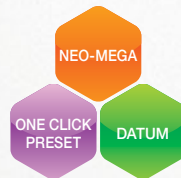


In addition to its MEGA power,  
the FS-N Series introduces unmatched setup ease  
with one click operation.

## FS-neo

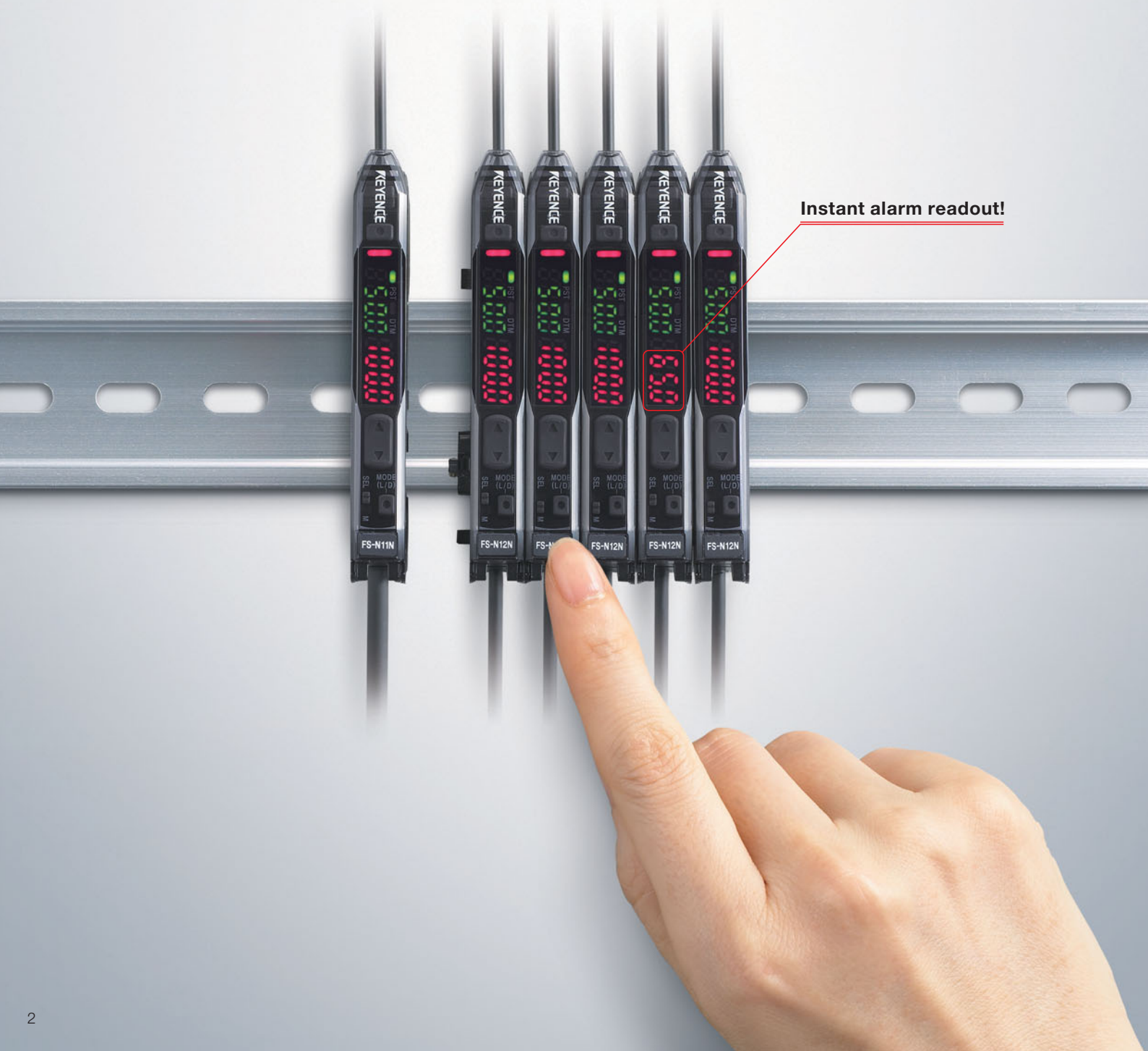


# Certainty and simplicity

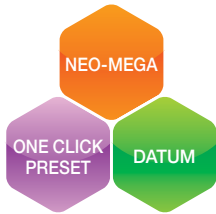
There are two major qualities that are important in fibre sensors.

First, the sensor must have generous basic performance, including sufficient beam power and accuracy, for greater detection stability.

Second, the sensor must be easy for anyone to setup and operate.



**Instant alarm readout!**



# FS-NEO

**New Concept**

## Complete setting in just one click

### ONE CLICK PRESET

An entirely new concept in setup ease. Just one click calibrates the sensitivity and resets the display.



**New Concept**

## Automatic maintenance

### DATUM

The sensor automatically detects reduced light intensity due to debris build-up and automatically re-calibrates to the original display state.

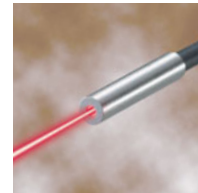


**Simple, Convenient**

## High power reduces labour hours

### NEO-MEGA

Increased sensor power greatly reduces maintenance and setup time.



## NEO is supported by the world's highest level of performance

World's most powerful beam

Achieves **250** times more received light intensity

World's most accurate

Detects wire as small as **∅0.6 μm**

World's highest ambient-light resistance

Unaffected up to **30,000 lux**

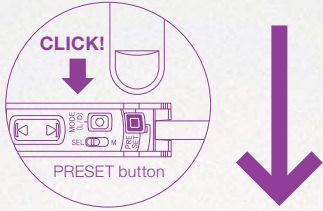
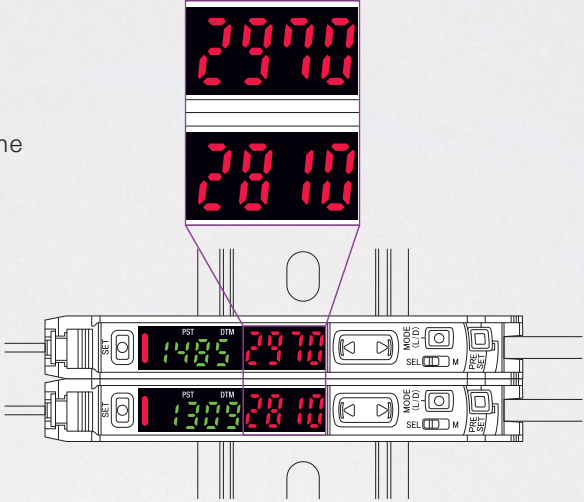
New Concept

# Complete setting in just one click

Click the button once to simultaneously set the sensitivity and reset the display value to 100.

### What customers are saying

“ I usually just set the sensitivity.  
It would be nice if I could reset all of the  
settings and current values,  
but I wouldn't use this feature  
if it's complicated. ”



“ With the NEO, just one click  
sets the sensitivity and  
resets the display! ”



**Point 1** Easy to detect changes (preventive maintenance)

The NEO provides an easy-to-read indication when the light intensity drops due to dirt or other environment related causes.

**Conventional problem**  
Light intensity reduction is difficult to grasp due to individual differences in numeric values.

**FS-NEO**  
All sensors initially display 100, making it easy to detect changes.

Failure!

Failure!

Easy to tell the value has changed

**Point 2** The digital value resets to exactly 100

**Conventional problem**  
The value easily shifted and the initial value of 2000 was arbitrary.

**FS-NEO**  
The numbers reset to exactly 100. The set values are reset to 50.

Set value reset to 50

Display value reset to exactly 100

Setting the value to an easier to read value of 1000 required a complicated operation. The ability to change the target value made it difficult to keep track of the original value.

Resetting numeric values with one click offers unmatched operating ease.

**Point 3** Greater convenience when using multiple sensors

**Correction required**

**Light intensity drop**

The preset function is even more useful when using multiple sensors. Quickly and easily locate sensors that have become dirty or misaligned. Main and expansion unit sensors can be reset with one click by pressing PRESET on the main unit.

**CLICK!**

**PRESET button**

If the light intensity drops

**Pressing PRESET resets to the initial state.**

If the light intensity drops significantly it will not return to 100.0, making it easy to detect the problem. The 2-output type can be used to provide a low light intensity signal to a PLC or similar controller.

ONE CLICK  
PRESET  
Hassle free  
setup

DATUM  
Automatic  
maintenance

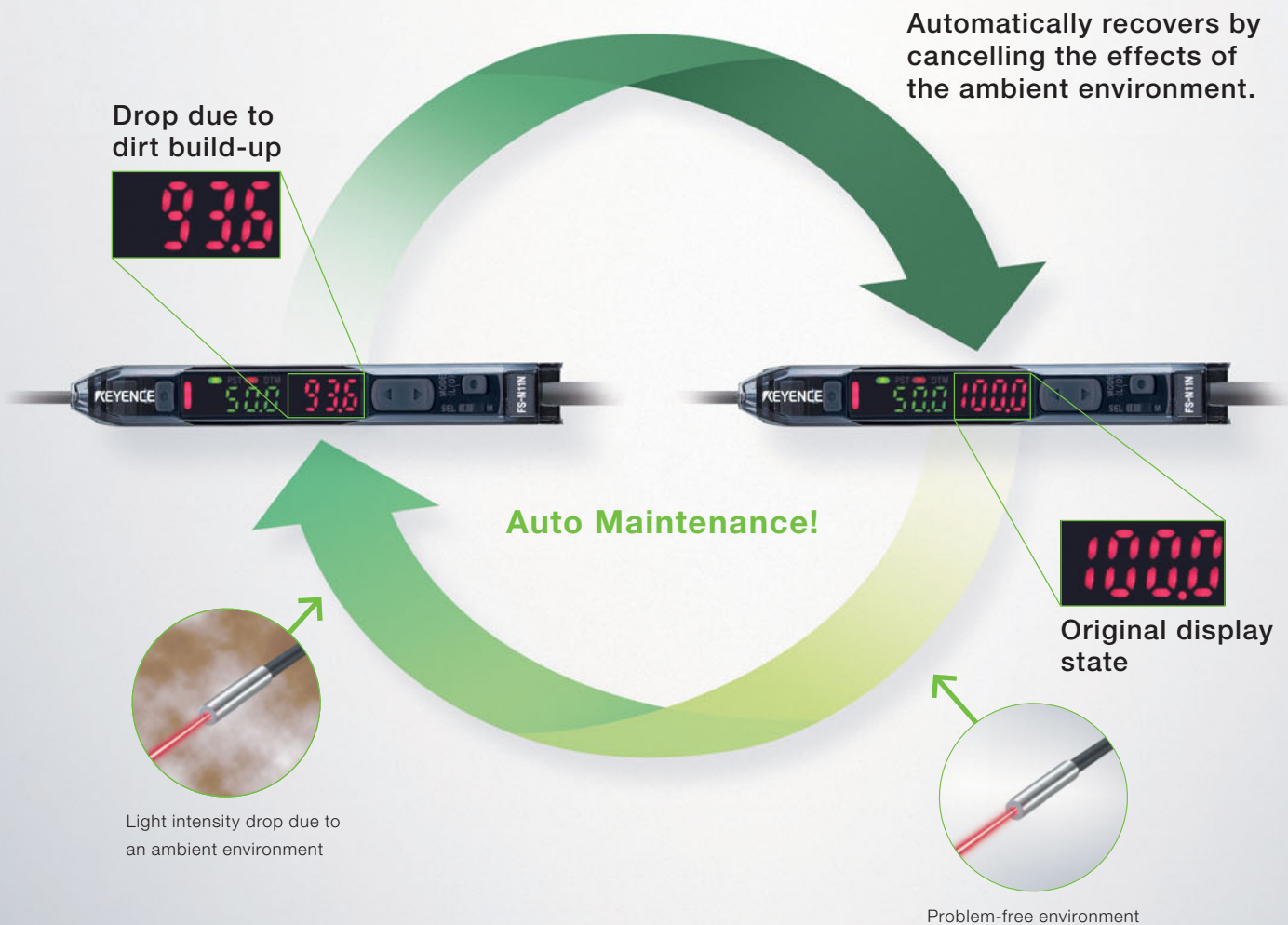
NEO-MEGA  
Harnessing  
power

FS-neo

New Concept

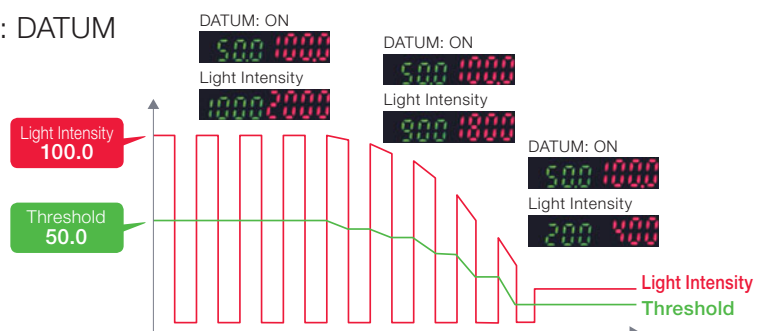
## Automatic maintenance

The automatic maintenance function detects light intensity reduction due to dirt or misalignment, and returns the sensor to its original display state. This feature can cancel the effects of the ambient environment, enabling the sensor to continue to perform highly accurate detections.



