SUNX

INSTRUCTION MANUAL

Photoelectric Sensor Digital Fiber sensor Amplifier

FX-501□

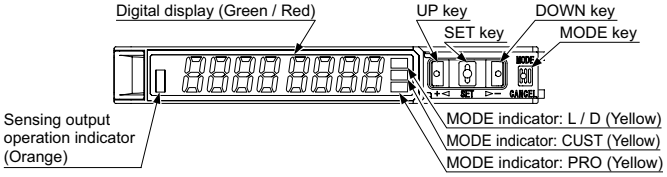
ME-FX501 No.0012-64V

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 sensing 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



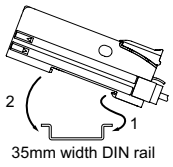
<Description of the operation part>

UP key	SET key	DOWN key	MODE key
• Select setting items	• Confirm the setting contents	• Select setting items	• Select Modes • Cancel during setting

2 MOUNTING

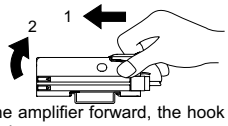
How to connect

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.

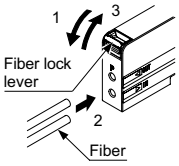


Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

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.



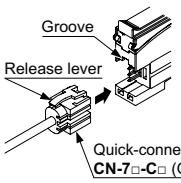
Notes: 1) In case the fiber cables are not inserted to a position where they should stop, the sensing range is reduced. Since a flexible fiber is easily bent, take care when inserting the fibers.
2) With the coaxial reflective type fiber, such as , **FD-G4** or **FD-FM2**, insert the single core fiber 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.

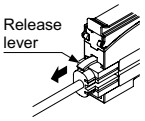
How to connect

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.



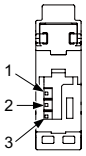
How to remove

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
3	0V

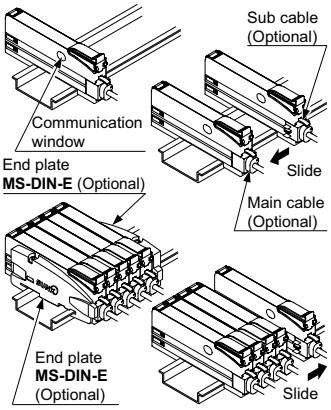
4 INSTALL MORE AMPLIFIER OF SERIES CONNECTION TYPE

- 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.
- In case the amplifiers move on the DIN rail because of 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 connected 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.

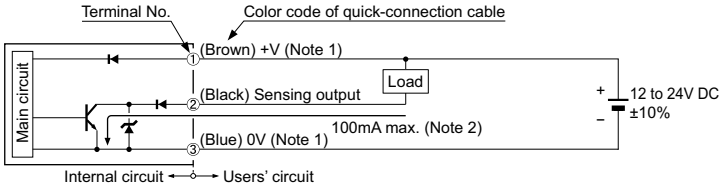


How to remove

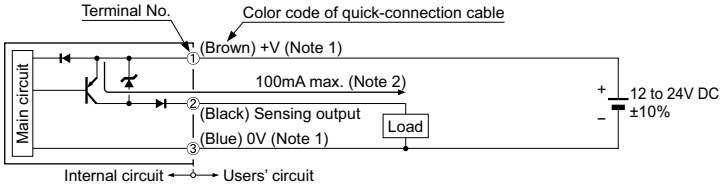
1. Loosen the screws of the end plates.
2. Remove the end plates.
3. Slide the amplifiers and remove them one by one.

5 I/O CIRCUIT DIAGRAM

<FX-501>



<FX-501P>

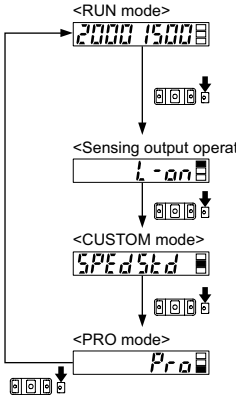


Notes: 1) The quick-connection sub cable does not incorporate +V (brown) and 0V (blue). The power is supplied from the connector of the main cable.
2) 50mA max. if 5 or more series connection type are connected together.
3) Do not use this devices as a series (AND) connection.

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, RUN mode 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.



