Panasonic **INSTRUCTION MANUAL**

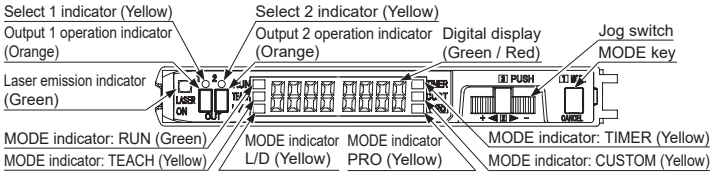
Digital Laser Sensor Amplifier **LS-403**

ME-LS403 No.0084-50V

Thank you very much for purchasing Panasonic products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product.
Kindly keep this manual in a convenient place for quick reference.

For details of the setting contents or setting procedures, refer to "**LS series PRO mode operation guide**" in "**Panasonic Industrial Devices SUNX website (http://panasonic.net/id/pidsx/global)**."

1 PART DESCRIPTION



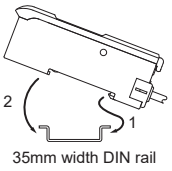
<Description of the operation part>

Jog switch			MODE key
Press	Turn to "+" side	Turn to "–" side	Press
To decide each item.	To select each item.		To select a mode or to cancel during setting.

2 MOUNTING

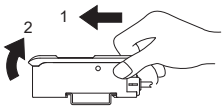
How to mount

1. Fit the rear part of the mounting section of the amplifier on a 35mm width DIN rail.
2. Press down the rear part of the mounting section of the unit on the 35mm width DIN rail and fit the front part of the mounting section to the DIN rail.



How to remove

1. Push the amplifier forward.
2. Lift up the front part of the amplifier to remove it.



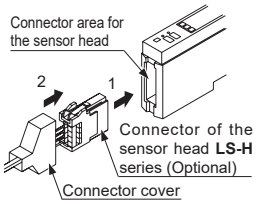
Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

3 CONNECTION OF A SENSOR HEAD

Make sure that the power supply is OFF while connecting or disconnecting the sensor head **LS-H** series (optional).

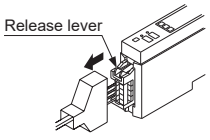
How to connect

1. Insert the connector of the sensor head **LS-H** series (optional) into the connector area for the sensor head of this product as shown in the right figure.
2. Fit the connector cover.



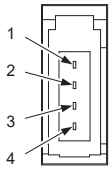
How to remove

1. Remove the connector cover.
2. Pressing the release lever attached to the connector of the sensor head, pull out the connector.



Note: Do not pull by holding the cable without pressing the release lever, as this can cause cable break or connector break.

<Terminal arrangement>



Terminal No.	Connection cable	
1	Cable core: Brown	Cable color: Gray
2	Shielded wire	
3	Cable core: Yellow	Cable color: Black
4	Shielded wire	

⚠ WARNING

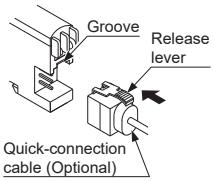
- Never use this product as a sensing device for personnel protection.
- In case of using devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- In case of control or adjustment using procedures other than those specified in this instruction manual, hazardous laser radiation exposure can result.

4 WIRING

Make sure to connect or disconnect the quick-connection cable (optional) in the power supply OFF condition.

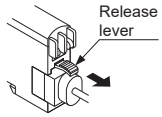
How to connect

1. Holding the connector of the quick-connection cable, align its release lever with the groove at the top portion of the controller connector.
2. Insert the connector till a click is felt.



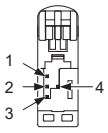
How to remove

1. Pressing the release lever at the top of the quick-connection cable connector, pull out the connector.



Note: Take care that if the connector is pulled out without pressing the release lever, the release lever may break. Do not use a quick-connection cable whose release lever has broken. Further, do not pull by holding the cable, as this can cause a cable-break.

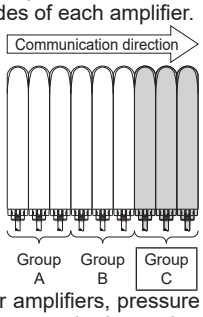
<Terminal arrangement>



Terminal No.	Terminal name
1	+V
2	Output 1
3	0V
4	Output 2

5 AMPLIFIER CASCADING

- Make sure that the power supply is OFF while adding or removing the amplifier.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case 2 or more amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When the amplifiers move on the DIN rail depending on the attaching condition or the amplifiers are mounted close to each other in cascade, fit them between the end plates **MS-DIN-E** (optional) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade).
- When connecting 2 or more amplifiers in cascade, use the sub cable **CN-72-C**□ (optional) as the quick-connection cable for the second amplifier onwards.
- When connecting amplifiers not close to each other in parallel, be sure to mount the end plate **MS-DIN-E** (optional) at both sides of each amplifier.
- When this product and other products (e.g. fiber sensor amplifiers, pressure sensor controllers, etc.) are connected together in cascade, install those products so that they are in order of Group A, B, and C as shown in the right figure. This product is included in Group C.

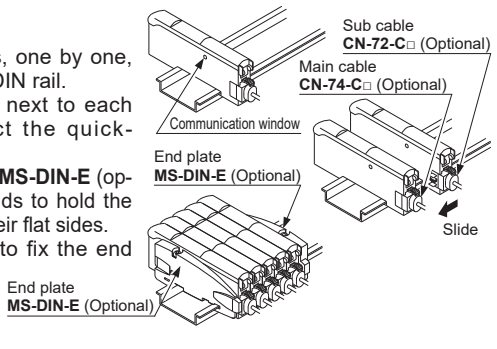


- As for the products that are located between different groups, put the amplifier protection seal **FX-MB1** (optional) on the communication window of each corresponding product.
- Within each group, identical models should be connected in a lump.
- When this product and other products (fiber sensor amplifiers, pressure sensor controllers, etc.) are connected together in cascade, items that can be copied at Copy setting are limited.
  Copiable items are digital display setting in RUN mode, Eco setting, time period hold setting and CUSTOM setting.

