# Ultrasonics

Cleaners / Processing Tools / Measuring Instruments
General Catalog

HONDA ELECTRONICS CO.,LTD.
Industrial Equipment Division

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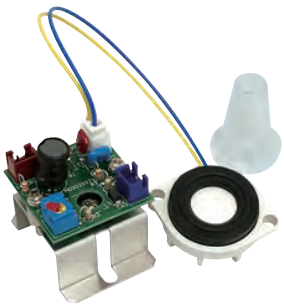

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# Ultrasonic cleaners

## Ultrasonic cleaning

**Ultrasonic cleaning technology removes fine particles of dust and contamination from objects (workpieces) that are submerged in water or solvent, by subjecting them to ultrasonic waves.**

- **The cleaning effects are achieved by combining the "physical effects" of ultrasonic waves with the "chemical effects" of the cleaning liquid.**
- **Physical effects**

  Effects such as cavitation, vibrational acceleration, and rectilinear flow can remove, disperse, and emulsify the contamination.
- **Chemical effects**

  The chemical effects of the cleaning liquid, along with the acceleration of chemical reactions by ultrasonic waves, can dissolve and degrade the contamination.

### Low frequency cleaning

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### Medium frequency cleaning

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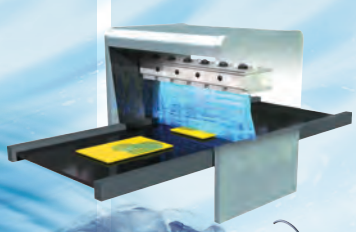
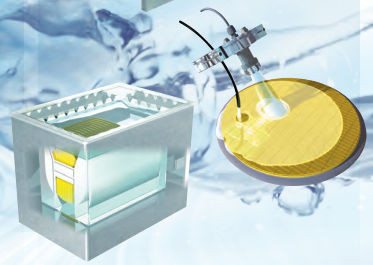




### Sonic monitor

▶page14


### Low frequency cleaning

Pressure impact by cavitation is effective for cleaning persistent contamination.

■Separate type
Mainly used for general industrial applications.
Custom, made-to-order transducer units are also available.

■Benchtop type
Suitable for cleaning small quantities of small-sized items.
Can also be used as test cleaning machines in facilities such as laboratories.

### Medium frequency cleaning

Suitable for removing slightly larger particles from delicate items such as HDD parts, LCD glass, and magnetic heads, which may become damaged if the more powerful low frequency cleaning is used.

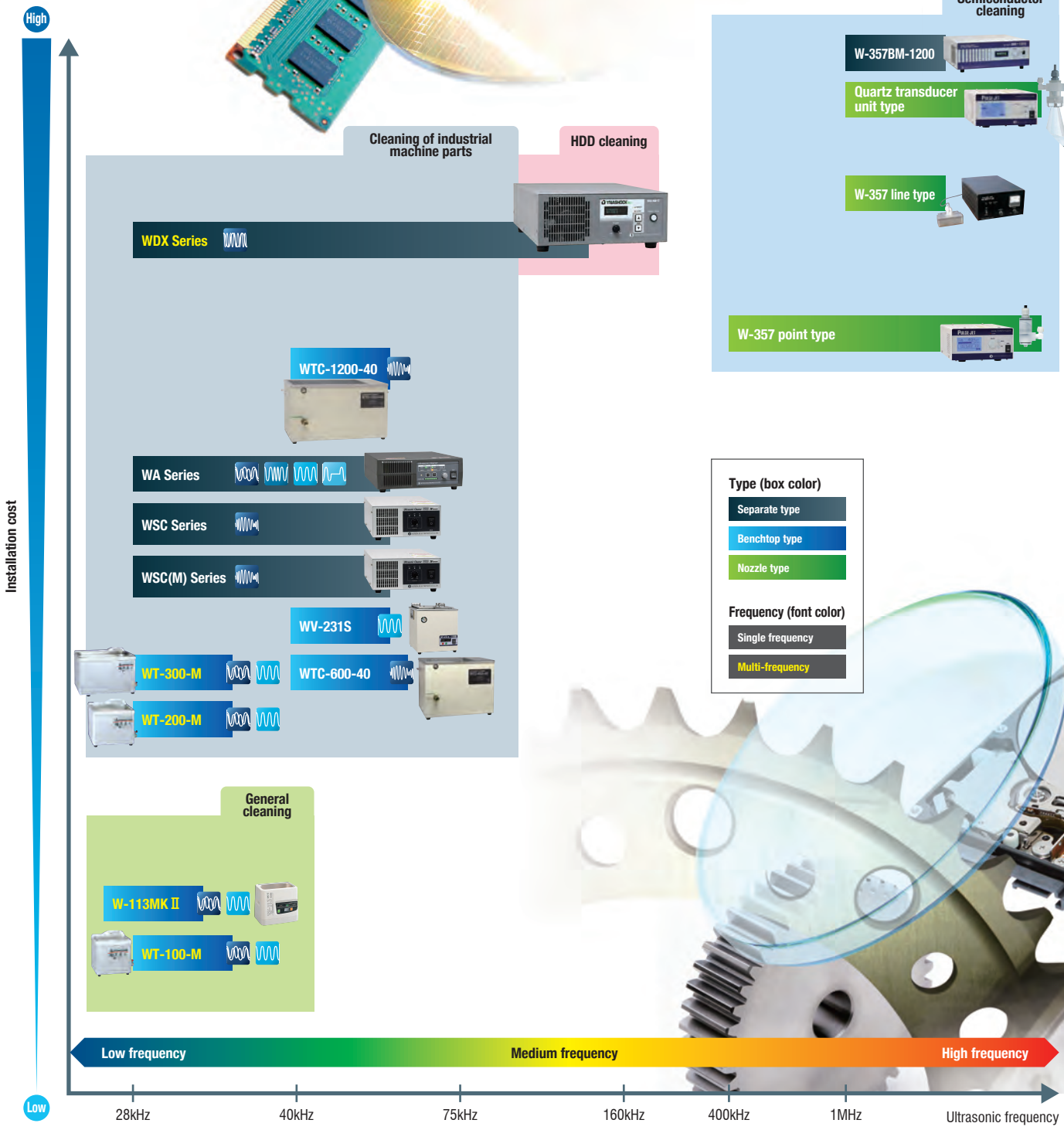
### High frequency cleaning

Vibrational acceleration and rectilinear flow enable the removal of submicron size particles without damaging the workpiece, making this method suitable for precision or ultra-precision cleaning of silicon wafers (for semiconductors), glass masks, LCD glass substrate, and HDD.

### Sonic monitor

Useful for checking the oscillation status of ultrasonic cleaners in daily inspections, by displaying the relative values.

# Lineup of ultrasonic cleaners




## Types of oscillation modes

### Adjacent dual-frequency switching oscillation mode

DUAL

- The pumping effect makes this mode suitable for cleaning inside fine tubes or through-hole boards.
- The area of cavitation is not stationary, and ultrasonic waves propagate farther.

### FM oscillation mode

F.M.

- Ultrasonic frequency modulation makes it possible to move the position of standing waves, resulting in cleaning that is more uniform.
- The cavitation position changes, preventing damage to the workpiece.

### Single frequency oscillation mode

SINGLE

- Strong cavitation is generated, making this mode suitable for removing persistent contamination.

### Pulse oscillation mode

PULSE

- The single-frequency intermittent pulse output enables gentle cleaning, and the reduced ultrasonic attenuation facilitates degassing.

### Multi-oscillation mode

MULTI

- The 28 kHz frequency is suitable for cleaning persistent contamination, 45 kHz is effective at cleaning fine parts, and 100 kHz enables superfine cleaning with minimal damage. To prevent standing waves that result in uneven cleaning, the oscillations at these three frequencies are repeated sequentially.

### DYNASHOCK modulation

DM

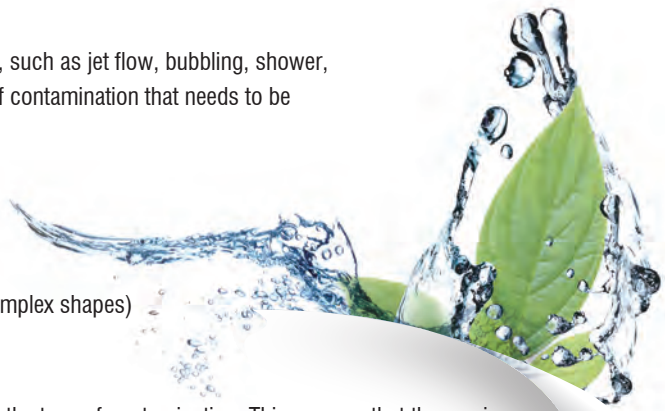
- This type of oscillation achieves optimal cleaning power, with two frequencies simultaneously transmitted at a specific ultrasonic power ratio.

### FM + AM modulation

FM+AM

- Ultrasonic waves are distributed uniformly with low power consumption.
  Unevenness is minimized in this mode, which is effective at responding to load fluctuations due to the workpieces, liquid type, and liquid depth.

In addition to ultrasonic cleaning, there are other industrial cleaning methods available, such as jet flow, bubbling, shower, agitation, and vapor cleaning. Cleaning methods are selected according to the types of contamination that needs to be removed from the workpieces, and the cleaning characteristics that are required.



The characteristics of ultrasonic cleaning are:

- Uniform cleaning quality
- Reduced cleaning time
- Ability to clean all parts of items (particularly suitable for fine parts or parts with complex shapes)

## ■Selecting the ultrasonic cleaner

In ultrasonic cleaning, it is important to select the appropriate cleaning liquid based on the type of contamination. This ensures that the maximum cleaning effects can be achieved by the combination of the physical effects of the ultrasonic waves and the chemical effects of the cleaning liquid.

Consider the points listed below when selecting the ultrasonic cleaner.
(1) Purpose of cleaning/Type of contamination·····Degreasing, removing abrasive material or particles, etc.
(2) Type of workpiece·····Material, size (including basket size, if basket is used), etc.
(3) Type of ultrasonic cleaner·····Separate type, benchtop type, quartz vibration unit type, nozzle type

* Before selecting the ultrasonic cleaner, it is important to determine which processes to incorporate into your cleaning system. At a minimum, the overall cleaning system must include the three processes of "cleaning" → "rinsing" → "drying". Benchtop cleaners are only capable of performing the "cleaning" process, so it is necessary to consider how the subsequent processes of "rinsing" and "drying" will be performed.

### Selecting the frequency

| Frequency | Contamination | Applications | Damage | Characteristics |
|---|---|---|---|---|
| 28kHz | Oil, visible contamination, large contamination | Degreasing metal parts, degreasing resin parts | Big | Used to remove persistent contamination such as grease, due to the strong cleaning energy. Enhances the effectiveness of the cleaning liquid. |
| 40kHz | Contamination over 10 μm, dust | Initial cleaning of LCD glass, cleaning precision metal parts | | Often used to clean precision parts, since there is less damage to the workpiece than at 28 kHz. |
| 75kHz ~ 100kHz | Over 5 μm - 10 μm | Cleaning HDD, CSP boards, precision metal parts, optical disks, HD heads | | Often used if there is damage to the workpiece at 40 kHz. This frequency has recently gained attention due to the relatively strong cleaning energy and less damage to the workpiece. |
| 120kHz ~ 160kHz | 1 μm - 10 μm | Compound wafers, HDD | | Used to perform initial cleaning of wafers. Possible to remove fine contamination with minimal damage to the workpiece. |
| 400kHz | 0.2 μm~5 μm | Silicon wafers, glass wafers, glass substrate | | May be suitable for various types of precision cleaning, due to the ability to remove a wide range of particle sizes. |
| 1MHz | 0.2 μm - 1 μm | Final cleaning of glass substrate, silicon wafers (with circuit), glass masks | | Used to remove small particles that are not visible to the naked eye. Less damage to the workpiece. Widely preferred as the frequency to use for wafer cleaning. |
| 3MHz | Below 0.2 μm | Silicon wafers (with circuit), glass masks | Small | Used to remove finer particles than at 1 MHz. Gaining attention as a new type of cleaning, due to particle acceleration that is stronger than at 1 MHz. |

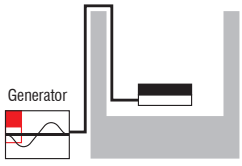
Low ↑ High

* 1 MHz particle acceleration = $10^5$G (100,000 times the gravitational acceleration of Earth)

## ■Selecting the type of ultrasonic cleaner

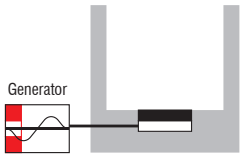
### ●Separate type

Separate type ultrasonic cleaners consist of an oscillator and transducer unit. Various combinations can be selected to suit the application, facility, and purpose.



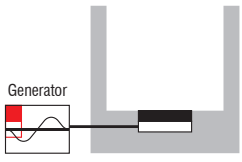

**N type**

Combination of generator and transducer unit that is immersed in the tank. Can be used with the customer's existing cleaning tank.



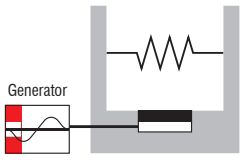

**F type**

Combination of generator and vibration plate type transducer unit. Can be incorporated into existing equipment.




**S type**

Combination of generator and special cleaning tank. Easy to set up and start using.

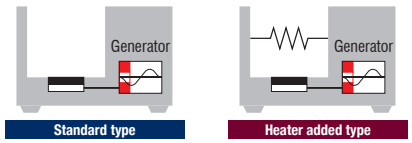



**SH type**

S type cleaner with heater. The effects of warm water achieve stronger cleaning power.

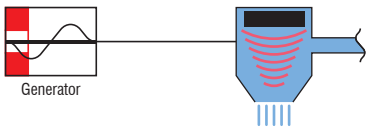
### ●Benchtop type

Compact all-in-one unit is easy to set up.




### ●Nozzle type

Cleaning is performed using water flow with high frequency ultrasonic waves.




### ●Quartz transducer unit type

Ultrasonic waves are applied to the quartz transducer unit, which is used to clean semiconductor wafers.

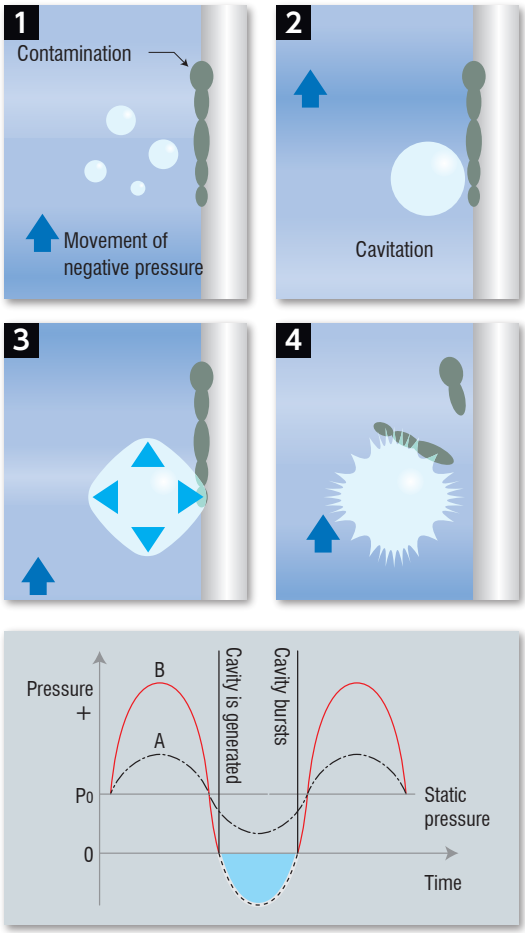
# Low / medium frequency cleaning

## Explanation

### Cavitation

Countless gas molecules exist in liquid. When powerful ultrasonic waves are emitted in liquid at frequencies of 20 kHz to 100 kHz, alternating cycles of positive and negative pressure are applied to the gas molecules. The positive pressure compresses the gas molecules, and the immediately following negative pressure causes them to expand dramatically. The gas molecules reach a very high pressure when they are compressed repeatedly through this process, and they collapse when the limit is reached. This phenomenon of generating extremely high-impact pressure is called cavitation. The shock waves that are created when bubbles burst act to separate contamination from the workpiece. This is called the cavitation effect.

In an ultrasonic cleaner, the way that cavitation is generated varies depending on the depth and type of liquid. It is therefore essential to control these conditions in order to ensure proper ultrasonic cleaning. For example, if it appears that cavitation is lingering on the vibration surface, the ultrasonic waves are not being generated effectively in the liquid, and damage to the vibration surface (erosion), which causes deterioration of the vibration plate, is accelerated. In this situation, a slight change to the liquid depth can improve the efficiency of cavitation, enabling more effective ultrasonic cleaning.




***Erosion**

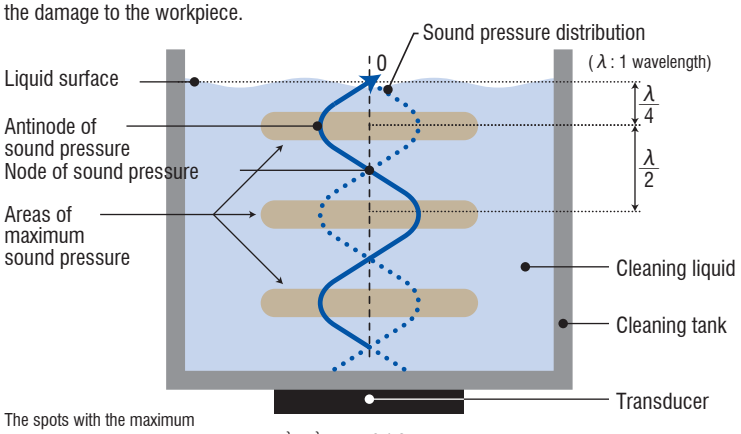
Erosion is a phenomenon whereby the surface of soft material such as aluminum is worn away by the physical power that is generated by the ultrasonic cavitation phenomenon (at high local temperatures of 5,000 K or greater, and high local pressures of approximately 1,300 atmospheres or greater). The amount of erosion that occurs is directly proportional to the strength of the ultrasonic waves, and inversely proportional to the frequency.

### Standing waves (uneven cleaning)

When ultrasonic waves are emitted, standing waves occur in the liquid according to the frequency. These standing waves, which result in spots where the cleaning effect is strong, are located at distances that are an integral multiple of $\lambda/2$. ($\lambda$ is one wavelength.)

Although standing waves have strong cleaning power, they also have the potential to damage the workpiece. To minimize the undesirable effect of standing waves, it is possible to take measures such as agitating the workpiece or using multiple frequencies.

It is necessary to carefully consider the balance between the cleaning effect and the damage to the workpiece.




The spots with the maximum cleaning effect are located at distances of $\frac{\lambda}{4}+\frac{\lambda}{2}n$ (n= 0,1,2,···) from the liquid surface.

1 wavelength = Acoustic velocity ÷ Frequency

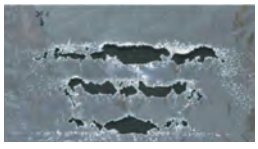
$$\left(\lambda=\frac{c}{f}\quad \begin{array}{l}\lambda:\text{wavelength (m)}\\ c:\text{Acoustic velocity (m/s)}\\ f:\text{Frequency (Hz)}\end{array}\right)$$

※C···For water :1,500m/s

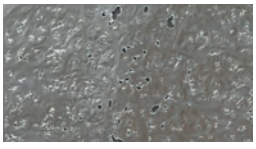
When the frequency is 40 kHz, one wavelength is calculated as:
1,500,000 (mm/s) ÷ 40,000 (Hz) = 37.5 (mm)
The standing wave interval is calculated as: 37.5 mm ÷ 2 = approx. 19 mm
In other words, an area of strong cleaning effect is located at each 19 mm interval.

