KEYENCE

Self-Contained
Full-Spectrum Sensor
LR-W Series

IO-Link

FULL-SPECTRUM SENSOR

Stable Detection of Changes in Appearance

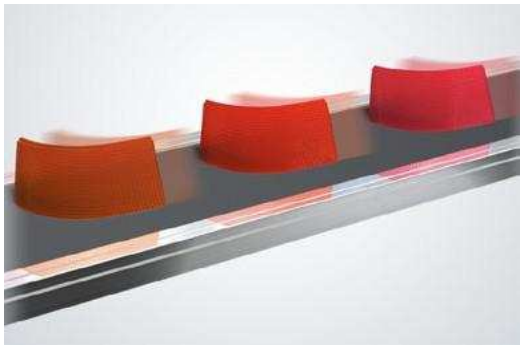
Long Range Model
LR-W500(C)

Small/Dual Spot Model
LR-W70(C)

Fiber Extension Model
LR-WF10(C)

PRESENCE AND ABSENCE

Part detection in a mold or die



Rounded target detection on a moving conveyor

WHAT IS A FULL-SPECTRUM SENSOR?

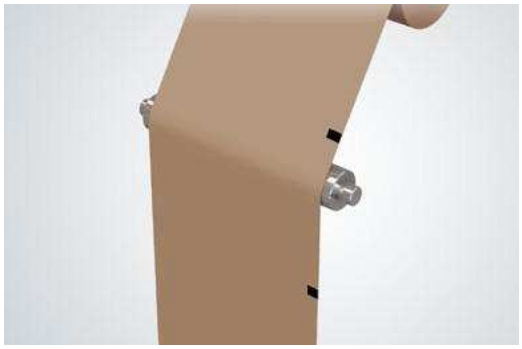
A Full-Spectrum sensor features unmatched detecting capabilities that allow it to complete the simplest to the most complex applications with ease. The LR-W Series is one such sensor that can truly handle the Full-Spectrum of applications.

Product differentiation based on appearance

Product treatment/coating verification

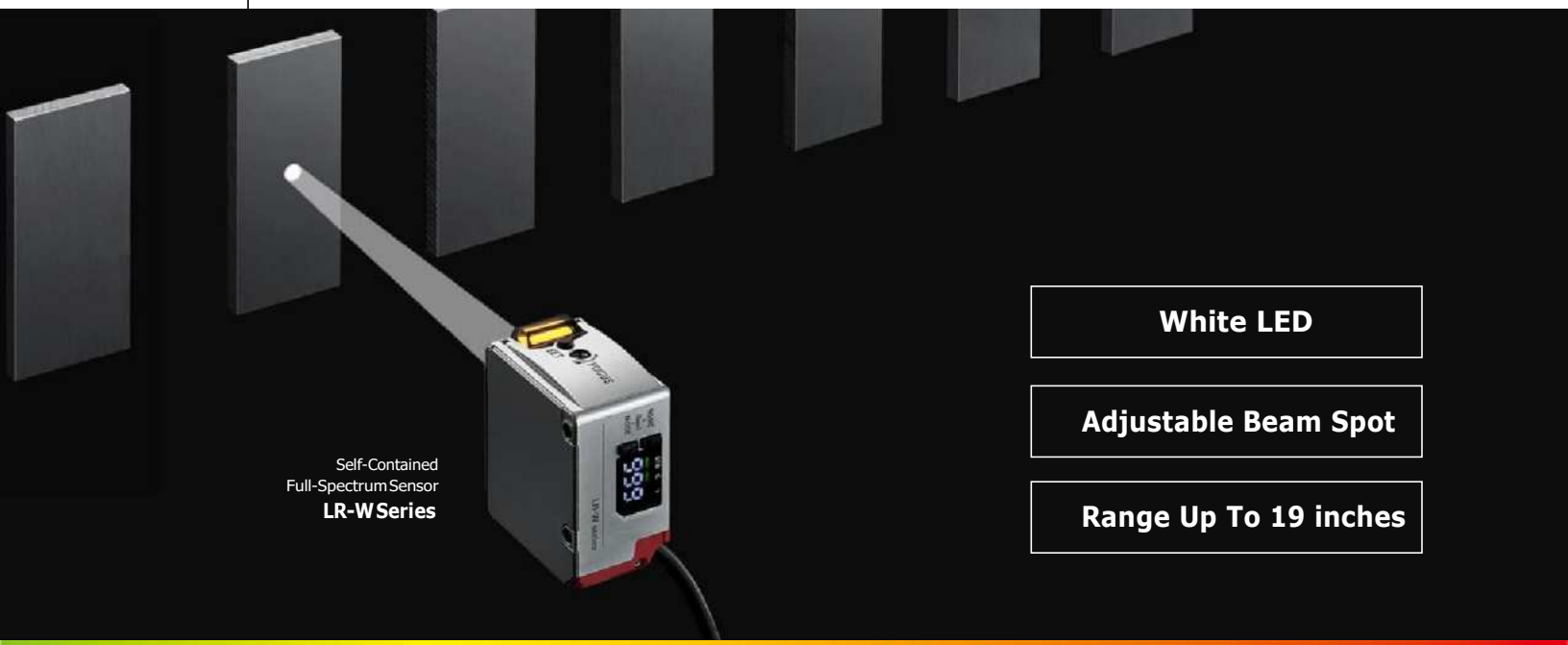
PRODUCT DIFFERENTIATION

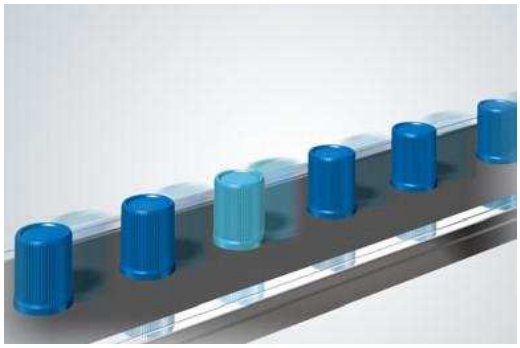
REGISTRATION MARKS



Registration mark detection on film

Registration mark detection on a rounded surface





Confirming proper color shade

Differentiating very similar colors

COLOR VERIFICATION

UNMATCHED DETECTION CAPABILITIES

- Superior Full-Spectrum Detecting Capabilities
- 500 mm 19.69" Range with Adjustable Beam Spot
- Automatic Light Power Control for Stable Detection

EASE-OF-USE

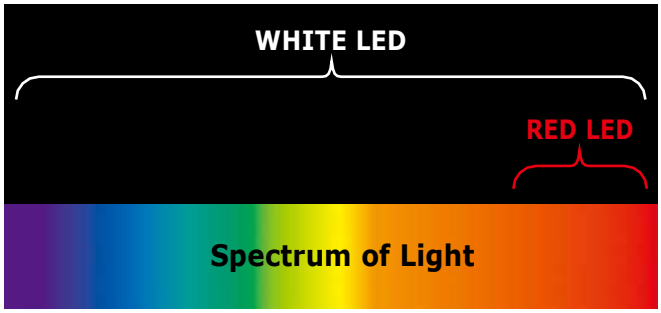
- One Touch Calibration
- User-Friendly Display
- Easy Integration into Any Setup

DURABILITY

- Robust Metal Housing
- Water Resistant
- Dustproof

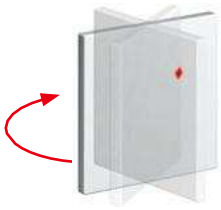
UNMATCHED DETECTING CAPABILITIES

Full-Spectrum Detection



Unlike conventional sensors which only use a Red LED, the LR-W utilizes a White LED and the full color spectrum. By doing this, the LR-W can reliably and stably differentiate a much wider range of targets.

Examples of targets the LR-W can stably detect

		
Targets with Slight Color Changes	**Metal Targets**	**Tilted Targets**

High Power White LED and Automatic Power Control

Detecting Dark Targets

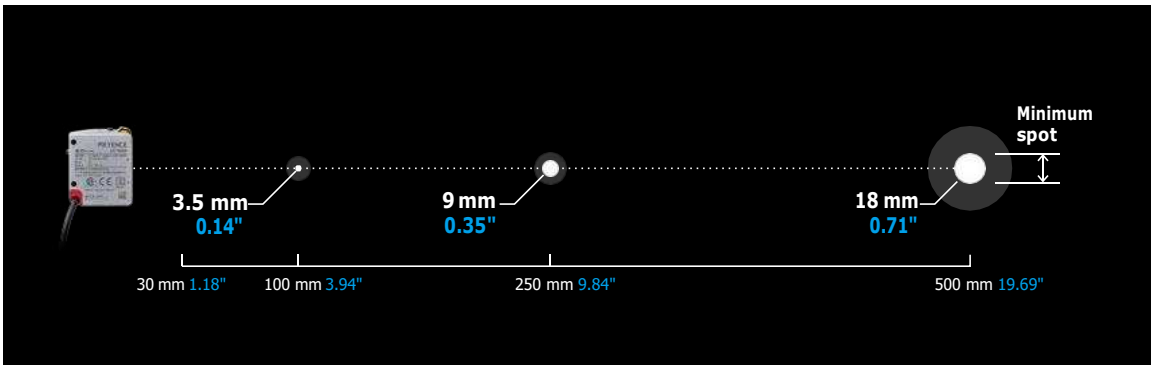
Detecting Glossy Targets

500,000× High Dynamic Range

By utilizing a High Powered White LED, the LR-W ensures detection of dark targets. For glossy targets, the LR-W features an Automatic Power Control function that optimizes the sensor's power and sensitivity to ensure stable detection.

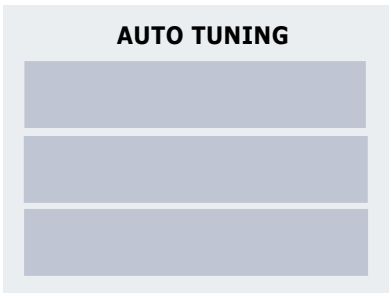
*10 ms or slower response time is required for Automatic Power Control

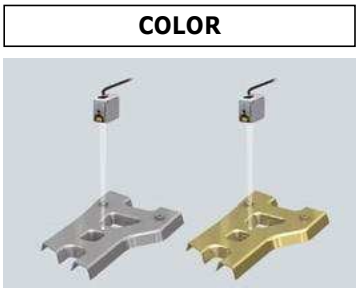
Superior Detecting Distance with Adjustable Spot

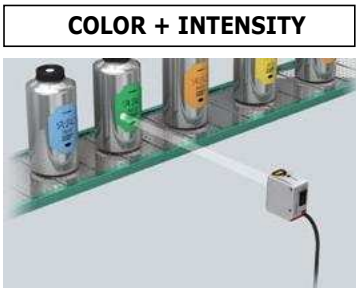


With an impressive 500 mm 19.69" range, the LR-W is able to solve applications that were once considered out of reach. The LR-W also features an easy to adjust spot that can be widened or focused to provide the best detection based on the target. These two features combine to make the LR-W a truly all-purpose solution.

Auto Tuning Ensures Best Detection Method







By using the Auto Tuning function, the LR-W accounts for a target's color, brightness, and surface finish to determine which detection method is best suited for the given application. This helps to ensure stable detection regardless of target variations.

EASE-OF-USE

Simplified Calibration

The LR-W can easily perform three different types of calibration. Users can choose from One-Point (1-P), Two Point (2-P), and Master Calibration.

Product Differentiation

1-P Calibration

One simple press is all that is needed to stably match a specific product.

Registration Mark Detection

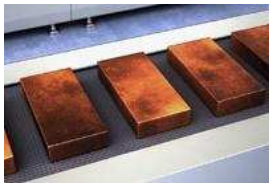
AUTO TUNING 2-P Calibration

Detect difficult registration marks with a simple Two-Point (2-P) Calibration.

Varying Color Detection

Master Calibration

Innovative tuning option to set clear thresholds for target variation.



Products fluttering on conveyor belts Color variances within products

Master Calibration/ Master Addition Calibration

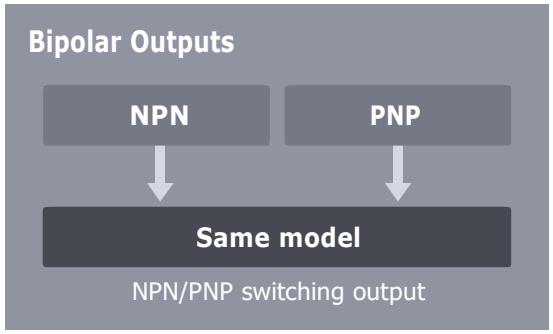
Color inconsistencies, vibration, worn surfaces, and tilting or angling of targets can all lead to unstable detection. Master Calibration allows user's to teach the sensor these variations in advance. Master Addition Calibration enables conditions to be easily added as they arise.

Intuitive Display and Indicators

The LR-W features a highly visible 7-segment display that provides constant feedback, as well as indicators to show detection mode and stability.

The highly visible indicator is bright and can clearly be seen from long distances.

Seamless Integration



The LR-W has selectable NPN or PNP outputs in the same unit, making it easy to standardize on different machine types.

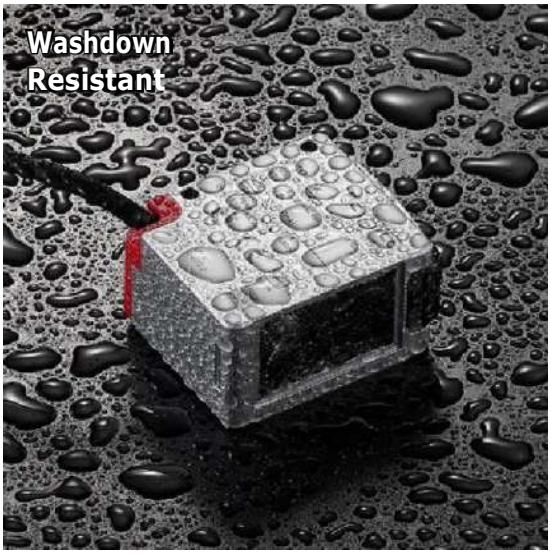
The LR-W Series offers a standard M12 4-pin quick disconnect option for easy wiring.

