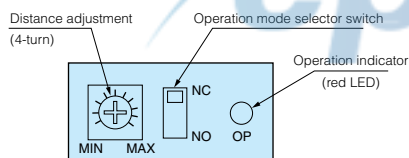# US series

Ultrasonic Sensors

- ● Unique circuit achieving high accuracy (1 mm = 10 mV)

- ● Improved resistance to noise by the use of an ultrasonic frequency of 200 kHz

  - ● Resistance to dust and dirt, wide range of detectable objects including transparent objects, liquid, particles, etc.

  - ● Comparator output available

■ Type

Type	Detection distance	Model	Operation mode	Output mode
Reflective type	0.08-1mm	US-1AH	Wave-ON/ Wave-OFF selectable (with switch)	● Analog output
		US-1AHPN		● Comparator output

■ Panel layout

Distance adjustment (4-turn)
Operation mode selector switch
Operation indicator (red LED)

NC
NO
OP
MIN   MAX

- ● The distance adjustment is a 4-turn volume. Turning clockwise increases the detecting distance up to about 1 m.
- ● Set the operation mode selector switch according to the application.
 NC: Wave-OFF (normally "closed")
  NO: Wave-ON (normally "open")
  For using the analog output only, the operation above is unnecessary. Use the sensor with the factory setting enabled.

■ Indicators

The reception indicator (green LED) and operation indicator (red LED) on the panel respectively show different received signal levels as described in the figure.
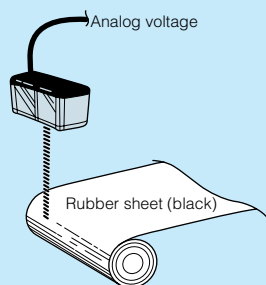The range of illumination for the operation indicator depends on the distance adjustment setting. The reception indicator is illuminated within the range of distance in which ultrasonic waves are received, although the boundaries may vary depending on the detection object. This indicates a margin of detection.
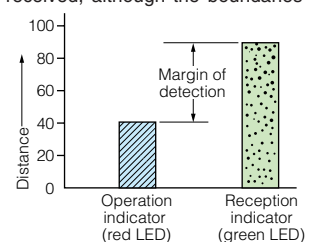
For detection of object with low ultrasonic reflectance such as rubber, the maximum detecting distance may be reduced.

Distance
100
80
60
40
20
0
Margin of detection
Operation indicator (red LED)
Reception indicator (green LED)

■ Sample Applications

- ● Winding thickness control/measurement
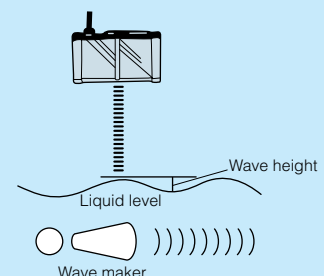 Analog voltage
  Rubber sheet (black)
  Ultrasonic wave sensor capable of detecting intense black rubber. Analog voltage output available for analog control.

- ● Detection of transparent objects/bottles
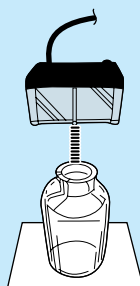
- ● Analog control of level of liquid/fine particles
  Wave height
  Liquid level
  Wave maker
  Wave height controlled in pool equipped with wave generator.

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US-1AH

■ Rating/Performance/Specification

	Type	Ultrasonic (analog output)	
	Model	**US-1AH**	**US-1AHPN**
Rating/performance	Detection method	Reflective type	
	Detecting distance	80-1000 ±10mm With 40x 40mm aluminum plate	
	Dead zone	60mm MAX	
	Power supply	12-24V DC ±10% / Ripple 10% max.	
	Current consumption	50mA max.	
	Output mode — Analog output	0.6 −10VE	
		Output impedance: 600 Ω	
	Output mode — Comparator output	NPN open collector sink current 100 mA (30 VDC) max.	PNP open collector Source current 100 mA (30 VDC) max.
	Operation mode	Wave-ON/Wave-OFF selectable (with switch)	
	Minimum resolution	1mm=10mV	
	Linearity	±3% FS (full scale)	
	Response time	Analog output: 10V→2V 60ms	
		2V→10V 50ms	
		analog response time + 10 ms	
	Hysteresis	3% max. of detecting distance	
Specification	Ultrasonic frequency	186kHz±10kHz	
	Indicator	Operation indictor: red LED (each on front/back)	
		Reception indicator: green LED (front)	
	Volume (VR)	Distance adjustment (4-turn without stopper) provided	
	Switch (SW)	Wave-ON/Wave-OFF selector switch	
	Protective feature	Output short circuit protection, protection against reverse connection	
	Material	Case: aluminum / Lid: polycarbonate	
		Front panel: acrylic resin / Back panel: ABS resin	
	Connection	Permanently attached cord (φ6.5)	
		0.3 mm² 4 cores, 2 m	
	Mass	350 g max.	

■ Environmental Specification

Environmen	Ambient temperature	−10 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Ambient wind speed	1m/s max
	Protective structure	IP51
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 directions
	Shock	500 m/s² / 2 times each in 3 directions (ultrasonic element excluded)
	Dielectric withstanding	500VAC for 1 minute
	Insulation resistance	500 VDC, 20 MΩ or higher

■ Characteristics (Typical Example)

● Activation area characteristics

Distance(mm)

Detecting position (mm)

● Distance-output characteristics

Output voltage (V)

(Not to be used for ranges shown with dotted line segments)

Detecting distance (mm)

■ Input/Output Circuit and Connection

US-1AH (NPN output)

Indicator
Internal circuit
Lead colors
Brown (Red)
Black (White) (Comparator output)
Load 100 mA max.
White (Green) (Analog output)
600Ω Min.
Blue (Black)

Colors in parentheses show previous color-coding.

US-1AHPN (PNP output)

Indicator
Internal circuit
Lead colors
Brown (Red)
(Comparator output)
Black (White)
Load 100 mA max.
White (Green) (Analog output)
600Ω Min.
Blue (Black)

Colors in parentheses show previous color-coding.

■ Dimensions (in mm)

Reception Ultrasonic oscillator Operation indicator

SUPER SONIC SENSOR
STB OPL
40
20
78
65
Max 0.8
8- M4 hole of 6 mm in depth
15
30 60
9
Cord 2m φ6.5
13

● Applicable comparator

(ANP Series)

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 nose 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 nose 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	● 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	● 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	● Sorting by height of packages ● Detection of height of vehicles
Constant rate feeding/positioning	● Detection of stopping position of unmanned carriages ● Detection of sag or winding length of rolled materials
Safety/alert	● Prevention of collision of cranes ● Detection of height of vehicles ● Detection of height of piles of goods ● Detection of ingress

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Ultrasonic Sensors