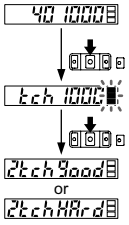
- Displays threshold value (green) and incident light intensity (red).
- Teaching, threshold value fine adjustment and key lock function can be set.
- For setting method of each function, refer to "**7 TEACHING MODE**," "**8 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION**," or "**9 KEY LOCK FUNCTION**."
- Select either Light-ON or Dark-ON.
- For the setting, refer to "**10 SENSING OUTPUT OPERATION MODE**."
- The default setting is "L-on" (Light-ON).
- 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).
- Advanced setting can be done.
- For the setting, refer to "**12 PRO MODE**."

7 TEACHING MODE

- Be sure that detection may become unstable depending on the use environment in teaching if less margin is applied.
- 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.

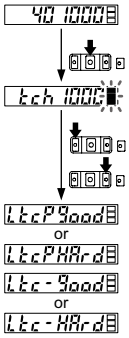
- Teaching can be set in RUN mode.

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.

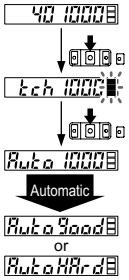
Limit-teaching



1. Press the SET key in the sensing object present condition.
   "tch" is displayed on the digital display (green) and the all MODE indicators (yellow) brink.
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)
   Press down DOWN key: The threshold level is shifted to a value approx. 15% lower (high sensitivity) than that set at step 1. (Note)
3. "LtcP" is displayed by pressing down UP key in the digital display (green) in step 2, and "Ltc-" is displayed by pressing down DOWN key in the digital display (green) 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 [Appro. 0~999% (unit 1 %)] or incident light intensity [0~9999 (Unit 1)].
For setting the shift amount, refer to **<PRO 1: Shift amount setting>** in "**12 PRO MODE**."

Full-auto teaching

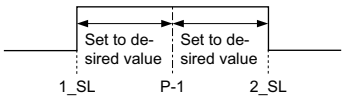


1. By pressing down SET key, "tch" is displeyed on the desital display (green) and all MODE indicators (yellow) brink.
2. Run the sensing object on the line and hold down the SET key.
3. "Auto" is displayed on the digital display (green) and when the sensing object passed through, release the SET key.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

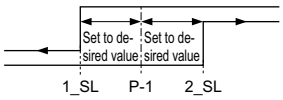
1-point teaching in Window comparator mode or Hysteresis mode

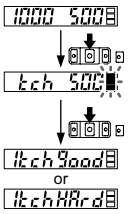
- This is the method to set the shift amount to the desired value and to set the threshold range by using the 1-point teaching.

<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.

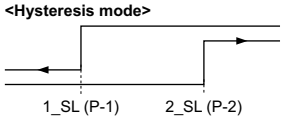
Notes: 1) The shift amount of 10% is an initial value. The shift amount can be set in PRO mode. Furthermore, the shift value can be set in incident light amount. For setting method, refer to **<PRO 6>** in "**12 PRO MODE**."
2) If the value after setting exceeds the maximum (minimum), the maximum (minimum) sensitivity will be set.

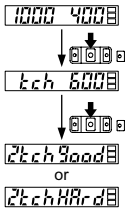
2-point teaching in Window comparator mode or Hysteresis mode

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

<Window comparator mode>

<Hysteresis mode>





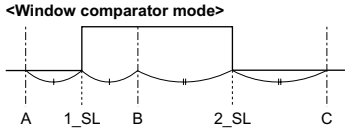
1. Press down the SET key in the sensing object present condition.
2. "tch" is displayed in digital display (green) and all MODE indicators (yellow) brink.
   In second time, pressing down SET key in sensing object present condition.
3. The value of the first point (1_SL) and the second point (2_SL)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

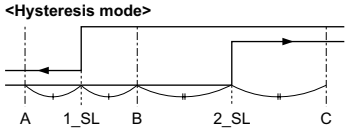
3-point teaching in Window comparator mode or Hysteresis mode

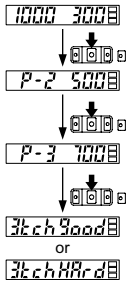
- This is the method to conduct the 3-point teaching (P-1, P-2, P-3) and to set the threshold range by setting the threshold value (1_SL) of the mid-point between "A" and "B" and the threshold value (2_SL) of the mid-point between "B" and "C".
- When conducting teaching, use sensing objects (A, B and 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>



