KEYENCE

NEW Dual Display Digital Fiberoptic Sensor
FS-V20 Series

CE

World's First Fiberoptic Sensor
with Dual Digital Display

VISUAL^2

Dual Display Digital Fiberoptic Sensor
FS-V20 Series

State-of-the-Art

KEYENCE's Digital Fiberoptic Sensors continue to develop in pursuit of State-of-the-Art performance

Dual Digital Display Monitor

Industry's First

Simple and reliable settings >>>>› Page 4

Once again KEYENCE has pulled ahead of everyone else in fiberoptic sensor development. The FS-V20 Digital Fiberoptic Sensor incorporates a Dual Digital Display Monitor, letting you view both the Preset and Current Values. It also offers simpler and more reliable settings than any other fiberoptic sensor. (Patent pending)

Examples of how the FS-V20's Dual Digital Displays can be configured.

- Preset Value and Current Value
- Peak Value and Bottom Value
- Mode Status Display
- And more

VISUAL^2

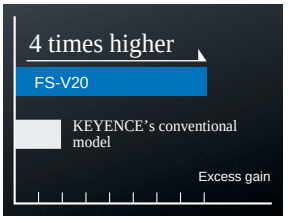
Dual Display Digital Fiberoptic Sensor
FS-V20 Series

Most Powerful Beam

Up to 1800mm (Thrubeam)

Longer detecting distance in harsh environments >>>>> Page 6

The FS-V20's newly developed processor delivers up to 4 times the power of conventional KEYENCE fiberoptic sensors. This enhanced power ensures stable detection in harsh conditions, such as when the detecting distance is too short due to a dark-colored target or when the sensor needs to be mounted in a dirty or dusty environment. The FS-V20's ULTRA High Power overcomes such challenges, eliminating sensing problems that arise from insufficient power.

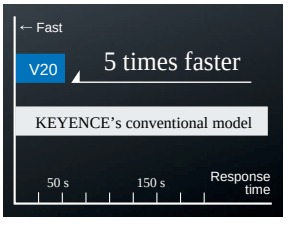


Highest Speed and Accuracy

Response Speed: 50 s

Without being influenced by temperature or environmental changes >>>>> Page 7

The FS-V20 is the world's first through-beam sensor that detects gold wires as thin as 0.005mm in diameter, and the built-in digital amplifier ensures the industry's highest response speed of 50 s. Not only fast, the FS-V20 provides the highest precision as well.

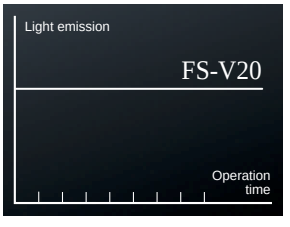


Stable Detection Over a Longer Lifetime

Revolutionary devices for more stable detection >>>>> Page 8

Fiberoptic sensors must maintain even light emissions, since any fluctuation will lead to unstable detection. The FS-V20's 4-element red LED gives it a long lifetime, while the S-APC circuit keeps light emissions even.
(Patent pending)

Stable and Longer Lifetime



Industry’s First Dual Digital Display Monitor

Benefits Provided by Dual Digital Display Monitor

Controlling the subtle tension of transparent film

Preset Value and Current Value

Preset Value can be changed while monitoring the amount of light received.

Unlike conventional sensors, the FS-V20 does not make you choose between Preset Value and Current Value display. This means that you can make Preset Value changes while monitoring the amount of light received, which facilitates reliable sensor configuration. Preset Value and Excess Gain (%) can also be displayed during operation.

Preset Value Current Value

Set button
Automatic calibration setting

Dual Digital Display Monitor
Dual monitor in green (for Preset Value) and red (for Current Value)

Bright and clear operation indicator
Lit with output turned ON

Power mode selection

FINE mode — 

TURBO mode — 

SUPER mode — 

Timer function setting

OFF delay timer — 

On delay timer — 

One shot timer — 

Mode Status Display

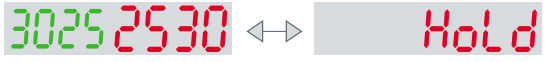
Easy-to-understand, simple operation.
The Dual Digital Display Monitor displays current amplifier mode.

Conventional, single-monitor models do not allow you to check amplifier mode status while making setting changes. The FS-V20’s Dual Digital Display Monitor gives you full access to amplifier status for easy setup, even for operators new to the product.

Peak Value and Bottom Value

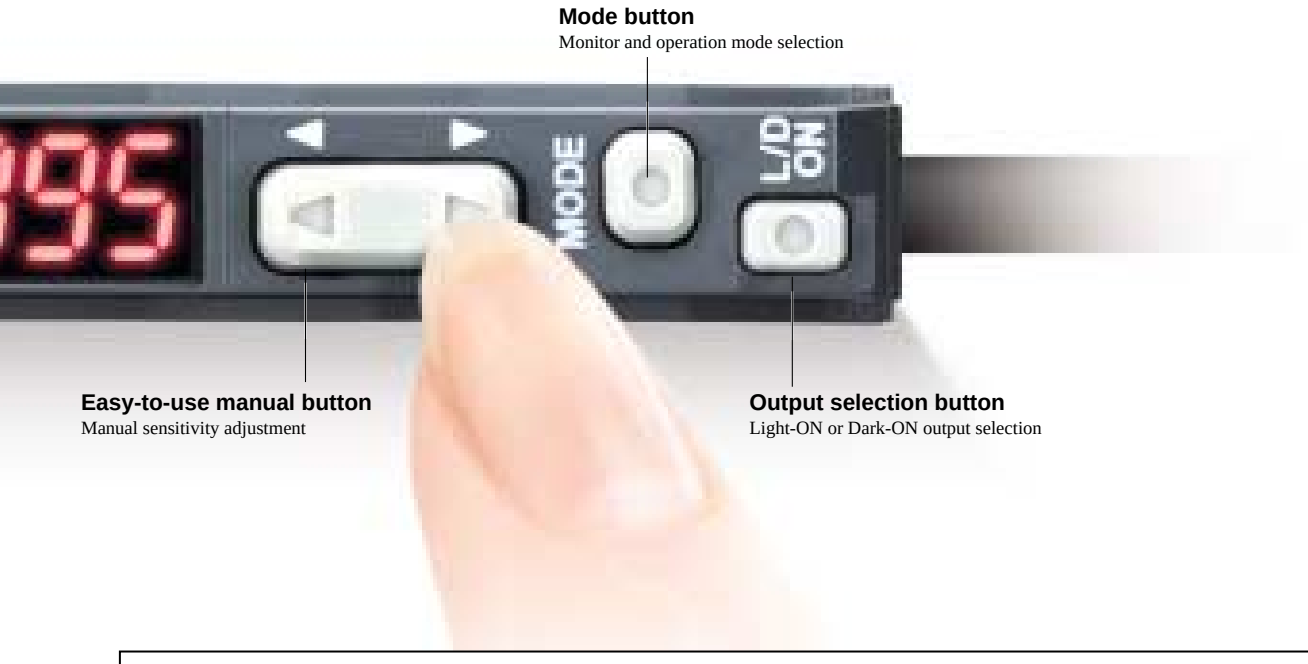
The Hold function makes it possible to display both peak and bottom values simultaneously.

Unlike single-monitor sensors, the FS-V20 does not make you choose one display at the expense of another. Its Dual Digital Display Monitor is ideal for the detection of high-speed targets or for checking fluctuations in received light intensity.



Peak value Bottom value

Counting chip components travelling at a high speed



Mode button
Monitor and operation mode selection

Easy-to-use manual button
Manual sensitivity adjustment

Output selection button
Light-ON or Dark-ON output selection

Power Saving Function

Ensures lowest power consumption in its class.