### Automatic maintenance function: DATUM

The setting value changes according to the intensity as shown in the figure to the right. This function corrects the setting value based on a running average of the received light intensity value. The correction cycle is the same as the sampling cycle and can be selected from three levels.



Simple, Convenient

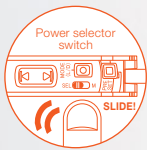
# World's highest power reduces maintenance time

"High power" = "large excess gain" that not only reduces the need for maintenance but also expands sensor head capabilities, which reduces setup time.

1

## Switch selectable MEGA power

Hassle-free operation allows easy changeover between standard and high power.



Long distance [MEGA]



Short distance [FINE]



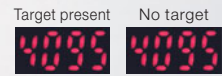
3

## Prevent light saturation with a simple operation

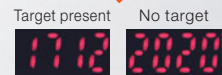
Strong light may result in reduced contrast. In this case, simply press the "MODE" + "SET" buttons to automatically adjust the NEO to the proper light intensity.



Detecting the seam between transparent films



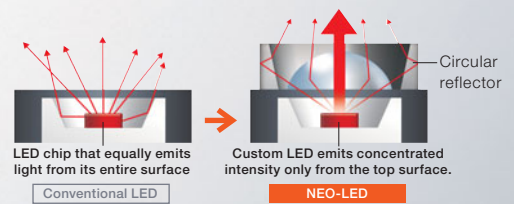
Light saturation



2

## Reduced light intensity variations

With conventional models, amplifying the projected beam of condensed light causes the focus of the beam to be sensitive to minute positioning errors in the light-emitting device. The NEO-LED solves this positioning problem by using a reflector around the light emitting source. The reflector reduces light intensity variations.



Conventional LED

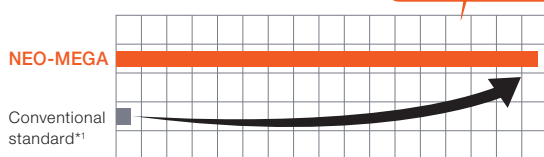
NEO-LED

The circular reflector helps compensate for light positioning errors by redirecting any stray light back into the fibre.

## World's most powerful beam: NEO-MEGA

### Guideline for received light intensity

250 times greater than conventional models

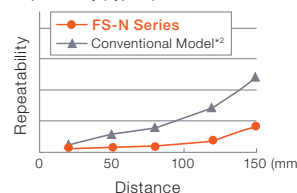


The emitted light intensity is about 4 times stronger than conventional models.

\*1. FS-V30 Series in FINE mode

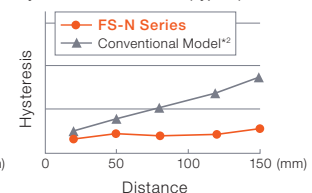
NEO-MEGA, the world's most powerful beam, allows for significant improvement of repeatability and hysteresis.

### Repeatability (Typical)



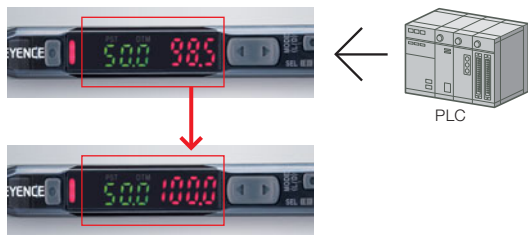
\*2. FS-V30 Series

### Hysteresis characteristics (Typical)



# Convenient functionality designed for ease of use in the field

## Using the external calibration input\*



The sensor can be calibrated from a PLC or other external device. Regularly executing the Preset function from an external input ensures uninterrupted, stable detection, even in harsh environments. The 2-output type can be used to provide a low light intensity signal if the sensor becomes extremely dirty.

\* Available on models with external input support.

## Easy sensitivity setting (two-point tuning)



Set by simply pressing the SET button once with the target present and once without it.

## Wire saving when adding sensors



When adding sensors, the power is supplied from the connector on the side. This reduces wiring by two cables per sensor, allowing for a neater, quicker installation.

Note: Only supports FS-N Series amplifiers.

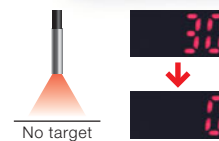
### Reliable even when using multiple sensors

All models are equipped with a standard heat sink. The heat sink reduces the temperature of the amplifier and reduces the stress on the LED light source as well as other internal parts.



## Zero Shift

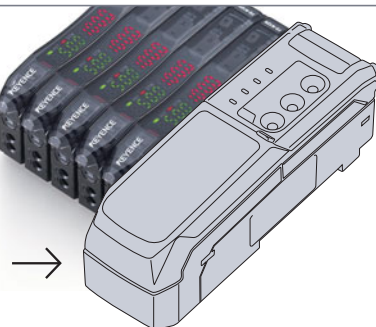
Setting the current value to "0" just got easier. Simply press the PRESET and RIGHT button at the same time.



Using a NEO amplifier with an external input, the Zero Shift adjustment can be performed on a regular basis using a PLC or other external device.

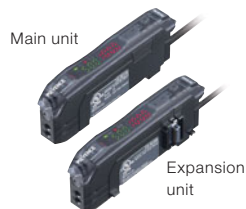
## Network support **COMING SOON**

KEYENCE engineers are currently developing a communication unit that will connect the FS-NEO directly to an open field network. This will provide easy read and write access for various settings.



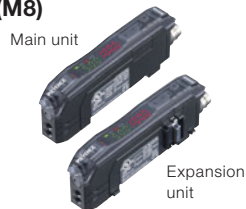
# Complete lineup

## Cable Type



Type		Model		Control outputs	External input	Analogue output
		NPN output	PNP output			
Standard	Main unit	FS-N11N	FS-N11P	1	0	0
	Expansion unit	FS-N12N	FS-N12P			
2-output	Main unit	FS-N13N	FS-N13P	2	1	0
	Expansion unit	FS-N14N	FS-N14P			
Analogue	Main unit	FS-N11MN	—	1	0	1

## Connector Type (M8)



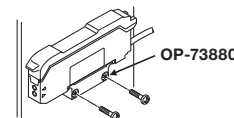
Type		Model		Control outputs	External input	Analogue output
		NPN output	PNP output			
Standard	Main unit	FS-N11CN	FS-N11CP	1	1	0
	Expansion unit	FS-N12CN	FS-N12CP			
2-output	Main unit	—	FS-N13CP	2	0	0
	Expansion unit	—	FS-N14CP			

## I Optional (sold separately)

### Amplifier securing bracket (for main unit)



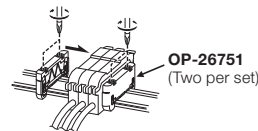
Description	Model
Can be installed without a DIN-rail. Can be installed from above or from the side.	OP-73880



### End unit (when using expansion units)



Used to secure the main and expansion units.  
(Two per set)



Description	Model
Used to secure the main and expansion units. (Two per set)	OP-26751

### M8 connector cable (2 m/10 m)



Used to connect to the M8 connector type amplifier (model numbers end with a "CN" or "CP"). Connector cables are not included with the amplifier.



Description	Model
Used to connect to the M8 connector type amplifier (model numbers end with a "CN" or "CP"). Connector cables are not included with the amplifier.	2 m type OP-73864
	10 m type OP-73865

Fibre Unit FU Series

# Fibre Unit [FU Series]

Choose from our selection of more than 100 types of fibre units.



Standard Type

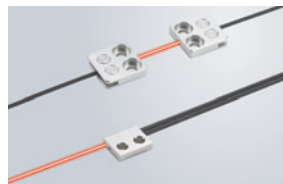


### Integrated Bracket

The sensor is integrated into an L-shaped bracket, which simplifies installation.

▶ P.13

Standard Type



### Flat

This thin profile sensor comes with mounting holes for installation where space is limited.

▶ P.13

Standard Type

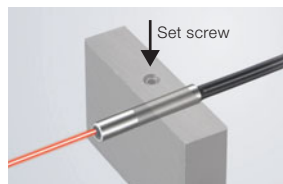


### Threaded and Hex-shaped Fibres

Threaded for easy mounting onto brackets and machine equipment.

▶ P.14

Standard Type



### Cylinder

Small size is suitable for installation in locations where space is limited. Installed by drilling a hole and using a set screw.

▶ P.16

Standard Type



### Sleeve

The fibre tip is a thin sleeve. Eliminate problems caused by limited mounting space. Lineup includes side-view and bendable sleeve types.

▶ P.17

Focused Beam Type

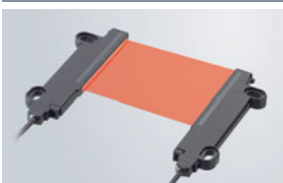


### Small Spot Reflective

Ideal for detecting small objects. Spot size and focal distance are adjustable, so there is no need to change the distance between the sensor and the target.

▶ P.18

High-power Beam Type

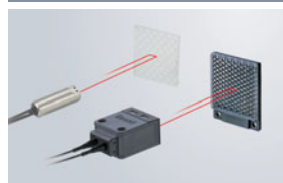


### Area

This sensor forms a wide-area beam, making it ideal for moving-target applications, such as detection of falling objects.

▶ P.19

High-power Beam Type



### Retro-reflective

The use of a reflector in place of the receiver used with thru-beam sensors simplifies installation and optical axis alignment. This sensor is suitable for detecting transparent objects.

▶ P.19



**High-power Beam Type**



▶ P.20

**Narrow Beam/High-power**

Narrow field of view based on focused aperture angle. This sensor reduces stray light for stable target detection. The high-power reflective type with an 8° aperture angle is suitable for detecting objects at longer distances.

**Fixed Range Type**

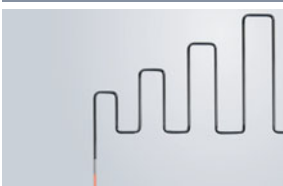


▶ P.20

**Definite-reflective**

Detects within a fixed distance. Reduces the effect of background, and features a space-saving thin-profile design.

**High-flex**



▶ P.21

**High-flex\***

The R2 ToughFlex fibre achieves excellent flexing characteristics with the same bend radius. \* 10 million bends

**Oil/Chemical Resistant**

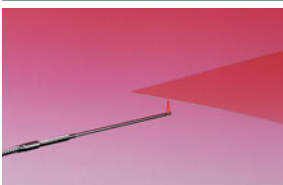


▶ P.21

**Oil/Chemical Resistant**

The PTFE coating allows these fibres to be used in almost any environment, including oil- or chemical-splash conditions.