For mounting and removing the amplifier, refer to "**2 MOUNTING**."

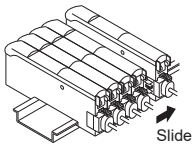
How to cascade

1. Mount the amplifiers, one by one, on the 35mm width DIN rail.
2. Slide the amplifiers next to each other, and connect the quick-connection cables.
3. Mount the end plates **MS-DIN-E** (optional) at both the ends to hold the amplifiers between their flat sides.
4. Tighten the screws to fix the end plates.

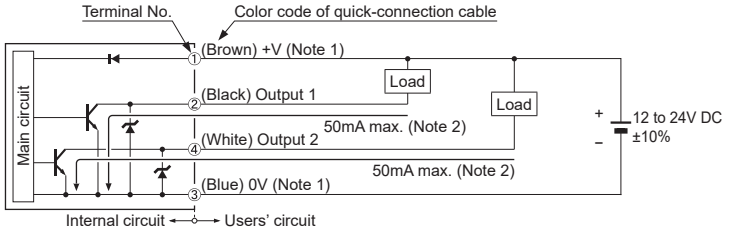


How to remove

1. Loosen the screws of the end plates.
2. Remove the end plates.
3. Slide the amplifiers and remove them one by one.



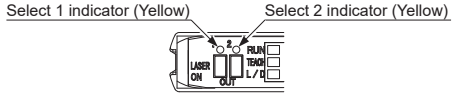
6 I/O CIRCUIT DIAGRAM



Notes: 1) The quick-connection sub cable does not have +V (brown) and 0V (blue). The power is supplied from the connector of the main cable.
2) 25mA max. if 5 or more controllers are connected together.
3) Do not use the amplifiers in a series (AND) connection.

7 OUTPUT CHANNEL SWITCHING

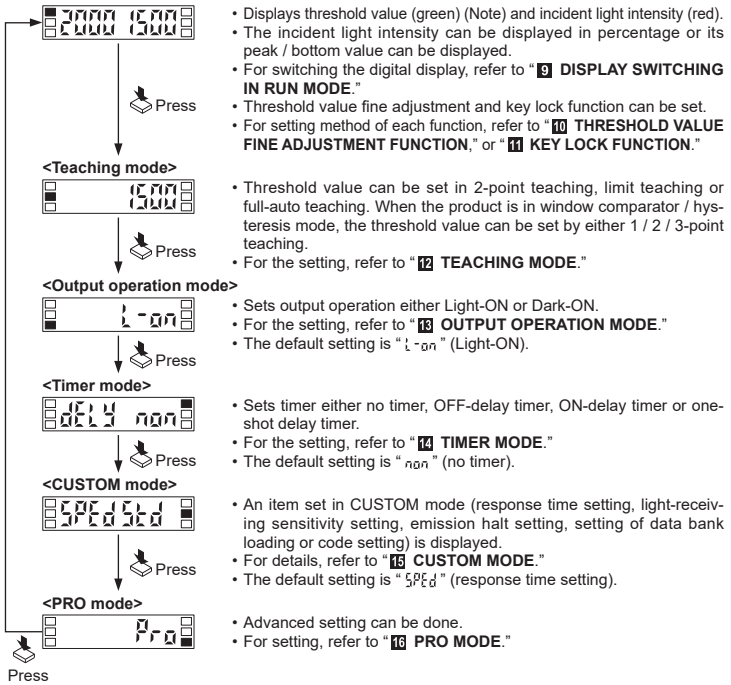
- Press the MODE key for 2 sec. or more to switch the output 1 / 2.
- The output 1 can be set when the Select 1 indicator (yellow) lights up, and the output 2 can be set when the Select 2 indicator (yellow) lights up.



8 OPERATION PROCEDURE

- Be sure to set the output 1 or the output 2 before setting each item.
- The items that can be set in the output 1 and the output 2 respectively are only 1. Threshold value, 2. Output operation, 3. Timer and 4. Output mode. The items other than those are common. (However, in case of code setting, a combination of the output 1 / 2 can be set only for output operation, timer and output mode.)
- The changed contents are not stored if turning the power OFF while setting. Therefore, make sure to confirm the settings by pressing the jog switch before turning the power OFF.

- When turning ON the power, normal condition is displayed [MODE indicator: RUN (green) lights up] and the digital display shows the threshold value (green) (Note) and the incident light intensity (red).
- When pressing MODE key, the mode changes as per the diagram below.