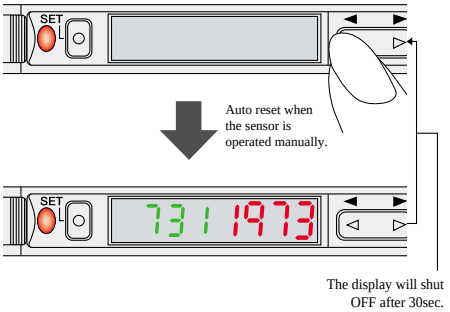
The digital display turns OFF if the sensor is not operated for 30sec. At this time power consumption will not exceed 480mW if a number of sensor are used in combination.

ECO-HALF mode provides a low energy option with display.

The red indicator is lit at the time of detection.

The green indicator is lit when nothing is detected.

Auto Display-OFF Function (480mW Max.)

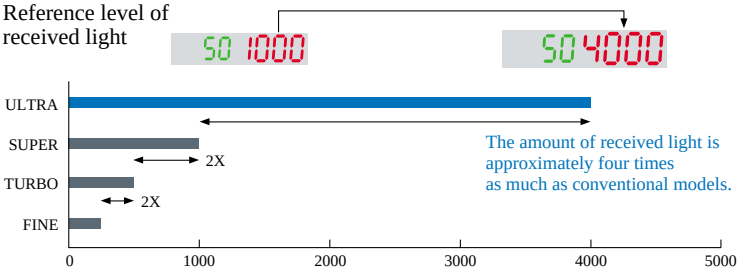


Industry’s Most Powerful Beam

Ensures easy optical axis adjustments and stable detection while in operation.

A newly developed processor ensures the high power of the FS-V20 Series. High power is important because it helps ensure stable detection, and this enables the FS-V20 to provide reliable detection in all environments where thin fibers are used, even in poor or deteriorating conditions.

4 times the power of conventional fiberoptic sensors



A sensing distance of 1500mm is achieved by the standard FU-7F Thrubeam Fiber Unit.

Industry’s Longest Detecting Distance

Advantages and benefits of ULTRA High-Power

Longer detecting distance

When detecting dark-colored targets with reflective-type sensors, the sensitivity must be set as high as possible to obtain a greater detecting distance. Insufficient sensor power may lead to unstable detection. The FS-V20’s ULTRA High Power ensures both a longer detecting distance and a wider margin for stable detection.

Detecting dark colored targets at a long distance

Use in harsh environments

Long usage gradually affects a sensor’s sensitivity as dust and dirt accumulate on the sensor head. Without enough power, the sensor may fail in harsh conditions where water, oil, or mist are present. The FS-V20’s ULTRA High Power means that stable detection is not at the mercy of harsh environmental conditions.

Detecting labels in a dusty environment

Easy optical axis adjustment

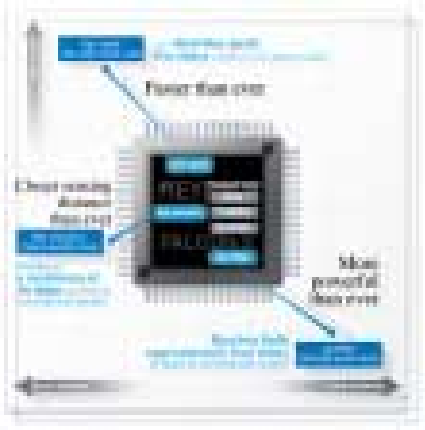
It is difficult to find the optimum optical axis position, especially when using a thin-type fiber unit. The FS-V20’s ULTRA High Power ensures both a longer detecting distance and easy optical axis adjustment, even with thin-type fiber units.

Detecting connector pins with thin-sleeve type heads

Industry’s Highest Speed and Accuracy

Provides a wider range of applications than conventional models with the industry’s highest speed and accuracy.

In addition to its ULTRA High Power mode, the FS-V20 has 2 other sensing modes that solve problems such as the failure of sensitivity settings due to slow response and received light saturation. These modes expand the FS-V20’s sensing capabilities while allowing it to avoid these problems.



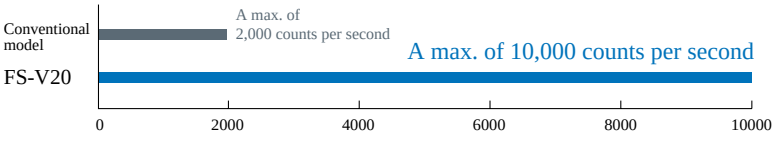
Ultra High-speed Mode- High Speed

Industry’s Highest Speed

The industry's highest response speed of 50µs for digital sensors

The industry-best response speed of 50µs is achieved without adversely affecting the FS-V20’s easy-to-configure sensor. The unit detects up to 10,000 targets per second, while making it possible to monitor the digital value settings for the targets.

* Conventional models have a response speed of 250µs and perform a maximum of 2,000 counts per second.



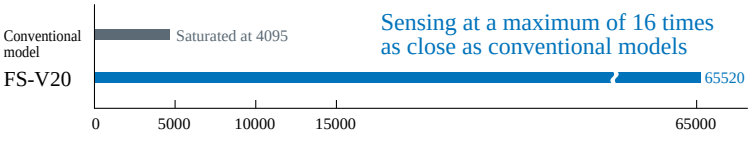
Detecting register marks moving at a high speed

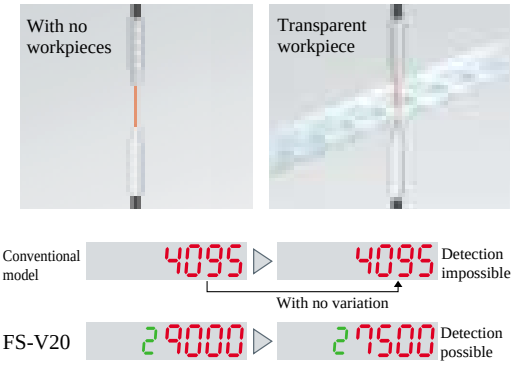
Close-proximity Mode- High Resolution

New Theory

With no saturation in close proximity

Saturation makes it difficult to make sensitivity adjustment with conventional high-power digital sensors (i.e., the incident level is set to 4,095) when sensing targets in close proximity. The FS-V20’s high-resolution mode expands the maximum incident level to 65,520 from the conventional 4,095 for sensing close targets. (Patent pending.)

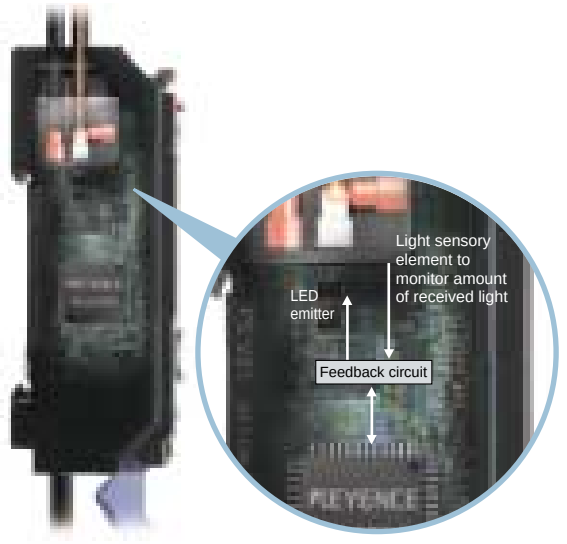




Stable Detection Over a Long Lifetime

Provided with two new devices for stable, high-precision detection

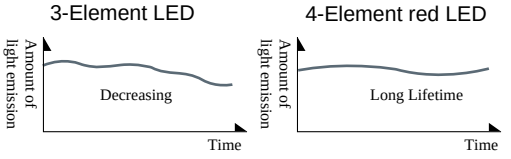
It is essential for fiberoptic sensors to be able to maintain stable light emissions for long periods of time. Fluctuations or decreased light emissions over a long period may compromise high-precision detection. The FS-V20's 4-element red LED and S-APC function solve these problems where conventional sensors fail.



