

#### OUTLINE

This product is a phase differential detection type distance sensor that has two outputs, an analog output (current output of 4-20mA) and a comparator output. This distance sensor is designed to adopt a new technology to measure a distance by detecting the phase differential of light (differential of time). Neither the influences of change in the receiving light quantities nor the influences of the background object are easily received. Therefore stable long distance detection can be obtained. A cover is required to avoid rain or direct sunshine at the minimum in case of the outdoor installation.

#### SPECIFICATIONS

Type	DX-7AH	
Detection distance	0.5 to 7.5m (Comparator output : 0.5 to 7.0m) (*1)	
Standard detection object	700×700mm White drawing paper	
Power supply	12 to 24 VDC±10% Ripple 10% or less	
Power consumption	2.3W or less	
Analog output characteristic	Current output	4 to 20mA ±10% (Allowable load resistance 250Ω or less)
	Resolution	±5% F.S. or less (*4), (*5)
	linearity	10% F.S. or less (*4)
	Response frequency	Approx. 20Hz (*2)
Comparator output characteristic	Setting range	0.5 to 7.0m (*1)
	Output mode	NPN open collector, Sink current 50mA or less (30 VDC), Residual voltage 2V or less
	Response frequency	Approx. 20Hz
	Operating mode	Light ON / Dark ON selectable (By exclusive switch)
Short circuit protection	Built-in	
Anti Interference	Provided (Master/slave setting)	
Light source (wavelength)	Infrared LED (870nm)	
Switch	Push button switch ×3	
Teaching method	Auto teaching (Comparator output only)	
Teaching variation	One point normal teaching Two point normal teaching One point zone teaching	
Materials	Case	Aluminum (anodized aluminum processing)
	Front and rear panel	ABS resin
	Lens	Polycarbonate
	Cover for lens	Polycarbonate
Connection	Six pin waterproof plastic connector	
Weight	Approx. 200g	
Accessory	Cable with connector (*3), 250Ω resistor for current-voltage conversion, Instruction manual	

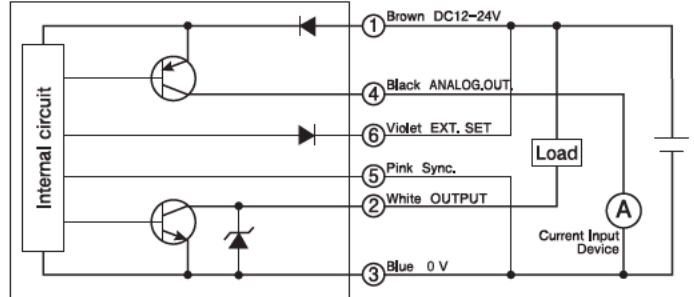
- \*1 Please note that it might malfunction when there is an object with a strong reflection 40m-80m ahead.
- \*2 Frequency in case that output amplitude attenuates up to approx. 90%.
- \*3 0.2mm<sup>2</sup>×6 core, 2m (outer diameter 4.8) : FAC-D6R2
- \*4 Value 15 minutes after the power is supplied
- \*5 A high-resolution output can be obtained by averaging processing or integrating.

#### ENVIRONMENTAL SPECIFICATION

Ambient light	5,000 lx (Max.)
Ambient temperature	-10°C to +55°C (without freezing)
Ambient humidity	35 to 85%RH
Protective structure	IP65
Vibration	10Hz to 55Hz, 1.5mm double amplitude, 2 hr. in X, Y and Z directions
Shock	500m/s <sup>2</sup> , 3 times in X, Y, and Z direction
Dielectric withstand voltage	1000 VAC for 1 minute
Insulation resistance	20MΩ or more when tested with 500 VDC

