# **TAKEX**

Ultrasonic sensor

## USA SERIES Instruction Manual

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## OUTLINE ( 6

- This product is an ultrasonic sensor with a current output (4 to 20mA)
- Built in CPU enables various setting.
- 12 bit D/A converter achieves excellent linearity.

### SPECIFICATIONS AND ENVIRONMENTAL CHARACTERISTICS

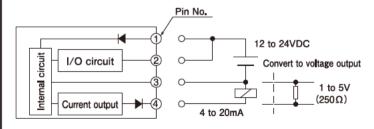
Model		USA-S1AN	USA-S3MAN	USA-S6AN
Detection		Ultrasonic reflection		
Range		0.1 to 1m	0.4 to 3m	0.4 to 6m
Min. dete	cting object	100×100mm, t=2mm, Aluminum board	300×300mm, t=2mm, Aluminum board	500×500mm, t=2mm, Aluminum board
Powers	supp <b>l</b> y	12 to 24VDC, ±10%, Ripple 10% (Max.)		
Power consumption		1.3W (Max.) (Current consumption approx. 110mA at 12VDC, approx. 55mA at 24VDC)		
Respon (When use	se time ed separately)	150ms or less	300ms or less	600ms or less
Analog output		4 to 20mA Current output (Allowable load resistance 0 to 250Ω)		
Min. resolution ※1		0.9mm (0.1% F.S.)	2.6mm (0.1% F.S.)	5.6mm (0.1% F.S.)
Linearity		±1% within F.S.		
Temperature characteristics		1% F.S. (Max.) against an output value at 23°C in a range of $-10$ to $+55$ °C		
Ultrasonic frequency		Approx. 200kHz	Approx. 110kHz	Approx. 40kHz
Indicators		RUN: Green, 4mA: Red, mid.: Orange, 20mA: Green		
Teaching system		Distance setting · Output inversion		
Connection		M12×4p DIN connector #2		
Weight (sensor only)		150 g (Max.)	300 g (Max.)	200 g (Max.)
Protection		Output short circuit. Power output reverse connection.		
Feature	s	Mutual interference prevention / Temperature compensation built-in		
Materials Case		Nickel-plated		
Waterials	Detection face	Nylon, Urethane, Glass epoxy	Nylon, Silicon, Glass epoxy	ABS, Urethane, Aluminum
Access	ory	Resistor for voltage conversion (250 $\!\Omega$ ), Instruction manual, Fixing nut		
Temperature range		-10 to +55°C (Storage: -20 to +65°C)		
Humidity		35 to 85%RH (Without condensation)		
Enclosure rating		I P67 allowed (No drop of water is allowed on the head.)		
Vibration resistance		10~55Hz, 1.5mm double amplitude 2hr, 3 directions		
Shock resistance		500 m/s <sup>2</sup> 3 times in X, Y and Z directions (excluding the ultrasonic element part)		
Dielectric strength		1000VAC 50/60Hz for 1 minute		
Insulation	n resistance	Min. 50MΩ (at 500VDC)		

×1 Shows the value more than 15 minutes after power is supplied. (or re-supplied).

The value may slightly fluctuate due to external disturbance, etc.

※2 Cable with M12 connector is sold separately.

## **OUTPUT CIRCUIT AND WIRING**

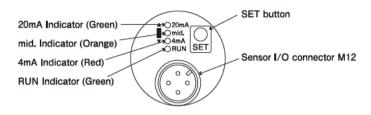


Cable extension

Use cables 0.3mm<sup>2</sup> cross-sectional area or more and the length should not exceed 300m.

 The current output (4-20mA) can be converted into voltage output (1-5V) with a resistor (250 $\Omega$ ) connected in parallel.

## OPERATION PANEL AND INDICATORS



#### Indicator operation

20mA indicator (Green)

- : Turns on when output current is approx. 20mA or more. mid. indicator (Orange)
- : Turns on when a detecting object is within the detection range. 4mA indicator (Red)
- : Turns on when output current is approx. 4mA or less. RUN indicator (Green)
- : Turns on when powered. (Remains off when slave mode is set.)

#### M12 connector pin arrangement (Sensor side)

Pin arrangement	Pin	Description	Core colors
(1) (3) (4)	1	Power supply (+)	Brown
	2	1/0	White
	3	0 V	Blue
	4	Current output	Black

(The above colors are core cable colors when the cable with connector for model FAC series is used.)

