KEYENCE

96M16235

CMOS Laser Sensor
LR-X Series
Instruction Manual



Read this instruction manual before using the product.
Keep this manual in a safe place after reading it so that it can be used at any time.

For detailed LR-X Series setting methods and for details on the functions of the LR-X Series, see the "LR-X Series User's Manual".

■ Symbols

The following symbols are used in this instruction manual to enable the recognition of important information at a glance. Be sure to read these messages carefully.

DANGER	**Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**Indicates a situation which, if not avoided, could result in product damage as well as property damage.**

1 Before Operation

Safety Precautions

DANGER	• **This product is only intended to detect objects. Do not use this product for the purpose of protecting a human body or a part of a human body.** • **This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.** • **Do not use this product in applications (such as power plants, aircraft, railroads, ships, vehicles, medical equipment, and playground equipment) that may cause serious harm to people or property due to the operating status of this product.**
WARNING	• **This is a direct current (DC) power supply type sensor. Application of an alternating current may result in explosion or fire.** • **If the product is used in a manner not specified by this manual, the protection provided by the product may be impaired.**
NOTICE	• **Use separate conduits for power lines and high-voltage lines. Use of a common conduit may result in device malfunction due to noise or damage to the sensor.** • **Always ground the frame ground terminal when using an off-the-shelf switching regulator.** • **Do not use this product outdoors.**

Precautions on Regulations and Standards

■ CE and UKCA Marking

KEYENCE Corporation has confirmed, on the basis of the following specifications, that this product complies with the essential requirements of the applicable EU Directive(s) and UK regulations. Be sure to consider the following specifications when using this product in the member states of the European Union and United Kingdom.

● **EMC Directive (CE) and Electromagnetic Compatibility Regulations (UKCA)**
Applied standard: (BS) EN 60947-5-2, Class A

Ensure that the cable length is 30 meters or less.
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of the EMC Directive and Electromagnetic Compatibility Regulations. The manufacturer of the end-product is solely responsible for the compliance of the end-product itself according to the EMC Directive and Electromagnetic Compatibility Regulations.

■ CSA Certificate

This product complies with the following CSA and UL standards and has been certified by CSA. Be sure to consider the following specifications when using this product as a product certified by CSA.

- Applied standard CSA/CSA C22.2 No.61010-1
  UL61010-1
- When using this product, use the following power supply.
  A CSA or UL certified power supply with Class 2 output defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code).
- Install this product at an altitude of 2000 m or less.
- Overvoltage category I
- Pollution degree 3
- Indoor use only.
- Check that the circuit connected to the I/O terminals of this product supports SELV.

The LR-X Series also complies with the following North American regulations.
- FCC Part 15 Subpart B, Class A Digital Device
- ICES-003, Class A Digital Apparatus

Operation of this product is subject to the following conditions.
(1) This product does not cause harmful radio frequency interference.
(2) This product must accept any radio frequency interference, including radio frequency interference that may cause undesired operation.

Precautions regarding FCC regulations

Changes or improvements not expressly approved by the party responsible for compliance with FCC regulations may void the user's authority to operate this product.

Cleaning Instructions

Clean the emitter / light receiving sections by blowing the dust off with clean air.
If heavily soiled, clean it with a soft cloth moistened with a neutral detergent.
Avoid aggressive rubbing, as this may damage the lens cover and cause malfunctions.

Precautions Regarding Laser Products

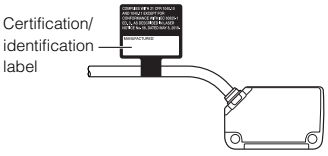
WARNING	• **This product employs a semiconductor laser for its light source.**
	• **Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.**
	• **Follow the instructions mentioned in this manual. Failing to do so may result in injury to the human body (such as to the eyes and skin).**
	  • **Laser emission from this product is not automatically stopped when it is disassembled. Never disassemble this product.**
	  • **Do not stare into the laser beam or its reflection from a mirror finished surface.**

Wavelength/output	505 nm/200 μW
FDA(CDRH) Part1040.10*	Class 1 laser product
IEC 60825-1 (JIS C6802)	Class 1 laser product

* The laser classification is implemented on the basis of IEC 60825-1 in accordance with the regulations of Laser Notice No. 56 of FDA (CDRH).