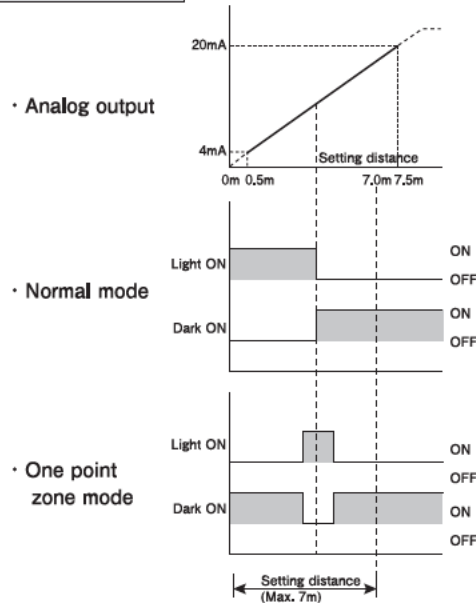
#### OUTPUT CIRCUIT AND WIRING

(When mutual interference prevention feature and external teaching line are unused.)

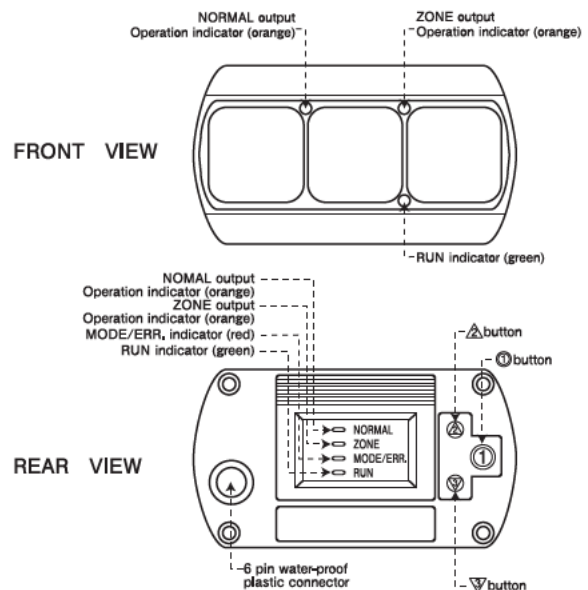


- Connect to power supply (+V) when EXT.SET line (VIO) is unused.
- Connect Sync. line (PNK) with 0V when mutual interference prevention feature is unused.

#### TIME DIAGRAM

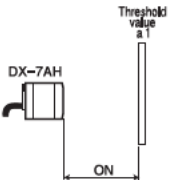
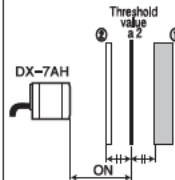
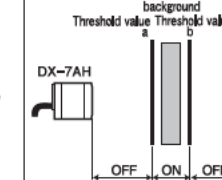


#### OPERATION PART AND INDICATORS



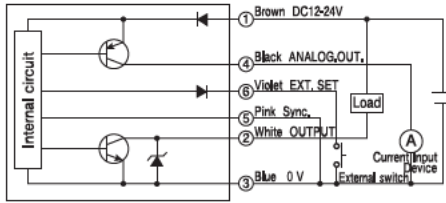
## SETTING AND OPERATION PROCEDURE

Use the optimum teaching method referring to the following.





Usage	Detecting at a fixed position	Setting a threshold value at midpoint between background and an object.	Setting a threshold only by background (To detect a lustrous object located at nearer position than background)
Teaching	One point normal teaching	Two point normal teaching	One point zone teaching (*External teaching possible)
Setting method	Teaching with an object located where detection is expected.	Teaching with background and an object	Teaching with background (conveyor, ground, etc.)
Set threshold	Threshold value a1 is set to the position in which the teaching was done.	Threshold value a2 is set on the mid point between ① (background etc.) and ② (object, etc.).	Threshold value a.b. is set on the position which is approx. $\pm 15\%$ of the distance to background.
Operation range			

## EXTERNAL TEACHING OPERATION



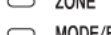





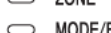

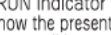
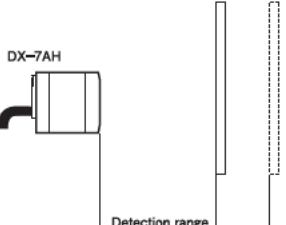
When "One point zone mode" is set, the teaching operation can be also conducted by external switch (⑥ pin VIO line GND shorted) instead of the button 3. (External switch can not be used when "Normal mode" is set.)





