KEYENCE

96M13761

Full-Spectrum Sensor

LR-W500(C)

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 for future reference.

The following symbols alert you to important messages. Be sure to read this section carefully.

WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	Indicates a situation which, if not avoided, could result in product damage as well as property damage.

1. Introduction

1-1 Safety Precautions

WARNING	• This product is only intended to detect object(s). Do not use this product for the purpose of protecting a human body or a part of the human body. • This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere. • This product uses DC power. The product may explode or burn if an AC voltage is applied.
NOTICE	• Do not wire this product along with power lines or high-tension lines. Doing so may lead to product malfunctions or damage due to noise. • Do not use this product outdoors or in a place where extraneous light can enter the light-receiving element directly.

1-2 Precautions on Regulations and Standards

■ CSA Certificate

This product complies with the following CSA and UL standards and has been certified by CSA. Be sure to consider the following specifications when using this product as a CSA-certified product.

- Applicable standards: CAN/CSA C22.2 No. 61010-1,
  UL61010-1
- Use one of the following types of power supplies.

A CSA/UL certified power supply that provides Class 2 output as defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code) or a CSA/UL certified power supply that has been evaluated as a Limited Power Source as defined in CAN/CSA-C22.2 No. 60950-1/UL60950-1.

- Use this product at an altitude of 2000 m or less.
- Overvoltage category: I
- Pollution degree: 3
- Indoor use only.

■ CE Marking

KEYENCE Corporation has confirmed, on the basis of the following specifications, that this product complies with the essential requirements of the applicable EU Directive. Be sure to consider the following specifications when using this product in a member state of the European Union.

● EMC Directive

- Applicable standard: EN60947-5-2, Class A

These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of the EMC Directive. The manufacturer of the end-product is solely responsible for confirming the compliance of the end-product itself according to the EMC Directive.