4-Element Red LED

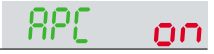
New Technology

Conventional 3-element LED's characteristically lose brightness gradually with extended usage. This means the sensitivity is also decreasing little by little. However, Keyence s 4-element red LED features a longer service life without light emission deterioration.



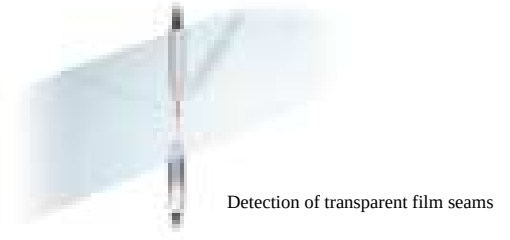
S-APC Function

Selectable



Ensures high-precision detection in clean environments.

Changes in temperature or environmental conditions may adversely affect high-precision detection. The S-APC (Selectable Auto-Power Control) feature maintains constant light emission by regulating current input to the light emission element.

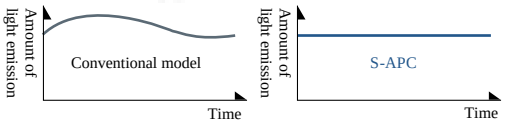


Detection of transparent film seams

S-APC Features

Maintaining constant light emission

Conventional models do not regulate light emission, leading to fluctuations in the amount of received light over a long period of time. The S-APC feature continuously monitors and corrects light emission.



S-APC may be deactivated

Since the S-APC feature is not required for typical use, the FS-V20 allows you to turn the S-APC function ON and OFF as necessary.

Ease of Forecast Maintenance and Troubleshooting

The END APC indicator for forecast maintenance will start flashing if an excessive load is imposed on the LED.

Simple Control and Display

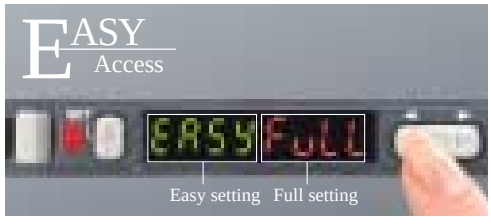
Surpassing conventional control methods

The FS-V20 was designed in pursuit of higher functionality and performance while maintaining simple control and display features. Keyence's long history of fiberoptic sensor development enabled us to give the FS-V20 an exquisite balance of easy-to-use controls and features.

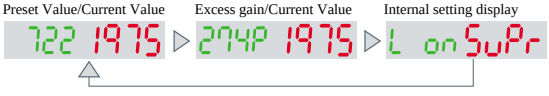
EASY Access

The EASY access setting is ideal for standard applications while the FULL access setting enables all selectable features.

All sensor manufacturers work to incorporate higher functionality and improved performance when developing new models. To these pursuits Keyence adds the quest for uniqueness. The EASY access setting makes it possible to skip a variety of functions and provide a simple display showing the power selection and timer setting modes only. (Patent pending.)



Full Access mode



EASY Access mode

Simple Sensitivity Settings

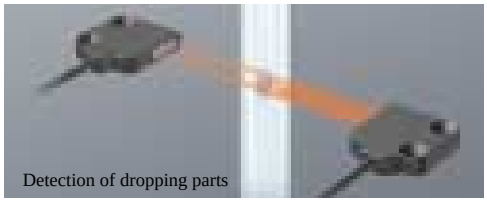
Allows direct settings and adjustments with no mode changes.

Full Automatic Calibration

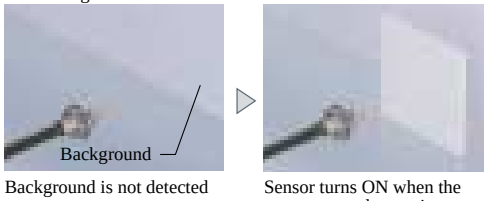
When detecting falling or minute targets, it is very difficult to make sensitivity adjustments when the sample targets are fixed. Fully automatic calibration is unique to the digital-type sensor, allowing you to generate a suitable sensitivity setting just by letting the sample target pass through the sensing area.

Maximum Sensitivity Settings

The sensitivity of the FS-V20 can be set to the maximum level without background detection. This feature makes it possible to set the sensitivity without detecting targets, while suppressing the influence of dust on sensor operation.



With background



Background is not detected

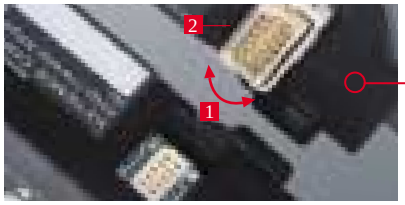
Sensor turns ON when the target enters the sensing area

Highly Reliable Expansion

Keyence's established 1-Line system is also featured on the FS-V20 Series

The sensor saves wiring with no accessories or additional man hours required. By supplying power through the connector on the side, each sensor will save two wires that are required when using conventional sensors.

Dedicated Expansion Connector for 1-Line System



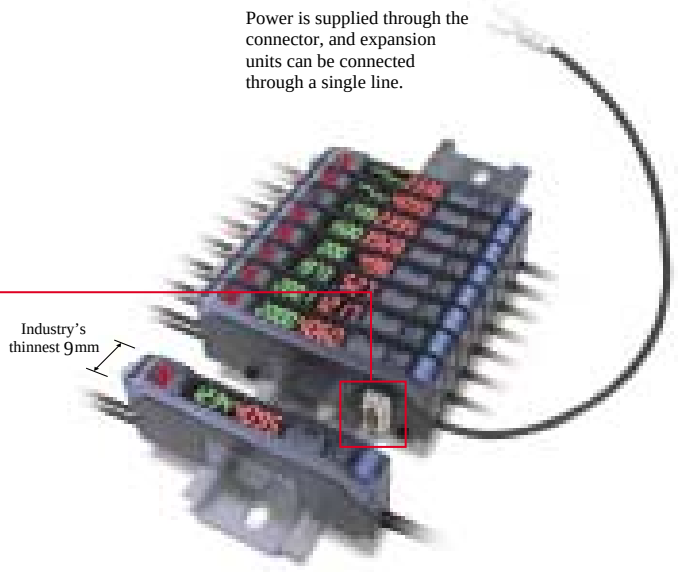
1 Shock absorber function incorporated

The connector is provided with a spring mechanism for shock absorption.

2 Dust cover provided

The dust cover prevents the exposure of the connector pins regardless of whether the expanded sensors are misaligned.

Power is supplied through the connector, and expansion units can be connected through a single line.



Use in Combination with Other Sensor Models

A full line of models showing proven results and high reliability.

It is possible to expand the scale of FS-V20 systems using other series of sensors in combination, provided that these sensors support the single-line method. When FS-V20 units are used for laser sensor timing adjustment, its interference prevention feature activates to prevent system failures.

From left to right

CZ-K1:
RGB Digital color sensor

FS-V22R:
Dual digital

LV-22A:
Long-distance laser

PS-T2:
Photoelectric sensor with separate amplifier

Mutual Interference Prevention Function

Stable mutual interference prevention for precise detection

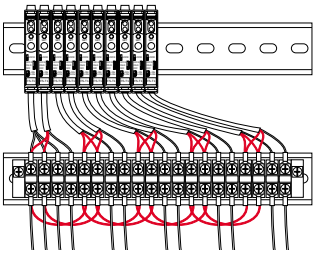
The FS-V20 Series electronically delays light emission timing when another sensor is connected. This allows for mutual interference prevention.

*Contact your local Keyence office for numbers of other models offering mutual interference prevention.

Mode	TURBO/SUPER/ULTRA	FINE
Number of models preventing mutual interference	8	4

1-Line Wire Connection System Significantly Reduces Wiring Time

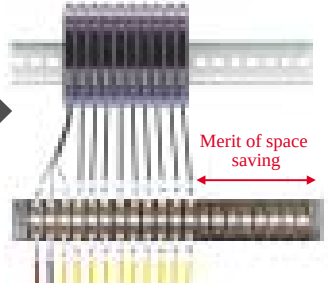
Conventional method



All red wires will be unnecessary.

