KEYENCE

96M11224

* 9 6 M 1 1 2 2 4 - 1 *

Dual Digital Fiber Sensor

# FS-V22/22G/22R(P)/20R/22X

# Instruction Manual

Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

## 1. Safety Precautions

**⚠ WARNING**

- *This product is just intended to detect the object(s). Do not use this product for the purpose to protect a human body or a part of human body.*
- *This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.*
- *This product is a sensor of DC power supply type. Do not apply AC power. The product may explode or burn if 100 VAC or a higher voltage is applied.*

**■ UL Certificate**

This product is an UL/C-UL Listed product.
- UL File No. E301717
- Category NRKH, NRKH7
- Enclosure Type 1 (Based on UL50)

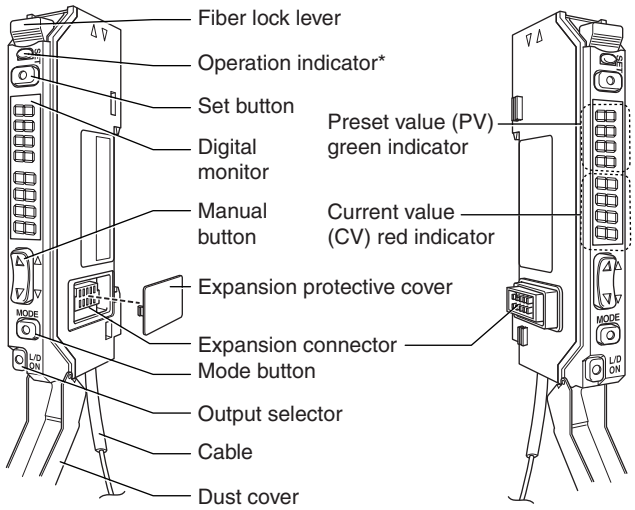
Be sure to consider the following specifications when using this product as an UL/C-UL Listed Product.
- Use the power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
- Use with the over current protection device which is rated 30V or more (rated 40V or more for NPN output type) and not more than 2A.

Check that all the accessories are ready before use.

**■ Accessories**

Instruction manual (x1)  End units (x2)
Expansion Sticker (x1)

## 2. Part Names

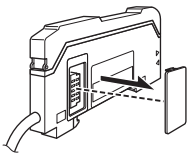



* The operation indicator of the FS-V22X (infrared model) will not be lit.

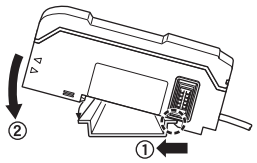
## 3. Amplifier Expansion

Up to 16 expansion units can be connected to each main unit.

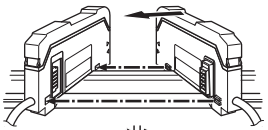
1) Remove the expansion protective cover from the main unit.

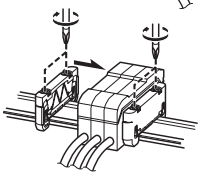


2) Mount each amplifier to the DIN rail.

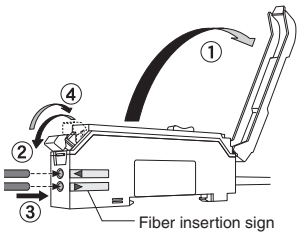


3) Press the two claws of each expansion unit to the grooves on the main unit until the claws snap.
4) Mount the end units to the left- and right-hand sides of the whole amplifiers in the method shown in the figure at step 2.
5) Check that the amplifiers are securely sandwiched by the end units. Use a Phillips screwdriver and securely tighten the screws on the end units (i.e., two screws on each end unit).





## 4. Connecting Fiber Unit

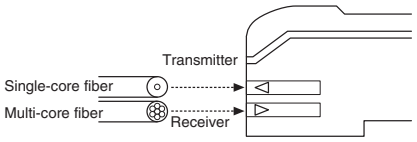



1) Open the dust cover in the direction shown by arrow ①.
2) Move down the fiber lock lever in the direction shown by arrow ②.
3) Insert a fiber unit into the fiber insertion holes to a length of the fiber insertion sign (i.e., approximately 14 mm).
4) Move up and return the fiber lock lever in the direction shown by arrow ④.

