E3NC-L

CSM_E3NC-L_DS_E_2_1

Long-distance Variable Spot to Match the Application. Stable Detection with Pinpoint 0.1-mm Spot.

- Select from two Sensor Heads to match the application from short distance to long distance.
- Product variations with variable spot and pinpoint spot for stable detection of your workpieces.
- Robot cable for reliable application in adverse environments.
 Laser Class 1 for safe application.
- White on black display characters for high visibility.
- Smart Tuning to achieve stable detection with easy setup.



Refer to the Safety Precautions on page 8.



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Ordering Information

Sensor Heads (Dimensions → page 10)

Sensing method	Appearance	Focus	Model
Diffuse-reflective		Variable spot	E3NC-LH02 2M
Limited-reflective		Spot	E3NC-LH01 2M

Amplifier Units (Dimensions → page 11)

Connecting method	Appearance	Inputs/outputs	Model		
Connecting method	Appearance inputs/outputs		NPN output	PNP output	
Pre-wired (2 m)		2 outputs + 1 input	E3NC-LA21 2M	E3NC-LA51 2M	
Wire-saving Connector		1 output + 1 input	E3NC-LA7	E3NC-LA9	
Connector for Sensor Communications Unit		2 outputs	E3NC-LA0 Available	soon.	

Accessories (Sold Separately)

Sensor Head Accessories

Sensor Head Mounting Brackets

A Mounting Bracket is not provided with the Sensor Head. It must be ordered separately as required. (Dimensions → page 13)

Applicable Sensor Head	Appearance	Model	Quantity	Contents
E3NC-LH02		E39-L185	1	Mounting Bracket: 1
E3NC-LH01		E39-L186	1	Nut plate: 1 Phillips screws (M3×18): 2

Amplifier Unit Accessories

Wire-saving Connectors (Required for models for Wire-saving Connectors.) (Dimensions → page 15)

A Connector is not provided with the Amplifier Unit. It must be ordered separately. *Protective stickers are provided.

Туре	Appearance	Cable length	No. of conductors	Model
Master Connector	*	2 m	4	E3X-CN21
Slave Connector		2 m	2	E3X-CN22

Amplifier Unit Mounting Bracket (Dimensions → page 16)

A Mounting Bracket is not provided with the Amplifier Unit. It must be ordered separately as required.

Appearance	Model	Quantity
	E39-L143	1

DIN Track

A DIN Track is not provided with the Amplifier Unit. It must be ordered separately as required. (Dimensions → page 16)

Appearance	Туре	Model	Quantity
	Shallow type, total length: 1 m	PFP-100N	1
	Shallow type, total length: 0.5m	PFP-50N	1
	Deep type, total length: 1 m	PFP-100N2	1

End Plate (Dimensions → page 16)

Two End Plates are provided with the Sensor Communications Unit.

End Plates are not provided with the Amplifier Unit. They must be ordered separately as required.

Appearance	Model	Quantity
3	PFP-M	1

Related Products

Sensor Communications Units (Dimensions → page 17)

Туре	Appearance	Model
Sensor Communications Unit for EtherCAT*		E3NW-ECT Available soon.
Sensor Dispersion Unit		E3NW-DS Available soon.

^{*}EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Ratings and Specifications

Sensor Heads

	Sensing method	Diffuse-reflective	Limited-reflective	
Item	Model	E3NC-LH02	E3NC-LH01	
Light source	e (wavelength)*1	Visible semiconductor laser diode (660 nm), 315 μW max. (JIS Class 1, IEC/EN Class 1, and FDA Class 1)		
	Giga-power mode (GIGA)	1,200 mm		
Sensing	Standard mode (Stnd)	750 mm		
distance*2	High-speed mode (HS)	250 mm	70±15 mm	
	Super-high-speed mode (SHS)	200 mm		
Spot diamet	er*3	Approx. 0.8 mm (at distances up to 300 mm)	Approx. 0.1 mm (at distances up to 70 mm)	
Differential	distance*4	10% of sensing distance		
Indicators		OUT indicator (orange) and STABILITY indicator	(green)	
Ambient illu	mbient illumination Illumination Illumination on received light surface: 10,000 lx max. of incandescent light, 20,00 sunlight			
Ambient ten	nperature range	Operating: -10 to 55°C; Storage: -25 to 70°C (with no icing or condensation)		
Ambient hu	midity range	Operating and storage: 35% to 85% (with no condensation)		
Insulation re	esistance	20 MΩ min. (at 500 VDC)		
Dielectric st	rength	1,000 VAC at 50/60 Hz for 1 min.		
Vibration re	sistance (destruction)	10 to 55 Hz with a 1.5-mm double amplitude or 100 m/s² for 2 hours each in X, Y, and Z directions		
Shock resis	tance (destruction)	500 m/s ² for 3 times each in X, Y, and Z direction	s	
Degree of p	rotection	IEC IP65 (E3NC-LH02: Applies only when adjust	er is locked.)	
Connecting method Pre-wired connecting method		Pre-wired connector (standard length: 2 m)		
Case		Polybutylene terephthalate (PBT)		
Materials	Lens	Methacrylic resin		
	Cable	PVC		
Weight (pack	ked state/Sensor Head only)	Approx. 115 g/approx. 65 g		
Accessories	3	Instruction Manual		