- Number of terminal blocks: 20
- Number of wires: 58
- Number of jumper wires: 8
- Required working time: 120 min.

Single-line method



- Number of terminal blocks: 12
- Number of wires: 24
- Number of jumper wires: 0
- Required working time: 50 min.

Wide Variety of Photoelectric Sensors

Sensor Variations for 1-Line Wire-Saving Connection System

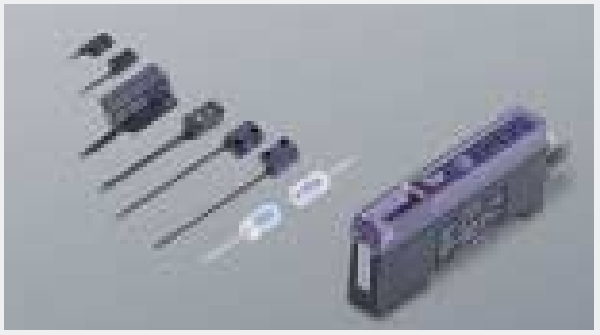
Long Distance Digital Laser Optic Sensors
LV Series

By using a semiconductor laser as the light source, the LV Series forms a sharp beam spot even at long distance.

RGB Digital Fiberoptic Sensors
CZ Series

The CZ Series works using a RGB color element, a detection method that is impossible using conventional light quantity receiving methods.

One-Touch Calibration Photoelectoric Sensors
PS01 Series



Long distance, small spot, Teflon®-sheathed a variety of sensor heads cover every application.

Combination of Main-unit and Expansion-unit

Main-units

Red LED NEW — Green LED NEW

FS-V21R **FS-V21G** — Dual Display Digital Fiberoptic Sensor

FS-V1 — 2-output Fiberoptic Sensor

LV-21A — Laser Optic Sensor

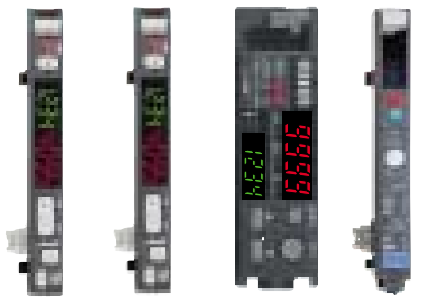
CZ-K1 — RGB Digital Sensor

PS-T1 — Photoelectric Sensor

+

Expansion-units

Red-LED NEW — Green-LED NEW



FS-V22R/-V20R **FS-V22G** — Dual Display Digital Fiberoptic Sensor

LV-22A — Laser Optic Sensor

PS-T2 — Photoelectric Sensor

Complete Line of Fiber Units

Select the type best suited to your application

ToughFlex

Armored ToughFlex

A flexible stainless steel jacket protects the fiber from daily wear.

Reflective type: FU-67G
Thrubeam type: FU-77G

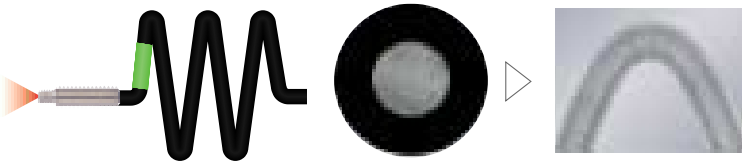
- Resists entanglement or shock
- More flexible than conventional spiral tubes
- Minimum bend radius: 10mm

Super ToughFlex

Flexible wiring without any bending restrictions or optical attenuation.

Multi-core Unit
613cores

Reflective type: FU-67V
Thrubeam type: FU-77V



The 613-core fiber (42 m dia.) is nearly impervious to excessive bending.

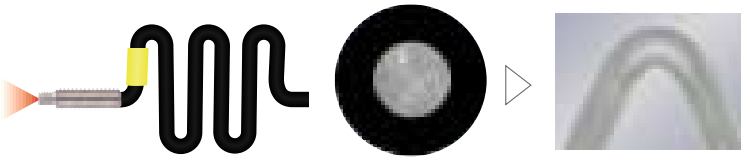
Super ToughFlex will not break even when sharply bent.

ToughFlex

Easy to handle with a minimum bending radius of 2 mm and minimal optical attenuation.

Multi-core Unit
217cores

Reflective type: FU-67
Thrubeam type: FU-77

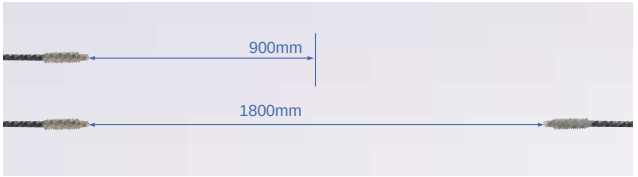


The 217-core fiber (66 m dia.) is hardly affected by excessive bending.

ToughFlex will not break even when sharply bent.

ToughFlex and Super ToughFlex fiber cores are used for many Keyence's fiber units.

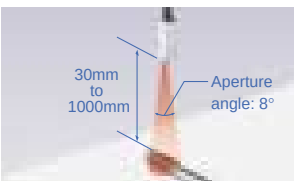
ULTRA Long Distance Detection



Reflective type: FU-61
Thrubeam type: FU-71

NEW

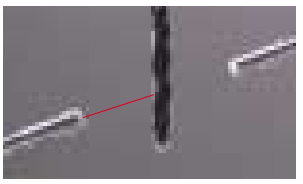
- ULTRA High-Power , resistant to dirty and dusty environment
- ULTRA Long detecting distance up to 900mm(FU-61), 1800mm(FU-71)
- Durable M6 stainless steel housing



Long detecting distance, high-power type

FU-40

- High-power reflective type resistant to dust
- Narrow-beam type for precise aiming at the target
- Armored ToughFlex fiber unit is available (model: FU-40G)



Long detecting distance, entirely Teflon®-sheathed type

FU-92

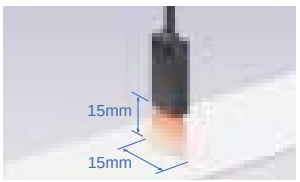
- Usable in most environment due to its Teflon®-sheathed body.
- Resists oil and chemicals.

Area Detection

10 mm width area detection, thrubeam type

FU-12

- Even if the target vibrates, the 10 mm width detection area allows it to be detected stably.
- The minimum bend radius is 2 mm thanks to the use of ToughFlex fiber.

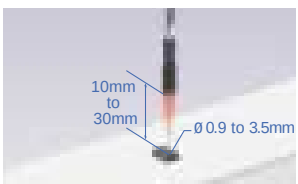


15 mm width area detection, reflective type

FU-11

- The wide beam area ensures stable detection of targets that are difficult to detect.
- Its original optical system has realized a truly compact high-performance sensor. Combined with the FS-V20, the
- FU-11 eliminates mutual interference.

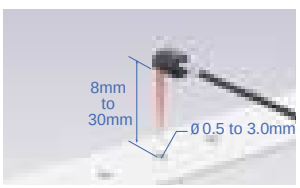
Small Beam Spot



Adjustable small beam spot type

FU-10

- The beam spot diameter is freely adjustable between 0.9 and 3.5 mm.
- Designed for easy installation and adjustment.

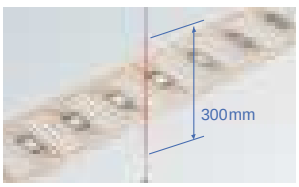


Adjustable focus, side-view lens

F-5HA

- Space-saving, side-view lens
- Produces a small beam spot at a long distance.
- The beam spot diameter is adjustable between 0.5 and 3.0 mm.

Thin Sleeve

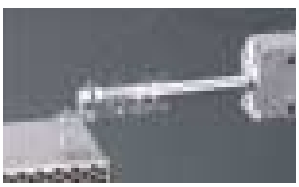


Thin-sleeve, Thrubeam type

FU-75F

- Thin sleeve with a diameter of 0.82 mm
- Long detecting distance: 300mm

High-Flex

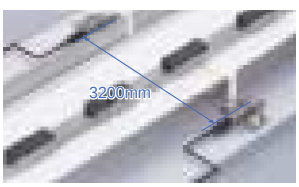


High-flex, reflective type

FU-69X

- Provides higher flexibility than an electric wire.
- R4 models are resistant to repeated bends.