**Note:** If a thin fiber unit is used, an adapter provided with the thin fiber unit will be required.
Unless the right adapter is connected, the thin fiber unit will not detect targets correctly.

| Cable outer dia. | Adapter | Appearance |
|---|---|---|
| ø1.3 | Adapter A |  |
| ø1.0 | Adapter B |  |

- To connect the coaxial reflective type fiber unit to the amplifier, connect the single-core fiber to the transmitter side, and connect the multiple-core fiber to the receiver side.




- To remove the amplifiers added, take the steps opposite to the mounting procedure.
- Put the provided sticker close to the sensor.

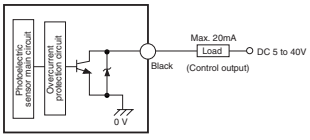
**Note** • The FS-V22/22G/22R(P)/20R/22X incorporates a mutual interference prevention function, thus allowing the close mounting of a number of fiber units in the following modes.

| Power mode | FINE | TURBO | SUPER TURBO | ULTRA TURBO |
|---|---|---|---|---|
| Number of units connected | 4 | 8 | 8 | 8 |

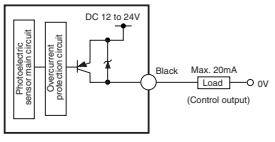
## 5. I/O Cricuit

Refer to the following I/O circuit diagram when connecting the unit to peripheral devices.

**● FS-V22/22G/22R/22X**




**● FS-V22RP**

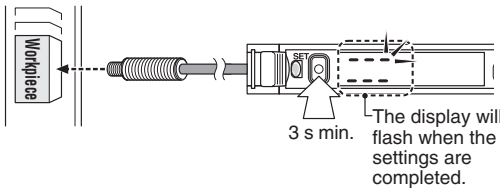


## 6. Making Sensitivity Settings

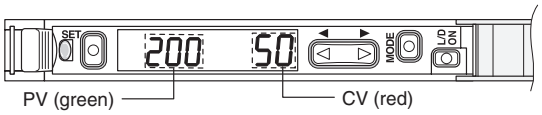
● **Full Auto Calibration**

In this mode, the PV will be set to the mean value of the maximum and minimum incident values obtained within a certain period.
Use this mode to detect moving workpieces.

1) Press the set button for a minimum of three seconds while the target workpiece is passing the sensing area of the fiber unit.
   - While the set button is pressed, the sensitivity of the sensor will be set according to the incident values.



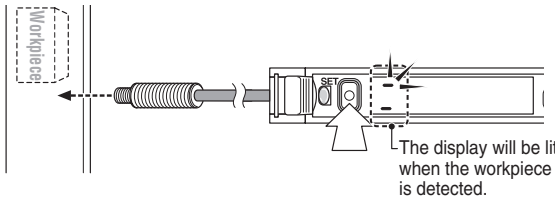

   - When the setting is finished, the digital monitor will display the PV in green.



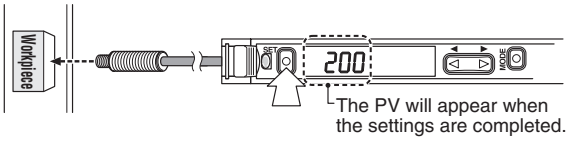

● **Two-point Calibration**

In this mode, the PV used will be the mean value of two sensing values obtained with and without a workpiece.

1) Press the set button for a moment without the workpiece in the sensing area (i.e., in front of the fiber unit).




2) Locate the workpiece in the sensing area (i.e., in front of the fiber unit). Then press the set button for a moment.

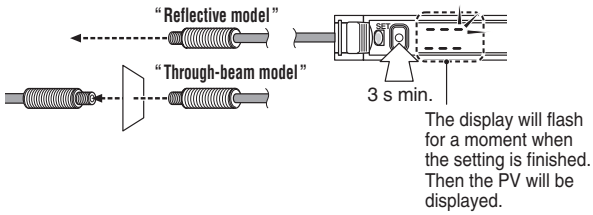



* If there is extremely little difference in sensitivity between the sensing values, the display ---- will flash on completion of tuning.

● **Maximum Sensitivity Setting**

If the sensing performance of the sensor drops due to dust or dirt, set the sensitivity of the sensor to maximum.

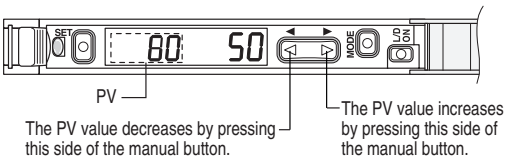
1) Press the set button without a workpiece if the fiber unit is a reflective model. Press the set button with a workpiece if the fiber unit is a through-beam model. In both cases, press the set button for a minimum of three seconds.




