

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 DIFFERENTIATION



Product treatment/coating verification

# **REGISTRATION MARKS**



Registration mark detection on film



Registration mark detection on a rounded surface





Confirming proper color shade

# **COLOR VERIFICATION**



Differentiating very similar colors





# 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



# 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









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.



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.

# Robust Housing

# Additional Lineup



# 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

**Difference Monitoring** 

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.



# 

Immediately detect registration marks without calibrating

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.

Detect target variations by monitoring the difference in appearance

between the two spots without the need for calibration.

## **Complex Registration Marks**



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

#### **Correct Combination Detection**



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.

# **Multi-Sensor Controller**

# When additional functionality is needed:

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



# **Various Output Options**



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**



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<sup>™</sup>.

# 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.

# **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







# 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

Туре		Detecting distance	Min. spot diameter	Light source	Model	Weight
Cable (2 m 6.6')	Standard	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. ø9 mm ø0.35" (at detecting distance of 250 mm 9.84")		LR-W500	Approx. 170 g	
M12 connector (Cable sold separately)	Туре	30 to 500 mm 1.18" to 19.69"	(at detecting distance of 250 mm 9.84°) • Approx. ø18 mm ø0.71° (at detecting distance of 500 mm 19.69°)	White LED	LR-W500C	Approx. 110 g
Cable (2 m 6.6')	Small/Dual		Approx. 1.6 × 2.9 mm 0.06° × 0.11°	White I ED	LR-W70	Approx. 130 g
M12 connector (Cable sold separately)	Spot Type	30 to 70 mm 1.18' to 2.76'	at 50 mm 1.97*	White LED	LR-W70C	Approx. 75 g
Cable (2 m 6.6 )	Eiber Ture	Detecting Distance and Min. Spot Diar	neter Based on Attached Fiber Head	White LED	LR-WF10	Approx. 150 g
Fiber Type W12 connector (Cable sold separately)	гысы туре	(See Pages 21 & 22 for details)	Wille LED	LR-WF10C	Approx. 95 g	

# Mounting bracket

Ţ	ype	Applicable Sensors	Model	Material/weight
	Standard mounting bracket (M3 screw × 2 supplied)	LR-W500/ W70/ WF10	0P-88021 <sup>*1</sup>	SUS304 Approx. 110 g
	Small mounting bracket (M3 screw × 2 supplied)	LR-W70/ WF10	OP-88022*1	SUS304 Approx. 50 g
06.	Adjustable bracket (M3 screw × 2 supplied)	LR-W500(C)/	OP-88023	Zinc nickel plating, etc. Approx. 110 g
	Adjustable bracket locking screw (105 mm 4.13')	WF10(C)	OP-88024	Iron nickel plating Approx. 140 g

# Attachment

T	уре	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.

\*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.

## Cable

Appearance	Cable material	Sensor side	Cable end	Length	Model	Weight
			- Loose wires -	2 m 6.6'	OP-75721	Approx. 60 g
	Cable: PVC (Polyvinyl chloride)			5 m 16.4'	OP-87272	Approx. 125 g
		M12 4-pin straight		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
				2 m 6.6'	OP-75722	Approx. 65 g
	Cable: PVC (Polyvinyl chloride)			5 m 16.4'	OP-87273	Approx. 130 g
		M12 4-pin L-shape		10 m 32.8'	OP-87274	Approx. 235 g
	Cable:			2 m 6.6'	OP-87640	Approx. 75 g
	PUR (Polyurethane)			10 m 32.8'	OP-87641	Approx. 330 g

## Controller

Туре	Control output	External input	Analog output	Model	Weight
Main unit	4 standard outputs max.*	5 inputs may *	1 output max.*	MU-N11	Approx. 70 g
Expansion unit	(13 signal collibilitations available using binary logic)	j nipuis fildx.	_	MU-N12	Approx. 70 g

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

## I 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			8-core loose wires			MU-CB8	Approx. 150 g
	Ivialit utili		4-core loose wires		2 m 6 6'	MU-CB4	Approx. 120 g	
	Expansion unit	D)/C (Debained oblevide)	6-core loose wires		2 111 0.0	MU-CB6	Approx. 130 g	
• /	Expansion unit		2-core loose wires	Connector		MU-CB2	Approx. 100 g	
	Main unit	r vo (roiyviliýi chiolide)	M12 4-pin straight	Connector	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
0		M12 4-pin		2 m 6.6'	OP-88025	Approx. 75 g
	PVC (Polyvinyl chloride)	straight	Connector	10 m 32.8'	OP-88026 <sup>*1</sup>	Approx. 280 g
		M12 4-pin	oomeetor	2 m 6.6'	OP-88026*1 OP-88027	Approx. 75 g
4.		L-shape		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.

