SUNX

# INSTRUCTION MANUAL

Photoelectric Sensor Digital Fiber Sensor Amplifier

# FX-502□

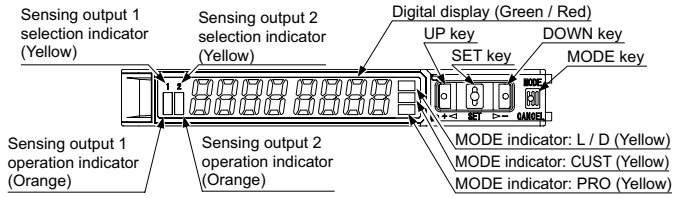
ME-FX502 No.0012-66V

Thank you very much for purchasing SUNX 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.

## ⚠ 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.

## 1 PART DESCRIPTION



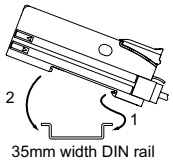

**<Description of the operation part>**

| UP key | SET key | DOWN key | MODE key |
|---|---|---|---|
| • Select setting items | • Confirm the setting contents | • Select setting items | • Select a mode<br>• Cancel during setting<br>• Select sensing output 1/2 by long pressing |

## 2 MOUNTING

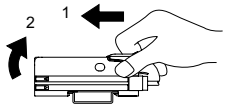
**How to connect**

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

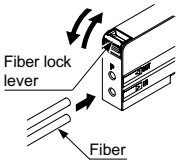



Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

**How to connect the fiber cable**

Be sure to fit the attachment to the fibers first before inserting the fibers to the amplifier. For details, refer to the Instruction Manual enclosed with the fibers.

1. Snap the fiber lock lever down till it stops completely.
2. Insert the fiber cables slowly into the inlets until they stops. (Note 1)
3. Return the fiber lock lever to the original position till it stops.



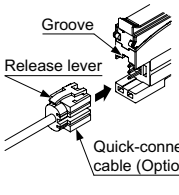

Notes: 1) In case the fiber cables are not inserted to a position where they should stop, the sensing range is reduced. Since a flexible fiber is easily bent, take care when inserting fiber.
2) With the coaxial reflective type fiber, such as , **FD-G4** or **FD-FM2**, insert the single core fiber cable into the beam-emitting inlet "P" and the Multi-core fiber cable into the beam-receiving inlet.
If they are inserted in reverse, the sensing performance will deteriorate.

## 3 WIRING

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

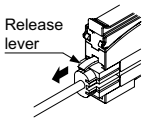
**How to connect**

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



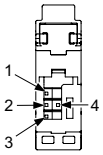

**How to remove**

1. Press the release lever at the top of the quick-connection cable connector, and 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. Furthermore, do not pull by holding the cable, as this can cause a cable-break.

**<Terminal arrangement>**




| Terminal No. | Terminal name |
|---|---|
| 1 | +V |
| 2 | Sensing output 1 |
| 3 | 0V |
| 4 | Sensing output 2 / External output |

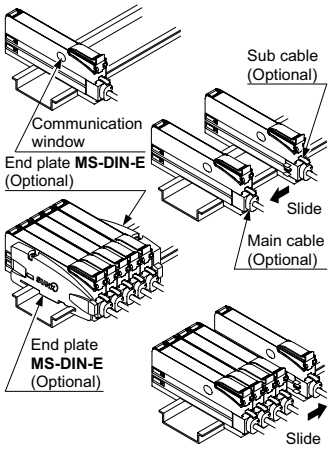
## 4 INSTALL MORE AMPLIFIER OF SERIES CONNECTION TYPE

- Make sure that the power supply is OFF while adding or removing the series connection type.
- Make sure to check the allowable ambient temperature since it depends on the number of the series connection types connected in cascade.
- In case 2 or more the series connection types 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.
- In case installing additional amplifier of series connection type, the maximum 11 the series connection types using sub cables can be added to an amplifier using a main connection cable.
- When connecting 2 or more the series connection types in cascade, use the sub cable (optional) for the second series connection type onwards.
- When connecting the series connection type are not close to each other in parallel, be sure to mount the end plate **MS-DIN-E** (optional) at both sides of each amplifier.
- For optical communication, refer to "**14 OPTICAL COMMUNICATION**."
- For interference prevention function, refer to "**15 INTERFERENCE PREVENTION FUNCTION**."

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.

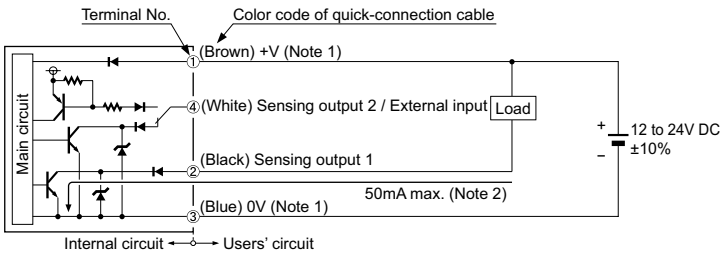



**How to remove**

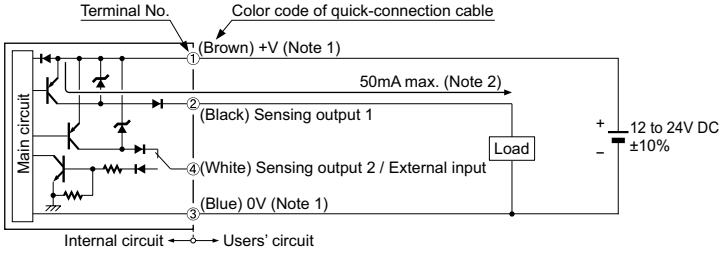
1. Loosen the screws of the end plates.
2. Remove the end plates.
3. Slide the amplifiers and remove them one by one.

## 5 I/O CIRCUIT DIAGRAM

**<FX-502>**




**<FX-502P>**




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

# 6 OPERATION PROCEDURE

The changed contents are not stored if turning the power OFF while setting. Therefore, make sure to confirm the settings by pressing the SET key before turning the power OFF.

