OMRON

CompoNet™
Digital Sensor Communications Unit
E3NW-CRT

User's Manual

Introduction

Thank you for purchasing the E3NW-CRT CompoNet Sensor Communications Unit.
This Communications Unit was developed with OMRON's advanced technologies and vast experience for use with E3NX-FA0-series Smart Fiber Amplifier Units, E3NC-LA0-series Smart Laser Amplifier Units (CMOS), and E3NC-SA0-series Smart Laser Amplifier Units.

● 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 installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA facilities.

This product must be used within the ranges that are given in the general specifications.

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Section 1

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User's Manual

Sensor Communications Unit
E3NW-CRT (CompoNet)

Terms and Conditions Agreement

Read and understand this Manual

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of the Product in combination with the end product, machine, system, or other applica-
tion or use. Buyer shall be solely responsible for determining appropriateness of the
particular Product with respect to Buyer's application, product or system. Buyer shall
take application responsibility in all cases.

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TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE
HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PROD-
UCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN
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■ 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

This manual uses the following signs and symbols to ensure safe operation of this product.

These signs and symbols are important for avoiding personal injury or damage to the product.

Make sure that they are observed.

⚠ 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	Indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

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

⚠ WARNING

Do not touch the terminals or disassemble the Unit and touch any internal components while power is being supplied. Do not supply power while the cover is open. Doing so may result in electric shock.

Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in electric shock.

Provide safety measures in external circuits, i.e., not in the Sensor Communications Unit, in order to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. Not doing so may result in serious accidents.

(1) Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
(2) The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
(3) The outputs from the Sensor Communications Unit 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 safety in the system.
(4) When the 24-VDC output (service power supply to the PLC) is overloaded or shortcircuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

The CPU Unit will refresh I/O even in an operation-stopped state (PROGRAM mode). Therefore, confirm safety when changing output bits allocated to the Sensor Communications Unit, or words allocated to Special I/O Units or CPU Bus Units in the CIO Area. Unexpected operation may occur in the loads connected to the Sensor Communications Unit, Special I/O Units, or CPU Bus Units.

• Transferring the contents of the I/O memory areas to the CPU Unit with a Programming Device
• Changing the present values with a Programming Device
• Force-setting/force-resetting any bit in memory with a Programming Device
• Transferring the contents of the I/O memory areas to the CPU Unit with a Memory Card or EM File Memory
• Transferring the contents of I/O memory from another PLC or a host computer on the network

Precautions for Safe Use

Observe the following precautions when using the Digital Sensor Communications Unit:

● **Power Supply**

- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable.
- Always turn OFF the power supply to the PLC, Slave Units, and other Units before attempting any of the following.
  - Assembling the Units (Expansion Units)
  - Mounting or dismounting terminal blocks on Remote I/O Terminals
  - Mounting or dismounting an I/O Unit, CPU Unit, Power Supply Unit, Memory Cassette, or Master Unit
  - Replacing component relays
  - Setting DIP switches or node address switches
  - Connecting or wiring the cables

● **Installation**

- Before touching the Unit, be sure to first touch a grounded metallic object in order to discharge any static buildup.
- Be sure that the terminal blocks, communications cables, and other items with locking devices are properly locked into place.
- Always use the enclosed End Plates to securely mount the Units to the DIN Track.
- Be sure that all the terminal screws and cable connector screws of the product are tightened to the torque specified in the relevant manuals.
- Be sure that the screws of the terminal block are tightened to the torque specified in the relevant manuals. Insufficient tightening torque may result in fire, malfunction, or failure.
- Always use specified communications cables and connectors.
- Abide by the specifications for the communications distance and the number of Units to be connected.
- When using cables in multiple systems, be sure to keep the distance of 5 mm or more between any two cables to avoid operational instability due to interference.

● **Wiring**

- Confirm that the wiring and switch settings are correct before supplying power.
- Use the correct wiring tools to perform wiring.
- Confirm terminal polarity before wiring.
- Do not let a piece of metal enter the Units when wiring or installing.
- Be careful of the following when wiring communications cables.
  - Keep communications cables away from power lines and high-voltage lines.
  - Do not fold over communications cables.
  - Abide by the specifications for the communications cable distance.
  - Do not place objects on top of communications cables.
  - Always wire communications cables through a duct.
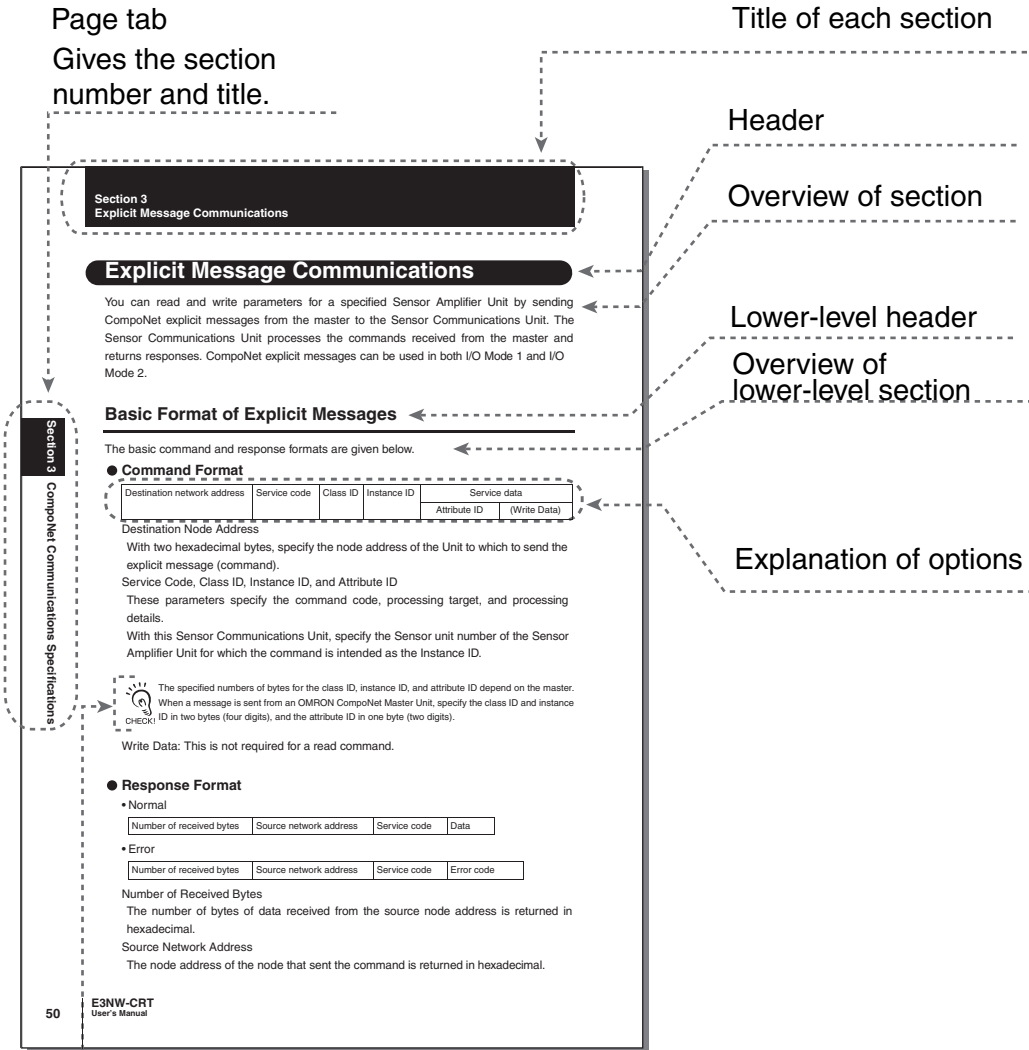
● **Handling**

- Do not forcibly bend or pull the cables.
- Check the user program for proper execution before actually running it on the Unit.
- Confirm that no adverse effect will occur in the system before attempting any of the following.
  - Changing the operating mode of the PLC
  - Force-setting/force-resetting bits in memory
  - Changing the present value or any set value of any word from the user program
- Do not use thinner or similar solvent for cleaning. Use commercial alcohol.
- Use a dedicated packing box to transport the Unit. Avoid excessive shock or vibration during transportation.

● **External Circuits**

- Install external breakers and take other safety measures against short-circuiting in external wiring.

Precautions for Correct Use

- Install the Unit properly as shown in this manual. Not doing so may result in a failure of the Unit.
- Do not install the Sensor Communications Unit in locations subject to the following conditions:
  - 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, acid, oil, or chemicals
  - Locations subject to shock or vibration
- Be sure to observe the voltage specifications when performing wiring between communications path and power supply, or at I/O crossovers. Wrong wiring may cause a failure of the Unit.
- Wire the Unit properly as indicated in this manual.
- Use the correct wiring parts to perform wiring.
- Take appropriate and sufficient countermeasures when using the Unit in the following locations:
  - 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 supplies
- Do not drop the Digital Sensor Communications Unit or expose it to any excessive vibration or shock. Doing so may result in damage to the Digital Sensor Communications Unit or malfunction.
- The CompoNet Communications Unit provides power to the connected Sensors. Therefore, the operation of the Sensors may become unstable if there are abnormalities in the power supply, such as a drop in the power supply voltage at startup. If Sensor operation is unstable, check the voltage specifications and wiring, and then cycle the power supply.

Reading This Manual

Page Format

Page tab
Gives the section
number and title.

Title of each section

Header

Overview of section

Section 3
Explicit Message Communications

Explicit Message Communications

You can read and write parameters for a specified Sensor Amplifier Unit by sending CompoNet explicit messages from the master to the Sensor Communications Unit. The Sensor Communications Unit processes the commands received from the master and returns responses. CompoNet explicit messages can be used in both I/O Mode 1 and I/O Mode 2.

Lower-level header

Overview of
lower-level section

Basic Format of Explicit Messages

The basic command and response formats are given below.

● **Command Format**

Destination network address	Service code	Class ID	Instance ID	Service data	
				Attribute ID	(Write Data)

Destination Node Address
With two hexadecimal bytes, specify the node address of the Unit to which to send the explicit message (command).

Service Code, Class ID, Instance ID, and Attribute ID
These parameters specify the command code, processing target, and processing details.
With this Sensor Communications Unit, specify the Sensor unit number of the Sensor Amplifier Unit for which the command is intended as the Instance ID.

Explanation of options

CHECK! The specified numbers of bytes for the class ID, instance ID, and attribute ID depend on the master. When a message is sent from an OMRON CompoNet Master Unit, specify the class ID and instance ID in two bytes (four digits), and the attribute ID in one byte (two digits).

Write Data: This is not required for a read command.

● **Response Format**
• Normal

Number of received bytes	Source network address	Service code	Data

• Error

Number of received bytes	Source network address	Service code	Error code

Number of Received Bytes
The number of bytes of data received from the source node address is returned in hexadecimal.

Source Network Address
The node address of the node that sent the command is returned in hexadecimal.

Section 3 CompoNet Communications Specifications

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User's Manual

Supplementary Explanation

Helpful information regarding operation and reference pages are introduced here using symbols.

CHECK!

■ Meaning of Symbols

Menu items that appear on the seven-segment display on the Amplifier Units are enclosed in brackets [ ].

■ Visual Aids

Indicates points that are important to achieve the full product performance, such as operational precautions and application procedures.

CHECK!

Indicates pages where related information can be found.

Indicates information helpful in operation.

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Contents

Introduction

Introduction

MEMO

Section 1
Overview

Features and System Configuration

Overview

The Sensor Communications Unit is a communications slave that is used to monitor Sensor Amplifier Unit ON/OFF outputs and detection levels, write parameters, and perform operations between Digital Sensors and a PLC with CompoNet communications.

Compatible Sensors: Smart Fiber Amplifier Unit   E3NX-FA0
                        Smart Laser Amplifier Unit   E3NC-LA0
                        Smart Laser Amplifier Unit(CMOS)   E3NC-SA0

ON/OFF outputs can be monitored with remote I/O communications. Also, parameters can be read and written with explicit messages.

Features

■ **This Unit provides a communications interface between OMRON PLCs (e.g., the CS, CJ, and NJ Series) or other CompoNet-compatible masters manufactured by other companies and Sensor Amplifier Units.**

● **Remote I/O Communications Slave**

ON/OFF outputs from Sensor Amplifier Units can be sent to the host (master) PLCs with remote I/O communications without any programming.

● **Message Communications**

You can send commands (explicit messages) from the PLC to read and write parameters, such as detection levels and thresholds, and perform operations, such as tuning.

● **Dummy Sensor Registration**

You can register Dummy Sensors so that you do not need to change the I/O assignments even if the number of Sensor Amplifier Units changes. You can also choose to return either an error or a normal completion when a command is sent to a Dummy Sensor. Explicit messages are used to register Dummy Sensors.

System Configuration

CompoNet Configurator

CompoNet master

PLC

Serial connection

CompoNet

Sensor Head

CompoNet slave

E3NW-CRT Sensor
Communications Unit
with CompoNet
Communications

Sensor Amplifier Units
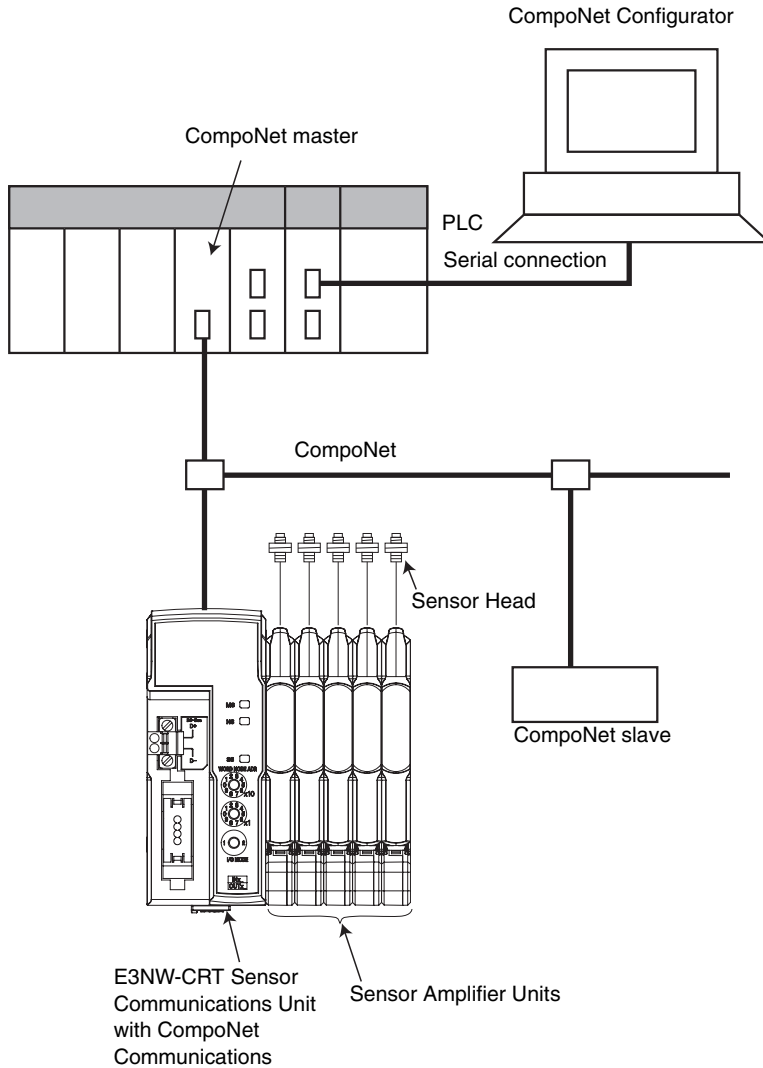
S e c t i o n 2
Installation and Connections

Specifications and Dimensions

Specifications

Item	Specifications and Performances
Connectable Sensors[*1]	N-Smart Smart Fiber Amplifier Unit: E3NX-FA0 Smart Laser Amplifier Unit: E3NC-LA0 Smart Laser Amplifier Unit (CMOS): E3NC-SA0
Power supply voltage	14 to 26.4 VDC
Power and current consumption	1.7 W max. (Does not include power supplied to Sensors.) at 24 VDC 70 mA max. (Does not include the current supplied to Sensors.)
Indicators	MS (machine status) indicator (green/red) NS (network status) indicator (green/red) SS (Sensor status) indicator (green/red)
Vibration resistance (destruction)	10 to 60 Hz with a 0.7-mm double amplitude, 50 m/s^2 at 60 to 150 Hz, for 1.5 hours each in X, Y, and Z directions
Shock resistance (destruction)	150 m/s^2 for 3 times each in X, Y, and Z directions
Ambient temperature range	Operating: 0 to 55°C;[*2] Storage: −30 to 70°C (with no icing or condensation)
Ambient humidity range	Operating and storage: 25% to 85% (with no condensation)
Maximum connectable Sensors	16[*3]
Maximum connectable Distributed Sensor Units	8
Insulation resistance	20 MΩ min. (at 500 VDC)
Withstand voltage	500 VAC at 50/60 Hz for 1 min
Installation method	35-mm DIN Track-mounting
Weight (packed state/Unit only)	Approx. 165 g/approx. 70 g
Materials	Polycabonate
Accessories	E3NW-DS Communications Connector, DIN Track End Plates (2), and Instruction Manual

*1 You cannot connect the E9NC-TA0 Smart Contact-type Amplifier Unit.