■ Certification/identification label

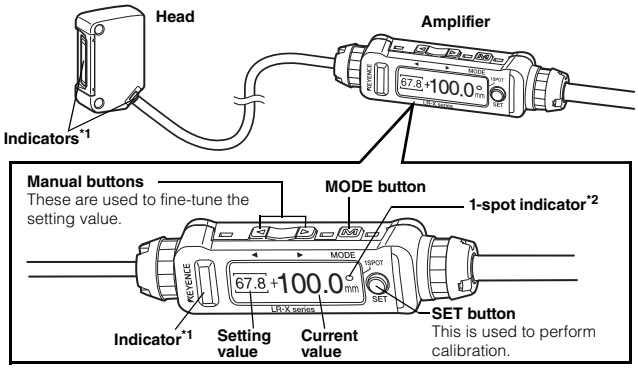
When using this product in the U.S. affix the certification/identification label included in the package of this product as shown in the figure on the right. (Affix this label in a location that is not splashed with oils or chemicals.)



2 Part Names and Basic Operations

The LR-X Series features two unique types, which can be selected based on application needs or user preference. The standard type features an in-cable amplifier that is a fixed distance from the sensor head (300mm). The separate amplifier type features a DIN mountable amplifier and allows for the cable length from the sensor head to the amplifier to be changed.

■ Standard type



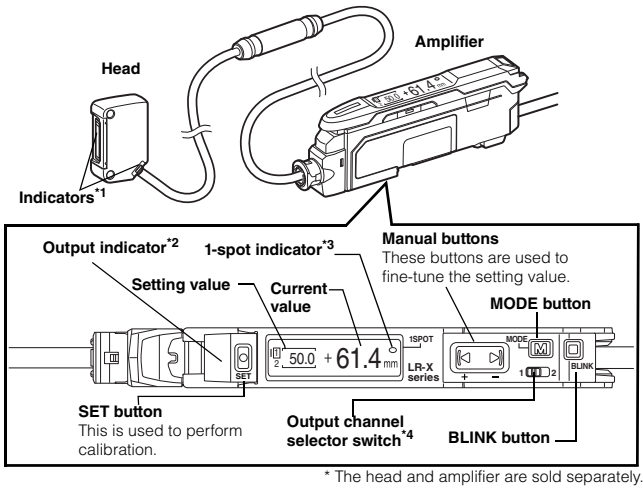
How to switch the output channel

1 Press [M] once or multiple times to display [Select Output].
2 Use [◁] [▷] to switch between channels.
3 Press [M].

The output channel cannot be switched when [OUT1+INPUT] is selected for the I/O in the initial settings.

*1 Operates according to the selected output channel. (When the output is ON: orange, when the output is OFF: green, when an error occurs: blinking in green)
*2 Unlit when light is not received or is reflected off of multiple surfaces (i.e. multiple reflected spots).

■ Separate amplifier type



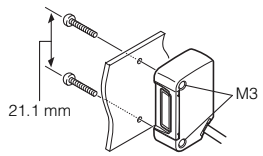
* The head and amplifier are sold separately.

