# NX-series Analog I/O Unit

#### CSM\_NX-TS\_HB\_DS\_E\_2\_<sup>\*</sup>

# NX Units to meet every temperature control need

- Temperature Input Unit (NX-TS) Standard and high-speed, high-precision temperature measurement and control
- Heater Burnout Detection Unit (NX-HB) Temperature control with heater burnout detection in conjunction with a temperature input unit and PID instructions





NX-TS2101

NX-TS3101 NX-TS2201

NX-TS3201



#### **General Specifications**

	Item	Specification			
Enclosure		Mounted in a panel			
Grounding m	ethod	Ground to 100 $\Omega$ or less			
	Ambient operating temperature	0 to 55°C			
	Ambient operating humidity	10% to 95% (with no condensation or icing)			
	Atmosphere	Must be free from corrosive gases.			
	Ambient storage temperature	-25 to 70°C (with no condensation or icing)			
	Altitude	2,000 m max.			
	Pollution degree	2 or less: Conforms to JIS B3502 and IEC 61131-2.			
Operating environment	Noise immunity	2 kV on power supply line (Conforms to IEC61000-4-4.)			
environment	Overvoltage category	Category II: Conforms to JIS B3502 and IEC 61131-2.			
	EMC immunity level	Zone B			
	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s <sup>2</sup> , 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 <sup>2</sup> , 3 times each in X, Y, and Z directions			
Applicable standards *		cULus: Listed (UL508), ANSI/ISA 12.12.01, EU: EN 61131-2, C-Tick or RCM, KC Registration, NK, LR			

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

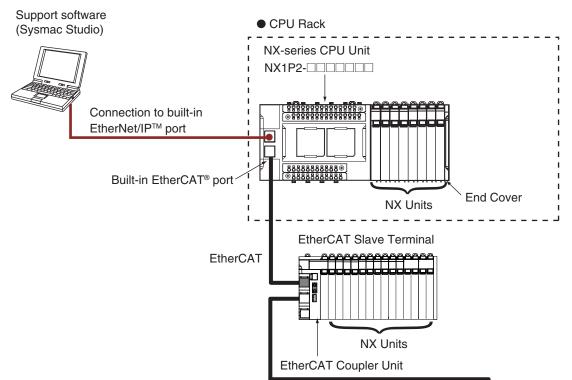
Sysmac is a trademark or registered trademark of OMRON Corporation in Japan and other countries for OMRON factory automation products. EtherCAT<sup>®</sup> is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany. EtherNet/IP<sup>™</sup> is a trademark of ODVA.

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#### **System Configurations**

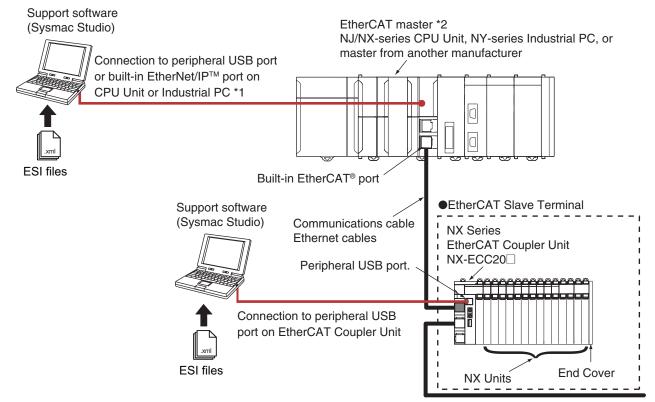
#### Connected to a CPU Unit

The following figure shows a system configuration when NX Units are connected to an NX-series CPU Unit.



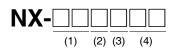
#### Connected to an EtherCAT Coupler Unit

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



- \*1. The connection method for the Sysmac Studio depends on the model of the CPU Unit or Industrial PC.
- \*2. 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.
- Note: To check whether NX Units can be connected to your CPU Unit or Communications Coupler Unit, refer to the user's manual for the CPU Unit or Communications Coupler Unit.

#### **Model Number Structure**



#### (1) Unit type

<u>. ,</u>	
No.	Specification
TS	Temperature input
HB	Heater burnout detection

#### (2) Number of points

No.	Specification			
2	2 points			
3	4 points			
4	8 points			

#### (3) I/O type

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

#### (4) Other specifications

• Temperature Input Units

			I/O refreshing method				
No.	Conversion time	Resolution	Free-Run refreshing only *1	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.

#### • Heater Burnout Detection Units

No.	
01	

### **Ordering Information**

#### **International Standards**

- The standards are abbreviated as follows: U: UL, U1: UL (Class I Division 2 Products for Hazardous Locations), C: CSA, UC: cULus, UC1: cULus (Class I Division 2 Products for Hazardous Locations), CU: cUL, N: NK, L: Lloyd, CE: EU Directives, RCM: Regulatory Compliance Mark, and KC: KC Registration.
- Contact your OMRON representative for further details and applicable conditions for these standards.

#### **Temperature Input Units**

					Specification					Standards
Unit type	Product name	Number of points	Input type	Resolution (25°C)	Over all accuracy (25°C)	Conversion time	I/O refreshing method	Terminals	Model	
		2 points		0.100		050		16 Terminals	NX-TS2101	-
	Thermocouple Input type	4 points		0.1°C max. *1		250 ms/ Unit		16 Terminals x 2	NX-TS3101	
		2 points		0.01°C				16 Terminals	NX-TS2102	
		4 points	Thermocouple	max.	Refer to the Reference accuracy and temperature coefficient according to the input type and measurement temperature of NX- series Temperature Input Unit in the Sysmac Integrated Catalog (Cat. No. P072).	10 ms/Unit	/Unit Free-Run refreshing s/	16 Terminals x 2	NX-TS3102	UC1, N, L, CE, RCM, KC
		2 points		0.001°C max.		60 ms/Unit		16 Terminals	NX-TS2104	
NX-series		4 points						16 Terminals x 2	NX-TS3104	
Temperature Input Unit	Resistance Thermometer Input type	2 points		0.1°C max.		250 ms/ Unit		16 Terminals	NX-TS2201	
		4 points						16 Terminals x 2	NX-TS3201	
		2 points	Resistance Thermometer	0.01°C		10 ms/Unit		16 Terminals	NX-TS2202	
		4 points	(Pt100/Pt1000, three-wire) *2	max.				16 Terminals x 2	NX-TS3202	
		2 points		0.001°C				16 Terminals	NX-TS2204	
		4 points		max.		60 ms/Unit		16 Terminals x 2	NX-TS3204	

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

\*2. The NX-TS2202 and NX-TS3202 only support Pt100 three-wire sensor.