#### Optional

Cable with connector (Sold separately)

· Model FAC-D4R2S (Cable length: 2m)

· Model FAC-D4R5S (Cabel length: 5m)

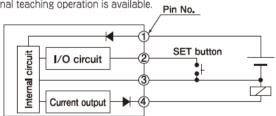
· Model FAC-D4R2L (Cabel length: 2m Langle)

· Model FAC-D4R5L (Cabel length: 5m Langle)

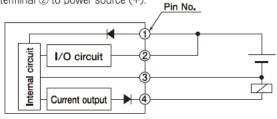
#### SETTING AND OPERATING PROCEDURE

Follow the below procedure for setting detection range. The same operation is obtained by using the external switch ( ② pin I/O line) instead of using SET button on the body. (Excluding a part of operating procedure)

• When using the external swittch ··· Connect terminal ② to 0V (blue). and external teaching operation is available.



● When the external switch (② pin, I/O line, white), etc. is not used, connect terminal 2 to power source (+).



- Indication status of indicators
  - Turns on
- ☼ Blinking
- Fast blinking

- O Turns off
- Alternate blinking
- [1] Setting of detection range (2-point teaching)

(The default setting is the maximum range according to the specification of the model.)

Proc.	Operation	Status
1	Place a detecting object at the furthest point of the detection range.  Detecting (((((( Sensor	
2	Press and hold the SET button for approx. 3 sec. (3 to 6 sec.)	20mA Blinking simultaneously RUN
3	Release the SET button.	<b>₫</b> \$ 20mA \
4	Place a detecting object at the closest point in the detection range.  Detecting (((((( Sensor	Blinking  4mA  RUN
(5)	Press the SET button once. (for 0.5 sec. or more)	O 20mA
Com- pleted	Current outputs of 4mA at the closest point and 20mA at the furthest point have been set and the sensor starts operation.	<ul><li>mid. The present</li><li>4mA measuring status</li><li>RUN is indicated.</li></ul>

[2] Setting of analog output mode (incremental/decremental) (Incremental mode is the default setting)

Proc.	Operation	Status
1	Press and hold the SET button for approx. 8 sec. (8 to 12 sec.)	Blinking simultaneously approx. 3 sec. later approx. 4 sec. \$\frac{1}{4}\) 20mA \$\frac{1}{4}\) mid. \$\frac{1}{4}\) 4mA \$\frac{1}{4}\) RUN
2	Release the SET button.	Decremental mode Incremental mode
3	The mid. LED (orange) is alternately turnned on and off each time the SET button is pressed.  mid. LED ON: Incremental mode mid. LED OFF: Decremental mode	Distance 20mA 20mA mid. 4mA RUN RUN
Com- pleted	The 20mA LED (green) starts blinking fast for approx. 4 sec. after the last switch operation, and the selected mode is stored then after 2 sec.	Blinking fast  20mA  mid.  4mA  Approx.  Approx.  RUN  2 sec. later  RUN

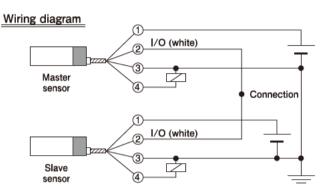
[3] Setting to the maximum detecting range (The factory setting is restored)

LO1	to a correction of the maximum detecting range (the ractory setting is restored)			
Proc.	Operation	Status		
1	Press the SET button for approx. 3 sec. without a detecting object. (with no ultrasonic received)  No detecting object ((((((((((((((((((((((((((((((((((((	Blinking simultaneously		
2	Release the SET button.	Description of the state of the		
3	Press the SET button once more without a detecting object. (with no ultrasonic received)	O 20mA		
Com- pleted	The maximum range has been set according to the specification of the model: 4mA at the closest point and 20mA at the furthest point. (The former setting is cancelled.)	mid. The present     4mA measuring status     RUN is indicated.		

I : To cover the front surface of the sensor with a soft and thick cloth avoiding contact
 the cloth with the sensor may simulate a state of no detecting object.