#### ■Comparison using aluminum foil

600 W, 28 kHz single frequency



WDX-600- Ⅰ
600 W, 28 kHz/75 kHz simultaneous oscillation, DM 60%



DYNASHOCK 爆洗™

# WDX Series

## Low/medium frequency separate type

Patented

## Strike a balance between uniform cleaning and minimal damage, and adjust the cleaning strength, from gentle to powerful, to best suit your application

WDX-600-I
WDX-1200-I

WDX-600-Ⅱ

### DYNASHOCK® Modulation (DM) mode

In DYNASHOCK® Modulation (DM) mode, two frequencies are simultaneously transmitted from a transducer at a specific total output power. The frequency component ratios of the two frequencies can be controlled by setting the DM modulation ratio (0 to 100%). This enables you to adjust the cleaning strength, from gentle to powerful, to achieve the optimum cleaning effect for your application.

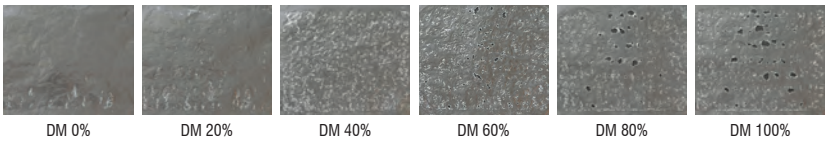
* DYNASHOCK® is the registered trademark of Honda Electronics Co., Ltd. In Japan, China and Europe under the EUTM.

### Evaluation of DM modulation ratios using aluminum foil

(Using WDX-600-I with output at constant 600 W)

Toward liquid surface

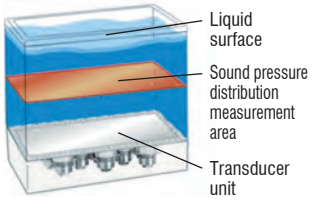
Toward transducer

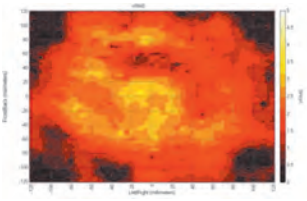


DM 0% | DM 20% | DM 40% | DM 60% | DM 80% | DM 100%

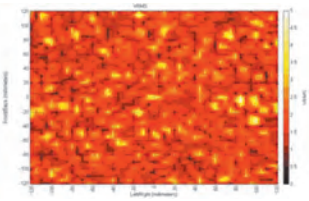
Gentle cleaning → Powerful cleaning

●By selecting the DM modulation ratio, uniform ultrasonic waves can be generated uniformly throughout the tank with high sound pressure. This enables cleaning to be performed evenly.



Sound pressure distribution with conventional mode



Sound pressure distribution with DM mode (WDX-600-I)

●The digital control system enables a variety of functions.

**Optimum cleaning**
Optimum frequency control and ultrasonic output control enable stable ultrasonic cleaning.

**Easy maintenance**
The auto-tuning function eliminates the need to calibrate the generator when the transducer unit is replaced.

**Monitoring function**
The front panel display shows the output power, which is one of the factors to monitor when controlling the ultrasonic cleaning unit.

**Supports a wide range of power input**
Power sources from 200 to 240 V AC are supported.

**Abnormality diagnosis function**
When an abnormality occurs, an error message is displayed to indicate the cause, thereby enabling a quick response.

**Sweep function**
The DM frequency sweep function enables ultrasonic cleaning to be performed more evenly.

### Generator

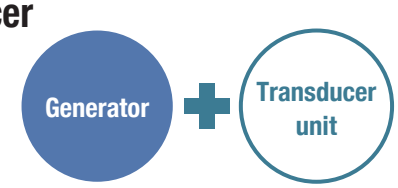
| Model No. | WDX-600-I | WDX-1200-I | WDX-600-Ⅱ |
|---|---|---|---|
| Oscillation mode | DYNASHOCK Modulation (DM) mode (modulation ratio: 0 to 100%) + Sweep function | | |
| Rated output | 600 W | 1200 W | 600 W |
| Nominal oscillation frequency | 28 kHz & 75 kHz | | 40 kHz、120 kHz |
| Power input | 200 V - 240 V AC<br>Single phase 50/60 Hz 1200 VA | 200 V - 240 V AC<br>Single phase 50/60 Hz 2400 VA | 200 V - 240 V AC<br>Single phase 50/60 Hz 1450 VA |
| Dimensions (W x D x H mm) | 330 x 462 x 148 (including rubber feet) | | |
| Weight | 11 kg | 12 kg | 11 kg |

- **I/O interface** **Remote function:** Ultrasonic oscillation ON/OFF (contact input), **Output function:** Alarm output when error occurs (Relay contact output: Open when error occurs)
- **Variable output range:** 0 - 100% • **Display function:** Power output (W), DM modulation ratio (%), error messages
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 5 to 80% (no condensation)
- **Power cable length:** 3.5 m • **Outline drawing** ▶Page22 • **Option:** Transducer connection terminal block ▶Page40

## ■ Transducer unit

# Powerful, high-efficiency ultrasonic cleaner, equipped with our own bolt-clamped Langevin type transducer

The transducer unit uses a bolt-clamped Langevin type transducer
with high electro-acoustic conversion efficiency and excellent durability.
Standard specifications that meet various frequencies and output power are available.



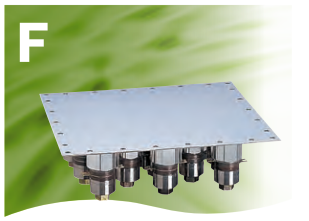

**Transducer units can be manufactured with custom specifications, such as decompression, upon request.**


■ Immersible type

## N TYPE | Immersible type

| Model No. | WDX-600N-I | WDX-1200N-I | WDX-600N-II |
|---|---|---|---|
| Generator Model No. | WDX-600-I | WDX-1200-I | WDX-600-II |
| Maximum allowable input | 600 W | 1200 W | 600 W |
| Nominal oscillation frequency | 28 kHz、75 kHz | | 40 kHz、120 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | 420 x 300 | 350 x 200 |
| Dimensions (W x Dmm) | 350 x 200 x 100 | 420 x 300 x 100 | 350 x 200 x 75 |
| Material | Case: SUS304 (SUS316L is available for custom orders) | | |
| Weight | 14 kg | 18 kg | 11 kg |

• **Liquid temperature range**: 5 to 80°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 2.5 m (blade part: 2 m) + Output cable length 3.5 m • **Outline drawing** ▶Page23




■ Vibration plate type

## F TYPE | Vibration plate type

| Model No. | WDX-600F- I | WDX-1200F- I | WDX-600F- II |
|---|---|---|---|
| Generator Model No. | WDX-600- I | WDX-1200- I | WDX-600- II |
| Maximum allowable input | 600 W | 1200 W | 600 W |
| Nominal oscillation frequency | 28 kHz、75 kHz | | 40 kHz、120 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | 420 x 300 | 350 x 200 |
| Dimensions (W x Dmm) (wires not included) | 390 x 240 x 83 t=2.5 mm | 460 x 340 x 83 t=2.5 mm | 390 x 240 x 57 t=2.5 mm |
| Material | Board: SUS304 (SUS316L is available for custom orders) Packing: EPDM, t=3 mm (Viton and other materials are available for custom orders) | | |
| Weight | 10 kg | 16 kg | 8 kg |

• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m + Output cable length 3.5 m • **Outline drawing** ▶Page23


■ Tank type

## S TYPE | Tank type

Build to order

| Model No. | WDX-600S- I | WDX-1200S- I | WDX-600S- II |
|---|---|---|---|
| Generator Model No. | WDX-600- I | WDX-1200- I | WDX-600- II |
| Maximum allowable input | 600 W | 1200 W | 600 W |
| Nominal oscillation frequency | 28 kHz、75 kHz | | 40 kHz、120 kHz |
| Effective cleaning area (W x Dmm) | 370 x 250 | 500 x 300 | 370 x 250 |
| Dimensions (W x Dmm) External: | 422 x 302 x 405 (including rubber feet) | 550 x 350 x 402 (including rubber feet) | 422 x 302 x 405 (including rubber feet) |
| Inside tank: | 370 x 250 x 250 (23 L) | 500 x 300×224 (35 L) *1 | 370 x 250 x 250 (23 L) |
| Material | Tank: SUS304 (SUS316L is available for custom orders) | | |
| Weight | 22 kg | 39 kg | 19 kg |

▪ **Included accessory:** Lid
• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m • **Outline drawing** ▶Page23 • **Option:** Cleaning basket (KG10F / KG11T) ▶Page40


■ Tank type with heater

## SH TYPE | Tank type with heater

Build to order

| Model No. | WDX-600SH- I | WDX-1200SH- I | WDX-600SH- II |
|---|---|---|---|
| Generator Model No. | WDX-600- I | WDX-1200- I | WDX-600- II |
| Maximum allowable input | 600 W | 1200 W | 600 W |
| Nominal oscillation frequency | 28 kHz、75 kHz | | 40 kHz、120 kHz |
| Heater | 200 V AC Single phase 50/60 Hz 2 kW | 200 V AC Single phase 50/60 Hz 3 kW | 200 V AC Single phase 50/60 Hz 2 kW |
| Effective cleaning area (W x Dmm) | 370 x 250 | 500 x 300 | 370 x 250 |
| Dimensions (W x Dmm) External: | 580 x 310 x 406 (including rubber feet) | 710 x 360 x 405 (including rubber feet) | 580 x 310 x 406 (including rubber feet) |
| Inside tank: | 370 x 250 x 250 (23 L) | 500 x 300 x 224 (35 L)*1 | 370 x 250 x 250 (23 L) |
| Material | Tank: SUS304 (SUS316L is available for custom orders) | | |
| Weight | 28 kg | 46 kg | 25 kg |

▪ **Included accessory:** Lid
• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m • **Outline drawing** ▶Page24 • **Option:** Cleaning basket (KG10F / KG11T) ▶Page40
* The heater is designed for use with water. Do not use with liquids other than water. A separate power supply is required for the heater.

*1 The bottom surface of the tank is angled to facilitate drainage.

# WA Series

# Low frequency separate type

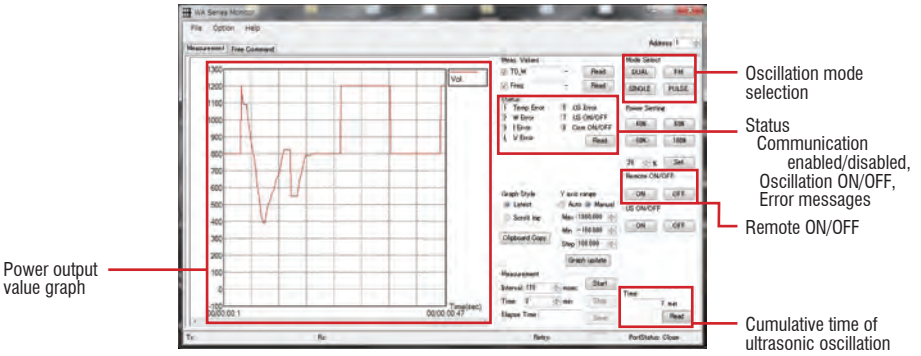
## New standard model of ultrasonic cleaner with communication functions that support day-to-day management

WA-600-28
WA-600-40
WA-1200-28
WA-1200-40

### RS-485 communication function

RS-485 communication (MODBUS® RTU) enables you to configure various settings and check the operating status.
The frequency and output power settings, as well as the oscillation status, can be read out, which can be used in preventive maintenance.

* MODBUS is the registered trademark of Schneider Electric USA, Inc.


### Optimum and stable cleaning

The digital control system enables automatic frequency tracking and constant power output, which ensures that ultrasonic wave oscillation is performed at the optimum frequency with stable and constant output in response to fluctuations in the load, such as the liquid depth, liquid temperature, liquid type, decompression status, and workpiece status. As a result, optimum cleaning is achieved.

### Easy maintenance

When the transducer unit is replaced by one with the same specifications, there is no need to calibrate the generator. When an abnormality occurs with the generator, the cause is diagnosed and the corresponding error is indicated by one of the six different LED lamp illumination patterns on the front panel.

### Generator

| Model No. | | WA-600-28T | WA-600-40T | WA-1200-28T | WA-1200-40T |
|---|---|---|---|---|---|
| Oscillation mode | | Adjacent dual-frequency switching oscillation (DUAL) FM oscillation (FM) Single frequency oscillation (SINGLE) Pulse oscillation (PULSE) | | | |
| Rated output | DUAL,FM | 400 W | | 800 W | |
| | SINGLE | 600 W | | 1200 W | |
| | PULSE | 600 W | | 1200 W | |
| Nominal oscillation frequency | | 28 kHz | 40 kHz | 28 kHz | 40 kHz |
| Power input | | Selectable (at time of ordering) from 200 V , 220 V, 230 V, 240 V AC Single phase 50/60 Hz 1200 VA | | Selectable (at time of ordering) from 200 V , 220 V, 230 V, 240 V AC Single phase 50/60 Hz 2400 VA | |
| Interface | Analog output | 4 to 20 mA current output | | | |
| | Contact output | 2 contacts Alarm output, Oscillation detection output | | | |
| | External drive input | Ultrasonic oscillation ON/OFF (contact input) | | | |
| | RS-485 communication | MODBUS (RTU) protocol *1 | | | |
| Dimensions (W x D x H mm) | | 336 x 400 x 125 (including rubber feet) | | | |
| Weight | | 6 kg | | | |

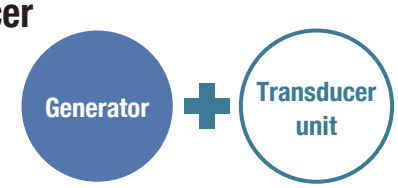
- **DUAL/FM frequency modulation width:** Central frequency ±1 kHz
- **Variable output range:** 20 - 100% • **Output display:** LED level indicator (responds to output)
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 5 to 80% (no condensation)
- **Power cable length:** 3.5 m • **Outline drawing** Page22
- **Option:** Transducer connection terminal block Page40

*1 RS-485 communication enables you to configure various settings and check the operating status.

## ■ Transducer unit

# Powerful, high-efficiency ultrasonic cleaner, equipped with our own bolt-clamped Langevin type transducer

The transducer unit uses a bolt-clamped Langevin type transducer
with high electro-acoustic conversion efficiency and excellent durability.
Standard specifications that meet various frequencies and output power are available.



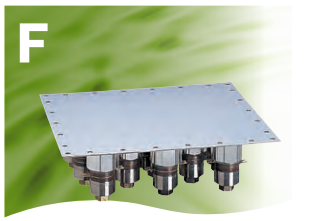

**Transducer units can be manufactured with custom specifications, such as decompression, upon request.**


■ Immersible type

## N TYPE | Immersible type

| Model No. | WA-600-28N | WA-600-40N | WA-1200-28N | WA-1200-40N |
|---|---|---|---|---|
| Generator Model No. | WA-600-28T | WA-600-40T | WA-1200-28T | WA-1200-40T |
| Maximum allowable input | 600 W | | 1200 W | |
| Nominal oscillation frequency | 28 kHz | 40 kHz | 28 kHz | 40 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | | 420 x 300 | |
| Dimensions (W x Dmm) | 350 x 200 x 100 | 350 x 200 x 75 | 420 x 300 x 100 | 420 x 300 x 75 |
| Material | Case: SUS304 (SUS316L is available for custom orders) | | | |
| Weight | 14 kg | 11 kg | 18 kg | 14 kg |

• **Liquid temperature range**: 5 to 80°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 2.5 m (blade part: 2 m) + Output cable length 3.5 m • **Outline drawing** ▶Page23




■ Vibration plate type

## F TYPE | Vibration plate type

| Model No. | WA-600-28F | WA-600-40F | WA-1200-28F | WA-1200-40F |
|---|---|---|---|---|
| Generator Model No. | WA-600-28T | WA-600-40T | WA-1200-28T | WA-1200-40T |
| Maximum allowable input | 600 W | | 1200 W | |
| Nominal oscillation frequency | 28 kHz | 40 kHz | 28 kHz | 40 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | | 420 x 300 | |
| Dimensions (W x Dmm) (wires not included) | 390 x 240 x 83 t=2.5 mm | 390 x 240 x 57 t=2.5 mm | 460 x 340 x 83 t=2.5 mm | 460 x 340 x 57 t=2.5 mm |
| Material | Board: SUS304 (SUS316L is available for custom orders) Packing: EPDM, t=3 mm (Viton and other materials are available for custom orders) | | | |
| Weight | 10 kg | 8 kg | 16 kg | 13 kg |

• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m + Output cable length 3.5 m • **Outline drawing** ▶Page23


■ Tank type

## S TYPE | Tank type

Build to order

| Model No. | WA-600-28S | WA-600-40S | WA-1200-28S | WA-1200-40S |
|---|---|---|---|---|
| Generator Model No. | WA-600-28T | WA-600-40T | WA-1200-28T | WA-1200-40T |
| Maximum allowable input | 600 W | | 1200 W | |
| Nominal oscillation frequency | 28 kHz | 40 kHz | 28 kHz | 40 kHz |
| Effective cleaning area (W x Dmm) | 370 x 250 | | 500 x 300 | |
| Dimensions (W x Dmm) External: | 422 x 302 x 405 (including rubber feet) | | 550 x 350 x 402 (including rubber feet) | |
| Dimensions (W x Dmm) Inside tank: | 370 x 250 x 250 (23 L) | | 500 x 300 x 224 (35 L)*1 | |
| Material | Tank: SUS304 (SUS316L is available for custom orders) | | | |
| Drain valve | Rc 1/2 | | Rc 3/4 | |
| Weight | 22 kg | 19 kg | 39 kg | 34 kg |

■ **Included accessory:** Lid
• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m • **Outline drawing** ▶Page23 • **Option:** Cleaning basket (KG10F / KG11T) ▶Page40


■ Tank type with heater

## SH TYPE | Tank type with heater

Build to order

| Model No. | WA-600-28SH | WA-600-40SH | WA-1200-28SH | WA-1200-40SH |
|---|---|---|---|---|
| Generator Model No. | WA-600-28T | WA-600-40T | WA-1200-28T | WA-1200-40T |
| Maximum allowable input | 600 W | | 1200 W | |
| Nominal oscillation frequency | 28 kHz | 40 kHz | 28 kHz | 40 kHz |
| Heater | 200 V AC Single phase 50/60 Hz 2 kW | | 200 V AC Single phase 50/60 Hz 3 kW | |
| Effective cleaning area (W x Dmm) | 370 x 250 | | 500 x 300 | |
| Dimensions (W x Dmm) External: | 580 x 310 x 406 (including rubber feet) | | 710 x 360 x 405 (including rubber feet) | |
| Dimensions (W x Dmm) Inside tank: | 370 x 250 x 250 (23 L) | | 500 x 300 x 224(35 L)*1 | |
| Material | Tank: SUS304 (SUS316L is available for custom orders) | | | |
| Drain valve | Rc 1/2 | | Rc 3/4 | |
| Weight | 28 kg | 25 kg | 46 kg | 40 kg |

■ **Included accessory:** Lid
• **Liquid temperature range**: 5 to 100°C • **Transducer**: Bolt-clamped Langevin type transducer
• **Transducer cable length**: 3.5 m • **Outline drawing** ▶Page24 • **Option:** Cleaning basket (KG10F / KG11T) ▶Page40
* The heater is designed for use with water. Do not use with liquids other than water. A separate power supply is required for the heater.

*1 The bottom surface of the tank is angled to facilitate drainage.

# Low frequency separate type

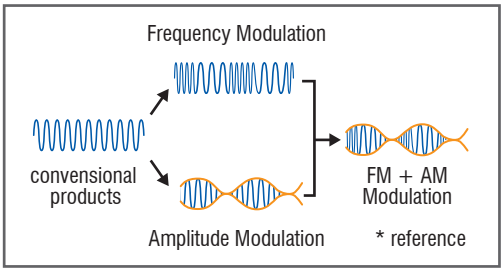
## WSC Series


WSC28 Standard
WSC28 High-Power
WSC40 Standard
WSC40 High-Power

## Combination of FM + AM oscillation achieves more uniform cleaning and lower power consumption

### FM + AM

FM, which stands for frequency modulation, is the process of varying the frequency continuously. AM, which stands for amplitude modulation, is the process of varying the output continuously.
FM + AM spreads the ultrasonic waves evenly throughout the entire tank to achieve more uniform cleaning, and it provides stable operation in response to load fluctuations due to the status of the workpiece, liquid type, and liquid depth.