#### **Heater Burnout Detection Units**

					Specification	l				
	Product	CT input section		Control output section						
Unit type	name	Number of inputs	Maximum heater current	Number of outputs	Internal I/O common	Maximum Ioad current	Rated voltage	I/O refreshing method	Model	Standards
NX-Series	Heater Burnout Detection Unit				NPN		12 to 24 VDC	Free-Run refreshing	NX-HB3101	
Heater Burnout Detection Unit		4	50 A AC	4	PNP	0.1 A/point, 0.4 A/Unit	24 VDC		NX-HB3201	UC1, CE, N, RCM, KC

#### NX-TS/HB

#### **Optional Products**

Product name	Specification	Model	Standards
Unit/Terminal Block Coding Pins	Pins for 10 Units (30 terminal block pins and 30 Unit pins)	NX-AUX02	

		Specif				
Product name	No. of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity	Model	Standards
Terminal Block	16	A/B	Not provided	10 A	NX-TBA162	

Product name	Specification	Model	Standards
Current Transformer (CT)*	Hole diameter: 5.8 mm	E54-CT1	
	Hole diameter: 12.0 mm	E54-CT3	

\* Can be connected to the NX-HB Heater Burnout Detection Unit.

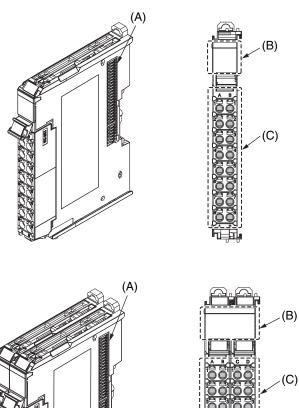
#### Accessories

Not included.

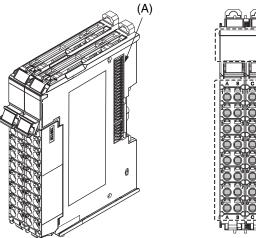
#### **External Interface**

## Screwless Clamping Terminal Block Type Temperature Input Unit (Resistance Thermometer Input type)/Heater Burnout Detection Unit

12mm Width

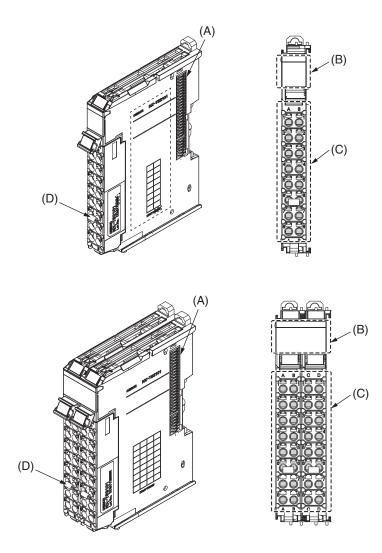


24mm Width



Letter	Item	Specification	
(A)	NX bus connector	This connector is used to connect to another Unit.	
(B)	Indicators	The indicators show the current operating status of the Unit.	
(C)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.	

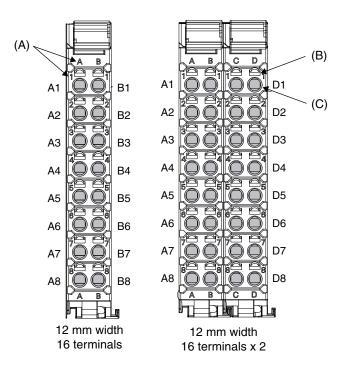
## Temperature Input Unit (Thermocouple Input type) 12mm Width



24mm Width

Let	tter	Item	Specification
(/	A)	NX bus connector	This connector is used to connect to another Unit.
(E	B)	Indicators	The indicators show the current operating status of the Unit.
(0	C)	Terminal block	The terminal block is used to connect to external devices. The number of terminals depends on the Unit.
([	D)	Cold junction sensor	This sensor is used to compensate the cold junction. The sensors are mounted on both left and right terminal blocks for models with 24 mm width.

#### **Terminal Blocks**



Letter	Item	Specification
(A)	Terminal number indications	The terminal number is identified by a column (A through D) and a row (1 through 8). Therefore, terminal numbers are written as a combination of columns and rows, A1 through A8 and B1 through B8. For a 24-mm-wide terminal block (16 terminals x 2), the left side contains terminals A1 through A8 and B1 through B8. The right side contains terminals C1 through C8 and D1 through D8. The terminal number indication is the same regardless of the number of terminals on the terminal block.
(B)	Release holes	A flat-blade screwdriver is inserted here to attach and remove the wiring.
(C)	Terminal holes	The wires are inserted into these holes.

#### Applicable Terminal Blocks for Each Unit Model

	Terminal Blocks						
Unit model	Model	No. of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity		
NX-TS2	NX-TBA162	16	A/B	None	10 A		
	NX-TBA162	- 16	A/B	None	10 A		
	NX-TBB162		C/D				
NX-HB3□01	NX-TBA162	16	A/B	Not provided	10A		

#### **Applicable Wires**

#### **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.

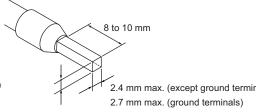
The applicable ferrules, wires, and crimping tool are given in the following table.

Terminal type	Manufacturer	Ferrule model	Applicable wire (mm <sup>2</sup> (AWG))	Crimping tool
Terminals other	Phoenix Contact	AI0,34-8	0.34 (#22)	Phoenix Contact (The figure in parentheses is the applicable wire size.)
than ground terminals		AI0,5-8	0.5 (#20)	CRIMPFOX 6 (0.25 to 6 mm <sup>2</sup> , AWG24 to 10)
lemmais		Al0,5-10	1	
		AI0,75-8	0.75 (#18)	
		AI0,75-10	1	
		AI1,0-8	1.0 (#18)	
		AI1,0-10		
		AI1,5-8	1.5 (#16)	
		AI1,5-10		
Ground terminals		Al2,5-10	2.0 *	
Terminals other	Weidmuller	H0.14/12	0.14 (#26)	Weidmuller (The figure in parentheses is the applicable wire size.)
than ground terminals		H0.25/12	0.25 (#24)	PZ6 Roto (0.14 to 6 mm <sup>2</sup> , AWG 26 to 10)
lemmais		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		

\* Some AWG 14 wires exceed 2.0 mm<sup>2</sup> 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.

