OMRON

Machine Automation Controller

NX-series

Analog I/O Units

User's Manual
for Temperature Input Units
and Heater Burnout Detection Units

NX-TS□□□□
NX-HB□□□□

Analog I/O Units

sysmac
always in control

W566-E1-06

Introduction

Thank you for purchasing an NX-series Temperature Input Unit or Heater Burnout Detection Unit.

This manual contains information that is necessary to use the Temperature Input Units and Heater Burnout Detection Units, which are classified as NX-series Analog I/O Units. Please read this manual and make sure you understand the functionality and performance of the NX-series Analog I/O Unit before you attempt to use it in a control system.

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

Intended Audience

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

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

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

Applicable Products

This manual covers the following product.

- NX-series Temperature Input Units

  NX-TS□□□□

- NX-series Heater Burnout Detection Units

  NX-HB□□□□

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Relevant Manuals

The table below provides the relevant manuals for the NX-series Analog I/O Units.

Read all of the manuals that are relevant to your system configuration and application to make the most of the NX-series Analog I/O Units.

Other manuals, such as related product manuals, are necessary for specific system configurations and applications. Refer to *Related Manuals* on page 28 for the related manuals.

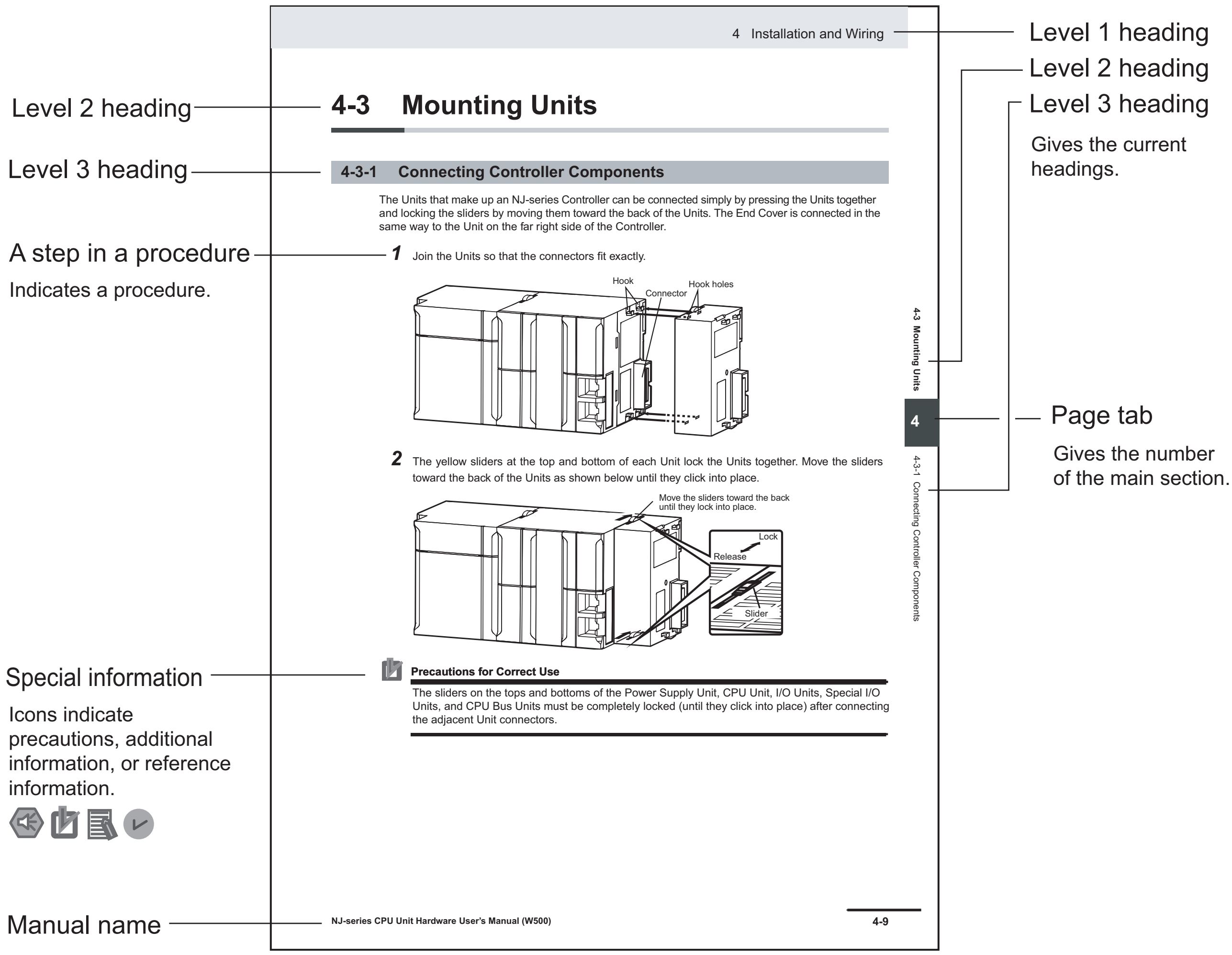
Manual name	Application
NX-series Analog I/O Units User's Manual for Temperature Input Units and Heater Burnout Detection Units*1	Learning how to use NX-series Temperature Input Units and Heater Burnout Detection Units
NX-series Data Reference Manual	Referencing lists of the data that is required to configure systems with NX-series Units

*1. The NX-series Temperature Input Units (NX-TS□□□□) that were included in the *NX-series Analog I/O Units User's Manual* (Cat No. W522) in revision 04 and earlier revisions were moved to this manual. For revision 05 of the *NX-series Analog I/O Units User's Manual* (Cat No. W522), the manual name was changed to *NX-series Analog I/O Units User's Manual for Analog Input Units and Analog Output Units* (Cat No. W522-E1-05).

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.

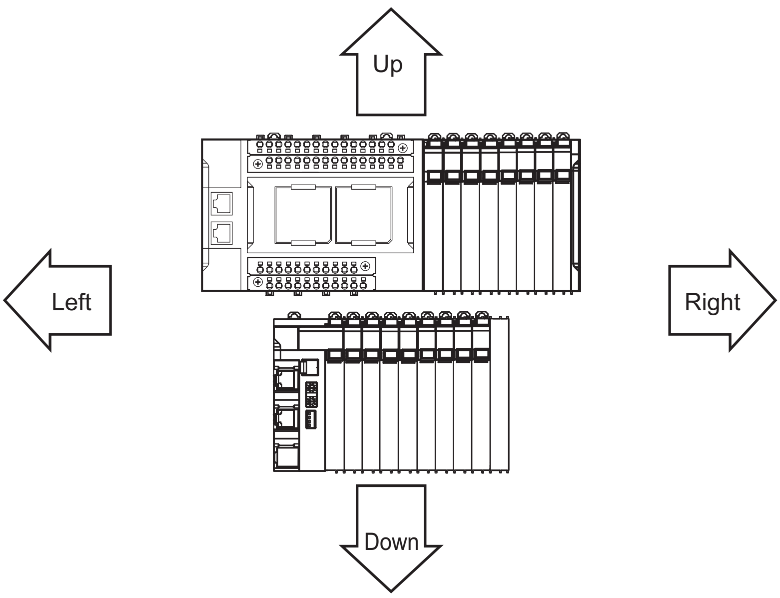
Version Information

Information on differences in specifications and functionality for CPU Units, Industrial PCs, Communications Coupler Units, and Communication Control Units with different unit versions and for different versions of the Support Software is given.

Note References are provided to more detailed or related information.

Precaution on Terminology

- In this manual, “download” refers to transferring data from the Support Software to a physical device and “upload” refers to transferring data from a physical device to the Support Software.
- In this manual, the directions in relation to the Units are given in the following figure, which shows upright installation.



- This user's manual refers to NY-series IPC Machine Controller Industrial Panel PCs and Industrial Box PCs as simply *Industrial PCs* or as *NY-series Industrial PCs*.
- This user's manual refers to the built-in EtherCAT port on an NJ/NX-series Controller or NY-series Industrial PC as simply a built-in EtherCAT port.
- This user's manual may omit manual names and manual numbers in places that refer to the user's manuals for CPU Units and Industrial PCs. The following table gives some examples. When necessary, refer to *Related Manuals* on page 28 to determine the appropriate manual based on the common text for the omitted contents.

Examples

Manual name	Omitted contents	Common text
NJ/NX-series CPU Unit Software User's Manual	Software user's manual for the connected CPU Unit or Industrial PC	Software User's Manual
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Software User's Manual		
NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual	User's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC	Built-in EtherCAT port
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Built-in EtherCAT® Port User's Manual		

- This user's manual may omit manual names and manual numbers in places that refer to the user's manuals for Communications Coupler Units. If you will use a Communications Coupler Unit, refer to *Related Manuals* on page 28 to identify the manual for your Unit.
- This user's manual may omit manual names and manual numbers in places that refer to the user's manuals for Communication Control Units. If you use a Communication Control Unit, refer to *Related Manuals* on page 28 to identify the manual for your Unit.

Terms and Conditions Agreement

Warranty, Limitations of Liability

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NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

Change in Specifications

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

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

Definition of Precautionary Information

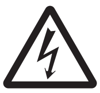
The following notation is used in this manual to provide precautions required to ensure safe usage of the NX-series Temperature Input Units and Heater Burnout Detection Units.

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

The following notation is used.

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

Symbols

	The circle and slash symbol indicates operations that you must not do. The specific operation is shown in the circle and explained in text. This example indicates prohibiting disassembly.
	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a precaution for electric shock.
	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a general precaution.
	The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for something that you must do.

Warnings

⚠ WARNING

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.

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, Industrial PC, 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 or Industrial PC, will turn OFF all outputs from Output Units in the following cases. The remote I/O slaves will operate according to the settings in the slaves.

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

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

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

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

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

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

Voltage and Current Inputs

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

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

Transferring

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

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

Cautions

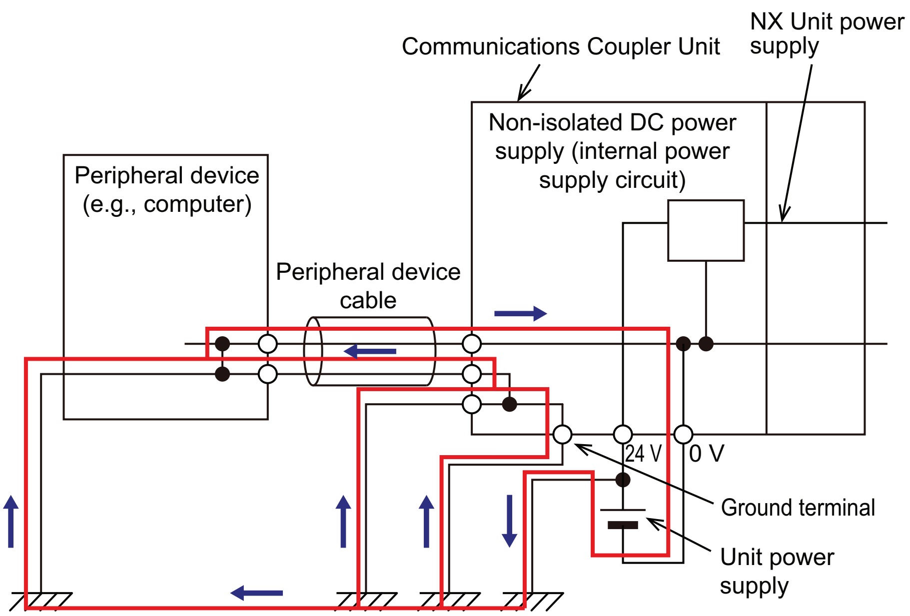
Caution

Wiring

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

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

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



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

Online Editing

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

Precautions for Safe Use

Transporting

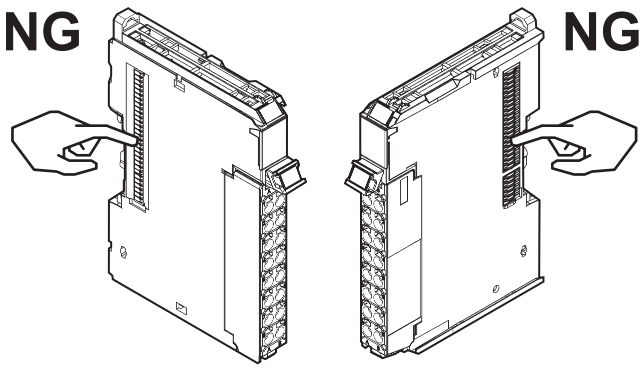
- When transporting any Unit, use the special packing box for it.
  Also, do not subject the Unit to excessive vibration or shock during transportation.
- Do not drop any Unit or subject it to abnormal vibration or shock.
  Doing so may result in Unit malfunction or burning.

Mounting

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

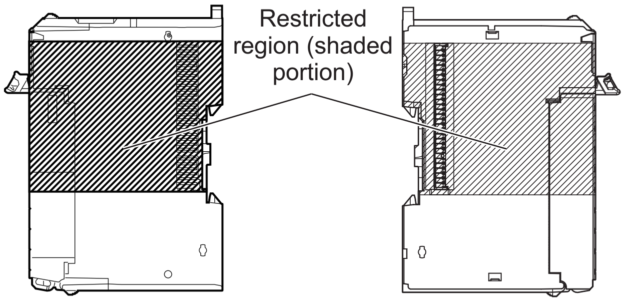
Installation

- Always turn OFF the power supply before installing the Unit. If the power supply is not OFF, the Unit may malfunction or may be damaged.
- Always turn OFF the Unit power supply and I/O power supply before you remove the NX Unit.
- Do not apply labels or tape to the Unit. When the Unit is installed or removed, adhesive or scraps may adhere to the pins in the NX bus connector, which may result in malfunctions.
- Do not touch the pins in the NX bus connector on the Unit. Dirt may adhere to the pins in the NX bus connector, which may result in malfunctions.

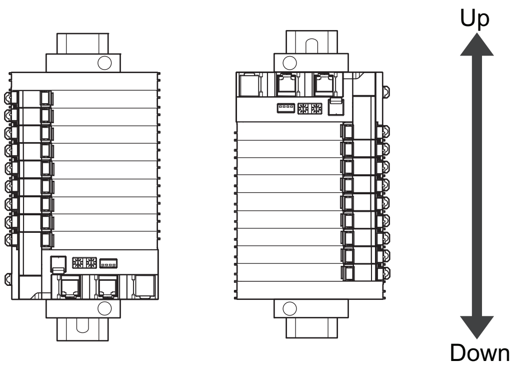


Example: NX Unit (12 mm width)

- Do not write on 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 CPU Rack or the Slave Terminal.
  Refer to the user's manual for the connected CPU Unit, Communications Coupler Unit, or Communication Control Unit for details on the restricted region on the CPU Unit, Communications Coupler Unit, or Communication Control Unit.

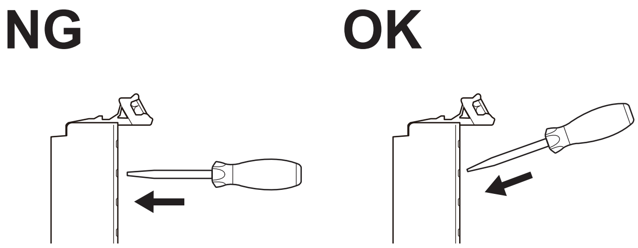


- For the installation orientations in the following figure, support the cables, e.g., with a duct, so that the End Plate on the bottom is not subjected to the weight of the cables. The weight of the cables may cause the bottom End Plate to slide downward so that the Slave Terminal is no longer secured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

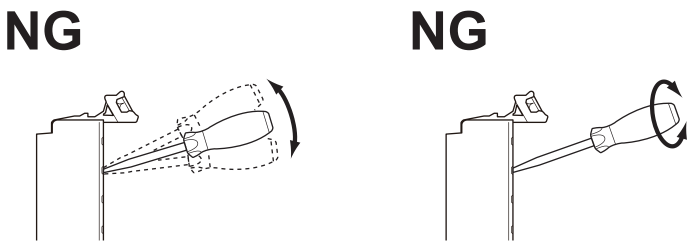


Wiring

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



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



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

Power Supply Design

- Use all Units within the I/O power supply ranges that are given in the specifications.
- The I/O power supply current for the CPU Rack with an NX-series CPU Unit should be within the range specified for the CPU Unit model. For example, use the NX1P2 CPU Unit with a current of 4 A or less. Using the currents that are outside of the specifications may cause failure or damage. Refer to the user's manual for the connected CPU Unit for the I/O power supply current for the CPU Unit model.
- Supply sufficient power according to the contents of this manual.
- Use the power supply voltage that is specified in this manual.
- Do not apply voltages that exceed the rated value to any Input Unit.
- Do not apply voltages or connect loads to the Output Units or slaves in excess of the maximum ratings.
- Inrush current occurs when the power supply is turned ON. When selecting fuses or breakers for external circuits, consider their fusing and detection characteristics as well as the above precautions and allow sufficient margin in shut-off performance.
- Install external breakers and take other safety measures against short-circuiting and overcurrents in external wiring.

Turning ON the Power Supply

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

Actual Operation

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

Turning OFF the Power Supply

- Do not disconnect the cable or turn OFF the power supply to the Controller or a Slave Terminal when downloading data or the user program from the Support Software.
- 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, CPU Unit, Industrial PC, or Communication Control Unit
  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 or the Industrial PC (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.
- If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Sysmac Studio, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

General Communications

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

Unit Replacement

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

Disposal

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

Temperature Input Units

- When you use Temperature Input Units that have cold junction sensors, do not remove the cold junction sensors. If the cold junction sensors are removed, you cannot measure the temperature correctly regardless of the cold junction compensation enable/disable setting.
- Use the cold junction sensor that is mounted on Temperature Input Unit when it is delivered. Calibration was carried out independently for each combination of the Unit, connection circuits, and cold junction sensor that is provided. If you use the cold junction sensor for another Temperature Input Unit or replace the cold junction sensors among multiple Temperature Input Units, the temperature cannot be measured correctly.

Heater Burnout Detection Units

- Before you perform wiring or maintenance work, always confirm that the power supply to the heater is turned OFF. If you provide power to the heater while the CT terminals are open, a high voltage will occur between the CT terminals, which creates an electric shock hazard.
- Use one of the CTs that can be connected to the Heater Burnout Detection Units. If you use any other CTs, the current values may not be accurate. This could result in failure to detect heater burnout or SSR failure. Also, if a SSR failure current is not detected, damage to equipment could result.
- Use an immediate output command only if you use autotuning in the PIDAT_HeatCool instruction of the NJ/NX/NY-series Controller. If you use an immediate output command with any other instruction or application other than autotuning, the device or machine may perform unexpected operation.

Precautions for Correct Use

Storage, Mounting, and Wiring

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

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

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

Actual Operation

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

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

Regulations and Standards

Conformance to EU Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

EMC Directives

OMRON devices that comply with EU 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 EU 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 61010-2-201.

Conformance to EU Directives

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

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

  EMC standard compliance was confirmed for the recommended Power Supplies. Refer to the user’s manual for the connected CPU Unit for the recommended power supplies for the CPU Rack with an NX-series CPU Unit. Refer to the user’s manual for the connected Communications Coupler Unit for the recommended power supplies for the Slave Terminal. Refer to the user’s manual for the connected Communication Control Unit for the recommended power supplies for the CPU Rack with an NX-series Communication Control Unit.
- NX-series Units that comply with EU 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 EU 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 Requirement to EU Directives

The immunity test conditions for the NX-series Temperature Input Units and Heater Burnout Detection Units are as follows:

Unit Type	Conversion time	Overall accuracy
Temperature Input Units	250 ms/Unit	+5% / -5%
	10 ms/Unit	
	60 ms/Unit	
Heater Burnout Detection Units	---	+5% / -5%

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.

For shipbuilding standard usage conditions, refer to *Conformance to Shipbuilding Standards* in the user's manual for the CPU Unit, Communications Coupler Unit, or Communication Control Unit that the NX Units are connected to.

Note that the usage conditions are provided in the relevant user's manuals for Units whose conformance to shipbuilding standards is confirmed.

Conformance to KC Certification

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

A급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A급) 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 Support Software versions.

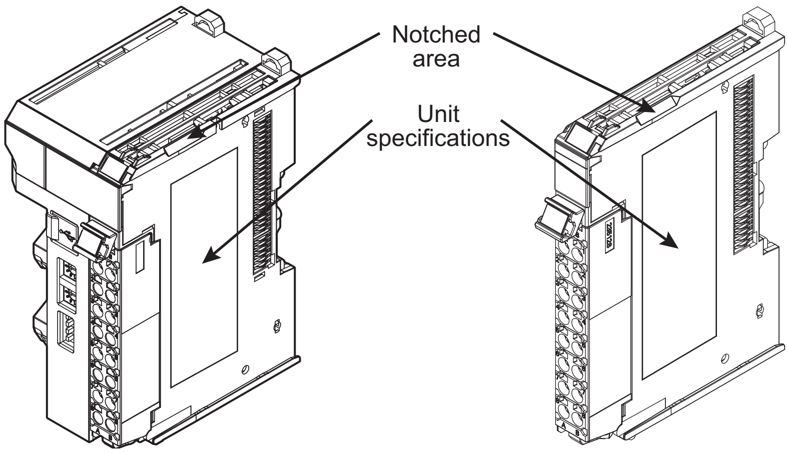
Unit Versions

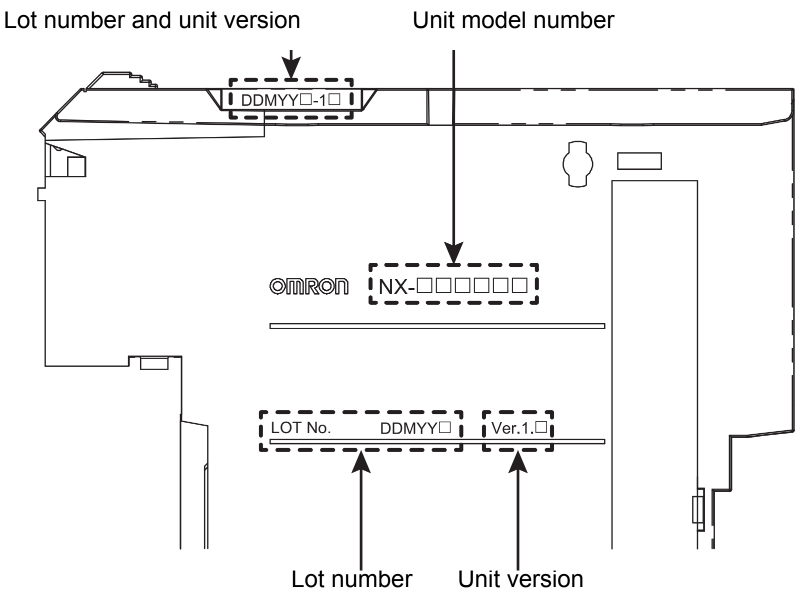
A “unit version” has been introduced to manage the Units in the NX Series according to differences in functionality accompanying Unit upgrades.

An example is provided below for Communications Coupler Units and NX Units. Refer to the user’s manual for each Unit for details on the version notation and the method for checking version information of the CPU Units, Industrial PCs, and Communication Control Units.

Notation of Unit Versions on Products

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





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

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

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

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

Confirming Unit Versions with the Support Software

If your NX Unit is connected to a CPU Unit, refer to the user’s manual of the connected CPU Unit for the confirmation method for the unit version of the NX Unit.

If your NX Unit is connected to a Communications Coupler Unit, refer to the user’s manual of the connected Communications Coupler Unit for the confirmation method for the unit version of the Communications Coupler Unit and NX Unit.

If your NX Unit is connected to a Communication Control Unit, refer to the user’s manual of the connected Communication Control Unit for the confirmation method for the unit version of the NX Unit.

Unit Versions and Support Software Versions

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

Depending on the Unit to which the NX Unit is connected, refer to the following appendices for the functions that are supported by each unit version.

- *A-5 Version Information with CPU Units* on page A-65
- *A-6 Version Information with Communications Coupler Units* on page A-68
- *A-7 Version Information with Communication Control Units* on page A-75

Related Manuals

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

Manual name	Cat. No.	Model numbers	Application	Description
NX-series Analog I/O Units User's Manual for Temperature Input Units and Heater Burnout Detection Units*1	W566	NX-TS□□□□ NX-HB□□□□	Learning how to use NX-series Temperature Input Units and Heater Burnout Detection Units	The hardware, setup methods, and functions of the NX-series Temperature Input Units and Heater Burnout Detection Units are described.
NX-series Data Reference Manual	W525	NX-□□□□□□	Referencing lists of the data that is required to configure systems with NX-series Units	Lists of the power consumptions, weights, and other NX Unit data that is required to configure systems with NX-series Units are provided.
NX-series System Units User's Manual	W523	NX-PD1□□□ NX-PF0□□□ NX-PC0□□□ NX-TBX01	Learning how to use NX-series System Units	The hardware and functions of the NX-series System Units are described.
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2□□□	Learning about the operating procedures and functions of the Sysmac Studio	Describes the operating procedures of the Sysmac Studio.
NX-IO Configurator Operation Manual	W585	CXONE-AL□□D-V4	Learning about the operating procedures and functions of the NX-IO Configurator.	Describes the operating procedures of the NX-IO Configurator.
NJ/NX-series Troubleshooting Manual	W503	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□ NX102-□□□□ NX1P2-□□□□	Learning about the errors that may be detected in an NJ/NX-series Controller	Concepts on managing errors that may be detected in an NJ/NX-series Controller and information on individual errors are described.
NY-series Troubleshooting Manual	W564	NY532-□□□□ NY512-□□□□	Learning about the errors that may be detected in an NY-series Industrial PC	Concepts on managing errors that may be detected in an NY-series Controller and information on individual errors are described.
NX-series EtherCAT® Coupler Unit User's Manual	W519	NX-ECC20□	Learning how to use an NX-series EtherCAT Coupler Unit and EtherCAT Slave Terminals	The following items are described: the overall system and configuration methods of an EtherCAT Slave Terminal (which consists of an NX-series EtherCAT Coupler Unit and NX Units), and information on hardware, setup, and functions to set up, control, and monitor NX Units through EtherCAT.

Manual name	Cat. No.	Model numbers	Application	Description
NX-series EtherNet/IP™ Coupler Unit User's Manual	W536	NX-EIC202	Learning how to use an NX-series EtherNet/IP Coupler Unit and EtherNet/IP Slave Terminals	The following items are described: the overall system and configuration methods of an EtherNet/IP Slave Terminal (which consists of an NX-series EtherNet/IP Coupler Unit and NX Units), and information on hardware, setup, and functions to set up, control, and monitor NX Units.
NX-series CPU Unit Hardware User’s Manual	W535	NX701-□□□□	Learning the basic specifications of the NX-series NX701 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX701 CPU Unit 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
NX-series NX102 CPU Unit Hardware User’s Manual	W593	NX102-□□□□	Learning the basic specifications of the NX-series NX102 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX102 CPU Unit 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
NX-series NX1P2 CPU Unit Hardware User’s Manual	W578	NX1P2-□□□□	Learning the basic specifications of the NX-series NX1P2 CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NX1P2 CPU Unit 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
NJ-series CPU Unit Hardware User’s Manual	W500	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NJ-series system is provided along with the following information on the CPU Unit. • Features and system configuration • Overview • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection

Manual name	Cat. No.	Model numbers	Application	Description
NY-series IPC Machine Controller Industrial Panel PC Hardware User's Manual	W557	NY532-□□□□	Learning the basic specifications of the NY-series Industrial Panel PCs, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NY-series system is provided along with the following information on the Industrial Panel PC. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NY-series IPC Machine Controller Industrial Box PC Hardware User's Manual	W556	NY512-□□□□	Learning the basic specifications of the NY-series Industrial Box PCs, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NY-series system is provided along with the following information on the Industrial Box PC. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NJ/NX-series CPU Unit Software User's Manual	W501	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□ NX102-□□□□ NX1P2-□□□□	Learning how to program and set up an NJ/NX-series CPU Unit. Mainly software information is provided.	The following information is provided on an NJ/NX-series CPU Unit. • CPU Unit operation • CPU Unit features • Initial settings • Programming based on IEC 61131-3 language specifications
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Software User's Manual	W558	NY532-□□□□ NY512-□□□□	Learning how to program and set up the Controller functions of an NY-series Industrial PC	The following information is provided on NY-series Machine Automation Control Software. • Controller operation • Controller features • Controller settings • Programming based on IEC 61131-3 language specifications
NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual	W505	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□ NX102-□□□□ NX1P2-□□□□	Using the built-in EtherCAT port on an NJ/NX-series CPU Unit	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup.
NY-series IPC Machine Controller Industrial Panel PC / Industrial Box PC Built-in EtherCAT® Port User's Manual	W562	NY532-□□□□ NY512-□□□□	Using the built-in EtherCAT port on an NY-series Industrial PC	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup.

Manual name	Cat. No.	Model numbers	Application	Description
NJ/NX-series Instructions Reference Manual	W502	NX701-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□ NX102-□□□□ NX1P2-□□□□	Learning detailed specifications on the basic instructions of an NJ/NX-series CPU Unit	The instructions in the instruction set (IEC 61131-3 specifications) are described.
NY-series Instructions Reference Manual	W560	NY532-□□□□ NY512-□□□□	Learning detailed specifications on the basic instructions of an NY-series Industrial PC	The instructions in the instruction set (IEC 61131-3 specifications) are described.
NX-series Safety Control Unit / Communication Control Unit User's Manual	Z395	NX-SL5□□□ NX-SI□□□□ NX-SO□□□□ NX-CSG□□□	Learning how to use the NX-series Safety Control Units and Communication Control Units.	Describes the hardware, setup methods, and functions of the NX-series Safety Control Units and Communication Control Units.

*1. The NX-series Temperature Input Units (NX-TS□□□□) that were included in the *NX-series Analog I/O Units User's Manual* (Cat No. W522) in revision 04 and earlier revisions were moved to this manual. From revision 05 of the *NX-series Analog I/O Units User's Manual* (Cat No. W522), the manual name was changed to *NX-series Analog I/O Units User's Manual for Analog Input Units and Analog Output Units* (Cat No. W522-E1-05).

Terminology

Term	Abbre-viation	Description
application layer status, AL status	---	Status for indicating information on errors that occur in an application on a slave.
CAN application protocol over EtherCAT	CoE	A CAN application protocol service implemented on EtherCAT.
CAN in Automation	CiA	CiA is the international users' and manufacturers' group that develops and supports higher-layer protocols.
Communication Control Unit		An interface unit for CIP Safety communications between a Safety CPU Unit and a CIP Safety on EtherNet/IP device on a network.
Communications Coupler Units	---	The generic name of an interface unit for remote I/O communications on a network between NX Units and a host network master.
CT	CT	An acronym for current transformer. A CT is a current sensor that performs non-contact measurement of alternating currents.
CPU Rack	---	A Rack to which a CPU Unit or Communication Control Unit is mounted. For NX-series CPU Units to which NX Units can be connected, a CPU Rack has a CPU Unit with NX Units and an End Cover mounted to it. For NX-series Communication Control Units, a CPU Rack has a Communication Control Unit with NX Units and an End Cover mounted to it.
DC time	---	In a CPU Rack of a NX-series CPU Unit to which NX Units can be connected, time indicated by the clock shared between the CPU Unit and the NX Units. EtherCAT slaves that support distributed clock synchronization have a clock that is shared by all slaves in the network. The time that is based on this distributed clock is called the DC time. The same clock is shared by a CPU Unit, NX Units connected to the CPU Unit, and applicable EtherCAT slaves.
device profile	---	A collection of device dependent information and functionality providing consistency between similar devices of the same device type.
device variable	---	A variable that is used to access a specific device through an I/O port by an NJ/NX-series CPU Unit or NY-series Industrial PC. Process data on an EtherCAT slave is allocated to this variable. For NX-series CPU Units to which NX Units can be connected, I/O data for the NX Units on a CPU Unit is allocated. A user application on a CPU Unit or Industrial PC accesses a device that can be connected, by directly reading and writing this device variable.
distributed clock	DC	Clock distribution mechanism used to synchronize EtherCAT slaves and the EtherCAT master.
EtherCAT slave controller	ESC	A controller for EtherCAT slave communications.
EtherCAT slave information	ESI	An XML file that contains setting information for an EtherCAT slave.
EtherCAT state machine	ESM	An EtherCAT communications state machine.
EtherCAT Technology Group	ETG	The ETG is a global organization in which OEM, end users, and technology providers join forces to support and promote the further technology development.
I/O map settings	---	Settings that assign variables to I/O ports. Assignment information between I/O ports and variables.
I/O port	---	A logical interface that is used by the NJ/NX-series CPU Unit or NY-series Industrial PC to exchange data with an external device (slave or Unit).
I/O refreshing	---	Cyclic data exchange with external devices that is performed with predetermined memory addresses.
index	---	Address of an object within an application process.

Term	Abbre-viation	Description
manipulated variable	MV	A variable used to change the control level of a control target to reach a set point.
network configuration information	---	The EtherCAT network configuration information held by the EtherCAT master.
NX bus	---	The NX-series internal bus.
object	---	An abstract representation of a particular component within a device, which consists of data, parameters, and methods.
object dictionary	OD	Data structure that contains description of data type objects, communication objects and application objects.
Operational	---	A state in which I/O refresh communications and NX message communications are possible between the communications master and the Communications Coupler Unit or NX Units.
PDO communications	---	An acronym for process data communications.
Pre-Operational	---	A state in which NX message communications are possible between the communications master and the Communications Coupler Unit or NX Units, but I/O refresh communications are not possible.
primary periodic task	---	The task with the highest priority.
process data	---	Collection of application objects designated to be downloaded cyclically or acyclically for the purpose of measurement and control.
process data communications	---	One type of EtherCAT communications in which process data objects (PDOs) are used to exchange information cyclically and in realtime. This is also called PDO communications.
process data object	PDO	A structure that describes the mappings of parameters that have one or more process data entities.
receive PDO	RxPDO	A process data object received by an EtherCAT slave.
Safe-Operational	---	A state in which input refresh communications and NX message communications are possible between the communications master and the Communications Coupler Unit or NX Units, but output refresh communications are not possible.
Safety Network Controller		A building-block Safety Controller, which consists of a Communication Control Unit connected with Safety Control Units.
SDO communications	---	One type of EtherCAT communications in which service data objects (SDOs) are used to transmit information whenever required.
service data object	SDO	CoE asynchronous mailbox communications where all objects in the object dictionary can be read and written.
Slave Information Interface	SII	Slave information that is stored in non-volatile memory in the slave.
Slave Terminal	---	A building-block remote I/O terminal to which a Communications Coupler Unit and NX Units are mounted
SSR	SSR	An acronym for solid-state relay. An SSR is a relay that does not have contacts.
subindex	---	Sub-address of an object within the object dictionary.
Sync0	---	A signal that gives the interrupt timing based on the distributed clock (DC) in EtherCAT communications. The slaves execute controls according to this interrupt timing.
Sync Manager	SM	Collection of control elements to coordinate access to concurrently used objects.
task period	---	The interval at which the primary periodic task or a periodic task is executed.
time-proportional output	---	The function that controls the control output with the supplied manipulated variable as a duty ratio.
transmit PDO	TxPDO	A process data object sent from an EtherCAT slave.

Revision History

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

Cat. No. W566-E1-06

Revision code

Revision code	Date	Revised content
01	April 2016	Original production
02	October 2016	• Made changes accompanying the addition of NY-series IPC Machine Controller Industrial Panel PCs and Industrial Box PCs. • Made changes accompanying the addition of the NX-series NX1P2 CPU Unit. • Corrected mistakes.
03	June 2017	• Made changes accompanying the upgrade of the NX-ECC203 unit version to version 1.5. • Made changes accompanying the upgrade of the NX-EIC202 unit version to version 1.2. • Corrected mistakes.
04	April 2018	• Made changes accompanying the addition of the NX-series NX102 CPU Unit. • Corrected mistakes.
05	July 2018	Made changes accompanying the addition of the NX-series Communication Control Unit.
06	October 2018	• Made revisions accompanying the appearance change of the indicators. • Corrected mistakes.

Sections in this Manual

1

Features and System Configuration

This section describes the NX system configuration and the types of Temperature Input Units and Heater Burnout Detection Units.

1-1 Features of Temperature Input Units

Temperature Input Units provide functionality to process inputs from temperature sensors. Temperature Input Units for thermocouple inputs and Temperature Input Units for resistance thermometer inputs are available.

NX-series Temperature Input Units have the following features.

Additional Information

CPU Rack

A CPU Rack is a rack to which a CPU Unit or Communication Control Unit is mounted. For NX-series CPU Units to which NX Units can be connected, a CPU Rack is configured to have a CPU Unit with NX Units and an End Cover mounted to it. For NX-series Communication Control Units, a CPU Rack has a Communication Control Unit with NX Units and an End Cover mounted to it.

Slave Terminal

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

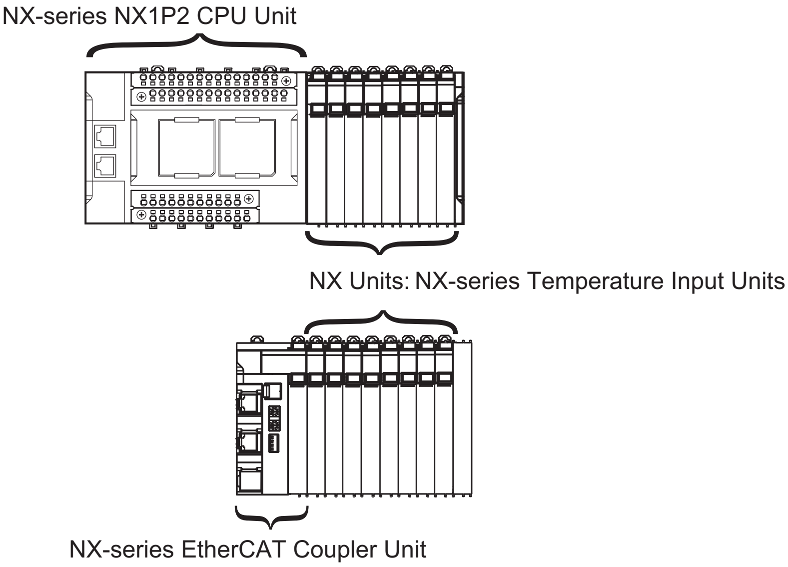
Can Be Connected to More Than One Unit with the NX Bus

NX-series Temperature Input Units can be connected to the following Units, which each support an NX bus.*1

- NX-series CPU Unit
- NX-series Communications Coupler Unit
- NX-series Communication Control Unit

When these Units are used, you can unify the methods for installing, wiring, and setting up NX Units, and eventually reduce design costs.

Example:



*1. For whether NX Units can be connected to the CPU Unit or Communications Coupler Unit to be used, refer to the user's manual for the CPU Unit or Communications Coupler Unit to be used.

Units with Conversion Times for General-purpose Applications through High-speed, High-precision Control Applications

Units are available with the following conversion times.

- 250 ms
- 60 ms
- 10 ms

Therefore, you can select Units to match the speed requirements of your devices.

Simple I/O Wiring with a Screwless Clamping Terminal Block

The terminal block is a screwless clamping terminal block.

You can connect the wires simply by pushing the ferrules into the terminals. The amount of wiring work is reduced without requiring the use of screws.

1-2 Features of Heater Burnout Detection Units

Heater Burnout Detection Units have the following functions.

- Monitoring of CT currents to provide alarms for heater burnouts and SSR failures
- Time-proportional control output processing to operate heaters with SSRs

NX-series Heater Burnout Detection Units have the following features.

Additional Information

CPU Rack

A CPU Rack is a rack to which a CPU Unit is mounted. For NX-series CPU Units to which NX Units can be connected, a CPU Rack is configured to have a CPU Unit with NX Units and an End Cover mounted to it.

Slave Terminal

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

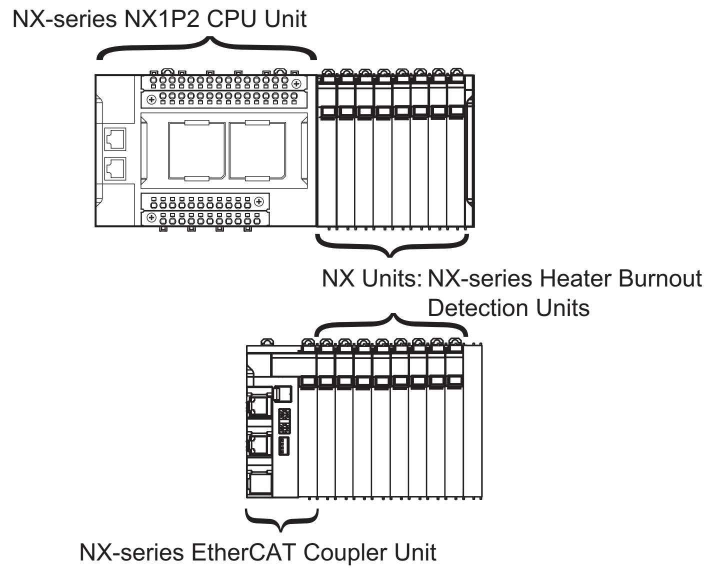
Can be Connected to a CPU Unit or Communications Coupler Unit

NX Unit NX-series Heater Burnout Detection Units can be connected to the following Units.*1

- NX-series CPU Unit
- NX-series Communications Coupler Unit

When a CPU Unit and a Communications Coupler Unit are used together, you can unify the methods for installing, wiring, and setting up NX Units, and eventually reduce design costs.

Example:



*1. For whether NX Units can be connected to the CPU Unit or Communications Coupler Unit to be used, refer to the user's manual for the CPU Unit or Communications Coupler Unit to be used.

Additional Information

Heater Burnout Detection Units cannot be connected to the Communication Control Unit.

Control Outputs Not Affected by Controller Cycle Time

The Unit can perform time-proportional output of command values from the Controller in sync with the control period without being affected by the Controller's cycle time.

Simple I/O Wiring with a Screwless Clamping Terminal Block

The terminal block is a screwless clamping terminal block.

You can connect the wires simply by pushing the ferrules into the terminals. The amount of wiring work is reduced without requiring the use of screws.

1-3 System Configuration

NX Unit NX-series Temperature Input Units and Heater Burnout Detection Units can be connected to the following Units .

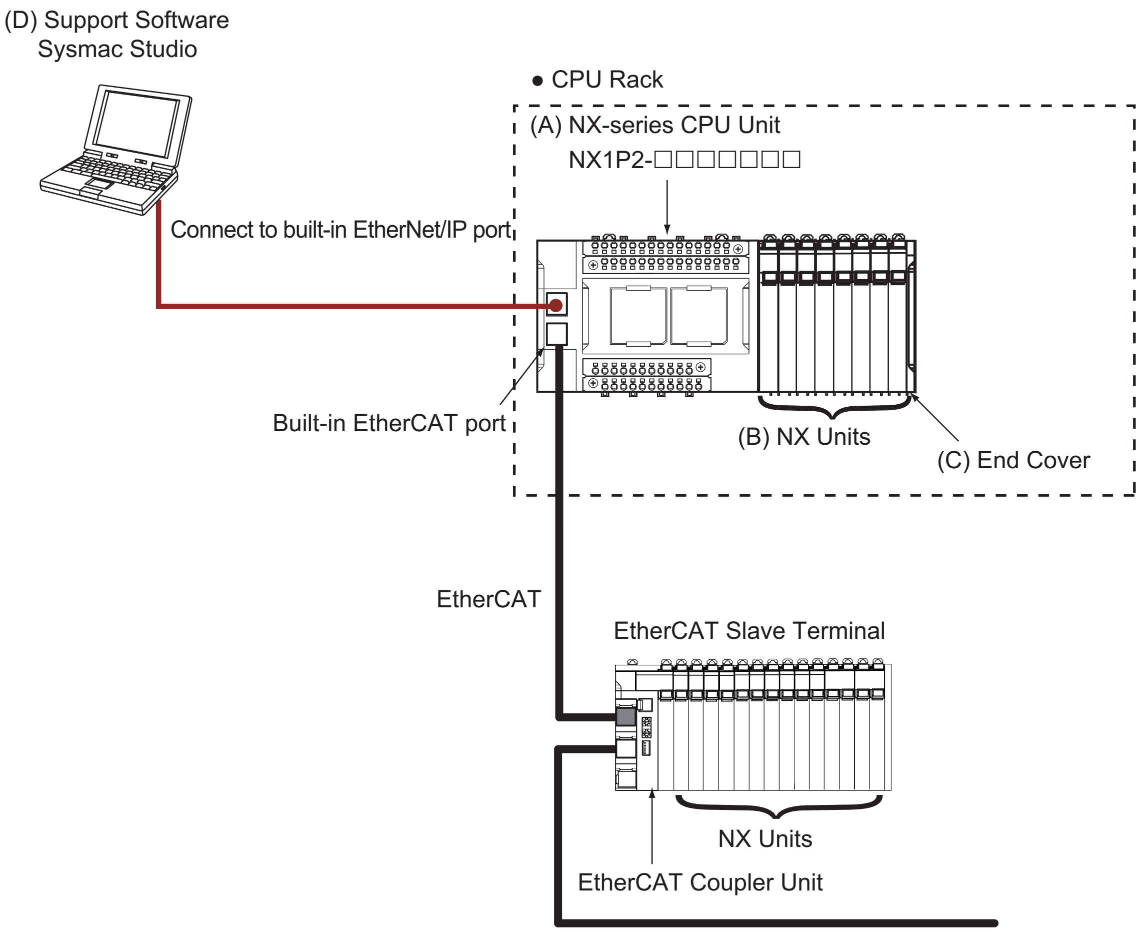
- NX-series CPU Unit
- NX-series Communications Coupler Unit
- NX-series Communication Control Unit

This section describes the system configuration for each connection of the NX Unit. Refer to *7-2 Temperature Control System* on page 7-3 for information on how to perform temperature control with these Units.

1-3-1 System Configuration in the Case of a CPU Unit

The following figure shows a system configuration when a group of NX Units is connected to an NX-series NX1P2 CPU Unit. You can connect the EtherCAT Slave Terminal to the built-in EtherCAT port on the CPU Unit. Refer to *1-3-2 System Configuration of Slave Terminals* on page 1-7 for details on the system configuration of a Slave Terminal.

Refer to the user's manual for the connected CPU Unit for details on how to configure the system if the connected CPU Unit is not an NX1P2 CPU Unit.



Symbol	Item	Description
(A)	NX-series CPU Unit	The Unit that serves as the center of control for a Machine Automation Controller. It executes tasks, refreshes I/O for other Units and slaves, etc. NX Units can be connected to an NX1P2 CPU Unit.

Symbol	Item	Description
(B)	NX Units*1	The NX Units perform I/O processing with connected external devices. The NX Units exchange data with the CPU Unit through I/O refreshing. A maximum of eight NX Units can be connected to an NX1P2 CPU Unit.
(C)	End Cover	The End Cover is attached to the end of a CPU Rack.
(D)	Support Software (Sysmac Studio)	A computer software application for setting, programming, debugging, and troubleshooting NJ/NX/NY-series Controllers. For an NX1P2 CPU Unit, this application performs setting operation by making a connection to a built-in EtherNet/IP port.

*1. For whether an NX Unit can be connected to the CPU Unit, refer to the version information in the user's manual for the NX Unit.

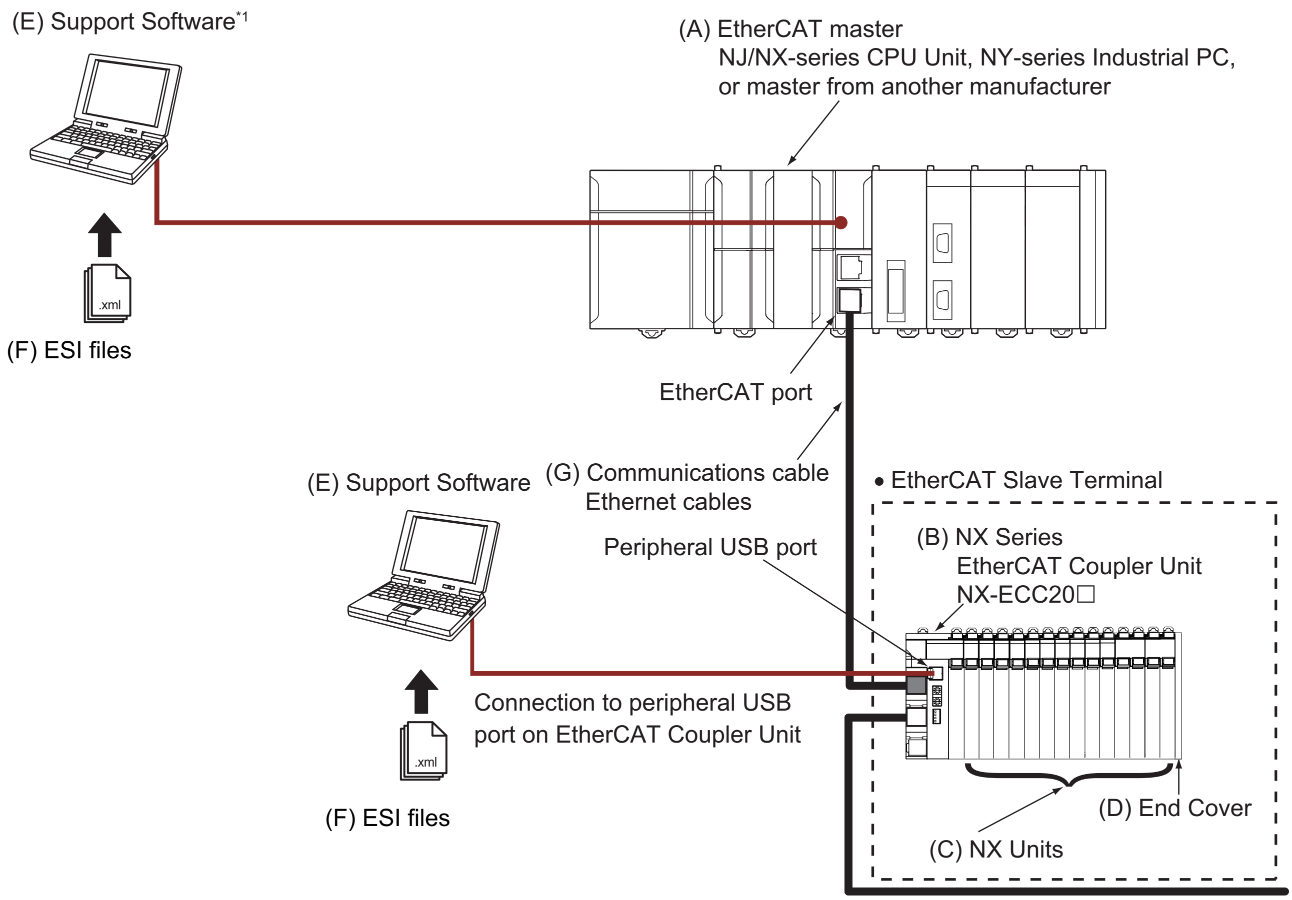
1-3-2 System Configuration of Slave Terminals

A building-block remote I/O slave provided with a group of NX Units connected to a Communications Coupler Unit is generically called a Slave Terminal.

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

The following figure shows an example of the system configuration when an EtherCAT Coupler Unit is used as a Communications Coupler Unit.

Refer to the user's manual for the connected Communications Coupler Unit for details on how to configure the system when any other type of Communications Coupler Unit is used.



*1. The connection method for the Support Software depends on the model of the CPU Unit or Industrial PC.

Letter	Item	Description
(A)	EtherCAT master *1	The EtherCAT master manages the network, monitors the status of slaves, and exchanges I/O data with slaves.
(B)	EtherCAT Coupler Unit	The EtherCAT Coupler Unit serves as an interface for process data communications on the 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*2	The NX Units perform I/O processing with connected external devices. The NX Units perform process data communications with the EtherCAT master through the EtherCAT Coupler Unit.
(D)	End Cover	The End Cover is attached to the end of the Slave Terminal.
(E)	Support Software *3 *4	The Sysmac Studio runs on a personal computer and it is used to configure the EtherCAT network and EtherCAT Slave Terminal, and to program, monitor, and troubleshoot the Controllers.
(F)	ESI (EtherCAT Slave Information) file	The ESI files contain information that is unique to the EtherCAT Slave Terminals in XML format. You can load an ESI file into the Support Software to easily allocate Slave Terminal process data and make other settings. The ESI files for OMRON EtherCAT slaves are installed in the Support Software. You can obtain the ESI files for the latest models through the Support Software's automatic update function.
(G)	Communications cable	Use a double-shielded cable with aluminum tape and braiding of Ethernet category 5 (100Base-TX) or higher, and use straight wiring.

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

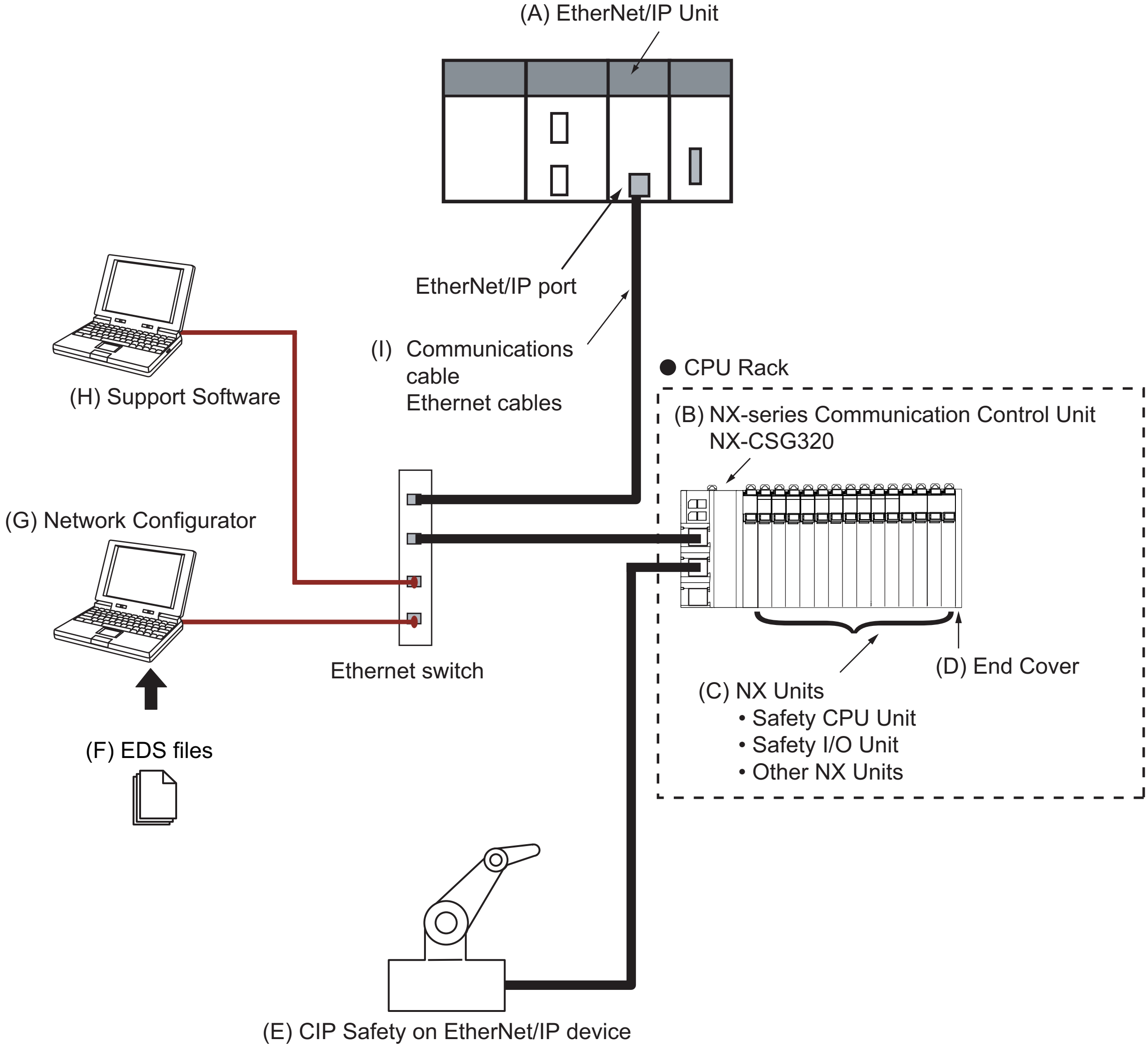
*2. For whether an NX Unit can be connected to the Communications Coupler Unit, refer to the version information in the user's manual for the NX Unit.

*3. The term Support Software indicates software that is provided by OMRON. If you connect to a master from another company, use the software tool corresponding to that master.

*4. Refer to *1-6 Support Software* on page 1-16 for information on Support Software.

1-3-3 System Configuration in the Case of a Communication Control Unit

The following figure shows a system configuration when a group of NX Units is connected to an NX-series Communication Control Unit. To configure a Safety Network Controller, mount the Safety CPU Unit, which is one of the NX Units, to the CPU Rack of the Communication Control Unit.



Letter	Item	Description
(A)	EtherNet/IP Unit	The EtherNet/IP Unit manages the EtherNet/IP network, monitors the status of slaves, and exchanges I/O data with the slaves. The types of EtherNet/IP Units are listed below. • CJ1W-EIP21 • Built-in EtherNet/IP port on a CPU Unit Refer to the user's manual for your EtherNet/IP Unit for information on the Support Software to configure the EtherNet/IP Unit.
(B)	Communication Control Unit	The Communication Control Unit has built-in EtherNet/IP ports and relays CIP Safety communications between the Safety CPU Unit and CIP Safety on EtherNet/IP devices. It also performs tag data link communications with standard controllers.

Letter	Item	Description
(C)	NX Units*1	• Safety CPU Unit This Unit serves as the center of control for the Safety Network Controller. It executes safety programs and CIP Safety communications. • Safety I/O Unit This Unit performs safety input or output processing. • Other NX Units Digital I/O Units and other types of NX Units perform standard I/O processing.
(D)	End Cover	The End Cover is attached to the end of the CPU Rack.
(E)	CIP Safety on EtherNet/IP device	The CIP Safety on EtherNet/IP device performs CIP Safety communications with the Safety CPU Unit.
(F)	EDS (Electronic Data Sheet) file	The EDS file contains information that is unique to the Communication Control Unit. You can load EDS files into the Network Configurator or other EtherNet/IP network setup software to easily allocate data and view or change settings.
(G)	Network Configurator	The software tool to configure the EtherNet/IP network.
(H)	Support Software*2	The Support Software runs on a personal computer and it is used to configure the CPU Rack, and to perform programming, monitoring, and troubleshooting.
(I)	Communications cable	Use an STP (shielded twisted-pair) cable of category 5 or higher. You can use either a straight or cross cable.

*1. For whether an NX Unit can be connected to the Communication Control Unit, refer to the version information in the user’s manual for the NX Unit.

*2. Refer to *1-6 Support Software* on page 1-16 for information on Support Software.

1-4 Model List

1-4-1 Model Notation

The Temperature Input Unit and Heater Burnout Detection Unit model numbers are assigned based on the following rules.

NX-□□□□□□

Unit type
TS: Temperature input
HB: Heater burnout detection

Number of points
2: 2 points
3: 4 points
4: 8 points

I/O type (signal range and sensor type)
Refer to *I/O Types* on page 1-11.

Other specifications
TS: Other specification
Refer to *Other Specifications* on page 1-12.

HB: Always 01.

I/O Types

The following tables list the I/O types.

● Temperature Input Units

No.	Sensor type
1	Thermocouple
2	Resistance thermometer

● Heater Burnout Detection Units

No.	Internal I/O common processing of control outputs
1	NPN
2	PNP

Other Specifications

● Temperature Input Units

Number	Conversion time	Resolution	I/O refreshing method	
			Free-Run refreshing *1 only	Switching Synchronous I/O refreshing *2 and Free-Run refreshing
01	250 ms/Unit	0.1°C max. *3	Yes	---
02	10 ms/Unit	0.01°C max.	Yes	---
04	60 ms/Unit	0.001°C max.	Yes	---

*1. Free-Run refreshing

*2. Synchronous I/O refreshing

*3. The resolution is 0.2°C max. when the input type is R, S, or W.

Refer to *Section 5 I/O Refreshing* for details on the I/O refreshing method.

1-4-2 Temperature Input Units

This section shows the specifications for Temperature Input Units.

Refer to *A-1-2 Temperature Input Units* on page A-4 for details on the specifications of individual Analog Input Units.

Temperature Input Units (Screwless Clamping Terminal Block, 12 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS2101	2 points	Thermocouple	250 ms/Unit	0.1°C max. *1	Free-Run refreshing	P. A-7
NX-TS2102			10 ms/Unit	0.01°C max.		P. A-8
NX-TS2104			60 ms/Unit	0.001°C max.		P. A-10
NX-TS2201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-11
NX-TS2202			10 ms/Unit	0.01°C max.		P. A-12
NX-TS2204			60 ms/Unit	0.001°C max.		P. A-13

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS2202 only supports Pt100 three-wire sensor.

Temperature Input Units (Screwless Clamping Terminal Block, 24 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS3101	4 points	Thermocouple	250 ms/Unit	0.1°C max. *1	Free-Run refreshing	P. A-14
NX-TS3102			10 ms/Unit	0.01°C max.		P. A-15
NX-TS3104			60 ms/Unit	0.001°C max.		P. A-17
NX-TS3201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-18
NX-TS3202			10 ms/Unit	0.01°C max.		P. A-19
NX-TS3204			60 ms/Unit	0.001°C max.		P. A-20

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS3202 only supports Pt100 three-wire sensor.

1-4-3 Heater Burnout Detection Units

The following table lists the Heater Burnout Detection Units.

For detailed specifications for each Unit, refer to *A-1-3 Heater Burnout Detection Units* on page A-25.

Model	CT input section		Control output section				I/O refreshing method	Reference
	Number of points	Maximum heater current	Number of points	Internal I/O common	Maximum load current	Rated voltage		
NX-HB3101	4 points	50 A AC	4 points	NPN	0.1 A/point, 0.4 A/Unit	12 to 24 VDC	Free-Run refreshing	P. A-27
NX-HB3201				PNP		24 VDC		P. A-29

1-5 List of Functions

This section provides an overview of the functions of the Temperature Input Units and Heater Burnout Detection Units.

Refer to the specifications of each model in *A-1 Data Sheet* on page A-2 for details on the functions.

1-5-1 Temperature Input Units

Function name	Description	Reference
Free-Run Refreshing	With this I/O refreshing method, the refresh cycle of the NX bus and the I/O refresh cycles of the NX Units are asynchronous.	*5-2-4 Free-Run Refreshing* on page 5-9
Selecting Channel To Use	This function disables errors in unused channels. The conversion time for its own Unit will not be shortened even if errors are disabled.	*6-5-3 Selecting Channel To Use* on page 6-20
Moving Average	This function uses the average value of inputs over a set period as the measured value. When the input value fluctuates frequently due to noise, a moving average can be used to obtain a stable measured value.	*6-5-4 Moving Average* on page 6-23
Sensor Disconnection Detection	This function detects disconnections of sensors that are connected to the input terminals.	*6-5-5 Sensor Disconnection Detection* on page 6-27
Over Range/Under Range Detection	This function detects when the measured value exceeds the range for which temperature conversion is possible.	*6-5-6 Over Range/Under Range Detection* on page 6-28
Cold Junction Compensation Enable/Disable Setting	This function enables or disables the cold junction compensation for thermocouple inputs. Enable this function normally.	*6-5-7 Cold Junction Compensation Enable/Disable Setting* on page 6-29
Temperature Unit Setting (°C/°F)	This function sets °C (celsius) or °F (fahrenheit) as the temperature unit for measured values.	*6-5-8 Temperature Unit (°C/°F) Setting* on page 6-32
Input Correction	This function corrects measured values. It is used when there is a noticeable variation from values measured with other gauges. One-point correction and two-point correction methods are provided.	*6-5-9 Input Correction* on page 6-35
Decimal Point Position Setting	This function sets the number of digits which is displayed after the decimal point when measured values are INT and DINT data.	*6-5-10 Decimal Point Position Setting* on page 6-40

1-5-2 Heater Burnout Detection Units

Function	Description	Reference
Free-Run Refreshing	With this I/O refreshing method, the refresh cycle of the NX bus and I/O refresh cycles of the NX Units are asynchronous.	*5-2-4 Free-Run Refreshing* on page 5-9
CT Allocation	This function is used to assign each CT input to a corresponding control output.	*7-6-2 CT Allocation* on page 7-21
Reading CT Currents	This function reads CT inputs as heater currents or leakage currents.	*7-6-3 Reading CT Currents* on page 7-25
Heater Burnout Detection	This function detects heater burnouts. A heater burnout is detected if the control output is ON and the heater current is equal to or less than the heater burnout detection current.	*7-6-4 Heater Burnout Detection* on page 7-26
SSR Failure Detection	This function detects SSR failures. An SSR failure is detected if the control output is OFF and the leakage current is equal to or greater than the detection current. An SSR failure is a failure that is caused by an SSR short-circuit.	*7-6-5 SSR Failure Detection* on page 7-30
Time-proportional Output	This function controls a control output by using the manipulated variable from the controller as a duty ratio. You can also specify the minimum pulse widths and execute immediate output commands.	*7-6-6 Time-proportional Output* on page 7-33
Load Rejection Output Setting	A function that performs the preset output operation when the Heater Burnout Detection Unit cannot receive output data due to an NX bus error or CPU Unit watchdog timer error, in the case of Units connected to a CPU Unit. A function that performs the preset output operation when the Heater Burnout Detection Unit cannot receive output data due to a host error on the Communications Coupler Unit or an error on the NX bus, in the case of Slave Terminals.	*7-6-7 Load Rejection Output Settings* on page 7-40
Load Short-circuit Protection	This function is used to protect the output circuits of the Heater Burnout Detection Unit when an external device short-circuits. This function is supported only by the NX-HB3201.	*7-6-8 Load Short-circuit Protection* on page 7-43

1-6 Support Software

The Support Software that is used depends on the system configuration.

● Support Software for a System Configured with a CPU Unit

If your system is configured by connecting an NX Unit to a CPU Unit, the Sysmac Studio is used as the Support Software.

● Support Software for a System Configured with a Slave Terminal

If your system is configured by connecting an NX Unit to a Communications Coupler Unit, refer to the user's manual for the Communications Coupler Unit for information on the Support Software.

● Support Software for a System Configured with a Communication Control Unit

If your system is configured by connecting an NX Unit to a Communication Control Unit, the Sysmac Studio is used as the Support Software.

Depending on the Unit to which the NX Unit is connected, refer to the following appendices for information on the Support Software versions.

A-5 Version Information with CPU Units on page A-65

A-6 Version Information with Communications Coupler Units on page A-68

A-7 Version Information with Communication Control Units on page A-75

2

Specifications

This section describes the general specifications and individual specifications of the Temperature Input Units and Heater Burnout Detection Units.

2-1 General Specifications

The general specifications of Temperature Input Units and Heater Burnout Detection Units are provided below.

Item		Specification
Enclosure		Mounted in a panel
Grounding methods		Ground of 100 Ω or less
Operating environment	Ambient operating temperature	0 to 55°C
	Ambient operating humidity	10 to 95% RH (with no icing or condensation)
	Atmosphere	Must be free from corrosive gases.
	Ambient storage temperature	-25 to 70°C (with no icing or condensation)
	Altitude	2,000 m max.
	Pollution degree	Pollution degree 2 or less: Conforms to JIS B 3502 and IEC 61131-2.
	Noise immunity	Conforms to IEC 61000-4-4, 2 kV (power supply line)
	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 amplitude of 3.5 mm, 8.4 to 150 Hz, acceleration of 9.8 m/s^2 100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock resistance	Conforms to IEC 60068-2-27, 147 m/s^2, 3 times each in X, Y, and Z directions
	Insulation resistance	*1
	Dielectric strength	*1
Applicable standards*2		cULus: Listed (UL508), ANSI/ISA 12.12.01, EU: EN 61131-2, C-Tick or RCM, KC: KC Registration, NK, and LR

*1. Depends on the model of the NX Unit. Refer to *A-1 Data Sheet* on page A-2 for the specifications of individual NX Units.

*2. Refer to the OMRON website (www.ia.omron.com) or ask your OMRON representative for the most recent applicable standards for each model.

2-2 Individual Specifications

Refer to *A-1 Data Sheet* on page A-2 for the specifications of individual Temperature Input Units and Heater Burnout Detection Units.

3

Part Names and Functions

This section describes the names and functions of the parts of the Temperature Input Units and Heater Burnout Detection Units.

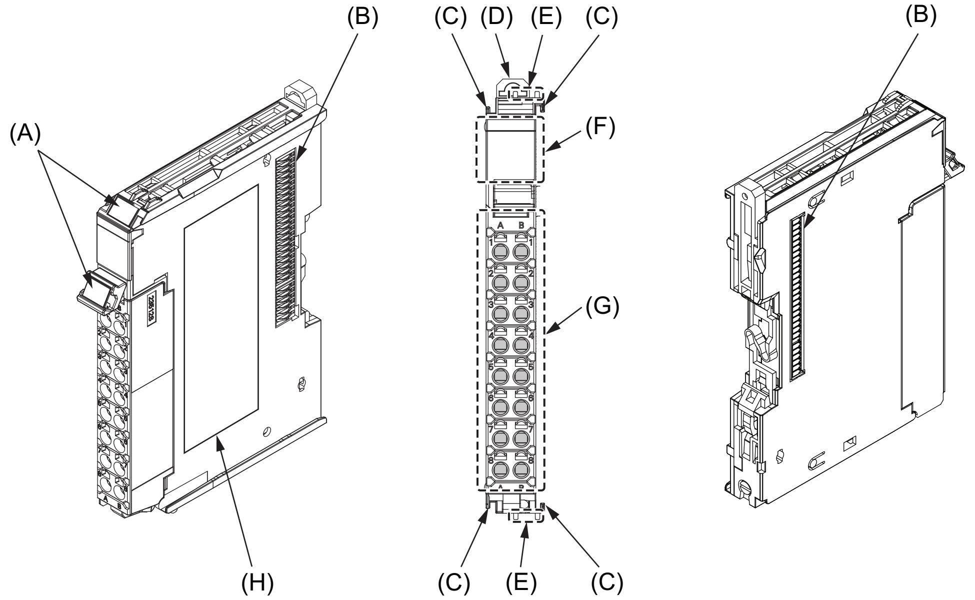
3-1 Part Names

This section describes the names and functions of the parts of the Temperature Input Units and Heater Burnout Detection Units.