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

<RUN mode>

- Displays threshold value (green) and incident light intensity (red).
- Teaching and threshold value fine adjustment and key lock function can be set.
- For setting method of each function, refer to "**7 TEACHING MODE**," "**8 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION**," or "**9 KEY LOCK FUNCTION**."

<Sensing output operation mode>

- Select either Light-ON or Dark-ON
- For the sensing output operation mode, refer to "**10 SENSING OUTPUT OPERATION MODE**."
- The default setting is "L-on" (Light-ON).

<CUSTOM mode>

- An item set in CUSTOM mode (Response time setting, Emission power setting and Hysteresis setting) is displayed.
- For details, refer to "**11 CUSTOM MODE**."
- The default setting is "SPEd" (response time setting).

<PRO mode>

- Advanced setting can be done.
- For the setting, refer to "**12 PRO MODE**."

# 7 TEACHING MODE

- Make sure that detection may become unstable if less margin is applied in the use environment when teaching.
- When teaching in Window comparator mode or Hysteresis mode, a setting has to be made in PRO mode beforehand.
  In case one point teaching, make sure to set the shift amount. (initial value is 10% or 100)
  For setting, refer to **<PRO 6>** in "**12 PRO MODE**."
- Normally, "Good" or "HArd" blinks as a result of stability detection.
- Teaching can be set in RUN mode.

## 2-point teaching

1. Press the SET key in the sensing object present condition.
   "tch" is displayed in the digital display (green) and the all MODE indicators (yellow) brink.
2. Press the SET key in the sensing object absent condition.
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.

## Limit-teaching

1. Press the SET Key in the sensing object present condition.
   "tch" is displayed in the Digital green display and the all MODE indicators (yellow) brinks.
2. Press down UP key or DOWN key
   Press down UP key: The threshold level is shifted to a value approx. 15% higher (low sensitivity) than that set at step 1. (Note 1)
   Press down DOWN key: The threshold level is shifted to a value approx. 15% lower (high sensitivity) than that set at step 1. (Note 1)
3. "LtcP" is displayed by pressing down UP key in the digital green display in step 2, and "Ltc-" is displayed by pressing down DOWN key in the digital yellow display in step 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

Note: The shift value of appox. 15% is an initial value. The shift value can be change to display in percent [Approx. 0 to 999% (unit 1 %)] or incident light intensity [0 to 9999 (Unit 1)]. For setting the shift amount, refer to **<PRO 1: Shift amount setting>** in "**12 PRO MODE**."

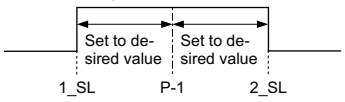
## Full-auto teaching

1. By pressing down SET key, "tch" is displeyed on the dsital display (green) and, all MODE indicators (yellow) brink.
2. Run the sensing object on the line and hold down the SET key.
3. "Auto" is displayed on the digital display (green) and when the sensing object passed through, release the SET key.
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.

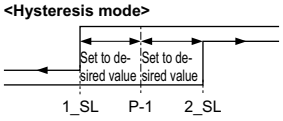
## 1-point teaching in Window comparator mode (except sensing output 2) or Hysteresis mode

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

<Window comparator mode>




<Hysteresis mode>



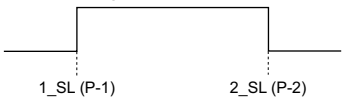

1. By pressing down SET key, "tch" is displeyed on the dsital display (green) and, all MODE indicators (yellow) brink.
2. Press down the SET key in the sensing object present condition.
3. The threshold value (1_SL) that is 10% lower from the incident light intensity and the threshold value (2_SL) that is 10% higher from the incident light intensity are set. (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 amount of 10% is an initial value. The shift amount can be set in PRO mode. Furthermore, the shift value can be set in incident light amount. For setting method, refer to **<PRO 6>** in "**12 PRO MODE**."
2) If the value after setting exceeds the maximum (minimum), the maximum (minimum) sensitivity will be set.

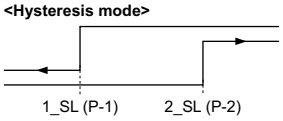
## 2-point teaching in Window comparator mode (except sensing output 2) or Hysteresis mode

- 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>



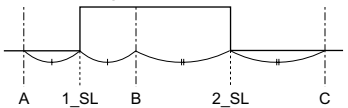

1. Press down the SET key in the sensing object present condition.
2. "tch" is displayed in the digital display (green) and the all MODE indicators (yellow) brink.
   Press down the SET key in the object present condition for the second point.
3. The value of the first point (1_SL) and the second point (2_SL) are set (green). (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.

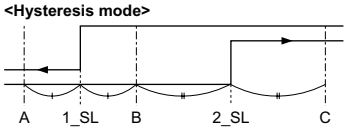
## 3-point teaching in Window comparator mode (except sensing output 2) or Hysteresis mode

- This is the method to conduct the 3-point teaching (P-1, P-2, P-3) and 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".
- When conducting teaching, use sensing objects (A, B and C) whose incident light intensities are different.
- 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>

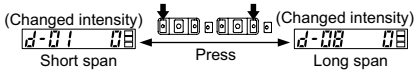



1. Press down the SET key in the sensing object present condition.
2. "P-2" is displayed in the green digital display.
   Press down the SET key in the sensing object present condition for the second point
3. "P-3" blinks in the green digital display.
   Press down the SET key in the sensing object present 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" are set. (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

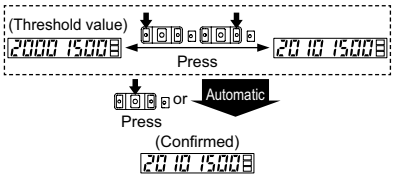
- The span adjustment in rising differential mode or trailing differential mode can be set by pressing down the UP key or DOWN key after pressing down SET key. At this time, all Mode indicators blinks.
- Press SET key to confirm the setting.
- The threshold can be set by using the threshold value fine adjustment function. For the threshold value fine adjustment function, refer to "**8 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION**."