*1 Operates according to the selected output channel. (When the output is ON: orange, when the output is OFF: green, when an error occurs: blinking in green)
*2 Operates according to the selected output channel. (When the output is ON: orange, when the output is OFF: unlit)
*3 Unlit when light is not received or is reflected off of multiple surfaces (i.e. multiple reflected spots).
*4 Not present on the LR-XN10

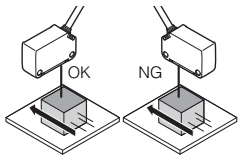
3 Installation and Wiring

Installing the Head

Tightening torque: 0.6 N·m or less



Installation orientation



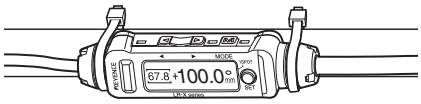
Attaching the Amplifier (Standard type)

■ Fixing the amplifier in place with cable ties

1 Prepare two cable ties.*

* Use cable ties with a width of 3 mm or less to match the amplifier grooves.

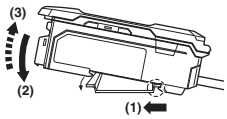
2 Align the cable ties with the amplifier grooves, and then firmly tighten the cable ties.



Attaching the Amplifier and Connecting Multiple Amplifiers (Separate Amplifier Type)

■ Attaching to DIN rail

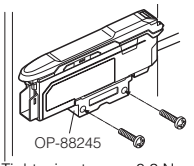
1 Align the claw at the bottom of the main unit with the DIN rail, as shown in the figure. While pushing the main unit in the direction of arrow (1), push down in the direction of arrow (2).



2 To remove the main unit, raise it in the direction of arrow (3) while pushing it in the direction of arrow (1).

■ Horizontal installation (main unit only)

1 Attach the main unit to the optional mounting adapter (OP-88245), and then insert M3 screws into the two locations shown in the figure to secure the main unit in place.



Tightening torque: 0.3 N·m or less

■ Connecting multiple amplifiers

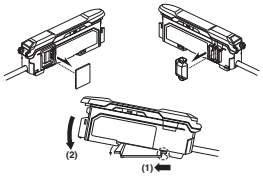
Up to eight expansion units can be connected to one main unit. Up to 16 LR-XN10 (zero line type) amplifiers can be connected to an NU Series networking unit.

CAUTION	**When connecting to multiple amplifiers or when mounting main units together, mount the units on a DIN rail installed on a metal surface.**

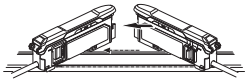
NOTICE	**• Be sure to turn the power off before connecting an expansion unit. • Do not touch the expansion connector.**

1 Remove the expansion protection covers from the main unit and expansion unit(s).

2 Install the amplifiers on the DIN rail one at a time.

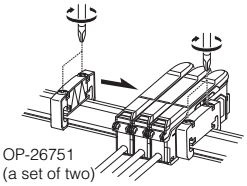


3 Slide the main unit and expansion unit(s) together. Mate the two claws of the expansion unit with the recesses on the main unit side until a click is heard/felt.



4 Attach the end units (sold separately: OP-26751) to the DIN rail on both sides of the amplifiers in the same way as step (2).

5 Secure the amplifiers between the end units. Tighten the screws from the top (two screws × two units) with a Phillips screwdriver to fix the end units in place.



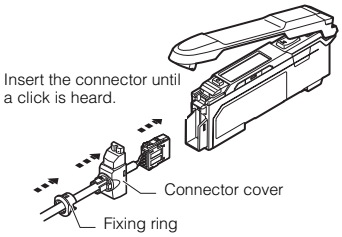
OP-26751
(a set of two)

When an expansion unit from a series other than the LR-X Series is connected to a LR-XN12N/XN12P/XN10.

When the LR-X Series interference prevention function is used, any non-LR-X Series expansion units that are connected, and feature an interference prevention function, may experience unstable detection.
In this case, change the "K1 Expansion Model" setting on the "LR-XN12N/XN12P/XN10", that is connected directly to the non-LR-X Series expansion unit, to "Other". For the setting method, refer to the "LR-X Series User's Manual".

■ Connecting the head and the amplifier (separate amplifier type)

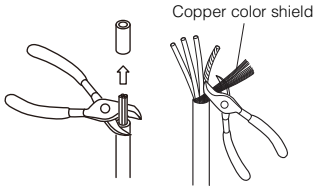
Insert the head connector into the amplifier with the power turned off.