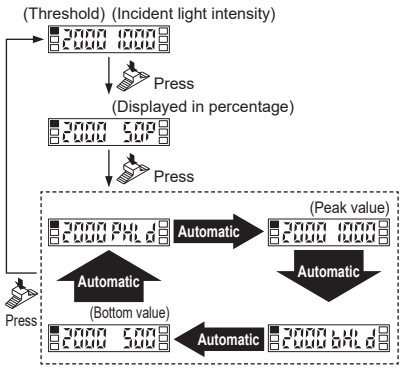
- Displays threshold value (green) (Note) and incident light intensity (red).
- The incident light intensity can be displayed in percentage or its peak / bottom value can be displayed.
- For switching the digital display, refer to "**9 DISPLAY SWITCHING IN RUN MODE**."
- Threshold value fine adjustment and key lock function can be set.
- For setting method of each function, refer to "**10 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION**," or "**11 KEY LOCK FUNCTION**."
- Threshold value can be set in 2-point teaching, limit teaching or full-auto teaching. When the product is in window comparator / hysteresis mode, the threshold value can be set by either 1 / 2 / 3-point teaching.
- For the setting, refer to "**12 TEACHING MODE**."
- Sets output operation either Light-ON or Dark-ON.
- For the setting, refer to "**13 OUTPUT OPERATION MODE**."
- The default setting is "L-on" (Light-ON).
- Sets timer either no timer, OFF-delay timer, ON-delay timer or one-shot delay timer.
- For the setting, refer to "**14 TIMER MODE**."
- The default setting is "non" (no timer).
- An item set in CUSTOM mode (response time setting, light-receiving sensitivity setting, emission halt setting, setting of data bank loading or code setting) is displayed.
- For details, refer to "**15 CUSTOM MODE**."
- The default setting is "SPEd" (response time setting).
- Advanced setting can be done.
- For setting, refer to "**16 PRO MODE**."

Note: When setting the output mode to the forced ON output mode, "on" is displayed on the digital display (green), while when setting to the forced OFF output mode, "oFF" is displayed on the digital display (green).
For the output mode, refer to **<PRO 6>** in "**16 PRO MODE**."

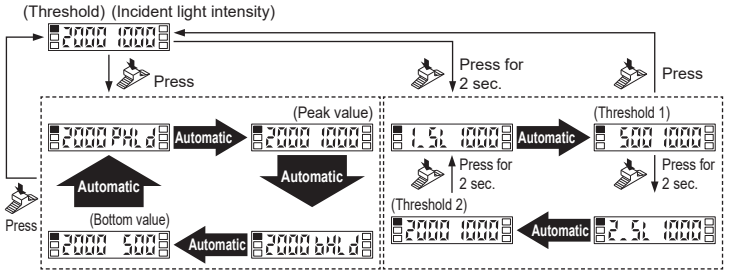
9 DISPLAY SWITCHING IN RUN MODE

- When switching the digital display in RUN mode, the digital display setting should be "d-Lc oFF" (lock OFF).
For the digital display setting, refer to **<PRO 2: Digital display setting>** in "**16 PRO MODE**."
- When pressing the jog switch while the MODE indicator: RUN (green) lights up, the digital display can be switched as the following diagram depending on each output mode.
For the output mode, refer to **<PRO 6>** in "**16 PRO MODE**."

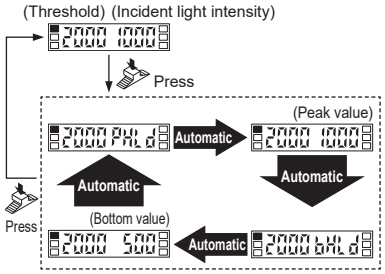
<In case of Normal mode>



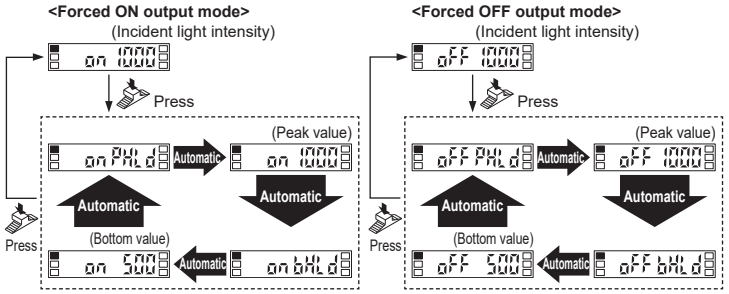
<In case of Window comparator mode or Hysteresis mode>



<In case of Rising differential mode or Trailing differential mode>



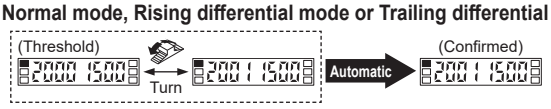
<In case of Forced ON output mode or Forced OFF output mode>



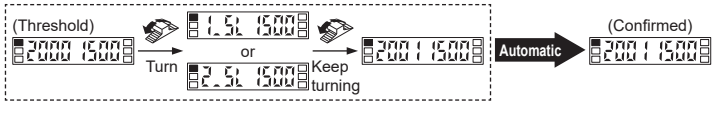
10 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION

- When the MODE indicator: RUN (green) lights up, threshold value fine adjustment can be done.
- Turn the jog switch to "+" side to increase the threshold value, while turn the jog switch to "–" side to decrease the threshold value.
- When setting output mode to the window comparator mode or hysteresis mode, turn the jog switch to show "1.SL" (or "2.SL"). Keep turning the jog switch to conduct the threshold value fine adjustment. Press down the jog switch for 2 sec. or more to show "2.SL" (or "1.SL").
- The value is automatically memorized unless TEACH mode is selected after the adjustment or any switch operation is not carried out within a certain period of time.
- For output mode, refer to **<PRO 6>** in "**16 PRO MODE**."

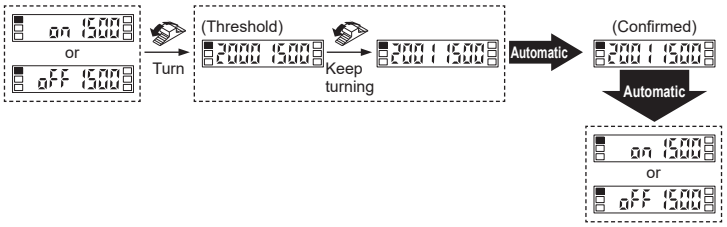
<In case of Normal mode, Rising differential mode or Trailing differential mode>



<In case of Window comparator mode or Hysteresis mode>



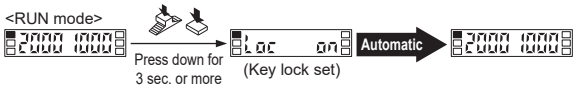
(In case of Forced ON output mode or Forced OFF output mode)



11 KEY LOCK FUNCTION

- The key lock function prevents key operations so that the conditions set in each setting mode are not inadvertently changed.
- If operating the jog switch or MODE key after key lock is set, "Loc on" is indicated on the digital display.

