



**Sensors & Instruments**  
 Rua Tuiuti, 1237 - CEP: 03081-000 - São Paulo  
 Tel.: 11 2145-0444 - Fax.: 11 2145-0404  
 vendas@sense.com.br - www.sense.com.br

## INSTRUCTIONS MANUAL

### FX-300 Series

#### 1. Specifications:

Models	NPN output	FX-301
	PNP output	FX-301P
Supply Voltage	12 to 24Vdc 10% Ripple P-P 10% or less	
Consumption current	Normal Operation: 40mA or less @ 24Vdc ECO Mode: 25mA or less @ 24Vdc	
Output	NPN transistor collector-open	PNP transistor collector-open
Max. switching current	100mA (Note 1)	
Applied voltage	30 Vdc or less (between output and 0V)	
Residual voltage	1.5 V or less (at 100mA consumption)	
Output operation	Light-ON or Dark-ON, selection through jog switch	
Short-circuit Protection	Built-in	
Response time	H-SP: 65 s or less, FAST: 150 s or less, S-D: 250 s or less, STD: 250 s or less, LONG: 2 ms or less; selection through jog switch	
Display	4-digit display Red LED	
Sensitivity setting	2 setting levels / Limit setting / Full-auto setting/ Max. Sensitivity setting / Manual setting	
Thin Sensitivity setting function	Built-in	
Timer function	Built-in with ON-delay/ OFF-delay/ ONE-SHOT timer variables, selectable between effective and ineffective (Time: approx. 0.5 to 9999ms)	
Interference prevention function	Built-in [up to 4 fibers can be assembled adjacent (However, the H-SP mode is for 2 fibers)]	
Ambient Temperature	-10° to +55°C (4 to 7 cascade units: -10° to +50°C) (8 to 16 cascade amplifiers: -10° to +45°C)	
Ambient Humidity	35 to 85% RH	
Emitter Element	Red LED (modulated)	
Material	Casing: ABS, Transparent Cover: Polycarbonate, Switch button: Acrylic, Jog Switch: ABS	
Weight	Approx. 20g	

Notes: 1) 50mA, five FX-301(P), or more, amplifiers are connected in cascade.  
 2) When the power is turned on, the light emitted is automatically adjusted to prevent interferences.

3) The cable for amplifier connection is not supplied as accessory. Make sure you use the quick connect cable described below:

Master cable (3 wires): **CN-73-C1** (1m cable), **CN-73-C2** (2m cable),

**CN-73-C5** (1m cable)

Sub cable (1 wire): **CN-71-C1** (1m cable), **CN-71-C2** (2m cable),

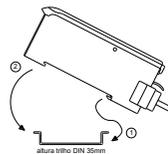
**CN-71-C5** (5m cable)

#### 2. Assembly:

##### Amplifier Assembly

1 - Attach the back of the amplifier on a 35mm DIN rail .

2 - Press down on the back of the unit on 35mm DIN rail and snap the front section by pressing down on the DIN rail.

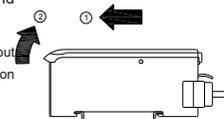


##### Removing Amplifier

1 - Push the amplifier forward.

2 - Lift the front of the amplifier and remove it.

Note: Take care when removing the front without pushing the amplifier forward because the latch on the back of the amplifier is capable of breaking.

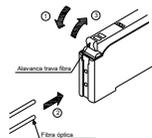


##### Optical fiber cable connection

1 - Push down the optical fiber lock .

2 - Insert the fiber cable carefully into the hole until the end of the course. (Note 1)

3 - Return the lock to its original position until it locks.



Notes: 1) In the case of fiber optic cable is not inserted until its complete stop, reduce the sensing distance. In case of using a flexible optical fiber, be careful when inserting the cable, because there may be a fold in the same amplifier during insertion.

2) With the coaxial reflective optical fiber type, such as **FD-G4** or **FD-FM2**. Insert the fiber optic cable wire in simple beam transmitter and fiber optic cable wires in multi-beam receiver. If inserted reversely, the sensor reading is compromised.

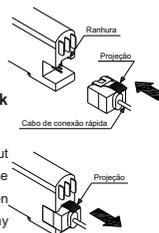
#### 3. FX-301 (P) connector type connection

Make sure that the amplifier is turned off when connecting or disconnecting the quick-connect.

