



- Capable of long-distance measurement
- Built-in teaching function for simple operation and highly-accurate measurement
 - Integrated temperature sensor for stable measurement
 - Anti Interference feature
 - High resolution 12-bit D/A converter
 - Attachments available for wider range of applications (wave guide/wave reflector)

Type

Measuring method	Measuring range	Model	Operation mode	Output mode
Reflective type	0.1~1m	USA-S1AN	Proportional output	Analog output
	0.4~3m	USA-S3AN		

Attachments (applicable to USA-S1AN)

Type	Measuring range with attachment provided	Model	Shape
Wave guide	Depends on the length of pipe	USA-WG08FS	Straight
		USA-WG08FL	Angled
Wave reflector	65~965mm	USA-WR	Side-on in direction of detection

Optional Parts

Type	Model	Shape, etc.
Cord with connector	FAC-D4R2S	4-core M12 straight, 2 m
	FAC-D4R5S	4-core M12 straight, 5 m

Rating/Performance/Specification

Model	USA-S1AN	USA-S3AN
Detecting distance	0.1-1m	0.4-3m
Detection object	100x100mm (sample object: 2-mm thick aluminum plate)	
Power supply	12-24V DC $\pm 10\%$ / Ripple (p-p) 10% max.	
Power consumption	1.3W max.	
Response speed (standalone use)	150ms max.	300ms max.
Analog output	4-20 mA current output (reverse output available with SET button); see *3 for voltage output	
Minimum resolution *1	0.9mm (0.1%F.S.)	2.6mm (0.1%F.S.)
Linearity	$\pm 1\%$ F.S.	
Temperature characteristics	$\pm 1\%$ of F.S. max. with reference to output at 23 °C between -10 and +55 °C ($\pm 0.03\%$ of F.S./ °C max.)	
Applicable load	0-250 Ω	
Ultrasonic frequency	About 200 kHz	About 75 kHz
Indicator	RUN: (green) 4mA: (red) mid (orange) 20mA (green)	
Teaching system	Teaching: distance setting, output inversion (with SET button)	
Connection	Connector (M12) *2	
Mass	Approx. 150 g	Approx. 300 g
Protective feature	Output short circuit protection, power supply output protection against reverse connection	
Material	Case: brass (nickel plated) / Detection side: nylon, silicon, glass epoxy resin	

*1 Value applicable about 15 minutes after power-up. Output may be slightly fluctuated by external disturbance, etc.

*2 Cord with M12 connector is separately available.

*3 May be converted into voltage output (1-5 V) with the resistor (250 Ω) provided.

Environmental Specification

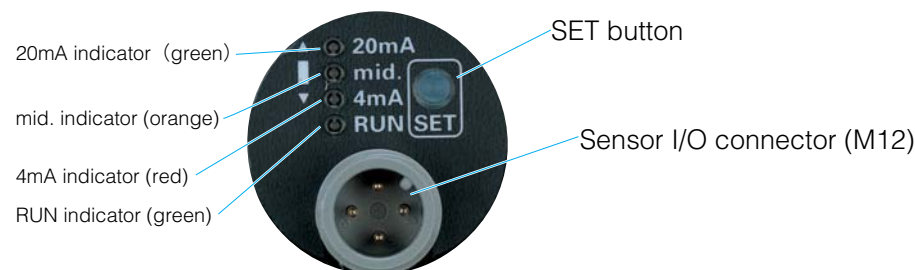
Ambient temperature	-10 - +55 °C (non-freezing)
Ambient humidity	35-85%RH (non-condensing)
Protective structure	IP67 (no drops of water allowed on head)
Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 directions
Shock	500 m/s ² / 3 times each in 3 directions (ultrasonic element excluded)
Dielectric withstanding	1000VAC 50/60Hz for 1 minute
Insulation resistance	500 VDC, 50 M Ω or higher

- Applicable comparator



(ANP Series)