Narrow Beam

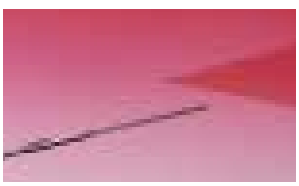


Long-distance, Side-view type

FU-16

- High-power unit with a side-view lens built in.
- Flexible fiber that can be laid out with ease.

Heat Resistant Type



Heat resistant fiber type

FU-81C

- Resists temperatures up to 350ßC (+662ßF)
- Moreover, the fiber unit is protected with a spiral tube.

For Semiconductor/Liquid Crystal Detection

Long detecting distance, definite-reflective type

FU-38R

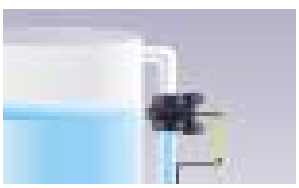
- Even a circuit board with deflection can be detected easily at a distance of 0 to 17 mm.

Super narrow-beam, Side-view type

FU-18

- Suitable for wafer mapping
- Super narrow-beam: aperture angle of 2ß.

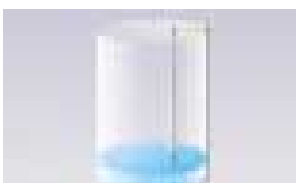
Liquid Level



ToughFlex tube-mountable liquid level detection type

FU-95Z

- Mountable to various tubes ranging from small to large diameters.
- Uses a ToughFlex fiber



ToughFlex immersion type liquid level detection type

FU-93Z

- Teflon°-sheathed immersion type
- Uses a ToughFlex fiber.

A Variety of Fiber Units

Thrubeam

(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type	Shape	Detecting distance *1 [mm] ULTRA TURBO, UPER TURBO, TURBO, FINE	Detecting distance *1 [mm] HIGH RESOLUTION, HIGH SPEED	Smallest detectable object [mm]*2	Minimum bend radius [mm]	Features	Model
Thrubeam – Standard	ø3	1500(1000) 760(640) 640(500) 320(250) *3	(130) (95) Lens F-1, F-2, F-4, F-5	ø0.005	R25	Long detecting distance	FU-5F (2m Free cut)
	M4						FU-7F (2m Free cut)
	M6	1800(1500) 1100(880) 900(720) 450(360)	(180) (160)	ø0.005		Ultra Long detecting distance	FU-71 (2m Free cut) NEW
	M4	700(560) 370(300) 300(240) 150(120)	(64) (60) Lens F-1, F-2, F-4, F-5	ø0.005	R4	A minimum bend radius of 4 mm	FU-78 (2m Free cut)
Thrubeam – ToughFlex	ø3			ø0.005	R2	ToughFlex	FU-5FZ (2m Free cut)
	M4	1200(960) 570(450) 460(360) 230(180)	(96) (80)		R0.5	Super ToughFlex	FU-77V (2m Free cut)
					R2	ToughFlex	FU-77 (2m Free cut)
	M4	*3	Lens F-1, F-2, F-4, F-5		R10	Armored ToughFlex	FU-77G (1m)
Thrubeam – High-flex	ø1.5	400(320) 220(175) 200(160) 100(80)	(40) (30)	ø0.005	R4	High-flex	FU-59 (1m Free cut)
	M3						FU-79 (1m Free cut)
Thrubeam – Thin-sleeve	ø0.82 M3 Do not bend sleeve.	300(240) 150(120) 120(96) 75(60)	(30) (20)	ø0.005	R10	Thin sleeve	FU-75F (1m Free cut)
	ø1.65 M4 Min. bend radius of sleeve: 10 mm	1500(1000) 760(600) 640(500) 320(250)	(125) (95)	ø0.005	R25	Long detecting distance, sleeve	FU-73 (2m Free cut)
Thrubeam – Side-view	ø0.82 ø2.5 Do not bend sleeve.	200(160) 80(64) 60(48) 30(24)	(12) (10)	ø0.005	R25	Side-view, thin sleeve	FU-32 (1m Free cut)
	ø1.2 ø3	400(320) 250(200) 200(160) 100(80)	(40) (40)	ø0.005		Space-saving, side-view	FU-34 (2m Free cut)
	ø4	3200(2600) 1700(1300) 1300(1000) 800(640)	(320) (230)	ø0.1	R10	Long detecting distance, side-view	FU-16 (2m Free cut)
Thrubeam – Area detection		1200(960) 1000(800) 800(640) 600(480)	(240) (150)	ø1.2 (TURBO mode)*4 ø0.3 (FINE mode)	R2	Area detection	FU-12 (2m Free cut)
Thrubeam – Side-view	ø4	2000(1600) 1300(1000) 1000(800) 650(520)	(280) (230)	ø0.1	R10	Wafer-mapping	FU-18 (2m Free cut)
Thrubeam – Heat resistant	M4	600(480) 370(300) 300(240) 150(120)	(64) (60) Lens F-1, F-2	ø0.005	R25	Heat resistance: 300°C(572°F), glass fiber	FU-84C (2m)
	M4	1000(800) 700(560) 500(400) 250(200)	(96) (90) Lens F-1, F-2, F-5		R0.5	Heat resistance: 100°C(212°F), plastic fiber	FU-86Z (2m Free cut)
	M4	1200(1000) 760(600) 640(500) 320(250)	(130) (95) Lens F-1, F-2, F-5		R25	Heat resistance: 105°C(221°F), plastic fiber	FU-86 (2m Free cut)
	M4	800(640) 500(400) 400(320) 200(160)	(80) (80)		R35	Heat resistance: 180°C(356°F), plastic fiber	FU-88 (2m Free cut)
Thrubeam – Oil-proof, chemical proof	ø5 (22)	3600(2900) 2500(2000) 2200(1700) 1100(880) *5	(440) (300)	ø0.2	R40	Teflon®-sheathed	FU-92 (2m Free cut)
	ø5 (23)	1800(1400) 870(700) 700(560) 350(280)	(150) (100)	ø0.1		Teflon®-sheathed, side-view	FU-96 (2m Free cut)

*1. Each detecting distance in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. The smallest detectable object was determined at the optical detecting distance and sensitivity setting.
*3. Lenses can be attached only to screw-mount type heads.
*4. Detecting range varies depending on detecting distance and target diameter.
*5. 3600 is assumed as maximum because the fiber cable has the length of 2m.

