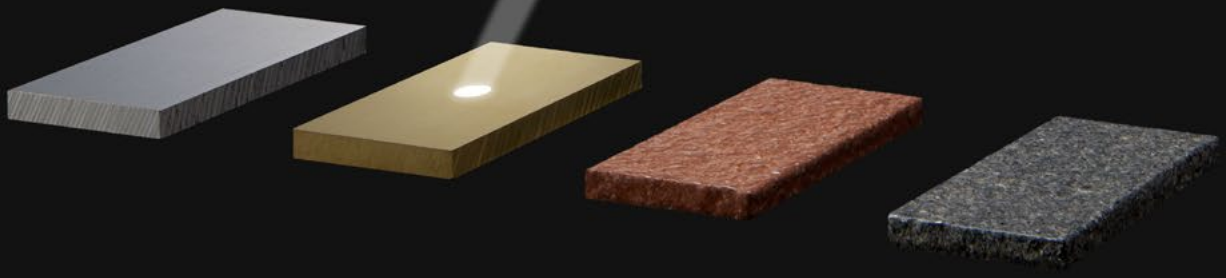
KEYENCE

Self-Contained
Full-Spectrum Sensor
LR-W Series

IO-Link

FULL-SPECTRUM SENSOR

Stable Detection of
Changes in Appearance



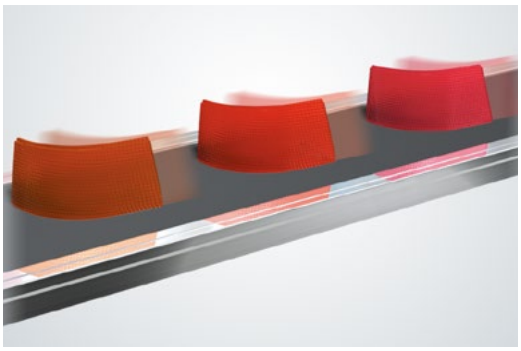
Long Range Model
LR-W500(C)

Small/Dual Spot Model
LR-W70(C)

Fibre Extension Model
LR-WF10(C)

PRESENCE AND ABSENCE

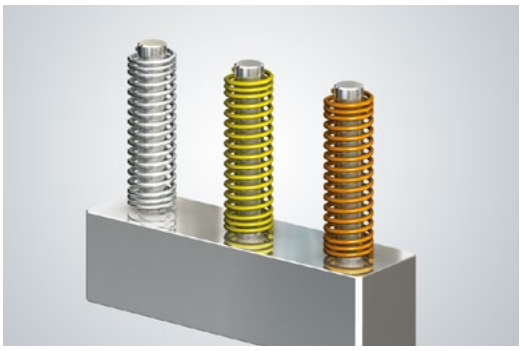
Part detection in a mould or die



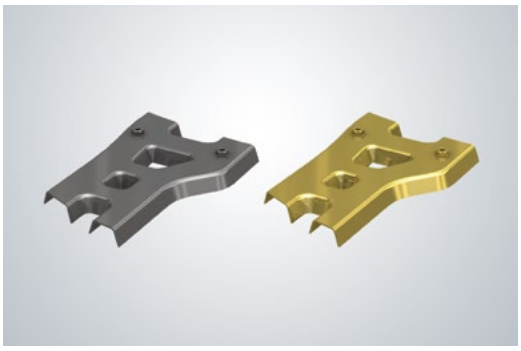
Rounded target detection on a moving conveyor

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.



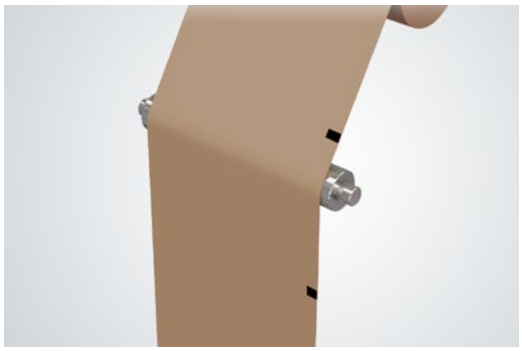
Product differentiation based on appearance



Product treatment/coating verification

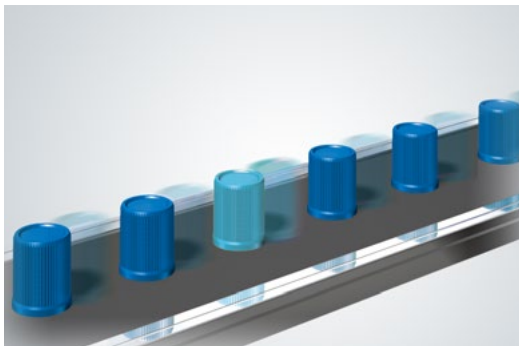
PRODUCT DIFFERENTIATION

REGISTRATION MARKS



Registration mark detection on film

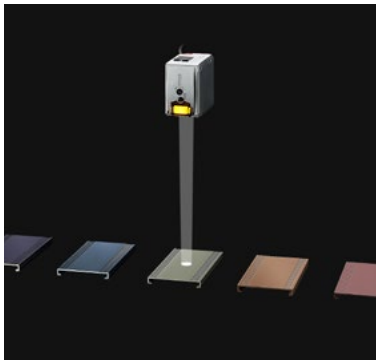
Registration mark detection on a rounded surface



Confirming proper colour shade

Differentiating very similar colour

COLOUR VERIFICATION



UNMATCHED DETECTION CAPABILITIES

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

EASE-OF-USE

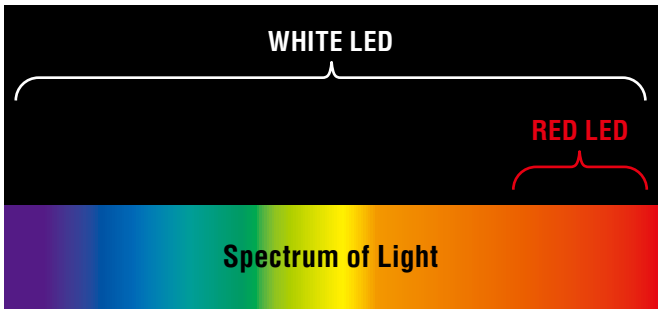
- One Touch Calibration
- User-Friendly Display
- Easy Integration into Any Setup

DURABILITY

- Robust Metal Housing
- Water Resistant
- Dustproof

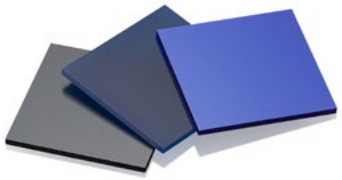
UNMATCHED DETECTING CAPABILITIES

Full-Spectrum Detection



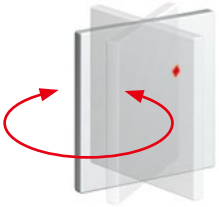
Unlike conventional sensors which only use a Red LED, the LR-W utilises a White LED and the full colour spectrum. By doing this, the LR-W can reliably and stably differentiate a much wider range of targets.

Examples of targets the LR-W can stably detect



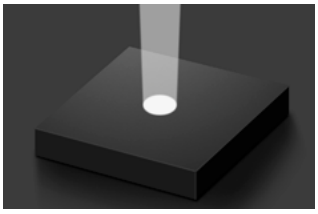
Targets with Slight Colour Changes

Metal Targets

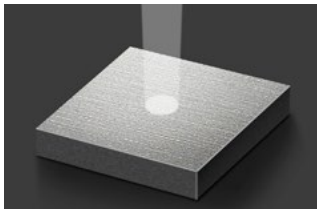


Tilted Targets

High Power White LED and Automatic Power Control



Detecting Dark Targets



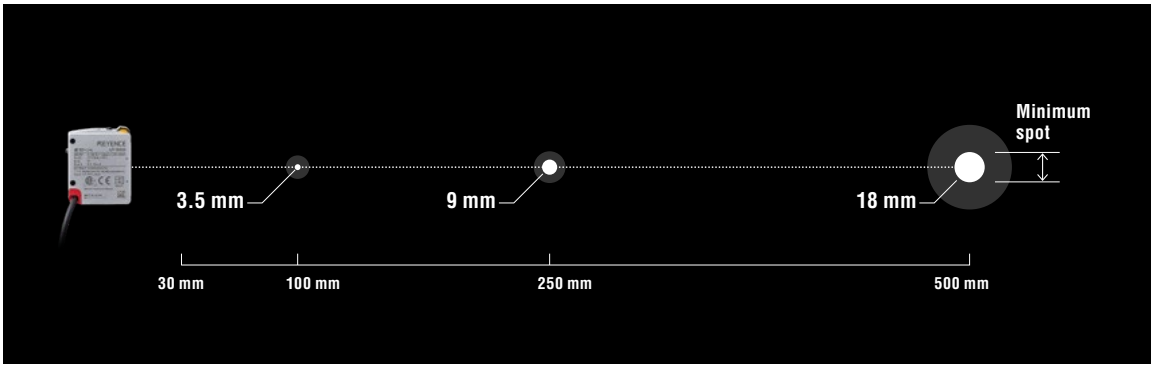
Detecting Glossy Targets

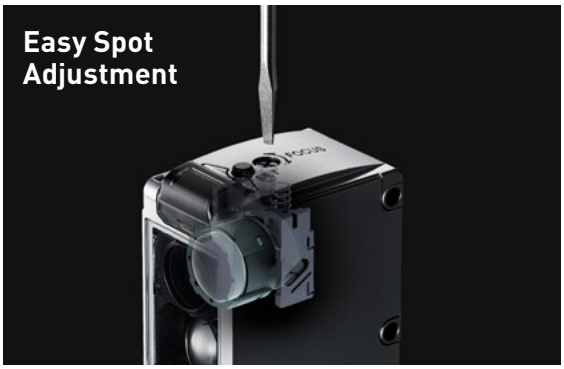
500,000× High Dynamic Range

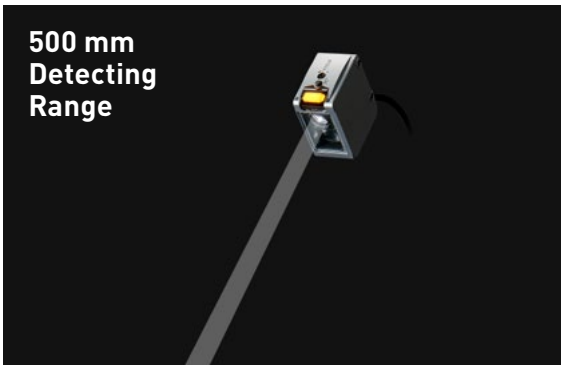
By utilising a High Powered White LED, the LR-W ensures detection of dark targets. For glossy targets, the LR-W features an Automatic Power Control function that optimises the sensor's power and sensitivity to ensure stable detection.