^{*1.} These Sensors are classified as Class 1 laser devices under IEC 60825-1 and the regulations of Laser Notice No. 50 for FDA certification. CDRH (Center for Devices and Radiological Health) registration has been completed. (Accession Number:1220690)

^{*2.} The values were measured using the OMRON standard sensing object (white paper).

^{*3.} Defined as 1/e² (13.5%) of the central light intensity at the measurement distance.

The spot diameter is sometimes influenced by the ambient conditions of the workpiece, such as light that leaks from the main beam, if the reflection factor of the area surrounding the workpiece is higher than that of the workpiece.

^{*4.} Measured at the rated sensing distance.

Amplifier Units

		Туре	Standard	d models	Model for Sensor Communications Unit		
	NPN output		E3NC-LA21	E3NC-LA7	E3NC-LA0		
Item		PNP output	E3NC-LA51	E3NC-LA9	Available soon.		
nem	Connecting method		Pre-wired Wire-saving Connector		Connector for Sensor Communications Unit		
Inputs/	Outputs		2 outputs	1 output	2 outputs		
outputs External inputs			1 input	1 input			
Power supply	y voltage		10 to 30 VDC, including 10% ripp	ole (p-p)			
Power consu	mption*1			DC (Current consumption: 65mA max. mW max. (Current consumption:			
			Load power supply voltage: 30 V Load current: Groups of 1 to 3 An 4 to 30 Amplifiers: 20 mA max.	DC max., open-collector output nplifiers: 100 mA max., Groups of			
Control outp	uts ^{*2}		Residual voltage: At load current of less than 10 At load current of 10 to 100 m	0 mA: 1 V max. nA: 2 V max.			
			OFF current: 0.1 mA max.				
External inpu	its		Refer to *3.				
Indicators			7-segment displays (Sub digital display: green, Main digital display: white) Display direction: Switchable between normal and reversed. OUT indicator (orange), L/D indicator (orange), ST indicator (blue), DPC indicator (green), and OUT selection indicator (orange, only on models with 2 outputs)				
Protection ci	rcuits		Power supply reverse polarity proprotection, and output reverse po	Power supply reverse polarity protection and output short-circuit protection			
	Super-high-sp	eed mode (SHS)*4	Operate or reset: 80 µs				
Response	High-speed me	ode (HS)	Operate or reset: 250 μs				
time	Standard mod	e (Stnd)	Operate or reset: 1 ms				
	Giga-power m	ode (GIGA)	Operate or reset: 16 ms				
Sensitivity ac	ljustment		Smart Tuning (2-point tuning, full percentage tuning (-99% to +999)		mum sensitivity tuning, power tuning, or		
No. of Units	Super-high-sp	eed mode (SHS)*4	0				
for mutual	High-speed me	ode (HS)	2				
interference prevention	Standard mod	e (Stnd)	2				
p. 0 . 0	Giga-power m	ode (GIGA)	4				
	Dynamic power	er control (DPC)	Provided				
	Timer		Select from timer disabled, OFF-	delay, ON-delay, one-shot, or ON-	delay + OFF-delay timer: 1 to 9,999 ms		
	Zero reset		Negative values can be displayed	d. (Threshold value is shifted.)			
	Resetting setti	ings ^{*5}	Select from initial reset (factory d	efaults) or user reset (saved settir	ngs).		
	Eco mode		Select from OFF (digital displays	lit) or ECO (digital displays not lit)			
	Bank switchin	g	Select from banks 1 to 4.				
Functions	Power tuning		Select from ON or OFF.				
	Output 1		Select from Normal Detection Mo	ode or Area Detection Mode.			
	Output 2		Select from normal detection mode, alarm output mode, or error output mode.		Select from normal detection mode, alarm output mode, or error output mode.		
	External input		Select from input OFF, tuning, po or bank switching.	wer tuning, laser OFF, zero reset,			
	Hysteresis wid	lth	Select from standard setting or us	ser setting.			