Finished Dimensions of Ferrules



1.6 mm max. (except ground terminals) 2.0 mm max. (ground terminals)

2.4 mm max. (except ground terminals)

#### **Using Twisted Wires/Solid Wires**

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

Terminals		Wire type				Wire size	Conductor length (stripping length)
		Twisted wires		Solid wire			
Classification	Current capacity	Plated	Unplated	Plated	Unplated		(suppling length)
	2 A or less	Possible	Possible	Possible	Possible	0.08 to 1.5 mm <sup>2</sup> AWG28 to 16	8 to 10 mm
All terminals except ground terminals	Greater than 2 A and 4 A or less		Not	Possible *1	Not		
ground terminals	Greater than 4 A	Possible *1	Possible	Not Possible	Possible		
Ground terminals		Possible	Possible	Possible *2	Possible *2	2.0 mm <sup>2</sup>	9 to 10 mm

\*1. Secure wires to the screwless clamping terminal block. Refer to the Securing Wires in the USER'S MANUAL 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)

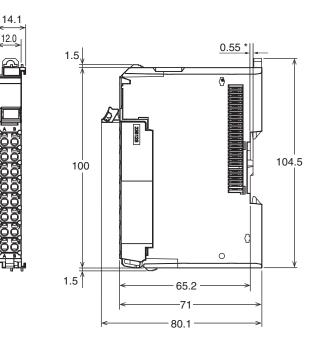
<Additional Information> If more than 2 A will flow on the wires, use plated wires or use ferrules.

#### (Unit/mm)

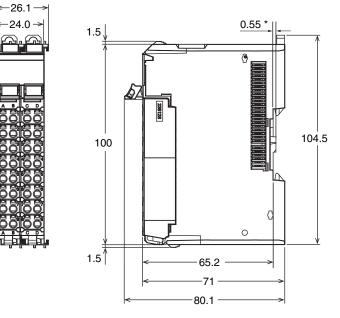
#### Dimensions

#### Screwless Clamping Terminal Block Type

12 mm Width



#### 24 mm Width



\* The dimension is 1.35 mm for Units with lot numbers through December 2014.

#### **Related Manual**

Cat. No.	Model number	Manual name	Application	Description
W566		NX-series Analog I/O Units User's Manual for 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 Temperature Input Unit NX-TS

### Standard and high-speed, highprecision temperature measurement and control

- Temperature Input Units for the NX-series modular I/O system
- Connect to other NX I/O Units and EtherCAT Coupler Units using the high-speed NX-bus
- Thermocouple and platinum resistance thermometer input models are available



#### Features

- Up to four temperature sensor inputs per unit
- Three sampling speeds, 250 ms, 60 ms, and 10 ms, are available to cover a wide range from general-purpose application to high-speed, high-precision control
- · Moving average, input sensor disconnection detection, cold junction compensation enable/disable setting, and input correction
- Detachable front connector with screwless Push-In Plus terminals for easy installation and maintenance
- Connect to the CJ PLC using the EtherNet/IP<sup>™</sup> bus coupler

#### **Temperature Input Unit Specifications**

#### Temperature Input Unit (Thermocouple Input type) 2 points NX-TS2101

Unit name	Temperature Input Unit (thermocouple input type)	Model	NX-TS2101		
Number of points	mber of points 2 points		Screwless clamping terminal block (16 terminals)		
I/O refreshing method	Free-Run refreshing				
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, B, WRe5-26, PLII		
	TS2101	Input conversion range	±20°C of the input range		
	■TS	Absolute maximum rating	±130 mV		
		Input impedance	20 kΩ min.		
Indicators		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 $M\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.25 W max.</li> <li>Connected to a Communications Coupler Unit 0.90 W max.</li> </ul>	Current consumption from I/O power supply	No consumption		
Weight	70 g max.				
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in upright installation. • Connected to a CPU 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 <i>Cold Junction Compensation Error Specifications for Units That Take a</i> <i>Thermocouple Input Type</i> .				
Terminal connection diagram	Temperature Input Unit NX-TS2101         A1       B1         NC       NC         NC       NC         NC       NC         NC       NC         NC       NC         TC2+       TC2-         TC1+       TC1-         NC       NC         NC       NC         NC       NC         TC1+       TC1-         NC       NC         A8       B8	e. nocouple input			

\*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.

\*3. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair.
 \*4. Befor to Compare the Compared to the terminal block (including a cold junction sensor mounted) and the Unit together for repair.

\*4. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type 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)		
/O refreshing method	Free-Run refreshing				
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, WRe5-26, PLII		
	TS2102	Input conversion range	±20°C of the input range		
	TS	Absolute maximum rating	±130 mV		
		Input impedance	20 kΩ min.		
ndicators		Resolution	0.01°C max.		
laidatoro		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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.15 W max.</li> <li>Connected to a Communications Coupler Unit 0.80 W max.</li> </ul>	Current consumption from I/O power supply	No consumption		
Weight	70 g max.				
Installation orientation and restrictions	Installation orientation: • Connected to a CPU 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 <i>Cold Junction Compensation Error Specifications for Units That Take a</i> <i>Thermocouple Input Type</i> .				
Terminal connection diagram	Temperature Input Unit NX-TS2102 A1 NC NC NC NC NC NC NC NC Cold junction sensor TC2+ TC2- CJ1+ CJ1- TC1+ TC1+ TC1- NC NC * Do not touch or remove. CJ1+ CJ1- TC1+ TC1- NC NC TC2+ TC2+ TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2+ TC2- TC2- TC2+ TC2- TC2- TC2- TC2- TC2- TC2- TC2- TC2-				

#### Temperature Input Unit (Thermocouple Input type) 2 points NX-TS2102

1. Refer to Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature.

\*2. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair.
\*3. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type 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			
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, WRe5-26, PLII	
	TS2104	Input conversion range	±20°C of the input range	
	■TS	Absolute maximum rating	±130 mV	
		Input impedance	20 kΩ min.	
ndicators		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: Powe = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator	
Insulation resistance	$\begin{array}{c} 20 \mbox{ M}\Omega \mbox{ min. between isolated circuits (at 100 VDC)} \end{array}$	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	<ul> <li>Connected to a CPU Unit 0.95 W max.</li> <li>Connected to a Communications Coupler Unit 0.80 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	70 g max.			
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Coupl Restrictions: The cold junction compensation error is re- consumption of adjacent Units. Refer to Co Thermocouple Input Type.	er Unit: Possible in 6 orienta	allation orientation and the power	
Terminal connection diagram	Temperature Input Unit NX-TS2104 A NC NC NC NC NC NC NC NC NC NC NC NC Cold junction sensor TC2+ TC2- CJ1+ CJ1- TC1+ TC1+ TC1- TC1+ TC1- TC1+ TC1+ TC1- TC1+ TC1+ TC1+ TC1- TC1+ TC1+ TC1+ TC1+ TC1+ TC1+ TC1+ TC1+			

#### Temperature Input Unit (Thermocouple Input type) 2 points NX-TS2104

\*2. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair.
\*3. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type for the specifications for each set

of operating conditions.