**Heat Resistant**



▶ P.22

**Heat Resistant**

Ideal for use in high temperature applications. Withstands temperatures up to 350°C.

**Application-specific Type**

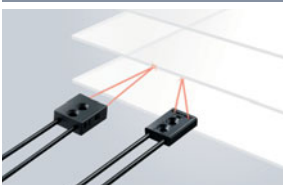


▶ P.23

**Liquid-level**

Detects liquid levels when immersed or attached to a transparent tube.

**Application-specific Type**



▶ P.23

**Liquid Crystal/  
Semiconductors**

Perfect for glass substrate detection. Lineup offers distance alignment, edge detection and wafer mapping types.

## Model search

Model	Page
<b>FU-10</b>	<a href="#">▶ P.18</a>
<b>FU-11</b>	
<b>FU-12</b>	<a href="#">▶ P.19</a>
<b>FU-13</b>	
<b>FU-15</b>	
<b>FU-16</b>	
<b>FU-16Z</b>	<a href="#">▶ P.20</a>
<b>FU-18</b>	
<b>FU-18M</b>	<a href="#">▶ P.20, 23</a>
<b>FU-20</b>	<a href="#">▶ P.18</a>
<b>FU-21X</b>	<a href="#">▶ P.15</a>
<b>FU-22X</b>	<a href="#">▶ P.16, 17</a>
<b>FU-23X</b>	<a href="#">▶ P.16</a>
<b>FU-24X</b>	
<b>FU-25</b>	<a href="#">▶ P.15</a>
<b>FU-31</b>	
<b>FU-32</b>	<a href="#">▶ P.17</a>
<b>FU-33</b>	
<b>FU-34</b>	
<b>FU-35FA</b>	
<b>FU-35FG</b>	
<b>FU-35FZ</b>	<a href="#">▶ P.15</a>
<b>FU-35TG</b>	
<b>FU-35TZ</b>	
<b>FU-37</b>	<a href="#">▶ P.20</a>
<b>FU-38</b>	
<b>FU-38H</b>	<a href="#">▶ P.22, 23</a>
<b>FU-38K</b>	
<b>FU-38L</b>	<a href="#">▶ P.23</a>
<b>FU-38LK</b>	<a href="#">▶ P.22, 23</a>
<b>FU-38R</b>	<a href="#">▶ P.23</a>
<b>FU-38S</b>	
<b>FU-38V</b>	<a href="#">▶ P.20, 23</a>
<b>FU-4F</b>	<a href="#">▶ P.16</a>
<b>FU-4FZ</b>	
<b>FU-40</b>	<a href="#">▶ P.20</a>
<b>FU-40G</b>	
<b>FU-40S</b>	<a href="#">▶ P.23</a>
<b>FU-41TZ</b>	<a href="#">▶ P.13</a>
<b>FU-42TZ</b>	
<b>FU-43</b>	<a href="#">▶ P.17</a>
<b>FU-44TZ</b>	<a href="#">▶ P.13</a>
<b>FU-45X</b>	<a href="#">▶ P.16, 17</a>
<b>FU-46</b>	
<b>FU-47TZ</b>	<a href="#">▶ P.13</a>
<b>FU-48</b>	<a href="#">▶ P.16, 21</a>

Model	Page
<b>FU-48U</b>	<a href="#">▶ P.21</a>
<b>FU-49U</b>	
<b>FU-49X</b>	<a href="#">▶ P.16, 21</a>
<b>FU-5F</b>	<a href="#">▶ P.16</a>
<b>FU-5FZ</b>	
<b>FU-50</b>	<a href="#">▶ P.20</a>
<b>FU-51TZ</b>	
<b>FU-52TZ</b>	<a href="#">▶ P.13</a>
<b>FU-53TZ</b>	
<b>FU-54TZ</b>	
<b>FU-55</b>	<a href="#">▶ P.16</a>
<b>FU-56</b>	<a href="#">▶ P.16, 17</a>
<b>FU-57TE</b>	<a href="#">▶ P.21</a>
<b>FU-57TZ</b>	<a href="#">▶ P.13</a>
<b>FU-58</b>	<a href="#">▶ P.16</a>
<b>FU-58U</b>	<a href="#">▶ P.21</a>
<b>FU-59</b>	<a href="#">▶ P.16, 21</a>
<b>FU-59U</b>	<a href="#">▶ P.21</a>
<b>FU-6F</b>	
<b>FU-61</b>	<a href="#">▶ P.15</a>
<b>FU-61Z</b>	
<b>FU-63</b>	
<b>FU-63T</b>	<a href="#">▶ P.17</a>
<b>FU-63Z</b>	
<b>FU-65X</b>	
<b>FU-66</b>	
<b>FU-66TZ</b>	
<b>FU-66Z</b>	
<b>FU-67</b>	<a href="#">▶ P.15</a>
<b>FU-67G</b>	
<b>FU-67TG</b>	
<b>FU-67TZ</b>	
<b>FU-67V</b>	
<b>FU-68</b>	
<b>FU-69U</b>	<a href="#">▶ P.21</a>
<b>FU-69X</b>	
<b>FU-7F</b>	<a href="#">▶ P.14</a>
<b>FU-70U</b>	<a href="#">▶ P.21</a>
<b>FU-71</b>	<a href="#">▶ P.14</a>
<b>FU-71Z</b>	
<b>FU-73</b>	
<b>FU-75F</b>	<a href="#">▶ P.17</a>
<b>FU-76F</b>	
<b>FU-77</b>	
<b>FU-77G</b>	<a href="#">▶ P.14</a>
<b>FU-77TG</b>	

Model	Page
<b>FU-77TZ</b>	
<b>FU-77V</b>	<a href="#">▶ P.14</a>
<b>FU-78</b>	
<b>FU-79</b>	<a href="#">▶ P.21</a>
<b>FU-79U</b>	
<b>FU-81C</b>	
<b>FU-82C</b>	
<b>FU-83C</b>	
<b>FU-84C</b>	
<b>FU-85A</b>	
<b>FU-85H</b>	
<b>FU-85Z</b>	<a href="#">▶ P.22</a>
<b>FU-86A</b>	
<b>FU-86H</b>	
<b>FU-86Z</b>	
<b>FU-87</b>	
<b>FU-87K</b>	
<b>FU-88</b>	
<b>FU-88K</b>	
<b>FU-91</b>	<a href="#">▶ P.21</a>
<b>FU-92</b>	
<b>FU-93</b>	
<b>FU-93Z</b>	
<b>FU-95</b>	
<b>FU-95HA</b>	<a href="#">▶ P.23</a>
<b>FU-95S</b>	
<b>FU-95W</b>	
<b>FU-95Z</b>	
<b>FU-96</b>	<a href="#">▶ P.21</a>
<b>FU-96T</b>	
<b>FU-A05</b>	
<b>FU-A05D</b>	
<b>FU-A10</b>	<a href="#">▶ P.19</a>
<b>FU-A10D</b>	
<b>FU-E11</b>	
<b>FU-E40</b>	
<b>FU-L50Z</b>	
<b>FU-L51Z</b>	
<b>FU-L52Z</b>	<a href="#">▶ P.13</a>
<b>FU-L53Z</b>	
<b>FU-L54Z</b>	
<b>FU-L41Z</b>	

## Integrated Bracket

Integrated bracket and sensor simplifies installation.

### Thrubeam/reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Beam emitting direction	Optical axis height (mm)				MEGA FINE	Other power modes		
Thrubeam	Top	10	2 m Free-cut (ø2.2) -40 to +50°C		R2 ToughFlex	MEGA: 2200 FINE: 450	ULTRA: 1700 SUPER: 1000 TURBO: 760 HSP: 290	ø1.13	<b>FU-L51Z</b> Approx. 30 g
		15	2 m Free-cut (ø2.2) -40 to +50°C						<b>FU-L52Z</b> Approx. 30 g
		20	2 m Free-cut (ø2.2) -40 to +50°C						<b>FU-L53Z</b> Approx. 30 g
	Top (lens)	10	2 m Free-cut (ø2.2) -40 to +50°C			MEGA: 3600 FINE: 3100	ULTRA: 3600 SUPER: 3600 TURBO: 3600 HSP: 2100	ø3.5	<b>FU-L50Z</b> Approx. 30 g
	Side	10	2 m Free-cut (ø2.2) -40 to +50°C			MEGA: 1900 FINE: 410	ULTRA: 1500 SUPER: 900 TURBO: 700 HSP: 270	ø1.13	<b>FU-L54Z</b> Approx. 30 g
Reflective	Top	10	2 m Free-cut (ø2.2) -40 to +50°C		R2 ToughFlex	MEGA: 760 FINE: 170	ULTRA: 580 SUPER: 430 TURBO: 320 HSP: 90	-	<b>FU-L41Z</b> Approx. 25 g

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

## Flat

Mount directly in locations where space is limited.

### Thrubeam/reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Beam emitting direction	Optical axis height (mm)				MEGA FINE	Other power modes		
Thrubeam	Top	10	1 m Free-cut (ø1.0) -40 to +50°C		R2 ToughFlex	MEGA: 810 FINE: 170	ULTRA: 520 SUPER: 340 TURBO: 260 HSP: 90	ø0.5	<b>FU-51TZ</b> Approx. 5 g
		15	2 m Free-cut (ø1.3) -40 to +50°C			MEGA: 2900 FINE: 610	ULTRA: 1900 SUPER: 1200 TURBO: 850 HSP: 260	ø1	<b>FU-52TZ</b> Approx. 15 g
	Side	10.5	1 m Free-cut (ø1.0) -40 to +50°C			MEGA: 740 FINE: 140	ULTRA: 480 SUPER: 280 TURBO: 200 HSP: 70	ø0.5	<b>FU-57TZ</b> Approx. 5 g
		13	1 m Free-cut (ø1.0) -40 to +50°C			MEGA: 500 FINE: 140	ULTRA: 340 SUPER: 230 TURBO: 180 HSP: 80		<b>FU-53TZ</b> Approx. 10 g
	Flat	15	2 m Free-cut (ø2.2) -40 to +50°C			MEGA: 2900 FINE: 610	ULTRA: 1900 SUPER: 1200 TURBO: 850 HSP: 260	ø1	<b>FU-54TZ</b> Approx. 25 g
		20	2 m Free-cut (ø2.2) -40 to +50°C						
Reflective	Top	6.5	1 m Free-cut (ø1.0 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 1 to 160 FINE: 1 to 36	ULTRA: 1 to 120 SUPER: 1 to 81 TURBO: 1 to 60 HSP: 1 to 13	-	<b>FU-44TZ</b> Approx. 3 g
	Side	7.2	1 m Free-cut (ø1.0 x 2) -40 to +50°C			MEGA: 1 to 160 FINE: 1 to 36	ULTRA: 1 to 120 SUPER: 1 to 81 TURBO: 1 to 60 HSP: 1 to 18	<b>FU-47TZ</b> Approx. 4 g	
		13	1 m Free-cut (ø1.0) -40 to +50°C			MEGA: 2 to 120 FINE: 2 to 24	ULTRA: 2 to 77 SUPER: 2 to 50 TURBO: 2 to 32 HSP: 2 to 8	<b>FU-41TZ</b> Approx. 5 g	
	Flat	20	2 m Free-cut (ø2.2 x 2) -40 to +50°C			MEGA: 1 to 500 FINE: 1 to 70	ULTRA: 1 to 320 SUPER: 1 to 190 TURBO: 1 to 130 HSP: 1 to 50	<b>FU-42TZ</b> Approx. 24 g	

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

# Threaded and Hex-shaped Fibres

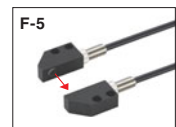
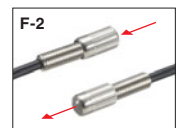
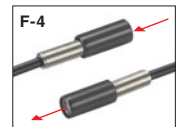
Most common fibre sensor.  
Easily mounts onto brackets or machine equipment.