### Energy-saving, compact design

The power consumption is approximately 1/3 that of conventional products (in our comparison), and the size of the generator is also approximately 1/3.

### No need to perform generator calibration

Maintenance is simplified by eliminating the need to calibrate the generator when the transducer unit is replaced by one with the same specifications.

### Wide variable output range

Wide-ranging power control is available to suit the requirements of your cleaning and processing operations.

**Generator**

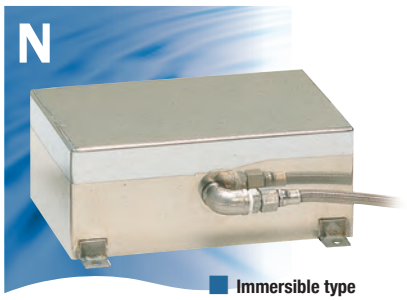
| Model No. | WSC28 | | WSC40 | |
|---|---|---|---|---|
| Type | Standard | High-Power | Standard | High-Power |
| Oscillation mode | FM + AM modulation | | | |
| Maximum output (average output) | 600 W (200 W) | 1200 W (400 W) | 600 W (200 W) | 1200 W (400 W) |
| Nominal oscillation frequency | 28 kHz | | 40 kHz | |
| Power input | 200 - 230 V AC Single phase 50/60 Hz | | | |
| | 300 VA | 600 VA | 300 VA | 600 VA |
| Dimensions (W x D x H mm) | 210 x 250 x 107 (including rubber feet) | | | |
| Weight | 3.6 kg | | | |

- **I/O interface** **Remote function:** Ultrasonic oscillation ON/OFF (contact input), **Output function:** Alarm output when error occurs (Relay contact output: Open when error occurs)
- **Variable output range:** 0 to 100%, continuously variable
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 5 to 80% (no condensation)
- **Power cable length:** 3.5 m
- **Outline drawing** Page22
- **Options:** I/O remote cable (5 m), Transducer connection terminal block Page40

## Transducer unit

Generator + Transducer unit

**Transducer units can be manufactured with custom specifications, such as decompression, upon request.**




### N TYPE | Immersible type

| Model No. | WSC28ST-N | WSC28HP-N | WSC40ST-N | WSC40HP-N |
|---|---|---|---|---|
| Type | Standard | High-Power | Standard | High-Power |
| Generator Model No. | WSC28 Standard | WSC28 High-Power | WSC40 Standard | WSC40 High-Power |
| Maximum allowable input | 600 W | 1200 W | 600 W | 1200 W |
| Nominal oscillation frequency | 28 kHz | 28 kHz | 40 kHz | 40 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | 420 x 300 | 350 x 200 | 420 x 300 |
| Dimensions (W x D x H mm) | 350 x 200 x 100 | 420 x 300 x 100 | 350 x 200 x 75 | 420 x 300 x 75 |
| Material | Case: SUS304 (SUS316L is available for custom orders) | | | |
| Weight | 8 kg | 14 kg | 7 kg | 12 kg |

- **Maximum liquid temperature**: 80°C
- **Transducer:** Bolt-clamped Langevin type
- **Transducer cable length:** 2.5 m (blade part: 2 m) + Output cable length 3.5 m
- **Outline drawing** Page23


### F TYPE | Vibration plate type

| Model No. | WSC28ST-F | WSC28HP-F | WSC40ST-F | WSC40HP-F |
|---|---|---|---|---|
| Type | Standard | High-Power | Standard | High-Power |
| Generator Model No. | WSC28 Standard | WSC28 High-Power | WSC40 Standard | WSC40 High-Power |
| Maximum allowable input | 600 W | 1200 W | 600 W | 1200 W |
| Nominal oscillation frequency | 28 kHz | 28 kHz | 40 kHz | 40 kHz |
| Effective cleaning area (W x Dmm) | 350 x 200 | 420 x 300 | 350 x 200 | 420 x 300 |
| Dimensions (W x D x H mm) (wires not included) | 390 x 240 x 71 t=2.5 mm | 460 x 340 x 71 t=2.5 mm | 390 x 240 x 57 t=2.5 mm | 460 x 340 x 57 t=2.5 mm |
| Material | Board: SUS304 (SUS316L is available for custom orders) Packing: EPDM, t=3 mm (Viton and other materials are available for custom orders) | | | |
| Weight | 5 kg | 9 kg | 4 kg | 8 kg |

- **Maximum liquid temperature**: 100°C
- **Transducer:** Bolt-clamped Langevin type
- **Transducer cable length:** 3.5 m + Output cable length 3.5 m
- **Outline drawing** Page23

# Low frequency separate type

# WSC(M) Series


WSC28 (M)
WSC40 (M)

## Compact cleaner for industrial applications saves space in production lines or when integrating with other equipment

selectable

- Can be manufactured with your requested size of transducer.
- The combination of input voltage (100 V, or 200 to 230 V) and ultrasonic frequency (28/40 kHz) can be selected.
- Remote operation using external input is available.
- Supports 24 hour continuous operation.

### Generator

| Model No. | WSC28 (M) | | WSC40 (M) | |
|---|---|---|---|---|
| Number of transducers | 1 | 2 | 1 | 2 |
| Oscillation mode | FM + AM modulation | | | |
| Maximum output (average output) | 60 W (20 W) | 100 W (33 W) | 60 W (20 W) | 100 W (33 W) |
| Nominal oscillation frequency | 28 kHz | | 40 kHz | |
| Power input | Selectable (at time of ordering) from 100 V AC, or 200 to 230 V AC Single phase 50/60 Hz | | | |
| | 55 VA | 100 VA | 55 VA | 100 VA |
| Dimensions (W x D x H mm) | 210 x 250 x 107 (including rubber feet) | | | |
| Weight | 3.6 kg | | | |

- **I/O interface** **Remote function:** Ultrasonic oscillation ON/OFF (contact input),
  **Output function:** Alarm output when error occurs (Relay contact output: Open when error occurs)
- **Variable output range:** 0 to 100%, continuously variable • **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 5 to 80% (no condensation)
- **Power cable length:** 3.5 m • **Outline drawing** Page22 • **Options:** I/O remote cable (5 m), Transducer connection terminal block Page40

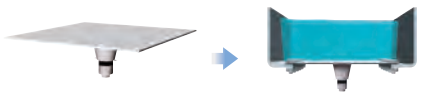
### Transducer unit

| Model No. | Immersible box type (closed) | Vibration plate type/Tank type (open) |
|---|---|---|
| Maximum liquid temperature | 80°C | 100°C |
| Transducer cable length | 6.5 m max | |
| Vibration surface material | Cold-rolled stainless steel, Hastelloy, etc. *1 | |
| Vibration surface thickness | 2.0、2.5、3.0、4.0mm *2 | |
| Surface processing | Hard chrome plating is available as option when ordering | |
| Nominal oscillation frequency | 28 kHz or 40 kHz | |
| Number of transducers | 1 or 2 | |
| Maximum allowable input | 60 W for 1 transducer, or 100 W for 2 transducers | |
| Dimensions | Varies depending on specifications | |

*1 Contact us with inquiries about special materials. *2 Plates with thickness of less than 2 mm may be supported, depending on the shape.

Immersible type

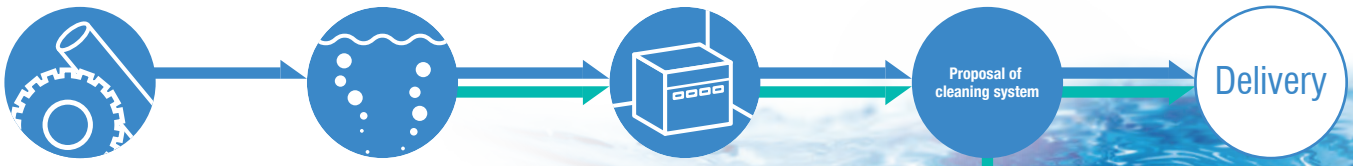
Vibration plate type



## We welcome requests for customized instruments designed to further enhance the cleaning effects!

We at Honda Electronics manufacture our own bolt-clamped Langevin type transducers with piezoelectric ceramics.
Because we use our own unique transducers that we design ourselves, we are able to meet a wide variety of specific needs by flexibly providing transducer units of various sizes and specifications, such as decompression, and by manufacturing customized instruments.

## Cleaning system proposal process




**Selecting the type of cleaning liquid**

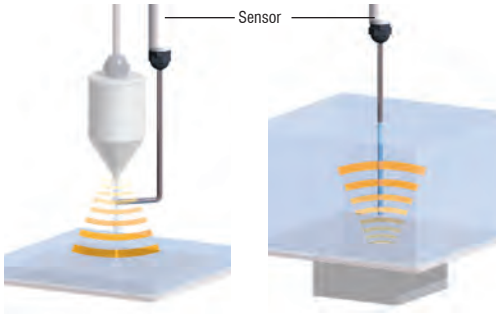
| Category | Cleaning liquid | Contamination | Characteristics |
|---|---|---|---|
| Water-based | Alkaline | Grease, shavings, dust | - Non-combustible, which eliminates fire concerns<br>- Primary ingredient is surfactant<br>- Wastewater treatment is required |
| | Neutral | | |
| | Acidic | Scales<br>Pre-cleaning for plating process | |
| Hydrocarbon-based | Isoparaffin-based | Grease<br>Flux | - Flammable, but ignition point is high<br>- Inexpensive and recyclable<br>- Low toxicity is not harmful to human health |
| | Normal paraffin-based | | |
| Solvent-based | Fluorine-based | Grease, shavings, dust | - High solvency power and quick drying characteristics<br>- Expensive but recyclable |
| | Bromine-based | | - High solvency power and quick drying characteristics<br>- Expensive but recyclable |
| | Alcohol-based | | - Flammable but quick drying characteristics<br>- Inexpensive |

# Sonic Monitor - Adjustment and inspection/quality control for cleaners -

## SONIC MONITOR
# HUS-3

## Essential tool for quality control of cleaning, featuring a portable design and rechargeable battery

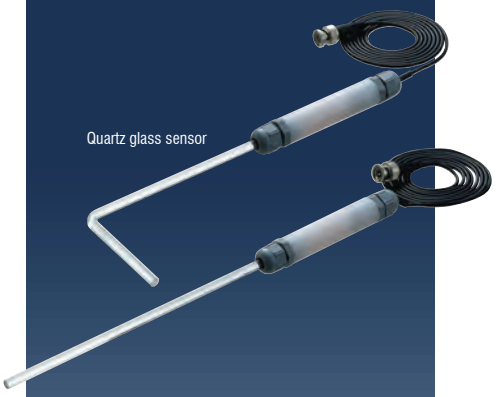

HUS-3 unit



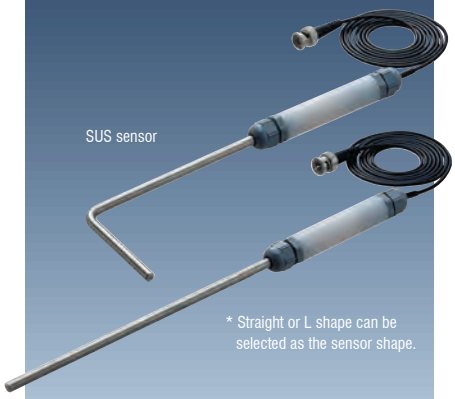

The sensor is placed in the ultrasonic cleaning tank (or in flowing water), and the strength of the ultrasonic waves is indicated in mV.

Carrying case

- Supports a wide range of frequencies, from 10 kHz (low) to 5 MHz (high).
- Rechargeable battery enables use in a variety of places.
  (provides approximately 10 hours of use)
- Readings can be obtained simply by dipping the tip of the sensor into the liquid.



Quartz glass sensor



SUS sensor

* Straight or L shape can be selected as the sensor shape.

### Main unit

| Model No. | HUS-3 |
|---|---|
| Frequency characteristics | 10 kHz - 5 MHz |
| Power input | Dedicated lithium ion battery<br>14.8 V DC 1.5 W |
| Measurement range | 10 mV / 50 mV / 100 mV / 500 mV |
| Meter indication values | Sensor detection voltage (mV) rms |
| Dimensions (W x D x H mm) | 179 x 132 x 55 |
| Weight | 640 g (including battery) |

- **Included accessories:** AC adapter for charging
  Dedicated lithium ion battery
- **Operating temperature range:** 5 to 40°C
- **AC adapter for charging:** Power input 100 to 240 V AC, 50/60 Hz
- **Options:** Point sensing cover, Charging stand

### Point sensing cover

* Cover for pinpointing the location to measure.
(for straight type only)
* Contact us if you wish to remove or install the point sensing cover.

### Sensor

| Model No. | HUS-5 SPS | HUS-5 SPL | HUS-5 SUS | HUS-5 SUL |
|---|---|---|---|---|
| Shape | Straight | L shape | Straight | L shape |
| Material | Quartz glass | | SUS316L | |
| Length (mm) | 340 | 260 ( L shape part 80) | 340 | 260 ( L shape part 80) |
| Weight | 80 g | | 140 g | |
| Incompatible liquids | Heated strong alkali, hot phosphoric acid, hydrofluoric acid | | All acids | |

- **Liquid temperature range:** 0 to 70°C
- **Cable length:** 1.5 m

*** Calibration cannot be performed for this equipment.**
*** This equipment provides relative values, and not absolute values.**
*** This equipment could fail if it is set up to perform continuous operation.**

# Benchtop type

Ultrasonic cleaner
with decompression chamber

## WV-231S

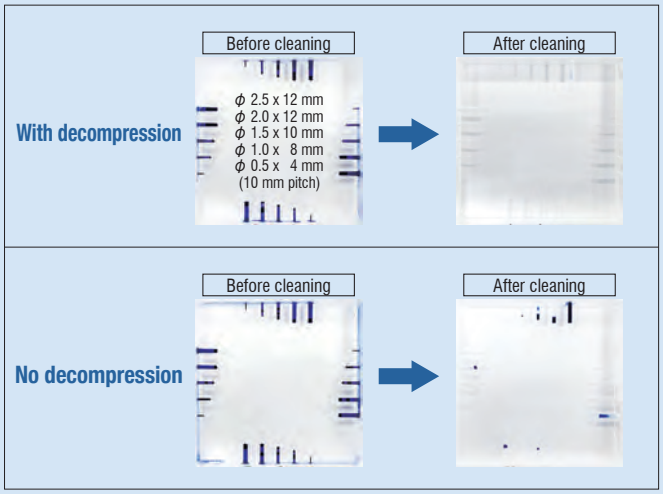

### Equipped with decompression function (for water-based solution)

- Able to clean micropores and blind holes, which could not be cleaned with conventional ultrasonic cleaners.
- Improved strength of cavitation effect, which is an important aspect of ultrasonic cleaner performance.
- Rapidly removes contamination by automatically and repeatedly applying normal pressure and decompression.

| Model No. | WV-231S |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 250 W |
| Nominal oscillation frequency | 40 kHz |
| Power input | 100 V AC Single phase 50/60 Hz 500 VA |
| Dimensions (W x D x H mm) External: | 382 x 367 x 440 (including rubber feet) |
| Inside tank: | 280 x 220 x 254 (12 L) |
| Drain valve | Rc 1/2 |
| Weight | 35 kg |

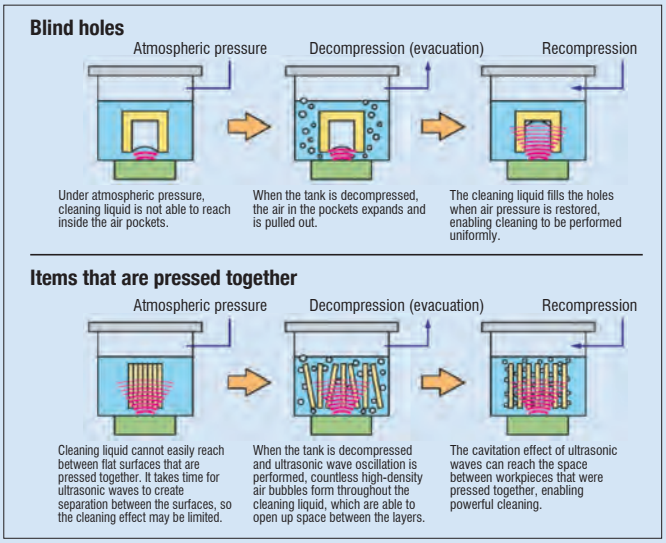
- **Maximum liquid temperature:** 70°C
- **Transducer: Bolt-clamped Langevin type**
- **Timer:** 0 to 60 min (1 min increments)
- **Decompression function:** Max. -75 kPa *May vary depending on liquid depth.
- **Switching of decompression/normal pressure:** 1 cycle (45 seconds of decompression/15 seconds of normal pressure)
- **Power cable length:** 2 m
- **Materials: Tank:** SUS304, Lid: SUS304
- **Options:** Cleaning basket (KG15F), Beaker rack (BR06) Page40

■Cleaning data <Cleaning test of blind holes in glass plates (100 x 100 x 19 t)>




* Water-soluble ink was used as the test contamination.
* The cleaning results may vary depending on the conditions.

■Advantages of ultrasonic cleaning with decompression




## WTC-600-40
## WTC-1200-40


### Enables cleaning of large items with simple hands-free operation

- High-efficiency, energy-saving model that uses FM (frequency modulation) + AM (amplitude modulation) to achieve uniform cleaning.
- In addition to the drain valve, a drain installation hole for overflow makes it easy to expand the circulation system.

| Model No. | WTC-600-40 | WTC-1200-40 |
|---|---|---|
| Oscillation mode | FM + AM modulation | |
| Maximum output (average output) | 600 W | 1200 W |
| Nominal oscillation frequency | 40 kHz | |
| Power input | 100 V AC 50/60 Hz 300 VA | 200 - 230 V AC Single phase 50/60 Hz 600 VA |
| Dimensions (W x D x H mm) External: | 600 x 410 x 472 (including rubber feet) | 800 x 460 x 472 (including rubber feet) |
| Inside tank: | 400 x 350 x 272 (40 L) * | 610 x 400 x 268 (69 L) * |
| Drain valve | Rc 3/4 | Rc 1 |
| Weight | 28 kg | 40 kg |

- **Liquid temperature range:** 5 to 80°C
- **Transducer:** Bolt-clamped Langevin type
- **Variable output range:** 0 to 100%, continuously variable
- **Timer:** 10 min /20 min/ 30 min/ Continuous
- **Operation switch:** ON/OFF via photoelectric sensor (with voice guidance)
- **Power cable length:** 3.5 m
- **Tank material:** SUS304
- **Outline drawing** Page23
- **Options:** Cleaning basket (KG08T / KG09T), Lid (FT05 / FT06), Stand (DA01 / DA02) Page40

*1 The bottom surface of the tank is angled to facilitate drainage.

ULTRASONIC CLEANER
日洗美人

# WT-100-M
# WT-200-M
# WT-300-M


## Stylish high-performance models that utilize two resonant frequencies to achieve uniform cleaning

- Able to select from three oscillation modes -- soft (single frequency), rhythmic (intermittent single frequency), powerful (switching dual frequencies) -- to best suit the items that are cleaned.
- The 28 kHz frequency is suitable for cleaning persistent contamination, and 45 kHz is effective for cleaning fine parts. Switching between these two frequencies prevents the standing waves that cause uneven cleaning, and reduces the damage (erosion) to the workpieces and tank.
- Simple, efficient and stylish design.

| Model No. | WT-100-M | WT-200-M | WT-300-M |
|---|---|---|---|
| Oscillation mode | Single frequency oscillation (Soft)/ Intermittent single frequency oscillation (Rhythmic)/ Switchingdual frequencies (Powerful) | | |
| Rated output | 100 W | 200 W | 300 W |
| Nominal oscillation frequency | 28 kHz、45 kHz | | |
| Power input | 100 V AC 50/60 Hz 325 VA | 100 V AC 50/60 Hz 650 VA | 100 V AC 50/60 Hz 1200 VA |
| Heater | 125 W | 250 W | 500 W |
| Dimensions (W x D x H mm) External: | 279 x 265 x 310 (including rubber feet) | 339 x 365 x 330 (including rubber feet) | 544 x 425 x 410 (including rubber feet) |
| Inside tank: | 240 x 140 x 150 (5 L) *1 | 300 x 240 x 150 (10.5 L) *1 | 505 x 300 x 200 (29.5 L) *1 |
| Drain valve | Rc 1/2, with hose nipple (outer diameter 14) | | |
| Weight | 7 kg | 10 kg | 15 kg |

■ **Included accessories:** Drainboard
- **Maximum liquid temperature**: 80℃
- **Transducer:** Special bolt-clamped Langevin type
- **Timer:** 0 to 60 min (1 min increments)
- **Power cable length:** 2 m
- **Tank material:** SUS304
- **Options:** Cleaning basket (KG04F / KG06F / KG07F), Lid (FT01 / FT03 / FT04), Beaker rack (BR02 / BR03 / BR04), Beakers (BK02) Page40

*1 Dimensions at top of tank, which is tapered.

