



Multi-Sensor Controller MU-N Series User's Manual LR-W500(C) Edition



This product can be used by connecting it to KEYENCE sensor models that support the MU-N Series.

It can also be used with product series that feature models that support N-bus (the name of KEYENCE's wire-saving system).

For details on these functions, see the "MU-N Series User's Manual".

There is a separate "MU-N Series User's Manual" for each sensor model that can be connected. These manuals can be downloaded from the KEYENCE website (<http://www.keyence.com>). Please contact your nearest KEYENCE office, when it is not possible to download these files over the internet.

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 these sections carefully.

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

Point Indicates additional information on proper operation.

1. Introduction

1-1 Safety Precautions

	WARNING	<ul style="list-style-type: none"> This product is only intended to detect objects. 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	<ul style="list-style-type: none"> 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.

1-3 Package Contents

- Controller
- Instruction manual

1-4 Specifications

Model		MU-N11	MU-N12
		Main unit	Expansion unit
Connected sensor		LR-W500(C)	
Response time		Single output: 300 μs/1.1 ms/11 ms/100 ms/500 ms selectable Multiple output: 2 ms/3 ms/11 ms/100 ms/500 ms selectable	
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	24 VDC, ripple (P-P) 10% or less, Class 2 or LPS	
	Current consumption	135 mA or less (without load) ^{*1}	120 mA or less (without load) ^{*2}
I/O ^{*4}	Control output	4 max., NPN open collector/PNP open collector selectable, 24 V or less, Main unit: 50 mA or less ^{*3} , Expansion unit: 20 mA or less, Residual voltage: 2 V or less, N.O./N.C. selectable	
	External input	5 max., Short-circuit current: NPN: 1 mA or less, PNP: 2 mA or less, For the applied voltage, see wiring diagrams (page 3 of the user's manual)	
I/O ^{*4}	Analog output	1 max., Current output/ Voltage output selectable, Current output: 4 to 20 mA, Max. load resistance: 450 Ω, Voltage output: 0 to 10 V, External load resistance: 5 kΩ or more	
	Protection circuit	Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection	
Expansion units		Up to 4 expansion units ^{*5}	
Environmental resistance	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 and dust cover: Polycarbonate Buttons: Polyacetal Display panel: PMMA	
Weight		Approx. 70 g	Approx. 70 g

*1 335 mA or less (when 4 outputs are used, with load)

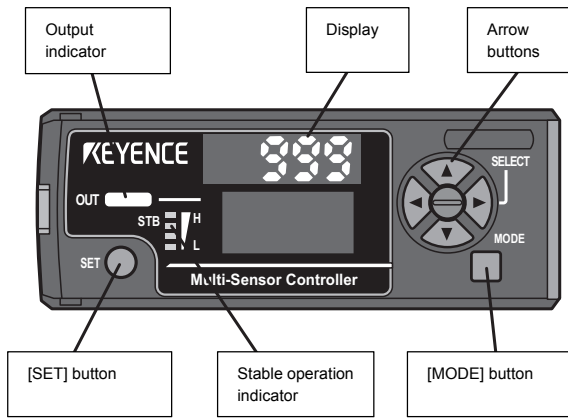
*2 200 mA or less (when 4 outputs are used, with load)

*3 20 mA or less when an expansion unit is connected.

*4 For more information on Control output, External input, and Analog output wire allocation, please refer to the table of "Power cable pin layout" on page 3 of this manual.

*5 Up to 5 N-bus devices, including the main unit (or network unit), can be linked together.

1-5 Names of Main Unit Components

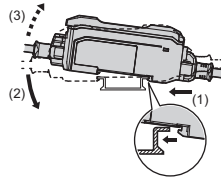


2. Installation and Wiring

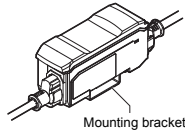
2-1 Installation

■ Attaching the MU-N11 (main unit)

1 Align the claw at the bottom of the main body with the DIN rail, as shown in the figure to the right. While pushing the main body in the direction of arrow (1), push down in the direction of arrow (2).



2 To remove the sensor, push the main body in the direction of arrow (1), while lifting the unit in the direction of arrow (3).



When using the mounting bracket (OP-76877, sold separately), attach the sensor as shown in the figure on the right.

■ Attaching the MU-N12 (expansion unit)

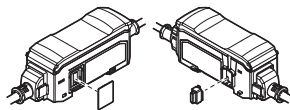
Several expansion units can be used in conjunction with a main unit. Up to four expansion units can be connected to one main unit.

* You can also connect up to four models that support N-bus (the name of KEYENCE's wire-saving system) to one main unit.

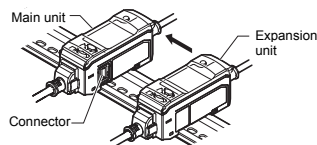
CAUTION	Mount the product on a DIN rail and install on a metal surface when connecting multiple expansion units or mounting main units close together.
NOTICE	Turn the power off before connecting expansion units.

- Point**
- Contact your nearest KEYENCE office when connecting units other than N-bus (the name of KEYENCE's wire-saving system) compatible sensors.
 - Turn the power off before connecting expansion units.
 - Do not touch the expansion unit connectors.
 - When using the MU-N Series as the main unit, verify that the expansion products used (other than MU-N Series expansion units) can operate within the power supply voltage range of the MU-N Series.

1 Remove the protection covers from the main unit and expansion unit(s).

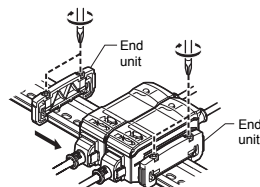


2 Install the expansion units on the DIN rail, one at a time. For more information about the installation, see "Attaching the MU-N11 (main unit)" (page 2).