*2 Temperature Limitations Based on Number of Connected Amplifier Units:
Groups of 1 or 2 Amplifier Units: 0 to 55°C, Groups of 3 to 10 Amplifier Units: 0 to 50°C, Groups of 11 to 16 Amplifier Units: 0 to 45°C
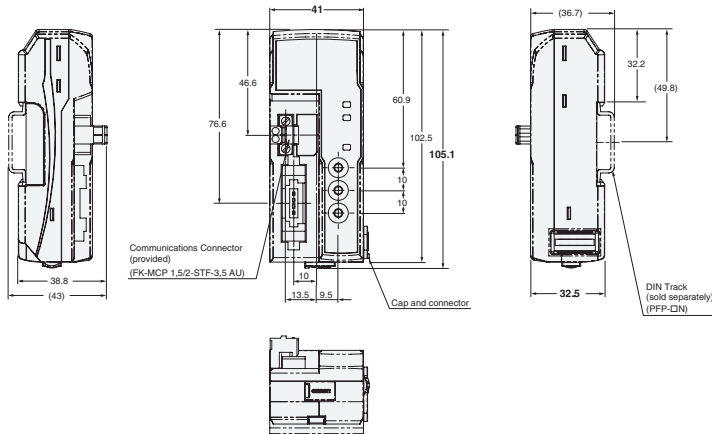
*3 You can connect up to 16 Sensors total to the Sensor Communications Unit and Distributed Sensor Units.
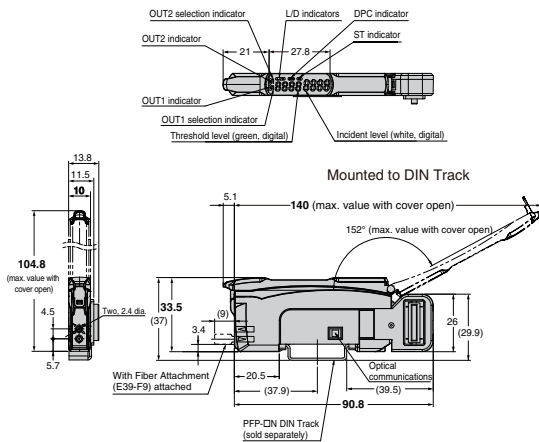
■ CompoNet Communications Specifications

Item	Specification
Communications protocol	Special CompoNet network protocol
Types of communications	Remote I/O communications (sharing data without programming) and message communications (explicit message communications when required)
Baud rate	4 Mbps, 3 Mbps, 1.5 Mbps, or 93.75 kbps
Modulation	Base band
Coding	Manchester code
Error control	Manchester encoding rules and CRC
Communications media	The following media can be used. • Round Cable I • Round Cable II • Flat Cable I (DCA4-4F10 Standard Flat Cable) • Flat Cable II (DCA5-4F10 Sheathed Flat Cable) Note Round Cable I, Round Cable II, Flat Cable I, and Flat Cable II are all different types of cable. To use more than one type of cable at a time, Repeater Units must be used to separate them on trunk lines and sub-trunk lines.
Communications distance and wiring	Refer to *Cable Types, Baud Rates, and Maximum Distances* in the *CompoNet Master Units Operation Manual* (Cat. No. W456).
Signal lines	Two lines: BDH (communications data high) and BDL (communications data low)
Power lines	Two lines: BS+ and BS− (power for communications and internal slave circuits) • Power is supplied from the Master Unit or Repeater Unit.
Connection forms	Round Cable II, Flat Cable I, or Flat Cable II at a baud rate of 93.75 kbps: No restrictions Other cables or baud rates: Trunk line and branch lines
	Connections for Slaves and Repeater Units: T-branch or multidrop connections
Noise resistance	Conforms to IEC 61000-4-4, 1 kV.
Address setting method	Decimal rotary address switch
Address range	0 to 62

Dimensions

E3NW-CRT

Communications Connector
(provided)
(FK-MCP 1,5/2-STF-3,5 AU)

Cap and connector

DIN Track
(sold separately)
(PFP-☐N)

E3NX-FA0

OUT2 selection indicator
OUT2 indicator
OUT1 indicator
OUT1 selection indicator
Threshold level (green, digital)
L/D indicators
DPC indicator
ST indicator
Incident level (white, digital)

Mounted to DIN Track

140 (max. value with cover open)
152° (max. value with cover open)

104.8
(max. value with cover open)

Two, 2.4 dia.

33.5
(37)

26
(29.9)

With Fiber Attachment
(E39-F9) attached

Optical
communications

PFP-☐N DIN Track
(sold separately)

90.8

E3NC-LA0

OUT2 selection indicator
OUT2 indicator
OUT1 indicator
OUT1 selection indicator
Threshold level (green, digital)
L/D indicators
DPC indicator
ST indicator
Incident level (white, digital)

Mounted to DIN Track

159.7 (max. value with cover open)
152° (max. value with cover open)

114
(max. value with
cover open)

33.5
(37)

26 (29.9)

Optical
communications

PFP-☐N DIN Track
(sold separately)

102.4

E3NC-SA0

OUT2 selection indicator
OUT2 indicator
OUT1 indicator
OUT1 selection indicator
Threshold level (green, digital)
L/D indicators
ZERO indicator
ST indicator
Measurement value
(white, digital display)

Mounted to DIN Track

159.7 (max. value with cover open)
152° (max. value with cover open)

114
(max. value with
cover open)

33.5
(37)

26 (29.9)

Optical
communications

102.4

PFP-☐N DIN Track
(sold separately)
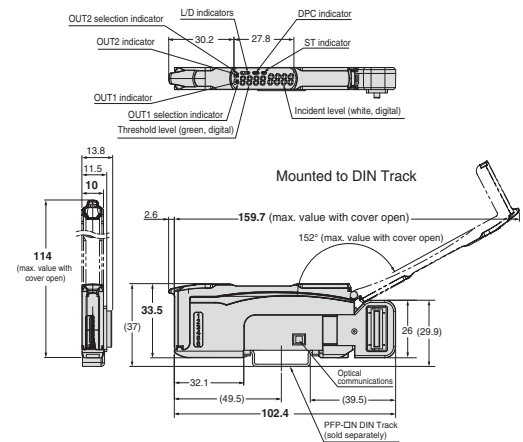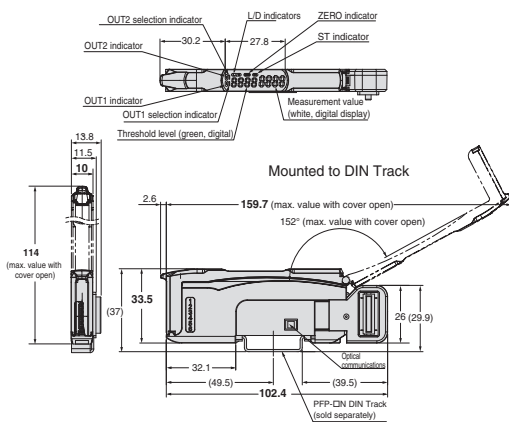
Connecting Sensor Amplifier Units

Connectable Sensor Amplifier Units

The Sensor Communications Unit can be connected to the following Sensor Amplifier Units.

Type	Model number	Features
Smart Fiber Amplifier Unit	E3NX-FA0	A standard, easy to operate and easy to configure Fiber Amplifier Unit.
Smart Laser Amplifier Unit	E3NC-LA0	A Laser Sensor that can reliably detect workpieces even with a small spot diameter
Smart Laser Amplifier Unit (CMOS)	E3NC-SA0	A CMOS-type Laser Sensor that can reliably detect steps.

Section 2 Installation and Connections

Number of Connectable Sensor Amplifier Units

You can connect the Sensor Communications Unit to up to 16 Sensor Amplifier Units, including any Sensor Amplifier Units connected to Distributed Sensor Units. The number of connectable Sensor Amplifier Units also depends on the settings of the Sensor Communications Unit.

Up to 10 Sensor Amplifier Units can be connected to a Distributed Sensor Unit.

| Type	Setting	Number of connectable Sensors	Features
Unit with CompoNet Communications (E3NW-CRT)	I/O Mode 1	15 max.	Two input words, outputs for 15 Sensors (with two outputs each for a total of 30 outputs), and two status bits are allocated as I/O. Explicit messages are used to change settings and perform tuning. This Sensor Amplifier Unit is best for connections to an OMRON NJ-series, CJ-series, or CS-series master.
	I/O Mode 2	16 max.	This mode allocates six input words and six output words. It is best suited for gateways and other products that do not support explicit messages. You can only change settings and perform tuning through control inputs and outputs assigned in the I/O area.

CHECK! The number of connectable Amplifier Units is not affected by the types of Amplifier Units.

The following are some connection examples.

Example 1: Communications Unit Only
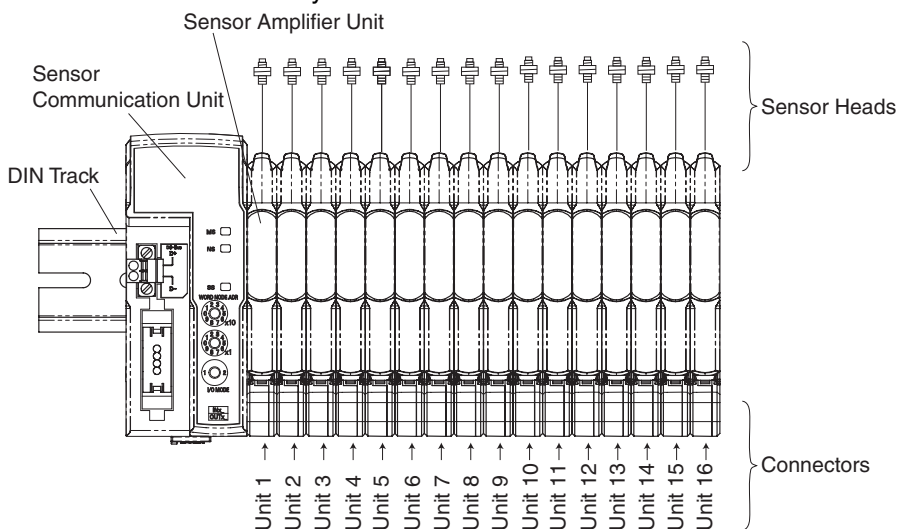
Unit numbers are in ascending order from the left.

Example 2: Connecting a Communications Unit and Distributed Sensor Units

Sensor Communications Unit

L1

DS-Bus
communications cable

First Sensor Distribution Unit
• Termination setting switch: OFF

L2

Second Sensor Distribution Unit
• Termination setting switch: OFF

Ln

nth Sensor Distribution Unit
• "n" is a maximum of 8.
• Termination setting switch: ON

Section 2 Installation and Connections
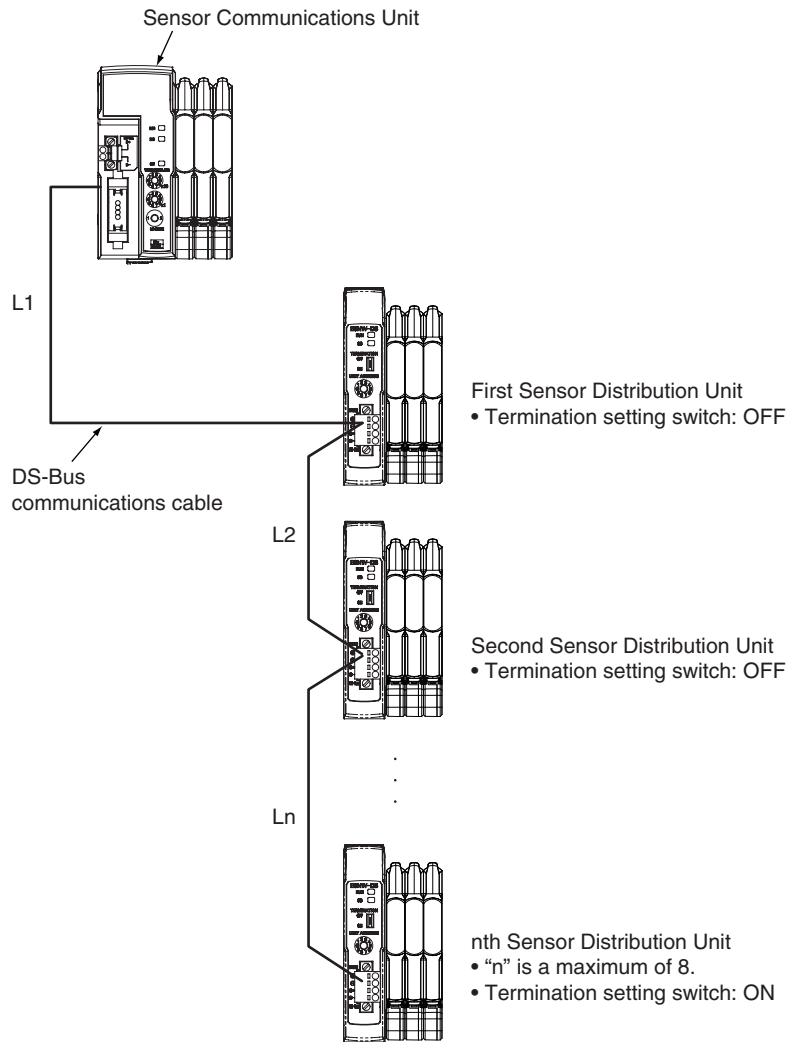
Sensor Amplifier Unit Connection and Identification (Unit Numbers)

The following figure shows a series of Sensor Amplifier Units mounted to the right of the Sensor Communications Unit. Use a DIN Track for mounting. Power is supplied to the connected Amplifier Units from the Sensor Communications Unit.
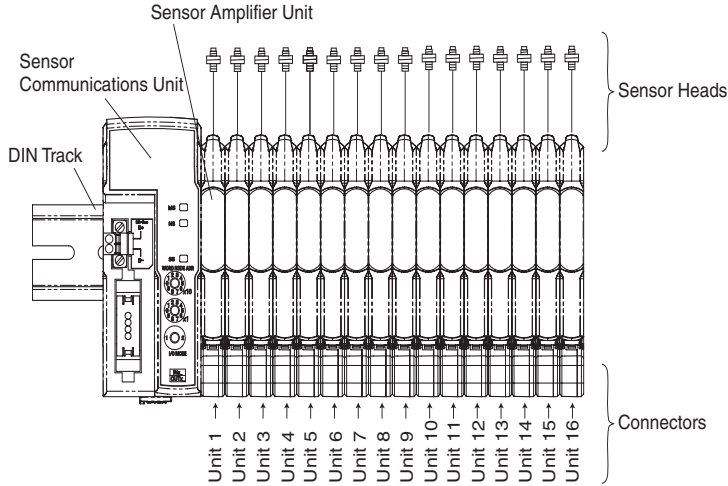
Unit numbers are in ascending order from the left.

The Sensor Communications Unit identifies the connected Sensor Amplifier Units according to their unit numbers.

Unit numbers of Sensor Amplifier Units are assigned to the units from unit number 1 starting from the Sensor Communications Unit.
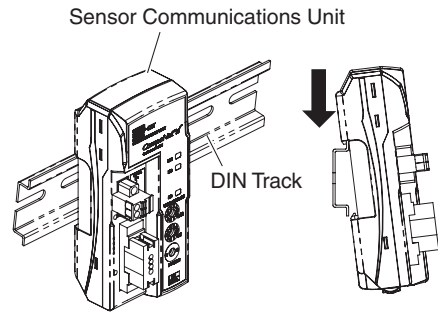
Each Sensor Amplifier Unit has two outputs: Sensor Output 1 and Sensor Output 2.

Installation

Installation Procedure

Use the following procedure to install the Units.

1. **Place the top part of the Unit onto the DIN Track.**

Sensor Communications Unit

DIN Track

2. **Press the bottom part of the Unit onto the DIN Track.**
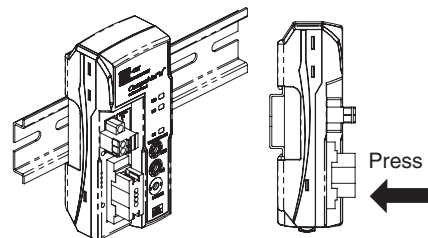
Press

3. **Remove the protective cap from the right side of the Sensor Communications Unit. Then, slide the Sensor Amplifier Unit, align the hooks on the connector with the Sensor Communications Unit, and press the Units together until you hear them lock into place.**
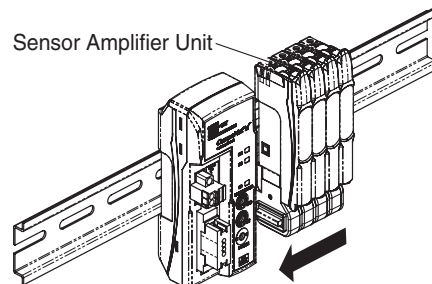
Sensor Amplifier Unit

Section 2 Installation and Connections

4. **Secure the enclosed DIN Track End Plates (PFP-M) onto the ends so that there is no space between them and the Units. Finally, attach the protective cap you removed in step 3 to the Sensor Amplifier Unit on the far right end.**

DIN Track
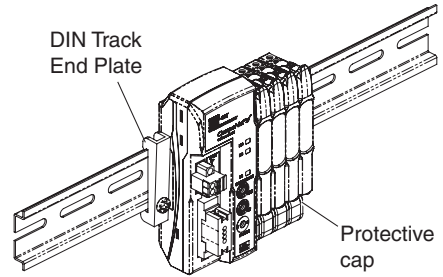End Plate

Protective
cap

CHECK! Do not reverse the order of steps 1 and 2, above. Doing so may reduce the mounting strength on the DIN Track.
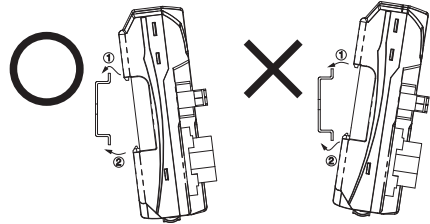
Do in order: step 1
and then step 2.

Do not perform
step 2 first.

After you have completed the above procedure, check to make sure that the E3NW-CRT is mounted securely into place.