* If the sensing distance is insufficient, make sensitivity settings in the sensor in two-point tuning mode.

● **Manual Calibration**

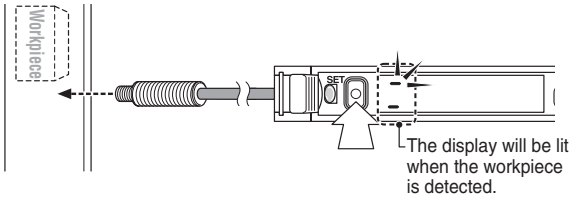
In this mode, make manual PV settings.



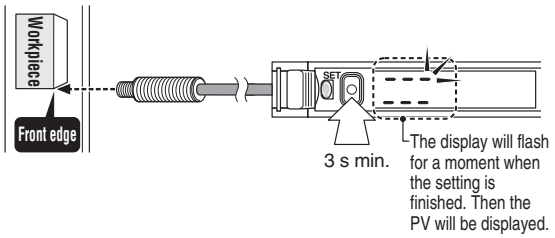

● **Positioning Calibration**

In this mode, a workpiece will be detected when the front edge of the workpiece has reached a preset position.

1) Press the set button for a moment without the workpiece in the sensing area (i.e., in front of the fiber unit).

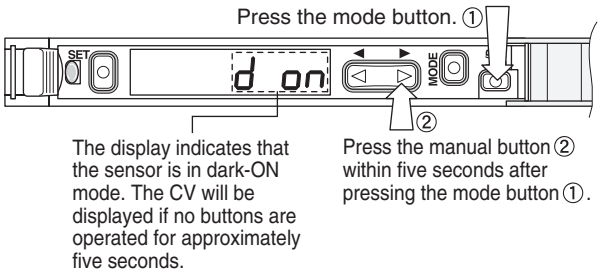



2) Locate the front edge of the workpiece in the sensing area. Then press the set button for a minimum of three seconds.




## 7. Selecting Output

Either light-ON mode or dark-ON mode is selectable.



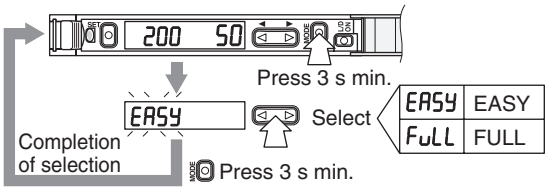

- Take the same steps to set the sensor to light-ON mode again.

## 8. User-friendly Functions

● **Access Mode Selection**

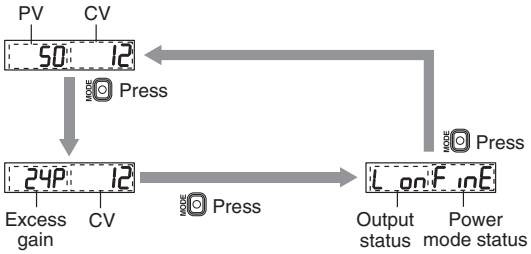
Two modes are available to the display of values and menu items.

| | |
|---|---|
| EASY | Only basic functions are displayed. |
| FULL | All available functions are displayed. |



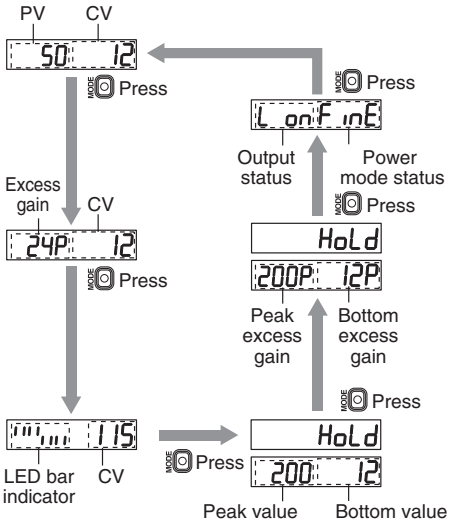

- The mode is set to EASY before shipping.