***1.** At Power Supply Voltage of 10 to 30 VDC.

Normal mode: 1,650 mW max. (Current consumption: 55 mA max. at 30 VDC, 115 mA max. at 10 VDC)

Power saving eco mode: 1,350 mW max. (Current consumption: 45 mA max. at 30 VDC, 80 mA max. at 10 VDC)

*2. The total for both outputs of a model with 2 outputs is 100 mA max. (Residual voltage: Load current of less than 10 mA: 1 V max., Load current of 10 to 100 mA: 2 V max.).

 $\ensuremath{\textbf{*3.}}$ The following details apply to the input.

	Contact input (relay or switch)	Non-contact input (transistor)	Input time
NPN	ON: Shorted to 0 V (Sourcing current: 1 mA max.). OFF: Open or shorted to Vcc.	ON: 1.5 V max. (Sourcing current: 1 mA max.) OFF: Vcc – 1.5 V to Vcc (Leakage current: 0.1 mA max.)	ON: 2 ms min.
PNP	ON: Shorted to Vcc (Sinking current: 3 mA max.). OFF: Open or shorted to 0 V.	ON: Vcc - 1.5 V to Vcc (Sinking current: 3 mA max.) OFF: 1.5 V max. (Leakage current: 0.1 mA max.)	OFF: 20 ms min.

^{*4.} The mutual interference prevention function is disabled if the detection mode is set to super-high-speed mode.

^{*5.} The bank is not reset by the user reset function or saved by the user save function.

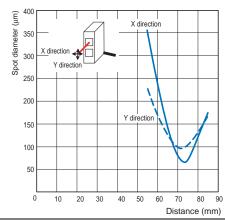
Туре		Standar	d models	Model for Sensor Communications Unit	
	NPN output	E3NC-LA21	E3NC-LA7	E3NC-LA0	
Item	PNP output	E3NC-LA51	E3NC-LA9	Available soon.	
	Connecting method	Pre-wired	Wire-saving Connector	Connector for Sensor Communications Unit	
Maximum connectable Units		30		·	
Ambient temperature range		Operating: Groups of 1 or 2 Amplifiers: –25 to 55°C, Groups of 3 to 10 Amplifiers: –25 to 50°C, Groups of 11 to 16 Amplifiers: –25 to 45°C, Groups of 17 to 30 Amplifiers: –25 to 40°C Storage: –30 to 70°C (with no icing or condensation)		Operating: Groups of 1 or 2 Amplifiers: 0 to 55°C, Groups of 3 to 10 Amplifiers: 0 to 50°C, Groups of 11 to 16 Amplifiers: 0 to 45°C, Groups of 17 to 30 Amplifiers: 0 to 40°C Storage: –30 to 70°C (with no icing or condensation)	
Ambient humidity range		Operating and storage: 35% to 85% (with no condensation)			
Insulation resistance		20 MΩ (at 500 VDC)			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min			
Vibration resistance (destruc	ction)	10 to 55 Hz with a 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance (destruction	on)	500 m/s² for 3 times each in X, Y	, and Z directions	150m/s² for 3 times each in X, Y, and Z directions	
Weight (packed state/Amplifier Unit only)		Approx. 115 g/approx. 75 g Approx. 60 g/approx. 20 g		Approx. 65 g/approx. 25 g	
	Case	Polycarbonate (PC)			
Materials	Cover	Polycarbonate (PC)			
	Cable	PVC			
Accessories		Instruction Manual			

Engineering Data (Reference Value)