#### Temperature Input Unit (Resistance Thermometer Input type) 2 points NX-TS2201

Unit name	Temperature Input Unit (resistance	Model	NX-TS2201
Unit hame	thermometer input type)		
Number of points	2 points	External connection terminals	Screwless clamping terminal block (16 terminals)
I/O refreshing method	Free-Run refreshing		
	TS indicator	Temperature sensor	Pt100 (three-wire)/Pt1000 (three-wire)
	TS2201	Input conversion range	±20°C of the input range
	■TS	Input detection current	Approx. 0.25 mA
Indicator		Resolution	0.1°C max.
		Reference accuracy	*
		Temperature coefficient	*
		Effect of conductor resistance	$0.06^{\circ}$ C/ $\Omega$ max. (also 20 $\Omega$ 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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.25 W max.</li> <li>Connected to a Communications Coupler Unit 0.90 W max.</li> </ul>	Current consumption from I/O power supply	No consumption
Weight	70 g max.		•
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Couple Restrictions: No restrictions		ions.
Terminal connection diagram	Temperature Input Unit NX-TS2201       A1     B1       NC     NC       NC     B2       A1     B1       NC     B1       NC     B1       B     B	Resistance thermomet	er input

#### Temperature Input Unit (Resistance Thermometer Input type) 2 points NX-TS2202

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					
	TS indicator	Temperature sensor	Pt100 (three-wire)			
	TS2202	Input conversion range	±20°C of the input range			
	■TS	Input detection current	Approx. 0.25 mA			
Indicator		Resolution	0.01°C max.			
		Reference accuracy	*			
	_	Temperature coefficient	*			
		Effect of conductor resistance	$0.06^{\circ}$ C/ $\Omega$ max. (also 20 $\Omega$ 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 $M\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.15 W max.</li> <li>Connected to a Communications Coupler Unit 0.75 W max.</li> </ul>	Current consumption from I/O power supply	No consumption			
Weight	70 g max.					
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Couple Restrictions: No restrictions		tions.			
Terminal connection diagram	Temperature Input Unit NX-TS2202     B1       A1     B1       NC     NC       NC     B2       A1     B1       NC     B1       NC     B1       B     B	Resistance thermomete	er input			

#### Temperature Input Unit (Resistance Thermometer Input type) 2 points NX-TS2204

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			
	TS indicator	Temperature sensor	Pt100 (three-wire)/Pt1000 (three-wire)	
	TS2204	Input conversion range	±20°C of the input range	
	■TS	Input detection current	Approx. 0.25 mA	
Indicator		Resolution	0.001°C max.	
		Reference accuracy	*	
	_	Temperature coefficient	*	
		Effect of conductor resistance	$0.06^{\circ}$ 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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 0.90 W max.</li> <li>Connected to a Communications Coupler Unit 0.75 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	70 g max.			
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Couple Restrictions: No restrictions		tions.	
Terminal connection diagram	Temperature Input Unit NX-TS2204       A1       NC       B2       A1       B1       B       A1       B1       B       B       B       B       B       B   Resistance thermometer input			

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 x 2)
I/O refreshing method	Free-Run refreshing		. ,
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, B, WRe5-26, PLI
	TS3101	Input conversion range	±20°C of the input range
	■TS	Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
Indicators		Resolution	0.1°C max. *1
Indicators		Reference accuracy	*2
		Temperature coefficient	*2
		Cold junction compensation error	±1.2°C *3 *4
		Input disconnection detection current	Арргох. 0.1µА
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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.75 W max.</li> <li>Connected to a Communications Coupler Unit 1.30 W max.</li> </ul>	Current consumption from I/O power supply	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Couple Restrictions: The cold junction compensation error is re- consumption of adjacent Units. Refer to Con- Thermocouple Input Type.	er Unit: Possible in 6 orientat	allation orientation and the power
Terminal connection diagram		ction sensor not touch or remove. Thermocouple input	

#### Temperature Input Unit (Thermocouple Input type) 4 points NX-TS3101

\*2. Refer to Reference Accuracy and Temperature Coefficient According to the Input Type and Measurement Temperature.

\*3. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair.
\*4. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type 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 x 2)
/O refreshing method	Free-Run refreshing		
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, WRe5-26, PLII
	TS3102	Input conversion range	±20°C of the input range
	∎TS	Absolute maximum rating	±130 mV
		Input impedance	20 kΩ min.
ndicators		Resolution	0.01°C max.
laidatoro		Reference accuracy	*1
		Temperature coefficient	*1
		Cold junction compensation error	±1.2°C *2 *3
		Input disconnection detection current	Арргох. 0.1 µА
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: Powe = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator
Insulation resistance	$20\ \text{M}\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.55 W max.</li> <li>Connected to a Communications Coupler Unit 1.10 W max.</li> </ul>	Current consumption from I/O power supply	No consumption
Weight	140 g max.		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Coupl Restrictions: The cold junction compensation error is re consumption of adjacent Units. Refer to Co Thermocouple Input Type.	er Unit: Possible in 6 orientat	allation orientation and the power
Terminal connection diagram		ction sensor not touch or remove. Thermocouple input	