● Low-voltage directive

- Applicable standard: EN62471

1-3 Package Contents

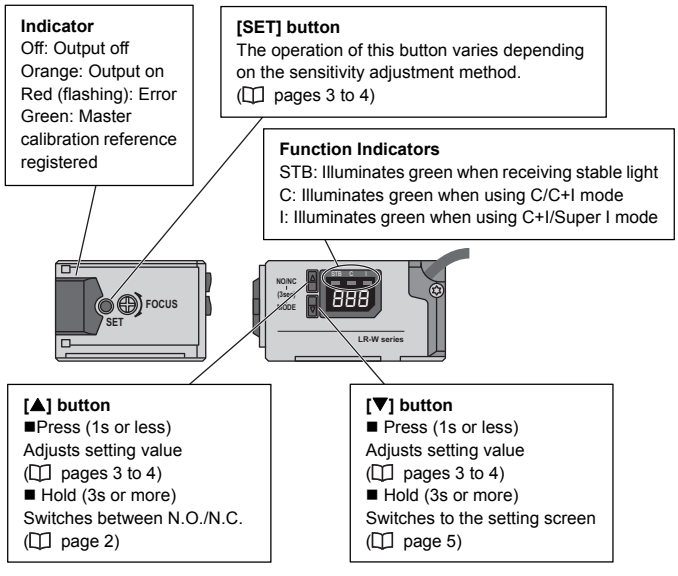
- Sensor
- Instruction manual

1-4 Specifications

Model		LR-W500 2 m cable type	LR-W500C 4-pin M12 connector type
Detectable distance		30 to 500 mm	
Min. spot diameter		Adjustable spot Approx. 3.5 mm at 100 mm Approx. 9 mm at 250 mm Approx. 18 mm at 500 mm	
Response time*1		200 µs/1 ms/10 ms/100 ms/500 ms selectable	
Light source		White LED	
Mutual interference reduction function		Up to 2 units with alternate frequencies set	
Timer function		OFF/ON delay/OFF delay/One-shot	
Power supply	Power supply voltage	10 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS	
	Current consumption*2	65 mA or less at 24 V (without load), 120 mA or less at 12 V (without load)	
I/O*3	Control output	NPN open collector/PNP open collector selectable, 30 V or less, 50 mA or less, residual voltage: 2 V or less, N.O./N.C. selectable	
	External input	Tuning /Transmission OFF selectable, Short-circuit current: NPN: 1 mA or less, PNP: 2 mA or less, For the applied voltage, see the wiring diagrams (📖 page 2 in the instruction manual), For the input times, see the time charts (📖 page 6 in the instruction manual)	
Protection circuit		Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection	
Environmental resistance	Enclosure ratings	IP65/IP67 (IEC60529)	
	Ambient light	Incandescent lamp: 10000 lux or less Sunlight: 20000 lux or less	
	Ambient temperature	-20 to +50°C (no freezing)	
	Ambient humidity	35 to 85%RH (no condensation)	
	Shock resistance	1,000 m/s^2 in X, Y, Z axis directions respectively 6 times	
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm in the X, Y, Z axis directions respectively, 2 hours	
Material		Case: Zinc die cast (Nickel chrome plating) Indicator cover: PPSU Buttons: PES Lens cover and display: PMMA (scratch-resistant coating) Spot adjustment dial: Iron (black oxide finish) Cable bushing (2 m cable type only): PBT Cable (2 m cable type only): PVC Connector ring (4-pin M12 connector type only): PMP Connector socket (4-pin M12 connector type only): PEI	
Weight		Approx. 170 g (including cable)	Approx. 110 g

*1 When you set an alternate frequency, the response time becomes approximately 20% slower.
*2 195 mA or less (at 10 V, with load)
*3 IO-Link specification v.1.1/COM2 (38.4 kbps) is supported.
You can download a setup file from the KEYENCE website (http://www.keyence.com). If you are using the product in an environment in which you cannot download files over the Internet, contact your nearest KEYENCE office.

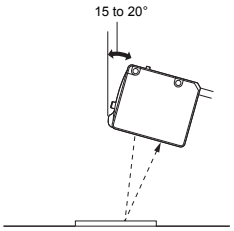
1-5 Part Functions



2. Installation and Wiring

2-1 Installation

- Tightening torque for the mounting holes: 0.63 N·m (M3 screw)
- If the workpiece contains a glossy surface that could interfere with stable detection, tilt the sensor approx. 15° to 20°. If tilting the sensor does not improve detection, please attach the reflection canceling attachment (LR-WA1).



- High-frequency light, such as that from an inverter fluorescent lamp, entering the receiver directly or after reflecting from the workpiece may lead to malfunctions. In this situation, implement countermeasures such as installing a light shielding plate or changing the product's installation position.

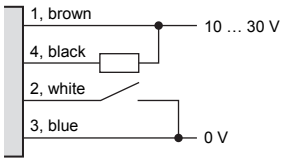
2-2 Wiring

Either an NPN or a PNP output can be selected during the initial setup of this product.
"3. Initial Settings (NPN/PNP Selection)" (page 2)

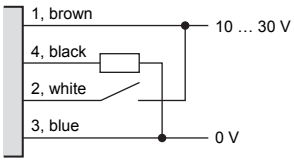
Independently insulate any unused I/O wires.

= Load (input device)

● When NPN output is selected

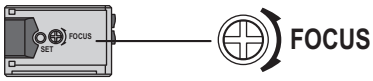


● When PNP output is selected



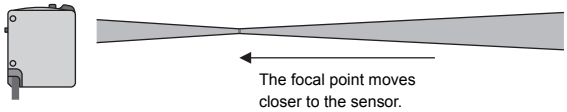
2-3 Adjusting the Spot Diameter

Use the dial on the side of the sensor to adjust the spot diameter.

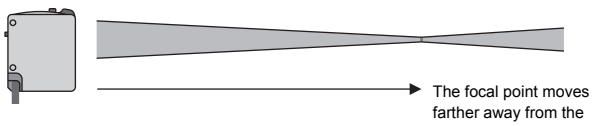


NOTICE	Dial turning torque: 0.2 N · m or less

- Turn the dial to the right to decrease the focal distance.

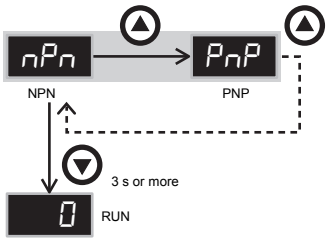


- Turn the dial to the left to increase the focal distance.