The LR-W features a standard mounting pitch of 25.4 mm 1.00", allowing it to easily mount on existing brackets.

If flexible mounting is required, an adjustable mounting bracket is also available.

DURABILITY

High Environmental Resistance



The LR-W Series meets the requirements of IP65 and IP67 for areas requiring washdown.

These IP Ratings also allow the LR-W to perform in dusty or dirty environments.

Robust Housing

The die cast metal housing can withstand impact from products, tools, or workers.

The rigid metal housing of the LR-W allows for secure mounting without the fear of damage to the unit.

Additional Lineup

LR-W70(C) : LR-W Series Small/Dual Spot Model

When precise detection is necessary:

- Small Targets
- Complex Reg. Marks
- Difficult Assemblies

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LR-WF10(C) : LR-W Series Fiber Extension Model

When unique mounting is required:

- Limited Space
- Harsh Environment
- Versatile Options

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MU-N Series : Multi-Sensor Controller

When additional functionality is needed:

- Multiple Outputs
- Analog
- Networking

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LR-Z & LR-T Series: Position Based Sensor Series

When color/ contrast needs to be ignored:

- Position Based
- Long Range
- Unaffected by Appearance

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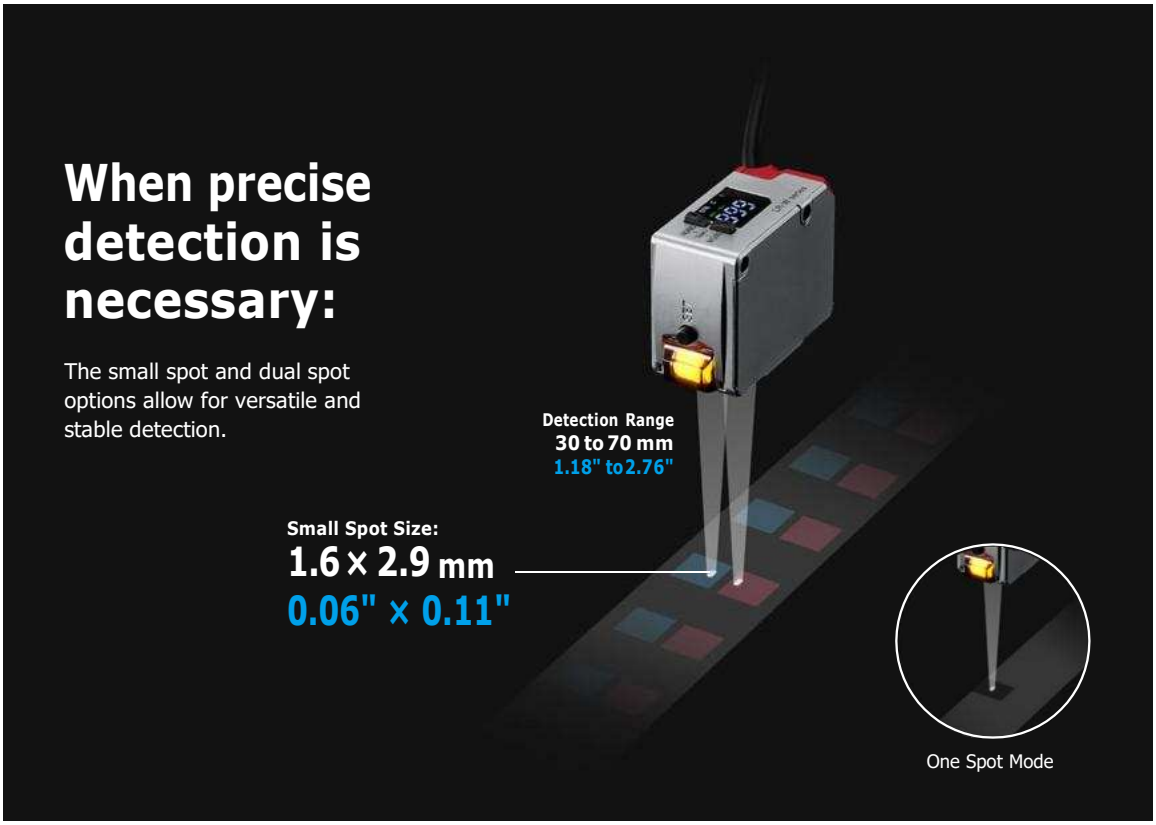
LR-W70(C)	LR-W Series Small/Dual Spot Model



Small Spot Detection

By utilizing the one spot detection mode, it is possible to easily detect/ confirm the appearance of smaller targets.

Confirmation of proper chip orientation

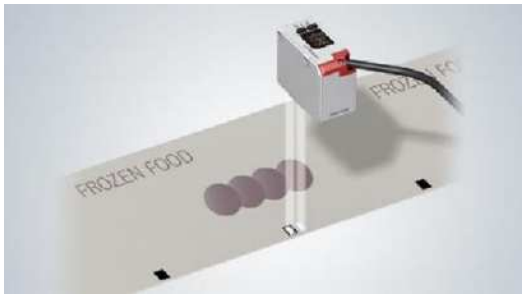
Weld seam detection on metal coil stock

Dual Spot Detection

The innovative usage of dual spot technology provides a level of precise appearance detection that has never been seen before. The LR-W70(C) also offers two unique sensing styles when using Dual Spot Detection.

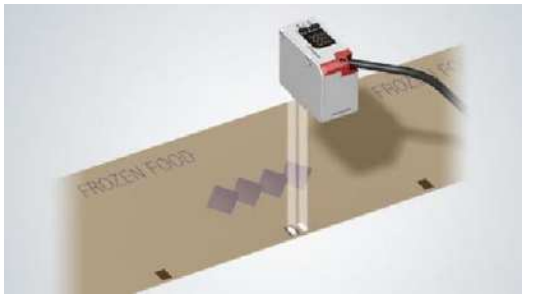
Difference Monitoring

Detect target variations by monitoring the difference in appearance between the two spots without the need for calibration.



Immediately detect registration marks without calibrating

No Tuning

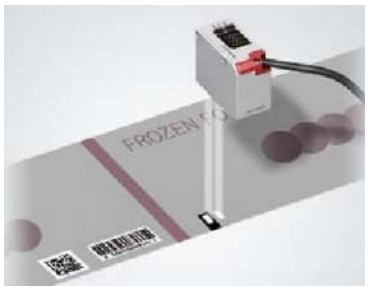


No calibration necessary even when switching targets

2-Point Matching

Complex or precise appearance detection is now possible by matching not one, but two spots.

Complex Registration Marks



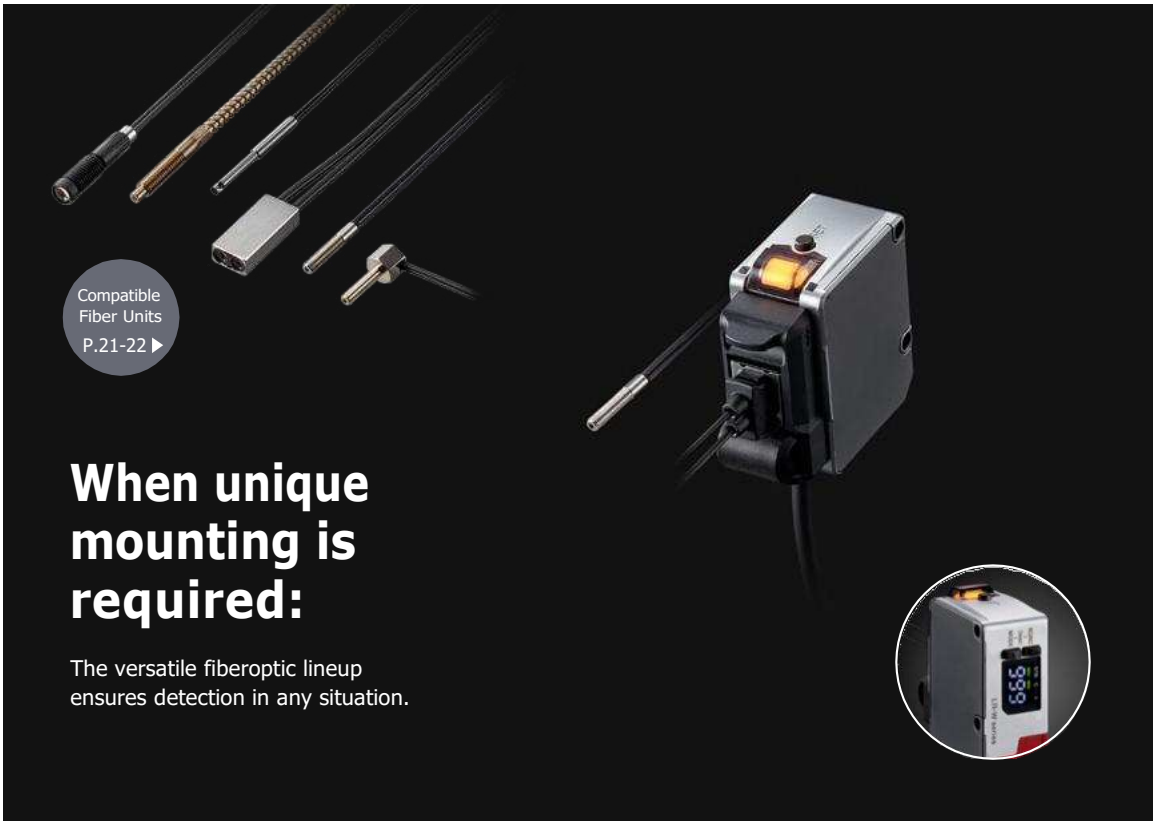
Difficult Marks: Ignore design variables
No Marks: Identify repeating patterns

Correct Combination Detection

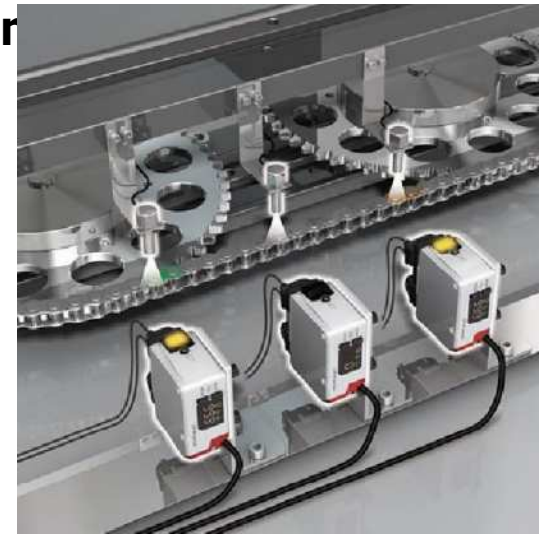
(Silver Pin) - Correct Part **(Gold Washer)** - Correct part

Ensure proper combination of two components by referencing two spots individually.

LR-WF10(C)	LR-W Series Fiber Extension Model



Benefits of Fiber Extension



Small Size Heads

Fiberoptics enable detection in locations that are too tight for conventional sensors.

Accessible Controls

Simple and accessible remote programming is possible when using fiberoptic heads.

Versatile Options

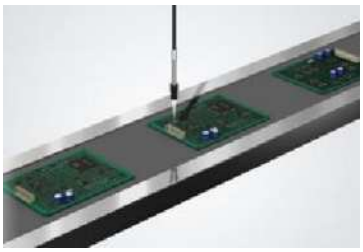
High temperature, high flex, and numerous mounting options are all available in the extensive fiberoptic lineup.

Mounting Constraints Require a Small Spot and Small Head

Through the use of built-in or attachable lenses, certain fiber heads are able to achieve exceedingly small spots for detection.

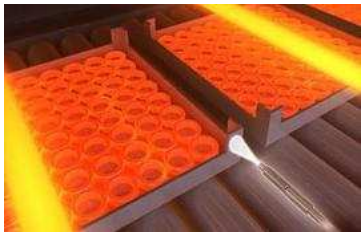
APPLICABLE HEADS

FU-20: Spot Diameter: 0.1 mm 0.004", Focal Distance: 5 mm 0.20"
FU-10: Spot Diameter: 0.9 to 3.5 mm 0.04" to 0.14", Focal Distance: 10 to 30 mm 0.39" to 1.18"
FU-35FZ w/ F-2HA Lens: Spot Diameter: 0.4 mm 0.016", Focal Distance: 7±2 mm 0.28"±0.08"



Environmental Concerns

Guarded (FU-40G, FU-35FG)
Stainless steel guarding prevents damage due to crushing or pinching.



High Temp (FU-83C)
Operate stably in environments of up to 300°C 572°F.

High Flex (FU-49U)
Mounting on machines with continuous motion is no longer a concern.

Unique Application Needs

Side View (FU-31, FU-35TZ)
Innovative head designs allow for unobtrusive mounting in tight spaces.

Area Beam (CZ-12)
Monitoring an area provides stable detection of non-repeatable targets.

Definite Reflective (FU-40S)
Ignore any appearance changes that do not occur within a designated window.

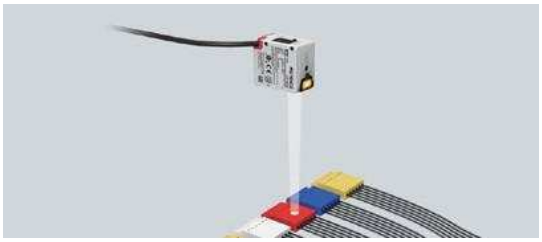
MU-N Series	Multi-Sensor Controller

When additional functionality is needed:

Increased I/O, network compatibility, and more, further expand the sensor's capabilities.