##### Connection Method

1 - Hold the cable connector for fast connection, aligning it with the projection recess, located on top of the dock connector of the amplifier.

2 - Insert the connector until you feel a click.



##### Disconnection method

1 - Press the projection on top of the quick connect cable, pull out the connector.

Note: Take care that the connector is not pulled without pressing the projection may cause breakage of the projection. Do not use the quick connect cable when projection is broken. Do not pull the plug on the cord, it may cause breakage of cable.

#### 4. Precautions

- When the stop is issued by the issuer of selected 'OFF' to 'ON', the output may become unstable. Do not use the output control for 0.5s after the beginning of the broadcast.
- Make sure that the power is disconnected wiring. Check Voltage Supply variation is within specification.
- Ensure that the voltage does not exceed the range of application, or if an AC source is connected directly may cause burning or damaging it.
- In case of noisy equipment (inverters, switching, etc.) are used around the amplifier, connect the ground terminal (FG) of the equipment to an earth ground.
- If power is supplied by a switchbox, ensure that the ground wire terminal (FG) of the power supply is grounded.
- Do not use during the initial transient 0.5s for operation after connecting the power supply.
- Beware of short circuit in the load or wrong connection, because it can cause burns or damage to the sensor.
- Do not run wires along the lines of high voltage power lines or put together the same routing. This may cause malfunction due to induction.
- To connect the cable to the **FX-301(P)** sensor, make sure you use the quick connect cable.
- Extensions beyond 100m is possible to use 0.3mm2 cable. or greater. However, to reduce noise, use the least possible extent.
- This sensor is suitable for indoor use.
- Prevent dirt, dust and vapor.
- Be careful that the product does not come into direct contact with water, oil, grease, or organic solvents, such as thinner, etc.
- This sensor can not be used in environments containing explosive or flammable gases. Never disassemble or modify the sensor.

#### 5. Cascading

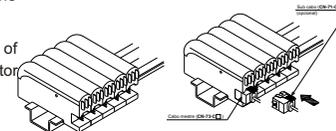
- Be sure to disconnect the power supply when adding or removing amplifiers.
- Be sure to check the temperature, as this depends on the number of amplifiers connected in cascade.
- In case of two or more amplifiers connected in cascade, perform assembly on a DIN rail.
- When the amplifier moves the DIN rail depending on the condition of fixation, pinning them between the terminator (MS-DIN-E) mounted on both sides.
- When connected in cascade, mount the amps next to each other, pinning them between the terminator (MS-DIN-E) mounted on both sides.
- Can be added up to 15 amps (total of 16 cascaded amplifiers).
- When connected more than two amplifiers in cascade, use the sub cable (CN-71-C) how quick connect cable to the second amplifier.

#### Cascade Mounting

- Mount the amplifiers, one by one, on 35mm DIN rail and place them next to each other.
- Insert the cable connector for quick connection to the connector of the amplifier.

3 - Mount the optional terminator (**MS-DIN-E**) on both sides, fixing the terminators between the amplifiers.

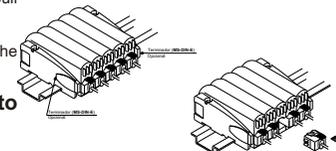
4 - Tighten the screws of the terminator (**MS-DIN-E**)



##### Disassembly

1 - Press the projection on top of the quick connect cable and pull out the connector.

2 - Remove the amplifier.



#### 6. I/O Circuito Diagram

##### NPN type output

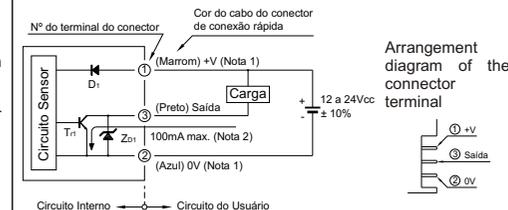
##### PNP type output

##### Notes:

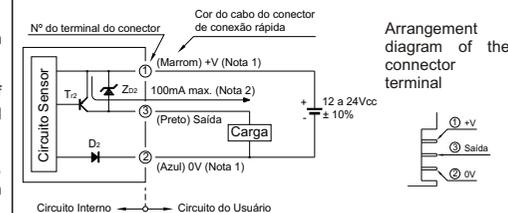
1 - The sub cable does not have power wires + V (brown) and 0V (blue). Power is Suppressed by master cable connector.