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

Superior Detecting Distance with Adjustable Spot

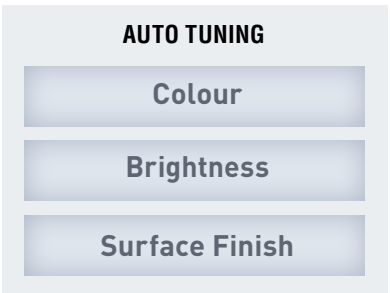


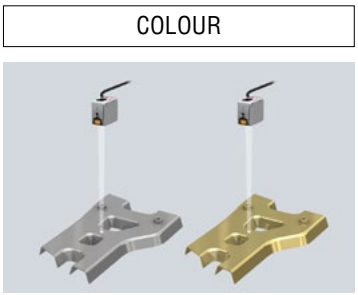


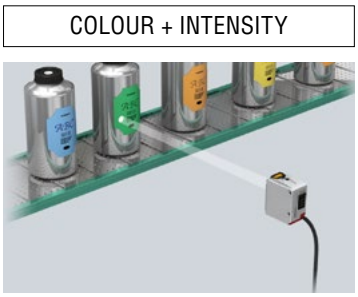


With an impressive 500 mm range, the LR-W is able to solve applications that were once considered out of reach.
The LR-W also features an easy to adjust spot that can be widened or focused to provide the best detection based on the target.
These two features combine to make the LR-W a truly all-purpose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

Auto Tuning Ensures Best Detection Method







By using the Auto Tuning function, the LR-W accounts for a target's colour, 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

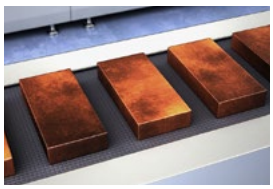
Detect difficult registration marks with a simple Two-Point (2-P) Calibration.

Varying Colour Detection

Master Calibration

Innovative tuning option to set clear thresholds for target variation.

Products fluttering on conveyor belts



Colour variances within products

Master Calibration/ Master Addition Calibration

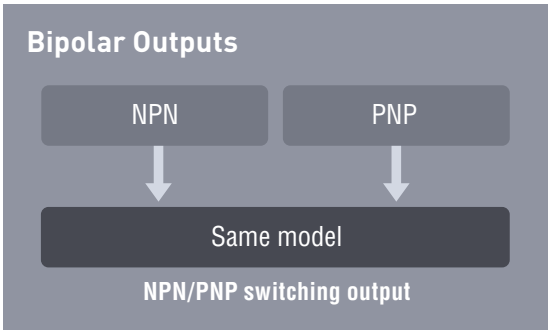
Colour inconsistencies, vibration, worn surfaces, and tilting or angling of targets can all lead to unstable detection. Master Calibration allows user's to teach the sensor these variations in advance. Master Addition Calibration enables conditions to be easily added as they arise.

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 standardise 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, 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

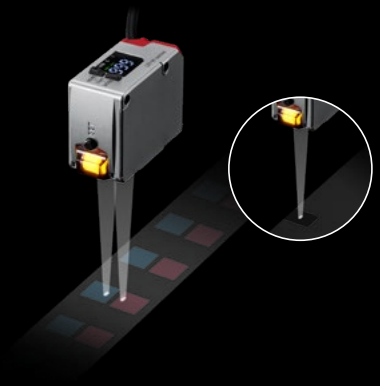
The die cast metal housing can withstand impact from products, tools, or workers.

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 Fibre 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
- Analogue
- Networking

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

When colour/ contrast needs to be ignored:

- Position Based
- Long Range
- Unaffected by Appearance

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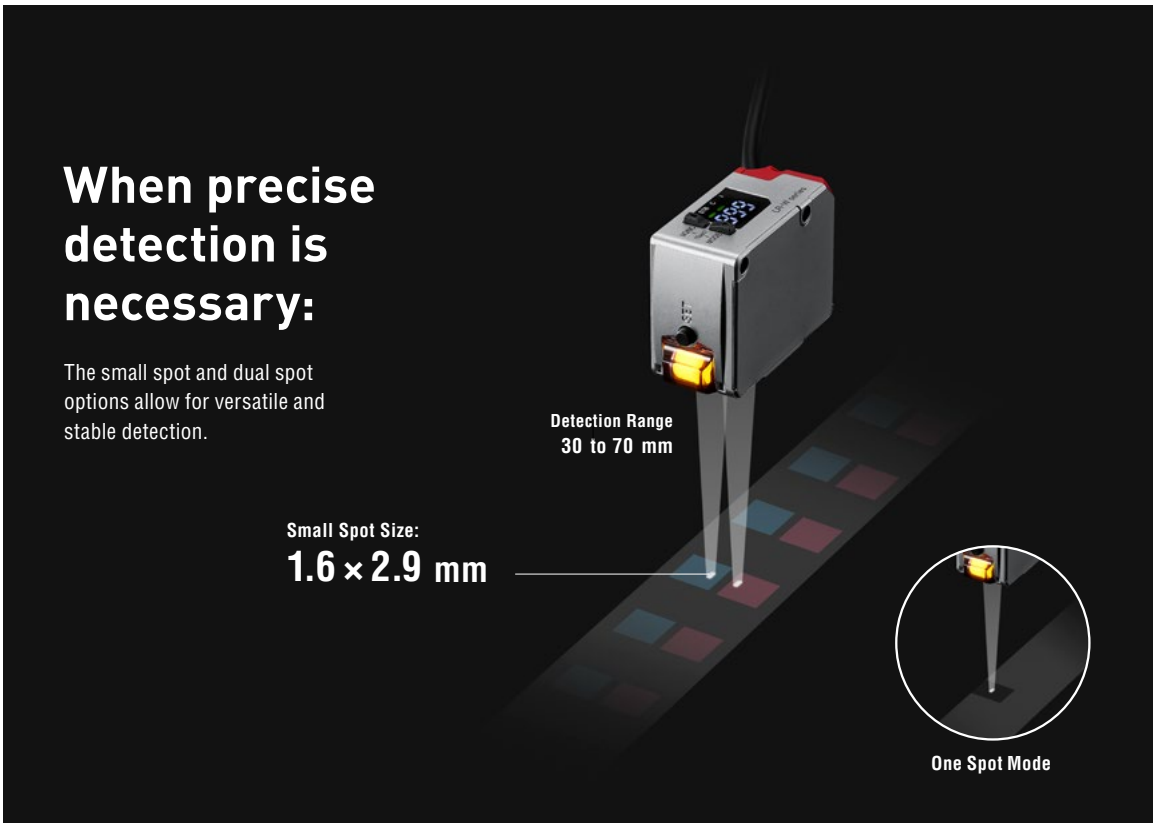
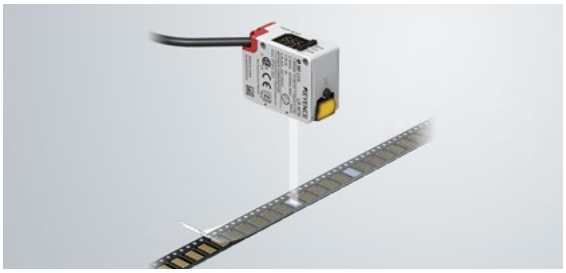
LR-W70(C)	LR-W Series Small/Dual Spot Model



Small Spot Detection

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



Confirmation of proper chip orientation

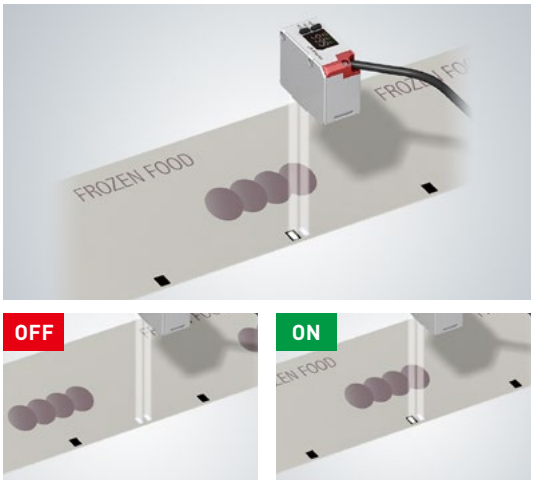
Weld seam detection on metal coil stock

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.