3. Initial Settings (NPN/PNP Selection)

When the power is turned on for the first time after purchase, or initialization is performed, the initial setting (NPN/PNP selection) is required as shown below.



* After the initial setup is complete, “NPN/PNP selection” setting cannot be changed. To change this setting, initialize the sensor. "6-2 Initialization" (page 4)

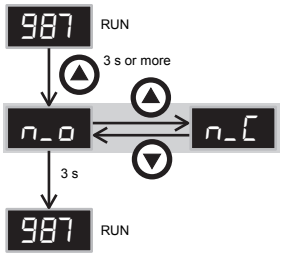
4. Basic Settings

4-1 Output Logic Selection (N.O./N.C. Selection)

Set the output logic to N.O. or N.C..

- n_o (Lon)*: Turns the output on when the registered condition is met (turns the output on when light is received) *.
- n_C (don)*: Turns the output on when a condition other than the registered condition is met (turns the output on when light is not received) *.

* The condition within parentheses indicates the condition when super I mode is selected.



4-2 Detection Mode

This sensor contains four detection modes.

Detection mode	Explanation
Auto (default)	When adjusting the sensitivity, the optimal mode is automatically selected between C+I or C.
C+I mode	Detection is performed according to the color components (R, G, B) and illumination (the received light intensity).
C mode	Detection is performed according to the color components (R, G, B) only.
Super I mode	Detection is performed according to the illumination (the received light intensity) only.

* To change the detection mode, see "7 Settings" (page 5).

5. Sensitivity Adjustment

5-1 Auto/C+I/C Mode

■ About the display value

• Conformity

The level of conformity of the current detected workpiece to the registered reference workpiece.

Display range: 0 to 999 (The more the workpiece conform to reference workpiece, the higher the value.)

• Setting value

The threshold of conformity at which a workpiece is judged to be the same as the registered workpiece.

To check or manually make fine adjustments to the setting value, see 🕮 "■Checking and adjusting the setting value" (page 3).

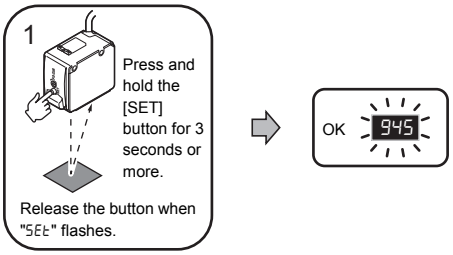
* The blinking numeric value that appears after calibration is the setting value.

■ Setting the sensitivity (apply one of the following three methods)

● **1-point calibration (use to detect 1 specific color)**

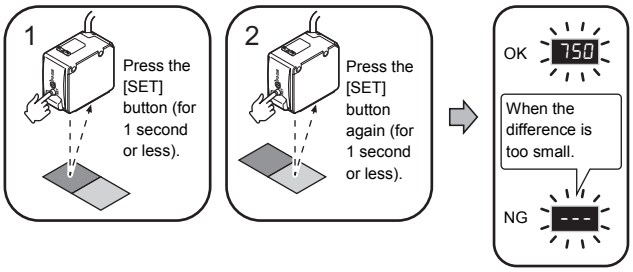
Register the color of the workpiece to be detected.

(When Auto mode is used, this function operates in C+I.)



● **2-point calibration (use to differentiate between 2 colors)**

Register the color of the reference workpiece and the color to be differentiated. (The first point is used as the reference color.)

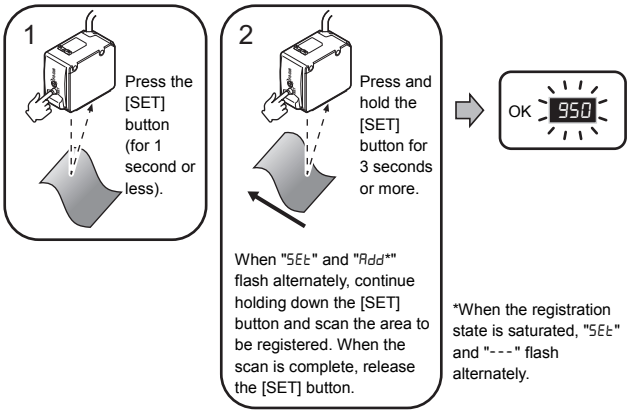


● **Master calibration (use to permit color variations within the same workpiece)**

Press the [SET] button to register the reference color. Then, press and hold the [SET] button to perform sampling. During sampling, references are added and are set to be judged as the same color. When a reference is added, the indicator flashes (once) in green.