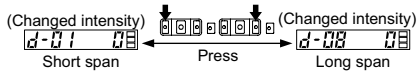


1. Press down the SET key in the sensing object present condition.
2. "P-2" is displayed in the digital display (green).
   Press down the SET key in the sensing object present condition for the second point.
3. "P-3" blinks in the digital display (green).
   Press down the SET key in the sensing object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

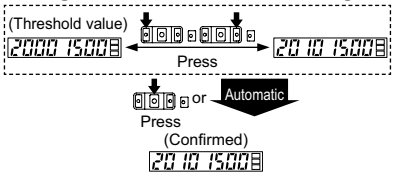
- The span adjustment in rising differential mode or trailing differential mode can be set by pressing down the UP key or DOWN key after pressing down SET key. At this time, all Mode indicators blinks.
- Press the SET key to confirm the setting item.
- The threshold can be set by using the threshold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



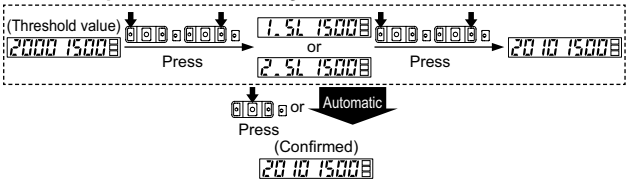
8 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION

- 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.SL " and " 2.SL " can be changed to another by pressing down SET key for 2 sec.
  In case conducting threshold value fine adjustment of " 2.SL " or " 1.SL ", press down UP key or Down key, and " 2.SL " or " 1.SL " 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>

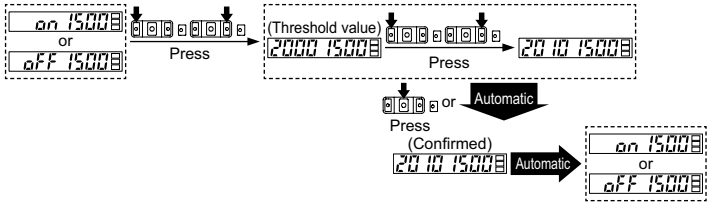


<Window comparator mode or Hysteresis mode>



Note: It may not respond when values of " 1.SL " and " 2.SL " are close because of relation of hysteresis. Be sure to confirm with this device.

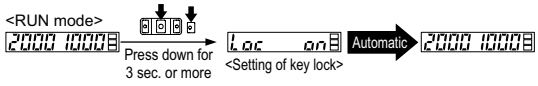
<Forced ON output mode or Forced OFF output mode>



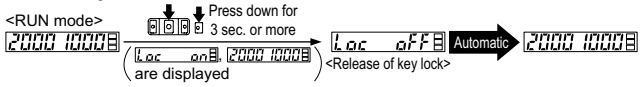
9 KEY LOCK FUNCTION

- 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>

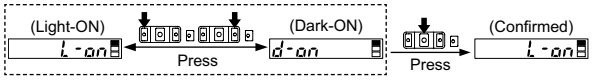


<Release key lock>



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 can be changed.
- Press SET key to confirm the setting.