## ● Display Selection (Access Mode: EASY)

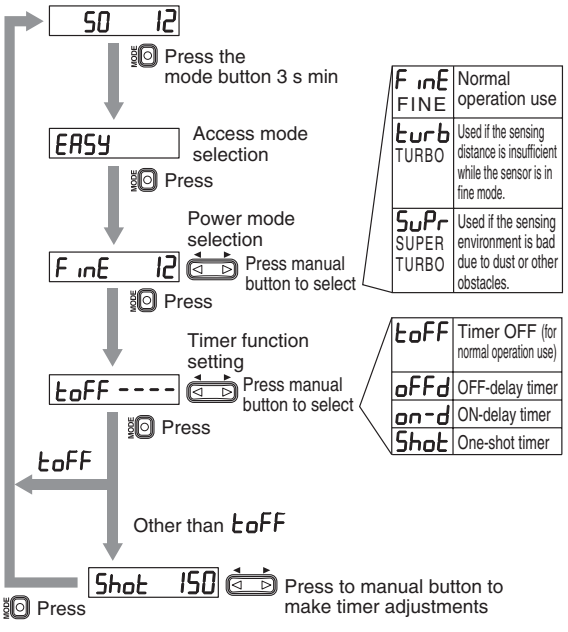



- The CV is displayed in percent based on the PV.
- The current value will be displayed if no keys are operated for approximately 30 s.
- If the timer function is set, the output status with power mode and the timer mode with set time will be displayed alternately.

## ● Display Selection (Access Mode: FULL)

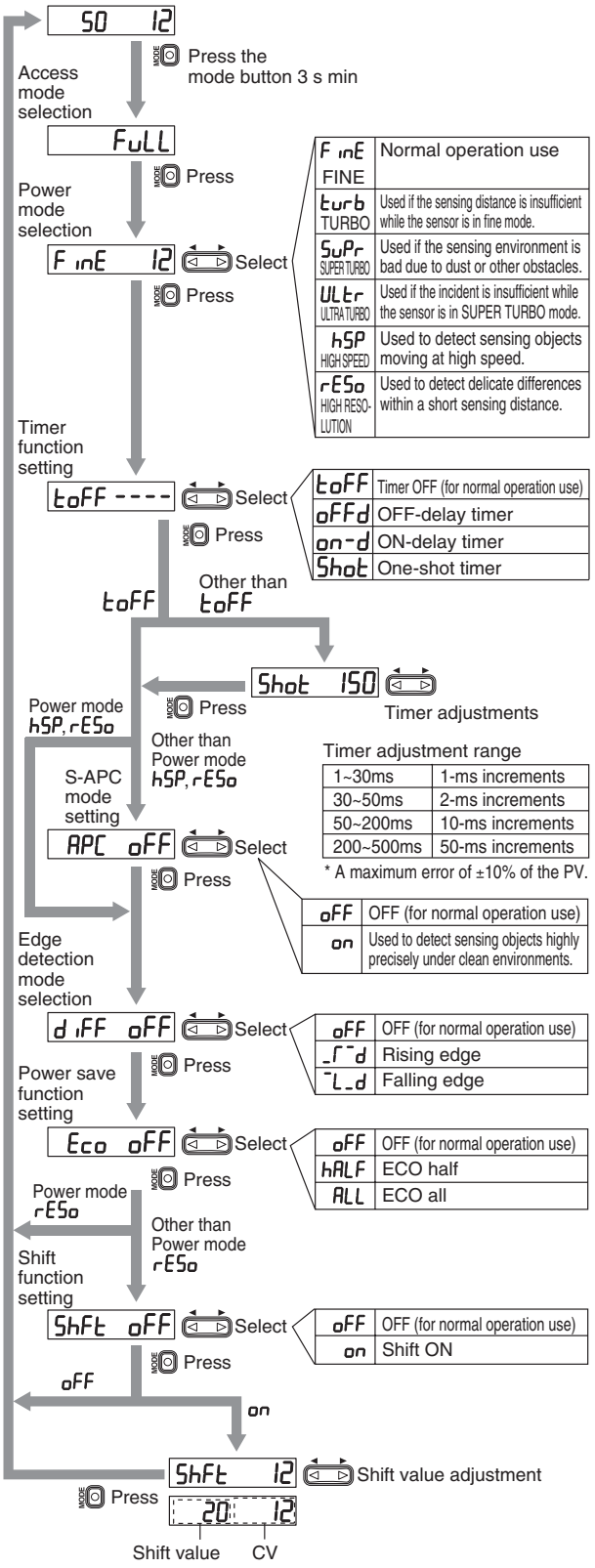



## ● Menu Selection (Access Mode: EASY)




* For timer values, refer to the corresponding table under FULL mode.