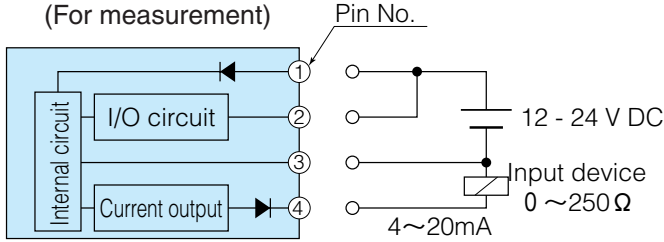
Panel and Indicators



Name	Color	Operation
20 mA indicator	Green	Illuminated when output current is about 20 mA or larger
mid. indicator	Orange	Illuminated when detection object is within measuring range
4 mA indicator	Red	Illuminated when output current is about 4 mA or smaller
RUN indicator	Green	Illuminated while power is supplied

Input/Output Circuit and Connection

(For measurement)



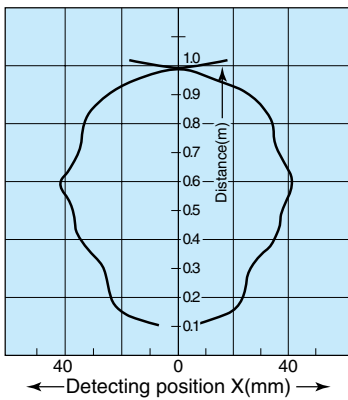
Cord with M12 connector

Pin arrangement	Pin No.	Description	Core colors
	①	Power supply (+)	Brown
	②	I/O	White
	③	0V	Blue
	④	Current output	Black

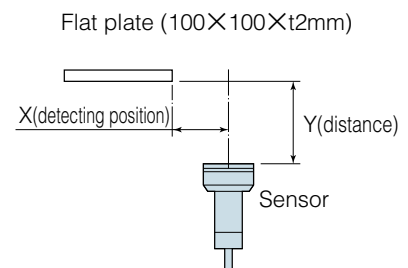
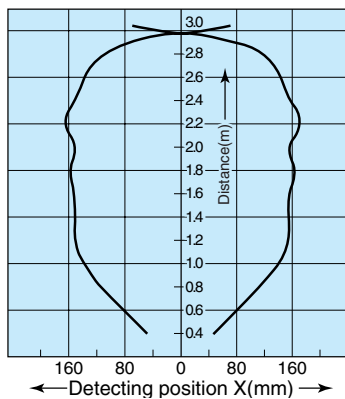
Characteristics (Typical Example)

- Detecting area characteristics (flat plate)

USA-S1AN

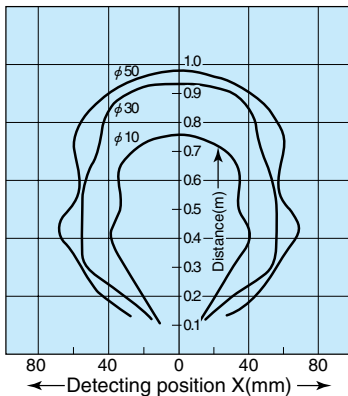


USA-S3AN

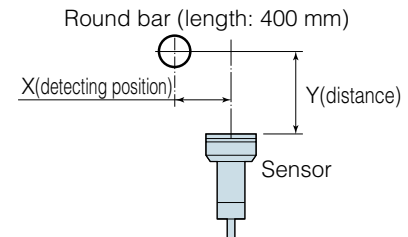
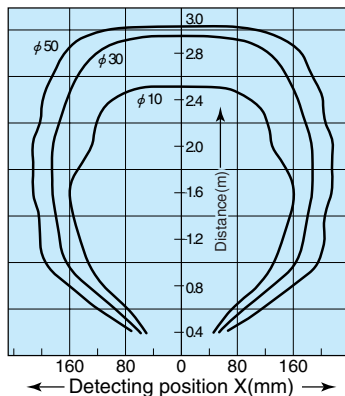