● When cutting the cable shorter, use the following method to attach the connector.

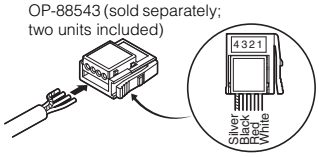
1 Cut the cable to the appropriate length, and then remove approximately 15 mm (15 ± 3 mm) of the sheath from the end of the cable. Cut the core wires and drain wire (silver) to the same length.

2 Cut the copper color shield wires at their base. Twist the drain wire (silver) three times or more to prevent its tip from unravelling. (Be careful to avoid breaking the drain wire.)



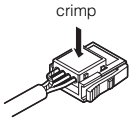
3 Insert the wires to match the pin numbers on the connector and the wire colors below.

OP-88543 (sold separately; two units included)



Connector pin number	1	2	3	4
Wire color	White	Red	Black	Silver

4 Use pliers or a similar tool to crimp the connector.



A connector that has been crimped cannot be reused.

NOTICE	**The product may not operate normally if the connection is not established as described above.**

Wiring (Standard Type and Connector Model for Separate Amplifier Type)

Target models: LR-X50/X50C/X50CG/X100/X100C/X100CG/X250/X250C/X250CG/XN11C

Select NPN or PNP and the function of I/O pin (2) (the white wire) during the initial settings.

Sensor pin layout

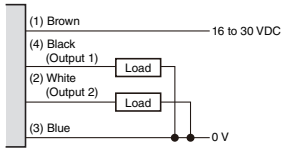


M8 connector tightening torque: 0.6 N·m

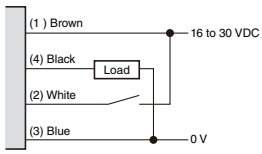
* Perform initial tightening by hand, and then use a tool to finish tightening. Loose tightening will lead to a decrease in waterproof performance.

● When using the sensor in PNP mode

OUT1 + OUT2

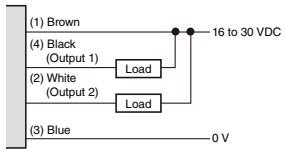


OUT1 + INPUT

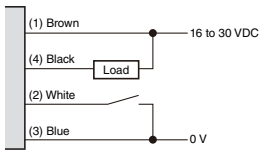


● When using the sensor in NPN mode

OUT1 + OUT2



OUT1 + INPUT

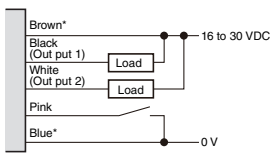


The wire colors indicate the colors when using an OP-73864/73865/88505/88506/88507 M8 connector cable that is sold separately.

Wiring (Cable Model for Separate Amplifier Type)

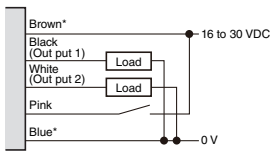
Target models: LR-XN11N/XN12N/XN11P/XN12P

● LR-XN11N/XN12N



* LR-XN11N only

● LR-XN11P/XN12P

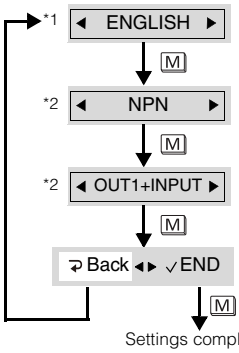


* LR-XN11P only

4 Initial Settings

■ Initial settings

When turning on the sensor for the first time, or when the sensor has been initialized/factory reset, select the initial settings shown below.



Use ◁ ▷ to select the language. (ENGLISH/日本語/中文/DEUTSCH)

Use ◁ ▷ to select NPN or PNP.

Use ◁ ▷ to select the I/O. (OUT1+INPUT/OUT1+OUT2)

After completion, if these setting need to be changed again, perform an initialization (page 3).

