FULL-SPECTRUM SENSOR

Stable Detection of Changes in Appearance
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
REGISTRATION MARKS

- Registration mark detection on film
- Registration mark detection on a rounded surface

COLOUR VERIFICATION

- Confirming proper colour shade
- Differentiating very similar colours
**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

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

500,000× High Dynamic Range
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**
  
  One simple press is all that is needed to stably match a specific product.

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

- **Varying Colour Detection**
  
  Innovative tuning option to set clear thresholds for target variation.

**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.

Dust and Dirt Resistant

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.

Secure Mounting

The rigid metal housing of the LR-W allows for secure mounting without the fear of damage to the unit.
MU-N Series
Multi-Sensor Controller

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

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

**Various Output Options**

<table>
<thead>
<tr>
<th>Selectable I/O</th>
<th>1 Output (16 banks)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parallel 4 Outputs (2 banks)</td>
</tr>
<tr>
<td></td>
<td>Binary 15 Outputs (No bank)</td>
</tr>
<tr>
<td>Analogue</td>
<td>4 to 20 mA or 0 to 10 V</td>
</tr>
</tbody>
</table>

**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.

**Rich OLED Display**

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

**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.

Enable copying and writing of data via wide varieties of communication protocols.
When colour/contrast needs to be ignored

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

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Detecting distance</th>
<th>Min. spot diameter</th>
<th>Light source</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable (2 m)</td>
<td>30 to 500 mm</td>
<td></td>
<td>Adjustable spot</td>
<td>LR-W500</td>
<td>Approx. 170 g</td>
</tr>
<tr>
<td>M12 connector</td>
<td></td>
<td></td>
<td></td>
<td>LR-W500C</td>
<td>Approx. 110 g</td>
</tr>
</tbody>
</table>

- 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)

### Mounting bracket

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Material/weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard mounting bracket for LR-W Series</td>
<td>OP-88021*1</td>
<td>SUS304 Approx. 110 g</td>
</tr>
<tr>
<td>Adjustable bracket for LR-W Series</td>
<td>OP-88023</td>
<td>Zinc nickel plating, etc. Approx. 110 g</td>
</tr>
<tr>
<td>Adjustable bracket locking screw (105 mm)</td>
<td>OP-88024</td>
<td>Iron nickel plating Approx. 140 g</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Material/weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lustre canceling attachment</td>
<td>LR-WA1**2</td>
<td>SUS304, PMMA, etc. Approx. 5 g</td>
</tr>
</tbody>
</table>

*1 When using LR-WA1, the detecting range may decrease on targets with low reflectance.
Perform sufficient checks in the actual installation environment.

**2 When using the LR-WA1, the enclosure rating (IP65/IP67) is not met.

### Cable

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Cable material</th>
<th>Sensor side</th>
<th>Cable end</th>
<th>Length (m)</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image 69x645 to 116x720]</td>
<td>Cable: PVC (Polyvinyl chloride)</td>
<td>M12 4-pin straight</td>
<td>Loose wires</td>
<td>2</td>
<td>OP-75721</td>
<td>Approx. 60 g</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR (Polyurethane)</td>
<td></td>
<td></td>
<td>5</td>
<td>OP-87272</td>
<td>Approx. 125 g</td>
</tr>
<tr>
<td>[Image 69x562 to 114x620]</td>
<td>Cable: PVC (Polyvinyl chloride)</td>
<td>M12 4-pin L-shape</td>
<td></td>
<td>10</td>
<td>OP-85502</td>
<td>Approx. 230 g</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR (Polyurethane)</td>
<td></td>
<td></td>
<td>2</td>
<td>OP-87636</td>
<td>Approx. 75 g</td>
</tr>
<tr>
<td>[Image 329x434 to 364x479]</td>
<td>Cable: PVC (Polyvinyl chloride)</td>
<td></td>
<td></td>
<td>10</td>
<td>OP-87637</td>
<td>Approx. 330 g</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR (Polyurethane)</td>
<td></td>
<td></td>
<td>2</td>
<td>OP-75722</td>
<td>Approx. 65 g</td>
</tr>
<tr>
<td>[Image 60x335 to 117x376]</td>
<td>Cable: PVC (Polyvinyl chloride)</td>
<td></td>
<td></td>
<td>5</td>
<td>OP-87273</td>
<td>Approx. 130 g</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR (Polyurethane)</td>
<td></td>
<td></td>
<td>10</td>
<td>OP-87274</td>
<td>Approx. 235 g</td>
</tr>
<tr>
<td>[Image 58x385 to 118x428]</td>
<td>Cable: PVC (Polyvinyl chloride)</td>
<td></td>
<td></td>
<td>2</td>
<td>OP-87640</td>
<td>Approx. 75 g</td>
</tr>
<tr>
<td></td>
<td>Cable: PUR (Polyurethane)</td>
<td></td>
<td></td>
<td>10</td>
<td>OP-87641</td>
<td>Approx. 330 g</td>
</tr>
</tbody>
</table>
### Controller