Spot Diameter Vs. Distance E3NC-LH02

3500 X direction 2500 Y direction 1500 2000 400 600 800 1000 1200 1400 Distance (mm)

E3NC-LH01

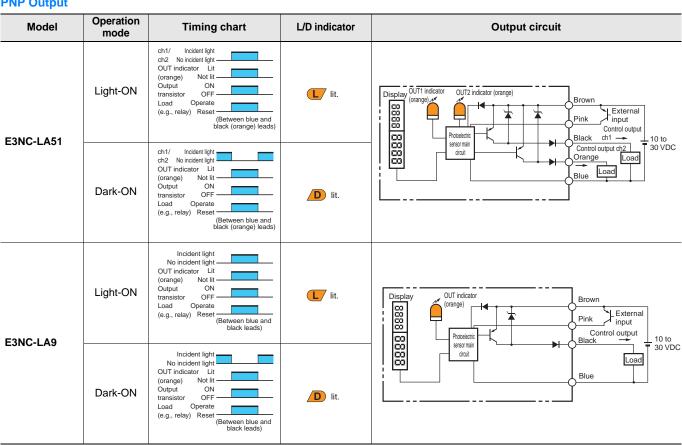


I/O Circuit Diagrams

NPN Output

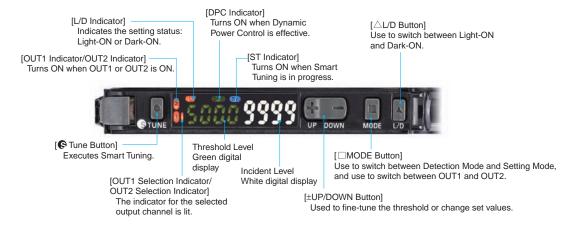
Model	Operation mode	Timing chart	L/D indicator	Output circuit
E3NC-LA21	Light-ON	ch1/ Incident light ch2 No incident light OUT indicator Lit (orange) Not lit Output ON transistor OFF Load Operate (e.g., relay) Reset (Between brown and black (orange) leads)	L lit.	Display OUT indicator OUT2 indicator (orange) Black Load Orange ch1 Control output Load Orange ch1 Sessor man circuit Blue Input Display OUT indicator Out 2 indicator Out 3 indicator Out 2 indicator Out 3 indicator Out 2 indicator Out 3 indicator Out 2 indicator Out 3 indicator Out 3 indicator Out 3 indicator Out 4 indicator Ou
	Dark-ON	ch1/ Incident light ch2 No incident light OUT indicator Lit (orange) Not lit Output ON transistor OFF Load Operate (e.g., relay) Reset (Between brown and black (orange) leads)	D lit.	
E3NC-LA7	Light-ON	Incident light No incident light OUT indicator Lit (orange) Not lit Output ON transistor OFF Load Operate (e.g., relay) Reset (Between brown and black leads)	L lit.	Display OUT indicator (orange) Photosectric sersor man circuit Pink External Blue Blue Brown Black Control output T 30 VDC
	Dark-ON	Incident light No incident light OUT indicator Lit (orange) Not lit Output ON transistor OFF Load Operate (e.g., relay) Reset (Between brown and black leads)	D lit.	

PNP Output

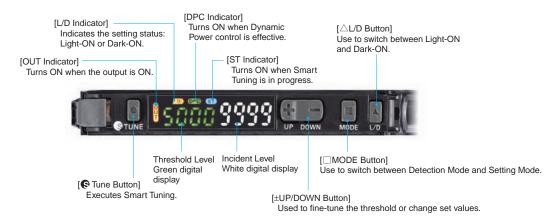


Nomenclature

E3NC-LA21/LA51/LA0



E3NC-LA7/LA9



Safety Precautions

To ensure safe operation, be sure to read and follow the Instruction Manual provided with the Sensor.

Sensor Heads

Laser Safety

Various safety standards regarding laser devices are stipulated in Japan and abroad. When this Sensor Head is used in Japan and when it is assembled in Japan but exported to a foreign country, the safety standards are classified into three cases.

1. When Using the Sensor Head in Japan

JIS C6802 stipulates the safety measures that must be observed by the user for each type of laser equipment.

E3NC-LH Sensor Heads: Class 1

⚠ WARNING

Do not expose your eyes to the laser beam either directly or indirectly (i.e., after reflection from a mirror or shiny surface). The laser beam has a high power density and exposure may result in loss of sight.



Do not disassemble the Sensor Head. Doing so may cause the laser beam to leak, resulting in a risk of visual impairment.



Displaying the Laser Label
 Attach the certification label that is shown at the right to the side of the Sensor Head.



Class1 LASER

2. Exporting the Sensor Head to the USA

When exporting devices in which the Sensor Head is installed to the USA, the devices are subject to FDA (Food and Drug Administration) laser regulations of the USA. These Sensors are classified as Class 1 laser devices under IEC/EN 60825-1 and the regulations of Laser Notice No. 50 for this certification. CDRH (Center for Devices and Radiological Health) registration has been completed. (Accession Number:1220690)

3. Exporting the Sensor Head to Europe

This Sensor Head is classified in Class 1 under EN 60825-1.

