Network Instrumentation Module
Communications box NX-CB1
Communications adapter NX-CL1/NX-CR1
Terminal adapter NX-TL1/NX-TR1

Overview
Network Instrumentation Modules make optimal distributed configuration a reality. Distributed modules execute cooperative control using Ethernet connectivity. This instrumentation offers an excellent solution for productivity and energy conservation needs.

The following devices are Ethernet-compatible, a key feature of Network Instrumentation Module instrumentation.
• Communications box NX-CB1
• Communications adapter NX-CL1/NX-CR1
• Terminal adapter NX-TL1/NX-TR1

Features
• Communications box
  • Equipped with 4 Ethernet ports on the front and 1 on the right side (side connector).
  • Ethernet connections between modules via side connectors reduce wiring.
  • Reduced wiring and distributed layout by Ethernet daisy chain
  • Redundancy by Ethernet ring connection
  • LED information indicators

• Communications adapter
  • Equipped with an Ethernet port on the front.
  • No power supply is needed.

• Terminal adapter
  • Used for Ethernet chain ring connections (using side connector).
  • No power supply is needed.
NX-CB1 block diagram

- Host communications
- Ethernet port 1
- Ethernet port 2
- Ethernet port 3
- Ethernet port 4
- RS-485 (3-wire) communications
- Ring communications or host communications (depending on the model No.)
- Internal circuits
- Pulse transformer
- Switching hub
- Power 24 Vdc
- Other modules

NX-CL1/NX-CR1 block diagram

- Side connector
- RJ45 connector Ethernet
- Pulse transformer
- Ring communications
- To host communications/neighboring CA
- Other modules

NX-TL1/NX-TR1 block diagram

- Side connector
- RJ45 connector Ethernet
- Loopback connector
- Pulse transformer
- Other modules
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication specifications</strong></td>
<td></td>
</tr>
<tr>
<td>NX-CB1</td>
<td>Ports 4</td>
</tr>
</tbody>
</table>
| Communication path type   | Ethernet port 1/2  
IEEE 802.3/IEEE 802.3u 10BASE-T/100BASE-TX  
(with Auto Negotiation and Auto MDI/MDI-X functions)  
Ethernet port 3/4  
IEEE 802.3u 100BASE-TX (with full duplex and Auto MDI/MDI-X functions. The auto negotiation function on a connected device should be enabled except when the device is connected between communication boxes.) |
| Connector                 | RJ-45                                                                                                                                       |
| Cable                     | UTP cable (4P) Cat 5e min. (straight) (both ends, ANSI/TIA/EIA-568-B)  
UTP cable (4P) Cat 5e min. (straight) (both ends, ANSI/TIA/EIA-568-B) |
| NX-CL1/NX-CR1             | Ports 1                                                                                                                                     |
| Communication path type   | IEEE 802.3u 100BASE-TX (with full duplex and Auto MDI/MDI-X functions. The auto negotiation function on a connected device should be enabled between communication boxes.) |
| Connector                 | RJ-45                                                                                                                                       |
| Cable                     | UTP cable (4P) Cat 5e min. (straight) (both ends, ANSI/TIA/EIA-568-B)  
UTP cable (4P) Cat 5e min. (straight) (both ends, ANSI/TIA/EIA-568-B) |
| **General descriptions**  |                                                                                                                                               |
| Standard conditions       | Ambient temperature 23 ± 2 °C  
Ambient humidity 60 ± 5 % RH (without condensation)  
Rated voltage NX-CB1: 24 Vdc  
Vibration resistance 0 m/s²  
Shock 0 m/s²  
Mounting angle Reference plane ± 3° |
| Operating conditions      | Ambient temperature 0 to 50 °C (below the installed NX)  
Ambient humidity 10 to 90 % RH (without condensation)  
Allowable operating voltage NX-CB1: 21.6 to 26.4 Vdc  
Vibration 0 to 3.2 m/s² (10 to 150 Hz for 2 h each in x, y, and z directions)  
Shock 0 to 9.8 m/s²  
Mounting angle Reference plane ± 3°  
Dust 0.3 mg/m³ max.  
Corrosive gas None  
Altitude 2000 m max.  
Pollution degree 2 (equivalent to normal office environments) |
| Transport and storage conditions | Ambient temperature -20 to +70 °C  
Ambient humidity 5 to 95 % RH (without condensation)  
Vibration 0 to 9.8 m/s² (10 to 150 Hz for 2 h each in x, y, and z directions)  
Shock 0 to 300 m/s² (vertically 3 times while on DIN rail)  
Package drop test Drop height 60 cm (free fall on 1 corner, 3 edges, 6 sides) |
| Memory storage system     | NX-CB1: Non-volatile (EEPROM)  
Power consumption NX-CB1: 4 W max. (under operating conditions)  
Inrush current NX-CB1: 10 A max. (under operating conditions)  
Power ON operation delay NX-CB1: Reset time: 3 s min. (required until normal operation begins under standard conditions)  
Insulation resistance NX-CB1: 20 MΩ min. (between power terminals 1 and 2 and I/O terminals isolated from the power terminals, with a 500 Vdc megger)  
Dielectric strength NX-CB1: 500 Vac for 1 min (between power terminals 1 and 2 and I/O terminals isolated from the power terminals)  
Case material, color Modified PPO resin, black  
Standards compliance NX-CB1: CE, C-UL (pending)  
Mounting method DIN rail  
Terminal screw tightening torque 0.6 ± 0.1 N•m  
Mass NX-CB1: 300 g max.  
NX-CL1/CR1: 35 g max.  
NX-TL1/TR1: 37 g max.  
Accessories NX-CB1: User’s manual (CP-UM-5558JE) |
## Model Selection