- Detecting area characteristics (round bar)

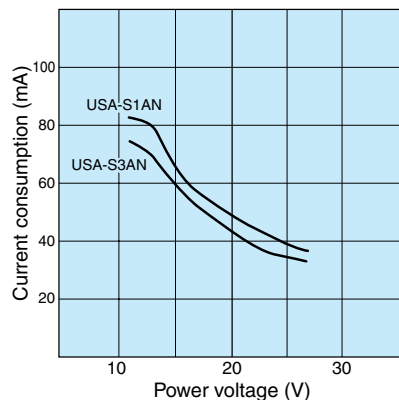
USA-S1AN



USA-S3AN



- Current consumption characteristics



Surface temperature of detection object

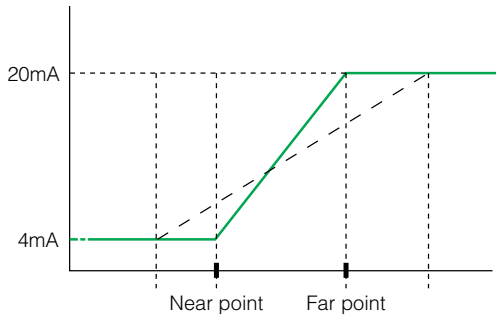
Ultrasonic waves reflected on a surface at a temperature above 100 °C may be extremely low. Be sure to test the operation before putting the sensor to use.

For Correct Use

Be sure to follow the instructions in the operation manual provided for correct use of the product.

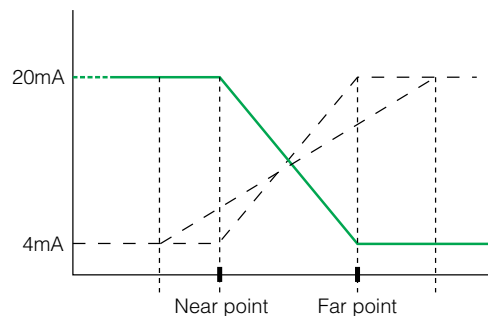
Teaching procedure

• Range setting



Current output between 4-20 mA is available between arbitrary 2 points within the measuring range.
(The factory setting is maximum measuring range.)

• Incremental/decremental mode switching



The operation can be switched between the modes in which output current increases and decreases according to the distance.
(The factory setting is the incremental mode.)

Procedure	Operation and indicator
①	Provide the detection object at the far point of the measuring range.
②	Press and hold down the SET button for about 3 seconds (3-6 seconds) <ul style="list-style-type: none"> 20mA mid. 4mA RUN <i>Flashes simultaneously</i>
③	Release the SET button. <ul style="list-style-type: none"> 20mA mid. 4mA RUN <i>Starts alternating</i>
④	Provide the detection object at the near point of the measuring range.
⑤	Press the SET button once (0.5 seconds min.). <ul style="list-style-type: none"> 20mA mid. 4mA RUN <i>Show current measuring conditions</i>
Completed	The setting has been made for output between 4 and 20 mA for near and far points respectively.

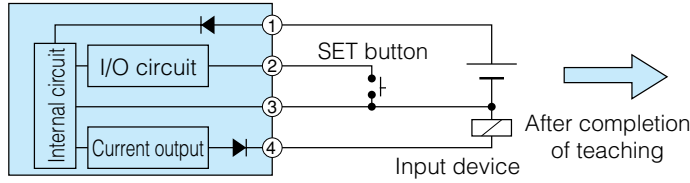
Procedure	Operation and indicator
①	Press and hold down the SET button for about 8 seconds (8-12 seconds). <ul style="list-style-type: none"> 20mA mid. 4mA RUN <i>Starts flashing simultaneously after about 3 seconds</i>
②	Release the SET button. The mid (orange) indicator turns on and off every time the SET button is pressed. mid (orange) illuminated: incremental mode mid (orange) not illuminated: decremental mode
③	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><i>Decremental mode</i></p> <ul style="list-style-type: none"> 20mA mid. 4mA RUN </div> <div style="text-align: center;"> <p><i>Incremental mode</i></p> <ul style="list-style-type: none"> 20mA mid. 4mA RUN </div> </div> <p style="text-align: center;"><i>Alternate</i></p>
Completed	The 20 mA (green) indicator starts flashing quickly about 4 seconds after the last switch operation and, about 2 seconds later, the mode is determined. <ul style="list-style-type: none"> 20mA mid. 4mA RUN <i>Quick flashing</i>