Reflective

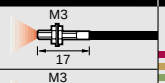
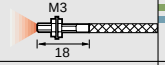
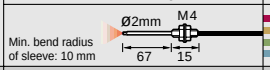
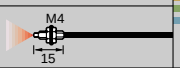
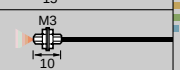
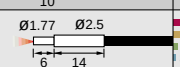
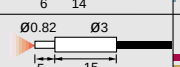
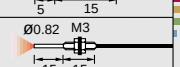
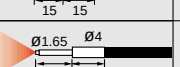
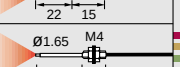
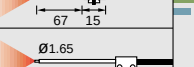
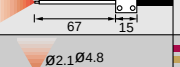
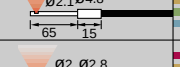
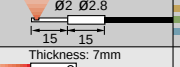
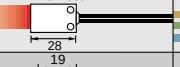
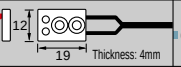
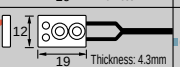
(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type		Shape	Detecting distance *1 *2 [mm] ULTRA TURBO, SUPER TURBO, TURBO, FINE	Detecting distance *1 *2 [mm] HIGH RESOLUTION, HIGH SPEED	Smallest detectable object [mm]*3	Minimum bend radius [mm]	Features	Model
Reflective	Standard	ø3	500(400) 300(240) 200(160) 100(80)	(40) (40)	ø0.005 (gold wire)	R25	Long detecting distance	FU-4F (2m Free cut)
		M6						FU-6F (2m Free cut)
		M6	900(720) 450(360) 300(240) 150(120)	(60) (60)			Ultra Long detecting distance	FU-61 (2m Free cut) NEW
		M4	500(400) 300(240) 200(160) 100(80)	(40) (40)			Long detecting distance	FU-66 (2m Free cut)
	Coaxial	ø3	500(400) 300(240) 200(160) 100(80)	(40) (40)			Suitable for positioning	FU-23X (50cm)
		M6	480(380) 240(190) 160(130) 80(65)	(32) (32)	ø0.005 (gold wire)	R25		FU-25 (2m Free cut)
		M3	56(45) 28(22) 20(16) 12(10) Lens F-2HA, F6-HA	—			0.2 mm spot diameter with F-2HA	FU-21X (50cm)
		M3	220(176) 110(88) 70(56) 35(28)	(12) (12) Lens F-2HA, F-3HA, F-4HA, F-5HA, F-6HA		R25	0.4 mm spot diameter with F-2HA	FU-35FA (1m Free cut)
	ToughFlex	ø3	260(200) 130(100) 80(64) 45(36)	(16) (16)	ø0.005 (gold wire)	R2	ToughFlex	FU-4FZ (2m Free cut)
		M4						FU-66Z (2m Free cut)
		M6	360(280) 180(140) 130(100) 65(50)	(24) (24)	ø0.005 (gold wire)	R0.5	Super ToughFlex	FU-67V (2m Free cut)
						R2	ToughFlex	FU-67 (2m Free cut)
		M6				R10	Armored ToughFlex	FU-67G (1m)
		Thickness: 5.2mm	30 to 1000 (30 to 800) 30 to 320(30 to 260) 30 to 220(30 to 180) 30 to 120 (30 to 95)	—	ø0.3 (gold wire)	R2	Narrow beam (8°)	FU-40 (2m Free cut)
		Thickness: 5.2mm				R10	Narrow beam (8°) Armored ToughFlex	FU-40G (1m)

*1. Each detecting distance in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. Standard target: White mat paper
*3. The smallest detectable object was determined at the optimal detecting distance and sensitivity setting.

Reflective

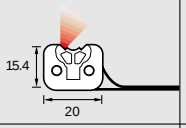
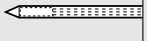
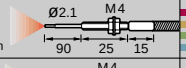
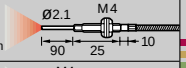
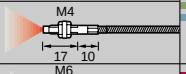
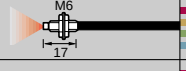
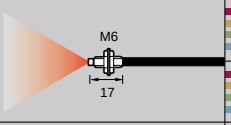
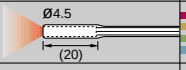
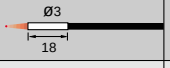
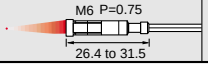
(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type		Shape	Detecting distance *1 *2 [mm] ULTRA TURBO,SUPER TURBO,TURBO,FINE	Detecting distance *1 *2 [mm] HIGH RESOLUTION, HIGH SPEED	Smallest detectable object [mm] *3	Minimum bend radius [mm]	Features	Model
Reflective	ToughFlex		130(100) 65(52) 45(36) 25(20)	(10) (10) Lens F-2HA, F-3HA, F-4HA, F-5HA, F-6HA	ø0.005 (gold wire)	R2	Coaxial, Ø0.4 mm spot using F-2HA	FU-35FZ 2m Free cut
						R10	Coaxial with Ø0.4 mm spot using F-2HA Armored	FU-2303 1m
			90(70) 45(36) 35(28) 20(16)	(8) (8)	ø0.005 (gold wire)	R2	Thin sleeve ToughFlex	FU-63Z 2m Free cut
	High-flex		110(90) 55(44) 40(32) 25(20)	(8) (8)	ø0.005 (gold wire)	R4	High-Flex	FU-48 2m Free cut
								FU-68 2m Free cut
			50(40) 25(20) 20(16) 15(12)	(4) (4)				FU-49X 1m
								FU-69X 1m
	Thin-sleeve		36(30) 12(10) 10(8) 8(6)	——	ø0.005 (gold wire)	R25	Narrow-beam, small-beam spot	FU-22X 50cm
			28(22) 14(11) 10(8) 6(5)	——		R4	Flush-mount, thin-sleeve	FU-45X 50cm
								FU-65X 50cm
			120(100) 70(56) 50(40) 30(24)	(12) (12)		R25	Flush-mount, sleeve	FU-43 2m Free cut
							Screw-mount	FU-63 2m Free cut
							Long-sleeve, Flat type	FU-63T 2m Free cut
	Side-view		120(96) 60(48) 40(32) 20(16)	(8) (8)	ø0.005 (copper wire)	R25	Long-sleeve	FU-33 50cm
			54(43) 27(22) 20(16) 13(10)	(4) (4)		R10	Compact	FU-31 2m Free cut
	Area detection		5 to 160(5 to 130) *4 5 to 130(5 to 100) 5 to 90(5 to 72)	(5 to 36) (5 to 36)	ø0.005 (gold wire)	R25	Area detection	FU-11 2m Free cut
	Definite-reflective		3 (Center of detecting distance)	(3)(center of detecting distance)	ø0.005 (gold wire)	R10	Almost unaffected by target color and background	FU-37 2m Free cut
			6 (Center of detecting distance)	(6)(center of detecting distance)				FU-38 2m Free cut
			0 to 4(0 to 4)	——	ø0.08 (copper wire)		Almost unaffected by target background, side-by-side detection available	FU-38V 2m Free cut
			0 to 14(0 to 14)	(0 to 14)	ø0.3 (copper wire)	R25	Almost unaffected by target color and background, long detecting distance	FU-38R 2m Free cut

*1. Each detecting distance in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. Standard target: White mat paper.
*3. The smallest detectable object was determined at the optimal detecting distance and sensitivity setting.
*4. FU-11 cannot be used in ULTRA Turbo mode.

Reflective

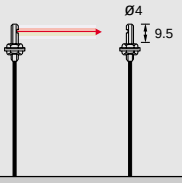
(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type		Shape	Detecting distance *1 *2 [mm] ULTRA TURBO, SUPER TURBO, TURBO, FINE	Detecting distance *1 *2 [mm] HIGH RESOLUTION, HIGH SPEED	Smallest detectable object [mm] *3	Minimum bend radius [mm]	Features	Model
Reflective	Liquid-level		Transparent tube of 4 to 26 mm dia.	——	——	R2	For mounting to a tube	FU-95Z (2m Free cut)
						R10		FU-95 (2m Free cut)
			Liquid (except for milky white liquids)	——	——	R0.5 *4	Liquid level detection by sensor head immersion. Teflon®-sheathed	FU-93Z (2m Free cut)
						R25 *4		FU-93 (2m Free cut)
			Liquid (except for milky white liquids)	——	——	R40 *5	Liquid level detection by sensor head immersion. Teflon® covered for high durability against chemicals. FU-94C heat resistant up to 200°C (392°F)	FU-94C (2m)
	Heat-resistant	Min. bend radius of sleeve: 10 mm 	360(280) 180(140) 120(100) 60(50)	(24) (20)	ø0.005 (gold wire)	R25	Heat-resistance: 350°C(662°F), glass fiber with sleeve	FU-81C (1m)
		Min. bend radius of sleeve: 10 mm 	420(340) 210(160) 140(110) 70(55)	(28) (25)			Heat-resistance: 300°C(572°F), glass fiber with sleeve	FU-82C (1m)
							Heat-resistance: 300°C(572°F), glass fiber	FU-83C (1m)
			360(280) 180(140) 130(100) 65(50)	(24) (24)		R5	Heat-resistance: 100°C(212°F), plastic fiber	FU-85Z (2m Free cut)
			500(400) 300(240) 200(160) 100(80)	(40) (40)		R25	Heat-resistance: 105°C(221°F), plastic fiber	FU-85 (2m Free cut)
			420(340) 210(170) 140(110) 70(55)	(28) (25)		R25	Heat-resistance: 180°C(356°F), plastic fiber	FU-87 (2m Free cut)
	Oil-proof, Chemical proof		220(180) 110(90) 85(70) 60(50)	(24) (23)	ø0.005 (gold wire)	R40	Teflon®-sheathed	FU-91 (2m Free cut)
	Ultra-small beam spot		5±1 with beam spot diameter of 0.1 mm	——	——	R25	Minute target detection, Space saving	FU-20 (50cm)
	Adjustable beam spot		10 mm to 30 mm with beam spot diameter of ø0.9 to ø3.5 mm		——	R25	Beam spot can be adjusted according to target size.	FU-10 (2m Free cut)