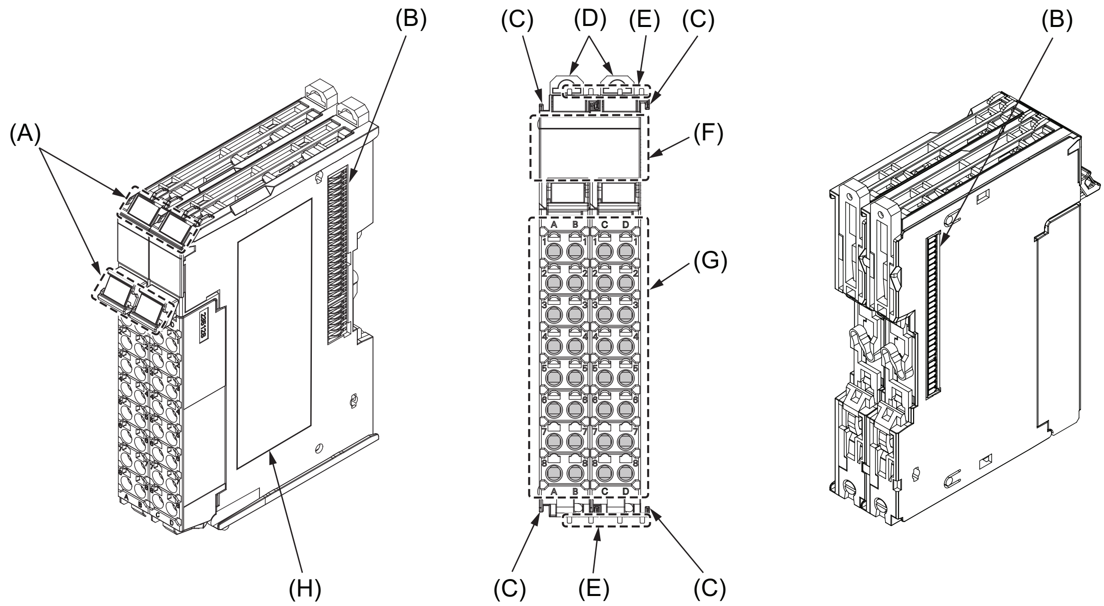
3-1-1 Screwless Clamping Terminal Block Type

Temperature Input Units for Resistance Thermometer Inputs and Heater Burnout Detection Units

● **12 mm Width**



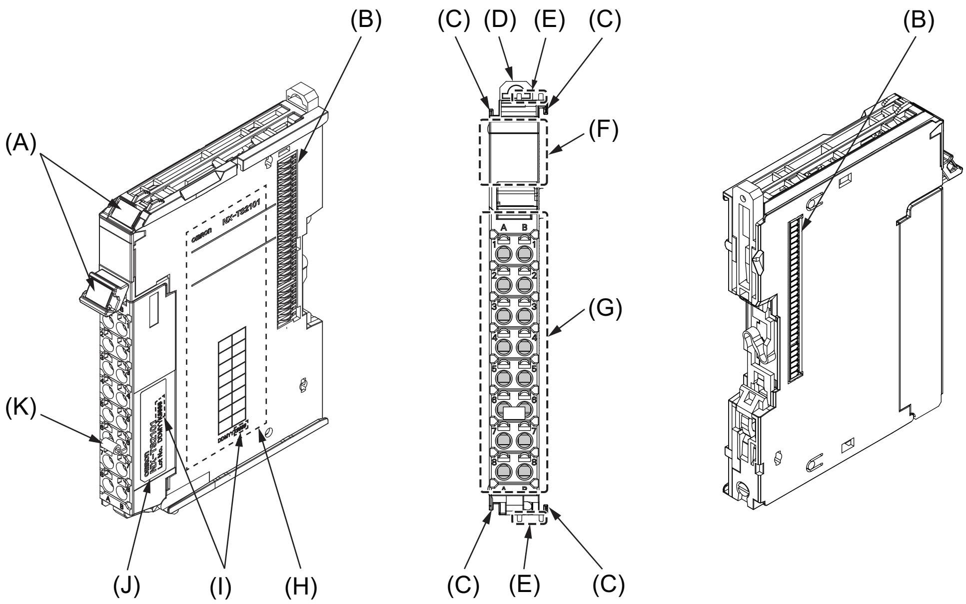
● **24 mm Width**



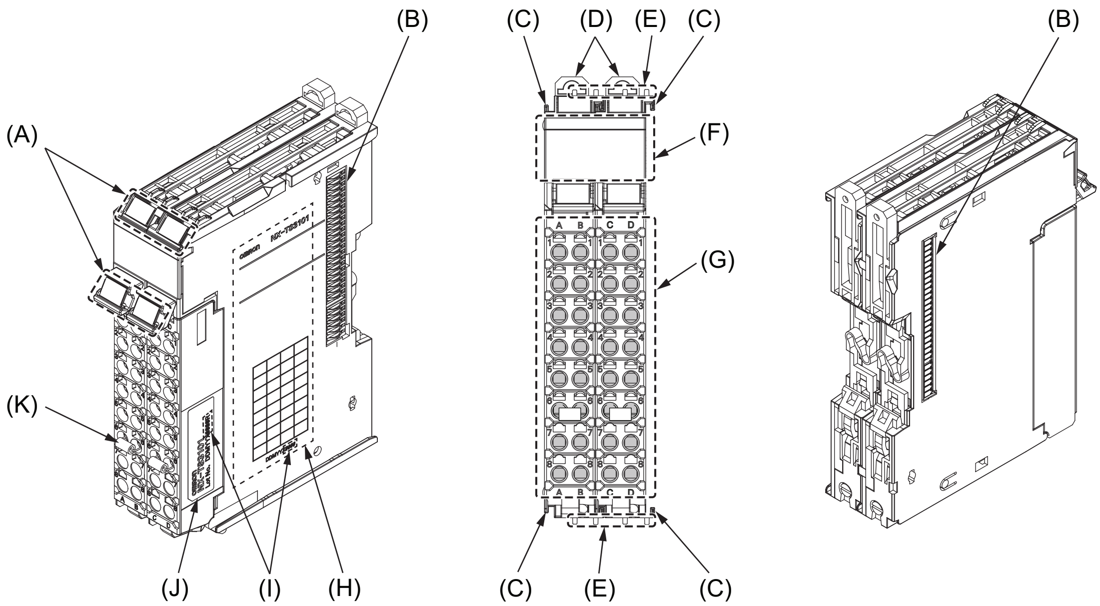
Let-ter	Name	Function
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. Refer to *4-1-2 Attaching Markers* on page 4-4
(B)	NX bus connector	This connector is 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	The protrusions to hold when removing the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit. Refer to *3-2 Indicators* on page 3-9
(G)	Terminal block	The terminal block is used to connect external devices. The number of terminals depends on the type of Unit.
(H)	Unit specifications	The specifications of the Unit are given.

Temperature Input Units for Thermocouple Inputs

- **12 mm Width**



- **24 mm Width**

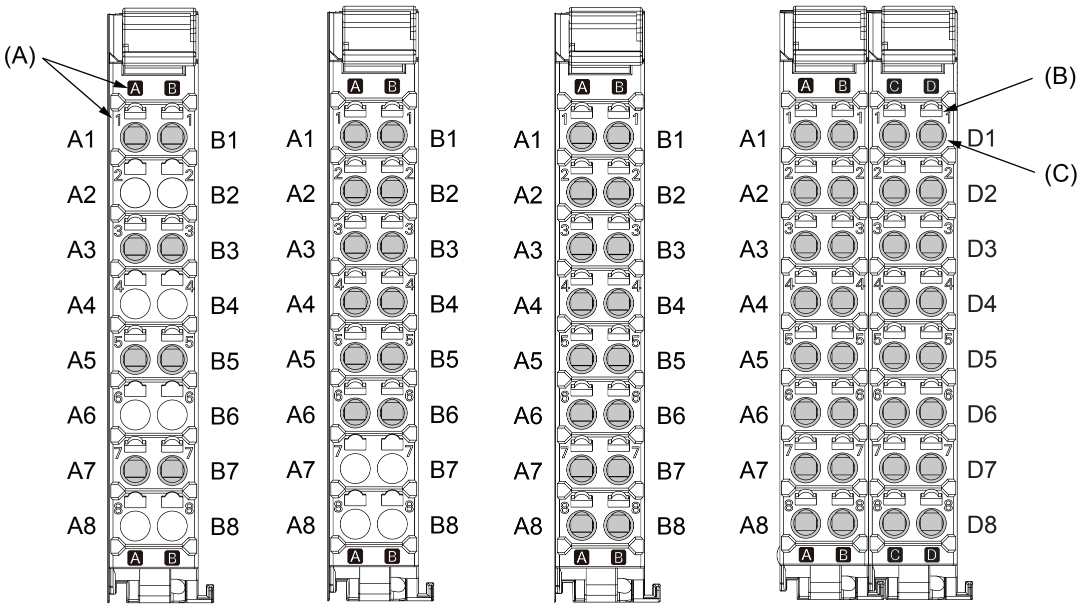


Letter	Name	Function
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. Refer to *4-1-2 Attaching Markers* on page 4-4
(B)	NX bus connector	This connector is used 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	The protrusions to hold when removing the Unit.
(F)	Indicators	The indicators show the current operating status of the Unit. Refer to *3-2 Indicators* on page 3-9
(G)	Terminal block	The terminal block is used to connected external devices. The number of terminals depends on the type of Unit.
(H)	Unit specifications	The specifications of the Unit are given.
(I)	Calibration control number	The calibration control number is used to guarantee overall accuracy. The overall accuracy is guaranteed by using the terminal block and the Unit as a set that have the same calibration control number. Refer to *Precaution for Installing Temperature Input Units (Thermocouple Input Type)* on page 4-25
(J)	Calibration control number label	The label attached on the terminal block with a calibration control number written on it. With 24 mm wide models, the labels are attached on both left and right terminal blocks. "L" or "R" is appended at the end of the calibration control number to identify left or right.
(K)	Cold junction sensor	This sensor is used to perform the cold junction compensation. The sensors are mounted on both left and right terminal blocks for models with 24 mm width.

Terminal Blocks

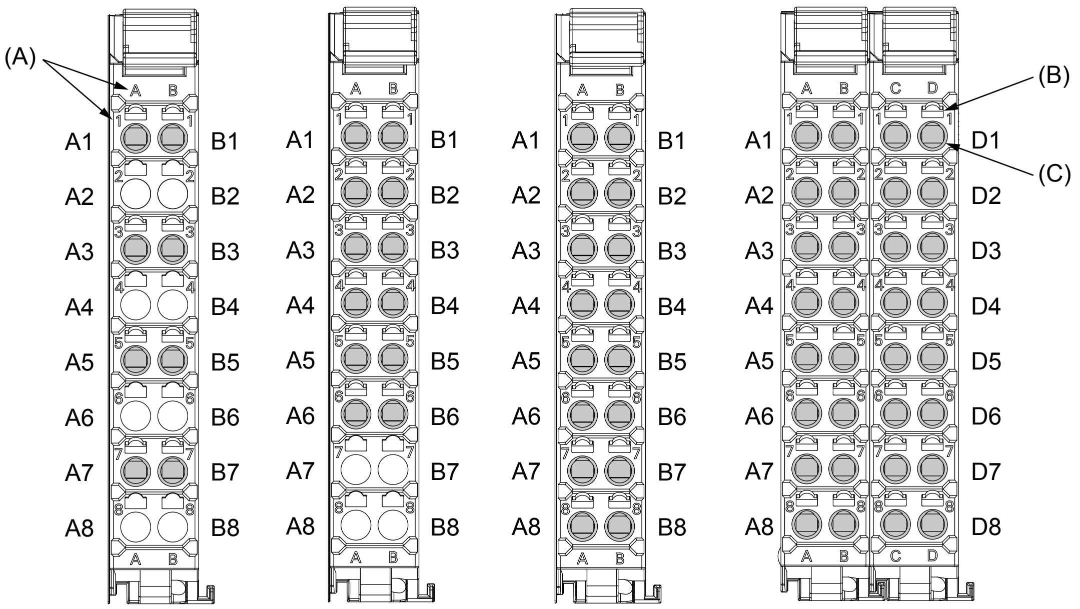
There are two models of screwless clamping terminal blocks: NX-TB□□□2 and NX-TB□□□1. Each model has three types of terminal blocks: 8-terminal type, 12-terminal type, and 16-terminal type.

- **NX-TB□□□2**



12 mm width 8-terminal type | 12 mm width 12-terminal type | 12 mm width 16-terminal type | 24 mm width 16-terminal type × 2

- **NX-TB□□□1**



12 mm width 8-terminal type | 12 mm width 12-terminal type | 12 mm width 16-terminal type | 24 mm width 16-terminal type × 2

Let-ter	Name	Function
(A)	Terminal number indications	Terminal numbers for which A to D indicate the column, and 1 to 8 indicate the line are displayed. The terminal number is a combination of column and line, i.e. A1 to A8 and B1 to B8. For models of 24 mm width, A1 to A8 and B1 to B8 are terminal number of the left terminal block, C1 to C8 and D1 to D8 are terminal numbers of the right terminal block. The terminal number indications are the same regardless of the number of terminals on the terminal block.
(B)	Release holes	Insert a flat-blade screwdriver into these holes to connect and remove the wires.
(C)	Terminal holes	The wires are inserted into these holes.

The NX-TB□□□2 and NX-TB□□□1 Terminal Blocks have different terminal current capacities. The NX-TB□□□2 has 10 A and NX-TB□□□1 has 4 A.

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

You can mount either NX-TB□□□1 or NX-TB□□□2 Terminal Blocks to the Units that the current capacity specification of the terminals is 4 A or less.

You can only mount the NX-TB□□□2 Terminal Block to the Units that the current capacity specification of the terminals is greater than 4 A.

Additional Information

- Each Temperature Input Unit or Heater Burnout Detection Unit is compatible with only one of three types of terminal blocks. You cannot use a terminal block with a number of terminals that differs from the specifications for a particular Unit.
- The 8-terminal type and 12-terminal type do not have terminal holes and release holes for following terminal numbers.
  8-terminal type: A2, A4, A6, A8, B2, B4, B6, and B8
  12-terminal type: A7, A8, B7, and B8

● Applicable Terminal Blocks for Each Unit Model

The following indicates the terminal blocks that are applicable to each Unit.

<table>
<tr><th rowspan="2">Unit model number</th><th colspan="4">Terminal block</th></tr>
<tr><th>Model</th><th>Number of terminals</th><th>Ground terminal mark</th><th>Current capacity</th></tr>
<tr><td>NX-TS21□□</td><td colspan="4" rowspan="2">You cannot replace the terminal blocks.
Refer to Precaution for Installing Temperature Input Units (Thermocouple Input Type) on page 4-25.</td></tr>
<tr><td>NX-TS31□□</td></tr>
<tr><td rowspan="2">NX-TS22□□</td><td>NX-TBA161</td><td rowspan="8">16</td><td rowspan="8">Not provided</td><td>4 A</td></tr>
<tr><td>NX-TBA162</td><td>10 A</td></tr>
<tr><td rowspan="4">NX-TS32□□</td><td>NX-TBA161
NX-TBB161</td><td>4 A</td></tr>
<tr><td>NX-TBA162
NX-TBB162</td><td>10 A</td></tr>
<tr><td rowspan="2">NX-HB3□01</td><td>NX-TBA161</td><td>4 A</td></tr>
<tr><td>NX-TBA162</td><td>10 A</td></tr>
</table>

Precautions for Correct Use

You can mount either NX-TB□□□1 or NX-TB□□□2 Terminal Blocks to the Units that the current capacity specification of the terminals is 4 A or less.

However, even if you mount the NX-TB□□□2 Terminal Block, the current specification does not change because the current capacity specification of the terminals on the Units is 4 A or less.

Refer to *A-4 List of Screwless Clamping Terminal Block Models* on page A-64 for information on the models of terminal blocks.

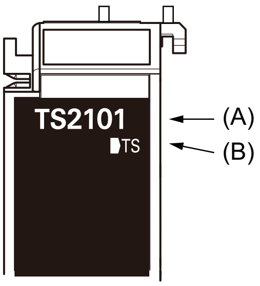
3-2 Indicators

There are the indicators to show the current operating status of the Temperature Input Unit or Heater Burnout Detection Unit or the signal I/O status on the Unit.

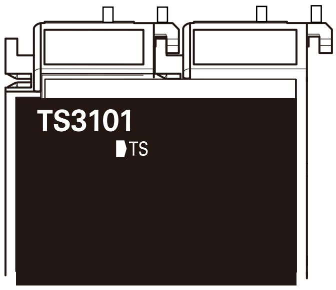
The indicator pattern depends on the Unit type and Unit width, as shown below.

The appearance of the indicators has been changed for models released in or before September 2018 with lot numbers that represent the date of or after September 20, 2018. In this manual, those models are shown with the indicators after the change. For details on the applicable models and the changes, refer to *3-2-3 Appearance Change of the Indicators* on page 3-12.

● Temperature Input Units

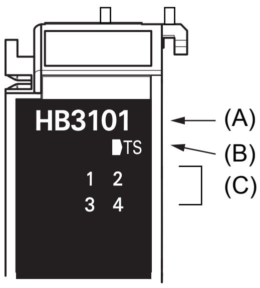


12 mm width



24 mm width

● Heater Burnout Detection Units

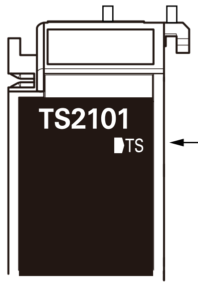


12-mm width

Letter	Name	Function
(A)	Model number indications	The model numbers of the NX Unit are displayed. (Example) "AD2603" in the case of NX-AD2603 The NX Units are separated in the following color depending on the type of inputs and outputs. Temperature Input Unit: Orange Heater Burnout Detection Units: White
(B)	TS indicator	The indicator shows the current operating status of the NX Unit.
(C)	Output indicators	These indicators show the output status of each control output terminal of the Heater Burnout Detection Unit.

The indicator specifications are given below.

3-2-1 TS Indicator



This indicator shows the current status of the Temperature Input Unit and Heater Burnout Detection Unit, their communications statuses with the CPU Unit, with the Communications Coupler Unit, or with the Communication Control Unit[*1].

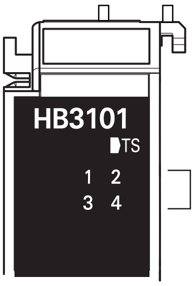
*1. Temperature Input Unit only

The meanings of light statuses are described as follows:

Color	Status	Description
Green	Lit	• The Unit is operating normally. • The Unit is ready for I/O refreshing. • I/O checking is operating.[*1]
	Flashing at 2-s intervals.	• Initializing • Restarting is in progress for the Unit. • Downloading
Red	Lit	A hardware failure, WDT error, or other fatal error that is common to all I/O Units occurred.
	Flashing at 1-s intervals.	A communications error or other NX bus-related error that is common to all I/O Units occurred.
---	Not lit	• No Unit power supply • Restarting is in progress for the Unit. • Waiting for initialization to start

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

3-2-2 Output Indicators



These indicators show the output status of each control output terminal of the Heater Burnout Detection Unit.

The following shows an example of Control Output 1. The number of the control output is lit or not lit.

Color	Status		Description
Yellow	1	Lit	The control output corresponding to the number is ON.
---	1	Not lit	The control output corresponding to the number is OFF.

Additional Information

Products models before the appearance change have a square-shaped light-emitter on the left side of each control output number. For details on the applicable models and the changes, refer to *3-2-3 Appearance Change of the Indicators* on page 3-12.

Color	Status		Description
Yellow		Lit	• The control output is ON.
---		Not lit	• The control output is OFF.

3-2-3 Appearance Change of the Indicators

The appearance of the indicators has been changed for models released in or before September 2018 with lot numbers that represent the date of or after September 20, 2018. See below for details on the applicable models and the changes. Models that are not listed here have the appearance after the change.

Applicable Models

- **Temperature Input Unit**

  NX-TS2101, NX-TS2102, NX-TS2104, NX-TS2201, NX-TS2202, NX-TS2204, NX-TS3101, NX-TS3102, NX-TS3104, NX-TS3201, NX-TS3202, NX-TS3204

- **Heater Burnout Detection Unit**

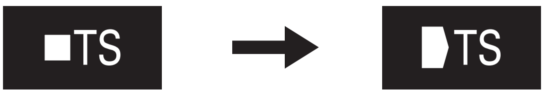
  NX-HB3101, NX-HB3201

Change Details

- **TS Indicator**

  The shape of the light emitting part of the indicator has been changed from a square to a pentagon.

  See below.

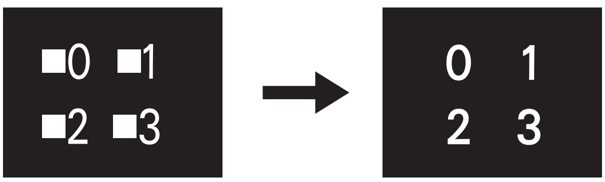


Before change After change

- **OUT Indicator**

  Only Heater Burnout Detection Units have this indicator.

  The indicators before the change have a square-shaped light-emitter on the left side of each control output number, and the indicators after the change have the control output numbers emitting light.



Before change After change

4

Installation and Wiring

This section describes how to install the NX Units, the types of power supplies provided to the NX Units and wiring methods, and how to wire the NX Units.

4-1 Installing NX Units

This section describes how to install NX Units.

Refer to the user's manual for the CPU Unit, Communications Coupler Unit, or Communication Control Unit to which NX Units are connected for information on preparations of installation and installation in a control panel.

4-1-1 Installing NX Units

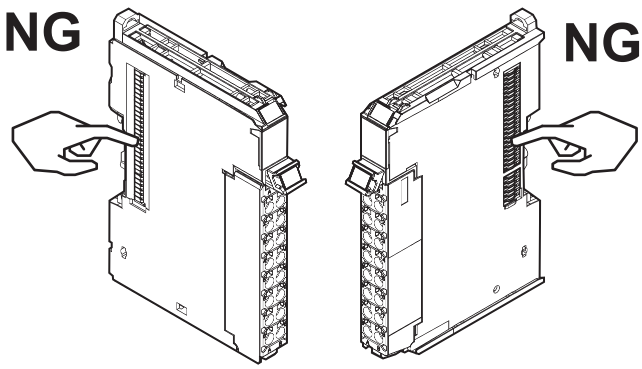
This section describes how to mount two NX Units to each other.

Always turn OFF the power supply before you mount NX Units.

Always mount NX Units one at a time. If you attempt to mount multiple NX Units that are already connected together, the connections between the NX Units may separate from each other and fall.

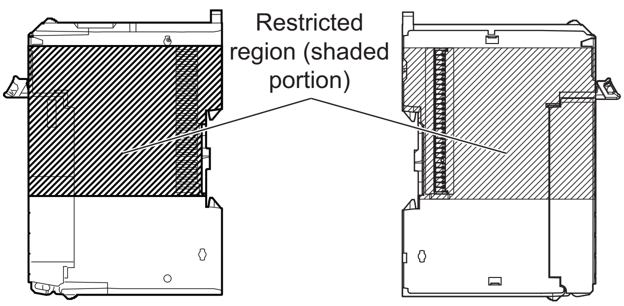
Precautions for Safe Use

- Always turn OFF the power supply before installing the Unit. If the power supply is not OFF, the Unit may malfunction or may be damaged.
- Do not apply labels or tape on the NX Units. When the Unit is installed or removed, adhesive or scrap may adhere to the pins of the NX bus connector, which may cause 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)

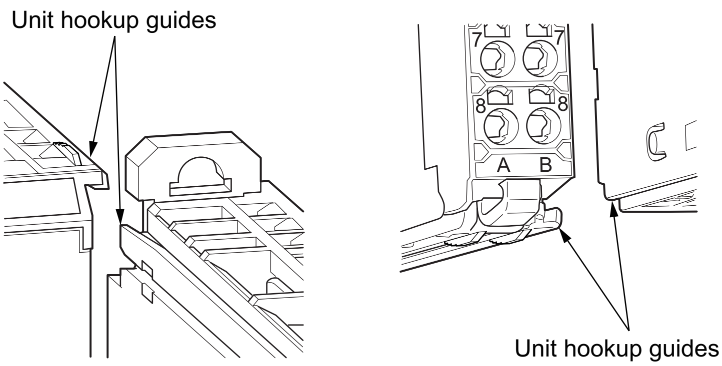
- Do not write on an NX Unit with ink within the restricted region that is shown in the following figure. Also do not get this area dirty. When the Unit is installed or removed, ink or dirt may adhere to the pins in the NX bus connector, which may result in malfunctions in the Slave Terminal.
  Refer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



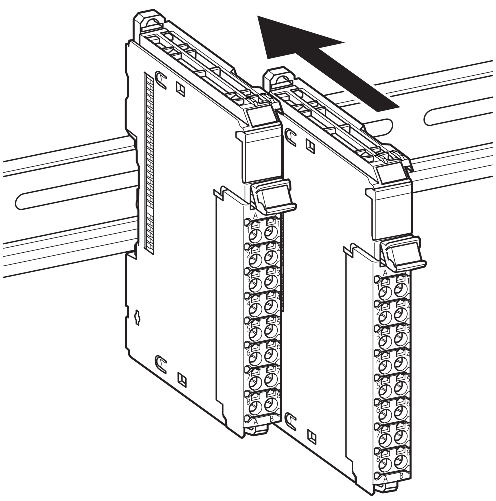
Precautions for Correct Use

- When you install an NX Unit, do not touch or bump the pins in the NX bus connector.
- When you handle an NX Unit, be careful not to apply any stress to the pins in the NX bus connector. If you install an NX Unit and turns ON the power supply when the pins in the NX bus connector are deformed, a contact defect may cause malfunctions.

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



2 Slide the NX Unit in on the hookup guides.



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

When you mount the NX Unit, it is not necessary to release the DIN track mounting hook on the NX Unit.

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

Additional Information

- Normally, it is not necessary to release the DIN track mounting hook when you mount the NX Unit. However, if you mount the NX Unit on a DIN Track that is not a recommended DIN Track, the DIN track mounting hook may not lock correctly. If that happens, first unlock the DIN track mounting hook, mount the NX Unit to the DIN Track, then lock the DIN track mounting hook.
- Refer to the user's manual for the CPU Unit to which NX Units can be connected for information on how to mount the CPU Unit, and how to mount NX Units to the CPU Unit.
- Refer to the user's manual for the Communications Coupler Unit for information on how to mount the Communications Coupler Unit, and how to mount the NX Unit to the Communications Coupler Unit.
- Refer to the user’s manual for the Communication Control Unit for information on how to mount the Communication Control Unit, and how to mount NX Units to the Communication Control Unit.

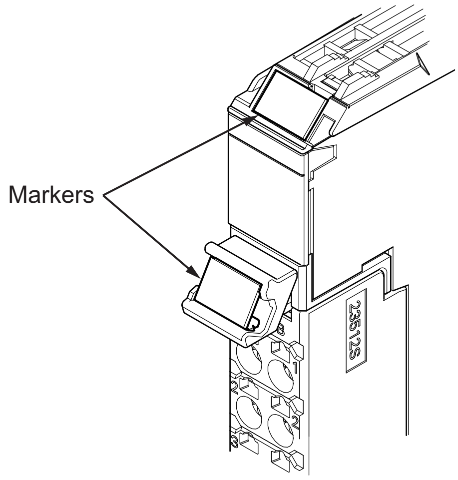
4-1-2 Attaching Markers

Markers can be attached to the NX Units and terminal blocks on NX Units to identify them.

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

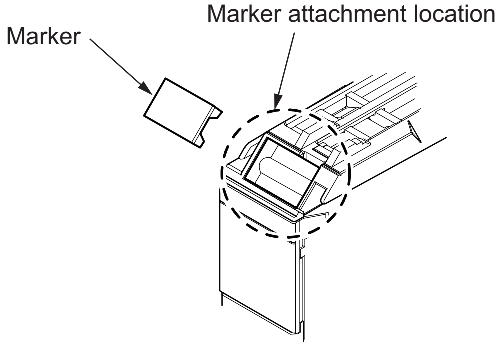
Commercially available markers can also be installed.

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

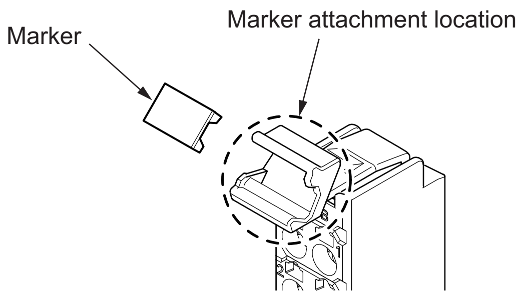


● Installation Method

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



<NX Unit>



<Terminal block>

● Commercially Available Markers

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

To use commercially available markers, purchase the following products.

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

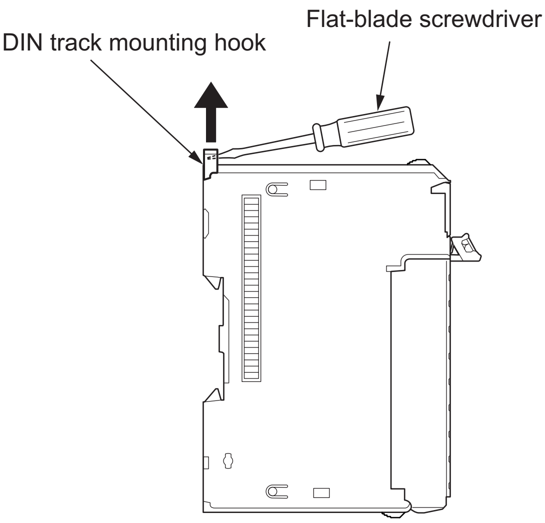
The markers made by OMRON cannot be printed on with commercially available special printers.

4-1-3 Removing NX Units

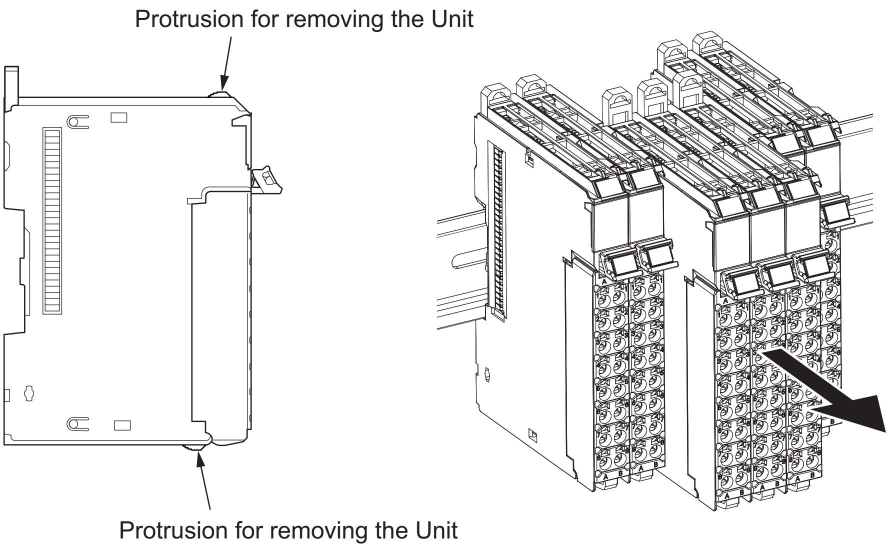
Precautions for Safe Use

Always turn OFF the Unit power supply and I/O power supply before you remove the NX Unit.

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



2 Put your fingers on the protrusions for removing multiple NX Units including the Unit to be removed, then pull out straight forward to remove.



Precautions for Correct Use

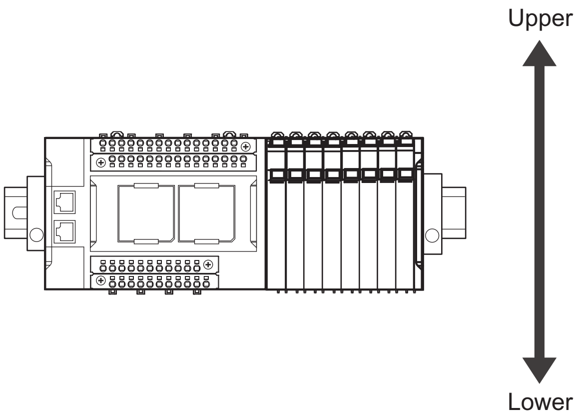
- When removing an NX Unit, remove multiple Units together which include the one you want to remove. If you attempt to remove only one Unit, it is stuck and hard to pull out.
- Do not unlock the DIN track mounting hooks on all of the NX Units at the same time. If you unlock the DIN Track mounting hooks on all of the NX Units at the same time, all of the Units may come off.

4-1-4 Installation Orientation

The following explains the installation orientation for each NX Unit connection destination.

Installation Orientation in the Case of a CPU Unit or Communication Control Unit

Orientation is possible only in the upright installation orientation.



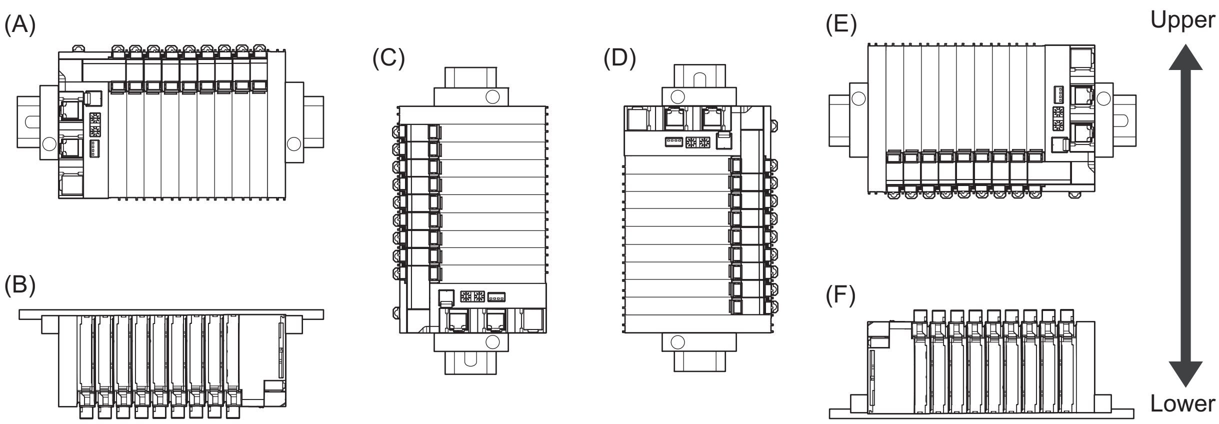
However, there are restrictions on the specifications depending on the NX Units to be used.

Refer to the user's manuals for the NX Units and System Units that you will use for details on restrictions.

Installation Orientation in the Case of a Slave Terminal

Orientation is possible in the following six directions.

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



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

Refer to the user's manuals for the Communications Coupler Units, NX Units and System Units that you will use for details on restrictions.

Precautions for Safe Use

For installation orientations (C) and (D) in the above 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 cause malfunctions.

4-2 Power Supply Types and Wiring

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

Power supply name	Description
NX Unit power supply	This power supply is used for operating the NX Units.
I/O power supply	This power supply is used for driving the I/O circuits of the NX Units and for the connected external devices.

The method for supplying power to the NX Units and the wiring method depend on the specifications for the CPU Unit, Slave Terminal, or Communication Control Unit to which NX Units are connected. Depending on where the NX Unit is connected, refer to *Designing the Power Supply System* or *Wiring* in the following manuals for details on the method for supplying power to the NX Units and the wiring method.

- CPU Unit Hardware User’s Manual
- User’s manual for the Communications Coupler Unit
- User’s manual for the Communication Control Unit

The subsequent sections describe the applications of I/O power supply for the Temperature Input Units and Heater Burnout Detection Units and supply methods, and how to calculate the total current consumption from the I/O power supply.

4-2-1 Applications of I/O Power Supply and Supply Methods

The applications of I/O power supply and supply methods for the Heater Burnout Detection Units are given as follows. Note that the Temperature Input Units does not use I/O power supply.

Applications of I/O Power Supply

The I/O power supply is used for the following applications.

- Driving the I/O circuits of the Heater Burnout Detection Units
- Supplying output current for control outputs of the Heater Burnout Detection Units

I/O Power Supply Method

I/O power is supplied to a Heater Burnout Detection Unit from the NX bus.

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

For the Units to which I/O power supply is provided by a CPU Rack with an NX-series CPU Unit, refer to *Designing the Power Supply System* or *Wiring* in the hardware user’s manual for the CPU Unit to be connected.

For the Units to which I/O power supply is provided by a Slave Terminal, refer to *Designing the Power Supply System* or *Wiring* in the user's manual for the Communications Coupler Unit to be connected.

For the Units to which I/O power supply is provided by a CPU Rack with a Communication Control Unit, refer to *Designing the Power Supply System* or *Wiring* in the user's manual for the Communication Control Unit to be connected.

Additional Information

Power Supply-related Units for the NX-series

The following three NX-series Units are related to power supply.

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

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

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

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

The total current consumption of I/O power supplied from the NX bus must be within the range of the maximum I/O power supply current of the Communications Coupler Unit, Communication Control Unit, or Additional I/O Power Supply Unit.

However, when an Additional I/O Power Supply Unit is connected to the CPU Rack of a CPU Unit, the maximum I/O power supply current value may be smaller than that of the Additional I/O Power Supply Unit. For example, the maximum I/O power supply current for the CPU Rack of an NX1P2 CPU Unit is 4 A.

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

The total current consumption from I/O power supply from the NX bus is the total sum of current consumption from I/O power supply of the NX Unit that supplies the I/O power from the NX bus, the current of each applicable I/O circuit, and current consumption of any connected external devices.

Note that the current consumption from I/O power supply indicated in the data sheet for each Unit type does not include the load current of any external connection load and current consumption of any connected external devices.

The total current consumption from the I/O power supply of the Heater Burnout Detection Unit is calculated as follows:

Total current consumption from I/O power supply of Heater Burnout Detection Unit

= (Current consumption from I/O power supply of Heater Burnout Detection Unit) + (Total output current from control outputs[*1])

*1. The output current from the control outputs is the input current to the connected SSRs.

Refer to *A-1 Data Sheet* on page A-2 for the current consumption from the I/O power supply for each model of Heater Burnout Detection Unit.

Precautions for Safe Use

The I/O power supply current for the CPU Rack with an NX-series CPU Unit should be within the range specified for the CPU Unit model. For example, use the NX1P2 CPU Unit with a current of 4 A or less. Using the currents that are outside of the specifications may cause failure or damage. Refer to the user's manual for the connected CPU Unit for the I/O power supply current for the CPU Unit model.

4-3 Wiring the Terminals

This section describes how to wire the terminals on the Temperature Input Units and Heater Burnout Detection Units.

⚠ WARNING

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

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

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

This section describes how to connect wires to the screwless clamping terminal block, the installation and removing methods, and functions for preventing incorrect attachment.

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

Wiring Terminals

The terminals to be wired are as follows.

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

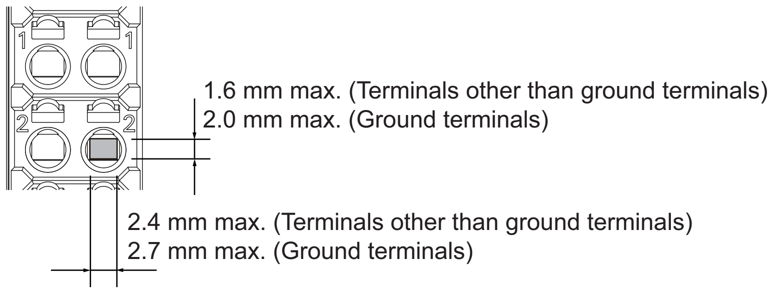
Applicable Wires

The wires that you can connect to the screwless clamping terminal block are twisted wires, solid wires, and ferrules that are attached to the twisted wires. The following section describes the dimensions and processed methods for applicable wires.

● Dimensions of Wires Connected to the Terminal Block

The dimensions of wires that you can connect into the terminal holes of the screwless clamping terminal block are as in the figure below.

Process the applicable wires that are specified in the following description to apply the dimensions.



● Using Ferrules

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

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

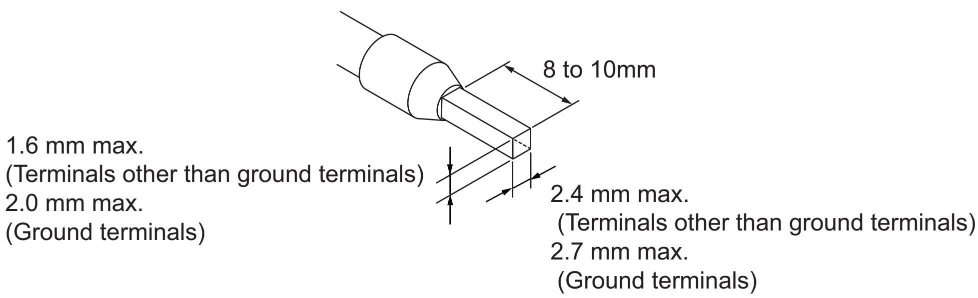
Always use plated one-pin ferrules. Do not use unplated ferrules or two-pin ferrules.

The applicable ferrules, wires, and crimping tools are listed in the following table.

Terminal types	Manufacturer	Ferrule model	Applicable wire (mm² (AWG))	Crimping tool
Terminals other than ground terminals	Phoenix Contact	AI0,34-8	0.34 (#22)	Phoenix Contact (The figure in parentheses is the applicable wire size.) CRIMPFOX 6 (0.25 to 6 mm², AWG24 to 10)
		AI0,5-8	0.5 (#20)	
		AI0,5-10		
		AI0,75-8	0.75 (#18)	
		AI0,75-10		
		AI1,0-8	1.0 (#18)	
		AI1,0-10		
		AI1,5-8	1.5 (#16)	
		AI1,5-10		
Ground terminals		AI2,5-10	2.0 *1	
Terminals other than ground terminals	Weidmuller	H0.14/12	0.14 (#26)	Weidmuller (The figure in parentheses is the applicable wire size.) PZ6 Roto (0.14 to 6 mm², AWG26 to 10)
		H0.25/12	0.25 (#24)	
		H0.34/12	0.34 (#22)	
		H0.5/14	0.5 (#20)	
		H0.5/16		
		H0.75/14	0.75 (#18)	
		H0.75/16		
		H1.0/14	1.0 (#18)	
		H1.0/16		
		H1.5/14	1.5 (#16)	
		H1.5/16		

*1. Some AWG14 wires exceed 2.0 mm² and cannot be used in the screwless clamping terminal block.

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



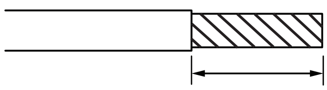
● Using Twisted Wires/Solid Wires

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

<table>
<tr><th colspan="2">Terminals</th><th colspan="4">Wire type</th><th rowspan="3">Wire size</th><th rowspan="3">Conductor length (stripping length)</th></tr>
<tr><th rowspan="2">Classification</th><th rowspan="2">Current capacity</th><th colspan="2">Twisted wires</th><th colspan="2">Solid wire</th></tr>
<tr><th>Plated</th><th>Unplated</th><th>Plated</th><th>Unplated</th></tr>
<tr><td rowspan="3">All terminals except ground terminals</td><td>2 A max.</td><td rowspan="2">Possible</td><td>Possible</td><td>Possible</td><td>Possible</td><td rowspan="3">0.08 to 1.5 mm^2 (AWG 28 to 16)</td><td rowspan="3">8 to 10 mm</td></tr>
<tr><td>Greater than 2 A and 4 A or less</td><td rowspan="2">Not Possible</td><td>Possible*1</td><td rowspan="2">Not Possible</td></tr>
<tr><td>Greater than 4 A</td><td>Possible*1</td><td>Not Possible</td></tr>
<tr><td>Ground terminals</td><td>---</td><td>Possible</td><td>Possible</td><td>Possible*2</td><td>Possible*2</td><td>2.0 mm^2</td><td>9 to 10 mm</td></tr>
</table>

*1. Secure wires to the screwless clamping terminal block. Refer to *Securing Wires* on page 4-20 for how to secure wires.

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

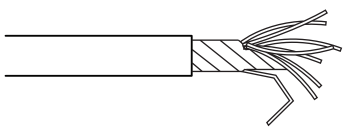


Conductor length (stripping length)

Precautions for Correct Use

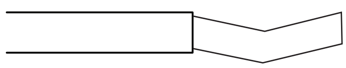
- Use cables with suitable wire sizes for the carrying current. There are also restrictions on the current due to the ambient temperature. Refer to the manuals for the cables and use the cables correctly for the operating environment.
- For twisted wires, strip the sheath and twist the conductor portion.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

NG



Unravel wires

NG



Bend wires

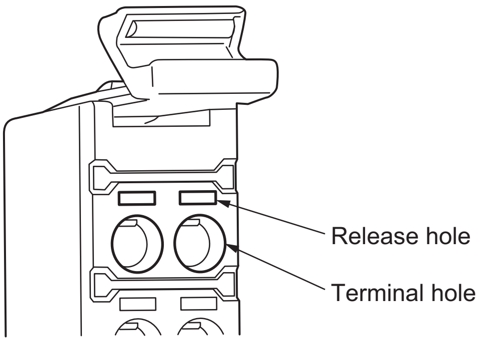
Additional Information

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

Connecting/Removing Wires

This section describes how to connect and remove wires.

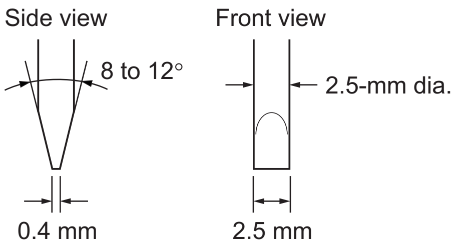
● Terminal Block Parts and Names



● Required Tools

Use a flat-blade screwdriver to connect and remove wires.

Use the following flat-blade screwdriver.



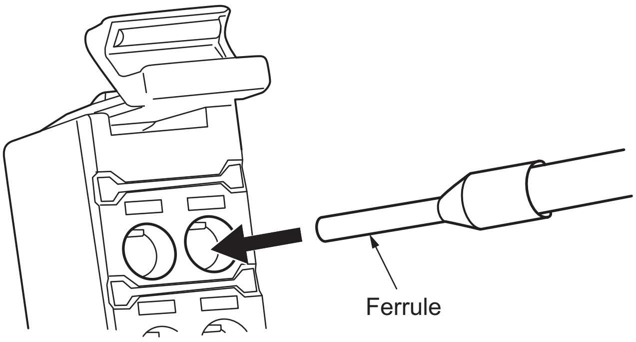
Recommended screwdriver

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

- **Connecting Ferrules**

Insert the ferrule straight into the terminal hole.

It is not necessary to press a flat-blade screwdriver into the release hole.



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

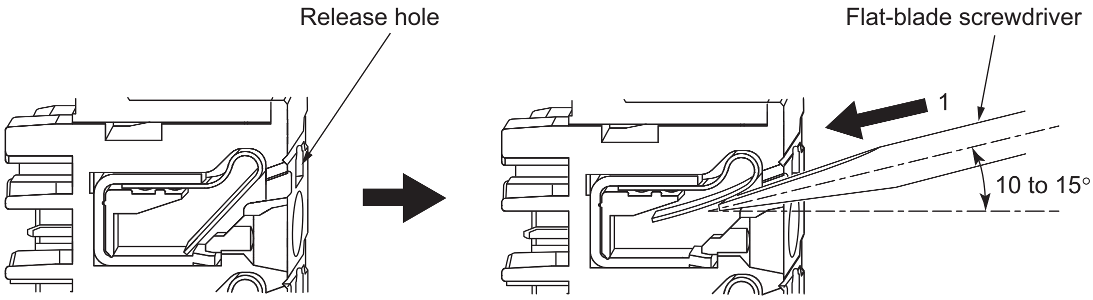
- **Connecting Twisted Wires/Solid Wires**

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

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

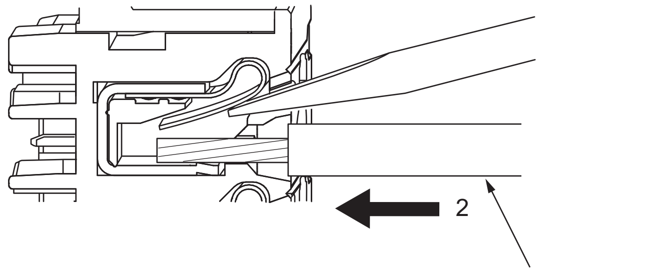
Press at an angle of 10° to 15°.

If you press in the screwdriver correctly, you will feel the spring in the release hole.

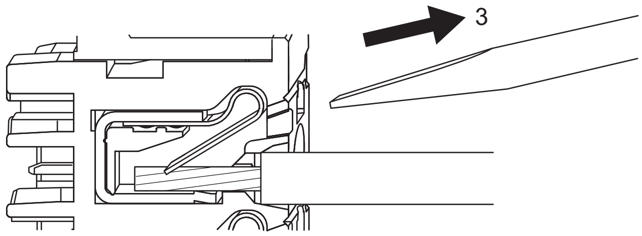


2 Leave the flat-blade screwdriver pressed into the release hole and insert the twisted wire or the solid wire into the terminal hole.

Insert the twisted wire or the solid wire until the stripped portion is no longer visible to prevent shorting.



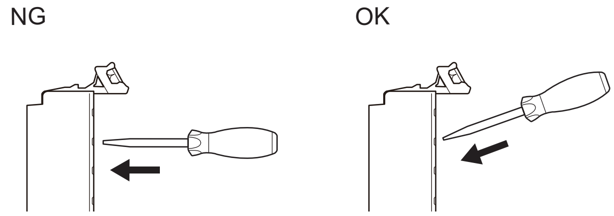
3 Remove the flat-blade screwdriver from the release hole.



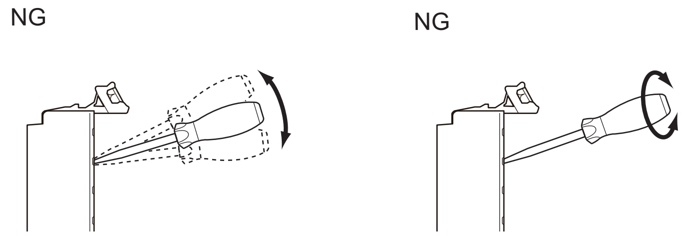
After you make a connection, make sure that the twisted wire or the solid wire is securely connected to the terminal block.

Precautions for Safe Use

- Do not press the flat-blade screwdriver straight into the release hole. Doing so may break the terminal block.



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



- Make sure that all wiring is correct.
- Do not bend the cable forcibly. Doing so may sever the cable.

Securing Wires

It is necessary to secure wires to the screwless clamping terminal block depending on the wire types that are used or the current flows on the wires.

The following table gives the necessity for securing wires.

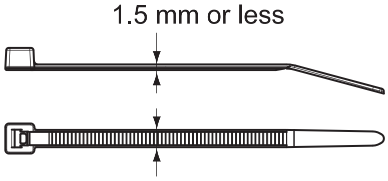
<table>
<tr><th colspan="2">Terminals</th><th colspan="5">Wire type</th></tr>
<tr><th rowspan="2">Classification</th><th rowspan="2">Current capacity</th><th rowspan="2">Ferrule</th><th colspan="2">Twisted wires</th><th colspan="2">Solid wire</th></tr>
<tr><th>Plated</th><th>Unplated</th><th>Plated</th><th>Unplated</th></tr>
<tr><td rowspan="3">All terminals except ground terminals</td><td>2 A max.</td><td rowspan="4">No</td><td rowspan="2">No</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td>Greater than 2 A and 4 A or less</td><td rowspan="2">Not Possible</td><td>Yes</td><td rowspan="2">Not Possible</td></tr>
<tr><td>Greater than 4 A</td><td>Yes</td><td>Not Possible</td></tr>
<tr><td>Ground terminals</td><td>-</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
</table>

Use the following procedure to secure the wires.

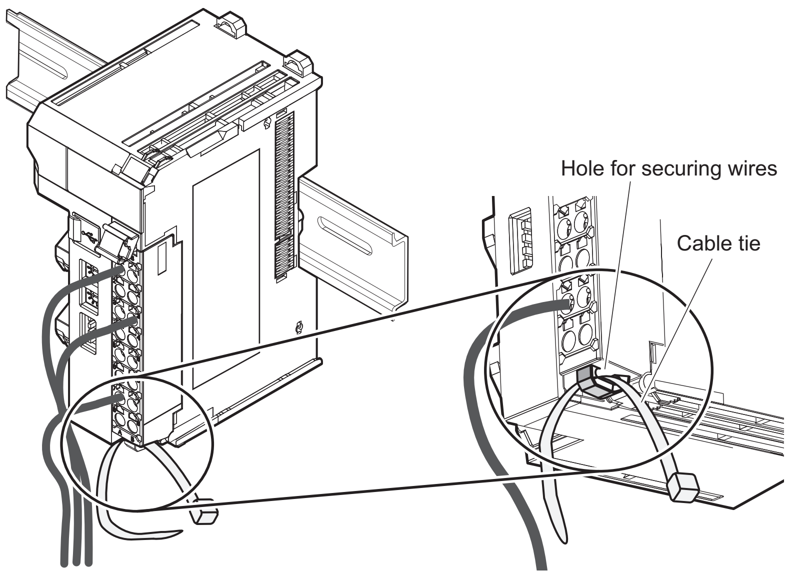
1 Prepare a cable tie.

A cable tie can be used with a width of 4 mm or less and a thickness of 1.5 mm or less.

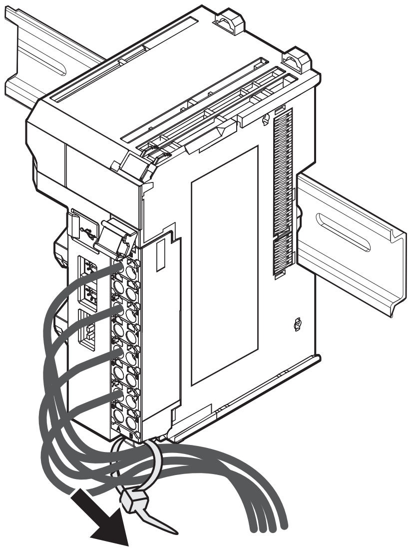
Select a cable tie correctly for the operating environment.



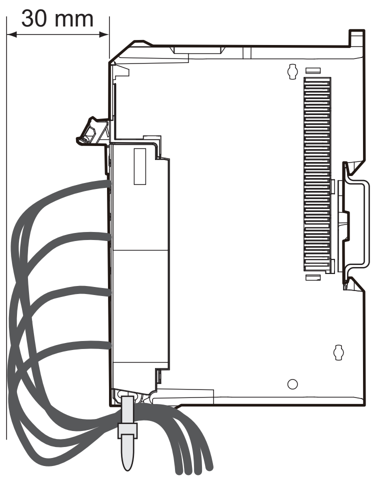
2 Pass a cable tie through the hole for securing wires on the bottom of the screwless clamping terminal block.



3 Bundle the wires with a cable tie and secure them to the screwless clamping terminal block.



Secure wires within the range of 30 mm from the screwless clamping terminal block.



● Removing Wires

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

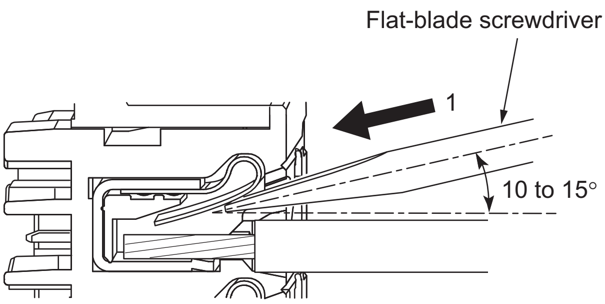
The removal method is the same for ferrules, twisted wires, and solid wires.

If wires are secured firmly to the terminal block, release them first.

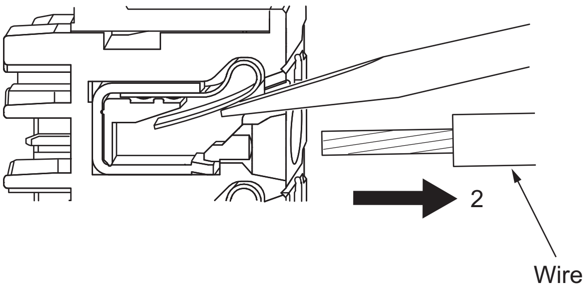
1 Press the flat-blade screwdriver diagonally into the release hole.

Press at an angle of 10° to 15°.

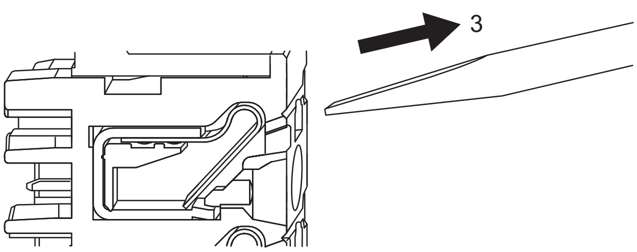
If you press in the screwdriver correctly, you will feel the spring in the release hole.



2 Leave the flat-blade screwdriver pressed into the release hole and pull out the wire.



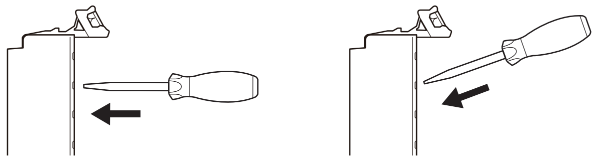
3 Remove the flat-blade screwdriver from the release hole.



Precautions for Safe Use

- Do not press the flat-blade screwdriver straight into the release hole. Doing so may break the terminal block.

NG OK



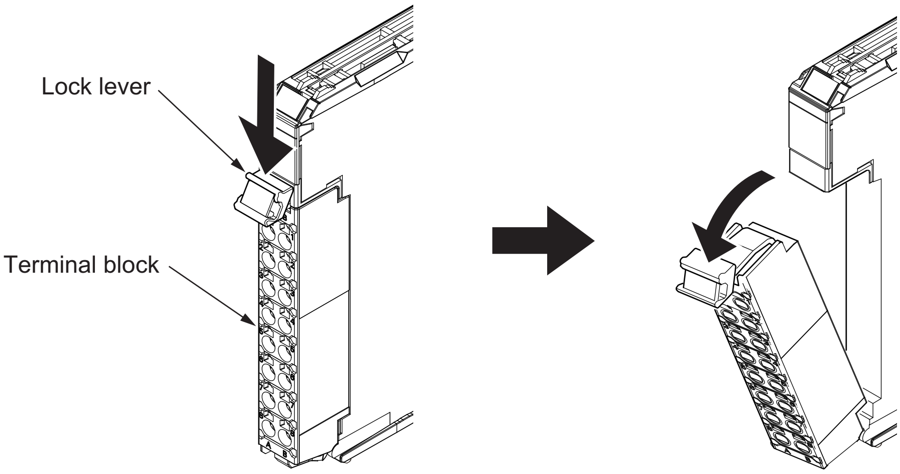
- When you insert a flat-blade screwdriver into a release hole, press it down with a force of 30 N max. Applying excessive force may damage the terminal block.
- Do not tilt or twist the flat-blade screwdriver while it is pressed into the release hole. Doing so may break the terminal block.

NG NG

- Make sure that all wiring is correct.
- Do not bend the cable forcibly. Doing so may sever the cable.

Removing a Terminal Block

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

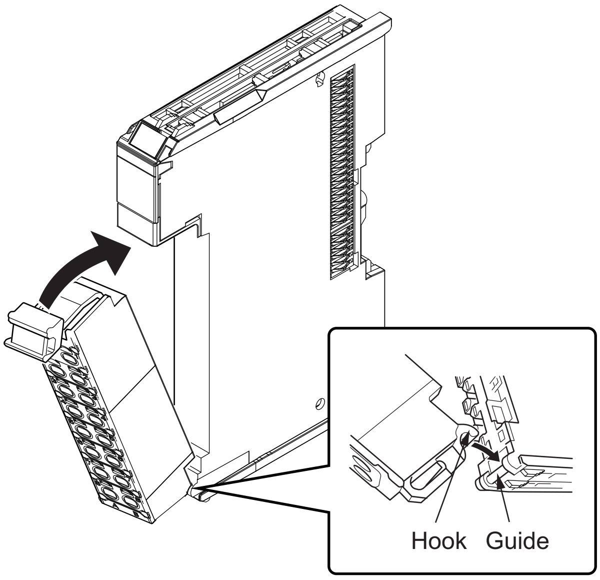


Attaching a Terminal Block

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

The terminal block will click into place on the Unit.

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



Mount a terminal block that is applicable to each Unit model.

Refer to *Applicable Terminal Blocks for Each Unit Model* on page 3-8 for the applicable terminal blocks.

Precaution for Installing Temperature Input Units (Thermocouple Input Type)

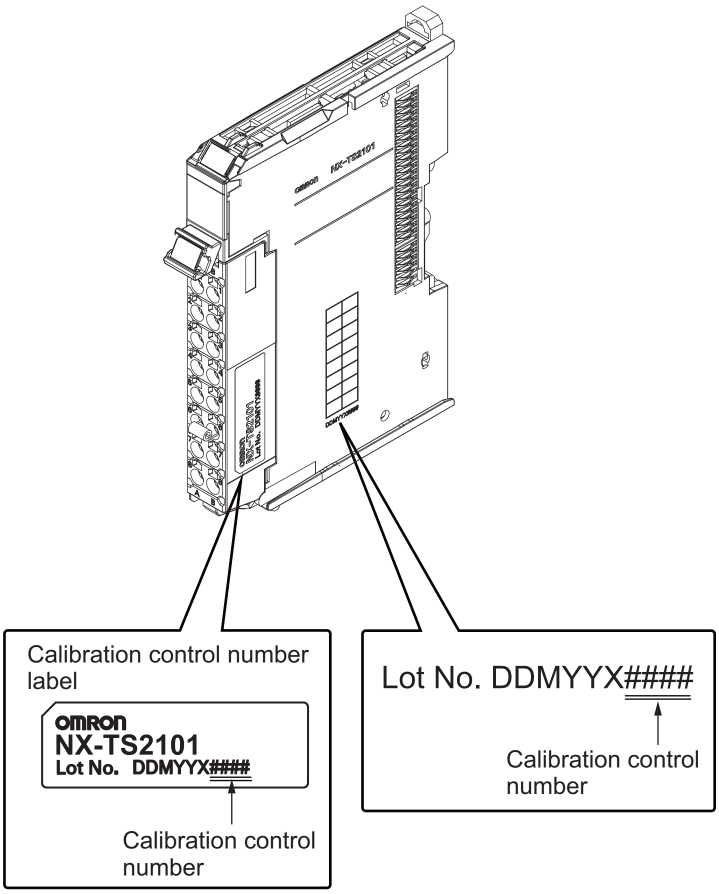
On a Thermocouple Temperature Input Unit, a cold junction sensor is mounted to the terminal block.

The overall accuracy is guaranteed for the set of that comprises a cold junction sensor mounted on the terminal block and a Unit that has the same calibration control number.

Be sure to use the terminal block and the Unit with the same calibration control number together.

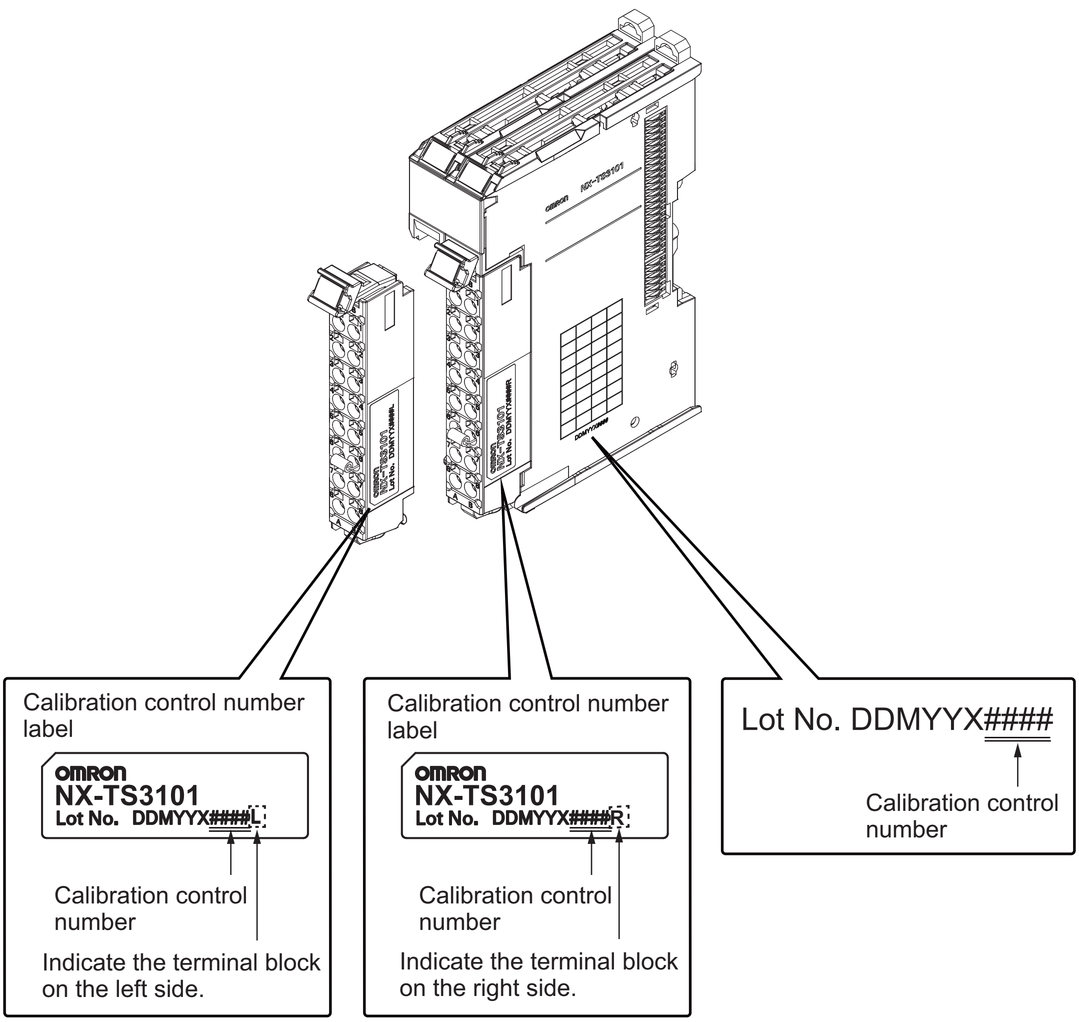
There is a label with the calibration control number on the terminal block as shown in the figure below, and the calibration control number is printed on the Unit side.

- **12 mm Width**



- **24 mm Width**

The left and right terminal blocks have the same calibration control number. In order to distinguish these two terminal blocks, each terminal block has either "L" (left side) or "R" (right side) appended at the end as shown in the figure below.



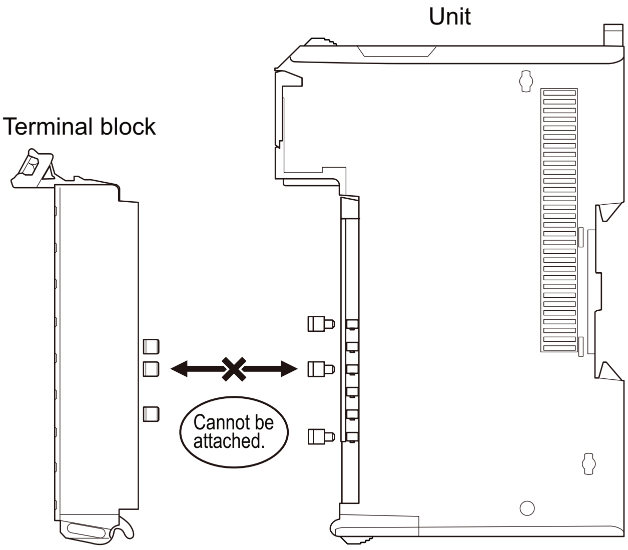
When returning the Unit, make sure to return the terminal block and the Temperature Input Unit together.

Preventing Incorrect Attachment of Terminal Blocks

In order to prevent unintentionally installing the wrong terminal block, you can limit the combination of a Unit and a terminal block.

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

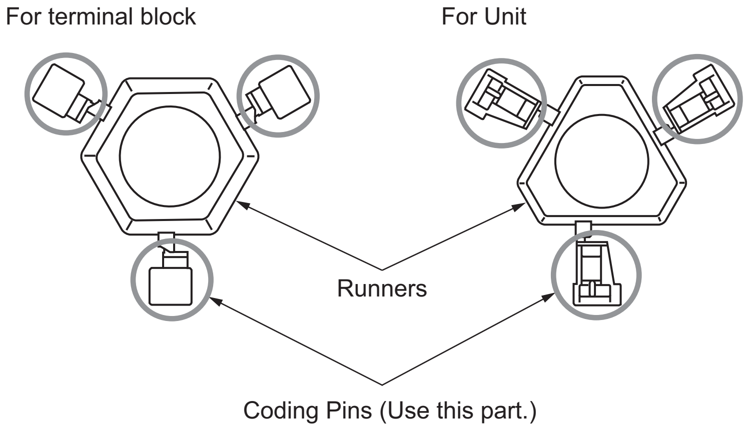
You can use these pins to create a combination in which the wrong terminal block cannot be attached because the pin patterns do not match.



Types of Coding Pins

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

Three pins come with each runner.



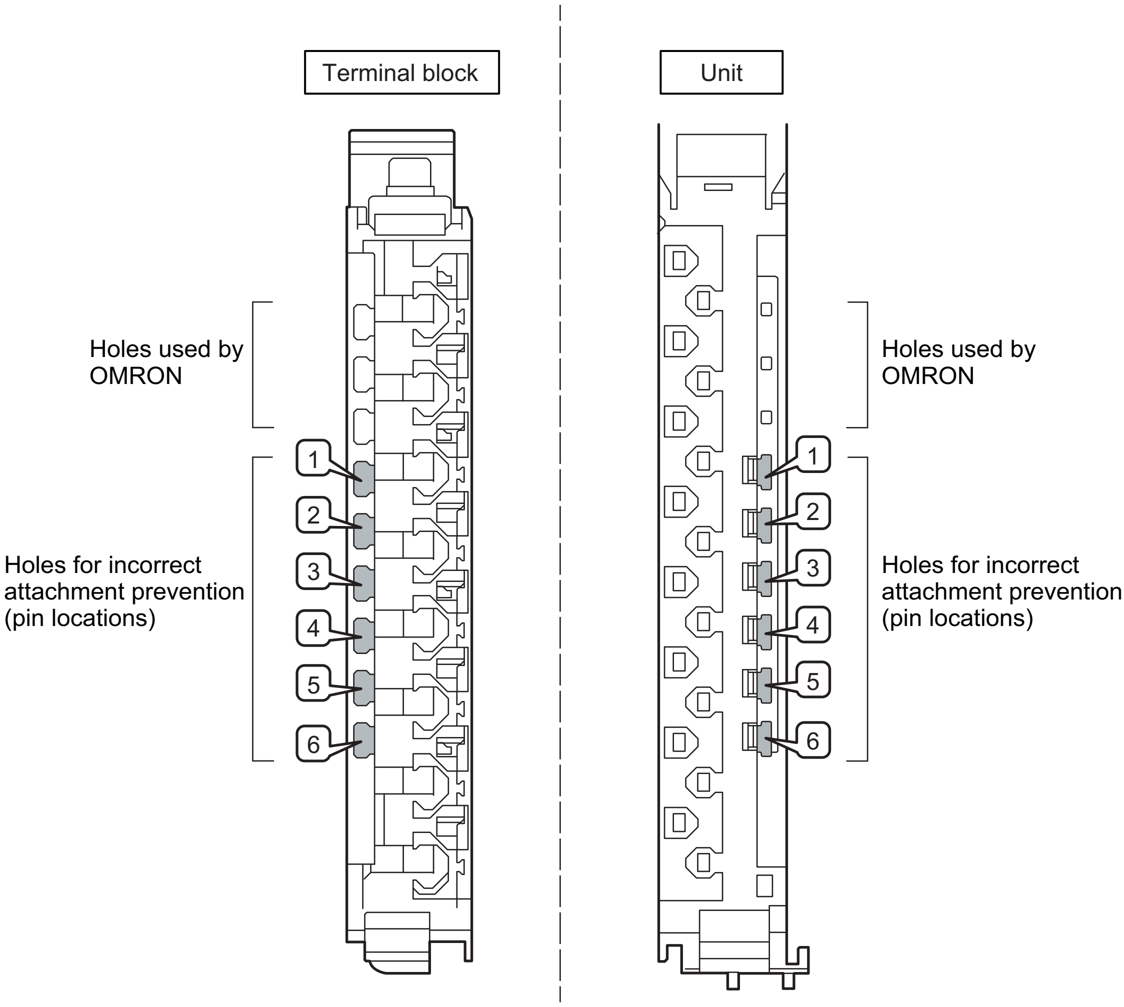
Use the following Coding Pins.

Name	Model	Specification
Coding Pin	NX-AUX02	For 10 Units (Terminal block: 30 pins, Unit: 30 pins)

● Insertion Locations and Patterns of Coding Pins

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

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



○: Pin inserted

Pattern	Pin locations for terminal block						Pin locations for Unit					
	1	2	3	4	5	6	1	2	3	4	5	6
No.1	○	○	○							○	○	○
No.2	○	○		○					○		○	○
No.3	○	○			○				○	○		○
No.4	○	○				○			○	○	○	
No.5	○		○	○				○			○	○
No.6	○		○		○			○		○		○
No.7	○		○			○		○		○	○	
No.8	○			○	○			○	○			○
No.9	○			○		○		○	○		○	
No.10	○				○	○		○	○	○		
No.11		○	○	○			○				○	○
No.12		○	○		○		○			○		○
No.13		○	○			○	○			○	○	
No.14		○		○	○		○		○			○
No.15		○		○		○	○		○		○	
No.16		○			○	○	○		○	○		
No.17			○	○	○		○	○				○
No.18			○	○		○	○	○			○	
No.19			○		○	○	○	○		○		
No.20				○	○	○	○	○	○			

To make the maximum of 20 patterns, purchase two sets of NX-AUX02 Pins. (One set for 10 Units.)