<table>
<thead>
<tr>
<th>Type</th>
<th>Control output</th>
<th>External input</th>
<th>Analogue output</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main unit</td>
<td>4 standard outputs max. (15 outputs available using binary logic)</td>
<td>5 inputs max. (three of the five inputs can be switched to control outputs)</td>
<td>1 output max. (control output/external input selectable)</td>
<td>MU-N11</td>
<td>Approx. 70 g</td>
</tr>
<tr>
<td>Expansion unit</td>
<td></td>
<td></td>
<td></td>
<td>MU-N12</td>
<td>Approx. 70 g</td>
</tr>
</tbody>
</table>

### Power supply cable for MU-N Series

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Applicable unit</th>
<th>Cable material</th>
<th>Cable end</th>
<th>Controller side</th>
<th>Length (m)</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main unit</td>
<td>PVC (Polyvinyl chloride)</td>
<td>8-core loose wires</td>
<td>Connector</td>
<td>2</td>
<td>MU-CB8</td>
<td>Approx. 150 g</td>
</tr>
<tr>
<td></td>
<td>Expansion unit</td>
<td></td>
<td>4-core loose wires</td>
<td></td>
<td>MU-CB4</td>
<td>Approx. 120 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4-core loose wires</td>
<td></td>
<td>MU-CB6</td>
<td>Approx. 130 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6-core loose wires</td>
<td></td>
<td>MU-CB2</td>
<td>Approx. 100 g</td>
<td></td>
</tr>
</tbody>
</table>

Cable is not included with the controller. Please purchase it separately.

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

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Cable material</th>
<th>Sensor side</th>
<th>Controller side</th>
<th>Length (m)</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PVC (Polyvinyl chloride)</td>
<td>M12 4-pin straight</td>
<td>Connector</td>
<td>2</td>
<td>OP-88025</td>
<td>Approx. 75 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 4-pin L-shape</td>
<td>10</td>
<td>OP-88026*1</td>
<td>Approx. 280 g</td>
<td></td>
</tr>
</tbody>
</table>

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

### Connector set for sensor-to-controller connection

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Type</th>
<th>Applicable model</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For PVC (Polyvinyl chloride)</td>
<td>LR-W500, OP-7552/87272/85502, OP-75722/87273/87274</td>
<td>OP-88029</td>
<td>Approx. 3 g</td>
</tr>
<tr>
<td></td>
<td>For PUR (Polyurethane)</td>
<td>OP-87636/87637, OP-87640/87641</td>
<td>OP-88030</td>
<td>Approx. 3 g</td>
</tr>
</tbody>
</table>

This set is required when the sensor cable end is loose wire or when the sensor-to-controller cable is cut.