Removal Procedure

Use the following procedure to remove the Unit.

1. **Slide the Sensor Amplifier Units to separate them from the Sensor Communications Unit.**
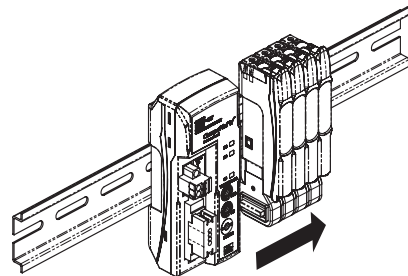
2. **Press in on the Sensor Communications Unit toward the DIN Track and lift up to remove it.**
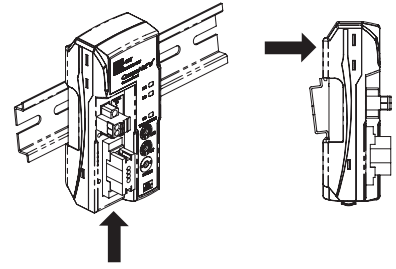
Section 3
CompoNet Communications Specifications

Overview of the Sensor Communications Unit with CompoNet Communications

Overview

A Digital Sensor Communications Unit with CompoNet Communications is used to output ON/OFF data from multiple Sensor Amplifier Units, monitor detection levels, write parameters, and perform operations via CompoNet.

ON/OFF outputs can be monitored with remote I/O communications. You can also read and write parameter with explicit messages.

You can register Dummy Sensors so that you do not need to change the I/O assignments even if the number of Sensor Amplifier Units changes. Explicit messages are also used to register Dummy Sensors.

When using this Digital Sensor Communications Unit, also refer to the following manuals:
CompoNet Master Units Operation Manual (Cat. No. W456), *CRT1-series CompoNet Slave Units and Repeater Unit Operation Manual* (Cat. No. W457), and
CJ1W-CRM21 CJ-series CompoNet Master Units Operation Manual for NJ-series CPU Unit (Cat. No. W493)

Section 3 CompoNet Communications Specifications

Overview of CompoNet Communications

● Remote I/O Communications

You can assign Sensor ON/OFF output data in the master input area to the E3NW-CRT Sensor Communications Unit.
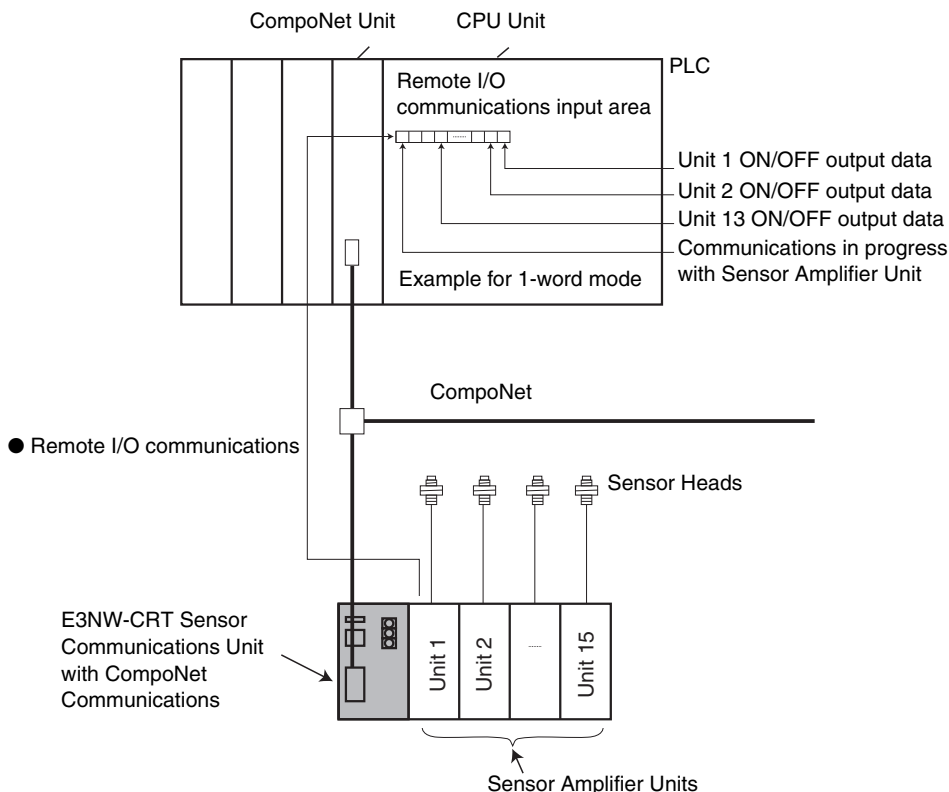
Mode	Allocated words	Communications	Number of connectable Sensors	Description
I/O Mode 1	2 words in input area	The following data is sent to the master. • ON/OFF output data for a maximum of 15 Sensors • Explicit Communications In-progress Flag • Sensor Error Status	15 max.	Use this mode when connecting to a CS-series, CJ-series, or NJ-series CompoNet master or other device that supports explicit communications.
I/O Mode 2	6 words in input area + 6 words in output area	The following data is sent to the master. • ON/OFF output data for a maximum of 16 Sensors • I/O command area data to control changing settings with I/O • I/O Command Execution In-progress Flag • Explicit Communications In-progress Flag • Sensor Error Status	16 max.	Use this mode when connecting to a GQ-CRM21 or other gateway that does not support explicit communications.

● **Explicit Message Communications**

You can read or write any parameters of the connected Sensors by sending explicit message commands to the E3NW-CRT Sensor Communications Unit.
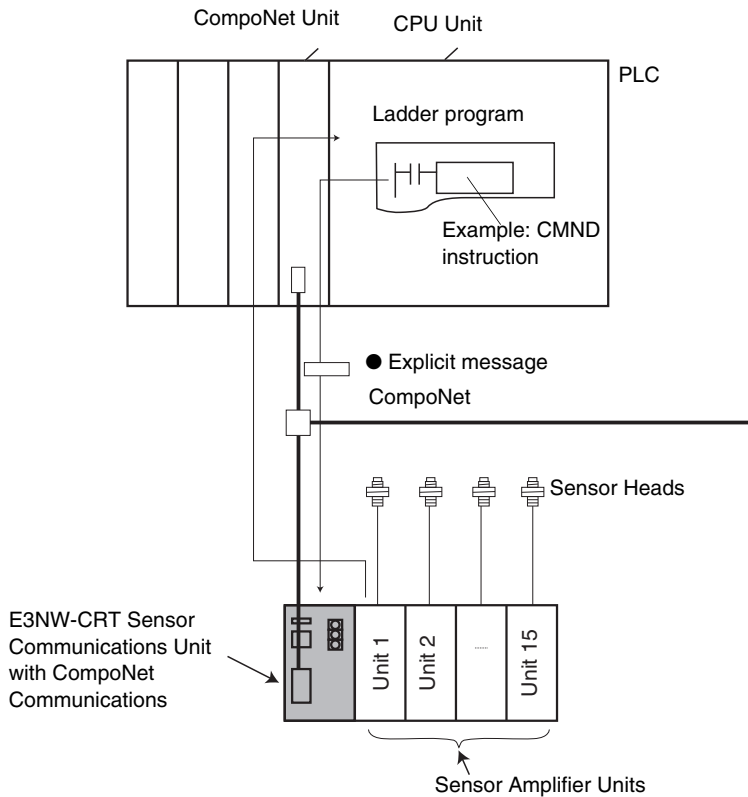
Type	Communications
Sending an Explicit Read/Write command	Reads or writes parameters, such as the detection levels or threshold values.
Sending an explicit operation command	Performs an operation such as tuning.

Remote I/O Communications Application Example

Example: Monitoring the ON/OFF Output State of Word 1 of Sensor Amplifier Unit 1

Using I/O Mode 1

The E3NW-CRT CompoNet node address is 00.

CompoNet Unit (CS1W-CRM21)
Fixed remote I/O communications allocations
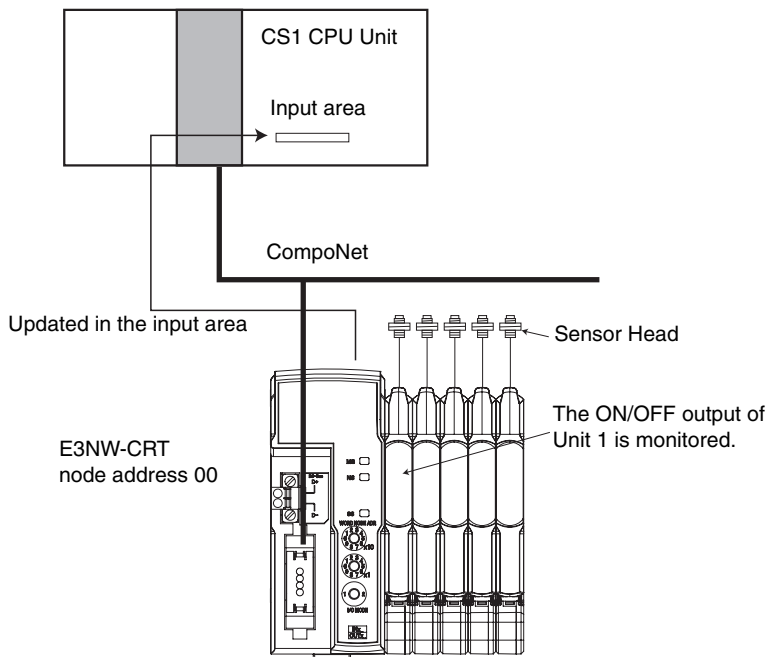
Input Area (Fixed Allocation Area 1)

Bits:	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word m																
Word m+1																

m = Word address for node address 00 in the input area

Sensor Amplifier Unit ON/OFF output status for Unit 1

Explicit Message Communications Application Example

Example: Writing a Threshold Value of 1,100 (64 hex) for IN1 (Sensor Amplifier Unit Output 1) of Unit 1

CompoNet Unit (CS1W-CRM21)
Unit 0 (Unit address: 20 hex)

CS1 CPU Unit

CMND instruction

CompoNet

Sensor Amplifier Unit

Explicit message

Set the sensor threshold value setting for IN1 (Sensor Output 1) of Unit 1.

E3NW-CRT node address 00
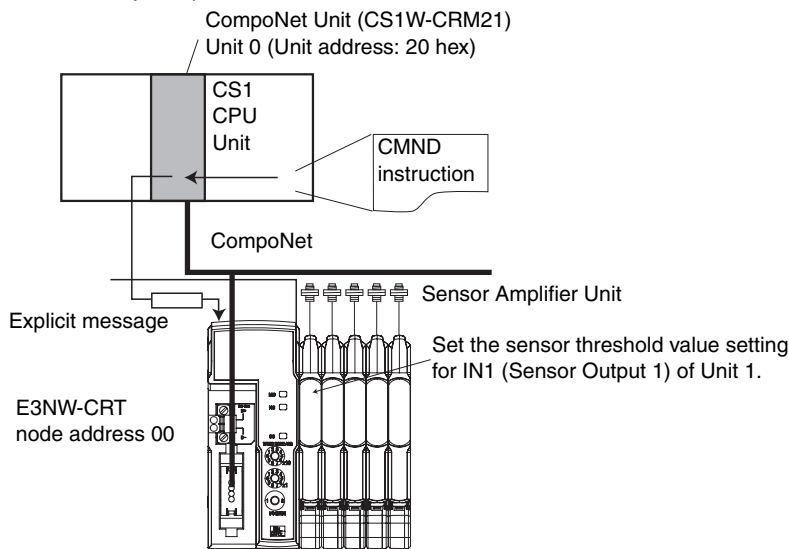
• Command Format for Setting Maximum Sensitivity

Send the following explicit message.

Destination node address	Service code	Class ID	Instance ID	Attribute ID	Data
1,000 hex	10 hex	9C hex	01 hex	72 hex	00000064 hex (100)
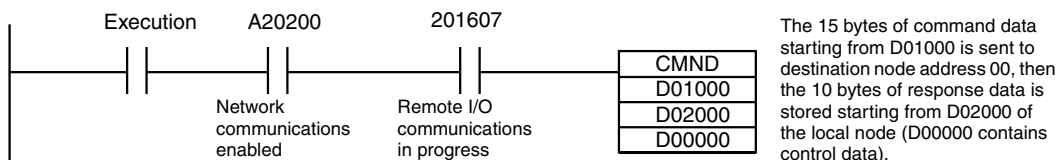
Execution   A20200   201607

Network communications enabled

Remote I/O communications in progress

CMND
D01000
D02000
D00000

The 15 bytes of command data starting from D01000 is sent to destination node address 00, then the 10 bytes of response data is stored starting from D02000 of the local node (D00000 contains control data).

S:	D01000	2	8	0	2	Command code
	D01001	1	0	0	0	Slave node address 00
	D01002	0	0	1	0	Service code 10 hex
	D01003	0	0	9	C	Class ID 9C hex
	D01004	0	0	0	1	Instance ID 01 hex (unit number)
	D01005	7	2	6	4	Attribute ID 72 hex + Data 64 hex (4th byte (least significant))
	D01006	0	0	0	0	Data 00 (3rd byte) + Data 00 (2nd byte)
	D01007	0	0	0	0	

D:	D02000					Set the first word address to store the response data.

C:	D00000	0	0	0	F	Command data bytes: 15
	D00001	0	0	0	A	Response data bytes: 10
	D00002	0	0	0	0	Destination network address 0
	D00003	0	0	2	0	Destination CompoNet node address: 00 hex
						Destination master unit address: 20 hex
	D00004	0	0	0	0	Response required, communications port number 0, number of retries: 0 hex
	D00005	0	0	C	8	Response monitoring timer: 30 seconds

Part Names

Part Names and Functions

DS-Bus communications connector
This connector connects to an E3NW-DS Distributed Sensor Unit.

Communications connector
This connector is for CompoNet communications.
When connecting to an E3NW-CRT, power is supplied from the communications connector. No power cable is required.

Indicators

Rotary switches

■ Indicators

The following table describes the indicators.

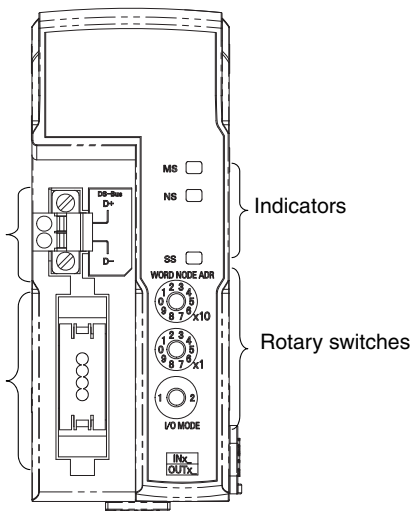| Indicator	Name	Indicator color	Status	Description
MS	Module status	Green	Lit	Normal operation
			Flashing	Not set up.
		Red	Lit	Fatal error
			Flashing	Non-fatal error
		---	OFF	Power OFF
NS	Network status	Green	Lit	CompoNet online and communications connected.
			Flashing	CompoNet online but not-connected.
		Red	Lit	CompoNet fatal communications error
			Flashing	CompoNet non-fatal communications error
		---	OFF	CompoNet offline and power OFF.
SS	Sensor communications status	Green	Lit	Communications with Sensor Amplifier Unit are normal.
		Red	Lit	Number of Sensor Amplifier Units is inconsistent.
		---	OFF	Waiting for communications with the Sensor Amplifier Units and power OFF.

● Normal Indicator Status

MS	Lit green when the Unit is normal.
NS	Lit green when network is normal (online and connected).
SS	Lit green when communicating with a Sensor Amplifier Unit.

■ Switches

● Rotary Switches

WORD NODE ADR

×10 CompoNet node address setting
Sets the CompoNet node address.
Range: 00 to 62 in I/O Mode 1, or 00 to 58 in I/O Mode 2 (Cannot be set to between 63 and 99.)

×1

Operating Mode Setting
Sets the operating mode. The data that is allocated in the master I/O area depends on the operating mode. Refer to *CompoNet Remote I/O Communications* on page 42 for details.

I/O MODE

I/O mode	Operating mode setting	Number of connectable Sensors
1	Mode for using explicit communications to monitor the detection levels and make settings.	15 max.
2	Mode for using the I/O command area to monitor detection levels and make settings.	16 max.

The E3NW-CRT automatically uses the same baud rate as the CompoNet master. There is no need to set the baud rate on a rotary switch.

Operating Procedure

Operating Procedure

Step	Item	Description
1	Mounting the Sensor Communications Unit to the DIN Track	Mount the Unit to the DIN Track. Mount the Sensor Amplifier Units to the DIN Track and then link them together. CHECK! To remove the Unit from the DIN Track, slide it on the DIN Track to disconnect it from the adjacent Units and then remove it from the DIN Track.
2	Connecting Sensor Amplifier Units to the Sensor Communications Unit	Slide the Sensor Communications Unit, align the clips on the edge, and press it onto the Sensor Amplifier Unit until you hear it lock into place.
3	Setting the Sensor Amplifier Units to [DETECTION] Mode	Use the mode switch to set the mode to [DETECTION] mode.
4	Connecting the CompoNet Communications Connector	Connect the CompoNet communications connector CHECK! The CompoNet communications power supply (V+, V-) provides DC power to the Sensor Communications Unit and all connected Sensor Amplifier Units.
5	Setting the Rotary Switches	Two upper switches — Set the CompoNet node address (0 to 62). One lower switch — Set the operating mode. (1 or 2) 1: I/O mode 1 Maximum number of connectable Sensors: 15 2: I/O mode 2 Maximum number of connectable Sensors: 16
6	DC Power Supply Turning ON the CompoNet Communications Power Supply (V+, V-)	• Set the Sensor Amplifier Units to [DETECTION] mode.
7	Checking the Indicators	MS — Lit green when the Unit is normal. NS — Lit green when network is normal (CompoNet online and connected). SS — Lit green during communications with a Sensor Amplifier Unit.
8	Starting Communications	
9	Registering Dummy Sensors	Register Dummy Sensors if required. Explicit messages are used to register Dummy Sensors.