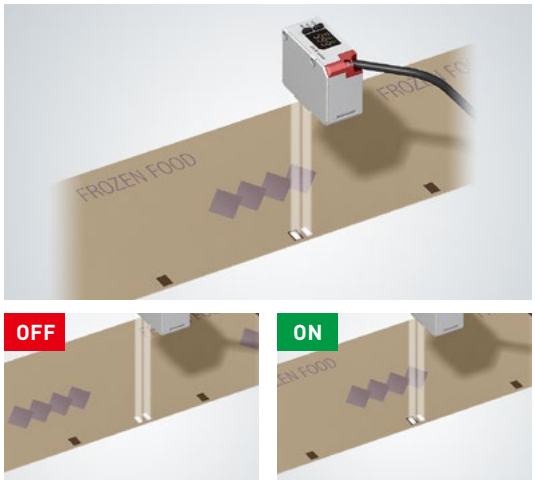
Difference Monitoring

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

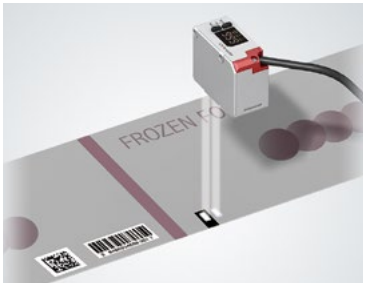


No calibration necessary even when switching targets

2-Point Matching

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

Complex Registration Marks



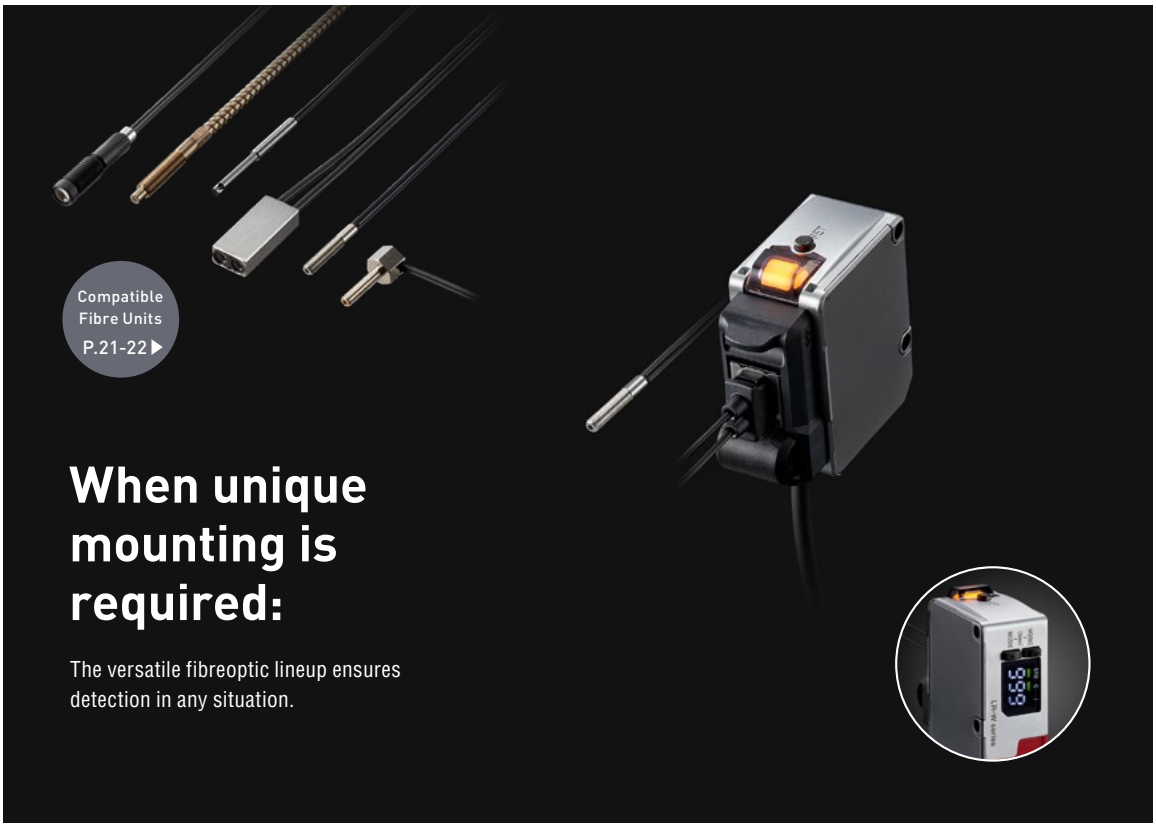
Difficult Marks: Ignore design variables
No Marks: Identify repeating patterns

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 Fibre Extension Model



Benefits of Fibre Extension

Small Size Heads

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

Accessible Controls

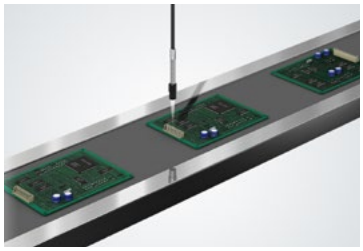
Simple and accessible remote programming is possible when using fibreoptic heads.

Versatile Options

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

Mounting Constraints Require a Small Spot and Small Head

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

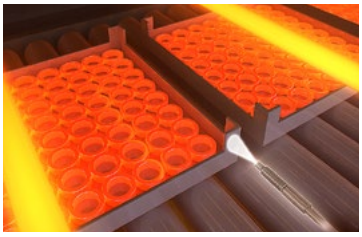


APPLICABLE HEADS

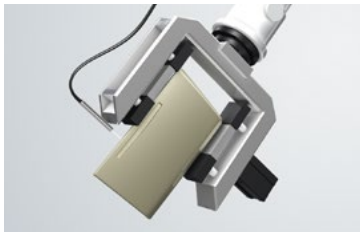
FU-20: Spot Diameter: 0.1 mm, Focal Distance: 5 mm
FU-10: Spot Diameter: 0.9 to 3.5 mm, Focal Distance: 10 to 30 mm
FU-35FZ w/ F-2HA Lens: Spot Diameter: 0.4 mm, Focal Distance: 7±2 mm

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.

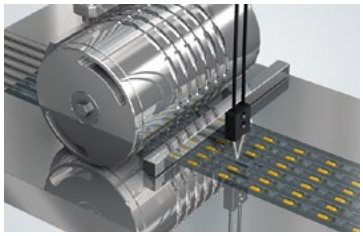


High Flex (FU-49U)
Mounting on machines with continuous motion is no longer a concern.

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.

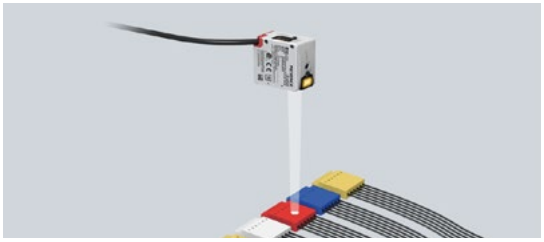
MU-N Series	Multi-Sensor Controller

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.

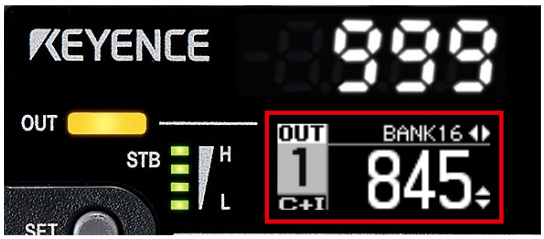
Various Output Options



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

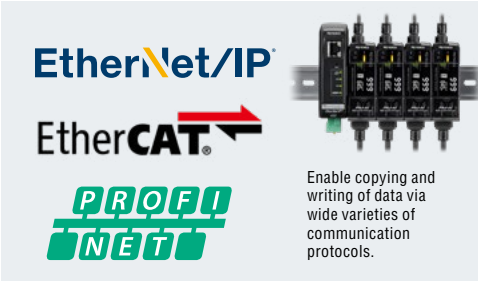
The MU-N Series controller offers customisable I/O. This includes both control outputs and a voltage/current analogue output.

Rich OLED Display



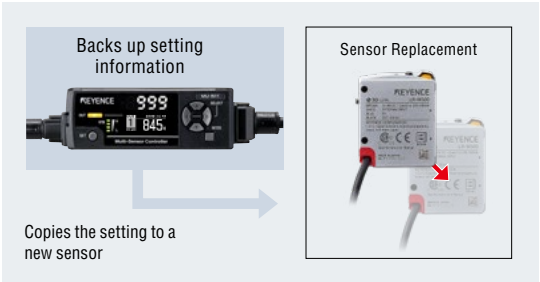
The combination of an OLED and 7-Segment Display allows users to quickly view data in real time. The MU-N also has the ability to display live graphs for easy machine monitoring.

Network Compatibility



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®, EtherCAT, and PROFINET.

Settings Back-Up Function

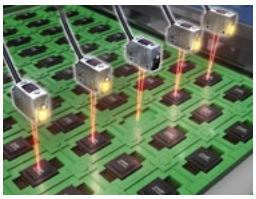


The Settings Back-Up Function allows users to save sensor settings on the MU-N and quickly transfer them to new sensors that are attached.

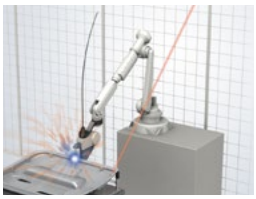
LR-Z & LR-T Series	Position Based Sensor Series

When colour/ contrast needs to be ignored:

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



LR-Z Series
Part presence regardless of varying colours



LR-T Series
Welding cell target detection

LR-T Series
Metal level detection

CMOS Laser Sensors
LR-Z

Detecting Distance (35 to 250 mm)

- 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)

- Max. 5 m 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)	Standard Type	30 to 500 mm	Adjustable spot • Approx. ø3.5 mm (at detecting distance of 100 mm) • Approx. ø9 mm (at detecting distance of 250 mm) • Approx. ø18 mm (at detecting distance of 500 mm)	White LED	**LR-W500**	Approx. 170 g
 M12 connector (Cable sold separately)					**LR-W500C**	Approx. 110 g
 Cable (2 m)	Small/Dual Spot Type	30 to 70 mm	Approx. 1.6 × 2.9 mm at 50 mm	White LED	**LR-W70**	Approx. 130 g
 M12 connector (Cable sold separately)					**LR-W70C**	Approx. 75 g
 Cable (2 m)	Fibre Type	Detecting Distance and Min. Spot Diameter Based on Attached Fibre 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)		**OP-88024**	Iron nickel plating Approx. 140 g

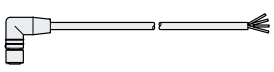
*1 The 4-pin M12 connector type may not be mounted in the orientation shown in the picture (connector downward). Confirm the dimensions and surroundings carefully.

Attachment

Type	Applicable Sensors	Model	Material/weight
 Lustre canceling attachment	LR-W500(C)	**LR-WA1**[*1 *2]	SUS304, PMMA, etc. Approx. 5 g
 Lustre 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	**OP-75721**	Approx. 60 g
				5 m	**OP-87272**	Approx. 125 g
				10 m	**OP-85502**	Approx. 230 g
	Cable: PUR (Polyurethane)			2 m	**OP-87636**	Approx. 75 g
				10 m	**OP-87637**	Approx. 330 g
	Cable: PVC (Polyvinyl chloride)	M12 4-pin L-shape		2 m	**OP-75722**	Approx. 65 g
				5 m	**OP-87273**	Approx. 130 g
				10 m	**OP-87274**	Approx. 235 g
	Cable: PUR (Polyurethane)			2 m	**OP-87640**	Approx. 75 g
				10 m	**OP-87641**	Approx. 330 g

Controller

Type	Control output	External input	Analogue 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	**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	**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	**OP-88025**	Approx. 75 g
				10 m	**OP-88026*1**	Approx. 280 g
		M12 4-pin L-shape		2 m	**OP-88027**	Approx. 75 g
				10 m	**OP-88028*1**	Approx. 280 g

*1 The 10 m 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.