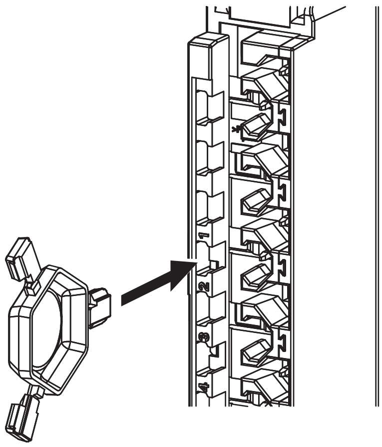
Precautions for Correct Use

- OMRON uses the holes other than No. 1 to 6 in the figure on the previous page. If you insert a Coding Pin into one of the holes used by OMRON on the terminal block side, this makes it impossible to mount the terminal block on a Unit.
- Do not use Coding Pins that have been attached and removed.

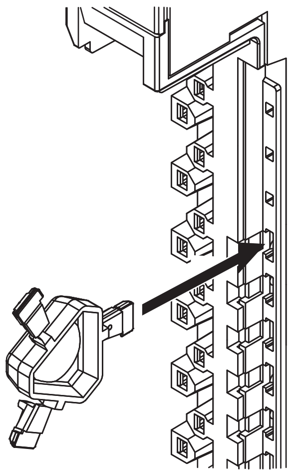
● Inserting the Coding Pins

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

Terminal block

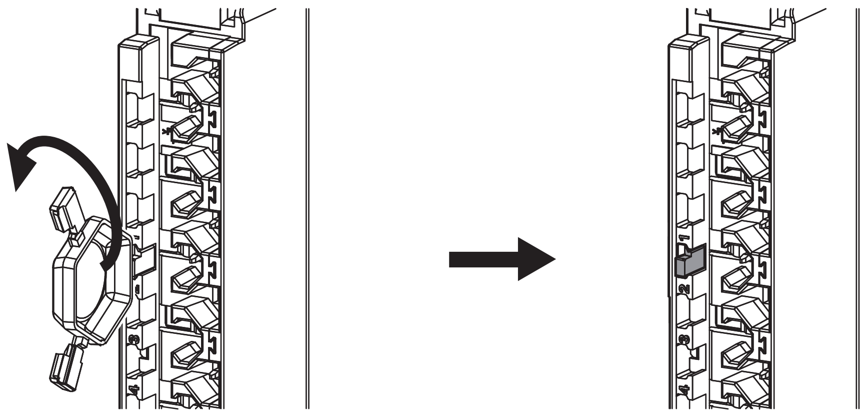


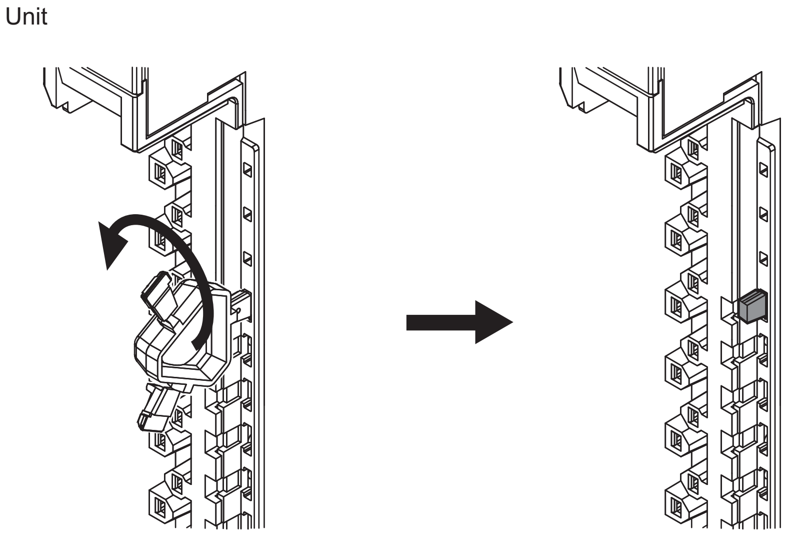
Unit



2 Rotate the runner to break off the Coding Pins.

Terminal block





4-3-2 Checking the Wiring

Check the wiring from the Watch Tab Page or other interface of the Support Software by reading Slave Terminal input data and writing Slave Terminal output data.

For Input Units, you can turn ON/OFF the inputs from external devices that are connected to the target Units and monitor the results.

For Output Units, you can control the I/O outputs of the target Units and check the operation of the connected external devices.

Refer to the operation manual for your Support Software for details on monitoring and output operations for I/O.

Additional Information

- In the Sysmac Studio, you can check the wiring from the I/O Map or Watch Tab Page. If you use the I/O Map, you can also monitor and perform forced refreshing even if the variables are not defined or the algorithms are not created. Therefore, you can easily check the wiring. Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for details on monitoring and forced refreshing operations.
- Some Communications Coupler Units support I/O checking that allows you to check wiring with only the Slave Terminal. Refer to the user's manual of the Communications Coupler Unit for detailed information on the support and functionality of I/O checking for your Communications Coupler Unit.

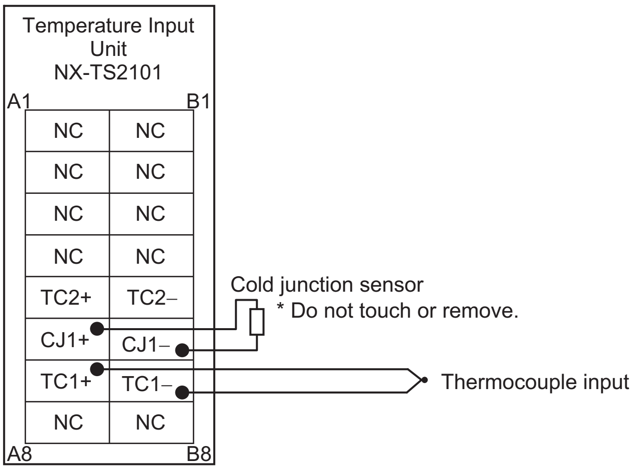
4-4 Wiring Examples

This section provides wiring examples for the Temperature Input Units and Heater Burnout Detection Units along with precautions for wiring.

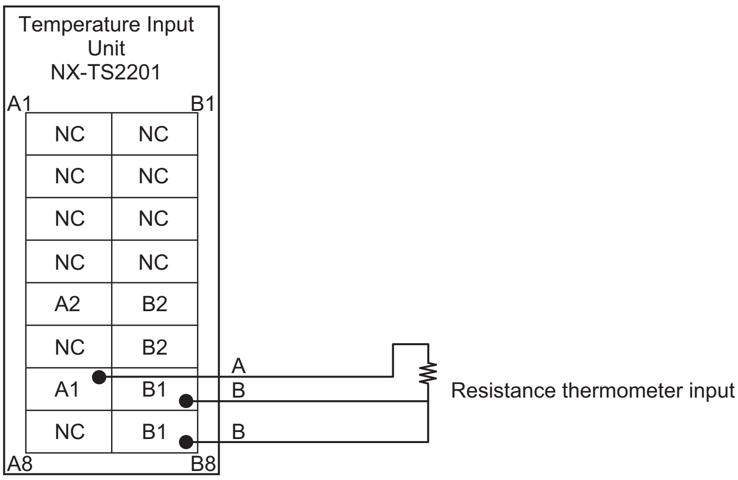
For the terminal array for each model, refer to the terminal connection diagram for each model in *A-1 Data Sheet* on page A-2.

4-4-1 Wiring Example for Temperature Input Units

● Wiring Example 1



● Wiring Example 2



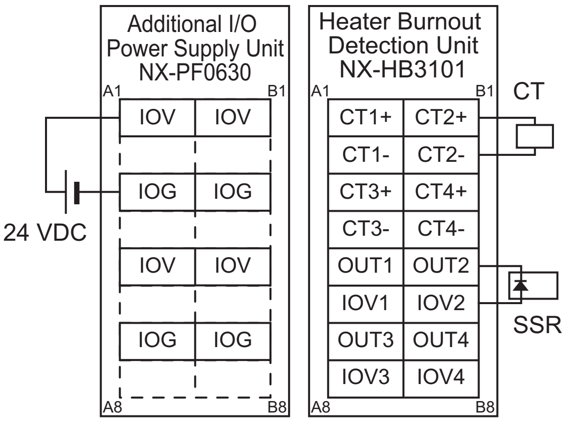
Precautions for Correct Use

- To ensure this NX Unit is kept in the best operating condition, observe the following points when wiring to avoid the effects of the noise.

  Wire the sensor connection lines and power lines (e.g., AC power supply lines or power lines) separately. Do not place such lines in the same duct.
  Insert a noise filter into the power supply input section if noise comes from power supply lines when using the same power supply to power an electrical welder or an electric discharge machine, or there is a high-frequency source nearby.
- Do not touch a cold junction sensor that is mounted to the terminal block on a Thermocouple Temperature Input Unit. The temperature may not be measured correctly and the cold junction sensor may be disconnected.

4-4-2 Wiring Example for Heater Burnout Detection Units

A wiring example for the NX-HB3101 is shown below.



When you wire a control output (OUT□), wire the polarity of the internal I/O common terminal correctly.

The polarity of the internal I/O common terminal for control outputs from the NX-HB3101 is NPN. Inside the NX-HB3101, the common side (0 VDC) is internally connected to 0 VDC of the I/O power supply through the NX bus.

The polarity of the internal I/O common terminal for control outputs from the NX-HB3201 is PNP. Inside the NX-HB3201, the common side (24 VDC) is internally connected to 24 VDC of the I/O power supply through the NX bus.

Precautions for Safe Use

Before you perform wiring or maintenance work, always confirm that the power supply to the heater is turned OFF. If you provide power to the heater while the CT terminals are open, a high voltage will occur between the CT terminals, which creates an electric shock hazard.

Precautions for Correct Use

- To ensure this NX Unit is kept in the best operating condition, observe the following points when wiring to avoid the effects of the noise.
- Wire the sensor connection lines and power lines (e.g., AC power supply lines or power lines) separately. Do not place such lines in the same duct.
- Insert a noise filter into the power supply input section if noise comes from power supply lines when using the same power supply to power an electrical welder or an electric discharge machine, or there is a high-frequency source nearby.

5

I/O Refreshing

This section describes the types and functions of I/O refreshing for the NX Units.

5-1 I/O Refreshing

This section describes I/O refreshing for the NX Units.

5-1-1 I/O Refreshing from CPU Units to NX Units

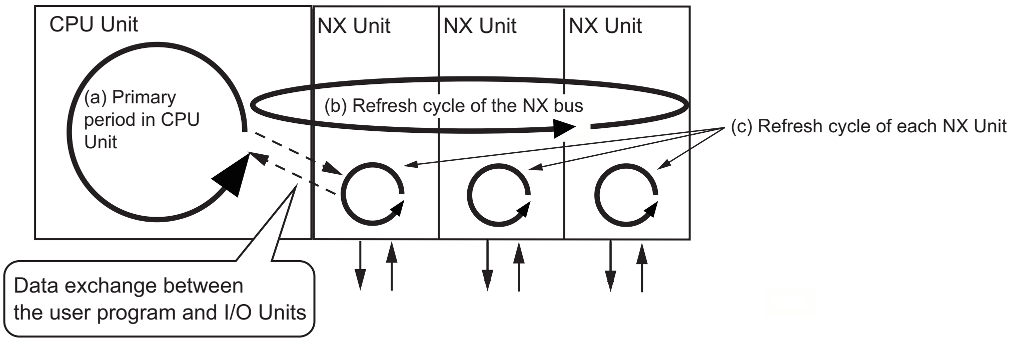
An NX-series CPU Unit cyclically performs I/O refreshing with the NX Units.

The following period and two cycles affect operation of the I/O refreshing between the CPU Unit and the NX Units.

(a) Primary period in CPU Unit

(b) Refresh cycle of the NX bus

(c) Refresh cycle of each NX Unit



The following operation occurs.

- The refresh cycle of the NX bus in item (b) is automatically synchronized with the primary period of the CPU Unit in item (a).
- The refresh cycle of each NX Unit in item (c) depends on the I/O refreshing method which is given below.

Refer to the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for detailed information on I/O refreshing between the CPU Unit and the NX Units.

Refer to *5-1-4 Calculating the I/O Response Times of NX Units* on page 5-4 for the I/O response times of NX Units in the CPU Rack of the CPU Unit.

5-1-2 I/O Refreshing from the CPU Unit or Industrial PC to Slave Terminals

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

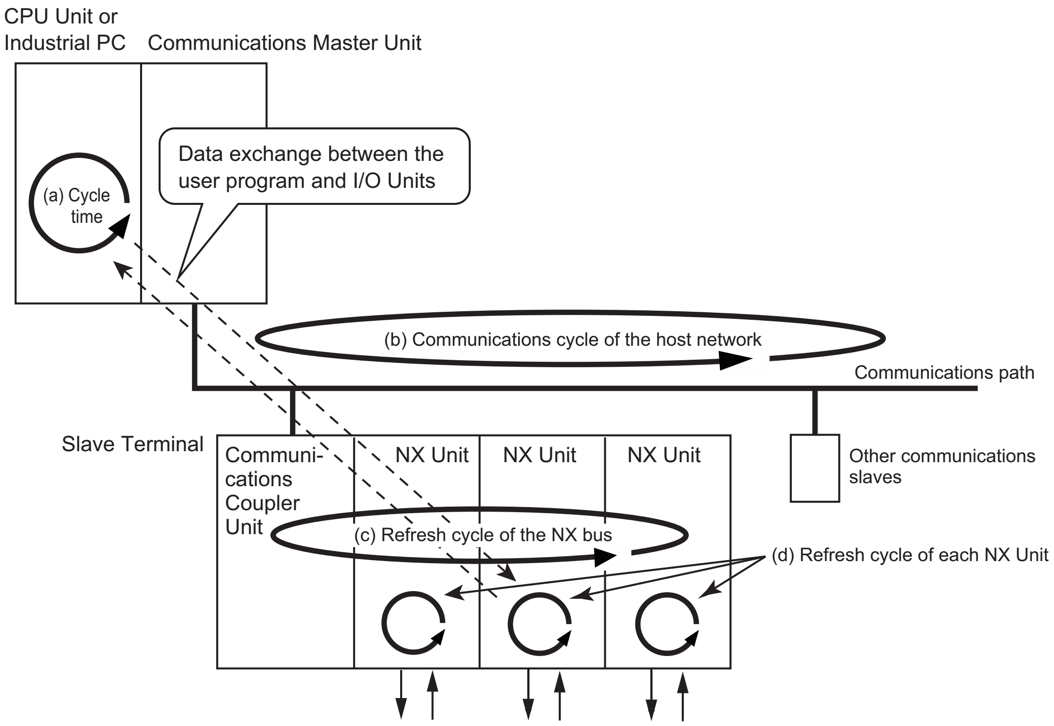
The following four cycles affect operation of the I/O refreshing between the CPU Unit or the Industrial PC and the NX Units in a Slave Terminal:

(a) Cycle time of the CPU Unit or Industrial PC

(b) Communications cycle of the host network

(c) Refresh cycle of the NX bus

(d) Refresh cycle of each NX Unit



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

The following explains operations when the built-in EtherCAT port on the NJ/NX-series CPU Unit or NY-series Industrial PC is used for communications with an EtherCAT Slave Terminal, with symbols in the figure.

Refer to the user's manual for the connected Communications Coupler Unit for information on the operation of I/O refreshing for Slave Terminals other than EtherCAT Slave Terminals.

Operation of I/O Refreshing with NX-series CPU Unit

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

- The process data communications cycle in item (b) and the refresh cycle of the NX bus in item (c) are automatically synchronized with the primary period or the task period of the priority-5 periodic task of the CPU Unit in item (a) when the distributed clock is enabled in the EtherCAT Coupler Unit.
- The refresh cycle of each NX Unit in item (d) depends on the I/O refreshing method which is given below.

The priority-5 periodic task must be supported by the connected CPU Unit model. Refer to the *NJ/NX-series CPU Unit Software User's Manual* (Cat. No. W501) for the periodic tasks supported by each model of NX-series CPU Unit.

Operation of I/O Refreshing with NJ-series CPU Unit or NY-series Industrial PC

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

- The process data communications cycle in item (b) and the refresh cycle of the NX bus in item (c) are automatically synchronized with the primary period of the CPU Unit or Industrial PC in item (a).*1
- The refresh cycle of each NX Unit in item (d) depends on the I/O refreshing method which is given below.

*1. This applies when the distributed clock is enabled in the EtherCAT Coupler Unit.

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

I/O Response Times for NX Units on Slave Terminals

Refer to *5-1-4 Calculating the I/O Response Times of NX Units* on page 5-4 for the I/O response times of NX Units on Slave Terminals.

5-1-3 I/O Refreshing from the Communication Control Unit to NX Units

Refer to the user's manual for the Communication Control Unit for details on I/O refreshing from the Communication Control Unit to NX Units.

Additional Information

Heater Burnout Detection Units cannot be connected to the Communication Control Unit.

5-1-4 Calculating the I/O Response Times of NX Units

Depending on where the NX Unit is connected, refer to the following manuals to calculate the I/O response times of an NX unit.

Connected to a CPU Unit

Manual to reference	Description
Software user's manual for the connected CPU Unit	The method for calculating the I/O response times of NX Units in the CPU Rack with a CPU Unit is described.
NX-series Data Reference Manual	The NX Unit parameter values used for calculating the I/O response times of NX Units are described.

Connected to a Communications Coupler Unit

Manual to reference	Description
User's manual for the connected Communications Coupler Unit	The method for calculating the I/O response times of NX Units on Slave Terminals is described.
NX-series Data Reference Manual	The NX Unit parameter values used for calculating the I/O response times of NX Units are described.

Connected to a Communication Control Unit

Manual to reference	Description
User's manual for the connected Communication Control Unit	The method for calculating the I/O response times of NX Units in the CPU Rack with a Communication Control Unit is described.
NX-series Data Reference Manual	The NX Unit parameter values used for calculating the I/O response times of NX Units are described.

5-2 I/O Refreshing Methods

This section describes I/O refreshing methods for the NX Units.

5-2-1 Types of I/O Refreshing Methods

Methods of I/O Refreshing between the CPU Unit and NX Units

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

Refer to the user's manual for the connected CPU Unit for information on I/O refreshing between the CPU Unit and the NX Units. For example, the I/O refreshing methods that you can use between the NX-series NX1P2 CPU Unit and the NX Units are described in the following table.

I/O refreshing method name*1		Outline of operation
Free-Run refreshing		With this I/O refreshing method, the refresh cycle of the NX bus and I/O refresh cycles of the NX Units are asynchronous.
Synchronous I/O refreshing		With this I/O refreshing method, the timing to read inputs or to refresh outputs is synchronized on a fixed interval between more than one NX Unit connected to a CPU Unit.
Time stamp refreshing		With this I/O refreshing method, the NX Units record the DC times when inputs change or perform outputs at specified DC times. These times are asynchronous to the NX bus refresh cycles. Data exchange between the NX Units and CPU Unit are performed cyclically on the NX bus refresh cycles.
	Input refreshing with input changed time	With this I/O refreshing method, the Input Units record the DC times when inputs changed.
	Output refreshing with specified time stamp	With this I/O refreshing method, the Output Units refresh outputs at specified DC times.

*1. Task period prioritized refreshing cannot be used for the NX1P2 CPU Unit.

Since the NX1P2 CPU Unit can execute all of the above I/O refreshing methods at the same time, you can use NX Units with different I/O refreshing methods together.

Methods of I/O Refreshing between the Communications Coupler Unit and NX Units

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

Refer to the user's manual for the connected Communications Coupler Unit for information on I/O refreshing between the Communications Coupler Unit and the NX Units.

For example, the I/O refreshing methods that you can use between an EtherCAT Coupler Unit and the NX Units when the EtherCAT Coupler Unit is connected to the built-in EtherCAT port on the NJ/NX-series CPU Unit or NY-series Industrial PC, are described in the following table.

I/O refreshing method name		Outline of operation
Free-Run refreshing		With this I/O refreshing method, the refresh cycle of the NX bus and the I/O refresh cycles of the NX Units are asynchronous.
Synchronous I/O refreshing		With this I/O refreshing method, the timing to read inputs or to refresh outputs is synchronized on a fixed interval between more than one NX Unit on more than one Slave Terminal.
Time stamp refreshing*1		With this I/O refreshing method, the NX Units record the DC times when inputs change or perform outputs at specified DC times. These times are asynchronous to the NX bus refresh cycles. Data exchange between the NX Units and EtherCAT Coupler Unit are performed cyclically on the NX bus refresh cycles.
	Input refreshing with input changed time	With this I/O refreshing method, the Input Units record the DC times when inputs changed.
	Output refreshing with specified time stamp	With this I/O refreshing method, the Output Units refresh outputs at specified DC times.
Task period prioritized refreshing*2		With this I/O refreshing method, shortening the task period is given priority over synchronizing the I/O timing with other NX Units. With this I/O refreshing method, the timing of I/O is not consistent with the timing of I/O for NX Units that use simultaneous I/O refreshing.

*1. Neither the Temperature Input Unit nor Heater Burnout Detection Unit supports time stamp refreshing.

*2. You need to use the EtherCAT Coupler Unit with the model number NX-ECC203.

Since the EtherCAT Coupler Unit can execute all I/O refreshing methods at the same time, you can use NX Units with different I/O refreshing methods together in the EtherCAT Slave Terminal.

Methods of I/O Refreshing between the Communication Control Unit and NX Units

Refer to the user's manual for the connected Communication Control Unit for information on the I/O refreshing methods that you can use between the Communication Control Unit and the NX Units.

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

Setting Methods between the CPU Unit and the NX Units

The setting method for the I/O refreshing method between the CPU Unit and the NX Units is determined by the connected CPU Unit.
Refer to the software user's manual for the connected CPU Unit for information on the setting method for I/O refreshing between the CPU Unit and the NX Units.

An example is provided below for an NX-series NX1P2 CPU Unit. There is no setting for this in the NX1P2 CPU Unit. Refreshing is determined as described in the following table.

NX Units that support only Free-Run refreshing	NX Units that support both Free-Run refreshing and synchronous I/O refreshing	NX Units that support Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing	NX Units that support only time stamp refreshing*1
Free-Run refreshing	Synchronous I/O refreshing		Time stamp refreshing

*1. Two types of time stamp refreshing are available: one is input refreshing with input changed time and the other is output refreshing with specified time stamp.

Setting Methods between the Communications Coupler Unit and the NX Units

The setting method for the I/O refreshing method between the Communications Coupler Unit and the NX Units is determined by the connected Communications Coupler Unit.
Refer to the user's manual for the connected Communications Coupler Unit for information on the setting method for I/O refreshing between the Communications Coupler Unit and the NX Units.

An example is provided below for when an EtherCAT Coupler Unit is connected to the built-in EtherCAT port on an NJ/NX-series CPU Unit or NY-series Industrial PC.
The I/O refreshing method between the EtherCAT Coupler Unit and each NX Unit depends on whether the DC is enabled in the EtherCAT Coupler Unit.

DC enable setting in the EtherCAT Coupler Unit	NX Units that support only Free-Run refreshing	NX Units that support both Free-Run refreshing and synchronous I/O refreshing	NX Units that support Free-Run refreshing, synchronous I/O refreshing, and task period prioritized refreshing	NX Units that support only time stamp refreshing
Enabled (DC for synchronization)*1	Free-Run refreshing	Synchronous I/O refreshing	Synchronous I/O refreshing	Time stamp refreshing
Enabled (DC with priority in cycle time)*1			Task period prioritized refreshing	
Disabled (FreeRun)*2		Free-Run refreshing	Free-Run refreshing	Operation with time stamp refreshing is not possible.*3

*1. The EtherCAT Slave Terminal operates in DC Mode.

*2. The EtherCAT Slave Terminal operates in Free-Run Mode.

*3. Refer to the manuals for the specific NX Units for details on the operation when the DC is set to *Disabled (FreeRun)*.

Setting Methods between the Communication Control Unit and the NX Units

Refer to the user's manual for the connected Communication Control Unit for information on how to set an I/O refreshing method between the Communication Control Unit and the NX Units.

5-2-3 Selecting NX Units

The I/O refreshing methods that you can use depend on the model of the NX Unit. After you decide on which I/O refreshing method to use, select the NX Units.

5-2-4 Free-Run Refreshing

With this I/O refreshing method, the refresh cycle of the NX bus and I/O refresh cycles of the NX Units are asynchronous.

NX Units read inputs and refresh outputs during I/O refreshing.

This method is used when it is not necessary to be aware of factors such as the I/O timing jitter and the concurrency of the timing to read inputs and refresh outputs between the NX Units.

This section explains operations when NX Units are connected to a CPU Unit or Communications Coupler Unit.

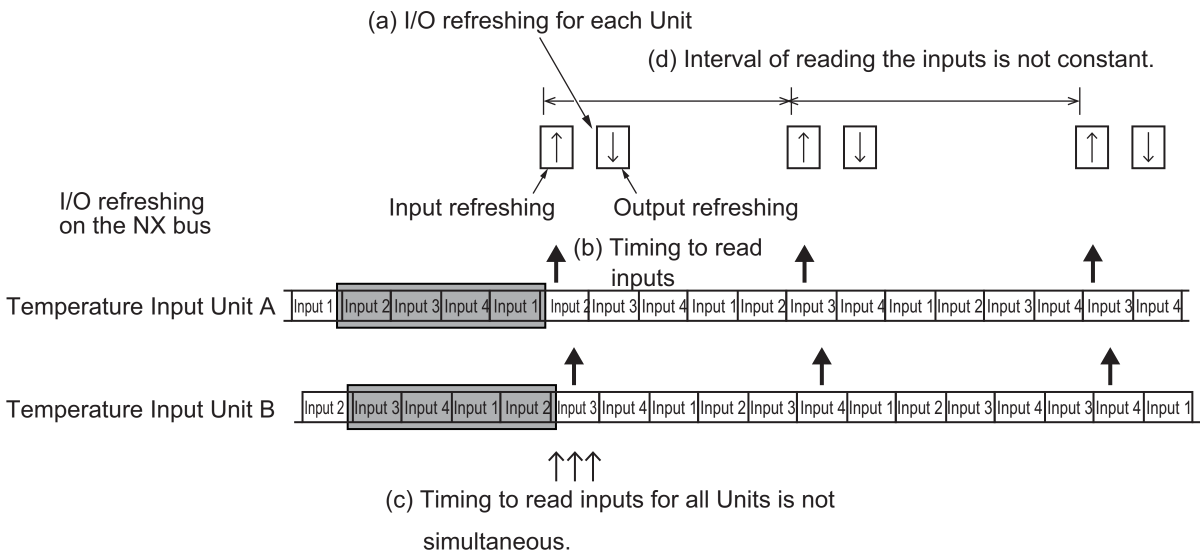
Refer to the user's manual for the Communication Control Unit for operations when NX Units are connected to a Communication Control Unit.

Description of CPU Unit Operation

The following describes the operation of Free-Run refreshing between an NX-series CPU Unit and the NX Units.

● Temperature Input Units

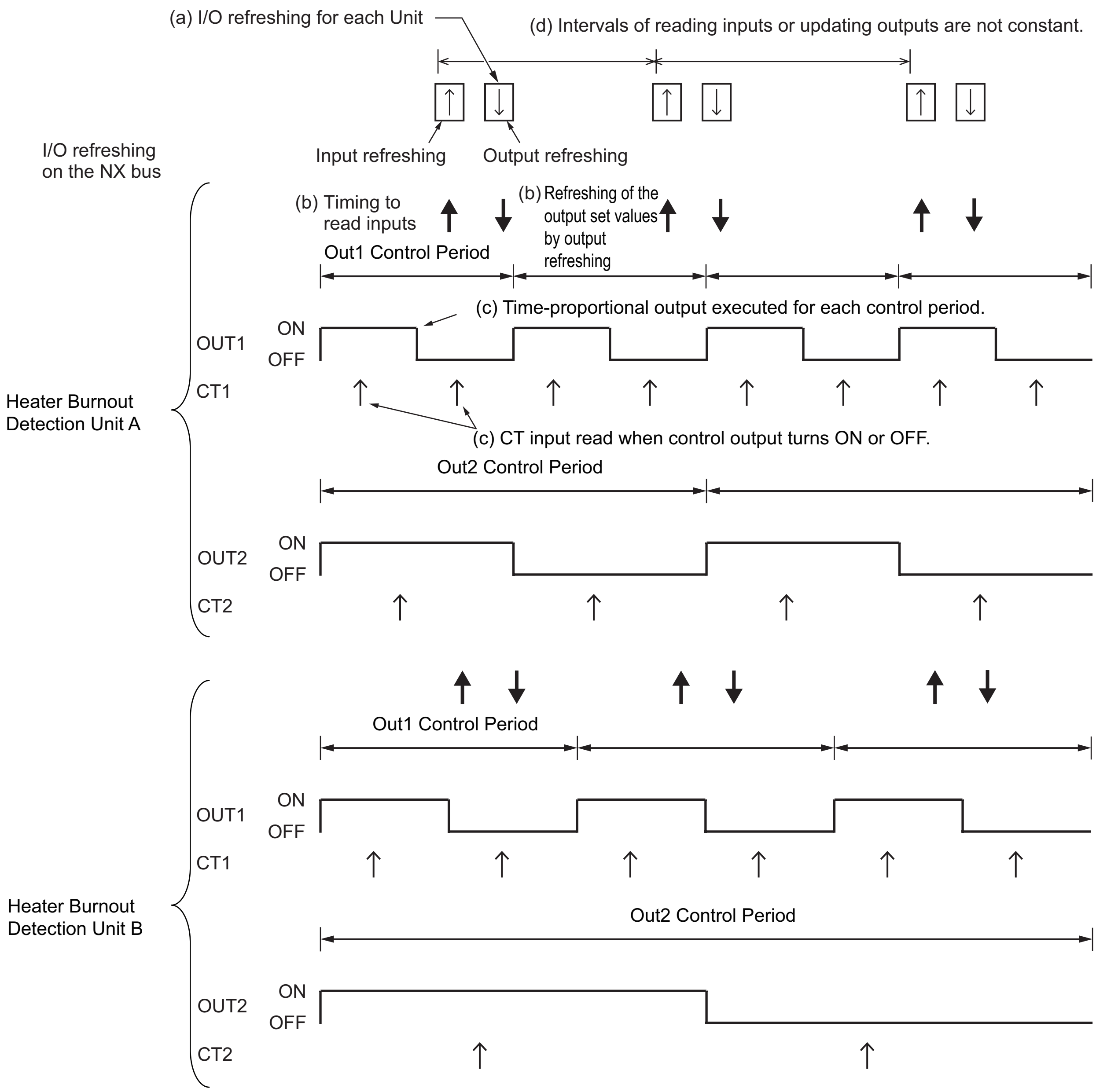
- The CPU Unit performs I/O refreshing for NX Units. (Refer to (a) in the figure below.)
- The Temperature Input Units read inputs during I/O refreshing. (Refer to (b) in the figure below.)
- The CPU Unit can read the most recent input values during I/O refreshing.
  However, timing to read inputs or to refresh outputs for each NX Unit in the Slave Terminal does not occur at the same time. (Refer to (c) in the figure below.)
- The interval of I/O refreshing varies with the processing conditions of the CPU Unit. Therefore, the interval of the timing to read inputs or to refresh outputs for NX Unit is not always the same. (Refer to (d) in the figure below.)
- The Temperature Input Units repeatedly perform AD conversion in the order of the input channels. AD conversion is not synchronized with I/O refreshing of the NX bus.
- At the time of I/O refreshing, the CPU Unit reads the converted values from the NX Unit for one Unit that AD conversion is complete before the timing to read inputs.



● Heater Burnout Detection Units

This section describes the refresh operation using an example. In this example, CT1 is allocated to OUT1 and CT2 is allocated to OUT2.
OUT3, OUT4, CT3, and CT4 are omitted.

- The CPU Unit refreshes the I/O of the NX Units. (Refer to (a) in the figure below.)
- When I/O is refreshed, the Heater Burnout Detection Unit reads the latest input values and refreshes the output set values. (Refer to (b) in the figure below.)
- The Heater Burnout Detection Unit is not synchronized with the I/O refresh timing of the NX bus. The Unit executes a time-proportional output in the control period that is set for each control output, and reads the CT input each time the control output turns ON or OFF. (Refer to (c) in the figure below.)
  The Unit also performs processing such as the detection of heater burnouts and SSR failures during each control period.
  The timing of updating the control outputs for changes in the output set values (manipulated variables) depends on the status of the outputs when the output set values are changed. For details on the timing of control output updates for changes in the output set values, refer to *Basic Function* on page 7-34 in *7-6-6 Time-proportional Output* on page 7-33.
- The I/O refreshing interval changes according to the processing conditions of the CPU Unit. Therefore, the intervals of the timing to read inputs or to refresh outputs for the Heater Burnout Detection Unit are not constant. (Refer to (d) in the figure below.)



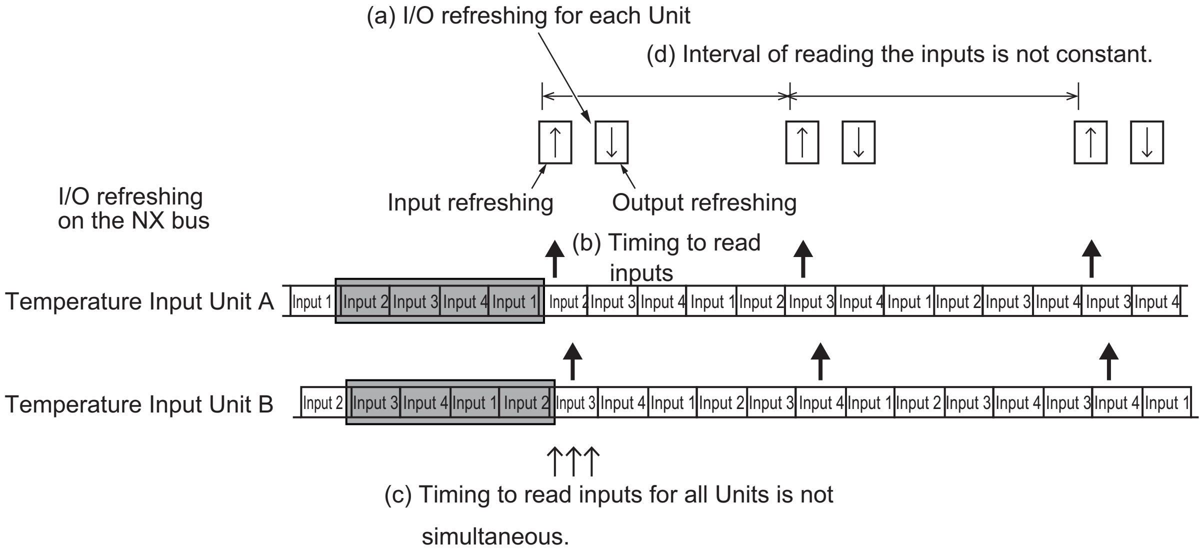
Description of Slave Terminal Operation

This section describes the slave terminal operation of each type of Unit.

Temperature Input Units

- The Communications Coupler Unit performs I/O refreshing for NX Units. (Refer to (a) in the figure below.)
- The Temperature Input Units read inputs during I/O refreshing. (Refer to (b) in the figure below.)
- The Communications Coupler Unit can read the most recent input values during I/O refreshing. However, timing to read inputs or to refresh outputs for each NX Unit in the Slave Terminal does not occur at the same time. (Refer to (c) in the figure below.)
- The interval of I/O refreshing varies with the processing conditions of the Communications Coupler Unit or the host communications master. Therefore, the interval of the timing to read inputs or to refresh outputs for NX Unit is not always the same. (Refer to (d) in the figure below.)
- The Temperature Input Units repeatedly perform AD conversion in the order of the input channels. AD conversion is not synchronized with I/O refreshing of the NX bus.

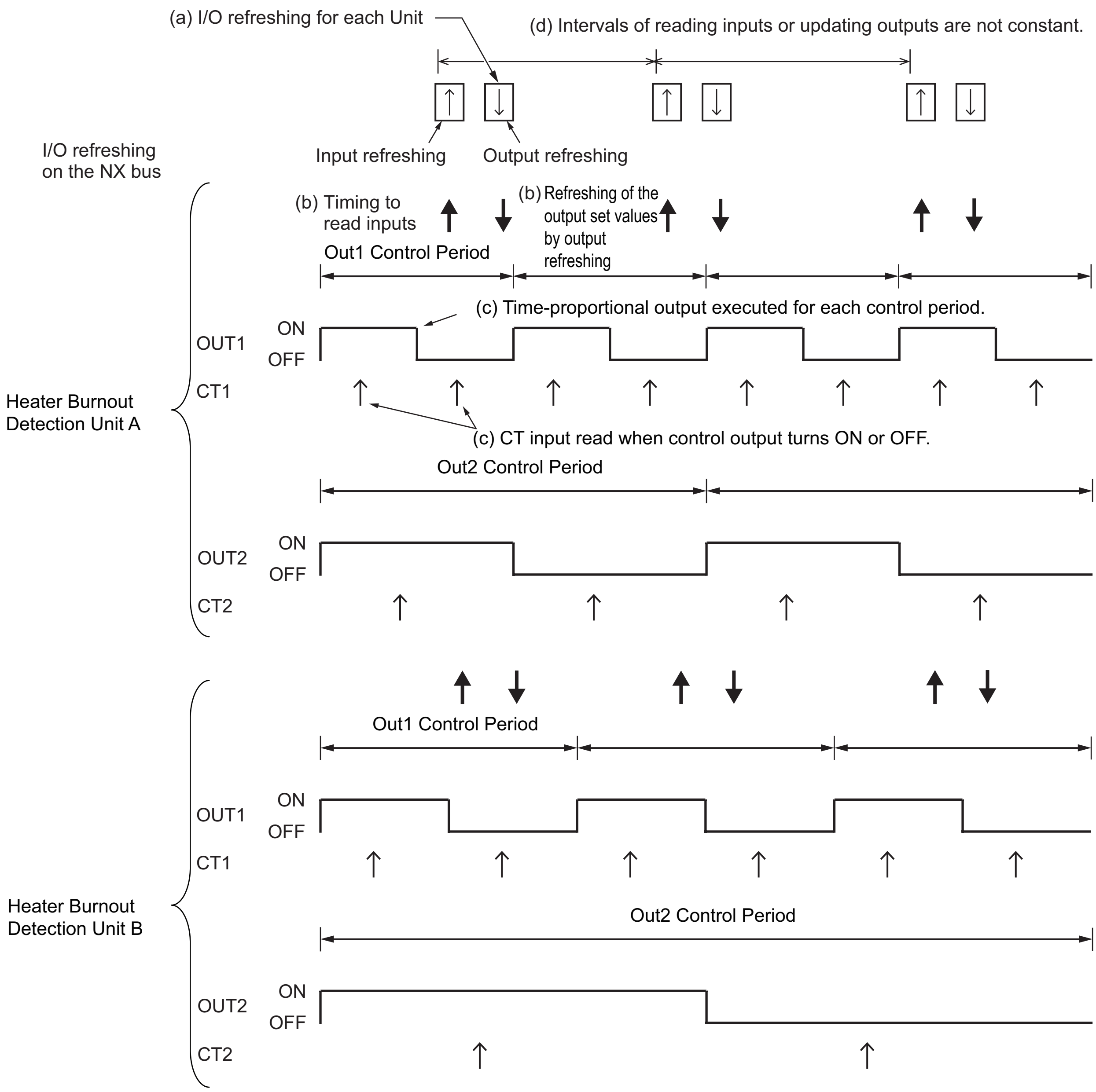
- At the time of I/O refreshing, the Communications Coupler Unit reads the converted values from the NX Unit for one Unit that AD conversion is complete before the timing to read inputs.



● Heater Burnout Detection Units

This section describes the refresh operation using an example. In this example, CT1 is allocated to OUT1 and CT2 is allocated to OUT2.
OUT3, OUT4, CT3, and CT4 are omitted.

- The Communications Coupler Unit refreshes the I/O of the NX Units. (Refer to (a) in the figure below.)
- When I/O is refreshed, the Heater Burnout Detection Unit reads the latest input values and refreshes the output set values. (Refer to (b) in the figure below.)
- The Heater Burnout Detection Unit is not synchronized with the I/O refresh timing of the NX bus. The Unit executes a time-proportional output in the control period that is set for each control output, and reads the CT input each time the control output turns ON or OFF. (Refer to (c) in the figure below.)
  The Unit also performs processing such as the detection of heater burnouts and SSR failures during each control period.
  The timing of updating the control outputs for changes in the output set values (manipulated variables) depends on the status of the outputs when the output set values are changed. For details on the timing of control output updates for changes in the output set values, refer to *Basic Function* on page 7-34 in *7-6-6 Time-proportional Output* on page 7-33.
- The I/O refreshing interval changes according to the processing conditions of the Communications Coupler Unit or the host communications master. Therefore, the intervals of the timing to read inputs or to refresh outputs for the Heater Burnout Detection Unit are not constant. (Refer to (d) in the figure below.)



(a) I/O refreshing for each Unit
(d) Intervals of reading inputs or updating outputs are not constant.
I/O refreshing on the NX bus
Input refreshing
Output refreshing
(b) Timing to read inputs
(b) Refreshing of the output set values by output refreshing
Out1 Control Period
(c) Time-proportional output executed for each control period.
ON
OFF
OUT1
CT1
Heater Burnout Detection Unit A
(c) CT input read when control output turns ON or OFF.
Out2 Control Period
ON
OFF
OUT2
CT2
Out1 Control Period
ON
OFF
OUT1
CT1
Heater Burnout Detection Unit B
Out2 Control Period
ON
OFF
OUT2
CT2

Settings

Add the NX Units that support Free-Run refreshing to the CPU Unit configuration or Slave Terminal configuration.

After you add the Units, set the I/O refreshing method for operation with Free-Run refreshing according to the connected CPU Unit or Communications Coupler Unit.

Refer to *5-2-2 Setting the I/O Refreshing Methods* on page 5-8 for the setting method for the I/O refreshing method.

6

Temperature Input Units

This section describes the types and functions of Temperature Input Units.

6-1 Types of Temperature Input Units

Temperature Input Units are NX Units with functionality to process inputs of the temperature sensors.

There are thermocouple input and resistance thermometer input types.

This section describes the types of Temperature Input Units.

Temperature Input Units (Screwless Clamping Terminal Block, 12 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS2101	2 points	Thermocouple	250 ms/Unit	0.1°C max. *1	Free-Run refreshing	P. A-7
NX-TS2102			10 ms/Unit	0.01°C max.		P. A-8
NX-TS2104			60 ms/Unit	0.001°C max.		P. A-10
NX-TS2201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-11
NX-TS2202			10 ms/Unit	0.01°C max.		P. A-12
NX-TS2204			60 ms/Unit	0.001°C max.		P. A-13

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS2202 only supports Pt100 three-wire sensor.

Temperature Input Units (Screwless Clamping Terminal Block, 24 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS3101	4 points	Thermocouple	250 ms/Unit	0.1°C max. *1	Free-Run refreshing	P. A-14
NX-TS3102			10 ms/Unit	0.01°C max.		P. A-15
NX-TS3104			60 ms/Unit	0.001°C max.		P. A-17
NX-TS3201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-18
NX-TS3202			10 ms/Unit	0.01°C max.		P. A-19
NX-TS3204			60 ms/Unit	0.001°CC		P. A-20

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS3202 only supports Pt100 three-wire sensor.

6-2 Input Types and Input Ranges

This section describes input types and setting methods of Temperature Input Units.

6-2-1 Corresponding Input Types and Input Ranges

The following table shows the corresponding input types, input ranges and convertible temperature ranges.

The convertible temperature ranges are increased by ±20°C for each input range.

The reference accuracy and temperature coefficient are guaranteed when the measured value is within the input range.

● Thermocouple Type

Input type*1	Input range	Convertible temperature range	Settable NX Units		
			Conversion time: 250 ms Resolution: 0.1°C max.*2	Conversion time: 10 ms Resolution: 0.01°C max.	Conversion time: 60 ms Resolution: 0.001°C max.
			NX-TS2101 NX-TS3101	NX-TS2102 NX-TS3102	NX-TS2104 NX-TS3104
K	–200 to 1300°C	–220 to 1320°C	Yes	Yes	Yes
K	–20 to 600°C (High Resolution)	–40 to 620°C	No	Yes	Yes
J	–200 to 1200°C	–220 to 1220°C	Yes	Yes	Yes
J	–20 to 600°C (High Resolution)	–40 to 620°C	No	Yes	Yes
T	–200 to 400°C	–220 to 420°C	Yes	Yes	Yes
E	–200 to 1000°C	–220 to 1020°C	Yes	Yes	Yes
L	–200 to 900°C	–220 to 920°C	Yes	Yes	Yes
U	–200 to 600°C	–220 to 620°C	Yes	Yes	Yes
N	–200 to 1300°C	–220 to 1320°C	Yes	Yes	Yes
R	–50 to 1700°C	–70 to 1720°C	Yes	Yes	Yes
S	–50 to 1700°C	–70 to 1720°C	Yes	Yes	Yes
B	0 to 1800°C	–20 to 1820°C	Yes	No	No
W	0 to 2300°C	–20 to 2320°C	Yes	Yes	Yes
PL II	0 to 1300°C	–20 to 1320°C	Yes	Yes	Yes

*1. If there are more than one input ranges for the same input type, the one with narrower input range has higher resolution.

*2. The resolution is 0.2°C max. when the input type is R, S, or W.

● Resistance Thermometer Type

Input type	Input range	Convertible temperature range	Settable NX Units		
			Conversion time: 250 ms Resolution: 0.1°C max.	Conversion time: 10 ms Resolution: 0.01°C max.	Conversion time: 60 ms Resolution: 0.001°C max.
			NX-TS2201 NX-TS3201	NX-TS2202 NX-TS3202	NX-TS2204 NX-TS3204
Pt100	–200 to 850°C	–220 to 870°C	Yes	Yes	Yes
Pt1000	–200 to 850°C	–220 to 870°C	Yes	No	Yes

Additional Information

- The decimal point position of INT and DINT measured values can be set from 0°C/°F, 0.1°C/°F or 0.01°C/°F. Refer to *6-5-10 Decimal Point Position Setting* on page 6-40.
- To convert the temperature unit from Celsius to Fahrenheit, use the following equation.
  Fahrenheit temperature (°F) = Celsius temperature (°C) x 1.8 + 32
- Regardless of the measured value data type, treat any measured value digits that exceed the specified resolution as reference values. The same is true if the data type is an integer type and a large number of digits are set for display with the decimal point position setting.

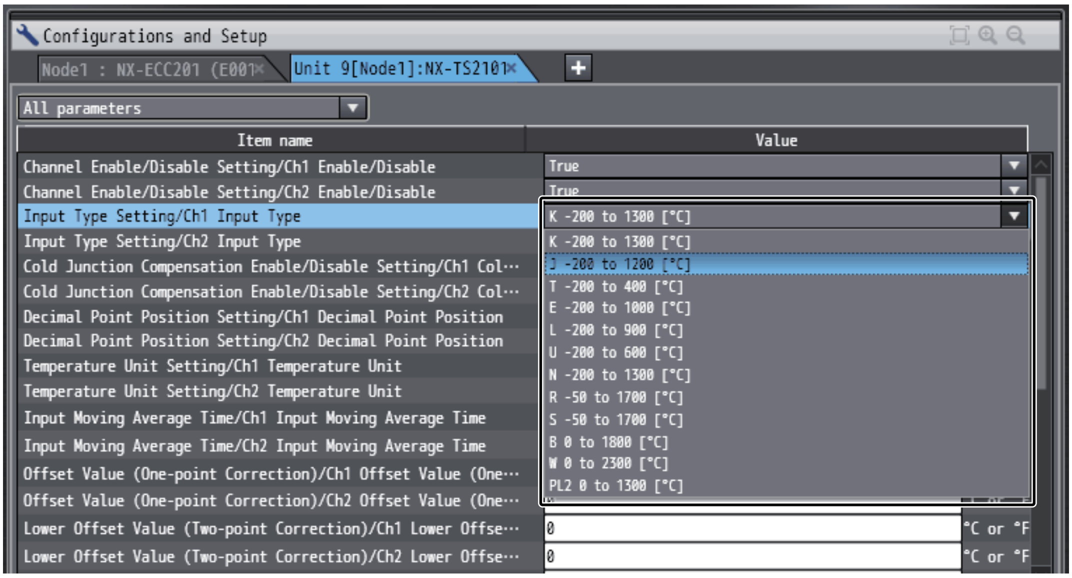
6-2-2 Setting Methods

This section gives the setting method with the Sysmac Studio.
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.
Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

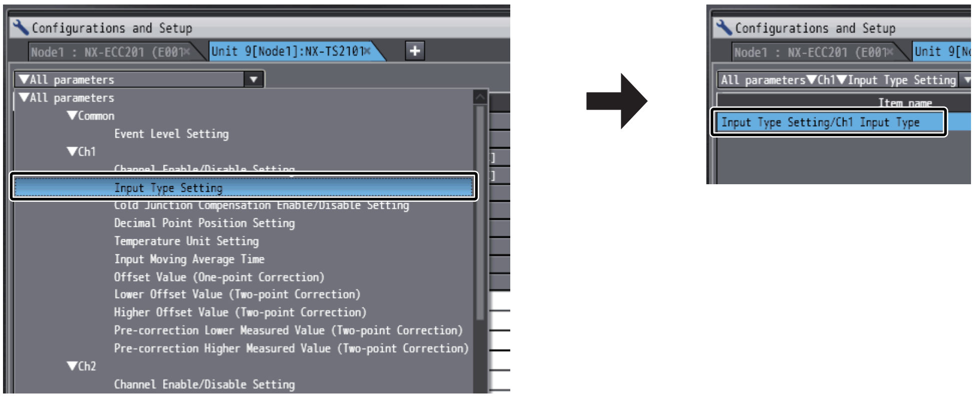
2 Select the input type from the list of Input Type Setting for which the channel you want to set.



Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



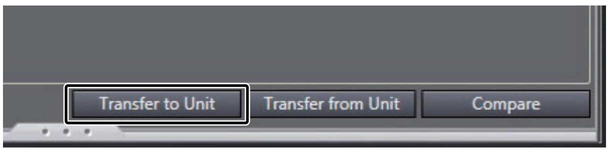
Select Input Type Setting under Ch1

Only Input Type Setting under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-3 Specifications of I/O Data

This section describes the I/O data for Temperature Input Units.

6-3-1 Allocatable I/O Data

This section describes the allocatable I/O data in the Temperature Input Units.

An I/O entry mapping is assigned to the I/O allocation settings for Temperature Input Unit.

A specific I/O entry is assigned to the I/O entry mapping for each NX Unit model.

These allocations are fixed, so you cannot add others or change them.

In the factory settings, only the following data is assigned to an I/O entry mapping.

- NX-TS☐☐01/TS☐☐02: Ch☐ Measured Value INT
- NX-TS☐☐04: Ch☐ Measured Value REAL

An I/O entry means the I/O data described in this section. An I/O entry mapping means a collection of I/O entries.

To assign the I/O allocation information of the NX Unit or Slave Terminal to an NJ/NX-series CPU Unit or NY-series Industrial PC, use the I/O ports for the allocated I/O data. However, with a Slave Terminal, an I/O port is not used for some communications masters or Communications Coupler Units.

Refer to the user's manual for the connected Communications Coupler Unit for the I/O data application procedures for the Slave Terminal.

Additional Information

To access data to which I/O is not allocated, use instructions or other messages to access the NX objects.
The method to access NX objects through instructions or other messages depends on where the NX Unit is connected.
If the NX Unit is connected to a CPU Unit, access is possible with the Read NX Unit Object instruction and the Write NX Unit Object instruction of the NJ/NX-series Controller.
When the NX Unit is connected to a Communications Coupler Unit, the method depends on the connected Communications Coupler Unit or communications master.
Refer to the user's manual for the connected Communications Coupler Unit for method to use messages to access NX objects on Slave Terminals.
For the index numbers and subindex numbers of NX objects, refer to *A-3-2 Temperature Input Units* on page A-34.

● Two-point Input Units

Data name	Description	Data type	Default value	I/O port name	Index	Subindex
Ch1 Status	Aggregated status data for Ch1. *1	WORD	0000 hex	Ch1 Status	6000 hex	01 hex
Ch2 Status	Aggregated status data for Ch2. *2	WORD	0000 hex	Ch2 Status		2 hex
Ch1 Measured Value INT	Analog input measured value (INT) for Ch1.	INT	0	Ch1 Measured Value INT	6001 hex	01 hex
Ch2 Measured Value INT	Analog input measured value (INT) for Ch2.	INT	0	Ch2 Measured Value INT		02 hex
Ch1 Measured Value DINT	Analog input measured value (DINT) for Ch1.	DINT	0	Ch1 Measured Value DINT	6002 hex	01 hex
Ch2 Measured Value DINT	Analog input measured value (DINT) for Ch2.	DINT	0	Ch2 Measured Value DINT		02 hex
Ch1 Measured Value REAL	Analog input measured value (REAL) for Ch1.	REAL	0	Ch1 Measured Value REAL	6003 hex	01 hex
Ch2 Measured Value REAL	Analog input measured value (REAL) for Ch2.	REAL	0	Ch2 Measured Value REAL		02 hex

*1. The following table gives the detailed status for Ch1.

Bit	Data name	Description	Data type	I/O port name
0	Ch1 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch1 Sensor Disconnected Error
1	Ch1 Over Range	Measured value over range	BOOL	Ch1 Over Range
2	Ch1 Under Range	Measured value under range	BOOL	Ch1 Under Range
3	Ch1 Cold Junction Error	Cold junction error	BOOL	Ch1 Cold Junction Error
4	Ch1 AD Converter Error	AD conversion error	BOOL	Ch1 AD Converter Error
5 to 16	Reserved	---	---	---

*2. The following table gives the detailed status for Ch2.

Bit	Data name	Description	Data type	I/O port name
0	Ch2 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch2 Sensor Disconnected Error
1	Ch2 Over Range	Measured value over range	BOOL	Ch2 Over Range
2	Ch2 Under Range	Measured value under range	BOOL	Ch2 Under Range
3	Ch2 Cold Junction Error	Cold junction error	BOOL	Ch2 Cold Junction Error

Bit	Data name	Description	Data type	I/O port name
4	Ch2 AD Converter Error	AD conversion error	BOOL	Ch2 AD Converter Error
5 to 16	Reserved	---	---	---

● Four-point Input Units

Data name	Description	Data type	Default value	I/O port name	Index	Subindex
Ch1 Status	Aggregated status data for Ch1. *1	WORD	0000 hex	Ch1 Status	6000 hex	01 hex
Ch2 Status	Aggregated status data for Ch2. *2	WORD	0000 hex	Ch2 Status		02 hex
Ch3 Status	Aggregated status data for Ch3. *1	WORD	0000 hex	Ch3 Status		3 hex
Ch4 Status	Aggregated status data for Ch4. *2	WORD	0000 hex	Ch4 Status		4 hex
Ch1 Measured Value INT	Analog input measured value (INT) for Ch1	INT	0	Ch1 Measured Value INT	6001 hex	01 hex
Ch2 Measured Value INT	Analog input measured value (INT) for Ch2	INT	0	Ch2 Measured Value INT		02 hex
Ch3 Measured Value INT	Analog input measured value (INT) for Ch3	INT	0	Ch3 Measured Value INT		03 hex
Ch4 Measured Value INT	Analog input measured value (INT) for Ch4	INT	0	Ch4 Measured Value INT		04 hex
Ch1 Measured Value DINT	Analog input measured value (DINT) for Ch1	DINT	0	Ch1 Measured Value DINT	6002 hex	01 hex
Ch2 Measured Value DINT	Analog input measured value (DINT) for Ch2	DINT	0	Ch2 Measured Value DINT		02 hex
Ch3 Measured Value DINT	Analog input measured value (DINT) for Ch3	DINT	0	Ch3 Measured Value DINT		03 hex
Ch4 Measured Value DINT	Analog input measured value (DINT) for Ch4	DINT	0	Ch4 Measured Value DINT		04 hex
Ch1 Measured Value REAL	Analog input measured value (REAL) for Ch1	REAL	0	Ch1 Measured Value REAL	6003 hex	01 hex
Ch2 Measured Value REAL	Analog input measured value (REAL) for Ch2	REAL	0	Ch2 Measured Value REAL		02 hex
Ch3 Measured Value REAL	Analog input measured value (REAL) for Ch3	REAL	0	Ch3 Measured Value REAL		03 hex
Ch4 Measured Value REAL	Analog input measured value (REAL) for Ch4	REAL	0	Ch4 Measured Value REAL		04 hex

*1. The following table gives the detailed status for Ch1.

Bit	Data name	Description	Data type	I/O port name
0	Ch1 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch1 Sensor Disconnected Error
1	Ch1 Over Range	Measured value over range	BOOL	Ch1 Over Range
2	Ch1 Under Range	Measured value under range	BOOL	Ch1 Under Range
3	Ch1 Cold Junction Error	Cold junction error	BOOL	Ch1 Cold Junction Error
4	Ch1 AD Converter Error	AD conversion error	BOOL	Ch1 AD Converter Error
5 to 16	Reserved	---	---	---

*2. The following table gives the detailed status for Ch2.

Bit	Data name	Description	Data type	I/O port name
0	Ch2 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch2 Sensor Disconnected Error
1	Ch2 Over Range	Measured value over range	BOOL	Ch2 Over Range
2	Ch2 Under Range	Measured value under range	BOOL	Ch2 Under Range
3	Ch2 Cold Junction Error	Cold junction error	BOOL	Ch2 Cold Junction Error
4	Ch2 AD Converter Error	AD conversion error	BOOL	Ch2 AD Converter Error
5 to 16	Reserved	---	---	---

*3. The following table gives the detailed status for Ch3.

Bit	Data name	Description	Data type	I/O port name
0	Ch3 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch3 Sensor Disconnected Error
1	Ch3 Over Range	Measured value over range	BOOL	Ch3 Over Range
2	Ch3 Under Range	Measured value under range	BOOL	Ch3 Under Range
3	Ch3 Cold Junction Error	Cold junction error	BOOL	Ch3 Cold Junction Error
4	Ch3 AD Converter Error	AD conversion error	BOOL	Ch3 AD Converter Error
5 to 16	Reserved	---	---	---

*4. The following table gives the detailed status for Ch4.

Bit	Data name	Description	Data type	I/O port name
0	Ch4 Sensor Disconnected Error	Sensor disconnected error	BOOL	Ch4 Sensor Disconnected Error
1	Ch4 Over Range	Measured value over range	BOOL	Ch4 Over Range
2	Ch4 Under Range	Measured value under range	BOOL	Ch4 Under Range
3	Ch4 Cold Junction Error	Cold junction error	BOOL	Ch4 Cold Junc-tion Error
4	Ch4 AD Converter Error	AD conversion error	BOOL	Ch4 AD Con-verter Error
5 to 16	Reserved	---	---	---

6-4 List of Settings

The followings are the setting descriptions, setting ranges, and default values of the functions that can be used in the Temperature Input Units.

If settings have been changed, restart the NX Unit.

The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

● Two-point Input Units

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Enable/Disable	Set to enable or disable the channel.*1 FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---	5000 hex	01 hex	P. 6-20
Ch2 Enable/Disable		TRUE	TRUE or FALSE	---		02 hex	
Ch1 Input Type	Set the sensor to be connected to the channel and its range. *1	*1	*1	---	5001 hex	01 hex	P. 6-3
Ch2 Input Type				---		02 hex	

*1. The meaning of the set value, default value and data range for Ch□ Input Type are as follows.
Meanings of the set values for Ch□ Input Type

Set value	Meaning
15	K –200 to 1300°C
16	K –20 to 600°C (High Resolution)
17	J –200 to 1200°C
18	J –20 to 600°C (High Resolution)
19	T –200 to 400°C
20	E –200 to 1000°C
21	L –200 to 900°C
22	U –200 to 600°C
23	N –200 to 1300°C
24	R –50 to 1700°C
25	S –50 to 1700°C
26	B 0 to 1800°C
27	W 0 to 2300°C
28	PL II 0 to 1300°C
0	Pt100 (3wire) –200 to 850°C
7	Pt1000 (3wire) –200 to 850°C

Default value and data range for Ch□ Input Type

• NX-TS21□□

NX Units	Default value	Data range
NX-TS2101	15	15, 17, 19 to 28
NX-TS2102/TS2104	15	15 to 28

• NX-TS22□□

NX Units	Default value	Data range
NX-TS2201/TS2204	0	0, 7
NX-TS2202	0	0

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Input Moving Average Time	Set the time to process moving average.	0	*1	ms	5005 hex	01 hex	P. 6-23
Ch2 Input moving Average Time		0	*1	ms		02 hex	
Ch1 Cold Junction Compensation Enable/Disable	Set to enable or disable the cold junction compensation for the thermocouple input. FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---	5002 hex	01 hex	P. 6-29
Ch2 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---		02 hex	
Ch1 Temperature Unit	Set the temperature unit for the channel analog input measured value. 0: °C 1: °F	0	0/1	---	5004 hex	01 hex	P. 6-32
Ch2 Temperature Unit		0	0/1	---		02 hex	
Ch1 Offset Value (One-point Correction)	Set the offset value to correct the one point of the channel analog input measured value.	0	-400 to 5000	°C or °F	5010 hex	01 hex	P. 6-35
Ch2 Offset Value (One-point Correction)		0	-400 to 5000			02 hex	
Ch1 Lower Offset Value (Two-point Correction)	Set the offset value (lower) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5011 hex	01 hex	
Ch2 Lower Offset Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch1 Higher Offset Value (Two-point Correction)	Set the offset value (upper) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5012 hex	01 hex	
Ch2 Higher Offset Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch1 Pre-correction Lower Measured Value (Two-point Correction)	Set the pre-correction measured value (lower) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5013 hex	01 hex	
Ch2 Pre-correction Lower Measured Value (Two-point Correction)		0	-400 to 5000			02 hex	

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Pre-correction Higher Measured Value (Two-point Correction)	Set the pre-correction measured value (upper) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5014 hex	01 hex	P. 6-35
Ch2 Pre-correction Higher Measured Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch1 Decimal Point Position	Set the decimal point position for the channel analog input measured value (INT and DINT). 0: ×1 °C or °F 1: ×0.1 °C or °F 2: ×0.01 °C or °F	1	0/1/2	---	5003 hex	01 hex	P. 6-40
Ch2 Decimal Point Position		1	0/1/2	---		02 hex	

*1. The data range of Ch☐ Input Moving Average Time depends on the model. The descriptions for each model are as below.

NX Units	Data range
NX-TS2☐01	0 to 32000
NX-TS2☐02	0 to 1280
NX-TS2☐04	0 to 7680

● Four-point Input Units

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Enable/Disable	Set to enable or disable the channel.*1 FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---	5000 hex	01 hex	P. 6-20
Ch2 Enable/Disable		TRUE	TRUE or FALSE	---		02 hex	
Ch3 Enable/Disable		TRUE	TRUE or FALSE	---		03 hex	
Ch4 Enable/Disable		TRUE	TRUE or FALSE	---		04 hex	
Ch1 Input Type	Set the sensor to be connected to the channel and its range. *1	*1	*1	---	5001 hex	01 hex	P. 6-3
Ch2 Input Type				---		02 hex	
Ch3 Input Type				---		03 hex	
Ch4 Input Type				---		04 hex	

*1. The meaning of the set value, default value and data range for Ch☐ Input Type are as follows.
Meanings of the set values for Ch☐ Input Type

Set value	Meaning
15	K –200 to 1300°C
16	K –20 to 600°C (High Resolution)
17	J –200 to 1200°C
18	J –20 to 600°C (High Resolution)
19	T –200 to 400°C
20	E –200 to 1000°C
21	L –200 to 900°C
22	U –200 to 600°C
23	N –200 to 1300°C
24	R –50 to 1700°C
25	S –50 to 1700°C
26	B 0 to 1800°C
27	W 0 to 2300°C
28	PL II 0 to 1300°C
0	Pt100 (3wire) –200 to 850°C
7	Pt1000 (3wire) –200 to 850°C

Default value and data range for Ch☐ Input Type

- NX-TS31☐☐

NX Units	Default value	Data range
NX-TS3101	15	15, 17, 19 to 28
NX-TS3102/3104	15	15 to 28

- NX-TS32☐☐

NX Units	Default value	Data range
NX-TS3201/3204	0	0, 7
NX-TS3202	0	0

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Input Moving Average Time	Set the time to process moving average.	0	*1	ms	5005 hex	01 hex	P. 6-23
Ch2 Input Moving Average Time		0	*1	ms		02 hex	
Ch3 Input Moving Average Time		0	*1	ms		03 hex	
Ch4 Input Moving Average Time		0	*1	ms		04 hex	
Ch1 Cold Junction Compensation Enable/Disable	Set to enable or disable the cold junction compensation for the thermocouple input. FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---	5002 hex	01 hex	P. 6-29
Ch2 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---		02 hex	
Ch3 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---		03 hex	
Ch4 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---		04 hex	
Ch1 Temperature Unit	Set the temperature unit for the channel analog input measured value. 0: °C 1: °F	0	0/1	---	5004 hex	01 hex	P. 6-32
Ch2 Temperature Unit		0	0/1	---		02 hex	
Ch3 Temperature Unit		0	0/1	---		03 hex	
Ch4 Temperature Unit		0	0/1	---		04 hex	
Ch1 Offset Value (One-point Correction)	Set the offset value to correct the one point of the channel analog input measured value.	0	-400 to 5000	°C or °F	5010 hex	01 hex	P. 6-35
Ch2 Offset Value (One-point Correction)		0	-400 to 5000			02 hex	
Ch3 Offset Value (One-point Correction)		0	-400 to 5000			03 hex	
Ch4 Offset Value (One-point Correction)		0	-400 to 5000			04 hex	
Ch1 Lower Offset Value (Two-point Correction)	Set the offset value (lower) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5011 hex	01 hex	P. 6-35
Ch2 Lower Offset Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch3 Lower Offset Value (Two-point Correction)		0	-400 to 5000			03 hex	
Ch4 Lower Offset Value (Two-point Correction)		0	-400 to 5000			04 hex	
Ch1 Higher Offset Value (Two-point Correction)	Set the offset value (upper) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5012 hex	01 hex	
Ch2 Higher Offset Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch3 Higher Offset Value (Two-point Correction)		0	-400 to 5000			03 hex	
Ch4 Higher Offset Value (Two-point Correction)		0	-400 to 5000			04 hex	

Setting name	Description	Default value	Setting range	Unit	Index	Subindex	Reference
Ch1 Pre-correction Lower Measured Value (Two-point Correction)	Set the pre-correction measured value (lower) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5013 hex	01 hex	P. 6-35
Ch2 Pre-correction Lower Measured Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch3 Pre-correction Lower Measured Value (Two-point Correction)		0	-400 to 5000			03 hex	
Ch4 Pre-correction Lower Measured Value (Two-point Correction)		0	-400 to 5000			04 hex	
Ch1 Pre-correction Higher Measured Value (Two-point Correction)	Set the pre-correction measured value (upper) to be used for the two-point correction of the channel analog input measured value.	0	-400 to 5000	°C or °F	5014 hex	01 hex	
Ch2 Pre-correction Higher Measured Value (Two-point Correction)		0	-400 to 5000			02 hex	
Ch3 Pre-correction Higher Measured Value (Two-point Correction)		0	-400 to 5000			03 hex	
Ch4 Pre-correction Higher Measured Value (Two-point Correction)		0	-400 to 5000			04 hex	
Ch1 Decimal Point Position	Set the decimal point position for the channel analog input measured value (INT and DINT). 0: ×1 °C or °F 1: ×0.1 °C or °F 2: ×0.01 °C or °F	1	0 to 2	---	5003 hex	01 hex	P. 6-40
Ch2 Decimal Point Position		1	0 to 2	---		02 hex	
Ch3 Decimal Point Position		1	0 to 2	---		03 hex	
Ch4 Decimal Point Position		1	0 to 2	---		04 hex	

*1. The data range of Ch□ Input Moving Average Time depends on the model. The descriptions for each model are as below.

NX Units	Data range
NX-TS3□01	0 to 32000
NX-TS3□02	0 to 1280
NX-TS3□04	0 to 7680

6-5 Functions

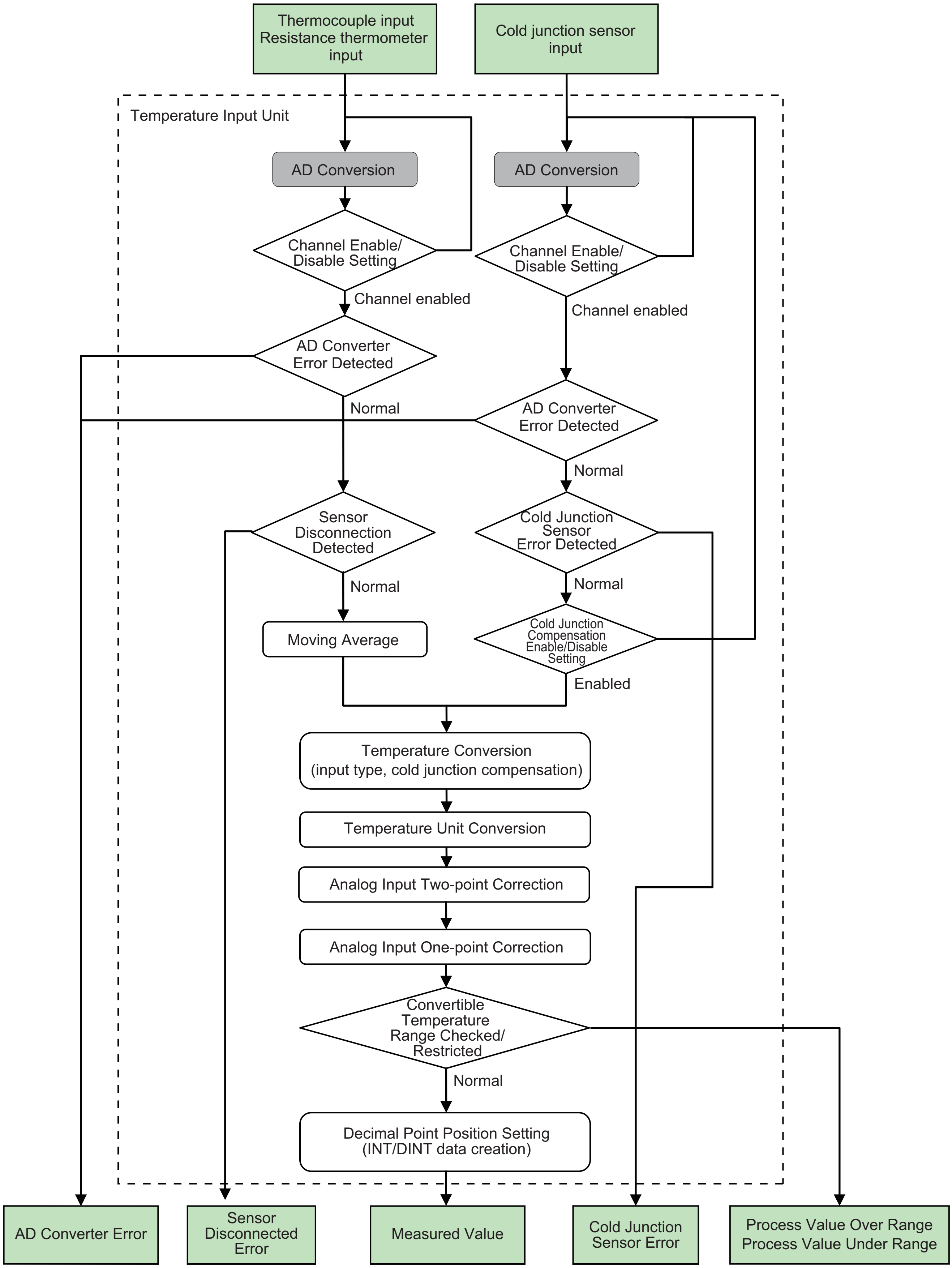
This section describes the Temperature Input Unit functions.

Refer to the specifications of each model in *A-1 Data Sheet* on page A-2 for details on the functions.