## I 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	Туре	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
Store State	For PUR (Polyurethane) cable	OP-87636/87637 OP-87640/87641	OP-88030	Approx. 3 g

# Controller mounting options

Appearance	Туре	Description	Model	Weight
	Mounting adapter (for main unit)	Allows the main unit to be mounted without a DIN rail.	OP-76877	Approx. 11 g
تشجي أنحي	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

# I Fiber unit specification when using LR-WF10(C)

Unit: mm inch

Feature	Туре	Fiber unit length (Diameter) Ambient temperature	Appearance	Minimum bend radius	Detecting distance	Model Weight
Threaded and	M3 Hex-shaped Coaxial	1 m 3.3' Free-cut (Ø1.3 Ø0.05' × 2) -40 to +50°C -40 to +122°F	0.73' 18.5 M3	R2 80.08*	500 ms: 47 1.85° 100 ms: 32 1.26° 10 ms: 12 0.47°	<b>FU-35TZ</b> Approx. 7 g
Hex-shaped Fibers	Term     Der     Antionel temporatore     Paper ministic     Derd million     Definiting ministic       Threaded and Here-shaped Folers     Im 3.5 Free-out 1m 3.5 Free-out (#13 0.05 × 2)     0.23 0.05 × 20 0.05 ×	<b>FU-35FZ</b> 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	0.39° 10 02 00.08°	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*	<b>FU-49U</b> Approx. 4 g
Small Spot	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	M6 26.4 to 31.5 1.04* to 1.24*	R25	10 to 30 0.39° to 1.18°	<b>FU-10</b> Approx. 5 g
Reflective	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 Tip:	e3 e0.12* 18 0.71*	R0.98"	5 ± 1 *1 0.20" ± 0.04"	<b>FU-20</b> Approx. 2 g
Focused Beam/ High-power	Aperture angle: Approx. 8°	2 m 6.6' Free-cut (ø2.2 o0.09' × 2) -40 to +50°C -40 to +122°F	Thickness: 5.2 0.20 21 0.83'	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: —	<b>FU-40</b> Approx. 23 g
Definite-reflective	Thin, Small	2 m 6.6' Free-cut (ø2.2 o0.09' × 2) -40 to +70°C -40 to +158°F	7.4 0.29' 19 17 0.67'	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°	<b>FU-40S</b> Approx. 25 g
Sleeve	Side view detection	2 m 6.6' Free-cut (ø1.0 00.04' × 2) -40 to +70°C -40 to +158°F	00.11° 00.08° 02.8 02 15 0.59° Do not bend sleeve.	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*	<b>FU-31</b> Approx. 5 g
Heat Resistant	Heat resistant temperature <sup>*2</sup> : 300°C 572°F	1 m 3.3' cut not allowed. -40 to +300°C -40 to +572°F -00.1 g2.6	0° 10 17 0.39° 0.67°	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°	<b>FU-83C</b> 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

Tuno	Beam spot	Eccal dictance		Lens		Fiber units	
Type	diameter	FUGAI UISTAILCE	Model	Appearance Weight	Minimum bend radius	Appearance	Model
	Approx. ø0.4	7 ±2	E 2UA	-30 to +70°C -22 to +158°F Tin: e4.3	R2 R0.08" ToughFlex		FU-35FZ
Small snot	ø0.02"	0.28" ±0.08"	F-211A	00.17" 15.6 0.61" Approx. 1 g	R2 R0.08" ToughFlex	-	FU-35TZ
onian spot	Approx. ø0.5	15 ±2	F-4HA	-30 to +70°C -22 to +158°F Tip: 07.4	R2 R0.08" ToughFlex		FU-35FZ
	ø0.02"	0.59" ±0.08"	1-4114	00.29 27 1.06 Approx. 2 g	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 5.6 0.22' 15 0.59' Approx. 2 g	R2 R0.08" ToughFlex		FU-35FZ

# CZ series unit

Unit: mm inch

Туре	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			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	R25	IP40	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	R0.98°		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		1067	Approx.
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'	IFU/	27 g
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		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	R0.98"		Approx. 23 g