2 - Max. 50mA, for five or more amplifiers **FX-301(P)** in cascade.

#### 7. Parts Description



#### 8. Operation Procedure



- When the power supply is connected, the communication will be auto-checked being taken normal condition [indicator MODE / RUN

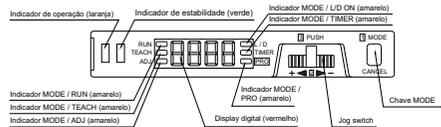
Symbology...D<sub>1</sub>, D<sub>2</sub>: Reverse polarity protection diode

Z<sub>D1</sub>, Z<sub>D2</sub>: Voltage regulator zener diode

T<sub>1</sub>: NPN output transistor

T<sub>2</sub>: PNP output transistor

(green)] illuminate and the display will be shown the incidence of



reflected light.

Switch MODE		Jog switch	
Press	Press	Turn side '+'	Turn side '-'

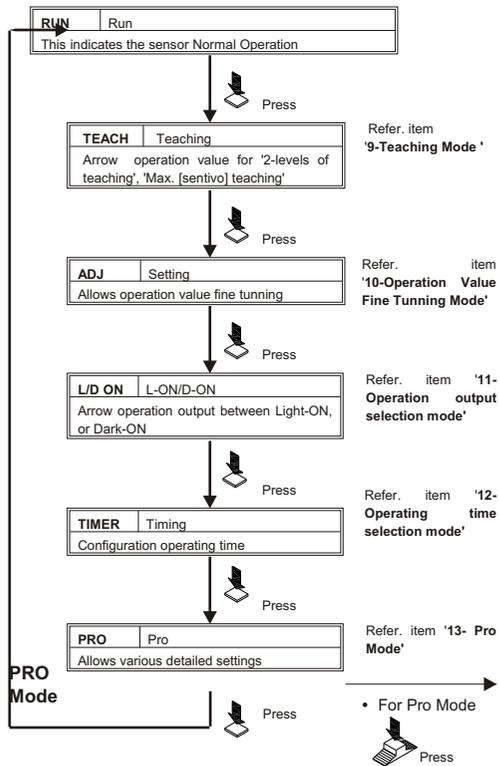
\*1: When the jog switch is pressed, the setting is confirmed.

\*2: When a MODE key is pressed for 2 seconds or more, the sensor returns to the "RUN" mode.

\*3: It is possible to cancel by pressing the MODE key while adjusting.

\*4: When the Jog Switch mode is selected 'RUN', the current limit will be shown. And then, the current value of the incident light will automatically appear.

• **NAVI Mode**



**PRO1**

- Response time change function 'SPEd'
- Time setting function 'dELY'
- Hysteresis function 'HYS'
- Stability function 'Stb'
- Shift function 'SHF'
- Light intensity selection function 'Pct'

Refer. item '13- PRO MODE Configuration Mode PRO1

**PRO2**

- Digital display configuration function 'dISP'
- Digital display inversion function 'turn'
- Configuration Function ECO Mode 'Eco'

Refer. item '13- PRO MODE Configuration Mode PRO2

**PRO3**

- Load database function 'chLO'
- Save database function 'chSA'

Refer. item '13- PRO MODE Configuration Mode PRO3

**PRO4**

- Copy function 'CoPY'
- Load remote database function 'chLO'
- Save remote database function 'chSA'
- Lock communication function 'C-Lc'
- Back-up function 'b-uP'

Refer. item '13- PRO MODE Configuration Mode PRO4

**PRO5**

- Code Function 'Code'
- 0-ADJ Function '0ADJ'
- Locked setting function 'A\_Lc'
- Reset Function 'rSET'

Refer. item '13- PRO MODE Configuration Mode PRO25

**9. Teaching Mode**

**In the case of 2 levels of teaching**

• In this method of setting the value selection is performed in two levels, corresponding to the object present and object absent conditions. Typically, the configuration is done by this method.

**Note:** In case of using fiber optics, the jog switch is pressed from the condition of an object absent in 2 and 3. Sensitivity setting will be the maximum.