### Controller mounting options

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Type</th>
<th>Description</th>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mounting adapter (for main unit)</td>
<td>Allows the main unit to be mounted without a DIN rail.</td>
<td>OP-76877</td>
<td>Approx. 11 g</td>
</tr>
<tr>
<td></td>
<td>End unit (for expansion)</td>
<td>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)</td>
<td>OP-26751</td>
<td>Approx. 15 g</td>
</tr>
</tbody>
</table>
Sensor specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>LR-W500</th>
<th>LR-W500C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 m cable type</td>
<td>M12 connector 4-pin type</td>
<td></td>
</tr>
</tbody>
</table>

Detecting distance: 30 to 600 mm

Min. spot diameter: Adjustable spot
- Approx. ø6.5 mm at 100 mm
- Approx. ø9 mm at 250 mm
- Approx. ø10 mm at 500 mm

Response time*1: 200 μs/1 ms/10 ms/100 ms/500 ms selectable

Light source: White LED

Mutual interference reduction function: Up to 2 units with alternate frequencies set

Power supply:
- Power voltage: 10 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS
- Current consumption*2:
  - 65 mA or less (without load) at 24 VDC
  - 120 mA or less (without load) at 12 VDC
- UO*3:
  - 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)
- Ambient light: Incandescent lamp: 10000 lux or less, Sunlight: 20000 lux or less
- 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 for sine amplitude 1.5 m/s² in X, Y, Z axis directions respectively, 2 hours

Material:
- Case: Zinc die cast (Nickel chrome plating), Indicator cover: PPSU, Buttons: PES
- Lens cover and display: PMMA (scratch-resistant coating), Cable bushing: PBT
- Connector ring (4-pin M12 connector type only): PMP, Connector socket (4-pin M12 connector type only): PEI

Weight:
- Approx. 170 g (including cable)
- Approx. 110 g

*1 When alternate frequencies are set, the response time increases by approximately 20%.
*2 195 mA or less (at 10 V, with load).
*3 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.

Reference data of distance vs. spot diameter (Typical)

Control output circuit

When NPN is selected
- 0 V
- Brown (10 to 30 VDC)
- Black
- Blue

When PNP is selected
- 0 V
- Brown (10 to 30 VDC)
- Black
- Blue

Input circuit

When NPN is selected
- 0 V
- Brown (10 to 30 VDC)
- Black
- Blue
- PLC, etc.

When PNP is selected
- 0 V
- Brown (10 to 30 VDC)
- Black
- Blue
- PLC, etc.

M12 Connector pin layout

For the applied voltage, see the wiring diagrams in the instruction manual.
For the input times, see the time charts in the instruction manual.

Material:
- Case: Zinc die cast (Nickel chrome plating), Indicator cover: PPSU, Buttons: PES
- Lens cover and display: PMMA (scratch-resistant coating), Cable bushing: PBT
- Connector ring (4-pin M12 connector type only): PMP, Connector socket (4-pin M12 connector type only): PEI

Weight:
- Approx. 170 g (including cable)
- Approx. 110 g

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Controller specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>MU-N11</th>
<th>MU-N12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main unit</td>
<td>Expansion unit</td>
</tr>
<tr>
<td>Response time</td>
<td>Single output: 300 μs/1.1 ms/11 ms/100 ms/500 ms selectable</td>
<td>Multiple output: 2 μs/3 μs/11 ms/100 ms/500 ms selectable</td>
</tr>
<tr>
<td>Mutually interference reduction function</td>
<td>Up to 2 units with alternate frequencies set</td>
<td></td>
</tr>
<tr>
<td>Timer</td>
<td>0.1/0.1/0.1/0.1/0.1 s delay</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Power voltage</td>
<td>Current consumption</td>
</tr>
<tr>
<td></td>
<td>24 VDC, ripple (P-P) 10% or less, Class 2 or LPS</td>
<td>135 mA or less (without load)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 mA or less (without load)</td>
</tr>
<tr>
<td>Control output</td>
<td>4 outputs max.</td>
<td>NPN open-collector/PNP open collector selectable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 VDC or less, main unit: 50 mA or less, expansion unit: 20 mA or less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remaining voltage: 2 V or less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N.O./N.C. selectable</td>
</tr>
<tr>
<td>External input</td>
<td>5 inputs max. (three of the five inputs can be switched to control outputs)</td>
<td>Short circuit current: 1 mA or less for NPN/2 mA or less for PNP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For the applied voltage, see the wiring diagrams in the instruction manual.</td>
</tr>
<tr>
<td>Analogue output</td>
<td>1 output max. (control output/external input selectable)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output/voltage output selectable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output: 4 to 20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum load resistance: 450 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage output: 0 to 10 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External load resistance: 5 kΩ or more</td>
</tr>
</tbody>
</table>