6-5-1 List of Temperature Input Unit Functions

Function name	Meaning	Reference
Free-Run Refreshing	With this I/O refreshing method, the refresh cycle of the NX bus and the I/O refresh cycles of the NX Units are asynchronous.	*5-2-4 Free-Run Refreshing* on page 5-9
Selecting Channel To Use	This function disables errors in unused channels. The conversion time for its own Unit will not be shortened even if errors are disabled.	*6-5-3 Selecting Channel To Use* on page 6-20
Moving Average	This function uses the average value of inputs over a set period as the measured value. When the input value fluctuates frequently due to noise, a moving average can be used to obtain a stable measured value.	*6-5-4 Moving Average* on page 6-23
Sensor Disconnection Detection	This function detects disconnections of sensors that are connected to the input terminals.	*6-5-5 Sensor Disconnection Detection* on page 6-27
Over Range/Under Range Detection	This function detects when the measured value exceeds the range for which temperature conversion is possible.	*6-5-6 Over Range/Under Range Detection* on page 6-28
Cold Junction Compensation Enable/Disable Setting	This function enables or disables the cold junction compensation for thermocouple inputs. Enable this function normally.	*6-5-7 Cold Junction Compensation Enable/Disable Setting* on page 6-29
Temperature Unit Setting (°C/°F)	This function sets °C (celsius) or °F (fahrenheit) as the temperature unit for measured values.	*6-5-8 Temperature Unit (°C/°F) Setting* on page 6-32
Input Correction	This function corrects measured values. It is used when there is a noticeable variation from values measured with other gauges. One-point correction and two-point correction methods are provided.	*6-5-9 Input Correction* on page 6-35
Decimal Point Position Setting	This function sets the number of digits which is displayed after the decimal point when measured values are INT and DINT data.	*6-5-10 Decimal Point Position Setting* on page 6-40

6-5-2 Function Block Diagram



6-5-3 Selecting Channel To Use

Purpose

This function is used to avoid errors in unused channels.

Details on the Function

This function disables measured value math operation and error detection processing for unused channels.

However, the conversion time of its own Unit will not be shortened even if the channels are disabled.

The measured value and status for the disabled channels are fixed to 0 after the power is reset.

The data are fixed to 0 are as follows.

- Status of each channel
- Measured value

● Two-point Input Units

Setting name	Description	Default value	Unit
Ch1 Enable/Disable	Set to enable or disable the channel. [*1] FALSE: Disable TRUE: Enable	TRUE	---
Ch2 Enable/Disable		TRUE	---

*1. If an unused channel for expansion exists, it is possible to avoid errors on that channel.

● Four-point Input Units

Setting name	Description	Default value	Unit
Ch1 Enable/Disable	Set to enable or disable the channel.[*1] FALSE: Disable TRUE: Enable	TRUE	---
Ch2 Enable/Disable		TRUE	---
Ch3 Enable/Disable		TRUE	---
Ch4 Enable/Disable		TRUE	---

*1. If an unused channel for expansion exists, it is possible to avoid errors on that channel.

Target NX Units

All Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

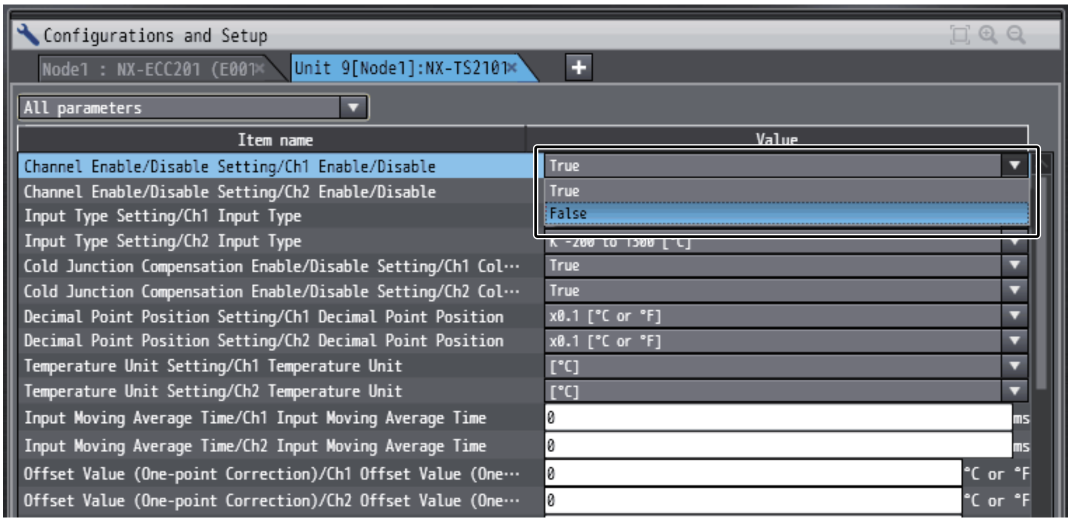
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

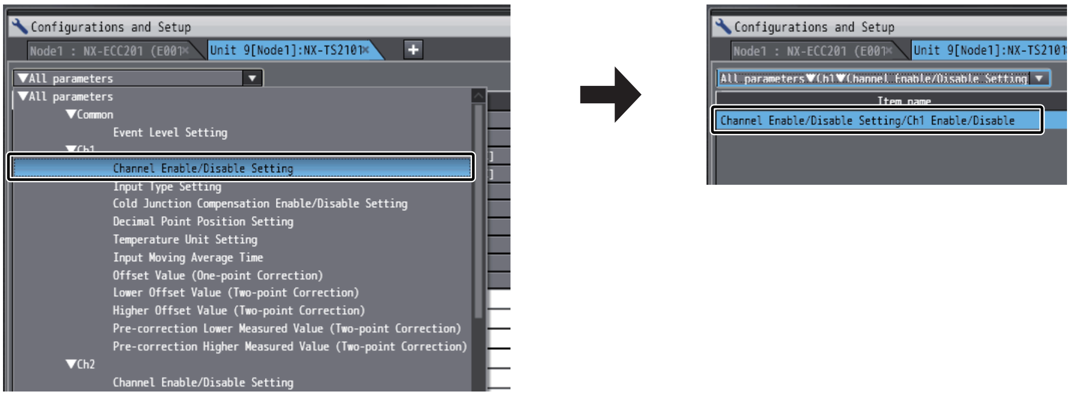
2 Select *True* (Enable) or *False* (Disable) from the list of Channel Enable/Disable Setting for which the channel you want to set.



Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



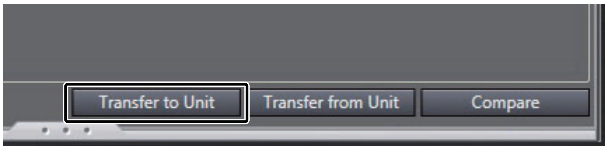
Select Channel Enable/Disable Setting under Ch1

Only Channel Enable/Disable Setting under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-5-4 Moving Average

Purpose

The measured value can be filtered in order to eliminate fluctuations due to noise or sharp changes.

Details on the Function

- The moving average of the past inputs of the set time is calculated and used as the measured value.
- The moving average processing is not performed if it is set to 0 ms.
- If an error that the measurement value used when an error occurs is detected, the moving average processing is not performed. The value becomes the measured value immediately when an error occurs. (Refer to *6-6 Measured Values Used When an Error Occurs* on page 6-44.)
- When turns ON the power and recovers from the error that the measurement value is used when an error occurs (Refer to *6-6 Measured Values Used When an Error Occurs* on page 6-44), the past input values are cleared and the input values at the recovery are stored in the moving average buffer.

Additional Information

The input moving average time setting is rounded up in units of conversion time. For example, if the input moving average time of channels is set to 12 ms in the NX Unit with a conversion time of 10 ms, internally, the input moving average time is set to 20 ms and the processing is performed by averaging the last one input and the latest input.

● Two-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Input Moving Average Time	Set the time to process moving average.	0	*1	ms
Ch2 Input Moving Average Time		0	*1	ms

*1. The data range of Ch□ Input Moving Average Time depends on the model. The descriptions for each model are as below.

NX Units	Data range
NX-TS2□ 01	0 to 32000
NX-TS2□ 02	0 to 1280
NX-TS2□ 04	0 to 7680

● Four-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Input Moving Average Time	Set the time to process moving average.	0	*1	ms
Ch2 Input Moving Average Time		0	*1	ms
Ch3 Input Moving Average Time		0	*1	ms
Ch4 Input Moving Average Time		0	*1	ms

*1. The data range of Ch□ Input Moving Average Time depends on the model. The descriptions for each model are as below.

NX Units	Data range
NX-TS3□01	0 to 32000
NX-TS3□02	0 to 1280
NX-TS3□04	0 to 7680

Target NX Units

All Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

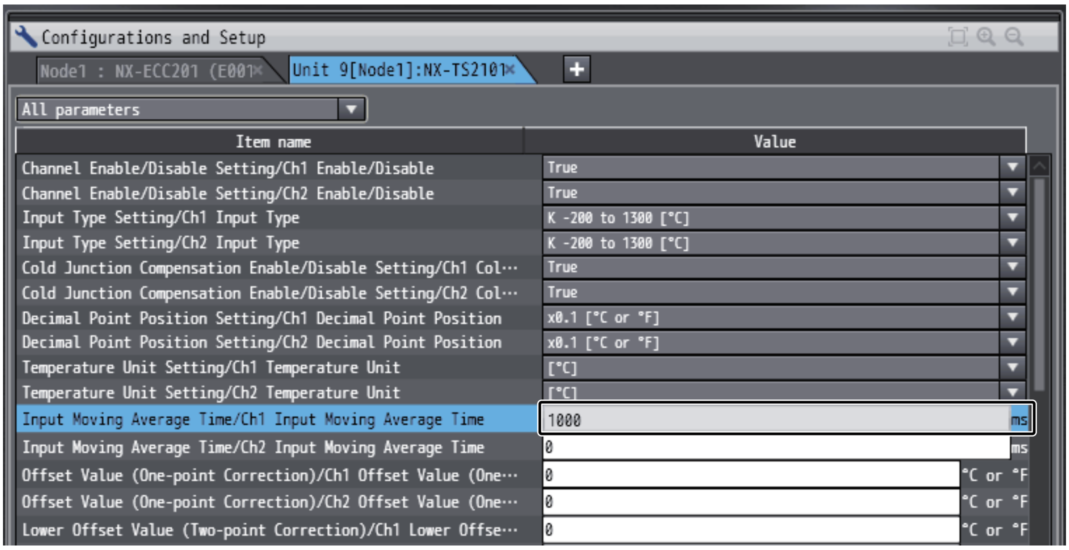
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

2 Enter the time to process moving average (0 to 32000 ms) in the text box of Input Moving Average Time for the channel you want to set.



6-5 Functions

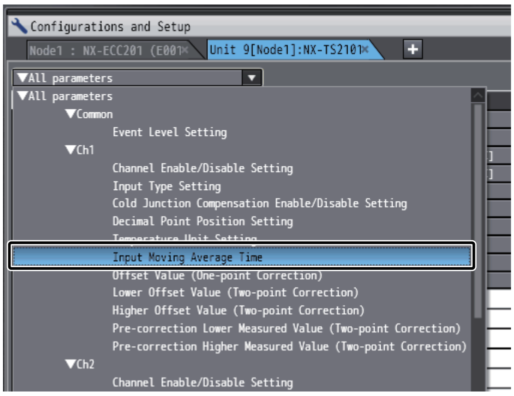
6

6-5-4 Moving Average

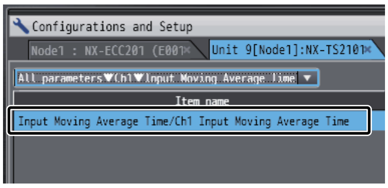
Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



Select Input Moving Average Time under Ch1

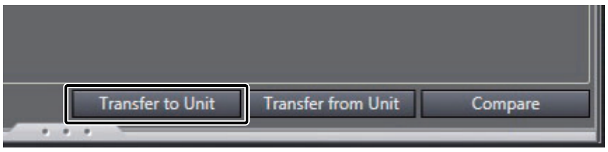


Only Input Moving Average Time under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-5-5 Sensor Disconnection Detection

Purpose

This function detects disconnections of thermocouple sensors and resistance thermometer sensors.

Details on the Function

- If a sensor is disconnected (including sensor is not connected and incorrect wiring), the value becomes the measured value when an error occurs. (Refer to *6-6 Measured Values Used When an Error Occurs* on page 6-44.) At this time, the Sensor Disconnected Error Status turns ON and a Sensor Disconnected Error event (event code: 65100000 hex) occurs.
- When the cause of the sensor disconnection is removed, the value becomes the normal measured value. When the cause of the error is removed and the error is reset, the Sensor Disconnected Error Status turns OFF.
- If the moving average is enabled, the disconnection detection is performed to the input value before the moving average processing.
- Refer to *A-3 List of NX Objects* on page A-33 for details on status and *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for details on events.

Additional Information

When a Sensor Disconnected Error event occurs, a Process Value Over Range event may also occur.

Target NX Units

All Temperature Input Units

Setting Method

No setting is required.

6-5-6 Over Range/Under Range Detection

Purpose

This function detects when the measured value exceeds the range for which temperature conversion is possible.

Details on the Function

- If the input exceeds the upper limit of the convertible temperature range, the measured value is fixed at the upper limit. At this time, the Over Range Status turns ON and a Process Value Over Range event (event code: 65110000 hex) occurs.
- If the input falls below the lower limit of the convertible temperature range, the measured value is fixed at the lower limit. At this time, the Under Range Status turns ON and a Process Value Under Range event (event code: 65120000 hex) occurs.
- When the input returns to the convertible temperature range, the fixing is cancelled and the value becomes the normal measured value. When the cause of the error is removed and the error is reset, the Over Range/Under Range Status turns OFF.
- Refer to *A-3 List of NX Objects* on page A-33 for details on status and *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for details on events.

Target NX Units

All Temperature Input Units

Setting Method

No setting is required.

6-5-7 Cold Junction Compensation Enable/Disable Setting

Purpose

This function enables or disables the cold junction compensation using cold junction sensors that are mounted on thermocouple input terminal blocks.

Enable this function normally.

Regardless of the cold junction compensation enable/disable setting, do not remove the cold junction sensors that are mounted on the terminal blocks when they are delivered.

Details on the Function

● If Cold Junction Compensation is Enable

The measured value is the value with cold junction compensation using the cold junction sensor that is mounted on the terminal block.

● If Cold Junction Compensation is Disable

The measured value is the value without the cold junction compensation using the cold junction sensor that is mounted on the terminal block.

● Cold Junction Sensor Error Detected

- If a cold junction sensor is disconnected, the measured value for channels of the corresponding sensor becomes the measured value when an error occurs. (Refer to *6-6 Measured Values Used When an Error Occurs* on page 6-44.) At this time, the Cold Junction Sensor Error status turns ON.
- When the cause of the cold junction sensor error is removed, the value becomes the normal measured value. When the cause of the error is removed and the error is reset, the Cold Junction Sensor Error Status turns OFF.
- Refer to *A-3 List of NX Objects* on page A-33 for details on the status.

● Two-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Cold Junction Compensation Enable/Disable	Set to enable or disable the cold junction compensation for the thermocouple input. FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---
Ch2 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---

● Four-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Cold Junction Compensation Enable/Disable	Set to enable or disable the cold junction compensation for the thermocouple input. FALSE: Disable TRUE: Enable	TRUE	TRUE or FALSE	---
Ch2 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---
Ch3 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---
Ch4 Cold Junction Compensation Enable/Disable		TRUE	TRUE or FALSE	---

Target NX Units

Thermocouple Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

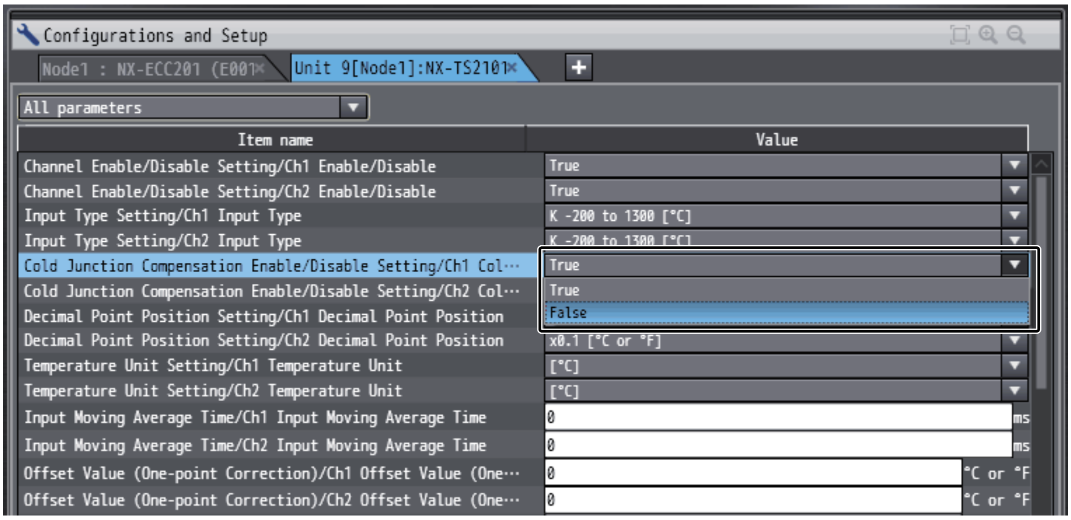
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

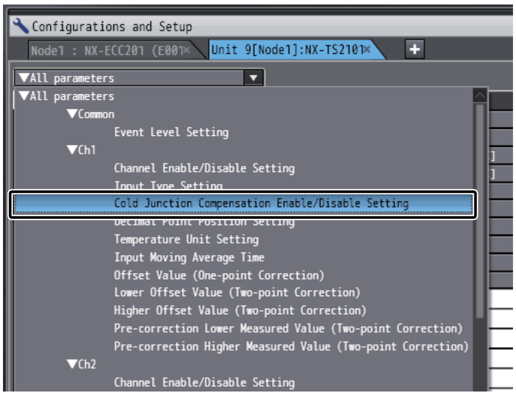
2 Select *True* (Enable) or *False* (Disable) from the list of Cold Junction Compensation Enable/Disable Setting for which the channel you want to set.



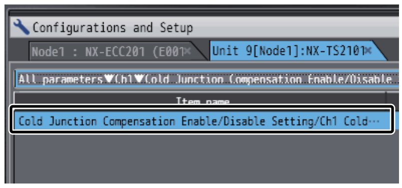
Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



Select Cold Junction Compensation Enable/Disable Setting under Ch1

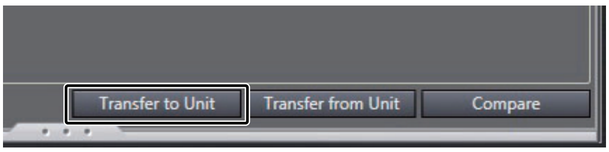


Only Cold Junction Compensation Enable/Disable Setting under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-5-8 Temperature Unit (°C/°F) Setting

Purpose

This function sets °C (celsius) or °F (fahrenheit) as the temperature unit for measured values.

Details on the Function

Measured values are treated as °C of REAL data inside the Temperature Input Unit. Therefore, if °F is set, measured values are converted with the following equation.

Measured value (°F) = Measured value (°C) x 1.8 + 32

● Two-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Temperature Unit	Set the temperature unit for the channel analog input measured value. 0: °C 1: °F	0	0/1	---
Ch2 Temperature Unit		0	0/1	---

● Four-point Input Units

Setting name	Description	Default value	Setting range	Unit
Ch1 Temperature Unit	Set the temperature unit for the channel analog input measured value. 0: °C 1: °F	0	0/1	---
Ch2 Temperature Unit		0	0/1	---
Ch3 Temperature Unit		0	0/1	---
Ch4 Temperature Unit		0	0/1	---

Target NX Units

All Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

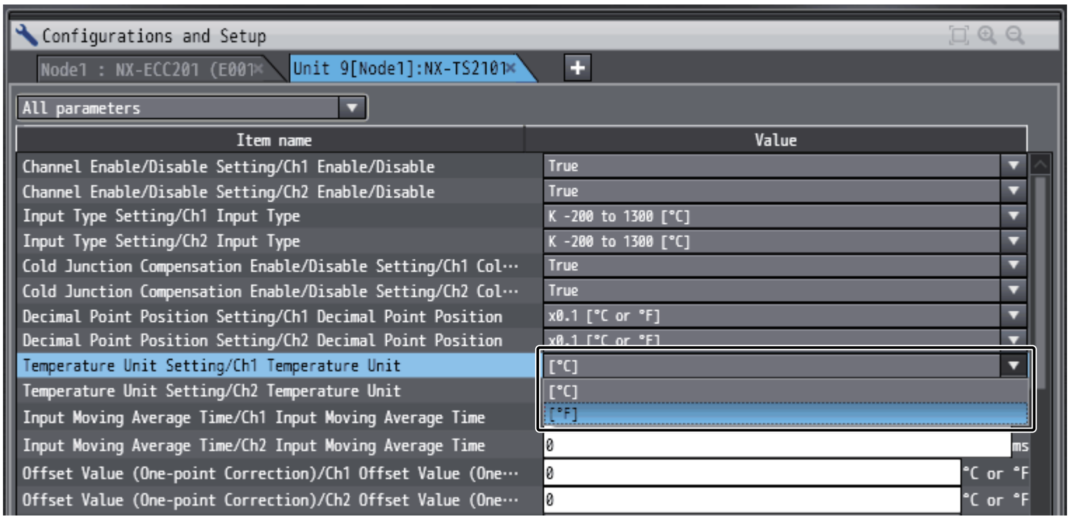
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

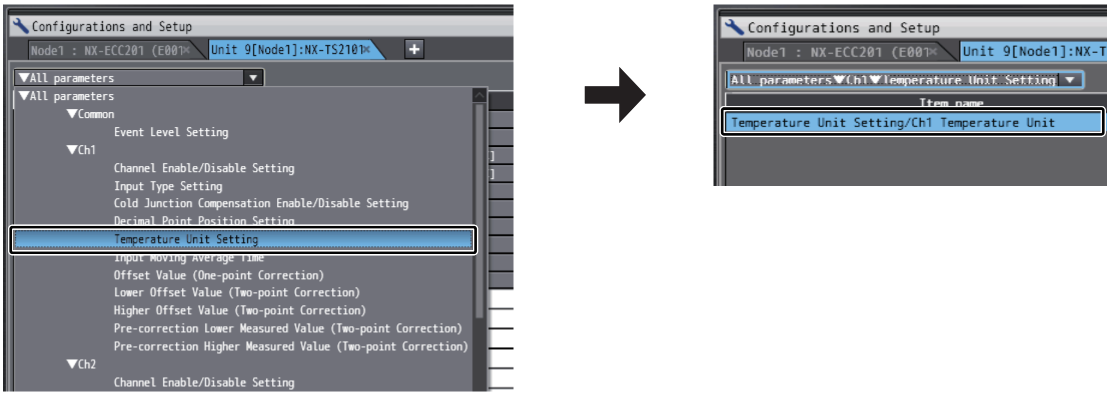
2 Select *[°C]* or *[°F]* from the list of Temperature Unit Setting for which the channel you want to set.



Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



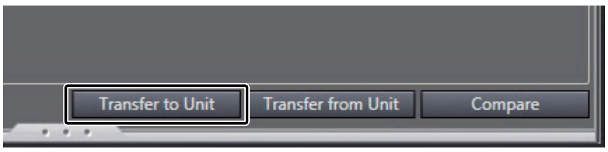
Select Temperature Unit Setting under Ch1

Only Temperature Unit Setting under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-5-9 Input Correction

Purpose

This function corrects measured values.

It is used when there is a noticeable variation from values measured with other gauges.

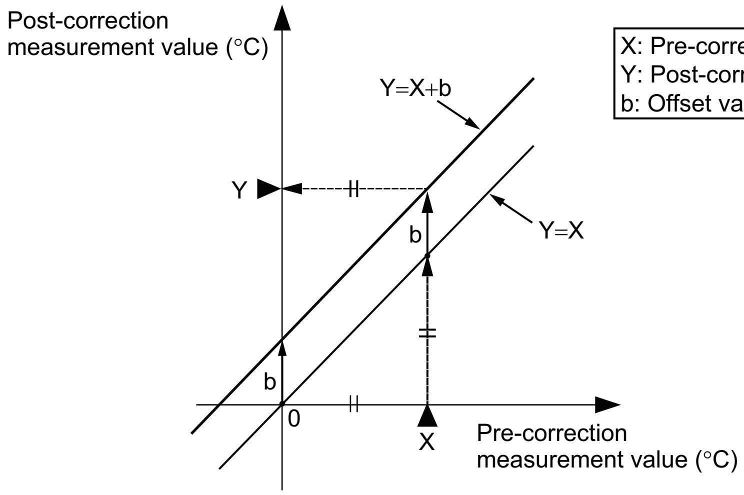
Details on the Function

One-point correction and two-point correction methods are provided.

Whether or not measured values are corrected, the convertible temperature range is the same.

One-point Correction

For all points in the sensor's measurable range, the offset value of measured values is shifted.



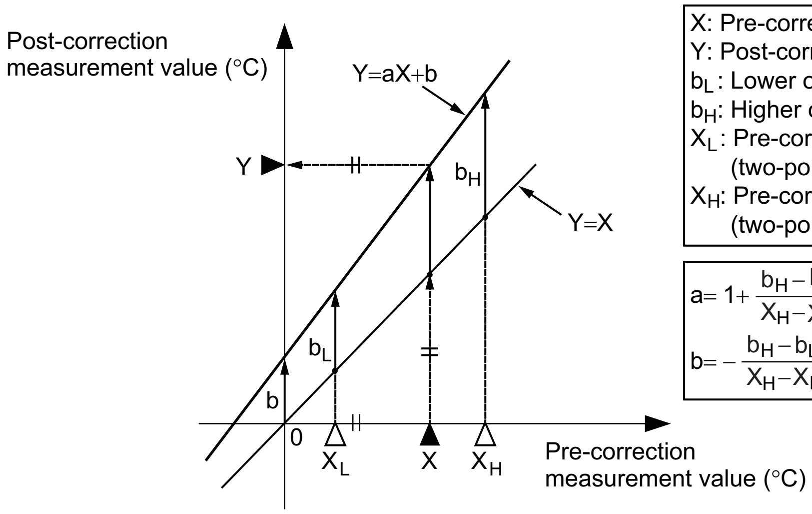
For example, if you want to increase the measured value by 1.2°C, set 1.2 for b (offset value (one-point correction)). This increases the measured values at all points by 1.2°C.

Set offset values using the Support Software.

Refer to *Setting Method* on page 6-38 for details.

Two-point Correction

Perform linear correction by setting the correction value at X_L within the measurement range (pre-correction lower measured value (two-point correction)) in b_L (lower offset value (two-point correction)) and the correction value at X_H (pre-correction higher measured value (two-point correction)) in b_H (higher offset value (two-point correction)).



X: Pre-correction measurement value
Y: Post-correction measurement value
b_L: Lower offset value (two-point correction)
b_H: Higher offset value (two-point correction)
X_L: Pre-correction lower measured value (two-point correction)
X_H: Pre-correction higher measured value (two-point correction)

$$a = 1 + \frac{b_H - b_L}{X_H - X_L}$$

$$b = -\frac{b_H - b_L}{X_H - X_L} X_L + b_L$$

Additional Information

To perform the two-point correction, set the value so that the difference between the values X_H and X_L is larger than 0.1 (°C or °F).

When you do not perform the two-point correction, set the values for both X_H and X_L to 0 or use the same value.

Example of Two-point Correction

The method for performing two-point correction of Temperature Input Units using a calibration device is shown below.

Precautions for Correct Use

Regardless of the cold junction compensation enable/disable setting, do not remove the cold junction sensors that are mounted on the terminal blocks when they are delivered.

1 Use the Support Software to set the following contents for the Temperature Input Unit, and then turn OFF the power supply.

- Ch□ Cold Junction Compensation Enable/Disable: Disable
- Ch□ Offset Value (One-point Correction): 0.0 (°C)
- Ch□ Lower Offset Value (Two-point Correction): 0.0 (°C)
- Ch□ Higher Offset Value (Two-point Correction): 0.0 (°C)
- Ch□ Input Type: Sensor used

Refer to *Setting Method* on page 6-38 for details on how to set offset values.

2 Connect the calibration devices below to the Temperature Input Unit.

Model	Calibration device
NX-TS□1□□	Voltage generator
NX-TS□2□□	Variable resistor

3 Turn ON the power supply to the Temperature Input Unit, then wait the following warm-up period.

Model	Warm-up period (minutes)
NX-TS□1□□	30
NX-TS□2□□	5

4 Enter the signal *1 corresponding to the lower limit of the measurement temperature from the calibration device and check the Ch□ Measured Value.

5 Enter the signal *1 corresponding to the upper limit of the measurement temperature from the calibration device and check the Ch□ Measured Value.

6 Use the Support Software to set the following contents for the Temperature Input Unit.

- Use the Ch□ Measured Value checked in Procedure 4.

  Ch□ Pre-correction Lower Measured Value (Two-point Correction): lower limit of the measurement temperature
  Ch□ Lower Offset Value (Two-point Correction): lower limit of the measurement temperature - Ch□ Measured Value
- Use the Ch□ Measured Value checked in Procedure 5.

  Ch□ Pre-correction Higher Measured Value (Two-point Correction): upper limit of the measurement temperature
  Ch□ Higher Offset Value (Two-point Correction): upper limit of the measurement temperature - Ch□ Measured Value

Refer to *Setting Method* on page 6-38 for details on how to set pre-correction measurement values and offset values.

7 Use the Support Software to set the following contents for the Temperature Input Unit, and then turn OFF the power supply.

- Ch□ Cold Junction Compensation Enable/Disable: Enable

However, this operation does not need when the cold junction compensation is disabled.

8 Disconnect the calibration device from the Temperature Input Unit and connect the temperature sensor.

*1. The values of reference thermal electromotive force listed in JIS C 1602-1995.

Target NX Units

All Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

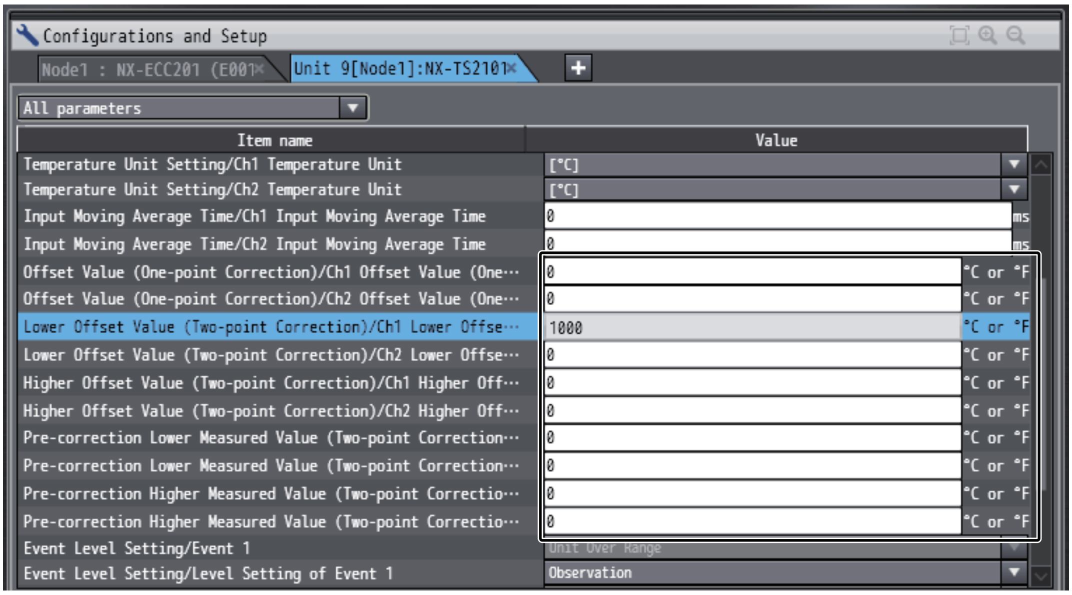
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

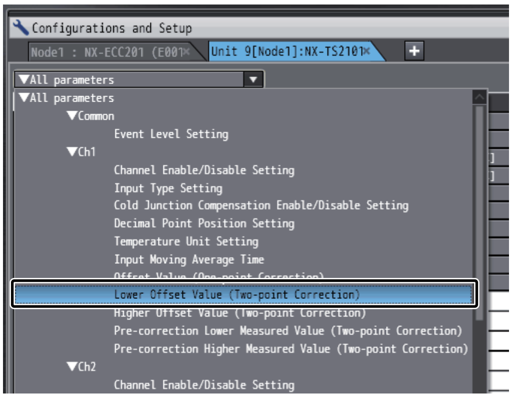
2 Enter each set value in the text box of the offset value and pre-correction measurement value you want to set.



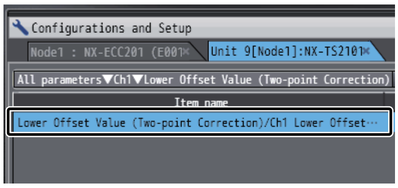
Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



Select Lower Offset Value (Two-point Correction) under Ch1

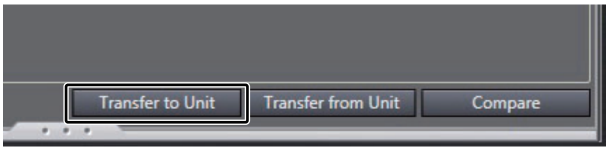


Only Lower Offset Value (Two-point Correction) under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



Additional Information

It is not necessary to restart an NX Unit after changing the parameters.

6-5-10 Decimal Point Position Setting

Purpose

This function sets the number of digits which is displayed after the decimal point when measured values are INT and DINT data.

Inside the Temperature Input Unit, there are the measured values with a resolution smaller than the first decimal place, which is the decimal point position for the default values.

It is effective to use INT data type for measured values in order to reduce the I/O size when the measurement range is narrow.

For example, if the decimal point position is set to 2, the measured value is displayed until the second decimal place. At this time, if the measurement temperature is within the range from -320.00 to +320.00°C, the INT data with the small size can be used for the measured value.

Details on the Function

The data types of measured values that the Temperature Input Unit can use are as follows.

After measured values are calculated inside the Temperature Input Unit with REAL data, they are converted to INT and DINT data.

I/O port	Data type	Normal range	Conversion method
Ch☐ Measured Value INT	INT	-32000 to 32000	Convert (Ch☐ Measured Value REAL x 10 ^ decimal point position) to INT data
Ch☐ Measured Value DINT	DINT	Convertible temperature range x 10 ^ decimal point position	Convert (Ch☐ Measured Value REAL x 10 ^ decimal point position) to DINT data
Ch☐ Measured Value REAL	REAL	Convertible temperature range	Do not convert since it is matched with data inside the Temperature Input Unit.

Additional Information

- When you use a model that the specification of resolution is 0.1°C or less, the value of the second decimal place of the measured value exceeds the specified resolution of the relevant model, so use this value as reference data.
- Digit data lost in conversion is rounded off.
  (Example) REAL data type of 1.454°C
  - INT data for decimal point position 0 = 1
  - INT data for decimal point position 1 = 15
  - INT data for decimal point position 2 = 145

  The same processing is performed for both DINT and INT data.
- If the conversion result exceeds the normal range, the measured value is the upper limit or lower limit of the normal range.
  (Example) Temperature = 1000°C, decimal point position = 2
  - Ch□ Measured Value INT = 1000 x 10 ^ 2 = 100000 -> The value is 32000 because it exceeds the range.
  - Ch□ Measured Value DINT = 1000 x 10 ^ 2 = 100000
  - Ch□ Measured Value REAL = 1000.0

● Two-point Input Units

Setting name	Description	Default value	Unit
Ch1 Decimal Point Position	Set the decimal point position for the channel analog input measured value (INT and DINT). 0: ×1 °C or °F 1: ×0.1 °C or °F 2: ×0.01 °C or °F	1	---
Ch1 Decimal Point Position		1	---

● Four-point Input Units

Setting name	Description	Default value	Unit
Ch1 Decimal Point Position	Set the decimal point position for the channel analog input measured value (INT and DINT). 0: ×1 °C or °F 1: ×0.1 °C or °F 2: ×0.01 °C or °F	1	---
Ch2 Decimal Point Position		1	---
Ch3 Decimal Point Position		1	---
Ch4 Decimal Point Position		1	---

Target NX Units

All Temperature Input Units

Setting Method

This section gives the setting method with the Sysmac Studio.

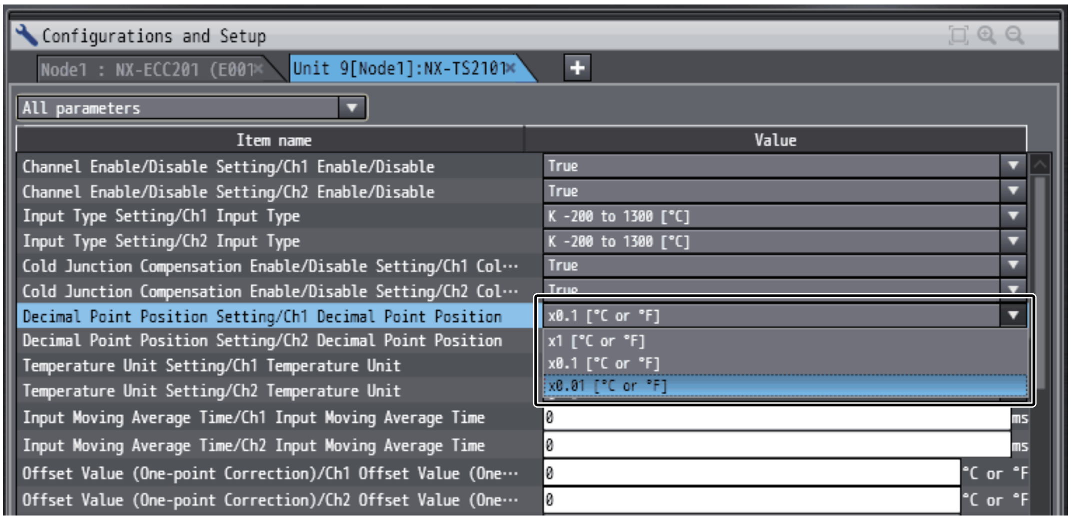
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

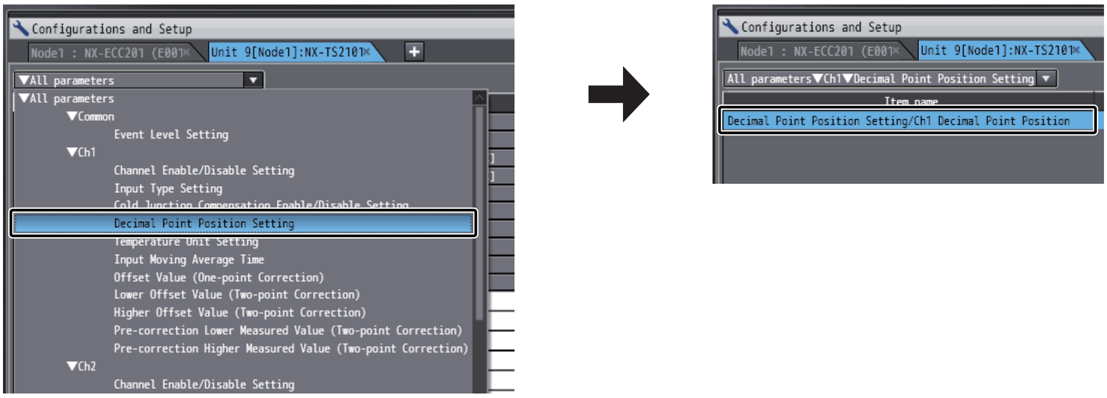
2 Select the decimal point position from the list of Decimal Point Position Setting for which the channel you want to set.



Additional Information

- Click a list button on the tab page to display the item in the Edit Unit Operation Settings Tab Page.

  Example:



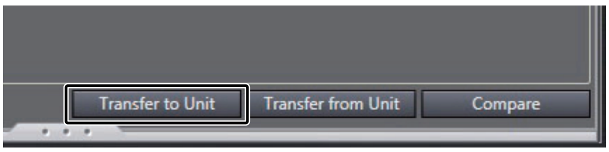
Select Decimal Point Position Setting under Ch1

Only Decimal Point Position Setting under Ch1 is displayed

- If you set a value different from the default value, the Value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

6-6 Measured Values Used When an Error Occurs

If an error is detected in measured value math operation, the measured value for that point becomes as in the table below and you can see from this measured value that an error has occurred.

This feature allows, the allocation error status to be omitted in order to reduce the size of I/O data.

However, the details for the error cannot be specified because the same measured value is used for more than one error.

The measured values differ depending on the data type as following, and they are always the fixed values without being affected by the decimal point position.

I/O port	Data type	Measured values used when an error occurs
Ch□ Measured Value INT	INT	32767
Ch□ Measured Value DINT	DINT	2147483647
Ch□ Measured Value REAL	REAL	1.0E + 10 *1

*1. If the error is detected by REAL data, be sure that the measured value is greater than 0.9E + 10.

7

Heater Burnout Detection Units

This section describes the types of Heater Burnout Detection Units and their functions.

7-1 Types of Heater Burnout Detection Units

The Heater Burnout Detection Unit is an NX Unit with the following features:

- Monitoring of CT currents to provide alarms for heater burnouts and SSR failures
- Processing of the time-proportional control outputs to operate heaters with SSRs

This section describes the types of Heater Burnout Detection Units.

Model	CT input section		Control output section				I/O refreshing method	Reference
	Number of points	Maximum heater current	Number of points	Internal I/O common	Maximum load current	Rated voltage		
NX-HB3101	4 points	50 A AC	4 points	NPN	0.1 A/point, 0.4 A/Unit	12 to 24 VDC	Free-Run refreshing	P. A-27
NX-HB3201				PNP		24 VDC		P. A-29

7-2 Temperature Control System

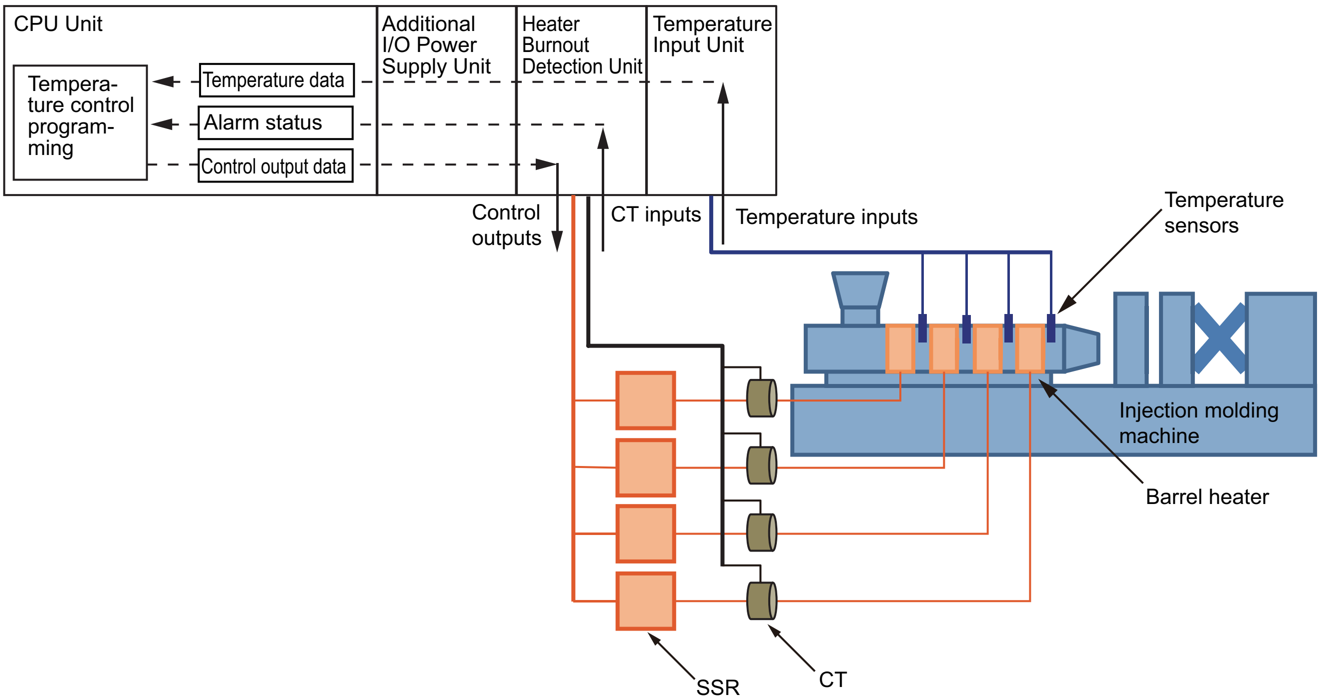
This section describes a temperature control system that combines a Heater Burnout Detection Unit with a CPU Unit or Industrial PC and Temperature Input Unit.

7-2-1 Temperature Control System Overview

You can construct a temperature control system by combining a Heater Burnout Detection Unit with a CPU Unit or Industrial PC and Temperature Input Unit. A temperature control system can be built to detect heater burnouts or SSR failures and process control outputs before the heater burnouts or SSR failures affect the heater temperature to prevent product defects or damage to machines.

The following section explains the role of each Unit by using the configuration of a temperature control system for the barrel heater in an injection molding machine. An injection molding machine molds plastic items by injecting resin that has been melted by a heater into molds.

Connection to the CPU Unit



The roles of the Units are as follows:

● Temperature Input Units

The Temperature Input Unit measures the temperatures of the resin for which temperature control is performed by means of temperature sensors.

● CPU Unit

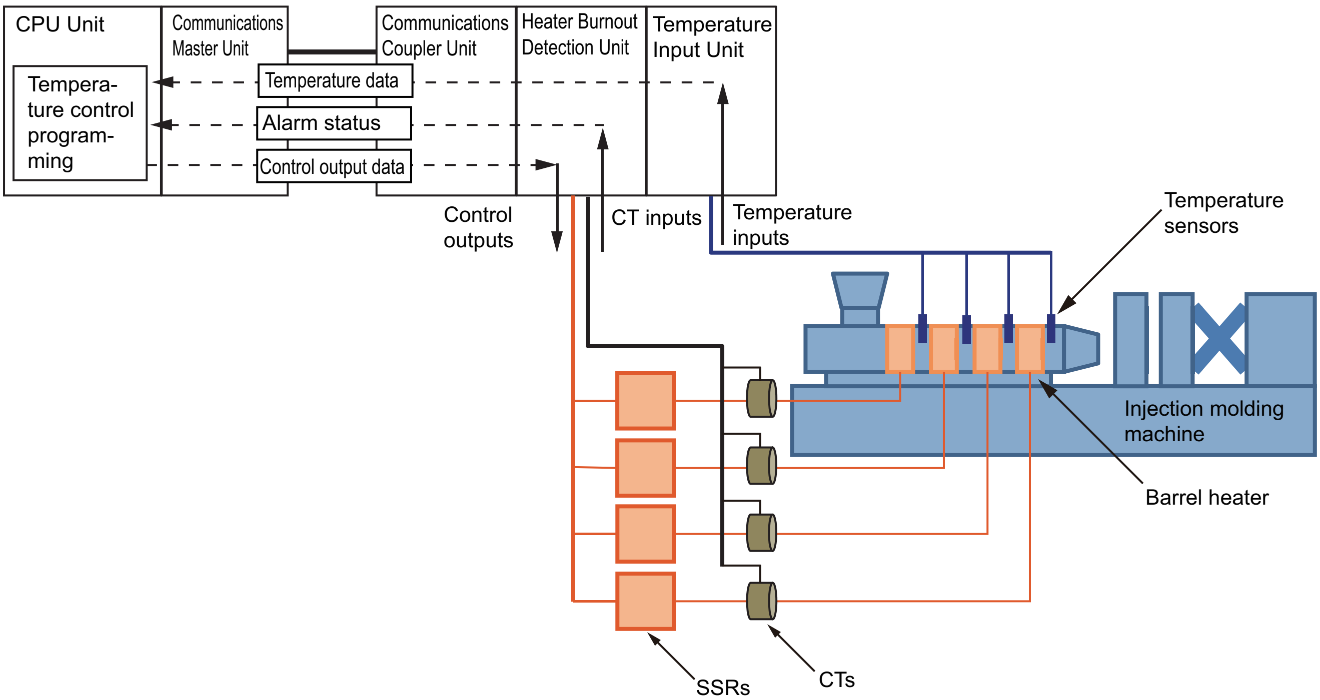
The CPU Unit executes the user program for system temperature control to control the temperature of the barrel heater, monitor the resin temperature, and perform processing if a heater burnout or SSR failure is detected.

● **Heater Burnout Detection Units**

Based on the results of execution of the user program by the CPU Unit, the Heater Burnout Detection Unit controls a control output as a time-proportional output to achieve SSR-driven barrel heater control.

The Unit also reads the heater currents and leakage currents that flow through the CTs every time the control outputs are turned ON/OFF. The Unit reads the current values to determine whether heater burnouts or SSR failures have occurred, and then notifies the CPU Unit of any such occurrence by means of the Alarm Status.

Connection to the Communications Coupler Unit



The roles of the Units are as follows:

● **Temperature Input Units**

The Temperature Input Unit measures the temperatures of the resin for which temperature control is performed by means of temperature sensors.

● **CPU Unit or Industrial PC**

The CPU Unit executes the user program for system temperature control to control the temperature of the barrel heater, monitor the resin temperature, and perform processing if a heater burnout or SSR failure is detected.

● **Heater Burnout Detection Units**

Based on the results of execution of the user program by the CPU Unit or Industrial PC, the Heater Burnout Detection Unit controls a control output as a time-proportional output to achieve SSR-driven barrel heater control.

The Unit also reads the heater currents and leakage currents that flow through the CTs every time the control outputs are turned ON/OFF. The Unit reads the current values to determine whether heater burnouts or SSR failures have occurred, and then notifies the CPU Unit or Industrial PC of any such occurrence by means of the Alarm Status.

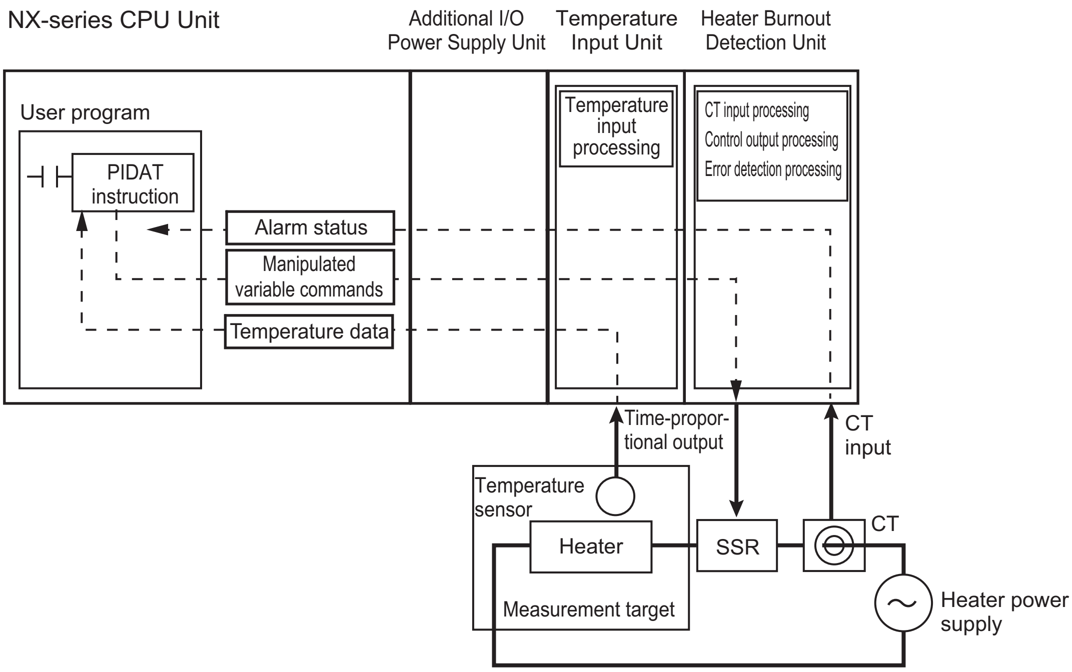
7-2-2 Temperature Control System Details

Connection to the CPU Unit

This section describes the temperature control system in detail with an example. As an example, it uses a Heater Burnout Detection Unit and Temperature Input Unit connected to an NX-series CPU Unit.

You connect the Temperature Input Unit and Heater Burnout Detection Unit to the NX-series CPU Unit. The analog control instructions of the NX-series Controllers, such as the PIDAT instruction, are used to perform temperature control. Details on the temperature control system and its operation are described below.

- The target temperature data that the Temperature Input Unit measures is sent to the CPU Unit during each refresh cycle of the NX bus.
- The NX-series Controller performs PID operation based on input temperature data and generates the manipulated variables for the Heater Burnout Detection Unit.
- The NX-series CPU Unit sends the manipulated variables during each refresh cycle of the NX bus.
- The Heater Burnout Detection Unit performs time-proportional output operations for each control period set for the Heater Burnout Detection Unit based on the manipulated variables from each refresh cycle of the NX bus.
- The Heater Burnout Detection Unit reads the currents that flow through the CTs. The Heater Burnout Detection Unit then compares those currents to the Heater Burnout Detection Current and SSR Failure Detection Current settings in the Heater Burnout Detection Unit. If a current is lower than the Heater Burnout Detection Current, the Unit detects a heater burnout, and if a current is higher than the SSR Failure Detection Current, the Unit detects a SSR failure.
- The Heater Burnout Detection Unit notifies the CPU Unit of any heater burnouts or SSR failures that are detected by means of the Alarm Status. The alarm status is sent to the CPU Unit during each refresh cycle of the NX bus.



For details on the analog control instructions of the NX-series Controllers, such as the PIDAT instruction, refer to the *NJ/NX-series Instructions Reference Manual* (Cat. No. W502).

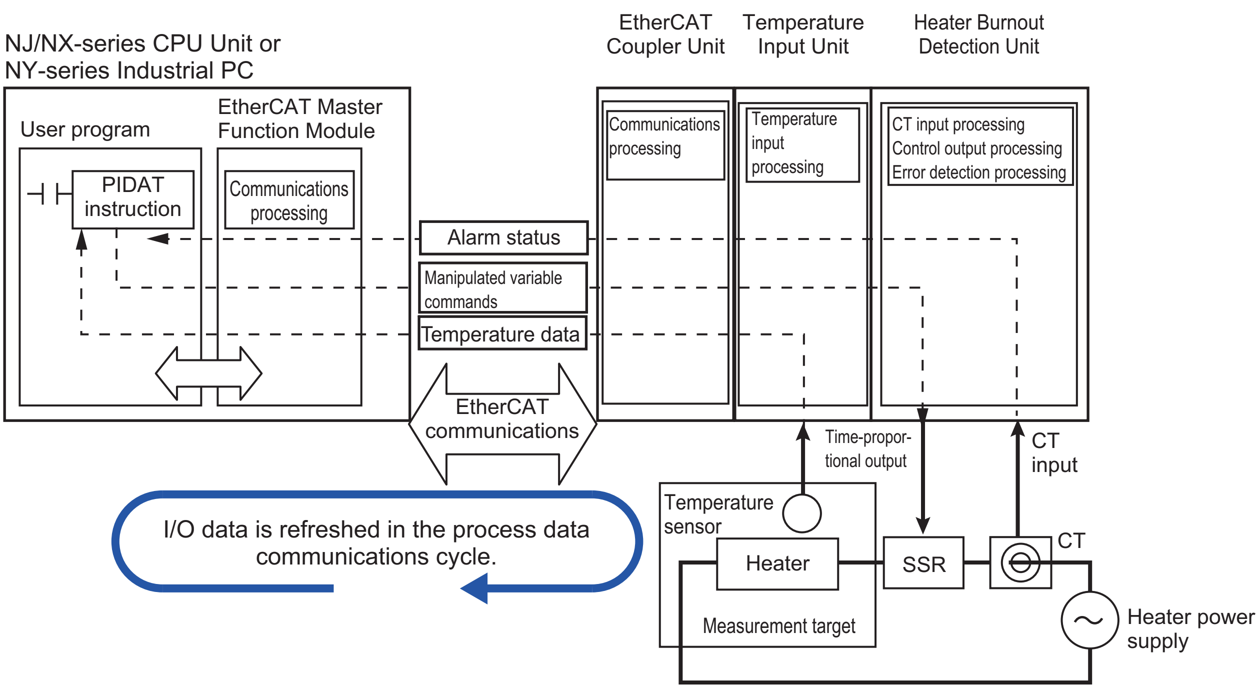
Refer to *7-8 Application Example* on page 7-57 for sample programming for temperature control.

Connection to the Communications Coupler Unit

This section describes the temperature control system in detail with an example. As an example, it uses a Heater Burnout Detection Unit and Temperature Input Unit connected to an EtherCAT Coupler Unit and combined with an NJ/NX/NY-series Controller.

You connect the EtherCAT Slave Terminal to the built-in EtherCAT port on the NJ/NX-series CPU Unit or NY-series Industrial PC. The analog control instructions of the NJ/NX/NY-series Controllers, such as the PIDAT instruction, are used to perform temperature control. Details on the temperature control system and its operation are described below.

- The target temperature data that the Temperature Input Unit measures is sent to the CPU Unit during each process data communications cycle of EtherCAT communications.
- The NJ/NX/NY-series Controller performs PID operation based on input temperature data and generates the manipulated variables for the Heater Burnout Detection Unit.
- The EtherCAT Master Function Module sends the manipulated variables with PDO communications during each process data communications cycle of EtherCAT communications.
- The Heater Burnout Detection Unit performs time-proportional output operations for each control period set for the Heater Burnout Detection Unit based on the manipulated variables from each process data communications cycle of EtherCAT communications.
- The Heater Burnout Detection Unit reads the currents that flow through the CTs. The Heater Burnout Detection Unit then compares those currents to the Heater Burnout Detection Current and SSR Failure Detection Current settings in the Heater Burnout Detection Unit. If a current is lower than the Heater Burnout Detection Current, the Unit detects a heater burnout, and if a current is higher than the SSR Failure Detection Current, the Unit detects a SSR failure.
- The Heater Burnout Detection Unit notifies the CPU Unit or Industrial PC of any heater burnouts or SSR failures that are detected by means of the Alarm Status. The alarm status is sent to the CPU Unit or Industrial PC during each process data communications cycle of EtherCAT communications.



For details on the analog control instructions of the NJ/NX/NY-series Controllers, such as the PIDAT instruction, refer to the instructions reference manual for the connected CPU Unit or Industrial PC.

Refer to *7-8 Application Example* on page 7-57 for sample programming for temperature control.

- **Using a Communications Coupler Unit Other Than an EtherCAT Coupler Unit**

If you use a Communications Coupler Unit that can be connected to an NJ/NX/NY-series Controller or CJ-series PLC, use analog control instructions, such as the PIDAT instruction, in the same way as for an EtherCAT Coupler Unit.

For details on the analog control instructions of the NJ/NX/NY-series Controllers, refer to the instructions reference manual for the connected CPU Unit or Industrial PC.

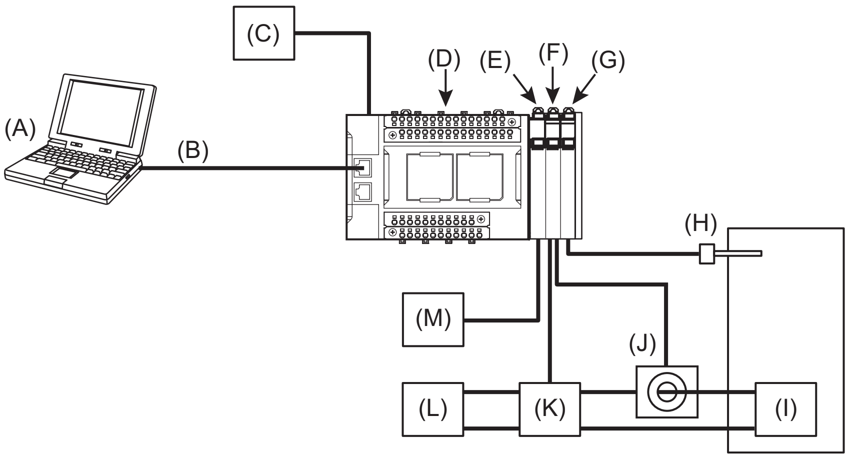
Refer to the *CS/CJ/NSJ-series Instructions Reference Manual* (Cat. No. W474) for details on the instructions of the CJ-series CPU Units.

7-2-3 System Configuration

Connected to a CPU Unit

The system configuration that you use to connect a Heater Burnout Detection Unit and Temperature Input Unit to an NX-series NX1P2 CPU Unit is shown in the following figure.

Refer to the user's manual for the connected CPU Unit for details on how to configure the system if the connected CPU Unit is not an NX1P2 CPU Unit.



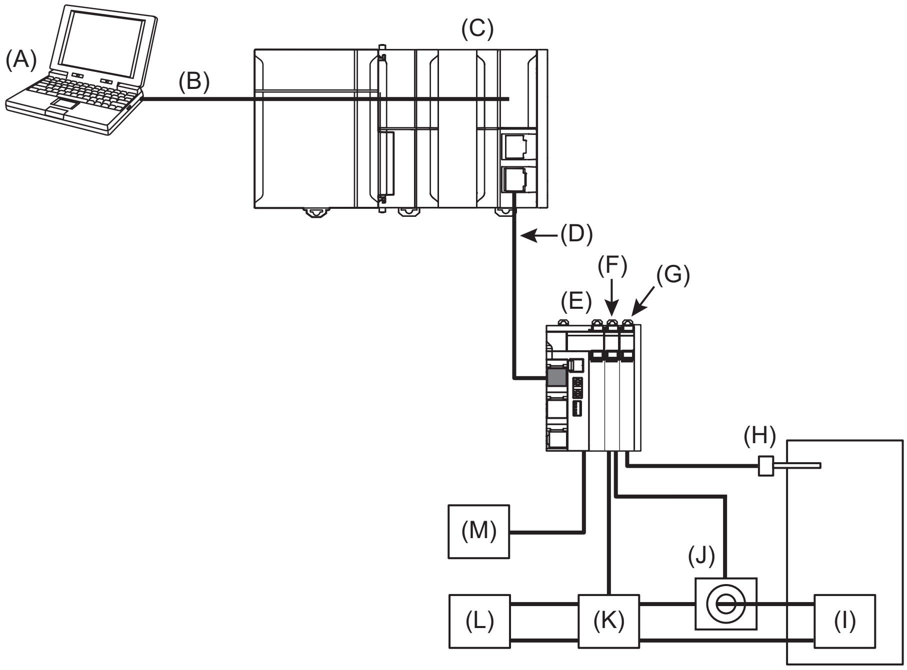
Letter	Description
(A)	Support Software (Sysmac Studio)
(B)	Connection to built-in EtherNet/IP port on NX-series NX1P2 CPU Unit
(C)	Unit power supply
(D)	NX-series NX1P2 CPU Unit
(E)	Additional I/O Power Supply Unit (NX-PF□□□□)
(F)	Heater Burnout Detection Unit (NX-HB□□□□)
(G)	Temperature Input Unit (NX-TS□□□□)
(H)	Temperature sensor
(I)	Heater
(J)	CT (E54-CT or E54-CT3)
(K)	SSR*1
(L)	Heater power supply
(M)	I/O power supply

*1. The SSR is used to turn the heater ON and OFF.

Connected to a Communications Coupler Unit

The system configuration that you use to connect a Heater Burnout Detection Unit and Temperature Input Unit to an EtherCAT Coupler Unit and combine these with an NJ/NX/NY-series Controller is shown in the following figure.

Refer to the user's manual for the connected Communications Coupler Unit for information on how to configure the system when any other type of Communications Coupler Unit is used.



Letter	Description
(A)	Sysmac Studio Support Software
(B)	Connection to peripheral USB port or built-in EtherNet/IP port on NJ/NX-series CPU Unit or NY-series Industrial PC*1
(C)	EtherCAT master (NJ/NX-series CPU Unit or NY-series Industrial PC)
(D)	EtherCAT communications cable
(E)	EtherCAT Coupler Unit (NX-ECC□□□)
(F)	Heater Burnout Detection Unit (NX-HB□□□□)
(G)	Temperature Input Unit (NX-TS□□□□)
(H)	Temperature sensor
(I)	Heater
(J)	CT (E54-CT or E54-CT3)
(K)	SSR*2
(L)	Heater power supply
(M)	Unit power supply and I/O power supply

*1. The connection method for the Sysmac Studio depends on the model of the CPU Unit or Industrial PC.

*2. The SSR is used to turn the heater ON and OFF.

7-3 Operating Procedure

This section describes the basic operating procedures to use the Sysmac Studio for an NJ/NX/NY-series Controller. Refer to the user's manual for the connected CPU Unit or Communications Coupler Unit for the application procedures and setting download method for the connected CPU Unit or Slave Terminal.

For Support Software other than the Sysmac Studio, refer to the operation manual for the Support Software that you are using.

Step	Item		Description	Reference
1	Unit Registration and I/O Allocation Settings		Create a project in the Sysmac Studio. Register the Heater Burnout Detection Unit and Temperature Input Unit offline. Set the I/O allocations.	• *6-3 Specifications of I/O Data* on page 6-6 • *7-4 Specifications of I/O Data* on page 7-11
2	Unit Operation Settings	Temperature Input Unit	Create the Unit operation settings for the Temperature Input Unit according to the Unit functions that you will use.	*6-5 Functions* on page 6-18
		Heater Burnout Detection Unit	Create the Unit operation settings for the Heater Burnout Detection Unit according to the Unit functions that you will use. Calculate and set the heater burnout detection currents and SSR failure detection currents.	• *7-6 Functions* on page 7-20 • *7-7 CT Installation and Alarm Current Calculation* on page 7-45
3	Creating the User Program		Create the user program with the Sysmac Studio. You can use the PIDAT instruction and other analog control instructions.	User's manuals for the connected CPU Unit or Industrial PC
4	Installing Units		Attach the Heater Burnout Detection Unit and Temperature Input Unit to the CPU Unit or Communications Coupler Unit.	*4-1 Installing NX Units* on page 4-2
5	Wiring the Unit		Wire the Heater Burnout Detection Unit and Temperature Input Unit.	• *4-2 Power Supply Types and Wiring* on page 4-9 • *4-3 Wiring the Terminals* on page 4-12 • *4-4 Wiring Examples* on page 4-31
6	Downloading Unit Settings and User Program		Turn ON the power supply to the CPU Rack or Slave Terminal and download the Unit settings that you created on the Sysmac Studio to the Heater Burnout Detection Unit and Temperature Input Unit. Also download the user program to the CPU Unit or Industrial PC.	• *6-5 Functions* on page 6-18 • *7-6 Functions* on page 7-20 • User's manual for the connected CPU Unit or Communications Coupler Unit
7	Checking Operation		Execute the following and check the operation of each Unit. • Use the Sysmac Studio to check the wiring by reading the input data and writing output data for the Units. • Check that the Unit settings and user program are running correctly. • In the I/O data, check the heater current, leakage current, and Alarm Status in both normal and error status. Adjust the heater burnout detection current and SSR failure detection current set values as necessary.	• *4-3-2 Checking the Wiring* on page 4-30 • *6-5 Functions* on page 6-18 • *7-6 Functions* on page 7-20 • *7-4 Specifications of I/O Data* on page 7-11

7-4 Specifications of I/O Data

This section describes the I/O data for the Heater Burnout Detection Unit.

7-4-1 Allocatable I/O Data

In the I/O allocation settings for the Heater Burnout Detection Unit, two I/O entry mappings are assigned for inputs and two I/O entry mappings are assigned for outputs. The I/O entries for the Heater Burnout Detection Unit are assigned to the I/O entry mappings.

The I/O entries used for I/O data are described in this section. An I/O entry mapping means a collection of I/O entries.

In the Heater Burnout Detection Unit, I/O entry mapping allocations are fixed and cannot be changed. Some I/O entries are fixed in the I/O entry mappings and other I/O entries can be added, deleted, or changed.

The I/O entry mappings in the Heater Burnout Detection Unit are described in the following table.

I/O	I/O entry mapping name	I/O entries		
		Editing	Maximum entries	Maximum size [bytes]
Outputs	Output Data Set 1	Not possible.	4	16
	Output Data Set 2	Not possible.	1	2
Inputs	Input Data Set 1	Possible.	20	56
	Input Data Set 2	Not possible.	1	2

To assign the I/O allocation information of the NX Unit or Slave Terminal to an NJ/NX-series CPU Unit or NY-series Industrial PC, use the I/O ports for the allocated I/O data.

However, with a Slave Terminal, an I/O port is not used for some communications masters or Communications Coupler Units.

Refer to the user's manual for the connected Communications Coupler Unit for the I/O data application procedures for the Slave Terminal.

Additional Information

To access data to which I/O is not allocated, use instructions or other messages to access the NX objects.
The method to access NX objects through instructions or other messages depends on where the NX Unit is connected.
If the NX Unit is connected to a CPU Unit, access is possible with the Read NX Unit Object instruction and the Write NX Unit Object instruction of the NJ/NX-series Controller.
When the NX Unit is connected to a Communications Coupler Unit, the method depends on the connected Communications Coupler Unit or communications master.
Refer to the user's manual for the connected Communications Coupler Unit for method to use messages to access NX objects on Slave Terminals. For the index numbers and subindex numbers of NX objects, refer to *A-3-3 Heater Burnout Detection Units* on page A-55.

Output Data Set 1

Data name	Description	Data type	Default	I/O port name	Registered by default	Index	Subindex
Out1 Manipulated Variable REAL	This is the REAL manipulated variable that is specified for Out1. The unit is %.	REAL	0	Out1 Manipulated Variable REAL	Yes	7000 hex	01 hex
Out2 Manipulated Variable REAL	This is the REAL manipulated variable that is specified as Out2. The unit is %.	REAL	0	Out2 Manipulated Variable REAL			02 hex
Out3 Manipulated Variable REAL	This is the REAL manipulated variable that is specified for Out3. The unit is %.	REAL	0	Out3 Manipulated Variable REAL			03 hex
Out4 Manipulated Variable REAL	This is the REAL manipulated variable that is specified for Out4. The unit is %.	REAL	0	Out4 Manipulated Variable REAL			04 hex

The range of data that you can set for Out☐ Manipulated Variable REAL is as follows:

- 0 to 100

If the manipulated variable is a negative value, the manipulated variable will be treated as 0%.

If the manipulated variable exceeds 100%, the manipulated variable will be treated as 100%.

If the data type of the manipulated variable of the connected Controller is not REAL, convert the data type to REAL in the user program.

Output Data Set 2

Data name	Description	Data type	Default	I/O port name	Registered by default	Index	Subindex
Immediate Output Command	This word contains all of the immediate output command bits for the control outputs.*1	WORD	0000 hex	Immediate Output Command	Yes	7001 hex	01 hex

*1. Details on the Immediate Output Command are provided in the following table.

Bit	Data name	Function*1	Data type	I/O port name
0	Out1 Immediate Output Command	Gives the execution status of the Out1 immediate output command. 1: Execute the Out1 immediate output command. 0: Do not execute the Out1 immediate output command.	BOOL	Out1 Immediate Output Command
1	Out2 Immediate Output Command	Gives the execution status of the Out2 immediate output command. 1: Execute the Out2 immediate output command. 0: Do not execute the Out2 immediate output command.	BOOL	Out2 Immediate Output Command
2	Out3 Immediate Output Command	Gives the execution status of the Out3 immediate output command. 1: Execute the Out3 immediate output command. 0: Do not execute the Out3 immediate output command.	BOOL	Out3 Immediate Output Command
3	Out4 Immediate Output Command	Gives the execution status of the Out4 immediate output command. 1: Execute the Out4 immediate output command. 0: Do not execute the Out4 immediate output command.	BOOL	Out4 Immediate Output Command
4 to 15	Reserved	---	---	---

*1. A 1 indicates TRUE and a 0 indicates FALSE.

