NX-CIF101	Ver.1.0	Ver.1.0	Ver.1.10	Ver.1.12
NX-CIF105	Ver.1.0			
NX-CIF210	Ver.1.0			

*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.

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