3 Push the expansion unit into the main unit connector port until a clicking sound can be heard.

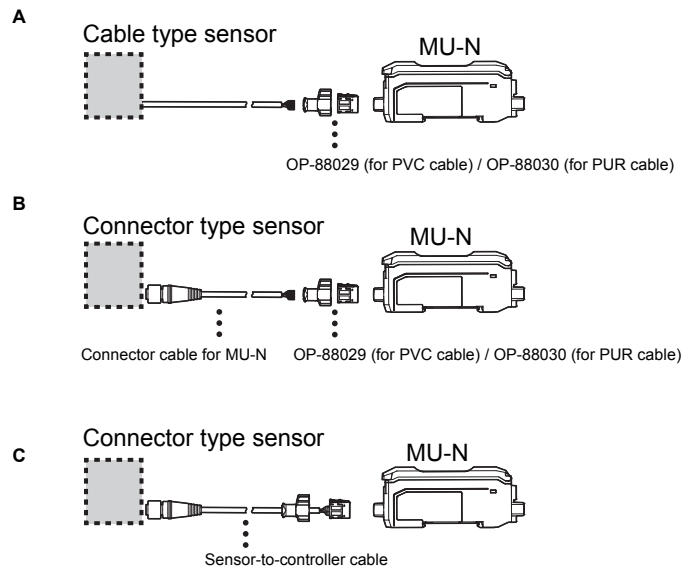
4 Using the same method as step (2), install the end units (OP-26751: 2 units in a set, sold separately) on either side of the main unit and expansion unit. Then, secure the end units in place.



2-2 Connecting the Sensor and Power Cables

NOTICE	<ul style="list-style-type: none"> Turn the power off before connecting the sensor cable and power cable. Insert the sensor cable and power cable securely into their respective ports. If not properly inserted, the cables can be easily disconnected.
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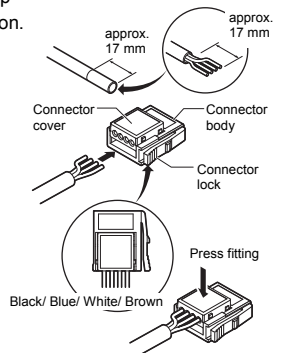
■ Sensor cable



In the case of A or B, please follow steps 1 through 3.

● Install the connector as follows:

1 Cut the cable to an appropriate length and strip away approx. 17 mm of the outermost insulation. It is not necessary to remove insulation from the core wires.



2 Insert the core wires into the connector by aligning the pin numbers on the connector body with the corresponding wire colors, refer to the table below for more information.

Connector pin number	Wire color
1	Brown
2	White
3	Blue
4	Black

3 To make a connection, press together the body and the connector cover into which the cables were inserted. (Use a pair of pliers or a similar tool to press them together.)

If the sensor cable needs to be cut to a shorter length, install the connector as described above.

* Do not reuse a connector that has already been press fitted.

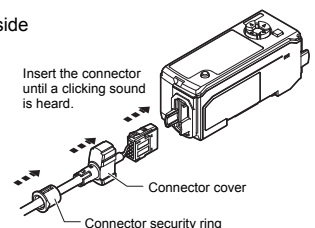
Use one of the following connectors.

OP-88029 (for use with PVC cables)

OP-88030 (for use with PUR cables)

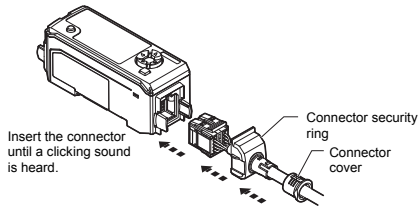
Note that 1 spare connector is included with the 10 m PVC type cables (OP-88026/88028).

4 Connect the sensor cable on the left side of the controller.



Power cable

Connect the power cable to the right side of the controller.



* Connector cover

The sensor cable and power cable are both equipped with a connector cover. After the connectors are inserted into the main unit, place the connector covers over the connectors. Finally, secure the connector covers with the connector security rings.

2-3 Wiring

Power cable pin layout

The tables below provide a breakdown of the power cables that can be used with the MU-N Series. They also contain information on the associated wire colors and functions.

<MU-N11 (main unit)>

Connector pin number	Wire color	Details	Power cable model/type	
A1	Brown (1*)	24 V	MU-CB4 4-core cable for main unit (MU-CC4:M12 connector type)*	MU-CB8 8-core cable for main unit
A3	Blue (3*)	0 V		
A4	Black (4*)	Output 1		
A2	White (2*)	Output 2/Input 1/Analog		
B1	Orange	Output 3/Input 2		
B2	Gray	Output 4/Input 3		
B3	Pink	Input 4		
B4	Violet	Input 5		

* Pin numbers when using an M12 connector cable

<MU-N12 (expansion unit)>

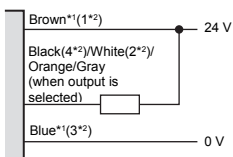
Connector pin number	Wire color	Details	Power cable model/type	
A4	Black	Output 1	MU-CB2 2-core cable for expansion unit	MU-CB6 6-core cable for expansion unit
A2	White	Output 2/Input 1		
B1	Orange	Output 3/Input 2		
B2	Gray	Output 4/Input 3		
B3	Pink	Input 4		
B4	Violet	Input 5		

Wiring

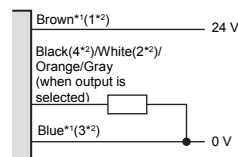
□ Load (input device) ⊗ Analog current or voltage input device

Control output

● NPN

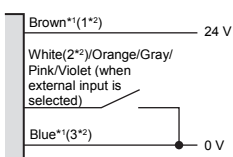


● PNP

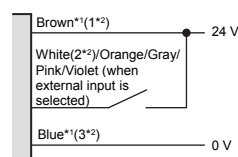


External input

● NPN

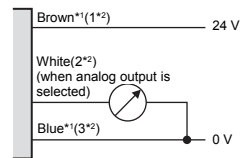


● PNP



Analog output*1

● NPN/PNP

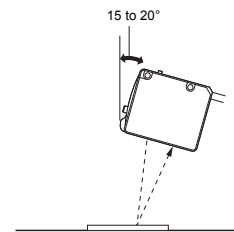


*1 MU-N11 only

*2 Pin numbers when using an M12 connector cable

2-4 Installing the Sensor

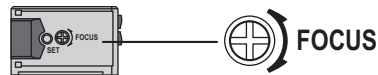
- Tightening torque for the mounting holes: 0.63 N·m (M3 screw)
- If the workpiece contains a glossy surface that could interfere with stable detection, tilt the sensor approx. 15° to 20°. If tilting the sensor does not improve detection, please attach the reflection canceling attachment (LR-WA1).