The LR-W Series can be connected to the MU-N to allow for increased functionality.

Various Output Options



Selectable I/O	1 Output (16 banks)
	Parallel 4 Outputs (2 banks)
	Binary 15 Outputs (No bank)
Analog	4 to 20 mA or 0 to 10 V

The MU-N Series controller offers customizable I/O. This includes both control outputs and a voltage/ current analog output.

Rich OLED Display

The combination of an OLED and 7-Segment Display allows users to quickly view data in real time. The MU-N also has the ability to display live graphs for easy machine monitoring.

Network Compatibility

EtherNet/IP™

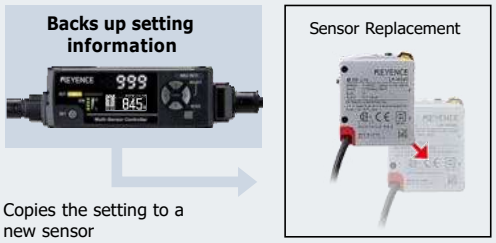
CC-Link V2

DeviceNet™

Enable copying and writing of data via wide varieties of communication protocols.

By pairing the MU-N Series with the KEYENCE NU Series, users can transmit data over a standard industrial network. Compatible networks include EtherNet/IP™, CC-Link, and DeviceNet™.

Settings Back-Up Function

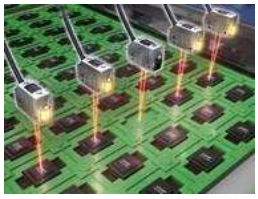


The Settings Back-Up Function allows users to save sensor settings on the MU-N and quickly transfer them to new sensors that are attached.

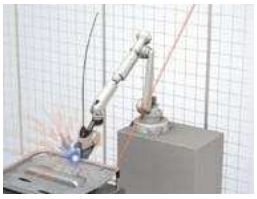
LR-Z & LR-T Series	Position Based Sensor Series

When color/ contrast needs to be ignored:

Distance-based measuring principles enable stable presence detection of any object.



LR-Z Series
Part presence regardless of varying colors



LR-T Series
Welding cell target detection

LR-T Series
Metal level detection

CMOS Laser Sensors
LR-Z

Detecting Distance (25 to 250 mm 0.98" to 9.84")

- **Best in class detecting ability**
- **Transparent object detection**
- **Stainless steel body with IP69K rating**

TOF Laser Sensors
LR-T

Detecting Distance (0.06 to 5 m 0.2' to 16.4')

- **Max. 5 m 16.4' detecting distance**
- **Custom IC for superior detecting capabilities**
- **Metal body with IP65/IP67 enclosure rating**

Lineup

Type		Detecting distance	Min. spot diameter	Light source	Model	Weight
Cable (2 m 6.6')	Standard Type	30 to 500 mm 1.18" to 19.69"	Adjustable spot ・Approx. ø3.5 mm ø0.14" (at detecting distance of 100 mm 3.94") ・Approx. ø9 mm ø0.35" (at detecting distance of 250 mm 9.84") ・Approx. ø18 mm ø0.71" (at detecting distance of 500 mm 19.69")	White LED	**LR-W500**	Approx. 170 g
M12 connector (Cable sold separately)					**LR-W500C**	Approx. 110 g
Cable (2 m 6.6')	Small/ Dual Spot Type	30 to 70 mm 1.18" to 2.76"	Approx. 1.6 × 2.9 mm 0.06" × 0.11" at 50 mm 1.97"	White LED	**LR-W70**	Approx. 130 g
M12 connector (Cable sold separately)					**LR-W70C**	Approx. 75 g
Cable (2 m 6.6')	Fiber Type	Detecting Distance and Min. Spot Diameter Based on Attached Fiber Head (See Pages 21 & 22 for details)		White LED	**LR-WF10**	Approx. 150 g
M12 connector (Cable sold separately)					**LR-WF10C**	Approx. 95 g

Mounting bracket

Type	Applicable Sensors	Model	Material / weight
Standard mounting bracket (M3 screw × 2 supplied)	LR-W500 / W70 / WF10	**OP-88021**[*1]	SUS304 Approx. 110 g
Small mounting bracket (M3 screw × 2 supplied)	LR-W70 / WF10	**OP-88022**[*1]	SUS304 Approx. 50 g
Adjustable bracket (M3 screw × 2 supplied)	LR-W500(C)/ W70(C)/ WF10(C)	**OP-88023**	Zinc nickel plating, etc. Approx. 110 g
Adjustable bracket locking screw (105 mm 4.13")		**OP-88024**	Iron nickel plating Approx. 140 g

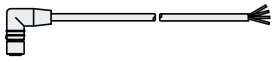
*1 The 4-pin M12 connector type may not be mounted in the orientation shown in the picture (connector downward). Confirm the dimensions and surroundings carefully.

Attachment

Type	Applicable Sensors	Model	Material / weight
Luster canceling attachment	LR-W500(C)	**LR-WA1**[*1 *2]	SUS304, PMMA, etc. Approx. 5 g
Luster canceling attachment	LR-W70(C)	**LR-WA2**[*1 *2]	SUS304, PMMA, etc. Approx. 7 g

*1 When using LR-WA1 or LR-WA2, detecting range may decrease on targets with low reflectance. Perform sufficient checks in the actual installation environment.
*2 When using the LR-WA1 or LR-WA2, the enclosure rating (IP65/IP67) is not met.

Cable

Appearance	Cable material	Sensor side	Cable end	Length	Model	Weight
	Cable: PVC (Polyvinyl chloride)	M12 4-pin straight	Loose wires	2 m 6.6'	**OP-75721**	Approx. 60 g
				5 m 16.4'	**OP-87272**	Approx. 125 g
				10 m 32.8'	**OP-85502**	Approx. 230 g
	Cable: PUR (Polyurethane)			2 m 6.6'	**OP-87636**	Approx. 75 g
				10 m 32.8'	**OP-87637**	Approx. 330 g
	Cable: PVC (Polyvinyl chloride)	M12 4-pin L-shape		2 m 6.6'	**OP-87722**	Approx. 65 g
				5 m 16.4'	**OP-87273**	Approx. 130 g
				10 m 32.8'	**OP-87274**	Approx. 235 g
	Cable: PUR (Polyurethane)			2 m 6.6'	**OP-87640**	Approx. 75 g
				10 m 32.8'	**OP-87641**	Approx. 330 g

Controller

Type	Control output	External input	Analog output	Model	Weight
Main unit	4 standard outputs max.* (15 signal combinations available using binary logic)	5 inputs max.*	1 output max.*	**MU-N11**	Approx. 70 g
Expansion unit			—	**MU-N12**	Approx. 70 g

*Six I/O wires available, see instruction manual for applicable wire allocations.

Power supply cable for MU-N Series Cable is not included with the controller. Must be purchased separately.

Appearance	Applicable unit	Cable material	Cable end	Controller side	Length	Model	Weight
	Main unit	PVC (Polyvinyl chloride)	8-core loose wires	Connector	2 m 6.6'	**MU-CB8**	Approx. 150 g
			4-core loose wires			**MU-CB4**	Approx. 120 g
	Expansion unit		6-core loose wires			**MU-CB6**	Approx. 130 g
			2-core loose wires			**MU-CB2**	Approx. 100 g
	Main unit		M12 4-pin straight		0.3 m 1.0'	**MU-CC4**	Approx. 30 g

Sensor-to-controller cable (for 4-pin M12 connector type)

Appearance	Cable material	Sensor side	Controller side	Length	Model	Weight
	PVC (Polyvinyl chloride)	M12 4-pin straight	Connector	2 m 6.6'	**OP-88025**	Approx. 75 g
				10 m 32.8'	**OP-88026**[*1]	Approx. 280 g
		M12 4-pin L-shape		2 m 6.6'	**OP-88027**	Approx. 75 g
				10 m 32.8'	**OP-88028**[*1]	Approx. 280 g

*1 The 10 m 32.8' cable includes one spare connector for the controller side.

Connector set for sensor-to-controller connection This set is required when the sensor cable end is loose wires or when the sensor-to-controller cable is cut.

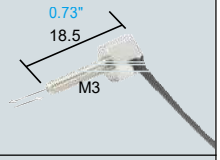
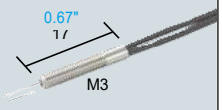
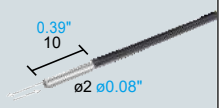
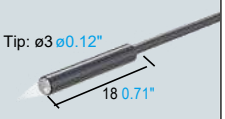
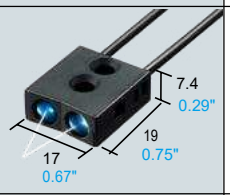
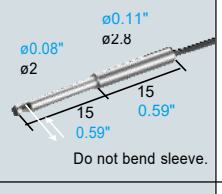
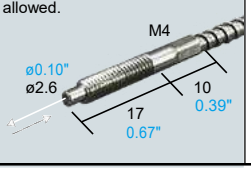
Appearance	Type	Applicable model	Model	Weight
	For PVC (Polyvinyl chloride) cable	LR-W500, LR-W70, LR-WF10 OP-75721/87272/85502 OP-75722/87273/87274	**OP-88029**	Approx. 3 g
	For PUR (Polyurethane) cable	OP-87636/87637 OP-87640/87641	**OP-88030**	Approx. 3 g

Controller mounting options

Appearance	Type	Description	Model	Weight
	Mounting adapter (for main unit)	Allows the main unit to be mounted without a DIN rail.	**OP-76877**	Approx. 11 g
	End unit (for expansion)	Used to secure the main and expansion units to DIN rail from both ends. End units must be used when an expansion unit is connected. (2 pieces included)	**OP-26751**	Approx. 15 g

Fiber unit specification when using LR-WF10(C)

Unit: mm inch

Feature	Type	Fiber unit length (Diameter) Ambient temperature	Appearance	Minimum bend radius	Detecting distance	Model Weight
Threaded and Hex-shaped Fibers	M3 Hex-shaped Coaxial	1 m 3.3' Free-cut (ø1.3 ø0.05" × 2) -40 to +50°C -40 to +122°F		R2 R0.08" ToughFlex	500 ms: 47 1.85" 100 ms: 32 1.26" 10 ms: 12 0.47" 1 ms: 7 0.28" 250 µs: 5 0.20"	**FU-35TZ** Approx. 7 g
	M3 Threaded Coaxial	1 m 3.3' Free-cut (ø1.3 ø0.05" × 2) -40 to +50°C -40 to +122°F				**FU-35FZ** Approx. 6 g
Cylinder (Set Screw Installation)	Diameter ø2 ø0.08"	1 m 3.3' Free-cut ø1.0 ø0.04" × 2 -40 to +50°C -40 to +122°F		R2 R0.08" ToughFlex High-flex	500 ms: 33 1.30" 100 ms: 24 0.94" 10 ms: 9 0.35" 1 ms: 4 0.16" 250 µs: 3 0.12"	**FU-49U** Approx. 4 g
Small Spot Reflective	Beam spot diameter ø0.9 to 3.5 ø0.04" to ø0.14" Focal distance 10 to 30 0.39" to 1.18"	2 m 6.6' Free-cut (ø1.3 ø0.05" × 2) -40 to +70°C -40 to +158°F		R25 R0.98"	10 to 30 0.39" to 1.18"	**FU-10** Approx. 5 g
	Beam spot diameter Approx. ø0.1 ø0.004" Focal distance 5 0.20"	50 cm 1.6' cut not allowed. -40 to +70°C -40 to +158°F			5 ± 1 *1 0.20" ± 0.04"	**FU-20** Approx. 2 g
Focused Beam/ High-power	Aperture angle: Approx. 8°	2 m 6.6' Free-cut (ø2.2 ø0.09" × 2) -40 to +50°C -40 to +122°F		R2 R0.08" ToughFlex	500 ms: 26 to 379 1.02" to 14.92" 100 ms: 27 to 270 1.06" to 10.63" 10 ms: 33 to 112 1.30" to 4.41" 1 ms: — 250 µs: —	**FU-40** Approx. 23 g
Definite-reflective	Thin, Small	2 m 6.6' Free-cut (ø2.2 ø0.09" × 2) -40 to +70°C -40 to +158°F		R25 R0.98"	500 ms: 2 to 131 0.08" to 5.16" 100 ms: 3 to 119 0.12" to 4.69" 10 ms: 10 to 93 0.39" to 3.66" 1 ms: 12 to 79 0.47" to 3.11" 250 µs: 13 to 68 0.51" to 2.68"	**FU-40S** Approx. 25 g
Sleeve	Side view detection	2 m 6.6' Free-cut (ø1.0 ø0.04" × 2) -40 to +70°C -40 to +158°F		R10 R0.39"	500 ms: 30 1.18" 100 ms: 20 0.79" 10 ms: 7 0.28" 1 ms: 3 0.12" 250 µs: 2 0.08"	**FU-31** Approx. 5 g
Heat Resistant	Heat resistant temperature*2: 300ºC 572°F	1 m 3.3' cut not allowed. -40 to +300°C -40 to +572°F		R25 R0.98"	500 ms: 158 6.22" 100 ms: 107 4.21" 10 ms: 40 1.57" 1 ms: 24 0.94" 250 µs: 16 0.63"	**FU-83C** Approx. 23 g

*1 Cannot be used with the response time of 250 µs and 1 ms.

*2 Use the fiber sensor under dry conditions. Allow some margin for the temperature upper limit when selecting a heat-resistant fiber unit.