# W-113 MK-Ⅱ


## Adjacent dual-frequency BAKUSEN (blast cleaning) mode effectively cleans persistent contamination

- BAKUSEN (blast cleaning) mode instantaneously generates powerful energy and high-order oscillation, which achieves high cleaning efficiency.
- Able to perform cleaning inside narrow tubes and through-hole boards.

| Model No. | W-113MK-Ⅱ |
|---|---|
| Oscillation mode | Single frequency oscillation/High-speed switching oscillation (BAKUSEN) |
| Rated output | 110 W |
| Nominal oscillation frequency | 24 kHz、31 kHz |
| Power input | 100 V AC 50/60 Hz 200 VA |
| Dimensions (W x D x H mm) External: | 290 x 208 x 249 (including rubber feet) |
| Inside tank: | 240 x 140 x 100 (3 L) *1 |
| Weight | 4.4 kg |

■ **Included accessories:** Lid
- **Maximum liquid temperature**: 80℃
- **Transducer:** Bolt - clamped Langevin type
- **Timer:** 1 to 99 min (1 min increments)
- **Power cable length:** 2 m
- **Material:** Main unit/lid: Polypropylene (PP), Tank: SUS304
- **Options:** Cleaning basket (KG03F), Beaker rack (BR01) Page40

*1 Dimensions at top of tank, which is tapered.

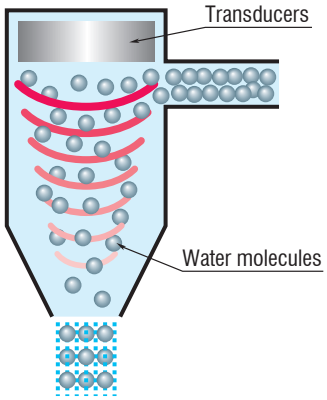
# High frequency cleaning

## Explanation

### Nozzle type cleaner

**■Cleaning with particle acceleration**

When vibrational acceleration is applied in ultrasonic cleaning, the impact of accelerated water molecules against the workpiece separates the particles of contamination from the workpiece. The cleaning effect is markedly stronger at higher frequencies, because the acceleration increases in proportion to the square of the frequency. This method is particularly effective for removing extremely fine particles that have strong adhesion.




**Changes to particle amounts before and after PULSE JET cleaning**

**Workpiece size**

300 x 300 x 1.1mm

**Measurement area**

280 x 280mm

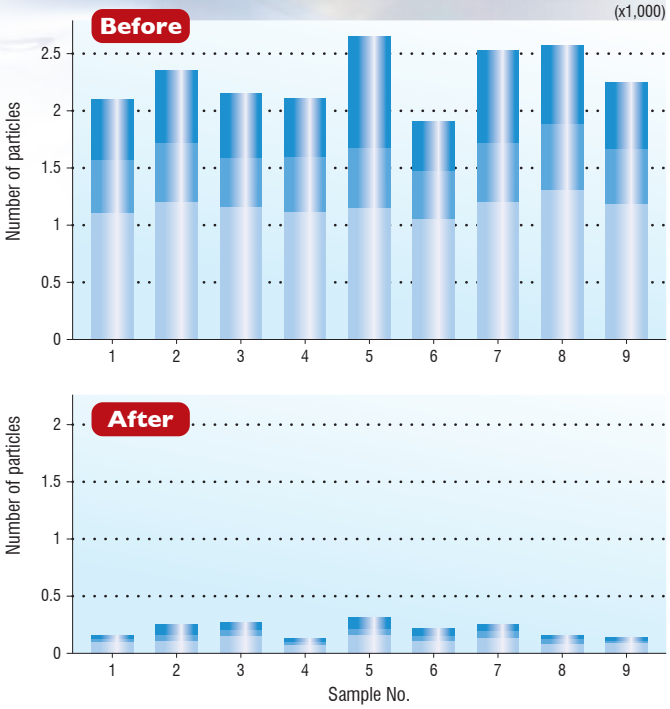
Both sides of blank glass

**Particle size**

S : 3.0～ 5.0μm

M : 5.0～10.0μm

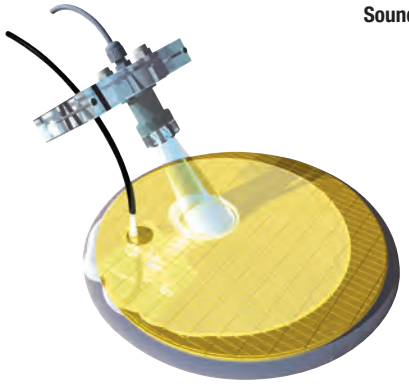
L : 10.0μm～



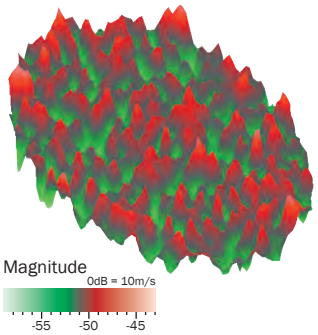

### Quartz transducer unit type cleaner

**■Next-generation cleaning with minimal damage and high cleaning performance**

In 2006, Honda Electronics developed the world's first quartz transducer unit type ultrasonic cleaning unit. With this method, ultrasonic waves are applied to the quartz transducer unit, which is used to clean semiconductor wafers. Smaller amounts of cleaning liquid are used compared to batch and nozzle type cleaners, and the cleaning liquid only comes into contact with the quartz glass, thereby ensuring a higher degree of cleanliness. In addition, the shape of the quartz transducer unit may be modified to ensure effective cleaning for different applications, such as low-damage cleaning, wide-area cleaning, or cleaning of special parts such as beveled surfaces and notches.



**Sound pressure distribution for W-357-IMQB-SK**




### Batch type cleaner

**■Batch cleaning of semiconductor wafers**

Multiple semiconductor wafers are placed in a tank for MHz-band ultrasonic cleaning, which is performed on all of the wafers simultaneously. This cleaning method has become the mainstream for the following reasons:

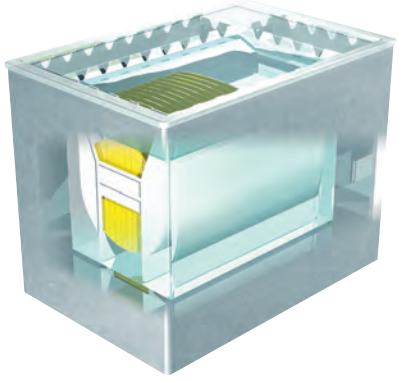
(1) Many wafers can be cleaned at the same time, which saves time.

(2) Less cleaning liquid is used than when wafers are cleaned individually.

(3) It is easier to use specific cleaning liquids such as when cleaning with dual tanks.

Normally, when cleaning liquid is used in batch cleaning, ultrasonic waves are applied indirectly using a dip type cleaning method with a dual structure of cleaning tank and quartz tank. In this method, the use of a quartz tank can prevent the elution of metal ions and impurities, and it is also effective for maintaining cleanliness.

However, there is a problem of particles reattaching to items in batch cleaning, due to the increasingly large sizes and fine patterns of semiconductor wafers.



# Quartz transducer unit type cleaner

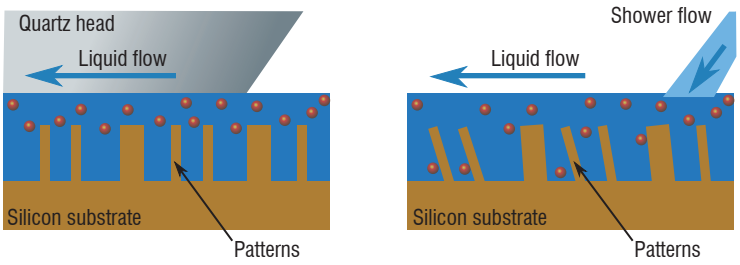
## W-357 -1MQG-SKC series


## W-357 -1MQG-SKH series

-with liquid supply hole


## Cleans fine-patterned wafers with minimal damage

- Equipped with a transducer cooling mechanism, which enables a maximum output that is 2.4 times higher than standard models
- Frequency fluctuation is reduced by cooling the transducer, enabling stable continuous operation
- The cooling mechanism prevents rapid temperature changes in the transducer, which ensures a long service life




**Cleaning of patterned Si wafer**

### Generator

| Model No. | W-357-1MQG-SKC | W-357-2MQG-SKC | W-357-3MQG-SKC |
|---|---|---|---|
| Oscillation mode | Single frequency oscillation | | |
| Rated output | 12 W | | |
| Nominal oscillation frequency | 1 MHz | 2 MHz | 3 MHz |
| Power input | 100 - 240 V AC Single phase 50/60 Hz 300 VA | | |
| Dimensions (W x D x H mm) | 185 x 265 x 100 (including rubber feet) | | |
| Weight | 2.2 kg | | |

- **Variable output range:** 0 to 12 W
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 10 to 85%
- **Ratings of contact points for external drive:** Ultrasonic oscillation control (on control side) contact input: 12 V DC, 18 mA or more
  Alarm output (this equipment) contact capacity: 24 V DC, 0.5 A
- **Included cables:** Power cable (100 V/2 m, or 200 V/3 m), Control cables (5 m) x 4

### Transducer unit

| Model No. | W-357-1MQG-SKC | W-357-2MQG-SKC | W-357-3MQG-SKC |
|---|---|---|---|
| Flow rate | Not specified | | |
| Weight | Approx. 600 g | | |
| Length | Approx. 159 mm | | Approx. 169 mm |
| Dimensions of chuck | dia.24 or 34 mm | | |
| Cleaning area | 24 ($cm^2$) | | 27 ($cm^2$) |

- **Liquid Temperature :** 20 to 50°C • **Transducer :** PZT
- **Material:** Transducer unit: Quartz, Quartz glass Packing: Silicone rubber Case: PCTFE
- **Liquid contact surface material:** Transducer unit: Quartz glass
- **Cable length:** Output cable 1.5 m + Relay cable 3.5 m
- **Air purge coupling:** Compatible tube (outer diameter: 6)

W-357-1MQG-SKH, W-357-2MQG-SKH and W-357-3MQG-SKH are the models that have liquid supply holes on the quartz transducer units. All specifications are the same as SKC series.
Cleaning liquid can be applied through a hole located at the center of the quartz transducer unit.

# Nozzle type cleaner - PULSE JET point type

This point type, nozzle type ultrasonic cleaner is mainly used for cleaning wafers and hard disks. Ultrasonic waves are applied to the stream of water from the nozzle tip, to ensure effective cleaning. The emitted stream of water works in conjunction with the propagated ultrasonic waves to remove the contamination from the item that is cleaned, and it also functions as a transport medium to carry the contamination away. As is characteristic of nozzle type cleaners, this model prevents particles from reattaching to the cleaned object, and it is effective for removing submicron contamination. A wide selection of variations are available to suit your applications and cleaning liquids.

## W-357-1MPG


Standard nozzle

### Removes fine contamination and prevents particles from reattaching

●The digital control system enables a variety of functions.

**No need to perform generator calibration**
Maintenance is simplified by eliminating the need to calibrate the generator when the transducer standard nozzle is replaced by one with the same specifications.

**Constant power oscillation**
The transducer drive frequency tracks the oscillator to ensure a constant voltage and current phase for the transducer. Control is performed using constant power, in order to maintain a stable energy supply to the transducer. This enables the device to provide stable ultrasonic oscillation in response to changes in water temperature and ambient temperature.

**Error detection function**
Alarm output enables monitoring of generator and nozzle abnormalities.
Disconnected cables, short circuits, power abnormalities, excessive current, transducer impedance abnormalities, and insufficient water flow can be detected.

**Output monitoring**
RS-422A is supported, which enables external control of output power. Output is available at 4 to 20 mA.

CE compliance is possible.
Contact us separately for details.

**Generator**

| Model No. | W-357-1MPG |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 40 W |
| Nominal oscillation frequency | 1 MHz |
| Power input | 100 - 240 V AC Single phase 50/60 Hz 300 VA |
| Dimensions (W x D x H mm) | 180 x 250 x 100 (including rubber feet) |
| Weight | 2.2 kg |

- **Variable output range:** 0 W to 40 W
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 10 to 85%
- **Ratings of contact points for external drive:**
  Ultrasonic oscillation control (on control side) contact input: DC12 V AC, 18 mA or more
  Alarm output (this equipment) contact capacity: DC 24V 0.5A
- **Included cables:** Power cable (100 V/2 m, or 200 V/3 m), Control cables (5 m) × 4

**Transducer standard nozzle**

| | |
|---|---|
| Flow rate | 0.9 L/min |
| Dimensions | dia. 25 x 78 mm |
| Nozzle diameter | dia. 4 mm |
| Weight | 300 g |

- **Liquid temperature range:** 20 to 50°C
- **Transducer:** PZT
- **Material:** Nozzle: PCTFE, PTFE
  Packing: Perfluoro compound
  Vibration plate: Special ceramic
- **Liquid contact surface material:**
  Nozzle: PCTFE, PTFE
  Packing: Perfluoro compound
  Vibration plate: Special ceramic
- **Inlet:** Compatible tube (outer diameter: 6)
- **Cable length:** Output cable 5 m

## W-357-1.5MPG


●High frequency of 1.5 MHz enables removal of fine particles. RS-422A communication is available.

**Generator**

| Model No. | W-357-1.5MPG |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 40 W |
| Nominal oscillation frequency | 1.5 MHz |
| Power input | 100 - 240 V AC Single phase 50/60 Hz 300 VA |
| Dimensions (W x D x H mm) | 180 x 250 x 100 (including rubber feet) |
| Weight | 2.2 kg |

- **Variable output range:** 0 W to 40 W
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 10 to 85%
- **Ratings of contact points for external drive:**
  Ultrasonic oscillation control (on control side) contact input: DC12 V AC, 18 mA or more
  Alarm output (this equipment) contact capacity: DC 24V 0.5A
- **Included cables:** Power cable (100 V/2 m, or 200 V/3 m), Control cables (5 m) × 4

**Transducer nozzle**

| | |
|---|---|
| Flow rate | 0.9 L/min (straight coupling) |
| Dimensions | 29 x 34 x 92 mm |
| Nozzle diameter | dia. 4 mm |
| Weight | 300 g |

- **Liquid temperature range:** 20 to 50°C
- **Transducer:** PZT
- **Material:** Nozzle: PCTFE, PTFE
  Packing: Perfluoro compound
  Vibration plate: Tantalum
- **Liquid contact surface material:**
  Nozzle: PCTFE, PTFE
  Packing: Perfluoro compound
  Vibration plate: Tantalum
- **Inlet:** Compatible tube (outer diameter: 6)
- **Cable length:** Output cable 5 m

## W-357-3MPG


●Higher frequency of 3 MHz enables the removal of finer particles with minimal damage.

**Generator**

| Model No. | W-357-3MPG |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 40 W |
| Nominal oscillation frequency | 3 MHz |
| Power input | 100 - 240 V AC Single phase 50/60 Hz 300 VA |
| Dimensions (W x D x H mm) | 180 x 250 x 100 (including rubber feet) |
| Weight | 2.2 kg |

- **Variable output range:** 0 W to 40 W
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 10 to 85%
- **Ratings of contact points for external drive:**
  Ultrasonic oscillation control (on control side) contact input: DC12 V AC, 18 mA or more
  Alarm output (this equipment) contact capacity: DC 24 V 0.5 A
- **Included cables:** Power cable (100 V/2 m, or 200 V/3 m), Control cables (5 m) × 4

**Transducer nozzle**

| | |
|---|---|
| Flow rate | 0.9 L/min (straight coupling) |
| Dimensions | 29 x 34 x 92 mm |
| Nozzle diameter | dia. 4 mm |
| Weight | 300 g |

- **Liquid temperature range:** 20 to 50°C
- **Transducer:** PZT
- **Material:** Nozzle: Special ceramic, PCTEF
  Packing: Viton rubber, Silicone rubber
  Vibration plate: Special ceramic
- **Liquid contact surface material:**
  Nozzle: Special ceramic, PCTEF
  Packing: Silicone rubber
  Vibration plate: Special ceramic
- **Inlet:** Compatible tube (outer diameter: 6)
- **Cable length:** Output cable 5 m

# Nozzle type cleaner - PULSE JET line type

In these line type, nozzle type ultrasonic cleaners, which are mainly used for cleaning LCD glass, ultrasonic waves are applied to a streaming curtain of cleaning liquid to remove particles. Like point type cleaners, these models prevent particles from reattaching to the cleaned object, and they are effective for removing submicron contamination.

## W-357LS-160

### Suitable for cleaning LCD glass up to 180 mm wide

**Generator**

| Model No. | W-357LS-160 |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 240 W (120 W x 2 CH) |
| Nominal oscillation frequency | 1 MHz±100 kHz |
| Power input | 200 V AC Single phase 50/60 Hz 600 VA |
| Dimensions (W x D x H mm) | 358 x 447 x 137 (including rubber feet) |
| Weight | 15 kg |

- **Variable output range:** 60 W to 120 W/ 1 CH
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 80% max.
- **Ratings of contact points for external drive:** Ultrasonic oscillation control (on control side) contact input: 250 V AC, 1 A or more
  Alarm output (this equipment) contact capacity: 250 V AC, 400 mA, or 24 V DC, 1.25 A
- **Included cables:** Power cable (5 m), Empty tank heating prevention cable (5 m), External drive cable (5 m), Alarm output cable (5 m)

**Transducer nozzle**

| | |
|---|---|
| Flow rate | 18 L/min |
| Dimensions (W x D x H mm) | 282 x 182 x 105 |
| Nozzle diameter | 194 x 2 mm |
| Effective cleaning area | 180 x 2 mm |
| Weight | 2.7 kg |

- **Liquid temperature range:** 20 to 40°C • **Transducer:** PZT
- **Material:** Nozzle: Polypropylene (PP), PTFE Packing: Silicone rubber Vibration plate: Tantalum
- **Liquid contact surface material:** Nozzle: Polypropylene (PP), PTFE Packing: Silicone rubber Vibration plate: Tantalum
- **Inlet:** Compatible tube (inner diameter: 11, outer diameter: 13) • **Cable length:** Output cable 5 m

'- Sales of this product are scheduled to be discontinued in May 2020

## W-357LS-380

### Instantly removes fine particles

●This model can be used to clean LCD glass up to 380 mm wide.

**Generator**

| Model No. | W-357LS-380 |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 480 W (120 W x 4 CH) |
| Nominal oscillation frequency | 1 MHz±100 kHz |
| Power input | 200 V AC Single phase 50/60 Hz 600 VA x 2 |
| Dimensions (W x D x H mm) | 358 x 447 x 137 (including rubber feet) (2 units) |
| Weight | 15 kg x 2 units |

- **Variable output range:** 60 W to 120 W/ 1 CH
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 80% max.
- **Ratings of contact points for external drive:**
  Ultrasonic oscillation control (on control side) contact input: 250 V AC, 1 A or more
  Alarm output (this equipment) contact capacity: 250 V AC, 400 mA, or 24 V DC, 1.25 A
- **Included cables:** Power cable (5 m), Empty tank heating prevention cable (5 m), External drive cable (5 m), Alarm output cable (5 m), Parallel drive cable (0.4 m)

**Transducer nozzle**

| | |
|---|---|
| Flow rate | 30 L/min |
| Dimensions (W x D x H mm) | 482 x 182 x 105 |
| Nozzle diameter | 400 x 2 mm |
| Effective cleaning area | 380 x 2 mm |
| Weight | 4.5 kg |

- **Liquid temperature range:** 20 to 40°C • **Transducer:** PZT
- **Material:** Nozzle: Polypropylene (PP), PTFE
  Packing: Silicone rubber
  Vibration plate: Tantalum
- **Liquid contact surface material:**
  Nozzle: Polypropylene (PP), PTFE
  Packing: Silicone rubber
  Vibration plate: Tantalum
- **Inlet:** Compatible tube (inner diameter: 11, outer diameter: 13)
- **Cable length:** Output cable 5 m

'- Sales of this product are scheduled to be discontinued in May 2020

## W-357LS-580

### Cleans and removes fine particles in a wider area

●This model can be used to clean LCD glass up to 580 mm wide.