*1 Hold down ◁ ▷ (both buttons) for 3 seconds or more to display ◂ mm ▸. On this display, ◁ ▷ can be used to select "mm" or "inch" for the units. After selecting the unit, press the M button to return to the language selection screen. When changing the unit of measurement, select the unit according to the weights and measures regulations and laws in the country or area where this product is used. Use of some units may be prohibited depending on the location where this product is used.

*2 This is not displayed on the LR-XN11N/XN12N/XN11P/XN12P/XN10.

5 Basic Settings

● **Switching the output style (N.O./N.C.)**

1 Press M once or multiple times to display N.O./N.C. (OUT1).
2 Use ◁ ▷ to switch the output style.
3 Press M.

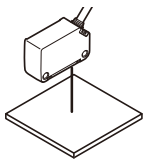
● **Switching the output channel**

See Part Names and Basic Operations (page 1).

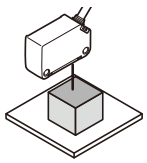
* To adjust the channel 2 output setting value, select "Standard" or "Area detection" for setting G Detection Mode2 under "8. Detailed Settings".

6 Adjusting Setting Values

■ 2-point calibration



Object to detect not present



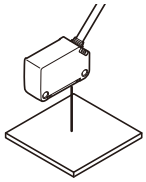
Object to detect present

To perform the calibration, press the SET button once when the object to detect is present and once when the object to detect is not present.

The settings can be configured even if the SET button is pressed with the object to detect not present and is then pressed with the object to detect present.

If "---" is displayed, the distance difference is small, so detection may be unstable.

■ DATUM calibration (detecting something other than the background)



Press the SET button once with no object to detect present.
Then, hold down the SET button for 3 seconds or more with no object to detect present.

This cannot be used when the background is not within the detection range.

■ Fine-tuning setting values

Use ◁ ▷ to adjust the setting value. Hold down either button to make adjustments more quickly.

For other setting methods and for details on the functions, refer to the "LR-X Series User's Manual".

7 Useful Functions

● **Initialization/Factory Reset**

Initialize all the settings and return the sensor to its factory default state.

Execute item b Initialize under "8. Detailed Settings".

● **Key lock**

Disable button operations.

Hold down M and ◁ or ▷ for 3 seconds or more.

To clear the key lock, use the same procedure.

● **Blink Indicators function (separate amplifier type only)**

This function forces the indicators on the head to blink in green, which makes it easy to identify which head is connected to the amplifier.

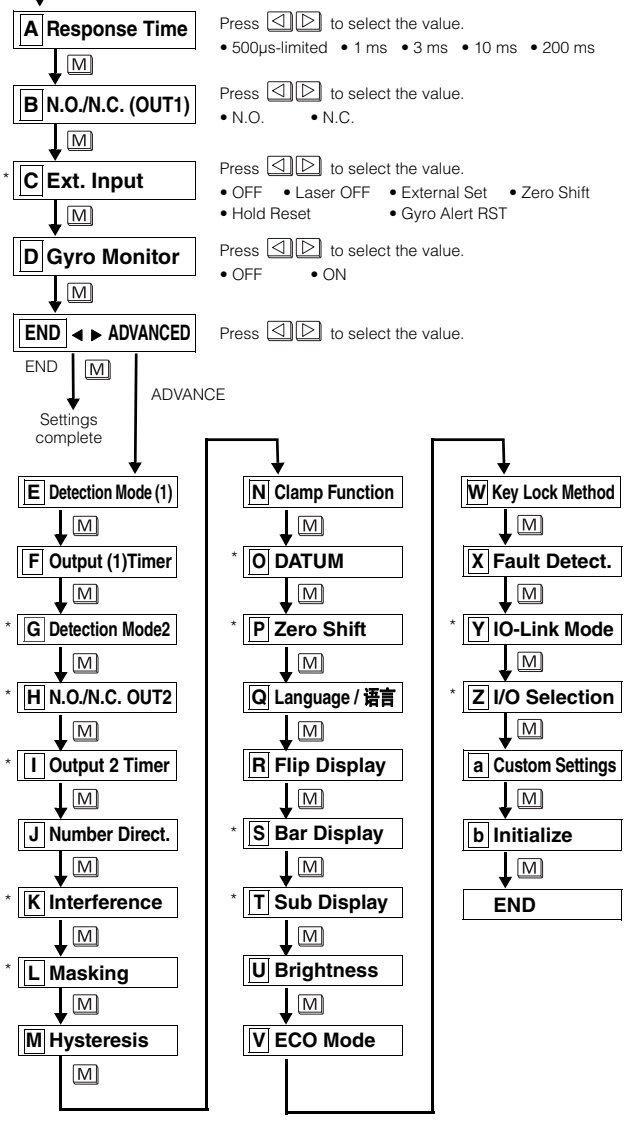
1 Press BLINK.
2 Press ▷ to make the head indicators blink.
3 Press BLINK to return to the normal status.