Input Data Set 1

Data name	Description	Data type	Default	I/O port name	Registered by default	Index	Subindex
CT1 Alarm Status	This word contains all of the alarm status for CT1.*1	WORD	0000 hex	CT1 Alarm Status	Yes	6000 hex	01 hex
CT2 Alarm Status	This word contains all of the alarm status for CT2.*1	WORD	0000 hex	CT2 Alarm Status			02 hex
CT3 Alarm Status	This word contains all of the alarm status for CT3.*1	WORD	0000 hex	CT3 Alarm Status			03 hex
CT4 Alarm Status	This word contains all of the alarm status for CT4.*1	WORD	0000 hex	CT4 Alarm Status			04H hex
CT1 Heater Current REAL	The REAL heater current for CT1. The unit is amperes.	REAL	0	CT1 Heater Current REAL	Yes	6001 hex	01 hex
CT2 Heater Current REAL	The REAL heater current for CT2. The unit is amperes.	REAL	0	CT2 Heater Current REAL			02 hex
CT3 Heater Current REAL	The REAL heater current for CT3. The unit is amperes.	REAL	0	CT3 Heater Current REAL			03 hex
CT4 Heater Current REAL	The REAL heater current for CT4. The unit is amperes.	REAL	0	CT4 Heater Current REAL			04 hex
CT1 Leakage Current REAL	The REAL leakage current for CT1. The unit is amperes.	REAL	0	CT1 Leakage Current REAL	Yes	6002 hex	01 hex
CT2 Leakage Current REAL	The REAL leakage current for CT2. The unit is amperes.	REAL	0	CT2 Leakage Current REAL			02 hex
CT3 Leakage Current REAL	The REAL leakage current for CT3. The unit is amperes.	REAL	0	CT3 Leakage Current REAL			03 hex
CT4 Leakage Current REAL	The REAL leakage current for CT4. The unit is amperes.	REAL	0	CT4 Leakage Current REAL			04 hex

Data name	Description	Data type	Default	I/O port name	Regis-tered by default	Index	Subin-dex
CT1 Heater Current UINT	The UINT heater current for CT1. The unit is 0.1 A.	UINT	0	CT1 Heater Cur-rent UINT		6003 hex	01 hex
CT2 Heater Current UINT	The UINT heater current for CT2. The unit is 0.1 A.	UINT	0	CT2 Heater Cur-rent UINT			02 hex
CT3 Heater Current UINT	The UINT heater current for CT3. The unit is 0.1 A.	UINT	0	CT3 Heater Cur-rent UINT			03 hex
CT4 Heater Current UINT	The UINT heater current for CT4. The unit is 0.1 A.	UINT	0	CT4 Heater Cur-rent UINT			04 hex
CT1 Leakage Current UINT	The UINT leakage current for CT1. The unit is 0.1 A.	UINT	0	CT1 Leakage Current UINT		6004 hex	01 hex
CT2 Leakage Current UINT	The UINT leakage current for CT2. The unit is 0.1 A.	UINT	0	CT2 Leakage Current UINT			02 hex
CT3 Leakage Current UINT	The UINT leakage current for CT3. The unit is 0.1 A.	UINT	0	CT3 Leakage Current UINT			03 hex
CT4 Leakage Current UINT	The UINT leakage current for CT4. The unit is 0.1 A.	UINT	0	CT4 Leakage Current UINT			04 hex

*1. Details on the CT☐ Alarm Status are provided in the following table. The box in CT☐ represents the CT input number.

Bit	Data name	Function*1	Data type	I/O port name
0	CT☐ Heater Burnout Detection	Indicates whether a heater burnout occurred for CT☐. 1: A heater burnout occurred. 0: A heater burnout did not occur.	BOOL	CT☐ Heater Burnout Detec-tion
1	CT☐ SSR Failure Detection	Indicates whether an SSR failure occurred for CT☐. 1: An SSR failure occurred. 0: An SSR failure did not occur.	BOOL	CT☐ SSR Fail-ure Detection
2 to 15	Reserved	---	---	---

*1. A 1 indicates TRUE and a 0 indicates FALSE.

● Input Data Set 2

Data name	Description	Data type	Default	I/O port name	Regis-tered by default	Index	Subin-dex
Control Out-put Status	This word contains the ON/OFF sta-tus for all of the control outputs that are controlled as time-proportional outputs.*1	WORD	00 hex	Control Output Status	Yes	6005 hex	01 hex

*1. Detailed Control Output Status is described in the following table.

Bit	Data name	Function[*1]	Data type	I/O port name
0	Out1 Control Output Status	Indicates the ON/OFF status of the Out1 control output controlled as a time-proportional output. 1: Out1 is ON. 0: Out1 is OFF.	BOOL	Out1 Control Output Status
1	Out2 Control Output Status	Indicates the ON/OFF status of the Out2 control output controlled as a time-proportional output. 1: Out2 is ON. 0: Out2 is OFF.	BOOL	Out2 Control Output Status
2	Out3 Control Output Status	Indicates the ON/OFF status of the Out3 control output controlled as a time-proportional output. 1: Out3 is ON. 0: Out3 is OFF.	BOOL	Out3 Control Output Status
3	Out4 Control Output Status	Indicates the ON/OFF status of the Out4 control output controlled as a time-proportional output. 1: Out4 is ON. 0: Out4 is OFF.	BOOL	Out4 Control Output Status
4 to 15	Reserved	---	---	---

*1. A 1 indicates TRUE and a 0 indicates FALSE.

7-5 List of Settings

This sections describes the settings, setting ranges, and default values of the functions that you can use in the Heater Burnout Detection Unit.

If you change any parameter that does not change until after the Unit is restarted, restart the NX Unit.

The settings are reflected after the Unit is restarted.

It is not necessary to restart the NX Unit for parameters that are updated immediately. The settings are updated immediately after the new settings are transferred even if the NX Unit is not restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

Setting name	Description	Default	Setting range	Unit	Index	Subindex	Update timing	Reference
CT1 Allocation	Set the control output to allocate to CT1.	OUT1	OUT1, OUT2, OUT3, OUT4, or Do not use	---	5000 hex	01 hex	After the Unit is restarted	*7-6-2 CT Allocation* on page 7-21
CT2 Allocation	Set the control output to allocate to CT2.	OUT2		---		02 hex		
CT3 Allocation	Set the control output to allocate to CT3.	OUT3		---		03 hex		
CT4 Allocation	Set the control output to allocate to CT4.	OUT4		---		04 hex		
CT1 Heater Burnout Detection Current	Set the heater burnout detection current for CT1.	0	0 to 50	A	5001 hex	01 hex	Immediately	*7-6-4 Heater Burnout Detection* on page 7-26
CT2 Heater Burnout Detection Current	Set the heater burnout detection current for CT2.	0		A		02 hex		
CT3 Heater Burnout Detection Current	Set the heater burnout detection current for CT3.	0		A		03 hex		
CT4 Heater Burnout Detection Current	Set the heater burnout detection current for CT4.	0		A		04 hex		

Setting name	Description	Default	Setting range	Unit	Index	Subindex	Update timing	Reference
CT1 SSR Failure Detection Current	Set the SSR failure detection current for CT1.	50	0 to 50	A	5002 hex	01 hex	Immediately	*7-6-5 SSR Failure Detection* on page 7-30
CT2 SSR Failure Detection Current	Set the SSR failure detection current for CT2.	50		A		02 hex		
CT3 SSR Failure Detection Current	Set the SSR failure detection current for CT3.	50		A		03 hex		
CT4 SSR Failure Detection Current	Set the SSR failure detection current for CT4.	50		A		04 hex		
Out1 Control Period	Set the control period for the time-proportional output on Out1.	2,000	50 to 100,000	ms	5003 hex	01 hex	After the Unit is restarted	*7-6-6 Time-proportional Output* on page 7-33
Out2 Control Period	Set the control period for the time-proportional output on Out2.	2,000	50 to 100,000	ms		02 hex		
Out3 Control Period	Set the control period for the time-proportional output on Out3.	2,000	50 to 100,000	ms		03 hex		
Out4 Control Period	Set the control period for the time-proportional output on Out4.	2,000	50 to 100,000	ms		04 hex		
Out1 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out1.	0	0 to 50	%	5004 hex	01 hex		
Out2 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out2.	0	0 to 50	%		02 hex		
Out3 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out3.	0	0 to 50	%		03 hex		
Out4 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out4.	0	0 to 50	%		04 hex		

Setting name	Description	Default	Setting range	Unit	Index	Subin-dex	Update timing	Reference
Out1 Hold Value Setting	Set the output value at load rejection for Out1.	User-specified Value Output	User-specified Value Output or Hold Output	---	5005 hex	01 hex	After the Unit is restarted	*7-6-7 Load Rejection Output Settings* on page 7-40
Out2 Hold Value Setting	Set the output value at load rejection for Out2.	User-specified Value Output	User-specified Value Output or Hold Output	---		02 hex		
Out3 Hold Value Setting	Set the output value at load rejection for Out3.	User-specified Value Output	User-specified Value Output or Hold Output	---		03 hex		
Out4 Hold Value Setting	Set the output value at load rejection for Out4.	User-specified Value Output	User-specified Value Output or Hold Output	---		04 hex		
Out1 User-specified Value Setting	Set the value to output when the Out1 Hold Value Setting is set to output a user-specified value.	0	0 to 100	%	5006 hex	01 hex		
Out2 User-specified Value Setting	Set the value to output when the Out2 Hold Value Setting is set to output a user-specified value.	0	0 to 100	%		02 hex		
Out3 User-specified Value Setting	Set the value to output when the Out3 Hold Value Setting is set to output a user-specified value.	0	0 to 100	%		03 hex		
Out4 User-specified Value Setting	Set the value to output when the Out4 Hold Value Setting is set to output a user-specified value.	0	0 to 100	%		04 hex		

7-6 Functions

This section describes the functions of the Heater Burnout Detection Units.

7-6-1 List of Functions

Function name	Description	Reference
Free-Run Refreshing	With this I/O refreshing method, the refresh cycle of the NX bus and I/O refresh cycles of the NX Units are asynchronous.	*5-2-4 Free-Run Refreshing* on page 5-9
CT Allocation	This function is used to assign each CT input to a corresponding control output.	*7-6-2 CT Allocation* on page 7-21
CT Current Reading	This function reads CT inputs as heater currents or leakage currents.	*7-6-3 Reading CT Currents* on page 7-25
Heater Burnout Detection	This function detects heater burnouts. A heater burnout is detected if the control output is ON and the heater current is equal to or less than the heater burnout detection current.	*7-6-4 Heater Burnout Detection* on page 7-26
SSR Failure Detection	This function detects SSR failures. An SSR failure is detected if the control output is OFF and the leakage current is equal to or greater than the detection current. An SSR failure is a failure that is caused by an SSR short-circuit.	*7-6-5 SSR Failure Detection* on page 7-30
Time-proportional Output	This function controls a control output by using the manipulated variable from the controller as a duty ratio. You can also specify the minimum pulse widths and execute immediate output commands.	*7-6-6 Time-proportional Output* on page 7-33
Load Rejection Output Setting	A function that performs the preset output operation when the Heater Burnout Detection Unit cannot receive output data due to an NX bus error or CPU Unit watchdog timer error, in the case of Units connected to a CPU Unit. A function that performs the preset output operation when the Heater Burnout Detection Unit cannot receive output data due to a host error on the Communications Coupler Unit or an error on the NX bus, in the case of Slave Terminals.	*7-6-7 Load Rejection Output Settings* on page 7-40
Load Short-circuit Protection	This function is used to protect the output circuits of the Heater Burnout Detection Unit when an external device short-circuits. This function is supported only by the NX-HB3201.	*7-6-8 Load Short-circuit Protection* on page 7-43

7-6-2 CT Allocation

Purpose

This function is used to assign each CT input to a corresponding control output.

Details on the Function

- The Unit reads heater currents and leakage currents from the CT inputs based on the ON/OFF timing of the control outputs that you allocate to those CT inputs. Also, the Unit performs heater burnout detection and SSR failure detection.
- You can allocate multiple CT inputs to one control output. Also, you do not have to allocate a CT input to a control output. If you do not allocate a CT input to a control output, the Unit will not read the heater current and leakage current of that CT input. The current will be 0. The Unit will also not perform heater burnout detection and SSR failure detection for the CT input.
- You can allocate one CT input to one control output to perform heater burnout detection and SSR failure detection for a single-phase heater.
- You can allocate two CT inputs to one control output to perform heater burnout detection and SSR failure detection for a three-phase heater.

Precautions for Correct Use

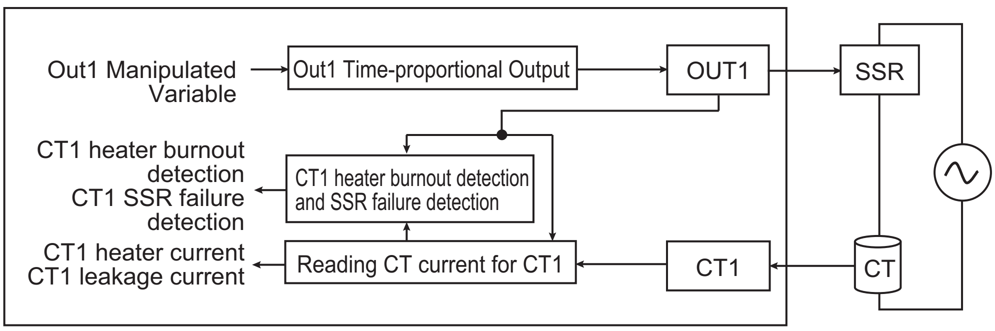
If you do not allocate a CT input to a control output, set the parameter to *Do not use*. If you allocate any of the following CTs as the input to a control output and output a signal on that control output, it may result in incorrect detection of a heater burnout or SSR failure.

- A CT that is not connected
- A CT that is connected but for which no heater wire passes through the CT

Examples of the allocation of CT inputs to control outputs are given below.

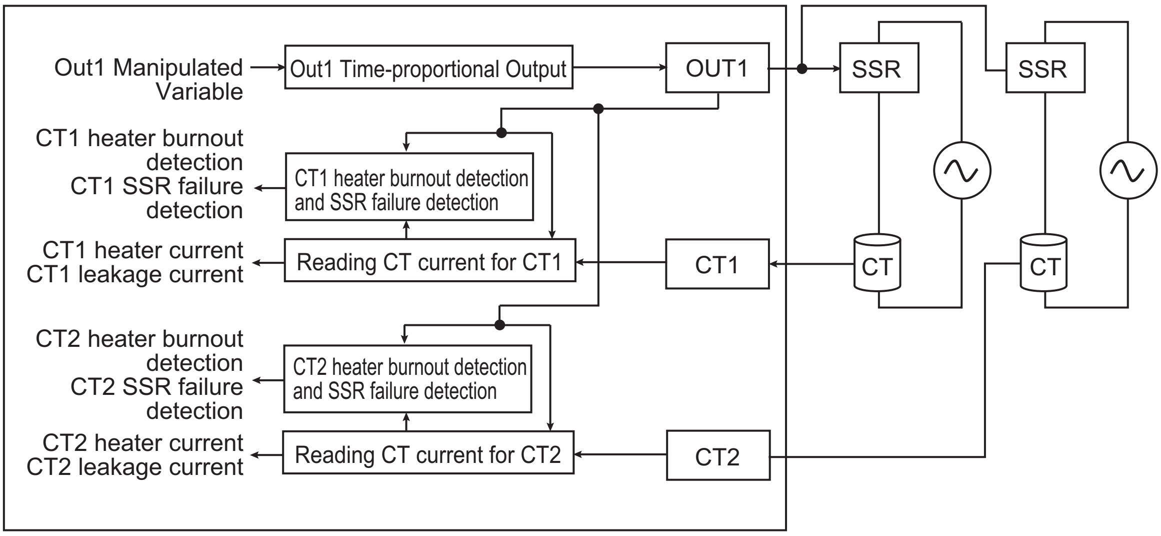
(a) Allocating CT1 to OUT1

The Unit reads the heater current and leakage current of CT1 based on the ON/OFF timing of OUT1. Also, the Unit performs heater burnout detection and SSR failure detection.



(b) Allocating CT1 and CT2 to OUT1

The Unit reads the heater currents and leakage currents of CT1 and CT2 based on the ON/OFF timing of OUT1. Also, the Unit performs heater burnout detection and SSR failure detection.



Settings

Setting name	Description	Default	Setting range	Unit
CT1 Allocation	Set the control output to allocate to CT1.	OUT1	OUT1, OUT2, OUT3, OUT4, or Do not use	---
CT2 Allocation	Set the control output to allocate to CT2.	OUT2		---
CT3 Allocation	Set the control output to allocate to CT3.	OUT3		---
CT4 Allocation	Set the control output to allocate to CT4.	OUT4		---

Setting Method

This section gives the setting method with the Sysmac Studio.

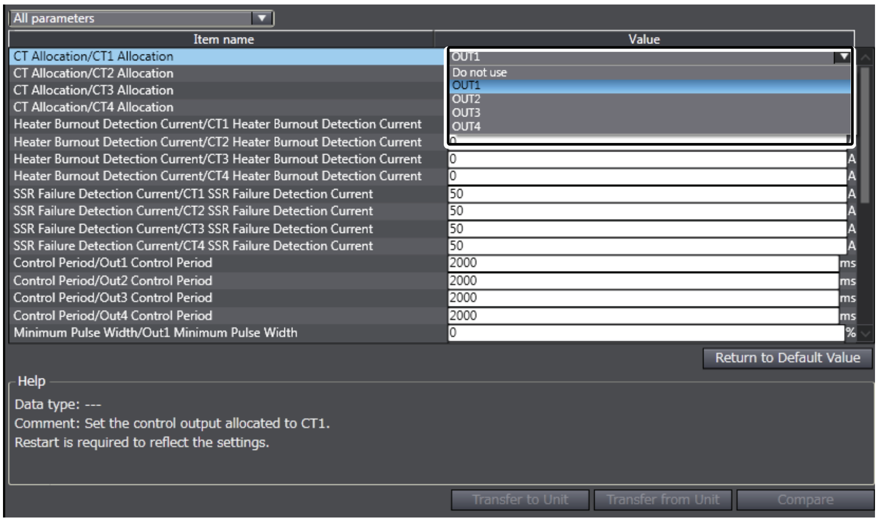
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

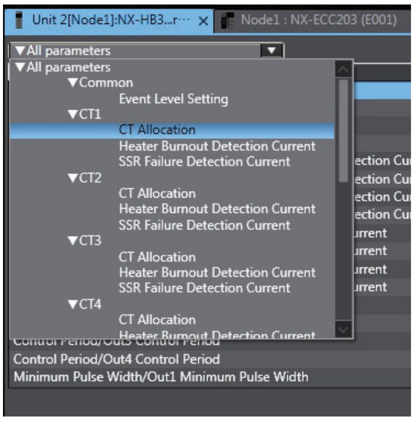
2 Select *Do not use*, *OUT1*, *OUT2*, *OUT3*, or *OUT4* from the CT☐ allocation list for the CT input that you want to set (CT☐).



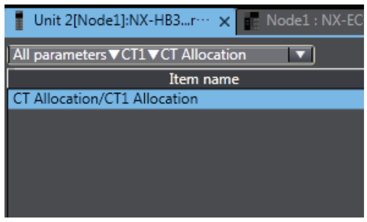
Additional Information

- You can click the list button on the Edit Unit Operation Settings Tab Page to restrict the items that are displayed. The following screen captures show an example of displaying only the CT allocation for CT1.

  Example:



Select *CT Allocation* for *CT1*.

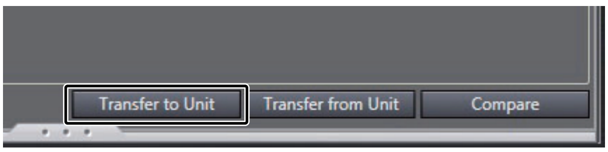


The CT allocation is displayed for only CT1.

- If you set a value different from the default value, the value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

7-6-3 Reading CT Currents

Purpose

This function reads CT inputs as heater currents or leakage currents.

Details on the Function

- The Unit updates the heater currents while the control output is ON. (Refer to (a) in the following figure.)

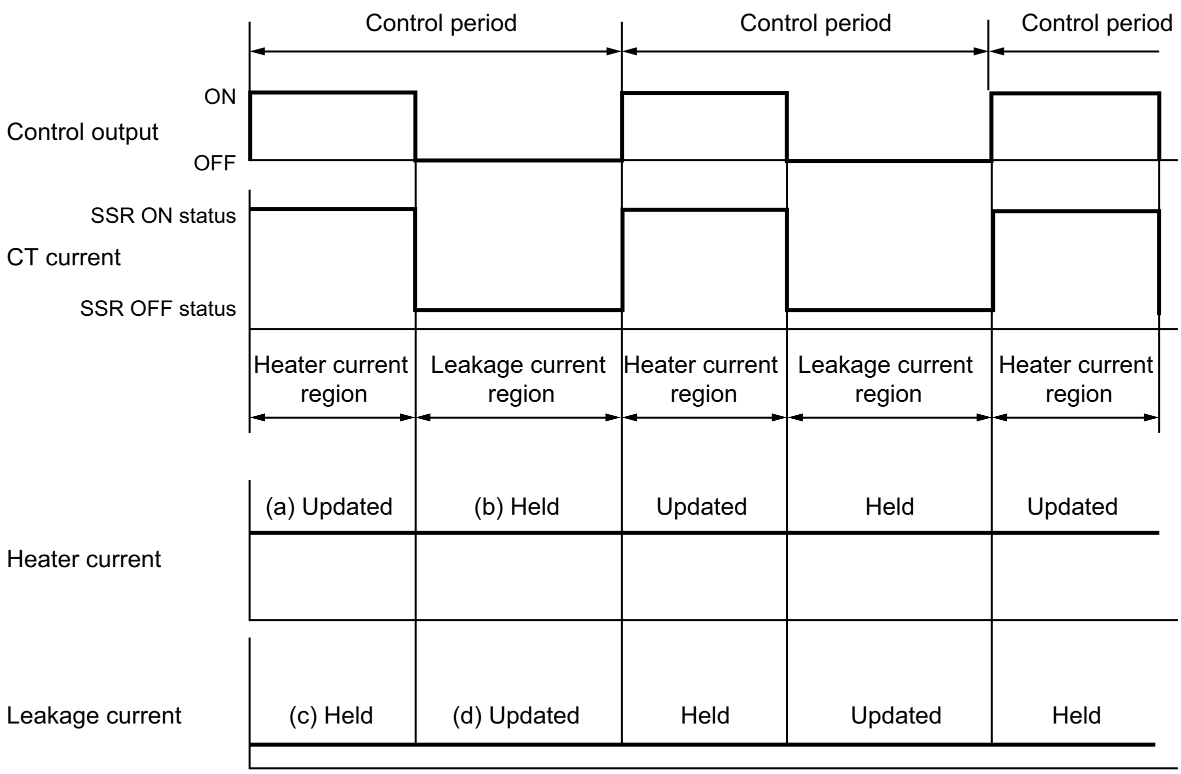
  While the control output is OFF, the Unit holds the most recently updated value. (Refer to (b) in the following figure.)

  Confirm heater currents with *CT□ Heater Current REAL* or *CT□ Heater Current UINT* for I/O data.
- The Unit updates the leakage currents while the control output is OFF. (Refer to (d) in the following figure.)

  While the control output is ON, the Unit holds the most recently updated value. (Refer to (c) in the following figure.)

  Confirm leakage currents with *CT□ Leakage Current REAL* or *CT□ Leakage Current UINT* for I/O data.
- If a heater current or leakage current exceeds the rated current of 55 A, the values are clamped at 55 A.

Refer to *7-4-1 Allocatable I/O Data* on page 7-11 for details on I/O data.



Setting Method

No setting is required.

7-6-4 Heater Burnout Detection

Purpose

This function detects heater burnouts. A heater burnout is detected if the control output is ON and the heater current is equal to or less than the heater burnout detection current.

Details on the Function

- While a control output with a CT input allocation is ON, the Unit reads the heater current from that CT input and performs heater burnout detection. The Unit determines that a heater burnout occurred if the control output is ON and the heater current becomes equal to or less than the set value of the Heater Burnout Detection Current. (Refer to (a) in the following figure.) However, if control output is ON for less than 30 ms, the Unit will not perform heater burnout detection.
- If a heater burnout occurs, the Heater Burnout Detection Bit in the Alarm Status for the relevant CT input will turn ON and a Heater Burnout Detected event (event code: 652C0000 hex) will occur.

  Refer to *7-4-1 Allocatable I/O Data* on page 7-11 for details on the Alarm Status. Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for details on events.
- Even if a heater burnout occurs, the Unit continues to perform control outputs and read the CT currents. (Refer to (b) in the following figure.)
- If the following condition is met after the Unit detects a heater burnout, the Unit will determine that the cause of the error has been eliminated.

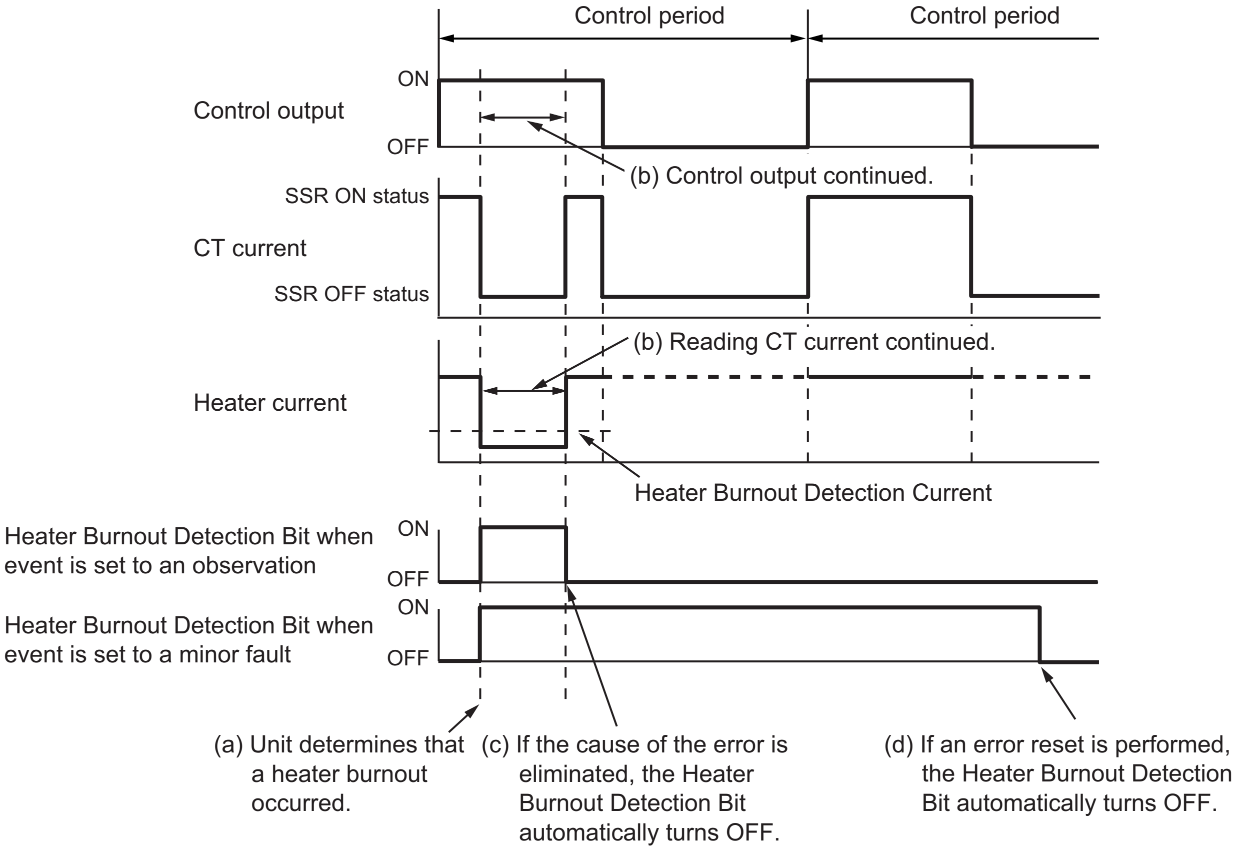
  Heater current ≥ Heater burnout detection current + 0.1 A

  However, if the Heater Burnout Detection Current is set to 50 A, the Unit will determine that the cause of the error has been eliminated if the following condition is met.

  Heater current ≥ Heater burnout detection current
- The operation of the Heater Burnout Detection Bit depends on the event level setting for the Heater Burnout Detected event. The operation is described in the following table.

Event level setting	Operation of Heater Burnout Detection Bit
Observation	Even if you do not reset the error, the Heater Burnout Detection Bit will automatically turn OFF when the cause of the error is eliminated. (Refer to (c) in the following figure.)
Minor fault	If only the cause of the error is eliminated, the Heater Burnout Detection Bit remains ON. The Heater Burnout Detection Bit will turn OFF when the error is reset. (Refer to (d) in the following figure.)

Refer to the user's manual for the connected CPU Unit or Communications Coupler Unit for information on how to set event levels. Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for information on events for the Heater Burnout Detection Unit that have changeable event levels.


Control period
Control period
ON
Control output
OFF
(b) Control output continued.
SSR ON status
CT current
SSR OFF status
(b) Reading CT current continued.
Heater current
Heater Burnout Detection Current
Heater Burnout Detection Bit when event is set to an observation
ON
OFF
Heater Burnout Detection Bit when event is set to a minor fault
ON
OFF
(a) Unit determines that a heater burnout occurred.
(c) If the cause of the error is eliminated, the Heater Burnout Detection Bit automatically turns OFF.
(d) If an error reset is performed, the Heater Burnout Detection Bit automatically turns OFF.

Settings

Setting name	Description	Default	Setting range	Unit
CT1 Heater Burnout Detection Current	Set the heater burnout detection current for CT1.	0	0 to 50	A
CT2 Heater Burnout Detection Current	Set the heater burnout detection current for CT2.	0	0 to 50	A
CT3 Heater Burnout Detection Current	Set the heater burnout detection current for CT3.	0	0 to 50	A
CT4 Heater Burnout Detection Current	Set the heater burnout detection current for CT4.	0	0 to 50	A

Precautions When You Change Set Values

If you adjust the set value of a Heater Burnout Detection Current or SSR Failure Detection Current in the actual system, change the set values of only these settings and transfer them to the Unit. If you change the set values of any other settings and transfer them to the Unit, you must restart the Unit.

Setting Method

This section gives the setting method with the Sysmac Studio.

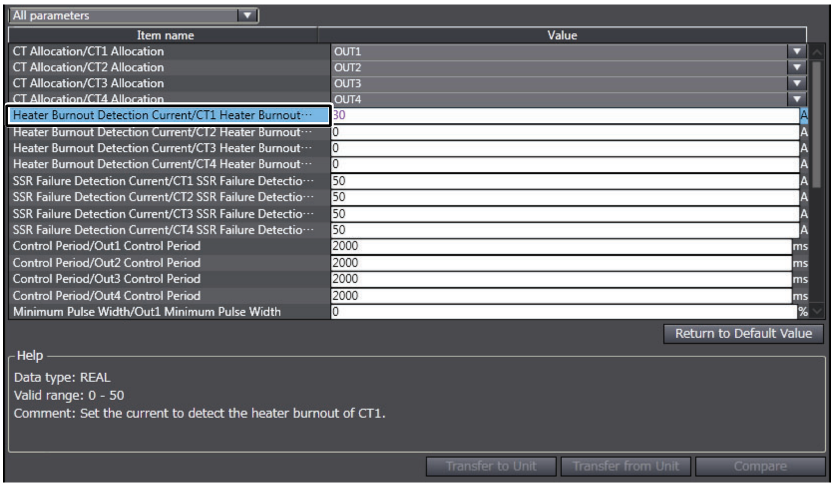
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

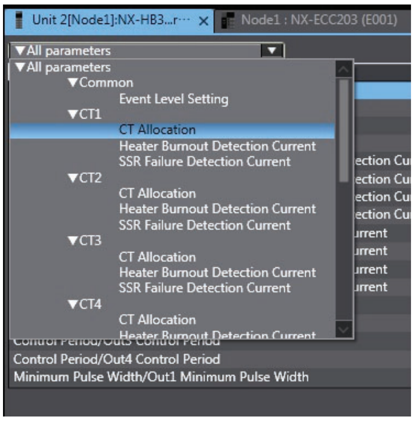
2 Enter the heater burnout detection current in the **Heater Burnout Detection Current** Box for the CT input you want to set (CT☐).



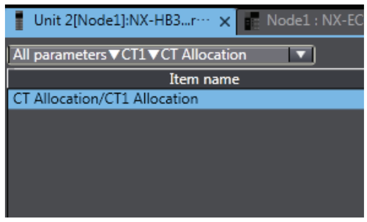
Additional Information

- You can click the list button on the Edit Unit Operation Settings Tab Page to restrict the items that are displayed. The following screen captures show an example of displaying only the CT allocation for CT1.

  Example:



Select *CT Allocation* for *CT1*.

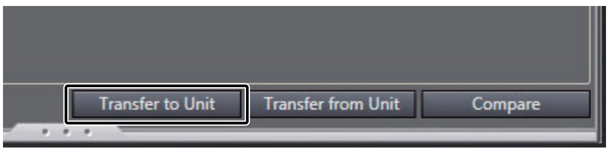


The CT allocation is displayed for only CT1.

- If you set a value different from the default value, the value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit. Any settings that you change apply immediately.*1



*1. If you change the set values of only the Heater Burnout Detection Currents and SSR Failure Detection Currents and transfer them, the new set values will be used even if the Unit is not restarted. However, if you also transfer the set values of other settings, a restart will occur when the set values are transferred.

7-6-5 SSR Failure Detection

Purpose

This function detects SSR failures. An SSR failure is detected if the control output is OFF and the leakage current is equal to or greater than the detection current. An SSR failure is a failure that is caused by an SSR short-circuit.

Details on the Function

- While a control output with a CT input allocation is OFF, the Unit reads the leakage current from that CT input and performs SSR failure detection. The Unit determines that an SSR failure occurred if the control output is OFF and the leakage current is equal to or greater than the set value of the SSR Failure Detection Current. (Refer to (a) in the following figure.) However, if control output is OFF for less than 35 ms, the Unit will not perform SSR failure detection.
- If an SSR failure occurs, the SSR Failure Detection Bit in the Alarm Status for the relevant CT input will turn ON and an SSR Failure Detected event (event code: 652D0000 hex) will occur.

  Refer to *7-4-1 Allocatable I/O Data* on page 7-11 for details on the Alarm Status. Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for details on events.
- Even if an SSR failure occurs, the Unit continues to perform control outputs and read CT currents. (Refer to (b) in the following figure.)
- If the following condition is met after the Unit detects an SSR failure, the Unit will determine that the cause of the error has been eliminated.

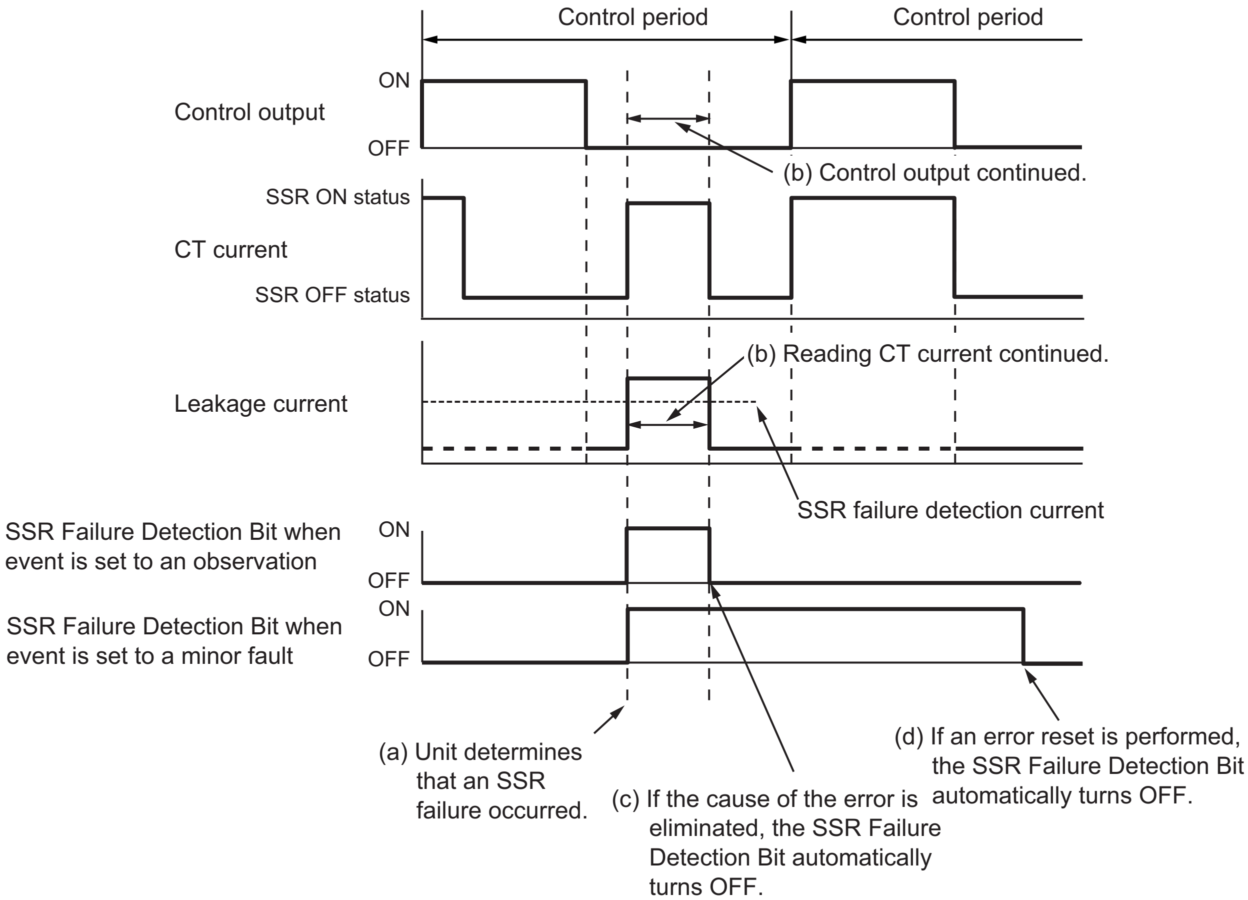
  Leakage current ≤ SSR failure detection current - 0.1 A

  If you set the SSR failure detection current to 0 A, the SSR Failure Detection Bit will automatically turn OFF if the following condition is met.

  Leakage current ≤ SSR failure detection current
- The operation of the SSR Failure Detection Bit depends on the event level setting for the SSR Failure Detected event. The operation is described in the following table.

Event level setting	Operation of SSR Failure Detection Bit
Observation	Even if you do not reset the error, the SSR Failure Detection Bit will automatically turn OFF when the cause of the error is eliminated. (Refer to (c) in the following figure.)
Minor fault	If only the cause of the error is eliminated, the SSR Failure Detection Bit remains ON. The SSR Failure Detection Bit will turn OFF when the error is reset. (Refer to (d) in the following figure.)

Refer to the user's manual for the connected CPU Unit or Communications Coupler Unit for information on how to set event levels. Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for information on events for the Heater Burnout Detection Unit that have changeable event levels.



Settings

Setting name	Description	Default	Setting range	Unit
CT1 SSR Failure Detection Current	Set the SSR failure detection current for CT1.	50	0 to 50	A
CT2 SSR Failure Detection Current	Set the SSR failure detection current for CT2.	50	0 to 50	A
CT3 SSR Failure Detection Current	Set the SSR failure detection current for CT3.	50	0 to 50	A
CT4 SSR Failure Detection Current	Set the SSR failure detection current for CT4.	50	0 to 50	A

Precautions When You Change Set Values

If you adjust the set value of a Heater Burnout Detection Current or SSR Failure Detection Current in the actual system, change the set values of only these settings and transfer them to the Unit. If you change the set values of any other settings and transfer them to the Unit, you must restart the Unit.

Setting Method

This section gives the setting method with the Sysmac Studio.

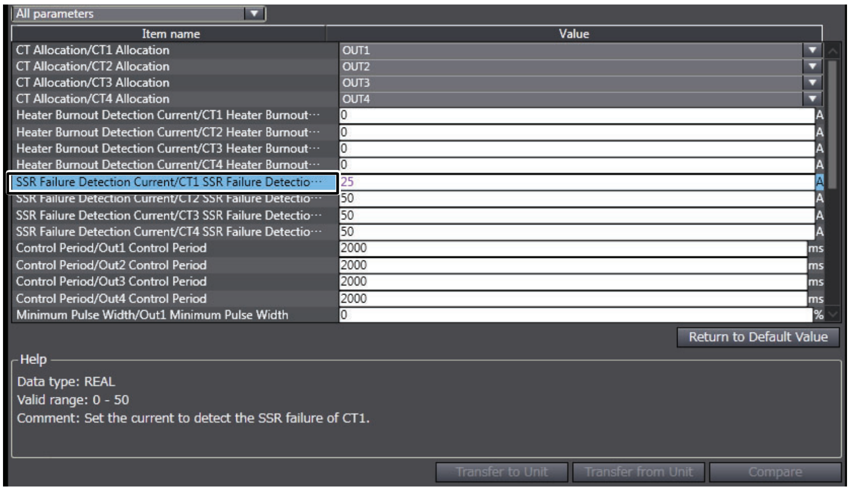
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

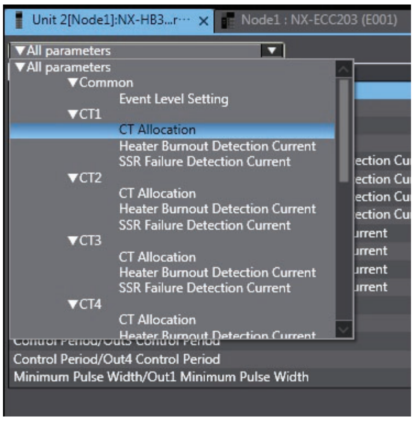
2 Enter the SSR failure detection current in the **SSR Failure Detection Current** Box for the CT input you want to set (CT☐).



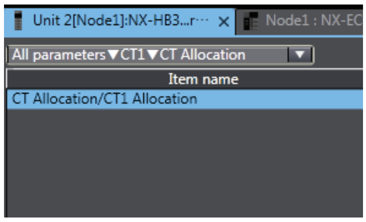
Additional Information

You can click the list button on the Edit Unit Operation Settings Tab Page to restrict the items that are displayed. The following screen captures show an example of displaying only the CT allocation for CT1.

Example:



Select *CT Allocation* for *CT1*.

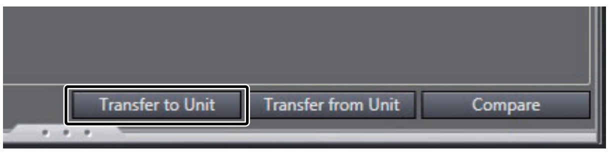


The CT allocation is displayed for only CT1.

- If you set a value different from the default value, the value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit. Any settings that you change apply immediately.*1



*1. If you change the set values of only the Heater Burnout Detection Currents and SSR Failure Detection Currents and transfer them, the new set values will be used even if the Unit is not restarted. However, if you also transfer the set values of other settings, a restart will occur when the set values are transferred.

7-6-6 Time-proportional Output

Purpose

This function controls a control output by using the manipulated variable from the controller as a duty ratio. You can also specify the minimum pulse widths and execute immediate output commands.

Details on the Function

The basic function of time-proportional outputs from the Heater Burnout Detection Unit is to control a control output by using the manipulated variable as a duty ratio. You can also use the following two control output adjustments.

- Minimum pulse width specification
- Immediate output commands

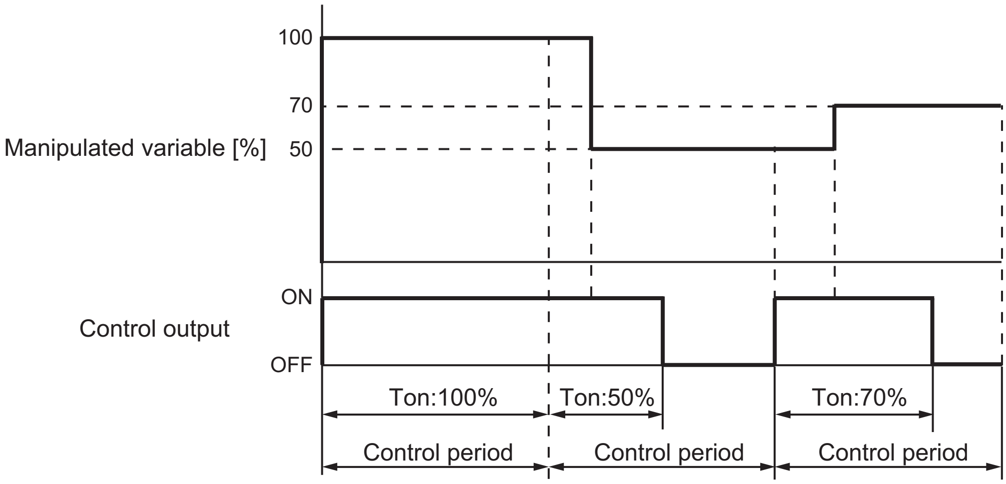
This section first explains the basic function, and then it explains the above two functions.

● Basic Function

Details on the function to control a control output by using the manipulated variable as a duty ratio are provided below. There are no settings required in the Heater Burnout Detection Unit to use this function.

- The Unit determines the ON/OFF duty ratio for a control output for each controlperiod based on the manipulated variable from the controller and outputs ON/OFF signals accordingly. The control output ON time (Ton) is expressed by the following formula.

  Ton [ms] = Control period [ms] × Manipulated variable [%]
- The manipulated variables are set in the I/O data. Refer to *7-4-1 Allocatable I/O Data* on page 7-11 for details on I/O data. For application examples that use the analog control instructions of the NJ/NX/NY-series Controllers, such as the PIDAT instruction, to perform control outputs, refer to *7-8 Application Example* on page 7-57.
- If the manipulated variable is a negative value, the manipulated variable will be treated as 0%. If the manipulated variable exceeds 100%, the manipulated variable will be treated as 100%.



Precautions for Correct Use

If control output is ON for less than 30 ms, the Unit will not perform heater burnout detection. Also, if control output is OFF for less than 35 ms, the Unit will not perform SSR failure detection.

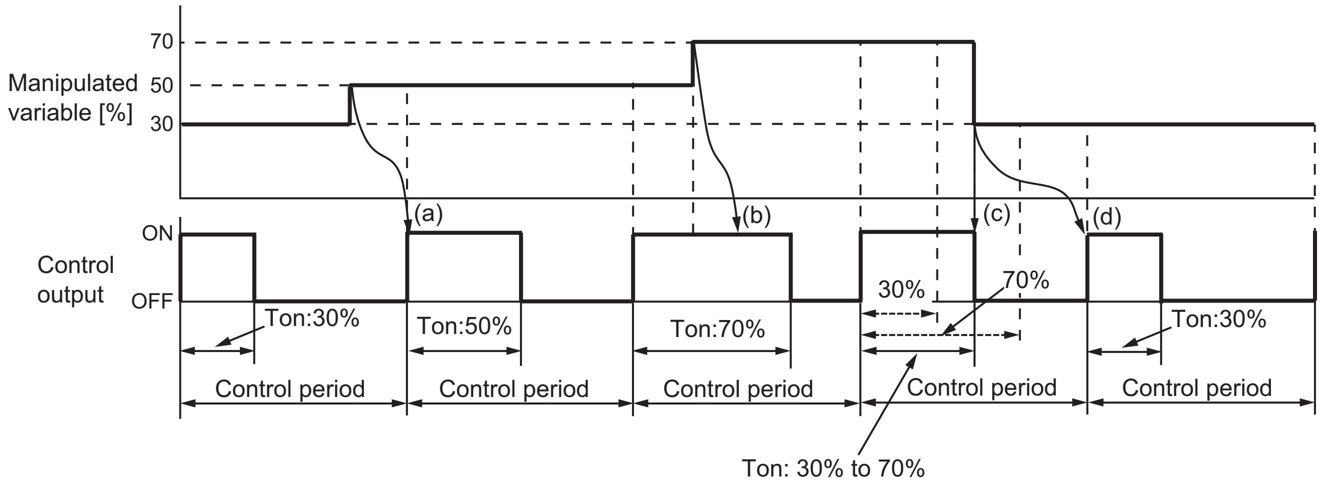
The timing of updating a control output for changes in the manipulated variable depends on the status of the output when the manipulated variable is changed.

- If the manipulated variable is changed while the control output is OFF, the Unit will control the output based on the updated manipulated variable the next time the control output turns ON. (Refer to (a) in the following figure.)

- If the manipulated variable is changed while the control output is ON, the Unit will immediately control the output based on the updated manipulated variable. (Refer to (b) in the following figure.)

  However, if the output value for the previous manipulated variable exceeds the output value for the new manipulated variable, the output for the previous manipulated variable will be turned OFF when the manipulated variable is updated. (Refer to (c) in the following figure.)

  If this occurs, the Unit will control the output based on the updated manipulated variable the next time the control output turns ON. (Refer to (d) in the following figure.)



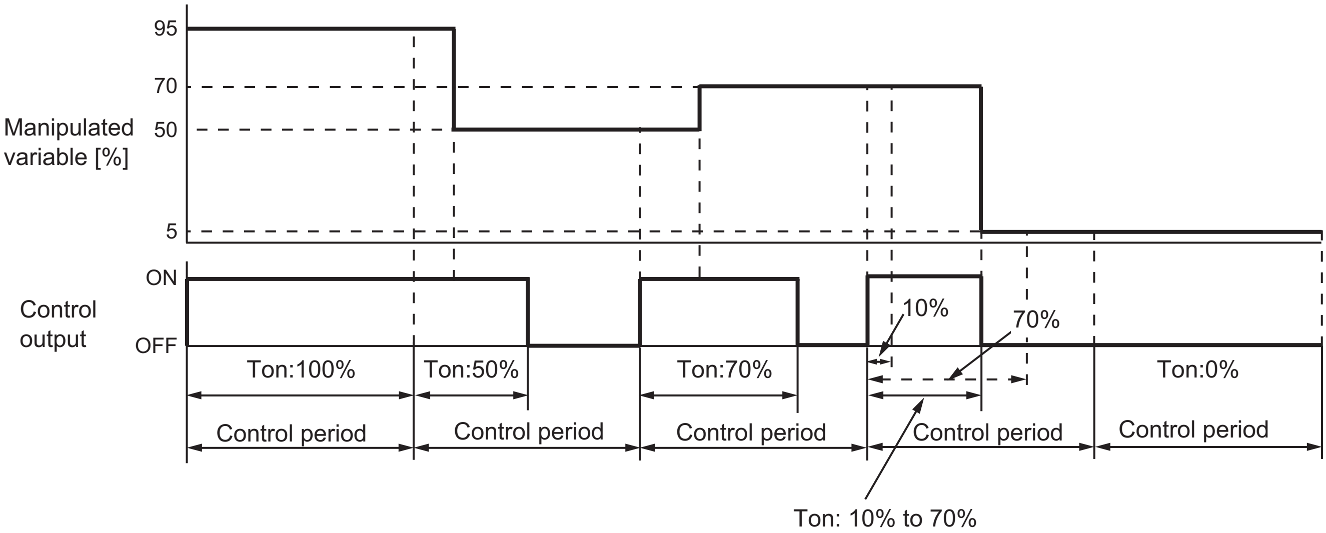
Minimum Pulse Width Specification

You can set the minimum ON widths of the control outputs. You can use these settings to prevent deterioration if mechanical relays are used as the external connection devices for the control outputs. Details on this function are given below.

- You can set the minimum pulse widths using the same unit as for the manipulated variables [%].
- The output operations of the control outputs are based on the relation between the minimum pulse widths and values of the manipulated variables. The following table gives the output operations of the control outputs according to the relation between the minimum pulse widths and manipulated variables.

Relation between minimum pulse width and value of manipulated variable	Output operation of control output
Manipulated variable [%] < Minimum pulse width [%]	The control output is always OFF.
Minimum pulse width [%] ≤ Manipulated variable [%] ≤ 100 [%] - Minimum pulse width [%]	The Unit controls the control output with the manipulated variable as a duty ratio.
Manipulated variable [%] > 100 [%] - Minimum pulse width [%]	The control output is always ON.

An example of controlling a control output for a manipulated variable with the minimum pulse width set to 10% is illustrated in the following figure.



The timing of updating a control output for changes in the manipulated variable depends on the status of the output when the manipulated variable is changed. For details on the timing of updating the control outputs for changes in manipulated variables, refer to *Details on the Function* on page 7-34.

Immediate Output Commands

You can use an immediate output command to immediately apply a new manipulated variable to the control output when the manipulated variable is changed from the controller. Use this function if you use autotuning in the PIDAT_HeatCool instruction of the NJ/NX/NY-series Controllers. Autotuning automatically finds the optimum PID constants.

Precautions for Safe Use

Use an immediate output command only if you use autotuning in the PIDAT_HeatCool instruction of the NJ/NX/NY-series Controller. If you use an immediate output command with any other instruction or application other than autotuning, the device or machine may perform unexpected operation.

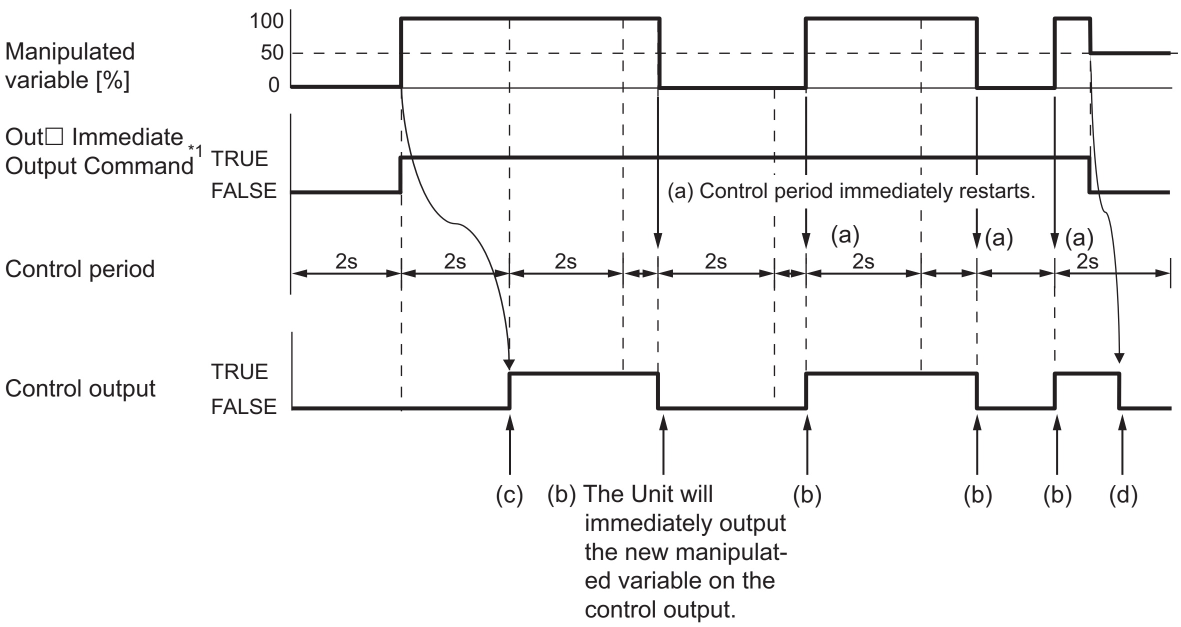
Precautions for Correct Use

Use the immediate output command if you use autotuning in the PIDAT_HeatCool instruction of the NJ/NX/NY-series Controllers. If you do not use the immediate output command, the optimum PID constants may not be found due to delays in updating the control output for changes to the manipulated variable during autotuning.

To use this function, allocate the *ATBusy* (Autotuning Busy) variable of the PIDAT_HeatCool instruction to the Out□ Immediate Output Command Bit in the I/O data of the Heater Burnout Detection Unit.

Details on this function are given below. The control period is set to 2 seconds in this example.

- The Unit executes an immediate output command when the Out□ Immediate Output Command Bit is changed to TRUE.
- If the manipulated variable changes while the Out□ Immediate Output Command Bit is TRUE, the control period restarts immediately ((a) in the following figure), and the Unit controls the control output with the updated manipulated variable. (Refer to (b) in the following figure.)
- If the values of the Out□ Immediate Output Command Bit and manipulated variable from the controller change simultaneously, the control period will not restart. The Unit controls the control output with the updated manipulated variable in the next control period. (Refer to (c) in the following figure.)
- If the manipulated variable changes while the Out□ Immediate Output Command Bit is FALSE, the control period does not restart, and the Unit controls the control output with the updated manipulated variable. (Refer to (d) in the following figure.)
- If a minimum pulse width is set, the set value of the minimum pulse width is disabled.



*1. Allocate the *ATBusy* (Autotuning Busy) variable of the PIDAT_HeatCool instruction to this bit.

Settings

Setting name	Description	Default	Setting range	Unit
Out1 Control Period	Set the control period for the time-proportional output on Out1.	2,000	50 to 100,000	ms
Out2 Control Period	Set the control period for the time-proportional output on Out2.	2,000	50 to 100,000	ms
Out3 Control Period	Set the control period for the time-proportional output on Out3.	2,000	50 to 100,000	ms
Out4 Control Period	Set the control period for the time-proportional output on Out4.	2,000	50 to 100,000	ms
Out1 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out1.	0	0 to 50	%
Out2 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out2.	0	0 to 50	%
Out3 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out3.	0	0 to 50	%
Out4 Minimum Pulse Width	Set the minimum pulse width for the time-proportional output on Out4.	0	0 to 50	%

Setting Method

This section gives the setting method with the Sysmac Studio.

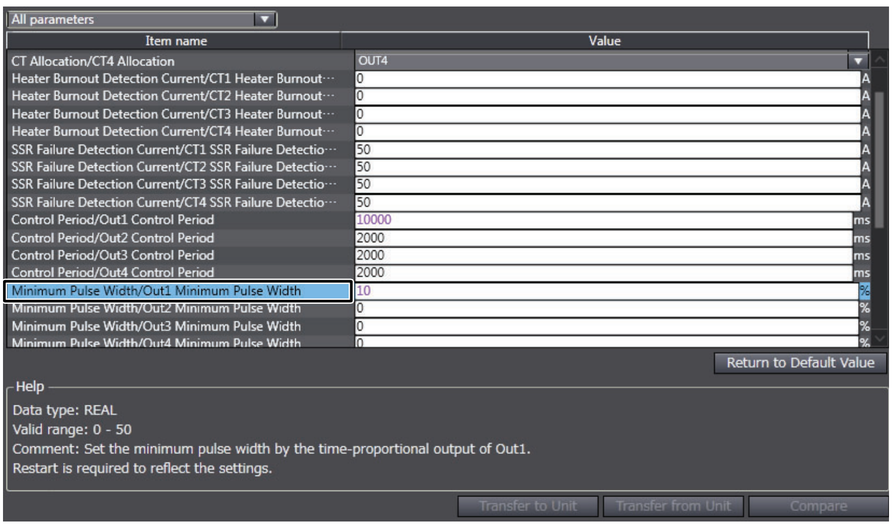
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

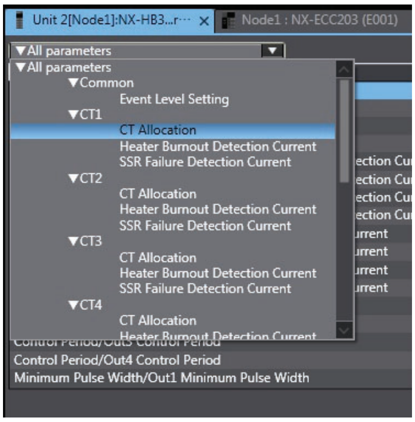
2 Enter the set values in the **Control Period** and **Minimum Pulse Width** Text Boxes for the control output you want to set (OUT☐).



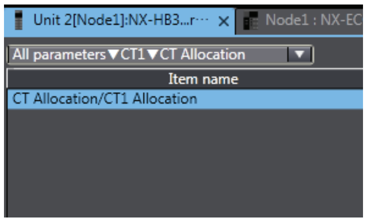
Additional Information

- You can click the list button on the Edit Unit Operation Settings Tab Page to restrict the items that are displayed. The following screen captures show an example of displaying only the CT allocation for CT1.

  Example:



Select *CT Allocation* for *CT1*.

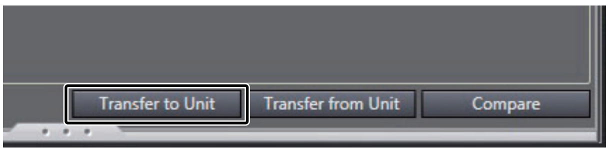


The CT allocation is displayed for only CT1.

- If you set a value different from the default value, the value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

7-6-7 Load Rejection Output Settings

Purpose

A function that performs the preset output operation when the Heater Burnout Detection Unit that is connected to a CPU Unit cannot receive output data due to an NX bus error or CPU Unit watchdog timer error.

A function that performs the preset output operation when the Heater Burnout Detection Unit in a Slave Terminal cannot receive output data due to a host error on the Communications Coupler Unit or an error on the NX bus.

Details on the Function

Set either of the following output values for each control output for when an error occurs.

Setting	Description
User-specified Value Output	The Unit outputs the user-specified value. The Unit outputs the output value set in the Out□ User-specified Value Setting, which is treated as the manipulated variable for the control output. The Minimum Pulse Width setting is ignored.
Hold Output	The Unit holds the output value from the control period immediately before the error, and outputs that value.

Select either to output a user-specified value or to hold the previous output in the Out□ Hold Value Setting.

Settings

Setting name	Description	Setting range	Default	Unit
Out1 Hold Value Setting	Set the output values at load rejection for Out□.	User-specified Value Output or Hold Output	User-specified Value Output	---
Out2 Hold Value Setting				
Out3 Hold Value Setting				
Out4 Hold Value Setting				
Out1 User-specified Value Setting	Set the value to output when the Out□ Hold Value Setting is set to output a user-specified value.	0 to 100*1	0	%
Out2 User-specified Value Setting				
Out3 User-specified Value Setting				
Out4 User-specified Value Setting				

*1. The user-specified value is treated as the manipulated variable for the control output.

Setting Method

This section gives the setting method with the Sysmac Studio.

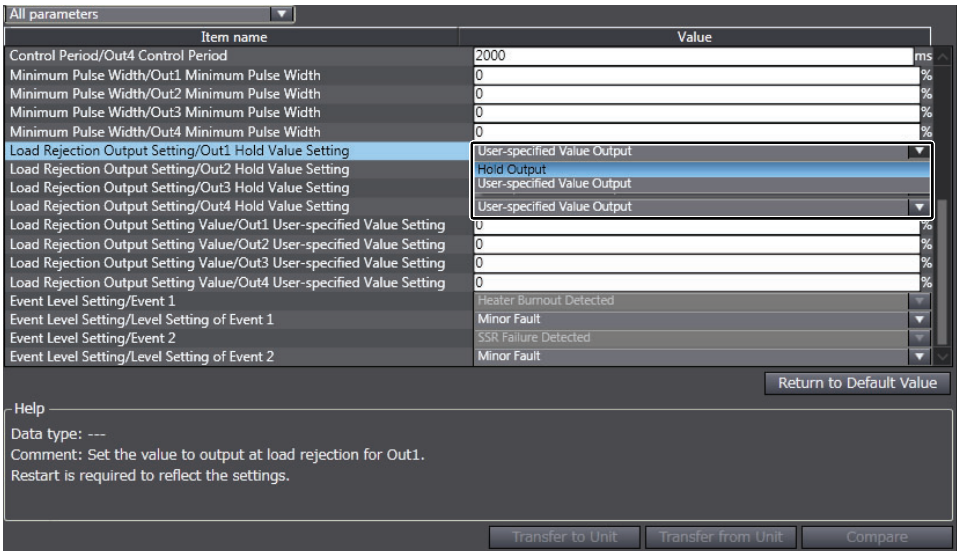
Even if you use Support Software other than the Sysmac Studio, set the parameters given in the procedure in the Edit Unit Operation Settings Tab Page and transfer them to the NX Units.

Refer to the operation manual for your Support Software for the method to display the Edit Unit Operation Settings Tab Page and the method to transfer settings to the NX Unit with Support Software other than the Sysmac Studio.

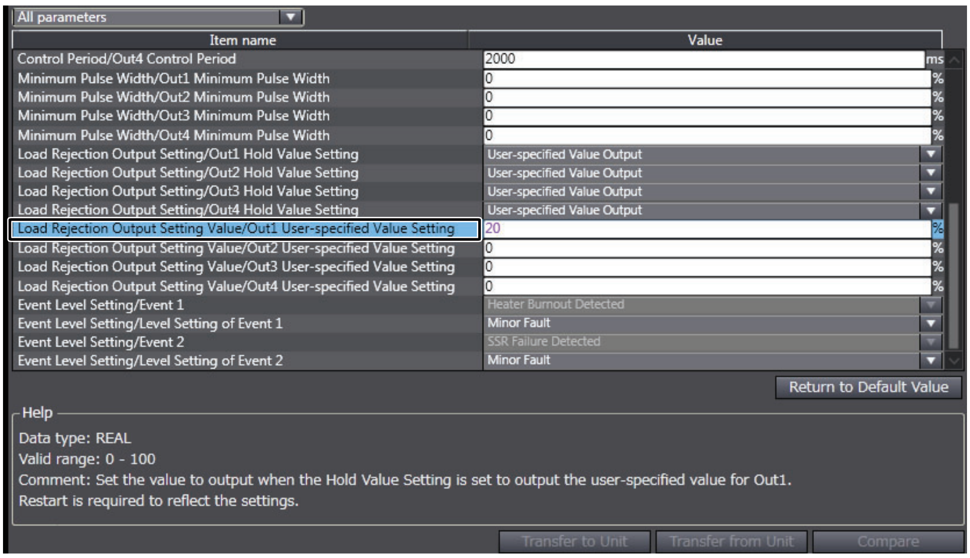
1 Display the Edit Unit Operation Settings Tab Page.

For the display methods, refer to *A-8 Displaying the Edit Unit Operation Settings Tab Page* on page A-78.

2 Select the output to set from the **Load Rejection Output Setting** Box for the control output you want to set (OUT□).



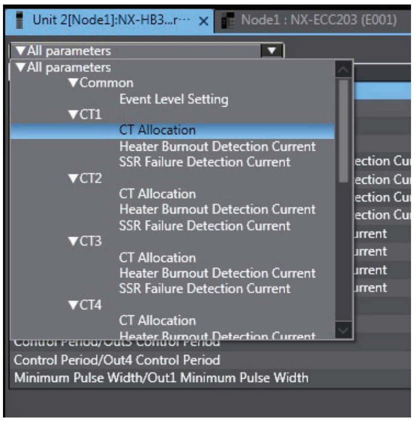
If you select *User-specified Value Output* for the output, enter the set value in the **Load Rejection Output Setting Value** Box for the control output.



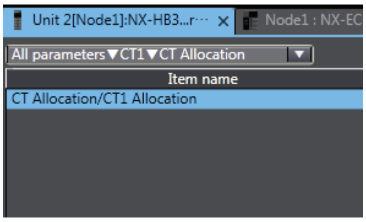
Additional Information

- You can click the list button on the Edit Unit Operation Settings Tab Page to restrict the items that are displayed. The following screen captures show an example of displaying only the CT allocation for CT1.

  Example:



Select *CT Allocation* for *CT1*.

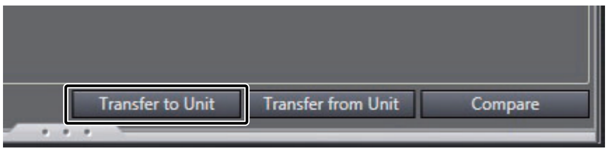


The CT allocation is displayed for only CT1.

- If you set a value different from the default value, the value on the Sysmac Studio is displayed in a different color.
- You can click the **Return to Default Value** Button to return all set values on the Sysmac Studio to the default values.
- Help for the settings is displayed at the bottom of the Edit Unit Operation Settings Tab Page.

3 Click the **Transfer to Unit** Button.

The settings are transferred from the Sysmac Studio to the NX Unit.



The settings are reflected after the Unit is restarted.

Precautions for Safe Use

If you transfer parameters for Unit operation settings that are updated when the Unit is restarted after the settings are changed on the Support Software, the Unit will be restarted after the transfer is completed. Always sufficiently check the safety at the connected devices before you transfer the Unit operation settings.

7-6-8 Load Short-circuit Protection

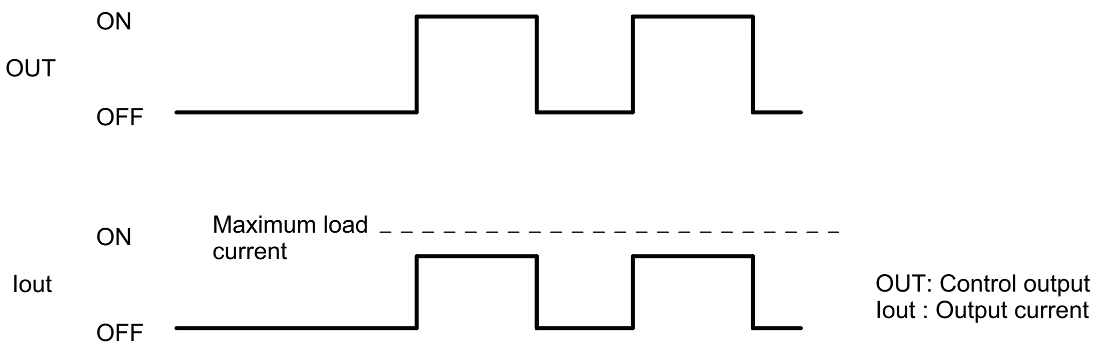
Purpose

This function is used to protect the output circuits of the Heater Burnout Detection Units when an externally connected device short-circuits.

Details on the Function

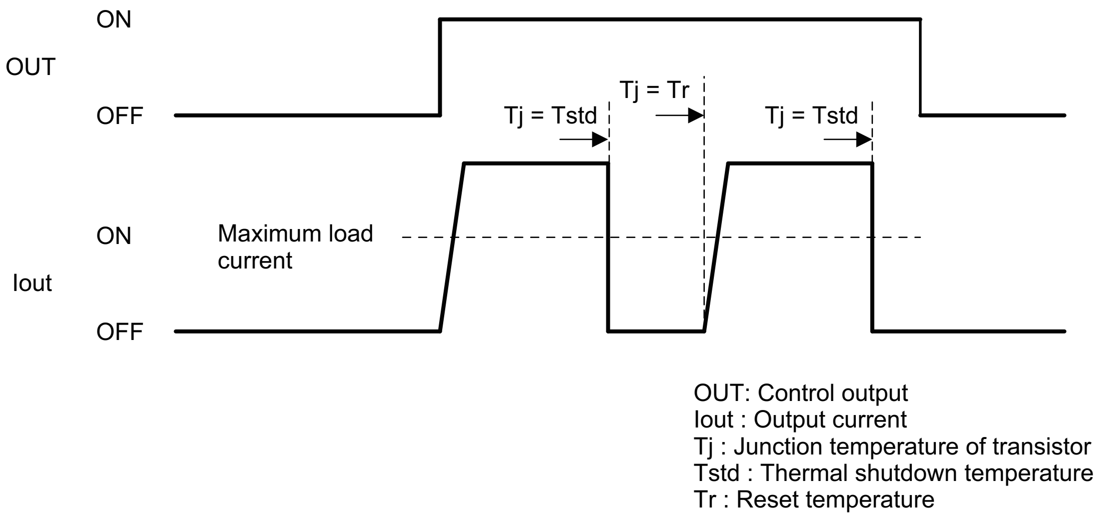
As shown in the figure below, normally when the control output (OUT) turns ON, the transistor turns ON and then output current (Iout) will flow.

The output circuit transistor in the Heater Burnout Detection Unit generates heat when output current (Iout) flows.



If an overload or short-circuit occurs, causing the output current (Iout) to exceed the maximum value of load current as shown in the figure below and the junction temperature (Tj) of the transistor to reach the thermal shutdown temperature (Tstd) in which a load short-circuit protection operates, the output will turn OFF to protect the transistor from being damaged.

When the junction temperature (Tj) of the transistor drops down to the reset temperature (Tr), the output OFF will be automatically reset and the output current will start flowing.



- **Restrictions on Use**

The load short-circuit protection function only protects internal circuits for a short period.

As shown in the figure above, the load short-circuit protection of the Heater Burnout Detection Unit is automatically released when Tj equals to Tr. Therefore, unless the cause of the short-circuit is removed, the control output will repeatedly turn ON and OFF.

If the short-circuit is not corrected, output elements deteriorate. If any external load is short-circuited, immediately turn OFF the applicable control output and remove the cause of the short-circuit.

Target NX Units

NX-HB3201

Setting Method

No setting is required.

7-7 CT Installation and Alarm Current Calculation

This section describes how to install CTs and how to calculate alarm currents.

Precautions for Safe Use

Use one of the CTs that can be connected to the Heater Burnout Detection Units. If you use any other CTs, the heater currents or leakage currents may not be accurate. This could result in failure to detect heater burnout or SSR failure. Also, if a SSR failure current is not detected, damage to equipment could result.