Lens + Fiber Unit

Unit: mm inch

Type	Beam spot diameter	Focal distance	Lens		Fiber units		
			Model	Appearance Weight	Minimum bend radius	Appearance	Model
Small spot	Approx. ø0.4 ø0.02"	7 ±2 0.28" ±0.08"	**F-2HA**	-30 to +70°C -22 to +158°F Tip: ø4.3 ø0.17" 15.6 0.61" Approx. 1 g	R2 R0.08" ToughFlex		**FU-35FZ**
					R2 R0.08" ToughFlex		**FU-35TZ**
	Approx. ø0.5 ø0.02"	15 ±2 0.59" ±0.08"	**F-4HA**	-30 to +70°C -22 to +158°F Tip: ø7.4 ø0.29" 27 1.06" Approx. 2 g	R2 R0.08" ToughFlex		**FU-35FZ**
					R2 R0.08" ToughFlex		**FU-35TZ**
Side-view adjustable spot	Approx. ø0.5 to ø3 ø0.02" to ø0.12"	8 to 30 0.32" to 1.18"	**F-5HA**	-30 to +70°C -22 to +158°F 8.7 0.34" 5.6 0.22" 15 0.59" Approx. 2 g	R2 R0.08" ToughFlex		**FU-35FZ**

CZ series unit

Unit: mm inch

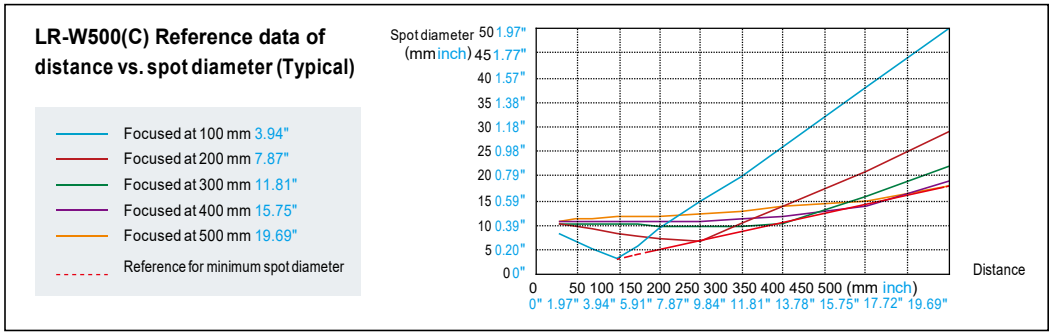
Type	Smallest spot diameter	Detection range	Model	Appearance	Minimum bend radius	Enclosure rating	Weight
Small size adjustable spot	ø0.9 to ø3.5 ø0.04" to ø0.14"	10 to 30 0.39" to 1.18"	**CZ-10**	2 m 6.6' Free-cut -40 to +70°C -40 to +158°F	R25 R0.98"	IP40	Approx. 5 g
Small size, side-view adjustable spot	ø0.9 to ø1.5 ø0.04" to ø0.06"	3 to 15 0.12" to 0.59"	**CZ-11**	1 m 3.3' -40 to +70°C -40 to +158°F			Approx. 13 g
Long detection distance, small beam spot	ø2 ø0.08"	35 ±3 1.38" ±0.12"	**CZ-13**	1 m 3.3' -40 to +70°C -40 to +158°F			Approx. 20 g
Long detection distance	ø6 ø0.24"	70 ±20 2.76" ±0.79"	**CZ-40**	2 m 6.6' Free-cut -40 to +70°C -40 to +158°F		IP67	Approx. 27 g
Small beam spot	ø1 ø0.04"	16 ±4 0.63" ±0.16"	**CZ-41**	2 m 6.6' Free-cut -40 to +70°C -40 to +158°F	R15 R0.59"		
Area beam spot, reflective	—	5 to 20 0.20" to 0.79"	**CZ-12**	2 m 6.6' Free-cut -40 to +70°C -40 to +158°F	R25 R0.98"	—	Approx. 19 g
Transparent object differentiation, retro-reflective	—	Reflector R-2: 40 to 1000 1.57" to 39.37" R-3: 40 to 500 1.57" to 19.69" R-5: 40 to 300 1.57" to 11.81"	**CZ-60**	2 m 6.6' Free-cut -20 to +55°C -4 to +131°F			Approx. 23 g

Sensor specifications

Type		Standard Type	Small/Dual Spot Type	Fiber Type
Model	2 m 6.6' cable type	LR-W500	LR-W70	LR-WF10
	M12 connector 4-pin type	LR-W500C	LR-W70C	LR-WF10C
Detecting distance		30 to 500 mm 1.18" to 19.69"	30 to 70 mm 1.18" to 2.76"	Detecting Distance and Min. Spot Diameter Based on Attached Fiber Head (See Pages 21 & 22 for details)
Min. spot diameter		Adjustable spot Approx. ø3.5 mm at 100 mm ø0.14" at 3.94" Approx. ø9 mm at 250 mm ø0.35" at 9.84" Approx. ø18 mm at 500 mm ø0.71" at 19.69"	Approx. 1.6 × 2.9 mm at 50 mm 0.06" × 0.11" at 1.97"	
Response time*1		200 µs/ 1 ms/ 10 ms/ 100 ms/ 500 ms selectable	1-Spot Mode: 200 µs, 1 ms, 10 ms, 100 ms, 500 ms selectable 2-Spot Mode, Difference Monitoring: 500 µs, 2.5 ms, 20 ms, 200 ms, 999 ms selectable 2-Spot Mode, 2-Point Matching: 400 µs, 2 ms, 20 ms, 200 ms, 999 ms selectable	250 µs, 1 ms, 10 ms, 100 ms, 500 ms Selectable*2
Light source		White LED		
Mutual interference reduction function		Up to 2 units when alternate frequencies set		
Timer		OFF/ ON delay/ OFF delay/ One-shot		
Power supply	Power voltage	10 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS		
	Current consumption*3	65 mA or less (without load) at 24 VDC; 120 mA or less (without load) at 12 VDC	60 mA or less (without load) at 24 VDC; 110 mA or less (without load) at 12 VDC	50 mA or less (without load) at 24 VDC; 90 mA or less (without load) at 12 VDC
I/O*4	Control output	NPN open collector/ PNP open collector selectable, 30 VDC or less, 50 mA or less, remaining voltage: 2 V or less, N.O./ N.C. selectable		
	External input	Tuning / laser emission stop selectable, Short circuit current: 1 mA or less for NPN/ 2 mA or less for PNP For the applied voltage, see the wiring diagrams in the instruction manual. For the input times, see the time charts in the instruction manual.		
Protection circuit		Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection		
Environmental resistance	Enclosure rating	IP65 / IP67 (IEC60529)		IP65 (IEC60529)*5*6
	Ambient light	Incandescent lamp: 10000 lux or less, Sunlight: 20000 lux or less		
	Ambient temperature	-20 to +50°C -4 to 122°F (no freezing)		-20 to +45°C -4 to 113°F (no freezing)
	Ambient humidity	35 to 85%RH (no condensation)		
	Shock resistance	1000 m/s² in X, Y, Z axis directions respectively 6 times		
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 0.06" in the X, Y, Z axis directions respectively, 2 hours		
Material		Case: Zinc die cast (Nickel chrome plating), Indicator cover: PPSU, Buttons: PES, Lens cover (except for Fiber type) and display: PMMA (scratch-resistant coating), Cable bushing: PBT Cable (2 m 6.6' cable type only): PVC, Spot adjustment dial(Standard type only): Iron (triiron tetraoxide coated), Connector ring (4-pin M12 connector type only): PMP, Connector socket (4-pin M12 connector type only) : PEI, Fiber locking mount (Fiber type only): PBT, NBR, Silicone rubber, SUS304 , SUSXM7 Adapter (Fiber type only): PBT		
Weight	2 m 6.6' cable type	Approx. 170 g (including cable)	Approx. 130 g (including cable)	Approx. 150 g (including cable)
	M12 connector 4-pin type	Approx. 110 g	Approx. 75 g	Approx. 95 g

*1 When alternate frequencies are set, the response time increases by approximately 20%. *2 When using the IO-Link communication, if the response time is set in 1ms or more, it becomes approximately 10% slower.
*3 Standard type: 195 mA or less (at 10 V, with load), Small/Dual Spot type: 180 mA or less (at 10 V, with load), Fiber type: 160 mA or less (at 10 V, with load)
*4 IO-Link : Specification v.1.1/COM2 (38.4 kbps) is supported. The setup file can be downloaded from KEYENCE website (http://www.keyence.com).If you are using the product in an environment in which you cannot download files over the Internet, contact your nearest KEYENCE office.
*5 When the following small-diameter fiber units (the diameter of the cable is ø1.3 mm ø0.05" or ø1.0 mm ø0.04") are used, the IP65 rating cannot be satisfied (FU-4F/66/91/93/43/63/63T etc.). When any small-diameter fiber units except for the above are used, IP65 is applied.
*6 In any of the following cases, the IP65 enclosure rating cannot be satisfied.
·When the waterproof adapter A/B are not used at the time of installation of a small-diameter fiber unit.

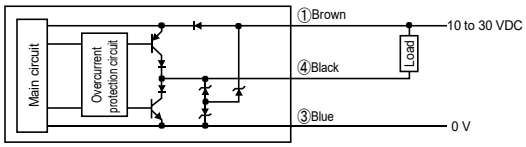
LR-W500(C) Reference data of distance vs. spot diameter (Typical)



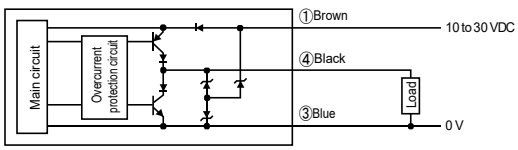
I/O circuit Diagrams

Control output circuit

When NPN is selected

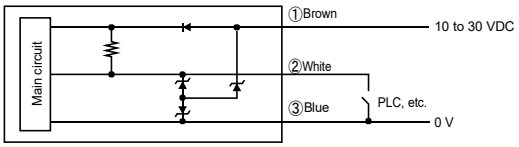


When PNP is selected

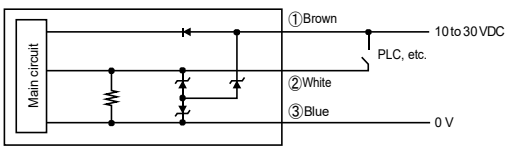


Input circuit

When NPN is selected



When PNP is selected



M12 Connector pin layout

Controller specifications

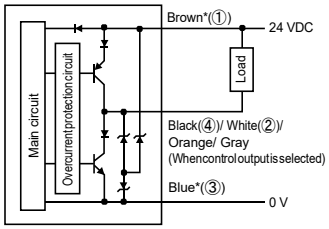
Model		MU-N11 Main unit			MU-N12 Expansion unit		
Connected sensor		LR-W500(C)	LR-W70(C)	LR-WF10(C)	LR-W500(C)	LR-W70(C)	LR-WF10(C)
Response time		Single output: 300 µs/ 1.1 ms/ 11 ms/ 100 ms/ 500 ms selectable Multiple output: 2 ms/ 3 ms/ 11 ms/ 100 ms/ 500 ms selectable	1- Spot Mode Single output: 300 µs/ 1.1 ms/ 11 ms/ 100 ms/ 500 ms selectable 2- Spot Mode Difference Monitoring: 600 µs/ 2.6 ms/ 21 ms/ 200 ms/ 1 s selectable 2-Spot Mode 2-Point Matching: 500 µs/ 2.1 ms/ 21 ms/ 200 ms/ 1s selectable 1- Spot Mode Multiple outputs: 2 ms/ 3 ms/ 11 ms/ 100 ms/ 500ms selectable 2- Spot Mode Multiple outputs: 2 ms/ 4 ms/ 21 ms/ 200 ms / 1 s selectable	Single output: 350 µs/ 1.2 ms/ 13 ms/ 120 ms/600 ms selectable Multiple output: 3 ms/4 ms/14 ms/ 120 ms/600 ms selectable	Single output: 300 µs/ 1.1 ms/ 11 ms/ 100 ms/ 500 ms selectable Multiple output: 2 ms/ 3 ms/ 11 ms/ 100 ms/ 500 ms selectable	1- Spot Mode Single output: 300 µs/ 1.1 ms/ 11 ms/ 100 ms/ 500 ms selectable 2- Spot Mode Difference Monitoring: 600 µs/ 2.6 ms/ 21 ms/ 200 ms/ 1 s selectable 2-Spot Mode 2-Point Matching: 500 µs/ 2.1 ms/ 21 ms/ 200 ms/ 1s selectable 1- Spot Mode Multiple outputs: 2 ms/ 3 ms/ 11 ms/ 100 ms/ 500 ms selectable 2- Spot Mode Multiple outputs: 2 ms/ 4 ms/ 21 ms/ 200 ms / 1 s selectable	Single output: 350 µs/ 1.2 ms/ 13 ms/ 120 ms/ 600 ms selectable Multiple output: 3 ms/ 4 ms/ 14 ms/ 120 ms/ 600 ms selectable
Mutual interference reduction function		Up to 2 units with alternate frequencies set					
Timer		OFF/ OFF delay/ ON delay/ One-shot					
Power supply	Power voltage	24 VDC, ripple (P-P) 10% or less, Class 2 or LPS					
	Current consumption	135 mA or less (without load) 335 mA or less (when 4 outputs are used, with load)	130 mA or less (without load) 330 mA or less (when 4 outputs are used, with load)	120 mA or less (without load) 320 mA or less (when 4 outputs are used, with load)	120 mA or less (without load) 200 mA or less (when 4 outputs are used, with load)	115 mA or less (without load) 195 mA or less (when 4 outputs are used, with load)	105 mA or less (without load) 185 mA or less (when 4 outputs are used, with load)
I/O	Control output	4 outputs max. NPN open collector/ PNP open collector selectable 24 VDC or less, main unit: 50 mA or less*1, expansion unit: 20 mA or less Remaining voltage: 2 V or less N.O./ N.C. selectable					
	External input	5 inputs max. Short circuit current: 1 mA or less for NPN/ 2 mA or less for PNP For the applied voltage, see the wiring diagrams in the instruction manual.					
	Analog output	1 output max. Current output/Voltage output selectable Current output: 4 to 20 mA Maximum load resistance: 450 Ω Voltage output: 0 to 10 V External load resistance: 5 kΩ or more			—		
Protection circuit		Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection					
Unit expansion		Up to 4 units per main unit*2					
Environmental resistance	Ambient temperature	-20 to +50°C -4 to 122°F (no freezing)					
	Ambient humidity	35 to 85%RH (no condensation)					
	Shock resistance	1000 m/ s² in X, Y, Z axis directions respectively 6 times					
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 0.06" in the X, Y, Z axis directions respectively, 2 hours					
Material		Case and dust cover: Polycarbonate, Button: Polyacetal, Display panel: Acrylic					
Weight		Approx. 70 g					

*1 20 mA or less when an expansion unit is connected.
*2 Up to 5 N-bus devices, including the main unit (or network unit), can be linked together.