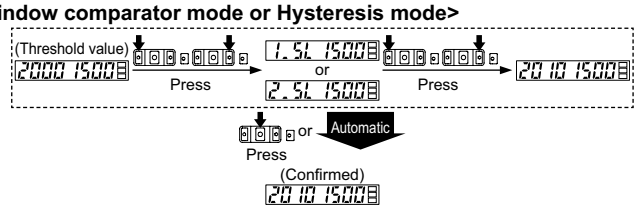
## 8 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION

- Set the fine adjustment of threshold value in RUN mode.
- Pressing down the UP key increases the threshold value, and Pressing down the DOWN key decreases the threshold value.
- When setting sensing output to the window comparator mode or hysteresis mode, " 1.5L " and " 2.5L " can be changed to another by pressing down the UP key for 2 sec. In case conducting threshold value fine adjustment of " 2.5L " or " 1.5L ", press down UP key or Down key, and " 2.5L " or " 1.5L " are displayed. Then, the threshold value fine adjustment can be conducted.
- Set by pressing down the SET key or the value is automatically memorized unless any key operation is carried out within a certain period of time.
- For setting of the sensing output, refer to **<PRO 6>** in "**12 PRO MODE**."

**<Normal mode, Rising differential mode or Trailing differential mode>**

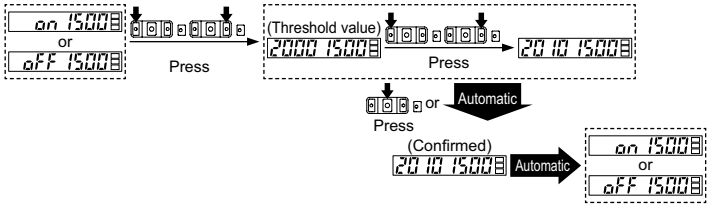



**<Window comparator mode or Hysteresis mode>**




Note: It may not respond when values of " 1.5L " and " 2.5L " are close because of relation of hysteresis. Be sure to confirm with this device.

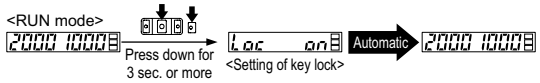
**<Forced ON output mode or Forced OFF output mode>**



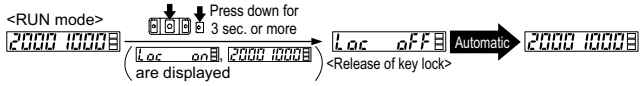

## 9 KEY LOCK FUNCTION

- The key lock function prevents key operations so that the conditions set in each setting mode are not inadvertently changed.
- By keeping to press down the SET key and the MODE key for 3 sec. or more, setting and releasing of key lock can be done.
- If operating key switch after key lock is set, " Loc on " is indicated on the digital display.

**<Set key lock>**

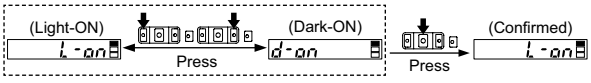



**<Release key lock>**




## 10 SENSING OUTPUT OPERATION MODE

- When MODE indicator: L / D (yellow) lights up, sensing output operation can be set.
- By pressing UP key or DOWN key, sensing output operation will be changed.
- Press SET key to confirm the setting.