**Generator**

| Model No. | W-357LS-580 |
|---|---|
| Oscillation mode | Single frequency oscillation |
| Rated output | 720 W (120 W x 6 CH) |
| Nominal oscillation frequency | 1 MHz±100 kHz |
| Power input | 200 V AC Single phase 50/60 Hz 600 VA x 3 |
| Dimensions (W x D x H mm) | 358 x 447 x 137 (including rubber feet) (3 units) |
| Weight | 15 kg x 3 units |

- **Variable output range:** 60 W to 120 W/ 1 CH
- **Ambient operating environment:** Temperature: 5 to 40°C, Humidity: 80% max.
- **Ratings of contact points for external drive:**
  Ultrasonic oscillation control (on control side) contact input: 250 V AC, 1 A or more
  Alarm output (this equipment) contact capacity: 250 V AC, 400 mA, or 24 V DC, 1.25 A
- **Included cables:** Power cable (5 m), Empty tank heating prevention cable (5 m), External drive cable (5 m), Alarm output cable (5 m), Parallel drive cable (0.4 m)

**Transducer nozzle**

| | |
|---|---|
| Flow rate | 45 - 60 L/min |
| Dimensions (W x D x H mm) | 682 x 182 x 105 |
| Nozzle diameter | 600 x 2 mm |
| Effective cleaning area | 580 x 2 mm |
| Weight | 6 kg |

- **Liquid temperature range:** 20 to 40°C • **Transducer:** PZT
- **Material:** Nozzle: Polypropylene (PP), PTFE
  Packing: Silicone rubber
  Vibration plate: Tantalum
- **Liquid contact surface material:**
  Nozzle: Polypropylene (PP), PTFE
  Packing: Silicone rubber
  Vibration plate: Tantalum
- **Inlet:** Compatible tube (inner diameter: 11, outer diameter: 13)
- **Cable length:** Output cable 5 m

'- Sales of this product are scheduled to be discontinued in May 2020

# Separate type batch cleaner


## W-357BM-1200

## Ultrasonic cleaner for removing submicron particles

- Digital control system enables stable oscillation.
- Versatile interface enables control that is compatible with other cleaning equipment.


### Generator

| Model No. | | W-357BM-1200 |
|---|---|---|
| Oscillation mode | | Single frequency oscillation |
| Rated output | | 1200 W |
| Nominal oscillation frequency | | 1 MHz |
| Power input | | 200 - 240 V AC Single phase 50/60 Hz 2400 VA |
| Display | | Vacuum fluorescent display (VFD), 16 characters x 2 lines |
| Interface | Analog output contacts | 4 to 20 mA current output |
| | Output | 3 contacts Alarm output, Oscillation detection output, Power ON output |
| | External drive input | 2 contacts Sensor input, Remote input |
| | RS-485 communication | MODBUS (RTU) protocol |
| Dimensions (W x D x H mm) | | 360 x 360 x 143 (including rubber feet) |
| Weight | | 7 kg |

• **Variable output range:** 200 to 1200 W • **Power cable length:** 3 m • **Outline drawing** Page22

## Transducer unit


Vibration plate type

### F TYPE | Vibration plate type — For 8 inch wafer

| Model No. | W-357BM-1200F |
|---|---|
| Generator Model No. | **W-357BM-1200** |
| Maximum allowable input | 1200 W |
| Nominal oscillation frequency | 1 MHz |
| Effective cleaning area (W x Dmm) | 272 x 154 |
| Dimensions (W x Dmm)(wires not included) | 355 x 245 x 68 |
| Material | Plate: SUS316L, Electropolished surface |
| Weight | 7 kg |

• **Liquid contact surface material:** Vibration plate: SUS316L
• **Liquid temperature range:** 5 to 80°C • **Transducer:** PZT **Transducer cable length:** 5 m x 2 • **Outline drawing** Page24


Tank type

### S TYPE | Tank type — For two 6 inch wafers

| Model No. | W-357BM-1200S |
|---|---|
| Generator Model No. | **W-357BM-1200** |
| Maximum allowable input | 1200 W |
| Nominal oscillation frequency | 1 MHz |
| Effective cleaning area (W x Dmm) | 135 x 160 2 locations |
| Dimensions (W x Dmm)External: | 496 x 336 x 372 |
| Inside tank: | 442 x 276 x 252 |
| Material | Tank: SUS316, Packing: Viton and PTFE |
| Drain valve | 1/2" |
| Weight | 18 kg |

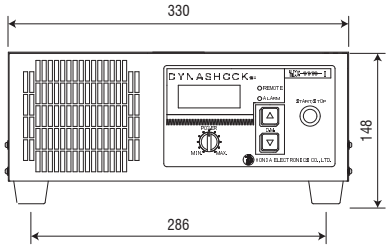
• **Liquid contact surface material:** Vibration plate, Tank: SUS316L Packing: PTFE Drain: SUS304
• **Liquid temperature range:** 5 to 80°C • **Transducer:** PZT **Transducer cable length:** 5 m x 2 • **Outline drawing** Page24

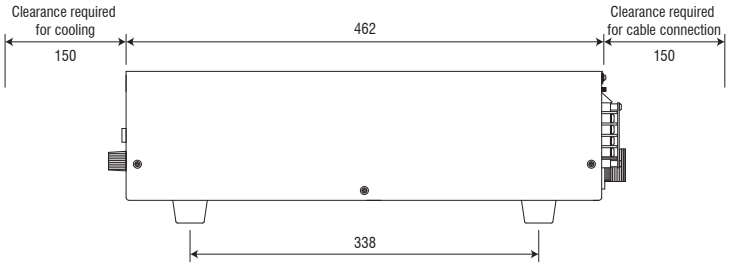
* Upon request, transducer units can be manufactured with custom specifications, such as 2400 W or 3600 W input, or support for 6 inch, 8 inch, or 12 inch wafers.

# Outline drawings

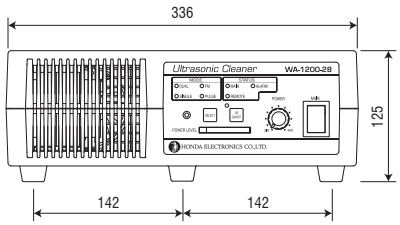
## ■Generator

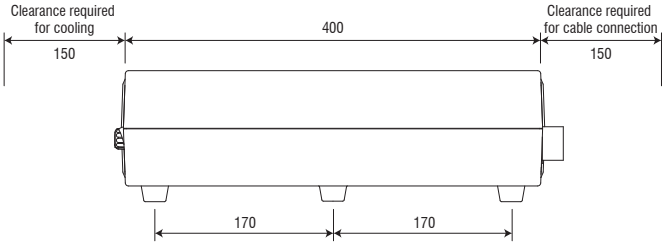
### ■WDX Series



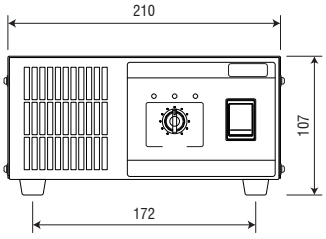



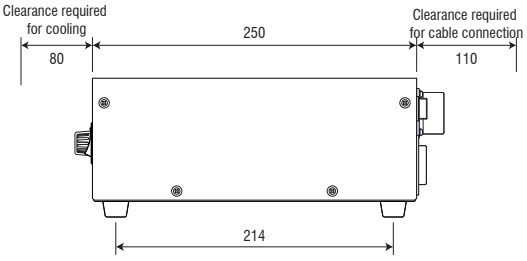

### ■WA Series



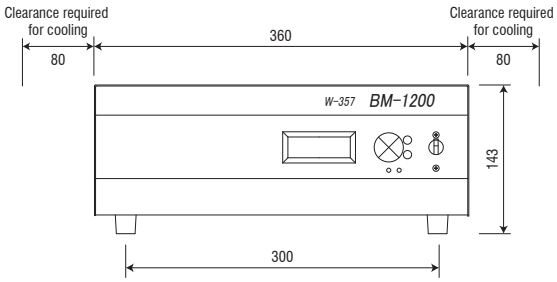



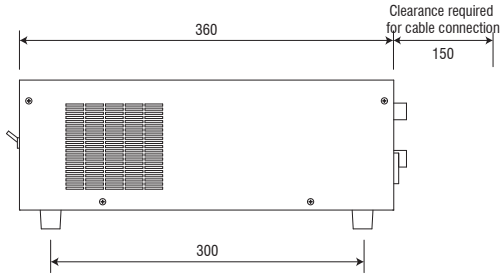

### ■WSC Series / WSC(M) Series



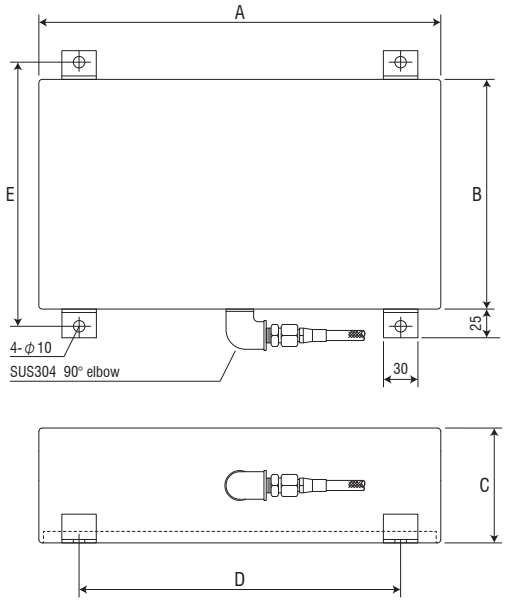

### ■W-357BM-1200



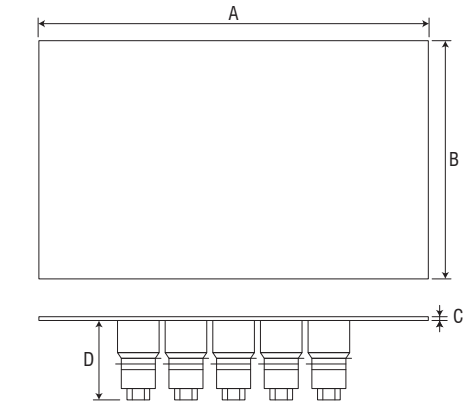
## ■Transducer unit

### ■N type Immersible type




| Transducer Unit Model No. | A | B | C | D | E |
|---|---|---|---|---|---|
| WDX-600N- Ⅰ | 350 | 200 | 100 | 280 | 230 |
| WDX-1200N- Ⅰ | 420 | 300 | 100 | 320 | 330 |
| WDX-600N- Ⅱ | 350 | 200 | 75 | 280 | 230 |
| WA-600-28N | 350 | 200 | 100 | 280 | 230 |
| WA-600-40N | 350 | 200 | 75 | 280 | 230 |
| WA-1200-28N | 420 | 300 | 100 | 320 | 330 |
| WA-1200-40N | 420 | 300 | 75 | 320 | 330 |
| WSC28ST-N | 350 | 200 | 100 | 280 | 230 |
| WSC28HP-N | 420 | 300 | 100 | 320 | 330 |
| WSC40ST-N | 350 | 200 | 75 | 280 | 230 |
| WSC40HP-N | 420 | 300 | 75 | 320 | 330 |

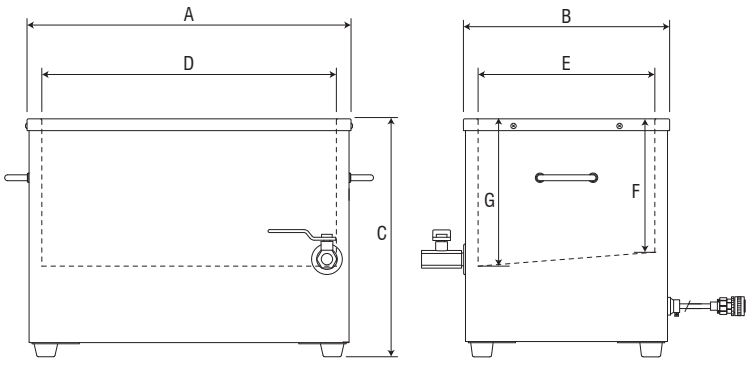
### ■F type Vibration plate type




| Transducer Unit Model No. | A | B | C (t) | D |
|---|---|---|---|---|
| WDX-600F- Ⅰ | 390 | 240 | 2.5 | 80 |
| WDX-1200F- Ⅰ | 460 | 340 | 2.5 | 80 |
| WDX-600F- Ⅱ | 390 | 240 | 2.5 | 57 |
| WA-600-28F | 390 | 240 | 2.5 | 80 |
| WA-600-40F | 390 | 240 | 2.5 | 54 |
| WA-1200-28F | 460 | 340 | 2.5 | 80 |
| WA-1200-40F | 460 | 340 | 2.5 | 54 |
| WSC28ST-F | 390 | 240 | 2.5 | 68 |
| WSC28HP-F | 460 | 340 | 2.5 | 68 |
| WSC40ST-F | 390 | 240 | 2.5 | 54 |
| WSC40HP-F | 460 | 340 | 2.5 | 54 |

* Contact us for details when transducer cover is attached.

### ■S type Tank type




| Transducer Unit Model No. | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| WDX-600S- Ⅰ | 422 | 302 | 405 | 370 | 250 | 250 | 250 |
| WDX-1200S- Ⅰ | 550 | 350 | 402 | 500 | 300 | 224 | 250 |
| WDX-600S- Ⅱ | 422 | 302 | 405 | 370 | 250 | 250 | 250 |
| WA-600-28S | 422 | 302 | 405 | 370 | 250 | 250 | 250 |
| WA-600-40S | 422 | 302 | 405 | 370 | 250 | 250 | 250 |
| WA-1200-28S | 550 | 350 | 402 | 500 | 300 | 224 | 250 |
| WA-1200-40S | 550 | 350 | 402 | 500 | 300 | 224 | 250 |
| WTC-600-40 | 600 | 410 | 472 | 400 | 350 | 272 | 300 |
| WTC-1200-40 | 800 | 460 | 472 | 610 | 400 | 268 | 300 |

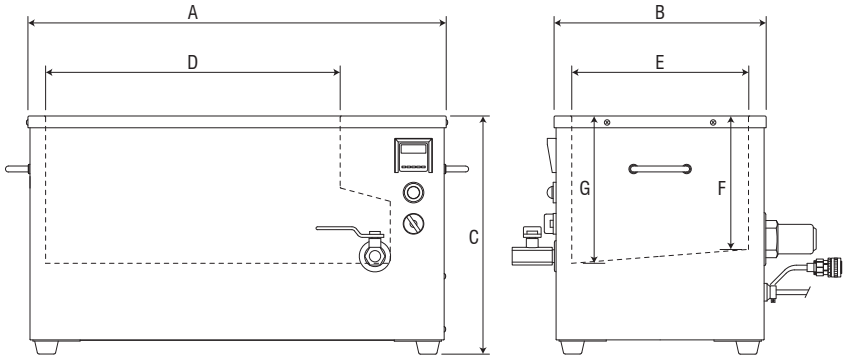
* The positions of parts such as drains, cables, and handles may vary depending on the model. Contact us for details.

(Unit: mm)

* Actual product dimensions may vary slightly from those provided here.

## ■Transducer unit

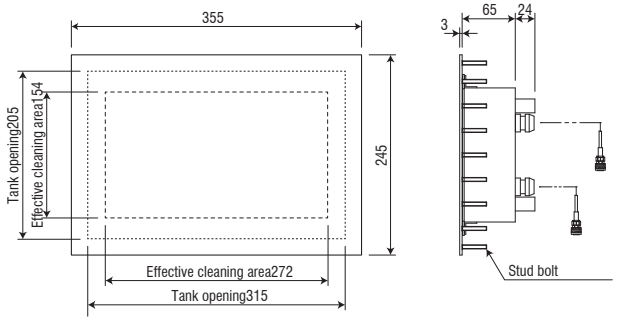
### ■SH TYPE　Tank type with heater



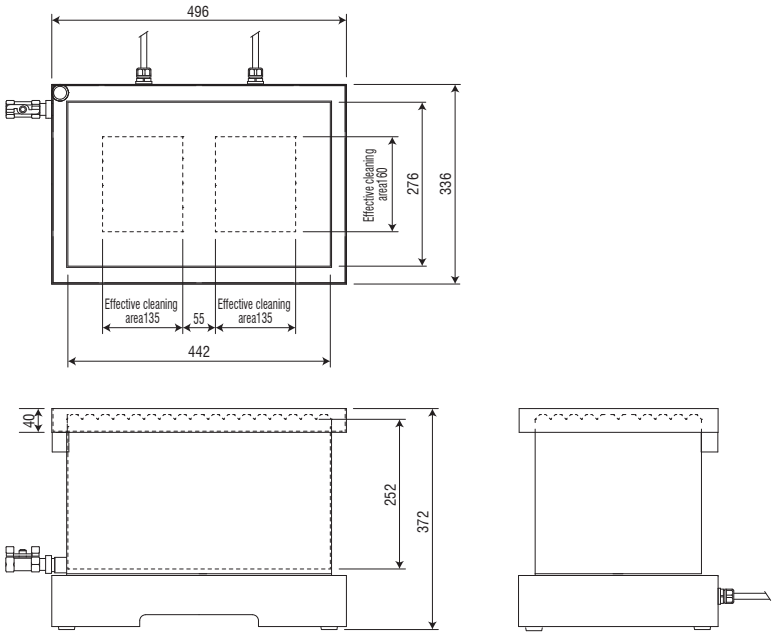

| Transducer Unit Model No. | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| WDX-600SH- Ⅰ | 580 | 310 | 406 | 370 | 250 | 250 | 250 |
| WDX-1200SH- Ⅰ | 710 | 360 | 405 | 500 | 300 | 224 | 250 |
| WDX-600SH- Ⅱ | 580 | 310 | 406 | 370 | 250 | 250 | 250 |
| WA-600-28SH | 580 | 310 | 406 | 370 | 250 | 250 | 250 |
| WA-600-40SH | 580 | 310 | 406 | 370 | 250 | 250 | 250 |
| WA-1200-28SH | 710 | 360 | 405 | 500 | 300 | 224 | 250 |
| WA-1200-40SH | 710 | 360 | 405 | 500 | 300 | 224 | 250 |

* The positions of parts such as drains, cables, and handles may vary depending on the model. Contact us for details.

### ■W-357BM-1200　F TYPE Vibration plate type




### ■W-357BM-1200　S TYPE Tank type




(Unit: mm)

* Actual product dimensions may vary slightly from those provided here.

# Ultrasonic processing tools

## Using ultrasound in power tool applications

**Ultrasonic waves can be used in power tool applications by transmitting the vibrational energy through a medium (liquid, solid, or gas). This is called "high-power ultrasound". Typical application examples include cleaning, cutting, welding, and atomization.**

### Characteristics of ultrasound

- Transmits more easily through higher density media (gas < liquid < solid)
- Longitudinal waves are generated in a gas or liquid, while waves such as longitudinal, transverse, torsional, or surface waves may be generated in a solid
- High sound pressure and strong power density are generated with small vibrational displacement
- A higher amplitude increases the transmission distance for ultrasonic waves at the same frequency

## Cutting

▶page26

### Cutting

When ultrasonic vibration is applied to a blade, the friction between the blade and the cutting surface is reduced, dramatically increasing the cutting ability.