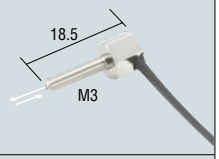
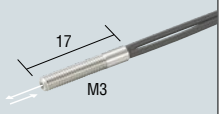
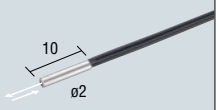
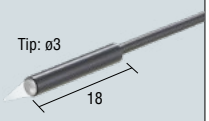
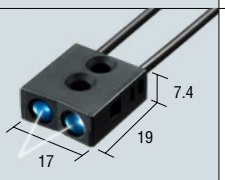
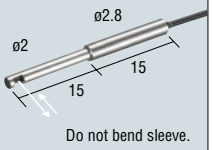
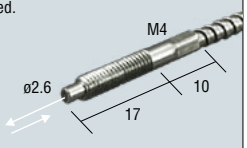
Appearance	Type	Applicable model	Model	Weight
	For PVC (Polyvinyl chloride) cable	LR-W500, LR-W70, LR-WF10 OP-75721/87272/85502 OP-75722/87273/87274	**OP-88029**	Approx. 3 g
	For PUR (Polyurethane) cable	OP-87636/87637 OP-87640/87641	**OP-88030**	Approx. 3 g

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

Fibre unit specification when using LR-WF10(C)

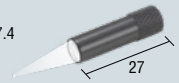
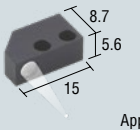
Unit: mm

Feature	Type	Fibre unit length (Diameter) Ambient temperature	Appearance	Minimum bend radius	Detecting distance	Model Weight
Threaded and Hex-shaped Fibres	M3 Hex-shaped Coaxial	1 m Free-cut (ø1.3 × 2) -40 to +50°C		R2 ToughFlex	500 ms: 47 100 ms: 32 10 ms: 12 1 ms: 7 250 µs: 5	**FU-35TZ** Approx. 7 g
	M3 Threaded Coaxial	1 m Free-cut (ø1.3 × 2) -40 to +50°C				**FU-35FZ** Approx. 6 g
Cylinder (Set Screw Installation)	Diameter ø2	1 m Free-cut ø1.0 × 2 -40 to +50°C		R2 ToughFlex High-flex	500 ms: 33 100 ms: 24 10 ms: 9 1 ms: 4 250 µs: 3	**FU-49U** Approx. 4 g
Small Spot Reflective	Beam spot diameter ø0.9 to 3.5 Focal distance 10 to 30	2 m Free-cut (ø1.3 × 2) -40 to +70°C		R25	10 to 30	**FU-10** Approx. 5 g
	Beam spot diameter Approx. ø0.1 Focal distance 5	50 cm cut not allowed. -40 to +70°C			5 ± 1 *1	**FU-20** Approx. 2 g
Focused Beam/ High-power	Aperture angle: Approx. 8°	2 m Free-cut (ø2.2 × 2) -40 to +50°C		R2 ToughFlex	500 ms: 26 to 379 100 ms: 27 to 270 10 ms: 33 to 112 1 ms: — 250 µs: —	**FU-40** Approx. 23 g
Definite-reflective	Thin, Small	2 m Free-cut (ø2.2 × 2) -40 to +70°C		R25	500 ms: 2 to 131 100 ms: 3 to 119 10 ms: 10 to 93 1 ms: 12 to 79 250 µs: 13 to 68	**FU-40S** Approx. 25 g
Sleeve	Side view detection	2 m Free-cut (ø1.0 × 2) -40 to +70°C		R10	500 ms: 30 100 ms: 20 10 ms: 7 1 ms: 3 250 µs: 2	**FU-31** Approx. 5 g
Heat Resistant	Heat resistant temperature*2: 300°C	1 m cut not allowed. -40 to +300°C		R25	500 ms: 158 100 ms: 107 10 ms: 40 1 ms: 24 250 µs: 16	**FU-83C** Approx. 23 g

*1 Cannot be used with the response time of 250 µs and 1 ms.
*2 Use the fibre sensor under dry conditions. Allow some margin for the temperature upper limit when selecting a heat-resistant fibre unit.

Lens + Fibre Unit

Unit: mm

Type	Beam spot diameter	Focal distance	Lens		Fibre units		
			Model	Appearance Weight	Minimum bend radius	Appearance	Model
Small spot	Approx. ø0.4	7 ±2	**F-2HA**	-30 to +70°C Tip: ø4.3  Approx. 1 g	R2 ToughFlex		**FU-35FZ**
					R2 ToughFlex		**FU-35TZ**
	Approx. ø0.5	15 ±2	**F-4HA**	-30 to +70°C Tip: ø7.4  Approx. 2 g	R2 ToughFlex		**FU-35FZ**
					R2 ToughFlex		**FU-35TZ**
Side-view adjustable spot	Approx. ø0.5 to ø3	8 to 30	**F-5HA**	-30 to +70°C  Approx. 2 g	R2 ToughFlex		**FU-35FZ**

CZ Series unit

Unit: mm

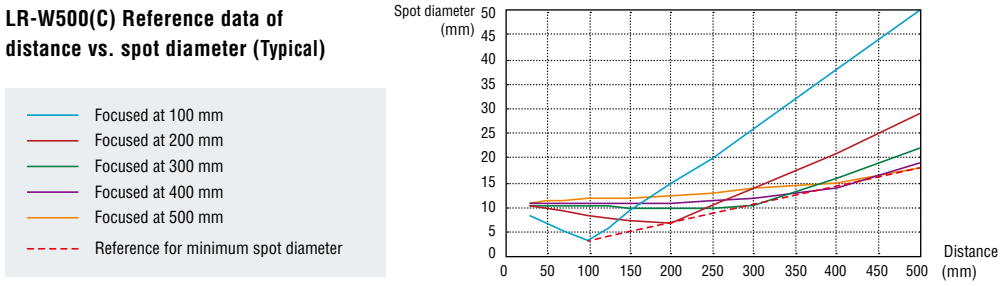
Type	Smallest spot diameter	Detection range	Model	Appearance	Minimum bend radius	Enclosure rating	Weight
Small size adjustable spot	ø0.9 to ø3.5	10 to 30	**CZ-10**	2 m Free-cut -40 to +70°C 	R25	IP40	Approx. 5 g
Small size, side-view adjustable spot	ø0.9 to ø1.5	3 to 15	**CZ-11**	1 m -40 to +70°C 			Approx. 13 g
Long detection distance, small beam spot	ø2	35 ±3	**CZ-13**	1 m -40 to +70°C 			Approx. 20 g
Long detection distance	ø6	70 ±20	**CZ-40**	2 m Free-cut -40 to +70°C 		IP67	Approx. 27 g
Small beam spot	ø1	16 ±4	**CZ-41**	2 m Free-cut -40 to +70°C 	R15		
Area beam spot, reflective	—	5 to 20	**CZ-12**	2 m Free-cut -40 to +70°C 	R25	—	Approx. 19 g

Sensor specifications

Type		Standard Type	Small/Dual Spot Type	Fibre Type
Model	2 m 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	30 to 70 mm	Detecting Distance and Min. Spot Diameter Based on Attached Fibre Head (See Pages 21 & 22 for details)
Min. spot diameter		Adjustable spot Approx. ø3.5 mm at 100 mm Approx. ø9 mm at 250 mm Approx. ø18 mm at 500 mm	Approx. 1.6 × 2.9 mm at 50 mm	
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 (no freezing)		-20 to +45°C (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 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 Fibre type) and display: PMMA (scratch-resistant coating), Cable bushing: PBT Cable (2 m 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, Fibre locking mount (Fibre type only): PBT, NBR, Silicone rubber, SUS304, SUSXM7 Adapter (Fibre type only): PBT		
Weight	2 m 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), Fibre 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 fibre units (the diameter of the cable is ø1.3 mm or ø1.0 mm) are used, the IP65 rating cannot be satisfied (FU-4F/66/91/93/43/63/63T etc.). When any small-diameter fibre 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 fibre unit.

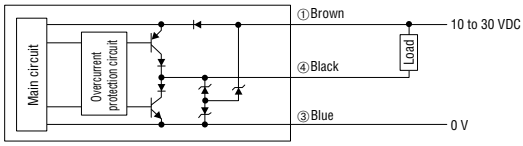
LR-W500(C) Reference data of distance vs. spot diameter (Typical)



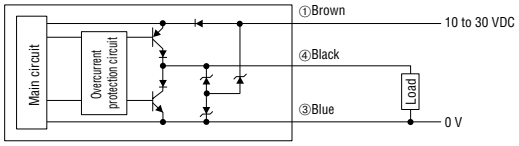
I/O circuit Diagrams

Control output circuit

When NPN is selected

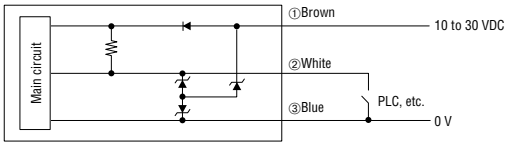


When PNP is selected

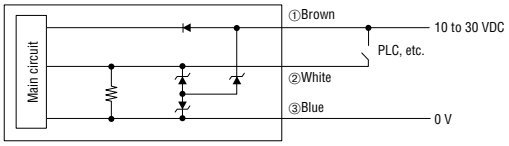


Input circuit

When NPN is selected



When PNP is selected



M12 Connector pin layout

Controller specifications

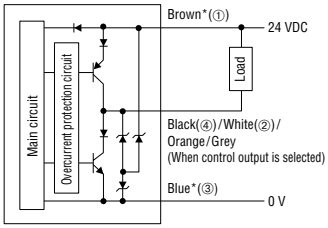
Model		MU-N11			MU-N12		
		Main unit			Expansion unit		
Connected sensor		LR-W500(C)	LR-W70(C)	LR-WF10(C)	LR-W500(C)	LR-W70(C)	LR-WF10(C)
Response time		Single output: 300 µs/1.1 ms/11 ms/ 100 ms/500 ms selectable Multiple output: 2 ms/3 ms/11 ms/ 100 ms/500 ms selectable	1-Spot Mode Single output: 300 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.					
	Analogue 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 (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 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.