### Communications box

<table>
<thead>
<tr>
<th>Basic model No.</th>
<th>Type</th>
<th>Ring connection 1</th>
<th>Ring connection 2</th>
<th>Output type</th>
<th>Option</th>
<th>Addition</th>
<th>Description</th>
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<tbody>
<tr>
<td>NX-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Network Instrumentation Module</td>
</tr>
<tr>
<td>CB1</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4-port switching hub</td>
</tr>
<tr>
<td></td>
<td>R</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Chain ring connection (using side connector)</td>
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<tr>
<td></td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chain ring connection (using side connector)</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-ring connection between chains (using front port)</td>
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<tr>
<td></td>
<td>04</td>
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<td></td>
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<td>0</td>
<td>RJ45 connector</td>
<td>4-port</td>
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<td></td>
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<td>D</td>
<td>Inspection certificate</td>
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</tr>
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<td>K</td>
<td>Anti-sulfide treatment</td>
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<td></td>
<td></td>
<td></td>
<td>B</td>
<td>Tropicalization treatment + inspection certificate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>Anti-sulfide treatment + inspection certificate</td>
<td></td>
</tr>
</tbody>
</table>

*1. Left and right are defined as seen when viewing the front of the unit after mounting.

### Communications adapter/Terminal adapter

<table>
<thead>
<tr>
<th>Basic model No.</th>
<th>Type</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Addition</th>
<th>Description</th>
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<td></td>
<td>CL1</td>
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<td></td>
<td>0</td>
<td>Communications adapter for left side [*1]</td>
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<td></td>
<td>CR1</td>
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<td></td>
<td></td>
<td>0</td>
<td>Communications adapter for right side[*1]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TL1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Terminal adapter for left side</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Chain ring connection (using side connector)[*1]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TR1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Terminal adapter for right side</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>0</td>
<td>Chain ring connection (using side connector)[*1]</td>
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<td>0</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

*1. Left and right are defined as seen when viewing the front of the unit after mounting.
External Dimensions

• Communications box NX-CB1

   (Unit: mm)

• Communications adapter NX-CL1/NX-CR1
   for left side NX-CL1
   for right side NX-CR1

• Terminal adapter NX-TL1/NX-TR1
   for left side NX-TL1
   for right side NX-TR1
Part Names and Functions