## Thrubeam

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)			Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Size/Shape					MEGA FINE	Other power modes			
Thrubeam	M4	Hex-shaped	2 m Free-cut (ø2.2) -40 to +50°C		R2 ToughFlex	MEGA: 3100 FINE: 640	ULTRA: 2100 SUPER: 1300 TURBO: 880 HSP: 320	ø1.13	FU-77TZ Approx. 43 g	
			1 m cut not allowed. -40 to +50°C		R10 Stainless Steel	MEGA: 1800 FINE: 640	ULTRA: 1800 SUPER: 1300 TURBO: 880 HSP: 320		FU-77TG Approx. 43 g	
		Threaded	2 m Free-cut (ø2.2) -40 to +50°C		R0.5 ToughFlex	MEGA: 3600 FINE: 880	ULTRA: 3000 SUPER: 1800 TURBO: 1300 HSP: 430		FU-77V Approx. 25 g	
			1 m cut not allowed. -40 to +50°C		R2 ToughFlex	MEGA: 1800 FINE: 880	ULTRA: 1800 SUPER: 1300 TURBO: 430		FU-77 Approx. 21 g	
			2 m Free-cut (ø2.2) -40 to +70°C		R25	MEGA: 3600 FINE: 1100	ULTRA: 3200 SUPER: 2200 TURBO: 1500 HSP: 540		FU-7F Approx. 21 g	
			2 m Free-cut (ø1.3) -40 to +70°C		R4	MEGA: 2200 FINE: 440	ULTRA: 1400 SUPER: 860 TURBO: 600 HSP: 220		FU-78 Approx. 9 g	
	M6	Threaded	2 m Free-cut (ø2.2) FU-71Z: -40 to +50°C FU-71: -40 to +70°C		R2 ToughFlex	MEGA: 3600 FINE: 1100	ULTRA: 3600 SUPER: 2300 TURBO: 1600 HSP: 590	ø1.5	FU-71Z Approx. 25 g	
					R25	MEGA: 3600 FINE: 1300	ULTRA: 3600 SUPER: 2600 TURBO: 1800 HSP: 650		FU-71 Approx. 25 g	

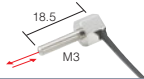
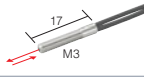
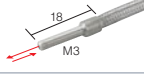
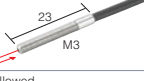
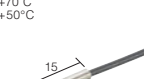

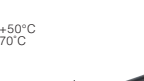

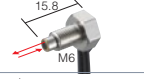
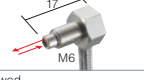
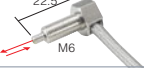
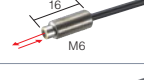




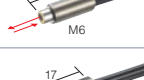

## Thrubeam Lenses

Type	Ambient temperature Appearance (mm)	Model Weight	Applicable fibre units	Detecting distance (mm)*1					
				MEGA	ULTRA	SUPER	TURBO	FINE	HSP
Ultra-long detecting distance Narrow field of view Aperture Angle: Approx. 8°	Heat Resistance: 70°C Tip: ø4.3 	F-4 Approx. 1 g	FU-77TZ/77V/77						2700
			FU-7F						3200
			FU-78						2200
			FU-77G/77TG	1800					
Long-detecting distance Aperture Angle: Approx. 15°	Heat Resistance: 300°C Tip: ø4 	F-2 Approx. 2 g	FU-77TZ/77V/77/84C/88K						2100
			FU-7F/86A						2500
			FU-86Z						1900
			FU-78	3600			3300		1600
FU-77G/77TG			1800						
Side-view with mounting holes	Heat Resistance: 105°C 	F-5 Approx. 10 g	FU-77V/77						2600
			FU-7F/86A						3100
			FU-86Z						2900
			FU-78						2300
FU-77G			1800						
Side-view	Heat Resistance: 70°C*2 Tip: ø4 	F-1 Approx. 2 g	FU-77V/77	3600	3100	1900	1300	900	530
			FU-77G	1800			1300	900	530
			FU-7F/86A	3600		3100	2100	1300	630
			FU-86Z	3600	3300	2300	1500	1100	500
			FU-78/84C/88K	3200	2500	1600	1100	800	360



\*1 The maximum sensing distance of 3600 mm (1800 mm) is possible because the fibre length on each side is 2 m (1 m).  
\*2 When using the F-1 at 70°C or more, specify the "Heat-resistant F-1". Be sure to use the "Heat-resistant F-1" at a constant temperature.

**Reflective**

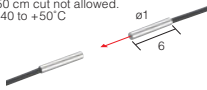
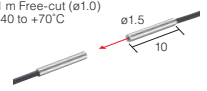
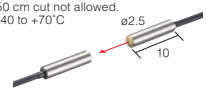
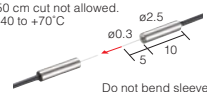
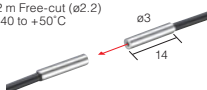
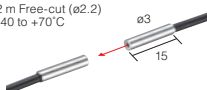
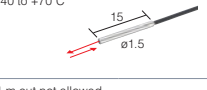
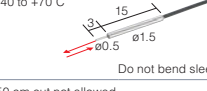
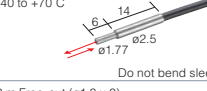
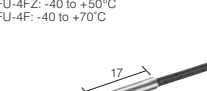

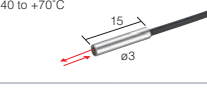
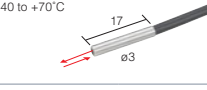
Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Model Weight		
	Size/Shape	Detecting arrangement				MEGA FINE	Other power modes			
Reflective	M3	Hex-shaped	1 m Free-cut (ø1.3 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 400	ULTRA: 270	<b>FU-35TZ</b> Approx. 7 g		
						FINE: 70	SUPER: 170			
		M3	Coaxial	1 m Free-cut (ø1.3 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 450	ULTRA: 290	<b>FU-35FZ</b> Approx. 6 g	
							FINE: 72	SUPER: 190		
				1 m Free-cut (ø1.3 x 2) Spiral 30 cm -40 to +50°C		R10 Stainless Steel	MEGA: 450	TURBO: 115	<b>FU-35FG</b> Approx. 15 g	
							FINE: 72	HSP: 36		
			Threaded	1 m Free-cut (ø1.3 x 2) -40 to +70°C		R25	MEGA: 550	ULTRA: 400	<b>FU-35FA</b> Approx. 6 g	
							FINE: 110	SUPER: 250		
				50 cm cut not allowed. FU-21X: -40 to +70°C FU-66Z: -40 to +50°C		R10	MEGA: 100	ULTRA: 72	<b>FU-21X</b> Approx. 4 g	
							FINE: 13	SUPER: 32		
	M4	Hex-shaped	2 m Free-cut (ø1.3 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 640	ULTRA: 420	<b>FU-66TZ</b> Approx. 10 g		
						FINE: 140	SUPER: 320			
		Threaded	2 m Free-cut (ø1.3 x 2) FU-66Z: -40 to +50°C FU-66: -40 to +70°C		R25	MEGA: 770	ULTRA: 560	<b>FU-66Z</b> Approx. 10 g		
						FINE: 190	SUPER: 380			
			Parallel	1 m cut not allowed. -40 to +70°C		R25	MEGA: 1100	ULTRA: 860	<b>FU-66</b> Approx. 10 g	
							FINE: 300	SUPER: 570		
		M6	Hex-shaped	2 m Free-cut (ø2.2 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 710	ULTRA: 550	<b>FU-67TZ</b> Approx. 32 g	
							FINE: 210	SUPER: 470		
				Coaxial	1 m cut not allowed. -40 to +50°C		R10 Stainless Steel	MEGA: 400	ULTRA: 310	<b>FU-67TG</b> Approx. 32 g
								FINE: 70	HSP: 90	
	Parallel				1 m cut not allowed. -40 to +50°C		R10 Stainless Steel	MEGA: 400	ULTRA: 270	<b>FU-35TG</b> Approx. 32 g
								FINE: 70	SUPER: 170	
	M6		Parallel	2 m Free-cut (ø2.2 x 2) -40 to +50°C		R0.5 ToughFlex	MEGA: 900	ULTRA: 740	<b>FU-67V</b> Approx. 25 g	
							FINE: 210	SUPER: 490		
2 m Free-cut (ø2.2 x 2) -40 to +50°C					R2 ToughFlex	MEGA: 1200	ULTRA: 900	<b>FU-61Z</b> Approx. 22 g		
						FINE: 300	SUPER: 590			
Threaded		2 m Free-cut (ø2.2 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 900	ULTRA: 740	<b>FU-67</b> Approx. 21 g			
					FINE: 210	SUPER: 490				
		1 m cut not allowed. -40 to +50°C		R10 Stainless Steel	MEGA: 900	TURBO: 320	<b>FU-67G</b> Approx. 29 g			
					FINE: 210	HSP: 110				
M6	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R25	MEGA: 1300	ULTRA: 1000	<b>FU-61</b> Approx. 21 g				
				FINE: 380	SUPER: 820					
	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R25	MEGA: 1100	ULTRA: 860	<b>FU-6F</b> Approx. 21 g				
				FINE: 300	SUPER: 570					
Coaxial	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R25	MEGA: 720	ULTRA: 630	<b>FU-25</b> Approx. 18 g				
				FINE: 160	SUPER: 410					

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

# Cylinder

Small size is suitable for installation in locations where space is limited.  
Installed by drilling a hole and using a set screw.

## Thrubeam/reflective types

Detecting method	Type	Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
					MEGA FINE	Other power modes		
Thrubeam	ø1.0	50 cm cut not allowed. -40 to +50°C		R10	MEGA: 380 FINE: 85	ULTRA: 270 SUPER: 180 TURBO: 120 HSP: 40	ø0.265	<b>FU-58</b> Approx. 8 g
		1 m Free-cut (ø1.0) -40 to +70°C		R4 High-flex	MEGA: 1200 FINE: 230	ULTRA: 810 SUPER: 590 TURBO: 410 HSP: 130	ø0.7	<b>FU-59</b> Approx. 3 g
	ø2.5	50 cm cut not allowed. -40 to +70°C		R10	MEGA: 45 FINE: 13	ULTRA: 32 SUPER: 23 TURBO: 18 HSP: -	ø0.125	<b>FU-55</b> Approx. 3 g
		50 cm cut not allowed. -40 to +70°C						
	ø3	2 m Free-cut (ø2.2) -40 to +50°C		R2 ToughFlex	MEGA: 3600 FINE: 880	ULTRA: 3000 SUPER: 1800 TURBO: 1300 HSP: 430	ø1.13	<b>FU-5FZ</b> Approx. 19 g
		2 m Free-cut (ø2.2) -40 to +70°C		R25	MEGA: 3600 FINE: 1100	ULTRA: 3200 SUPER: 2200 TURBO: 1500 HSP: 540	ø1	<b>FU-5F</b> Approx. 19 g
Reflective	ø1.5	1 m cut not allowed -40 to +70°C		R4 High-flex	MEGA: 150 FINE: 32	ULTRA: 100 SUPER: 80 TURBO: 54 HSP: 22	-	<b>FU-49X</b> Approx. 3 g
		1 m cut not allowed -40 to +70°C		R10	MEGA: 27 FINE: 4.8	ULTRA: 18 SUPER: 13 TURBO: 10 HSP: 2.4		<b>FU-46</b> Approx. 2 g
	ø2.5	50 cm cut not allowed -40 to +70°C		R25	MEGA: 72 FINE: 23	ULTRA: 59 SUPER: 45 TURBO: 32 HSP: 12	<b>FU-22X</b> Approx. 4 g	
	ø3	2 m Free-cut (ø1.3 x 2) FU-4FZ: -40 to +50°C FU-4F: -40 to +70°C		R2 ToughFlex	MEGA: 770 FINE: 190	ULTRA: 560 SUPER: 380 TURBO: 260 HSP: 80	<b>FU-4FZ</b> Approx. 8 g	
				R25	MEGA: 1100 FINE: 300	ULTRA: 860 SUPER: 570 TURBO: 410 HSP: 140	<b>FU-4F</b> Approx. 8 g	
	ø3	2 m Free-cut (ø1.0 x 2) -40 to +70°C		R4 High-flex	MEGA: 290 FINE: 63	ULTRA: 200 SUPER: 130 TURBO: 80 HSP: 32	<b>FU-48</b> Approx. 7 g	
		50 cm cut not allowed -40 to +70°C		R25	MEGA: 830 FINE: 180	ULTRA: 680 SUPER: 470 TURBO: 320 HSP: 130	<b>FU-23X</b> Approx. 4 g	
		50 cm cut not allowed -40 to +70°C		R4	MEGA: 68 FINE: 18	ULTRA: 54 SUPER: 40 TURBO: 27 HSP: 8	<b>FU-45X</b> Approx. 4 g	

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

Sleeve

Eliminate problems caused by limited mounting space.