<Setting of key lock>



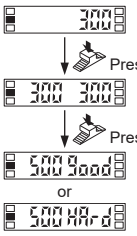
<Release of key lock>

12 TEACHING MODE

When teaching in Window comparator mode or Hysteresis mode, a setting has to be made in PRO mode beforehand.
In case of 1-point teaching, a shift value (the initial value is 100 or 15%) has to be set as well.
For setting, refer to **<PRO 6>** in "16 **PRO MODE**."

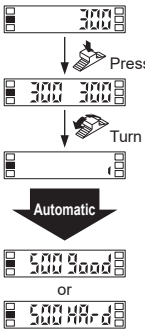
- When MODE indicator: TEACH (yellow) lights up, teaching can be done.

In case of 2-point teaching



1. Press the jog switch in the sensing object present condition.
2. Press the jog switch in the sensing object absent condition.
   The MODE indicator: TEACH (yellow) blinks.
3. A threshold value is set between the step 1 and 2.
   In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

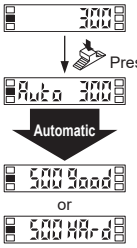
In case of Limit-teaching



1. Press the jog switch in the sensing object absent condition.
2. The MODE indicator: TEACH (yellow) blinks.
3. Turn the jog switch to "+" or "–" side.
   Turn to "+" side: The threshold level is shifted to a value approx. 15% higher (low sensitivity) than that set at step 1. (Note)
   Turn to "–" side: The threshold level is shifted to a value approx. 15% lower (high sensitivity) than that set at step 1. (Note)
4. In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

Note: Approx. 15% of the shift amount is an initial value. The shift amount can be changed in a range of approx. 0 to 999% (increment of 1%).
For setting the shift amount, refer to **<PRO 1: Shift setting>** in "16 **PRO MODE**."

In case of Full-auto teaching

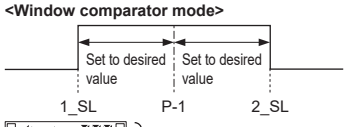


1. Run the sensing object on the line and hold down the jog switch.
2. "Auto" is displayed on the green digital display and when the sensing object passed through, release the jog switch.
   The MODE indicator: TEACH (yellow) blinks.
3. In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

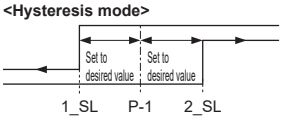
In case of 1-point teaching in Window comparator mode or Hysteresis mode

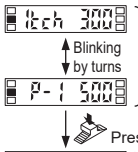
- This is the method to set the shift value to the desired value and set the threshold range by using the 1-point teaching.

<Window comparator mode>



<Hysteresis mode>





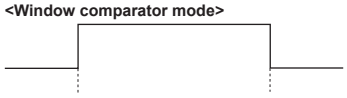
1. Press the jog switch in the sensing object present condition when "P-1" is displayed on the green digital display.
2. The threshold value (1_SL) that has been calculated by subtracting the shift value (100) from the incident light intensity and the threshold value (2_SL) that has been calculated by adding the shift value (100) to the incident light intensity are alternatively blinks on the green digital display. (Note 1, 2)
   In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

Notes: 1) The shift value of 100 is an initial value. The shift value can be set in PRO mode. Furthermore, the shift value can be set in percentage. For the setting, refer to **<PRO 6>** in "16 **PRO MODE**."
2) If the value after setting exceeds the maximum (minimum), the maximum (minimum) sensitivity will be set.

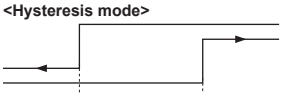
In case of 2-point teaching in Window comparator mode or Hysteresis mode

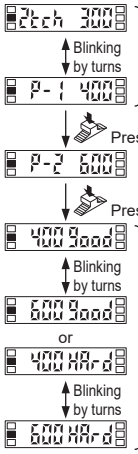
- This method is to set the threshold range by using the 2-point teaching (P-1, P-2).
- When conducting teaching, use sensing objects (P-1 and P-2) whose incident light intensity is different from each other.

<Window comparator mode>



<Hysteresis mode>





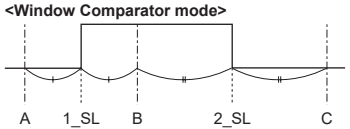
1. Press the jog switch in the sensing object present condition when "P-1" is displayed on the green digital display.
2. "P-2" blinks in the green digital display.
   Press the jog switch in the sensing object present condition for the second point.
3. The value of the first point (1_SL) and the second point (2_SL) are alternatively blink on the green digital display. (Note)
   In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

Note: If the value after setting exceeds the maximum (minimum), the maximum (minimum) sensitivity will be set.