### Body

- **LED operation indicators**
  - PWR
  - RUN
  - MOD
  - COM
  - NST
  - FAIL
- **Ethernet ports 3 and 4**
- **Maintenance jack**
  (for Azbil Corp. use only):
  Cannot be connected to SLP-NX smart loader package.
- **Port operation indicators 1 to 4**

### Base

- **DIN rail locking tab**
  Used for locking on a DIN rail.
- **Side connector**
  Used for connecting modules.
- **Power supply terminal**
  1: 24 Vdc(+)
  2: 24 Vdc(-)
- **RS-485 communications terminal**
  3 wire RS-485 connector terminal
  4: DA
  5: DB
  6: SG
  * Connected to the module on the right via the side connector.

### Mounting

#### Location

- **Wiring duct, etc.**
  - 50 mm
  - 80 mm
- **From the front**
  - 50 mm

Install the controller in a location that meets the following criteria:

- Install the controller in a location that meets the following criteria:
- No high/low temperature/humidity.
- Free from sulfide gas or corrosive gas.
- Not dusty or sooty.
- Protected from direct sunlight, wind, and rain.
- Little mechanical vibration or shock.
- Not close to high voltage line, welding machine or other electrical noise generating source.
- At least 15 meters away from the high voltage ignition device for a boiler.

- No strong magnetic fields.
- No flammable liquid or gas.
- Indoors
- I/O common mode voltages: voltage to ground is 30 Vrms max., 42.4 V peak max., and 60 Vdc max.

### Linking modules

The NX-CB1 can be linked to other modules using the connectors on the right of the base. When linked, modules share the power supply connection, eliminating the need for wiring.

### Mounting procedure

The NX-CB1 is used while mounted on a DIN rail. After mounting the DIN rail and pulling the locking tab completely off, hook the base onto the DIN rail. Then, push the DIN rail locking tab upwards firmly until it clicks into place.

#### Handling Precautions

- Install the module so that it is vertical, with the DIN rail locking tab at the bottom.
- Link the NX-CB1 to the other modules before mounting it on a DIN rail.

### Attaching the main unit to the base

#### Handling Precautions

- The included base and main unit must be used as a pair.
- Be sure to fit the hook on the main unit into the base first. If this is not done, the hook might be broken during mounting.

1. Fit the hook on the main unit into the base.
2. Push the main unit onto the base until it clicks into place.

To remove the main unit from the base, pull it towards you while pressing down on the lever.

(1) Fit the hook on the main unit into the base.
(2) Push the main unit onto the base until it clicks into place.
## Wiring Precautions

- **Do not** run wires outside. The equipment could be damaged in the event of lightning.
- When connecting wires to the power terminals, use crimp terminals with insulating sleeves.
- Check the model number of the controller and the terminal numbers on the wiring diagram on the side of the module to prevent any wiring errors.
- For power supply terminal, RS-485 communication terminal connections, use crimp terminals that are the correct size for M3 screws.
- Be careful not to allow any crimp-type terminal lugs to touch adjacent terminals.
- The signal wires and power wires of the module should be at least 60 cm away from other power wires or power sources. Also, do not pass these wires through the same conduit or wiring duct.
- Before connecting the NX-CB1 to other devices in parallel, check their connection conditions carefully.
- To ensure stable operation, the NX-CB1 is designed not to operate for three seconds after the power is turned ON.
- After wiring, check that there are no mistakes before turning the power ON.

### Connecting the power supply

Connect the power terminals as shown below.

#### Handling Precautions

- Linked modules supply power to each other.
- Supply power to one of the linked modules.
- Use a power supply that can supply the total power requirement of the linked modules.
- For compliance with UL standards, use a UL-approved Class 2 power supply.

#### Connecting the RS-485 communications

Connect the RS-485 wiring for CPL or MODBUS as shown below.

**Handling Precautions**

- 0.5 W or greater terminating resistor of 150 Ω ±5% at each end of the communications lines. However, if any device that does not allow a terminating resistor is connected to the same communications line, follow the instructions on that device.
- Be sure to connect the SG terminals to each other. Failure to do so might cause unstable communications.
- For communications wiring, use twisted pair cables.
- Since the module has no RS-485 communication function, connect another module to the right-hand connector on the module base and connect a communication cable to that module.