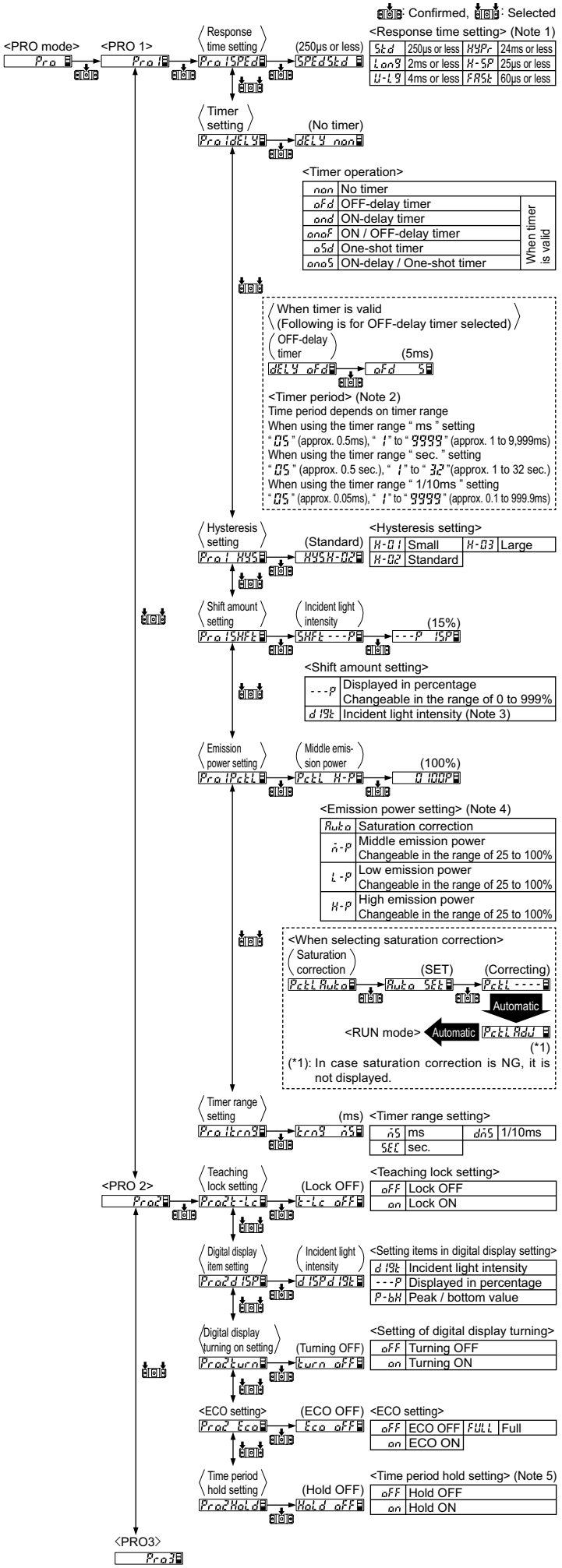
11 CUSTOM MODE

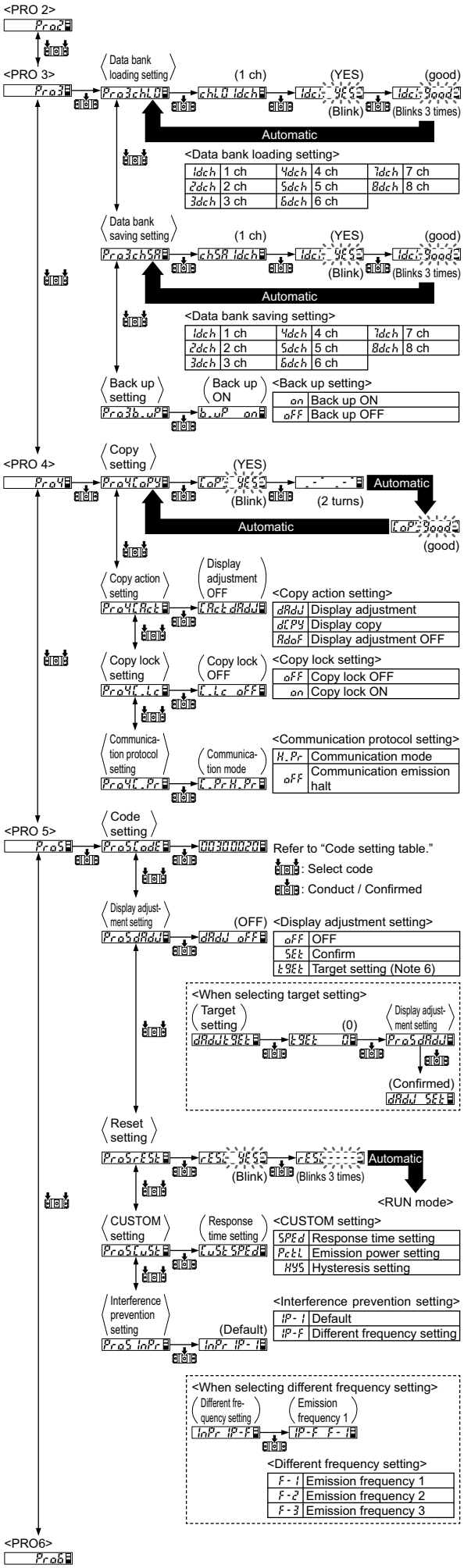
- When MODE indicator: CUST (yellow) lights up, Response time setting, Emission power setting or Hysteresis setting can be displayed.
  Setting contents of the displayed item can be changed.
  For the setting procedure, refer to **<PRO 5: CUSTOM setting>** in"**12 PRO MODE**."
- By pressing UP key or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