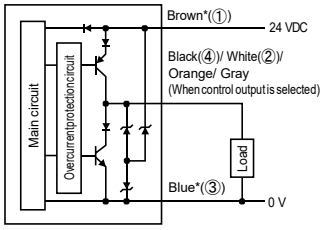
I/O circuit diagrams

Control output circuit

When NPN is selected



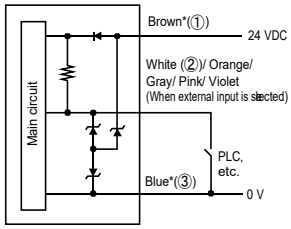
When PNP is selected



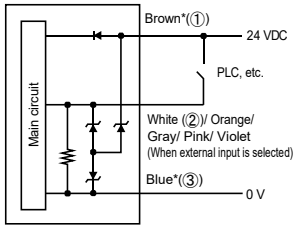
*MU-N11 only

Input circuit

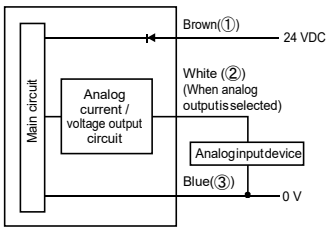
When NPN is selected



When PNP is selected



Analog output circuit*



Pin layout when the M12 connector (4-pin) cable is used

Power Cable wire colors

MU-N11 (main unit)

Wire color	Details	Power cable model/type	
Brown (1*)	24 V	MU-CB4 4-core cable for main unit (MU-CC4: M12 connector type)*	MU-CB8 8-core cable for main unit
Blue (3*)	0 V		
Black (4*)	Output 1		
White (2*)	Output 2/ Input1/Analog		
Orange	Output 3/ Input 2	—	
Gray	Output 4/ Input 3		
Pink	Input 4		
Violet	Input 5		

* Pin numbers when using an M12 connector cable

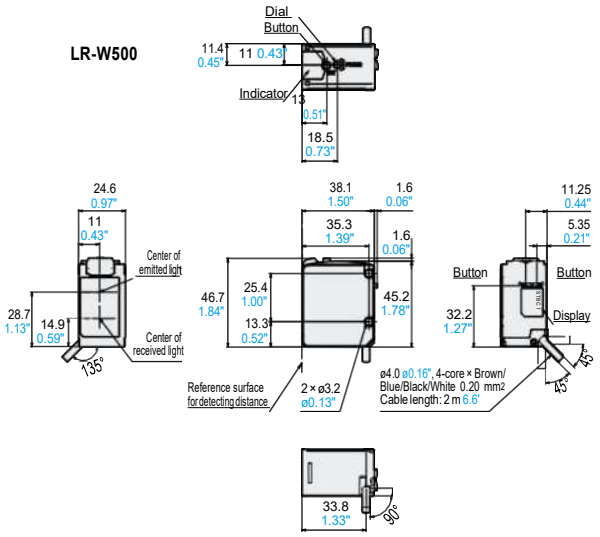
MU-N12 (expansion unit)

Wire color	Details	Power cable model/type	
Black	Output 1	MU-CB2 2-core cable for expansion unit	MU-CB6 6-core cable for expansion unit
White	Output2/ Input 1		
Orange	Output 3/ Input 2	—	
Gray	Output 4/ Input 3		
Pink	Input 4		
Violet	Input 5		

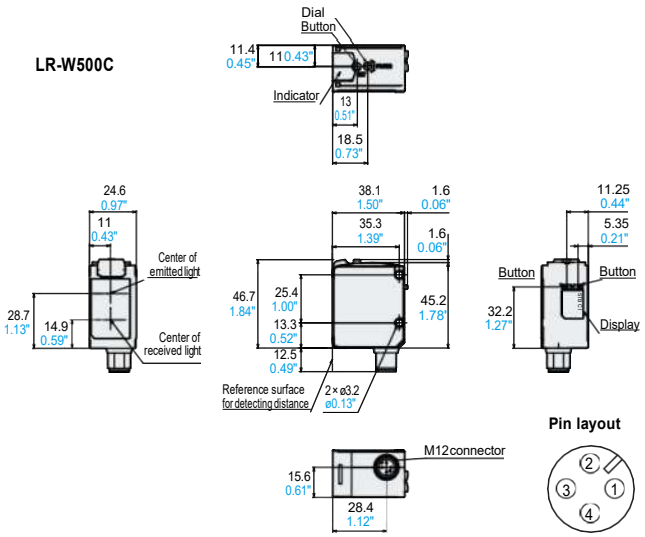
Dimensions

Unit: mm inch

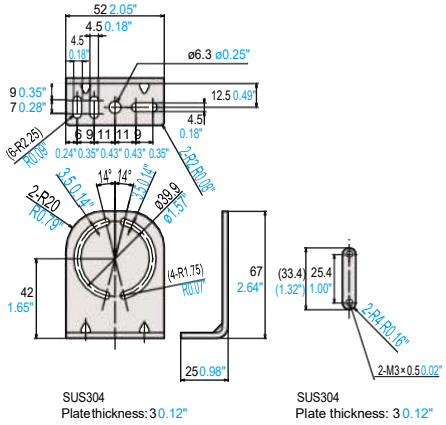
LR-W500



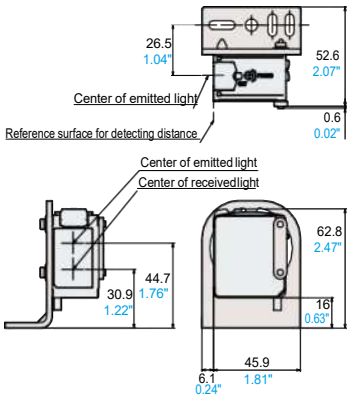
LR-W500C



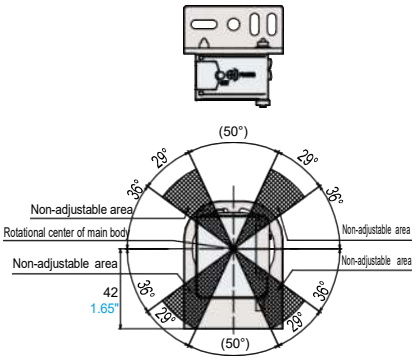
OP-88021



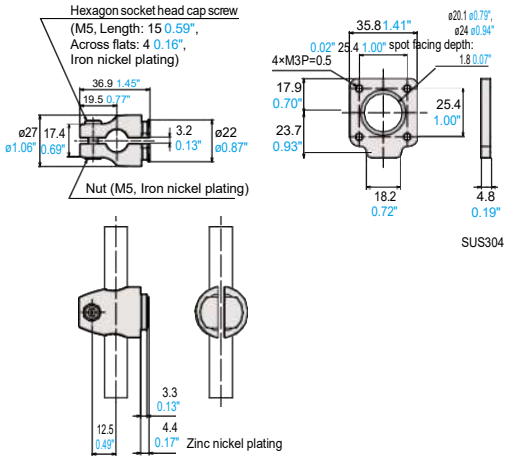
OP-88021 + LR-W500



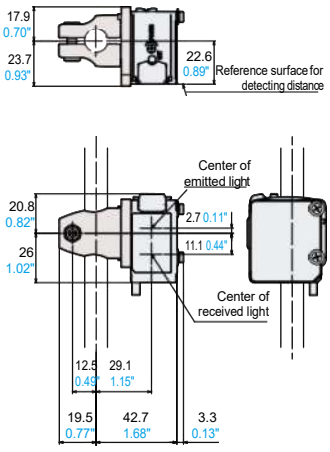
Angle non-adjustable area when **OP-88021** is used



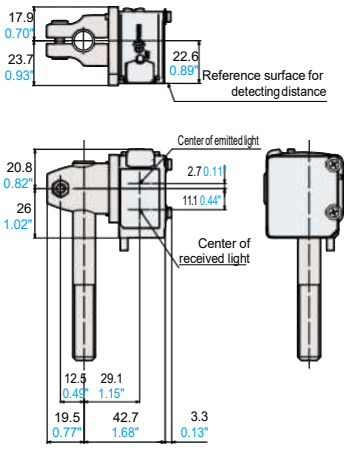
OP-88023



OP-88023 + LR-W500

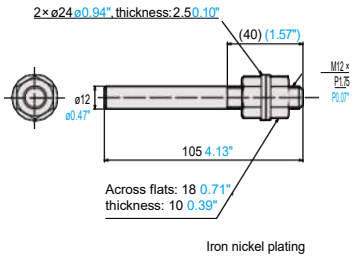


OP-88023 + OP-88024 + LR-W500

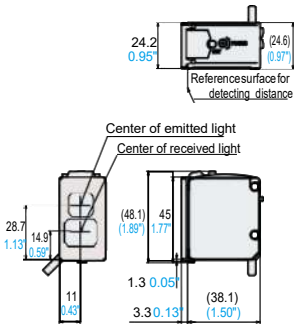


Dimensions

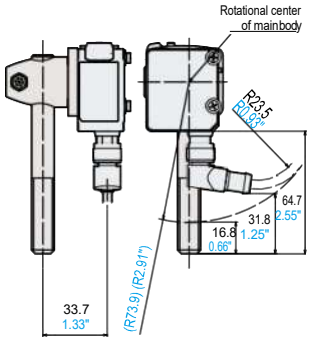
OP-88024



LR-WA1 + LR-W500

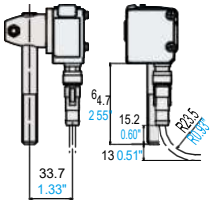


When **OP-88023** + **OP-88024** + **LR-W500C** + L-shape type M12 connector are used

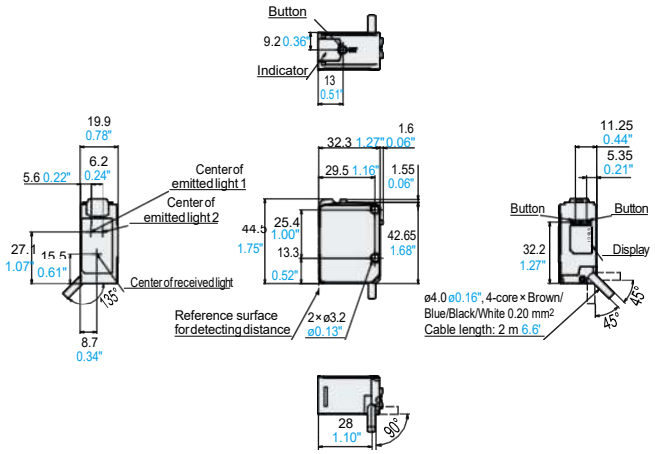


Warning for when an M12 connector type is used

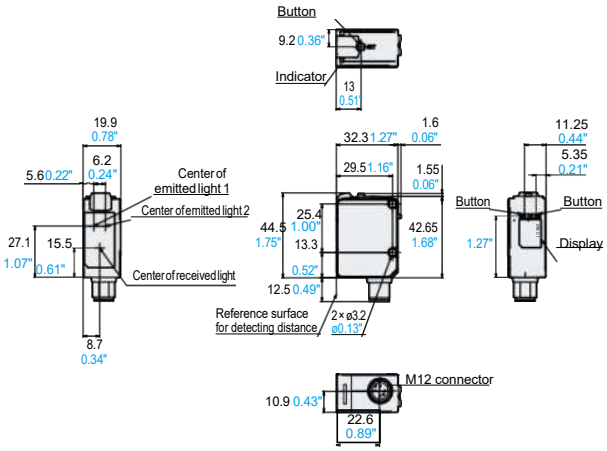
When mounting the unit as shown in the figure below (connector downward), carefully check the surroundings for any objects that might interfere with the connector cable.