CHECK! You can register Dummy Sensors so that you do not need to change I/O assignments even if the number of Sensor Amplifier Units changes. Explicit messages are also used to register Dummy Sensors.

CompoNet Remote I/O Communications

Assigning Data in the Master

E3NW-CRT data is stored in the input area of the CompoNet master.

Select one of the following two modes using the rotary switch:

I/O mode	Operating mode setting	Number of connectable Sensors
1	Mode for using explicit communications to monitor the detection levels and make settings.	15 max.
2	Mode for using the I/O command area to monitor detection levels and make settings.	16 max.

■ I/O Mode 1

In this mode, you can connect a maximum of 15 Sensor Amplifier Units. The input area uses two words in the master. The unit numbers of the Sensor Amplifier Units are automatically assigned to the Units from unit number 1 starting from the Unit that is next to Sensor Communications Unit (i.e., the leftmost Unit).

Word m

Bit	Description
00	Unit 1 ON/OFF output data 1
01	Unit 1 ON/OFF output data 2
02	Unit 2 ON/OFF output data 1
03	Unit 2 ON/OFF output data 2
04	Unit 3 ON/OFF output data 1
05	Unit 3 ON/OFF output data 2
06	Unit 4 ON/OFF output data 1
07	Unit 4 ON/OFF output data 2
08	Unit 5 ON/OFF output data 1
09	Unit 5 ON/OFF output data 2
10	Unit 6 ON/OFF output data 1
11	Unit 6 ON/OFF output data 2
12	Unit 7 ON/OFF output data 1
13	Unit 7 ON/OFF output data 2
14	Unit 8 ON/OFF output data 1
15	Unit 8 ON/OFF output data 2

Word m + 1

Bit	Description
00	Unit 9 ON/OFF output data 1
01	Unit 9 ON/OFF output data 2
02	Unit 10 ON/OFF output data 1
03	Unit 10 ON/OFF output data 2
04	Unit 11 ON/OFF output data 1
05	Unit 11 ON/OFF output data 2
06	Unit 12 ON/OFF output data 1
07	Unit 12 ON/OFF output data 2
08	Unit 13 ON/OFF output data 1
09	Unit 13 ON/OFF output data 2
10	Unit 14 ON/OFF output data 1
11	Unit 14 ON/OFF output data 2
12	Unit 15 ON/OFF output data 1
13	Unit 15 ON/OFF output data 2
14	BUSY: Explicit Communications in Progress with Sensor Amplifier Unit
15	S_ERR : Connection Error with Sensor Amplifier Unit

• Explicit Message Communications in Progress with Sensor Amplifier Unit:

This flag turns ON when explicit message communications are in progress with a Sensor Amplifier Unit.

Do not send a new explicit message to the Unit while this flag is ON.

• Communications Error with Sensor Amplifier Unit:

This flag turns ON when the registered number of connected Sensors does not match the number of Sensors available for communications, or when communications with a Sensor Amplifier Unit fails after a connection with the Sensor Amplifier Unit has been established.

■ I/O Mode 2

This mode uses the I/O area to check the Sensor Amplifier Unit's detection level and change settings.

This enables you to change Sensor Amplifier Unit settings even when connected to a master that does not support explicit messages.

In this mode, you can connect a maximum of 16 Sensor Amplifier Units.

The I/O area that is allocated in the master consists of six input words and six output words.

Input: Word m

Bit	Description
00	Unit 1 ON/OFF output data 1
01	Unit 1 ON/OFF output data 2
02	Unit 2 ON/OFF output data 1
03	Unit 2 ON/OFF output data 2
04	Unit 3 ON/OFF output data 1
05	Unit 3 ON/OFF output data 2
06	Unit 4 ON/OFF output data 1
07	Unit 4 ON/OFF output data 2
08	Unit 5 ON/OFF output data 1
09	Unit 5 ON/OFF output data 2
10	Unit 6 ON/OFF output data 1
11	Unit 6 ON/OFF output data 2
12	Unit 7 ON/OFF output data 1
13	Unit 7 ON/OFF output data 2
14	Unit 8 ON/OFF output data 1
15	Unit 8 ON/OFF output data 2

Input: Word m + 1

Bit	Description
00	Unit 9 ON/OFF output data 1
01	Unit 9 ON/OFF output data 2
02	Unit 10 ON/OFF output data 1
03	Unit 10 ON/OFF output data 2
04	Unit 11 ON/OFF output data 1
05	Unit 11 ON/OFF output data 2
06	Unit 12 ON/OFF output data 1
07	Unit 12 ON/OFF output data 2
08	Unit 13 ON/OFF output data 1
09	Unit 13 ON/OFF output data 2
10	Unit 14 ON/OFF output data 1
11	Unit 14 ON/OFF output data 2
12	Unit 15 ON/OFF output data 1
13	Unit 15 ON/OFF output data 2
14	Unit 16 ON/OFF output data 1
15	Unit 16 ON/OFF output data 2

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Word m + 2	*1	*2	*3	Reserved			*4	*5	Error Flags							
Word m + 3	Read Data															
Word m + 4	Read Data															
Word m + 5	Warning Flags*6															

*1 S_ERR : Connection Error with Sensor Amplifier Unit

This flag turns ON when the registered number of connected Sensors does not match the number of Sensors available for communications, or when communications with a Sensor Amplifier Unit fails after a connection with the Sensor Amplifier Unit has been established.

*2 BUSY_MSG: Explicit Message Communications in Progress with Sensor Amplifier Unit:

This flag turns ON when explicit message communications are in progress with a Sensor Amplifier Unit.

Do not send a new explicit message or use I/O to send a command to the Unit while this flag is ON.

*3 BUSY_IO: Command Execution in Progress with Sensor Amplifier Unit Using I/O

This output turns ON when remote I/O communications are in progress with a Sensor Amplifier Unit.

Do not send a new explicit message or use I/O to send a command to the Unit while this flag is ON.

*4 NORM_RES: Normal Response

Read the response data when this output turns ON.

*5 ERR_RES: Error Response

The command was not executed normally if this output is ON.

Check the contents of the command in the error response and try executing the command again.

*6 Warning Flags

The bits between 00 and 15 that correspond to the unit numbers of the Sensor Amplifier Units that are currently in a warning state turn ON.

Output Area	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word n	*7		Reserved							Sensor Output Number*8						
Word n + 1	Multi-command Destination Bit Specification*9															
Word n + 2	Command Code															
Word n + 3	Write Data															
Word n + 4	Write Data															
Word n + 5	Reserved															

*7 Execution Command Bit (trigger output)

When this output is turned ON, the Sensor Unit Number, Sensor Output Number, Command Code, and Write Data are read and the command is executed.

*8 Sensor Output Number

Specify the sensor output number. (Both = 00 hex, IN1 = 01 hex, IN2 = 02 hex)

Specify 00 hex for commands to the Sensor Communications Unit.

*9 Multi-command Destination Bit Specification

Specify the command destination.

Turn ON the bits between 00 and 15 that correspond to the unit numbers of the Sensor Amplifier Units.

You can specify multiple Sensor Amplifier Units for a write/execute command, but you can specify only one Sensor Amplifier Unit for a read command.

If bits 00 to 15 are all turned OFF for a write/execute command, the command is sent to all connected Sensor Amplifier Units.

● **Commands**

The following table lists the commands.

Description	Output 1 and 2, or Both	Read	Write	Execute	Applicable Sensor Amplifier Units		
					FA0	LA0	SA0
Sensor Communications Status	---	00	---	---	---	---	---
Number of Mounted Sensors	---	01	---	---	---	---	---
Sensor Power ON	---	---	---	05	---	---	---
Sensor Power OFF	---	---	---	04	---	---	---
Sensor Model	Both	29	---	---	OK	OK	OK
Read Detection Level	Outputs 1 and 2	20	---	---	OK	OK	OK
Continuous Read Detection Level	Outputs 1 and 2	21	---	---	OK	OK	OK
Read Peak Detection Level	Both	22	---	---	OK	OK	OK
Read Bottom Detection Level	Both	24	---	---	OK	OK	OK
Threshold Setting 1	Outputs 1 and 2	40	A0	---	OK	OK	OK
Threshold Setting 2	Both	41	A1	---	OK	OK	OK
Sensor Status	Both	28	---	---	OK	OK	OK
Zero Reset Level	Both	27	---	---	OK	OK	OK
Output Mode Setting	Outputs 1 and 2	42	A2	---	OK	OK	OK
Operating Mode	Outputs 1 and 2	44	A4	---	OK	OK	OK
Detection	Both	45	A5	---	OK	OK	OK
Timer Setting	Outputs 1 and 2	47	A7	---	OK	OK	OK
Timer Time 1	Outputs 1 and 2	48	A8	---	OK	OK	OK
Timer Time 2	Outputs 1 and 2	49	A9	---	OK	OK	OK
DPC Setting	Both	4A	AA	---	OK	OK	NA
Display Switch	Both	50	B0	---	OK	OK	OK
Reversed Display	Both	51	B1	---	OK	OK	OK
Channel Display	Both	---	---	B2	OK	OK	OK
Clear Channel Display	Both	---	---	B6	OK	OK	OK
Eco Mode	Both	53	B3	---	OK	OK	OK
Key Lock Setting	Both	54	B4	---	OK	OK	OK
Flash Display Setting	Both	---	---	B5	OK	OK	OK
Cancel Flash Display Setting	Both	---	---	B7	OK	OK	OK
Hysteresis Width Setting	Both	60	C0	---	OK	OK	OK
Hysteresis Width 1	Both	61	C1	---	OK	OK	OK
Hysteresis Width 2	Both	62	C2	---	OK	OK	OK
Keep Setting	Both	63	C3	---	NA	NA	OK
Hold Mode Setting	Both	64	C4	---	NA	NA	OK
Warning Output Level	Both	65	C5	---	OK	OK	NA
Maximum Sensitivity Tuning	Outputs 1 and 2	---	---	C6	OK	OK	NA
Zero Reset	Both	67	C7	---	OK	OK	OK

Description	Output 1 and 2, or Both	Read	Write	Execute	Applicable Sensor Amplifier Units		
					FA0	LA0	SA0
Light OFF	Both	---	---	C8	OK	OK	OK
Clear Light OFF	Both	---	---	DD	OK	OK	OK
Two-point Tuning First Point	Outputs 1 and 2	---	---	C9	OK	OK	OK
Two-point Tuning Second Point	Outputs 1 and 2	---	---	CA	OK	OK	OK
Position Tuning	Outputs 1 and 2	---	---	CB	OK	OK	NA
Full Auto Tuning Setup	Outputs 1 and 2	---	---	CC	OK	OK	OK
Execute Full Auto Tuning	Outputs 1 and 2	---	---	CD	OK	OK	OK
Percentage Tuning Setting	Outputs 1 and 2	6E	CE	---	OK	OK	NA
Percentage Tuning Level	Outputs 1 and 2	6F	CF	---	OK	OK	NA
Execute Percentage Tuning	Outputs 1 and 2	---	---	D0	OK	OK	NA
Power Tuning Setting	Both	71	D1	---	OK	OK	NA
Power Tuning Level	Both	72	D2	---	OK	OK	NA
Execute Power Tuning	Both	---	---	D3	OK	OK	NA
One-point Tuning	Outputs 1 and 2	---	---	D4	NA	NA	OK
Flashing	Both	---	---	D7	OK	OK	OK
Clear Flashing	Both	---	---	DE	OK	OK	OK
Initialize	Both	---	---	D8	OK	OK	OK
Self-Trigger Level	Both	79	D9	---	NA	NA	OK
Tuning without a Workpiece	Outputs 1 and 2	---	---	DA	NA	NA	OK
Background Suppression	Both	7B	DB	---	NA	NA	OK

● Command Data

Refer to *Command Descriptions and Data Formats* in *Section 5 Appendices* for details on read, write, and execute command data.

● Error Flags

The following table lists the error flags.

Error Flag	Description
01	A command that cannot be processed by the Sensor Amplifier Unit was specified.
02	A command was executed when the Sensor Amplifier Unit could not respond.
04	The command data value is outside the Sensor Amplifier Unit's allowable range.
08	A checksum error occurred.
10	The TRIGGER bit was turned OFF while execution of a command was in progress.
20	The command response timed out.
40	A command was sent to a disconnected Sensor Amplifier Unit An incorrect Sensor output number was sent. The command data value was outside the command's allowable range.

● **Command Timing Chart**

Read, Write, and Execute Commands
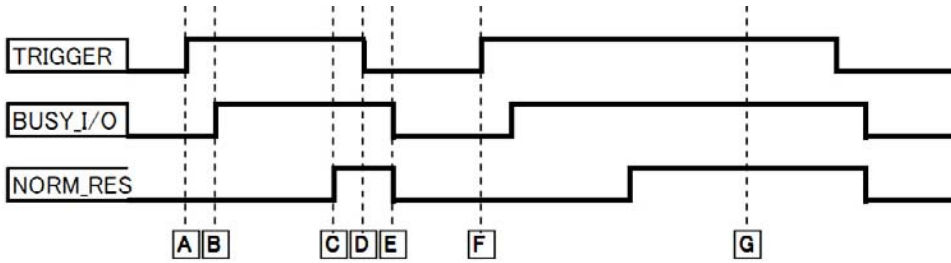
A: The TRIGGER signal from the host is turned ON. (Set the Unit Number, Sensor Channel, Command Code, and Command Data at the same time as you turn ON the TRIGGER signal.)

B: When the Sensor Communications Unit detects the ON TRIGGER signal from the host, it turns ON the BUSY signal.

C: When command processing is completed, the Sensor Communications Unit turns ON NORM_RES.

Read the Read Data at this time.

For a continuous detection level read command, the read data (i.e., the detection level) will be overwritten continuously in this state.

D: After processing is completed, turn OFF the TRIGGER signal.

E: When the TRIGGER signal is turned OFF, the BUSY and NORM_RES signals also turn OFF.

F: After the BUSY and NORM_RES turn OFF, the next command execute signal is turned ON.

G: BUSY and NORM_RES will remain ON until the host turns OFF the TRIGGER signal.
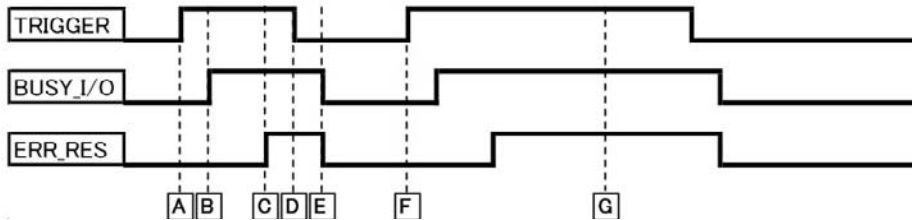
A: The TRIGGER signal from the host is turned ON. (Set the Unit Number, Sensor Channel, Command Code, and Command Data at the same time as you turn ON the TRIGGER signal.)

B: When the Sensor Communications Unit detects the ON TRIGGER signal from the host, it turns ON the BUSY signal.

C: An error was returned from the Sensor Amplifier Unit, so ERR_RES and the corresponding error flag are turned ON.

D: The host checks the error flag and turns OFF the TRIGGER signal.

E: When the TRIGGER signal is turned OFF, the BUSY and ERR_RES signals also turn OFF.

F: When the host detects that the BUSY and ERR_RES are turned OFF, it turns ON the next TRIGGER signal.

G: BUSY and ERR_RES will remain ON until the host turns OFF the TRIGGER signal.

Explicit Message Communications

You can read and write parameters for a specified Sensor Amplifier Unit by sending CompoNet explicit messages from the master to the Sensor Communications Unit. The Sensor Communications Unit processes the commands received from the master and returns responses. CompoNet explicit messages can be used in both I/O Mode 1 and I/O Mode 2.

Basic Format of Explicit Messages

The basic command and response formats are given below.

● Command Format

Destination network address	Service code	Class ID	Instance ID	Service data	
				Attribute ID	(Write Data)

Destination Node Address

  With two hexadecimal bytes, specify the node address of the Unit to which to send the explicit message (command).

Service Code, Class ID, Instance ID, and Attribute ID

  These parameters specify the command code, processing target, and processing details.

  With this Sensor Communications Unit, specify the Sensor unit number of the Sensor Amplifier Unit for which the command is intended as the Instance ID.

> CHECK! The specified numbers of bytes for the class ID, instance ID, and attribute ID depend on the master. When a message is sent from an OMRON CompoNet Master Unit, specify the class ID and instance ID in two bytes (four digits), and the attribute ID in one byte (two digits).

Write Data: This is not required for a read command.

● Response Format

• Normal

Number of received bytes	Source network address	Service code	Data

• Error

Number of received bytes	Source network address	Service code	Error code

Number of Received Bytes

  The number of bytes of data received from the source node address is returned in hexadecimal.

Source Network Address

  The node address of the node that sent the command is returned in hexadecimal.

Service Code

When the command is completed normally, the leftmost bit of the service code that is specified in the command is turned ON and the service code is stored as follows:

Command service code	Response service code
10 hex	90 hex
0E hex	8E hex
16 hex	96 hex
06 hex	86 hex
07 hex	87 hex
05 hex	85 hex

When an error message is returned for an explicit message, the returned service code will always be 94 hex.

Data: The read data is stored only when a read command has been sent.

Error Code: The error code for the explicit message.

Refer to *Error Codes* on page 59.