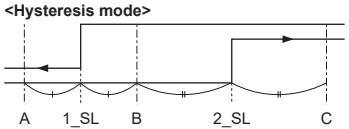
In case of 3-point teaching in Window comparator mode or Hysteresis mode

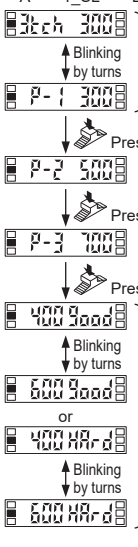
- This is the method to set the threshold range by setting the threshold (1_SL) of the mid-point between "A" and "B" and the threshold (2_SL) of the mid-point between "B" and "C", using the 3-point teaching (P-1, P-2 and P-3).
- When conducting teaching, use sensing objects (A, B and C) whose incident light intensity is different from each other.
- After teaching, P-1, P-2 and P-3 will be automatically relocated in ascending order: i.e. the lowest value is placed in "A", the second lowest in "B" and the highest in "C".

<Window Comparator mode>



<Hysteresis mode>



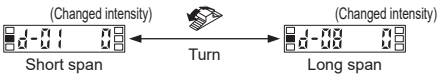


1. Press the jog switch in the sensing object present condition when "P-1" is displayed on the green digital display.
2. "P-2" blinks in the green digital display.
   Press the jog switch in the sensing object present condition for the second point.
3. "P-3" blinks in the green digital display.
   Press the jog switch in the sensing object present condition for the third point.
4. The threshold (1_SL) of the mid-point between "A" and "B" and the threshold (2_SL) of the mid-point between "B" and "C" blinks alternatively on the green digital display. (Note)
   In case stable sensing is possible: "Good" blinks in the red digital display.
   In case stable sensing is not possible: "HArd" blinks in the red digital display.

Note: If the value after setting exceeds the maximum (minimum), the maximum (minimum) sensitivity will be set.

Span adjustment in Rising differential mode or Trailing differential mode

- The span adjustment in rising differential mode or trailing differential mode can be set as follows. The value is automatically memorized unless the Output operation mode is selected after the adjustment or any switch operation is not carried out within a certain period of time.
- The threshold can be set by using the threshold value fine adjustment function. For the threshold value fine adjustment function, refer to "**10 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION**."

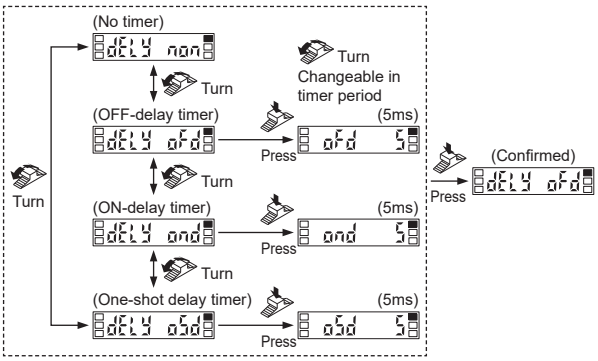


13 OUTPUT OPERATION MODE

- When MODE indicator: L/D (yellow) lights up, output operation can be set.
- Turn the jog switch to "+" or "–" side to switch the output operation.
- Press the jog switch to confirm the setting.

14 TIMER MODE

- When MODE indicator: TIMER (yellow) lights up, timer operation and timer period can be set.
- Turn the jog switch to "+" or "–" side to switch the timer operation and the timer period.
- When selecting OFF-delay timer, ON-delay timer or one-shot delay timer, the timer period can be set in the range of approx. 0.5ms or approx. 1 to 9,999ms.
- Press the jog switch to confirm the setting.
- This mode works in conjunction with the timer setting in PRO 1 under PRO mode. For the timer setting, refer to **<PRO 1: Timer setting>** in "**16 PRO MODE**."