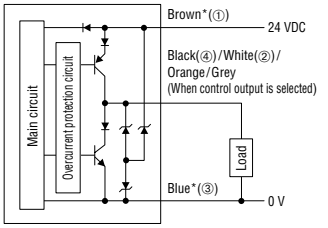
I/O circuit diagrams

Control output circuit

When NPN is selected



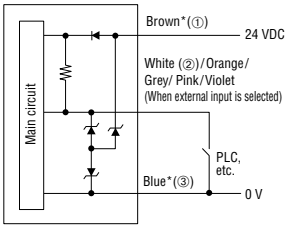
When PNP is selected



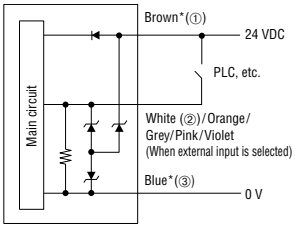
* MU-N11 only

Input circuit

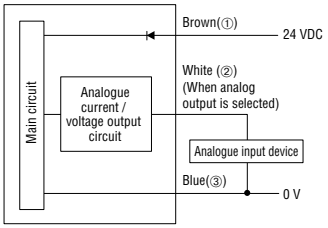
When NPN is selected



When PNP is selected



Analogue output circuit *



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

Power Cable wire colours

MU-N11 (main unit)

Wire colour	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/ Input 1/ Analogue		
Orange	Output 3/ Input 2	—	
Grey	Output 4/ Input 3		
Pink	Input 4		
Violet	Input 5		

* Pin numbers when using an M12 connector cable

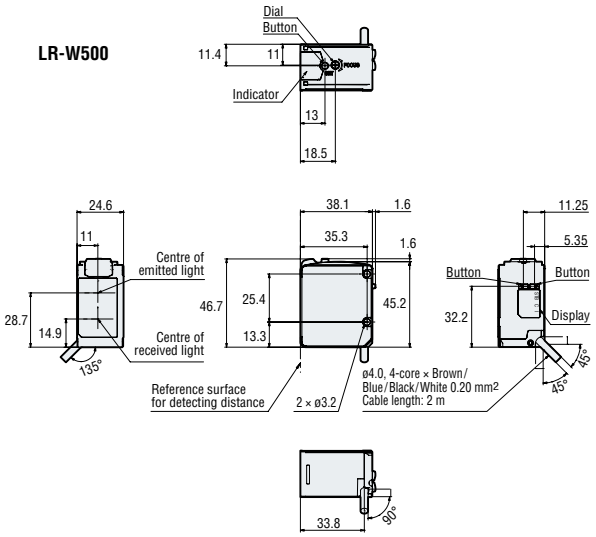
MU-N12 (expansion unit)

Wire colour	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	Output 2/ Input 1		
Orange	Output 3/ Input 2	—	
Grey	Output 4/ Input 3		
Pink	Input 4		
Violet	Input 5		

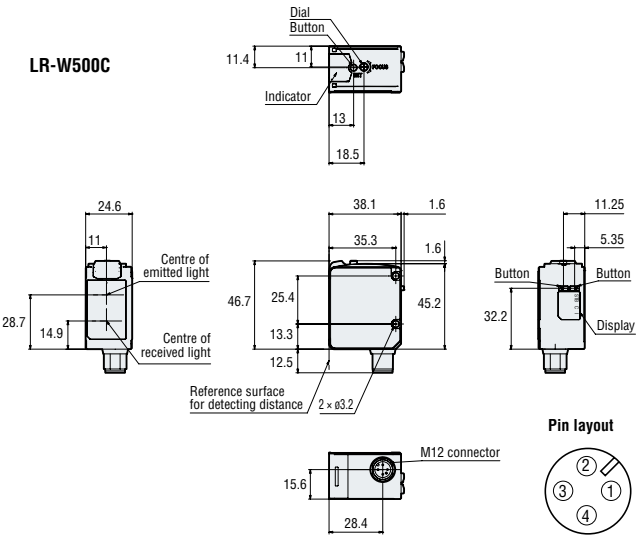
Dimensions

Unit: mm

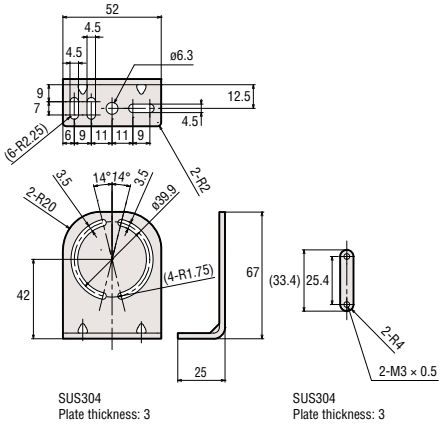
LR-W500



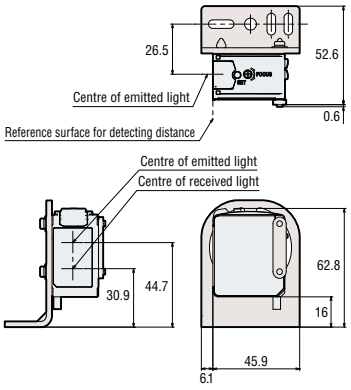
LR-W500C



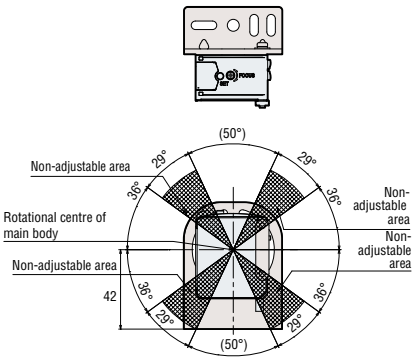
OP-88021



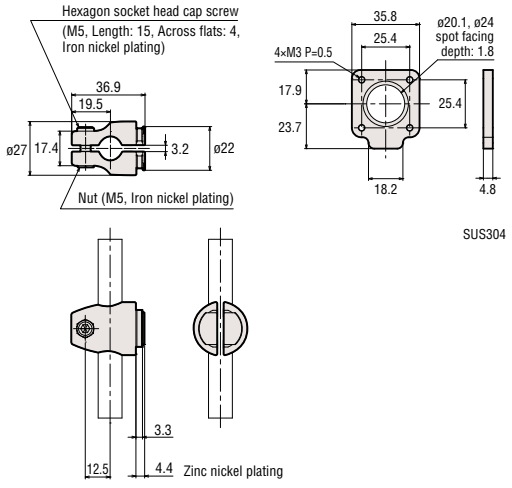
OP-88021 + LR-W500



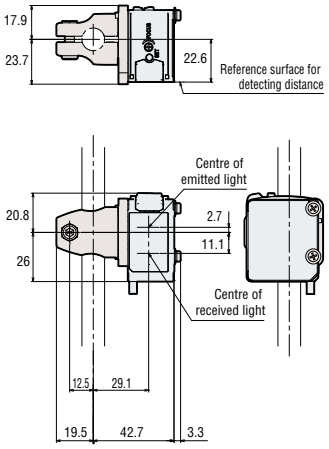
Angle non-adjustable area when **OP-88021** is used



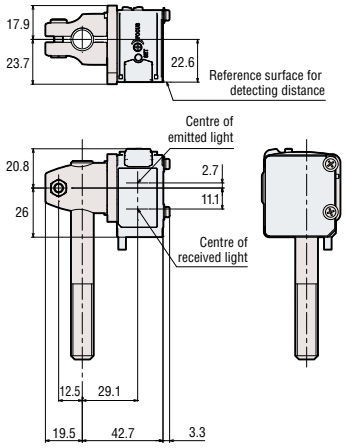
OP-88023



OP-88023 + LR-W500

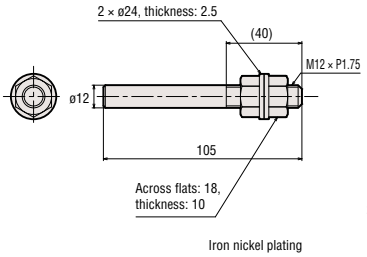


OP-88023 + OP-88024 + LR-W500

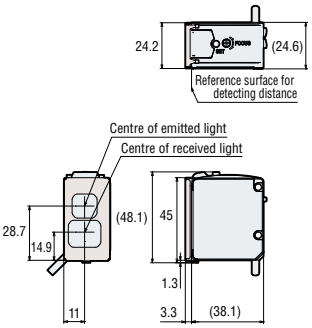


Dimensions

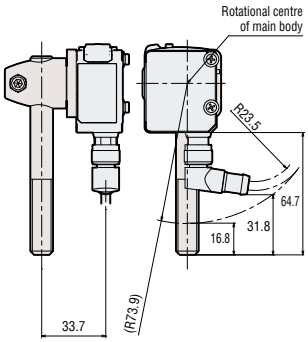
OP-88024



LR-WA1 + LR-W500

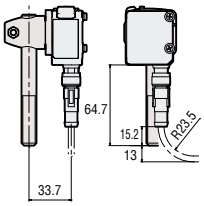


When **OP-88023** + **OP-88024** + **LR-W500C** + L-shape type M12 connector are used

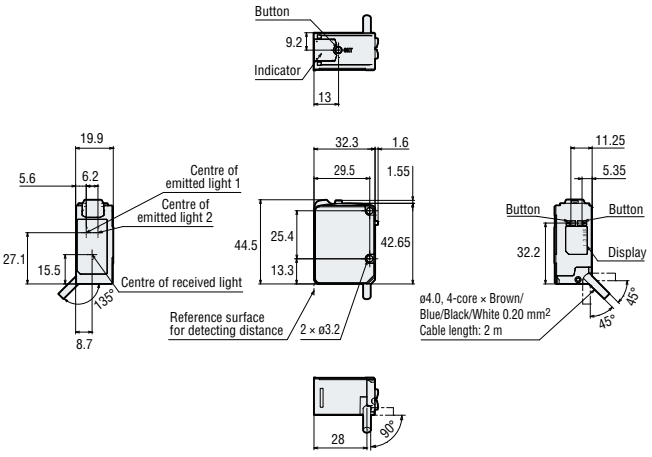


Warning for when an M12 connector type is used

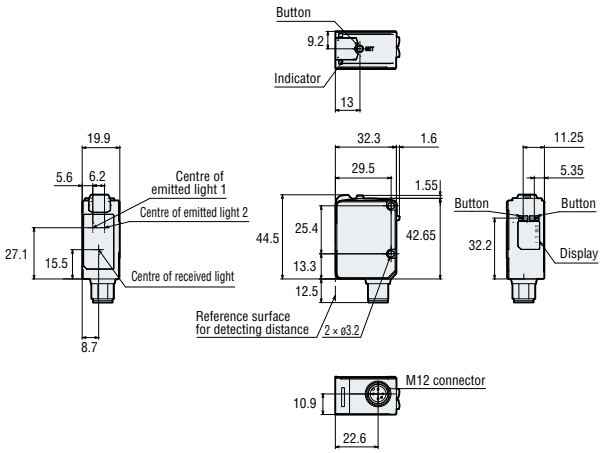
When mounting the unit as shown in the figure below (connector downward), carefully check the surroundings for any objects that might interfere with the connector cable.