> • With this Sensor Communications Unit, some commands (such as power tuning commands) require time to be processed. Change the timer set value for these commands. Set the CompoNet message monitoring timer to 30 seconds or longer.
>
> Refer to *6-1-5 Message Monitoring Timer* in the *CS1W-CRM21/CJ1W-CRM21 CompoNet Master Units Operation Manual* (Cat. No. W456).

CHECK!

Read and Write Commands

Read and write commands read and write data to and from the Sensor Communications Unit or connected Sensor Amplifier Units.

The command and response formats when using an OMRON Master Unit are given below.

● Command Format

Destination network address	Service code	Class ID	Instance ID	Attribute ID	Write data (for write commands only)
*1 *2	000E (Read) 0010 (Write)		*3 *3		
2 bytes	2 bytes	2 bytes	2 bytes	1 byte	4 bytes

*1: I/O Mode 1 (Input Unit): 10 hex
    I/O Mode 2 (Mixed Unit): 30 hex

*2: Unit number of the Sensor Communications Unit

*3: When sending a command to a Multisensor Amplifier Unit, set the instance ID to 00FF hex and append the following bytes after the attribute ID.
    This does not apply to read commands.

Output 1/ Output 2	Multisensor No.	
*4	*5	*5
1 byte	2 bytes	

*4: Output 1 specification: Bit 0 ON (01 hex)
    Output 2 specification: Bit 1 ON (02 hex)
    Both outputs specified, to Communications Unit: All OFF (00 hex)

*5: Two bytes, where bit 0 corresponds to Unit 1 and the bit 15 corresponds to Unit 16, input in little endian format.
    Set all bits to 0 to specify all Units.
    Example: To specify Unit 1, specify 0001 hex with 01 00.
               To specify Unit 1 and Unit 3, specify 0005 hex with 05 00.
               To specify Unit 16, specify 8000 hex with 00 80.

● **Response Format**

• Normal

Number of received bytes	Destination network address	Service code	Read Data (read commands only)
		008E (Read) 0090 (Write)	
2 bytes	2 bytes	2 bytes	4 bytes

• Error

Number of received bytes	Destination network address	Service code	Error code
		0094	
2 bytes	2 bytes	2 bytes	4 bytes

■ Read and Write Commands

The following table lists the explicit message read and write commands.

Applicable Models

E3NX-FA0: FA0, E3NC-LA0: LA0, and E3NC-SA0: SA0

Instance IDs

If "Unit No./Output" is specified for the instance ID, use the following value: (Unit number - 1) $\times$ 2 + Output number.

The output numbers are sequential. Use 01 for output 1 of Unit 1, 02 for output 2 of Unit 1, 03 for output 1 of Unit 2, etc.

If "Unit No." is given for the instance ID, use the unit number.

The output numbers are sequential. Use 01 for Unit 1, 02 or Unit 2, 03 for Unit 3, etc.

| Explicit message | Function | Command | | | Applicable Sensor Amplifier Units | | |
		Class ID	Instance ID	Attribute ID	FA0	LA0	SA0
Sensor Communications Status	Reads the status of the Sensor Communications Unit.	9F	00	AA	---	---	---
Dummy Sensor Registration	Registers a Dummy Sensor.	9C	00	71	---	---	---
Dummy Sensor Response Setting	Sets the response to return when an explicit message is sent to a Dummy Sensor.	9C	00	70	---	---	---
Number of Mounted Sensors	Reads the number of connected Sensor Amplifier Units (including Dummy Sensors).	9F	00	C0	---	---	---
Sensor Warning Status	Reads the warning status of the Sensor Amplifier Unit.	9F	00	C1	---	---	---
Sensor Model	Reads the model of the Sensor Amplifier Unit.	9F	Unit No.	C9	OK	OK	OK
Read Detection Level	Reads the Detection Level of the Sensor Amplifier Unit.	9F	Unit No./ Output	B0	OK	OK	OK
Read Peak Detection Level	Reads the Peak Detection Level of the Sensor Amplifier Unit.	9F	Unit No.	B1	OK	OK	OK
Read Bottom Detection Level	Reads the Bottom Detection Level of the Sensor Amplifier Unit.	9F	Unit No.	B2	OK	OK	OK
Threshold Setting 1	Reads or writes Threshold Value 1 settings.	9C	Unit No./ Output	72	OK	OK	OK
Threshold Setting 2	Reads or writes Threshold Value 2 settings.	9C	Unit No.	CE	OK	OK	OK
Sensor Status	Reads the status of the Sensor Amplifier Unit.	9F	Unit No.	C8	OK	OK	OK
Zero Reset Level	Reads the Zero Reset Level.	9F	Unit No.	48	OK	OK	OK

Explicit message	Function	Command			Applicable Sensor Amplifier Units		
		Class ID	Instance ID	Attribute ID	FA0	LA0	SA0
Output Mode Setting	Reads or writes the Output Mode Setting.	9C	Unit No./ Output	CF	OK	OK	OK
Operating Mode	Reads or writes the Operating Mode settings.	9C	Unit No./ Output	20	OK	OK	OK
Detection	Reads or writes Detection Settings.	9C	Unit No.	21	OK	OK	OK
Timer Setting	Reads or writes the Timer Settings.	9C	Unit No./ Output	24	OK	OK	OK
Timer Time 1	Reads or writes Timer Time 1 settings.	9C	Unit No./ Output	25	OK	OK	OK
Timer Time 2	Reads or writes Timer Time 2 settings.	9C	Unit No./ Output	D1	OK	OK	OK
DPC Setting	Reads or writes the DPC Settings.	9C	Unit No.	D2	OK	OK	NA
Display Switch	Reads or writes the Display Switch Setting.	9C	Unit No.	26	OK	OK	OK
Reversed Display	Reads or writes the Reversed Display Setting.	9C	Unit No.	28	OK	OK	OK
Eco Mode	Reads or writes the Eco Mode Settings.	9C	Unit No.	45	OK	OK	OK
Key Lock Setting	Reads or writes the Key Lock Settings.	9C	Unit No.	50	OK	OK	OK
Hysteresis Width Setting	Reads or writes the Hysteresis Width Setting.	9C	Unit No.	D5	OK	OK	OK
Hysteresis Width 1	Reads or writes Hysteresis Width 1 settings.	9C	Unit No.	D6	OK	OK	OK
Hysteresis Width 2	Reads or writes Hysteresis Width 2 settings.	9C	Unit No.	D7	OK	OK	OK
Keep Setting	Reads or writes the Keep Settings.	9C	Unit No.	D8	NA	NA	OK
Hold Mode Setting	Reads or writes the Hold Mode Settings.	9C	Unit No.	D9	NA	NA	OK
Warning Output Level	Reads or writes the Warning Output Level settings.	9C	Unit No.	DA	OK	OK	NA
Zero Reset	Reads or writes the Zero Reset Settings.	9C	Unit No.	56	OK	OK	OK
Percentage Tuning Setting	Reads or writes the Percentage Tuning Settings.	9C	Unit No./ Output	DB	OK	OK	NA
Percentage Tuning Level	Reads or writes the Percentage Tuning Level settings.	9C	Unit No./ Output	DC	OK	OK	NA
Power Tuning Setting	Reads or writes the Power Tuning Settings.	9C	Unit No.	41	OK	OK	NA
Power Tuning Level	Reads or writes the Power Tuning Level settings.	9C	Unit No.	29	OK	OK	NA

Explicit message	Function	Command			Applicable Sensor Amplifier Units		
		Class ID	Instance ID	Attribute ID	FA0	LA0	SA0
Self-Trigger Level	Reads or writes the Self Trigger Level settings.	9C	Unit No.	E1	NA	NA	OK
Background Suppression	Reads or writes the Background Suppression settings.	9C	Unit No.	E4	NA	NA	OK

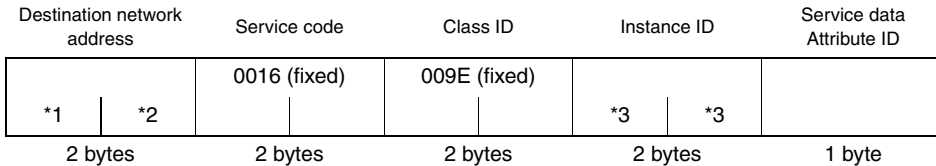The valid unit number range for the instance ID is 0001 to 0020 hex.

Refer to *Command Descriptions and Data Formats* in *Section 5 Appendices* for details on read and write command data.

Operation Execution Commands

Operation execution commands execute operations such as tuning for connected Sensor Amplifier Units.

The command and response formats when using an OMRON Master Unit are given below.

Operation execution commands do not have a 4-byte data area like read and write commands.

● **Command Format**

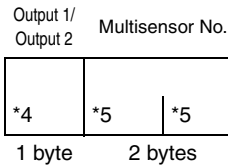| Destination network address		Service code	Class ID	Instance ID		Service data Attribute ID
		0016 (fixed)	009E (fixed)			
*1	*2			*3	*3	
2 bytes		2 bytes	2 bytes	2 bytes		1 byte

*1: I/O Mode 1 (Input Unit): 10 hex

I/O Mode 2 (Mixed Unit): 30 hex

*2: Unit number of the Sensor Communications Unit

*3: When sending a command to a Multisensor Amplifier Unit, set the instance ID to 00FF hex and append the following bytes after the attribute ID.

This does not apply to read commands.

Output 1/ Output 2	Multisensor No.	
*4	*5	*5
1 byte	2 bytes	

*4: Output 1 specification: Bit 0 ON (01 hex)

Output 2 specification: Bit 1 ON (02 hex)

Both outputs specified, to Communications Unit: All OFF (00 hex)

*5: Two bytes, where bit 0 corresponds to Unit 1 and the bit 15 corresponds to Unit 16, input in little endian format.

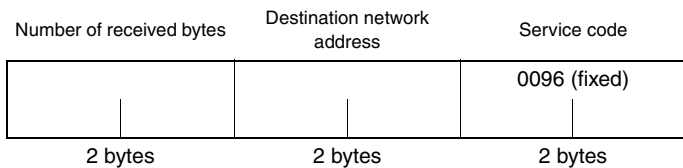Set all bits to 0 to specify all Units.

Example: To specify Unit 1, specify 0001 hex with 01 00.

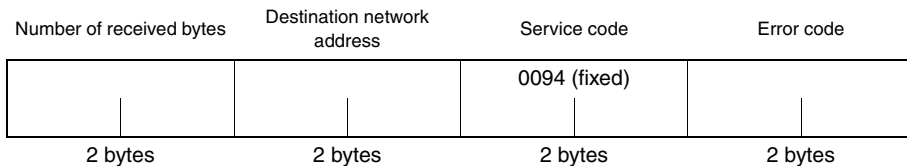To specify Unit 1 and Unit 3, specify 0005 hex with 05 00.

To specify Unit 16, specify 8000 hex with 00 80.

● **Response Format**

• Normal

Number of received bytes	Destination network address	Service code
		0096 (fixed)
2 bytes	2 bytes	2 bytes

• Error

Number of received bytes	Destination network address	Service code	Error code
		0094 (fixed)	
2 bytes	2 bytes	2 bytes	2 bytes

■ Operation Execution Commands

The following table lists the explicit message operation execution commands.

Applicable Models

E3NX-FA0: FA0, E3NC-LA0: LA0, and E3NC-SA0: SA0

Instance IDs

If "Unit No./Output" is specified for the instance ID, use the following value: (Unit number - 1) $\times$ 2 + Output number.

The output numbers are sequential. Use 01 for output 1 of Unit 1, 02 for output 2 of Unit 1, 03 for output 1 of Unit 2, etc.

If "Unit No." is given for the instance ID, use the unit number.

The output numbers are sequential. Use 01 for Unit 1, 02 or Unit 2, 03 for Unit 3, etc.

Explicit message	Function	Command			Applicable Sensor Amplifier Units		
		Class ID	Instance ID	Attribute ID	FA0	LA0	SA0
Sensor Power ON	Turns ON the power to the Sensor Amplifier Unit.	9E	00	71	OK	OK	OK
Sensor Power OFF	Turns OFF the power to the Sensor Amplifier Unit.	9E	00	70	OK	OK	OK
Channel Display	Displays the channel on the Sensor Amplifier Unit's display.	9E	Unit No.	D3	OK	OK	OK
Clear Channel Display	Cancels the channel display on the Sensor Amplifier Unit.	9E	Unit No.	D4	OK	OK	OK
Flash Display Setting	Flashes the Sensor Amplifier Unit's display.	9E	Unit No.	52	OK	OK	OK
Cancel Flash Display Setting	Stops flashing the Sensor Amplifier Unit's display.	9E	Unit No.	53	OK	OK	OK
Maximum Sensitivity Tuning	Performs maximum sensitivity tuning.	9E	Unit No./ Output	30	OK	OK	NA
Light OFF	Turns OFF the light.	9E	Unit No.	58	OK	OK	OK
Clear Light OFF	Turns ON the light.	9E	Unit No.	59	OK	OK	OK
Two-point Tuning First Point	Performs tuning for the first point for two-point tuning.	9E	Unit No./ Output	33	OK	OK	OK
Two-point Tuning Second Point	Performs tuning for the second point for two-point tuning.	9E	Unit No./ Output	34	OK	OK	OK
Position Tuning	Performs positioning tuning.	9E	Unit No./ Output	37	OK	OK	NA
Full Auto Tuning Setup	Starts full auto tuning setup.	9E	Unit No./ Output	35	OK	OK	OK
Execute Full Auto Tuning	Performs full auto tuning.	9E	Unit No./ Output	36	OK	OK	OK
Execute Percentage Tuning	Performs percentage tuning.	9E	Unit No./ Output	DD	OK	OK	NA
Execute Power Tuning	Performs power tuning.	9E	Unit No.	40	OK	OK	NA

| Explicit message	Function	Command			Applicable Sensor Amplifier Units		
		Class ID	Instance ID	Attribute ID	FA0	LA0	SA0
One-point Tuning	Performs one-point tuning.	9E	Unit No./ Output	DE	NA	NA	OK
Flashing	Flashes the light.	9E	Unit No.	DF	OK	OK	OK
Clear Flashing	Stops flashing of the light.	9E	Unit No.	E0	OK	OK	OK
Initialize	Resets all internal Sensor Amplifier Unit set values to their default settings.	9E	Unit No.	45	OK	OK	OK
Tuning without a Workpiece	Performs tuning without a workpiece.	9E	Unit No./ Output	E2	NA	NA	OK

*1:The valid unit number range for the instance ID is 0001 to 0020 hex.

Error Codes

Response code	Error name	Cause
08FF	Service not supported	An error was detected in the service code.
14FF	Invalid Attribute value	The specified attribute value is not supported. The written data is out of range. • The number of connected Sensors is not within between 1 and 16. • The number of Units specified for detection level monitoring is not between 1 and 16.
16FF	Object does not exist	The specified instance ID is not supported. • The unit number specified in the instance ID exceeds the number of connected Sensors.
15FF	Too much data	The data is longer than the specified size.
13FF	Not enough data	The data is shorter than the specified size.
0CFF	Object state conflict	The specified command cannot be executed. • An error occurred in communications with the Sensor Amplifier Unit. • The Sensor Amplifier Unit is not in Detection Mode. • A command was sent to perform second-point tuning for two-point tuning or positioning tuning without performing tuning for the first point. • An unsupported command was sent. (For example, a command to read digital values was sent to a Terminal Block Unit.)
20FF	Invalid Parameter	The specified operation execution data is not supported.
0EFF	Attribute not settable	A write service code was sent with a read-only attribute ID.

Explicit Message Functions Application Example

An example of sending explicit messages using the CS1W-CRM21 is given below.
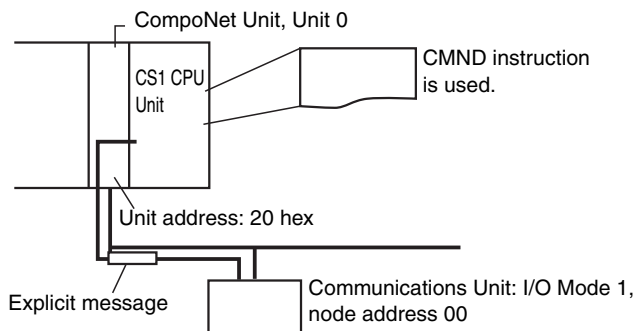
● **Operation**

- Threshold Value 1 for the Sensor Amplifier Unit is written to Unit 1 connected to the Sensor Communications Unit.
- The Send Explicit Message command (28 02) is used to read data.
- Command data is written starting from D01000. The response data is stored starting from D02000.
- If the command ends in an error, the completion code is stored in D00006 and the same command is resent.

● **Command Details**

Refer to the *CS/CJ-series Instructions Reference Manual* (Cat. No. W340) for detailed information on instructions.