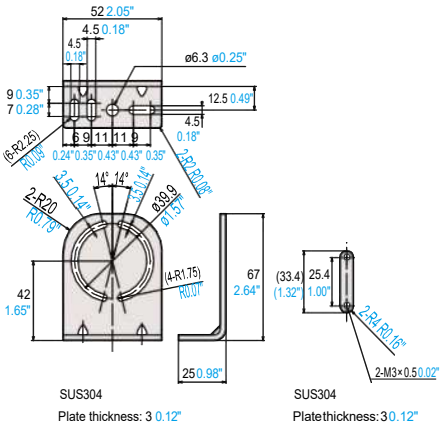
LR-W70



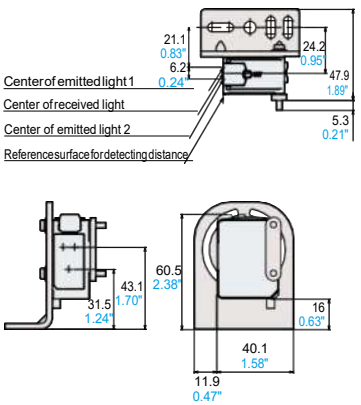
LR-W70C



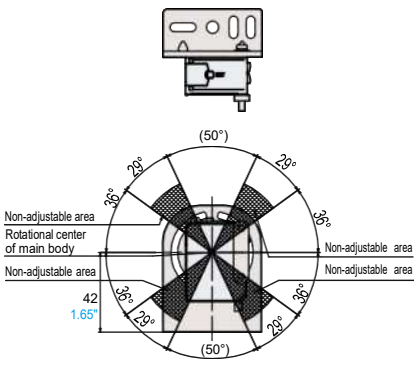
OP-88021



OP-88021 + LR-W70

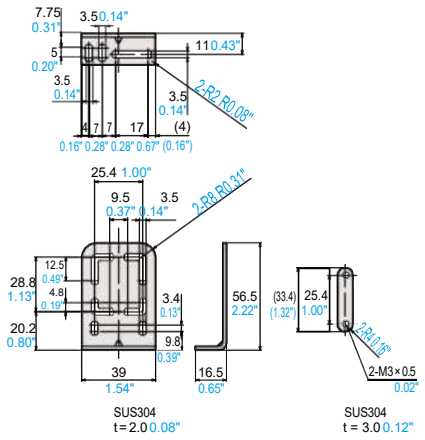


Angle non-adjustable area when **OP-88021** is used

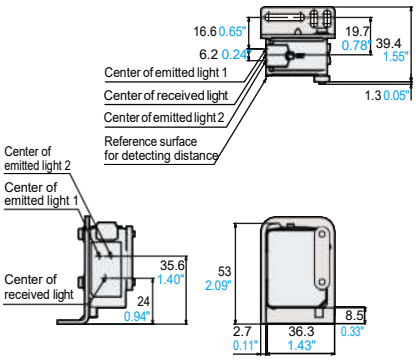


Unit: mm inch

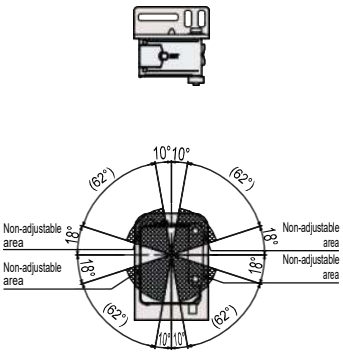
OP-88022



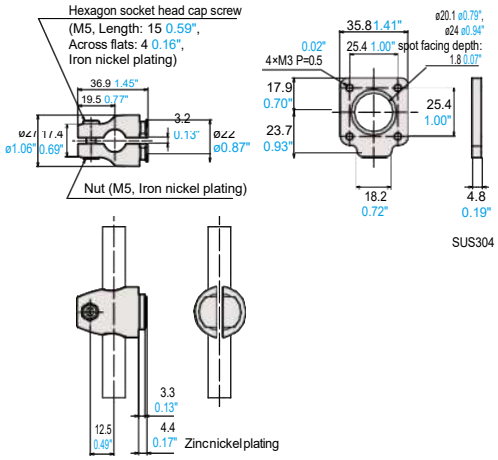
OP-88022 + LR-W70



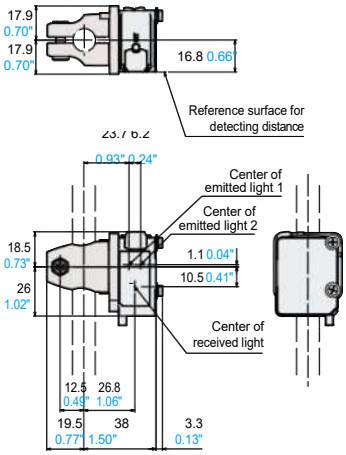
Angle non-adjustable area when **OP-88022** is used



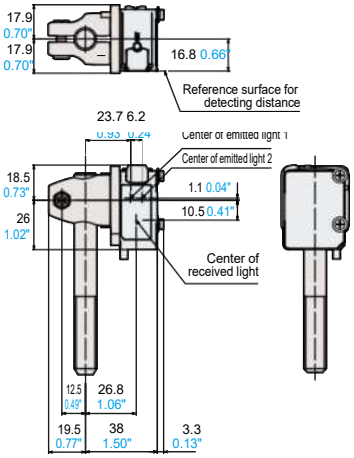
OP-88023



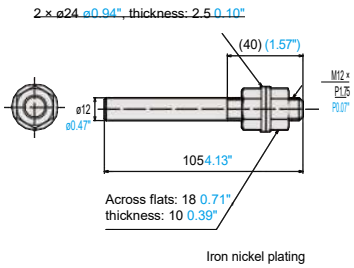
OP-88023 + LR-W70



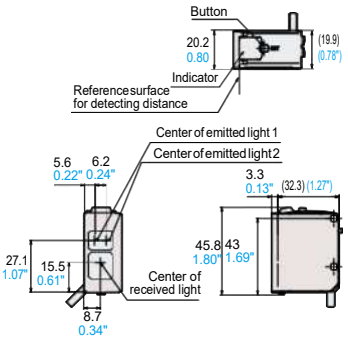
OP-88023 + OP-88024 + LR-W70



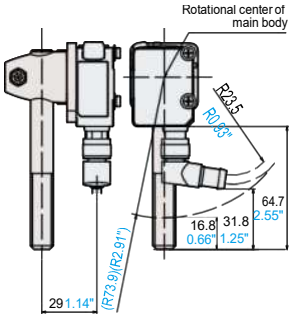
OP-88024



LR-WA2 + LR-W70

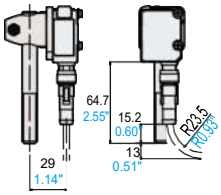


When **OP-88023** + **OP-88024** + **LR-WF70C** + L-shape type M12 connector are used



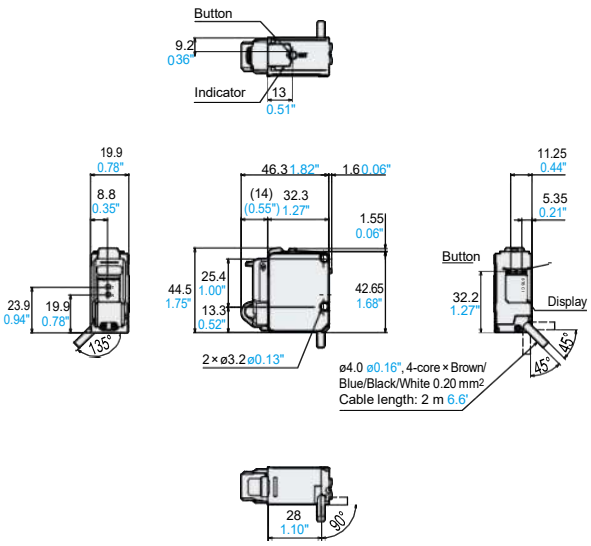
Warning for when an M12 connector type is used

When mounting the unit as shown in the figure below (connector downward), carefully check the surroundings for any objects that might interfere with the connector cable.

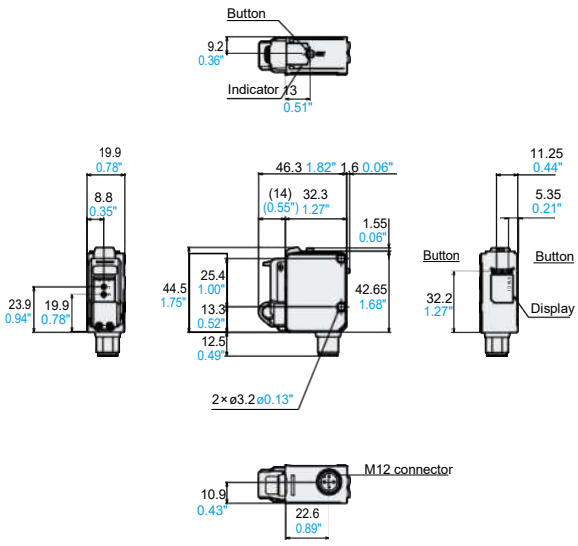


Dimensions

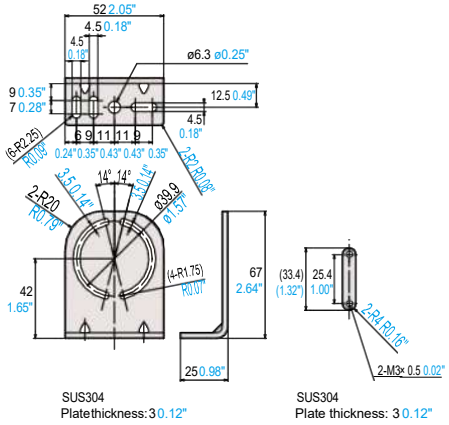
LR-WF10



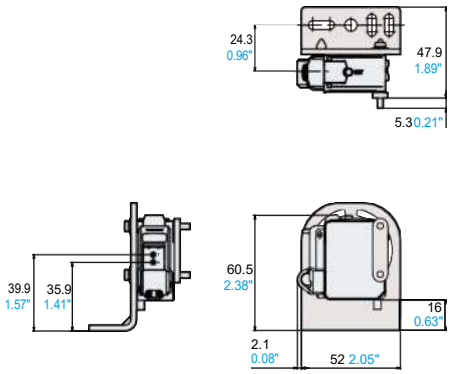
LR-WF10C



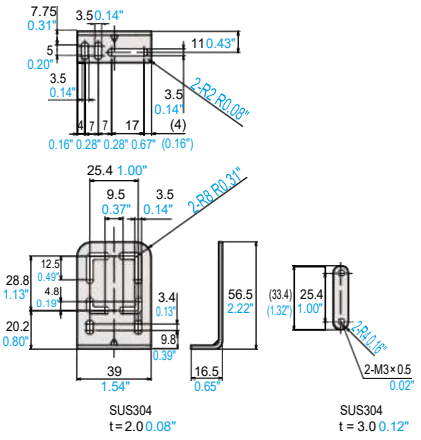
OP-88021



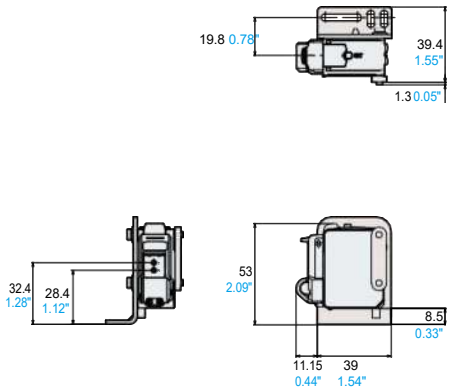
OP-88021 + LR-WF10



OP-88022

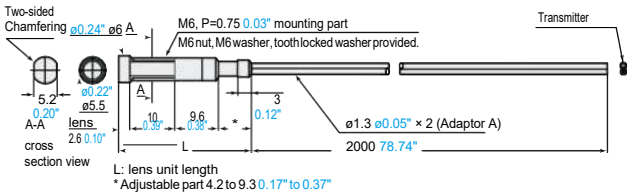


OP-88022 +LR-WF10

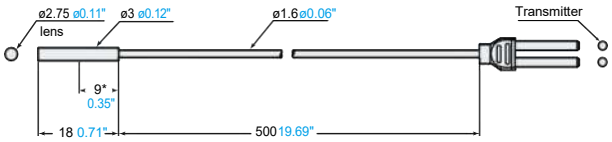


Unit: mm inch

FU-10 Free-cut

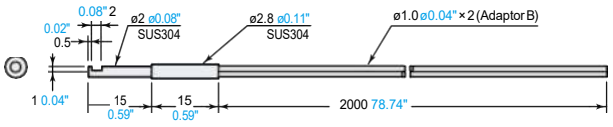


FU-20

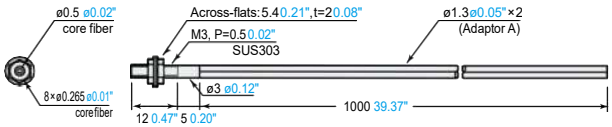


* Set-screw tightening area

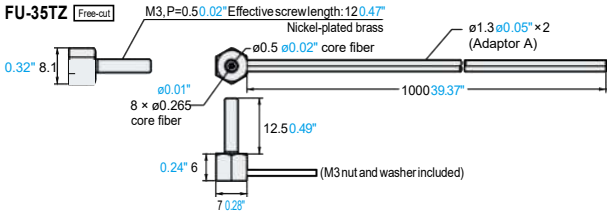
FU-31 Free-cut



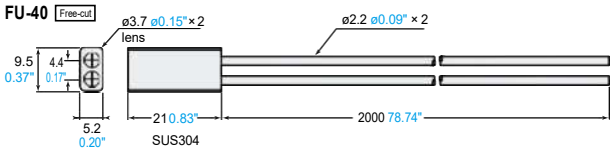
FU-35FZ Free-cut



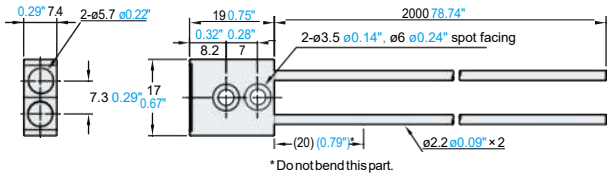
FU-35TZ Free-cut



FU-40 Free-cut

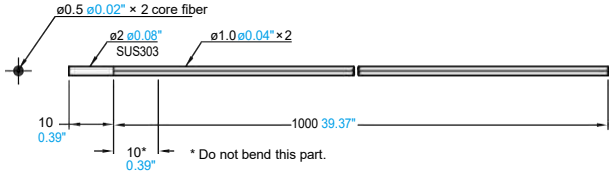


FU-40S Free-cut



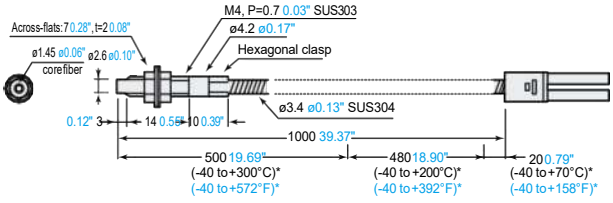
* Do not bend this part.