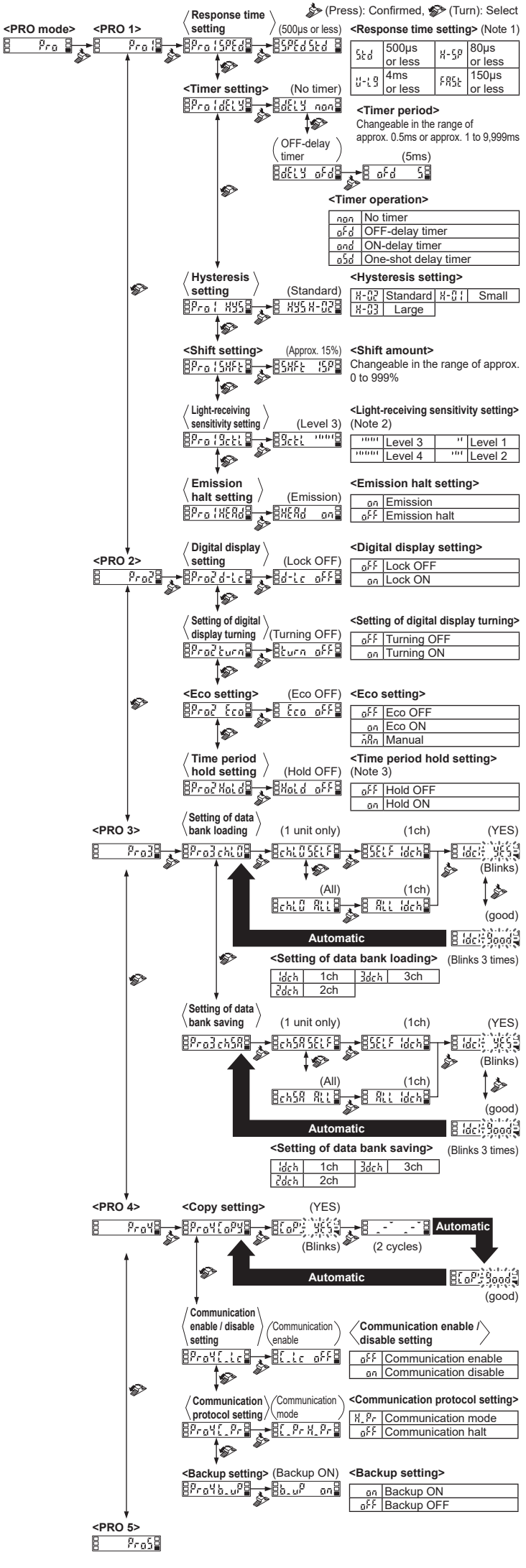
15 CUSTOM MODE

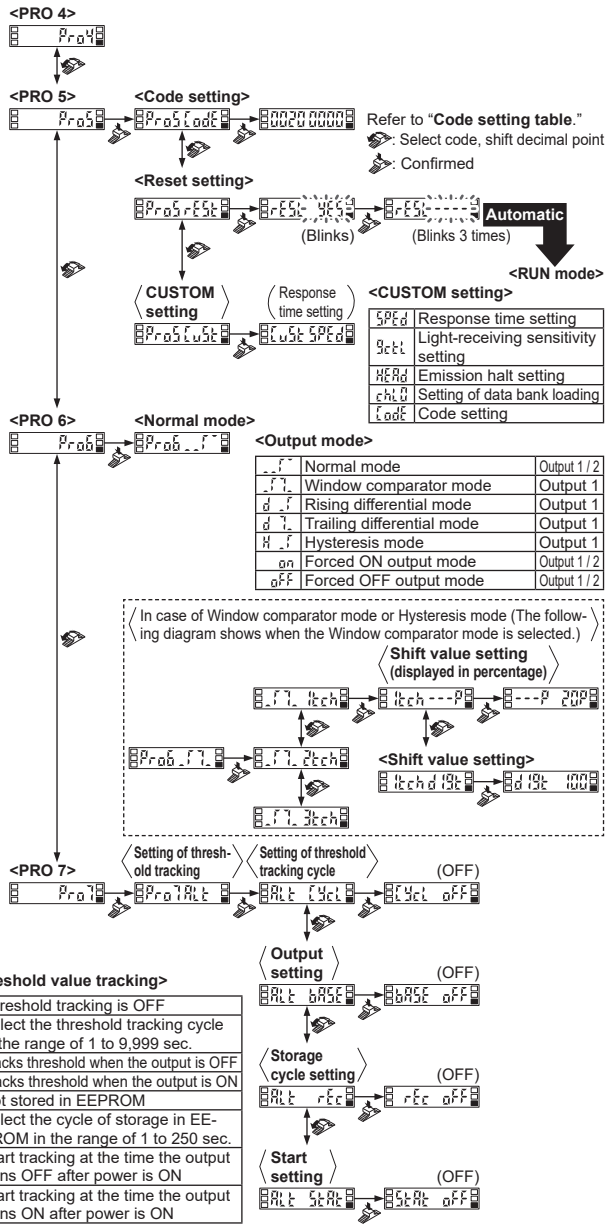
- When MODE indicator: CUST (yellow) lights up, response time setting, light-receiving sensitivity setting, emission halt setting, setting of data bank loading (one unit only) or code setting can be displayed. For the setting procedure, refer to **<PRO 5: CUSTOM setting>** in "**16 PRO MODE**."
- Turn the jog switch to "+" or "–" side to switch the setting contents of each item.
- Press the jog switch to confirm the setting.
- For setting of each item, refer to the following table.

Item	Digital display	Reference item
Response time setting	SPEd Std	**<PRO 1: Response time setting>** in "**16 PRO MODE**"
Light-receiving sensitivity setting	SEtt ----	**<PRO 1: Light-receiving sensitivity setting>** in "**16 PRO MODE**"
Emission halt setting	HEAd on	**<PRO 1: Emission halt setting>** in "**16 PRO MODE**"
Setting of data bank loading (One unit only)	chLO Idch	**<PRO 3: Setting of data bank loading>** in "**16 PRO MODE**"
Code setting	CodE	**<PRO 5: Code setting>** in "**16 PRO MODE**"

16 PRO MODE

- When MODE indicator: PRO (yellow) lights up, PRO mode can be set.
- Press the jog switch to confirm the setting.





<Setting of threshold value tracking>

Cycl	oFF	Threshold tracking is OFF
	1	Select the threshold tracking cycle in the range of 1 to 9,999 sec.
bASE	oFF	Tracks threshold when the output is OFF
	on	Tracks threshold when the output is ON
rEc	oFF	Not stored in EEPROM
	1	Select the cycle of storage in EEPROM in the range of 1 to 250 sec.
StRt	oFF	Start tracking at the time the output turns OFF after power is ON
	on	Start tracking at the time the output turns ON after power is ON

Notes 1) Display for laser amount can show the digit of max. 4,000 if " H-SP " for ultra high speed or " FASt " for high speed is selected in the response time setting " SPEd ", but will display the digit of max. 9,999 if " Std " for standard or " U-LG " for ultra long distance is selected.
2) Level 4 of the light-receiving sensitivity can be set only when " U-LG " for ultra long distance (response time: 4ms or less) is set at the response time setting " SPEd ".
3) In order to clear the value, set the time period holding function to OFF once. Turning the power OFF can also clear the value.