CMND S D C

S: D01000 + 0: 2802 hex, Command code

+ 1: 1000 hex, Sensor Communications Unit address 1000 (I/O Mode 1, address 00)

+ 2: 0010 hex, Service code 10 hex

+ 3: 009C hex, Class ID 9C hex

+4: 0001 hex, Instance ID 01 hex

+5: 7264 hex, Attribute ID 72 hex + Write data (4th byte (least significant)) 64 hex

+ 6: 0000 hex, Write data (3rd byte) 00 hex + Write data (2nd byte) 00 hex

+ 7: 0000 hex, Write data upper byte 00 hex

D: D02000   : First response word

C: D00000 + 0: 000F hex, Number of command data bytes

+ 1: 000A hex, Number of response data bytes

+ 2: 0000 hex, Destination network address 00 hex

+ 3: 0020 hex, Destination node address 00 hex + Destination master unit address 20 hex

+ 4: 0000 hex, Response required, communications port number 0, number of retries: 0 hex

+5: 00C8 hex, Response monitoring time 30 seconds

● **Response**
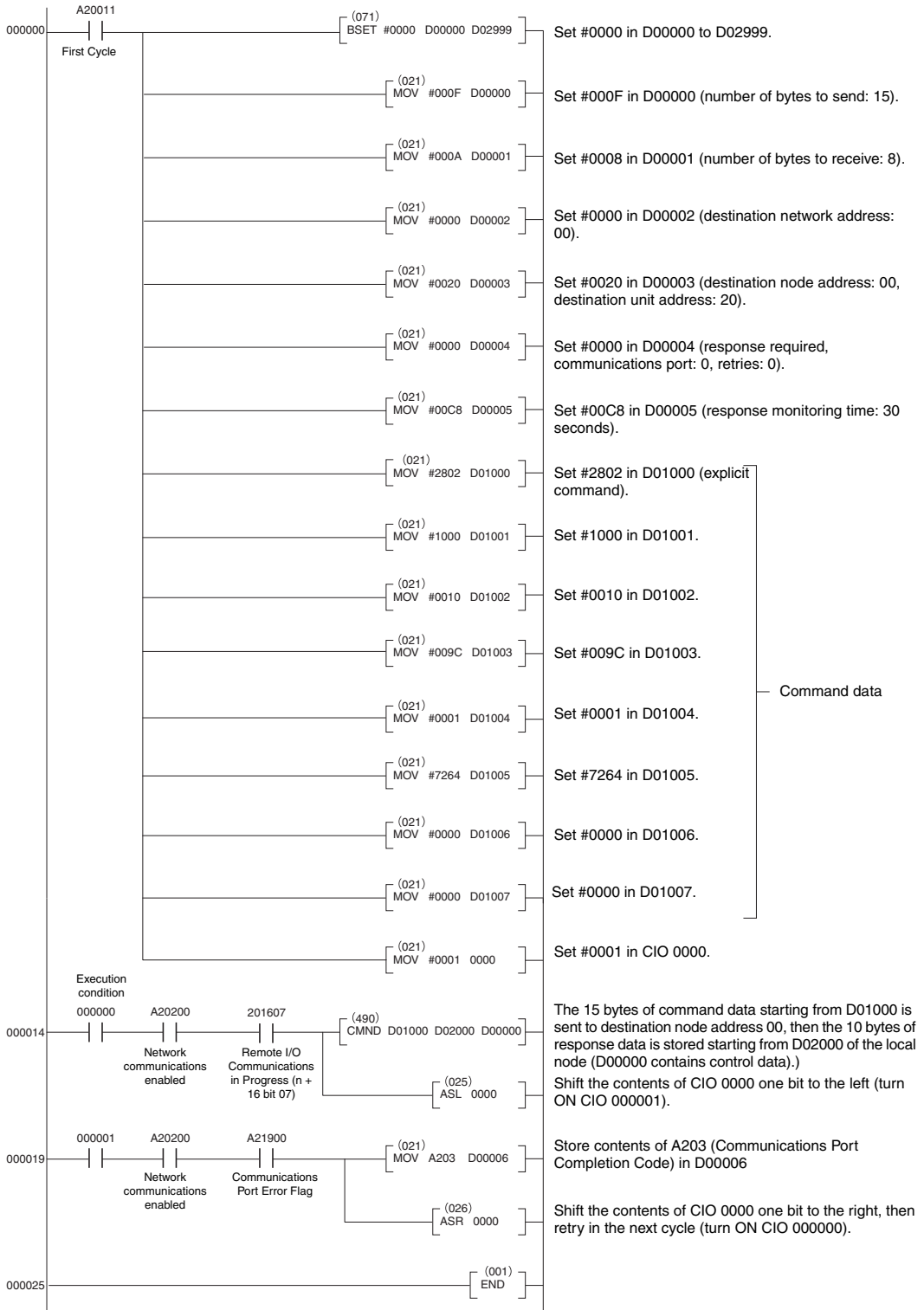
D02000 + 0: 2802 hex

+ 1: 0000 hex

+ 2: 0004 hex

+ 3: 1000 hex

+ 4: 0090 hex, Response source node address 0 (00 hex) + Normal completion 90 hex

● **Programming Example**

A20011 First Cycle — 000000	(071) BSET #0000 D00000 D02999 — Set #0000 in D00000 to D02999.
	(021) MOV #000F D00000 — Set #000F in D00000 (number of bytes to send: 15).
	(021) MOV #000A D00001 — Set #0008 in D00001 (number of bytes to receive: 8).
	(021) MOV #0000 D00002 — Set #0000 in D00002 (destination network address: 00).
	(021) MOV #0020 D00003 — Set #0020 in D00003 (destination node address: 00, destination unit address: 20).
	(021) MOV #0000 D00004 — Set #0000 in D00004 (response required, communications port: 0, retries: 0).
	(021) MOV #00C8 D00005 — Set #00C8 in D00005 (response monitoring time: 30 seconds).
	(021) MOV #2802 D01000 — Set #2802 in D01000 (explicit command).
	(021) MOV #1000 D01001 — Set #1000 in D01001.
	(021) MOV #0010 D01002 — Set #0010 in D01002.
	(021) MOV #009C D01003 — Set #009C in D01003.
	(021) MOV #0001 D01004 — Set #0001 in D01004.
	(021) MOV #7264 D01005 — Set #7264 in D01005.
	(021) MOV #0000 D01006 — Set #0000 in D01006.
	(021) MOV #0000 D01007 — Set #0000 in D01007.
	(021) MOV #0001 0000 — Set #0001 in CIO 0000.

Command data (D01000–D01007)

Execution condition

000014 000000 A20200 (Network communications enabled) 201607 (Remote I/O Communications in Progress (n + 16 bit 07)) (490) CMND D01000 D02000 D00000

The 15 bytes of command data starting from D01000 is sent to destination node address 00, then the 10 bytes of response data is stored starting from D02000 of the local node (D00000 contains control data).)

(025) ASL 0000 — Shift the contents of CIO 0000 one bit to the left (turn ON CIO 000001).

000019 000001 A20200 (Network communications enabled) A21900 (Communications Port Error Flag) (021) MOV A203 D00006

Store contents of A203 (Communications Port Completion Code) in D00006

(026) ASR 0000 — Shift the contents of CIO 0000 one bit to the right, then retry in the next cycle (turn ON CIO 000000).

000025 (001) END

END

S e c t i o n   4
Using the Distributed Sensor Unit

Models of Sensor Amplifier Units Connectable to a Distributed Sensor Unit

This section describes the models and features of the Sensor Amplifier Units that can be connected to an E3NW-DS Distributed Sensor Unit.

Type	Model number	Features
Smart Fiber Amplifier Unit	E3NX-FA0	A standard, easy to operate and easy to configure Fiber Amplifier Unit.
Smart Laser Amplifier Unit	E3NC-LA0	A Laser Sensor that can reliably detect workpieces even with a small spot diameter
Smart Laser Amplifier Unit (CMOS)	E3NC-SA0	A CMOS-type Laser Sensor that can reliably detect steps.

Section 4 Using the Distributed Sensor Unit

Mounting and Removing Distributed Sensor Units

This section describes how to mount an E3NW-DS Distributed Sensor Unit and Sensor Amplifier Units to a DIN Track and how to remove them.

Installation Procedure

Use the following procedure to install the Units.
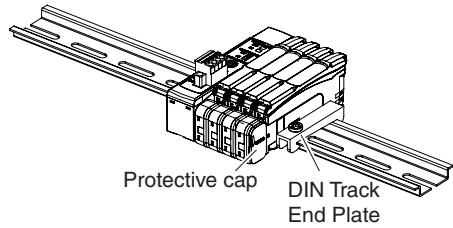
1. **Place the top part of the Unit onto the DIN Track.**
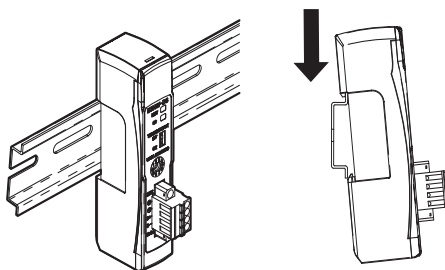
2. **Press the bottom part of the Unit onto the DIN Track.**
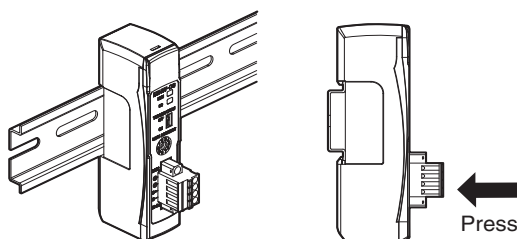
Press

3. **Remove the protective cap from the right side of the Distributed Sensor Unit. Then, slide the Sensor Amplifier Unit, align the hooks on the connector with the Distributed Sensor Unit, and press the Units together until you hear them lock into place.**
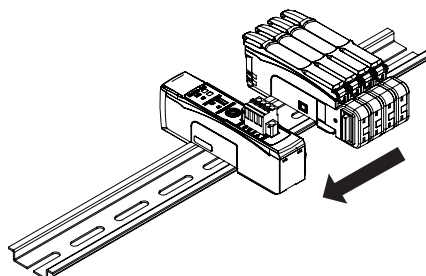
Section 4 Using the Distributed Sensor Unit

4. **Secure the enclosed DIN Track End Plates (PFP-M) onto the ends so that there is no space between them and the Units. Finally, attach the protective cap you removed in step 3 to the Sensor Amplifier Unit on the far right end.**

Protective cap   DIN Track
End Plate

CHECK! Do not reverse the order of steps 1 and 2, above. Doing so may reduce the mounting strength on the DIN Track.

Do in order: step 1 and then step

Do not perform step 2 first.
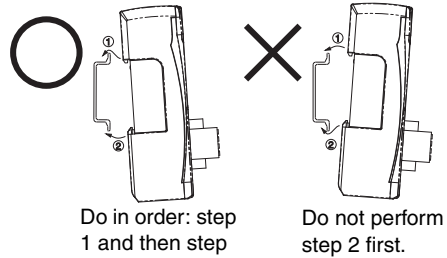
After you have completed the above procedure, check to make sure that the E3NW-DS is mounted securely into place.
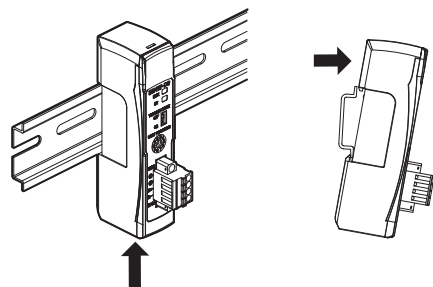
Removal Procedure

Use the following procedure to remove the Unit.

1. **Slide the Sensor Amplifier Units to separate them from the Distributed Sensor Unit.**
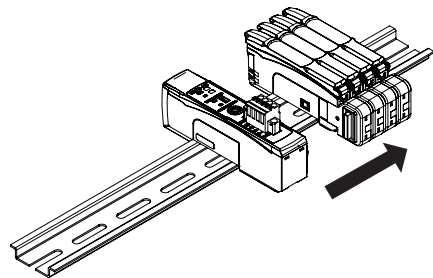
2. **Press in on the Distributed Sensor Unit toward the DIN Track and lift up to remove it.**

Installing a DS-Bus Network

This section describes how to install a DS-Bus network.

Precautions for Installing a DS-Bus Network

This section provides basic precautions for installing a DS-Bus network.

● Precautions for Installing a Network

- When installing a DS-Bus network, observe proper safety measures and follow all applicable standards. (Refer to JIS X5252 and *Electrical Equipment Technical Standards.*) We recommend that you have an engineer who is familiar with the proper safety measures and standards perform this work.
- Do not place any DS-Bus network devices near any devices that generate noise. If no other suitable location is available, place the device or devices in a metal case or take other measures to reduce ambient noise.

● Precautions for Installing Communications Cables

- Check the following conditions for the communications cables in the network.
    - Are there any disconnections?
    - Are there any short circuits?
    - Are there any problems with connector connections?
- When connecting to the communications connector on each device, be sure to insert the wires until they lock into place in the communications cable connector.
- Separate communications cables from high-voltage power lines and install them in ducts.
- Do not wire communications cables near devices that generate noise.
- Do not wire communications cables in high-temperature, high-humidity environments.
- Use in locations free of dirt, oil mist, and other foreign matter.
- There is a limit to the bending radius of communications cables. Refer to the specifications for your communications cables for information on allowable bending radii.
- You can connect up to eight Distributed Sensor Units to one Sensor Communications Unit.
- Keep the total length of DS-Bus communications cables (L1 + L2 + ... + Ln) to within 30 m.
- Turn ON the DS-Bus termination setting switch for the last Distributed Sensor Unit on the DS-Bus network. Turn this switch OFF for all other Distributed Sensor Units.

Section 4 Using the Distributed Sensor Unit

Preparing to Install the Network

Prepare the following equipment.

| Item	Remarks
DS-Bus communications cable	Use the recommended product that is given below.
Sensor Communications Unit DS-Bus Communications Connector	Enclosed with the E3NW Series Sensor Communications Unit.
Distributed Sensor Unit DS-Bus Communications Connector	Enclosed with the E3NW-DS Distributed Sensor Unit.
Ferrite core	Two are required. Enclosed with the E3NW-DS Distributed Sensor Unit.

● Recommended Part

Part	Manufacturer	Model	Contact information
Communications Cable	Bando Densen Co., Ltd.	ESVC 0.5X2C black	Kanetsu Co. Overseas Sales Division

Connecting the Communications Cables and Connectors

● E3NW-series Sensor Communications Unit

Connect the communications cable to the DS-Bus communications connector on the Communications Unit.

Clamp a ferrite core (enclosed with the Distributed Sensor Unit) to the communications cable.

Section 4 Using the Distributed Sensor Unit
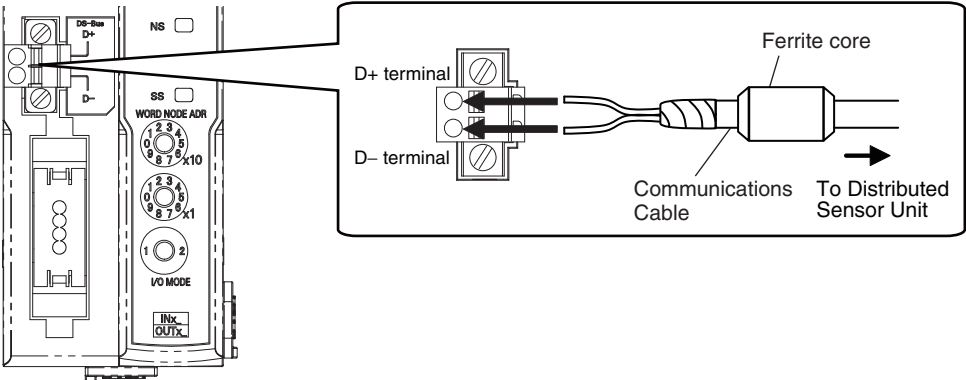
● **E3NW-DS Distributed Sensor Unit**

Connect the D+ and D− signal lines and shield wire of the communications cable to the power supply/communications connector on the Sensor Communications Unit. Clamp a ferrite core (enclosed with the Distributed Sensor Unit) to the communications cable. Connect the shield wire on the communications cable between Distributed Sensor Units to the −V terminal on only one of the Distributed Sensor Units. Do not connect the shield wire to both Units.
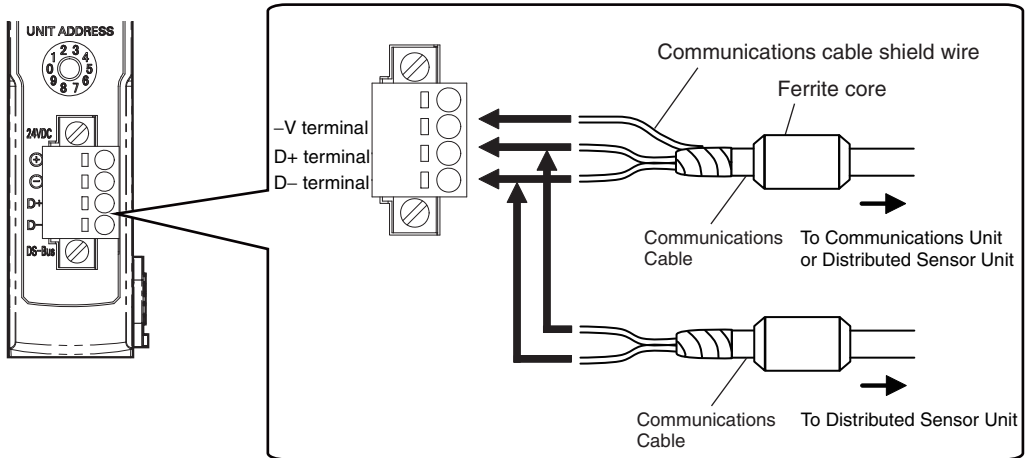
Distributed Sensor Unit Power Supply Specifications and Connections

Precautions on Supplying Unit Power

Consider the following points on the allowable current and voltage drop on cables and connectors and the placement of the power supply used to supply power to the Units.

● **Precaution on Cable Voltage Drop**

Make sure that the power supply voltage to the Distributed Sensor Unit farthest from the power supply is within the allowable fluctuation range.

● **Supplying Power to Units from Multiple Power Supplies**

Using multiple power supplies to supply power can allow you to reduce the line current, reduce voltage drop, and decrease cable size.

It also helps to maintain system stability in the event of a power supply problems.

● **Power Supply Problems**

You must decide how to place your power supplies and how to group them depending on whether you want to stop the entire system when a power supply problem occurs or if you want to avoid stopping the entire system when possible.