*1. Each detecting distacne in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. Standard target: White mat paper.
*3. The smallest detectable object was determined at the optimal detecting distance and sensitivity setting.
*4. The minimum bend radius of the Teflon-sheathed section is R40mm.
*5. The 80-mm section from the tip cannot be bent.

Lens for Thrubeam type

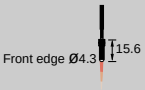
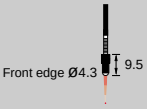
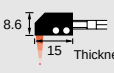
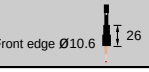
(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type		Configuration	Applicable fiber units	Detecting distance *1 [mm] ULTRA TURBO, SUPER TURBO,T URBO, FINE	Detecting distance *1 [mm] HIGH RESOLUTION, HIGH SPEED	Features	Model
Thrubeam	Side-view		FU-7F,86	1600(1300) 1000(800) 800(640) 400(320)	(160) (130)	Space-saving, side-view type	F-1*2 Heat resistance: 70˚C (158˚F)
			FU-86Z	1200(960) 750(600) 600(480) 300(240)	(120) (110)		
			FU-77,77V	1040(830) 670(530) 540(430) 260(200)	(100) (90)		
			FU-78	880(700) 550(440) 440(360) 220(180)	(85) (80)		
			FU-84C				
	Long detecting distance		FU-7F,86	3600(3600) 3600(3400) 3600(2800) 1800(1400) *3	(720) (650)	Greatly increases the detecting distance. Aperture angle: 15°	F-2 Heat resistance: 300˚C (572˚F)
			FU-86Z	3600(3600) 3600(3000) 3200(2600) 1600(1300) *3	(640) (550)		
			FU-77,77V	3600(3600) 3600(2800) 3000(2400) 1500(1200) *3	(600) (500)		
			FU-84C				
			FU-78	3600(3600) 3000(2400) 2400(1900) 1200(950) *3	(480) (400)		
	Ultra-long detecting distance		FU-7F	3600(3600) 3600(3600) 3600(3600) 3000(2400) *3	(1200) (1000)	Greatly increases the detecting distance. Aperture angle: 8˚	F-4 Heat resistance: 70˚C (158˚F)
			FU-77,77V	3600(3600) 3600(3600) 3600(3600) 2500(2000) *3	(1000) (800)		
			FU-78	3600(3600) 3600(3600) 3600(3200) 2000(1600) *3	(800) (650)		

*1. Each detecting distance in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. When using the F-1 at a temperature of 70°C(158°F) or more, specify the "Heat-resistant F-1".
*3. "3600" is assumed as maximum because the fiber cable has the length of 2m.

Lens for Reflective type

(ULTRA TURBO SUPER TURBO TURBO FINE HIGH RESOLUTION HIGH SPEED)

Type		Configuration	Applicable fiber units	Detecting distance *1 *2 [mm] ULTRA TURBO, SUPER TURBO, TURBO, FINE	Detecting distance *1 *2 [mm] HIGH RESOLUTION, HIGH SPEED	Beam spot diameter	Model
Reflective	Focusing lens		FU-35FA FU-35FZ	7±2(7±2) 7±2(7±2) 7±2(7±2)	(7±2)	0.4mm	F-2HA*3
			FU-21X	7±2(7±2) 7±2(7±2) 7±2(7±2)	—	0.2mm	
	Long detecting distance, high focusing lens		FU-35FA FU-35FZ	15±2(15±2) 15±2(15±2) 15±2(15±2) 15±2(15±2)	(15±2) (15±2)	0.5mm	F-4HA
	Long detecting distance, high focusing lens		FU-35FA	65(52) 55(44) 45(36)	(12) (12)	0.4mm (within the detecting of 0 to 20mm)	F-3HA*3
			FU-35FZ	35(28) 30(24) 25(20)	(10) (10)		
	Adjustable beam spot, side-view		FU-35FA FU-35FZ	8 to 30(8 to 30) 8 to 30(8 to 30) 8 to 30(8 to 30)	—	0.5 to 3.0mm	F-5HA*3
			FU-21X	8 to 30(8 to 30) 8 to 30(8 to 30) 8 to 30(8 to 30) 8 to 30(8 to 30)	—		
	Long detecting distance, focusing lens		FU-35FA FU-35FZ FU-21X	35±3(35±3) 35±3(35±3) 35±3(35±3) 35±3(35±3)	(35±3) (35±3)	2.0mm(with FU-35FA/35FZ) 1.0mm(with FU-21X)	F-6HA

*1. Each detecting distance in parentheses shows the data when the S-APC function is ON. S-APC will be always turned ON when the high-resolution or high-speed mode is selected.
*2. Standard target: White mat paper.
*3. F-2HA/3HA/5HA cannot be used in ULTRA Turbo mode. (except F-5HA with FU-21X)

Specifications

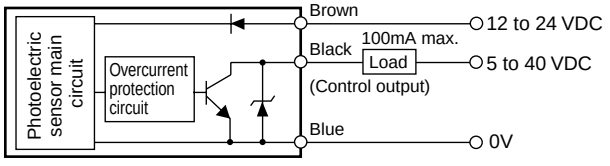
Type		Main unit		1-line expansion unit		0-line expansion unit
Model	NPN	FS-V21R	FS-V21G	FS-V22R	FS-V22G	FS-V20R
	PNP	FS-V21RP	-	FS-V22RP	-	-
Light source		Red LED	Green LED	Red LED	Green LED	Red LED
Response time		250µs (FINE)/500µs (TURBO)/1ms (SUPER TURBO)/4ms (ULTRA TURBO)/500µs (HIGH RESOLUTION)/50µs (HIGH SPEED)				
Output selection		Light-ON/Dark-ON selectable				
Display indicator		• Operation indicator: Red LED • Dual digital monitor: Dual 7-segment display Preset Value (4-digit green LED indicator) and Current Value (4-digit red LED indicator) illuminated together. Current Value range: 0 to 65520; Excess gain: 0P to 999P • Hold function: Possible to display both peak and bottom hold values. • Bar LED monitor: Possible to display together with Current Value Excess gain displayed (85% to 115% in 7 steps)				
Detection mode		Light intensity/rising edge/falling edge				
Display shift function		Max. ±1999 (variable)				
Timer function	Mode	Timer OFF/OFF-delay timer/ON-delay timer/One-shot timer, selectable				
	Variable range	1 to 500ms [1 to 30ms (in 1ms increments), 30 to 50ms (in 2ms increments), 50 to 200ms (in 10ms increments), 200 to 500ms (in 50ms increments)]				
	Accuracy	±10% of the Preset Value				
Control output		NPN or PNP 100 mA max. (40VDC max), Residual voltage : 1Vmax.				
Power supply		12 to 24VDC ±10% , ripple: 10% max.				
Current consumption*1	Normal	S-APC OFF: 650 mW max. (27mA max. at 24VDC), S-APC ON: (720mA max. at 24VDC)				
	ECO half	S-APC OFF: 530 mW max. (22mA max. at 24VDC), S-APC ON: (600mA max. at 24VDC)				
	ECO all	S-APC OFF: 480 mW max. (20mA max. at 24VDC), S-APC ON: (550mA max. at 24VDC)				
Environment resistance	Ambient illumination	Incandescent lamp: 20,000 lux max. , Sunlight: 30,000 lux max.				
	Ambient temperature*2	–10˚C to 55˚C (14 to 131˚F), No freezing				
	Relative humidity	35 to 85%, No condensation				
	Vibration	10 to 55 Hz, 1.5-mm double amplitude, each in X, Y, and Z directions for two hours				
Shock resistance		500 m/s² Three times each in X, Y, and Z directions				
Housing		Polycarbonate				
Weight (including 2-m cable)		Approx. 80 g		Approx. 45 g		Approx. 30 g