8 Detailed Settings

For detailed setting methods and for details on the functions, refer to the "LR-X Series User's Manual".

Switch the language to English before use to match the displays below.

Hold down M for 3 seconds or more to enter the settings menu. Then, press M to change the item or press ◁ ▷ to switch the setting value. Press M + ◁ to return to the previous item.



* This item may not be displayed depending on the settings or the model.

9 Specifications

■ Standard type

Model	Cable type	LR-X50	LR-X100	LR-X250
	M8 Connector type (metal jacket)[*1]	LR-X50C(G)	LR-X100C(G)	LR-X250C(G)
Detecting distance		25.0 to 50.0 mm	25.0 to 100.0 mm	30 to 250 mm
Standard detectable deviation		0.5 mm	1.0 mm	30 to 180 mm: 9 mm 180 to 250 mm: 18 mm
Display resolution		0.1 mm	0.1 mm	1 to 2 mm
Spot size		Approx. 0.2 × 1.5 mm (at a distance of 50 mm)	Approx. 0.3 × 2 mm (at a distance of 100 mm)	Approx. 0.8 × 1.2 mm (at a distance of 250 mm)
Response time[*2]		500 µs/1 ms/3 ms/10 ms/200 ms selectable		
Light source	Type	Green laser (505 nm)		
	Laser class	Class 1 laser product (IEC60825-1, FDA (CDRH), Part1040.10[*3])		
IO-Link		Specification v1.1/COM2 (38.4kbps)		
Control output[*4]		NPN open collector/PNP open collector, N.O./N.C. selectable 30 VDC or less, 50 mA or less, residual voltage: 2 V or less		
External input[*4]		External Set/Laser OFF/Zero Shift/Hold Reset/Gyro Alert RST selectable Short circuit current: NPN: 1 mA or less, PNP: 2 mA or less Input time: 3 ms or more ON, 20 ms or more OFF (25 ms or more ON, 25 ms or more OFF only when "External Set" is selected)		
Protection circuit		Protection against reverse power connection, output overcurrent, output surge, and reverse output connection		
Power supply	Power voltage	16 to 30 VDC (including 10% ripple (P-P) or less), class 2		
	Power consumption (excluding the load current)	Normal operation: 970 mW (38 mA or less at 24 V, 53 mA or less at 16 V) ECO ON/ALL: 821 mW (32 mA or less at 24 V, 44 mA or less at 16 V)		
Environmental resistance	Enclosure rating	IP65/IP67(IEC60529)		
	Ambient light	Incandescent lamp: 16,000 lx or less Sunlight: 16,000 lx or less		Incandescent lamp: 8,000 lx or less Sunlight: 8,000 lx or less
	Operating ambient temperature	-10 to +50°C (no freezing)		
	Operating ambient humidity	35 to 85%RH (no condensation)		
	Shock resistance	1,000 m/s^2 (100 G); 6 times each for X, Y, and Z axes		
	Vibration resistance	10 to 500 Hz; power spectral density: 0.816 G^2/Hz; X, Y, and Z directions		
Material		Head case: SUS316L; Head lens cover: PSU; Head packing: FKM (lens cover), EVM (cable); Cable: PVC; Metal jacket[*5]: SUS304; Amplifier case: PBT; Amplifier display, indicator: PAR; Amplifier packing: NBR; Button: POM Amplifier M8 connector[*6]: SUS303;		
Weight		LR-X50/X100/X250: approx. 90 g, LR-X50C/X100C/X250C: approx. 35 g, LR-X50CG/X100CG/X250CG: approx. 45 g		
Accessories		Instruction manual, laser warning label		