## ● Menu Selection (Access Mode: FULL)




* A maximum error of ±10% of the PV.

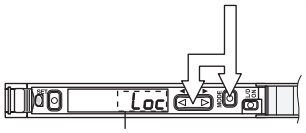
### Sensitivity Settings in Edge Detection Mode

The sensitivity of the sensor will be set to maximum by pressing the ▽ while the sensor is in edge detection mode. Make fine sensitivity adjustments by pressing the ◁▷.

**Note**:
- Press the mode button (MODE) for a minimum of three seconds to return to the display of the CV from any menu selection stage. To return to the previous display, press the mode button (MODE) first, and press the left side (◁) of the manual button (◁▷).
- When the power mode is set to HIGH RESOLUTION, the S-APC mode will be always turned ON.
- When the power mode is set to HIGH SPEED, the S-APC mode will be always turned ON in the case of the R model, or otherwise the S-APC mode will be always turned OFF.

## 9. Key Lock

The key lock function disables the operation of all keys.




Press the manual button for three seconds while pressing the mode button.

Indicates that the keys are locked.

- Take the same step to unlock the keys.

## 10. Mode Settings before Shipping (Initialization)

The following factory settings are made before shipping.

| | | |
|---|---|---|
| Access mode | EASY | EASY |
| Power mode | FINE | FINE |
| Timer function | OFF | toFF |
| Output selection | Light-ON | L on |

* Returning to factory settings: Press the SET button for a minimum of five seconds while pressing the S2 button.

## 11. Hints On Correct Use

- To extend the cable length, use a cable with at least a 0.3 mm² cross-section area. Limit the length of cable extension to no more than 100 m. (To connect several units, contact Keyence for further information.)
- Do not wire the amplifier line along with power lines or high-tension lines, or otherwise the sensor may malfunction or receive damage due to noise.
- When using a commercially available switching regulator, ground the frame ground terminal and ground terminal.
- Do not use the FS series outdoors, or in a place where extraneous light can enter the light receiving surface directly.
- Due to the individual dispersion of characteristics and the difference in fiber unit model, the maximum sensing distance or displayed value of all the units are not the same.
- If the sensor is used in S-APC mode for a long time, the LED indicators will be imposed with a heavy load. In that case, the sensor will be automatically set to ACC mode where the current consumption of the sensor for light emission will be constant, and "END APC" will be displayed. The sensor can be continuously used in this case. Replace the sensor, however, if highly precise detection is required.

## 12. Specifications

| | | | | | | |
|---|---|---|---|---|---|---|
| Model | | FS-V22 | FS-V22G | FS-V22R(P) | FS-V20R | FS-V22X |
| Light source | | Red LED | Greed LED | 4-element red LED | 4-element red LED | Infrared (950 nm) |
| Response time *1 | | 250µs (FINE)/500µs (TURBO)/1ms (SUPER TURBO)/ 4ms (ULTRA TURBO)/500µs (HIGH RESOLUTION)/ 50µs (HIGH SPEED) | | | | |
| Display shift function | | Max. ±1999 (variable) | | | | |
| Timer function | | Timer OFF, OFF-delay timer, ON-delay timer, and one-shot timer 1 to 500 ms | | | | |
| Control output | | NPN open collector output at 40 V (or PNP open collector output at 30 V) with 20 mA max. and a residual voltage of 1 V max. | | | | |
| Rating | Supply voltage | DC12-24V ±10% with a maximum ripple (peak to peak) of 10%, Class 2 | | | | |
| | Current consumption | Model / Mode / S-APC mode OFF / S-APC mode turned ON or when the HIGH SPEED mode is selected. | | | | |
| | | Other than R model / Normal / 580 mW / 720 mW | | | | |
| | | Other than R model / ECO half / 480 mW / 600 mW | | | | |
| | | Other than R model / ECO all / 430 mW / 550 mW | | | | |
| | | R model / Normal / 650 mW / 720 mW | | | | |
| | | R model / ECO half / 530 mW / 600 mW | | | | |
| | | R model / ECO all / 480 mW / 550 mW | | | | |
| Environment resistance | Ambient illumination | Incandescent lamp: 20,000 lux max. Sunlight: 30,000 lux max. | | | | |
| | Ambient temperature | -10°C to 55°C (No freezing)*2 | | | | |
| | Relative humidity | 35% to 85% RH (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 material | | Unit and cover are both polycarbonate made | | | | |
| Size | | W 9 mm x L70 mm x H 30 mm | | | | |
| Weight | | Approximately 45 g (including 2-m Cable) | | | | |

*1. The FS-V20R has a response time between 210µs and 4.7 ms, depending on the number of Units connected.