When master calibration is executed, the setting value becomes 950 (default). To change this value, see 🕮 "7-8 Master Calibration Set Value" (page 6).

(When Auto mode is used, this function operates in C+I.)



< Precautions for master calibration>

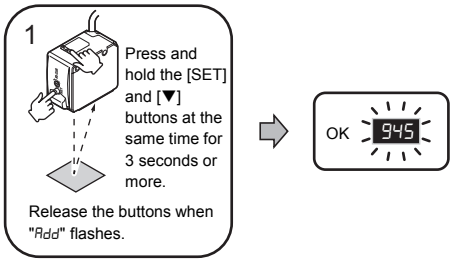
- Continue calibration until the green light that indicates reference addition does not turn on any more.
- If the master calibration is performed again, the registered contents from the first master calibration will be overwritten. To add an allowable range after the master calibration, perform the master addition calibration.
- If the registration status is saturated and "---" is displayed. Perform the master calibration again after lowering the 🕮 "7-8 Master Calibration Set Value " (page 6).
- Changing the master calibration set value after a master calibration has been performed, does not affect the current setting value, only subsequent calibrations.

■ Permitting color variations between different workpieces

● **Master addition calibration (when adding workpieces to be permitted)**

Position a workpiece which is to be judged the same as the current registered color. Then press and hold the [SET] button and the [▼] button. When the added registration is successful, the "setting value" flashes three times, and the sensor returns to the normal screen (the setting value is not changed at this point in time).

In this case, references are added to permit colors between "the current registered color" and "the additional registered color".



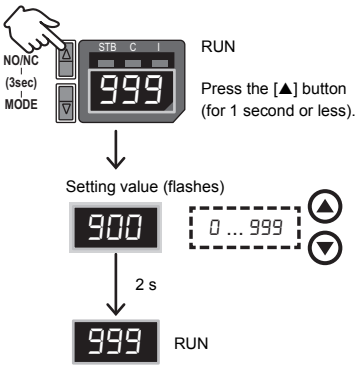
< Precautions for master addition calibration>

- To clear the master addition calibration, perform another calibration.
- If the setting fails or the registration state is saturated, "---" is displayed. To add an allowable range, lower the setting value, and perform the master addition calibration again.

■ Checking and adjusting the setting value

When a larger setting value is in place, the detection tolerance is tight.

In contrast, when the setting value is reduced, a wider detection tolerance is enabled. The [▲] and [▼] buttons can be used to increase or decrease the setting value.



* After master calibration or master addition calibration has been executed, the setting value cannot be increased.

5-2 Super I Mode

■ About the display value

• Received light intensity

The current received light intensity is displayed.

Display range: 0 to 999 (The greater the received light intensity, the higher the value.)

• Setting value

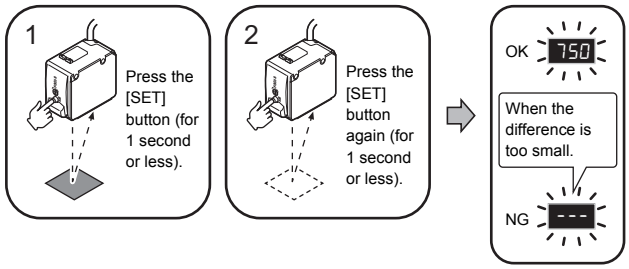
The threshold at which the received light intensity is judged to indicate that a workpiece is present.

To check or manually make fine adjustments to the value, see "■Checking and adjusting the setting value" (page 4).