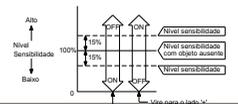
• In this method of setting the value adjustment is done only with the object absent condition (condition of incident light stable). This

Step	Display	Description
1	1234	Adjust the optical fiber within the sensing distance
2	567	Press the MODE switch until the light turns on on TEACH (yellow)
3	1234	Press the Jog switch in the condition of the present object
4	Good	If the teaching is accepted, the reading light intensity flashes in the digital display
5	900	The MODE/ TEACH indicator (yellow) will blink.
6	1234	Press the Jog switch in the absence of the object
7	Hard	If the setting is accepted, the reading of the intensity of light will flash in the display and the set value will be the average between the incidence of light intensity of the present and the absent object.
8	900	After this configuration, the display will indicate the stabilization status of sensing
9	1234	If stabilization is possible, 'Good' will be shown 'on display'. If stabilization is not possible, 'Hard' will be shown 'on display'.
10	900	Configuration value will be shown on display.
11	1234	Light incidence intensity will be shown on display after full configuration

**In the case of limit setting**

method is used to detect the presence of background or for the detection of small objects.

Step	Display	Description
1	1234	Adjust the optical fiber within the sensing distance
2	1234	Press the MODE switch until the light turns on on TEACH (yellow)
3	1234	Press the Jog switch in the condition of the present object
4	1	If the teaching is accepted, the reading light intensity flashes in the digital display
5	Good	The MODE/ TEACH indicator (yellow) will blink.
6	Hard	Press the Jog switch in the absence of the object
7	1234	If Jog switch is rolled to the side '+', '1', roll twice the display from right to left, and the level of adjustment will be modified to a value near 15% bigger (low sensitivity) than the adjustment in 2. Turn to side '+'(note). In this case, the reflective fiber type is used.
8	1	If Jog switch is rolled to the side '-', '1', roll twice the display from right to left, and the level of adjustment will be modified to a value near 15% smaller (higher sensitivity) than the adjustment in 2. Turn to side '-'(note). In this case, the barrier fiber type is used.
9	Good	After this, the sensor can judge whether or not the configuration
10	Hard	When the adjustment is possible 'Good' will be shown on the display. When the adjustment is not possible 'Hard' will be shown on the display.
11	1234	Configuration value will be shown on display
12	1234	Light incidence intensity will be shown on display after full configuration



Note: The 15% is the approximate amount of the initial value. The amount of adjustment can be modified in PRO mode in approximately 5 to 80% (Step of 5%). Referenced in '13-PRO MODE PRO1 Configuration mode' for the setting method.

**In the case of automatic learning**

The automatic learning is used when you want to adjust the setting value without stopping the production line, with the object movement condition.

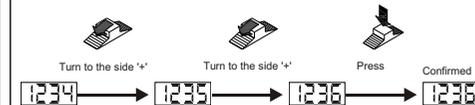
Step	Display	Description
1	1234	Adjust the optical fiber not [sic] within the sensing distance
2	567	Press the MODE switch until the light turns on on TEACH (yellow)
3	Auto	Keep the Jog switch pressed for 0.5s or more with the moving object in the process line. (The intensity of the incident light will be displayed for the sampling.)
4	Good	If the teaching is accepted, the reading light intensity flashes in the digital display
5	Hard	'Auto' will be shown on display. Loose jog switch when the object is passing.
6	900	If the teaching is accepted, the reading of the incident light will flash on the digital display and the setting value will be set to the average value in the condition between the incidence of light intensity with the present and the absent and object.
7	1234	After this step, the judgment of the stability of sensing is shown in display.
8	Hard	If stabilization is possible, 'Good' will be shown 'on display'. If stabilization is not possible, 'Hard' will be shown 'on display'.
9	900	Configuration value will be shown on display.
10	1234	Light incidence intensity will be shown on display after full configuration

**10. Fine configuration setting mode**

The configuration value fine setting can be made when the MODE / ADJ indicator (yellow) turns on.

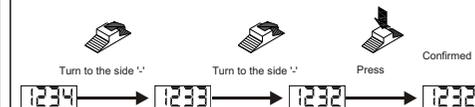
• When the jog switch is turned to the '+' side, the setting value increases (sensitivity decreases).

When the jog switch is pressed, the configuration value is confirmed.



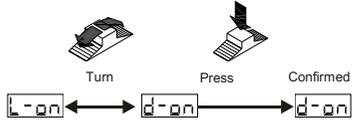
• When the jog switch is turned to the '-' side, the setting value decreases (sensitivity increases).