## Welding

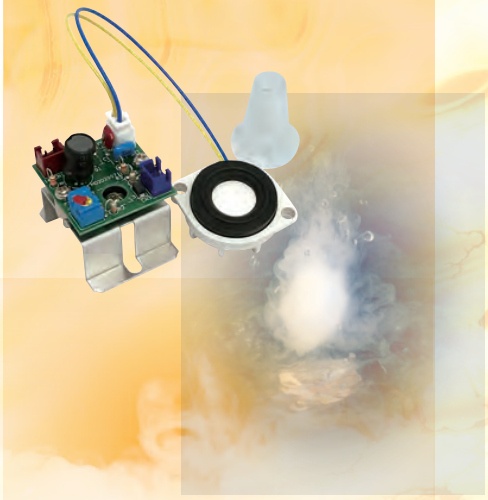
▶page27

### Welding

When ultrasonic vibration is repeatedly applied to the materials of two surfaces that are touching each other, frictional heat is instantly generated between the two surfaces, causing them to soften and weld together.

## Atomizing

▶page27



### Atomizing

When high frequency ultrasound is applied to a liquid, the surface tension is broken, resulting in a spray of fine particles.

# Ultrasonic cutting

Ultrasonic cutter

## ZO-91

**Cutting with ultrasonic vibration**

When ultrasonic vibration is applied to a blade, the friction between the blade and the workpiece is reduced. As a result, less physical force needs to be applied to the cutter or knife when cutting the workpiece.

* If the blade is not capable of cutting the material by itself (without ultrasonic vibration), it will not be able to cut the material when ultrasonic vibration is applied.

# Standard model ultrasonic cutter with user-friendly design

- Equipped with new TAF™ circuit that adds power when cutting is difficult!
- Able to select Normal mode or High mode.

| Model No. | ZO-91 |
|---|---|
| Oscillation frequency | 40 kHz |
| Power consumption | Approx. 40 W max. |
| AC adapter | 100 V - 240 V AC 50/60 Hz 80 VA OUTPUT: 12 V DC 3.3 A *1 |
| Dimensions | Main unit 173 x 89 x 76 mm (excluding protrusions)<br>Handpiece dia. 32 x 144 mm (including blade) |
| Ambient operating environment | 10 to 35°C, Humidity 20 to 70% (no condensation) |
| Circuit protection | Temperature sensor is built into handpiece.<br>Drive circuit is monitored for abnormalities caused by overload. |
| Weight | Main unit Approx. 260 g<br>Handpiece Approx. 70 g (including handpiece cable) |
| Power cable length | Total length 2.7 mm (adapter cable 1.5 m + AC cable 1.2 m) |
| Handpiece cable length | 1.6 m (straight) |

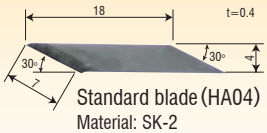
■ **Included accessories:** BDC-200P (1 case of 40 replacement blades *Blades with holes cannot be used), Blade fixture ZH04 (1 pc), Blade fixing screws HB03 (3 pcs), Hexagon wrench RR02 (1 pc)

## Main applications and usage examples

- Gate cutting and deburring plastic, small objects, and parts
- Cutting plastic models
- Cutting films, sheets, cloth, etc.
- Cutting substrate patterns

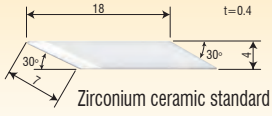
*1 The included power cable complies with regulations and safety standards in Japan (100 V).
If you intend to use this product outside Japan, purchase and use a power cable that complies with the relevant regulations and safety standards of your country or region.

## Ultrasonic cutter blade selection

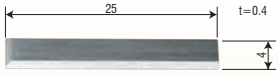



Standard blade (HA04)
Material: SK-2

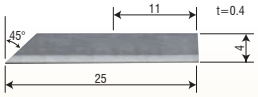

Carbide blade (HA07)
Material: Tungsten carbide
* Superior wear resistance, used in a wider range of applications than steel
* Not electrically conductive or magnetic



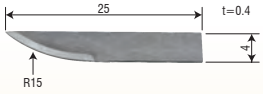

Zirconium ceramic standard blade (ZH48)
Material: Zirconium ceramic




Square blad (HA08) *1
Material: SKH
* Popular option for hole cutting processes




Long blade (ZH10) *1
Material: SKH




Round tip blade (ZH09)
Material: SKH


Round tip blade (HA10) *1
Material: SKH

*1 The effective length of the blade is 11 mm shorter when installed in the handpiece.

# Ultrasonic welder

**Using the vibrational energy of ultrasound for welding.**
Ultrasonic vibration generates frictional heat on objects at the point of contact, and the heat causes the material to melt and become welded.
No preheating is required, so the welder can be used as soon as it is turned ON. The lack of a heat source also makes it very safe to use. In addition, ultrasonic welders are well-suited for use in food packaging applications, because the absence of metal staples and adhesives eliminates the concerns for product contamination.

Portable ultrasonic welder

## SONAC-37

Sonic sealer


## Facilitates packaging operations with safe, energy-saving, eco-friendly design

- Ultrasonic vibration (approx. 60,000 cycles per second) enables safe and easy welding.
- The lightweight, compact handpiece is easy to use, and it fits into the unit for storage.
- No metal staples are used, which removes the risk of product contamination and eliminates the need to separate the waste materials after use.
- Durability is improved with empty welding prevention function.

| Model No. | SONAC-37 |
|---|---|
| Rated output | 20 W |
| Nominal oscillation frequency | 57 kHz |
| Power input | 100 V AC 50/60 Hz 30 W |
| Dimensions (W x D x H mm) Main unit: | 70 x 220 x 165 |
| (excluding protrusions) Handpiece: | 32 x 125 x 49 |
| Weight | 920 g |

Standard (YK01)

For creating a tamper-evident seal (YK02)
* A hole is created in the package when the seal is broken, making it easy to recognize whether or not the package has been opened.

■ **Included accessories:** Welder clasp (YK01)
- **Transducer:** Bolt-clamped Langevin type transducer
- **Effective welding range:** 6 x 3 mm
- **Output cable length:** 0.5 m (curled cable)
- **Protective equipment:** Thermostat, Empty welding prevention function
- **Power cable length:** 1.5 m
- **Option:** Welder clasp (YK02) P41

### Main applications and usage examples

- Food packaging (OPS, A-PET)
- Blister packages
- Temporary tacking of synthetic clothing
- Industrial film
- Sealing of plastic bags
- Resin tape (tags, garden tape)

- **Welding examples**


Food packaging


Non-woven cloth


Plastic bag


Net packaging

# Ultrasonic atomizer

Ultrasonic atomizer unit

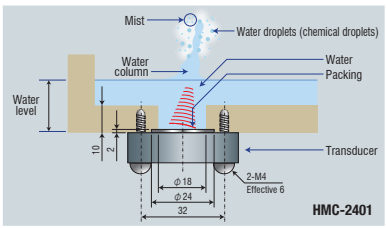
## HMC-2400

## HMC-2401

In an ultrasonic atomizer, ultrasonic energy is focused on the liquid surface to generate fine droplets that are dispersed as mist. When an ultrasonic transducer is aimed toward the liquid surface and strong ultrasonic vibration is applied, waves are produced at the center of the area with high acoustic pressure. When the ultrasonic wave energy is concentrated further, a liquid column is created. Fine waves, called capillary waves, are generated as standing waves on the surface of the liquid column. Droplets are formed from the crests of the waves, and they are dispersed as mist. This phenomenon is called atomization.

## Standard ultrasonic atomizer unit with wide range of application possibilities

- Fine mist generated by ultrasonic vibration can be used for various applications.
- Designed for use with hypochlorous acid solution (up to 50 ppm).




| Model No. | HMC-2400 | HMC-2401 |
|---|---|---|
| Nominal oscillation frequency | 2.4 MHz | |
| Power input | 24 V DC | |
| Consumption current | Approx. 550 mA | |
| Appropriate liquid level *1 | During normal use: 36±5 mm With horn installed: 43±5 mm | 32.5±5 mm |
| Mist production *2 | During normal use: Approx. 150 ml/h With horn installed: Approx. 360 ml/h | Approx. 190 ml/h |
| Atomized particle diameter | Approx. 3 μm | |
| Ultrasonic emission angle | 0° (Vertical) | Approx. 10° |
| Material Vibration plate: | Special coating | |
| Material Packing: | Viton | |
| Dimensions (W x D x Hmm) Transducer assembly: | 38 x 29 x 14 | |
| Dimensions (W x D x Hmm) Oscillation circuit board: | 38 x 30 x 39 | |
| Dimensions (excluding protrusions) Horn: | dia. 22 x 27 | — |
| Weight | Transducer assembly: Approx. 8 g | Oscillation circuit board: Approx. 17 g |

- **Operating water temperature range:** 10 to 40°C
- **Operating temperature range:** 5 to 35°C
- **Output cable length:** 145 mm
- **Power cable length:** 0.3 m

*1 From vibration surface to liquid surface *2 Atomization volume when operating in a standard water tank as measured by Honda Electronics, at a water temperature of 22°C.
*** Forced cooling is required, using a cooling fan for the heatsink on the oscillation circuit board.**

# Ultrasonic measuring instruments

## Using ultrasound in information processing applications

**Ultrasonic waves can be used in information processing applications by transmitting signals from an ultrasonic sensor through a medium (liquid, solid, or gas). Typical application examples include level meters, flowmeters, and non-destructive inspection devices.**

### Characteristics of ultrasound

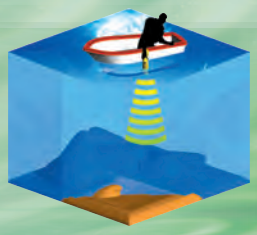
- The speed of sound is slower than that of radio waves and light, so measurement results are more accurate. Ultrasound is particularly useful when performing measurements in a solid or medium with low light transmittance, or when measuring distance to a transparent object that does not reflect light.
- Ultrasonic wavelengths are shorter and have better directivity than those at audible frequencies.
- Attenuation of ultrasonic waves is greater than that of audible frequencies, so the waves tend to travel shorter distances.

## Level meter

■Non-contact level measurement ▶page29
■Interface level measurement ▶page32


## Depth sounder

■Water depth measurement ▶page31

## Flowmeter

▶page34



### Level meter

**■Non-contact level measurement**
There is no physical contact between the sensor and surface, enabling continuous measurement of tank levels even under dusty conditions.

**■Interface level measurement**
The interface level can be measured in cloudy sewage water or in deep tanks, without dropping the sensor down to the sediment layer.

### Depth sounder

**■Water depth measurement**
The distance to the bottom surface is determined by emitting ultrasonic waves and measuring the echo return time, which is similar to how fish finders work.

### Flowmeter

Ultrasonic waves are used to measure the fluid velocity, which is then used to calculate the flow rate.

# Ultrasonic non-contact level measurement

**Principle**

Ultrasonic waves transmitted from the sensor are reflected back from the measured object, and the distance is calculated based on the echo return time. This makes it possible to perform operations such as measuring the liquid level inside a tank, or monitoring the remaining amount of materials in a tank.

**Distance = Speed of sound × Time**

The distance to the measured surface is calculated based on the speed of sound and the time elapsed between the transmission of the signal and the return of the echo. The distance to the bottom of the tank is set in advance, so that the amount of liquid remaining in the tank can be calculated.

**Advantages**

Levels can be monitored without any contact with the materials that are measured. Levels can be monitored continuously, even under dusty conditions.

## HD320


## HD323

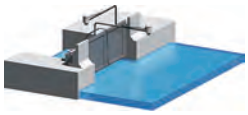

## Low-cost model with two-wire system, featuring a graphic LCD display

- Two-wire system reduces the cost of installation, wiring, and operation
- Graphic LCD display shows the A-mode waveform
- When performing measurements, masking can be applied to objects positioned between the sensor and target

### Main applications and usage examples

- Management of liquid level in tanks
- Management of sewage level inside pipes
- Measurement of water level in lakes, ponds, and rivers

■ Measurement of liquid level



■ Management of river water level

| Model No. | | HD320 / HD323 |
|---|---|---|
| Number of channels | | 1 |
| Frequency | | 50 kHz |
| Measurement target | | Liquid |
| Measurement distance range | | 0.25 to 7.5 m |
| Resolution | Measurement | 1 mm |
| | Display | 1 mm |
| Accuracy | | ±0.25% F.S. (±18.8 mm) |
| Data update cycle | | 10 sec |
| Sensor directivity angle | | 14° (-6 dB) 10° (-3 dB) |
| Power source | Voltage | 24 V DC ±10% |
| | Power consumption | 0.6 W |
| Display | | Graphic LCD |
| Display size | | HD320: LCD (28.1 x 9.1 mm) HD323: LCD (50 x 25 mm) |
| Output | 4 to 20 mA current output | Resolution: 12 bits (Max. load resistance 500Ω, 24 V) |

| | Main unit (Sensor) |
|---|---|
| Ambient operating temperature | -20 to +70°C |
| Material | PP (Polypropylene) |
| Protection standard | IP65 equivalent (Without lid: IP20 equivalent) |
| Dimensions | dia. 93 x 110 mm |
| Wiring cable length | 10 m |
| Weight | 350 g |
| Mounting screws (former JIS) | G2 (PF2) |

**What is a two-wire system?**

A two-wire system supplies electric power through the data line, so that the electrical wiring can be performed with only two lines (the power + data wire, and the ground wire).

**Use resin nuts, flanges, etc. for installation.**
**Do not use metal nuts, flanges, etc. Doing so may cause measurement errors.**

## HD350-A


## HD353-A


## Low-cost DSP level meter

- Graphic LCD display shows the A-mode waveform
- Wide measurement range, from 0.3 to 10 m
- When performing measurements, masking can be applied to objects positioned between the sensor and target
- Remote operation is enabled with RS-485 (MODBUS® protocol), 4 to 20 mA current output, and alarm output contact points

### Main applications and usage examples

- Management of liquid/powder levels in tanks
- Measurement of water level in lakes, ponds, and rivers

| Model No. | | HD350-A / HD353-A |
|---|---|---|
| Number of channels | | 1 |
| Frequency | | 50 kHz |
| Measurement target | | Liquid/powder |
| Measurement distance range (1/2 for powder) | | 0.3 to 10 m |
| Resolution | Measurement | 1 mm |
| | Display | 1 mm |
| Accuracy | | ±0.25% F.S. (±2.5 cm) |
| Data update cycle | | 0.5 sec |
| Sensor directivity angle | | 14° (-6 dB) 10° (-3 dB) |
| Power source | Voltage | 12 V - 24 V DC ±10% |
| | Power consumption | 3 W |
| Display | | Graphic LCD |
| Display size | | HD350: LCD (28.1 x 9.1 mm) HD353: LCD (50 x 25 mm) |
| Output | Alarm output | 1 point each for upper/lower |
| | 4 to 20 mA current output | Resolution: 12 bits (Max. load resistance 500Ω) |
| Interface | | Transmission distance: Max. 1200 m |

| | Main unit (Sensor) |
|---|---|
| Ambient operating temperature | -20 to +70°C |
| Material | PP (Polypropylene) |
| Protection standard | IP65 equivalent (Without lid: IP20 equivalent) |
| Dimensions | dia. 93 x 110 mm |
| Wiring cable length | 10 m |
| Weight | 350 g |
| Mounting screws (former JIS) | G2 (PF2) |

**Option** ● **30 m cable (HD-002)** P41

* MODBUS is the registered trademark of Schneider Electric USA, Inc.

**Use resin nuts, flanges, etc. for installation.**
**Do not use metal nuts, flanges, etc. Doing so may cause measurement errors.**

# HD1200



## Equipped with DSP that achieves stable measurement

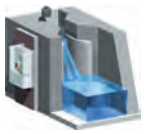
- A unique level detection algorithm is achieved with DSP, which enables stable measurement by eliminating the effects of noise and unwanted reflection
- Two sensors can be connected to the main unit at the same time, so measurement can be performed at two separate locations with different measurement ranges
- Log data can be stored on a micro SD™ card
- Standard-equipped with a weir type flowmeter function

### Main applications and usage examples

- Management of liquid/powder levels in tanks
- Measurement of water level in lakes, ponds, and rivers
- Weir type flow measurement


■ Measurement of liquid level


■ Measurement of powder level


■ Application in large capacity weir

| Model No. | | HD1200 |
|---|---|---|
| Number of channels | | 2 |
| Frequency | | 10 to 60 kHz (selected according to sensor specifications) |
| Measurement target | | Liquid/powder |
| Resolution | Measurement | 1 mm |
| | Display | 1 mm |
| Accuracy | | ±0.25% F.S. |
| Data update cycle | | Approx. 2 sec (varies depending on sensor specifications) |
| Power source | Voltage | 100 V - 240 V AC ±10% |
| | Power consumption | 10 VA |
| Display | | LCD display (with backlight) |
| Output | Alarm output | 4 points per channel<br>250 V AC, 5 A (relay contact) |
| | 4 to 20 mA current output | Resolution: 1/4000<br>(Max. load resistance 600Ω) |
| Interface | | RS485 (Transmission distance: Max. 1200 m)<br>RS232C (Transmission distance :Max. 10 m) |
| External memory | | microSD™ |

| Model No. | HD1200 |
|---|---|
| Ambient operating temperature | -20 to 70°C |
| Material | ABS |
| Structure | IP66 equivalent |
| Dimensions (W x D x H mm) | 176 x 84 x 237 |
| Weight | 1.8 kg |

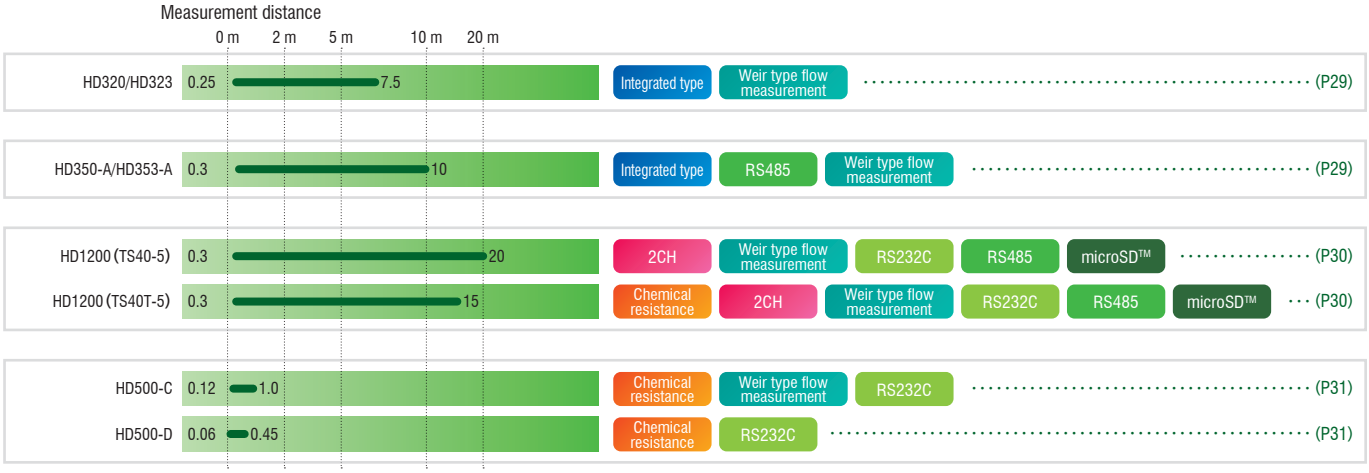
**Note: Weir type flowmeter is available for CH1 only.**

* microSD™ is the trademark or registered trademark of SD Card Association.

| Model No. | Sensor | |
|---|---|---|
| | TS40-5 | TS40T-5 |
| Frequency | 40 kHz | |
| Measurement distance range (1/2 for powder) | 0.3 to 20 m | 0.3 to 15 m |
| Sensor directivity angle | 12°(-6 dB)<br>8°(-3 dB) | 22°(-6 dB)<br>16°(-3 dB) |
| Ambient operating temperature | -20 to 70°C | |
| Material | Epoxy/silicone/PP | PVDF |
| Structure | IP68 equivalent | IP68 equivalent |
| Dimensions | dia. 84 x 90mm | dia. 98 x 87 mm |
| Sensor cable length | 5 m | |
| Weight | 500 g | 860 g |
| Sensor mounting screws (former JIS) | R1 (PT1) | G1 (PF1) |

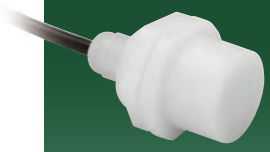
• The sensors cannot be used in a hydrofluoric acid environment.
* Contact us if sensor cable extension is required.