## MUTUAL INTERFERENCE PREVENTION

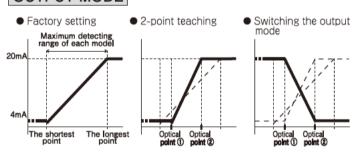
- This sensor is equipped with a mutual interference prevention function. When two sensors are installed in parallel or in opposite positions, activate the mutual interference prevention function and make master/slave setting. To activate the function, connect ② pin I/O (sync) lines and common the 0V between the two (master and slave) sensors. One master unit can be connected with one slave unit only.
- When teaching is conducted for one unit, turn off power or remove the
  connector of the other unit before teaching. <u>Teaching can't be</u>
  <u>conducted for two or more sensors at the same time.</u> Response time
  will be reduced by approx. 50% when the murual interference prevention
  function is activated.



Master/Slave setting

Proc.	Operation	Status
$\odot$	Supply power while pressing SET button. Press the SET button on the sensor to be set.  The setting can't be done by the external switch operation (② pin I/O).	All blinking fast (3 indicators)  20mA mid.  4mA Approx. C RUN 2 sec. Later
@	Release the SET button.	O 20mA The present detecting status is indicated.
3	Slave setting is completed.	O RUN Turns off (Slave mode)
4	Repeat the procedure ① and ②, and the setting can be changed Master and Slave alternately.	O 20mA

#### **OUTPUT MODE**



- Factory setting
- : 4 to 20mA current output with the maximum detecting range of each model.
- 2-point teaching
  - : 4 to 20mA current output at optional points within the detection range of each model.
- Switching the output mode
  - : Output mode can be switched between incremental and decremental modes. Decremental mode : Output current decreases as the distance increases. Incremental mode : Output current increases as the distance increases.

Do not use the sensor at short distance less than 0.4m (400mm) for USA-S3MAN and USA-S6AN, or less than 0.1m (100mm) for USA-S1AN. The operation may become unstable within the range.

#### **DIMENSIONS** (in mm) USA-S1AN USA-S3MAN USA-S6AN FAC-D4R2S FAC-D4R2L (L:2m) (L:2m) M12×1 connector FAC-D4R5S FAC-D4R5L Indicator (L:5m) (L:5m) $(\phi 6 \ 0.3 \text{mm}^2 \times 4)$ 20 M30×1.5 M12×1 connecto (9.8) 2—tightening nut Indicate M12×1 connector (9.8)Indicato M30×1.5 50 M30×1.5 2—tightening 165 2—tightening Washer 78

#### INSTALLATION

- Be sure to use the attached nuts and washer for installation. The tightening torque should be 15N·m or less.
- Be sure to turn off power before inserting or removing the connector cable. Do not apply excessive force on the connector and the cable; it may cause a loose connection. The connector is a DIN M12.
- Secure a space to operate the SET button when installing the sensor.
- Detection at the center of the ultrasonic beam provides precise linear output. Install the sensor so that the object is detected at the center of the ultrasonic beam. The center axis of the ultrasonic beam may have deviation from the physical center of the sensor housing by a few degrees.
- Detectable objects are restricted by material. Objects absorbing ultrasonic like soft clothes, sponge or bubbles on a fluid surface reduce the detecting distance. Mirror like objects may not be detected when it is placed at an angle to the sensor.
- When using a DC unit with an insulated transformer or a switching regulator, be sure to ground the frame ground (FG) terminal.

#### **PRECAUTIONS**

- The sensor is designed to discriminate its emitted ultrasonic from external sounds, but avoid using it where a similar sound frequency - metallic sound, sound from air nozzle or glass cutter - is generated.
- The sensitivity may deteriorate in vacuum, pressured or decompressed space or by a local temperature change or strong air convection, as air is medium of sound.
- Do not wet the sensor front. The sensor doesn't work once the front surface (ultrasonic element) is wetted.
- Avoid to turn on and off the sensor consecutively.
- Do not use a same conduit with high voltage or inverter lines for wiring.
- The sensor requires 15 minutes of warming up time. Operation during the period may not be stabilized.
- A temperature sensor is built in the sensor front. A local temperature change around the sensor will produce an error in the current output. Install the sensor in a uniform ambient temperature.
- Perform a test and verify the operation when to detect an object at a temperature of 100°C or above. Objects of high temperature reflect few ultrasonic.
- Limit the current of the power supply in accordance with the size of the sensor cable.
- Do not disassemble or modify the sensor.
- 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.