*2. Ambient operating temperature with amplifier expansion
1 to 2 units: -10°C to 55°C
3 to 10 units: -10°C to 50°C
11 to 16 units: -10°C to 45°C

## 13. List of Digital Display Items

| | |
|---|---|
| 200 50 Preset value/Current value display | oFFd 150 Timer function setting (OFF-delay timer) |
| d on Output selection (Dark ON) | on-d 150 Timer function setting (ON-delay timer) |
| L on Output selection (Light-ON) | Shot 150 Timer function setting (One-shot timer) |
| EASY Access mode selection (EASY) | APC oFF S-APC mode setting (S-APC OFF) |
| FULL Access mode selection (FULL) | APC on S-APC mode setting (S-APC ON) |
| 24P 12 Excess gain display | d.FF oFF Edge detection mode (OFF) |
| LED bar display | d.FF_r^d Edge detection mode (Rising edge) |
| HoLd Hold display | d.FF ^L_d Edge detection mode (Falling edge) |
| F.nE 50 Power mode selection (FINE) | Eco oFF ECO mode setting (ECO mode OFF) |
| turb 100 Power mode selection (TURBO) | Eco hALF ECO mode setting (ECO half) |
| SuPr 200 Power mode selection (SUPER TURBO) | Eco ALL ECO mode setting (ECO all) |
| ULtr 800 Power mode selection (ULTRA TURBO) | ShFt oFF Shift function setting (Shift OFF) |
| hSP 100 Power mode selection (HIGH SPEED) | ShFt on Shift function setting (Shift ON) |
| rESo 100 Power mode selection (HIGH RESOLUTION) | Loc Key lock setting |
| toFF ---- Timer function setting (Timer OFF) | unL Key unlock |
| End APC Forecast maintenance warning (END APC) | |

## WARRANTY

KEYENCE products are strictly factory-inspected. However, in the event of a failure, contact your nearest KEYENCE office with details of the failure.

**1. WARRANTY PERIOD**

The warranty period shall be for one year from the date that the product has been delivered to the location specified by the purchaser.

**2. WARRANTY SCOPE**

(1) If a failure attributable to KEYENCE occurs within the abovementioned warranty period, we will repair the product, free of charge. However, the following cases shall be excluded from the warranty scope.
- Any failure resulting from improper conditions, improper environments, improper handling, or improper usage other than described in the instruction manual, the user's manual, or the specifications specifically arranged between the purchaser and KEYENCE.
- Any failure resulting from factors other than a defect of our product, such as the purchaser's equipment or the design of the purchaser's software.
- Any failure resulting from modifications or repairs carried out by any person other than KEYENCE staff.
- Any failure that can certainly be prevented when the expendable part(s) is maintained or replaced correctly as described in the instruction manual, the user's manual, etc.
- Any failure caused by a factor that cannot be foreseen at a scientific/technical level at the time when the product has been shipped from KEYENCE.
- Any disaster such as fire, earthquake, and flood, or any other external factor, such as abnormal voltage, for which we are not liable.

(2) The warranty scope is limited to the extent set forth in item (1), and KEYENCE assumes no liability for any purchaser's secondary damage (damage of equipment, loss of opportunities, loss of profits, etc.) or any other damage resulting from a failure of our product.

**3. PRODUCT APPLICABILITY**

KEYENCE products are designed and manufactured as general-purpose products for general industries.
Therefore, our products are not intended for the applications below and are not applicable to them. If, however, the purchaser consults with us in advance regarding the employment of our product, understands the specifications, ratings, and performance of the product on their own responsibility, and takes necessary safety measures, the product may be applied. In this case, the warranty scope shall be the same as above.
- Facilities where the product may greatly affect human life or property, such as nuclear power plants, aviation, railroads, ships, motor vehicles, or medical equipment
- Public utilities such as electricity, gas, or water services
- Usage outdoors, under similar conditions or in similar environments

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