*1 Ensure the cable length is 30 m or less for the M8 connector type. Ensure the cable length is 20 meters or less when utilizing IO-Link communication.
*2 When 500 µs (limited) is selected, the following restrictions are present.
- Only 2-point calibration can be performed.
- The detection area mask is set during calibration. (Manual setting of the mask area is not supported.)
- Output 2 is limited to an alarm output, such as gyro, and standard/area cannot be used.

*3 The laser classification is implemented on the basis of IEC 60825-1 in accordance with Laser Notice No. 56 of FDA (CDRH).
*4 The I/O can be selected from the following combinations.
Control output × 2, control output + external input
*5 LR-X50CG/X100CG/X250CG only
*6 LR-X50C(G)/X100C(G)/X250C(G) only

■ Separate amplifier type

Head

Model	Cable length: 2 m	LR-XH50	LR-XH100	LR-XH250
	Cable length: 10 m	LR-XH50(10M)	LR-XH100(10M)	LR-XH250(10M)
Detecting distance		25.0 to 50.0 mm	25.0 to 100.0 mm	30 to 250 mm
Standard detectable deviation		0.5 mm	1.0 mm	30 to 180 mm: 9 mm 180 to 250 mm: 18 mm
Display resolution		0.1 mm	0.1 mm	1 to 2 mm
Spot size		Approx. 0.2 × 1.5 mm (at a distance of 50 mm)	Approx. 0.3 × 2 mm (at a distance of 100 mm)	Approx. 0.8 × 1.2 mm (at a distance of 250 mm)
Light source	Type	Green laser (505 nm)		
	Laser class	Class 1 laser product (IEC60825-1, FDA (CDRH), Part1040.10[*1])		
Environmental resistance	Enclosure rating	IP65/IP67(IEC60529)		
	Ambient light	Incandescent lamp: 16,000 lx or less Sunlight: 16,000 lx or less		Incandescent lamp: 8,000 lx or less Sunlight: 8,000 lx or less
	Operating ambient temperature	-10 to +50°C (no freezing)		
	Operating ambient humidity	35 to 85%RH (no condensation)		
	Shock resistance	1,000 m/s^2 (100G); 6 times each for X, Y, and Z axes		
	Vibration resistance	10 to 500 Hz; power spectral density: 0.816 G^2/Hz; X, Y, and Z directions		
Material		Case: SUS316L; Lens cover: PSU; Packing: FKM (lens cover), EVM (cable);		
Weight		2 m cable type: approx. 75 g, 10 m cable type: approx. 250 g		
Accessories		Laser warning label, head connector (10 m cable type only)		