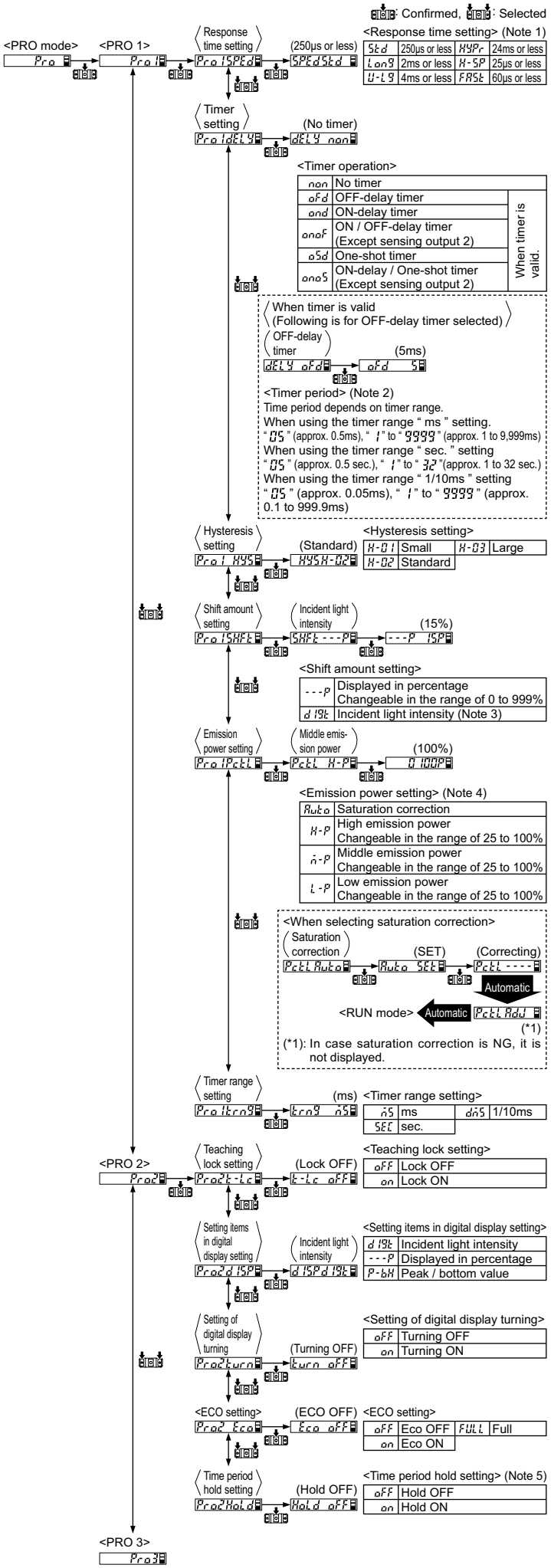

## 11 CUSTOM MODE

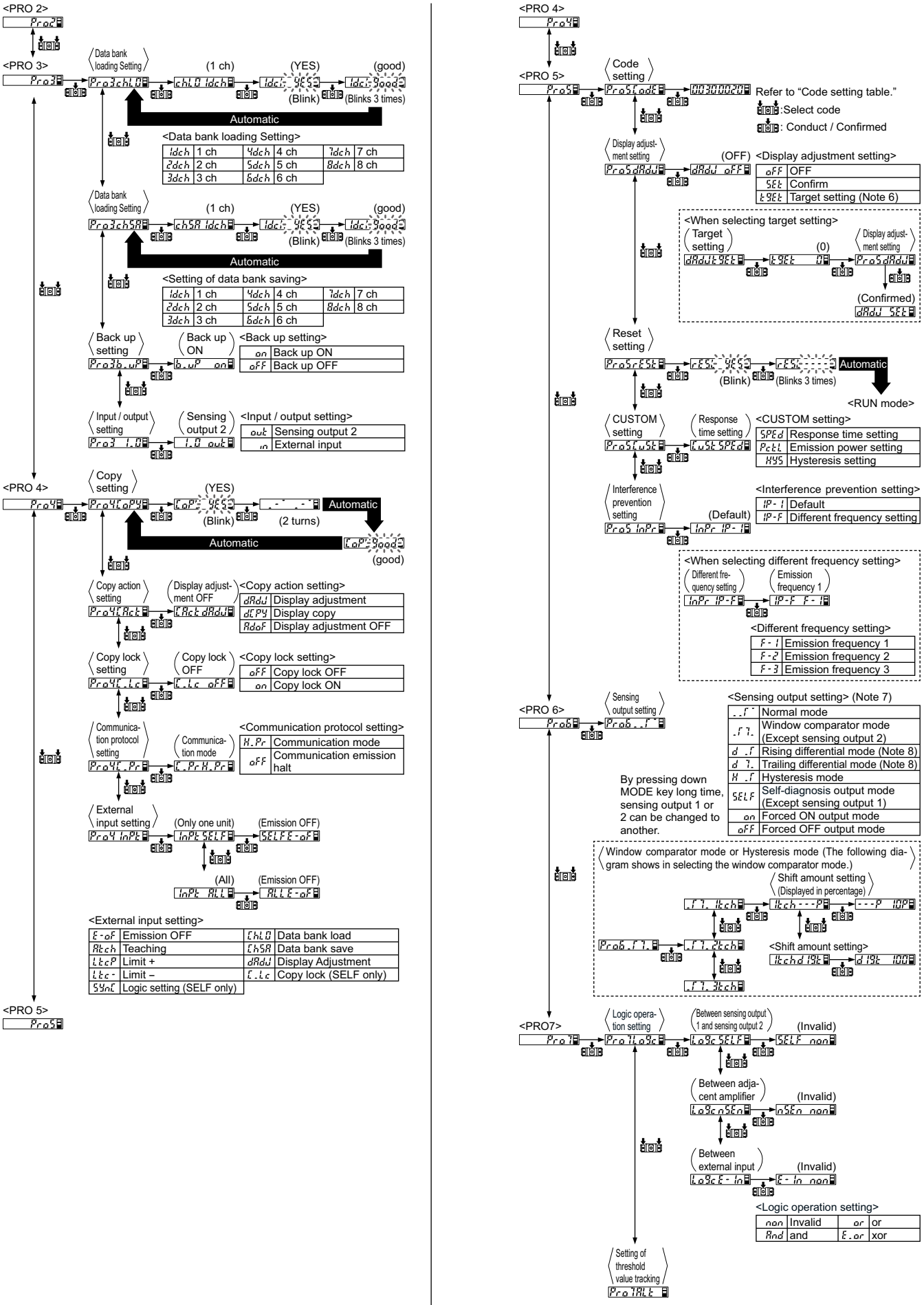
- When MODE indicator: CUST (yellow) lights up, Response time setting, Emission power setting or Hysteresis setting can be displayed. Setting contents of the displayed item can be changed. For the setting procedure, refer to **<PRO 5: CUSTOM setting>** in "**12 PRO MODE**."
- By pressing UP key or DOWN key, the setting in each item will be changed.
- Press SET key to confirm the setting.
- For setting of each item, refer to the following table.

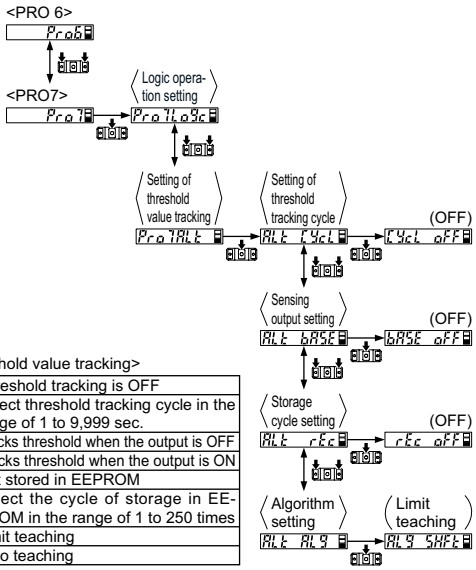
| Item | Digital display | Reference item |
|---|---|---|
| Response time setting | SPEdStd | **<PRO 1: Response time setting>** in "**12 PRO MODE**" |
| Emission power setting | PctL H-P | **<PRO 1: Emission power setting>** in "**12 PRO MODE**" |
| Hysteresis setting | HYSH-02 | **<PRO 1: Hysteresis setting>** in "**12 PRO MODE**" |