*1. S-APC will be always turned ON when the high-resolution or high-speed mode is selected. S-APC is by default set to OFF in any other mode.
*2. If more than one unit is used together, the ambient temperature varies with the conditions below. Mount the units on the DIN rail with mounting brackets and check that the output current is 20 mA or less.
3 to 10 Units: –10˚C to 50˚C (14 to 122˚F) 11 to 16 Units: –10˚C to 45˚C (14 to 113˚F)

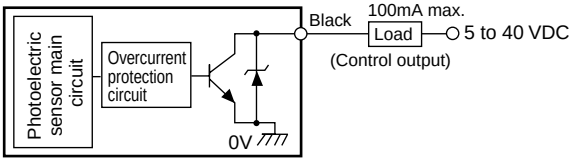
I/O Circuit

NPN

FS-V21R/FS-V21G

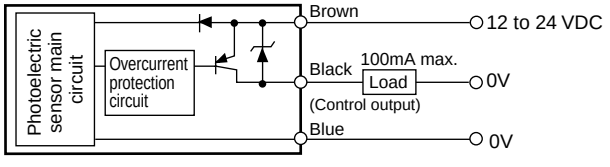


FS-V22R/FS-V22G

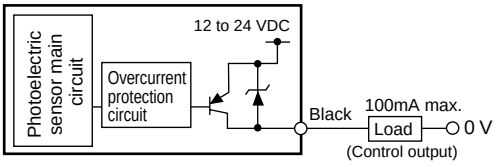


PNP

FS-V21RP



FS-V22RP



FS-V21G and FS-V22G Detecting Distance

Model	ULTRA TURBO	SUPER TURBO	TURBO	FINE	HIGH RESOLUTION	HIGH SPEED
FU-7F	220	110	80	50	15	20
FU-77 (V)	190	95	70	45	10	15
FU-6F	80	40	30	20	—	6
FU-67 (V)	40	20	15	10	—	4
FU-35FZ	24	12	8	5	—	—
FU-22X	9	6	4	—	—	—
FU-10	10 to 30*		—	—	—	—

* The beam spot diameter is variable between 0.9 and 3.5 mm.

(mm)

With Lens

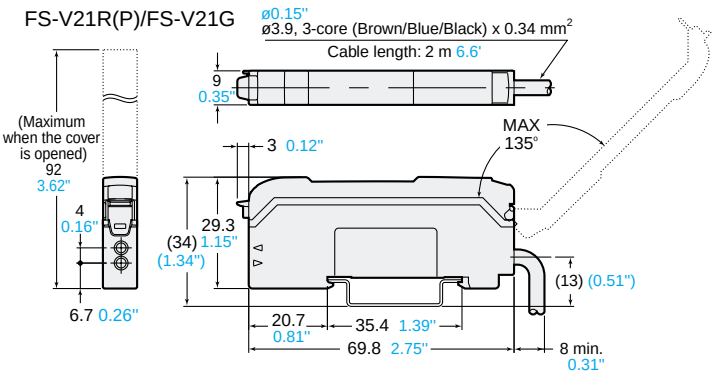
Model	Fiber Unit	ULTRA TURBO	SUPER TURBO	TURBO	FINE	HIGH RESOLUTION	HIGH SPEED
F-1	FU-77 (V)	240	120	90	50	10	15
F-2		1400	700	500	350	80	120
F-4		2000	1000	750	500	100	150
F-2HA	FU-35FA (Z),-2303	7±2				—	—
	FU-21X	7±2	—	—	—	—	—
F-3HA	FU -35FZ, -2303	35	25	20	15	—	—

(mm)

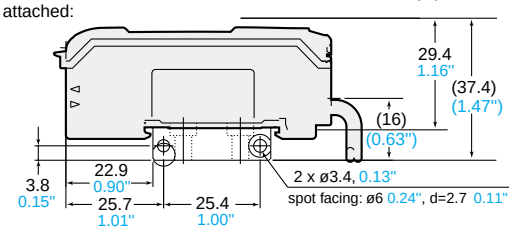
Dimensions

unit: mm inch

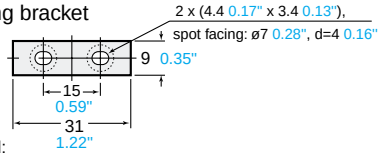
FS-V21R(P)/FS-V21G



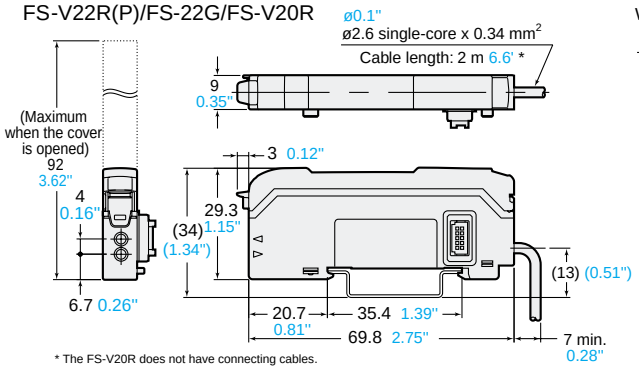
When the mounting bracket (included in the FS-V21R(P)/FS-21G) is attached:



Rear of mounting bracket

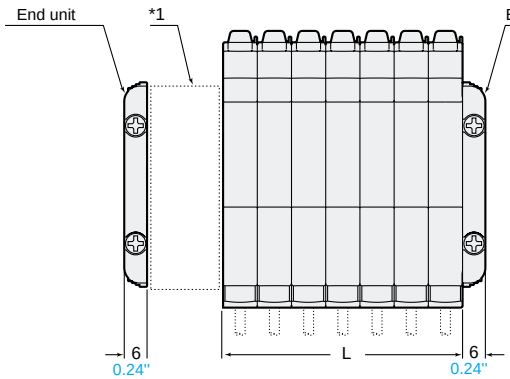


FS-V22R(P)/FS-22G/FS-V20R



* The FS-V20R does not have connecting cables.

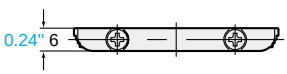
When several units are connected:



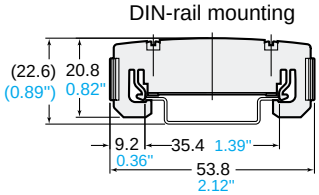
No.of Units	L(mm)
1	9 0.35"
2	18 0.71"
3	27 1.06"
4	36 1.42"
5	45 1.77"
6	54 2.13"
7	63 2.48"
8	72 2.83"
9	81 3.19"
10	90 3.54"
11	99 3.90"
12	108 4.25"
13	117 4.61"
14	126 4.96"
15	135 5.31"
16	144 5.67"

1. The FS-V21R(P)/FS-V21G/FS-11V(P)/ T1(P)/M1(P)/V1(P)/PS-T1(P)/LV-21A(P)/ CZ-K1(P) is mounted in [ ]. (The PNP models cannot be connected to the NPN models.)
2. When using expansion units, be sure to use the end unit (accessory to the expansion unit).

End unit (included in the FS-V22R(P)/FS-V22G)



DIN-rail mounting



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