When the jog switch is pressed, the configuration value is confirmed.



### 11. Operation output configuration mode

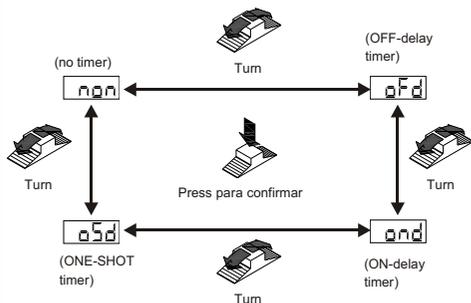
- The operation output configuration can be performed when the MODE / L/D indicator (yellow) turns on.
- The operation output configuration is changed when the jog switch turns to side '+' or '-'.  
When the jog switch is pressed, confirmation value is confirmed.



### 12. Temporization configuration mode

- The timer setting may or may not be used when indicator MODE / TIMER (yellow) turns on.
- The 10ms time OFF-delay (initial value) is automatically set when the timer is used.

Reference item '13- Pro Mode / PRO1 configuration mode' for OFF-delay time, ON-delay time and ONE-SHOT time interval configuration.

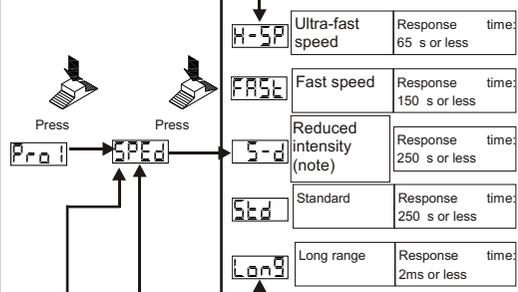


- Notes: 1) The time interval set in PRO mode appears in the display  
2) Factory setting does not have 'non' timing.

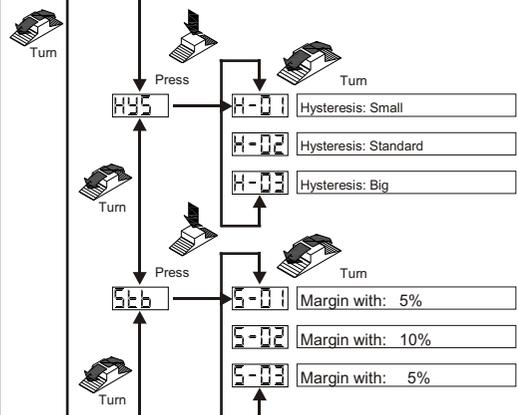
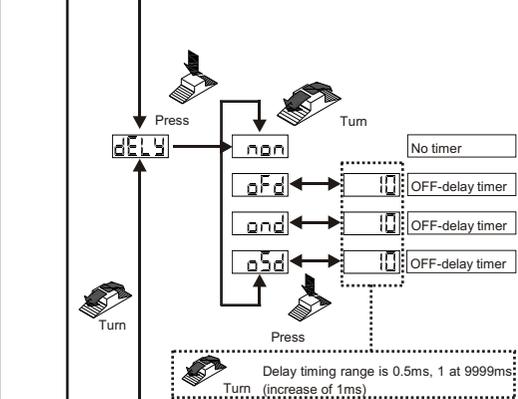
### 13. PRO Mode

- The PRO configuration can be performed when the indicator MODE / PRO (yellow) turns on.