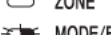






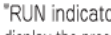
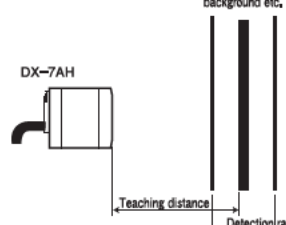
## INDICATOR STATUS

 Light
  Flickers
  Alternately flickers
  Goes OFF

### [1] Normal mode One point normal teaching / Two point normal teaching operation

Procedure	Operation		Indicator status
	One point normal teaching	Two point normal teaching	
①	Place a detecting object where detection is expected.	Place a detecting object.	
②	Continue to press the button  until "RUN indicator (green)" flickers. (Approx. 3sec)		<ul style="list-style-type: none"> <li> NORMAL</li> <li> ZONE</li> <li> MODE/ERR.</li> <li> RUN ← Flickering</li> </ul>
③	In addition, press the button  . At the same position once. (Approx. 0.5sec)	Press the button  once after moving the object. (Approx. 0.5sec)	<ul style="list-style-type: none"> <li> NORMAL</li> <li> ZONE</li> <li> MODE/ERR.</li> <li> RUN</li> </ul> <p>"RUN indicator" lights to show the present detection status. (However, when the slave is set, "RUN indicator" remains Off.)</p>
			<ul style="list-style-type: none"> <li>• <b>Setting and operation of L/D MODE</b> When L.ON is set : Operates in the detection range. When D.ON is set : Operates outside the detection range.</li> <li>• <b>The Hysteresis becomes approx.20% or less of the detection range.</b> The teaching can be conducted from either side, a far side or a near side for "Two point normal teaching".</li> </ul>

### [2] One point zone mode One point zone teaching operation

Procedure	Operation		Indicator status
	When set button on the sensor is used	When an external switch is used	
①	Turn the sensor detection face toward the background (conveyor or ground, etc.).		
②	Continue to press the button  until "Run" indicator (green) and "MODE/ERR indicator (red)" will flicker alternately. (Approx. 3sec)	Continue to press the external switch until "Run" indicator (green) and "MODE/ERR indicator (red)" will flicker alternately. (Approx. 3sec)	<ul style="list-style-type: none"> <li> NORMAL</li> <li> ZONE</li> <li> MODE/ERR. ← Alternately flickers</li> <li> RUN ← Alternately flickers</li> </ul>
③	In addition, press the button  once with the same condition. (Approx. 0.5sec)	In addition, press the external switch once with the same condition. (Approx. 0.5sec)	<ul style="list-style-type: none"> <li> NORMAL</li> <li> ZONE</li> <li> MODE/ERR.</li> <li> RUN</li> </ul> <p>"RUN indicator" lights to display the present detection status. (However, when the slave is set, "RUN indicator" remains Off.)</p>
			<p>The detection range (detection zone) is 15% or less of the teaching distance.</p> <p>• <b>Setting and operation of L/D MODE</b> When L.ON is set : Operates in the detection range. When D.ON is set : Operates outside the detection range.</p>

- Make use of this operation method when you intend to conduct the teaching with background only or to detect a lustrous object placed nearer than background.
- The lustrous object is recognized to be further than background and is detected.

## TEACHING ERROR

Error indicator [ERR.] (red) flickers when the error occurs on the teaching. Press button ① once to reset.

- **For the teaching conducted in normal mode**  
Cause : Missing object or insufficient receiving light amount. An object is passing by too near.