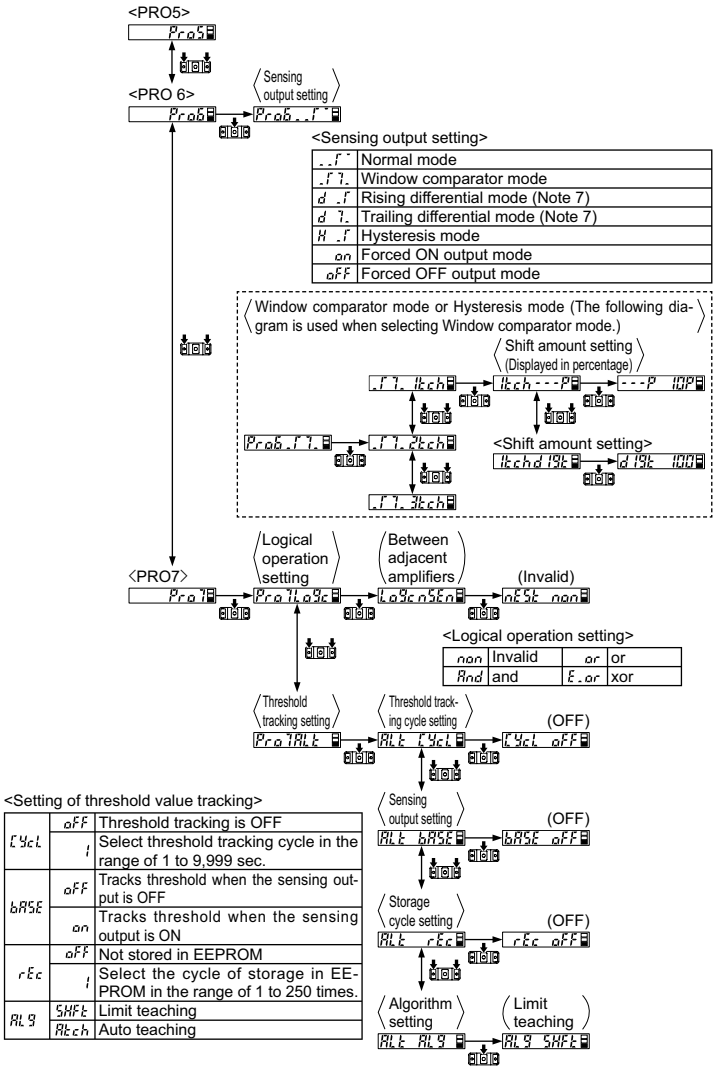
Item	Digital display	Reference item
Response time setting	SPEdStd	**<PRO 1: Response time setting>** in "**12 PRO MODE**"
Emission power setting	PctL H-P	**<PRO 1: Emission power setting>** in "**12 PRO MODE**"
Hysteresis setting	HYSH-02	**<PRO 1: Hysteresis setting>** in "**12 PRO MODE**"

12 PRO MODE

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







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 " LonG " is selected, It will display the digit of max. 8,000. And, In case " U-LG " 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 setting " 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 " LonG ", the maximum light intensity can be set to 8,000. And, the response time is set to " U-LG " 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 " LonG ", the display adjustment setting ban be set from -1,999 to 8,000. And setting to " U-LG " or " HYPr ", the display adjustment setting can be set from -1,999 to 9,999.
7) 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. 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. " AutO ": Saturation correction " H-P ": High emission power (25 to 100%) " n-P ": Middle emission power (25 to 100%) " L-P ": Low emission power (25 to 100%)
Timer range setting	trnG mS	Change unit time of timer.
Teaching lock setting	t-Lc oFF	Be able to prevent from wrong operation of teaching. " oFF ": Teaching mode is valid " on ": Teaching mode is invalid
Digital display item setting	diSPd 19t	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. " oFF ": ECO OFF " on ": If any key operation is not carried out for 20 sec. in RUN mode, the digital display turns OFF. " FULL ": If key operation is not done in 20 sec. or setting the key lock function, digital display turns OFF. Furthermore, if key lock function is set to ON, all indicator turns OFF.