#### Temperature Input Unit (Thermocouple Input type) 4 points NX-TS3102

\*2. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair. \*3. Refer to *Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type* 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 x 2)	
/O refreshing method	Free-Run refreshing			
	TS indicator	Temperature sensor	K, J, T, E, L, U, N, R, S, WRe5-26, PLII	
	TS3104	Input conversion range	±20°C of the input range	
	∎TS	Absolute maximum rating	±130 mV	
		Input impedance	20 kΩ min.	
ndicators		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: Powe = Transformer, Signal = Digital isolator Between inputs: Power = Transformer, Signal = Digital isolator	
nsulation resistance	20 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.45 W max.</li> <li>Connected to a Communications Coupler Unit 1.10 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	140 g max.	-		
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Couple Restrictions: The cold junction compensation error is re- consumption of adjacent Units. Refer to Co Thermocouple Input Type.	er Unit: Possible in 6 orienta	allation orientation and the power	
Terminal connection diagram	$\begin{array}{ c c c c c c }\hline Temperature Input Unit \\ NX-TS3104 \\ \hline \\ A1 & B1 & C1 & \\ \hline \\ NC & NC & NC & NC \\ \hline \\ \hline \\ NC & NC & NC & NC \\ \hline \\ NC & NC & NC & NC \\ \hline \\ NC & NC & NC & NC \\ \hline \\ CJ1 + & CJ1 - & CJ2 + & CJ2 - \\ \hline \\ CJ1 + & CJ1 - & CJ2 + & CJ2 - \\ \hline \\ \hline \\ TC1 + & TC1 - & TC3 + & TC3 - \\ \hline \\ \hline \\ Rc & NC & NC & NC \\ \hline \\ \hline \\ Rc & NC & NC & NC \\ \hline \\ B8 & C8 & D8 \\ \hline \\ $			

#### Temperature Input Unit (Thermocouple Input type) 4 points NX-TS3104

\*2. 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 the Temperature Input Unit together. A calibration control number is both displayed on the terminal block and the Unit. Make sure to return the terminal block (including a cold junction sensor mounted) and the Unit together for repair.
\*3. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type for the specifications for each set

\*3. Refer to Cold Junction Compensation Error Specifications for Units That Take a Thermocouple Input Type for the specifications for each set of operating conditions.

#### Temperature Input Unit (Resistance Thermometer Input type) 4 points NX-TS3201

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 x 2)	
I/O refreshing method	Free-Run refreshing			
	TS indicator	Temperature sensor	Pt100 (three-wire)/Pt1000 (three-wire)	
	TS3201	Input conversion range	±20°C of the input range	
	■TS	Input detection current	Approx. 0.25 mA	
Indicator		Resolution	0.1°C max.	
indicator		Reference accuracy	*	
		Temperature coefficient	*	
		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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.75 W max.</li> <li>Connected to a Communications Coupler Unit 1.30 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	140 g max.			
Installation orientation 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	Temperature Input Unit NX-TS3201       A1     B1 C1     D1       NC     NC     NC       NC     B2     NC       B1     A3     B3       B     B       A8     B8 C8		rermometer input	

#### Temperature Input Unit (Resistance Thermometer Input type) 4 points NX-TS3202

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 x 2)	
I/O refreshing method	Free-Run refreshing			
	TS indicator	Temperature sensor	Pt100 (three-wire)	
	TS3202	Input conversion range	±20°C of the input range	
	■TS	Input detection current	Approx. 0.25 mA	
Indicator		Resolution	0.01°C max.	
		Reference accuracy	*	
		Temperature coefficient	*	
		Effect of conductor resistance	$0.06^{\circ}$ C/ $\Omega$ max. (also 20 $\Omega$ 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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.50 W max.</li> <li>Connected to a Communications Coupler Unit 1.05 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	130 g max.			
Installation orientation and restrictions	Installation orientation: • Connected to a CPU Unit: Possible in u • Connected to a Communications Coupl Restrictions: No restrictions		tions.	
Terminal connection diagram	Temperature Input Unit NX-TS3202       A1     B1 C1     D1       NC     NC     NC       A2     B2     NC       B1     A3     B3       B3     B       A8     B8 C8     D8		ermometer input	

#### Temperature Input Unit (Resistance Thermometer Input type) 4 points NX-TS3204

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 x 2)	
I/O refreshing method	Free-Run refreshing			
	TS indicator	Temperature sensor	Pt100 (three-wire)/Pt1000 (three-wire)	
	TS3204	Input conversion range	±20°C of the input range	
	■TS	Input detection current	Approx. 0.25 mA	
Indicator		Resolution	0.001°C max.	
		Reference accuracy	*	
		Temperature coefficient	*	
		Effect of conductor resistance	$0.06^{\circ}$ C/ $\Omega$ max. (also 20 $\Omega$ 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 M $\Omega$ 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	<ul> <li>Connected to a CPU Unit 1.45 W max.</li> <li>Connected to a Communications Coupler Unit 1.05 W max.</li> </ul>	Current consumption from I/O power supply	No consumption	
Weight	130 g max.	130 g max.		
Installation orientation 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	Temperature Input Unit NX-TS3204       A1     B1 C1     D1       NC     NC     NC       NC     B2     NC       B1     A3     B3       B     B       A8     B8 C8		ermometer input	