Item	Default setting	Description
Response time setting	SPEd Std	Sets response time.
Timer setting	dELY non	Sets operation and period of the timer. This setting works in conjunction with the timer mode. For the timer mode, refer to "14 **TIMER MODE**."
Hysteresis setting	HYS H-02	Hysteresis can be set when the normal mode or the window comparator mode is selected.
Shift setting	SHFt 1SP	Shifts the threshold value by a certain percentage increment in limit teaching.
Light-receiving sensitivity setting	SEtt nnnn	Selects light-receiving sensitivity from 3 levels [4 levels, only for ultra long distance (U-LG)].
Emission halt setting	HEAd on	Selects laser emission from the sensor head to execute or halt.
Digital display setting	d-Lc oFF	When setting to " d-Lc oFF " (lock OFF) and pressing the jog switch in RUN mode, incident light intensity, incident light intensity in percentage or the peak / bottom value can be displayed on the digital display (red).
Eco setting	Eco oFF	Power consumption can be lowered. " oFF ": Eco OFF " on ": If any key operation is not carried out for 20 sec. in RUN mode, the digital display turns OFF. " Lon " : If the key lock function is set to ON in RUN mode, the digital display turns OFF.
Time period hold setting	Hold oFF	" oFF " : Peak / bottom value in the digital display refreshing condition can be displayed. " on " : Peak / bottom value in the hold condition can be displayed.

Item	Default setting	Description
Setting of data bank loading	chLdSELF	Loads configuration setting from the data bank. " SELF " : Select this mode when only one amplifier to load. " ALL " : Select this mode when all the cascading amplifiers to load in a lump by optical communications. For the optical communications, refer to "18 **OPTICAL COMMUNICATIONS**."
Setting of data bank saving	chSASELF	Saves configuration setting to the data bank. " SELF " : Select this mode when only one amplifier to save. " ALL " : Select this mode when all the cascading amplifiers to save in a lump by optical communications. For the optical communications, refer to "18 **OPTICAL COMMUNICATIONS**."
Copy setting	–	Using optical communications, configuration settings from the main amplifier are copied to all of the sub amplifiers connected on the right side of the main controller connector. However, except the data bank loading / saving. For optical communications, refer to "18 **OPTICAL COMMUNICATIONS**."
Communication enable / disable setting	C_Lc oFF	When conducting the copy setting or setting of data bank loading / saving from the main amplifier via optical communications, it is possible that only the sub amplifier which is set to communication disable " C_Lc on ", not to receive the set contents.
Communication protocol setting	C_Pr_Pr	When conducting the copy setting or setting of data bank loading / saving from the main amplifier via optical communications, the optical communications through a sub amplifier which is set to communication halt " C_Pr oFF " and the following sub amplifiers can be halted.
Backup setting	b_uP on	Allows to save or not to save the threshold value by teaching in EEPROM.
Code setting	0020 0000	Consistent setting can be done by inputting 8-digit code instead of independent setting. In addition, present setting can be confirmed.
Reset setting	–	If setting to " YES ", returns to default settings (factory settings).
CUSTOM setting	CuSt SPEd	Selects an item in CUSTOM mode to display.
Output mode	Pro6_r	Sets output 1 and output 2 individually. **<Settable for both output 1 and 2>** " _r " : Normal mode Sets a threshold value for ON / OFF operation. " on " : Forced ON output mode Sets forcibly the output to ON. " oFF " : Forced OFF output mode Sets forcibly the output to OFF. **<Settable only for output 1>** " _r7_ " : Window comparator mode Judges if set two threshold values are within the required range or not. This can be selected in 1 / 2 / 3-point teaching. " d_r " : Rising differential mode Only drastic rises in incident light intensity are detected. " d_7_ " : Trailing differential mode Only drastic drops in incident light intensity are detected. " H_r " : Hysteresis mode Changes hysteresis to ignore small change of incident light intensity. This can be selected in 1 / 2 / 3-point teaching.
Setting of threshold tracking cycle (Note)	Cycl oFF	This mode can change the threshold value depending on the cycle (1 to 9,999 sec.) that is set with the variations of the incident light intensity. The tracking shift amount is the one which is set at the **<Shift setting>**.
Output setting	bASE oFF	Selects whether tracking threshold when the output is OFF or when the output is ON.
Storage cycle setting	rEc oFF	Selects a threshold storage cycle in EEPROM from 1 to 250 sec.
Start setting	StRt oFF	Selects whether start tracking threshold at the time the output turns OFF or at the time the output turns ON after power is ON .

Note: Conducts the limit teaching for the changed incident light intensity.
Shift direction of the threshold differs depending on the combination of the output status and the output operation.

Output status	Output operation	Shift direction
Output ON	Light-ON	– side
Output ON	Dark-ON	+ side
Output OFF	Light-ON	+ side
Output OFF	Dark-OFF	– side

Code setting table

- **Green digital display (right side is the first digit)**

Code	4th digit: Output operation mode – Output 1	4th digit: Output operation mode – Output 2	Code	3rd digit: Timer mode – Output 1	3rd digit: Timer mode – Output 2	Code	2nd digit: Response time setting	Code	1st digit: Light-receiving sensitivity setting
0	Light-ON	Light-ON	0	No timer	No timer	0	80µs or less (H-SP)	0	Level 3
1	Dark-ON		1	OFF-delay timer		1	150µs or less (FAST)	1	Level 2
2	Light-ON	Dark-ON	2	ON-delay timer		2	500µs or less (STD)	2	Level 1
3	Dark-ON		3	One-shot delay timer		3	4ms or less (U-LG)	3	Level 4 (U-LG only)
4	–	–	4	No timer	OFF-delay timer	4	–	4	–
5	–	–	5		ON-delay timer	5	–	5	–
6	–	–	6		One-shot delay timer	6	–	6	–
7	–	–	7	–	–	7	–	7	–
8	–	–	8	–	–	8	–	8	–