Item	Default setting	Description
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.
Data bank loading setting	chLO Idch	Load a setting from specified data bank.
Data bank saving setting	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.
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. This product can send and receive threshold value. For the optical communications, refer to " 14 **OPTICAL COMMUNICATIONS**."
Copy action setting	CAct AdoF	Copy of items in display adjustment setting and incident light intensity are conducted or canceled by using optical communication. In case the incident light intensity does not have enough margin, automatically set optimum value. For the optical communications, refer to " 14 **OPTICAL COMMUNICATIONS**." " dAdJ ": Display adjustment of main amplifier and sub amplifiers can be conducted. Set to the target value of display adjustment in each amplifier. " dCPY ": Incident light intensity of main amplifire can be copied to sub amplifier. However, when the difference between main amplifier and sub amplifier is big, it will not be copied. " 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 displayed in confirmation, also do not press down SET key many times.
Copy lock setting	C.Lc oFF	When setting data loading / saving bank setting by optical communication, this function can set that the sub amplifier which is set copy lock ON " C.Lc on " and the lower sub amplifier do not receive the setting contents. However, even if copy lock ON " C.Lc on " is set, the copy action setting is communicated.
Communication protocol setting	C.PrH.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.
Code setting	00300020	Consistent setting can be done by inputting 8-digit code instead of independent setting. In addition, present setting can be confirmed.
Display adjustment setting	dAdJ oFF	The incident light intensity can be set to target value. If the display adjustment setting is conducted when incident light intensity does not have enough margin, " OUEr " brinks. " oFF ": Display adjustment OFF " SEt ": Slide to (smaller side) incident light intensity from the set of target setting. " tGEt ": Set incident light intensity to value you want. In case setting to 0-adjustment, set to 0.
Reset setting	–	If setting to " YES ", return 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. For detail, refer " 15 **INTERFERENCE PREVENTION FUNCTION**." " IP-1 ": Set when using the interference prevention function by optical communication. Maximum adherence mounting of sensor head is 12 units " 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 setting	Pro6..r	Set sensing output. " ..r " (Normal mode) • Sets a threshold value for ON / OFF operation. " .r7. " (Window comparator mode) • Sets two threshold values and judges either within the required range or not. This can be selected in 1 / 2 / 3-point teaching. " d .r " (Rising differential mode) • Only when drastic rises in incident light intensity are detected. " d 7. " (Trailing differential mode) • Only when 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. • Sets a threshold value for ON / OFF operation. " on " (Forced ON output mode) • Sets forcibly the output to ON. " oFF " (Forced OFF output mode)

Item		Default setting	Description
Logical operation setting		LoGcnSEn	Set a logical operation method between sensing output (in case 2 outputs, sensing output 1) of this device and an adjacent and upper amplifier from (and, or, xor).

Sensing output of an adjacent and upper amplifier	Sensing output 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 in each 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 was set at the shift setting.
	Sensing output setting	bASE oFF	Selects either a tracking threshold when the sensing output is OFF or a tracking threshold when the sensing output is ON.
	Storage cycle setting	rEc oFF	Selects a threshold storage cycle in EEPROM from 1 to 250 times.
	Algorithm setting (Note 8)	ALG SHFt	When setting to limit teaching, threshold value be 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: 8) When setting " SHFt ," conducts the limit teaching toward 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	Code	Third digit: Timer operation	Code	Second digit: Timer period	Code	First digit: CUSTOM setting
0	Light-ON	0	No timer	0	0.5ms	0	Response time setting
1	Dark-ON	1	OFD	1	1ms	1	Emission power setting
2	—	2	OND	2	3ms	2	Hysteresis setting
3	—	3	ONOF	3	5ms	3	—
4	—	4	OSD	4	10ms	4	—
5	—	5	ONOS	5	30ms	5	—
6	—	6	—	6	50ms	6	—
7	—	7	—	7	100ms	7	—
8	—	8	—	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 setting
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)

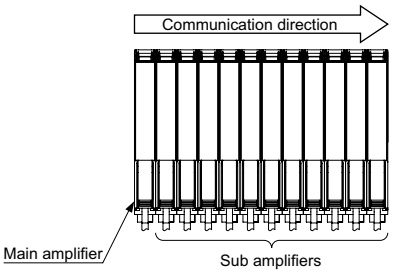
13 ERROR INDICATION

- In case of errors, attempt the following measures.