- 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.

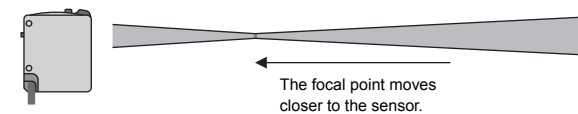
2-5 Adjusting the Spot Diameter

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

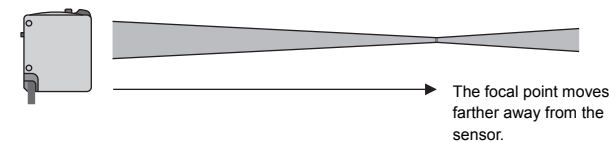


NOTICE Dial turning torque: 0.2 N·m or less

- 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

NOTICE When the MU-N Series and an LR-W500(C) are connected, the button operations for the LR-W500(C) main unit are disabled.

Depending on the setup statuses of the MU-N Series and the LR-W500(C), the following initial settings are required when power is turned on.

Condition	Required initial settings
Both the MU-N Series and the LR-W500(C) are in factory default.	3-1 Settings when both units are Initialized
The settings on the MU-N Series and the LR-W500(C) do not match.	3-2 Selecting the Settings to Use
The settings on the MU-N Series and the LR-W500(C) match.	Initial settings are not required.

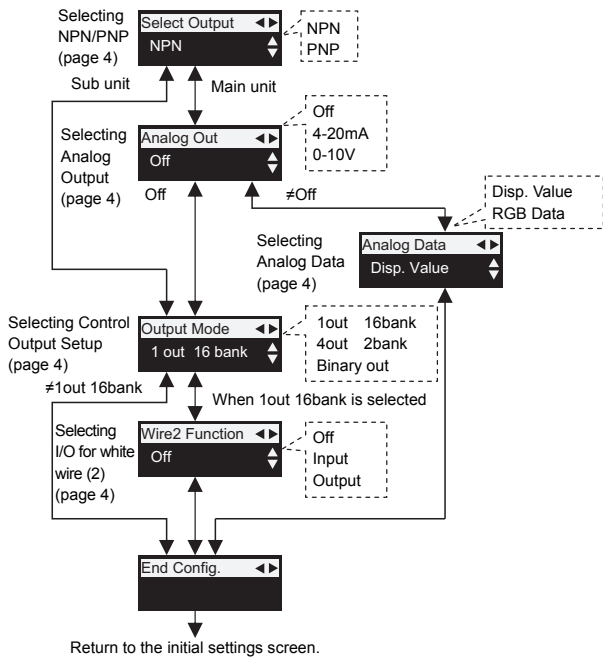
* When "6-2 Initialization" (page 6) is performed, "3-1 Settings when both units are Initialized" (page 4) is required.

3-1 Settings when both units are Initialized

Press or to advance through the menus.

Press to return to the previous menu.

Press or to select/change menu options.



* During initial settings, the 7 segment display shows [---].

■ Selecting NPN/PNP

Select the output type from either NPN or PNP. See "2-3 Wiring" (page 3).

■ Selecting Analog Output (only for MU-N11)

When using the analog output, select from the following:

- Current output [4 - 20mA]
- Voltage output [0 - 10V]

■ Selecting Analog Data (only for MU-N11)

Select the data to output in analog format from the following:

- Display value [Disp. Value]^{*1}: Outputs the value (0-999) displayed on the unit.
- RGB data [RGB Data]^{*2}: Outputs one of the following values (0-999) selected using an external input: Display value, R (red) amount, G (green) amount, or B (blue) amount^{*3}.

*1 When [Disp. Value] is selected, the control output is set to 1out 16bank.

*2 When [RGB Data] is selected, the control output is set to 1out 4bank. The external input is set to the RGB selection setting.

*3 R (red) amount, G (green) amount, and B (blue) amount are values related to that specific color elements portion of the full RGB reading. All three components will total 1000.

For the selection method, see "8-2 Switching Banks through External Inputs" (page 11).

■ Selecting Control Output Setup

When using the control output(s), select from the following:

- 1 output 16 banks [1out 16bank]: 1 output wire with 16 banks available
- 4 outputs 2 banks [4out 2bank]: 4 output wires with 2 banks available
- Binary output (Up to 15 patterns) [Binary out]: 4 output wires with 1 to 15 signal combinations possible

(See "8-2 Switching Banks through External Inputs" (page 11).)

■ Selecting I/O for white wire (2)

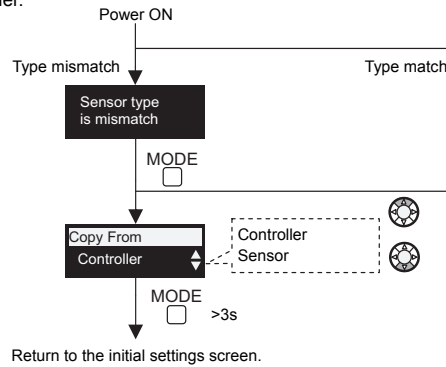
When "1out 16bank" is selected, the Input or Output functionality of the white wire (2) can be selected.

- External input [Input]
- Control output [Output]

* Disabled when [Off] is selected. See "8-1 Input/Output Wire Settings List" (page 11).

3-2 Selecting the Settings to Use

When the settings on the MU-N Series and the LR-W500(C) do not match at power-on, the desired settings need to be chosen from either the sensor or the controller.



Controller ^{*1} (Default ^{*2})	Sends the MU-N settings to the LR-W500(C).
Sensor	Sends the LR-W500(C) settings to the MU-N.

*1 If the settings stored in the MU-N cannot be sent to LR-W500(C), [Initialize] is displayed instead of [Controller]. Selecting [Initialize] requires "3-1 Settings when both units are Initialized" (page 4).