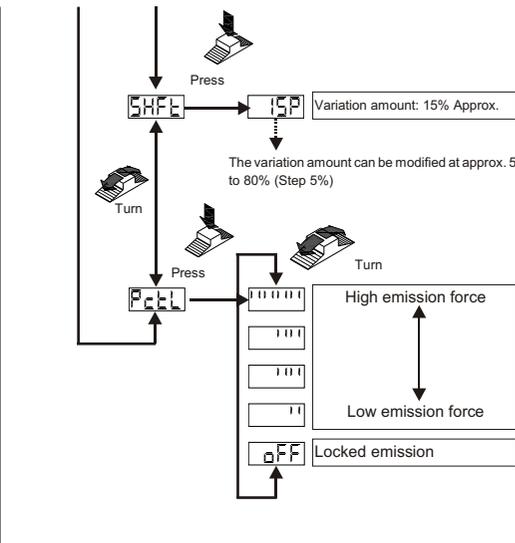
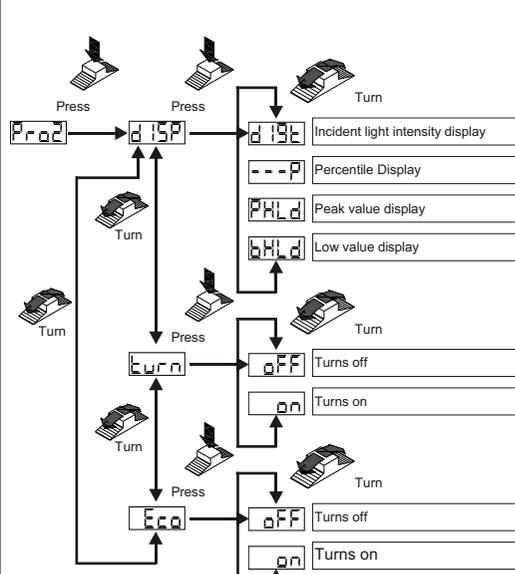
#### PRO1 configuration mode



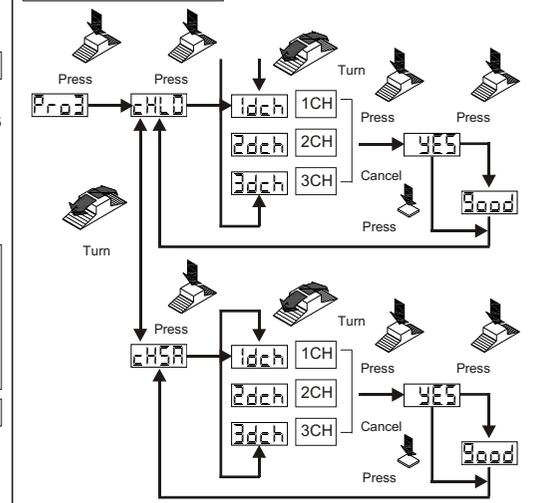
Note: S-D mode is indicated for delicate sensing, such as incoming light is saturated due to short or when the detection of translucent objects.