Thrubeam/reflective types

Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight	
Detecting method	Beam emitting direction				MEGA FINE	Other power modes			
Thrubeam	Side-view	1 m Free-cut (ø1.3) -40 to +70°C		R25	MEGA: 520 FINE: 100	ULTRA: 380 SUPER: 230 TURBO: 160 HSP: 55	ø0.6	<b>FU-32</b> Approx. 5 g	
		2 m Free-cut (ø2.2) -40 to +70°C			MEGA: 1600 FINE: 330	ULTRA: 1100 SUPER: 660 TURBO: 470 HSP: 140	ø1	<b>FU-34</b> Approx. 17 g	
	Top view	2 m Free-cut (ø2.2) -40 to +70°C			MEGA: 3600 FINE: 1100	ULTRA: 3200 SUPER: 2200 TURBO: 1500 HSP: 540		ø0.5	<b>FU-73</b> Approx. 24 g
		1 m Free-cut (ø1.0) -40 to +70°C			MEGA: 690 FINE: 170	ULTRA: 500 SUPER: 340 TURBO: 240 HSP: 72	ø0.265		<b>FU-75F</b> Approx. 10 g
		1 m Free-Free-cut (ø1.0) -40 to +70°C			MEGA: 370 FINE: 85	ULTRA: 260 SUPER: 180 TURBO: 120 HSP: 40			ø0.125
		50 cm cut not allowed -40 to +70°C			MEGA: 45 FINE: 13	ULTRA: 32 SUPER: 23 TURBO: 18 HSP: -	<b>FU-56</b> Approx. 3 g		
Reflective	Side	2 m Free-cut (ø1.0 x 2) -40 to +70°C		R10	MEGA: 180 FINE: 32	ULTRA: 130 SUPER: 81 TURBO: 50 HSP: 18	-	<b>FU-31</b> Approx. 5 g	
		1 m Free-cut (ø2.2 x 2) -40 to +70°C			MEGA: 320 FINE: 45	ULTRA: 250 SUPER: 140 TURBO: 90 HSP: 32		<b>FU-33</b> Approx. 10 g	
	Top	50 cm cut not allowed -40 to +70°C		R4	MEGA: 68 FINE: 18	ULTRA: 54 SUPER: 40 TURBO: 27 HSP: 8		<b>FU-65X</b> Approx. 5 g	
		2 m Free-cut (ø1.3 x 2) -40 to +50°C		ToughFlex R2	MEGA: 290 FINE: 54	ULTRA: 190 SUPER: 120 TURBO: 80 HSP: 23		<b>FU-63Z</b> Approx. 10 g	
		2 m Free-cut (ø1.3 x 2) -40 to +70°C		R25	MEGA: 330 FINE: 72	ULTRA: 230 SUPER: 150 TURBO: 100 HSP: 36		<b>FU-63</b> Approx. 10 g	
		2 m Free-cut (ø1.3 x 2) -40 to +70°C						<b>FU-63T</b> Approx. 10 g	
		50 cm cut not allowed -40 to +70°C		R4	MEGA: 68 FINE: 18	ULTRA: 54 SUPER: 40 TURBO: 27 HSP: 8		<b>FU-45X</b> Approx. 4 g	
		2 m Free-cut (ø1.3 x 2) -40 to +70°C		R25	MEGA: 330 FINE: 72	ULTRA: 230 SUPER: 150 TURBO: 100 HSP: 36		<b>FU-43</b> Approx. 8 g	
		1 m cut not allowed -40 to +70°C		R10	MEGA: 27 FINE: 4.8	ULTRA: 18 SUPER: 13 TURBO: 10 HSP: 2.4		<b>FU-46</b> Approx. 2 g	
		Coaxial, narrow beam 10°	50 cm cut not allowed -40 to +70°C		R25	MEGA: 72 FINE: 23		ULTRA: 59 SUPER: 45 TURBO: 32 HSP: 12	<b>FU-22X</b> Approx. 4 g


\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

# Small Spot Reflective

Ideal for detecting small objects.  
Select the sensor according to the size of the object.

## Parallel Beam Spot

Lens + Fibre Unit

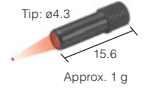


Type	Beam spot diameter (mm)	Lens		Fibre units			Detecting distance (mm)**1	
		Appearance (mm) Weight	Model	Minimum bend radius (mm)	Appearance	Model	MEGA FINE	Other power modes
Parallel beam	Approx. ø4 (within the detecting distance of 0 to 20 mm)		<b>F-3HA</b>	R2 ToughFlex	<b>FU-35FZ</b>	MEGA: 45 FINE: 36	ULTRA: 45 SUPER: 45 TURBO: 40 HSP: 27	
				R10 Stainless Steel	<b>FU-35FG</b>			
				R25	<b>FU-35FA</b>	MEGA: 65 FINE: 54	ULTRA: 65 SUPER: 65 TURBO: 60 HSP: 45	
				R2 ToughFlex	<b>FU-35TZ</b>	MEGA: 40 FINE: 27	ULTRA: 40 SUPER: 40 TURBO: 32 HSP: 23	
				R10 Stainless Steel	<b>FU-35TG</b>			



\*\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.


## Small Beam Spot

Lens + Fibre Unit

Type	Beam spot diameter (mm)	Focal distance (mm)	Lens		Fibre units		
			Appearance (mm) Weight	Model	Minimum bend radius (mm)	Appearance	Model
Small spot	Approx. ø0.1	7±2		<b>F-2HA</b>	R10		<b>FU-24X</b>
	Approx. ø0.2				R25		<b>FU-21X</b>
	Approx. ø0.4				R2 ToughFlex		<b>FU-35FZ</b>
					R10 Stainless Steel		<b>FU-35FG</b>
					R25		<b>FU-35FA</b>
					R2 ToughFlex		<b>FU-35TZ</b>
	Approx. ø0.5	15±2		<b>F-4HA</b>	R2 ToughFlex		<b>FU-35FZ</b>
		R10 Stainless Steel				<b>FU-35FG</b>	
		R2 ToughFlex				<b>FU-35TZ</b>	
		R10 Stainless Steel				<b>FU-35TG</b>	
	Approx. ø1.0	35±3		<b>F-6HA</b>	R25		<b>FU-21X</b>
					R2 ToughFlex		<b>FU-35FZ</b>
R10 Stainless Steel						<b>FU-35FG</b>	
R2 ToughFlex						<b>FU-35TZ</b>	
Approx. ø2.0			R25		<b>FU-35FA</b>		




## Built-in Lens Fibre Unit

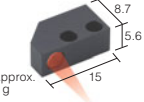
Type	Beam spot diameter (mm)	Focal distance (mm)	Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Model Weight	Minimum bend radius (mm)
Small spot	Approx. ø0.1	5	50 cm cut not allowed -40 to +70°C		<b>FU-20</b> Approx. 2 g	R25

## Adjustable Beam Spot

Built-in Lens Fibre Unit

Type	Beam spot diameter (mm)	Focal distance (mm)	Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Model Weight	Minimum bend radius (mm)
Adjustable beam spot	ø0.9 to 3.5	10 to 30	2 m Free-cut (ø1.3 x 2) -40 to +70°C		<b>FU-10</b> Approx. 5 g	R25

## Lens + Fibre Unit

Type	Beam spot diameter (mm)	Focal distance (mm)	Lens		Fibre units		
			Appearance (mm) Weight	Model	Minimum bend radius (mm)	Appearance	Model
Side-view adjustable spot	ø0.5 to 3	8 to 30		<b>F-5HA</b>	R2 ToughFlex		<b>FU-35FZ</b>
					R10 Stainless Steel		<b>FU-35FG</b>
					R25		<b>FU-35FA</b>



## Area

Great for applications where target position varies or for detecting targets with complicated shapes or rough surface finish.

### Thrubeam/reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm)	Model Weight
	Type	Optical axis width (mm)				MEGA FINE	Other power modes		
Thrubeam	Area	10	2 m Free-cut (ø2.2) -40 to +50°C		R2 ToughFlex	MEGA: 3400	ULTRA: 2800	10x3	FU-12 Approx. 23 g
		11		MEGA: 3600		ULTRA: 3600			
		40		MEGA: 3600		ULTRA: 3600			
Thrubeam	Array	5	2 m Free-cut (ø2.2) -40 to +70°C		R4	MEGA: 2200 FINE: 440	ULTRA: 1400	Approx. 6 x 0.3	FU-A05 Approx. 20 g
		10		ULTRA: 840 SUPER: 540 TURBO: 200 HSP: 200					
Reflective	Area	15 (at distance 15)	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R25	MEGA: 5 to 200 FINE: 5 to 140	ULTRA: 5 to 200 SUPER: 5 to 200 TURBO: 5 to 160 HSP: 5 to 110	-	FU-11 Approx. 19 g
	Array	10 (at distance 4)			R4	MEGA: 740 FINE: 140	ULTRA: 460 SUPER: 260 TURBO: 180 HSP: 60	-	FU-A05D Approx. 20 g
		15 (at distance 4)					-	FU-A10D Approx. 20 g	

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

## Retro-reflective

Useful for detecting transparent objects.

### Retro-reflective type

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Model Weight
	Beam emitting direction	Optical axis width (mm)				MEGA FINE	Other power modes	
Retro-Reflective	M6	17	2 m Free-cut (ø1.0 x 2) -40 to +50°C		R2 ToughFlex	MEGA: 10 to 960 FINE: 10 to 120	ULTRA: 10 to 760 SUPER: 10 to 380 TURBO: 10 to 230 HSP: -	FU-13 Approx. 8 g
	Square type	26.9				R10	MEGA: 100 to 6400 FINE: 100 to 1260	ULTRA: 100 to 5000 SUPER: 100 to 2500 TURBO: 100 to 1690 HSP: 100 to 1000

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

### Reflector/Reflective Tape Specifications (Optional Parts)

Model	Power modes	Detecting distance (mm)*1			
		R-2 (OP-95388) 51.2 x 61	R-3 (OP-96436) 35 x 42	R-5 14 x 36	Reflective tape (OP-96629) 40 x 30
FU-13	MEGA	10 to 1880	10 to 1540	10 to 1060	10 to 960
	ULTRA	10 to 1500	10 to 1240	10 to 860	10 to 760
	SUPER	10 to 760	10 to 640	10 to 440	10 to 380
	TURBO	10 to 450	10 to 360	10 to 230	10 to 230
	FINE	10 to 250	10 to 200	10 to 130	10 to 120
FU-15*2	HSP	-	-	-	-
	MEGA	100 to 6400	100 to 4400	100 to 2600	-
	ULTRA	100 to 5000	100 to 3600	100 to 2200	-
	SUPER	100 to 2500	100 to 2000	100 to 1500	-
	TURBO	100 to 1690	100 to 1350	100 to 1200	-
	FINE	100 to 1260	100 to 1000	100 to 1000	-
	HSP	100 to 1000	100 to 860	100 to 860	-

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

\*2 Reflective tape cannot be used.