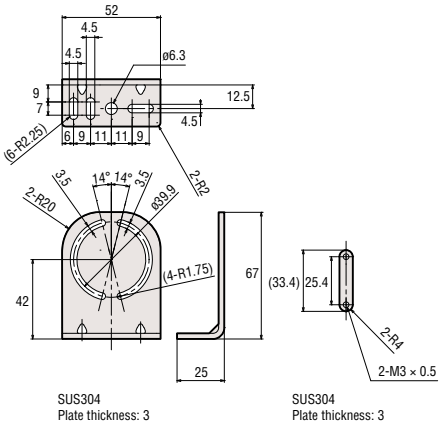
LR-W70



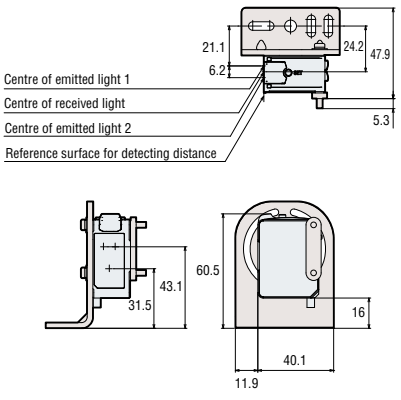
LR-W70C



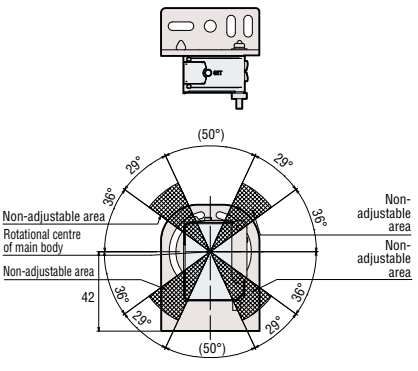
OP-88021



OP-88021 + LR-W70

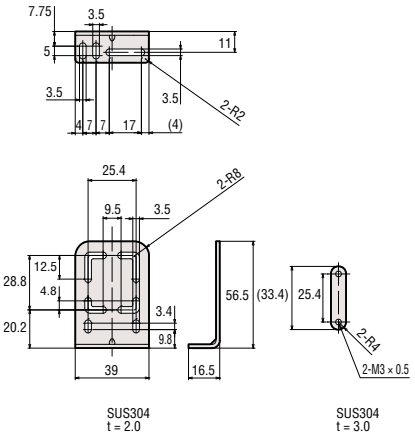


Angle non-adjustable area when **OP-88021** is used

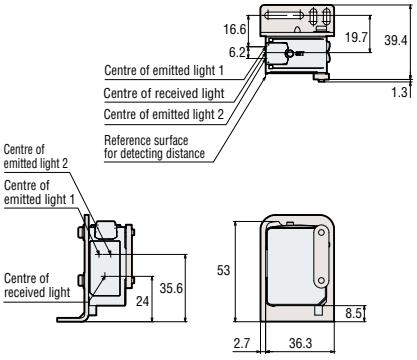


Unit: mm

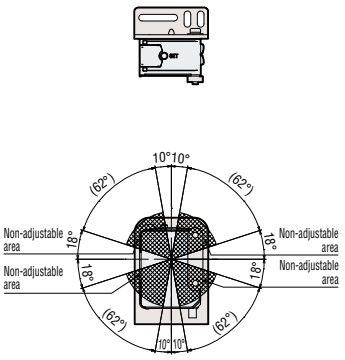
OP-88022



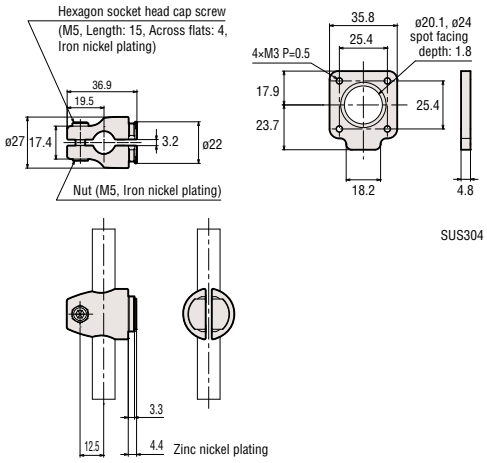
OP-88022 + LR-W70



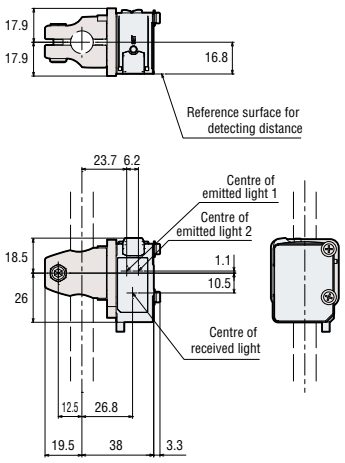
Angle non-adjustable area when **OP-88022** is used



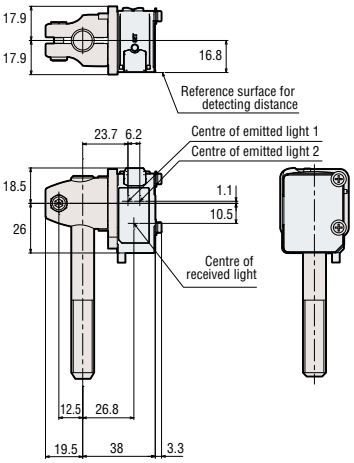
OP-88023



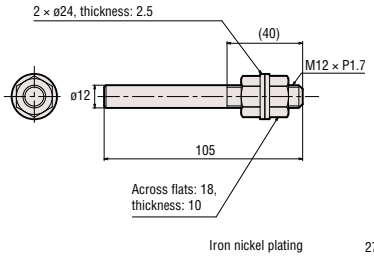
OP-88023 + LR-W70



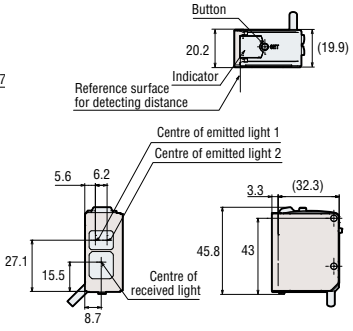
OP-88023 + OP-88024 + LR-W70



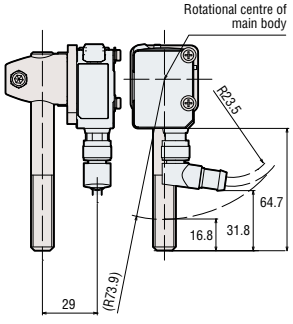
OP-88024



LR-WA2 + LR-W70

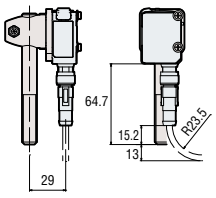


When **OP-88023** + **OP-88024** + **LR-WF70C** + L-shape type M12 connector are used



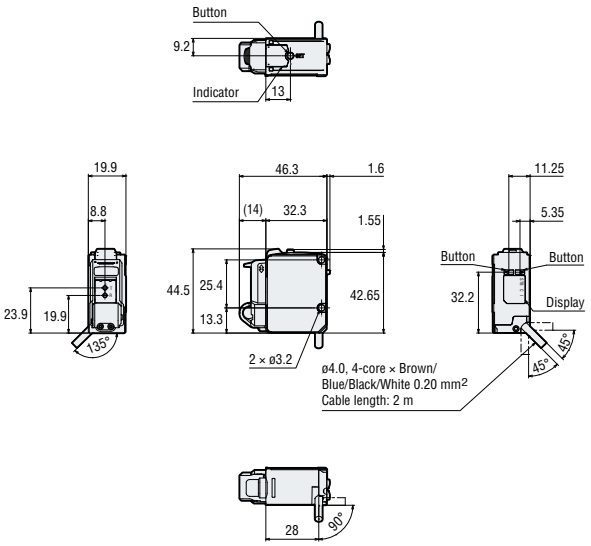
Warning for when an M12 connector type is used

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.