Precautions for Safe Use

The following precautions must be observed to ensure safe operation of the Sensor Head.

- 1. Installation Environment
- Do not use the Sensor Head in an environment where explosive or flammable gas is present.
- To secure the safety of operation and maintenance, do not install the Sensor Head close to high-voltage devices or power devices.
- 2. Power Supply and Wiring
- Always use an E3NC-LA□□ or E3NC-LA0 Amplifier Unit. If a different Amplifier Unit is used, damage or fire may occur.
- High-voltage lines and power lines must be wired separately from the Sensor Head. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- Always turn OFF the power supply before connecting or disconnecting the connectors.
- 3. Installation
- During installation, tighten the screws securely, but do not exceed the specified tightening torque.
 Specified torque (M3): 0.5 N·m

- 4. Others
- Never disassemble, repair, modify, deform by pressure, or incinerate the Sensor Head. Do not turn the adjuster on the E3NC-LH02 with a force that is greater than 40 mN·m. Damage or fire may occur.
- Dispose of the Sensor Head as industrial waste.
- If you notice any abnormalities, immediately stop using the Sensor Head, turn OFF the power supply, and contact your OMRON representative.

Precautions for Correct Use

Observe the following precautions to prevent failure to operate, malfunctions, or undesirable effects on Sensor Head performance.

1. Installation Environment

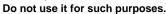
Do not install the Sensor Head in locations subject to the following conditions:

- · Ambient temperatures outside of the rated range
- Condensation caused by rapid changes in temperature
- Relative humidity that is not between 35% and 85%
- · Corrosive or flammable gas
- · Dust, salt, or iron particles
- Direct vibration or shock
- Strong external light interference (such as other laser beams or electric arc-welding machines)
- · Direct sunlight or near heaters
- · Water, oil, or chemical fumes or spray
- Strong magnetic or electric fields
- 2. Warming Up
- The circuits will be unstable just after the power supply is turned ON, so measurement values may fluctuate gradually.
- 3. Maintenance and Inspection
- Always turn OFF the power supply before adjusting or connecting/ disconnecting the Sensor Head.
- Do not use thinner, benzene, acetone, or kerosene to clean the Sensor Head.
- If large dust particles or dirt adheres to the filter on the front of the Sensor Head, use a blower brush (such as one used to clean camera lenses) to blow it off. Do not blow the dust particles or dirt with your mouth. To remove dust particles or dirt, wipe it off gently with a soft cloth (such as one for cleaning lenses) moistened with a small amount of alcohol. Do not wipe it off with excessive force. Scratches on the filter may cause errors.
- 4. Sensing Object
- The Sensor Head cannot accurately measure the following types of objects: Transparent objects, objects with an extremely low reflection ratio, objects smaller than the spot diameter, objects with a large curvature, excessively inclined objects, etc.

Amplifier Units

MARNING

This Amplifier Unit is not designed or rated for ensuring safety of persons either directly or indirectly.





A CAUTION

Excess voltage may result in malfunction or fire. Do not use the Amplifier Unit with a voltage that exceeds the rated voltage.



Explosion may result.

Never use the Amplifier Unit with an AC power supply.



Precautions for Safe Use

The following precautions must be observed to ensure safe operation of the Amplifier Unit. Damage or fire may occur.

- Do not use the Amplifier Unit in an environment where explosive or flammable gas is present.
- Do not use the Amplifier Unit in a location subject to splattering with water, stream, oil, or chemicals.
- 3. Do not attempt to disassemble, repair, or modify the Amplifier Unit.
- Do not apply a voltage or current that exceeds the rated range to the Amplifier Unit.
- 5. Do not use the Amplifier Unit in an ambient atmosphere or environment that exceeds the ratings.
- 6. Wire the power supply correctly, including the polarity.
- 7. Connect the load correctly.
- 8. Do not short-circuit the load at both ends.
- 9. Do not use the Amplifier Unit if the case is damaged.
- 10.Dispose of the Amplifier Unit as industrial waste.
- 11.Burn injury may result. The surface of the Amplifier Unit may be hot depending on operating conditions (e.g., the ambient temperature or power supply voltage). Be careful during operation and cleaning.
- 12. Take appropriate safety measures, such as stopping the equipment, before you change any Amplifier Unit settings.
- 13.To secure the safety of operation and maintenance, do not install the Amplifier Unit close to high-voltage devices or power devices.
- 14. High-voltage lines and power lines must be wired separately from the Amplifier Unit. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- **15.**Do not install the Amplifier Unit in locations subject to strong electrical or magnetic fields.
- 16.Do not short the load of an open-collector output.
- **17.**Do not use a load that exceeds the rated range.