FU-49U Free-cut



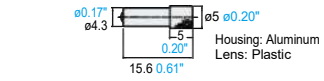
* Do not bend this part.

FU-83C

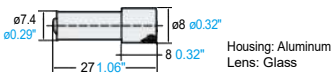


* Maximum temperature resistance for each part is shown in ( ).

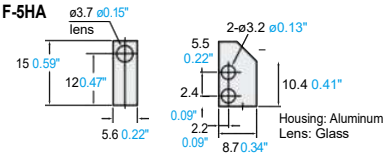
F-2HA



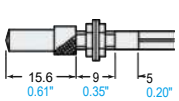
F-4HA



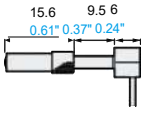
F-5HA



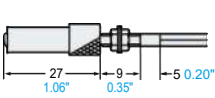
F-2HA + FU-35FZ



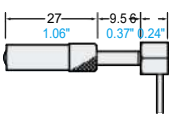
F-2HA + FU-35TZ



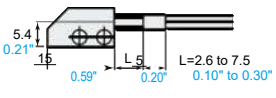
F-4HA + FU-35FZ



F-4HA + FU-35TZ

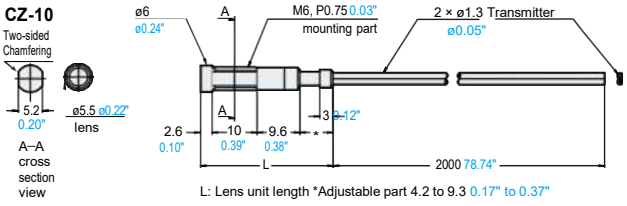


F-5HA + FU-35FZ



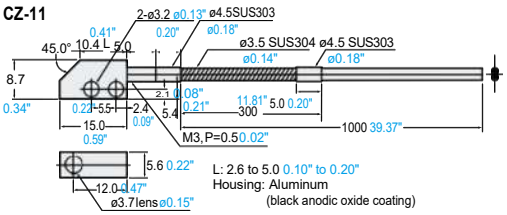
Dimensions

CZ-10



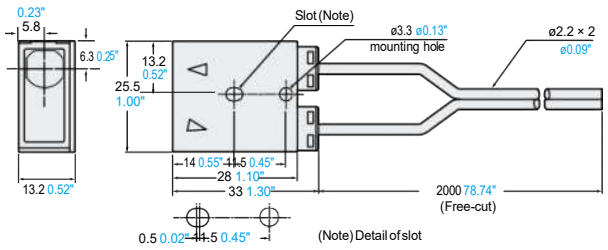
L: Lens unit length *Adjustable part 4.2 to 9.3 0.17" to 0.37"

CZ-11

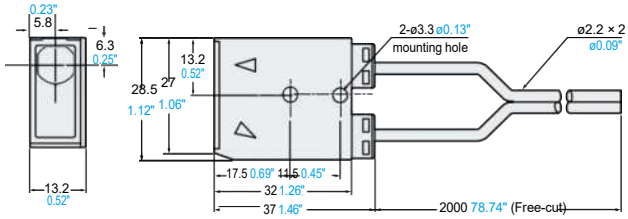


L: 2.6 to 5.0 0.10" to 0.20"
Housing: Aluminum
(black anodic oxide coating)

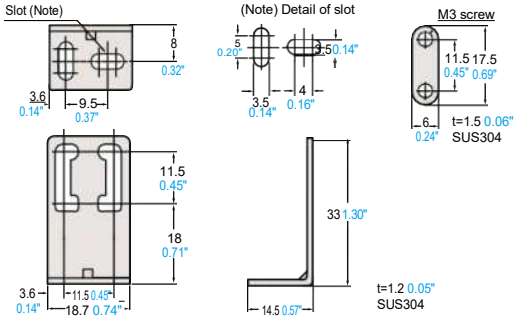
CZ-40



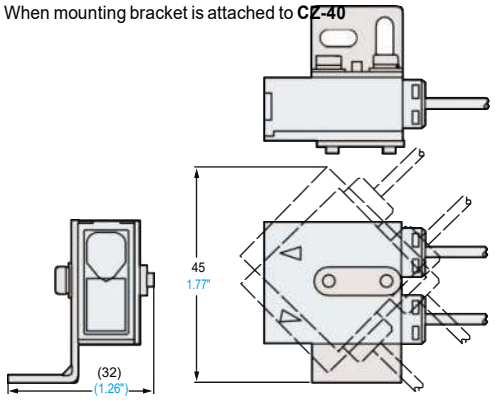
CZ-41



Mounting bracket (attached to **CZ-40/41**)

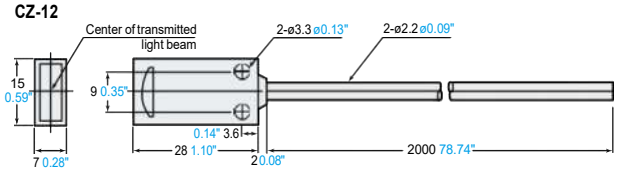


When mounting bracket is attached to **CZ-40**

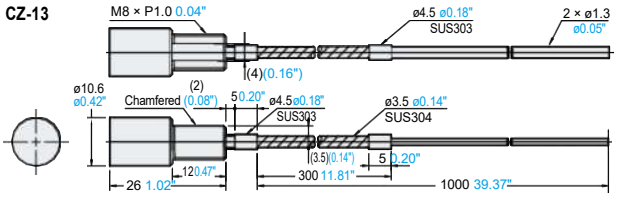


The sensor head angle can be changed by a maximum of 45 degrees upward and downward.

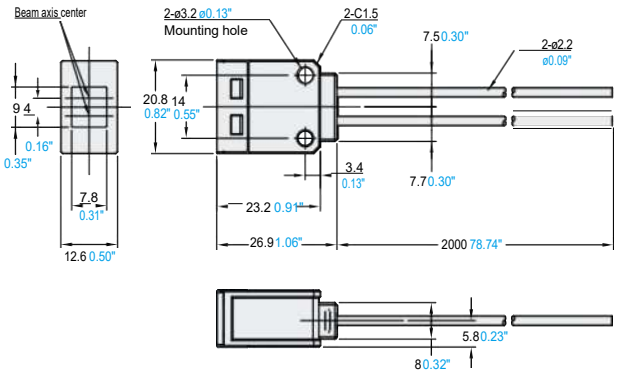
CZ-12



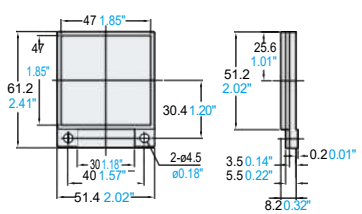
CZ-13



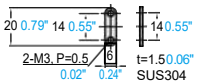
CZ-60



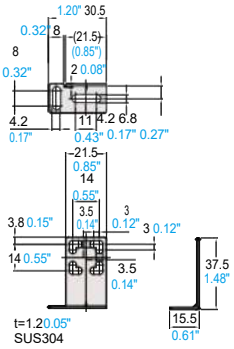
R-2 reflector (attached to **CZ-60**)



Flat nut (attached to **CZ-60**)

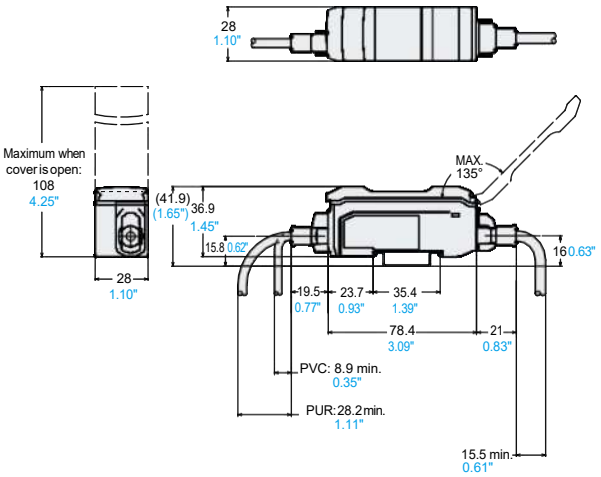


Mounting bracket (attached to **CZ-60**)

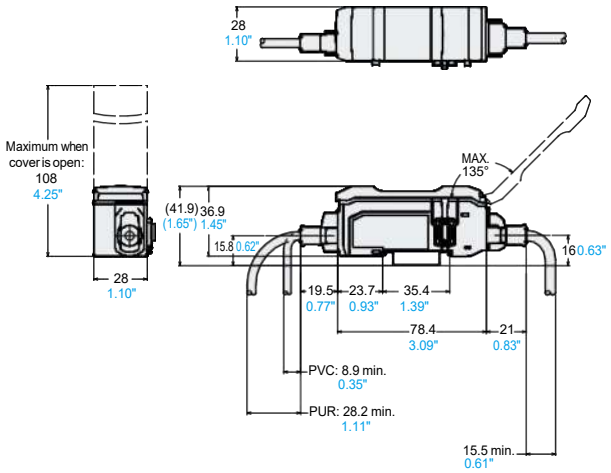


Unit: mm inch

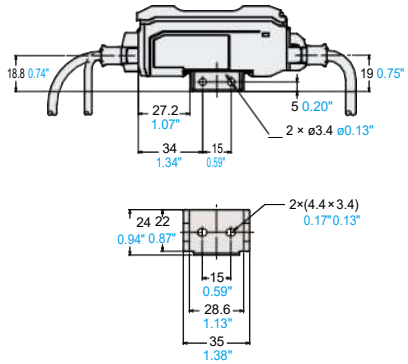
MU-N11 (Main unit)



MU-N12 (Expansion unit)

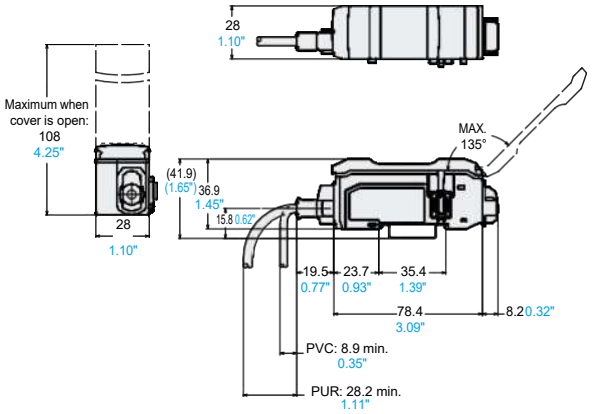


When mounting adapter is attached (**OP-76877**, optional, sold separately)

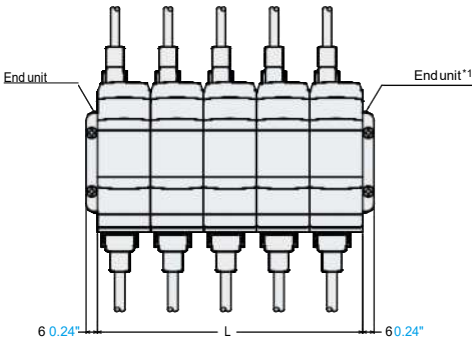


Back of mounting adapter

When the communication unit is connected without using a power supply cable



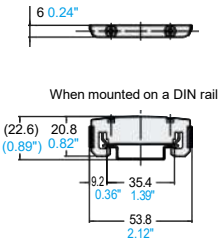
When expansion units are connected



*1 End units must be used when an expansion unit is connected. (Optional)

No. of expansion units	L
1	28 1.10"
2	56 2.20"
3	84 3.31"
4	112 4.41"
5	140 5.51"

End unit (**OP-26751**, optional, sold separately)

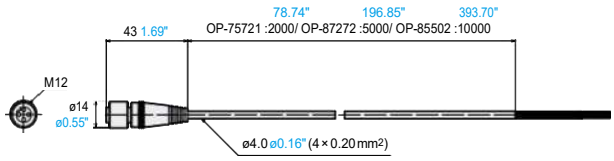


Dimensions

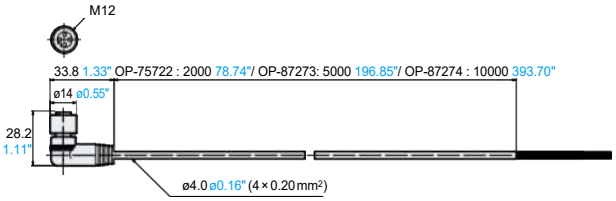
Unit: mm inch

M12 connector cable for sensor

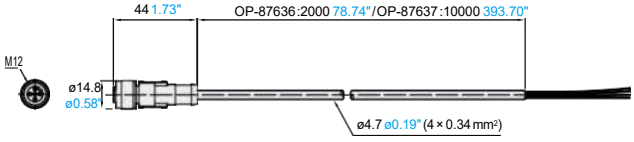
OP-75721/87272/85502



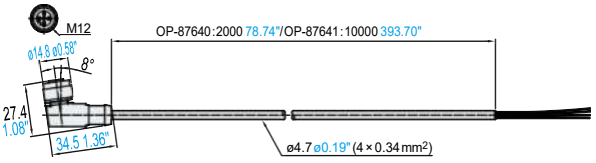
OP-75722 / 87273 / 87274



OP-87636/87637



OP-87640/87641

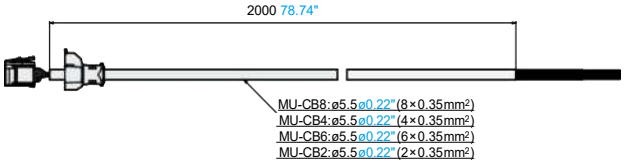


Pin layout

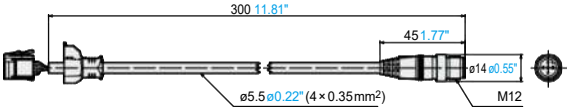
No.	Color
①	Brown
②	White
③	Blue
④	Black