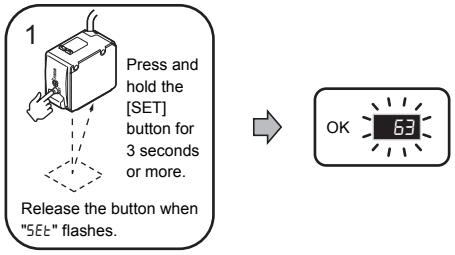
* The blinking numeric value that appears after calibration is the setting value.

■ Setting the sensitivity (apply one of the following three methods)

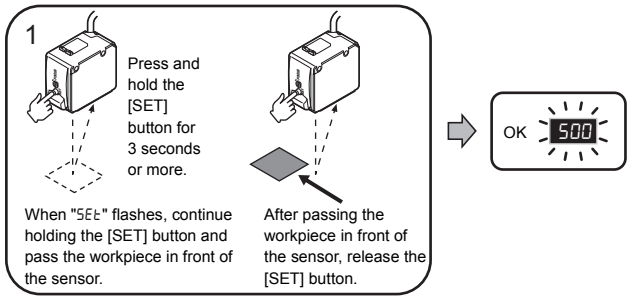
● **2-point calibration (basic intensity differentiation)**



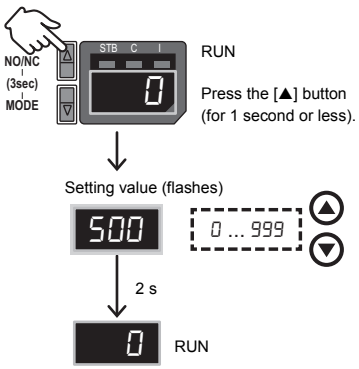
● **Maximum sensitivity calibration (use to increase the sensitivity of the sensor to detect small changes)**



● **Full auto calibration (use when workpiece movement cannot be stopped for calibration)**

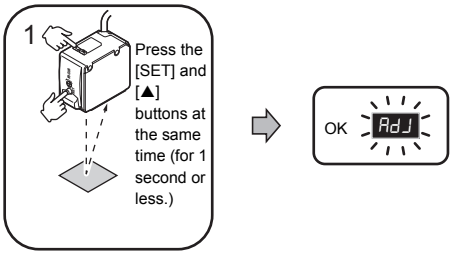


■ Checking and adjusting the setting value



■ When the received light intensity is saturated or insufficient

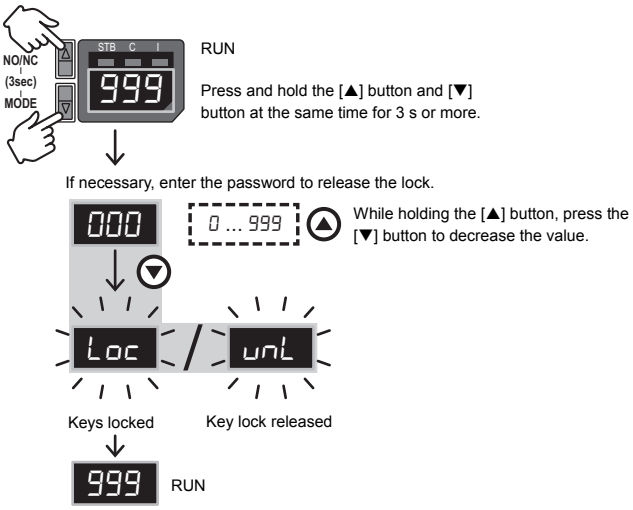
When using the product with the hSP (200 µs) or 1 ms response time selected, stable operation may be reduced. In this situation, it may be possible to increase stability by adjusting the light intensity to the optimal value using the steps below.