## 12 PRO MODE

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




<PRO 2>
Pro2
<PRO 3>
Pro3
Data bank loading Setting
Pro3chLO
(1 ch)
chLO 1dch
(YES)
1dch YES
(Blink)
1dch good
(good)
(Blinks 3 times)
Automatic
<Data bank loading Setting>
1dch 1 ch
2dch 2 ch
3dch 3 ch
4dch 4 ch
5dch 5 ch
6dch 6 ch
7dch 7 ch
8dch 8 ch
Data bank loading Setting
Pro3chSA
chSA 1dch
1dch YES
1dch good
Automatic
<Setting of data bank saving>
Back up setting
Pro3b.uP
Back up ON
b.uP on
<Back up setting>
on Back up ON
oFF Back up OFF
Input / output setting
Pro3 I.O
Sensing output 2
I.O outP
<Input / output setting>
outP Sensing output 2
in External input
<PRO 4>
Pro4
Copy setting
Pro4CoPY
CoPY YES
CoPY - - -
(2 turns)
CoPY good
<Copy action setting>
Copy action setting
Pro4CAct
Display adjustment OFF
CAct dRdJ
dRdJ Display adjustment
dCPY Display copy
RdoF Display adjustment OFF
Copy lock setting
Pro4C.Lc
Copy lock OFF
C.Lc oFF
<Copy lock setting>
oFF Copy lock OFF
on Copy lock ON
Communication protocol setting
Pro4C.Pr
Communication mode
C.PrM.Pr
<Communication protocol setting>
M.Pr Communication mode
oFF Communication emission halt
External input setting
Pro4 inPt
(Only one unit)
inPt SELF
(Emission OFF)
SELFE-oF
(All)
inPt ALL
ALLE-oF
<External input setting>
E-oF Emission OFF
Rtch Teaching
LtcP Limit +
Ltc- Limit –
SYnC Logic setting (SELF only)
ChLO Data bank load
ChSA Data bank save
dRdJ Display Adjustment
C.Lc Copy lock (SELF only)
<PRO 5>
Pro5
<PRO 4>
Pro4
<PRO 5>
Pro5
Code setting
Pro5Code
Refer to “Code setting table.”
:Select code
: Conduct / Confirmed
Display adjustment setting
Pro5dRdJ
(OFF)
dRdJ oFF
<Display adjustment setting>
oFF OFF
SEt Confirm
tSEt Target setting (Note 6)
<When selecting target setting>
Target setting
dRdJtSEt
(0)
tSEt 0
Display adjustment setting
Pro5dRdJ
(Confirmed)
dRdJ SEt
Reset setting
Pro5rESt
rESt YES
rESt - - -
(Blink)
(Blinks 3 times)
Automatic
<RUN mode>
CUSTOM setting
Pro5CuSt
Response time setting
CuSt SPEd
<CUSTOM setting>
SPEd Response time setting
Pctt Emission power setting
HYS Hysteresis setting
Interference prevention setting
Pro5 inPr
(Default)
inPr 1P-1
<Interference prevention setting>
1P-1 Default
1P-F Different frequency setting
<When selecting different frequency setting>
Different frequency setting
inPr 1P-F
Emission frequency 1
1P-F F-1
<Different frequency setting>
F-1 Emission frequency 1
F-2 Emission frequency 2
F-3 Emission frequency 3
<PRO 6>
Pro6
Sensing output setting
Pro6..r
<Sensing output setting> (Note 7)
..r Normal mode
.r7. Window comparator mode (Except sensing output 2)
d .r Rising differential mode (Note 8)
d r. Trailing differential mode (Note 8)
H .r Hysteresis mode
SELF Self-diagnosis output mode (Except sensing output 1)
on Forced ON output mode
oFF Forced OFF output mode
By pressing down MODE key long time, sensing output 1 or 2 can be changed to another.
Window comparator mode or Hysteresis mode (The following diagram shows in selecting the window comparator mode.)
Shift amount setting (Displayed in percentage)
.r7. Htch
Htch ---P
---P 1HP
Pro6.r7.
.r7.Ptch
.r7. 3Ptch
<Shift amount setting>
Htchd 19t
d 19t 100
<PRO7>
Pro7
Logic operation setting
Pro7Log
Between sensing output 1 and sensing output 2
LogcSELF
(Invalid)
SELF non
Between adjacent amplifier
LogcnSEn
nSEn non
Between external input
LogcE-In
E-In non
<Logic operation setting>
non Invalid
And and
or or
E.or xor
Setting of threshold value tracking
Pro7RLt




<Setting of threshold value tracking>

| | | |
|---|---|---|
| CYCL | oFF | Threshold tracking is OFF |
| | 1 | Select 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 times |
| ALG | SHFt | Limit teaching |
| | Atch | Auto teaching |

Notes: 1) In case response time setting " SPEd " is set to " Std ", " H-SP " or " FAST ", the display for incident light intensity can shows the digit of max. 4,000. In case " Lon9 " is selected, It will display the digit of max. 8,000. And, In case " U-L9 " or " HYPr " is selected, it will display the digit of max. 9,999.
2) Set timer period after setting timer range since timer period depends on the timer range.
3) In case the response time " SPEd " is set to " Std ", " H-SP " or " FAST ", the maximum light intensity can be set to 4,000. And the response time is set to " Lon9 ", the maximum light intensity can be set to 8,000. And, the response time is set to " U-L9 " or " HYPr ", the maximum light intensity can be set to 9,999.
4) In case the response time setting " SPEd " is set to " H-SP " when the hysteresis setting " HYS " is " H-01 " , the emitting power becomes low sensibility (" L-P ") whichever selecting " H-P ", " n-P " or " L-P ".
5) In order to clear the value, set the time period holding function to OFF once. Turning the power OFF can also clear the value.
6) In case the response time setting " SPEd " is set to " Std ", " H-SP " or " FAST ", target setting of the display adjustment setting ban be set from -1,999 to 4,000. And, setting to " Lon9 ", the display adjustment setting ban be set from -1,999 to 8,000. And setting to " U-L9 " or " HYPr ", the display adjustment setting can be set from -1,999 to 9,999.
7) Set Sensing output setting after setting Input / output setting.
8) In case using in differential mode, set threshold value 20 or more when the hysteresis setting " HYS " is " H-01 " and set threshold value 80 or more when the hysteresis setting " HYS " is " H-02 " or " H-03 ".