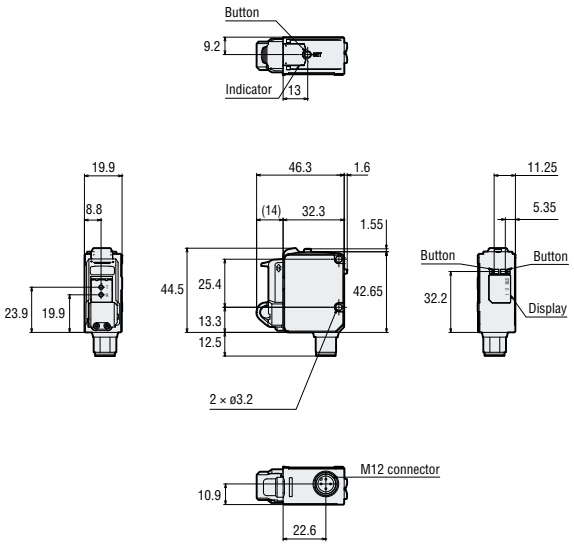


Dimensions

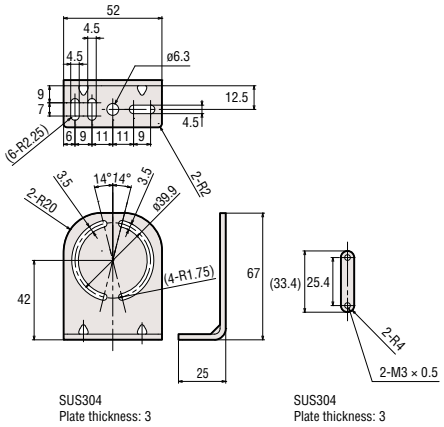
LR-WF10



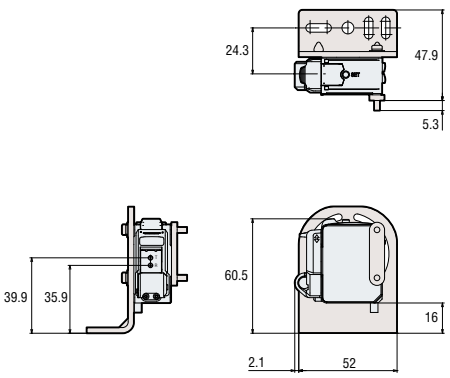
LR-WF10C



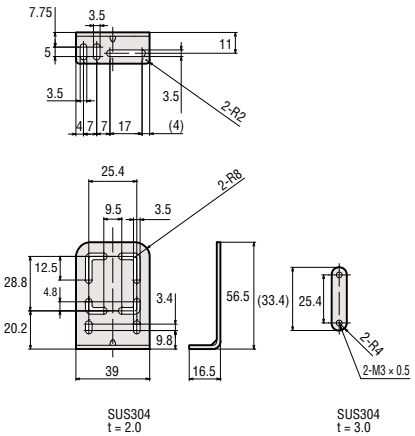
OP-88021



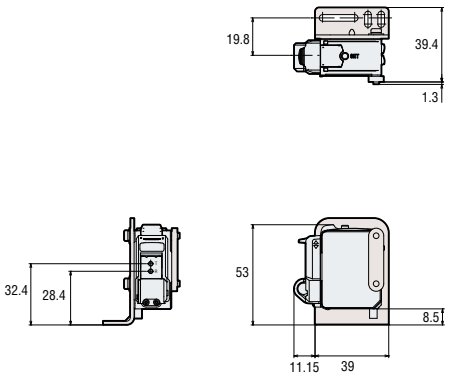
OP-88021 + LR-WF10



OP-88022

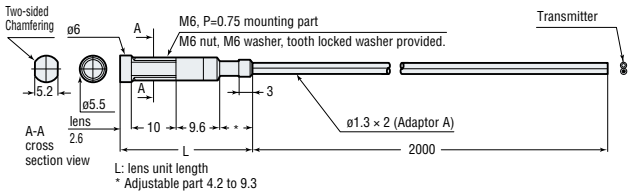


OP-88022 + LR-WF10

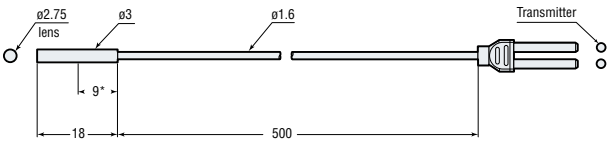


Unit: mm

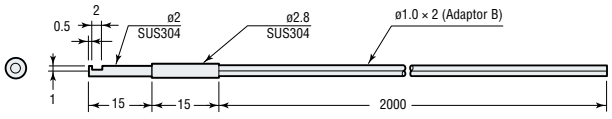
FU-10 Free-cut



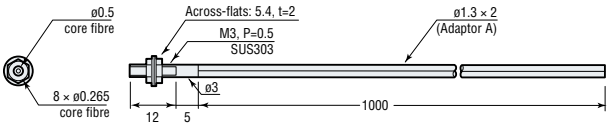
FU-20



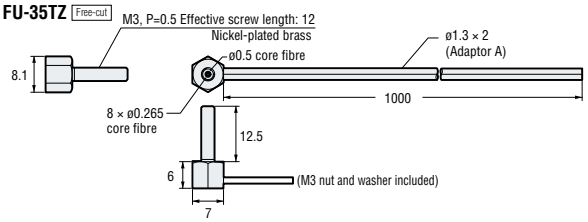
FU-31 Free-cut



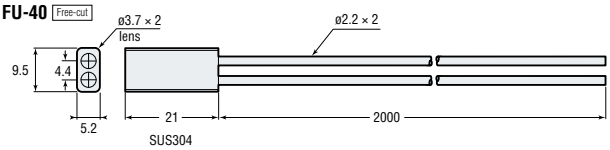
FU-35FZ Free-cut



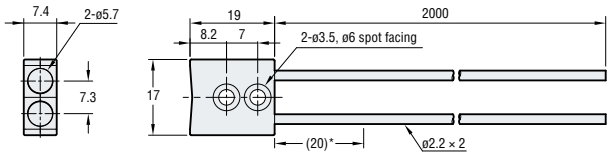
FU-35TZ Free-cut



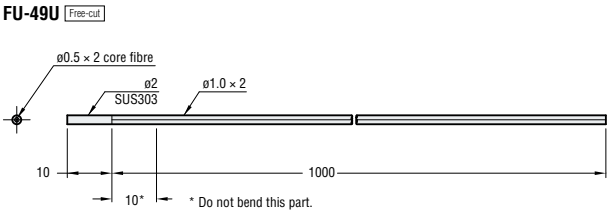
FU-40 Free-cut



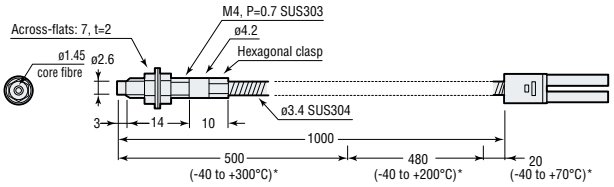
FU-40S Free-cut



FU-49U Free-cut

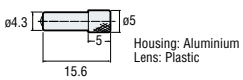


FU-83C

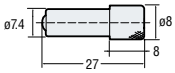


* Maximum temperature resistance for each part is shown in ( ).

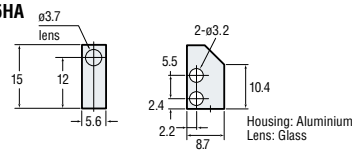
F-2HA



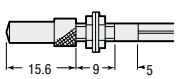
F-4HA



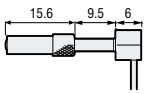
F-5HA



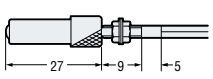
F-2HA + FU-35FZ



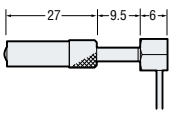
F-2HA + FU-35TZ



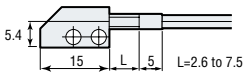
F-4HA + FU-35FZ



F-4HA + FU-35TZ

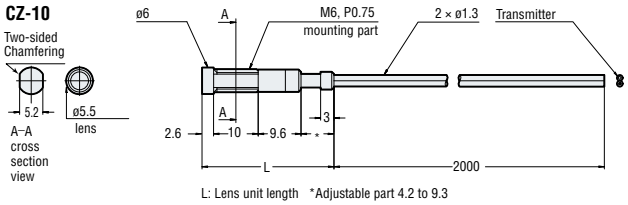


F-5HA + FU-35FZ

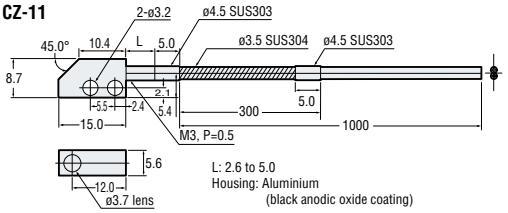


Dimensions

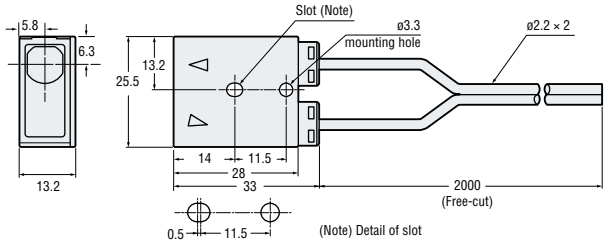
CZ-10



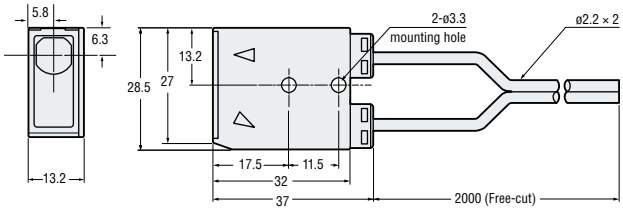
CZ-11



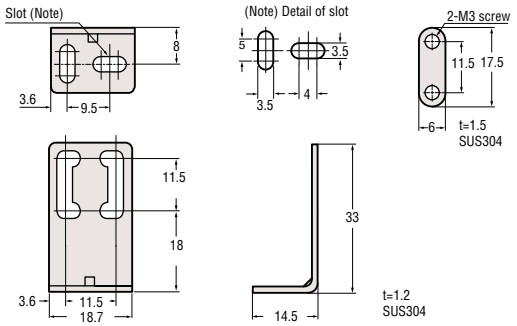
CZ-40



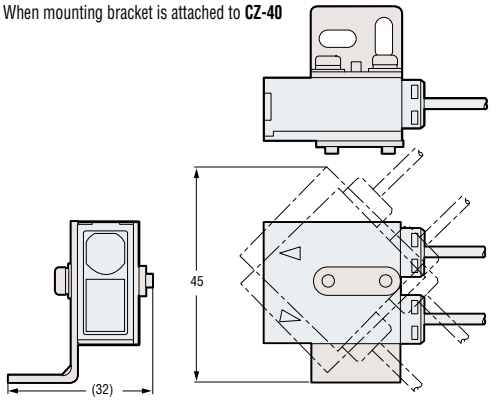
CZ-41



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

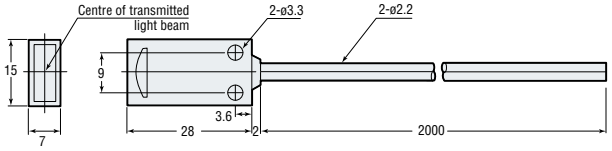


When mounting bracket is attached to **CZ-40**

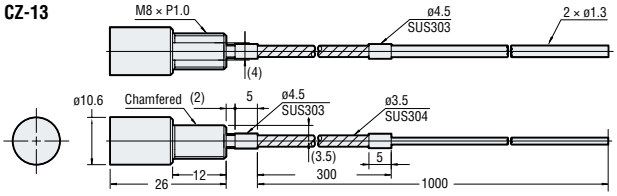


The sensor head angle can be changed by a maximum of 45 degrees upward and downward.

CZ-12

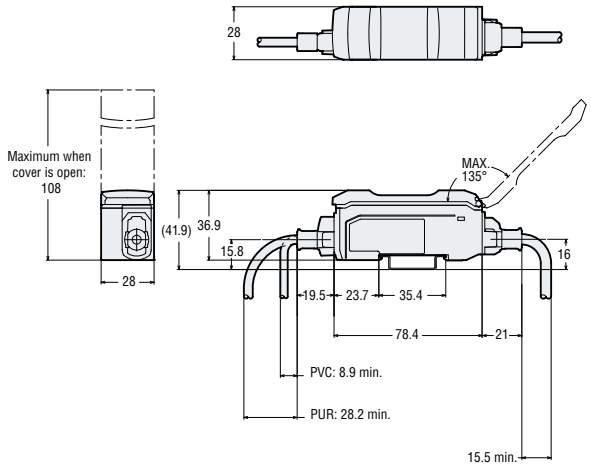


CZ-13

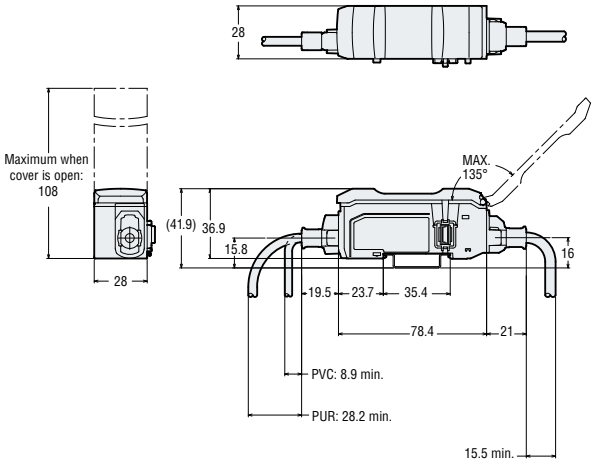


Unit: mm

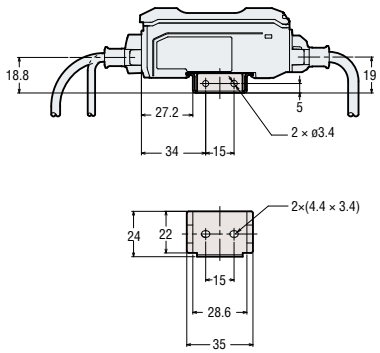
MU-N11 **(Main unit)**



MU-N12 **(Expansion unit)**

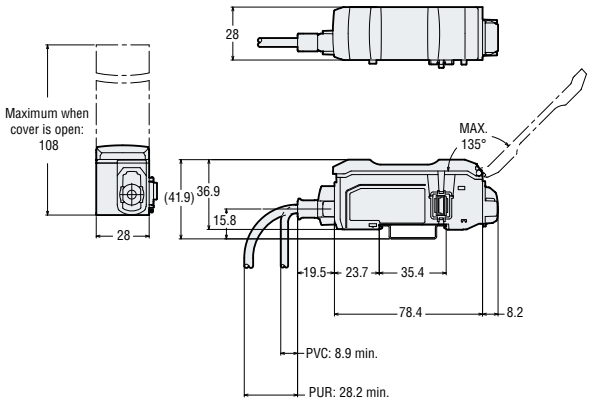


When mounting adapter is attached (**OP-76877**, optional, sold separately)