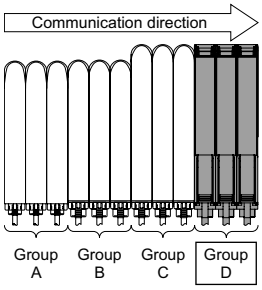
Error indication	Description	Remedy
Er01	EEPROM is broken or reached the end of its working life.	Please contact our office.
Er02	EEPROM writing error.	
Er11	Load of the sensing output is short-circuited causing an over-current to flow.	Turn OFF the power and check the load.
Er52	Communication error 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, add the sub amplifiers to right side of 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 device and other device (e.g. fiber sensor amplifiers, pressure sensor controller, etc.) are connected together in cascade, install those products so that they are in order of Group A, B, C and D as shown below. This device 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

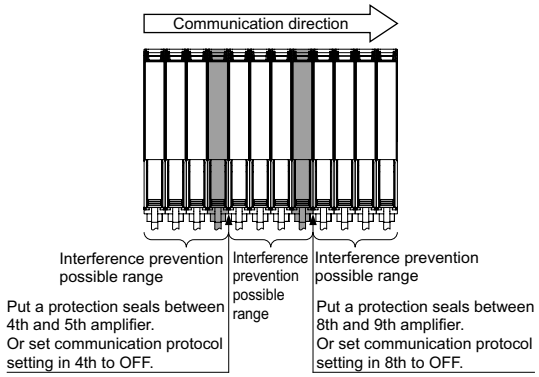
- As for the products that are located between different groups, affix the amplifier protection seal **FX-MB1** (optional) on the communication window of each corresponding product.
- Set same model of devices in same group.
- In case putting in this device and other type of devices (e.g. fiber sensor amplifiers, pressure sensor controller, etc.) as mixed installation, items that can copy are limited.
- The items that can copy in mixed installation are digital display setting in RUN mode, ECO setting, 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.

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 the 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 between 4th and 5th amplifiers and between 8th and 9th amplifiers or change 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 1 million times or more because of the EEPROM's lifetime.

17 SPECIFICATIONS

Item \ Type	Series connection type	
	NPN output	PNP output
Model No.	**FX-501**	**FX-501P**
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) Eco mode: 600mW or less (current consumption 28mA or less at 24V supply voltage)	
Sensing output	NPN open-collector transistor • Maximum sink current: 100mA (Note 1) • Applied voltage: 30V DC or less (between sensing output and 0V) • Residual voltage: 2V or less (Note 2) [At 100mA (Note 1) sink current]	PNP open-collector transistor • Maximum source current: 100mA (Note 1) • Applied voltage: 30V DC or less (between sensing output and +V) • Residual voltage: 2V or less (Note 2) [At 100mA (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	
Timer function	Changeable in OFF-delay timer, ON-delay timer, One-shot timer, ON / OFF-delay timer or ON-delay / One-shot timer Switchable either effective or ineffective (<Timer period> When using the timer range " ms " setting: Approx. 0.5ms, Approx. 1 to 9,999ms When using the timer range " sec. " setting: Approx. 0.5 sec., Approx. 1 to 32 sec. 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) Storage: −20 to +70°C	
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
Material	Enclosure: Heat-resistant ABS, Switch: TPEE Operation key cover: Polycarbonate	
Weight (Main body only)	Approx. 15g	
Accessory	**FX-MB1** (Amplifier protective seal): 1 set	

Notes: 1) 50mA 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) Number of sensor heads which is possible to mount closely in interference prevention function depends on response time like follows.
4) The cable for amplifier connection is not supplied as an accessory. Be sure to use the optional cables given below.

<Series connection type>

	Cable					
	Cable length 1m		Cable length 2m		Cable length 5m	
	Main cable	Sub cable	Main cable	Sub cable	Main cable	Sub cable
FX-501□	**CN-73-C1**	**CN-71-C1**	**CN-73-C2**	**CN-71-C2**	**CN-73-C5**	**CN-71-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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