*2 If the connected MU-N is in the initial setting, [Sensor] is the default value.

While setting the above, the 7 segment display shows [---].

4. Basic Settings

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

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

* To change the output logic, see "7. Advanced settings" (page 8).

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. Advanced settings" (page 8).

* When using the binary output mode, this cannot be selected.

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 5).

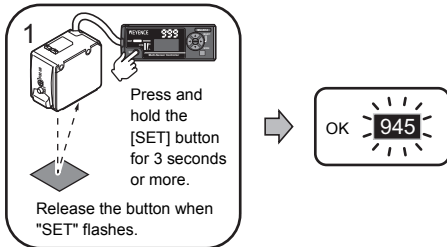
* The blinking numeric value that appears after calibration is the setting value.

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

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

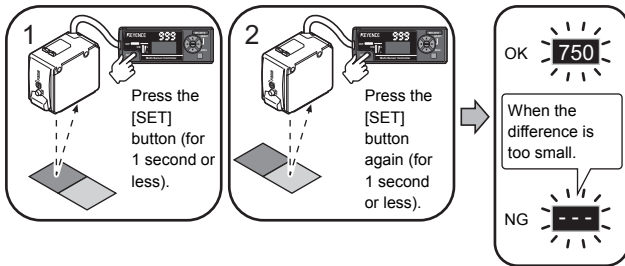
Register the color of the workpiece to be detected.

(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.)

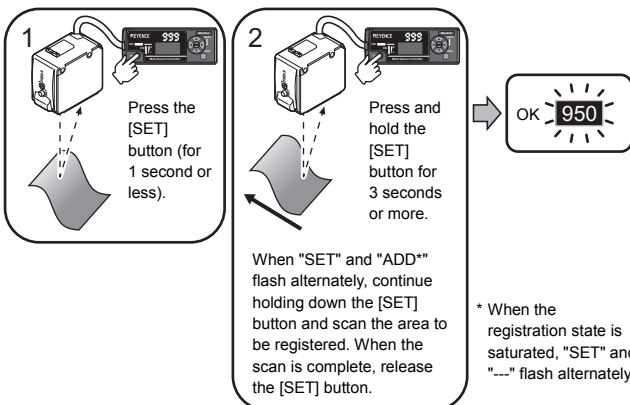


● Master calibration (use to permit color variations within the same workpiece)

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 "7-12 Master Calibration Set Value" (page 10).

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



< Precautions for master calibration >

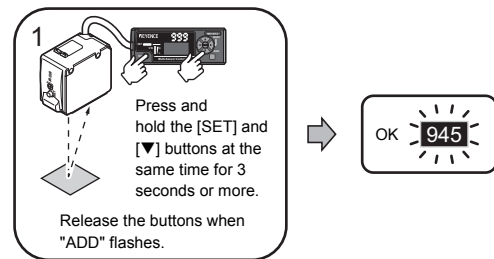
- Continue calibration until the green light that indicates reference addition does not turn on any more.
- If the master calibration is performed again, the registered contents from the first master calibration will be overwritten. To add an allowable range after the master calibration, perform the master addition calibration.
- If the registration status is saturated and "----" is displayed. Perform the master calibration again after lowering the "7-12 Master Calibration Set Value" (page 10).
- 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".



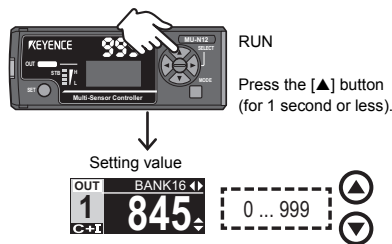
< Precautions for master addition calibration >

- 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.



<Note for sensitivity setting and setting value adjustment >

*1 When using the following settings, the master calibration and master addition calibration cannot be used.

- When using 1 output 16 banks, banks 5 through 16 cannot use these functions.
- When selecting the response time of 2 ms while using 4 outputs 2 banks
- When using the binary output mode

*2 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

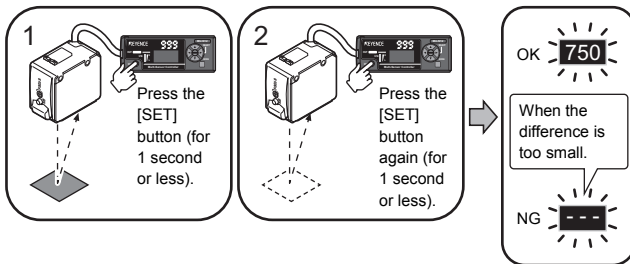
The threshold at which the received light intensity is judged to indicate that a workpiece is present.

To check or manually make fine adjustments to the value, see "■ Checking and adjusting the setting value" (page 6).

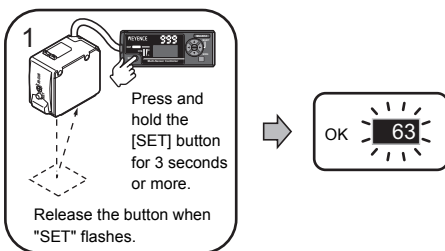
* The blinking numeric value that appears after calibration is the setting value.

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

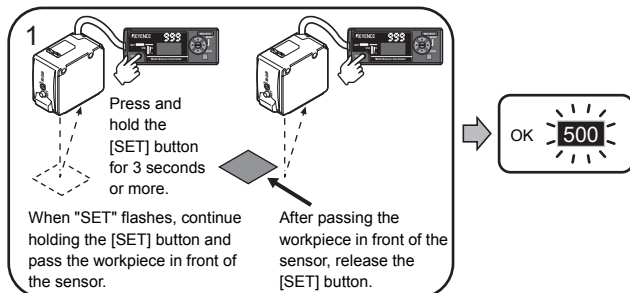
● 2-point calibration (basic intensity differentiation)



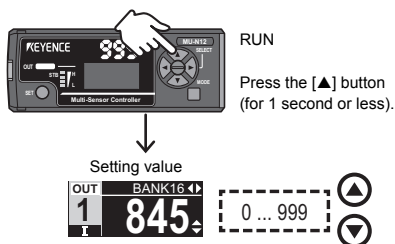
● Maximum sensitivity calibration (use to increase the sensitivity of the sensor to detect small changes)



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



■ Checking and adjusting the setting value

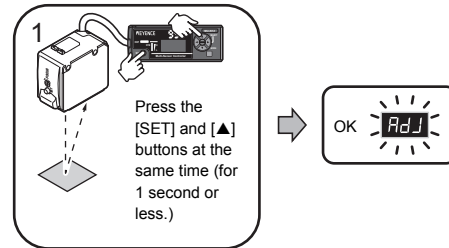


■ When the received light intensity is saturated or insufficient

When using the product with the $300 \mu s^{*1}$ or $1.1 ms^{*2}$ 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.