## • Reference accuracy and temperature coefficient according to the input type and measurement temperature \*1

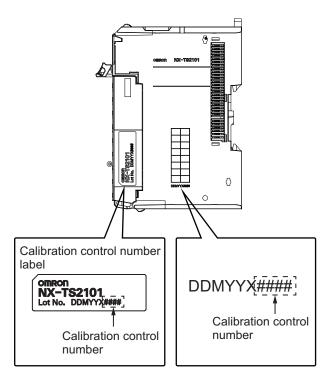
#### For NX-TS 02/TS 04

Conversion	li	nput type	Magaurament	Deferrer en en en en en e	Temperature coefficient °C/°C *4 (ppm/°C *5)
time	Input type *2	Temperature range (°C)	Measurement temperature (°C)	Reference accuracy °C (%) *3	
	К	-200 to 1300	Same as the left	±0.75 (±0.05%)	±0.08 (±50 ppm/°C)
	к	-20 to 600 (High Resolution)	Same as the left	±0.30 (±0.05%)	±0.03 (±48 ppm/°C)
		000 to 1000	-200 to 0		±0.13 (±96 ppm/°C)
	J	-200 to 1200	0 to 1200	- ±0.70 (±0.05%)	±0.06 (±42 ppm/°C)
	J	-20 to 600 (High Resolution)	Same as the left	±0.30 (±0.05%)	±0.04 (±72 ppm/°C)
			-200 to -180	±1.30 (±0.22%)	
	Т	-200 to 400	-180 to 0	±0.70 (±0.12%)	±0.05 (±75 ppm/°C)
			0 to 400	±0.33 (±0.055%)	
	E	200 to 1000	-200 to 0		±0.12 (±100 ppm/°C)
	E	-200 to 1000	0 to 1000	±0.60 (±0.05%)	±0.06 (±50 ppm/°C)
	L	-200 to 900	Same as the left	±0.50 (±0.05%)	±0.04 (±40 ppm/°C)
		-200 to 600	-200 to -100	±0.70 (±0.09%)	
	U		-100 to 0	±0.50 (±0.07%)	±0.06 (±75 ppm/°C)
			0 to 600	±0.40 (±0.05%)	
0/60ms		N -200 to 1300	-200 to -150	±1.60 (±0.11%)	· 0 11 (· 70 mm/20)
	Ν		-150 to -100	±0.75 (±0.05%)	±0.11 (±70 ppm/°C)
			-100 to 1300		±0.08 (±50 ppm/°C)
			-50 to 0	±3.20 (±0.19%)	±0.13 (±77 ppm/°C)
	R	-50 to 1700	0 to 100	±2.50 (±0.15%)	·0.11(·60.555/20)
			100 to 1700	±1.75 (±0.10%)	±0.11 (±60 ppm/°C)
	-50 to 0	-50 to 0	±3.20 (±0.19%)	±0.13 (±77 ppm/°C)	
	S	-50 to 1700	0 to 100	±2.50 (±0.15%)	(0.11 () 60 ppm/°C)
			100 to 1700	±1.75 (±0.10%)	±0.11 (±60 ppm/°C)
			0 to 1500		±0.13 (±58 ppm/°C)
	WRe5-26	0 to 2300	1500 to 2200	- ±1.15 (±0.05%)	(0.21 () 01 ppm/°C)
			2200 to 2300	±1.40 (±0.07%)	±0.21 (±91 ppm/°C)
	PL II	0 to 1300	Same as the left	±0.65 (±0.05%)	±0.07 (±57 ppm/°C)
			-200 to -50	±0.50 (±0.05%)	±0.08 (±78 ppm/°C)
	Pt100	-200 to 850	-50 to 150	±0.21 (±0.02%)	±0.03 (±29 ppm/°C)
			150 to 850	±0.50 (±0.05%)	±0.08 (±78 ppm/°C)
	Pt1000	-200 to 850	Same as the left	±0.50 (±0.05%)	±0.09 (±85 ppm/°C)

#### For NX-TSDD1

Conversion	l	nput type	Measurement	Reference accuracy °C	Temperature coefficient °C/°C *4
time	Input type	Temperature range (°C)	temperature (°C)	(%) *3	(ppm/°C *5)
			-200 to -100		±0.15 (±100 ppm/°C)
	К	-200 to 1300	-100 to 400	±1.5 (±0.1%)	±0.30 (±200 ppm/°C)
			400 to 1300		±0.38 (±250 ppm/°C)
			-200 to 400	±1.4 (±0.1%)	±0.14 (±100 ppm/°C)
	J	-200 to 1200	400 to 900	.1.0 (.0.000())	±0.28 (±200 ppm/°C)
			900 to 1200	±1.2 (±0.09%)	±0.35 (±250 ppm/°C)
	-	000 to 100	-200 to -100	.1.0.(.0.0%)	±0.30 (±500 ppm/°C)
	Т	-200 to 400	-100 to 400	- ±1.2 (±0.2%)	±0.12 (±200 ppm/°C)
			-200 to 400	±1.2 (±0.1%)	±0.12 (±100 ppm/°C)
	E	-200 to 1000	400 to 700	.0.0 (.0.170()	±0.24 (±200 ppm/°C)
			700 to 1000	- ±2.0 (±0.17%)	±0.30 (±250 ppm/°C)
			-200 to 300	±1.1 (±0.1%)	±0.11 (±100 ppm/°C)
	L	-200 to 900	300 to 700	0.0 ( 0.00()	±0.22 (±200 ppm/°C)
			700 to 900	- ±2.2 (±0.2%)	±0.28 (±250 ppm/°C)
			-200 to 400	±1.2 (±0.15%)	
U N	U	-200 to 600	400 to 600	±1.0 (±0.13%)	±0.12 (±150 ppm/°C)
			-200 to 400	±1.5 (±0.1%)	
	N	-200 to 1300	400 to 1000		±0.30 (±200 ppm/°C)
			1000 to 1300		±0.38 (±250 ppm/°C)
			-50 to 500	±1.75 (±0.1%)	
50 ms	R	-50 to 1700	500 to 1200	0.5 ( .0.450())	±0.44 (±250 ppm/°C)
50 115			1200 to 1700	- ±2.5 (±0.15%)	
			-50 to 600	±1.75 (±0.1%)	±0.44 (±250 ppm/°C)
	S	-50 to 1700	600 to 1100		
			1100 to 1700	- ±2.5 (±0.15%)	
			0.0 to 400.0	Reference accuracy does not apply	Reference accuracy does not apply
	В	0 to 1800	400 to 1200	±3.6 (±0.2%)	±0.45 (±250 ppm/°C)
			1200 to 1800	±5.0 (±0.28%)	±0.54 (±300 ppm/°C)
			0 to 300	±1.15 (±0.05%)	
		0.45.0000	300 to 800	±2.3 (±0.1%)	±0.46 (±200 ppm/°C)
	WRe5-26	0 to 2300	800 to 1500		
			1500 to 2300	±3.0 (±0.13%)	±0.691 (±300 ppm/°C)
			0 to 400	±1.3 (±0.1%)	±0.23 (±200 ppm/°C)
	PLII	0 to 1300	400 to 800		±0.39 (±300 ppm/°C)
			800 to 1300	- ±2.0 (±0.15%)	±0.65 (±500 ppm/°C)
			-200 to 300	±1.0 (±0.1%)	±0.1 (±100 ppm/°C)
	Pt100	-200 to 850	300 to 700	±2.0 (±0.2%)	±0.2 (±200 ppm/°C)
			700 to 850	±2.5 (±0.25%)	±0.25 (±250 ppm/°C)
			-200 to 300	±1.0 (±0.1%)	±0.1 (±100 ppm/°C)
	Pt1000 -200 to 850	-200 to 850	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)

ditions

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 =  $\pm 1.5^{\circ}C + (\pm 0.30^{\circ}C)^{\circ}C) \times 5 \text{ deg} + \pm 1.2^{\circ}C$ 

= ±4.2°C

\*5. The ppm value is for the full scale of temperature 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<sup>\*</sup>.

(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  $\pm 1.2^{\circ}$ C.

However, there are exceptions depending on the input type and temperature. Those conditions and the cold junction compensation error are as in the table below.

Input type and temperature range	Cold junction compensation error
T below -90°C	
J, E, K and N below -100°C	+3.0°C
U, L and PLII	1 ± 3.0 ℃
R and S below 200°C	
B below 400°C	Not guaranteed
W	±3.0°C

(b) 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  $\pm 4.0^{\circ}$ C.