### I/O isolation

Items surrounded by solid lines are isolated from other signals.

**NX-CB1**

| Power supply (including side connector) *1 | Ethernet port 1 |
| Logic circuits | Ethernet port 2 |
| Maintenance jack | Ethernet port 3 |
| RS-485 communications (SG only) *1 *2 | Ethernet port 4 |
| Indicators (led) | Ring communications through side connector *1 |
| Ethernet communications through side connector *1 | |

*1: Power, side-connector ring communications, and RS-485/side-connector Ethernet communications are isolated from each other.

*2: DA and DB signals for RS-485 communications are connected not to the module’s internal circuitry, but instead directly to the side connector.

**NX-CL1/NX-CR1**

| Ethernet communications through side connector *1 | Ethernet port 1, 2, 3 and 6-pin |
| Ethernet port 4, 5 and 8-pin | Ring communications through side connector *1 |
Ethernet connections

For details, see Network Instrumentation Module User's Manual: Network Design Version, No. CP-SP-1313E.

A good understanding of connection methods, model selection, etc. is required before use.

- Abbreviations

<table>
<thead>
<tr>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Communications adapter</td>
</tr>
<tr>
<td>TA</td>
<td>Terminal adapter</td>
</tr>
<tr>
<td>CB</td>
<td>Communications box</td>
</tr>
</tbody>
</table>

- Node notations

<table>
<thead>
<tr>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Ring communication type</td>
</tr>
<tr>
<td>N</td>
<td>Non-ring communication type</td>
</tr>
</tbody>
</table>

- CB notations

<table>
<thead>
<tr>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td>Chain connection: Ring communication type</td>
</tr>
<tr>
<td>RN</td>
<td>Connection between chains: Ring communication type</td>
</tr>
<tr>
<td>NR</td>
<td>Chain connection: Non-ring communication type</td>
</tr>
<tr>
<td>NN</td>
<td>Connection between chains: Non-ring communication type</td>
</tr>
</tbody>
</table>

**Basic network configuration**

The network is configured by linking modules.

<table>
<thead>
<tr>
<th>Non-ring</th>
<th>Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Non-ring Diagram" /></td>
<td><img src="image2" alt="Ring Diagram" /></td>
</tr>
</tbody>
</table>

A distributed configuration can be achieved using an Ethernet cable.

<table>
<thead>
<tr>
<th>Non-ring</th>
<th>Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Non-ring Diagram" /></td>
<td><img src="image4" alt="Ring Diagram" /></td>
</tr>
</tbody>
</table>

Even if modules are connected using Ethernet cables, they are recognized as one chain in the SLP-NX.

This type of distributed configuration is suitable when modules are located relatively close together, for example, in the same platform or a neighboring platform (with a connecting cable that is less than 50 m in length).

**Attaching the main unit to the base**

The following four types of network configurations are possible, depending on the model number of the communication box.

<table>
<thead>
<tr>
<th>Chain connection</th>
<th>Non-ring</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Chain connection Diagram" /></td>
<td><img src="image6" alt="Non-ring Diagram" /></td>
</tr>
</tbody>
</table>

Communication adapters can be used to set up a distributed configuration for chain connections (the horizontal connections in this diagram).

Connections between chains (the vertical connections in this diagram) are performed when connecting modules located in different locations.
## Configuration Methods

- **Chain connection: non-ring communications**
  Modules are configured in a daisy chain topology.

  ![Daisy Chain Topology](image1.png)

- **Chain connection: ring communications**
  You can build a redundant communication path by connecting daisy chain topology to ring topology.

  ![Ring Topology](image2.png)

- **Connection between chains: non-ring communications**
  Chains can be connected using communication boxes and daisy chain topology.

  ![Chain Connection Diagram](image3.png)

- **Chain connection: non-ring communications**
  Redundant communications can be built using a communication box and daisy chain topology in a ring-type network.

  ![Redundant Communication](image4.png)