## Ultrasonic level meter selection guide




* Please select the model that the desired measurement distance is around the middle of covering range.

# HD500 Series

Standard Sensor

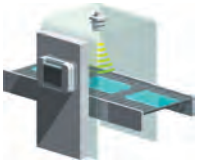
## Chemical-resistant resin (PFA) sensor enables use with chemicals, and short distances can be measured with accuracy

- Use of high frequency minimizes the dead zone and enables measurement of short distances
- RS232C, 4 to 20 mA current output, and alarm output contacts facilitate integration into various systems

### Main applications and usage examples

- Management of liquid level in small tanks
- Detection and positioning of objects on production lines

■ Measurement of liquid level in small tank



■ Detection of glass wafers

| Model No. | | HD500-C | HD500-D |
|---|---|---|---|
| Number of channels | | 1 | |
| Frequency | | 200 kHz | 400 kHz |
| Measurement target | | Liquid | |
| Measurement distance range | | 0.12 to 1.0 m | 0.06 to 0.45 m |
| Resolution | Measurement | 0.1 mm | |
| | Display | 0.1 mm | |
| Accuracy | | ±0.25% F.S. (±0.25 cm) | ±0.25% F.S. (±0.1 cm) |
| Data update cycle | | 0.05 sec | |
| Sensor directivity angle | | 10° (-6 dB) 7° (-3 dB) | 5° (-6 dB) 4° (-3 dB) |
| Power source | Voltage | 12 V - 24 V DC ±15% | |
| | Power consumption | 3 W (500 mA when started) | |
| Display | | 4-digit LED | |
| Output | Alarm output | 2 points each for upper/lower 30 V DC 0.1 A (NPN open collector) | |
| | 4 to 20 mA current output | Resolution: 16bit (Max. load resistance 450Ω) | |
| Interface | | RS232C (Transmission distance: Max. 10 m) | |

| | Main unit | Sensor |
|---|---|---|
| Ambient operating temperature | 0 to 50°C | |
| Material | ABS | PFA Cable: FEP CAPCON: PVDF CAPCON inner seal: PPE-V |
| Structure | IP43 equivalent | IP65 equivalent |
| Dimensions (W x D x H mm) | 113 x 52.5 x 94 | dia. 42 x 39 |
| Sensor cable length | — | 2 m |
| Max. sensor cable length | — | 2 m |
| Wiring cable length | Not provided | — |
| Weight | 300 g | 150 g |
| Sensor mounting screws (former JIS) | — | M32 P1.0 |

- **Only the HD500-C is standard-equipped with the weir type flowmeter function**
  The flow rate can also be measured for a triangular weir

# Water depth measurement

Ultrasonic Depth sounder

# PS-7 Series


PS-7

Float sensor

PS-7FL

**Principle**

Ultrasonic waves are transmitted from a sensor placed in water, and the depth is calculated based on the amount of time it takes for the echo to return from the bottom surface (river or sea floor).

**Distance = Speed of sound × Time**

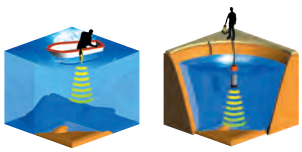
The distance to the measured surface is calculated based on the speed of sound and the time elapsed between the transmission of the signal and the return of the echo.

## Equipped with a float sensor that enables water depth measurement even when the surface is out of reach

- Durable and easy to use, with an impact-resistant design that is waterproof to 50 m (PS-7)
- To operate, simply press and hold the switch on the case for 2 to 3 seconds, and aim the sensor in the desired direction

* Measurement may not be performed properly if slime, seaweed, or other materials are present in the water.

- The unit is powered by a dry-cell battery (006P). Power automatically turns OFF approx. 10 seconds after releasing the power switch
- Equipped with high impact-resistant float sensor. The 10 m cable enables depth measurement from a distance (PS-7FL)



### Main applications and usage examples

- Measurement of water depth at construction sites
- Measurement of water depth at survey sites

| Model No. | PS-7 | PS-7FL |
|---|---|---|
| Number of channels | 1 | |
| Frequency | 200 kHz | |
| Measurement target | Bottom underwater surface | |
| Measurement range | 0.6 to 80 m | |
| Sensor directivity angle (half of full angle of sound pressure) | 24° | 15° |
| Power source | 9 V DC (006P dry-cell battery) | |
| Display | LCD display (with backlight) | |

| Model No. | PS-7 | PS-7FL |
|---|---|---|
| Ambient operating temperature | 0 to 50°C | |
| Dimensions (mm) | dia. 42 x 198 | main unit: dia. 42 x 198 Float sensor: dia. 50 x 140 |
| Sensor cable length | – | 10 m |
| Weight | 190 g | main unit: 170 g Float sensor: 320 g |

# Ultrasonic interface level measurement

Ultrasonic interface level meter

# HL2000


**Principle**

One characteristic of ultrasonic waves is that they reflect off the interfaces between different media. When ultrasonic waves are transmitted from a sensor placed in water, the position of an interface can be calculated based on the amount of time it takes for the echo to return from the interface.

**Advantages**

Measurement is performed without having to make contact with the sediment. The interface level can be measured in cloudy sewage water or in deep tanks, without dropping the sensor down the sediment layer.

## Enables stable measurement of sludge interface in sedimentation tanks

- Non-contact measurement is performed with a stationary sensor, which eliminates the risk of the sensor interfering with the rake. The sensor also does not disturb the interface, enabling long-term stable measurement
- Distances of 0.4 to 10 m from the sensor transmission surface can be measured
- Two sensors can be connected to the unit at the same time, so interface measurements can be performed at two locations (The second sensor is optional)

### Main applications and usage examples

- Management of interfaces in sedimentation tanks at industrial wastewater treatment facilities
- Management of interfaces in sedimentation tanks at sewage treatment facilities

| Model No. | | HL2000 |
|---|---|---|
| Number of channels | | 2 |
| Frequency | | 400 kHz |
| Measurement target | | Sludge interface |
| Measurement distance range | | 0.4 to 10 m |
| Resolution | Measurement | 1 cm |
| | Display | 1 cm |
| Data update cycle | | 1 sec |
| Sensor directivity angle (half of full angle of sound pressure) | | 6° |
| Power source | Voltage | 100 V - 240 V AC ±15% |
| | Power consumption | 10 VA |
| Display | | LCD display (with backlight) |
| Output | Alarm output | 2 points each for upper/lower channel 250 V AC, 30 V DC, 5 A (relay contact) |
| | 4 to 20 mA current output | Resolution: 16 bits, 1 point per channel (Max. load resistance 450Ω) |
| Interface | | RS232C (Transmission distance: Max. 10 m) |

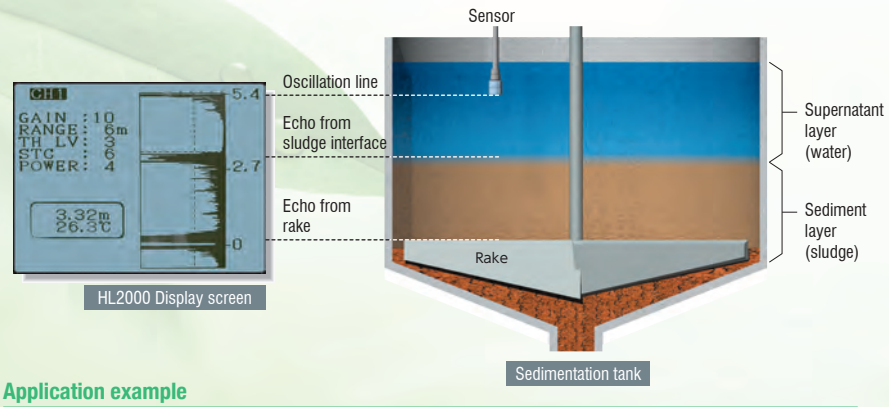
| | Main unit | sensor |
|---|---|---|
| Ambient operating temperature | -10 to 60°C | -5 to 60°C |
| Material | Painted steel | Case: PVC<br>Cable: PVC |
| Structure | IP54 equivalent | IP68 equivalent |
| Dimensions (W x D x H mm) | 280 x 92.5 x 322 | dia. 80 x 95 |
| Sensor cable length | — | 20 m |
| Max. sensor cable length | — | 100 m* |
| Weight | 3.6 kg | 2.2 kg |

*** Contact us if sensor cable extension is required.**

Option • **Cleaning nozzle**

### Ultrasonic interface level meter concept and application example

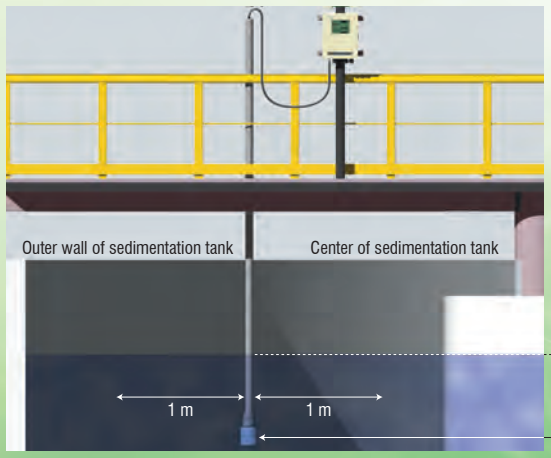
#### Concept




HL2000 Display screen

Sedimentation tank

#### Application example




#### Sensor cleaning procedure

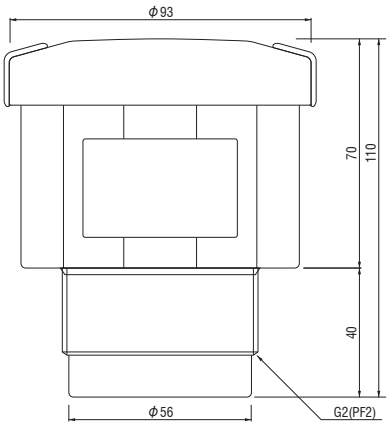
- Contamination on the sensor surface interferes with sludge interface measurement. Use the cleaning nozzle to keep the sensor clean.
- Constantly supply water to the cleaning nozzle. (The recommended flow rate is 20 L/min.)

# Outline drawings



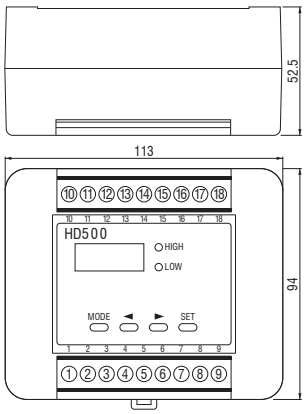
## ■HD320・HD323・HD350-A・HD353-A

### ■Main unit (Sensor)

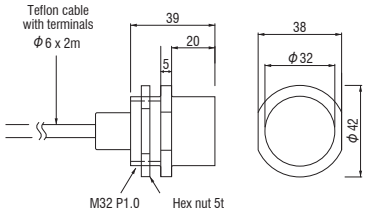



## ■HD500-C /D

### ■Main unit

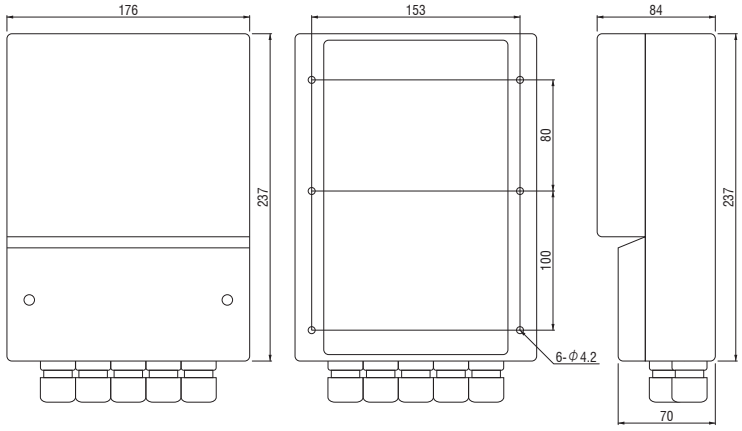



### ■Standard Sensor

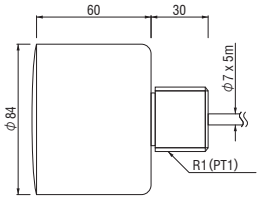



## ■HD1200

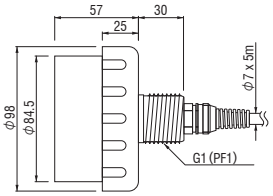
### ■Main unit




### ■TS40-5

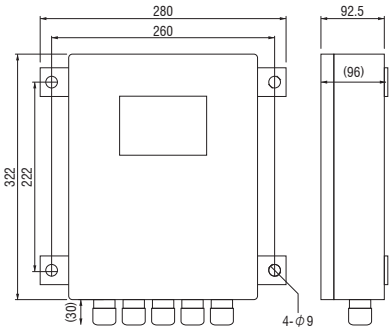



### ■TS40T-5

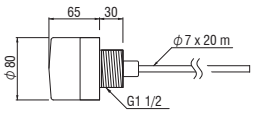



## ■HL2000

### ■Main unit

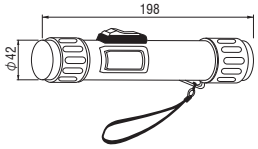



### ■Sensor

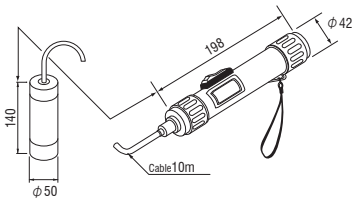



## ■PS-7/7FL

### ■Main unit (PS-7)




### ■Main unit (PS-7FL)



# Ultrasonic flow measurement

Ultrasonic flowmeter

# HLF800 Series

Converter HLF810

Converter HLF820

**Principle**

Propagation time difference measurement method: Ultrasonic waves are used to measure the fluid velocity, which is then used to calculate the flow rate.
Sensors installed upstream and downstream transmit ultrasonic waves to each other in the forward and reverse directions of flow. The fluid velocity is determined based on the differences between the arrival times of the ultrasonic waves at each sensor, and this velocity is used to calculate the flow rate.

**Advantages**

- No structures are placed in the piping, so the flow rate can be measured with minimal pressure loss.
- A wide range of flow rates can be measured, from high to low.

## Equipped with a digital signal processor that enables high-precision, stable flow measurement

- Stable flow measurement is achieved with our unique signal arithmetic processing method performed by a digital signal processor (DSP)
- The ability to use two channels saves space and improves cost effectiveness
- Wiring work is simplified with detachable sensors and cables
- With no moving parts in the flow path, there is minimal pressure loss
- The use of NEW PFA on all liquid contact surfaces provides high corrosion resistance, which is suitable for measuring the flow rates of DIW or chemical liquids
- Complies with EMC (EN 61326) and RoHS directives
- Able to select from models with a display (HLF820) or without a display (HLF810)

### Main applications and usage examples

- Measuring the flow of deionized water or ultrapure water for semiconductor manufacturing processes
- Managing the flow of highly corrosive chemical liquids used in chemical treatment processes
- Measuring the flow of slurry liquids for chemical mechanical polishing (CMP) processes

Patented

CE

### Converter

| Model No. | | HLF810 | HLF820 |
|---|---|---|---|
| Measurement method | | Measuring propagation time difference between sending and receiveng ultrasonic wave | |
| Accuracy | | ±1% F.S. (DIW at 20°C) | |
| Data update cycle | | 0.01 sec | |
| Power source | Voltage | 24 V DC ±10% (21.6 to 26.4 V) | |
| | Power consumption | 4 W | 5 W |
| Display | | — | Vacuum fluorescent display (VFD), 16 characters x 2 lines |
| Digital input | | Open collector input or non-voltage contact input, 2 points<br>Selectable from integrated value reset or zero-point adjustment | |
| Output | 4 to 20 mA current output | 2 points<br>Resolution: 12 bits (Max. load resistance 600Ω) | |
| | Digital output | Open collector output (Max. 35 V/0.1 A), 2 points<br>Selectable from comparison, integrated pulse, instantaneous frequency, or error output | |
| Interface | | RS485 (MODBUS® protocol, RTU mode)<br>Up to 32 converters can be concatenated (Address setting: 1 to 32)<br>Baud rate: 9600,19200,38400,57600bps | |
| Case material | | ABS | |
| Ambient operating temperature | | 0 to 50°C (No condensation) | |
| Weight | | 130 g | 230 g |
| Installation method | | DIN rail | Panel mount |

* MODBUS is the registered trademark of Schneider Electric USA, Inc.

### Sensor

| Model No. | | HLFS01-04 | HLFS01-06 | HLFS01-08 | HLFS01-12 | HLFS01-16 |
|---|---|---|---|---|---|---|
| Measurement target | | Ultrapure water/Deionized water/Chemical liquids | | | | |
| Flow rate measurement range | | 0 to 2 L/min | 0 to 6 L/min | 0 to 20 L/min | 0 to 50 L/min | 0 to 80 L/min |
| Connection tube size | | 1/4" | 3/8" | 1/2" | 3/4" | 1" |
| Max. operating pressure | | 0.5 MPa (0 to 90°C) /0.2 MPa (90 to 200°C) | | | | *1 |
| Fluid temperature | Standard type | 0 to 90°C | | | | — |
| | High-temperature type | 0 to 180°C | 0 to 200°C | | | |
| Ambient operating temperature | | 0 to 80°C | | | | |
| Liquid contact surface material | | NEW PFA | | | | |
| Weight | | 90 g | 110 g | 130 g | 160 g | 212 g |
| Pressure loss factor | | 3.7863 | 0.6937 | 0.1146 | 0.0138 | 0.0033 |

*1 0.5 MPa (0 to 60°C) /0.2 MPa (60 to 200°C)

Pressure loss

$\Delta P = AQ^2$ ΔP: Pressure loss[kPa] A: Pressure loss factor (DIW at 20°C) Q: Flow rate[L/min]

### Connection cable between converter and sensor

| Model No. | HLFS01 cable 5 m | HLFS01 cable 7 m |
|---|---|---|
| Material | ETFE | |
| Length | 5 m | 7 m |
| Weight | 150 g | 210 g |

### Type name and specifications

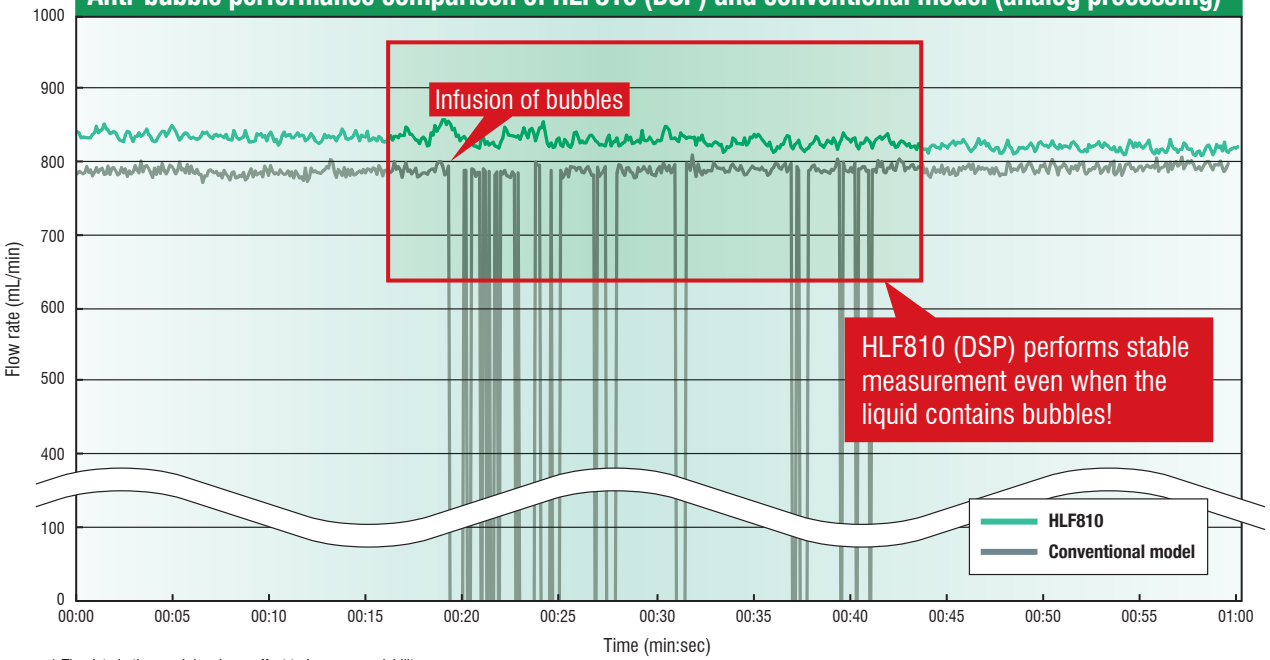
HLFS01-○○△□

**Applicable temperature** None: Standard, 0 to 90°C
K: High-temperature, 0 to 200°C (or up to 180°C for 04 type)

**Shape** U: U-shape Z: Z-shape

**Connection tube size** 04: 1/4″
06: 3/8″
08: 1/2″
12: 3/4″
16: 1″
* See table above for flow rates

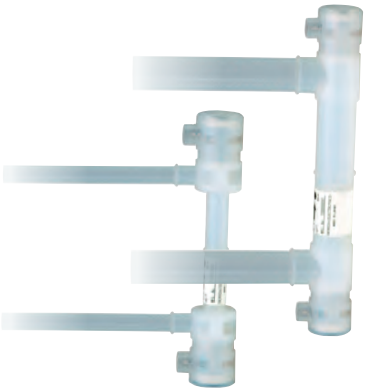
## Anti-bubble performance comparison of HLF810 (DSP) and conventional model (analog processing)




* The data in the graph has been offset to improve readability.