Amplifier

Model	NPN output	LR-XN11N	LR-XN12N	LR-XN11C (Selectable output)	LR-XN10
	PNP output	LR-XN11P	LR-XN12P		
Cable/connector		Cable		M8 connector[*2]	—
Main unit/expansion unit		Main unit	Expansion unit	Main unit (expansion not possible)	Expansion unit
No. of control outputs		2	2	2[*3]	None[*4]
No. of external inputs		1	1	1[*3]	—
Response time[*5]		500 µs/1 ms/3 ms/10 ms/200 ms selectable			
IO-Link (LR-XN11C only)		Specification v1.1/COM2 (38.4 kbps)			
Control output		Open collector, 30 VDC or less, N.O./N.C. selectable 100 mA or less per output / 100 mA or less total for 2 outputs (when used as a solitary unit), 50 mA or less per output (when used as an expansion unit) Residual voltage NPN 1.4 V or less (output current: 10 mA or less)/ 2 V or less (output current: 10 to 100 mA) PNP 1.6 V or less (output current: 10 mA or less)/ 2.2 V or less (output current: 10 to 100 mA)			
External input		External Set/Laser OFF/Zero Shift/Hold Reset/Gyro Alert RST selectable Short circuit current: NPN: 1 mA or less, PNP: 2 mA or less Input time: 3 ms or more ON, 20 ms or more OFF (25 ms or more ON, 25 ms or more OFF only when "External Set" is selected)			
Protection circuit		Protection against reverse power connection, output overcurrent, output surge, and reverse output connection			
Power supply	Power voltage	16 to 30 VDC[*6] (including 10% ripple (P-P) or less), class 2			
	Power consumption (excluding the load current)	NPN output type and LR-XN10 During normal operation: 1060 mW (44 mA or less at 24 V, 61 mA or less at 16 V) ECO ON/ALL: 895 mW (37 mA or less at 24 V, 50 mA or less at 16 V) PNP output type and LR-XN11C During normal operation: 1150 mW (47 mA or less at 24 V, 64 mA or less at 16 V) ECO ON/ALL: 985 mW (40 mA or less at 24 V, 53 mA or less at 16 V)			
Environmental resistance	Operating ambient temperature	–20 to +55°C (no freezing)[*7]			
	Operating ambient humidity	35 to 85%RH (no condensation)			
	Shock resistance	500 m/s^2 (50G); 3 times each for X, Y, and Z axes			
	Vibration resistance	10 to 500 Hz; power spectral density: 0.816 G^2/Hz; X, Y, and Z directions			
Case material		Main unit and cover: polycarbonate			
Weight		Approx. 80 g	Approx. 70 g	Approx. 22 g	Approx. 21 g
Accessories		Instruction manual			

*1 The laser classification is implemented on the basis of IEC 60825-1 in accordance with Laser Notice No. 56 of FDA (CDRH).
*2 Ensure the cable length is 30 m or less for the M8 connector type. Ensure the cable length is 20 meters or less when utilizing IO-Link communication.
*3 Output 2 and the external input are selectable.
*4 This counts as one output when connecting multiple units to the FS-MC8N/P, NU Series.
*5 When 500 µs (limited) is selected, the following restrictions are present.
- Only 2-point calibration can be performed.
- The detection area mask is set during calibration. (Manual setting of the mask area is not supported.)
- Output 2 is limited to an alarm output, such as gyro, and standard/area cannot be used.
- The interference prevention function is not supported.

*6 When expanding the system by 4 or more expansion units, use a power voltage of 20 V or higher.
*7 When the system is expanded by 1 or 2 units: –20 to +55°C, by 3 to 10 units: -20 to +50°C, by 11 to 16 units: -20 to +45°C

Interference Prevention Function (Separate Amplifier Type Only)

The separate amplifier type can prevent interference in a system expanded with additional amplifiers. To prevent interference, select four or eight units for the interference prevention setting. Set all the target amplifiers to the same number of units and the same response time.

When four or eight units is selected for the interference prevention setting, the response time changes as shown below.

Interference prevention setting	Response time
OFF	500 µs, 1 ms, 3 ms, 10 ms, 200 ms selectable
4 units	6 ms, 18 ms, 60 ms, 1.2 s selectable
8 units	12 ms, 36 ms, 120 ms, 2.4 s selectable

Set all the amplifiers in the expanded system to the same response time.

The IO-Link settings file (IODD) can be downloaded from the KEYENCE website (https://www.keyence.co.jp).

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