If you want to avoid stopping the entire system, install power supplies in multiple locations and divide the Distributed Sensor Units into groups.

This will also help to reduce voltage drop and enable you to use smaller cables.

Unit Power Supply Specifications

Use a standard power supply that meets the following specifications.

Item	Specification
Output voltage	24 VDC ±10%
Output ripple	600 mVp–p
Output current	Must be able to supply current that is higher than the total sum of the current consumed by all Slave Units.
Isolation	Between the outputs and AC power supply and between the outputs and case ground

We recommend using an OMRON S8JX-series power supply for the Unit power supply.

• When calculating the output current for the Unit power supply, always include the current consumption of the E3NW-DS and the current consumption of all Sensor Amplifier Units in the Unit power supply consumption current.

• Make sure that the power supply has sufficient capacity to handle the inrush current when the system is started.

Connecting the Unit Power Supply

Connect a cable from the Unit power supply (24 VDC) to the power supply connectors on each Distributed Sensor Unit.
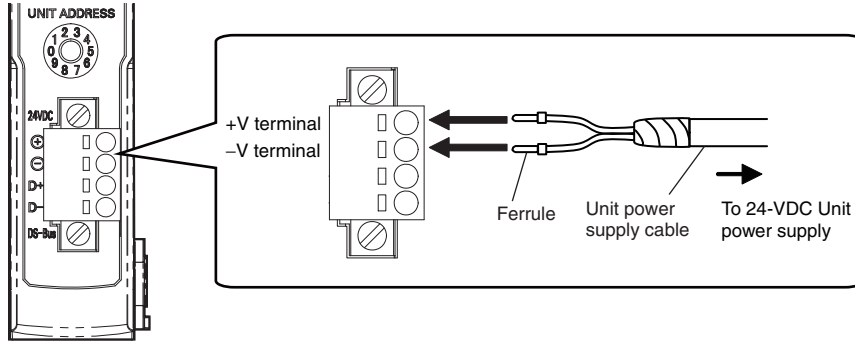
Securely attach ferrules to the Unit power supply cable wires.

● Recommended Parts

We recommend using the following ferrules for the Unit power supply cable.

Model number	Applicable wire size	Crimp tool	Manufacturer
AI0,5-10WH	0.5 mm^2/AWG20	CRIMPFOX UD6 (product No. 1204436) or CRIMPFOX ZA3 Series	Phoenix Contact Co., Ltd.
H0.5/16 orange	0.5 mm^2/AWG20	Crimper PZ1.5 (product No. 900599)	Weidmueller Japan Co., Ltd.

We recommend the following screwdriver for the removal of ferrules.

Model number	Manufacturer
XW4Z-00C	OMRON Corporation

General Specifications of the Distributed Sensor Unit

The following table gives the general specifications of the E3NW-DS Distributed Sensor Unit.

Item	Specifications and Performances
Unit power supply voltage	24 VDC (20.4 to 26.4 V)
Power and current consumption	2 W max. (Not including the power supplied to Sensors.), 80 mA max. (Not including the current supplied to Sensors.)
Noise resistance	Conforms to IEC 61000-4-4, 1 kV (power supply line).
Vibration resistance	10 to 60 Hz with a 0.7-mm double amplitude, 50 m/s^2 at 60 to 150 Hz, for 1.5 hours each in X, Y, and Z directions
Shock resistance	150 m/s^2 for 3 times each in X, Y, and Z directions
Withstand voltage	500 VAC at 50/60 Hz for 1 min
Insulation resistance	20 MΩ min. (at 500 VDC)
Ambient operating temperature	0 to 55°C *1
Operating ambient humidity	25% to 85% (with no condensation or icing)
Operating ambient environment	No corrosive gases.
Storage temperature	−30 to 70°C (with no condensation or icing)
Storage humidity	25% to 85% (with no condensation or icing)
Installation Procedure	35-mm DIN Track-mounting

*1.   Temperature Limitations Based on Number of Connected Amplifier Units:
   Groups of 1 or 2 Amplifier Units: 0 to 55°C, Groups of 3 to 10 Amplifier Units: 0 to 50°C

Section 4 Using the Distributed Sensor Unit

Hardware Specifications of the Distributed Sensor Unit

Status Indicators

These indicators show the current status of the E3NW-DS.
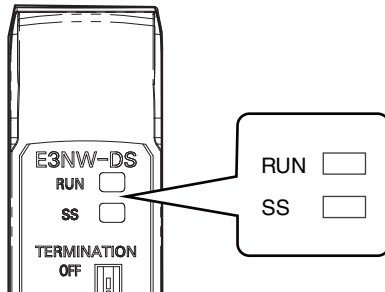
● RUN Indicator

This indicator shows the operating status.

Color	Status	Description
Green	OFF	The power is OFF or one of the following errors has occurred: Rotary switch setting error, WDT error (timeout), hardware error, or RAM check error
	Flashing	No access from the Sensor Communications Unit (for 3 seconds or longer).
	Lit	Normal operation or sensor not connected error

● SS Indicator

This indicator shows the Sensor connection status and various error information.

Color	Status	Description
	OFF	Power is OFF, initial confirmations are in progress after turning ON the power, or one of the following errors has occurred: Hardware error or sensor not connected error
Green	Lit	The number of connected Sensors does not match the number of connected Sensors setting or there was a RAM check error.
Red	Lit	One of the following errors has occurred: Number of connected Sensors verification error, too many Sensors connected error, RAM check error, or rotary switch setting error

Unit Address Setting Switch

This switch sets the Unit address (as a decimal number) of the E3NW-DS on the DS-Bus network.

The setting range is 1 to 8. (Factory setting: 1)

If multiple Distributed Sensor Units are connected to the Sensor Communications Unit, set the addresses of the Distributed Sensor Units in order starting from 1.
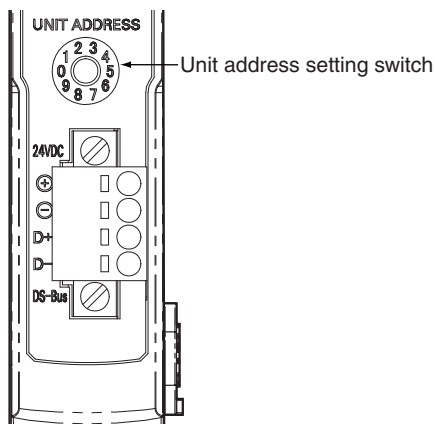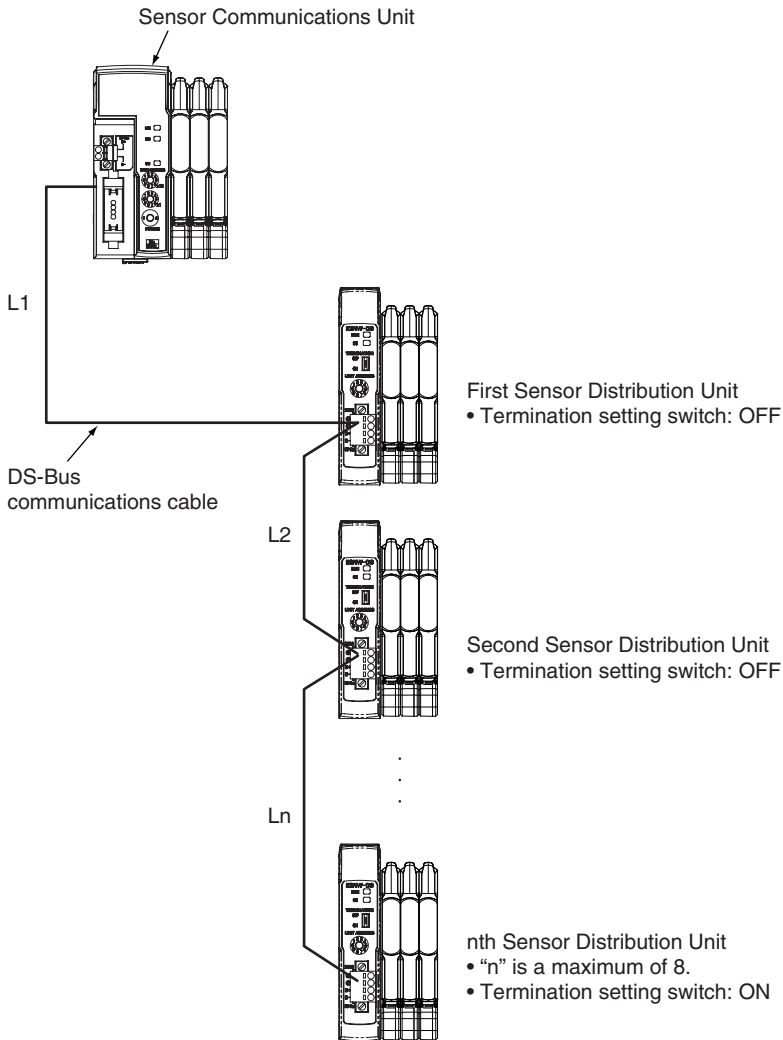

- The setting of the unit address switch is read only once when the power is turned ON. Changing this setting after the power is turned ON will have no effect until after the next time the power is turned ON.
- An error will occur and operation will not continue normally if the same Unit address is assigned to more than one Unit.

DS-Bus Network Termination Setting Switch

This switch turns the communications terminating resistance ON or OFF on the DS-Bus network.
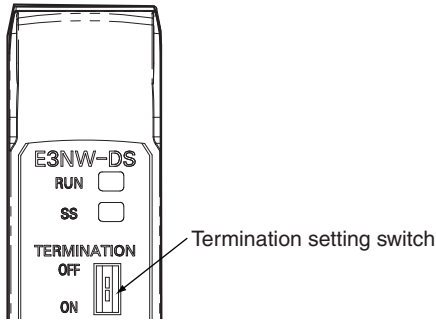

Termination setting switch

Turn ON the DS-Bus termination setting switch for the last Distributed Sensor Unit on the DS-Bus network. Turn this switch OFF for all other Distributed Sensor Units. This is shown in the following figure.

Sensor Communications Unit

L1

First Sensor Distribution Unit
• Termination setting switch: OFF

DS-Bus
communications cable

L2

Second Sensor Distribution Unit
• Termination setting switch: OFF

Ln

nth Sensor Distribution Unit
• "n" is a maximum of 8.
• Termination setting switch: ON

Communications and Power Supply Connector

Connect the power cable from the Unit power supply and DS-Bus communications cable to this connector.

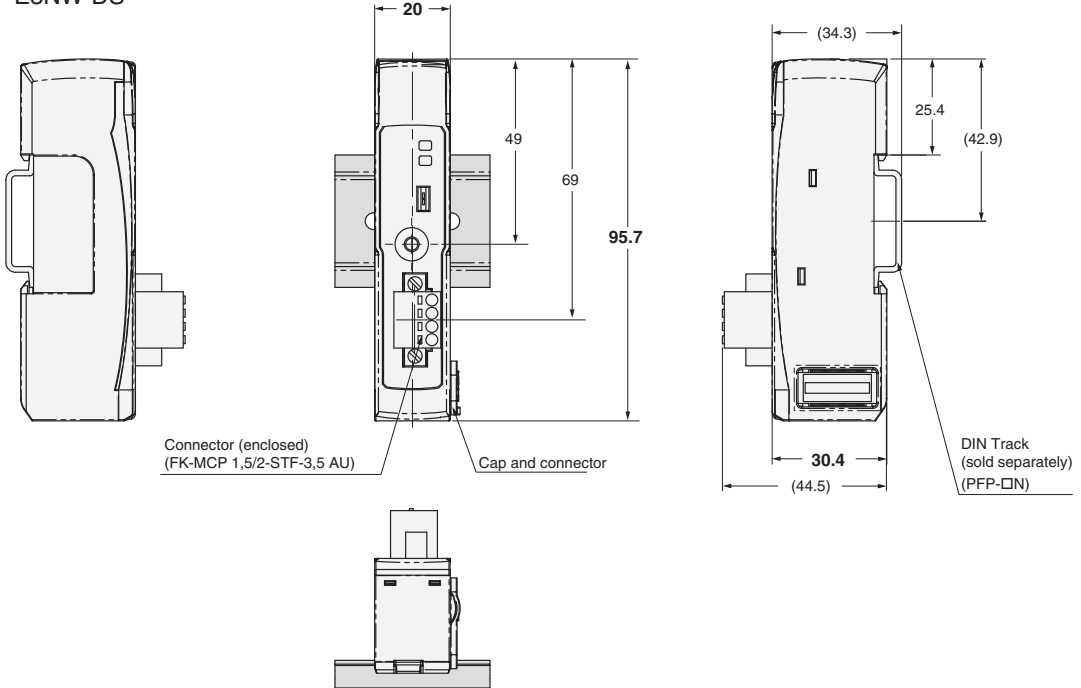• Connector type: Four-pin spring cage connector with lock screws

Name	Specification
+V	24 VDC
−V	0 VDC
D+	Communications data signal +
D−	Communications data signal −
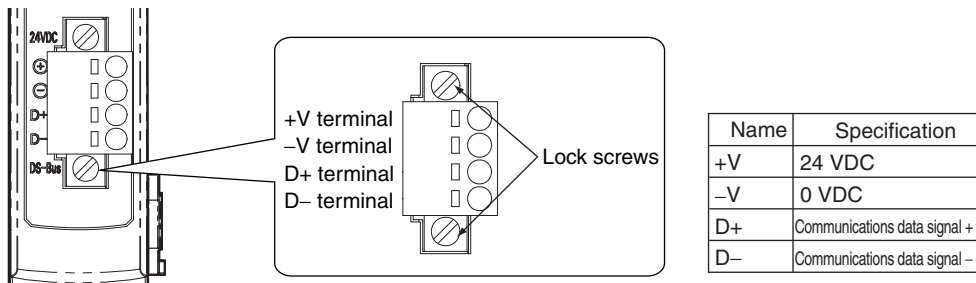
• Supported ferrule diameter: 0.25 to 0.5 mm^2 (AWG24 to AWG20)
  (Use ferrules with insulating sleeves.)

Refer to *Connecting the Unit Power Supply* on page 72 for the recommended ferrules.

External Dimensions of the Distributed Sensor Unit

E3NW-DS

Connector (enclosed)
(FK-MCP 1,5/2-STF-3,5 AU)

Cap and connector

20

49

69

95.7

(34.3)

25.4

(42.9)

30.4

(44.5)

DIN Track
(sold separately)
(PFP-□N)

S e c t i o n 5
Appendices

Command Descriptions and Data Formats

This section describes the commands and data formats for the Sensor Communications Unit.

The data formats are the same for explicit message communications and I/O command communications in I/O Mode 2. However, when using explicit messages, 4-byte data is expressed in little endian format. (For example, data such as 00 00 12 34 would be expressed as 34 12 00 00.)

● Sensor Communications Status

This command reads the status of consistency in the number of connected Sensor Amplifier Units and the status of communications with the Sensor Amplifier Units.

Bit	Description	Data
00 to 04	Number of Mounted Sensors	Given in hexadecimal.
05 to 07	No applicable data	Always 0
08 to 12	Number of Sensors available for communications	Given in hexadecimal.
13	No applicable data	Always 0
14	Inconsistent Number of Sensor Amplifier Units	0: Consistent number of Sensor Amplifier Units 1: Inconsistent number of Sensor Amplifier Units
15	No applicable data	Always 1

• Number of Mounted Sensors

The number of mounted Sensors that was recognized at startup is given in hexadecimal.

• Number of Sensors Available for Communications

The number of Sensors that is currently available for communications is given in hexadecimal. If Dummy Sensors have been registered, this value will be the sum of the actual number of Sensors available for communications plus all registered Dummy Sensors.

• Inconsistent Number of Sensor Amplifier Units

This bit turns ON if a communications error occurs after communications are established with a Sensor Amplifier Unit (e.g., if the Sensor Amplifier Unit or Distributed Sensor Unit is disconnected).

● **Number of Mounted Sensors**

This command reads the current number of Sensors, including Dummy Sensors.

Bit	Description	Data
00 to 04	Number of Mounted Sensors	Data range: 0 (00000000 hex) to 16 (00000010 hex)
05 to 31	No applicable data	Always 0

● **Sensor Warning Status**

This command reads the Sensor warning status of the Sensor Amplifier Unit.

When a Sensor Amplifier Unit enters the warning state, the bit that corresponds to the unit number of the Sensor Amplifier Unit will change to 1. During normal operation, the bit is 0.

When one of the bits between 08 and 15 in the Sensor Status of the Sensor Amplifier Unit turns ON, a warning has occurred.

This does not apply for I/O commands.

Bit	Description	Data
00 to 15	Sensor Warning Status	Each bit: 0: Sensor warning OFF 1: Sensor warning ON
16 to 31	No applicable data	Always 0

● **Sensor Power ON**

This command turns ON the Sensor power supply for all Sensor Amplifier Units connected to the Communications Unit.

This does not apply to Sensor Amplifier Units that are connected to a Distributed Sensor Unit.

● **Sensor Power OFF**

This command turns OFF the Sensor power supply for all Sensor Amplifier Units connected to the Communications Unit.

This does not apply to Sensor Amplifier Units that are connected to a Distributed Sensor Unit.

Section 5 Appendices

● **Dummy Sensor Response Setting**

This command registers a Dummy Sensor.

If a Dummy Sensor is registered as Unit 1 (i.e., if bit 00 is 1), the actual first Unit (i.e., the leftmost Sensor Amplifier Unit) will be Unit 2.

You must restart the Sensor Communications Unit for any changes to the Dummy Sensor Settings to take affect.

This setting cannot be changed via I/O commands in I/O Mode 2.