## Sensor specifications

CE		🚷 IO-Link
----	--	-----------

Туре		Standard Type	Small/Dual Spot Type	Fiber Type	
M. 1.1	2 m 6.6' cable type	LR-W500	LR-W70	LR-WF10	
woder	M12 connector 4-pin type	LR-W500C	LR-W70C	LR-WF10C	
Detecting dista	nce	30 to 500 mm 1.18" to 19.69" 30 to 70 mm 1.18" to 2.76"			
Min. spot diameterAdjustable spot Approx. ø3.5 mm at 100 mm ø0.14" at 3.94" Approx. 99 mm at 250 mm ø0.35" at 9.84" Approx. 91 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"Detectin Attache		Detecting Distance and Min. Spot Diameter Based on Attached Fiber Head (See Pages 21 & 22 for details)			
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 $\mu s,$ 1 ms, 10 ms, 100 ms, 500 ms $\mbox{ Selectable}^{\star2}$	
Light source			White LED		
Mutual interfer	ence reduction function	Up to 2 units when alternate frequencies set			
Timer		OFF/ON delay/OFF delay/One-shot			
	Power voltage		10 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS		
Power supply	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	
	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			
I/0*4	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 circl	uit	Protection against reverse power c	onnection, power supply surge, output overcurrent, output su	rge, and reverse output connection	
	Enclosure rating	IP65/IP67	(IEC60529)	IP65 (IEC60529)*5*6	
	Ambient light	Incandescent lamp: 10000 lux or less, Sunlight: 20000 lux or less			
Environmental	Ambient temperature	-20 to +50°C -4 to	122°F (no freezing)	-20 to +45°C -4 to 113°F (no freezing)	
resistance	Ambient humidity		35 to 85%RH (no condensation)		
	Shock resistance		1000 m/s <sup>2</sup> 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			ectively, 2 hours		
Material		Case: Zinc die cast (Nickel chrome plating), Indicator cover: Cable (2 m 6.6' cable type only): PVC, Spot adjustm Connector socket (4-pin M12 connector type only): PE	PPSU, Buttons: PES, Lens cover (except for Fiber type) and dis ent dial(Standard type only): Iron (triiron tetraoxide coated), Co I, Fiber locking mount (Fiber type only): PBT, NBR, Silicone rub	play: PMMA (scratch-resistant coating), Cable bushing: PBT nnector ring (4-pin M12 connector type only): PMP, ober, 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)	
weight	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.



0 V

## I/O circuit Diagrams

## Control output circuit



#### When PNP is selected



## Input circuit



#### When PNP is selected



#### M12 Connector pin layout



## Controller specifications

Madal		MU-N11			MU-N12			
wouer			Main unit		Expansion unit			
Connected sen	sor	LR-W500(C)	00(C) LR-W70(C) LR-WF10(C) LR-W500(C) LR-W70(C) LR-			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/1 s 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/1 s 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 interferen	ce reduction function			Up to 2 units with alt	ernate frequencies set			
Timer				OFF/OFF delay/C	N delay/One-shot			
	Power voltage		100 1 1 ( 11 11 11	24 VDC, ripple (P-P) 10	% or less, Class 2 or LPS		105 1 ( ))	
Power supply	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)	200 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)	
Control output		4 outputs max. NPN open collector /PNP open collector selectable 24 VDC or less, main unit: 50 mA or less <sup>1</sup> , expansion unit: 20 mA or less Remaining voltage: 2 V or less N.O./N.C. selectable						
I/O	External input		s For th	5 inpu Short circuit current: 1 mA or le: ne applied voltage, see the wirin	ts max. ss for NPN/2 mA or less for PN g diagrams in the instruction m	P anual.		
	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 circ	uit	Pr	otection against reverse power	connection, power supply surge	e, output overcurrent, output sur	ge, and reverse output connecti	on	
Unit expansion				Up to 4 units p	per main unit <sup>*2</sup>			
	Ambient temperature			-20 to +50°C -4 to	122°F (no freezing)			
Environmental	Ambient humidity			35 to 85%RH (r	io condensation)			
resistance	SHOCK resistance		10 to EE 11- D-	IUUU M/S <sup>2</sup> IN X, Y, Z AXIS di	the X_X Z evic directions	ativaly 0 hours		
Material	vibration resistance		IU IU 55 HZ DO	d dust cover : Polycarbonato P	then: Polyacetal Display page	: Activitie		
Weight			Gase all	u uusi cover . r oiycarbollate, Di Annro	x 70 n	. Aci yile		

\*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 \*

Power Cable wire colors MU-N11 (main unit)

Wire color Details

Black (4\*) Output 1

Output 2/

Input 1/An

Output 3/ Input 2

Output 4/ Input 3

Input 4

Brown (1\*) 24 V

Blue (3\*) 0 V

White (2\*)

Orange

Gray

Pink



# cable is used

Pin layout when the M12



connector (4-pin)