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[^4]

Environmental resistance

- Ambient temperature: -20 to +50°C (no freezing)
- Ambient humidity: 25 to 80%RH (no condensation)
- Shock resistance: 1000 m/s[^2] 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]: 335 mA or less (when 4 outputs are used, with load)
[^2]: 200 mA or less (when 4 outputs are used, with load)
[^3]: 20 mA or less when an expansion unit is connected
[^4]: Contact KEYENCE in cases of expansion using models other than the sensor amplifiers supporting N-bus (generic name for KEYENCE’s simplified wiring system) including the MU-N Series and the NU Series communication unit

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

**Analogue output circuit**

- When NPN is selected
- When PNP is selected

Pin layout

- When the M12 connector (4-pin) cable is used

[^MU-N11 only]: Only applies to MU-N11
### Dimensions

#### OP-88021

- **Zinc nickel plating**
- **Nut (M5, Iron nickel plating)**
- **Hexagon socket head cap screw (M5, Length: 15 mm, Across flats: 4 mm, Iron nickel plating)**
- **Ø22**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88021 + LR-W500

- **Hexagon socket head cap screw (M5, Length: 15 mm, Across flats: 4 mm, Iron nickel plating)**
- **Nut (M5, Iron nickel plating)**
- **Zinc nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023

- **Hexagon socket head cap screw (M5, Length: 15 mm, Across flats: 4 mm, Iron nickel plating)**
- **Nut (M5, Iron nickel plating)**
- **Zinc nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023 + LR-W500

- **Hexagon socket head cap screw (M5, Length: 15 mm, Across flats: 4 mm, Iron nickel plating)**
- **Nut (M5, Iron nickel plating)**
- **Zinc nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023 + OP-88024 + LR-W500

- **Hexagon socket head cap screw (M5, Length: 15 mm, Across flats: 4 mm, Iron nickel plating)**
- **Nut (M5, Iron nickel plating)**
- **Zinc nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88024

- **2 x φ4, thickness: 2.5**
- **Iron nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### LR-WA1 + LR-W500

- **2 x φ4, thickness: 2.5**
- **Iron nickel plating**
- **SUS304 Plate thickness: 3**
- **Center of received light**
- **Reference surface for detecting distance**

#### 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.

#### OP-88021

- **Ø22**
- **SUS304 Plate thickness: 3**
- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88021 + LR-W500

- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023

- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023 + LR-W500

- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88023 + OP-88024 + LR-W500

- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### OP-88024

- **Center of emitted light**
- **Center of received light**
- **Reference surface for detecting distance**

#### LR-WA1 + LR-W500

- **Center of received light**
- **Reference surface for detecting distance**

#### 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.
MU-N11 (Main unit)

When mounting adapter is attached (OP-78877, optional, sold separately)

Back of mounting adapter

When expansion units are connected

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

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

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

<table>
<thead>
<tr>
<th>No. of expansion units</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>84</td>
</tr>
<tr>
<td>4</td>
<td>112</td>
</tr>
<tr>
<td>5</td>
<td>140</td>
</tr>
</tbody>
</table>

Unit: mm
### Dimensions

**M12 connector cable for sensor**

OP-75721/87272/85502

![Diagram of M12 connector cable for sensor]

**Power supply cable for MU-N**

MU-CB8/CB4/CB6/CB2

![Diagram of power supply cable for MU-N]

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

OP-88025/88026

![Diagram of sensor-to-controller cable]

**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.

---

**Unit: mm**

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### Open field network unit

<table>
<thead>
<tr>
<th>Communication unit</th>
<th>Appearance</th>
<th>Network</th>
<th>Model</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherNet/IP™</td>
<td>NU-EP1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EtherCAT</td>
<td>NU-EC1</td>
<td></td>
<td></td>
<td>10 x 28 x 35</td>
</tr>
<tr>
<td>PROFINET</td>
<td>NU-PN1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Model</th>
<th>NU-EP1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ethernet specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Compliant standards</td>
<td>IEEE802.3 (10BASE-T)</td>
</tr>
<tr>
<td>Transmission rate</td>
<td>10 Mbps (10BASE-T)</td>
</tr>
<tr>
<td>Transmission media</td>
<td>STP or Category3 or higher UTP (10BASE-T)</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>100 m (between this unit and Ethernet switch)</td>
</tr>
<tr>
<td>Maximum number of connectable hubs</td>
<td>4 (10BASE-T) 2 (100BASE-TX)</td>
</tr>
</tbody>
</table>