*1 2 ms during multiple outputs

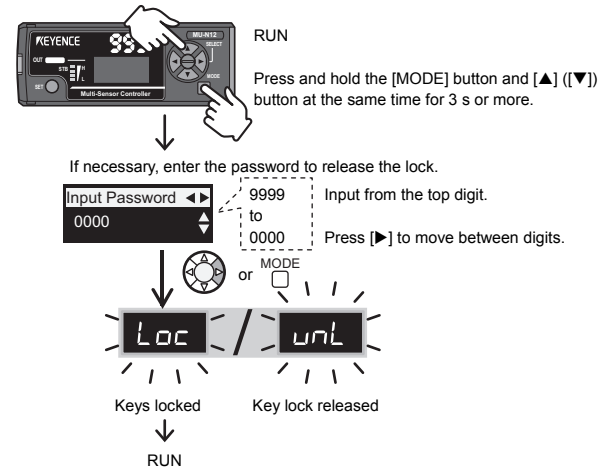
*2 3 ms during multiple outputs



6. Useful Functions

6-1 Key Lock

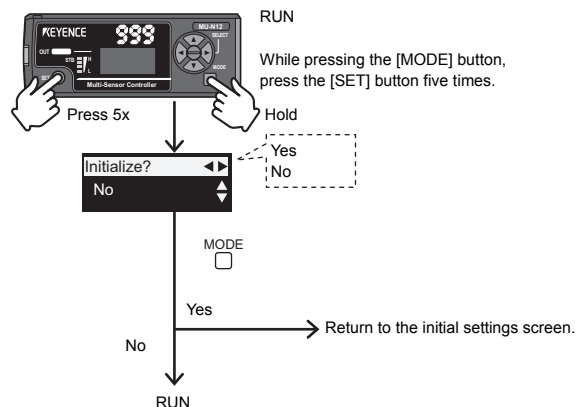
This function prevents operation mistakes, or the inadvertent changing of settings, by locking/disabling key operations. To require a password to release the key lock, set a password in advance. "7-15 Password" (page 11)



6-2 Initialization

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

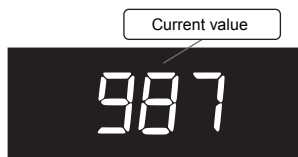
"3-1 Settings when both units are Initialized" (page 4)



6-3 Switching the Display Screen

■ Basic screen

- 7 segment display





When tuning, the bank and channel of the output that is having its setting value changed is displayed.

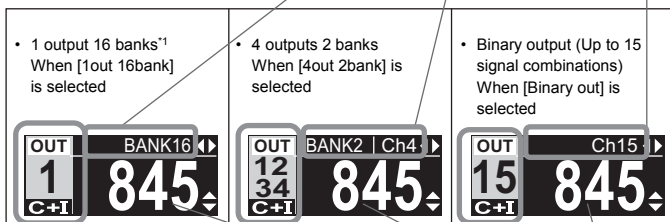
Press



to switch the bank and channel.

(Press  +  to return to the previous screen.)

- Display





[OUT]: Illuminates when the control output is ON.
[1 to 15]: The number of the channel whose control output is ON illuminates.^{*2}
[C+I]: The selected mode illuminates.^{*3}

The setting value

*1 When the analog output [RGB Data] is selected, 1output 4banks is set.

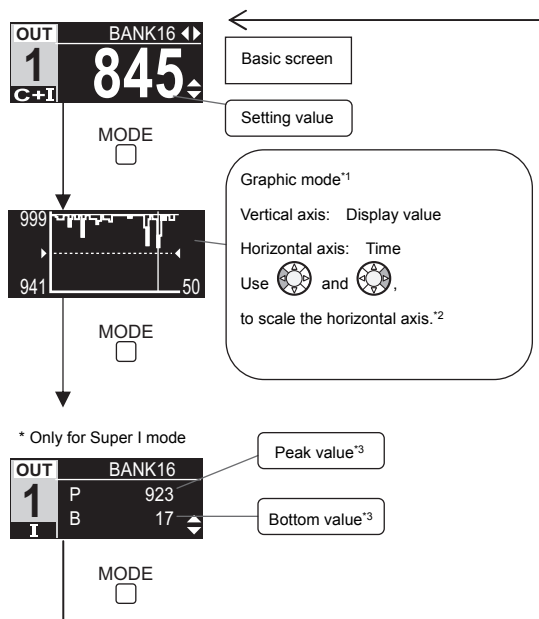
Therefore, the bank can be selected from BANK1 to 4. (only for MU-N11)



*2 When using the binary output, the channel No. with the output ON illuminates.


*3 When super I mode is selected, press  +  to display the light source being used to make judgments.

■ Display switching method

Information to display can be selected from the following.