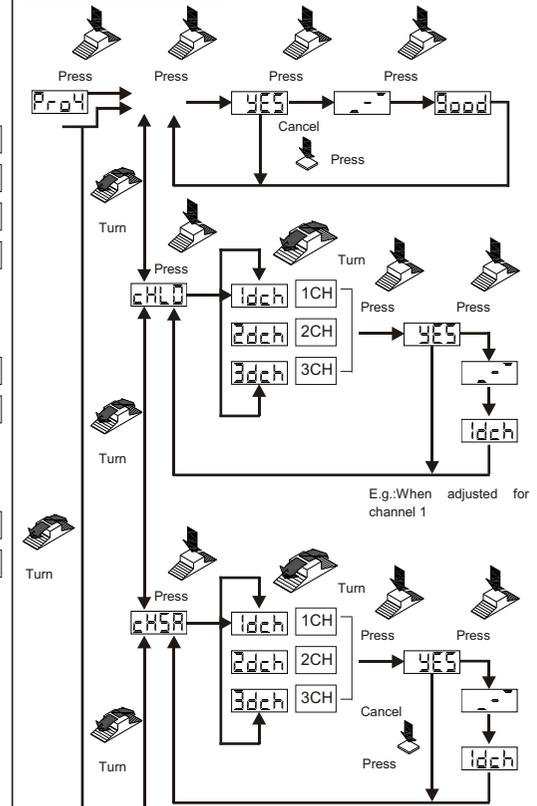
#### PRO2 configuration mode

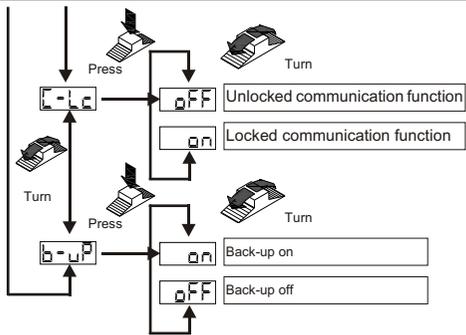


#### PRO3 configuration mode

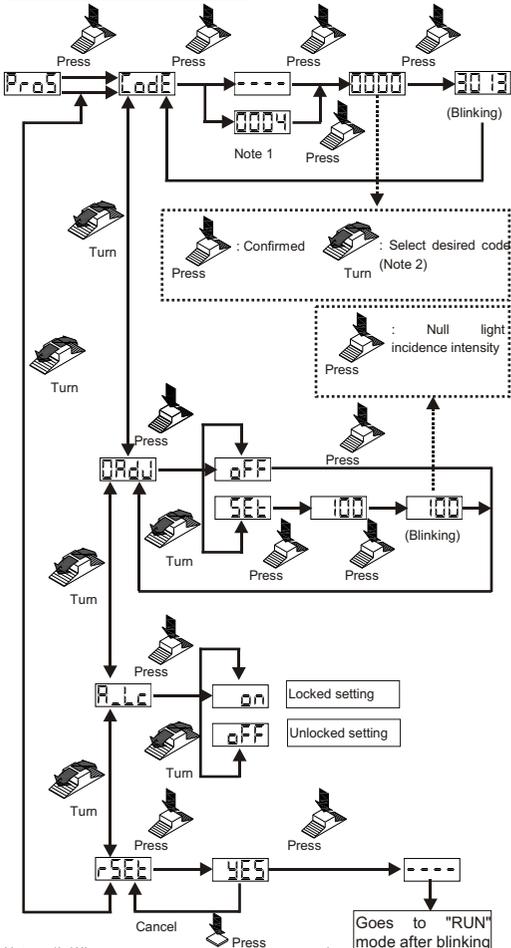


#### PRO4 configuration mode



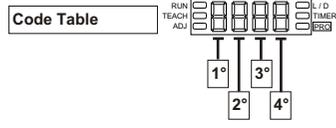


**PRO5 configuration mode**



Notes: 1) When any code, except the ones fixed on the table below is used, '---' is shown on display. The factory setting is set as '0004'

2) When the setup code is used, reference the code table below.



1° digit			2° digit		
Code	Response time	Hysteresis	Code	L-ON/D-ON	Display
[Code]	STD	H-02 (standard)	[Code]	L-ON	digit
[Code]	STD	H-03 (Large)	[Code]	L-ON	Percentile
[Code]	STD	H-01 (small)	[Code]	L-ON	Peak
[Code]	LONG	H-02 (standard)	[Code]	L-ON	Inferior
[Code]	LONG	H-03 (Large)	[Code]	D-ON	digit
[Code]	LONG	H-01 (small)	[Code]	D-ON	Percentile
[Code]	FAST	H-02 (standard)	[Code]	D-ON	Peak
[Code]	FAST	H-03 (Large)	[Code]	D-ON	Inferior
[Code]	FAST	H-01 (small)	-	-	-
[Code]	S-D	H-02 (standard)	-	-	-

3° digit			4° digit	
Code	Locked setting	Temporized Operation	Code	Temporization
[Code]	ON	NON	[Code]	OFF
[Code]	ON	OFF-delay	[Code]	1ms
[Code]	ON	ON-delay	[Code]	3ms
[Code]	ON	ONE-SHOT	[Code]	5ms
[Code]	OFF	NON	[Code]	10ms
[Code]	OFF	OFF-delay	[Code]	30ms
[Code]	OFF	ON-delay	[Code]	50ms
[Code]	OFF	ONE-SHOT	[Code]	100ms
-	-	-	[Code]	300ms
-	-	-	[Code]	500ms
-	-	-	[Code]	1s
-	-	-	[Code]	2s
-	-	-	[Code]	3s
-	-	-	[Code]	4s
-	-	-	[Code]	5s

3) In order to change PRO mode to 'RUN' mode, press MODE switch for 2 seconds or more.

**14. Lock Switch Function**

- If the jog switch and MODE switch is pressed for longer than 2 seconds at the same time in the condition 'RUN' mode, the operating switch is blocked, and only the functions of setting value or setting (valid only when the function is canceled caught setting) is valid.
- To cancel block function, press both switches for more than 2 seconds once more.

**15. One difference between the modified version unit and the conventional version unit.**

- The unit in which 'NAVI' is printed on one side is the modified version unit. The unit in which 'NAVI' is printed on both sides is the conventional version unit. Make sure to check it out when you use both version units together.