- **Red digital display (right side is the first digit)**

Code	4th digit: Communication enable / disable setting	4th digit: Hysteresis setting	Code	3rd digit: Backup setting	Code	2nd digit: CUSTOM mode	Code	1st digit: Output mode – Output 1	1st digit: Output mode – Output 2
0	Communication enable	H-02	0	Backup ON	0	Response time setting	0	Normal mode	Normal mode
1	Communication disable	H-02	1	Backup OFF	1	Light-receiving sensitivity setting	1	Window comparator mode	
2	Communication enable	H-03	2	–	2	Emission halt setting	2	Rising differential mode	
3	Communication disable	H-03	3	–	3	Setting of data bank loading	3	Trailing differential mode	
4	Communication enable	H-01	4	–	4	Code setting	4	Hysteresis mode	
5	Communication disable	H-01	5	–	5	–	5	Forced ON output mode	
6	–	–	6	–	6	–	6	Forced OFF output mode	
7	–	–	7	–	7	–	7	Normal mode	Forced ON output mode
8	–	–	8	–	8	–	8		Forced OFF output mode

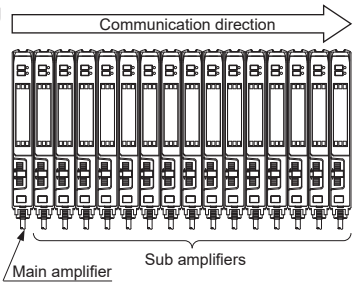
17 ERROR INDICATION

- In case of errors, attempt the following measures.

Error indication	Description	Remedy
Er01	EEPROM is broken or reached the end of its working life.	Please contact our office.
Er02	EEPROM writing error.	
Er11	Load of the output 1 is short-circuited causing an overcurrent to flow.	Turn OFF the power and check the load.
Er12	Load of the output 2 is short-circuited causing an overcurrent to flow.	
Er40	Disconnection error of sensor head.	Check the connection of sensor head.
Er52	Communication error when the amplifiers are mounted in cascade.	Verify that there is no loose or clearance between amplifiers.
Er53	Communication error between the upper communication unit and amplifiers.	Verify that there is no loose or clearance between the upper communication unit and amplifiers.

18 OPTICAL COMMUNICATION

- When the setting of data bank loading / saving, or copy setting is conducted via optical communications, cascade the sub amplifiers right side to the main amplifier as follows.
- If an amplifier is under any of the following conditions, the setting of data bank loading / saving, or copy setting cannot be carried out .
  - In case the digital display is blinking
  - In case PRO mode is being set
  - In case the communication enable / disable setting is set to communication disable "C.Lc oFF"
- When communication protocol of a sub amplifier is set to communication halt "C.Pr oFF", the setting of data bank loading / saving, or copy setting cannot be carried out to sub amplifiers subsequent to the mentioned amplifier.
- The sensing operation stops during optical communications.



19 SPECIFICATIONS

Item \ Type	Digital laser sensor amplifier
Model No.	**LS-403**
Supply voltage	12 to 24V DC±10% Ripple P-P 10% or less
Power consumption	Normal operation: 950mW or less (current consumption 40mA or less at 24V supply voltage) Eco mode: 780mW or less (current consumption 33mA or less at 24V supply voltage)
Output (Output 1 / 2)	NPN open-collector transistor • Maximum sink current: 50mA (Note 1) • Applied voltage: 30V DC or less (between output and 0V) • Residual voltage: 1.5V or less (Note 2) [at 50mA (Note 1) sink current]
Output operation	Switchable either Light-ON or Dark-ON
Short-circuit protection	Incorporated
Response time	H-SP: 80µs or less, FAST: 150µs or less, STD: 500µs or less, U-LG: 4ms or less Selectable with jog switch
Timer function	Changeable in ON-delay, OFF-delay or One-shot delay timer Switchable either effective or ineffective (timer period: approx. 0.5ms, approx. 1 to 9,999ms)
Interference prevention function	Incorporated [Up to four sensor heads can be mounted adjacently (However, in H-SP mode, up to two sensor heads can be mounted adjacently)]
Ambient temperature	–10 to +55°C (If 4 to 7 units are cascaded: –10 to +50°C, if 8 to 16 units are cascaded: –10 to +45°C) (No dew condensation or icing allowed), Storage: –20 to +70°C
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH
Material	Enclosure: Heat-resistant ABS, Protective cover: Polycarbonate Jog switch: ABS, MODE key: Acrylic
Weight	Approx. 15g (Main body only)

Notes: 1) 25mA max. if 5 or more units are connected in cascade.
2) In case of using the quick-connection cable (cable length 5m) (optional).
3) Make sure to use the quick-connection cables (optional) given below.
Main cable (4-core):
CN-74-C1 (cable length 1m), **CN-74-C2** (cable length 2m), **CN-74-C5** (cable length 5m)
Sub cable (2-core):
CN-72-C1 (cable length 1m), **CN-72-C2** (cable length 2m), **CN-72-C5** (cable length 5m)
4) The values specified above are applied only to the amplifier. Regarding the specifications for the applied sensor head, refer to the instruction manual enclosed with the sensor head.

20 CAUTIONS

- This product has been developed / produced for industrial use only.
- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- Take care that short circuit of the load or wrong wiring may burn or damage the product.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway.
  This can cause malfunction due to induction.
- The specification may not be satisfied in a strong magnetic field.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- The ultra long distance (U-LG) mode is more likely to be affected by extraneous noise since the sensitivity of that is higher than the other modes. Make sure to check the environment before use.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched ON.
- Make sure to use the quick-connection cable (optional) for the connection of the controller. Extension up to total 100m is possible with 0.3mm^2 or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- Make sure that stress by forcible bend or pulling is not applied to the sensor cable joint.
- This product is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
- This product cannot be used in an environment containing inflammable or explosive gasses.
- Never disassemble or modify the product.
- This product adopts EEPROM. Settings cannot be done 100 thousand times or more, because of the EEPROM's lifetime.

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