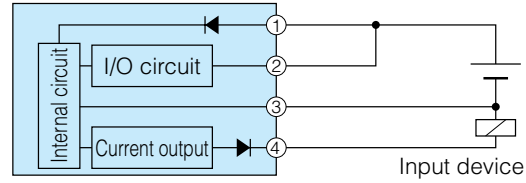
- Do not use the sensor for protection of human body.
- For safety applications, ensure safe operation of the detection and control system as a whole.

External teaching

Teaching operation may be performed by using the external switch (Pin (2) I/O line) instead of the SET button on the sensor unit.



Short-circuit Pin (2)(I/O) to Pin (3) (GND) for use as teaching switch wiring.



When teaching has been completed, connect Pin (2) to Pin (1) (+). Leaving the Pin (2) line

Installation

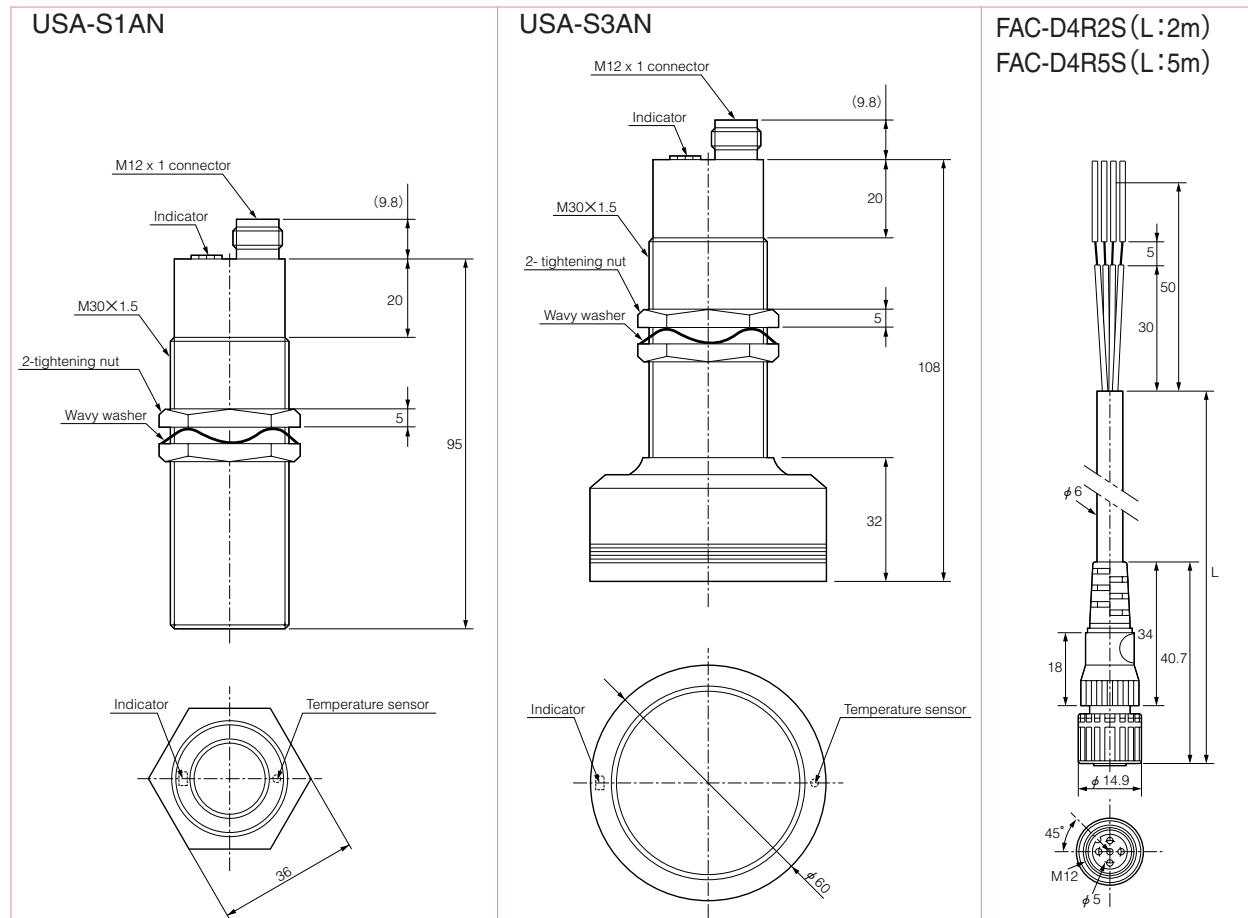
Be sure to use the nuts provided to install the sensor and tighten with a torque of 15 N·m max.