Bit	Description	Data
00 to 15	Dummy Settings	Each bit: 0: Clear Dummy Sensor 1: Register Dummy Sensor
16 to 31	No applicable data	Always 0

● **Dummy Sensor Response Setting**

You can specify the response to return when an explicit message is sent to a Dummy Sensor.

If you select to return a normal completion instead of an error completion, 0000 will be returned for any read command sent to a Dummy Sensor.

This setting cannot be changed via I/O commands in I/O Mode 2.

Bit	Description	Data
00	Response Mode	0: Return a normal completion instead of an error completion. 1: Return an error completion.
01 to 31	No applicable data	Always 0

● **Sensor Model**

This command reads the model of the Sensor Amplifier Unit that corresponds to the specified unit number.

Data	Description
0160 hex	E3NX-FA0
0260 hex	E3NC-LA0
0360 hex	E3NC-SA0

● **Read Detection Level**

This command reads the detection level (incident light level) of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Read Detection Level	Data range: −1,999 (FFFFF831 hex) to 9,999 (0000270F hex)

● Continuous Read Detection Level

This command continuously reads the Detection Level (incident light level) of the Sensor Amplifier Unit that corresponds to the specified unit number and output number. This is not supported by explicit messages.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Read Detection Level	Data range: −1999 (FFFFF831 hex) to 9999 (0000270F hex)

● Read Peak Detection Level

This command reads the Peak Detection Level (incident light level) of the Sensor Amplifier Unit that corresponds to the specified unit number.

To read the peak detection level, you must select the input peak minimum value and interrupted light bottom maximum value [P-b] for the Display Switch Setting.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Read Peak Detection Level	Data range: −1999 (FFFFF831 hex) to 9999 (0000270F hex)

● Read Bottom Detection Level

This command reads the Bottom Detection Level (incident light level) of the Sensor Amplifier Unit that corresponds to the specified unit number.

To read the Bottom Detection Level, you must select the input peak minimum value and interrupted light bottom maximum value [P-b] for the Display Switch Setting.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Read Bottom Detection Level	Data range: −1999 (FFFFF831 hex) to 9999 (0000270F hex)

● Threshold Setting 1

This command reads or writes Threshold Value 1 of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Threshold Value 1 is the threshold value in normal detection mode or the low threshold value in area detection mode.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Threshold Setting 1	Data range: −1999 (FFFFF831 hex) to 9999 (0000270F hex)

CHECK!   Do not execute any write instructions that exceed the allowable data range for each model.

● **Threshold Setting 2**

This command reads or writes Threshold Value 2 of the Sensor Amplifier Unit that corresponds to the specified unit number.

Threshold Value 2 is the high threshold value in area detection mode.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Threshold Setting 2	Data range: −1999 (FFFFF831 hex) to 9999 (0000270F hex)

Do not execute any write instructions that exceed the allowable data range for each model.

CHECK!

● **Sensor Status**

This command reads the sensor status of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Sensor status
00	Normal operation (For normal operation, this bit is always 1. If any bit after 08 changes to 1, this bit changes to 0.)
01	DPC status (DPC ON: 1, ST OFF: 0)
02	Smart Tuning status (ST ON: 1, ST OFF: 0)
03 to 07	Always 0 (not used).
08	DPC error (FA0/LA0)
09	EEPROM error (all models)
10	Load short-circuit error (all models)
11	Head-related error (SA0)
12 to 31	Always 0 (not used).

● **Zero Reset Level**

This command reads the zero reset level of the Sensor Amplifier Unit that corresponds to the specified unit number.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Zero Reset Level	Data range: −9999 (FFFFD8F1 hex) to 9999 (0000270F hex)

● Output Mode Setting

This command reads or writes the Output Mode of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Bit	Description	Data	
		Output 1	Output 2
00 or 01	Output Mode	0: Normal detection mode 1: Area detection mode 2: Do not use. 3: Hold mode (SA0 only)	0: Normal detection mode 1: Alarm output mode (FA0/LA0) 2: Error output mode
02 to 31	No applicable data	Not used.	Not used.

If a measurement error occurs in hold mode, the previous value is retained.

● Operating Mode

This command reads or writes the Operating Mode of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Bit	Description	Data
00	Operating Mode	0: Light ON 1: Dark ON
01 to 31	No applicable data	Always 0

● Detection

This command sets the Operating Mode of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Detection Mode	0: SHS (Super-high-speed Mode), 1: HS (High-speed Mode),
01		2: STND (Standard Mode), 3: GIGA (High-resolution Mode)
02 to 31	No applicable data	Always 0

● Timer Setting

This command sets the timer of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Bit	Description	Data
00 to 02	Timer Setting	0: Timer OFF 1: OFFD (OFF delay) 2: ON-D (ON delay) 3: SHOT (one-shot timer) 4: ONOFF (ON delay + OFF delay)
03 to 31	No applicable data	Always 0

● **Timer Time 1**

This command reads or writes Timer Time 1 of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Timer Time 1 is assigned to the ON delay or one-shot timer.

Bit	Description	Data
00 to 15	Timer Time 1	Data range: 1 (00000001 hex) to 9999 (0000270F hex)
16 to 31	No applicable data	Always 0

● **Timer Time 2**

This command reads or writes Timer Time 2 of the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Timer Time 2 is assigned to the OFF delay timer.

Bit	Description	Data
00 to 15	Timer Time 2	Data range: 1 (00000001 hex) to 9999 (0000270F hex)
16 to 31	No applicable data	Always 0

● **DPC Setting**

This command sets the DPC of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Operating Mode	0: DPC OFF 1: DPC ON
01 to 31	No applicable data	Always 0

● **Display Switch**

This command sets the display on the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Display Switch	0: Threshold value/detection level [Std]
01		1: Detection level margin for the threshold value [PEr]
02		2: Incident light peak minimum value and interrupted light bottom maximum value [P-b]
03		3: Bar display [bAr]
		4: Peak detection level [PEAK]
		5: Channel number and detection level [ch]
		6: Change finder [CFdr] (FA0/LA0)
04 to 07	No applicable data	Always 0
09	Display Switch	0: Solution Viewer OFF
		1: Solution Viewer ON
10 to 31	No applicable data	Always 0

"Detection level" in this table is the amount of incident light to the Sensor Amplifier Unit or the amount of displacement.

*   The display that is set in bits 00 to 03 is displayed when an Amplifier Unit operation is performed after setting up the Solution Viewer.

   Example: Set the Display Switch Setting to 00010000 hex, change to the Solution Viewer display, and perform an Amplifier Unit operation. The threshold value/detection level [Std] will be displayed.

*   The Solution Viewer does not apply to the SA0.

● **Reversed Display**

This command reverses the display on the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Reversed Display	0: Reversed display OFF
		1: Reversed display ON
01 to 15	No applicable data	Always 0

● **Channel Display**

This command sets the channel display of the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Clear Channel Display**

This command clears the channel display of the Sensor Amplifier Unit that corresponds to the specified unit number.

Section 5 Appendices

● **Eco Mode**

This command sets the Eco Mode of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Eco Mode	0: Eco Mode OFF 1: Eco Mode ON 2: Eco Mode LO
02 to 31	No applicable data	Always 0

● **Key Lock Setting**

This command sets the key lock of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Key Lock Setting	0: Key lock OFF 1: Key lock ON
01 to 31	No applicable data	Always 0

● **Flash Display Setting**

This command sets the Flash Display Setting of the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Cancel Flash Display Setting**

This command cancels the Flash Display of the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Hysteresis Width Setting**

This command sets the Hysteresis Width of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Hysteresis Width Setting	0: Standard 1: User setting
01 to 31	No applicable data	Always 0

● **Hysteresis Width 1**

This command sets Hysteresis Width 1 of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00 to 31	Hysteresis Width 1	Data range: 0 (00000000 hex) to 9999 (0000270F hex)

● **Hysteresis Width 2**

This command sets Hysteresis Width 2 of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00 to 31	Hysteresis Width 2	Data range: 0 (00000000 hex) to 9999 (0000270F hex)

● **Keep Setting**

This command sets the Keep Setting of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Keep Setting	0: Keep OFF 1: Keep ON
01 to 31	No applicable data	Always 0

● **Hold Mode Setting**

This command sets the hold mode of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Hold Mode Setting	0: Peak 1: Bottom
01 to 31	No applicable data	Always 0

● **Warning Output Level**

This command sets the Warning Output Level of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00 to 31	Warning Output Level	Data range: 0 (00000000 hex) to 100 (00000064 hex)

● **Maximum Sensitivity Tuning**

The command executes maximum sensitivity tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.
This must be executed at least 3 seconds after the full auto tuning setup is performed.

Section 5 Appendices

● **Zero Reset**

This command sets the Zero Reset of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Zero Reset	0: Zero reset OFF 1: Zero reset ON
01 to 31	No applicable data	Always 0

● **Light OFF**

This command turns OFF the light on the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Clear Light OFF**

This command turns ON the light on the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Two-point Tuning First Point**

This command executes tuning for the first point of two-point tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

● **Two-point Tuning Second Point**

This command executes tuning for the second point of two-point tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.
Tuning for the first point of two-point tuning must be executed first.

● **Position Tuning**

The command executes position tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.
Tuning for the first point of two-point tuning must be executed first.

● **Full Auto Tuning Setup**

This command executes the full auto tuning setup for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

● **Execute Full Auto Tuning**

This command executes full auto tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.
Wait at least 3 seconds after the full auto tuning setup is executed.

● **Percentage Tuning Setting**

This command sets Percentage Tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Bit	Description	Data
00	Percentage Tuning Setting	0: Percentage tuning setting OFF 1: Percentage tuning setting ON
01 to 31	No applicable data	Always 0

● **Percentage Tuning Level**

This command sets the Percentage Tuning Level for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Percentage Tuning Level	Data range: -99 (FFFFFF9D hex) to 99 (00000063 hex)

● **Execute Percentage Tuning**

This command executes percentage tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

● **Power Tuning Settings**

This command sets the Power Tuning of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Power Tuning Settings	0: Power tuning setting ON 1: Power tuning setting OFF
01 to 31	No applicable data	Always 0

● **Power Tuning Level**

This command sets the Power Tuning Level of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00 to 31	Power Tuning Level	Data range: 100 (00000064 hex) to 9999 (0000270F hex)

● **Execute Power Tuning**

This command executes power tuning for the Sensor Amplifier Unit that corresponds to the specified unit number.

Section 5 Appendices

● **One-point Tuning**

This command executes one-point tuning for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

This must be performed at least 3 seconds after a full auto tuning setup is executed with no workpiece.

● **Flashing**

This command executes flashing for the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Clear Flashing**

This command clears flashing for the Sensor Amplifier Unit that corresponds to the specified unit number.

● **Initialize**

This command initializes the Sensor for the Sensor Amplifier Unit that corresponds to the specified unit number.

Do not press the button on the Unit to initialize the Sensor during operation. When in operation, always use this command to perform Sensor initialization.

Sensor initialization will not reset the Channel Display, Display Flash, Light OFF, and Flashing Settings.

● **Self-Trigger Level**

This command sets the Self-Trigger Level of the Sensor Amplifier Unit that corresponds to the specified unit number.

The data is given as the two's complement of a 4-byte (8-digit) hexadecimal value.

Bit	Description	Data
00 to 31	Self-Trigger Level	Data range: -1999 (FFFFF831 hex) to 9999 (0000270F hex)

● **Tuning without a Workpiece**

The command executes tuning without a workpiece for the Sensor Amplifier Unit that corresponds to the specified unit number and output number.

Tuning for the first point of two-point tuning must be executed first and there must be no workpiece.

● **Background Suppression**

This command sets Background Suppression of the Sensor Amplifier Unit that corresponds to the specified unit number.

Bit	Description	Data
00	Background Suppression	0: Background suppression OFF 1: Background suppression ON
01 to 31	No applicable data	Always 0

Command Response Time (Reference Values)

The time required from when a command is sent to obtain the incident light level of input 1 of Sensor Amplifier Unit 1 connected to an E3NW-CRT Communications Unit until a response is received is approximately 6 ms. (when an explicit message is used).

* The command response time is a reference value only. Perform thorough testing in your own environment before use.
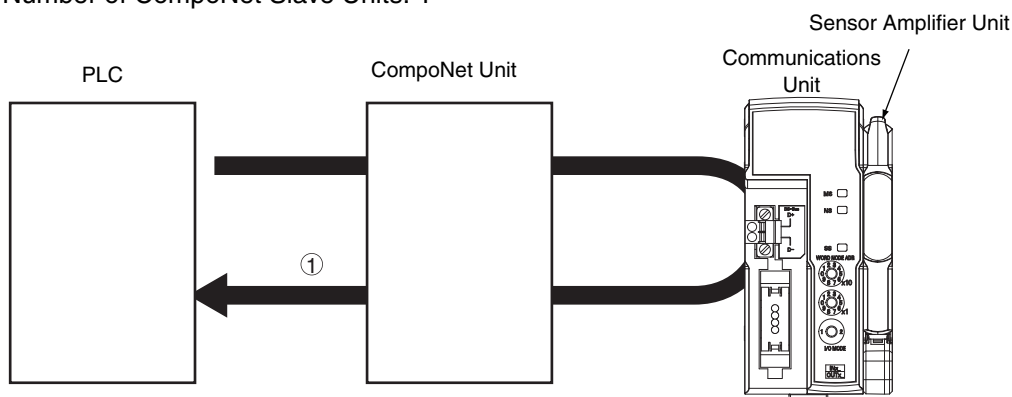
Command response time = (1)
Test conditions
Baud rate: 4 Mbps
CPU Unit cycle time: 1 ms
Number of CompoNet Slave Units: 1

● Communications Configuration

Item	Model number	Version
CPU Unit	NJ301-1100	Version 1.02
CompoNet Master Unit	CJ1W-CRM21	Version 1.3
CompoNet Slave Unit	E3NW-CRT	
Sensor Amplifier Unit	E3NW-FA0	

● Executed Command

ServiceCode	0E
ClassID	9F
InstanceID	03
AttributeID	82

Section 5 Appendices

Troubleshooting

The following table lists the possible indicator status, possible causes, and remedies for problems.

Status	Possible cause	Remedy
MS and NS indicators not lit	Power is not being supplied.	Supply power from the CompoNet communications connector.
	The power voltage is outside the allowable range.	Maintain the power voltage within the allowable range.
	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.
MS indicator lit red	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.
MS indicator lit green NS indicator flashing green	Waiting for a CompoNet communications connection.	Check the following items and restart the Unit. • Are the cables the correct length (main and auxiliary lines)? • Are any cables short-circuited, disconnected, or loose? • Are the cables wired correctly? • Is the terminating resistance set only at the ends of the main line? • Is there too much noise? • Is the master turned ON?
	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.
MS indicator lit green NS indicator lit red	CompoNet is in the Busoff state.	Check the following items and restart the Unit. • Are the cables the correct length (main and auxiliary lines)? • Are any cables short-circuited, disconnected, or loose? • Is the terminating resistance set only at the ends of the main line? • Is there too much noise?
	The node address is the same as another node.	Set the address correctly.
	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.
MS indicator lit green NS indicator flashing red	A communications timeout has occurred.	Check the following items and restart the Unit. • Are the cables the correct length (main and auxiliary lines)? • Are any cables short-circuited, disconnected, or loose? • Is the terminating resistance set only at the ends of the main line? • Is there too much noise?
	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.
SS indicator not lit	No Sensor Amplifier Units are connected.	Connect the Sensor Amplifier Units correctly.
	The Sensor Amplifier Unit next to the Sensor Communications Unit is faulty.	Replace the Sensor Amplifier Unit next to the Sensor Communications Unit.
	The E3NW-CRT Unit is faulty.	Replace the E3NW-CRT Unit.

Status	Possible cause	Remedy
SS indicator lit red	One of the connected Sensor Amplifier Units is faulty.	Replace the faulty Sensor Amplifier Unit. You can determine which Sensor Amplifier Unit is faulty by checking the number of Sensors available for communications.
	One of the connected Sensor Amplifier Units has been disconnected.	Connect the Sensor Amplifier Units correctly.
	The number of connected Sensor Amplifier Units exceeds the maximum allowable number.	Keep the number of connected Sensor Amplifier Units within the maximum allowable number. The total number of connected Sensors, including all registered Dummy Sensors, must be within the maximum allowable number.
	One of the connected Distributed Sensor Units has been disconnected.	There is a problem with the Distributed Sensor Unit connection. Check the installation of the Distributed Sensor Unit.

# CompoNet Device Profile

Device Profile

You can use an explicit command to check the device profile.

• Class ID 0x01

• Instance ID 0x01

Attribute ID	ID	Contents	Get	Set	Value
	1	Vendor	Y	N	47
	2	Product type	Y	N	12
	3	Product code	Y	N	1657
	4	Revision	Y	N	1.1
	5	Status (bits supported)	Y	N	Bit 0 only
	6	Serial number	Y	N	Each Unit
	7	Product name	Y	N	E3NW-CRT
	8	State	N	N	
Service Code	CompoNex service		Parameter options		
	05	Reset	None		
	0E	Get_Attribute_Single	None		

Revision History

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

Cat. No. E430-E1-03   (Web Version 3)

↑ Revision code   ↑ Reprint code (on the back cover only)
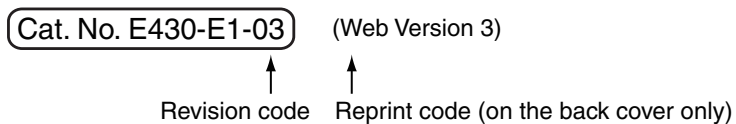
Revision code	Reprint code	Date	Revised content
A	01	July 2013	Original production
B	01	September 2013	**Page 94:** Added information at end of first sentence and added test conditions.
C	01	July 2014	**Page 88:** Added setting for Eco Mode LO.