| **EtherNet/IP™ specifications** |        |
| Supported functions | Cyclic communication | Message communication (Explicit message communication) supporting UCMII and Class 3 |
| Number of connections | 64 |
| PPI (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 |
| Number of connectable sensors | 16 units max. |
| Power supply | Supplied from this unit via the sensor amplifier connector |
| Allowable passing current | 1200 mA or less total |
| PoE power supply *4 | *Supplied voltage: 24 VDC (10%) to 48 VDC (10%), supported current: 600 mA or less* |
| Power voltage | 24 VDC (70%) (48 VDC (30%) when the PoE power supply is used) |
| Power consumption | 1500 mW or less (60 mA or less at 24 VDC) |
| Weight (including connector) | Approx. 80 g |
| Accessories | Instruction manual, power supply connector, end unit x 2 |

* The following KEYENCE PoE power supply units cannot be connected: [D-T100A] [D-T500] [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.
<table>
<thead>
<tr>
<th>EtherCAT compatible communication unit: NU-EC1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td><strong>Ethernet specifications</strong></td>
</tr>
<tr>
<td>Compliant standards</td>
</tr>
<tr>
<td>Transmission rate</td>
</tr>
<tr>
<td>Transmission media</td>
</tr>
<tr>
<td>Distance between nodes</td>
</tr>
<tr>
<td>Communication port</td>
</tr>
<tr>
<td><strong>EtherCAT communication specifications</strong></td>
</tr>
<tr>
<td>Supported functions</td>
</tr>
<tr>
<td>Number of connectable sensors</td>
</tr>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Weight (including connector)</td>
</tr>
<tr>
<td><strong>Sensor connection specifications</strong></td>
</tr>
<tr>
<td>Connectable sensors</td>
</tr>
<tr>
<td>Allowable passing current*3</td>
</tr>
<tr>
<td>Power voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Power voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td><strong>PROFINET compatible communication unit: NU-PN1</strong></td>
</tr>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td><strong>Ethernet specifications</strong></td>
</tr>
<tr>
<td>Compliant standards</td>
</tr>
<tr>
<td>Transmission rate</td>
</tr>
<tr>
<td>Transmission media</td>
</tr>
<tr>
<td>Maximum cable length</td>
</tr>
<tr>
<td>Maximum number of connectable hubs</td>
</tr>
<tr>
<td><strong>PROFINET specifications</strong></td>
</tr>
<tr>
<td>Supported functions</td>
</tr>
<tr>
<td>Number of connectable controllers</td>
</tr>
<tr>
<td>Update Time</td>
</tr>
<tr>
<td>Version of GSDML</td>
</tr>
<tr>
<td>Conformance class</td>
</tr>
<tr>
<td>Conformance test</td>
</tr>
<tr>
<td>Applicable protocols</td>
</tr>
<tr>
<td><strong>Sensor connection specifications</strong></td>
</tr>
<tr>
<td>Connectable sensors</td>
</tr>
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</tr>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>Allowable passing current*3</td>
</tr>
<tr>
<td>PoE power supply*3</td>
</tr>
<tr>
<td>Power voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
</tr>
</tbody>
</table>

* EtherCAT is a registered trade name of Beckhoff.
* N-bus is the name of KEYENCE’s simplified wiring system for sensor amplifiers.
* Varies depending on the sensor amplifier to be connected.
* This is the current value that can be supplied to this unit or the sensor amplifier connected to this unit.
* Excluding the current supplied to the connected sensor amplifier.

*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 +40°C: 360 mA or less, +40 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**

**NU-EP1/PN1**

- 29.4
- 25.6
- 15

**NU-EC1**

- 29.4
- 15.8
- 34.1
- 43.5
- 5

Maximum when the cover is opened

73.6

Unit: mm

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