Cord Extension

To extend the cord, use wires of at least 0.3 mm² and limit the length to within 300 m.

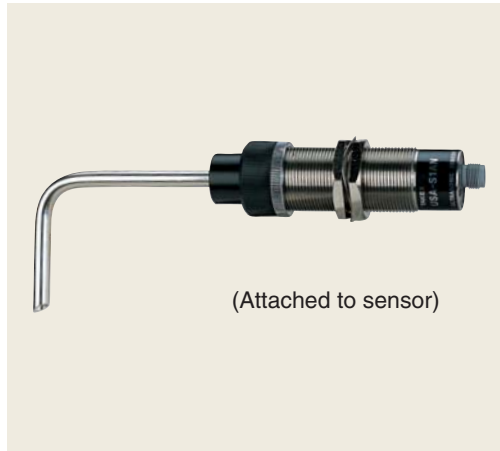
When the wiring is 5 m or longer, separate the GND lines for output and power supply at a point within 5 m.

Dimensions (in mm)



Attachment

Produce name: wave guide



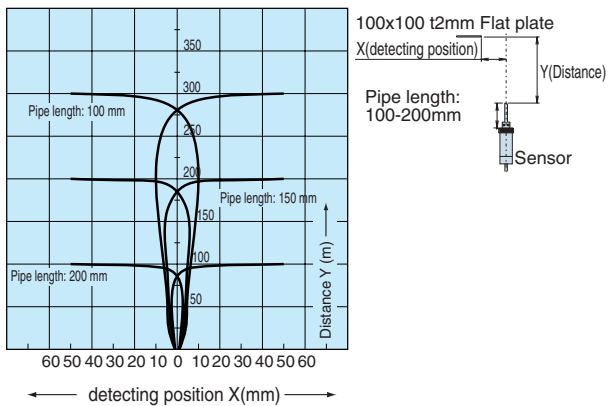
- Offers flexibility of detection head
- Small angle of aperture for pinpoint detection
- No dead zone and capable of close proximity detection
- Free-cutting pipe counteracts installation space restrictions

Model	Straight			Angled		
	USA-WG08FS			USA-WG08FL		
Detecting distance(*)	0-300mm <small>(with pipe length 100 mm)</small>	0-200mm <small>(with pipe length 150 mm)</small>	0-100mm <small>(with pipe length 200 mm)</small>	0-100mm <small>(with pipe length 100 mm)</small>	0-75mm <small>(with pipe length 150 mm)</small>	0-50mm <small>(with pipe length 200 mm)</small>
	(*) Detecting distance depends on the length of pipe.					
Pipe length	Pipe can be cut freely on the sensor side.					
Standard detection object	100x100mm t=2mm aluminum plate					
Material	Pipe: copper (nickel plated) Clamp: polyacetal resin Locking ring: brass (nickel plated)					
Applicable sensor	USA-S1AN					