6. Useful Functions

6-1 Key Lock

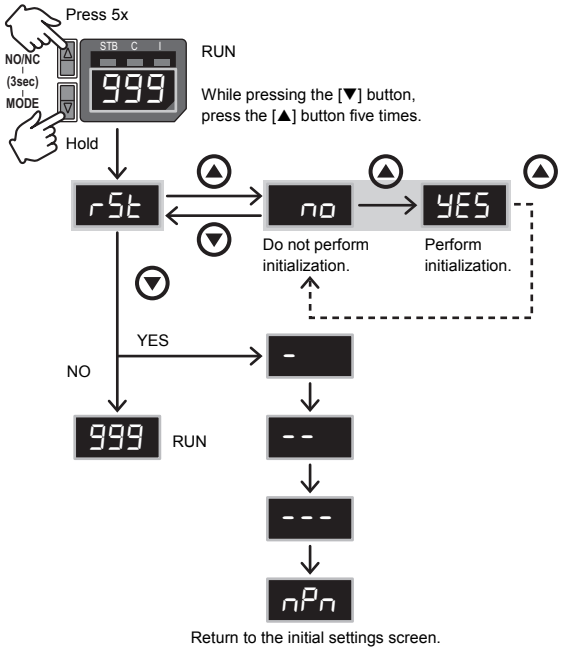
This function prevents operation mistakes, or the inadvertent changing of settings, by locking/disabling key operations. To require a password to release the key lock, set a password in advance. "7-9 Password" (page 6)