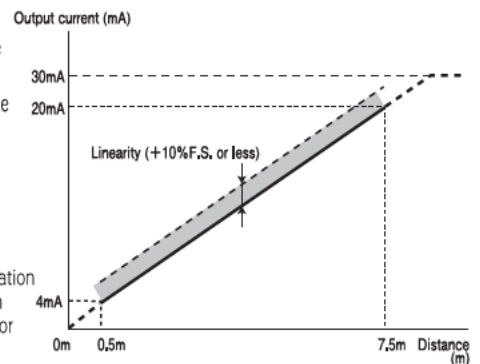
- **For the teaching conducted in zone mode**  
Cause : Missing object (background) or teaching distance are too short (too near)

Do not fail to conduct the teaching correctly after it is reset.  
All teaching data in the past has been deleted.

## ANALOG OUTPUT

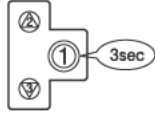
The change of the setting is impossible using with the set button etc. though this product is equipped with the analog output of 4-20mA. Please refer to the table below for the characteristic of the analog output.

- The analog output current issues the upper limit saturation value (approx. 30mA) when detecting object is missing or the reflection of the object body is so small that light can not return to the sensor.



## LIGHT ON / DARK ON SETTING

The setting changes whenever the button ① is pressed with the teaching correctly conducted.

Procedure	Operation	Indicator status										
①	<p>MODE (red) is turned On and Off whenever the button ① is pressed for approx. 3 seconds.</p> 	<table border="0"> <tr> <td><b>L.ON setting</b></td> <td><b>D.ON setting</b></td> </tr> <tr> <td><input type="radio"/> NORMAL</td> <td><input type="radio"/> NORMAL</td> </tr> <tr> <td><input type="radio"/> ZONE</td> <td><input type="radio"/> ZONE</td> </tr> <tr> <td><input type="radio"/> MODE/ERR. <small>Alternately</small></td> <td><input type="radio"/> MODE/ERR.</td> </tr> <tr> <td><input checked="" type="radio"/> RUN</td> <td><input checked="" type="radio"/> RUN</td> </tr> </table> <p>MODE/ERR. remains Off : L.ON operation MODE/ERR. lighting : D.ON operation However, when the slave is set, "RUN indicator" remains Off.</p>	<b>L.ON setting</b>	<b>D.ON setting</b>	<input type="radio"/> NORMAL	<input type="radio"/> NORMAL	<input type="radio"/> ZONE	<input type="radio"/> ZONE	<input type="radio"/> MODE/ERR. <small>Alternately</small>	<input type="radio"/> MODE/ERR.	<input checked="" type="radio"/> RUN	<input checked="" type="radio"/> RUN
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<input type="radio"/> MODE/ERR. <small>Alternately</small>	<input type="radio"/> MODE/ERR.											
<input checked="" type="radio"/> RUN	<input checked="" type="radio"/> RUN											

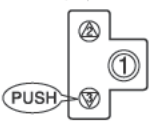
## MUTUAL INTERFERENCE

This product has the mutual interference prevention feature built-in. Do not fail to set the master/slave setting, connect ⑤ pin (pink) mutually and make 0V of the power supply common whenever the products are used closely.

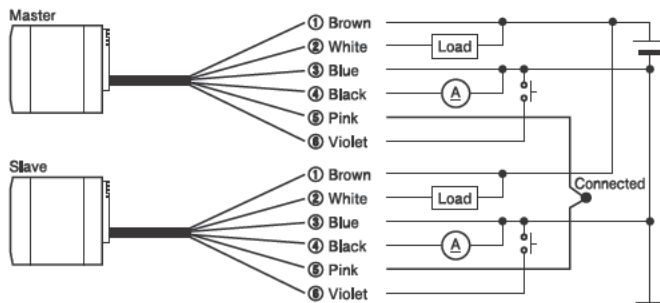
Connect one slave machine Max. to one master machine.