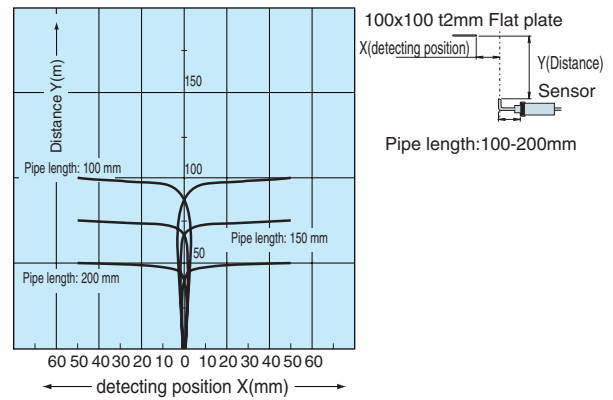
Detection area characteristics (Typical Example)

Flat plate detection (100x100mm)

Model USA-WG08FS (straight)

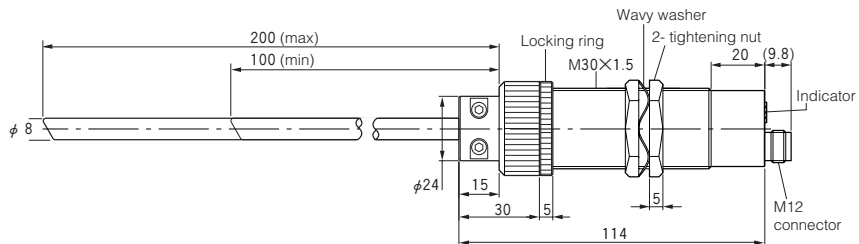
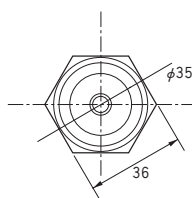


Model USA-WG08FS (Angled)

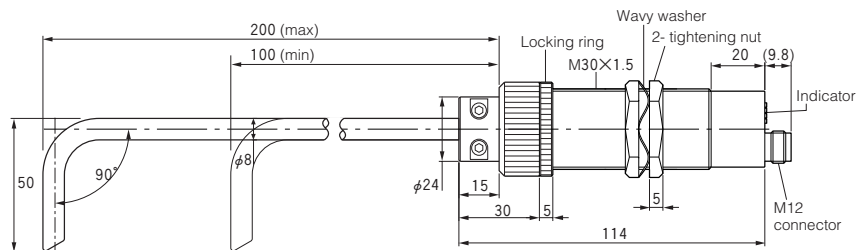
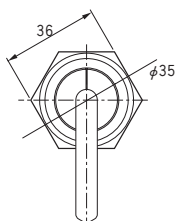


Dimensions (in mm)

Model USA-WG08FS



Model USA-WG08FL



(Attached to sensor)

Attachment

Produce name: wave reflector



(Attached to sensor)

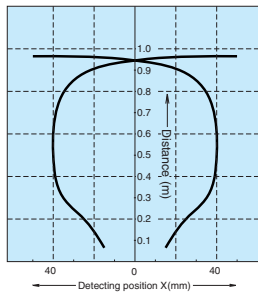
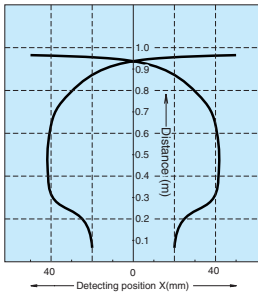
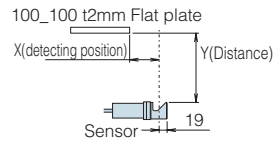
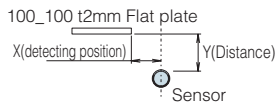
- Side-on attachment for deflecting the detection angle by 90°
- Eliminates installation space restrictions