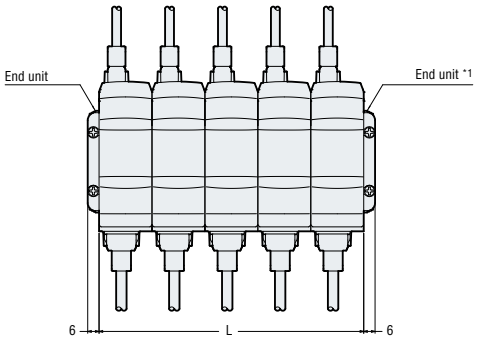


Back of mounting adapter

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



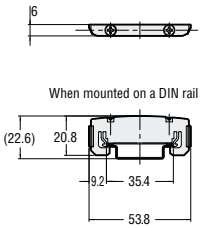
When expansion units are connected



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

No. of expansion units	L
1	28
2	56
3	84
4	112
5	140

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

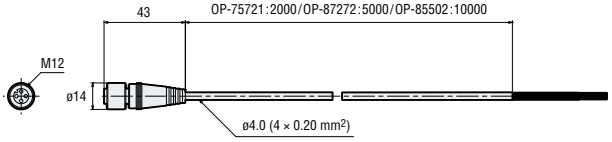


Dimensions

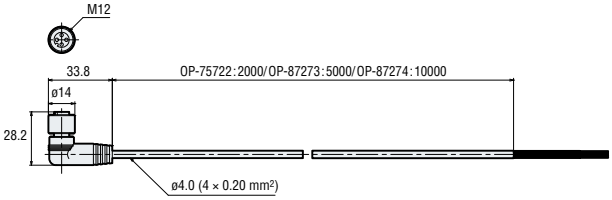
Unit: mm

M12 connector cable for sensor

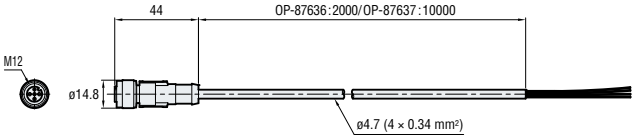
OP-75721/87272/85502



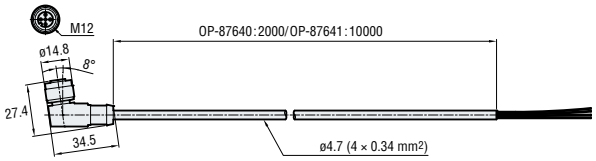
OP-75722/87273/87274



OP-87636/87637



OP-87640/87641

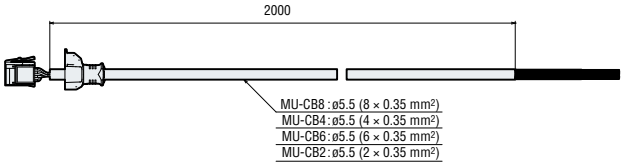


Pin layout

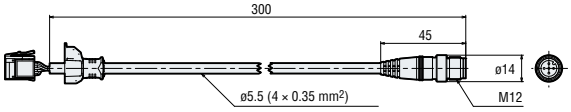
No.	Colour
①	Brown
②	White
③	Blue
④	Black

Power supply cable for MU-N

MU-CB8/CB4/CB6/CB2



MU-CC4

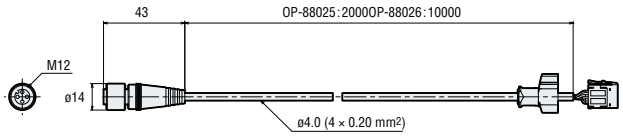


M12 Connector pin layout

No.	Colour
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	Colour
①	①	Brown
②	②	White
③	③	Blue
④	④	Black

Y
Connector pin layout

OP-88027/88028

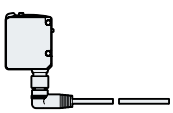
X
M12 Connector pin layout

X	Y	Colour
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.



Network communication unit NU Series

Open field network unit

Type	Appearance	Network	Model
Communication unit		EtherNet/IP®	**NU-EP1**
		EtherCAT	**NU-EC1**
		PROFINET	**NU-PN1**

The NU Series models also have the following communication units: CC-Link-compatible NU-CL1 and DeviceNet®-compatible NU-DN1.

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 (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: 360 mA or less, +45 to +50°C: 260 mA or less, +50 to +55°C: 140 mA or less)
*8 Excluding the current supplied to the connected sensor amplifier.

EtherCAT compatible communication unit: NU-EC1

Model		NU-EC1
Ethernet specifications	Compliant standards	IEEE802.3u (100BASE-TX)
	Transmission rate	100 Mbps (100BASE-TX)
	Transmission media	Category5e or higher STP
	Distance between nodes	100 m
	Communication port	RJ-45 × 2
EtherCAT communication specifications	Supported functions	Process data object communication (cyclic communication) Mailbox communication (message communication) CoE compatible
Sensor connection specifications	Connectable sensor	N-bus sensor amplifier*1
	Number of connectable sensors	16 units max.*2
	Power supply	Supplied from the unit via a wiring-saving connector
	Allowable passing current*3	1200 mA or less total
Power voltage		24 VDC ±10%, ripple (p-p) 10% or less
Power consumption		1700 mW or less (70 mA max. at 24 V)*4
Weight (including connector)		Approx. 80 g
Accessories		Instruction manual, power supply connector, end unit × 2

* EtherCAT is a registered trade name of BECKHOFF.

*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 unit or the sensor amplifier connected to this unit.

*4 Excluding the current supplied to the connected sensor amplifier.

PROFINET compatible communication unit: NU-PN1

Model		NU-PN1
Ethernet specifications	Compliant Standards	IEEE802.3u (100BASE-TX)
	Transmission rate	100 Mbps (100BASE-TX)
	Transmission media	STP or Category5 or higher UTP
	Maximum cable length	100 m
	Maximum number of connectable hubs	2
PROFINET specifications	Supported functions	Cyclic communication (Data I/O communication)
		Acyclic communication (Record data communication)
	Number of connectable controllers	1
	Update Time	2 to 512 ms
	Version of GSDML	Version 2.3
	Conformance class	Class A supported
	Conformance test	V2.2.4 supported
	Applicable protocols	LLDP, DCP
Sensor connection specifications	Connectable sensors	N-bus sensor amplifier*1
	Number of connectable sensors	16 units max.*2
	Power supply	Supplied from this unit via the sensor amplifier connector
	Allowable passing current*2	1200 mA or less total
	PoE power supply*3	Supplied voltage: 24 V±10%, supplied current: 360 mA or less*4
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)*5
Weight		Approx. 80 g
Accessories		Instruction manual, power supply 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 Indicates the current that can be supplied to the NU-PN1 and to the sensor units linked to the NU-PN1.

*4 This is the power that can be supplied to the sensor amplifier when the PoE power supply function is used.

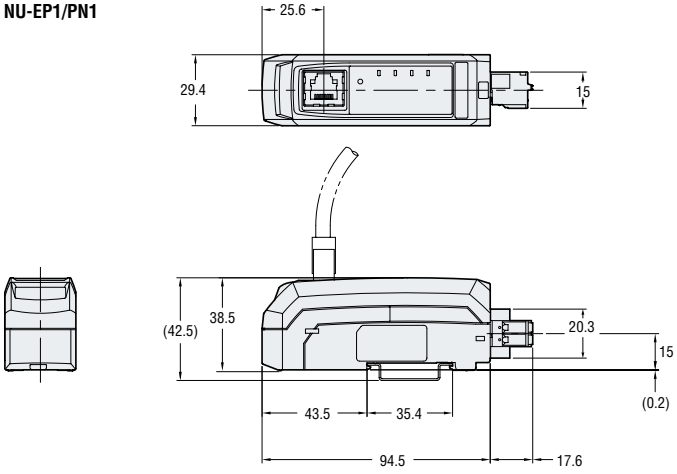
*5 Varies depending on the ambient temperature. (-20 to +45°C: 360 mA or less, +45 to +50°C: 260 mA or less, +50 to +55°C: 140 mA or less)

*6 Excluding the current supplied to the connected sensor amplifier.

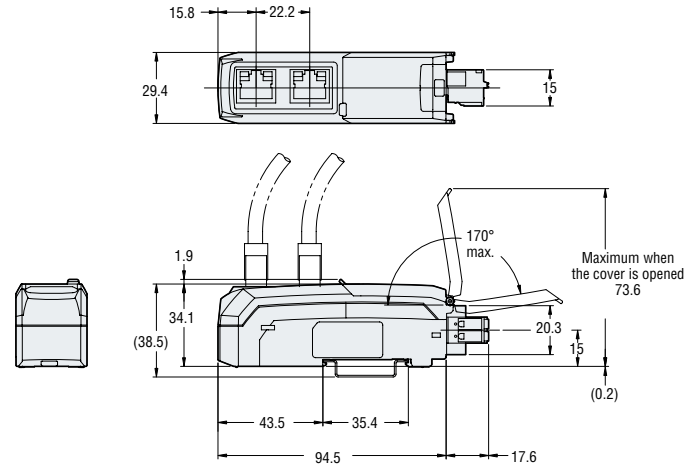
Dimensions

Unit: mm

NU-EP1/PN1



NU-EC1



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