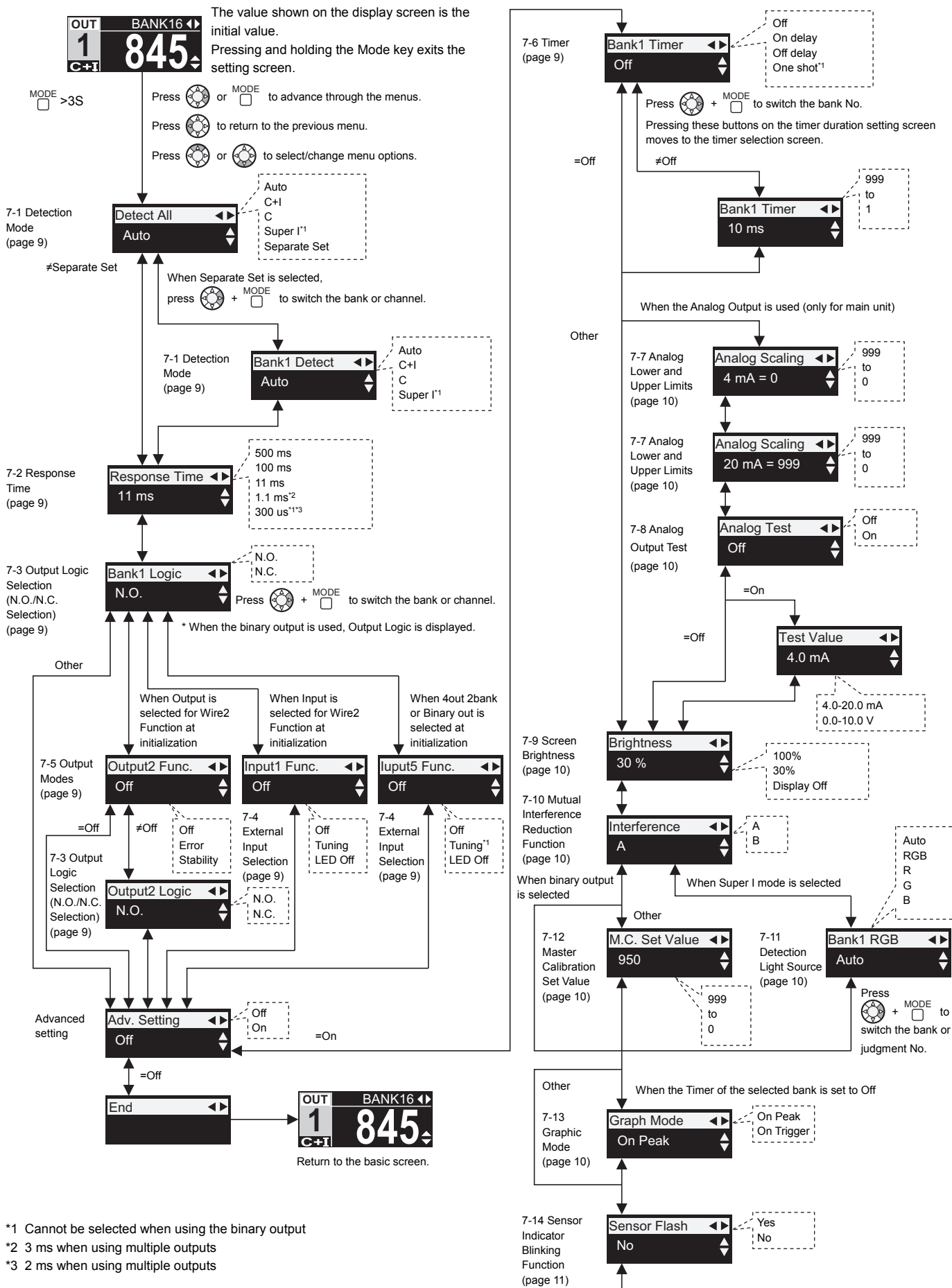


*1 Press  and  simultaneously for approx. 3 seconds to reset the graphics display.

*2 For details, see  "7-13 Graphic Mode" (page 10).

*3 When the output changes from ON to OFF, the peak value is updated.
When the output changes from OFF to ON, the bottom value is updated.
(Operation for N.O. ON and OFF are reversed for N.C.)

7. Advanced settings



*1 Cannot be selected when using the binary output
 *2 3 ms when using multiple outputs
 *3 2 ms when using multiple outputs

(Continued to the next page)

7-5 Output Modes

■ Stability [Stability]

This function can indicate when the amount of light received is not stable. This output will turn ON when the amount of light is unstable and the stability indicators do not illuminate.

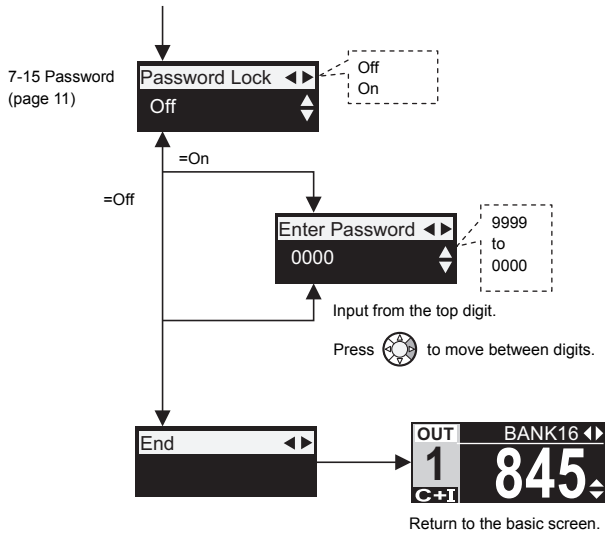
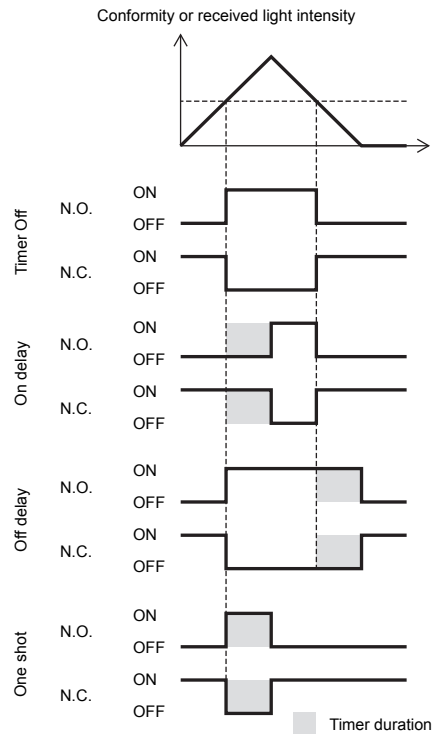
■ Error [Error]

This output turns ON when an error occurs. As soon as the error is cleared, the output is automatically reset. For the cause of the error, see "9-1 Error Display" (page 12).