However, there are exceptions depending on the input type and temperature. Those conditions and the cold junction compensation error are as in the table below.

Input type and temperature range	Cold junction compensation error	
T below -90°C		
J, E, K and N below -100°C	+7.0°C	
U, L and PLII	±7.0°C	
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.

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.

<sup>\*</sup> The power consumption of adjacent Units is the total of the following values.

#### **Version Information**

#### Connected to a CPU Unit

Refer to the user's manual for the CPU Unit for details on the CPU Units to which NX Units can be connected.

NX	Unit	Correspond	ling version *		
Model	Model Unit Version		Sysmac Studio		
NX-TS2101	Ver.1.0				
NA-152101	Ver.1.1				
NX-TS2102	Ver.1.1				
NX-TS2104	Ver.1.1				
NIX TOOOO1	Ver.1.0				
NX-TS2201	Ver.1.1				
NX-TS2202	Ver.1.1				
NX-TS2204	Ver.1.1	Var 1 10 an latar	Var 4 47 an bishar		
	Ver.1.0	Ver.1.13 or later	Ver.1.17 or higher		
NX-TS3101	Ver.1.1				
NX-TS3102	Ver.1.1				
NX-TS3104	Ver.1.1				
NIX TOOODA	Ver.1.0				
NX-TS3201	Ver.1.1				
NX-TS3202	Ver.1.1	1			
NX-TS3204	Ver.1.1	1			

\* Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

#### **Connected to a Communications Coupler Unit**

NX	Unit	Corresponding version *				
		EtherCAT		Ethernet/IP		
Model	Unit Version	Communications Coupler Unit	NJ/NX-series CPU Unit or NY-series Industrial PC	Sysmac Studio	Communications Coupler Unit	Sysmac Studio
NX-TS2101	Ver.1.0			Ver.1.06 or higher		
NA-132101	Ver.1.1			Ver.1.08 or higher		
NX-TS2102	Ver.1.1			Ver.1.08 or higher		
NX-TS2104	Ver.1.1			Ver.1.08 or higher		Ver.1.10 or higher
NX-TS2201	Ver.1.0			Ver.1.06 or higher	- Ver.1.0 or later	
NA-152201	Ver.1.1		-	Ver.1.08 or higher		
NX-TS2202	Ver.1.1			Ver.1.08 or higher		
NX-TS2204	Ver.1.1		May 1 OF an later	Ver.1.08 or higher		
NV T02101	Ver.1.0	Ver.1.0 or later	Ver.1.05 or later	Ver.1.06 or higher		
NX-TS3101	Ver.1.1	1		Ver.1.08 or higher		
NX-TS3102	Ver.1.1			Ver.1.08 or higher	-	
NX-TS3104	Ver.1.1			Ver.1.08 or higher	-	
	Ver.1.0			Ver.1.06 or higher	-	
NX-TS3201	Ver.1.1	•		Ver.1.08 or higher		
NX-TS3202	Ver.1.1			Ver.1.08 or higher		
NX-TS3204	Ver.1.1			Ver.1.08 or higher		

\* Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

## NX-series Heater Burnout Detection Unit NX-HB

# Temperature control with heater burnout detection in conjunction with a temperature input unit and PID instructions

- Reduce the costs for communications programming and other development
- Achieve flexible temperature control



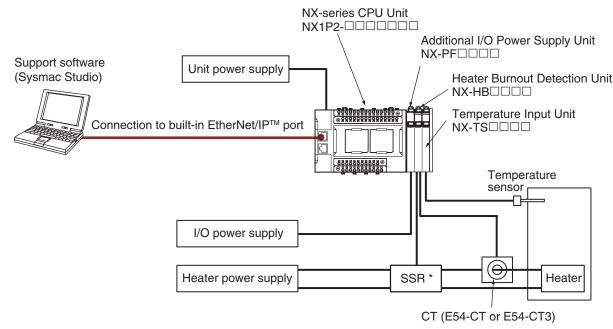
#### Features

- Up to four CT inputs per unit
- Omron's proven heater burnout detection function
- · Monitoring of CT currents to detect heater burnouts and SSR failures
- Time-proportional control outputs to drive SSRs
- · Control outputs not affected by controller cycle time
- Four control outputs to drive SSRs (100 mA max.)
- Heater burnout detection for a single-phase or three-phase heater
- Detachable front connector with screwless Push-In Plus terminals for easy installation and maintenance

#### **System Configurations**

#### Connected to a CPU Unit

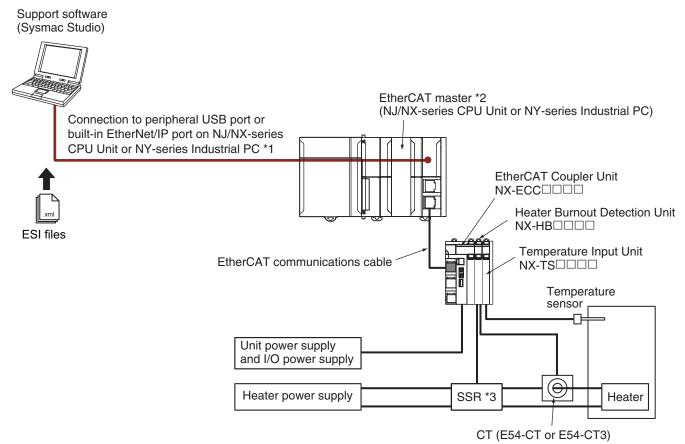
The following figure shows a system configuration when NX Units are connected to an NX-series CPU Unit.



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

#### Connected to an EtherCAT Coupler Unit

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



- \*1. The connection method for the Sysmac Studio depends on the model of the CPU Unit or Industrial PC.
- \*2. 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.
- \*3. The SSR is used to turn the heater ON and OFF.
- Note: To check whether NX Units can be connected to your CPU Unit or Communications Coupler Unit, refer to the user's manual for the CPU Unit or Communications Coupler Unit.

## **Function Specifications**

Function	Description
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.
CT Allocation	This function is used to assign each CT input to a corresponding control output.
Reading CT Currents	This function reads CT inputs as heater currents or leakage currents.
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.
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.
Time-proportional Output	This function controls a control output by using the manipulated variable from the host controller as a duty ratio. You can also specify the minimum pulse widths and execute immediate output commands.
Load Rejection Output Setting	This function performs a preset output operation when the Heater Burnout Detection Unit cannot receive an output set value due to a communications error between the host and the Communications Coupler Unit or due to an error on the NX bus.
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.