| Item | Default setting | Description |
|---|---|---|
| Response time setting | SPEdStd | Set response time. |
| Timer setting | dELY non | Set operation and period of the timer. |
| Hysteresis setting | HYSH-02 | Hysteresis can be set when the normal mode or the window comparator mode is selected.<br>When setting to " H-01 ", it becomes low sensibility. |
| Shift amount setting | SHFt ---P | Set shift amount of threshold value in limit teaching. |
| Emission power setting | PctL H-P | Set emission power.<br>" Auto ": Saturated incident light intensity can be automatically adjusted<br>" H-P ": High emission power (25 to 100%)<br>" n-P ": Middle emission power (25 to 100%)<br>" L-P ": Low emission power (25 to 100%) |
| Timer range setting | trn9 nS | Change unit time of timer. |
| Teaching lock setting | t-Lc oFF | Be able to prevent from wrong operation of teaching.<br>" oFF ": Teaching mode is valid<br>" on ": Teaching mode is invalid |
| Digital display item setting | d ISPd I9t | Incident light intensity can be displayed in percentage or the peak / bottom value can be displayed on the digital display (red). |
| Digital display turning on setting | turn oFF | Sets the viewing orientation of the digital display. |
| ECO setting | Eco oFF | Power consumption can be lowered.<br>" oFF ": ECO OFF<br>" on ": If any key operation is not carried out for 20 sec. in RUN mode, the digital display turns OFF.<br>" FULL ": If key operation is not done in 20 sec. or setting the key lock function in Run mode, all indicators turns OFF. |
| Period hold Setting | HoLd oFF | " oFF ": Peak / bottom value in the digital display refreshing condition can be displayed.<br>" on ": Peak / bottom value in the hold condition can be displayed. |
| Data bank loading | chLO Idch | Load a setting from specified data bank. |
| Data bank saving | chSA Idch | Save a setting to specified data bank. |
| Back up setting | b.uP on | Select to save or not to save the threshold value by teaching in EEPROM. |
| Input / output setting | I.O out | Select either sensing output 2 or external output. |
| Copy setting | – | Using optical communications, be able to copy setting contents in main amplifier to all of the sub amplifiers connected from the main amplifier.<br>This product cannot send and receive threshold value.<br>For the optical communications, refer to " **14 OPTICAL COMMUNICATIONS**." |

| Item | Default setting | Description |
|---|---|---|
| Copy action setting | CAct dAdJ | Copy of items in display adjustment setting and incident light intensity are conducted or canceled by using optical communication.<br>In case incident light intensity does not have enough margin, automatically set optimum value.<br>For the optical communications, refer to " **14 OPTICAL COMMUNICATIONS**."<br>" dAdJ ": Display adjustment of main amplifier and sub amplifiers can be conducted. Set to the target value of display adjustment in each amplifier.<br>" dCPY ": Incident light intensity of main amplifier can be copied to sub amplifier. However, when the difference between main amplifier and sub amplifier is big, it will not be copied.<br>" AdoF ": Display adjustment of sub amplifier can be set to OFF. Display adjustment of main amplifier is not set to OFF. Do not press down the SET key many times in display of " AdoF ". When " AdoF " is not displayed in confirmation, also do not press down set key many times. |
| Copy lock setting | C.Lc oFF | When conducting the setting of copy setting or data bank loading / saving from the main amplifier via optical communications, it is possible that only the sub amplifier which is set to copy lock ON " C.Lc on " does not receive the set contents. However, even if copy lock on " C.Lc on " is set, the copy action setting is communicated. |
| Communication protocol setting | C.Pr H.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 emission halt " C.Pr oFF " and the following sub amplifiers can be halted. |
| External input setting | InPt SELF | Set external input. |
| Code setting | 00300020 | Consistent setting can be done by inputting 8-digit code instead of independent setting.<br>In addition, present setting can be confirmed. |
| Display adjustment setting | dAdJ oFF | Set incident light intensity to target value.<br>If conducting display adjustment setting when incident light intensity does not have enough margin, " OVEr " is blinked<br>" oFF ": Display adjustment OFF<br>" SEt ": Slide to (smaller side) incident light intensity from the set of target setting.<br>" tSEt ": Set incident light intensity to value you want. In case setting to 0-adjustment, set to 0. |
| Reset setting | – | If setting to " YES ," returns to default settings (factory settings). |
| CUSTOM setting | CuSt SPEd | Select an item in CUSTOM mode to display. |
| Interference prevention setting | InPr IP-1 | Number of adherence mounting of sensor head depends on response time of interference prevention function.<br>For detail, refer " **15 INTERFERENCE PREVENTION FUNCTION**."<br>" IP-1 ": Set when using the interference prevention function by optical communication. Maximum adherence mounting of sensor head is 12 units<br>" IP-F ": Set when using interference prevention function by changing emitting frequency. The maximum adherence mounting by setting 3 types of emission frequency is 3 units. |
| Sensing output mode | Prob..F- | Set sensing output 1 mode and sensing output 2 mode.<br>" _.F- ": Normal mode<br>• Sets a threshold value for ON / OFF operation.<br>" _F7_ ": Window comparator mode<br>(Except sensing output 2)<br>• Sets two threshold values and judges they are within the required range or not. This can be selected in 1 / 2 / 3-point teaching.<br>" d_.F- ": Rising differential mode<br>• Only drastic rises in incident light intensity are detected.<br>" d_7_ ": Trailing differential mode<br>• Only drastic drops in incident light intensity are detected.<br>" H_.F- ": Hysteresis mode<br>• Changes hysteresis to ignore small change of incident light intensity.<br>• This can be selected in 1 / 2 / 3-point teaching.<br>" SELF ": Self diagnosis output mode<br>(Expect sensing output 1)<br>• Conduct self diagnosis output<br>" on ": Forced ON output mode<br>• Sets forcibly the output to ON.<br>" oFF ": Forced OFF output mode<br>• Sets forcibly the output to OFF. |
| Logical operation setting | Lo9c SELF | Select for logical operation and set logical operation methods (and, or, xor).<br>" SELF ": Logical operation is sensing output 2 of this device and conduct logical operation between the sensing output 2 and sensing output 1 of this device.<br>" nSEn ": Logical operation is sensing output 1 of an upper adjacent amplifier and conduct logical operation between the sensing output and sensing output 1 of this device.<br>" E-In ": Logical operation is outer input and conduct logical operation between the output and sensing output 1 of this device. |

| Logical operation | Sensing output 1 of this device | Setting of logical operations | | |
|---|---|---|---|---|
| | | and | or | xor |
| ON | ON | ON | ON | OFF |
| ON | OFF | OFF | ON | ON |
| OFF | ON | OFF | ON | ON |
| OFF | OFF | OFF | OFF | OFF |

| Item | | Default setting | Description |
|---|---|---|---|
| Setting of threshold value tracking | | 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. |
| | Sensing 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 times. |
| | Algorithm setting (Note 9) | ALG SHFT | When setting to limit teaching, threshold value is followed up on the bases of shift amount. Furthermore, when setting to auto teaching, threshold value be followed up on the bases of each cycle. |