Conduct the teaching with the power supply of the other sensor turned off or with the connector of the other sensor disconnected under such condition.

### Master/slave mode setting procedure

Procedure	Operation	Indicator status										
①	<p>Turn on the power supply with the button <math>\nabla</math> pressed.</p> 											
②	<p>Release the button <math>\nabla</math></p>	<table border="0"> <tr> <td><b>Master setting</b></td> <td><b>Slave setting</b></td> </tr> <tr> <td><input type="radio"/> NORMAL</td> <td><input type="radio"/> NORMAL</td> </tr> <tr> <td><input type="radio"/> ZONE</td> <td><input type="radio"/> ZONE</td> </tr> <tr> <td><input type="radio"/> MODE/ERR.</td> <td><input type="radio"/> MODE/ERR.</td> </tr> <tr> <td><input checked="" type="radio"/> RUN</td> <td><input type="radio"/> RUN</td> </tr> </table>	<b>Master setting</b>	<b>Slave setting</b>	<input type="radio"/> NORMAL	<input type="radio"/> NORMAL	<input type="radio"/> ZONE	<input type="radio"/> ZONE	<input type="radio"/> MODE/ERR.	<input type="radio"/> MODE/ERR.	<input checked="" type="radio"/> RUN	<input type="radio"/> RUN
<b>Master setting</b>	<b>Slave setting</b>											
<input type="radio"/> NORMAL	<input type="radio"/> NORMAL											
<input type="radio"/> ZONE	<input type="radio"/> ZONE											
<input type="radio"/> MODE/ERR.	<input type="radio"/> MODE/ERR.											
<input checked="" type="radio"/> RUN	<input type="radio"/> RUN											
③	<p>Repeat the procedure ① → ② to change the setting Master ↔ Slave.</p>	<p>RUN lights : Master mode RUN remains Off : Slave mode</p>										

### Wiring example



- When ⑥ EXT.SET line (VIO) is unused, connect it to power supply (+V).
- Do not fail to use the sensor with ⑤ Sync. line (PNK) connected to GND when the sensor is used separately with the mutual interference prevention feature unused.

- The guarantee period of this product is one year after the delivery.
- If any defect is found during the guarantee period, Takenaka will repair or replace the defective product.
- This product is an industrial sensor which issues an output upon detecting an object. It does not have any function to prevent accidents, death or injuries.
- Takenaka will not held responsible for any damage or loss incurred due to accidents, faulty installation, abuse, misuse, improper maintenance or acts of God including lightning surge.

## PRECAUTIONS

- When a background (wall etc.) exists 8m to 30m separated from the sensor and an object comes across the detection range :
  - The output of the near point might issue by the object edge rather than a regular analog value when the analog output is used.
  - The sensor is likely to operate instantaneously by the object edge when the comparator output is used.
- The power source should be within the specification range so as not to exceed the rated voltage range.
- Make sure that the wiring has been made correctly before power is supplied because mis-wiring causes burnout or damage.
- The sensor line should be separated from high voltage line or power line because wiring in the same conduit might cause malfunction or damage by noise.
- Do not fail to ground Frame Ground (F.G.) terminal when a switching regulator is used for the power supply. Please note that it is likely to malfunction because of the switching noise if it is not grounded.
- Avoid the transient state just after the power supply is turned on (200ms).
- Install the sensor so that strong rays such as the sun light, the fluorescent lamps, or the incandescent lamp should not enter the sensor operational area.
- Please note that it might cause malfunction or damage if the sensor is used in the place which is subject to vibration, shock, or direct disperse of oil / the chemicals, or which corrosive gas is generated.
- Periodically wipe off stains on lens with soft cloth because they might cause malfunction.
- Use power supply which limits the current in accordance with the capacity of the lead wire.

## DIMENSIONS (in mm)