### Heater Burnout Detection Unit

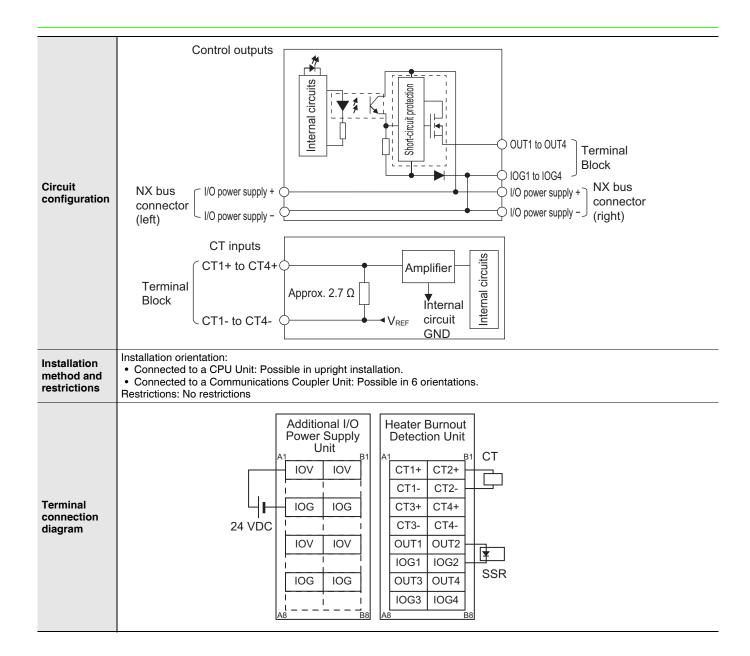
Unit name	Heater Burnout De	tection Unit	Model	NX-HB3101			
Number of points	4 CT inputs and 4 of	control outputs	External connection terminals	Screwless Clamping Terminal Block (16 terminals)			
I/O refreshing method	Free-Run refreshing						
	TS indicator and ou	utput indicators					
Indicators	HB3101 TS 1 12 B3 14						
	CT current input range	0 to 0.125 A		Internal I/O common	NPN		
	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%		
CT input section				Resolution	1 ms		
				Rated voltage	12 to 24 V DC		
	Maximum heater current	50 A AC	Control	Operating load voltage range	10.2 to 28.8 VDC		
	Resolution	0.1 A	output section	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		
	(20 0)			Leakage current	0.1 mA max.		
	Influence of			Residual voltage	1.5 V max.		
	temperature (0 to 55°C)	±2% (full scale) ±1 digit		Disconnection/ short-circuit detection	None		
	Conversion time	10 ms	-	Protective functions	None		
Dimensions (mm)	12 × 100 × 71 mm	(W×H×D)	Isolation method	Between control outputs and Internal circuits: Photocoupler isolation No isolation between Internal circuits and CT inputs			
Insulation resistance	20 M $\Omega$ min. between isolated circuits (at 100 VDC)		Dielectric strength	510 VAC between isolated circuits for 1 minute with leakage current of 5 mA max.			
I/O power supply method	Supplied from the NX bus.         Current capacity of I/O power supply terminals         IOV: 0.1 A max. per terminal		er terminal				
NX Unit power consumption	<ul> <li>Connected to a CPU Unit 1.05 W max.</li> <li>Connected to a Communications Coupler Unit 0.75 W max.</li> </ul>		Current consumption from I/O power supply	20 mA max.			
Weight	70 g max.						

#### Heater Burnout Detection Unit (NPN) NX-HB3101

Circuit configuration	Control outputs
Ū	NX bus connector (left)
	CT inputs CT1+ to CT4+ Approx. 2.7 Ω Internal Block CT1- to CT4- CT1- to CT4-
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	Additional I/O Power Supply Unit A1 IOV IOV IOG IOG 24 VDC 24 VDC IOG IOG IOG IOG IOG IOG IOG IOG IOG IOG A1 IOV IOV IOV IOV IOV IOV IOV IOV IOV IOV IOV

Unit name	Heater Burnout De	tection 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 refreshin	g	- L			
Indicators	TS indicator and ou HB3201 TS 1 2 B 4	utput indicators				
	CT current input range	0 to 0.125 A		Internal I/O common	PNP	
	Input resistance	Approx. 2.7 Ω		Control period	50 to 100,000 ms	
				Manipulated variable	0% to 100%	
	Connectable CTs	E54-CT1 and E54-CT3		Resolution	1 ms	
				Rated voltage	24 VDC	
CT input section	Maximum heater current	50 A AC	Control output section	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	
	(25 C)			Leakage current	0.1 mA max.	
	Influence of temperature (0 to 55°C) ±2% (full scale) ±1 digit	+2% (full scale)		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 outputs and Internal circuits: Photocoupler isolation No isolation between Internal circuits and CT input		
Insulation resistance	20 M $\Omega$ min. between isolated circuits (at 100 VDC)		Dielectric strength	510 VAC between isolated circuits for 1 minute wit leakage current of 5 mA max.		
I/O power supply method	Supplied from the I	NX bus.	Current capacity of I/ O power supply terminals	IOV: 0.1 A max. per terminal		
NX Unit power consumption	<ul> <li>Connected to a CPU Unit 1.05 W max.</li> <li>Connected to a Communications Coupler Unit 0.75 W max.</li> </ul>		Current consumption from I/O power supply	20 mA max.		
Weight	70 g max.					

#### Heater Burnout Detection Unit (PNP) NX-HB3201



#### **Version Information**

#### Connected to a CPU Unit

Refer to the user's manual for details on the CPU Units for the CPU Unit to which NX Units can be connected.

NX Unit		Corresponding version *		
Model	Unit version	CPU Unit Sysmac Studio		
NX-HB3101	Ver.1.0	Ver.1.13 or later	Ver.1.17 or higher	
NX-HB3201	ver.1.0	ver. 1. 13 OF later	ver. 1. 17 of higher	

\* Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

#### **Connected to a Communications Coupler Unit**

NX Unit		Corresponding version *				
NX OIII		EtherCAT			EtherNet/IP	
Model	Unit version	Communications Coupler Unit NJ/NX-series CPU Unit or NY-series Industrial PC		Communications Coupler Unit	Sysmac Studio	
NX-HB3101 NX-HB3201	Ver.1.0	Ver.1.0 or later	Ver.1.05 or later	Ver.1.16 or higher	Ver.1.0 or later	Ver.1.16 or higher

\* Some Units do not have all of the versions given in the above table. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

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