

## OUTLINE



- 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

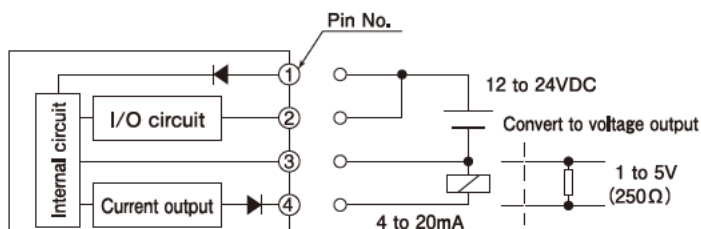
Model	USA-S1AN	USA-S3MAN	USA-S6AN
Detection	Ultrasonic reflection		
Range	0.1 to 1m	0.4 to 3m	0.4 to 6m
Min. detecting object	100×100mm, t=2mm, Aluminum board	300×300mm, t=2mm, Aluminum board	500×500mm, t=2mm, Aluminum board
Power supply	12 to 24VDC, ±10%, Ripple 10% (Max.)		
Power consumption	1.3W (Max.) (Current consumption approx. 110mA at 12VDC, approx. 55mA at 24VDC)		
Response time (When used 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.		
Features	Mutual interference prevention / Temperature compensation built-in		
Materials	Case	Nickel-plated	
	Detection face	Nylon, Urethane, Glass epoxy	Nylon, Silicon, Glass epoxy
Accessory	Resistor for voltage conversion (250Ω), Instruction manual, Fixing nut		
Temperature range	-10 to +55°C (Storage : -20 to +65°C)		
Humidity	35 to 85%RH (Without condensation)		
Enclosure rating	IP67 allowed (No drop of water is allowed on the head.)		
Vibration resistance	10~55Hz, 1.5mm double amplitude 2hr, 3 directions		
Shock resistance	500m/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 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.

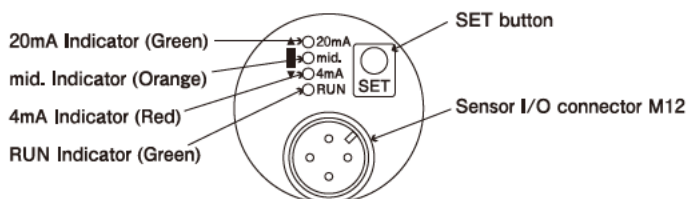
※2 Cable with M12 connector is sold separately.

## 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 (250Ω) 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	Power supply (+)	Brown
	②	I / O	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

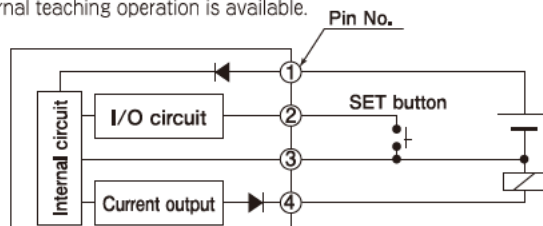
Cable with connector (Sold separately)

- Model FAC-D4R2S (Cable length : 2m)
- Model FAC-D4R5S (Cable length : 5m)
- Model FAC-D4R2L (Cable length : 2m L angle)
- Model FAC-D4R5L (Cable length : 5m L angle)

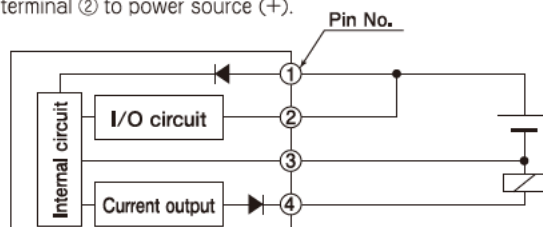
## SETTING AND OPERATING PROCEDURE

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 switch ... 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

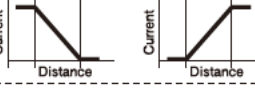
- Turns on
- Blinking
- Fast blinking
- Turns off
- Alternate blinking

### [1] Setting of detection range (2-point teaching)

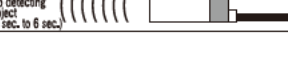
(The default setting is the maximum range according to the specification of the model.)

Proc.	Operation	Status
①	Place a detecting object at the furthest point of the detection range. 	
②	Press and hold the SET button for approx. 3 sec. (3 to 6 sec.)	20mA mid. 4mA RUN Blinking simultaneously
③	Release the SET button.	
④	Place a detecting object at the closest point in the detection range. 	20mA mid. 4mA RUN Blinking alternately
⑤	Press the SET button once. (for 0.5 sec. or more)	20mA mid. 4mA RUN The present measuring status is indicated.
Completed	Current outputs of 4mA at the closest point and 20mA at the furthest point have been set and the sensor starts operation.	

### [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 20mA mid. 4mA RUN → Blinking alternately after approx. 8 sec. 20mA mid. 4mA RUN
②	Release the SET button.	Decremental mode Incremental mode
③	The mid. LED (orange) is alternately turned on and off each time the SET button is pressed. mid. LED ON : Incremental mode mid. LED OFF : Decremental mode 	
Completed	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 RUN → Approx. 2 sec. later 20mA mid. 4mA RUN

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

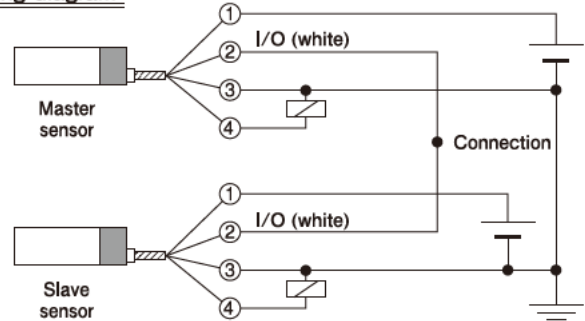
Proc.	Operation	Status
①	Press the SET button for approx. 3 sec. without a detecting object. (with no ultrasonic received) 	20mA mid. 4mA RUN Blinking simultaneously
②	Release the SET button.	20mA mid. 4mA RUN Blinking alternately
③	Press the SET button once more without a detecting object. (with no ultrasonic received)	20mA mid. 4mA RUN The present measuring status is indicated.
Completed	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.)	

※1 : 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. Teaching can't be conducted for two or more sensors at the same time. Response time will be reduced by approx. 50% when the mutual interference prevention function is activated.

### Wiring diagram

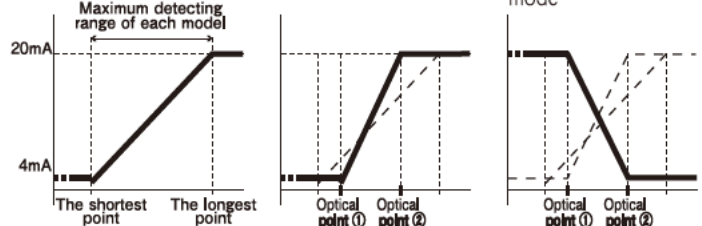


### ● Master/Slave setting

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

## OUTPUT MODE

- Factory setting
- 2-point teaching
- Switching the 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.

## (in mm)



- ## PRECAUTIONS

- ## TAKEX