#### MIL N12 (avpancion unit)

	i.)		1010-1012	(expans	ion unit)	
	Power cable model/type		Wire color	Details	Power cable model/typ	
	MU-CB4		Black	Output 1	MU-CB2	
	4-core cable for main unit		White	Output 2/ Input 1	2-core cable for expansion unit	MU-CB6
00	connector type)*	MU-CB8 8-core	Orange	Output 3/ Input 2		6-core cable
	117	cable for	Gray	Output 4/ Input 3	_	expansion
		main unit	Pink	Input 4	1	
	-		Violet	Input 5	1	

Violet Input 5 \* Pin numbers when using an M12 connector cable

## Dimensions



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





0P-88021 + LR-W500



OP-88023 + LR-W500



OP-88023

OP-88021









0P-88023 + 0P-88024 + LR-W500



#### Unit: mm inch

## Dimensions

#### OP-88024 LR-WA1 + LR-W500 When OP-88023 + OP-88024 + LR-W500C + L-shape type M12 connector are used Rotational center of main body 2 × Ø24 Ø0.94", thickness: 2.5 0.10 24.2 0.95\* è. (40) (1.57") 0 Reference surface for detecting distance cable. M12 × P1.75 ø12 Center of emitted light Center of received light ſa 105 4.1 64. Across flats: 18 0.71 thickness: 10 0.39" 31.8 (48.1) 49 16.8 64 28.7 (R2.91 Iron nickel plating (R73.9) (I 1.3 0.0 33.7 (38.1) 33.7 1.33" 3.3 0.1

#### 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



LR-W70



LR-W70C



OP-88021



0P-88021 + LR-W70





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



#### Unit: mm inch

#### OP-88022



#### 0P-88022 + LR-W70

Center of emitted light 2

Center of emitted light

Center of

received light





OP-88023



0P-88023 + LR-W70



₩

19.7 0.78 39.4

8.5

36.3

2

1.3 <mark>0.0</mark>

16.6 (

Center of emitted light 1

Center of received light

Center of emitted light 2

35.6 53 1.40° 2.09°

Reference surface for detecting distance

6.2 0.2

0P-88023 + 0P-88024 + LR-W70



#### OP-88024



Iron nickel plating

#### 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

OP-88021

OP-88022

9 0.35

42 1.65"

LR-WF10 Button 9.2 0.36 Indicator 13 19.9 11.25 0.44" 1.6 0.06 46.3 1.82" 8.8 (14) 32.3 5.35 1.55 0.06\* Button Button 25. 44.5 1.75\* 42.65 32.2 23.9 0.94" Display 19.9 13.3 Q 450 2 × ø3.2 ø0.13\* ø4.0 ø0.16', 4-core × Brown/ Blue/Black/White 0.20 mm<sup>2</sup> Cable length: 2 m 6.6'



ø6.3 ø0.25"

4.5

B

-R1.75)

25 0.98"

6 9 11 11 9

SUS304 Plate thickness: 3 0.12" 12.5 0.49

67 (33.4) 25.4

2-M3 × 0.5 0.02"

SUS304 Plate thickness: 3 0.12 LR-WF10C





0P-88021 + LR-WF10

24.3 0.96<sup>-</sup> 5.3 0.21<sup>+</sup>



OP-88022 + LR-WF10











FU-40S Free-cut



12.5 0.49"

(M3 nut and washer included)

0.24\* 6



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

F-2HA





F-2HA + FU-35TZ

6









F-4HA + FU-35FZ









#### FU-20



\* Set-screw tightening area







## Dimensions





Mounting bracket (attached to CZ-40/41)



















R-2 reflector (attached to CZ-60)





Mounting bracket (attached to CZ-60)



#### MU-N11 (Main unit)

Maximum when cover is open: 108 4.25"

(41.9) 1.65") 36.9

15.8 0

23.7

0.93" 1.39"

PVC: 8.9 min.

- PUR: 28.2 min. 1.11" 35.4

3.09

 $\bigcirc$ 

28

1.10



MAX. 135°

-21-

0.83

15.5 min.-0.61"



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



When expansion units are connected



3

4 5 84 3.31" 112 4.41" 140 5.51" When the communication unit is connected without using a power supply cable



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



When mounted on a DIN rail



31

## Dimensions

#### OP-75721/87272/85502



OP-87636/87637





Unit: mm inch



## OP-87640/87641





#### Power supply cable for MU-N



MU-CC4





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

OP-88025/88026





connector base cannot be rotated.