Precautions for Correct Use

- Do not use the Amplifier Unit in locations subject to the following conditions:
- Direct sunlight
- · High humidity with the chance of condensation
- Corrosive gas
- · Vibration or shock that exceeds the rated range
- 2. Do not extend the length of the cable to more than 100 m. Use wires of 0.3 mm² or larger to extend the cable.
- 3. Do not subject the cable to more than the following forces. Pull: 40 N, Torque: 0.1 N·m, Pressure: 20 N, Bending: 3 kg
- 4. Detection will be possible 200 ms after the power supply turns ON. If separate power supplies are used for the load and the Amplifier Unit, turn ON the power supply to the Amplifier Unit first.
- Depending on the operating environment, time may be required for the incident level to stabilize after the power supply is turned ON.
- 6. When using the Amplifier Units with Wire-saving Connectors, attach the protective stickers (provided with E3X-CN-series Connectors) on the unused power pins to prevent electrical shock and short circuiting.

Attach the protective cap when using a model with a connector for a Sensor Communications Unit.

Amplifier Unit with Wiresaving Connector



Amplifier Unit with Connector for Sensor Communications Unit

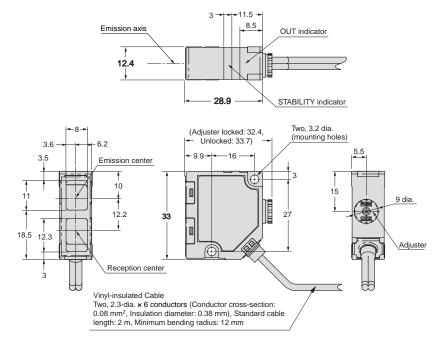


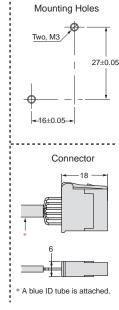
- Output pulses may occur when the power supply is turned OFF. Turn OFF the power supply to the load or load line first.
- 8. Always turn OFF the power supply before connecting, disconnecting, or adding an Amplifier Unit.
- Do not pull on the fiber, twist it, or otherwise subject it to excessive force when it is attached to the connector on the Amplifier Unit. (Do not exceed 9.8 N·m.)
- 10. The E3X-MC11, E3X-MC11-SV2, and E3X-MC11-S Mobile Consoles cannot be used.
- 11. Connection is not possible to the E3C, E2C, E3X-NA, or E3X-SD.
- 12.Connection is not possible to the E3X-HD, E3X-DA-S, E3X-DA-N, or E3X-MDA.
- 13. The E3NW-ECT Sensor Communications Unit can be used, but the E3X-DRT21-S, E3X-CRT, and E3X-ECT Communications Units cannot be used.
- 14. Always keep the protective cover in place when using the Amplifier Unit. Otherwise, the Amplifier Unit may malfunction.
- 15.Do not use thinner, benzene, acetone, or kerosene to clean the Amplifier Unit.