7-6 Timer

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

- On delay
- Off delay
- One shot



7-1 Detection Mode

Select the desired detection mode.

☐ See "4-2 Detection Mode" (page 4).

Selecting [Separate Set] allows different detection modes to be set for each bank and channel individually.

7-2 Response Time

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

7-3 Output Logic Selection (N.O./N.C. Selection)

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

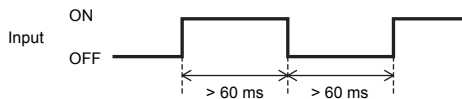
- N.O.: Turns the output on when the registered condition is met (turns the output on when light is received) *.
- N.C.: Turns the output on when a condition other than the registered condition is met (turns the output on when light is not received) *.

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

7-4 External Input Selection

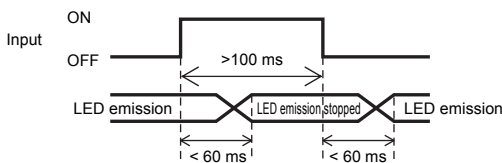
■ Calibration [Tuning]

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



■ Transmission OFF [LED Off]

This external input stops the emission of the LED.



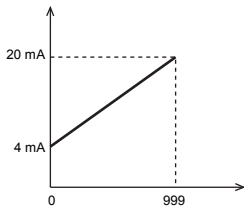
7-7 Analog Lower and Upper Limits

Configure scaling settings, if necessary.

■ Current output (4 to 20 mA)

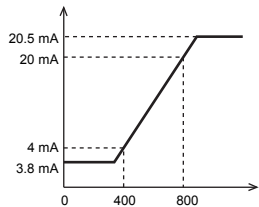
● Initial settings

Analog 4 mA	0
Analog 20 mA	999

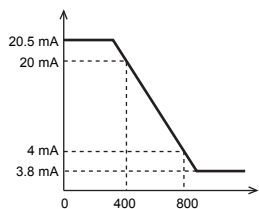


● When settings are changed (example)

Analog 4 mA	400
Analog 20 mA	800



Analog 4 mA	800
Analog 20 mA	400

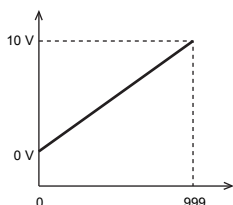


For details on the analog output when an error occurs, see "9-2 Displays Other than Numeric Values" (page 12).

■ Voltage output (0 to 10 V)

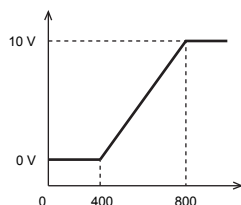
● Initial settings

Analog 0 V	0
Analog 10 V	999

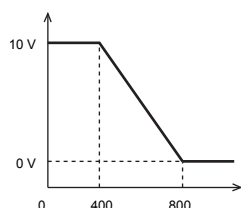


● When settings are changed (example)

Analog 0 V	400
Analog 10 V	800



Analog 0 V	800
Analog 10 V	400



For details on the analog output when an error occurs, see "9-2 Displays Other than Numeric Values" (page 12).

7-8 Analog Output Test

It is possible to output arbitrary current or voltage values to ensure the analog signal is properly received by the analog input device.

7-9 Screen Brightness

Screen brightness after no operation has been done for a certain period of time can be configured.

Item	Description
100%	The display brightness is always kept at 100%.
30% (default value)	After a certain period of time, the display brightness will be set to 30%.
Display Off	After a certain period of time, the display will be turned OFF.

- After using LR-W for a long period of time, the brightness will gradually decrease.
- When screen brightness is set to [100%], the brightness will decrease at a faster rate.
- When screen brightness is set to [Display Off], the 7 segment display will show as follows.



* Display will be back to normal state after button operation.

7-10 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.

7-11 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.

7-12 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.

7-13 Graphic Mode

Recent display values and peak values can be shown on a graph.

■ Peak at ON [On Peak]



This graph displays the peak values that occur during each output cycle. The peak value is updated each time the output turns off*.

- Vertical axis: Peak value while the output was ON
- Horizontal axis: The number of times the output turned ON. The maximum value is selectable from the following :
50 (default), 500, 2000, 10000

* Operation for N.O. ON and OFF are reversed for N.C.

Trigger at ON [On Trigger]



The transition of the display value before and after the output turned ON for the most recent output cycle will be plotted on the graph*.

- Vertical axis: Display value at ON
- Horizontal axis: Time and display range selectable from the following :
0.1 sec. (default), 1 sec., 10 sec.

* Operation for N.O. ON and OFF are reversed for N.C.

7-14 Sensor Indicator Blinking Function

While [Yes] is selected, the sensor indicator blinks in green. This function notifies users which sensor is being set. Exiting this screen returns the setting to [No].

7-15 Password

If you set this to [ON], you can set a personal identification number that must be entered to release the "6-1 Key Lock" (page 6). You can set the personal identification number to a value from 0 to 9999.