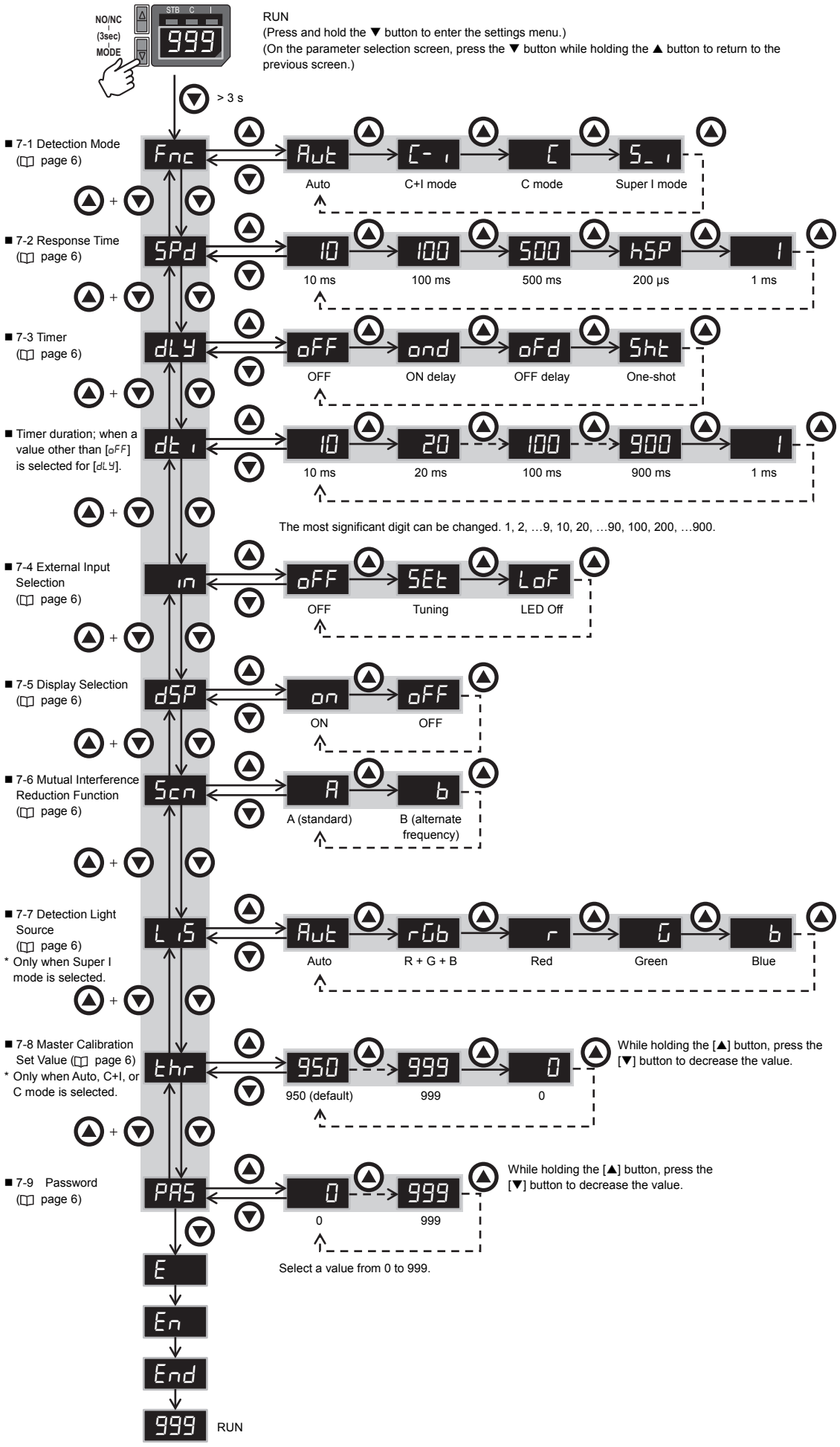
6-2 Initialization

It is possible to reset the product to its factory default settings. After initialization, the user must configure the settings again.

"3. Initial Settings (NPN/PNP Selection)" (page 2)



7. Settings


NO/NC
(3sec)
MODE
STB C I
999
RUN
(Press and hold the ▼ button to enter the settings menu.)
(On the parameter selection screen, press the ▼ button while holding the ▲ button to return to the previous screen.)
> 3 s
■ 7-1 Detection Mode
(page 6)
Fnc
Aut
C-I
C
S_I
Auto
C+I mode
C mode
Super I mode
■ 7-2 Response Time
(page 6)
SPd
10
100
500
hSP
1
10 ms
100 ms
500 ms
200 µs
1 ms
■ 7-3 Timer
(page 6)
dLY
oFF
ond
oFd
Sht
OFF
ON delay
OFF delay
One-shot
■ Timer duration; when a value other than [oFF] is selected for [dLY].
dt I
10
20
100
900
1
10 ms
20 ms
100 ms
900 ms
1 ms
The most significant digit can be changed. 1, 2, …9, 10, 20, …90, 100, 200, …900.
■ 7-4 External Input Selection
(page 6)
in
oFF
SEt
LoF
OFF
Tuning
LED Off
■ 7-5 Display Selection
(page 6)
dSP
on
oFF
ON
OFF
■ 7-6 Mutual Interference Reduction Function
(page 6)
Scn
A
b
A (standard)
B (alternate frequency)
■ 7-7 Detection Light Source
(page 6)
* Only when Super I mode is selected.
L IS
Aut
rGb
r
G
b
Auto
R + G + B
Red
Green
Blue
■ 7-8 Master Calibration Set Value (page 6)
* Only when Auto, C+I, or C mode is selected.
thr
950
999
0
950 (default)
999
0
While holding the [▲] button, press the [▼] button to decrease the value.
■ 7-9 Password
(page 6)
PAS
0
999
0
999
While holding the [▲] button, press the [▼] button to decrease the value.
Select a value from 0 to 999.
E
En
End
999
RUN

7-1 Detection Mode

Select the desired detection mode.
See "4-2 Detection Mode" (page 2).

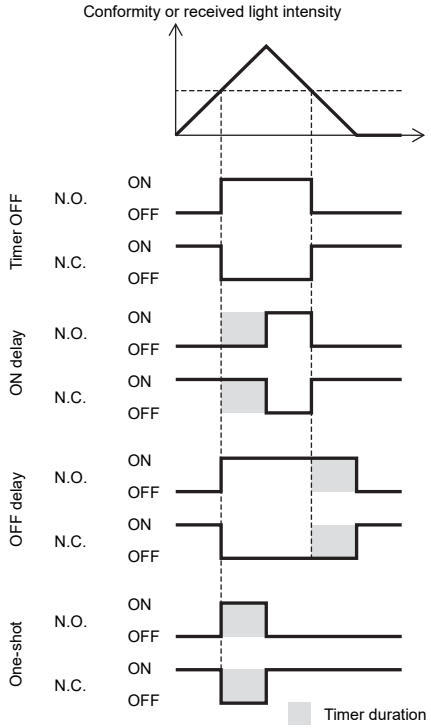
7-2 Response Time

The longer the response time, the more reliable and stable the detection.
When detection is unstable due to the workpieces moving at a high speed, set the response time to a smaller value.