7-7-1 Connectable CTs

The following table lists the CTs that you can connect to Heater Burnout Detection Units.

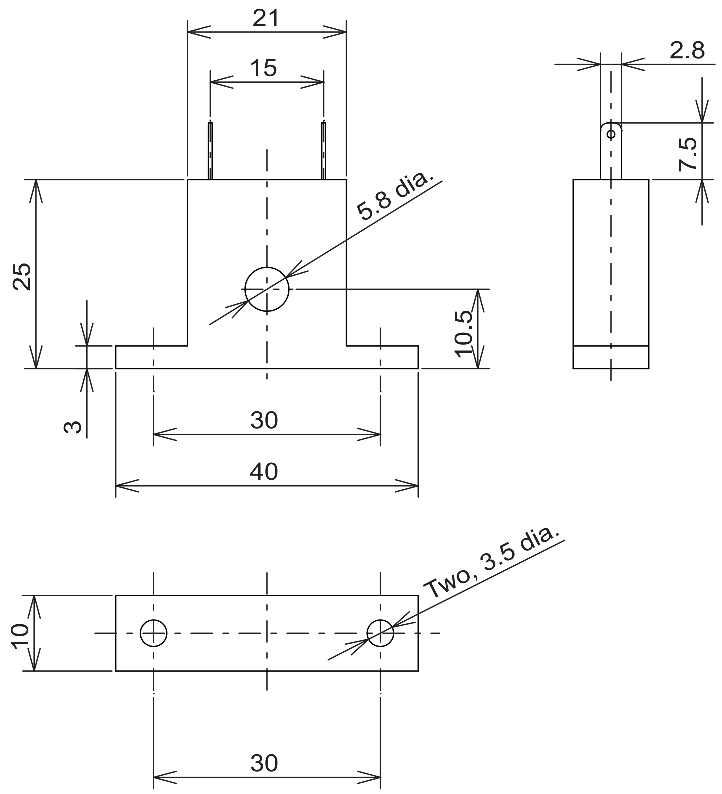
Specifications

Item	Specifications	
Model number	E54-CT1	E54-CT3
Manufacturer	OMRON	
Max. continuous current	50 A	120 A*1
No. of turns	400±2 turns	
Dielectric strength	1,000 VAC (for 1 min)	
Vibration resistance	50 Hz, 98 m/s^2	
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	None	Armature (2), Plug (2)

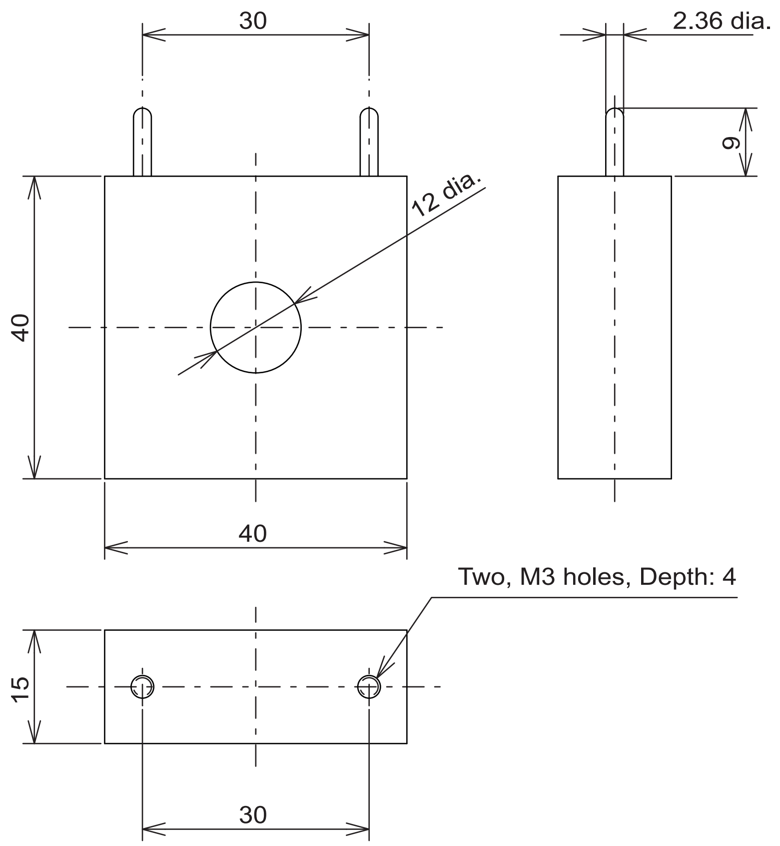
*1. With the NX-HB□□□□, the maximum continuous current that can flow to the heater is 50 A. Therefore, set the current that flows in the heater to 50 A or less.

Dimensions

- E54-CT1



- E54-CT3

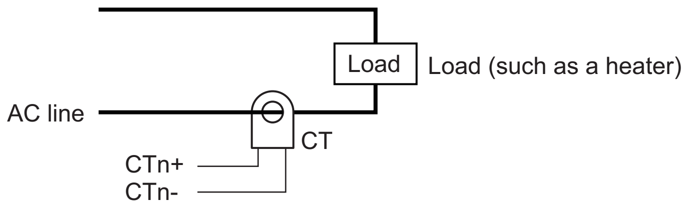


7-7-2 CT Installation Locations

Connect the CT to the input terminal of the Heater Burnout Detection Unit, and run the heater power line through the opening on the CT. CT installation locations for single-phase and three-phase heaters are shown in the following figure.

Single-phase Heaters

Install the CT in the location shown in the following figure.

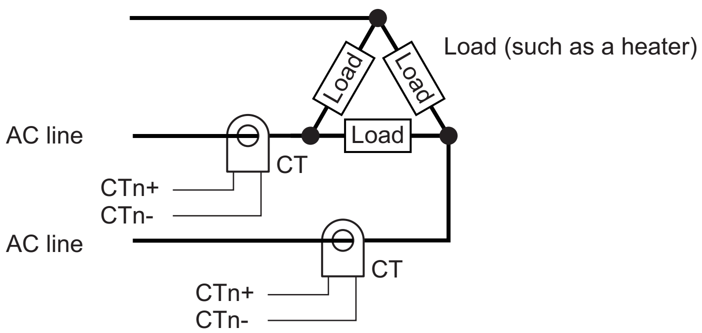


Three-phase Heaters

When a 3-phase heater is used, two CTs are required. CT installation locations for each type of wiring are shown in the following figures.

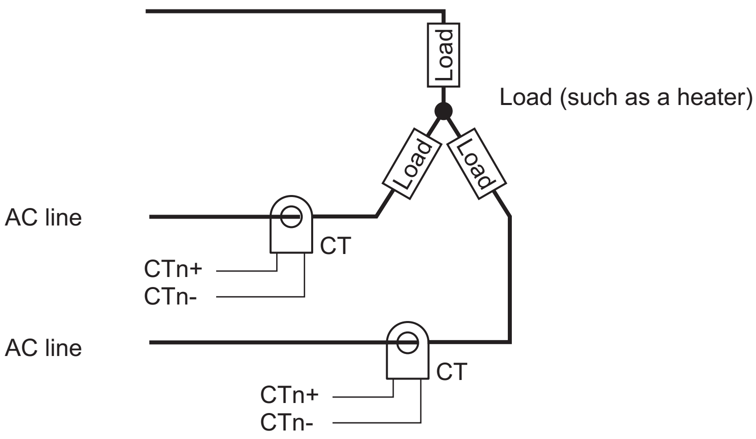
- **Delta Connection**

  Install the CTs in the locations shown in the following figure.



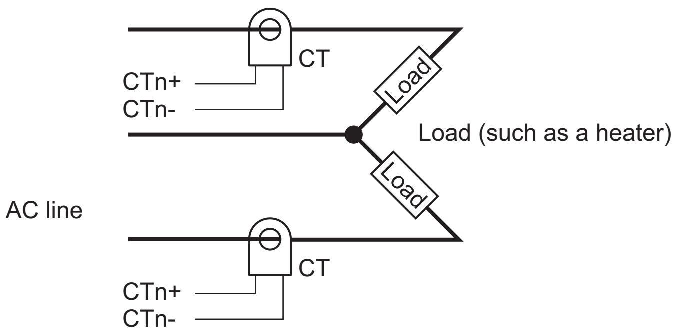
- **Star Connection**

Install the CTs in the locations shown in the following figure.



- **V Connection**

Install the CTs in the locations shown in the following figure.



7-7-3 Calculation Methods for Heater Burnout Detection Currents and SSR Failure Detection Currents

How to Calculate Detection Currents

If you run only one heater power line through a CT, calculate the set values using the following formulas.

$$\text{Heater burnout detection current} = \frac{\text{Normal current} + \text{Current when heater burnout occurs}}{2}$$

$$\text{SSR failure detection current} = \frac{\text{Leakage current}^{*1} + \text{Current when SSR failure occurs}}{2}$$

*1. This is the current when the SSR is OFF.

Calculate the set values of Heater burnout detection currents when you run multiple heater power lines through a CT by using the current when the heater with the smallest current burns out, as indicated in the following formula. If all currents are the same when heater burnout occurs, use the value for when one heater burns out.

$$\text{Heater burnout detection current} = \frac{\text{Normal heater current} + \text{Heater current when the heater that has the smallest current burns out}}{2}$$

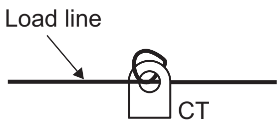
If you run multiple heater power lines through a CT, the total of the heater currents must be 50 A or less.

Conditions for Stable Detection

If the difference between the current in normal operation and the current when an abnormality occurs is small, detection may become unstable. To enable stable detection, make sure the following conditions are met.

Heater current	Condition for stable burnout detection	Condition for stable SSR failure detection
Less than 10.0 A	Normal current - Current when heater burnout occurs ≥ 1 A	Current when SSR failure occurs - Leakage current ≥ 1 A
10.0 A min.	Normal current - Current when heater burnout occurs ≥ 2.5 A	Current when SSR failure occurs - Leakage current ≥ 2.5 A

If the heater current is not large enough to meet the above conditions, wind the heater power line or lines so that they run through the CT multiple times, as shown in the following figure.



If you wind a heater power line so that it runs through the CT multiple times, calculate the Heater burnout detection current using the following formula.

$$\text{Heater burnout detection current} = \frac{(\text{Normal current} + \text{Current when heater burnout occurs}) \times \text{No. of times run through CT}}{2}$$

Wind the heater power line one time to double the heater burnout detection current.

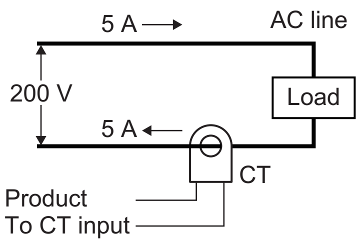
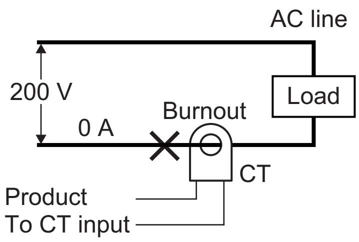
If you wind a heater power line and run it through a CT multiple times, adjust the number of times you run the line through the CT so that the normal current is 50 A or less.

Examples of Calculating Heater Burnout Detection Currents

This section provides examples of calculating heater burnout detection currents.

● Single-phase Heaters

A calculation example is given below for a 200-VAC, 1-kW heater.

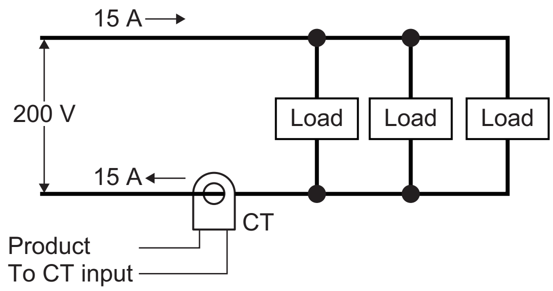
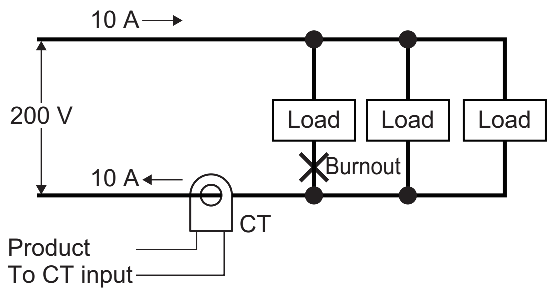
Status	Heater current
Normal	The heater current is 5 A. 
Burnout	The heater current is 0 A. 

The heater power supply provides 5 A when the current is normal, and 0 A when there is a burnout, so the heater burnout detection current is calculated as follows:

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{5+0}{2} = 2.5\ [\text{A}]$$

A calculation example is given below for three 200-VAC, 1-kW heaters.

Status	During heater current burnout
Normal	The heater current is 15 A. 
Burnout	The heater current is 10 A. 

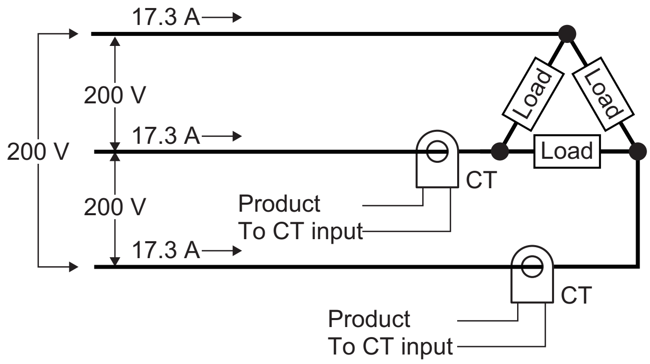
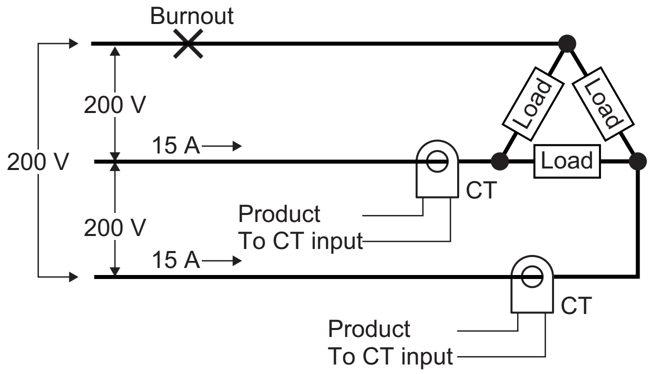
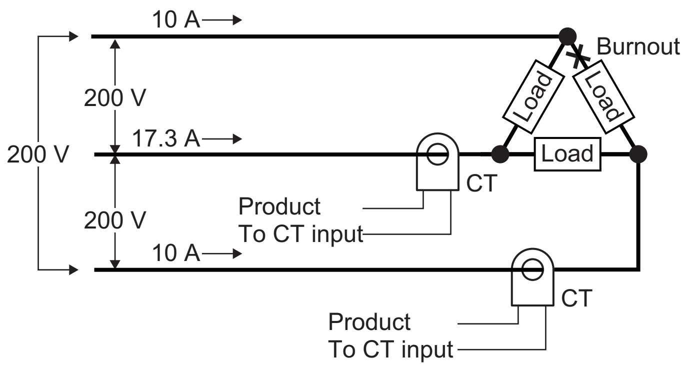
The heater power supply provides 15 A when the current is normal, and 10 A when there is a burn-out, so the heater burnout detection current is calculated as follows:

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{15 + 10}{2} = 12.5\ [\text{A}]$$

● Three-phase Delta Connection Heaters

A calculation example is given below for three 200-VAC, 2-kW heaters.

Status	Heater current
Normal	The heater currents are illustrated in the following figure. 17.3A(≈√ 3 × 10A) 
Burnout	The heater current when there is a burnout on the load line is as follows: 15A(=√ 3 × 10A ×(√ 3/2)) 
	The heater current when there is a burnout on the load side is as follows: 10A(=√ 3 × 10A ×(1/√ 3)) 

The heater burnout detection current for a burnout on the load line side is as follows:

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{17.3 + 15}{2} = 16.15\ [A]$$

The heater burnout detection current for a burnout on the load side is given below.

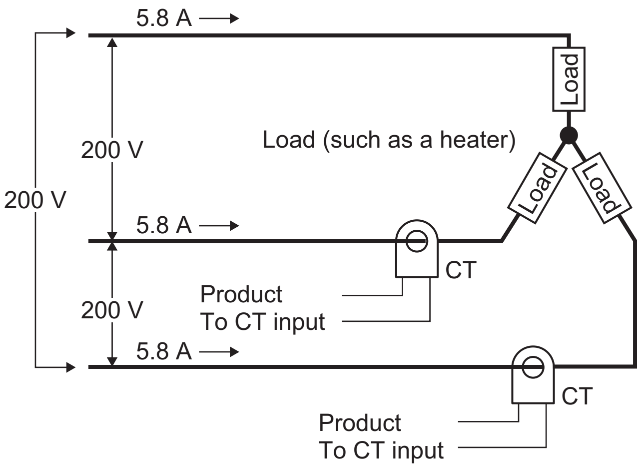
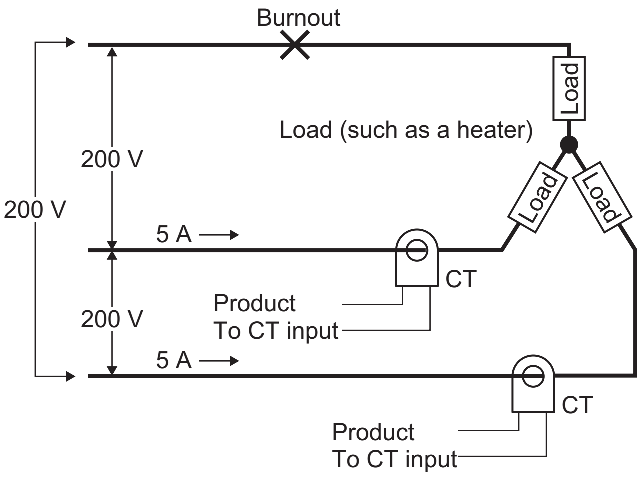
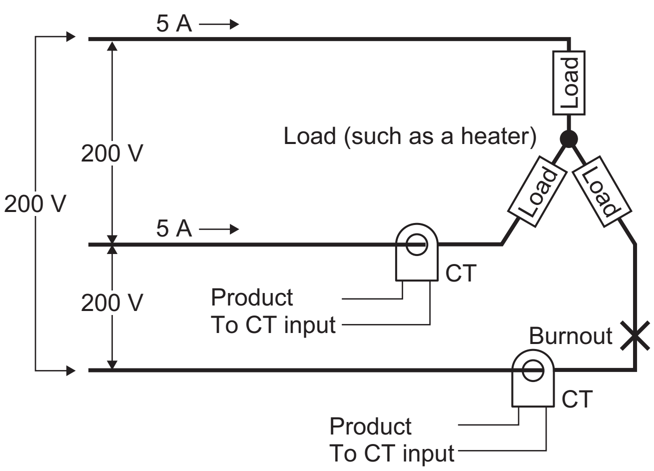
$$\text{Heater burnout detection current} = \frac{\text{Normal current} + \text{Heater burnout current}}{2}$$

$$= \frac{17.3 + 10}{2} = 13.65\ [\text{A}]$$

To enable burnout detection on the load line side or load side, use 16.1 A as the heater burnout detection current.

- **Three-phase Star Connection Heaters**

A calculation example is given below for three 200-VAC, 2-kW heaters.

Status	Heater current
Normal	The heater current for each phase is given in the following figure. 5.8A(≈(1/√ 3) × 10A) 
Burnout	The heater current when there is a burnout on the load line is as follows: 5A(=(1/√ 3) × 10A ×(√ 3/2)) 
	The heater current when there is a burnout on the load side is as follows: 5A(=(1/√ 3) × 10A ×(√ 3/2)) 

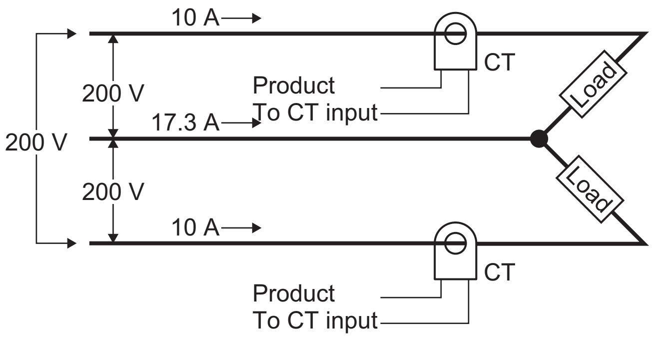
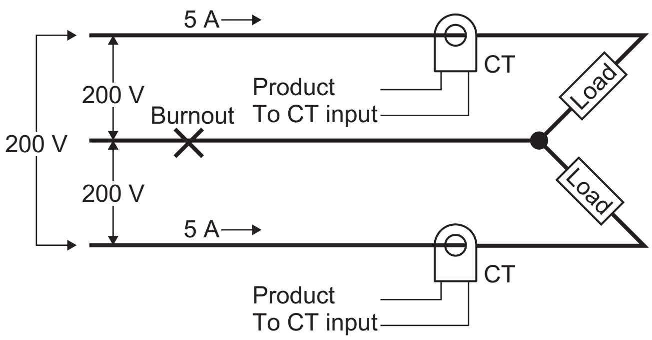
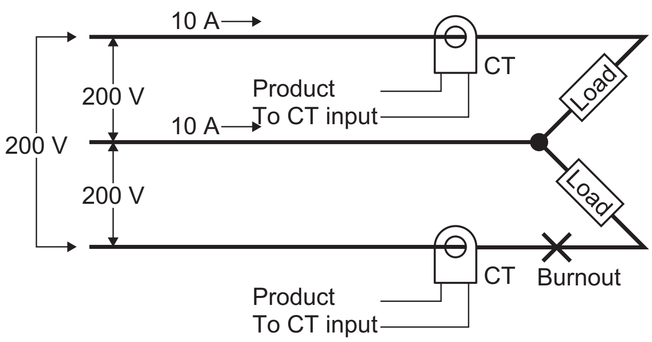
Based on the above information, the heater burnout detection current for this wiring is given below.

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{5.8 + 5.0}{2} = 5.4\ [\text{A}]$$

● Three-phase V Connection Heaters

A calculation example is given below for three 200-VAC, 2-kW heaters.

<table>
<tr><th>Status</th><th>Heater current</th></tr>
<tr><td>Normal</td><td>The heater current is 10 A.

</td></tr>
<tr><td>Burnout</td><td>The heater current when there is a burnout on the common side is as follows:
5 A (= 10 A ×(1/2))

</td></tr>
<tr><td></td><td>The heater current when there is a burnout on the load side is 0 A.

</td></tr>
</table>

The heater burnout detection current for a burnout on the common side is given below.

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{10 + 5}{2} = 7.5\ [A]$$

The heater burnout detection current for a burnout on the load side is given below.

$$\text{Heater burnout detection current} = \frac{\text{Normal current + Heater burnout current}}{2}$$

$$= \frac{10 + 0}{2} = 5\ [A]$$

To enable burnout detection on either the common or load side, use 7.5 A as the heater burnout detection current.

7-8 Application Example

This section provides an application example for a Heater Burnout Detection Unit. This section gives the system configuration, setting, and programming examples for one possible case scenario.

The system configuration example uses an EtherCAT Slave Terminal.

For NX Units with the configuration described below and that are connected to an NX-series NX1P2 CPU Unit, only the differences from the example that uses an EtherCAT Slave Terminal are described.

Refer to *7-8-5 Using Heater Burnout Detection Units Connected to a CPU Unit* on page 7-70 for details.

7-8-1 Assumed Configuration

The following table gives the details for the assumed configuration.

Item	Description
Control type	The Unit performs heating/cooling control for a control target. When the Unit detects a heater burnout or SSR failure, the Unit stops heating/cooling control.
Control method	The Unit performs feedback control with PID control. The PIDAT_HeatCool instruction*1 of the NJ/NX/NY-series Controllers is used.
Autotuning	Autotuning is performed at the start of operation to find the optimum PID constants. The immediate output command for the control output is used during autotuning.
Control inputs	• One thermocouple temperature input Used to measure the temperature of the control target. • One CT input Used to measure the heater current.
Control outputs	• One heating-side control output Used for heater ON/OFF control. • One cooling-side control output Used for ON/OFF control of the solenoid valve for cooling water.

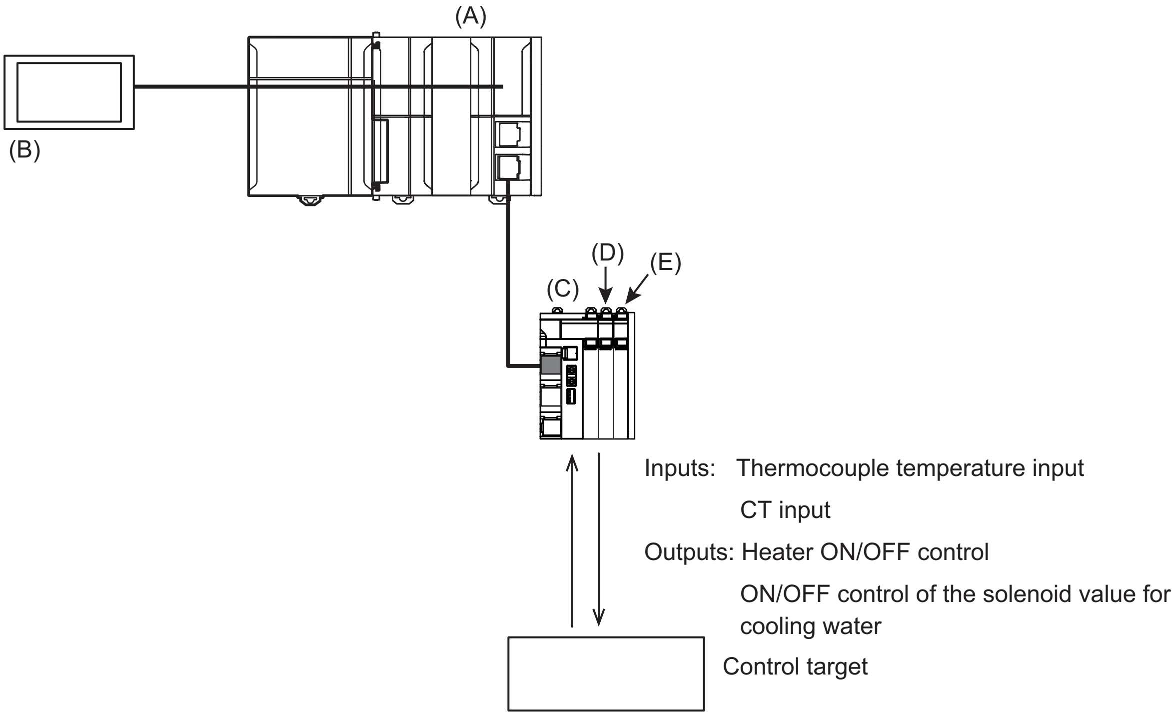
*1. Refer to the instructions reference manual for the connected CPU Unit or Industrial PC for information on the PIDAT_HeatCool instruction.

7-8-2 System Configuration

This section describes the example system configuration to implement the control described in the previous section with an NJ-series Controller, EtherCAT Coupler Unit, Temperature Input Unit, and Heater Burnout Detection Unit.

Unit Configuration

The Unit configuration is given in the following figure.



Letter	Description	Model	Remarks
(A)	Controller and EtherCAT master	NJ501-1500	Use the PIDAT_HeatCool instruction.
(B)	Touch panel	---	For details, refer to *Touch Panel Specifications* on page 7-59.
(C)	EtherCAT Coupler Unit	NX-ECC203	Node address: 1
(D)	Temperature Input Unit	NX-TS2101	• NX Unit number: 1 • Input channel used: Ch1
(E)	Heater Burnout Detection Unit	NX-HB3101	• NX Unit number: 2 • CT input used: CT1 • Control output used on heating side: OUT1 • Control output used on cooling side: OUT2

Touch Panel Specifications

The sample program described toward the end of this section assumes that a touch panel is connected to the Controller. The following I/O information is handled through the touch panel.

I/O	Information
Inputs	Sample programming execution flag
	Manual/auto control flag
	Set point
	Autotuning execution flag
	Deadband
	Initial setting parameters
	Operation setting parameters
I/O	Proportional band, integration time, and derivative time for heating control
	Proportional band, integration time, and derivative time for cooling control
	Manual manipulated variable
Outputs	Process value
	Autotuning normal completion flag
	Autotuning executing flag
	Error flag
	Manipulated variable
	Manipulated variable for heating control
	Manipulated variable for cooling control

7-8-3 Setting Example

This section describes the settings that are required to build the example system.

Unit Operation Settings

The Unit operation settings for Temperature Input Units and Heater Burnout Detection Units are provided below.

● Settings for Temperature Input Unit

Examples of Unit operation settings for the Temperature Input Unit are given in the following table.

Setting	Set value	Meaning of setting
Ch1 Enable/Disable	TRUE	Enabled
Ch2 Enable/Disable	FALSE	Disabled
Ch1 Input Type	K -200 to 1300°C	---
Ch1 Cold Junction Compensation Enable/Disable	TRUE	Enabled
Ch1 Decimal Point Position	0.1°C or 0.1°F	---
Ch1 Temperature Unit (°C/°F)	°C	---

Settings for Heater Burnout Detection Unit

Examples of Unit operation settings for the Heater Burnout Detection Unit are given in the following table.

Setting	Set value	Meaning of setting
CT1 Allocation	OUT1	---
CT2 Allocation	Do not use	---
CT3 Allocation	Do not use	---
CT4 Allocation	Do not use	---
CT1 Heater Burnout Detection Current	12.5*1	---
CT1 SSR Failure Detection Current	13*1	---
Out1 Control Period	2,000	---
Out2 Control Period	20,000	---
Out1 Minimum Pulse Width	0	---
Out2 Minimum Pulse Width	0	---
Out1 Hold Value Setting	Hold output	---
Out2 Hold Value Setting	Hold output	---

*1. The above set values are for the use of one 200-VAC, 5-kW heater and a leakage current of 1 A through the CT. The normal heater current is 25 A.

I/O Allocation Settings

The I/O allocation settings for Temperature Input Unit and Heater Burnout Detection Unit are provided below.

I/O Allocation Settings for Temperature Input Unit

The I/O allocation settings for the Temperature Input Unit are given in the following table. These are the default allocation settings.

I/O	I/O entry mapping name	I/O entry to allocate	
		I/O entry name	Description
Input	Input Data Set 1	Ch1 Measured Value INT	Channel measured value (INT)

● I/O Allocation Settings for Heater Burnout Detection Unit

The I/O allocation settings for the Heater Burnout Detection Unit are given in the following table. These are the default allocation settings.

I/O	I/O entry mapping name	I/O entry to allocate	
		I/O entry name	Description
Outputs	Output Data Set 1	Out1 Manipulated Variable REAL	Manipulated variable specified for Out1 Unit: %
		Out2 Manipulated Variable REAL	Manipulated variable specified for Out2 Unit: %
		Out3 Manipulated Variable REAL	Manipulated variable specified for Out3 Unit: %
		Out4 Manipulated Variable REAL	Manipulated variable specified for Out4 Unit: %
	Output Data Set 2	Immediate Output Command	This word contains all of the immediate output command bits for the control outputs.
Inputs	Input Data Set 1	CT1 Alarm Status	This word contains all of the alarm status for CT1.
		CT1 Heater Current REAL	CT1 heater current Unit: Amperes
		CT1 Leakage Current REAL	CT1 leakage current Unit: Amperes
	Input Data Set 2	Control Output Status	This word contains the ON/OFF status for all of the control outputs that are controlled as time-proportional outputs.

I/O Map

The settings of variables for the Temperature Input Unit and Heater Burnout Detection Unit to allocate to the I/O map are provided below.

Unit	I/O port name	Description	Variable	Variable comment	Variable type
NX-TS2101 (NX Unit number 1)	Ch1 Measured Value INT	Channel measured value (INT)	N1_Ch1_Measured_Value_INT	Thermocouple input from NX-TS2101	Global variable
NX-HB3101 (NX Unit number 2)	CT1 Heater Burnout Detection	CT1 heater burnout flag	N2_CT1_Heater_Burnout_Detection	Heating-side heater burnout detection flag	Global variable
	CT1 SSR Failure Detection	CT1 SSR failure flag	N2_CT1_SSR_Failure_Detection	Heating-side SSR failure detection flag	Global variable
	Out1 Manipulated Variable REAL	Manipulated variable specified for Out1 Unit: %	N2_Out1_Manipulated_Variable_REAL	Manipulated variable for heating side	Global variable
	Out1 Immediate Output Command	Out1 immediate output command	N2_Out1_Immediate_Output_Command	Immediate output command for heating side	Global variable
	Out2 Manipulated Variable REAL	Manipulated variable specified for Out2 Unit: %	N2_Out2_Manipulated_Variable_REAL	Manipulated variable for cooling side	Global variable
	Out2 Immediate Output Command	Out2 immediate output command	N2_Out2_Immediate_Output_Command	Immediate output command for cooling side	Global variable

7-8-4 Programming Example

This section provides basic programming examples.

Variables Used in Programming

The following global variable table is set from the Sysmac Studio.

● External Variables

Name	Data type	Default	AT	Retained	Network Publish	Comment
PTIn_Run	BOOL	FALSE	---	TRUE	Input	Sample programming execution flag input from touch panel
PTIn_ManCtl	BOOL	FALSE	---	TRUE	Input	Manual/auto control flag input from touch panel
PTIn_SP	REAL	---	---	TRUE	Input	Set point input from touch panel
PTIn_StartAT	BOOL	FALSE	---	TRUE	Input	Autotuning execution flag input from touch panel
PTIn_InitParam	_sINIT_SET_PARAMS	(SampTime :=T#100ms,RngLowLmt := 0.0, RngUpLmt := 100.0, DirOpr := FALSE)	---	TRUE	Input	Initial setting parameter input from touch panel
PTIn_InitSetOpr_SampTime	LINT	100	---	TRUE	Input	PID sampling period input from touch panel (unit: ms)
PTIn_OprParam	_sOPR_SET_PARAMS	(MVLowLmt := 0, MVUpLmt := 100, ManResetVal := 0.0, MVTrackSw := FALSE, MVTrackVal := 0.0, StopMV := 0.0, ErrorMV := 0.0, Alpha := 0.65, ATCalcGain := 1.0, ATHystrs := 0.2)	---	TRUE	Input	Operation setting parameter input from touch panel
PTOut_PV	REAL	---	---	FALSE	Output	Process value output to touch panel
PT_PB_Heat	REAL	1	---	TRUE	Input	Proportional band for heating control I/O from touch panel
PT_PB_Cool	REAL	1	---	TRUE	Input	Proportional band for cooling control I/O from touch panel

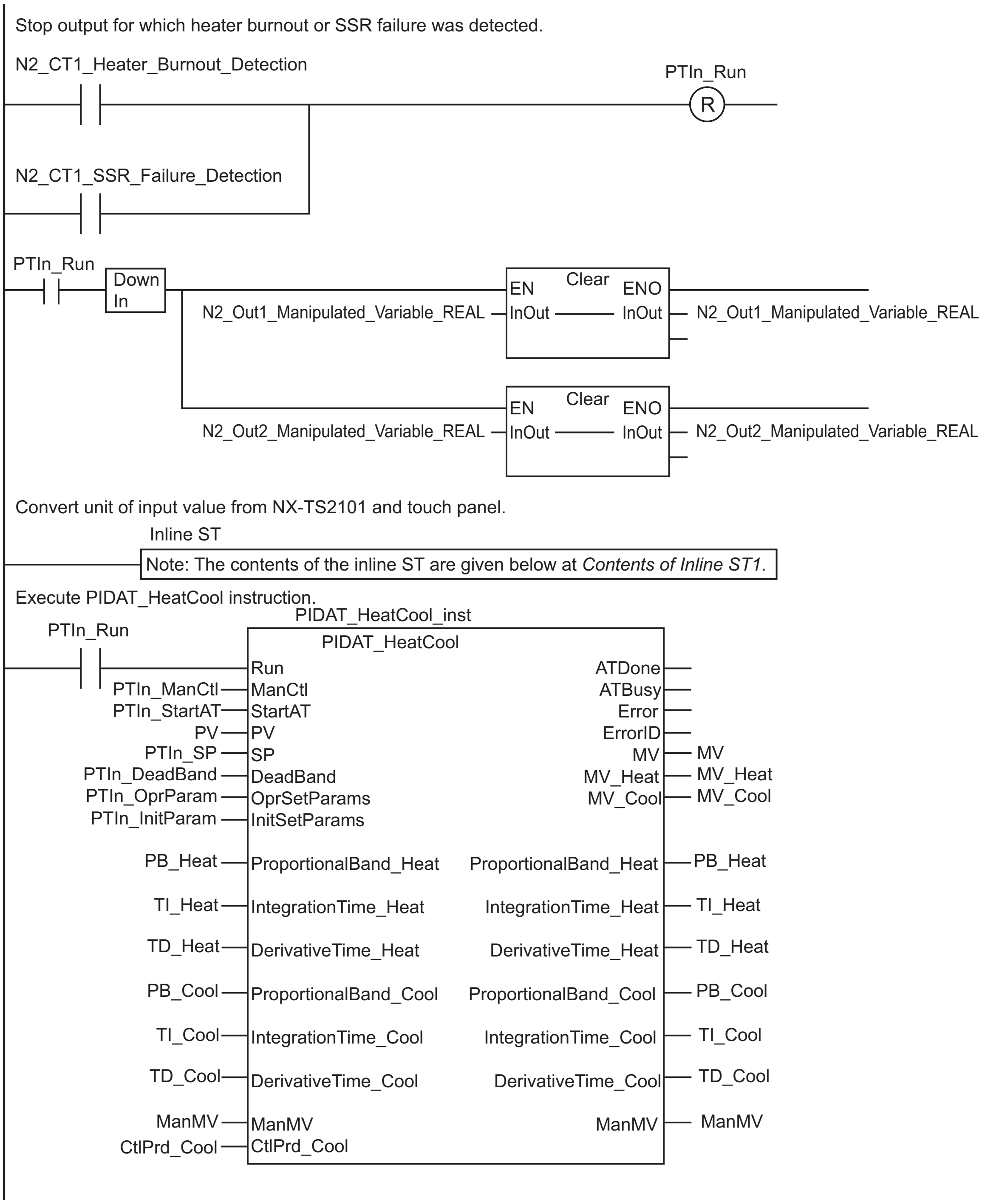
Name	Data type	Default	AT	Retained	Network Publish	Comment
PT_TI_Heat	LINT	1000	---	TRUE	Input	Integration time for heating control I/O from touch panel (unit: ms)
PT_TI_Cool	LINT	1000	---	TRUE	Input	Integration time for cooling control I/O from touch panel (unit: ms)
PT_TD_Heat	LINT	1000	---	TRUE	Input	Derivative time for heating control I/O from touch panel (unit: ms)
PTIn_DeadBand	REAL	---	---	TRUE	Input	Deadband input from touch panel
PT_TD_Cool	LINT	1000	---	TRUE	Input	Derivative time for cooling control I/O from touch panel (unit: ms)
PT_ManMV	REAL	0.0	---	TRUE	Input	Manual manipulated variable I/O from touch panel
PTOut_ATDone	BOOL	---	---	FALSE	Output	Autotuning normal completion flag output to touch panel
PTOut_ATBusy	BOOL	---	---	FALSE	Output	Autotuning executing flag output to touch panel
PTOut_Error	BOOL	---	---	FALSE	Output	Error flag output to touch panel
PTOut_MV	REAL	---	---	FALSE	Output	Manipulated variable output to touch panel
PTOut_MVHeat	BOOL	---	---	FALSE	Output	Manipulated variable for heating control output to touch panel
PTOut_MVCool	BOOL	---	---	FALSE	Output	Manipulated variable for cooling control output to touch panel
N2_CT1_Heater_Burnout_Detection	BOOL	---	ECAT://node#[1,2]/CT1 Alarm Status/CT1 Heater Burnout Detection	FALSE	Do not publish.	Heating-side heater burnout detection flag
N2_CT1_SSR_Failure_Detection	BOOL	---	ECAT://node#[1,2]/CT1 Alarm Status/CT1 SSR Failure Detection	FALSE	Do not publish.	Heating-side SSR failure detection flag
N2_Out1_Manipulated_Variable_REAL	REAL	---	ECAT://node#[1,2]/Out1 Manipulated Variable REAL	FALSE	Do not publish.	Manipulated variable for heating side

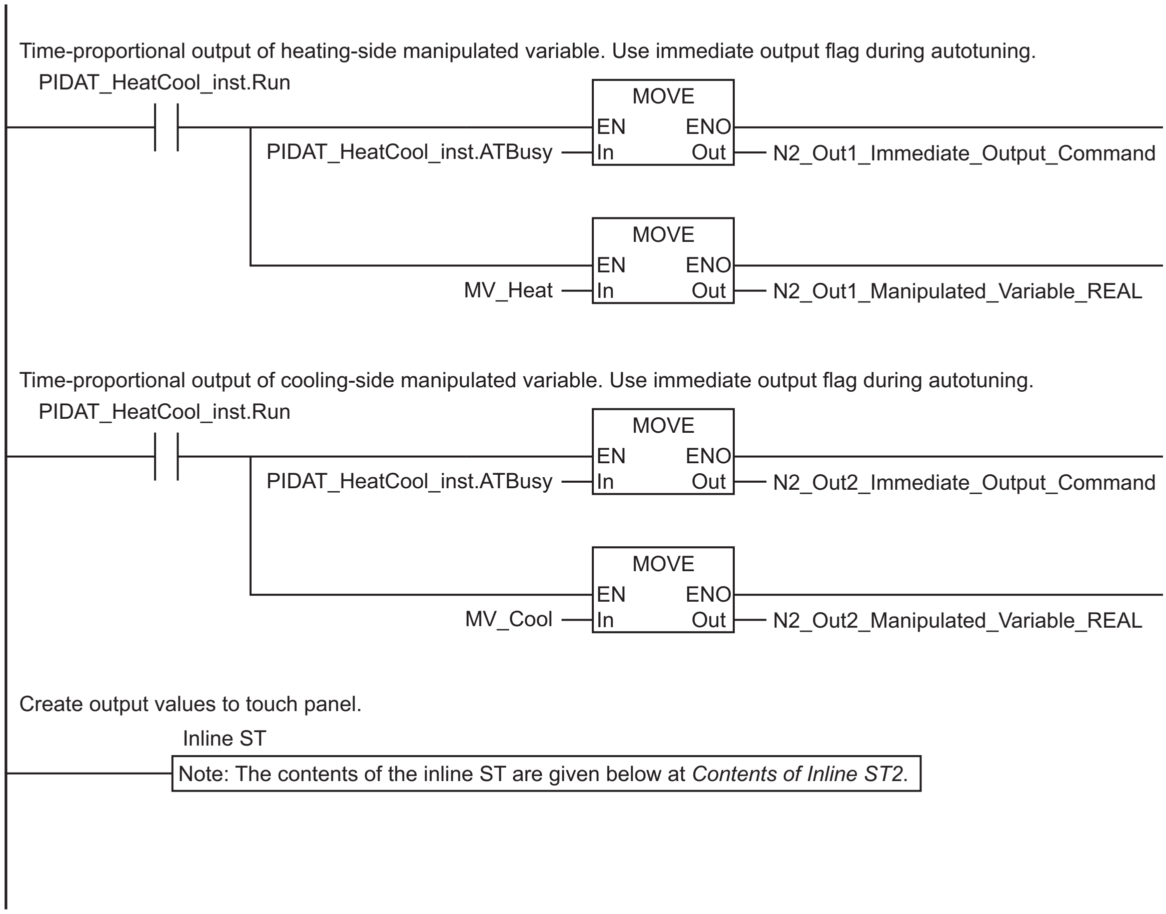
Name	Data type	Default	AT	Retained	Network Publish	Comment
N2_Out1_Immediate_Output_Command	BOOL	---	ECAT://node#[1,2]/Immediate Output Command/Out1 Immediate Output Command	FALSE	Do not publish.	Immediate output command flag for heating side
N1_Ch1_Measured_Value_INT	INT	---	ECAT://node#[1,1]/Ch1 Measured Value INT	FALSE	Do not publish.	Thermocouple input from NX-TS2101
N2_Out2_Manipulated_Variable_REAL	REAL	---	ECAT://node#[1,2]/Out2 Manipulated Variable REAL	FALSE	Do not publish.	Manipulated variable for cooling side
N2_Out2_Immediate_Output_Command	BOOL	---	ECAT://node#[1,2]/Immediate Output Command/Out2 Immediate Output Command	FALSE	Do not publish.	Immediate output command flag for cooling side

● Internal Variables

Name	Data type	Default	Comment
PB_Heat	REAL	0	Proportional band for heating control
PB_Cool	REAL	0	Proportional band for cooling control
MV	REAL	0	Manipulated variable
MV_Heat	REAL	0	Manipulated variable for heating control
MV_Cool	REAL	0	Manipulated variable for cooling control
PIDAT_HeatCool_inst	PIDAT_HeatCool		Instance of PIDAT_HeatCool instruction
TI_Heat	TIME	T#0s	Integration time for heating control
TI_Cool	TIME	T#0s	Integration time for cooling control
CtlPrd_Cool	TIME	T#0s	Cooling control period
CtlPrd_Heat	TIME	T#0s	Heating control period
TD_Heat	TIME	T#0s	Derivative time for heating control
TD_Cool	TIME	T#0s	Integration time for cooling control
ManMV	REAL	0	Manual manipulated variable
PV	REAL	0	Process value

Ladder Programming





● Contents of Inline ST1

```
// Convert unit of input value from NX-TS2101 and touch panel.
PV:=INT_TO_REAL(N1_Ch1_Measured_Value_INT)/REAL#10.0;
PTIn_InitParam.SampTime:=NanoSecToTime(PTIn_InitSetOpr_SampTime*1000000);
PB_Heat:=PT_PB_Heat;
TI_Heat:=NanoSecToTime(PT_TI_Heat*1000000);
TD_Heat:=NanoSecToTime(PT_TD_Heat*1000000);
PB_Cool:=PT_PB_Cool;
TI_Cool:=NanoSecToTime(PT_TI_Cool*1000000);
TD_Cool:=NanoSecToTime(PT_TD_Cool*1000000);
ManMV:=PT_ManMV;
```

● Contents of Inline ST 2

```
// Create output values to touch panel.
PTOut_PV:=PV;
PTOut_ATDone:=PIDAT_HeatCool_inst.ATDone;
PTOut_ATBusy:=PIDAT_HeatCool_inst.ATBusy;
PTOut_Error:=PIDAT_HeatCool_inst.Error;
PTOut_MV:=PIDAT_HeatCool_inst.MV;
PTOut_MVHeat:=PIDAT_HeatCool_inst.MV_Heat;
PTOut_MVCool :=PIDAT_HeatCool_inst.MV_Cool;
PT_PB_Heat := PB_Heat;
PT_TI_Heat :=TimeToNanoSec(TI_Heat)/1000000;
PT_TD_Heat :=TimeToNanoSec(TD_Heat)/1000000;
PT_PB_Cool :=PB_Cool;
PT_TI_Cool :=TimeToNanoSec(TI_Cool)/1000000;
PT_TD_Cool :=TimeToNanoSec(TD_Cool)/1000000;
PT_ManMV :=ManMV;
```

ST Programming

```
//Heater burnout, SSR failure detection processing
IF N2_CT1_Heater_Burnout_Detection=TRUE OR N2_CT1_SSR_Failure_Detection=TRUE
THEN;

//Stop output when error is detected
PTIn_Run:=FALSE;

END_IF;

//Convert unit of input value from NX-TS2101 and touch panel.
PV:=INT_TO_REAL(N1_Ch1_Measured_Value_INT)/REAL#10.0;
PTIn_InitParam.SampTime:=NanoSecToTime(PTIn_InitSetOpr_SampTime*1000000);
PB_Heat:=PT_PB_Heat;
TI_Heat:=NanoSecToTime(PT_TI_Heat*1000000);
TD_Heat:=NanoSecToTime(PT_TD_Heat*1000000);
PB_Cool:=PT_PB_Cool;
TI_Cool:=NanoSecToTime(PT_TI_Cool*1000000);
TD_Cool:=NanoSecToTime(PT_TD_Cool*1000000);
ManMV:=PT_ManMV;

//Execute PIDAT_HeatCool instruction.
PIDAT_HeatCool_inst(Run:=PTIn_Run,
                    ManCtl:=PTIn_ManCtl,
                    StartAT:=PTIn_StartAT,
                    PV:=PV,
                    SP:=PTIn_SP,
                    DeadBand:=PTIn_DeadBand,
                    OprSetParams:=PTIn_OprParam,
                    InitSetParams:=PTIn_InitParam,
                    ProportionalBand_Heat:=PB_Heat,
                    IntegrationTime_Heat:=TI_Heat,
                    DerivativeTime_Heat:=TD_Heat,
                    ProportionalBand_Cool:=PB_Cool,
                    IntegrationTime_Cool:=TI_Cool,
                    DerivativeTime_Cool:=TD_Cool,
                    ManMV:=ManMV,
                    CtlPrd_Cool:=CtlPrd_Cool,
                    MV=>MV,
                    MV_Heat=>MV_Heat,
                    MV_Cool=>MV_Cool);

//Time-proportional output for heating operation. Use immediate output flag during
autotuning.
N2_Out1_Immediate_Output_Command:=PIDAT_HeatCool_inst.ATBusy;
N2_Out1_Manipulated_Variable_REAL:=MV_Heat;
//Time-proportional output of cooling operation. Use immediate output flag during
autotuning.
N2_Out2_Immediate_Output_Command:=PIDAT_HeatCool_inst.ATBusy;
N2_Out2_Manipulated_Variable_REAL:=MV_Cool;

//Create output values to touch panel.
PTOut_PV:=PV;
PTOut_ATDone:=PIDAT_HeatCool_inst.ATDone;
PTOut_ATBusy:=PIDAT_HeatCool_inst.ATBusy;
PTOut_Error:=PIDAT_HeatCool_inst.Error;
PTOut_MV:=PIDAT_HeatCool_inst.MV;
PTOut_MVHeat:=PIDAT_HeatCool_inst.MV_Heat;
PTOut_MVCool :=PIDAT_HeatCool_inst.MV_Cool;
PT_PB_Heat := PB_Heat;
PT_TI_Heat :=TimeToNanoSec(TI_Heat)/1000000;
```

```
PT_TD_Heat :=TimeToNanoSec(TD_Heat)/1000000;
PT_PB_Cool :=PB_Cool;
PT_TI_Cool :=TimeToNanoSec(TI_Cool)/1000000;
PT_TD_Cool :=TimeToNanoSec(TD_Cool)/1000000;
PT_ManMV :=ManMV;
```

7-8-5 Using Heater Burnout Detection Units Connected to a CPU Unit

This section describes a configuration example in which NX Units are connected to an NX-series NX1P2 CPU Unit. Only the differences from the previous example in which the same NX Units are connected in an EtherCAT Slave Terminal are described.

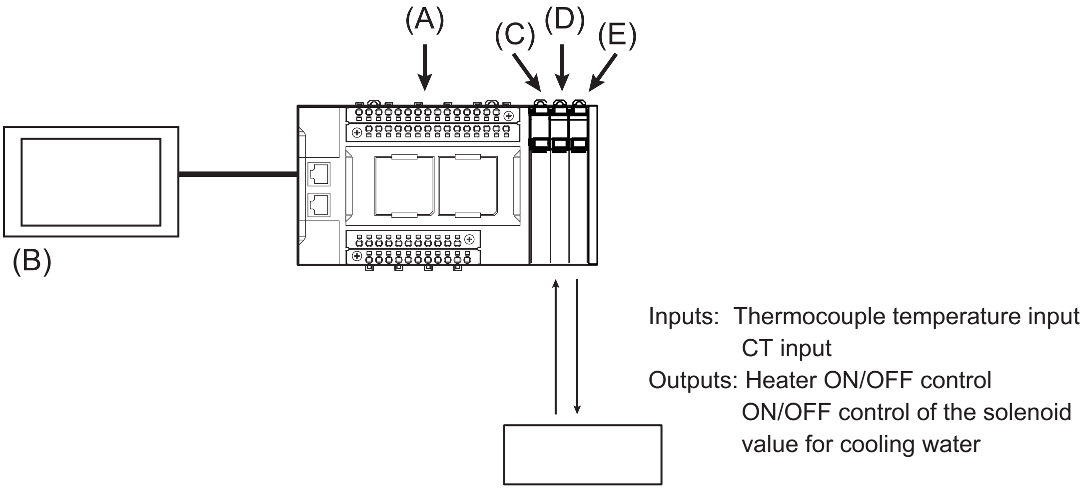
Consider these differences while reading the above example that uses an EtherCAT Slave Terminal.

Assumed Configuration

Interpret NJ/NX/NY-series controller in the example for the EtherCAT Slave Terminal as NX-series NX1P2 CPU Unit.

System Configuration

The system configuration example is given below.



Letter	Description	Model	Differences from example using an EtherCAT Slave Terminal
(A)	NX-series NX1P2 CPU Unit	NX1P2-1140DT1	This is an NX1P2 CPU Unit.
(B)	Touch panel	---	These are the same as in the other example.
(C)	Additional I/O Power Supply Unit	NX-PF0630	The NX1P2 CPU Unit does not have terminals for the I/O power supply to NX Units. You must mount this Unit immediately to the right of the CPU Unit.
(D)	Temperature Input Unit	NX-TS2101	These are the same as in the other example.
(E)	Heater Burnout Detection Unit	NX-HB3101	

In comparison to the NX Unit configuration in the EtherCAT Slave Terminal example, the Additional I/O Power Supply Unit for supplying I/O power to the Digital I/O Units must be immediately to the right of the CPU Unit. Therefore, the NX Unit numbers of the NX Units change. These are described in the following table.

Unit Type	Model	Differences from example using an EtherCAT Slave Terminal
CPU Unit	NX1P2-1140DT1	This is an NX1P2 CPU Unit.
Additional I/O Power Supply Unit	NX-PF0630	This Unit supplies I/O power to the Digital I/O Units and is mounted immediately to the right of the CPU Unit. Its NX Unit number is 1.
Temperature Input Unit	NX-TS2101	The NX Unit number is increased by 1 to become 2.
Heater Burnout Detection Unit	NX-HB3101	The NX Unit number is increased by 1 to become 3.

● Touch Panel Specifications

These specifications are the same as in the example that uses an EtherCAT Slave Terminal.

Setting Example

● Unit Operation Settings

These specifications are the same as in the example that uses an EtherCAT Slave Terminal.

● I/O Allocation Settings

These specifications are the same as in the example that uses an EtherCAT Slave Terminal.

● I/O Map

Add 1 to the NX Unit numbers from the example for the EtherCAT Slave Terminal. Change the following variable names. These differences are based on the assumption that a variable name of an NX Unit whose NX Unit number is n, begins with Nn_.

Variable names	
Slave Terminal Operation	CPU Unit Operation
N1_Ch1_Measured_Value_INT	N2_Ch1_Measured_Value_INT
N2_CT1_Heater_Burnout_Detection	N3_CT1_Heater_Burnout_Detection
N2_CT1_SSR_Failure_Detection	N3_CT1_SSR_Failure_Detection
N2_Out1_Manipulated_Variable_REAL	N3_Out1_Manipulated_Variable_REAL
N2_Out1_Immediate_Output_Command	N3_Out1_Immediate_Output_Command
N2_Out2_Manipulated_Variable_REAL	N3_Out2_Manipulated_Variable_REAL
N2_Out2_Immediate_Output_Command	N3_Out2_Immediate_Output_Command

Programming Example

● Variables Used in Programming

Change the following variable names and AT specification from the example for the EtherCAT Slave Terminal.

Variable names when these Units are connected to the EtherCAT Coupler Unit		Variable names when these Units are connected to the CPU Unit	
Variable name	AT	Variable name	AT
N2_CT1_Heater_Burnout_Detection	ECAT://node#[1,2]/CT1 Alarm Status/CT1 Heater Burnout Detection	N3_CT1_Heater_Burnout_Detection	IOBus://unit#[3]/CT1 Alarm Status/CT1 Heater Burnout Detection

Variable names when these Units are connected to the EtherCAT Coupler Unit		Variable names when these Units are connected to the CPU Unit	
Variable name	AT	Variable name	AT
N2_CT1_SSR_Failure_-Detection	ECAT://node#[1,2]/CT1 Alarm Status/CT1 SSR Failure Detection	N3_CT1_SSR_Failure_-Detection	IOBus://unit#[3]/CT1 Alarm Status/CT1 SSR Failure Detection
N2_Out1_Manipulated_-Variable_REAL	ECAT://node#[1,2]/Out1 Manipulated Variable REAL	N3_Out1_Manipulated_-Variable_REAL	IOBus://unit#[3]/Out1 Manipulated Variable REAL
N2_Out1_Immedi-ate_Output_Command	ECAT://node#[1,2]/Imme-diate Output Com-mand/Out1 Immediate Output Command	N3_Out1_Immedi-ate_Output_Command	IOBus://unit#[3]/Immedi-ate Output Com-mand/Out1 Immediate Output Command
N1_Ch1_Measured_Val-ue_INT	ECAT://node#[1,1]/Ch1 Measured Value INT	N2_Ch1_Measured_Val-ue_INT	IOBus://unit#[2]/Ch1 Measured Value INT
N2_Out2_Manipulated_-Variable_REAL	ECAT://node#[1,2]/Out2 Manipulated Variable REAL	N3_Out2_Manipulated_-Variable_REAL	IOBus://unit#[3]/Out2 Manipulated Variable REAL
N2_Out2_Immedi-ate_Output_Command	ECAT://node#[1,2]/Imme-diate Output Com-mand/Out2 Immediate Output Command	N3_Out2_Immedi-ate_Output_Command	IOBus://unit#[3]/Immedi-ate Output Com-mand/Out2 Immediate Output Command

- **Ladder Programming**

Change the variable names from the example for the EtherCAT Slave Terminal. Changes are the same as the description of I/O Map in this section.

- **ST Programming**

Change the variable names from the example for the EtherCAT Slave Terminal. Changes are the same as the description of I/O Map in this section.

8

Troubleshooting

This section provides error information and corrections for errors that can occur when the Temperature Input Units and Heater Burnout Detection Units are used.

8-1 How to Check for Errors

Use one of the following error checking methods.

- Checking the indicators
- Troubleshooting with Support Software

Refer to the user's manual for the CPU Unit, Communications Coupler Unit, or Communication Control Unit connected for details on troubleshooting with the Support Software.

8-2 Checking for Errors with the Indicators

You can use the TS indicators on the NX Units to check the NX 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.

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

Main Errors and Corrections

● Temperature Input Units

TS indicator		Cause	Correction
Green	Red		
Lit	Not Lit	---	--- (This is the normal status.)
FS (2 s)	Not Lit	• Initializing • Downloading	--- (Normal. Wait until the processing is completed.)
Lit	Lit	This status is not present.	
Not Lit	Not Lit	The Unit power supply is not supplied.	Check the following items and supply the Unit power supply correctly. [Check items for power supply] • Make sure that the power supply cable is wired correctly. • Make sure that the power supply cable is not disconnected. • Make sure that power supply voltage is within the specified range. • Make sure that the power supply has enough capacity. • Make sure that power supply has not failed.
		• Waiting for initialization start • Restarting	--- (Normal. Wait until the processing is completed.)
		If you cannot resolve the problem after you check the above items and cycle the Unit power supply, the Unit may have a hardware failure. If this happens, replace the Unit.	
Not Lit	Lit	Hardware failure	If this error occurs after you cycle the Unit power supply, replace the Unit.
Not Lit	Lit	Non-volatile Memory Hardware Error	Refer to Event *Non-volatile Memory Hardware Error* on page 8-18.
Not Lit	Lit	Control Parameter Error in Master	Refer to Event *Control Parameter Error in Master* on page 8-21.

TS indicator		Cause	Correction
Green	Red		
Not Lit	Lit	NX Unit Processing Error	Refer to Event *NX Unit Processing Error* on page 8-22.
Not Lit	Lit	A/D Converter Error	Refer to Event *A/D Converter Error* on page 8-19.
Not Lit	Lit	NX Unit Clock Not Synchronized Error	Refer to Event *NX Unit Clock Not Synchronized Error* on page 8-26.
Not Lit	FS (1 s)	NX Unit I/O Communications Error	Refer to Event *NX Unit I/O Communications Error* on page 8-24.
The indicator status is held immediately before the event occurred.		Cold Junction Sensor Error	Refer to Event *Cold Junction Sensor Error* on page 8-20.
		Sensor Disconnected Error	Refer to Event *Sensor Disconnected Error* on page 8-23.
		Process Value Over Range	Refer to Event *Process Value Over Range* on page 8-27.
		Process Value Under Range	Refer to Event *Process Value Under Range* on page 8-28.
		NX Message Communications Error	Refer to Event *NX Message Communications Error* on page 8-29.

● Heater Burnout Detection Units

TS indicator		Cause	Correction
Green	Red		
Lit	Not Lit	---	--- (This is the normal status.)
FS (2s)	Not Lit	• Initializing • Downloading	--- (Normal. Wait until the processing is completed.)
Lit	Lit	This status does not exist.	
Not Lit	Not Lit	The Unit power supply is not supplied.	Check the following items and supply the Unit power supply correctly. [Check items for power supply] • Make sure that the power supply cable is wired correctly. • Make sure that the power supply cable is not disconnected. • Make sure that the power supply voltage is within the specified range. • Make sure that the power supply has enough capacity. • Make sure that power supply has not failed.
		• Waiting for initialization to start • Restarting	--- (Normal. Wait until the processing is completed.)
		If you cannot resolve the problem after you check the above items and cycle the Unit power supply, the Unit may have a hardware failure. If this happens, replace the Unit.	
Not Lit	Lit	Hardware failure	If this error occurs after you cycle the Unit power supply, replace the Unit.
Not Lit	Lit	Non-volatile Memory Hardware Error	Refer to Event *Non-volatile Memory Hardware Error* on page 8-31.
Not Lit	Lit	Control Parameter Error in Master	Refer to Event *Control Parameter Error in Master* on page 8-33.
Not Lit	Lit	NX Unit Processing Error	Refer to Event *NX Unit Processing Error* on page 8-34.
Not Lit	Lit	A/D Converter Error	Refer to Event *A/D Converter Error* on page 8-32.
Not Lit	Lit	NX Unit Clock Not Synchronized Error	Refer to Event *NX Unit Clock Not Synchronized Error* on page 8-39.

TS indicator		Cause	Correction
Green	Red		
Not Lit	FS (1 s)	NX Unit I/O Communications Error	Refer to Event *NX Unit I/O Communications Error* on page 8-37.
The indicator status is held immediately before the event occurred.		Heater Burnout Detected	Refer to Event *Heater Burnout Detected* on page 8-35.
		SSR Failure Detected	Refer to Event *SSR Failure Detected* on page 8-36.
		NX Message Communications Error	Refer to Event *NX Message Communications Error* on page 8-40.

8-3 Checking for Errors and Troubleshooting on the Support Software

Error management on the NX Series is based on the methods used for the NJ/NX/NY-series Controllers.

This allows you to use the Support Software to check the meanings of errors and troubleshooting procedures.

The confirmation method depends on the Support Software that you use.

8-3-1 Checking for Errors from the Sysmac Studio

When an error occurs, you can place the Sysmac Studio online to the Controller or the Communications Coupler Unit to check current Controller errors and the log of past Controller errors.

Refer to the user's manual for the connected CPU Unit, Communications Coupler Unit, or Communication Control Unit for information on checking errors.

Current Errors

Open the Sysmac Studio's Controller Error Tab Page to check the current error's level, source, source details, event name, event codes, details, attached information 1 to 4, and correction.

Errors in the observation level are not displayed.

Additional Information

Number of Current Errors

The following table gives the number of errors that are reported simultaneously as current errors in each Unit.

Unit	Number of simultaneous error notifications
Temperature Input Units	15 errors
Heater Burnout Detection Units	15 errors

If the number of errors exceeds the maximum number of reportable current errors, errors are reported with a priority given to the oldest and highest-level errors. Errors that exceed the limit on simultaneous error notifications are not reported.

Errors that are not reported are still reflected in the error status.

Log of Past Errors

Open the Sysmac Studio's Controller Event Log Tab Page to check the times, levels, sources, source details, event names, event codes, details, attached information 1 to 4, and corrections for previous errors.

Additional Information

Number of Logs of Past Errors

Event logs in the Temperature Input Units are stored in the Temperature Input Unit itself.
Event logs in the Heater Burnout Detection Units are stored in the Heater Burnout Detection Unit itself.

The system event log can record 15 events. The access event log can record 2 events.

Refer to the troubleshooting manual for the connected CPU Unit or Industrial PC and the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the items that you can check and the procedures to check for errors.
Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for details on event codes.

8-3-2 Checking for Errors from Support Software Other Than the Sysmac Studio

You can check the error descriptions and logs with Support Software other than the Sysmac Studio.
For the error checking methods, refer to the user's manual for the connected Communications Coupler Unit and the operation manual for the Support Software.
Refer to *8-3-3 Event Codes and Corrections for Errors* on page 8-8 for information on event codes.

The number of current errors and the number of error log errors that occurred in the past in a Temperature Input Unit or Heater Burnout Detection Unit are the same as for the Sysmac Studio.

8-3-3 Event Codes and Corrections for Errors

The errors (i.e., events) that can occur in the Temperature Input Units and Heater Burnout Detection Units are given on the following pages.

The following abbreviations are used in the event level column.

Abbreviation	Name
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 troubleshooting manual for the connected CPU Unit or Industrial PC for information on NJ/NX/NY-series event codes.

Temperature Input Units

The errors (i.e. events) that occur in the Temperature Input Units are shown below.

If your NX Unit is connected to a Communication Control Unit, replace CPU Unit with Communication Control Unit in the descriptions provided for “For the NX bus of CPU Units” in the table below.

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. 8-18
05100000 hex	A/D Converter Error	An error occurred in the A/D converter	• Noise • A/D converter failure			S			P. 8-19
05110000 hex	Cold Junction Sensor Error	The temperature cannot be converted because the cold junction sensor is disconnected.	• There is a faulty connection to the cold junction sensor. • The cold junction sensor failed.			S	U		P. 8-20

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
1041 0000 hex	Control Parameter Error in Master	An error occurred in the control parameters that are saved in the master.	For the NX bus of CPU Units • The power supply to the CPU Unit was turned OFF while writing the Unit operation settings was in progress. Or there is an error in the area of the non-volatile memory in the CPU Unit in which the Unit operation settings for the relevant NX Unit are saved. For Communications Coupler Units • The power supply to the Communications Coupler Unit was turned OFF while writing the Unit operation settings was in progress. Or 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 relevant NX Unit are saved.			S			P. 8-21
4020 0000 hex	NX Unit Processing Error	A fatal error occurred in an NX Unit.	• An error occurred in the software.			S			P. 8-22
6510 0000 hex	Sensor Disconnected Error	A disconnected temperature sensor was detected.	• The temperature sensor is damaged or the wires are broken. • An unused channel is not disabled. • The wiring to the temperature sensor is incorrect.			S	U		P. 8-23

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 in an NX Unit.	For the NX bus of CPU Units • An error that prevents normal NX bus communications occurred in a CPU 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 an NX Unit. For Communications Coupler Units • An error that prevents normal NX bus communications occurred in a Communications Coupler Unit. • The NX Unit is not mounted properly. • The power cable for the Unit power supply is disconnected. Or, the wiring from the Unit power supply to the NX Units is incorrect. • The power cable for the Unit power supply is broken. • The voltage of the Unit power supply is outside the specified range. Or, the capacity of the Unit power supply is insufficient. • There is a hardware error in the NX Unit.			S			P. 8-24

Event code	Event name	Meaning	Assumed cause	Level: Maj	Prt	Min	Obs	Info	Reference
80240000 hex	NX Unit Clock Not Synchronized Error	A time information error occurred in an NX Unit.	For the NX bus of CPU Units • There is a hardware error in an NX Unit. • There is a hardware error in a CPU Unit. For Communications Coupler Units • There is a hardware error in an NX Unit. • There is a hardware error in an EtherCAT Coupler Unit.			S			P. 8-26
65110000 hex	Process Value Over Range	The process temperature exceeded the upper limit of temperature conversion range.	• The sensor is disconnected. • The sensor or the compensating cables are not wired correctly. • The sensor and the input type setting do not agree. • The range of the input type is too narrow for the temperatures that need to be measured. • An unused channel is not disabled.			U	S		P. 8-27
65120000 hex	Process Value Under Range	The process temperature went below the lower limit of temperature conversion range.	• The sensor or the compensating cables are not wired correctly. • The sensor and the input type setting do not agree. • The range of the input type is too narrow for the temperatures that need to be measured.			U	S		P. 8-28

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
80220000 hex	NX Message Communications Error	An error was detected in message communications and the message frame was discarded.	For the NX bus of CPU Units • The message communications load is high. For Communications Coupler Units • The message communications load is high. • The communications cable is disconnected or broken. • Message communications were cutoff in communications.				S		P. 8-29
90400000 hex	Event Log Cleared	The event log was cleared.	• The event log was cleared by the user.					S	P. 8-30

Heater Burnout Detection Units

The errors (i.e. events) that occur in the Heater Burnout Detection Units are shown below.

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. 8-31
05100000 hex	AD Converter Error	An error occurred in the A/D converter.	• Noise • A/D converter failure			S			P. 8-32
10410000 hex	Control Parameter Error in Master	An error occurred in the control parameters that are saved in the master.	For the NX bus of CPU Units • The power supply to the CPU Unit was turned OFF while writing the Unit operation settings was in progress. Or there is an error in the area of the non-volatile memory in the CPU Unit in which the Unit operation settings for the relevant NX Unit are saved. For Communications Coupler Units • The power supply to the Communications Coupler Unit was turned OFF while writing the Unit operation settings was in progress. Or 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 relevant NX Unit are saved.			S			P. 8-33
40200000 hex	NX Unit Processing Error	A fatal error occurred in an NX Unit.	• An error occurred in the software.			S			P. 8-34

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
652C0000 hex	Heater Burn-out Detected	A heater burnout was detected.	• A heater was burned out or damaged. • The setting of the Heater Burnout Detection Current is too high. • A CT input that is not used is allocated to a control output in the CT Allocation setting when this error occurs in the Heater Burnout Detection Unit. • An unused channel is not disabled when this error occurs in the Temperature Control Unit.			S	U		P. 8-35
652D0000 hex	SSR Failure Detected	An SSR failure was detected.	• The SSR was short-circuited or damaged. • The setting of the SSR Failure Detection Current is too small. • A CT input that is not used is allocated to a control output in the CT Allocation setting when this error occurs in the Heater Burnout Detection Unit. • An unused channel is not disabled when this error occurs in the Temperature Control Unit.			S	U		P. 8-36

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 in an NX Unit.	For the NX bus of CPU Units • An error that prevents normal NX bus communications occurred in a CPU 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 an NX Unit. For Communications Coupler Units • An error that prevents normal NX bus communications occurred in a Communications Coupler Unit. • The NX Unit is not mounted properly. • The power cable for the Unit power supply is disconnected. Or, the wiring from the Unit power supply to the NX Units is incorrect. • The power cable for the Unit power supply is broken. • The voltage of the Unit power supply is outside the specified range. Or, the capacity of the Unit power supply is insufficient. • There is a hardware error in the NX Unit.			S			P. 8-37

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
80240000 hex	NX Unit Clock Not Synchronized Error	A time information error occurred in an NX Unit.	For the NX bus of CPU Units • There is a hardware error in an NX Unit. • There is a hardware error in a CPU Unit. For Communications Coupler Units • There is a hardware error in an NX Unit. • There is a hardware error in an EtherCAT Coupler Unit.			S			P. 8-39
80220000 hex	NX Message Communications Error	An error was detected in message communications and the message frame was discarded.	For the NX bus of CPU Units • The message communications load is high. For Communications Coupler Units • The message communications load is high. • The communications cable is disconnected or broken. • Message communications were cutoff in communications.				S		P. 8-40
90400000 hex	Event Log Cleared	The event log was cleared.	• The event log was cleared by the user.					S	P. 8-41

8-3-4 Meaning of Error

This section describes the information that is given for individual errors.