Model	USA-WR
Detecting distance	65-965mm
Detection object	100x100mm t=2mm aluminum plate
Material	Body: polyacetal resin Locking ring: brass (nickel plated)
Applicable sensor	USA-S1AN

Detection area characteristics (Typical Example)

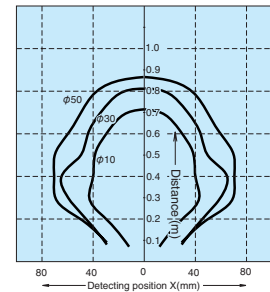
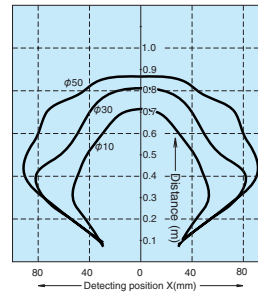
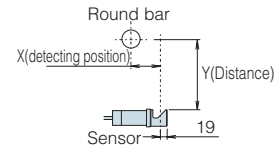
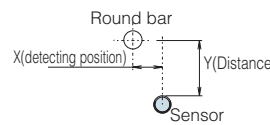
Flat plate detection (100x100mm)

Model USA-WR

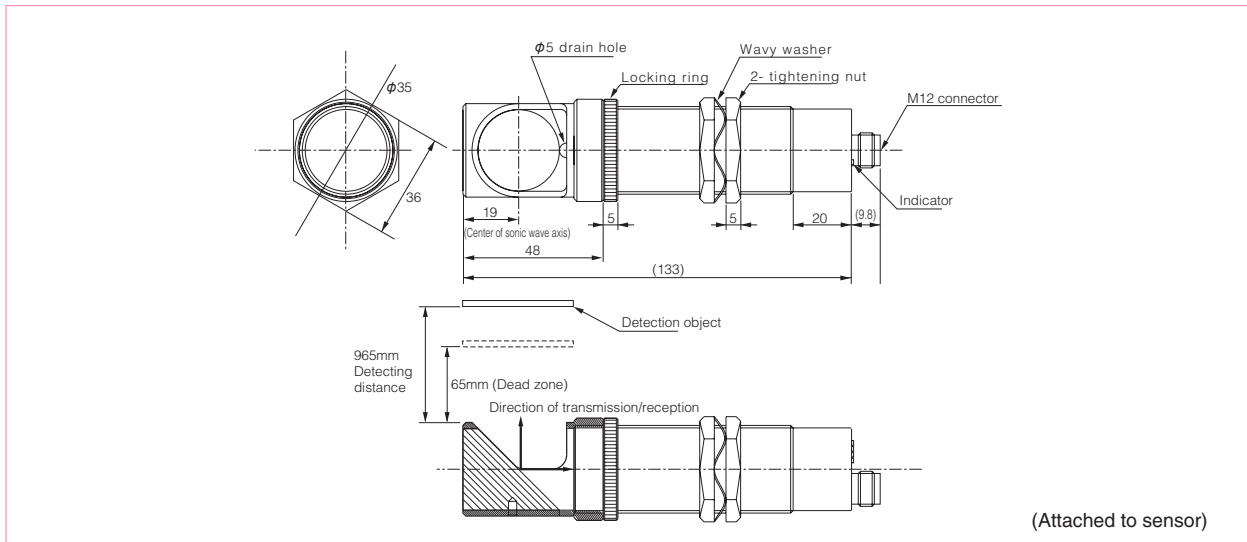


Round bar detection

Model USA-WR



Dimensions (in mm)



(Attached to sensor)

Ultrasonic Sensors

For Correct Use

Notes on use of ultrasonic sensors

• Installation location and external disturbance

- Although a circuit is employed that uses ultrasonic waves with high oscillation frequency for distinction from external sounds, do not install the sensor in a place subject to frequent sound of glass cutting, sound generated from air nozzles, high-frequency clanks, etc.
- Ultrasonic sensors use air as the transmission medium and places subject to localized temperature change or significant change in convection (air from air conditioner or heat generator) must be avoided.
- While the sensor is waterproofed, note that water on the ultrasonic element (white part on the front of the sensor) may reduce the sensitivity. Also absorption of water may cause deterioration.