7-3 Timer

This function can be used to delay the timing of the sensor output switching.

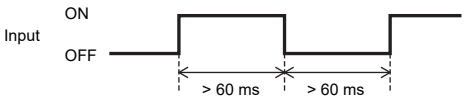
- ON delay [ond]
- OFF delay [oFd]
- One-shot [5ht]



7-4 External Input Selection

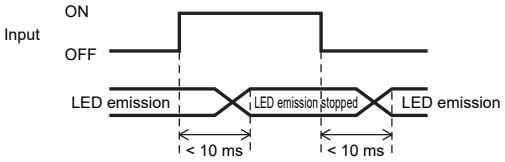
■ Calibration [SEt]

This external input performs the same function as pressing the [SET] button.



■ Transmission OFF [LoF]

This external input stops the emission of the LED.



7-5 Display Selection

The display can be turned off by selecting oFF.

7-6 Mutual Interference Reduction Function

The effect of mutual interference can be reduced by changing the light emission period. When using multiple LR-W Series units in close proximity, set each unit to a different light emission period. When selecting frequency B (alternate frequency), the response time becomes approximately 20% slower.

7-7 Detection Light Source

When using Super I mode, the light source used for detection is automatically selected to provide optimal performance. To require the sensor to use a specific light source, adjust this setting to Red, Green, Blue, or RGB.

7-8 Master Calibration Set Value

When using Auto/C+I/C mode, a predetermined set value is used when master calibration is executed. The predetermined set value can be changed using this menu. When a larger setting value is used, the detection tolerance is tighter. In contrast, when the setting value is reduced, a wider detection tolerance is enabled.
With a higher setting value, there is a higher possibility of saturation or "---" occurring after Master calibration. If Master calibration results in "---", perform Master calibration again after lowering this value.

7-9 Password

An optional password can be set to further prohibit unauthorized releasing of the "6-1 Key Lock" (page 4). Select a value from 1 to 999 for this setting. If "0" is selected, the password will not be required.

8. Troubleshooting

8-1 Error Display

Display	Cause	Solution
ErC	Excessive current (overcurrent) is flowing through the output wire.	• Check if the output wires are connected correctly and are not in contact with other wires. • Check if the load is within the rated range for the output.
ErE	The memory has reached its end of life, or the sensor is malfunctioning.	Perform initialization. If the problem persists, contact KEYENCE.
uuu	Displayed when excessive light is received by the sensor (Auto/C+I/C modes)	Adjust the sensor's installation angle so that specular reflections do not enter the receiver.
nnn	Displayed when insufficient light is received by the sensor (Auto/C+I/C modes)	Check whether the detection distance is within specified range.
Loc	The key lock function is enabled.	Release the key lock. (page 4)
- (The bar pulses across the display.)	The display selection is set to OFF.	Set the display selection to ON. (page 5)

8-2 Output When an Error Occurs

Display	Output Condition		Indicator Condition	
	N.O.	N.C.	N.O.	N.C.
ErC	OFF	OFF	Flashing in red	
ErE	Normal operation		Flashing in red	
uuu	OFF	ON	Off	Orange
nnn	OFF	ON	Off	Orange
Loc	Normal operation		Normal operation	
- (The bar pulses across the display.)	Normal operation		Normal operation	

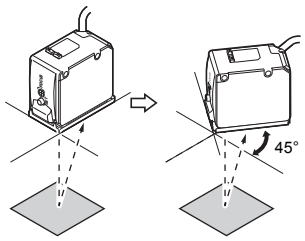
8-3 Default Settings/Values List

Item	Initial value
NPN/PNP selection	NPN
N.O./N.C. selection	N.O.
Detection mode	Auto
Response time	10 ms
Timer	OFF
Timer duration	10 ms
External input	OFF
Display selection	ON
Mutual Interference Reduction Function	A (standard)
Detection light source	Auto
Master calibration setting value	950

8-4 Other Precautions

• When using the luster canceling attachment (LR-WA1)

With some glossy targets (ex. stretched films), stable detection may not be achievable at certain angles. In such cases, rotate the sensor +/-45°, as shown in the diagram below, to determine the most appropriate angle for stable detection.



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