How to Read 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 colspan="2">Tells the level of influence on control.[*1]</td><td>Log category</td><td colspan="2">Tells which log the error is saved in.[*2]</td></tr>
<tr><td>Recovery</td><td colspan="5">Gives the recovery method.[*3]</td></tr>
<tr><td>Effects</td><td>User program</td><td>Tells what will happen to execution of the user program.[*4]</td><td>Operation</td><td colspan="3">Provides special information on the operation that results from the error.</td></tr>
<tr><td>Indicators</td><td colspan="6">Gives the status of the built-in EtherNet/IP port and built-in EtherCAT port indicators. Indicator status is given only for errors in the EtherCAT Master Function Module and the EtherNet/IP Function Module.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="6">Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">Lists the possible causes, corrections, and preventive measures for the error.</td></tr>
<tr><td>Attached information</td><td colspan="6">This is the attached information that is displayed by the Support Software 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:
System: System event log
Access: Access event log

*3. 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.

*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 troubleshooting manual for the connected CPU Unit or Industrial PC for the applicable range of the HMI Troubleshooter.

8-3-5 Error Descriptions of Temperature Input Units

This section describes the information that occurs on the Temperature Input Units.

If your NX Unit is connected to a Communication Control Unit, replace CPU Unit with Communication Control Unit in the descriptions provided for “For the NX bus of CPU Units” in the tables below.

<table>
<tr><th>Event name</th><td colspan="3">Non-volatile Memory Hardware Error</td><th>Event code</th><td colspan="2">00200000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">An error occurred in non-volatile memory.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Support Software is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>When power is turned ON to the NX Unit</td></tr>
<tr><th rowspan="2">Error attributes</th><th>Level</th><td colspan="2">Minor fault</td><th>Log category</th><td colspan="2">System</td></tr>
<tr><th>Recovery</th><td colspan="5">For the NX bus of CPU Units
Cycle the power supply to the Unit or restart the NX bus.
For Communications Coupler Units
Cycle the power supply to the Unit or restart the Slave Terminal.
If the errors are detected in the Controller, reset all of the errors in the Controller.</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">I/O refreshing for the NX Unit stops. Messages cannot be sent to the NX Unit.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="2">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">Non-volatile memory failure.</td><td colspan="2">For the NX bus of CPU Units
Cycle the power supply to the Unit or restart the NX bus. If the error persists even after you make the above correction, replace the relevant NX Unit.
For Communications Coupler Units
Cycle the power supply to the Unit or restart the Slave Terminal. If the error persists even after you make the above correction, replace the relevant NX Unit.</td><td colspan="2">None</td></tr>
<tr><th>Attached information</th><td colspan="6">None</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">None</td></tr>
</table>

<table>
<tr><th>Event name</th><td colspan="3">A/D Converter Error</td><th>Event code</th><td colspan="2">05100000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">An error occurred in the A/D converter</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Support Software is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>Continuously</td></tr>
<tr><th rowspan="2">Error attributes</th><th>Level</th><td colspan="2">Minor fault</td><th>Log category</th><td colspan="2">System</td></tr>
<tr><th>Recovery</th><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">The process value goes to 32767 for INT data, to 2147483647 for DINT data, and to 1.0E+10 for REAL data.</td></tr>
<tr><th rowspan="2">Sys-tem-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="3">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">Noise</td><td colspan="2">Cycle the power to the NX Unit and see if this clears the error.
If the error occurs frequently, check for noise entry paths and implement noise countermea-sures as required.</td><td colspan="2">Implement noise countermea-sures.</td></tr>
<tr><td colspan="2">A/D converter failure</td><td colspan="2">If cycling the power supply to the NX Unit does not clear the error, replace the NX Unit.</td><td colspan="2">None</td></tr>
<tr><th>Attached information</th><td colspan="6">Attached Information 1: Error Channel
0001 hex: Channel 1
0010 hex: Channel 2
0100 hex: Channel 3
1000 hex: Channel 4
If this error occurs at the same time for more than one channel, the sum of the codes is given.
For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">None</td></tr>
</table>

Event name	Cold Junction Sensor Error			Event code	05110000 hex	
Meaning	The temperature cannot be converted because the cold junction sensor is disconnected.					
Source	Depends on where the Support Software is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Minor fault		Log category	System	
	Recovery	Reset error in the NX Unit.				
Effects	User program	Continues.	Operation	Operation before Cause Is Removed: The process value goes to 32767 for INT data, to 2147483647 for DINT data, and to 1.0E+10 for REAL data. Operation after Cause Is Removed: The process value returns to normal when the connection is restored.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a faulty connection to the cold junction sensor.		Check the connections to the cold junction sensor on the terminal block and correct any bad connections that are found.		Make sure that the cold junction sensor is corrected correctly on the terminal block.	
	The cold junction sensor failed.		Replace the NX Unit.		None	
Attached information	Attached Information 1: Error Channel 0001 hex: Channel 1 0010 hex: Channel 2 0100 hex: Channel 3 1000 hex: Channel 4 If this error occurs at the same time for more than one channel, the sum of the codes is given. For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.					
Precautions/ Remarks	You can change the event level to the observation level.					

<table>
<tr><td>Event name</td><td colspan="4">Control Parameter Error in Master</td><td>Event code</td><td colspan="2">10410000 hex</td></tr>
<tr><td>Meaning</td><td colspan="7">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 Support Software is connected and the system configuration.</td><td>Source details</td><td>NX Unit</td><td>Detection timing</td><td colspan="2">When power is turned ON to the NX Unit</td></tr>
<tr><td rowspan="2">Error attributes</td><td>Level</td><td colspan="3">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="6">For the NX bus of CPU Units
When Fail-soft Operation Is Set to Stop
Restart the NX Unit and then reset the error in the NX Bus Function Module.
When Fail-soft Operation Is Set to Fail-soft
Restart the NX Unit and then reset the error in the NX Unit.
For Communications Coupler Units
When Fail-soft Operation Is Set to Stop
If the errors are detected in the Controller, restart the NX Unit and then reset all of the errors in the Controller.
If the errors are not detected in the Controller, restart the NX Unit and then reset the error in the Communications Coupler Unit.
When Fail-soft Operation Is Set to Fail-soft
Restart the NX Unit and then reset the error in the Communications Coupler Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="4">I/O refreshing for the NX Unit stops.</td></tr>
<tr><td rowspan="2">Sys-tem-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="3">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="3">---</td></tr>
<tr><td rowspan="5">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="3">Prevention</td></tr>
<tr><td colspan="7">For the NX bus of CPU Units</td></tr>
<tr><td colspan="2">The power supply to the CPU Unit was turned OFF while writing the Unit operation settings was in progress. Or there is an error in the area of the non-volatile memory in the CPU Unit in which the Unit operation settings for the relevant NX Unit are saved.</td><td colspan="2">Download the Unit operation settings of the NX Unit again. If the error persists even after you make the above correction, replace the CPU Unit.</td><td colspan="3">Do not turn OFF the power supply to the CPU Unit while transfer of the Unit operation settings for the NX Unit or save of NX Unit parameters by a message is in progress.</td></tr>
<tr><td colspan="7">For Communications Coupler Units</td></tr>
<tr><td colspan="2">The power supply to the Communications Coupler Unit was turned OFF while writing the Unit operation settings was in progress. Or 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 relevant NX Unit are saved.</td><td colspan="2">Download the Unit operation settings of the NX Unit again. If the error occurs again even after you make the above correction, replace the Communications Coupler Unit.</td><td colspan="3">Do not turn OFF the power supply to the Communications Coupler Unit while transfer of the Unit operation settings for the NX Unit by the Support Software or save of NX Unit parameters by a message is in progress.</td></tr>
<tr><td>Attached information</td><td colspan="7">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="7">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">NX Unit Processing Error</td><td>Event code</td><td colspan="2">40200000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">A fatal error occurred in an NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">For the NX bus of CPU Units
Cycle the power supply to the NX Unit and then reset the error in the NX Bus Function Module.
For Communications Coupler Units
Cycle the power supply to the NX Unit and then reset the error in the Communications Coupler Unit.</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. Messages cannot be sent to the NX Unit.</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">An error occurred in the software.</td><td colspan="2">For the NX bus of CPU Units
Cycle the power supply to the Unit, restart the NX Unit, or restart the NX bus. If this error occurs again even after the above correction, contact your OMRON representative.
For Communications Coupler Units
Cycle the power supply to the Unit, restart the NX Unit, or restart the Slave Terminal. If this error occurs again even after the above correction, contact your OMRON representative.</td><td colspan="2">None</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: System information
Attached information 2: System information
Attached information 3: System information
Attached information 4: System information</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">Sensor Disconnected Error</td><td>Event code</td><td colspan="2">6510 0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">A disconnected temperature sensor was detected.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Operation before Cause Is Removed: The process value goes to 32767 for INT data, to 2147483647 for DINT data, and to 1.0E+10 for REAL data.
Operation after Cause Is Removed: The process value returns to normal when the connection is restored.</td></tr>
<tr><td rowspan="2">Sys-tem-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 temperature sensor is damaged or the wires are broken.</td><td colspan="2">Check the temperature sensor for damage or broken wires and replace it if it is damaged or there are broken wires.</td><td colspan="2">Make sure that the temperature sensor is not damaged and that no wires are broken before you use it.</td></tr>
<tr><td colspan="2">An unused channel is not dis-abled.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td></tr>
<tr><td colspan="2">The wiring to the temperature sen-sor is incorrect.</td><td colspan="2">Check the position where the tem-perature sensor is connected and the polarity. If it is wrong, connect it properly.</td><td colspan="2">Check the position where the tem-perature sensor is connected and the polarity for proper connection.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached Information 1: Error Channel
0001 hex: Channel 1
0010 hex: Channel 2
0100 hex: Channel 3
1000 hex: Channel 4
If this error occurs at the same time for more than one channel, the sum of the codes is given.
For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.</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="3">NX Unit I/O Communications Error</td><td>Event code</td><td colspan="2">80200000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An I/O communications error occurred in an NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">For the NX bus of CPU Units
When Fail-soft Operation Is Set to Stop
Reset the error in the NX Bus Function Module.
When Fail-soft Operation Is Set to Fail-soft
Reset the error in the NX Unit.
For Communications Coupler Units
When Fail-soft Operation Is Set to Stop
If the errors are detected in the Controller, reset all of the errors in the Controller.
If the errors are not detected in the Controller, reset errors in the Communications Coupler Unit and NX Unit.
When Fail-soft Operation Is Set to Fail-soft
Reset errors in the Communications Coupler Unit and NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.</td></tr>
<tr><td rowspan="2">Sys-tem-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>
</table>

Cause and correction	Assumed cause	Correction	Prevention
	For the NX bus of CPU Units		
	An error that prevents normal NX bus communications occurred in a CPU Unit.	Check the error that occurred in the CPU Unit and perform the required corrections.	Take preventive measures against the error that occurred in the CPU Unit.
	An 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.	Wire the Unit power supply to the NX Units securely.	Wire the Unit power supply to the NX Units securely.
	The power cable for the Unit power supply is broken.	If the power cable between the Unit power supply and the NX Units is broken, replace it.	None
	The voltage of the Unit power supply is outside the specified range, or the capacity of the Unit power supply is insufficient.	Configure the power supply system configuration correctly according to the power supply design method.	Configure the power supply system configuration correctly according to the power supply design method.
	There is a hardware error in an NX Unit.	If the error persists even after you make the above correction, replace the NX Unit.	None
	For Communications Coupler Units		
	An error that prevents normal NX bus communications occurred in a Communications Coupler Unit.	Check the error that occurred in the Communications Coupler Unit and perform the required corrections.	Take preventive measures against the error that occurred in the Communications Coupler Unit.
	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.	If the power cable between the Unit power supply and the NX Units is broken, replace it.	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="3">NX Unit Clock Not Synchronized Error</td><td>Event code</td><td colspan="2">80240000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">A time information error occurred in an NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">For the NX bus of CPU Units
Cycle the power supply to the Unit.
For Communications Coupler Units
Cycle the power supply to the Unit and then reset all of the errors in the Controller.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.
Output data: The output values depend on the Load Rejection Output Setting.</td></tr>
<tr><td rowspan="2">Sys-tem-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="7">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">For the NX bus of CPU Units</td></tr>
<tr><td colspan="2">There is a hardware error in an NX Unit.</td><td colspan="2">If the error occurs only in a specific NX Unit, replace the relevant NX Unit.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">There is a hardware error in a CPU Unit.</td><td colspan="2">If the error occurs in all of the NX Units mounted on a CPU Unit, replace the CPU Unit.</td><td colspan="2">None</td></tr>
<tr><td colspan="6">For Communications Coupler Units</td></tr>
<tr><td colspan="2">There is a hardware error in an NX Unit.</td><td colspan="2">If the error occurs only in a specific NX Unit, replace the relevant NX Unit.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">There is a hardware error in an EtherCAT Coupler Unit.</td><td colspan="2">If the error occurs in all of the NX Units mounted on a Communications Coupler Unit, replace the Communications Coupler Unit.</td><td colspan="2">None</td></tr>
<tr><td>Attached information</td><td colspan="6">None</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">Process Value Over Range</td><td>Event code</td><td colspan="2">65110000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">The process temperature exceeded the upper limit of temperature conversion range.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Observation</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Operation before Cause Is Removed: The process value goes to the upper limit of temperature conversion range.
Operation after Cause Is Removed: The process value returns to normal.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="6">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The sensor is disconnected.</td><td colspan="2" rowspan="5">Find the reason the upper limit of the temperature conversion range was exceeded and make suitable corrections.</td><td colspan="2" rowspan="5">Investigate reasons for exceeding the upper limit of the temperature conversion range and take suitable preventive measures.</td></tr>
<tr><td colspan="2">The sensor or the compensating cables are not wired correctly.</td></tr>
<tr><td colspan="2">The sensor and the input type setting do not agree.</td></tr>
<tr><td colspan="2">The range of the input type is too narrow for the temperatures that need to be measured.</td></tr>
<tr><td colspan="2">An unused channel is not disabled.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached Information 1: Error Channel
0001 hex: Channel 1
0010 hex: Channel 2
0100 hex: Channel 3
1000 hex: Channel 4
If this error occurs at the same time for more than one channel, the sum of the codes is given.
For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">You can change the event level to the minor fault level.</td></tr>
</table>

Event name	Process Value Under Range			Event code	65120000 hex	
Meaning	The process temperature went below the lower limit of temperature conversion range.					
Source	Depends on where the Support Software is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Observation		Log category	System	
	Recovery	Reset error in the NX Unit.				
Effects	User program	Continues.	Operation	Operation before Cause Is Removed: The process value goes to the lower limit of temperature conversion range. Operation after Cause Is Removed: The process value returns to normal.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The sensor or the compensating cables are not wired correctly.		Find the reason for going below the lower limit of the temperature conversion range and make suitable corrections.		Investigate reasons for going below the lower limit of the temperature conversion range and take suitable preventive measures.	
	The sensor and the input type setting do not agree.					
	The range of the input type is too narrow for the temperatures that need to be measured.					
Attached information	Attached Information 1: Error Channel 0001 hex: Channel 1 0010 hex: Channel 2 0100 hex: Channel 3 1000 hex: Channel 4 If this error occurs at the same time for more than one channel, the sum of the codes is given. For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.					
Precautions/ Remarks	You can change the event level to the minor fault level.					

<table>
<tr><td>Event name</td><td colspan="3">NX Message Communications Error</td><td>Event code</td><td colspan="2">80220000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">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 Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Observation</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">---</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">Sys-tem-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="7">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">For the NX bus of CPU Units</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.</td><td colspan="2">Reduce the number of times that instructions are used to send NX messages.</td></tr>
<tr><td colspan="6">For Communications Coupler Units</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.</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 cutoff by executing the followings in message communications.
• Transfer of parameters by the Support Software
• Restoration of the backup data (if this error occurred in the EtherCAT Slave Terminal)
• Disconnection of an EtherCAT slave (if this error occurred in the EtherCAT Slave Terminal)</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td>Attached information</td><td colspan="6">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="6">None</td></tr>
</table>

Event name	Event Log Cleared		**Event code**	90400000 hex	
Meaning	The event log was cleared.				
Source	Depends on where the Support Software is connected and the system configuration.	**Source details**	NX Unit	**Detection timing**	When commanded from user
Error attributes	**Level**	Information	**Log category**	Access	
	Recovery	---			
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: Events that were cleared 1: The system event log was cleared. 2: The access event log was cleared.				
Precautions/ Remarks	None				

8-3-6 Error Descriptions of Heater Burnout Detection Units

This section describes the information that occurs on the Heater Burnout Detection Units.

Event name	Non-volatile Memory Hardware Error			**Event code**	00200000 hex
Meaning	An error occurred in non-volatile memory.				
Source	Depends on where the Support Software 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		**Log category**	System
	Recovery	For the NX bus of CPU Units Cycle the power supply to the Unit or restart the NX bus. For Communications Coupler Units Cycle the power supply to the Unit or restart the Slave Terminal. If the errors are detected in the Controller, reset all of the errors in the Controller.			
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**
	Non-volatile memory failure.		For the NX bus of CPU Units Cycle the power supply to the Unit or restart the NX bus. If the error persists even after you make the above correction, replace the relevant NX Unit. For Communications Coupler Units Cycle the power supply to the Unit or restart the Slave Terminal. If the error persists even after you make the above correction, replace the relevant NX Unit.		None
Attached information	None				
Precautions/ Remarks	None				

<table>
<tr><td>Event name</td><td colspan="3">A/D Converter Error</td><td>Event code</td><td colspan="2">05100000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An error occurred in the A/D converter</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The process value goes to 65535 for UINT data, and to 1.0E+10 for REAL data.</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">Noise</td><td colspan="2">Cycle the power to the NX Unit and see if this clears the error.
If the error occurs frequently, check for noise entry paths and implement noise countermeasures as required.</td><td colspan="2">Implement noise countermeasures.</td></tr>
<tr><td colspan="2">A/D converter failure</td><td colspan="2">If cycling the power supply to the NX Unit does not clear the error, replace the NX Unit.</td><td colspan="2">None</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached Information 1: Error Channel
0001 hex: Channel 1
0010 hex: Channel 2
0100 hex: Channel 3
1000 hex: Channel 4
If this error occurs at the same time for more than one channel, the sum of the codes is given.
For example, if errors occur at the same time for all channels (1 to 4), then 1111 hex is given.</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">None</td></tr>
</table>

<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 Support Software 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 colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">For the NX bus of CPU Units
When Fail-soft Operation Is Set to Stop
Restart the NX Unit and then reset the error in the NX Bus Function Module.
When Fail-soft Operation Is Set to Fail-soft
Restart the NX Unit and then reset the error in the NX Unit.
For Communications Coupler Units
When Fail-soft Operation Is Set to Stop
If the errors are detected in the Controller, restart the NX Unit and then reset all of the errors in the Controller.
If the errors are not detected in the Controller, restart the NX Unit and then reset the error in the Communications Coupler Unit.
When Fail-soft Operation Is Set to Fail-soft
Restart the NX Unit and then reset the error in the Communications Coupler Unit.</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="5">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">For the NX bus of CPU Units</td></tr>
<tr><td colspan="2">The power supply to the CPU Unit was turned OFF while writing the Unit operation settings was in progress. Or there is an error in the area of the non-volatile memory in the CPU Unit in which the Unit operation settings for the relevant NX Unit are saved.</td><td colspan="2">Download the Unit operation settings of the NX Unit again. If the error persists even after you make the above correction, replace the CPU Unit.</td><td colspan="2">Do not turn OFF the power supply to the CPU Unit while transfer of the Unit operation settings for the NX Unit or save of NX Unit parameters by a message is in progress.</td></tr>
<tr><td colspan="6">For Communications Coupler Units</td></tr>
<tr><td colspan="2">The power supply to the Communications Coupler Unit was turned OFF while writing the Unit operation settings was in progress. Or 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 relevant NX Unit are saved.</td><td colspan="2">Download the Unit operation settings of the NX Unit again. 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 Communications Coupler Unit while transfer of the Unit operation settings for the NX Unit by the Support Software or save of NX Unit parameters by a message 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 Support Software is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Minor fault		Log category	System	
	Recovery	For the NX bus of CPU Units Cycle the power supply to the NX Unit and then reset the error in the NX Bus Function Module. For Communications Coupler Units Cycle the power supply to the NX Unit and then reset the error in the Communications Coupler Unit.				
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.		For the NX bus of CPU Units Cycle the power supply to the Unit, restart the NX Unit, or restart the NX bus. If this error occurs again even after the above correction, contact your OMRON representative. For Communications Coupler Units Cycle the power supply to the Unit, restart the NX Unit, or restart the Slave Terminal. If this error occurs again even after the above correction, 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					

<table>
<tr><th>Event name</th><td colspan="3">Heater Burnout Detected</td><th>Event code</th><td colspan="2">652C0000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">A heater burnout was detected.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Support Software is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>Continuously</td></tr>
<tr><th rowspan="2">Error attributes</th><th>Level</th><td colspan="2">Minor fault</td><th>Log category</th><td colspan="2">System</td></tr>
<tr><th>Recovery</th><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">Operation will continue.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="5">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">A heater was burned out or damaged.</td><td colspan="2">Check the heater to see if it is burned out or damaged. If the heater is burned out or damaged, replace it.</td><td colspan="2">Find the reasons for the heater burnout or damage and take suitable preventive measures.</td></tr>
<tr><td colspan="2">The setting of the Heater Burnout Detection Current is too high.</td><td colspan="2">Set the Heater Burnout Detection Current to a suitable value.</td><td colspan="2">Set the Heater Burnout Detection Current to a suitable value.</td></tr>
<tr><td colspan="2">A CT input that is not used is allocated to a control output in the CT Allocation setting when this error occurs in the Heater Burnout Detection Unit.</td><td colspan="2">Set the CT Allocation setting for a CT input that is not used to Do not use.</td><td colspan="2">Set the CT Allocation setting for a CT input that is not used to Do not use.</td></tr>
<tr><td colspan="2">An unused channel is not disabled when this error occurs in the Temperature Control Unit.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td></tr>
<tr><th>Attached information</th><td colspan="6">Attached Information 1: CT Input with Error
0001 hex:CT1
0010 hex:CT2
0100 hex:CT3
1000 hex:CT4
If this error occurs at the same time for more than one CT input, the sum of the codes is given.
For example, if errors occur at the same time for all of CT1 to CT4, then 1111 hex is given.</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">You can change the event level to the observation level.</td></tr>
</table>

<table>
<tr><td>Event name</td><td colspan="3">SSR Failure Detected</td><td>Event code</td><td colspan="2">652D0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An SSR failure was detected.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error in the NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Operation will continue.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="5">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The SSR was short-circuited or damaged.</td><td colspan="2">Check the SSR to see if it is short-circuited or damaged. If the SSR is short-circuited or damaged, replace it.</td><td colspan="2">Find the reasons for the SSR short circuit or damage and take suitable preventive measures.</td></tr>
<tr><td colspan="2">The setting of the SSR Failure Detection Current is too small.</td><td colspan="2">Set the SSR Failure Detection Current to a suitable value.</td><td colspan="2">Set the SSR Failure Detection Current to a suitable value.</td></tr>
<tr><td colspan="2">A CT input that is not used is allocated to a control output in the CT Allocation setting when this error occurs in the Heater Burnout Detection Unit.</td><td colspan="2">Set the CT Allocation setting for a CT input that is not used to Do not use.</td><td colspan="2">Set the CT Allocation setting for a CT input that is not used to Do not use.</td></tr>
<tr><td colspan="2">An unused channel is not disabled when this error occurs in the Temperature Control Unit.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td><td colspan="2">Set the Channel Enable/Disable Setting parameter to FALSE for the unused channels.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached Information 1: CT Input with Error
0001 hex: CT1
0010 hex: CT2
0100 hex: CT3
1000 hex: CT4
If this error occurs at the same time for more than one CT input, the sum of the codes is given.
For example, if errors occur at the same time for all of CT1 to CT4, then 1111 hex is given.</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="3">NX Unit I/O Communications Error</td><td>Event code</td><td colspan="2">80200000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An I/O communications error occurred in an NX Unit.</td></tr>
<tr><td>Source</td><td colspan="2">Depends on where the Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">For the NX bus of CPU Units
When Fail-soft Operation Is Set to Stop
Reset the error in the NX Bus Function Module.
When Fail-soft Operation Is Set to Fail-soft
Reset the error in the NX Unit.
For Communications Coupler Units
When Fail-soft Operation Is Set to Stop
If the errors are detected in the Controller, reset all of the errors in the Controller.
If the errors are not detected in the Controller, reset errors in the Communications Coupler Unit and NX Unit.
When Fail-soft Operation Is Set to Fail-soft
Reset errors in the Communications Coupler Unit and NX Unit.</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">The NX Unit will continue to operate.
Input data: Updating input values stops.</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>
</table>

Cause and correction	Assumed cause	Correction	Prevention
	For the NX bus of CPU Units		
	An error that prevents normal NX bus communications occurred in a CPU Unit.	Check the error that occurred in the CPU Unit and perform the required corrections.	Take preventive measures against the error that occurred in the CPU Unit.
	An 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.	Wire the Unit power supply to the NX Units securely.	Wire the Unit power supply to the NX Units securely.
	The power cable for the Unit power supply is broken.	If the power cable between the Unit power supply and the NX Units is broken, replace it.	None
	The voltage of the Unit power supply is outside the specified range, or the capacity of the Unit power supply is insufficient.	Configure the power supply system configuration correctly according to the power supply design method.	Configure the power supply system configuration correctly according to the power supply design method.
	There is a hardware error in an NX Unit.	If the error persists even after you make the above correction, replace the NX Unit.	None
	For Communications Coupler Units		
	An error that prevents normal NX bus communications occurred in a Communications Coupler Unit.	Check the error that occurred in the Communications Coupler Unit and perform the required corrections.	Take preventive measures against the error that occurred in the Communications Coupler Unit.
	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.	If the power cable between the Unit power supply and the NX Units is broken, replace it.	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		

Event name	NX Unit Clock Not Synchronized Error			Event code	8024 0000 hex	
Meaning	A time information error occurred in an NX Unit.					
Source	Depends on where the Support Software is connected and the system configuration.		Source details	NX Unit	Detection timing	Continuously
Error attributes	Level	Minor fault		Log category	System	
	Recovery	For the NX bus of CPU Units Cycle the power supply to the Unit. For Communications Coupler Units Cycle the power supply to the Unit and then reset all of the errors in the Controller.				
Effects	User program	Continues.	Operation	The NX Unit will continue to operate. Input data: Updating input values stops. Output data: The output values depend on the Load Rejection Output Setting.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	For the NX bus of CPU Units					
	There is a hardware error in an NX Unit.		If the error occurs only in a specific NX Unit, replace the relevant NX Unit.		None	
	There is a hardware error in a CPU Unit.		If the error occurs in all of the NX Units mounted on a CPU Unit, replace the CPU Unit.		None	
	For Communications Coupler Units					
	There is a hardware error in an NX Unit.		If the error occurs only in a specific NX Unit, replace the relevant NX Unit.		None	
	There is a hardware error in an EtherCAT Coupler Unit.		If the error occurs in all of the NX Units mounted on a Communications Coupler Unit, replace the Communications Coupler Unit.		None	
Attached information	None					
Precautions/ Remarks	None					

<table>
<tr><td>Event name</td><td colspan="3">NX Message Communications Error</td><td>Event code</td><td colspan="2">80220000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">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 Support Software 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 rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Observation</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">---</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="7">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">For the NX bus of CPU Units</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.</td><td colspan="2">Reduce the number of times that instructions are used to send NX messages.</td></tr>
<tr><td colspan="6">For Communications Coupler Units</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.</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 cutoff by executing the followings in message communications.
• Transfer of parameters by the Support Software
• Restoration of the backup data (if this error occurred in the EtherCAT Slave Terminal)
• Disconnection of an EtherCAT slave (if this error occurred in the EtherCAT Slave Terminal)</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td>Attached information</td><td colspan="6">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="6">None</td></tr>
</table>

<table>
<tr><th>Event name</th><td colspan="3">Event Log Cleared</td><th>Event code</th><td colspan="2">9040 0000 hex</td></tr>
<tr><th>Meaning</th><td colspan="6">The event log was cleared.</td></tr>
<tr><th>Source</th><td colspan="2">Depends on where the Support Software is connected and the system configuration.</td><th>Source details</th><td>NX Unit</td><th>Detection timing</th><td>When commanded from user</td></tr>
<tr><th rowspan="2">Error attributes</th><th>Level</th><td colspan="2">Information</td><th>Log category</th><td colspan="2">Access</td></tr>
<tr><th>Recovery</th><td colspan="5">---</td></tr>
<tr><th>Effects</th><th>User program</th><td>Continues.</td><th>Operation</th><td colspan="3">Not affected.</td></tr>
<tr><th rowspan="2">System-defined variables</th><th colspan="2">Variable</th><th colspan="2">Data type</th><th colspan="2">Name</th></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th rowspan="2">Cause and correction</th><th colspan="2">Assumed cause</th><th colspan="2">Correction</th><th colspan="2">Prevention</th></tr>
<tr><td colspan="2">The event log was cleared by the user.</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><th>Attached information</th><td colspan="6">Attached information 1: Events that were cleared
1: The system event log was cleared.
2: The access event log was cleared.</td></tr>
<tr><th>Precautions/ Remarks</th><td colspan="6">None</td></tr>
</table>

8-4 Resetting Errors

Refer to the user's manual for the connected CPU Unit, Communications Coupler Unit, or Communication Control Unit for information on how to reset errors.

8-5 Troubles Specific To Each Type of NX Units

8-5-1 Temperature Input Units

Unit type	Problem	Assumed cause	Correction
All Units	The measurement error occurs when using the input correction.	The temperature unit was changed after the input correction parameters (Index 5010 to 5014) are set.	Implement one of the following measures. • After loading the input correction parameters, perform the unit conversion and set again. • Perform the input correction again and set the input correction parameters.
	The converted values or analog signal values are different from expected or the error is too large.	The user calibration error is too large.	Execute the user calibration again.
		The required input or output is disabled.	Check to see if the setting is enabled.
		Wiring is incorrect. (Positive and negative are reversed etc.)	Check that the wiring is correct.
Thermocouple Input Unit	The cold junction sensor error occurs when the cold junction compensation is disabled.	The cold junction sensor is disconnected.	Connect the cold junction sensor.

8-5-2 Heater Burnout Detection Units

Problem	Cause	Correction
A heater burnout was not detected.	The manipulated variable is set so that the control output is ON for less than 30 ms.	The Unit detects a heater burnout when the control output is ON for 30 ms or longer. Set the value of the manipulated variable so that the control output is ON for at least 30 ms.
	The correct CT input is not allocated to the control output of the heater for heater burnout detection.	Set the CT allocation so that the CT input for the heater for detection matches the control output.
	The value of the Heater Burnout Detection Current is too small.	Set the Heater Burnout Detection Current to a suitable value.

Problem	Cause	Correction
An SSR failure was not detected.	The manipulated variable is set so that the control output is OFF for less than 35 ms.	The Unit detects an SSR failure when the control output is OFF for 35 ms or longer. Set the Unit so that the control output is OFF for at least 35 ms.
	The correct CT input is not allocated to the control output of the heater for SSR failure detection.	Set the CT allocation so that the CT input for the heater for detection matches the control output.
	The value of the SSR Failure Detection Current is too high.	Set the SSR Failure Detection Current to a suitable value.
The heater current or leakage current does not change.	The manipulated variable is set so that the control output is always ON or OFF.	The Unit updates the heater current when the control output is ON, and the leakage current when the control output is OFF. Set the Unit so that the control output turns ON and OFF.
	The appropriate CT input is not allocated to the control output of the heater to measure.	Set the CT allocation so that the CT input for the heater to measure matches the control output.
The value of the heater current or leakage current is different from expected or the error is too large.	The wiring to the CT is not correct.	Check the wiring to the CT.
	The wiring to the CT is disconnected.	Check the wiring to the CT.
	There is a problem with the CT.	Replace the CT.
	The CT that is used is not one of the CTs that can be connected to the Heater Burnout Detection Units.	Use one of the CTs that can be connected to the Heater Burnout Detection Units. Refer to *7-7-1 Connectable CTs* on page 7-45 for the CTs that can be connected.
The OUT indicator is lit, but there is no control output.	The I/O power is not supplied.	Check that the I/O power is supplied. When the Unit is connected to a CPU Unit, I/O power is supplied to the Additional I/O Power Supply Unit. When the Unit is connected to a Communication Coupler Unit, I/O power is supplied to the Communication Coupler Unit.
	The I/O power supply is outside the ratings.	Set the I/O power supply voltage so that it is within the rated voltage range.
	The Unit is not wired correctly with the connected external device.	Check the wiring with the connected external device.
	The wiring to the connected external device is disconnected.	Check the wiring with the connected external device.
	The connected external device is faulty.	Replace the connected external device.
	Load short-circuit protection is in progress. (NX-HB3201 only)	Eliminate the cause of the short-circuit.

Problem	Cause	Correction
The OUT indicator is not lit, and there is no control output.	An error occurred, and the output follows the set value of the Load Rejection Output Setting. With this setting, the User-specified Value Output and output set value are 0.	• Check if a Controller error, communications coupler error, or NX bus error occurred. • Correct the Load Rejection Output Setting.
	The manipulated variable is set so that the control output is always OFF.	Set the value of the manipulated variable so that there is a period when the control output is ON.

8-6 Troubleshooting Flowchart

Refer to the user's manual for the connected CPU Unit, Communications Coupler Unit, or Communication Control Unit for details on the standard troubleshooting process when an error occurs.

9

Inspection and Maintenance

This section describes how to clean, inspect, and maintain the Temperature Input Units and Heater Burnout Detection Units.

9-1 Cleaning and Inspection

This section describes daily device maintenance such as cleaning and inspection.

Make sure to perform daily or periodic inspections in order to maintain the Temperature Input Unit and Heater Burnout Detection Unit functions in the best operating condition.

9-1-1 Cleaning

Perform the following cleaning procedures periodically to ensure the Temperature Input Units and Heater Burnout Detection Units are maintained in the best operating condition.

- Wipe the equipment over with a soft, dry cloth when performing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- Units will become stained if items such as rubber, vinyl products, or adhesive tape are left on the NX Unit for a long period. Remove such items during regular cleaning.

Precautions for Correct Use

- Never use benzene, thinners, other volatile solvents, or chemical cloths.
- Do not touch the NX bus connectors.

9-1-2 Periodic Inspection

NX Units do not have parts with a specific life. However, its elements 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 may be necessary depending on the severe environments.

Take immediate steps to correct the situation if any of the conditions in the following table are not met.

Periodic Inspection Items

No.	Inspection item	Inspection details	Criteria	Correction
1	External power supply	Is the power supply voltage measured at the terminal block within standards?	Within the power supply voltage range	Use a voltage tester to check the power supply at the terminals. Take necessary steps to bring the power supply within the power supply voltage range.
2	I/O power supply	Is the power supply voltage measured at the I/O terminal block within standards?	Voltages must be within I/O specifications of each NX Unit.	Use a voltage tester to check the power voltage at the terminals. Take necessary steps to bring the I/O power supply within NX Unit standards.
3	Ambient environment	Is the ambient operating temperature within standards?	0 to 55°C	Use a thermometer to check the temperature and ensure that the ambient operating temperature remains within the allowed range of 0 to 55°C.
		Is the ambient operating humidity within standards?	Relative humidity must be 10% to 95% with no condensation.	Use a hygrometer to check the humidity and ensure that the ambient operating humidity remains between 10% and 95%. Make sure that condensation does not occur due to rapid changes in temperature.
		Is it subject to direct sunlight?	Not in direct sunlight	Protect the Controller if necessary.
		Is there an accumulation of dirt, dust, salt, metal powder, etc.?	No accumulation	Clean and protect the Controller if necessary.
		Is there water, oil, or chemical sprays hitting the Controller?	No spray	Clean and protect the Controller if necessary.
		Are there corrosive or flammable gases in the area of the Controller?	No spray	Check by smell or use a sensor.
		Is the Unit subject to shock or vibration?	Vibration resistance and shock resistance must be within specifications.	Install cushioning or other vibration and shock absorbing equipment if necessary.
		Are there noise sources near the Controller?	No significant noise sources	Either separate the Controller and noise source, or protect the Controller.
4	Installation and wiring	Are the DIN track mounting hooks for each NX Unit securely locked?	No looseness	Securely lock the DIN track mounting hooks.
		Are the cable connectors fully inserted and locked?	No looseness	Correct any improperly installed connectors.
		Are there any loose screws on the End Plates (PFP-M)?	No looseness	Tighten loose screws with a Phillips-head screwdriver.
		Are the NX Units connected to each other along the hookup guides and until they touch the DIN track?	You must connect and fix the NX Units to the DIN track.	Connect the NX Units to each other along the hookup guides and until they touch the DIN track.
		Are there any 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 pure cotton cloth

Tools Required Occasionally

- Oscilloscope
- Thermometer and hygrometer

9-2 Maintenance Procedures

When you replace an Temperature Input Unit or Heater Burnout Detection Unit, follow the procedure in the user's manual for the connected CPU Unit, Communications Coupler Unit, or Communication Control Unit.

A

Appendices

The appendices provide data sheets, dimensions, and other information for Temperature Input Units and Heater Burnout Detection Units.

A-1 Data Sheet

The specifications of individual Analog I/O Unit are shown below.

A-1-1 Model List

Temperature Input Units (Screwless Clamping Terminal Block, 12 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS2101	2 points	Thermocouple	250 ms/Unit	0.1°C max. *1	Free-Run refreshing	P. A-7
NX-TS2102			10 ms/Unit	0.01°C max.		P. A-8
NX-TS2104			60 ms/Unit	0.001°C max.		P. A-10
NX-TS2201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-11
NX-TS2202			10 ms/Unit	0.01°C max.		P. A-12
NX-TS2204			60 ms/Unit	0.001°C max.		P. A-13

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS2202 only supports Pt100 three-wire sensor.

Temperature Input Units (Screwless Clamping Terminal Block, 24 mm Width)

Model	Number of points	Input type	Conversion time	Resolution	I/O refreshing method	Reference
NX-TS3101	4 points	Thermocouple	250 ms/Unit	0.1°C max.*1	Free-Run refreshing	P. A-14
NX-TS3102			10 ms/Unit	0.01°C max.		P. A-15
NX-TS3104			60 ms/Unit	0.001°C max.		P. A-17
NX-TS3201		Resistance thermometer (Pt100/Pt1000, three-wire) *2	250 ms/Unit	0.1°C max.		P. A-18
NX-TS3202			10 ms/Unit	0.01°C max.		P. A-19
NX-TS3204			60m ms/Unit	0.01°C max.		P. A-20

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. The NX-TS3202 only supports Pt100 three-wire sensor.

Heater Burnout Detection Unit (Screwless Clamping Terminal Block, 12-mm Width)

Model	CT input section		Control output section				I/O refreshing method	Reference
	Number of points	Maximum heater current	Number of points	Internal I/O common	Maximum load current	Rated voltage		
NX-HB3101	4 points	50 A AC	4 points	NPN	0.1 A/point, 0.4 A/Unit	12 to 24 V DC	Free-Run refreshing	P. A-27
NX-HB3201				PNP		24 VDC		P. A-29

A-1-2 Temperature Input Units

Description of Items on the Data sheet of the Temperature Input Unit

The meanings of the items on the data sheet of the Temperature Input Unit are explained in the table below.

● Thermocouple Type

Item	Description
Unit name	The name of the Unit.
Model	The model of the Unit.
Number of points	The number of temperature input points provided by the Unit.
External connection terminals	The type of terminal block and connector that is used for connecting the Unit. The number of terminals on the terminal block is also described when a screwless clamping terminal block is used.
I/O refreshing method	The I/O refreshing methods that are used by the Unit. Only Free-Run refreshing method is available.
Indicators	The type of indicators on the Unit and the layout of those indicators.*1
Temperature sensor	A temperature sensor that can be connected to the Unit.
Input conversion range	The conversion range of temperature data for the full scale of the Unit. Input temperature data outside this range are fixed to the conversion limit value.
Absolute maximum rating	The maximum value of sensor input signal of the Unit. If a signal exceeding this range is input, the Unit may be damaged.
Input impedance	The input impedance of the Unit.
Resolution	The resolution of the measured values for the Unit. It is defined in °C.
Reference accuracy	The reference conversion accuracy of temperature inputs of the Unit. It is defined at an ambient temperature of 25°C.
Temperature coefficient	The conversion coefficient of temperature inputs of the Unit.
Cold junction compensation error	The cold junction compensation error of the Unit.
Input disconnection detection current	The current that detects disconnection of the temperature sensor of the Unit.
Warm-up period	The warm-up period of the Unit. If the Unit is warmed up, the temperature inside the Unit is stable. Thus, the measured value is stable. If the Unit is not warmed up, the temperature data error becomes larger.
Conversion time	The time required to convert temperature input signals of the Unit to temperature data.
Dimensions	The dimensions of the Unit. They are described as W x H x D. The unit is "mm".
Isolation method	The isolation method between the input circuits and internal circuits and between the input circuits of the Unit.
Insulation resistance	The insulation resistance between the input circuits and internal circuits and between each input circuit of the Unit.
Dielectric strength	The dielectric strength between the input circuits and internal circuits and between each input circuit of the Unit.
I/O power supply method	The method for supplying I/O power for the Unit. The supply method is determined for each Unit. The power is supplied from the NX bus or the external source. There is no I/O power supply for the connected external devices.
Current capacity of I/O power supply terminal	The current capacity of the I/O power supply terminals (IOV/IOG) of the Unit. Do not exceed this value when supplying I/O power to the connected external devices.
NX Unit power consumption	The power consumption of the NX Unit power supply of the Unit. The power consumption of the Unit connected to each of the following Units is separately given. If some of the following Units can not be connected to the Unit, relevant information is omitted. • CPU Unit • Communications Coupler Unit • Communication Control Unit
Current consumption from I/O power supply	The current consumption from I/O power supply of the Unit. The current consumption of any connected external devices is excluded.
Weight	The weight of the Unit.

Item	Description
Installation orientation and restrictions	The installation orientation of the Unit. The installation orientation of the Unit connected to each of the following Units is separately given, along with details of the specifications restricted due to the installation orientation, if any. If some of the following Units can not be connected to the Unit, relevant information is omitted. • CPU Unit • Communications Coupler Unit • Communication Control Unit
Terminal connection diagram	A diagram of the connection between the Unit and connected external devices. When an I/O Power Supply Connection Unit or a Shield Connection Unit is required to be connected to the connected external devices, the description for such is included.

*1. The layout of the indicators after the appearance change is shown for models released in or before September 2018. For details on the applicable models and the changes, refer to *3-2-3 Appearance Change of the Indicators* on page 3-12.

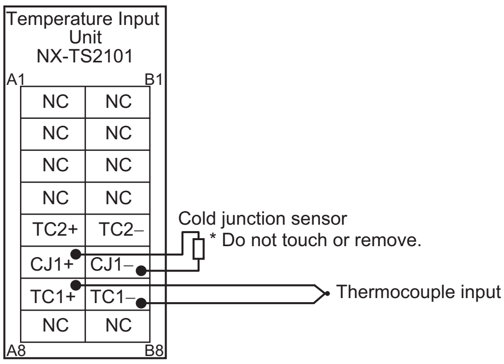
● Resistance Thermometer Type

Item	Description
Unit name	The name of the Unit.
Model	The model of the Unit.
Number of points	The number of temperature input points provided by the Unit.
External connection terminals	The type of terminal block and connector that is used for connecting the Unit. The number of terminals on the terminal block is also described when a screwless clamping terminal block is used.
I/O refreshing method	The I/O refreshing methods that are used by the Unit. Only Free-Run refreshing method is available.
Indicators	The type of indicators on the Unit and the layout of those indicators.*1
Temperature sensor	A temperature sensor that can be connected to the Unit.
Input conversion range	The conversion range of temperature data for the full scale of the Unit. Input temperature data outside this range are fixed to the conversion limit value.
Input detection current	The current value for detecting temperature inputs of the Unit.
Resolution	The resolution of the measured values for the Unit. It is defined in °C.
Reference accuracy	The reference conversion accuracy of temperature inputs of the Unit. It is defined at an ambient temperature of 25°C.
Temperature coefficient	The conversion coefficient of temperature inputs of the Unit.
Effect of conductor resistance	The effect of conductor resistance of the Unit.
Warm-up period	The warm-up period of the Unit. If the Unit is warmed up, the temperature inside the Unit is stable. Thus, the measured value is stable. If the Unit is not warmed up, the temperature data error becomes larger.
Conversion time	The time required to convert temperature input signals of the Unit to temperature data.
Dimensions	The dimensions of the Unit. They are described as W x H x D. The unit is "mm".
Isolation method	The isolation method between the input circuits and internal circuits and between the input circuits of the Unit.
Insulation resistance	The insulation resistance between the input circuits and internal circuits and between each input circuit of the Unit.
Dielectric strength	The dielectric strength between the input circuits and internal circuits and between each input circuit of the Unit.
I/O power supply method	The method for supplying I/O power for the Unit. The supply method is determined for each Unit. The power is supplied from the NX bus or the external source. There is no I/O power supply for the connected external devices.
Current capacity of I/O power supply terminal	The current capacity of I/O power supply terminals (IOV/IOG) of the Unit. Do not exceed this value when supplying I/O power to the connected external devices.
NX Unit power consumption	The power consumption of the NX Unit power supply of the Unit. The power consumption of the Unit connected to each of the following Units is separately given. If some of the following Units can not be connected to the Unit, relevant information is omitted. • CPU Unit • Communications Coupler Unit • Communication Control Unit
Current consumption from I/O power supply	The current consumption from I/O power supply of the Unit. The current consumption of any connected external devices is excluded.
Weight	The weight of the Unit.

Installation orientation and restrictions	The installation orientation of the Unit. The installation orientation of the Unit connected to each of the following Units is separately given, along with details of the specifications restricted due to the installation orientation, if any. If some of the following Units can not be connected to the Unit, relevant information is omitted. • CPU Unit • Communications Coupler Unit • Communication Control Unit
Terminal connection diagram	A diagram of the connection between the Unit and connected external devices. When an I/O Power Supply Connection Unit or a Shield Connection Unit is required to be connected to the connected external devices, the description for such is included.

*1. The layout of the indicators after the appearance change is shown for models released in or before September 2018. For details on the applicable models and the changes, refer to *3-2-3 Appearance Change of the Indicators* on page 3-12.

Temperature Input Units (Screwless Clamping Terminal Block, 12 mm Width)

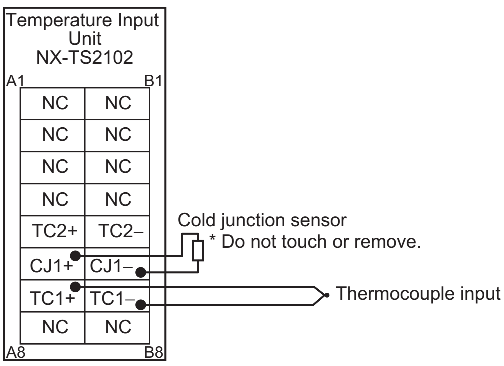
Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS2101
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, B, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.1°C max. *1
		Reference accuracy	*2
		Temperature coefficient	*2
		Cold junction compensation error	±1.2°C *3 *4
		Input disconnection detection current	Approx. 0.1 μA
Warm-up period	30 minutes	**Conversion time**	250 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Photocoupler Between inputs: Power = Transformer, Signal = Photocoupler
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.25 W max. • Connected to a Communications Coupler Unit 0.90 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*3. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

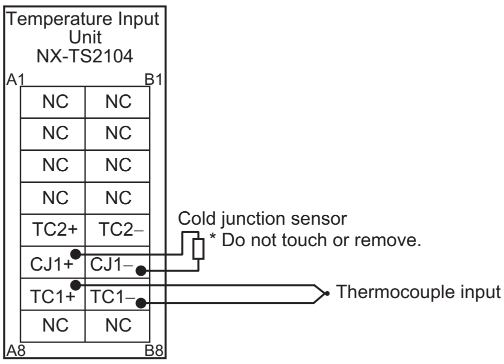
*4. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS2102
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.01°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Cold junction compensation error	±1.2°C *2 *3
		Input disconnection detection current	Approx. 0.1 μA
Warm-up period	45 minutes	**Conversion time**	10 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.15 W max. • Connected to a Communications Coupler Unit 0.80 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*2. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

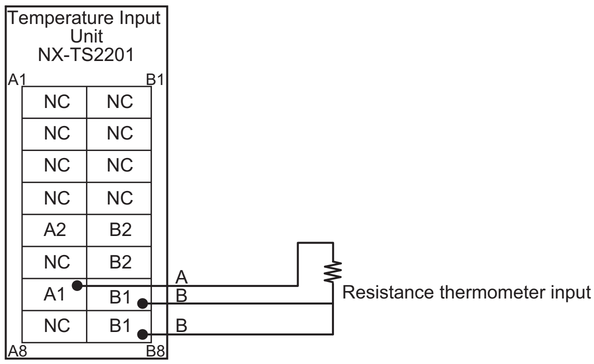
*3. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS2104
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.001°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Cold junction compensation error	±1.2°C *2 *3
		Input disconnection detection current	Approx. 0.1 μA
Warm-up period	45 minutes	**Conversion time**	60 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 0.95 W max. • Connected to a Communications Coupler Unit 0.80 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

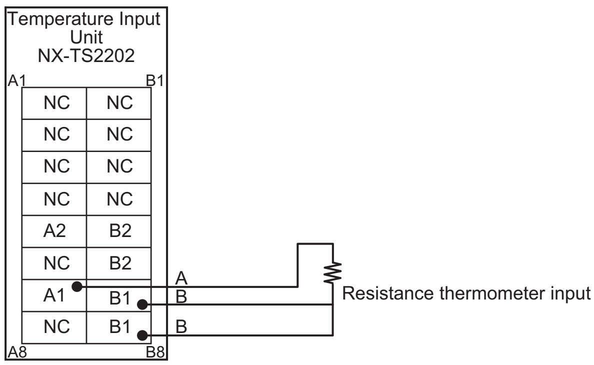
*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*2. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

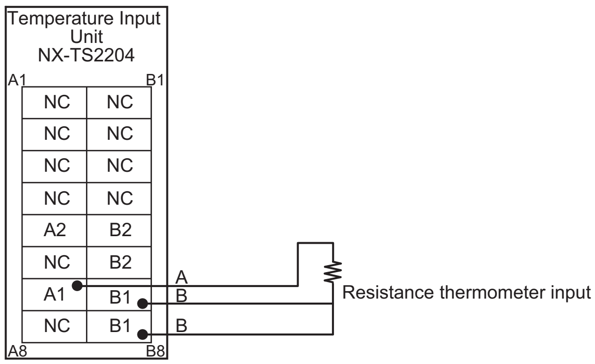
*3. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS2201
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)/Pt1000 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.1°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	10 minutes	**Conversion time**	250 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Photocoupler Between inputs: Power = Transformer, Signal = Photocoupler
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.25 W max. • Connected to a Communications Coupler Unit 0.90 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

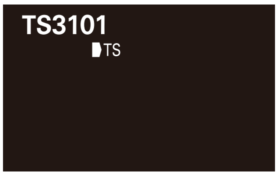
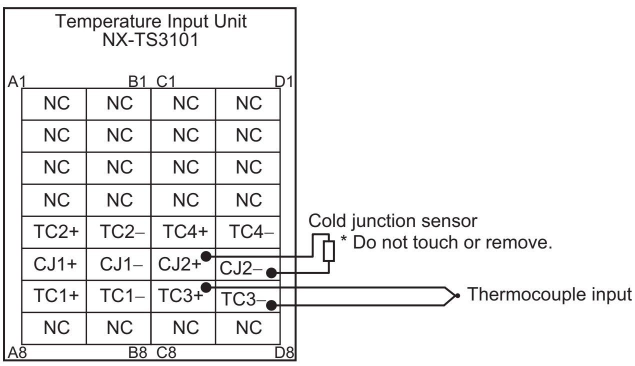
Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS2202
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.01°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	30 minutes	**Conversion time**	10 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.15 W max. • Connected to a Communications Coupler Unit 0.75 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS2204
Number of points	2 points	**External connection terminals**	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)/Pt1000 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.001°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	30 minutes	**Conversion time**	60 ms/Unit
Dimensions	12 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 0.90 W max. • Connected to a Communications Coupler Unit 0.75 W max.	**Current consumption from I/O power supply**	No consumption
Weight	70 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

Temperature Input Units (Screwless Clamping Terminal Block, 24 mm Width)

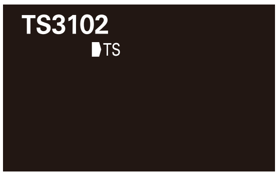
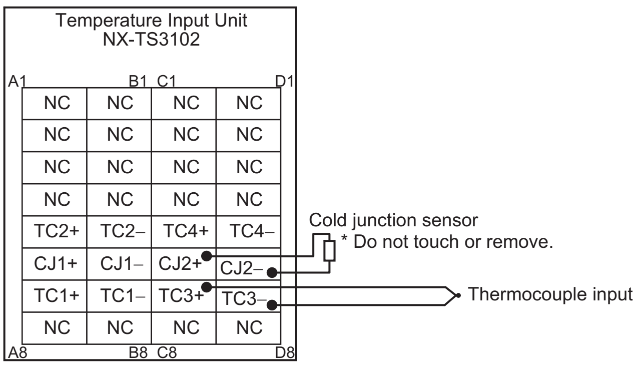
Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS3101
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, B, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.1°C max. *1
		Reference accuracy	*2
		Temperature coefficient	*2
		Cold junction compensation error	±1.2°C *3 *4
		Input disconnection detection current	Approx. 0.1 µA
Warm-up period	30 minutes	**Conversion time**	250 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Photocoupler Between inputs: Power = Transformer, Signal = Photocoupler
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.75 W max. • Connected to a Communications Coupler Unit 1.30 W max.	**Current consumption from I/O power supply**	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

*1. The resolution is 0.2°C max. when the input type is R, S, or W.

*2. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*3. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

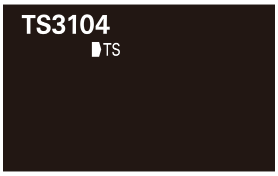
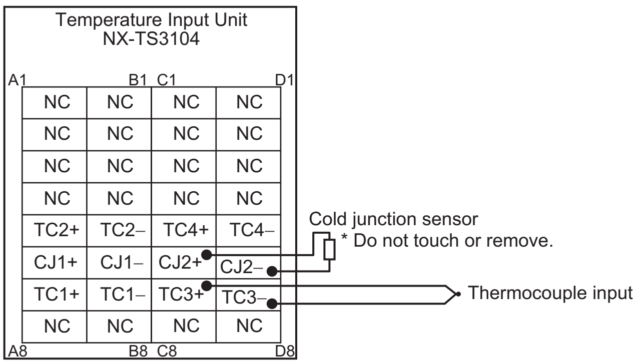
*4. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS3102
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.01°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Cold junction compensation error	±1.2°C *2 *3
		Input disconnection detection current	Approx. 0.1 μA
Warm-up period	45 minutes	**Conversion time**	10 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.55 W max. • Connected to a Communications Coupler Unit 1.10 W max.	**Current consumption from I/O power supply**	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*2. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

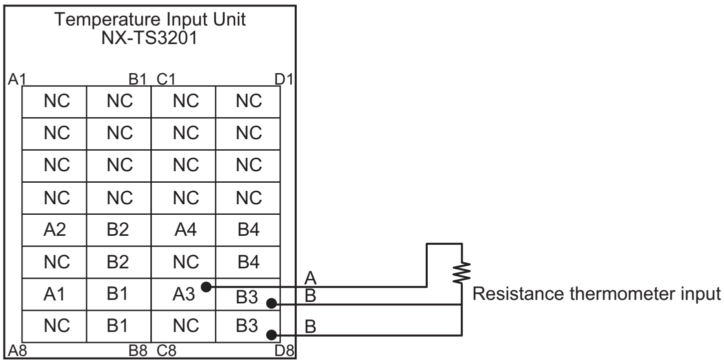
*3. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (thermocouple input type)	**Model**	NX-TS3104
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	K, J, T, E, L, U, N, R, S, WRe5-26, PLII
		Input conversion range	±20°C of the input range
		Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
		Resolution	0.001°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Cold junction compensation error	±1.2°C *2 *3
		Input disconnection detection current	Approx. 0.1 μA
Warm-up period	45 minutes	**Conversion time**	60 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.45 W max. • Connected to a Communications Coupler Unit 1.10 W max.	**Current consumption from I/O power supply**	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: The cold junction compensation error is restricted according to the installation orientation and the power consumption of adjacent Units. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for details.		
Terminal connection diagram			

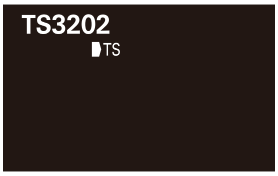
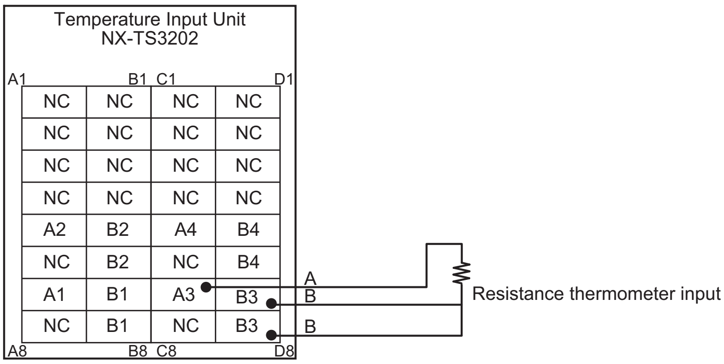
*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

*2. The cold junction compensation error is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. When returning the Unit, make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together.

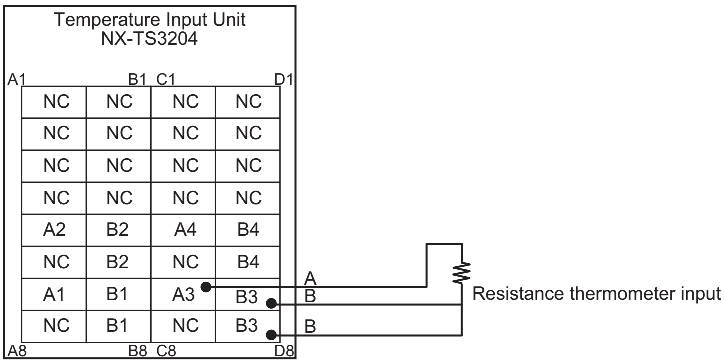
*3. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* on page A-24 for the specifications for each set of operating conditions.

Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS3201
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)/Pt1000 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.1°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	10 minutes	**Conversion time**	250 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Photocoupler Between inputs: Power = Transformer, Signal = Photocoupler
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.75 W max. • Connected to a Communications Coupler Unit 1.30 W max.	**Current consumption from I/O power supply**	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS3202
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.01°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	30 minutes	**Conversion time**	10 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.50 W max. • Connected to a Communications Coupler Unit 1.05 W max.	**Current consumption from I/O power supply**	No consumption
Weight	130 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

Unit name	Temperature Input Unit (resistance thermometer input type)	**Model**	NX-TS3204
Number of points	4 points	**External connection terminals**	Screwless clamping terminal block (16 terminals × 2)
I/O refreshing method	Free-Run refreshing		
Indicators	TS indicator 	**Temperature sensor**	Pt100 (three-wire)/Pt1000 (three-wire)
		Input conversion range	±20°C of the input range
		Input detection current	Approx. 0.25 mA
		Resolution	0.001°C max.
		Reference accuracy	*1
		Temperature coefficient	*1
		Effect of conductor resistance	0.06°C/Ω max. (also 20 Ω max.)
Warm-up period	30 minutes	**Conversion time**	60 ms/Unit
Dimensions	24 (W) x 100 (H) x 71 (D)	**Isolation method**	Between the input and the NX bus: Power = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	**Dielectric strength**	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.
I/O power supply method	No supply	**Current capacity of I/O power supply terminal**	Without I/O power supply terminals
NX Unit power consumption	• Connected to a CPU Unit or Communication Control Unit 1.45 W max. • Connected to a Communications Coupler Unit 1.05 W max.	**Current consumption from I/O power supply**	No consumption
Weight	130 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit or Communication Control Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions		
Terminal connection diagram			

*1. Refer to *Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1* on page A-21.

Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature *1

NX-TS□□02/TS□□04

Conversion time	Input type: Input type*2	Input type: Temperature range (°C)	Measurement temperature (°C)	Reference accuracy °C (%) *3	Temperature coefficient °C/°C *4 (ppm/°C *5)
10 ms 60 ms	K	-200 to 1300	-200 to 1300	±0.75 (±0.05%)	±0.08 (±50 ppm/°C)
	K	-20 to 600 (High Resolution)	-20 to 600	±0.3 (±0.05%)	±0.03 (±48 ppm/°C)
	J	-200 to 1200	-200 to 0	±0.7 (±0.05%)	±0.13 (±96 ppm/°C)
			0 to 1200		±0.06 (±42 ppm/°C)
	J	-20 to 600 (High Resolution)	-20 to 600	±0.3 (±0.05%)	±0.04 (±72 ppm/°C)
	T	-200 to 400	-200 to -180	±1.3 (±0.22%)	±0.05 (±75 ppm/°C)
			-180 to 0	±0.7 (±0.12%)	
			0 to 400	±0.33 (±0.055%)	
	E	-200 to 1000	-200 to 0	±0.6 (±0.05%)	±0.12 (±100 ppm/°C)
			0 to 1000		±0.06 (±50 ppm/°C)
	L	-200 to 900	-200 to 900	±0.5 (±0.05%)	±0.04 (±40 ppm/°C)
	U	-200 to 600	-200 to -100	±0.7 (±0.09%)	±0.06 (±75 ppm/°C)
			-100 to 0	±0.5 (±0.07%)	
			0 to 600	±0.4 (±0.05%)	
	N	-200 to 1300	-200 to -150	±1.6 (±0.11%)	±0.11 (±70 ppm/°C)
			-150 to -100	±0.75 (±0.05%)	
			-100 to 1300		±0.08 (±50 ppm/°C)
	R	-50 to 1700	-50 to 0	±3.2 (±0.19%)	±0.13 (±77 ppm/°C)
			0 to 100	±2.5 (±0.15%)	±0.11 (±60 ppm/°C)
			100 to 1700	±1.75 (±0.1%)	
	S	-50 to 1700	-50 to 0	±3.2 (±0.19%)	±0.13 (±77 ppm/°C)
			0 to 100	±2.5 (±0.15%)	±0.11 (±60 ppm/°C)
			100 to 1700	±1.75 (±0.1%)	
	WRe5-26	0 to 2300	0 to 1500	±1.15 (±0.05%)	±0.13 (±58 ppm/°C)
			1500 to 2200		±0.21 (±91 ppm/°C)
			2200 to 2300	±1.4 (±0.07%)	
	PL II	0 to 1300	0 to 1300	±0.65 (±0.05%)	±0.07 (±57 ppm/°C)
	Pt100	-200 to 850	-200 to -50	±0.5 (±0.05%)	±0.08 (±78 ppm/°C)
			-50 to 150	±0.21 (±0.02%)	±0.03 (±29 ppm/°C)
			150 to 850	±0.5 (±0.05%)	±0.08 (±78 ppm/°C)
	Pt1000	-200 to 850	-200 to 850	±0.5 (±0.05%)	±0.09 (±85 ppm/°C)

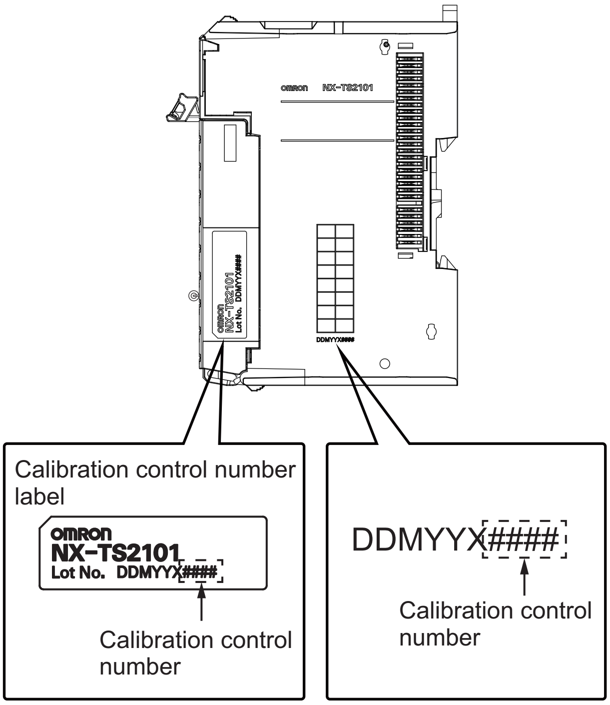
NX-TS□□01

Conver-sion time	Input type		Measurement tem-perature (°C)	Reference accuracy °C (%) *3	Temperature coefficient °C/°C *4 (ppm/°C *5)
	Input type	Temperature range (°C)			
250 ms	K	-200 to 1300	-200 to -100	±1.5 (±0.1%)	±0.15 (±100 ppm/°C)
			-100 to 400		±0.30 (±200 ppm/°C)
			400 to 1300		±0.38 (±250 ppm/°C)
	J	-200 to 1200	-200 to 400	±1.4 (±0.1%)	±0.14 (±100 ppm/°C)
			400 to 900	±1.2 (±0.09%)	±0.28 (±200 ppm/°C)
			900 to 1200		±0.35 (±250 ppm/°C)
	T	-200 to 400	-200 to -100	±1.2 (±0.2%)	±0.30 (±500 ppm/°C)
			-100 to 400		±0.12 (±200 ppm/°C)
	E	-200 to 1000	-200 to 400	±1.2 (±0.1%)	±0.12 (±100 ppm/°C)
			400 to 700	±2.0 (±0.17%)	±0.24 (±200 ppm/°C)
			700 to 1000		±0.30 (±250 ppm/°C)
	L	-200 to 900	-200 to 300	±1.1 (±0.1%)	±0.11 (±100 ppm/°C)
			300 to 700	±2.2 (±0.2%)	±0.22 (±200 ppm/°C)
			700 to 900		±0.28 (±250 ppm/°C)
	U	-200 to 600	-200 to 400	±1.2 (±0.15%)	±0.12 (±150 ppm/°C)
			400 to 600	±1.0 (±0.13%)	
	N	-200 to 1300	-200 to 400	±1.5 (±0.1%)	±0.30 (±200 ppm/°C)
			400 to 1000		
			1000 to 1300		±0.38 (±250 ppm/°C)
	R	-50 to 1700	-50 to 500	±1.75 (±0.1%)	±0.44 (±250 ppm/°C)
			500 to 1200	±2.5 (±0.15%)	
			1200 to 1700		
	S	-50 to 1700	-50 to 600	±1.75 (±0.1%)	±0.44 (±250 ppm/°C)
			600 to 1100	±2.5 (±0.15%)	
			1100 to 1700		
	B	0 to 1800	0.0 to 400.0	Reference accuracy does not apply	Reference accuracy does not apply
			400 to 1200	±3.6 (±0.2%)	±0.45 (±250 ppm/°C)
			1200 to 1800	±5.0 (±0.28%)	±0.54 (±300 ppm/°C)
	WRe5-26	0 to 2300	0 to 300	±1.15 (±0.05%)	±0.46 (±200 ppm/°C)
			300 to 800	±2.3 (±0.1%)	
			800 to 1500	±3.0 (±0.13%)	
			1500 to 2300		±0.691 (±300 ppm/°C)
	PLII	0 to 1300	0 to 400	±1.3 (±0.1%)	±0.23 (±200 ppm/°C)
			400 to 800	±2.0 (±0.15%)	±0.39 (±300 ppm/°C)
			800 to 1300		±0.65 (±500 ppm/°C)
	Pt100	-200 to 850	-200 to 300	±1.0 (±0.1%)	±0.1 (±100 ppm/°C)
			300 to 700	±2.0 (±0.2%)	±0.2 (±200 ppm/°C)
			700 to 850	±2.5 (±0.25%)	±0.25 (±250 ppm/°C)
	Pt1000	-200 to 850	-200 to 300	±1.0 (±0.1%)	±0.1 (±100 ppm/°C)
			300 to 700	±2.0 (±0.2%)	±0.2 (±200 ppm/°C)
			700 to 850	±2.5 (±0.25%)	±0.25 (±250 ppm/°C)

*1. To convert the temperature unit from Celsius to Fahrenheit, use the following equation.
Fahrenheit temperature (°F) = Celsius temperature (°C) x 1.8 + 32

*2. If there is more than one input range for the same input type, the one with narrower input range has higher resolution.

*3. For a thermocouple input type Temperature Input Unit, the overall accuracy is guaranteed for a set consisting of a cold junction sensor that is mounted on the terminal block and a Temperature Input Unit. Be sure to use the terminal block and Temperature Input Unit with the same calibration control number together. For the 24 mm wide model, also be sure the left and right terminal blocks are correctly attached.



*4. An error for a measured value when the ambient temperature changes by 1°C.
The following formula is used to calculate the error of the measured value.
Overall accuracy = Reference accuracy + Temperature characteristic x Change in the ambient temperature + Cold junction compensation error
(Calculation example)
Conditions

Item	Description
Ambient temperature	30°C
Measured value	100°C
NX Unit	NX-TS2101
Thermocouple	K thermocouple

The characteristic values are formulated from the data sheet or reference accuracy and temperature coefficient table under the above conditions

Item	Description
Reference accuracy	-100 to 400°C: ±1.5°C
Temperature coefficient	-100 to 400°C: ±0.30°C/°C
Change in the ambient temperature	25°C -> 30°C 5 deg
Cold junction compensation error	±1.2°C

Therefore,
Overall accuracy = Reference accuracy + Temperature characteristic x Change in the ambient temperature + Cold junction compensation error
= ±1.5°C + (±0.30°C/°C) x 5 deg + ±1.2°C
= ±4.2°C

*5. The ppm value is for the full scale of the input range.

● Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type

The cold junction compensation error for Units that take a thermocouple input type is restricted as follows according to the installation orientation and the power consumption of adjacent Units *1.

(a) For upright installation, when the power consumption is 1.5 W or less for both the left and right adjacent Units

The cold junction compensation error is ±1.2°C.

However, there are some exceptions according to the input type and temperature range. The conditions and the cold junction compensation errors are given in the following table.

Input type and temperature range	Cold junction compensation error
T below -90°C	±3.0°C
J, E, K and N below -100°C	
U, L and PLII	
R and S below 200°C	
B below 400°C	Not guaranteed
W	±3.0°C

(b) For upright installation, when the power consumption of either the left or the right adjacent Unit is more than 1.5 W but less than 3.9 W or for any installation other than upright, when the power consumption of both the left and right adjacent Units is less than 3.9 W

The cold junction compensation error is ±4.0°C.

However, there are some exceptions according to the input type and temperature range. The conditions and the cold junction compensation errors are given in the following table.

Input type and temperature range	Cold junction compensation error
T below -90°C	±7.0°C
J, E, K and N below -100°C	
U, L and PLII	
R and S below 200°C	
B below 400°C	Not guaranteed
W	±9.0°C

(c) When the power consumption exceeds 3.9 W for either the left or right adjacent Unit

Do not use the above condition (c) because the cold junction compensation error is not guaranteed in this condition.

*1. The power consumption of adjacent Units is the total of the following values.
The power consumption of the NX Unit power supply and I/O power supply for the NX Units adjacent to the Temperature Input Unit. If the adjacent Unit is an Input Unit, it is the total power consumption according to the input current.