Power supply cable for MU-N

MU-CB8/CB4/CB6/CB2



MU-CC4

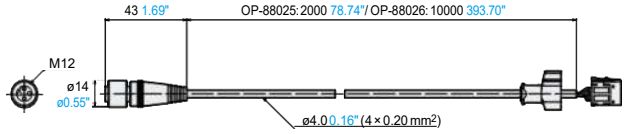


M12 Connector pin layout

No.	Color
①	Brown
②	White
③	Blue
④	Black

Sensor-to-controller cable (4-pin M12 connector type)

OP-88025/88026

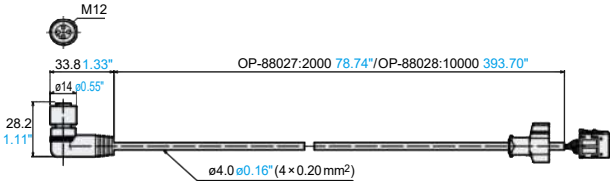


X
M12 Connector pin layout

X	Y	Color
①	①	Brown
②	②	White
③	③	Blue
④	④	Black

Y
Connector pin layout

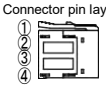
OP-88027 / 88028



X
M12 Connector pin layout

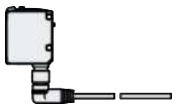
X	Y	Color
①	①	Brown
②	②	White
③	③	Blue
④	④	Black

Y
Connector pin layout



Warning for when an L-shape type M12 connector is used

When the L-shape type M12 connector is used, the cable is fixed in the direction shown in the right figure. The connector base cannot be rotated.



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Network communication unit NU Series

Open field network unit

Type	Appearance	Network	Model
Communication unit		CC-Link	**NU-CL1**
		DeviceNet™	**NU-DN1**
		EtherNet/IP™	**NU-EP1**
e-CON Input unit		—	**NU-EN8N**

Options

Model	Type
OP-79426	Version 1.10 supported CC-Link dedicated cable 20 m 65.6'
OP-79427	Version 1.10 supported CC-Link dedicated cable 100 m 328.1'
OP-51504	STP (Shielded twisted-pair) cable 0.2 m 0.7'
OP-51505	STP (Shielded twisted-pair) cable 0.5 m 1.6'
OP-51506	STP (Shielded twisted-pair) cable 1 m 3.3'
OP-51507	STP (Shielded twisted-pair) cable 3 m 9.8'
OP-51508	STP (Shielded twisted-pair) cable 5 m 16.4'
OP-51509	STP (Shielded twisted-pair) cable 10 m 32.8'
OP-84338*1	e-CON connector (2 pieces included)

*1 Use a cable with sheath outer diameter of 1.15 to 1.35 mm 0.05" to 0.05" and wire range of 0.1 to 0.5 mm^2.
To connect a device using a cable other than as specified above, prepare an e-CON connector that conforms with its wire diameter.

CC-Link communication unit: NU-CL1

Model		NU-CL1
CC-Link specifications	Supported version	Version 2.00 / version 1.10 (selectable)
	No. of occupied stations	Version 2.00: 3 stations; Version 1.10: 1 / 2 / 3 / 4 stations (selectable)
	Station type	Remote device station
	Transmission rate	156 kbps/ 625 kbps/ 2.5 Mbps/ 5 Mbps/ 10 Mbps
	Station No. setting	1 to 64
Sensor connection specifications	Connectable sensor	N-bus supporting sensor amplifier*1
	Number of connectable sensors	16 units max.*2
	Power supply	Supplied from this unit via the simplified wiring connector
	Allowable passing current	1200 mA or less total*3
Power voltage		24 VDC±10%, ripple (p-p) 10% or less
Power consumption		1400 mW or less (55 mA or less at 24 V)*4
Weight (including connector)		Approx. 80 g
Accessories		Instruction manual, CC-Link connector, power supply connector, electrical termination, end unit × 2

*1 N-bus is the name of KEYENCE's simplified wiring system for sensor amplifiers. *2 Varies depending on the sensor amplifier to be connected.
*3 This is the current value that can be supplied to this product or the sensor amplifier/unit connected to this product. *4 Excluding the current supplied to the connected sensor amplifier.

DeviceNet™ communication unit: NU-DN1

Model		NU-DN1		
DeviceNet™ specifications	Supported functions	I / O communication (Poll), Explicit message communication		
	Address setting	0 to 63 (PGM supported)		
	Communication speed (automatic selection)	500 kbps	250 kbps	125 kbps
	Maximum cable length	100 m 328.1' (thick cable)	250 m 820.2' (thick cable)	500 m 1640.4' (thick cable)
		100 m 328.1' (thin cable)	100 m 328.1' (thin cable)	100 m 328.1' (thin cable)
Sensor connection specifications	Connectable sensor	N-bus sensor amplifier*1		
	Number of connectable sensors	16 units max.*2		
	Power supply	Supplied from the DeviceNet™ communication power supply via this unit.		
	Allowable passing current	1200 mA or less total*3		
Power voltage		11 to 25 VDC		
Power consumption		1480 mW or less (60 mA or less at 24 V, 106 mA or less at 12 V)*4		
Weight (including connector)		Approx. 65 g		
Accessories		Instruction manual, DeviceNet™ connector, end unit × 2		

*1 N-bus is the name of KEYENCE's simplified wiring system for sensor amplifiers. *2 Varies depending on the sensor amplifier to be connected.
*3 This is the current value that can be supplied to this product or the sensor amplifier/unit connected to this product. *4 Excluding the current supplied to the connected sensor amplifier.

EtherNet/ IP™ compatible communication unit: NU-EP1

Model		NU-EP1
Ethernet specifications	Compliant standards	IEEE802.3 (10BASE-T) IEEE802.3u (100BASE-TX) IEEE802.3af (Power over Ethernet, Class3)
	Transmission rate	10 Mbps (10BASE-T) 100 Mbps (100BASE-TX)
	Transmission media	STP or Category3 or higher UTP (10BASE-T)*1 STP or Category5 or higher UTP (100BASE-TX)
	Maximum cable length	100 m 328.1' (between this unit and Ethernet switch)
	Maximum number of connectable hubs*2	4 (10BASE-T) 2 (100BASE-TX)
EtherNet/IP™ specifications	Supported functions	Cyclic communication Message communication (Explicit message communication) supporting UCMM and Class 3
	Number of connections	64
	RPI (communication cycle)	0.5 to 10000 ms (Unit: 0.5 ms)
	Tolerable communication bandwidth for cyclic communication	6000 pps
	Conformance test	Version A7 supported
Sensor connection specifications	Connectable sensor	N-bus sensor amplifier*3
	Number of connectable sensors	16 units max.*4
	Power supply	Supplied from this unit via the sensor amplifier connector
	Allowable passing current*5	1200 mA or less total
	PoE power supply*6	Supplied voltage: 24 V±10%, supplied current: 360 mA or less*7
Power voltage		24 VDC±10%, ripple (p-p) 10% or less (when the power supply connector is used) 48 VDC (57 VDC max.) (when PoE power supply is used)
Power consumption		1500 mW or less (60 mA or less at 24 V)*8
Weight (including connector)		Approx. 80 g
Accessories		Instruction manual, power supply connector, end unit × 2

* The following KEYENCE PoE power supply units cannot be connected: [DT-100A] [DT-500] [NE-V08]
*1 Use an STP cable or a Category5 or higher UTP cable for the connection using PoE power supply function.
*2 When a switch is used, there is no limit to the number of connectable units.
*3 N-bus is the name of KEYENCE's simplified wiring system for sensor amplifiers.
*4 Varies depending on the sensor amplifier to be connected.
*5 This is the current value that can be supplied to this unit or the sensor amplifier connected to this unit.
*6 This is the power that can be supplied to the sensor amplifier when the PoE power supply function is used.
*7 Varies depending on the ambient temperature. (-20 to +45°C -4 to 113°F : 360 mA or less, +45 to +50°C 113 to 122°F: 260 mA or less, +50 to +55°C 122 to 131°F: 140 mA or less)
*8 Excluding the current supplied to the connected sensor amplifier.

e-CON input unit for communication units: NU-EN8N

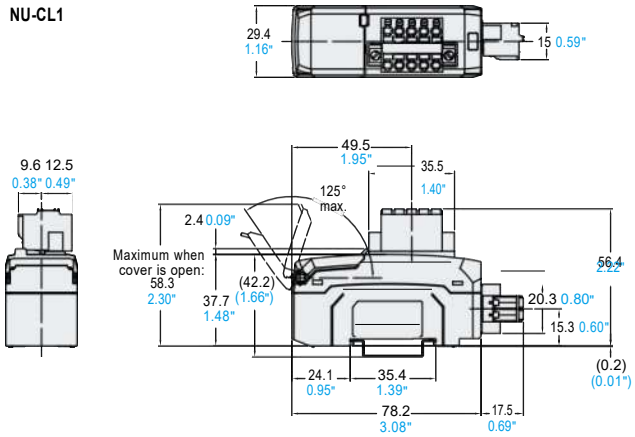
Model		NU-EN8N
Connectable communication unit		NU-CL1, NU-DN1, NU-EP1
Number of connectable units		2 units max. (No. of ID numbers to be occupied: 8)*1
I/O	Connector	e-CON connector (4-pin)
	Number of inputs	8
	Supply voltage	Supplied from communication unit
	Supply current	520 mA or less (8 inputs in total)
	Input signal	NPN open collector output, Contact output*2
	Input response time	20 µs or less
	Internal input voltage	8 VDC (reference input current: 3.1 mA)
	Input resistance	2.4 kΩ
Power voltage		12 to 24 VDC, ripple (p-p) 10% or less*3
Weight (including tag)		Approx. 55 g
Accessories		Instruction manual, tag, index sticker

*1 When connecting this unit to a communication unit, connect it last after the sensor amplifiers. Sensor amplifiers connected after this unit will not be recognized by the communication unit.
*2 Two-wire type sensors and switches cannot be used. Use three-wire type devices.
*3 This unit receives power supply from the connected communication unit.

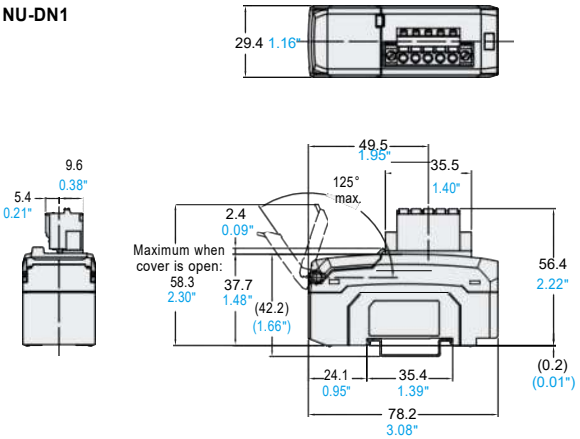
Dimensions

Unit: mm inch

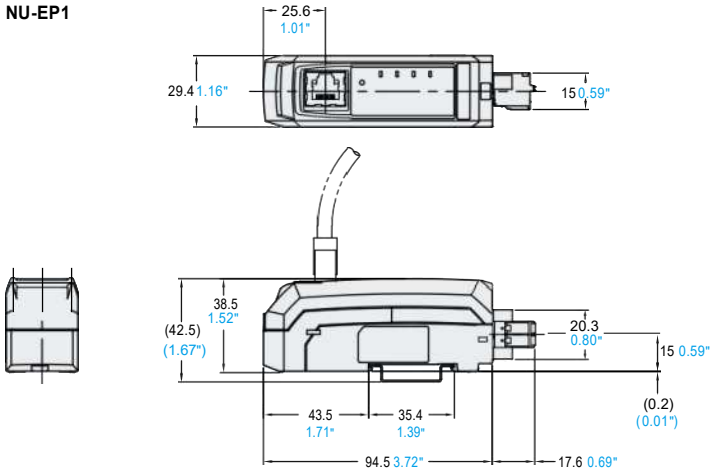
NU-CL1



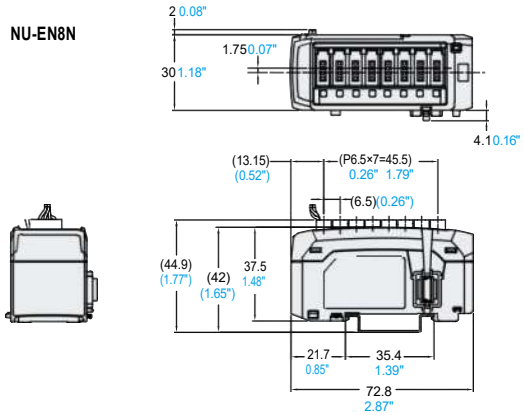
NU-DN1



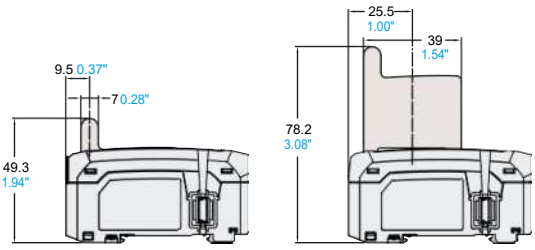
NU-EP1



NU-EN8N



When a tag is attached



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