8. Input/Output Wire Settings

8-1 Input/Output Wire Settings List

Wiring	Wire No.	1	2	3	4	5	6
	Wire color	Black (4)	White (2)	Orange	Gray	Pink	Violet
	I/O No.	Output 1	Output 2/ Input 1	Output 3/ Input 2	Output 4/ Input 3	Input 4	Input 5
I/O specifications	1 output 16 banks	Control output 1	External input ¹ or Control output ² selectable	Bank input A	Bank input B	Bank input C	Bank input D
	4 outputs 2 banks	Control output 1 (Ch1)	Control output 2 (Ch2)	Control output 3 (Ch3)	Control output 4 (Ch4)	Bank input A	External input ¹
	Display value (Analog output) + 1 output 16 banks	Control output 1	Analog output	Bank input A	Bank input B	Bank input C	Bank input D
	RGB data (Analog output) + 1 output 4 banks	Control output 1	Analog output	Bank input A	Bank input B	Analog selection input 1	Analog selection input 2
	Binary output	Binary output A	Binary output B	Binary output C	Binary output D	- (Invalid)	External Input ³

*1 [Off]/[Tuning]/[LED off] selectable

*2 [Off]/[Stability]/[Error] selectable

*3 [Off]/[LED off] selectable

8-2 Switching Banks through External Inputs

To switch banks through external inputs, the unit needs to be in a key locked status.

Set the key lock beforehand. "6-1 Key Lock" (page 6)

Bank inputs for 1 output 16 banks

Wiring	Wire color	Orange	Gray	Pink	Violet
	I/O No.	Input 2	Input 3	Input 4	Input 5
	External input	Bank input A	Bank input B	Bank input C	Bank input D
Bank No.	BANK1	OFF	OFF	OFF	OFF
	BANK2	ON	OFF	OFF	OFF
	BANK3	OFF	ON	OFF	OFF
	BANK4	ON	ON	OFF	OFF
	BANK5	OFF	OFF	ON	OFF
	BANK6	ON	OFF	ON	OFF
	BANK7	OFF	ON	ON	OFF
	BANK8	ON	ON	ON	OFF
	BANK9	OFF	OFF	OFF	ON
	BANK10	ON	OFF	OFF	ON
	BANK11	OFF	ON	OFF	ON
	BANK12	ON	ON	OFF	ON
	BANK13	OFF	OFF	ON	ON
	BANK14	ON	OFF	ON	ON
	BANK15	OFF	ON	ON	ON
	BANK16	ON	ON	ON	ON

Bank inputs for 4 outputs 2 banks

Wiring	Wire color	Pink
	I/O No.	5
	External input	Bank input A
Bank No.	BANK1	OFF
	BANK2	ON

Analog output selection inputs and bank inputs for RGB data (Analog output) + 1 output 4banks

Wiring	Wire color	Orange	Gray	Pink	Violet
	I/O No.	Input 2	Input 3	Input 4	Input 5
	External input	Bank input A	Bank input B	Analog selection input 1	Analog selection input 2
Analog output selection	Display value ¹	-	-	OFF	OFF
	R (red) amount ²			ON	OFF
	G (green) amount ³			OFF	ON
	B (blue) amount ⁴			ON	ON
Bank No.	BANK1	OFF	OFF	-	-
	BANK2	ON	OFF		
	BANK3	OFF	ON		
	BANK4	ON	ON		

*1 Outputs display value.

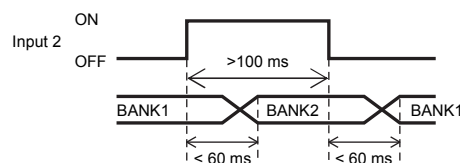
*2 Outputs R (red) amount considering the total RGB amount is 1000.

*3 Outputs G (green) amount considering the total RGB amount is 1000.

*4 Outputs B (blue) amount considering the total RGB amount is 1000.

<Time chart for bank input and analog selection input>

(Example)



8-3 Control Outputs during Binary Output

Wiring	Wire color	Black (4)		White (2)		Orange		Gray	
	I/O No.	1	2	3	4	5	6	7	8
Control output	Binary output A	Binary output B	Binary output C	Binary output D	Binary output E	Binary output F	Binary output G	Binary output H	Binary output I
Signal Combination When Match Occurs	No match	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	Matches ch5	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
	Matches ch6	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
	Matches ch7	ON	ON	ON	ON	ON	ON	ON	ON
	Matches ch8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch9	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch10	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch11	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
	Matches ch12	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
	Matches ch13	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
	Matches ch14	OFF	ON	ON	ON	ON	ON	ON	ON
Matches ch15	ON	ON	ON	ON	ON	ON	ON	ON	

- If the unit matches on multiple channels, it outputs the channel with the highest matching degree.
- If N.C. is set, ON and OFF output logic is reversed in the above chart.

9. Troubleshooting

9-1 Error Display

Display	Cause	Solution
<i>E-H</i>	The sensor cable is broken, or the sensor is disconnected.	<ul style="list-style-type: none"> • Check if the sensor is connected. • Check if the sensor cable is not broken. • Check if the sensor cable is properly wired to the connector. After confirmation, turn the power on again.
<i>E-C</i>	Excessive current (overcurrent) is flowing through the output wire.	<ul style="list-style-type: none"> • 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.
<i>E-E</i>	The memory has reached its end of life, or the sensor is malfunctioning.	Perform initialization. If the problem persists, contact KEYENCE.
<i>uuu</i>	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.
<i>nnn</i>	Displayed when insufficient light is received by the sensor (Auto/C+I/C modes)	Check whether the detection distance is within specified range.
<i>Lcc</i>	The key lock function is enabled.	Release the key lock. (<input type="checkbox"/> page 6)
<i>-</i> (The bar pulses across the display.)	The Screen brightness is set to [Display Off].	Set the Screen brightness to [30%]. (<input type="checkbox"/> page 8)

9-2 Displays Other than Numeric Values

Indication	ON/OFF output		Analog output		Indicator	
	N.O.	N.C.	4-20 mA	0-10 V	N.O.	N.C.
<i>E-H</i>	OFF*	OFF*	2 mA	0 V	Blinking red	
<i>E-C</i>	OFF	OFF	Normal		Blinking red	
<i>E-E</i>	Normal*		Normal		Blinking red	
<i>uuu</i>	OFF	ON	2 mA	0 V	OFF	Orange
<i>nnn</i>	OFF	ON	2 mA	0 V	OFF	Orange
<i>Lcc</i>	Normal		Normal		Normal	
<i>-</i> (Bar moves along the display)	Normal		Normal		Normal	

- * When Output modes is set to [Error], MU-N would turn ON with N.O. and turn OFF with N.C.

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