• Interference

- Adjacent installation or installation of more than one sensor in a small space may cause interference.
- Prevent faulty operation due to irregular reflection caused by spread of ultrasonic waves especially by side lobe.

Installation adjustment and objects

• Through-beam type

- Through-beam type offers high sensitivity and reflection on walls or floor may make it difficult to block the signals sufficiently. Apply noise absorbing materials or reduce the sensitivity with the adjustment.

• Reflective type

- Certain limitations apply to objects detectable with reflective type. With objects that may function as noise absorbing materials, soft cloths, sponges, etc., operating distance may be significantly reduced or the sensor may not be activated.
Transparent or black objects offer the same detecting distances as objects of other colors.
With objects with polished surfaces like mirrors, the reflected sound waves may not return to the sensor depending on the angle of the passing object.

- Air nozzles may cause variation of the detecting distance. Provide sufficient measures for noise in a place with many nozzles.

• Reflective type analog output

- Certain limitations apply to detectable objects.
With objects that may function as noise absorbing materials, soft cloths, sponges, etc., operating distance may be significantly reduced or the sensor may not be activated. Use hard objects such as iron plate to check the operation at the same distance.
Transparent or black objects offer the same detecting distances as objects of other colors. Objects with polished surfaces like mirrors, the reflected sound waves may not return to the sensor depending on the angle of the passing object.
- Detection at the center of ultrasonic wave axis offers normal distance output. For detection of passing objects, set the sensor so that the detection occurs as close to the central axis as possible. The central axes of the sensor and the ultrasonic wave may be apart by a few degrees.
- **Dead zone**
Ultrasonic sensors measure the distance from the object by measuring the time before the reflected ultrasonic waves are received. Reverberation is present in the vicinity of the ultrasonic element and the reception operation is stopped for a certain period for avoiding its effect. In a very short range, reflection and reception of waves may occur more than once between the object and sensor, which generates higher output than for the actual detecting distance and prevents the generation of normal output in proportion to the detecting distance. To avoid such situations, do not use the sensor in the short distance, which is specified as a dead zone.
- **Running time**
After power-up, it takes about 30 minutes before the analog output stabilizes. For measurement or operation requiring accuracy, supply power well in advance.
- **Sensor mounting**
Ultrasonic waves spread over a large angle and the angle of the object may significantly affect detection. Be sure to mount the sensor in such a way that it faces the surface to be detected at right angles except for objects that reflect waves diffusely such as fine particles.

Major Applications of Ultrasonic Sensors

Classification	Application
Detection of passage or presence, counting	<ul style="list-style-type: none"> • Detection of passage of bottles or corrugated cardboard • Detection of sheets • Detection of papers • Presence of wood materials or processed goods • Presence of glass plates
Level detection	<ul style="list-style-type: none"> • Detection of level of fine particles in hopper • Detection of level of grain, feedstuff, etc. • Detection of height of piles • Detection of chemicals, etc. in hopper • Detection of water level
Sorting	<ul style="list-style-type: none"> • Sorting by height of packages • Detection of height of vehicles
Constant rate feeding/positioning	<ul style="list-style-type: none"> • Detection of stopping position of unmanned carriages • Detection of sag or winding length of rolled materials
Safety/alert	<ul style="list-style-type: none"> • Prevention of collision of cranes • Detection of height of vehicles • Detection of height of piles of goods • Detection of ingress