Notes: 9) Conducts the limit teaching for the changed incident light intensity.
Shift direction of the threshold differs depending on the combination of the sensing output status and the sensing output operation.

| Sensing output status | Sensing output operation | Shift direction |
|---|---|---|
| Sensing output ON | Light-ON | – |
| Sensing output ON | Dark-ON | + |
| Sensing output OFF | Light-ON | + |
| Sensing output OFF | Dark-ON | – |

**Code setting table**

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

| Code | Forth digit: Sensing output operation mode – Sensing output 1 | Forth digit: Sensing output operation mode – Sensing output 2 | Code | Third digit: Timer operation – Sensing output 1 | Third digit: Timer operation – Sensing output 2 | Code | Second digit: Timer period | Code | First digit: CUSTOM setting |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Light-ON | Light-ON | 0 | No timer | No timer | 0 | 0.5ms | 0 | Response time setting |
| 1 | Light-ON | Dark-ON | 1 | OFD | No timer | 1 | 1ms | 1 | Emission power setting |
| 2 | Dark-ON | Light-ON | 2 | OND | No timer | 2 | 3ms | 2 | Hysteresis setting |
| 3 | Dark-ON | Dark-ON | 3 | ONOF | No timer | 3 | 5ms | 3 | — |
| 4 | — | — | 4 | OSD | No timer | 4 | 10ms | 4 | — |
| 5 | — | — | 5 | ONOS | No timer | 5 | 30ms | 5 | — |
| 6 | — | — | 6 | No timer | OFD | 6 | 50ms | 6 | — |
| 7 | — | — | 7 | No timer | OND | 7 | 100ms | 7 | — |
| 8 | — | — | 8 | No timer | OSD | 8 | 300ms | 8 | — |
| 9 | — | — | 9 | — | — | 9 | 500ms | 9 | — |
| A | — | — | A | — | — | A | 1 sec. | A | — |
| b | — | — | b | — | — | b | 2 sec. | b | — |
| C | — | — | C | — | — | C | 3 sec. | C | — |
| d | — | — | d | — | — | d | 4 sec. | d | — |
| E | — | — | E | — | — | E | 5 sec. | E | — |

(OFD: OFF-delay timer, OND: ON-delay timer
ONOF: ON / OFF-delay timer, OSD: One-shot timer,
ONOS: ON-delay / One-shot timer)

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

| Code | Forth digit: Copy lock setting | Forth digit: Hysteresis setting | Code | Third digit: Setting items in digital display setting | Third digit: Back up setting | Code | Second digit: Response time setting | Code | First digit: Sensing output mode (Note) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Copy lock OFF | H-02 | 0 | Incident light intensity | Back up ON | 0 | H-SP | 0 | Normal mode |
| 1 | Copy lock ON | H-02 | 1 | Incident light intensity | Back up OFF | 1 | FAST | 1 | WC mode |
| 2 | Copy lock OFF | H-03 | 2 | Displayed in percentage | Back up ON | 2 | STD | 2 | Rising differential mode |
| 3 | Copy lock ON | H-03 | 3 | Displayed in percentage | Back up OFF | 3 | LONG | 3 | Trailing differential mode |
| 4 | Copy lock OFF | H-01 | 4 | Peak / bottom value | Back up ON | 4 | U-LG | 4 | HYS mode |
| 5 | Copy lock ON | H-01 | 5 | Peak / bottom value | Back up OFF | 5 | HYPER | 5 | — |

(WC mode: Window comparator mode, HYS mode: Hysteresis mode)

Note: It is a setting only for sensing output 1. Sensing output 2 is not set.

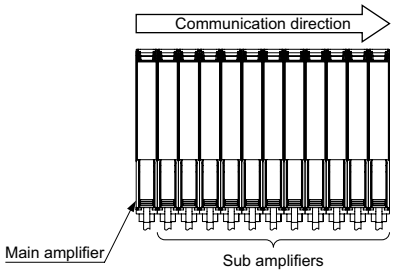
## 13 ERROR INDICATION

- In case of errors, attempt the following measures.

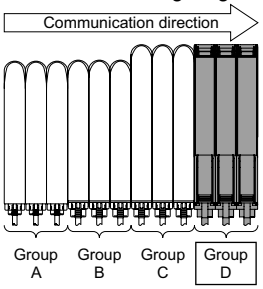
| Error indication | Description | Remedy |
|---|---|---|
| Er01 | EEPROM is broken or reached the end of its working life. | Please contact our office. |
| Er02 | EEPROM writing error. | |
| Er11 | Load of the sensing output 1 is short-circuited causing an over-current to flow. | Turn OFF the power and check the load. |
| Er12 | Load of the sensing output 2 is short-circuited causing an over-current to flow. | |
| 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. |

## 14 OPTICAL COMMUNICATION

- When the setting of data bank loading / saving, copy setting, or copy action 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 .
  - Copy lock setting is set to copy lock ON " C.Lc on "
  - Digital display is blinking
- When communication protocol of a sub amplifier is set to communication emission 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.
- Make sure to mount closely like follows since interference prevention function is conducted by optical communication.




- 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, C, and D as shown in the right figure. This product is included in Group D.




| Group | Model No. |
|---|---|
| A | **FX-301**□ (Conventional version unit) **FX-301B**□/**G**□/**H**□, **LS-401**□ |
| B | **FX-301**□ (Modified version unit) **FX-305**□, **FX-301**□**-C1** |
| C | **LS-403**□, **DPS** series |
| D | **FX-500** series |

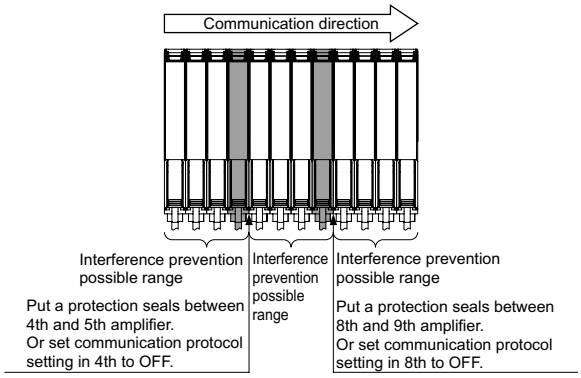
- As for the products that are located between different groups, affix the amplifier protection seal **FX-MB1** (optional) on the communication window of each corresponding product.
- Within each group, identical models should be connected in a lump.
- When this product and other products (fiber sensor 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.
- In case conducting copy setting of this device and other **FX-500** series together, functions which are incorporated in this device will be copied but functions which are not incorporated in this device will not be copied.
- This device can not copy the threshold value.