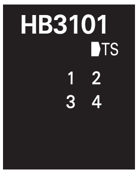
A-1-3 Heater Burnout Detection Units

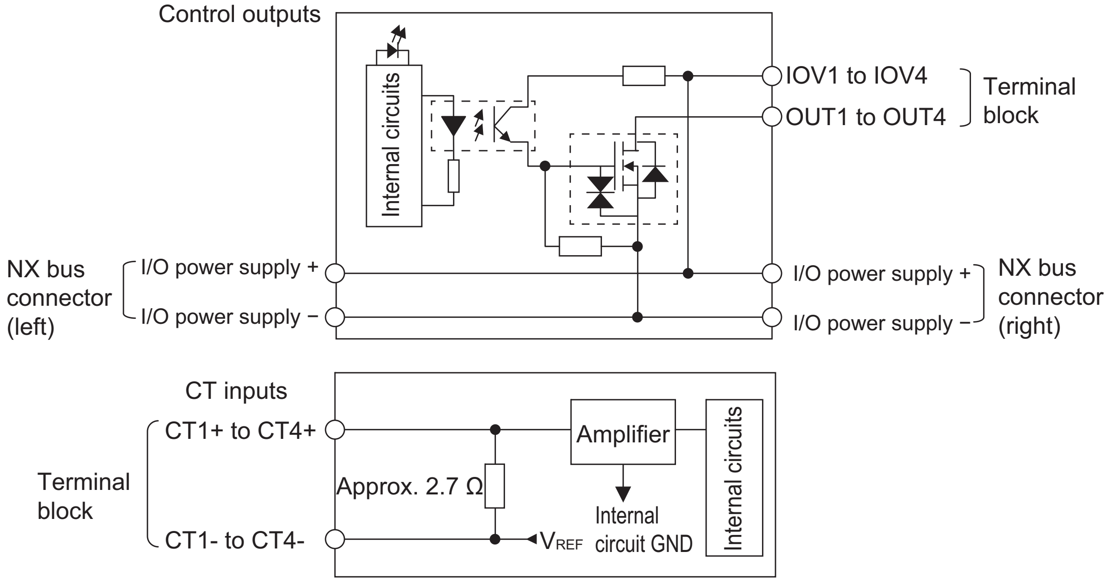
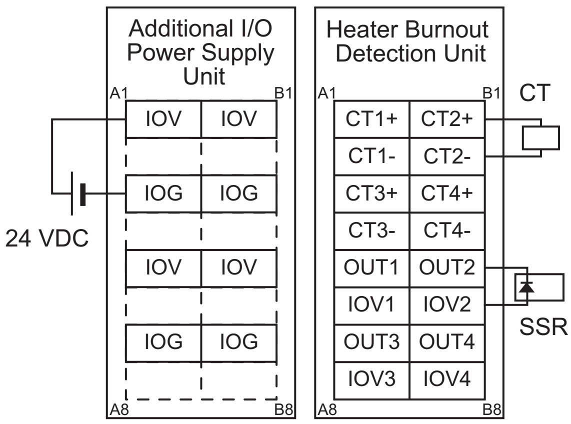
The following table gives the meaning of the data sheet items for the Heater Burnout Detection Unit.

Item		Description
Unit name		The name of the Unit.
Model		The model number of the Unit.
Number of points		The number of CT inputs or the number of control output signals support by the Unit.
External connection terminals		The type of terminal block or connector that is used to wire the Unit. This specification includes the number of terminals for a screwless clamping terminal block.
I/O refreshing method		The I/O refreshing method of the Unit. Only Free-Run refreshing is supported.
Indicators		The names and the layout of the indicators on the Unit.*1
CT input section	**CT current input range**	The CT input signal input range of the Unit.
	Input resistance	The resistance within the Unit viewed from the CT input terminal of the Unit.
	Connectable CTs	The CT models that can connect to the Unit.
	Maximum heater current	The maximum value of the current that can flow through the heater power line on the primary side of the CT that is connected to the Unit.
	Resolution	The resolution of the CT current converted value in the Unit.
	Overall accuracy (25°C)	The accuracy of the CT current input conversion in the Unit. The accuracy is defined at 25°C.
	Influence of temperature (0 to 55°C)	The accuracy of the CT current input for changes in the ambient temperature of the Unit. It is defined as the deviation from the overall accuracy.
	Conversion time	The time required to convert CT input signals to heater current converted values in the Unit.
Control output section	**Internal I/O common**	The polarity that the Unit uses to connect to output devices. There are models with NPN and PNP connections.
	Control period	The period when the ON/OFF time ratio is changed in time-proportional operation in the Unit.
	Manipulated variable	The range of the value of a manipulated variable that you can input to the Unit.
	Resolution	The minimum output width for which control of the control outputs is reliable.
	Rated voltage	The rated voltage of the control outputs on the Unit.
	Operating load voltage range	The load voltage range of the control outputs on the Unit.
	Maximum load current	The maximum load current for control outputs from the Unit. A specification is given for each control output and each Unit.
	Maximum inrush current	The maximum allowable inrush current of the Unit. The inrush current of the external connection load must be lower than this value.
	Leakage current	The leakage current when a control output on the Unit is OFF.
	Residual voltage	The residual voltage when a control output on the Unit is ON.
	Disconnection/short-circuit detection	The function of the Unit to detect disconnections and short-circuits.
	Protective functions	The protective functions of the Unit.
Dimensions		The dimensions of the Unit. The dimensions are given in the form W × H × D. The dimensions are given in millimeters.
Isolation method		The method that is used to isolate the output circuits, input circuits, and internal circuits of the Unit.
Insulation resistance		The resistance between the output circuits, input circuits, and internal circuits of the Unit.
Dielectric strength		The dielectric strength between the output circuits, input circuits, and internal circuits of the Unit.

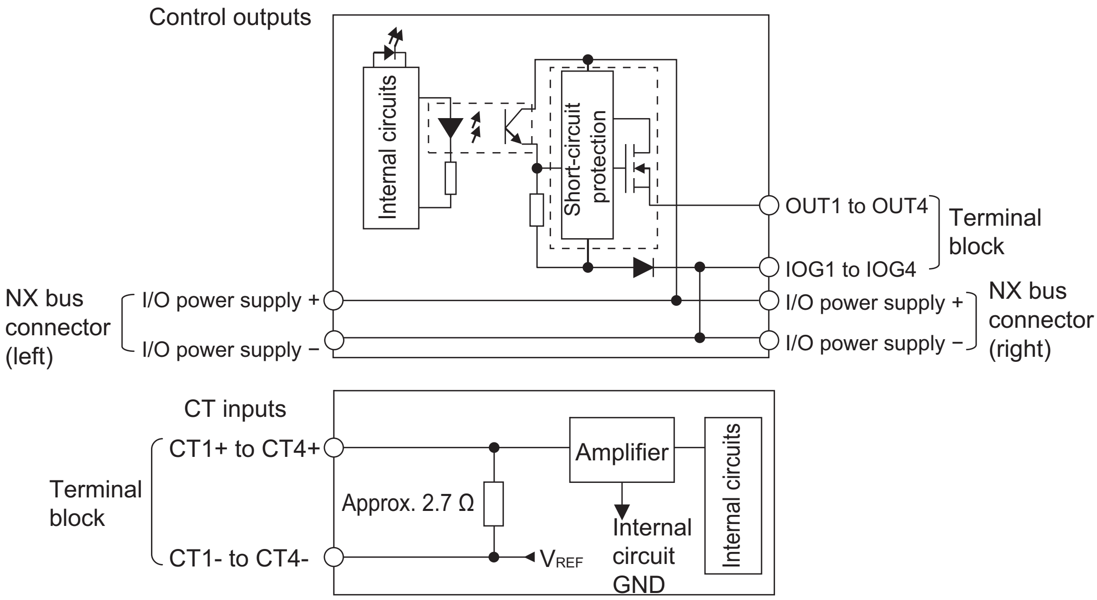
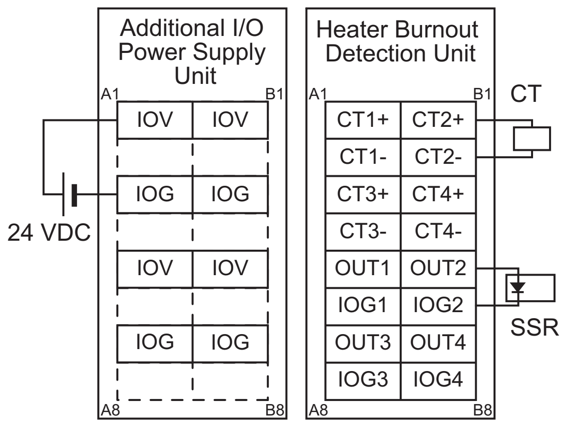
I/O power supply method	The method for supplying I/O power for the Unit. The supply method is determined for each Unit. The power is supplied from the NX bus or the external source.
Current capacity of I/O power supply terminal	The current capacity of the I/O power supply terminals (IOV/IOG) of the Unit. Do not exceed this value when supplying I/O power to the connected external devices.
NX Unit power consumption	The power consumption of the NX Unit power supply of the Unit. The power consumption when NX Units are connected to a CPU Unit and the power consumption when NX Units are connected to a Communications Coupler Unit.
Current consumption from I/O power supply	The current consumption of the Unit from the I/O power supply. This value does not include the load current of any external connection loads or the current consumption of any connected external devices.
Weight	The weight of the Unit.
Circuit layout	The circuit layout of the CT input circuits and control output circuits of the Unit.
Installation orientation and restrictions	The installation orientation of a CPU Unit containing the Unit and the installation orientation of a Slave Terminal containing the Unit. Any restrictions to specifications that result from the installation orientation are also given.
Terminal connection diagram	The connection diagram between the Unit and external devices. Any I/O Power Supply Connection Units or Shield Connection Units that are required to connect the connected external devices are also shown.

*1. The layout of the indicators after the appearance change is shown for models released in or before September 2018. For details on the applicable models and the changes, refer to *3-2-3 Appearance Change of the Indicators* on page 3-12.

<table>
<tr><td>Unit name</td><td colspan="2">Heater Burnout Detection Unit</td><td>Model</td><td colspan="2">NX-HB3101</td></tr>
<tr><td>Number of points</td><td colspan="2">4 CT inputs and 4 control outputs</td><td>External connection terminals</td><td colspan="2">Screwless clamping terminal block (16 terminals)</td></tr>
<tr><td>I/O refreshing method</td><td colspan="5">Free-Run refreshing</td></tr>
<tr><td>Indicators</td><td colspan="5">TS indicator and output indicators

</td></tr>
<tr><td rowspan="12">CT input section</td><td>CT current input range</td><td>0 to 0.125 A</td><td rowspan="12">Control output section</td><td>Internal I/O common</td><td>NPN</td></tr>
<tr><td>Input resistance</td><td>Approx. 2.7 Ω</td><td>Control period</td><td>50 to 100,000 ms</td></tr>
<tr><td rowspan="3">Connectable CTs</td><td rowspan="3">E54-CT1 and E54-CT3</td><td>Manipulated variable</td><td>0% to 100%</td></tr>
<tr><td>Resolution</td><td>1 ms</td></tr>
<tr><td>Rated voltage</td><td>12 to 24 V DC</td></tr>
<tr><td>Maximum heater current</td><td>50 A AC</td><td>Operating load voltage range</td><td>10.2 to 28.8 VDC</td></tr>
<tr><td>Resolution</td><td>0.1 A</td><td>Maximum load current</td><td>0.1 A/point, 0.4 A/Unit</td></tr>
<tr><td rowspan="2">Overall accuracy (25°C)</td><td rowspan="2">±5% (full scale)
±1 digit</td><td>Maximum inrush current</td><td>1.0 A/point max., 10 ms</td></tr>
<tr><td>Leakage current</td><td>0.1 mA max.</td></tr>
<tr><td rowspan="2">Influence of temperature (0 to 55°C)</td><td rowspan="2">±2% (full scale)
±1 digit</td><td>Residual voltage</td><td>1.5 V max.</td></tr>
<tr><td>Disconnection/short-circuit detection</td><td>None</td></tr>
<tr><td>Conversion time</td><td>10 ms</td><td>Protective functions</td><td>None</td></tr>
<tr><td>Dimensions (mm)</td><td colspan="2">12 × 100 × 71 mm (W×H×D)</td><td>Isolation method</td><td colspan="2">Between control output and internal circuit: Photocoupler isolation
No isolation between internal circuits and CT inputs</td></tr>
<tr><td>Insulation resistance</td><td colspan="2">20 MΩ min. between isolated circuits (at 100 VDC)</td><td>Dielectric strength</td><td colspan="2">510 VAC between isolated circuits for 1 minute with a leakage current of 5 mA max.</td></tr>
<tr><td>I/O power supply method</td><td colspan="2">Supplied from the NX bus.</td><td>Current capacity of I/O power supply terminals</td><td colspan="2">IOV: 0.1 A max. per terminal</td></tr>
<tr><td>NX Unit power consumption</td><td colspan="2">• Connected to a CPU Unit
1.05 W max.
• Connected to a Communications Coupler Unit
0.75 W max.</td><td>Current consumption from I/O power supply</td><td colspan="2">20 mA max.</td></tr>
<tr><td>Weight</td><td colspan="5">70 g max.</td></tr>
</table>

Circuit configuration	
Installation method and restrictions	Installation orientation: • Connected to a CPU Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions
Terminal connection diagram	

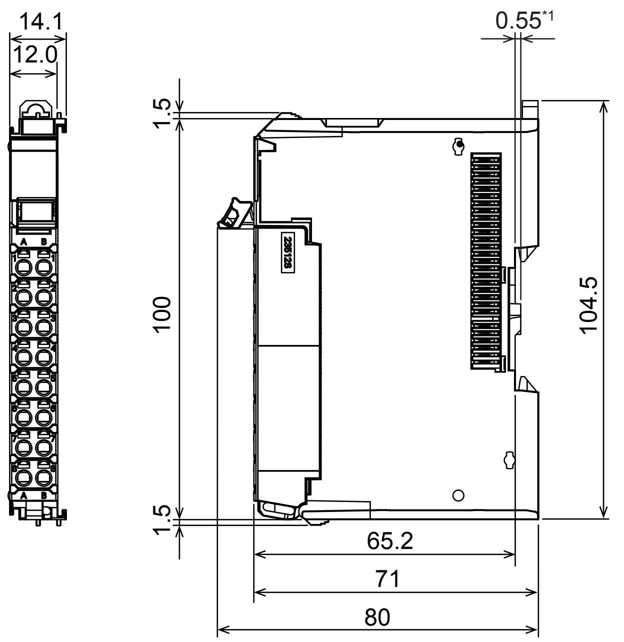
Unit name	Heater Burnout Detection Unit		**Model**	NX-HB3201	
Number of points	4 CT inputs and 4 control outputs		**External connection terminals**	Screwless clamping terminal block (16 terminals)	
I/O refreshing method	Free-Run refreshing				
Indicators	TS indicator and output indicators  				
CT input section	**CT current input range**	0 to 0.125 A	**Control output section**	**Internal I/O common**	PNP
	Input resistance	Approx. 2.7 Ω		**Control period**	50 to 100,000 ms
	Connectable CTs	E54-CT1 and E54-CT3		**Manipulated variable**	0% to 100%
				Resolution	1 ms
				Rated voltage	24 VDC
	Maximum heater current	50 A AC		**Operating load voltage range**	15 to 28.8 VDC
	Resolution	0.1 A		**Maximum load current**	0.1 A/point, 0.4 A/Unit
	Overall accuracy (25°C)	±5% (full scale) ±1 digit		**Maximum inrush current**	1.0 A/point max., 10 ms
				Leakage current	0.1 mA max.
	Influence of temperature (0 to 55°C)	±2% (full scale) ±1 digit		**Residual voltage**	1.5 V max.
				Disconnection/short-circuit detection	None
	Conversion time	10 ms		**Protective functions**	Provided.
Dimensions (mm)	12 × 100 × 71 mm (W×H×D)		**Isolation method**	Between control output and internal circuit: Photocoupler isolation No isolation between internal circuits and CT inputs	
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)		**Dielectric strength**	510 VAC between isolated circuits for 1 minute with a leakage current of 5 mA max.	
I/O power supply method	Supplied from the NX bus.		**Current capacity of I/O power supply terminals**	IOV: 0.1 A max. per terminal	
NX Unit power consumption	• Connected to a CPU Unit 1.05 W max. • Connected to a Communications Coupler Unit 0.75 W max.		**Current consumption from I/O power supply**	20 mA max.	
Weight	70 g max.				

Circuit configuration	
Installation method and restrictions	Installation orientation: • Connected to a CPU Unit Possible in upright installation. • Connected to a Communications Coupler Unit Possible in 6 orientations. Restrictions: No restrictions
Terminal connection diagram	

A-2 Dimensions

A-2-1 Screwless Clamping Terminal Block Type

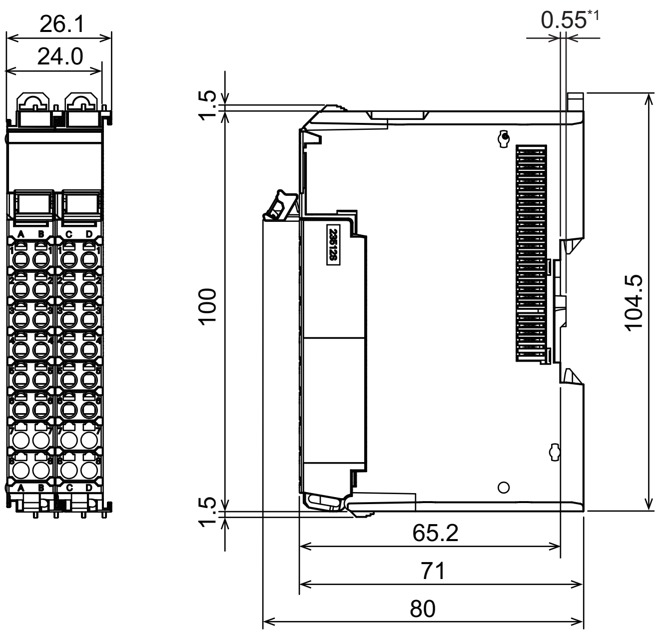
12 mm Width



(Unit: mm)

*1. The dimension is 1.35 mm for Units with lot numbers through December 2014.

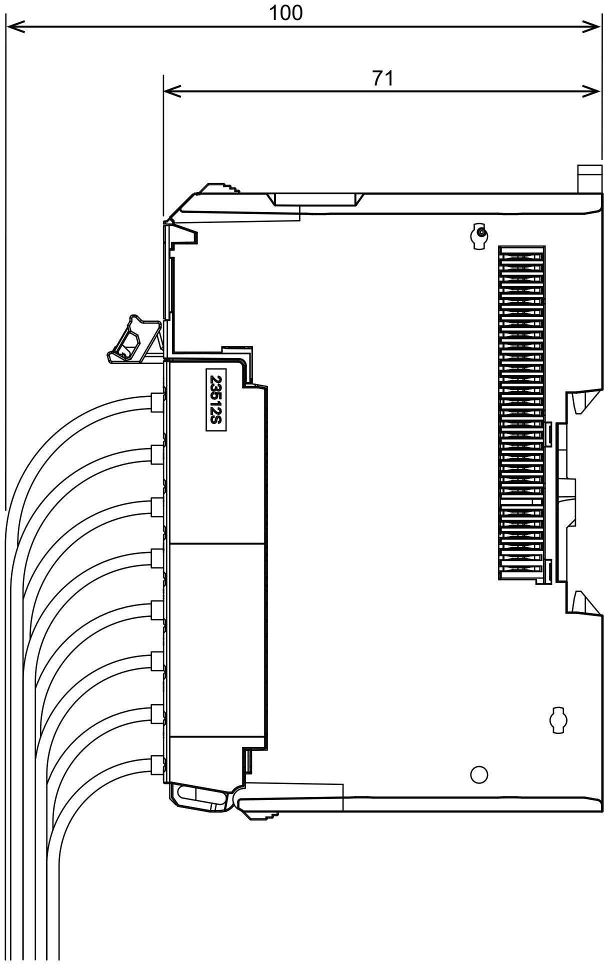
24 mm Width



(Unit: mm)

*1. The dimension is 1.35 mm for Units with lot numbers through December 2014.

Installation Height



(Unit: mm)

A-3 List of NX Objects

This section describes the NX objects of the Temperature Input Units and Heater Burnout Detection Units.

The method to access NX objects through instructions or other messages depends on where the NX Unit is connected. If the NX Unit is connected to a CPU Unit, access is possible with the Read NX Unit Object instruction and the Write NX Unit Object instruction. When the NX Unit is connected to a Communications Coupler Unit, the method depends on the connected communications master and Communications Coupler Unit. Refer to the user's manual for the connected Communications Coupler Unit for method to use messages to access NX objects on Slave Terminals.

Refer to the user's manual for the Communication Control Unit for the method to use messages to access NX objects of NX Units connected to a Communication Control Unit.

A-3-1 Format of Object Descriptions

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

Index (hex)	Subindex (hex)	Object name	Default value	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 that is expressed as 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 value : 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 unit is the physical units.

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 Temperature Input Units

Unit Information Objects

This object gives the product information.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
1000	---	NX Bus Identity	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	Not possible	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	Not possible	---
	03	Device Type	*2	---	---	UDINT	RO	Not possible	---
	05	Vendor Code	00000001 hex *3	---	---	UDINT	RO	Not possible	---
	06	Unit Version	*4	---	---	UDINT	RO	Not possible	---
	07	Serial Number	*5	00000000 to FFFFFFFF hex	---	UDINT	RO	Not possible	---
1001	---	Production Info	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible	---
	01	Lot Number	*6	00000000 to FFFFFFFF hex	---	UDINT	RO	Not possible	---
	02	Hardware Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	Not possible	---
	03	Software Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	Not possible	---

*1. The product models are assigned in ascending order from the lowest number of array elements. Any remainder elements are filled with spaces.

*2. The device types are assigned for each product Unit type.
Bits 0 to 31: Device type

*3. OMRON vendor code

*4. Bits 24 to 31: Integer part of the Unit version.
Bits 16 to 23: Fractional part of the Unit version.
Bits 0 to 15: Reserved
(Example) For Ver.1.0, 0100□□□□ hex

*5. A unique serial number is assigned for each product unit.
Bits 0 to 31: Serial number

*6. The year, month, and day of production are assigned to the "lot number".
Bits 24 to 31: Date of production
Bits 16 to 23: Month of production
Bits 8 to 15: Year of production
Bits 0 to 7: Reserved

*7. The version is given in order in the lowest elements of the array. Unused elements are padded with spaces.

Objects That Accept I/O Allocations

These objects accept I/O allocations.

If you assign any of the objects that are described below to I/O, you can no longer access those objects with the Read NX Unit Object instruction, Write NX Unit Object instruction, or other messages.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6000	---	Channel Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Status *2	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible	---
	02	Ch2 Status *2	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible	---
	03	Ch3 Status *2	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible	---
	04	Ch4 Status *2	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meaning of each bit in Ch☐ Status is as follows.

Bit	Meaning
0	Ch☐ Sensor Disconnected Error
1	Ch☐ Over Range
2	Ch☐ Under Range
3	Ch☐ Cold Junction Error
4	Ch☐ AD Converter Error
5 to 16	Reserved

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6001	---	Measured Value INT	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Measured Value INT	0	-32000 to 32000 *2	°C or °F	INT	RO	Possible	---
	02	Ch2 Measured Value INT	0	-32000 to 32000 *2		INT	RO	Possible	---
	03	Ch3 Measured Value INT	0	-32000 to 32000 *2		INT	RO	Possible	---
	04	Ch4 Measured Value INT	0	-32000 to 32000 *2		INT	RO	Possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. If an error occurs, the measured value is 32767.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6002	---	Measured Value DINT	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Measured Value DINT	0	-2147483000 to 2147483000 *2	°C or °F	DINT	RO	Possible	---
	02	Ch2 Measured Value DINT	0	-2147483000 to 2147483000 *2		DINT	RO	Possible	---
	03	Ch3 Measured Value DINT	0	-2147483000 to 2147483000 *2		DINT	RO	Possible	---
	04	Ch4 Measured Value DINT	0	-2147483000 to 2147483000 *2		DINT	RO	Possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. If an error occurs, the measured value is 2147483647.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6003	---	Measured Value REAL	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Measured Value REAL	0	-2147483000 to 2147483000 *2	°C or °F	REAL	RO	Possible	---
	02	Ch2 Measured Value REAL	0	-2147483000 to 2147483000 *2		REAL	RO	Possible	---
	03	Ch3 Measured Value REAL	0	-2147483000 to 2147483000 *2		REAL	RO	Possible	---
	04	Ch4 Measured Value REAL	0	-2147483000 to 2147483000 *2		REAL	RO	Possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. If an error occurs, the measured value is 1.0E + 10.

Other Objects

This section lists other objects.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	Channel Enable/Disable Setting	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Enable/Disable	TRUE	TRUE or FALSE *2	---	BOOL	RW	Not possible	Y
	02	Ch2 Enable/Disable	TRUE			BOOL	RW	Not possible	Y
	03	Ch3 Enable/Disable	TRUE			BOOL	RW	Not possible	Y
	04	Ch4 Enable/Disable	TRUE			BOOL	RW	Not possible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of the set values for Ch□ Enable/Disable are as follows.

Set value	Meaning
FALSE	Disable
TRUE	Enable

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Input Type Setting	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Input Type	*2	*2	---	USINT	RW	Not possible	Y
	02	Ch2 Input Type				USINT	RW	Not possible	Y
	03	Ch3 Input Type				USINT	RW	Not possible	Y
	04	Ch4 Input Type				USINT	RW	Not possible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meaning of the set value, default value and data range for Ch□ Input Type are as follows.
Meanings of the set values for Ch□ Input Type

Set value	Meaning
15	K -200 to 1300°C
16	K -20 to 600°C (High Resolution)
17	J -200 to 1200°C
18	J -20 to 600°C (High Resolution)
19	T -200 to 400°C
20	E -200 to 1000°C
21	L -200 to 900°C
22	U -200 to 600°C
23	N -200 to 1300°C
24	R -50 to 1700°C
25	S -50 to 1700°C
26	B 0 to 1800°C
27	W 0 to 2300°C
28	PL II 0 to 1300°C
0	Pt100 (3wire) -200 to 850°C
7	Pt1000 (3wire) -200 to 850°C

Default value and data range for Ch□ Input Type

• NX-TS□1□□

NX Units	Default value	Data range
NX-TS2101/TS3101	15	15, 17, 19 to 28
NX-TS2102/TS2104/TS3102/TS3104	15	15 to 28

• NX-TS□2□□

NX Units	Default value	Data range
NX-TS2201/TS2204/TS3201/TS3204	0	0, 7
NX-TS2202/TS3202	0	0

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Cold Junction Compensation Enable/Disable Setting	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Cold Junction Compensation Enable/Disable	TRUE	TRUE or FALSE *2	---	BOOL	RW	Not possible	Y
	02	Ch2 Cold Junction Compensation Enable/Disable	TRUE			BOOL	RW	Not possible	Y
	03	Ch3 Cold Junction Compensation Enable/Disable	TRUE			BOOL	RW	Not possible	Y
	04	Ch4 Cold Junction Compensation Enable/Disable	TRUE			BOOL	RW	Not possible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of the set values for Ch□ Cold Junction Compensation Enable/Disable are as follows.

Set value	Meaning
FALSE	Disable
TRUE	Enable

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Acc ess	I/O allo-cat-ion	Data attri-bute
5003	---	Decimal Point Position Set-ting	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not pos-sible	---
	01	Ch1 Decimal Point Position	1	0/1/2 *2	---	UINT	RW	Not pos-sible	Y
	02	Ch2 Decimal Point Position	1			UINT	RW	Not pos-sible	Y
	03	Ch3 Decimal Point Position	1			UINT	RW	Not pos-sible	Y
	04	Ch4 Decimal Point Position	1			UINT	RW	Not pos-sible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of the set values for Ch□ Decimal Point Position are as follows.

Set value	Meaning
0	×1 °C or °F
1	×0.1 °C or °F
2	×0.01 °C or °F

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Temperature Unit Setting	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Temperature Unit	0	0/1 *2	---	UINT	RW	Not possible	Y
	02	Ch2 Temperature Unit	0			UINT	RW	Not possible	Y
	03	Ch3 Temperature Unit	0			UINT	RW	Not possible	Y
	04	Ch4 Temperature Unit	0			UINT	RW	Not possible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of the set values for Ch□ Temperature Unit are as follows.

Set value	Meaning
0	°C
1	°F

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Input Moving Average Time	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Input Moving Average Time	0	*2	ms	UINT	RW	Not possible	Y
	02	Ch2 Input Moving Average Time	0	*2	ms	UINT	RW	Not possible	Y
	03	Ch3 Input Moving Average Time	0	*2	ms	UINT	RW	Not possible	Y
	04	Ch4 Input Moving Average Time	0	*2	ms	UINT	RW	Not possible	Y

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The data range of Ch□ Input Moving Average Time depends on the model. The descriptions for each model are as below.

NX Units	Data range
NX-TS□□01	0 to 32000
NX-TS□□02	0 to 1280
NX-TS□□04	0 to 7680

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5007	---	Sensor Disconnected Error Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Sensor Disconnected Error Status	FALSE	TRUE or FALSE *2	---	BOOL	RO	Not possible	---
	02	Ch2 Sensor Disconnected Error Status	FALSE			BOOL	RO	Not possible	---
	03	Ch3 Sensor Disconnected Error Status	FALSE			BOOL	RO	Not possible	---
	04	Ch4 Sensor Disconnected Error Status	FALSE			BOOL	RO	Not possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of Ch□ Sensor Disconnected Error Status are as follows.

Value	Meaning
FALSE	Normal
TRUE	Disconnection Detected

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5008	---	Measured Value Over Range Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Measured Value Over Range	FALSE	TRUE or FALSE *2	---	BOOL	RO	Not possible	---
	02	Ch2 Measured Value Over Range	FALSE			BOOL	RO	Not possible	---
	03	Ch3 Measured Value Over Range	FALSE			BOOL	RO	Not possible	---
	04	Ch4 Measured Value Over Range	FALSE			BOOL	RO	Not possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of Ch□ Measured Value Over Range are as follows.

Value	Meaning
FALSE	Normal
TRUE	Over Range Detected

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Acc ess	I/O allo-cat-ion	Data attri-bute
5009	---	Measured Value Under Range Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not pos-sible	---
	01	Ch1 Measured Value Under Range	FALSE	TRUE or FALSE*2	---	BOOL	RO	Not pos-sible	---
	02	Ch2 Measured Value Under Range	FALSE			BOOL	RO	Not pos-sible	---
	03	Ch3 Measured Value Under Range	FALSE			BOOL	RO	Not pos-sible	---
	04	Ch4 Measured Value Under Range	FALSE			BOOL	RO	Not pos-sible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of Ch□ Measured Value Under Range are as follows.

Value	Meaning
FALSE	Normal
TRUE	Under Range Detected

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500A	---	Cold Junction Sensor Error Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Cold Junction Sensor Error Status	FALSE	TRUE or FALSE *2	---	BOOL	RO	Not possible	---
	02	Ch2 Cold Junction Sensor Error Status	FALSE			BOOL	RO	Not possible	---
	03	Ch3 Cold Junction Sensor Error Status	FALSE			BOOL	RO	Not possible	---
	04	Ch4 Cold Junction Sensor Error Status	FALSE			BOOL	RO	Not possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of Ch□ Cold Junction Sensor Error Status are as follows.

Value	Meaning
FALSE	Normal
TRUE	Disconnection Detected

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
500B	---	AD Converter Error Status	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 AD Converter Error Status	FALSE	TRUE or FALSE *2	---	BOOL	RO	Not possible	---
	02	Ch2 AD Converter Error Status	FALSE			BOOL	RO	Not possible	---
	03	Ch3 AD Converter Error Status	FALSE			BOOL	RO	Not possible	---
	04	Ch4 AD Converter Error Status	FALSE			BOOL	RO	Not possible	---

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

*2. The meanings of Ch□ AD Converter Error Status are as follows.

Value	Meaning
FALSE	Normal
TRUE	Error

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5010	---	Offset Value (One-point Correction)	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Offset Value (One-point Correction)	0	-400 to 5000	°C or °F	REAL	RW	Not possible	N
	02	Ch2 Offset Value (One-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	03	Ch3 Offset Value (One-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	04	Ch4 Offset Value (One-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5011	---	Lower Offset Value (Two-point Correction)	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Lower Offset Value (Two-point Correction)	0	-400 to 5000	°C or °F	REAL	RW	Not possible	N
	02	Ch2 Lower Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	03	Ch3 Lower Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	04	Ch4 Lower Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5012	---	Higher Offset Value (Two-point Correction)	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Higher Offset Value (Two-point Correction)	0	-400 to 5000	°C or °F	REAL	RW	Not possible	N
	02	Ch2 Higher Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	03	Ch3 Higher Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	04	Ch4 Higher Offset Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5013	---	Pre-correction Lower Measured Value (Two-point Correction)	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Pre-correction Lower Measured Value (Two-point Correction)	0	-400 to 5000	°C or °F	REAL	RW	Not possible	N
	02	Ch2 Pre-correction Lower Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	03	Ch3 Pre-correction Lower Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	04	Ch4 Pre-correction Lower Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5014	---	Pre-correction Higher Measured Value (Two-point Correction)	---	---	---	---	---	---	---
	00	Number of Entries	*1	*1	---	USINT	RO	Not possible	---
	01	Ch1 Pre-correction Higher Measured Value (Two-point Correction)	0	-400 to 5000	°C or °F	REAL	RW	Not possible	N
	02	Ch2 Pre-correction Higher Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	03	Ch3 Pre-correction Higher Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N
	04	Ch4 Pre-correction Higher Measured Value (Two-point Correction)	0	-400 to 5000		REAL	RW	Not possible	N

*1. The default value and data range for Number of Entries are as follows.

NX Units	Default value	Data range
NX-TS2101/TS2102/TS2104/TS2201/TS2202/TS2204	2	2
NX-TS3101/TS3102/TS3104/TS3201/TS3202/TS3204	4	4
Other models	0	0

A-3-3 Heater Burnout Detection Units

Unit Information Objects

These objects are related to product information.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
1000	---	NX Bus Identity	---	---	---	---	---	---	---
	00	Number of Entries	7	7	---	USINT	RO	Not possible	---
	02	Model	*1	---	---	ARRAY [0..11] OF BYTE	RO	Not possible	---
	03	Device Type	*2	---	---	UDINT	RO	Not possible	---
	05	Vendor Code	00000001 hex *3	---	---	UDINT	RO	Not possible	---
	06	Unit Version	*4	---	---	UDINT	RO	Not possible	---
	07	Serial Number	*5	00000000 to FFFFFFFF hex	---	UDINT	RO	Not possible	---
1001	---	Production Info	---	---	---	---	---	---	---
	00	Number of Entries	2	2	---	USINT	RO	Not possible	---
	01	Lot Number	*6	00000000 to FFFFFFFF hex	---	UDINT	RO	Not possible	---
	02	Hardware Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	Not possible	---
	03	Software Version	*7	---	---	ARRAY [0..19] OF BYTE	RO	Not possible	---

*1. The product model is given in order in the lowest elements of the array. Unused elements are padded with spaces.

*2. A device type is assigned to each product Unit type.
Bits 0 to 31: Device type

*3. OMRON's vendor code.

*4. Bits 24 to 31: Integer part of the Unit version.
Bits 16 to 23: Fractional part of the Unit version.
Bits 0 to 15: Reserved
Example for version 1.0: 0100□□□□ hex

*5. A unique serial number is assigned for each product unit.
Bits 0 to 31: Serial number

*6. The date of manufacture is given for the lot number.
Bits 24 to 31: Day 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 given in order in the lowest elements of the array. Unused elements are padded with spaces.

Objects That Accept I/O Allocations

These objects accept I/O allocations.

If you assign any of the objects that are described below to I/O, you can no longer access those objects with the Read NX Unit Object instruction, Write NX Unit Object instruction, or other messages.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6000	---	Alarm Status	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Alarm Status*1	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible.	---
	02	CT2 Alarm Status*1	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible.	---
	03	CT3 Alarm Status*1	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible.	---
	04	CT4 Alarm Status*1	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible.	---

*1. The meanings of the individual bits in the C□ Alarm Status are given below.

Bit	Data name	Meaning*1
0	CT□ Heater Burnout Detection	Indicates whether a heater burnout occurred for CT□. 1: A heater burnout occurred. 0: A heater burnout did not occur.
1	CT□ SSR Failure Detection	Indicates whether an SSR failure occurred for CT□. 1: An SSR failure occurred. 0: An SSR failure did not occur.
2 to 15	Reserved	

*1. A 1 indicates TRUE and a 0 indicates FALSE.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6001	---	Heater Current REAL	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Heater Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	02	CT2 Heater Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	03	CT3 Heater Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	04	CT4 Heater Current REAL	0	0 to 55	A	REAL	RO	Possible.	---

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6002	---	Leakage Current REAL	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Leakage Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	02	CT2 Leakage Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	03	CT3 Leakage Current REAL	0	0 to 55	A	REAL	RO	Possible.	---
	04	CT4 Leakage Current REAL	0	0 to 55t	A	REAL	RO	Possible.	---

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6003	---	Heater Current UINT	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Heater Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	02	CT2 Heater Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	03	CT3 Heater Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	04	CT4 Heater Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6004	---	Leakage Current UINT	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Leakage Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	02	CT2 Leakage Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	03	CT3 Leakage Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---
	04	CT4 Leakage Current UINT	0	0 to 550	0.1 A	UINT	RO	Possible.	---

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
6005	---	Control Output Status	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	Not possible.	---
	01	Control Output Status*1	0000 hex	0000 to FFFF hex	---	WORD	RO	Possible.	---

*1. The meanings of the individual bits in the Control Output Status are given below.

Bit	Data	Meaning*1
0	Out1 Control Output Status	Indicates the ON/OFF status of the Out1 control output controlled as a time-proportional output. 1: Out1 is ON. 0: Out1 is OFF.
1	Out2 Control Output Status	Indicates the ON/OFF status of the Out2 control output controlled as a time-proportional output. 1: Out2 is ON. 0: Out2 is OFF.
2	Out3 Control Output Status	Indicates the ON/OFF status of the Out3 control output controlled as a time-proportional output. 1: Out3 is ON. 0: Out3 is OFF.
3	Out4 Control Output Status	Indicates the ON/OFF status of the Out4 control output controlled as a time-proportional output. 1: Out4 is ON. 0: Out4 is OFF.
4 to 7	Reserved	

*1. A 1 indicates TRUE and a 0 indicates FALSE.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7000	---	Manipulated Variable REAL	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	Out1 Manipulated Variable REAL	0	0 to 100*1	%	REAL	RW	Possible.	N
	02	Out2 Manipulated Variable REAL	0	0 to 100*1	%	REAL	RW	Possible.	N
	03	Out3 Manipulated Variable REAL	0	0 to 100*1	%	REAL	RW	Possible.	N
	04	Out4 Manipulated Variable REAL	0	0 to 100*1	%	REAL	RW	Possible.	N

*1. If the manipulated variable is a negative value, the manipulated variable will be treated as 0%. If the manipulated variable exceeds 100%, the manipulated variable will be treated as 100%.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
7001	---	Immediate Output Command	---	---	---	---	---	---	---
	00	Number of Entries	1	1	---	USINT	RO	Not possible.	---
	01	Immediate Output Command*1	0000 hex	0000 to FFFF hex	---	WORD	RW	Possible.	N

*1. The meanings of the individual bits in the Immediate Output Command are given below.

Bit	Data	Meaning*1
0	Out1 Immediate Output Command	Gives the execution status of the Out1 immediate output command. 1: Execute the Out1 immediate output command. 0: Do not execute the Out1 immediate output command.
1	Out2 Immediate Output Command	Gives the execution status of the Out2 immediate output command. 1: Execute the Out2 immediate output command. 0: Do not execute the Out2 immediate output command.
2	Out3 Immediate Output Command	Gives the execution status of the Out3 immediate output command. 1: Execute the Out3 immediate output command. 0: Do not execute the Out3 immediate output command.
3	Out4 Immediate Output Command	Gives the execution status of the Out4 immediate output command. 1: Execute the Out4 immediate output command. 0: Do not execute the Out4 immediate output command.
4 to 15	Reserved	

*1. A 1 indicates TRUE and a 0 indicates FALSE.

Other Objects

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5000	---	CT Allocation	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Allocation	1	0 to 4*1	---	USINT	RW	Not possible.	Y
	02	CT2 Allocation	2	0 to 4*1	---	USINT	RW	Not possible.	Y
	03	CT3 Allocation	3	0 to 4*1	---	USINT	RW	Not possible.	Y
	04	CT4 Allocation	4	0 to 4*1	---	USINT	RW	Not possible.	Y

*1. The following table gives the meanings of the set values for the CT□ Allocations.

Set value	Meaning
0	Do not allocate CT□ to the control output.
1	Allocate CT□ to Out1.
2	Allocate CT□ to Out2.
3	Allocate CT□ to Out3.
4	Allocate CT□ to Out4.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5001	---	Heater Burnout Detection Current	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 Heater Burnout Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	02	CT2 Heater Burnout Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	03	CT3 Heater Burnout Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	04	CT4 Heater Burnout Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5002	---	Heater Burnout Detection Current	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	CT1 SSR Failure Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	02	CT2 SSR Failure Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	03	CT3 SSR Failure Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N
	04	CT4 SSR Failure Detection Current	0	0 to 50	A	REAL	RW	Not possible.	N

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5003	---	Control Period	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	Out1 Control Period	2,000	50 to 100,000	ms	UDINT	RW	Not possible.	Y
	02	Out2 Control Period	2,000	50 to 100,000	ms	UDINT	RW	Not possible.	Y
	03	Out3 Control Period	2,000	50 to 100,000	ms	UDINT	RW	Not possible.	Y
	04	Out3 Control Period	2,000	50 to 100,000	ms	UDINT	RW	Not possible.	Y

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5004	---	Minimum Pulse Width	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	Out1 Minimum Pulse Width	0	0 to 50	%	REAL	RW	Not possible.	Y
	02	Out2 Minimum Pulse Width	0	0 to 50	%	REAL	RW	Not possible.	Y
	03	Out3 Minimum Pulse Width	0	0 to 50	%	REAL	RW	Not possible.	Y
	04	Out4 Minimum Pulse Width	0	0 to 50	%	REAL	RW	Not possible.	Y

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5005	---	Load Rejection Output Setting	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	Out1 Hold Value Setting	1	0 or 1*1	---	USINT	RW	Not possible.	Y
	02	Out2 Hold Value Setting	1	0 or 1*1	---	USINT	RW	Not possible.	Y
	03	Out3 Hold Value Setting	1	0 or 1*1	---	USINT	RW	Not possible.	Y
	04	Out4 Hold Value Setting	1	0 or 1*1	---	USINT	RW	Not possible.	Y

*1. The meanings of the set values for Out☐ Hold Value Setting are as follows.

Set value	Meaning
0	Hold Output
1	User-specified Value Output

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data type	Access	I/O allocation	Data attribute
5006	---	Load Rejection Output Setting Value	---	---	---	---	---	---	---
	00	Number of Entries	4	4	---	USINT	RO	Not possible.	---
	01	Out1 User-specified Value Setting	0	0 to 100*1	%	REAL	RW	Not possible.	Y
	02	Out2 User-specified Value Setting	0	0 to 100*1	%	REAL	RW	Not possible.	Y
	03	Out3 User-specified Value Setting	0	0 to 100*1	%	REAL	RW	Not possible.	Y
	04	Out4 User-specified Value Setting	0	0 to 100*1	%	REAL	RW	Not possible.	Y

*1. The user-specified value is treated as the manipulated variable for the control output.

A-4 List of Screwless Clamping Terminal Block Models

This section explains how to read the screwless clamping terminal block model numbers and shows the model number table.

A-4-1 Model Notation

The screwless clamping terminal block models are assigned based on the following rules.

NX-TB□□□□

Product type
TB: Terminal block

Terminal specifications
A: Column letter indication A/B, without functional ground terminal
B: Column letter indication C/D, without functional ground terminal
C: Column letter indication A/B, with functional ground terminal

Number of terminals
08: 8 terminals
12: 12 terminals
16: 16 terminals

Other specifications
1: Terminal current capacity of 4 A
2: Terminal current capacity of 10 A

A-4-2 List of Terminal Block Models

The following table shows a list of screwless clamping terminal blocks.

Terminal block model	Number of terminals	Ground terminal mark	Terminal current capacity
NX-TBA081	8	Not provided	4 A
NX-TBA121	12		
NX-TBA161	16		
NX-TBB121	12		
NX-TBB161	16		
NX-TBA082	8		10 A
NX-TBA122	12		
NX-TBA162	16		
NX-TBB082	8		
NX-TBB122	12		
NX-TBB162	16		
NX-TBC082	8	Provided	
NX-TBC162	16		

Note When you purchase a terminal block, purchase an NX-TB□□□2.

A-5 Version Information with CPU Units

This section provides version-related information when connecting Units to a CPU Unit. This section describes the relationships between the unit versions of each Unit and the CPU Unit, and Sysmac Studio version, and the specification changes for each unit version of each Unit.

A-5-1 Relationship between Unit Versions of Units

The relationship between the unit versions of each Unit and the CPU Unit, and Sysmac Studio version are shown below.

Interpreting the Version Combination Tables

The items that are used in the version combination tables are given below.

Refer to the user's manual for the CPU Unit for the models of CPU Unit to which NX Units can be connected.

NX Unit		Corresponding unit versions/versions	
Model	**Unit version**	**CPU Unit**	**Sysmac Studio**
Model numbers of NX Units.	Unit versions of NX Units.	Unit versions of the CPU that are compatible with the NX Units.	Sysmac Studio versions that are compatible with the NX Units and CPU Unit.

Version Combination Tables

- With the combinations of the unit versions/versions shown below, you can use the functions that are supported by the unit version of the Unit model. Use the unit versions/versions (or the later/higher unit versions/versions) that correspond to the NX Unit models and the unit versions. You cannot use the specifications that were added or changed for the relevant NX Unit models and the unit versions unless you use the corresponding unit versions/versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the CPU Unit.

Temperature Input Units

NX Unit		Corresponding unit versions/versions	
Model	Unit version	CPU Unit	Sysmac Studio
NX-TS2101	Ver.1.0	Ver.1.13	Ver.1.17
	Ver.1.1		
NX-TS2102	Ver.1.1		
NX-TS2104	Ver.1.1		
NX-TS2201	Ver.1.0		
	Ver.1.1		
NX-TS2202	Ver.1.1		
NX-TS2204	Ver.1.1		
NX-TS3101	Ver.1.0		
	Ver.1.1		
NX-TS3102	Ver.1.1		
NX-TS3104	Ver.1.1		
NX-TS3201	Ver.1.0		
	Ver.1.1		
NX-TS3202	Ver.1.1		
NX-TS3204	Ver.1.1		

Heater Burnout Detection Units

NX Unit		Corresponding unit versions/versions	
Model	Unit version	CPU Unit	Sysmac Studio
NX-HB3101	Ver.1.0	Ver.1.13	Ver.1.17
NX-HB3201			

A-5-2 Functions That Were Added or Changed for Each Unit Version

The following table shows the relationships between the unit versions/versions of the NX Units and CPU Units and Sysmac Studio for changes in or additions to the functions.

Interpreting the Version Corresponding Table for Functions

The items that are used in the version corresponding table for functions are given below.

Function	Change or addition	NX Unit		Corresponding unit versions/versions	
		Model	Unit version	CPU Unit	Sysmac Studio
This is the function of the NX Unit.	Indicates whether the function was newly added or changed.	This is the model number of the NX Unit.	This is the unit version of the NX Unit that is compatible with the function.	This is the unit version of the CPU Units that support the NX Units with the specified function.	This is the version of the Sysmac Studio that supports the NX Units and CPU Units.

Version Corresponding Table for Functions

The version corresponding table for functions is as follows.

- You can also use the added or changed functions with the unit versions/versions given in the table or with later/higher versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the CPU Unit.

Function	Change or addition	NX Unit		Corresponding unit versions/versions	
		Model	Unit version	CPU Unit	Sysmac Studio
Restarting a specified NX Unit *1	Addition	NX-TS□□□□	Ver.1.1	Ver.1.1.3	Ver.1.17
Monitoring total power-ON time *2	Addition				

*1. Refer to the user's manual for the connected CPU Unit for information on specifying an NX Unit for the restart instruction.

*2. Refer to the user's manual for the connected CPU Unit for information on monitoring the total power-ON time.

A-6 Version Information with Communications Coupler Units

This section provides version-related information when connecting Units to a Communications Coupler Unit.

Version information is provided separately for each Communications Coupler Unit that an NX Unit is connected to.

A-6-1 Connection to an EtherCAT Coupler Unit

This section describes the relationship between the unit versions of each Unit, EtherCAT Coupler Unit, CPU Unit and Industrial PC, versions of the Sysmac Studio, and the specification changes for each unit version.

Relationship between Unit Versions of Units

The items that are used in the version combination table are given below.

NX Unit		Corresponding unit versions/versions		
Model	**Unit version**	**EtherCAT Coupler Unit**	**CPU Unit or Industrial PC**	**Sysmac Studio**
Model numbers of NX Units.	Unit versions of NX Units.	Unit versions of EtherCAT Coupler Units that are compatible with the NX Units.	Unit version of the NJ/NX-series CPU Units or NY-series Industrial PCs that are compatible with the EtherCAT Coupler Unit.	Sysmac Studio versions that are compatible with the NX Units, EtherCAT Coupler Units, CPU Units, and Industrial PCs.

The version combination table is given below.

- With the combinations of the unit versions/versions shown below, you can use the functions that are supported by the unit version of the Unit model. Use the unit versions/versions (or the later/higher unit versions/versions) that correspond to the NX Unit models and the unit versions. You cannot use the specifications that were added or changed for the relevant NX Unit models and the unit versions unless you use the corresponding unit versions/versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- You cannot connect the relevant NX Unit to the target Communications Coupler Unit if "---" is shown in the corresponding unit versions/versions column.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communications Coupler Unit, CPU Unit, and Industrial PC.

Refer to *Functions That Were Added or Changed for Each Unit Version* on page A-70 for the functions that are supported by each unit version of the Communications Coupler Units and NX Units.

Temperature Input Units

NX Unit		Corresponding unit versions/versions		
Model	Unit Version	EtherCAT Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio
NX-TS2101	Ver.1.0	Ver.1.0	Ver.1.05	Ver.1.06
	Ver.1.1			Ver.1.08
NX-TS2102	Ver.1.1			
NX-TS2104	Ver.1.1			
NX-TS2201	Ver.1.0			Ver.1.06
	Ver.1.1			Ver.1.08
NX-TS2202	Ver.1.1			
NX-TS2204	Ver.1.1			
NX-TS3101	Ver.1.0			Ver.1.06
	Ver.1.1			Ver.1.08
NX-TS3102	Ver.1.1			
NX-TS3104	Ver.1.1			
NX-TS3201	Ver.1.0			Ver.1.06
	Ver.1.1			Ver.1.08
NX-TS3202	Ver.1.1			
NX-TS3204	Ver.1.1			

Heater Burnout Detection Units

NX Unit		Corresponding unit versions/versions		
Model	Unit version	EtherCAT Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio
NX-HB3101	Ver.1.0	Ver.1.0	Ver.1.05	Ver.1.16
NX-HB3201				

Functions That Were Added or Changed for Each Unit Version

The following table shows the relationships between the unit versions/versions of the NX Units, Communications Coupler Units, CPU Units, Industrial PCs, and Sysmac Studio for changes in or additions to the functions.

The items that are used in the version corresponding table for functions are given below.

Function	Change or addition	NX Unit		Corresponding unit versions/versions		
		Model	Unit version	EtherCAT Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio
Functions of NX Units.	Indicates whether the function was newly added or changed.	Model numbers of NX Units.	Unit versions of the NX Units that are compatible with the function.	Unit versions of EtherCAT Coupler Units that are compatible with the NX Units with the function.	Unit versions of the NJ/NX-series CPU Units or NY-series Industrial PCs that support the EtherCAT Coupler Units.	Sysmac Studio versions that are compatible with the NX Units, EtherCAT Coupler Units and CPU Units.

The version corresponding table for functions is as follows.

- You can also use the added or changed functions with the unit versions/versions given in the table or with later/higher versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communications Coupler Unit, CPU Unit, and Industrial PC.

● Temperature Input Units

Function	Change or addition	NX Unit		Corresponding unit versions/versions		
		Model	Unit Version	EtherCAT Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio
Restarting a specified NX Unit*1	Addition	NX-TS□□□□	Ver.1.1	Ver.1.2	Ver.1.07 *2	Ver.1.08
Monitoring total power-ON time*3	Addition				Ver.1.05	

*1. Refer to the user's manual for the Communications Coupler Unit for details on how to restart a specified NX Unit.

*2. If you use a CPU Unit, a CPU Unit with unit version 1.07 or later is required to specify an NX Unit for the restart instruction. If you do not specify an NX Unit with the restart instruction, you can use version 1.05. Refer to the instructions reference manual for the connected CPU Unit or Industrial PC for information on specifying an NX Unit for the restart instruction.

*3. Refer to the user's manual for the Communications Coupler Unit for details on monitoring the total power-ON time.

A-6-2 Connection to an EtherNet/IP Coupler Unit

This section describes the relationship between the unit versions of each Unit, EtherNet/IP Coupler Unit, CPU Unit and Industrial PC, versions of the Sysmac Studio and NX-IO Configurator, and the specification changes for each unit version.

Relationship between Unit Versions of Units

The items that are used in the version combination tables are given below.

NX Unit		Corresponding unit versions/versions					
Model	Unit version	Application with an NJ/NX/NY-series Controller			Application with a CS/CJ/CP-series PLC		
		EtherNet/IP Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio	EtherNet/IP Coupler Unit	Sysmac Studio	NX-IO Configurator
Model numbers of NX Units.	Unit versions of NX Units.	Unit versions of EtherNet/IP Coupler Units that are compatible with the NX Units.	Unit version of the NJ/NX-series CPU Units or NY-series Industrial PCs that are compatible with the EtherNet/IP Coupler Unit.	Sysmac Studio versions that are compatible with the NX Units, EtherCAT Coupler Units, CPU Units, and Industrial PCs.	Unit versions of EtherNet/IP Coupler Units that are compatible with the NX Units.	Sysmac Studio versions that are compatible with the NX Units and EtherNet/IP Coupler Units.	Version of the NX-IO Configurator that supports the NX Units, EtherNet/IP Coupler Units, and CPU Units.

The version combination tables are given below.

- With the combinations of the unit versions/versions shown below, you can use the functions that are supported by the unit version of the Unit model. Use the unit versions/versions (or the later/higher unit versions/versions) that correspond to the NX Unit models and the unit versions. You cannot use the specifications that were added or changed for the relevant NX Unit models and the unit versions unless you use the corresponding unit versions/versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- You cannot connect the relevant NX Unit to the target Communications Coupler Unit if "---" is shown in the corresponding unit versions/versions column.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communications Coupler Unit, CPU Unit, and Industrial PC.

Refer to *Functions That Were Added or Changed for Each Unit Version* on page A-70 for the functions that are supported by each unit version of the Communications Coupler Units and NX Units.

Temperature Input Units

NX Unit		Corresponding unit versions/versions					
		Application with an NJ/NX/NY-series Controller*1			Application with a CS/CJ/CP-series PLC*2		
Model	Unit version	EtherNet/IP Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio	EtherNet/IP Coupler Unit	Sysmac Studio	NX-IO Configurator *3
NX-TS2101	Ver.1.0	Ver.1.2	Ver.1.14	Ver.1.19	Ver.1.0	Ver.1.10	Ver.1.00
	Ver.1.1						
NX-TS2102	Ver.1.1						
NX-TS2104	Ver.1.1						
NX-TS2201	Ver.1.0						
	Ver.1.1						
NX-TS2202	Ver.1.1						
NX-TS2204	Ver.1.1						
NX-TS3101	Ver.1.0						
	Ver.1.1						
NX-TS3102	Ver.1.1						
NX-TS3104	Ver.1.1						
NX-TS3201	Ver.1.0						
	Ver.1.1						
NX-TS3202	Ver.1.1						
NX-TS3204	Ver.1.1						

*1. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*2. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of CPU Units and EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*3. For connection to an EtherNet/IP Coupler Unit with unit version 1.0, connection is supported only for a connection to the peripheral USB port on the EtherNet/IP Coupler Unit. You cannot connect by any other path. If you need to connect by another path, use an EtherNet/IP Coupler Unit with unit version 1.2 or later.

Heater Burnout Detection Units

NX Unit		Corresponding unit versions/versions					
		Application with an NJ/NX/NY-series Controller*1			Application with a CS/CJ/CP-series PLC*2		
Model	Unit version	EtherNet/IP Coupler Unit	CPU Unit or Industrial PC	Sysmac Studio	EtherNet/IP Coupler Unit	Sysmac Studio	NX-IO Configurator*3
NX-HB3101	Ver.1.0	Ver.1.2	Ver.1.14	Ver.1.19	Ver.1.0	Ver.1.16	Ver.1.00
NX-HB3201							

*1. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*2. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of CPU Units and EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*3. For connection to an EtherNet/IP Coupler Unit with unit version 1.0, connection is supported only for a connection to the peripheral USB port on the EtherNet/IP Coupler Unit. You cannot connect by any other path. If you need to connect by another path, use an EtherNet/IP Coupler Unit with unit version 1.2 or later.

Functions That Were Added or Changed for Each Unit Version

The following table shows the relationships between the unit versions/versions of the NX Units, Communications Coupler Units, CPU Units, Industrial PCs, Sysmac Studio, and NX-IO Configurator for changes in or additions to the functions.

The items that are used in the version corresponding table for functions are given below.

Function	Change or addition	NX Unit		Corresponding unit versions/versions				
				Application with an NJ/NX/NY-series Controller		Application with a CS/CJ/CP-series PLC		
		Model	Unit version	EtherNet/IP Coupler Unit	Sysmac Studio	EtherNet/IP Coupler Unit	Sysmac Studio	NX-IO Configurator
Function of NX Units.	Indicates whether the function was newly added or changed.	Model numbers of NX Units.	Unit version of the NX Unit that is compatible with the function.	Unit version of EtherNet/IP Coupler Units that are compatible with the NX Units with the function.	Sysmac Studio versions that are compatible with the NX Units and EtherNet/IP Coupler Unit.	Unit version of EtherNet/IP Coupler Units that are compatible with the NX Units with the function.	Sysmac Studio versions that are compatible with the NX Units and EtherNet/IP Coupler Unit.	Version of the NX-IO Configurator that supports the NX Units and EtherNet/IP Coupler Unit.

The version corresponding table for functions is as follows.

- You can also use the added or changed functions with the unit versions/versions given in the table or with later/higher versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communications Coupler Unit, CPU Unit, and Industrial PC.

Temperature Input Units

Function	Change or addition	NX Unit		Corresponding unit versions/versions				
				Application with an NJ/NX/NY-series Controller*1		Application with a CS/CJ/CP-series PLC*2		
		Model	Unit version	EtherNet/IP Coupler Unit	Sysmac Studio	EtherNet/IP Coupler Unit	Sysmac Studio	NX-IO Configurator *3
Restarting a specified NX Unit*4	Addition	NX-TS□□□□	Ver.1.1	Ver.1.2	Ver.1.19	Ver.1.0	Ver.1.10	Ver.1.00
Monitoring total power-ON time*5	Addition							

*1. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*2. Refer to the user's manual of the EtherNet/IP Coupler Unit for the unit versions of CPU Units and EtherNet/IP Units corresponding to EtherNet/IP Coupler Units.

*3. For connection to an EtherNet/IP Coupler Unit with unit version 1.0, connection is supported only for a connection to the peripheral USB port on the EtherNet/IP Coupler Unit. You cannot connect by any other path. If you need to connect by another path, use an EtherNet/IP Coupler Unit with unit version 1.2 or later.

*4. Refer to the user's manual for the Communications Coupler Unit for details on how to restart a specified NX Unit.

*5. Refer to the user's manual for the Communications Coupler Unit for details on monitoring the total power-ON time.

A-7 Version Information with Communication Control Units

This section provides version-related information when connecting Units to a Communication Control Unit. This section describes the relationship between the unit versions of each Unit and the Communication Control Unit, and Sysmac Studio version, and the specification changes for each unit version of each Unit.

A-7-1 Relationship between Unit Versions of Units

The relationship between the unit versions of each Unit and the Communication Control Unit, and Sysmac Studio version are shown below.

Interpreting the Version Combination Tables

The items that are used in the version combination tables are given below.

NX Unit		Corresponding unit versions/versions	
Model	Unit version	Communication Control Unit	Sysmac Studio
Model numbers of NX Units.	Unit versions of NX Units.	Unit versions of the Communication Control Unit that are compatible with the NX Units.	Sysmac Studio versions that are compatible with the NX Units and Communication Control Unit.

Version Combination Tables

- With the combinations of the unit versions/versions shown below, you can use the functions that are supported by the unit version of the Unit model. Use the unit versions/versions (or the later/higher unit versions/versions) that correspond to the NX Unit models and the unit versions. You cannot use the specifications that were added or changed for the relevant NX Unit models and the unit versions unless you use the corresponding unit versions/versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- You cannot connect the relevant NX Unit to the Communication Control Unit if "---" is shown in the corresponding unit versions/versions column.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communication Control Unit.

Temperature Input Units

NX Unit		Corresponding unit versions/versions	
Model	Unit version	Communication Control Unit	Sysmac Studio
NX-TS2101	Ver.1.0	Ver.1.00	Ver.1.24
	Ver.1.1		
NX-TS2102	Ver.1.1		
NX-TS2104	Ver.1.1		
NX-TS2201	Ver.1.0		
	Ver.1.1		
NX-TS2202	Ver.1.1		
NX-TS2204	Ver.1.1		
NX-TS3101	Ver.1.0	Ver.1.00	Ver.1.24
	Ver.1.1		
NX-TS3102	Ver.1.1		
NX-TS3104	Ver.1.1		
NX-TS3201	Ver.1.0		
	Ver.1.1		
NX-TS3202	Ver.1.1		
NX-TS3204	Ver.1.1		

Heater Burnout Detection Units

NX Unit		Corresponding unit versions/versions	
Model	Unit version	Communication Control Unit	Sysmac Studio
NX-HB3101	Ver.1.0	---	---
NX-HB3201			

A-7-2 Functions That Were Added or Changed for Each Unit Version

The following table shows the relationships between the unit versions/versions of the NX Units and Communication Control Units and Sysmac Studio for changes in or additions to the functions.

Interpreting the Version Corresponding Table for Functions

The items that are used in the version corresponding table for functions are given below.

Function	Change or addition	NX Unit		Corresponding unit versions/versions	
		Model	Unit version	Communication Control Unit	Sysmac Studio
This is the function of the NX Unit.	Indicates whether the function was newly added or changed.	This is the model number of the NX Unit.	This is the unit version of the NX Unit that is compatible with the function.	This is the unit version of Communication Control Units that are compatible with the NX Units with the function.	Sysmac Studio versions that are compatible with the NX Units and Communication Control Unit.

Version Corresponding Table for Functions

The version corresponding table for functions is as follows.

- You can also use the added or changed functions with the unit versions/versions given in the table or with later/higher versions.
- Depending on the type and model of the Unit to which the NX Unit is connected, some Units do not have the corresponding versions given in the 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.
- If you use the corresponding unit versions/versions given in the following table or later/higher versions, refer to the version information in the user's manual for the Communication Control Unit.

Function	Change or addition	NX Unit		Corresponding unit versions/versions	
		Model	Unit version	Communication Control Unit	Sysmac Studio
Restarting a specified NX Unit *1	Addition	NX-TS□□□□	Ver.1.1	Ver.1.00	Ver.1.24
Monitoring total power-ON time *2	Addition				

*1. Refer to the user's manual for the connected Communication Control Unit for information on specifying an NX Unit for the restart instruction.

*2. Refer to the user's manual for the connected Communication Control Unit for information on monitoring the total power-ON time.

A-8 Displaying the Edit Unit Operation Settings Tab Page

A-8-1 Connection to the CPU Unit or the Communication Control Unit

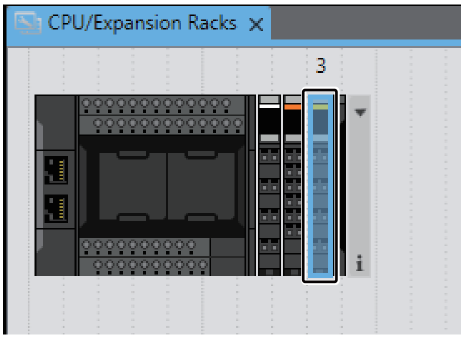
This section describes how to display the Edit Unit Operation Settings Tab Page that is used to create Unit operation settings on the Sysmac Studio for the NX Units connected to the CPU Unit or Communication Control Unit.

You can use the methods described below to display the Edit Unit Operation Settings Tab Page on the CPU and Expansion Racks Tab Page for the CPU Unit or Communication Control Unit on the Sysmac Studio.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the method of displaying the CPU and Expansion Racks Tab Page.

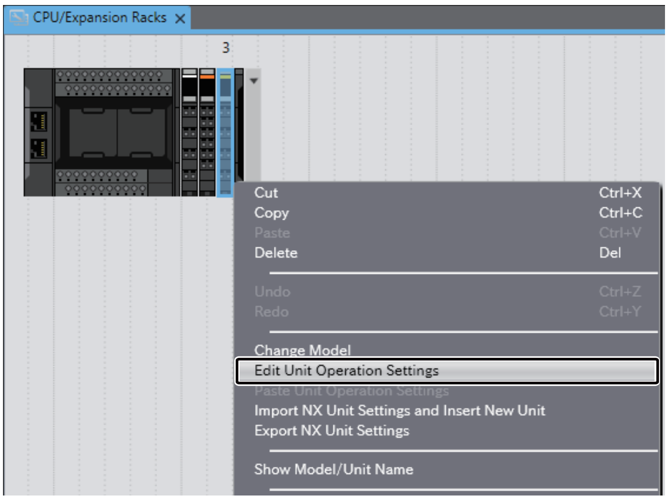
● Method 1

Double-click the NX Unit to set.



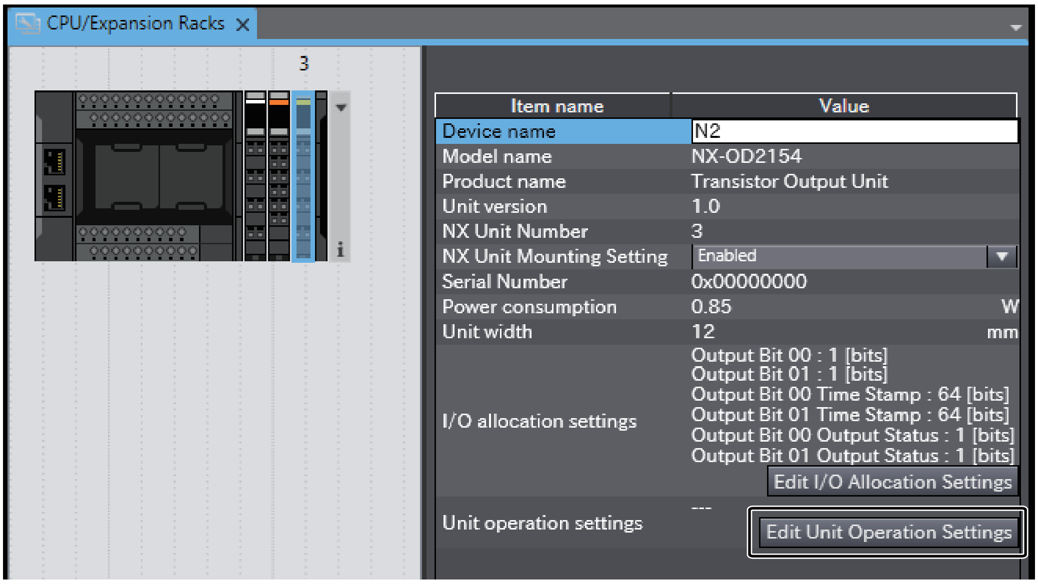
● Method 2

Right-click the NX Unit and select **Edit Unit Operation Settings** from the menu.



● Method 3

Select the NX Unit and click the **Edit Unit Operation Settings** Button.



A-8-2 Slave Terminal

This section describes how to display the Edit Unit Operation Settings Tab Page that is used to create Unit operation settings on the Sysmac Studio for NX Units in the Slave Terminal.

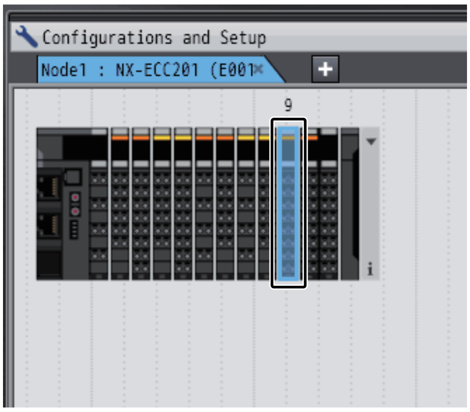
You can use the methods described below to display the Edit Unit Operation Settings Tab Page on the Edit Slave Terminal Configuration Tab Page on the Sysmac Studio.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for the method of displaying the Edit Slave Terminal Configuration Tab Page.

Refer to the operation manual for your Support Software for the method to display the Edit Slave Terminal Configuration Tab Page or Edit Unit Operation Settings Tab Page with Support Software other than the Sysmac Studio.

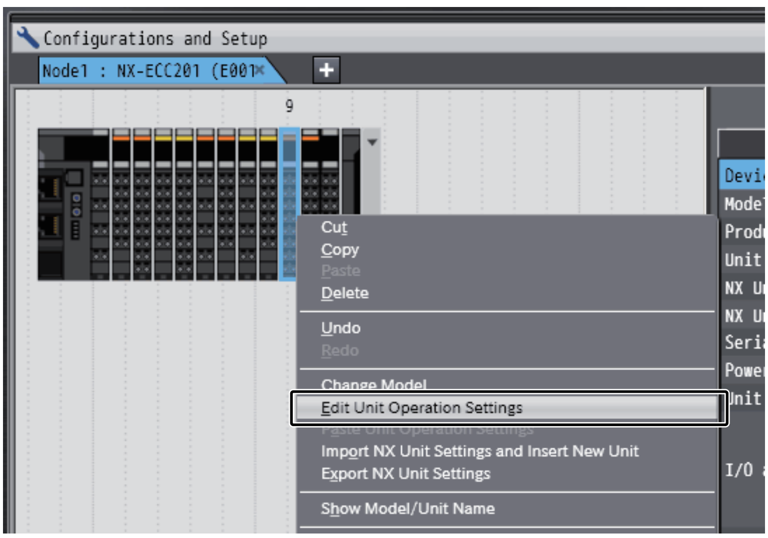
● Method 1

Double-click the NX Unit to set.



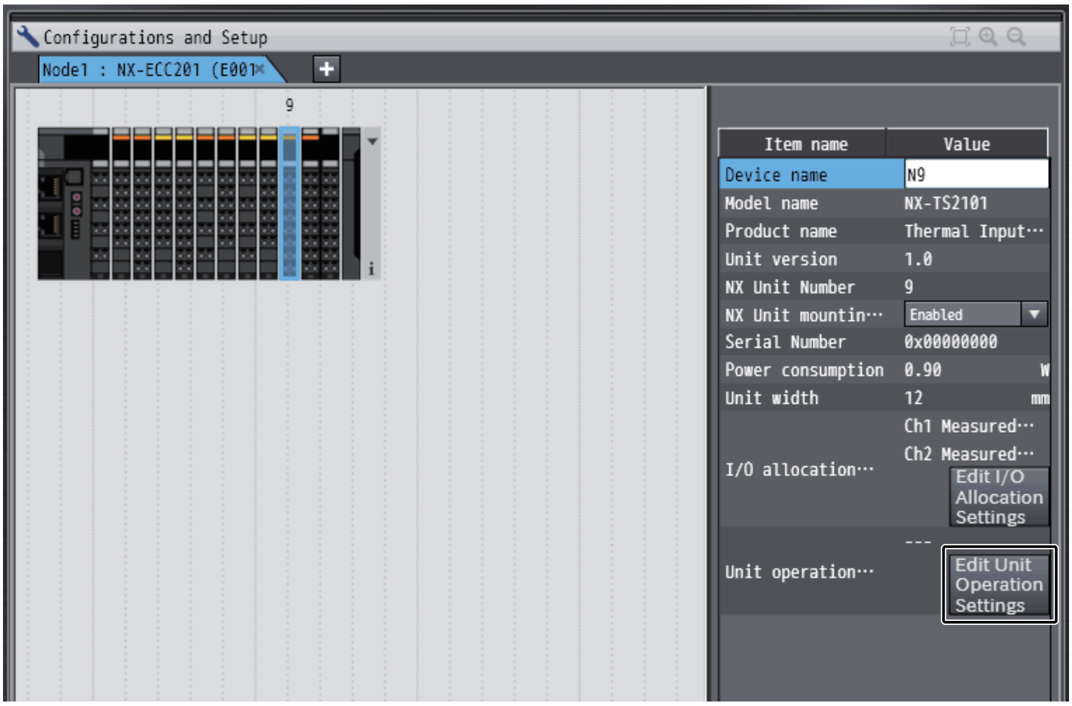
● Method 2

Right-click the NX Unit and select ***Edit Unit Operation Settings*** from the menu.



● Method 3

Select the NX Unit and click the **Edit Unit Operation Settings** Button.



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