Sensor Heads

E3C-LH02

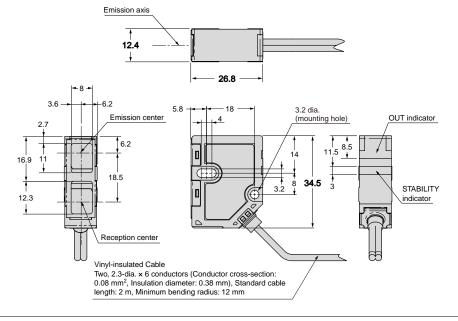


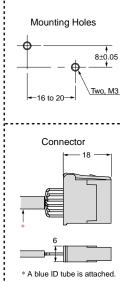




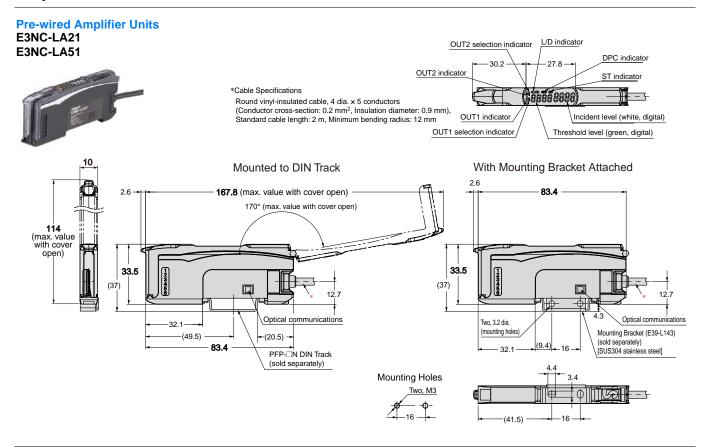


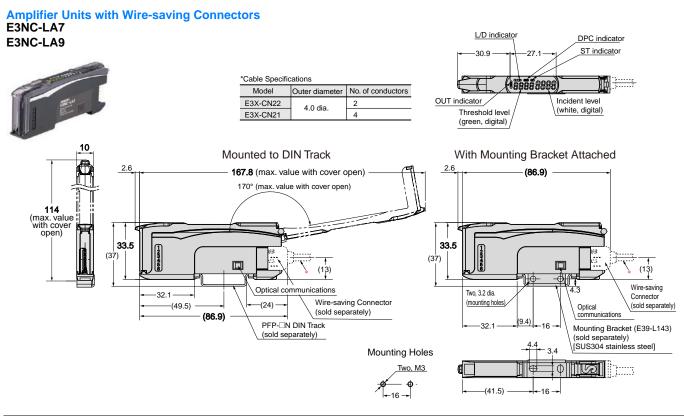






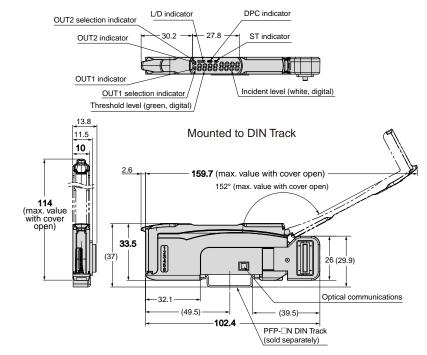
Amplifier Units





Amplifier Unit with Connector for Sensor Communications Unit E3NC-LA0 Available soon.



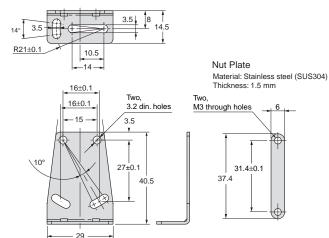


Accessories (Sold Separately)

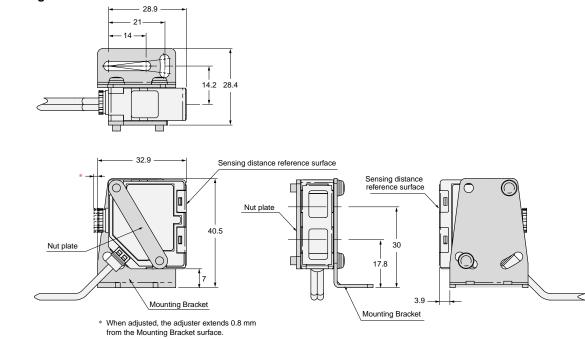
Sensor Head Mounting Brackets E39-L185 (for E3NC-LH02)



Mounting Bracket
Material: Stainless steel (SUS304)
Thickness: 1.2 mm
Accessories: Phillips screws (M3×18, P = 0.5, stainless steel): 2
Nut plate: 1



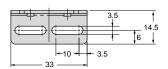
With E39-L185 Mounting Bracket Attached

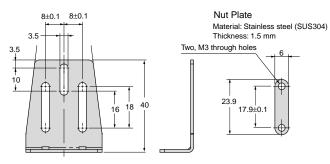


E39-L186 (for E3NC-LH01)

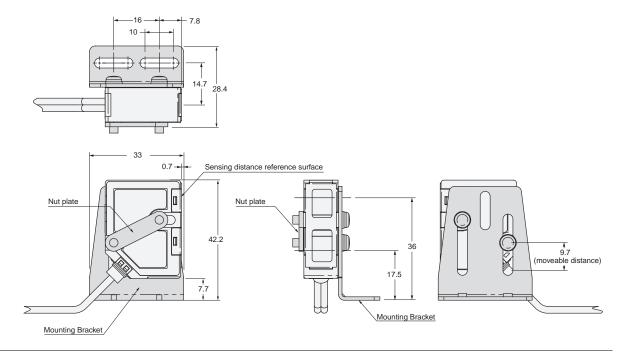


Mounting Bracket
Material: Stainless steel (SUS304)
Thickness: 1.2 mm
Accessories: Phillips screws (M3x18, P = 0.5, stainless steel): 2
Nut plate: 1