## Narrow Beam/High-power

Built-in lens reduces beam width and helps reduce stray light.

### Thrubeam/reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Beam emitting direction	Aperture angle				MEGA FINE	Other power modes		
Thrubeam	Side	Approx. 6°	2 m Free-cut (ø1.0) FU-16Z: -40 to +50°C FU-16/18: -40 to +70°C		R2 ToughFlex	MEGA: 3600 FINE: 1260	ULTRA: 3600 SUPER: 2600 TURBO: 1800 HSP: 760	ø2.5	<b>FU-16Z</b> Approx. 8 g
		Approx. 2°				MEGA: 3600 FINE: 1900	ULTRA: 3600 SUPER: 3600 TURBO: 2700 HSP: 1000		<b>FU-16</b> Approx. 8 g
	Top	Approx. 3°	2 m Free-cut (ø1.0) -40 to +70°C		R10	MEGA: 3600 FINE: 1600	ULTRA: 3600 SUPER: 3000 TURBO: 2100 HSP: 960	ø1	<b>FU-18</b> Approx. 8 g
		Approx. 6°	2 m Free-cut (ø1.0) -40 to +50°C				R2 ToughFlex		MEGA: 3600 FINE: 3600
Reflective	Top	Approx. 8°	2 m Free-cut (ø2.2 x 2) -40 to +50°C		R2 ToughFlex		MEGA: 30 to 2300 FINE: 30 to 290	ULTRA: 30 to 1600 SUPER: 30 to 760 TURBO: 30 to 410 HSP: 30 to 160	-
			1 m cut not allowed -40 to +50°C		R10 Stainless Steel	<b>FU-40G</b> Approx. 50 g			

\*1 3600 mm is assumed as maximum because the fibre cable has a length of 2 m.  
Detecting distance for reflective fibres is based on a standard target: White matte paper.

## Definite-reflective

Helps reduce the effect of target background.  
The thin, small design requires less space.

### Definite-reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Beam spot diameter (mm)	Model Weight
	Beam emitting direction	Aperture angle				MEGA FINE	Other power modes		
Definite-reflective	Side	Approx. 6°	2 m Free-cut (ø1.0 x 2) -40 to +70°C		R10	MEGA: 3 centre of detecting distance FINE: 3 centre of detecting distance	ULTRA: 3 centre of detecting distance SUPER: 3 centre of detecting distance TURBO: 3 centre of detecting distance HSP: 3 centre of detecting distance	Approx. ø4.5 ↑ Approx. ø3.5 (at distance of 3)	<b>FU-37</b> Approx. 6 g
		Approx. 2°				MEGA: 6 centre of detecting distance FINE: 6 centre of detecting distance	ULTRA: 6 centre of detecting distance SUPER: 6 centre of detecting distance TURBO: 6 centre of detecting distance HSP: 6 centre of detecting distance		Approx. ø1.5 (at distance of 6)
	Top	Approx. 3°	2 m Free-cut (ø1.0 x 2) -40 to +70°C		R10	MEGA: 0 to 4 FINE: 0 to 4	ULTRA: 0 to 4 SUPER: 0 to 4 TURBO: 0 to 4 HSP: 2±1.4	-	<b>FU-38V</b> Approx. 5 g

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

## High-flex

Provides higher flexibility than electric wire.  
R2 types are resistant to repeated bends up to 10 million bends.

### Thrubeam/reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight	
	Size (mm)					MEGA FINE	Other power modes			
Thrubeam	ø1.5		1 m Free-cut (ø1.0) -40 to +70°C		R4 High-flex	MEGA: 1200 FINE: 230	ULTRA: 810 SUPER: 590 TURBO: 410 HSP: 130	ø0.7	FU-59 Approx. 3 g	
		M3	1 m Free-cut (ø1.0) -40 to +70°C						FU-79 Approx. 6 g	
		6x10.5x2.5	1 m Free-cut (ø1.0) -40 to +70°C						FU-57TE Approx. 5 g	
	ø1.0		1 m Free-cut (ø1.0) -40 to +50°C			R2 ToughFlex High-flex	MEGA: 590 FINE: 140	ULTRA: 430 SUPER: 300 TURBO: 180 HSP: 55	ø0.5	FU-58U Approx. 4 g
		ø1.5	1 m Free-cut (ø1.0) -40 to +50°C							FU-59U Approx. 4 g
		M3	1 m Free-cut (ø1.0) -40 to +50°C							FU-79U Approx. 4 g
		M4 Built-in lens	1 m Free-cut (ø1.0) -40 to +50°C							FU-70U Approx. 5 g
Reflective	ø1.5		1 m cut not allowed -40 to +70°C		R4 High-flex	MEGA: 150 FINE: 32	ULTRA: 100 SUPER: 80 TURBO: 54 HSP: 22	-	FU-49X Approx. 3 g	
		M3	1 m cut not allowed -40 to +70°C						FU-69X Approx. 3 g	
		ø3	2 m Free-cut (ø1.0 x 2) -40 to +70°C						FU-48 Approx. 7 g	
	M4		2 m Free-cut (ø1.0 x 2) -40 to +70°C			R2 ToughFlex High-flex	MEGA: 290 FINE: 63	ULTRA: 200 SUPER: 130 TURBO: 80 HSP: 32	-	FU-68 Approx. 8 g
		ø2	1 m Free-cut (ø1.0 x 2) -40 to +50°C							FU-49U Approx. 4 g
	ø3		1 m Free-cut (ø1.0 x 2) -40 to +50°C			R2 ToughFlex High-flex	MEGA: 140 FINE: 40	ULTRA: 110 SUPER: 80 TURBO: 60 HSP: 13	-	FU-48U Approx. 4 g
		M3	1 m Free-cut (ø1.0 x 2) -40 to +50°C							FU-69U Approx. 4 g

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper.

## Oil/Chemical Resistant

PTFE coating allows for use in almost any environment.

### Thrubeam/Reflective types

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Beam emitting direction	Size (mm)				MEGA FINE	Other power modes		
Thrubeam	Top	ø5	2 m Free-cut (ø2.2) -40 to +70°C		R40	MEGA: 3600 FINE: 2800	ULTRA: 3600 SUPER: 3600 TURBO: 3600 HSP: 1400	ø3.7	FU-92 Approx. 71 g
		ø5	2 m Free-cut (ø2.2) -40 to +70°C						FU-96 Approx. 71 g
	Side	13x14.3x7	2 m Free-cut (ø2.2) -40 to +60°C						R25
Reflective	Top	ø4.5	2 m Free-cut (ø1.3 x 2) -40 to +70°C		R40	MEGA: 310 FINE: 140	ULTRA: 290 SUPER: 250 TURBO: 200 HSP: 80	-	FU-91 Approx. 32 g

\*1 3600 mm is assumed as maximum because the fibre cable has a length of 2 m. Detecting distance for reflective fibres is based on a standard target: White matte paper.

# Heat Resistant

Resists temperatures up to 350°C.

A wide variety of heat-resistant types are available, including the easy-to-install R5 type and the high-temperature type, resistant to temperatures up to 350°C. Fibres used in sensors resistant to temperatures of 200°C or more are made from multi-component glass.

## Thrubeam/reflective types

Detecting method	Type	Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)*1		Optical axis diameter (mm) (Standard target to be detected)	Model Weight
					MEGA FINE	Other power modes		
Thrubeam	100°C*3	2 m Free-cut (ø2.2) -40 to +100°C		R5 ToughFlex	MEGA: 3600 FINE: 680 Lens attachment: P14	ULTRA: 2200 SUPER: 1600 TURBO: 900 HSP: 390	ø1	<b>FU-86Z</b> Approx. 25 g
	105°C*3	2 m Free-cut (ø2.2) -40 to +105°C		R25	MEGA: 3600 FINE: 1100 Lens attachment: P14	ULTRA: 3200 SUPER: 2200 TURBO: 1500 HSP: 540		<b>FU-86A</b> Approx. 22 g
	150°C*4	2 m Free-cut (ø2.2) -40 to +150°C		R20	MEGA: 2700 FINE: 520	ULTRA: 1800 SUPER: 1100 TURBO: 720 HSP: 340	ø1.5	<b>FU-86H</b> Approx. 35 g
	180°C*5	2 m Free-cut (ø2.2) -60 to +180°C		R35	MEGA: 2700 FINE: 570	ULTRA: 1900 SUPER: 1200 TURBO: 790 HSP: 380		<b>FU-88</b> Approx. 36 g
	200°C	2 m cut not allowed. -40 to +200°C		R8	MEGA: 1800 FINE: 390 Lens attachment: P14	ULTRA: 1300 SUPER: 900 TURBO: 680 HSP: 250	ø1	<b>FU-88K</b> Approx. 30 g
	300°C	2 m cut not allowed. -40 to +300°C		R25				<b>FU-84C</b> Approx. 66 g
Reflective	100°C*3	2 m Free-cut (ø2.2 x 2) -40 to +100°C		R5 ToughFlex	MEGA: 740 FINE: 160	ULTRA: 580 SUPER: 410 TURBO: 320 HSP: 90	-	<b>FU-85Z</b> Approx. 25 g
	105°C*3	2 m Free-cut (ø2.2 x 2) -40 to +105°C		R25	MEGA: 1100 FINE: 230	ULTRA: 860 SUPER: 590 TURBO: 410 HSP: 140		<b>FU-85A</b> Approx. 21 g
	150°C*4	2 m Free-cut (ø2.2 x 2) -40 to +150°C		R20	MEGA: 720 FINE: 160	ULTRA: 560 SUPER: 410 TURBO: 320 HSP: 90	<b>FU-85H</b> Approx. 35 g	
	180°C*5	2 m Free-cut (ø2.2 x 2) -60 to +180°C		R35	MEGA: 860 FINE: 200	ULTRA: 710 SUPER: 470 TURBO: 350 HSP: 100	<b>FU-87</b> Approx. 33 g	
	200°C	1 m cut not allowed. -40 to +200°C		R8	MEGA: 770 FINE: 190	ULTRA: 650 SUPER: 450 TURBO: 340 HSP: 100	-	<b>FU-87K</b> Approx. 15 g
	300°C	1 m cut not allowed. -40 to +300°C		R25				MEGA: 650 FINE: 140
		1 m cut not allowed. -40 to +300°C			<b>FU-83C</b> Approx. 23 g			
	350°C	1 m cut not allowed. -30 to +350°C		R25	MEGA: 8 to 37 FINE: 8 to 30	ULTRA: 8 to 34 SUPER: 8 to 32 TURBO: 8 to 30 HSP: 10 to 18	<b>FU-81C</b> Approx. 24 g	
	250°C	2 m cut not allowed. -40 to +250°C		R25	MEGA: 2.5 to 65 FINE: 2.5 to 16	ULTRA: 2.5 to 55 SUPER: 2.5 to 27 TURBO: 2.5 to 22 HSP: 2.5 to 10	<b>FU-38LK</b> Approx. 70 g	
		1 m cut not allowed. -40 to +250°C					<b>FU-38K</b> Approx. 45 g	
	180°C	2 m Free-cut (ø2.2 x 2) -60 to +180°C		R35			<b>FU-38H</b> Approx. 45 g	

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper. (For the FU-38LK, the distances are based on a glass substrate (t = 0.7 mm) detected in the planar direction.)

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

\*3 The recommended maximum ambient temperature during operation is 90°C when constantly using a fibre unit in a high-temperature environment.



\*4 The recommended maximum ambient temperature during operation is 130°C when constantly using a fibre unit in a high-temperature environment.

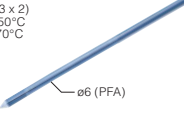
\*5 The recommended maximum ambient temperature during operation is 150°C when constantly using a fibre unit in a high-temperature environment.

## Liquid-level

Liquid-level detection sensors.  
Available in tube-mountable and immersible types.