## 15 INTERFERENCE PREVENTION FUNCTION

- This device incorporates an interference prevention function by setting different emitting frequencies different from an interference prevention function by optical communication.
- For setting, refer to **< PRO5: Interference prevention function>** in " 12 **PRO MODE"**.
- Possible number of amplifiers for interference prevention function is different as shown in table below.

| Interference prevention function setting \ Response time | H-SP | FAST | STD | LONG | U-LG | HYPR |
|---|---|---|---|---|---|---|
| iP- 1 | 0 | 2 | 4 | 8 | 8 | 12 |

- In case putting in more amplifiers than limit of interference prevention function, put the amplifier protection seal to amplifier which is adjacent of end of an amplifier that the interference function is valid or set OFF in communication protocol setting of the end of amplifier that the interference prevention function is valid.
- For comunicaton protocol setting procedure, refer **< PRO4: communication protocol setting>** in" 12 **PRO MODE.**"
  Example: putting in 12 of this device and set STD of responce time setting.
  - Possble number of interference prevantion is 4. Put the amplifier protection seals 4th and 5th amplifiers and between 8th and 9th amplifiers or cahng the communication protocol setting of 4th and 8th to OFF since interference prevention works from 1st to 4th, from 5th to 8th and 9th to 12th.




- In case mounting more amplifiers whose response time setting are different, put protection seal between amplifiers that have different response time setting or set communication protocol setting of the upper amplifier to OFF.
- For communication protocol setting procedure, refer to **< PRO4: communication protocol setting >** in " 12 **PRO MODE.**"

## 16 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, HYPR) 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 (H-SP, FAST, STD: 0.5 sec., LONG, U-LG, HYPR: 1 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 and fiber cable.
- 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.

## 17 SPECIFICATIONS

| Item \ Type | Series connection type | |
|---|---|---|
| | NPN output | PNP output |
| Model No. | **FX-502** | **FX-502P** |
| Supply voltage | 12 to 24V DC ±10% Ripple P-P 10% or less | |
| Power consumption | Normal operation: 960mW or less (current consumption 40mA or less at 24V supply voltage)<br>Eco mode: 680mW or less (current consumption 28mA or less at 24V supply voltage) | |
| Sensing output | **<NPN output type>**<br>NPN open-collector transistor<br>• Maximum sink current: 50mA (Note 1)<br>• Applied voltage: 30V DC or less (Between sensing output and 0V)<br>• Residual voltage: 2V or less (Note 2) [At 50mA (Note 1) sink current] | **<PNP output type>**<br>PNP open-collector transistor<br>• Maximum source current: 50mA (Note 1)<br>• Applied voltage: 30V DC or less (Between sensing output and +V)<br>• Residual voltage: 2V or less (Note 2) [At 50mA (Note 1) source current] |
| Output operation | Switchable either Light-ON or Dark-ON | |
| Short-circuit protection | Incorporated | |
| Response time | H-SP: 25µs or less, FAST: 60µs or less, STD: 250µs or less, LONG: 2ms or less, U-LG: 4ms or less, HYPR: 24ms or less, Selectable | |
| External input | • Signal condition<br>High: +8V to +V DC or Open<br>Low: 0 to +1.2V DC (at 0.5mA source current)<br>• Input impedance: Approx. 10kΩ | • Signal condition<br>High: +4V to +V DC (at 3mA sink current)<br>Low: 0 to +0.6V DC or Open<br>• Input impedance: Approx. 10kΩ |
| Timer function | Changeable in OFF-delay, ON-delay, One-shot timer, ON / OFF-delay or ON-delay / One-shot timer<br>(<Timer period><br>Time period depends on timer range<br>When using the timer range " ms " setting: Approx. 0.5ms, Approx. 1 to 9,999ms<br>When using the timer range " sec. " setting: Approx. 0.5 sec., Approx. 1 to 32 sec.<br>When using the timer range " 1/10ms. " setting: Approx. 0.05ms, Approx. 0.1 to 999.9ms) | |
| Interference prevention function | Incorporate (Note 3) | |
| Ambient temperature | -10 to +55°C (If 4 to 7 units are mounted in cascade: -10 to +50°C or if 8 to 12 units are mounted in cascade: -10 to +45°C) (No dew condensation or icing allowed)<br>Storage: –20 to +70°C | |
| Ambient humidity | 35 to 85% RH, Storage: 35 to 85% RH | |
| Material | Enclosure: Heat-resistant ABS, Switch: TPEE<br>Operation key cover: Polycarbonate | |
| Weight (Main body only) | Approx. 15g | |
| Accessory | **FX-MB1** (Amplifier protection seal): 1 set. | |

Notes: 1) 25mA max. if 5 or more series connection types are connected together.
2) In case of using the quick-connection cable (cable length 5m) (optional).
3) Interference prevention function depends on response time as follow.
For details, refer to " 15 **INTERFERENCE PREVENTION FUNCTION**."
4) The cable for amplifier connection is not supplied as an accessory. Be sure to use the optional cables given below.

**<Series connection connector type>**

| | Cable | | | | | |
|---|---|---|---|---|---|---|
| | Cable length 1m | | Cable length 2m | | Cable length 5m | |
| | Main cable | Sub cable | Main cable | Sub cable | Main cable | Sub cable |
| **FX-502□** | **CN-74-C1** | **CN-72-C1** | **CN-74-C2** | **CN-72-C2** | **CN-74-C5** | **CN-72-C5** |

## 18 INTENDED PRODUCTS FOR CE MARKING

- The model listed under " 17 **SPECIFICATIONS**" comes with CE Marking.
  As for all other models, please contact our office.

CE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