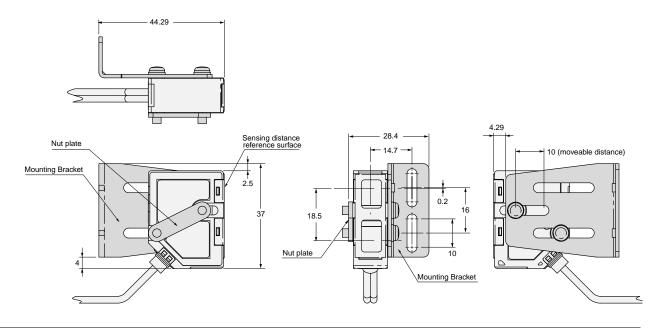




With E39-L186 Mounting Bracket Attached for Bottom Mounting



With E39-L186 Mounting Bracket Attached for Back Mounting

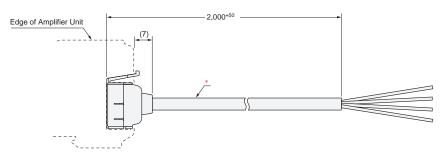


Wire-saving Connectors

Master Connector E3X-CN21





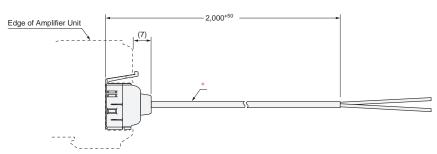


*4-dia. cable with 4 conductors, Standard cable length: 2 m (Conductor cross-section: 0.2 mm² (AWG24), Insulation diameter: 1.1 mm)

Slave Connector E3X-CN22







*4-dia. cable with 2 conductors, Standard cable length: 2 m (Conductor cross-section: 0.2 mm² (AWG24), Insulation diameter: 1.1 mm)

Amplifier Unit Mounting Bracket E39-L143







Two, 3.2 dia.

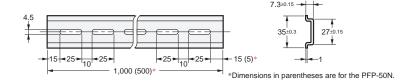




Material: Stainless steel (SUS304)

DIN Track PFP-100N PFP-50N

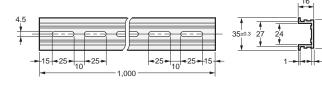




Material: Aluminum

PFP-100N2



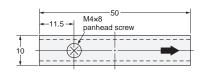


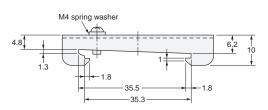
Material: Aluminum

End Plate

PFP-M



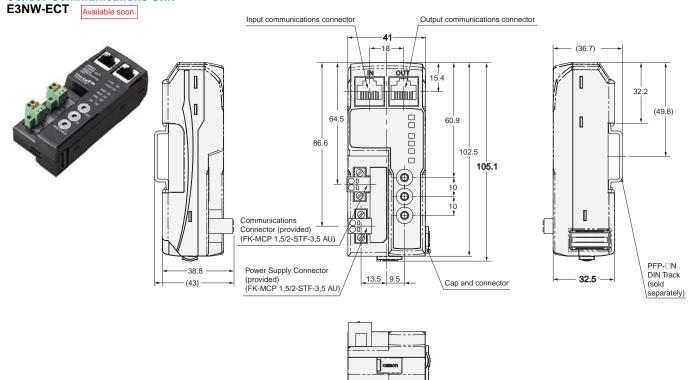


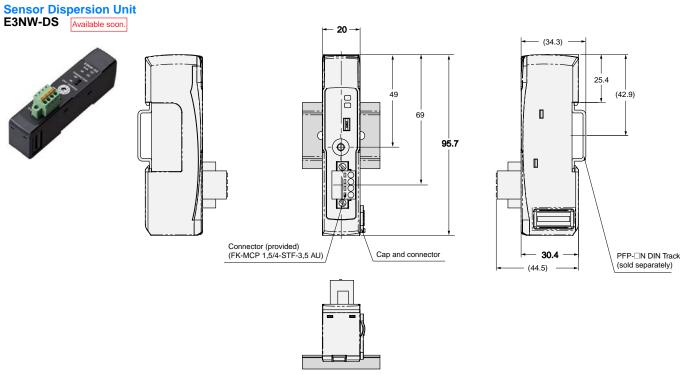


Materials: Iron, zinc plating

Related Products

Sensor Communications Unit





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