### Reflective

Detecting method	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Accessory	Model Weight
	Transparent tube diameter (mm)	Beam axis					
Tube-mountable type	ø4 to 26	16	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R5	Binding band x 2 Nonslip rubber x 2	<b>FU-95S</b> Approx. 23 g
		1	2 m Free-cut (ø1.0 x 2) FU-95Z: -40 to +50°C FU-95HA: -40 to +105°C FU-95: -40 to +70°C		R2 ToughFlex	Binding band x 2 Nonslip rubber x 2 Spacer x 2 Screw x 2 Nut x 2	<b>FU-95Z</b> Approx. 7 g
			R25	<b>FU-95HA</b> Approx. 7 g			
	R10	<b>FU-95</b> Approx. 7 g					
	ø26 or more recommended	16	2 m Free-cut (ø2.2 x 2) -40 to +70°C		R5	None (Optionally available)	<b>FU-95W</b> Approx. 20 g

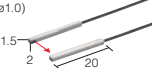
Detecting method	Type	Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)		Model Weight
				PFA-sheathed section	Fibre	
Immersion		2 m Free-cut (ø1.3 x 2) FU-93Z: -40 to +50°C FU-93: -40 to +70°C		R40*	R0.5 ToughFlex	<b>FU-93Z</b> Approx. 78 g
					R25	<b>FU-93</b> Approx. 78 g

\* Not bendable up to 80 mm from the tip.





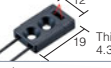
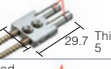
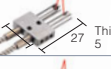
## Liquid Crystal/Semiconductors

Perfect for detecting glass substrates.  
Lineup offers distance alignment, edge detection and wafer mapping types.

### Thrubeam

Application	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)**			Optical axis diameter (mm) (Standard target to be detected)	Model Weight
	Beam emitting direction	Aperture angle				MEGA FINE	Other power modes			
Mapping	Side	Approx. 3°	2 m Free-cut (ø1.0) -40 to +70°C		R10	MEGA: 1300 FINE: 330	ULTRA: 900 SUPER: 680 TURBO: 530 HSP: 210	ø1	<b>FU-18M</b> Approx. 6 g	

### Reflective

Application	Type		Fibre unit length (Diameter) Ambient temperature	Appearance (mm)	Minimum bend radius (mm)	Detecting distance (mm)**			Model Weight
	Beam emitting direction	Heat resistant*2 temperatures				MEGA FINE	Other power modes		
Glass substrate mapping	Top		2 m Free-cut (ø2.2 x 2) -40 to +70°C		R25	MEGA: 15 to 70 FINE: 15 to 30	ULTRA: 15 to 60 SUPER: 15 to 46 TURBO: 15 to 38 HSP: -	<b>FU-40S</b> Approx. 25 g	
Glass substrate alignment	Flat		2 m Free-cut (ø2.2 x 2) -10 to +60°C			MEGA: 8 to 38 FINE: 8 to 32	ULTRA: 8 to 36 SUPER: 8 to 35 TURBO: 8 to 34 HSP: 10 to 26	<b>FU-38L</b> Approx. 20 g	
Glass substrate alignment			2 m Free-cut (ø2.2 x 2) -40 to +70°C		MEGA: 0 to 25 FINE: 0 to 25	ULTRA: 0 to 25 SUPER: 0 to 25 TURBO: 0 to 14 HSP: -	<b>FU-38S</b> Approx. 20 g		
Seating check			2 m Free-cut (ø2.2 x 2) -40 to +70°C		MEGA: 0 to 14 FINE: 0 to 14	ULTRA: 0 to 14 SUPER: 0 to 14 TURBO: 0 to 14 HSP: 0 to 12	<b>FU-38R</b> Approx. 20 g		
Heat-resistant glass substrate alignment	Flat	250°C	2 m cut not allowed. -40 to +250°C		R25	MEGA: 8 to 37 FINE: 8 to 30	ULTRA: 8 to 34 SUPER: 8 to 32 TURBO: 8 to 30 HSP: 10 to 18	<b>FU-38LK</b> Approx. 70 g	
Heat-resistant seating, presence check		180°C*3	1 m cut not allowed. -40 to +250°C			MEGA: 2.5 to 65 FINE: 2.5 to 16	ULTRA: 2.5 to 55 SUPER: 2.5 to 27 TURBO: 2.5 to 22 HSP: 2.5 to 10	<b>FU-38K</b> Approx. 45 g	
Heat-resistant seating, presence check			2 m Free-cut (ø2.2 x 2) -40 to +180°C		R35			<b>FU-38H</b> Approx. 45 g	

\*1 Detecting distance for reflective fibres is based on a standard target: White matte paper. (For the FU-38LK, the distances are based on a glass substrate (t = 0.7 mm) detected in the planar direction.)

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

\*3 The recommended maximum ambient temperature during operation is 150°C when constantly using a fibre unit in a high-temperature environment.

# Specifications

Type		Standard 1 output				High functionality 2 output				Monitor output
		Cable		M8 connector*1		Cable		M8 connector*1		Cable
Model	NPN	FS-N11N	FS-N12N	FS-N11CN	FS-N12CN	FS-N13N	FS-N14N	–	–	FS-N11MN
	PNP	FS-N11P	FS-N12P	FS-N11CP	FS-N12CP	FS-N13P	FS-N14P	FS-N13CP	FS-N14CP	–
Main unit/Expansion unit		Main unit	Expansion unit	Main unit	Expansion unit	Main unit	Expansion unit	Main unit	Expansion unit	Main unit
Control output		1	1	1	1	2	2	2	2	1
Monitor output (1-5 V)		–	–	–	–	–	–	–	–	1
External input		–	–	1	1	1	1	–	–	–
Response time		50 µs (HIGH SPEED)/250 µs (FINE)/500 µs (TURBO)/1 ms (SUPER)/4 ms (ULTRA)/16 ms (MEGA)								
Control output	NPN output	NPN open collector 30 V; 1 output max: 100 mA or less; 2 output total: 100 mA or less (used stand-alone)/20 mA or less (multiple connections); residual voltage 1 V or less								
	PNP output	PNP open collector 30 V; 1 output max: 100 mA or less; 2 output total: 100 mA or less (used stand-alone)/20 mA or less (multiple connections); residual voltage 1 V or less								
Monitor output*2		1 to 5 V voltage output; load resistance 10 kΩ or more; repeat precision ±0.5% of F.S.; 1 ms response time (HIGH SPEED, FINE, TURBO)*3								
External input		input time 2 ms (ON)/20 ms (OFF) or more								
Multiple connections to Expansion units		Up to 16 units can be connected total (two output type is treated as two units)								
Light source		Red, 4-element LED								
APC		ON/OFF switchable (Factory setting: OFF)								
Number of interference prevention units		0 for HIGH SPEED; 4 for FINE; 8 for TURBO/SUPER/ULTRA/MEGA (When set to double, the number of interference-prevention units will be doubled.)								
Rating	Power voltage	12 - 24 V DC ±10% ripple (P-P) 10% or less								
	NPN Amplifier Current Consumption	Normal: 900 mW or less (36 mA max. at 24 V, 48 mA max. at 12 V)*4 Eco on mode: 800 mW or less (32 mA max. at 24 V, 39 mA max. at 12 V)*4 Eco Full mode: 470 mW or less (19 mA max. at 24 V, 23 mA max. at 12 V)								
	PNP Amplifier Current Consumption	Normal: 950 mW or less (39 mA max. at 24 V, 52 mA max. at 12 V)*4 Eco on mode: 850 mW or less (35 mA max. at 24 V, 44 mA max. at 12 V)*4 Eco Full mode: 520 mW or less (21 mA max. at 24 V, 26 mA max. at 12 V)				Normal: 1050 mW or less (42 mA max. at 24 V, 56 mA max. at 12 V)*4 Eco on mode: 950 mW or less (38 mA max. at 24 V, 47 mA max. at 12 V)*4 Eco Full mode: 600 mW or less (24 mA max. at 24 V, 29 mA max. at 12 V)				–
Environmental resistance	Operating ambient luminance	Incandescent lamp: 20000 lux or less; Sunlight: 30000 lux or less								
	Operating ambient temperature	-20 to +55 °C (no freezing)*5								
	Operating ambient humidity	35 to 85% RH (no condensation)								
	Vibration resistance	10 to 55 Hz Compound amplitude 1.5 mm, 2 hours for each of X,Y,Z axis								
	Shock resistance	500 m/s <sup>2</sup> 3 times for each of X,Y,Z axis								
Case material		Both main unit and expansion unit housing material: Polycarbonate								
Weight		Approx. 75 g	Approx. 45 g	Approx. 22 g	Approx. 22 g	Approx. 80 g	Approx. 70 g	Approx. 22 g	Approx. 22 g	Approx. 75 g

\*1 Use a cable length of 30m or less for M8 connector types.

\*2 FS-N11MN only

\*3 SUPER: 1.2 ms, ULTRA: 1.8 ms, MEGA: 4.2 ms

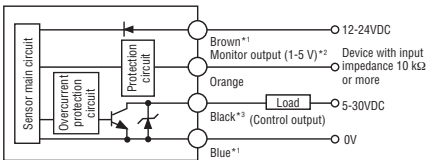
\*4 Increases 100 mW (4.0 mA) for High Speed mode

\*5 One or two more units connected: -20 to +55°C; 3 to 10 more units connected: -20 to +50°C; 11 to 16 more units connected: -20 to +45°C. When using 2-outputs, one unit is counted as two units. All temperature regulations are for when the unit is mounted on a DIN rail and installed on metal sheeting.

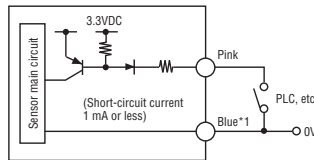
# Input and Output Circuit Diagrams

## FS-N11N / N12N / N11MN / N13N / N14N

Output Circuit Diagram



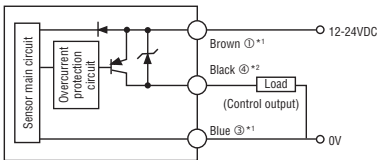
Input Circuit Diagram (FS-N13N/N14N only)



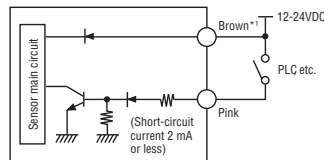
- \*1 FS-N11N/N11MN/N13N only
- \*2 FS-N11MN only
- \*3 The FS-N13N/N14N has a white cable as separate output 2.

## FS-N11P / N12P / N13P / N14P / N13CP / N14CP

Output Circuit Diagram



Input Circuit Diagram (FS-N13P/N14P only)



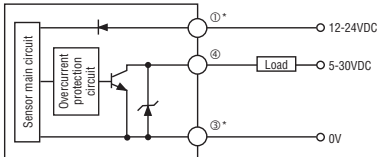
M8 connector pin layout



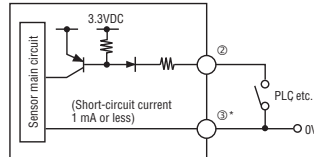
- \*1 FS-N11P/N13P/N13CP only
- \*2 The FS-N13P/N14P has a white cable as separate output. The FS-N13CP/N14CP has pin ② as separate output 2.