CAD	DAIA	
CAD	δάτα	

## Open field network unit

Туре	Appearance	Network	Model
		CC-Link	NU-CL1
Communication unit		DeviceNet <sup>TM</sup>	NU-DN1
	A LOC	EtherNet/IP <sup>TM</sup>	NU-EP1
e-CON Input unit		_	NU-EN8N

## Options

-	
Model	Туре
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<sup>2</sup>.

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
	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)
CC-Link specifications	Station type	Remote device station
	Transmission rate	156 kbps/625 kbps/2.5 Mbps/5 Mbps/10 Mbps
	Station No. setting	1 to 64
	Connectable sensor	N-bus supporting sensor amplifier*1
Sancar connection constituations	Number of connectable sensors	16 units max.*2
Sensor connection specifications	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<sup>™</sup> communication unit: NU-DN1

Model		NU-DN1		
	Supported functions	I/O communication (Poll), Explicit message communication		
	Address setting		0 to 63 (PGM supported)	
DeviceNet <sup>™</sup> specifications	Communication speed (automatic selection)	500 kbps	250 kbps	125 kbps
	Maximum apple 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)
	Connectable sensor	N-bus sensor amplifier*1		
Concer connection on officiations	Number of connectable sensors	16 units max.*2		
Sensor connection specifications	Power supply	Supplied from the DeviceNet <sup>™</sup> 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 <sup>™</sup> 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<sup>TM</sup> compatible communication unit: NU-EP1

Model		NU-EP1
	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)
Eulemei specifications	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)
	Supported functions	Cyclic communication Message communication (Explicit message communication) supporting UCMM and Class 3
	Number of connections	64
EtherNet/IDTM energifications	RPI (communication cycle)	0.5 to 10000 ms (Unit: 0.5 ms)
EtherNet/IP1M specifications	Tolerable communication bandwidth for cyclic communication	6000 pps
	Conformance test	Version A7 supported
	Connectable sensor	N-bus sensor amplifier*3
Concor connection	Number of connectable sensors	16 units max.*4
Selisor connections	Power supply	Supplied from this unit via the sensor amplifier connector
specifications	Allowable passing current*5	1200 mA or less total
	PoE power supply <sup>*6</sup>	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)		Арргох. 80 д
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.

## I 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
	Connector	e-CON connector (4-pin)
	Number of inputs	8
	Supply voltage	Supplied from communication unit
1/0	Supply current	520 mA or less (8 inputs in total)
1/0	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.

29.4

## Dimensions

Unit: mm inch

NU-CL1



88888

000000

15 0.59

NU-DN1





NU-EP1



NU-EN8N



2 0.08"

When a tag is attached





CAD DATA DOWNLOAD





www.keyence.com



SAFETY INFORMATION

## CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

<b>KEYENCE C</b>	ORPORA	TION OF AMER	RICA							
Head Office	500 P	ark Boulevard,	Suite 200, Itasca	, IL 60143, U.S.A.	PHONE: +1-201	-930-0100 FAX: +1-	855-539-0123	E-mail: keyence@ke	yence.com	
AL Birmingha AR Little Rock AZ Phoenix CA San Franc	m sco	CA San Jose CA Cupertino CA Los Angeles CA Irvine	CO Denver FL Tampa GA Atlanta IA Iowa	IL Chicago IN Indianapolis KY Louisville MA Boston	MI Detroit MI Grand Rapids MN Minneapolis MO Kansas City	MO St. Louis NJ Elmwood Park NY Rochester NC Charlotte	NC Raleigh OH Cincinnati OH Cleveland OR Portland	PA Philadelphia PA Pittsburgh SC Greenville TN Knoxville	TN Nashville TX Austin TX Dallas WA Seattle	<b>WI</b> Milwauke
KEYENCE CANADA INC.							KEYENCE MEXICO S.A. DE C.V.			
Head Office     PHONE: +1-905-366-7655     FAX: +1-905-366-1122     E-mail: keyencecanada@keyence.com       Montreal     PHONE: +1-514-694-4740     FAX: +1-514-694-3206     Windsor PHONE: +1-905-366-7655     FAX: +1-905-366-1122							PHONE: +52-55-8850-0100 FAX: +52-81-8220-9097 E-mail: keyencemexico@keyence.com			
The information in	this publicat	ion is based on KEYEN	CE's internal research/eval	uation at the time of release a	nd is subject to change with	out notice.				KA1-10

The immunoi in minimum product names mentioned in the Lefter allowed and the transferred and the mention of the transferred and the transferred an Copyright (c) 2015 KEYENCE CORPORATION. All rights reserved.

Milwaukee