## FS-N11CN / N12CN

Output Circuit Diagram



Input Circuit Diagram



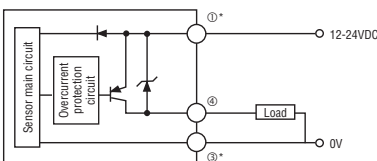
M8 connector pin layout



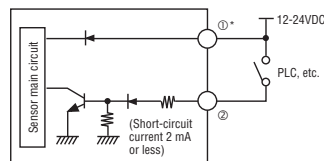
- \* FS-N11CN only

## FS-N11CP / N12CP

Output Circuit Diagram



Input Circuit Diagram



M8 connector pin layout



- \* FS-N11CP only

## Socket Cable (sold separately)

For FS-N11CN / N11CP / N12CN / N12CP / N13CP / N14CP

**OP-73864**  
(Cable length: 2 m)

**OP-73865**  
(Cable length: 10 m)

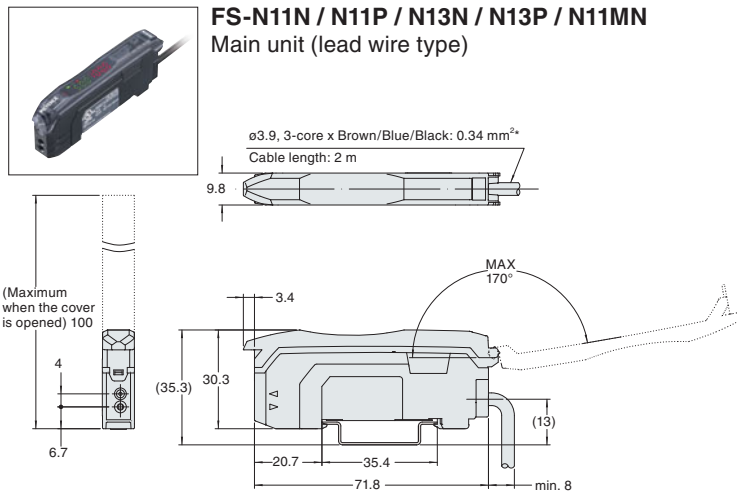


Pin – wire colour

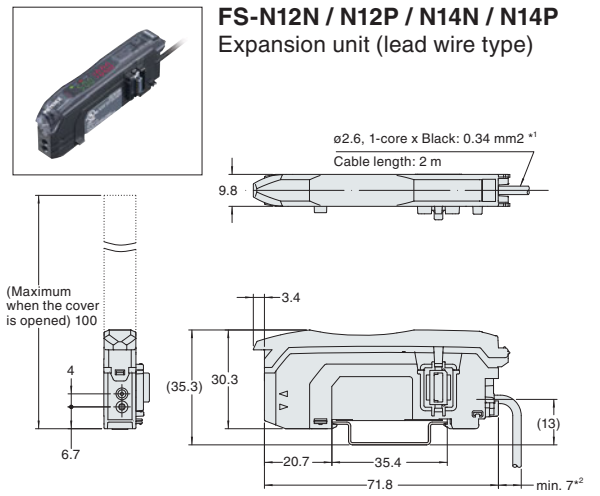
Connected pin number	Core wire cover colour
①	Brown
②	White
③	Blue
④	Black

# Dimensions

Unit: mm

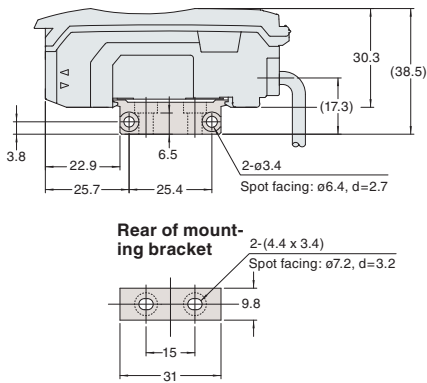


\* FS-N11MN: ø3.9, 4-core x Brown/Blue: 0.34 mm<sup>2</sup> Black/Orange: 0.18 mm<sup>2</sup>  
FS-N13N/N13P: ø3.9, 5-core x Brown/Blue: 0.34 mm<sup>2</sup> Black/White/Pink: 0.18 mm<sup>2</sup>

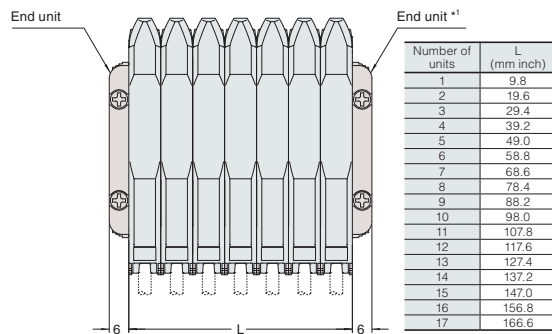


\*<sup>1</sup> FS-N14N/N14P: ø3.9, 3-core x Black/White/Pink: 0.18 mm<sup>2</sup>  
<sup>2</sup> FS-N14N/N14P: min. 8

When the mounting bracket is attached  
(OP-73880 sold separately)

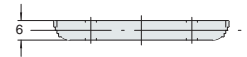


When several units are connected

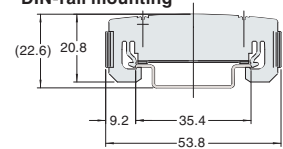


\*<sup>1</sup> When using expansion units, be sure to use the end unit. (Optional)

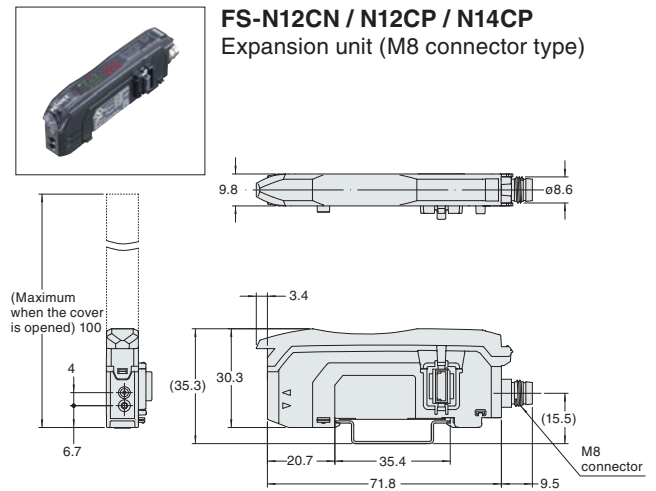
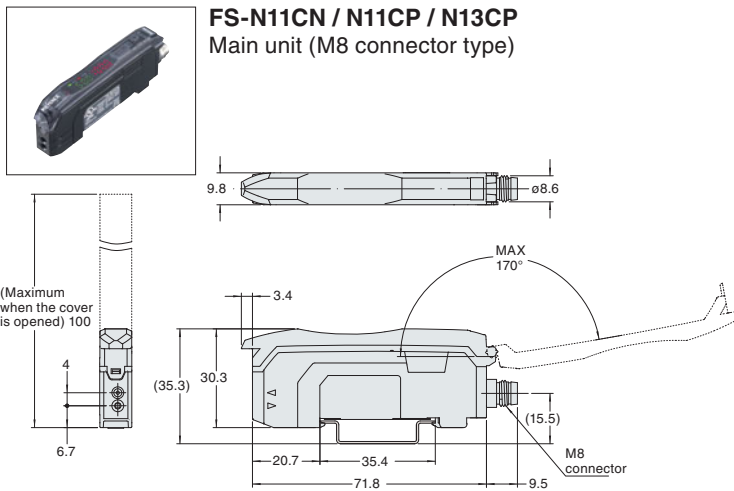
End unit  
(OP-26751 sold separately)



DIN-rail mounting

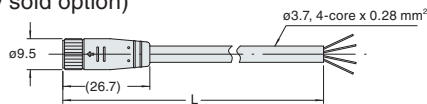


Unit: mm

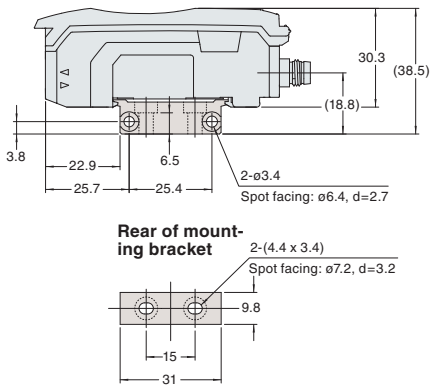


M8 socket cable (separately sold option)

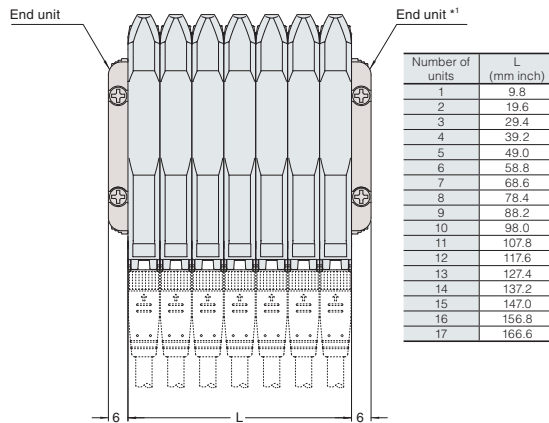
Cable length	L (m foot)
<b>OP-73864</b>	2
<b>OP-73865</b>	10



When the mounting bracket is attached (OP-73880 sold separately)



When several units are connected

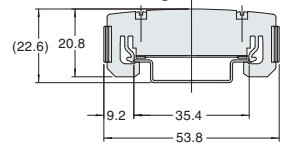


\*1 When using expansion units, be sure to use the end unit. (Optional)

End unit (OP-26751 sold separately)



DIN-rail mounting



## New! Improved FIBRE CUTTER

**Leaves a clean cut edge which prevents uneven light intensity.**

The new cutter comes with the FS-N Series (amplifier). The cutter included with the fibre unit will be phased out from the old type to the new type. Once the changeover is complete, cutters will no longer be included with amplifier units.



# KEYENCE

Please visit: [www.keyence.com](http://www.keyence.com)



### SAFETY INFORMATION

Please read the instruction manual carefully in order to safely operate any KEYENCE product.

#### KEYENCE GLOBAL HEADQUARTERS

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku, Osaka, 533-8555, Japan PHONE: +81-6-6379-2211

#### AUSTRIA

Phone: +43 22 36-3782 66-0 Fax: +43 22 36-3782 66-30

#### BELGIUM

Phone: +32 27 16 40 63 Fax: +32 27 16 47 27

#### CANADA

Phone: +1-905-696-9970 Fax: +1-905-696-8340

#### CHINA

Phone: +86-21-68757500 Fax: +86-21-68757550

#### CZECH REPUBLIC

Phone: +420 222 191 483 Fax: +420 222 191 505

#### FRANCE

Phone: +33 1 56 37 78 00 Fax: +33 1 56 37 78 01

#### GERMANY

Phone: +49 61 02 36 89-0 Fax: +49 61 02 36 89-100

#### HONG KONG

Phone: +852-3104-1010 Fax: +852-3104-1080

#### HUNGARY

Phone: +36 1 802 73 60 Fax: +36 1 802 73 61

#### ITALY

Phone: +39-02-6688220 Fax: +39-02-66825099

#### JAPAN

Phone: +81-6-6379-2211 Fax: +81-6-6379-2131

#### KOREA

Phone: +82-31-642-1270 Fax: +82-31-642-1271

#### MALAYSIA

Phone: +60-3-2092-2211 Fax: +60-3-2092-2131

#### MEXICO

Phone: +52-81-8220-7900 Fax: +52-81-8220-9097

#### NETHERLANDS

Phone: +31 40 20 66 100 Fax: +31 40 20 66 112

#### POLAND

Phone: +48 71 36861 60 Fax: +48 71 36861 62

#### SINGAPORE

Phone: +65-6392-1011 Fax: +65-6392-5055

#### SLOVAKIA

Phone: +421 2 5939 6461 Fax: +421 2 5939 6200

#### SWITZERLAND

Phone: +41 43-45577 30 Fax: +41 43-45577 40

#### TAIWAN

Phone: +886-2-2718-8700 Fax: +886-2-2718-8711

#### THAILAND

Phone: +66-2-369-2777 Fax: +66-2-369-2775

#### UK & IRELAND

Phone: +44-1908-696900 Fax: +44-1908-696777

#### USA

Phone: +1-201-930-0100 Fax: +1-201-930-0099

WW1-1010