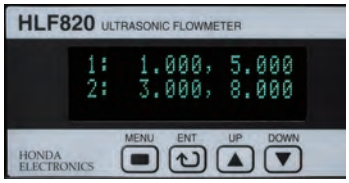
## Two different sizes of sensors can be connected to the same converter

The ability to connect two sensors to one converter saves space and improves cost performance, by enabling flow rates to be measured at multiple locations. The sensors can be used to measure the flow rates of different fluids, or different sizes of sensors can be connected.



## Equipped with VFD display

The vacuum fluorescent display (VFD) provides excellent visibility. (HLF820 only)

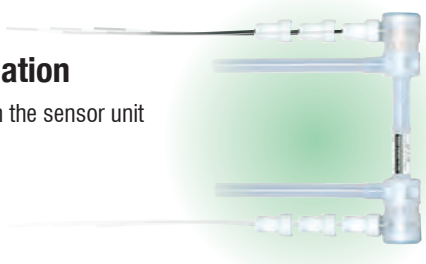



## Supports measurement of high-temperature chemical liquids

Suitable for use in recent applications that incorporate a diversity of chemicals at a wide range of temperatures. All liquid contact surfaces are made of NEW PFA, which provides excellent chemical resistance. Our self-developed transducers enable flow measurement at high temperatures of up to 200°C (K type). *The maximum temperature for the 04 size model is 180°C.

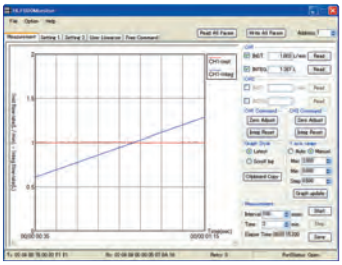
## Detachable cables enable easy installation

Setup is simplified with cables that can be detached from the sensor unit before installation, and then reattached later.
Cable lengths of 5 m or 7 m can be selected.



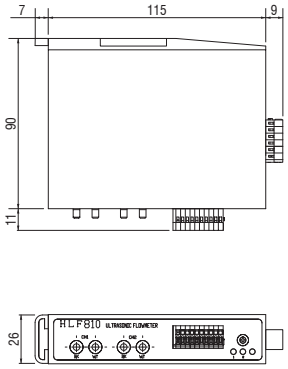
## RS-485 enables remote monitoring via computer

With the standard-equipped RS-485 communication function, the dedicated control software (HLF800 Monitor) can be used on a computer to set the parameters and monitor the flow rate data remotely.

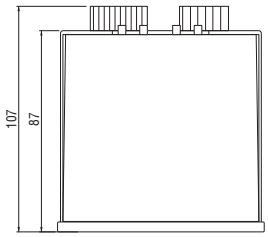


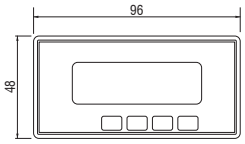
## HLF810/820

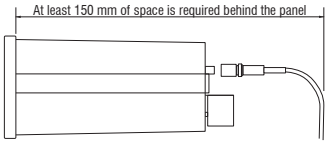
### Converter (HLF810)



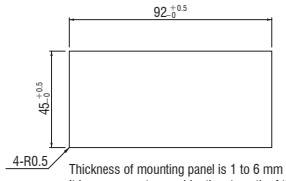

### Converter (HLF820)



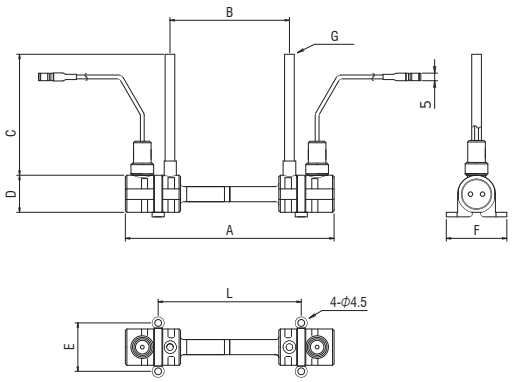

Dimensional drawing of mounting holes

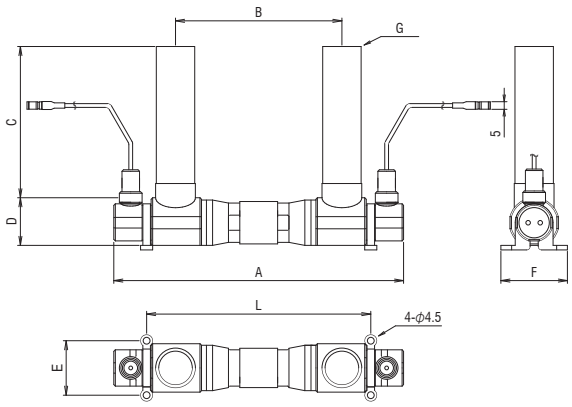



Thickness of mounting panel is 1 to 6 mm
It is necessary to consider the strength of the mounting panel material

### Sensor (HLFS01)

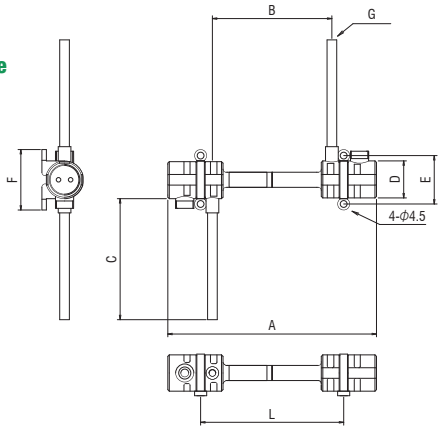
#### U-shape

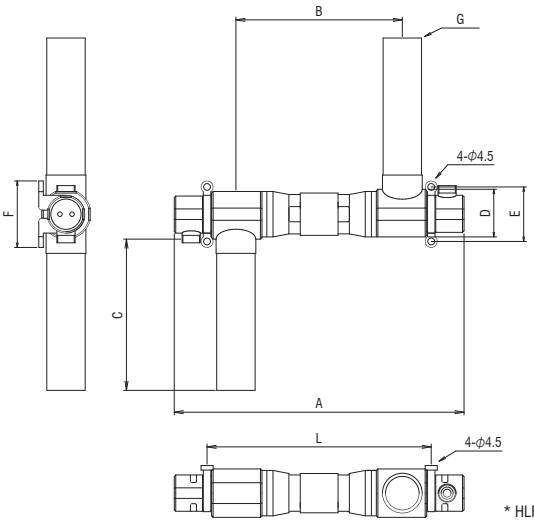



* HLFS01-16 only

#### Z-shape




* HLFS01-16 only

| Model No. | A | B | C | D | E | F | G | L |
|---|---|---|---|---|---|---|---|---|
| HLFS01-04 | 138 | 80 | 80 | 24.5 | 32 | 40 | 1/4" | 94.6 |
| HLFS01-06 | 145 | 80 | 100 | 24.5 | 32 | 40 | 3/8" | 101.6 |
| HLFS01-08 | 178 | 110 | 100 | 24.5 | 32 | 40 | 1/2" | 134.6 |
| HLFS01-12 | 184 | 110 | 100 | 24.5 | 32 | 40 | 3/4" | 140.6 |
| HLFS01-16 | 192 | 110 | 100 | 31.5 | 36 | 44 | 1" | 148.2 |

(Unit: mm)

* Actual product dimensions may vary slightly from those provided here.

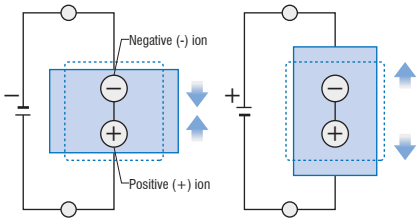
# Transducers - Piezoelectric ceramics -

Using piezoelectric ceramics in ultrasonic cleaners

For processing equipment

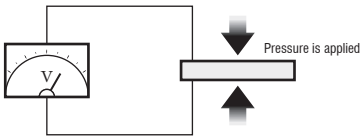
## Bolt-clamped Langevin type transducers

Ordinary sound is generated by the vibrations that occur when an object is struck. However, a special method is required to generate high frequency sound such as ultrasound. By attaching electrodes to a vibration element (ceramic) and applying AC voltage, the element expands and contracts repeatedly to generate vibrations that produce ultrasound. Conversely, when pressure is applied to the vibration element, voltage is generated between the electrodes. This phenomenon is called the piezoelectric effect, and this type of element is called an electro-acoustic conversion element or transducer. Piezoelectric ceramics are polycrystalline ceramics that consist of high-purity powders (titanium oxide, barium oxide, etc.) sintered at high temperatures. When polarization treatment is applied, this type of ceramic acquires the same piezoelectric properties exhibited by single-crystal materials such as quartz. These piezoelectric ceramics have unlimited potential for use in electronics and ultrasonic sensors.



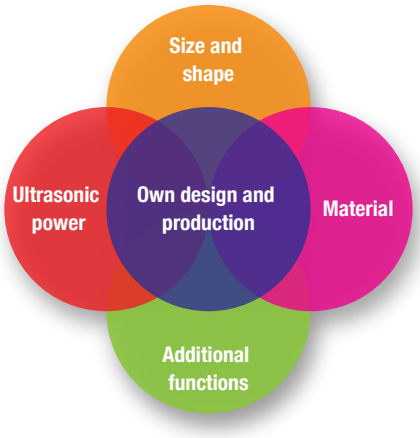

Element contracts when negative voltage is applied at top and positive voltage is applied at bottom

Element expands when positive voltage is applied at top and negative voltage is applied at bottom




## Our strong point

Honda Electronics produces transducers from piezoelectric ceramic materials. Our unique self-developed transducers are designed and manufactured to achieve optimum performance with excellent quality, low cost, and quick delivery, and they are incorporated into our own ultrasonic products.




### Transducer design based on FEM analysis

**Variety of specially designed ultrasonic transducers**

The shape and performance of ultrasonic transducers are optimized to suit the application

**Special material**

HEC-1540P4HFD

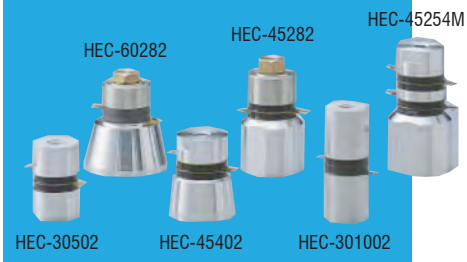
**Special shape**

HEC-1560P2HFE

**Special processing**

HC-2024

# Bolt-clamped Langevin type transducers




## Using piezoelectric ceramics in ultrasonic cleaners

Piezoelectric ceramics are mechanically connected in series, which makes them robust and capable of high-amplitude oscillation without damage. In addition, due to the high electro-acoustic conversion efficiency and low heat generation, stable operation is achieved even at high temperatures.

### PZT type

| Model No. | Weight (g) | Diameter (mm) | Length (mm) | Bolt size | Frequency (kHz) | Measurement voltage (Vrms) | Impedance (Ω) | Electrostatic capacity (pF) | Allowable input power (W)*1 |
|---|---|---|---|---|---|---|---|---|---|
| HEC-45282 | 395 | 45 | 80 | M10 P1.0 | 28 | 1.0 | 35 or less | 3300 | 50 |
| HEC-60282 | 410 | 60 | 68 | M10 P1.0 | 28 | 1.0 | 35 or less | 3300 | 50 |
| HEC-45402 | 225 | 45 | 54 | M10 P1.0 | 40 | 1.0 | 35 or less | 3300 | 50 |
| HEC-45254M | 385 | 45 | 88 | M10 P1.0 | 25・45 | 1.0 | 30 or less | 6600 | 50 |
| HEC-30502 | 130 | 31.5 | 50 | M10 P1.0 | 50 | 1.0 | 30 or less | 2100 | 30 |
| HEC-45752 | 395 | 45 | 80 | M10 P1.0 | 70.5 | 1.0 | 45±30 | 3300 | 30 |
| HEC-301002 | 175 | 30 | 74 | M10 P1.0 | 108 | 1.0 | 50 or less | 2600 | 30 |
| HEC-421002 | 250 | 42 | 61 | M10 P1.0 | 127 | 1.0 | 30 or less | 3300 | 50 |
| HEC-422002 | 250 | 42 | 61 | M10 P1.0 | 231 | 1.0 | 200 or less | 3300 | 50 |

(Measurement condition : Room temperature 25±3°C) *1 Reference power value.

### Lead-free type

brand name LEAD OFF™

| Model No. | Weight (g) | Diameter (mm) | Length (mm) | Bolt size | Frequency (kHz) | Measurement voltage (Vrms) | Impedance (Ω) | Electrostatic capacity (pF) | Allowable input power (W)*1 |
|---|---|---|---|---|---|---|---|---|---|
| HEC-45282Z | 395 | 45 | 80 | M10 P1.0 | 28 | 1.0 | 75±25 | 1300 | 50 |
| HEC-45284Z | 405 | 45 | 85 | M10 P1.0 | 28 | 1.0 | 40±20 | 3300 | 50 |
| HEC-45382Z | 270 | 45 | 60 | M10 P1.0 | 38.5 | 1.0 | 70±25 | 1300 | 50 |

(Measurement conditions: Room temperature 25±3°C)

"LEAD OFF" is Honda Electronics' brand name of lead-free piezoelectric ceramics.

**◆Installation torque for each vibration plate thickness**

| Vibration plate thickness (mm) | Installation torque (N•m)*2 |
|---|---|
| 1.0～1.5 | 5 |
| 1.6～2.0 | 8 |
| 2.1～3.0 | 10 |

*2 The installation torque values are for reference only.

## Using piezoelectric ceramics in processing equipment

Our original structural design achieves high-amplitude oscillation with a high electro-acoustic conversion efficiency, minimal mechanical vibration loss, and low heat generation.

### PZT type

| Model No. | Weight (g) | Diameter (mm) | Length (mm) | Bolt size | Frequency (kHz) | Measurement voltage (Vrms) | Admittance (mS) | Electrostatic capacity (pF) | Allowable input power (W)*1 | Transmission installation torque (N・m)*2 |
|---|---|---|---|---|---|---|---|---|---|---|
| HEC-1340P4BF | 30 | 13 | 65 | M6 P0.75 | 40 | 5 | 15 | 2000 | 20 | 7 |
| HEC-1540P2BF | 40 | 15 | 67 | M6 P0.75 | 40 | 10 | 10 | 850 | 30 | 7 |
| HEC-1560P4B | 30 | 15 | 39 | M5 P0.5 | 60 | 5 | 40 | 2000 | 50 | 5 |
| HEC-2528P2BF | 165 | 25 | 88 | M8 P1.0 | 28 | 10 | 25 | 2300 | 150 | 15 |
| HEC-2528P4B | 180 | 25 | 89 | M10 P1.0 | 28 | 10 | 40 | 4300 | 300 | 20 |
| HEC-3020P2B | 310 | 30 | 130 | M10 P1.0 | 20 | 10 | 20 | 2900 | 200 | 20 |
| HEC-3028P2BF | 225 | 30 | 90 | M10 P1.0 | 28 | 10 | 20 | 3000 | 200 | 20 |
| HEC-3028P4B | 280 | 30 | 88 | M10 P1.0 | 28 | 10 | 45 | 5750 | 400 | 20 |
| HEC-3039P4B | 115 | 30 | 60 | M10 P1.0 | 39 | 1 | 200 | 7600 | 300 | 20 |
| HEC-4020P4B | 570 | 40 | 125 | M16 P1.0 | 20 | 10 | 100 | 8400 | 500 | 70 |
| HEC-4027P4B | 445 | 40 | 90 | M16 P1.0 | 27 | 10 | 150 | 10000 | 500 | 70 |
| HEC-4028P4BH | 435 | 40 | 90 | M10 P1.0 | 28 | 10 | 150 | 10000 | 500 | 20 |
| HEC-5020P4B | 925 | 50 | 127 | M18 P1.5 | 20 | 10 | 200 | 15500 | 700 | 80 |
| HEC-5020P6B | 980 | 50 | 124 | M18 P1.5 | 20 | 10 | 250 | 23000 | 1000 | 80 |
| HEC-6015P4B | 1800 | 60 | 161 | M20 P1.5 | 15 | 10 | 150 | 10500 | 1500 | 100 |
| HEC-7015P4B | 2590 | 70 | 164 | M24 P1.5 | 15 | 10 | 250 | 20000 | 2000 | 110 |

(Measurement conditions: Room temperature 25±3°C) *1 Reference power value. *2 The installation torque values are for reference only.

### High-power type

| Model No. | Weight (g) | Diameter (mm) | Length (mm) | Bolt size | Frequency (kHz) | Measurement voltage (Vrms) | Admittance (mS) | Electrostatic capacity (pF) | Allowable input power (W)*1 | Transmission installation torque (N・m)*2 |
|---|---|---|---|---|---|---|---|---|---|---|
| HEC-5020P4BW | 973 | 50 | 127 | M18 P1.5 | 20 | 10 | 260 | 12900 | 900 | 80 |
| HEC-5020P6BW | 1020 | 50 | 124 | M18 P1.5 | 20 | 10 | 360 | 19200 | 1200 | 80 |

(Measurement condition : Room temperature 25±3°C) *1 Reference power value. *2 The installation torque values are for reference only.

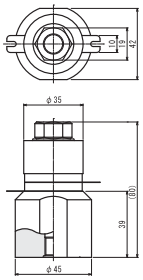
* These are made-to-order products. Contact us for details about delivery times.
* Contact us with inquiries about manufacturing products to custom specifications not described in this catalog.

# Outline drawings

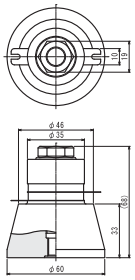
## Using piezoelectric ceramics in ultrasonic cleaners

### PZT type

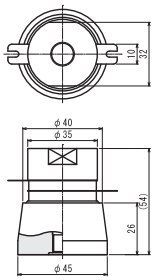
■HEC-45282



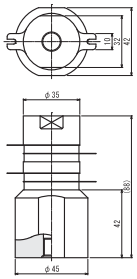
■HEC-60282



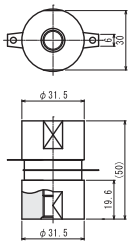
■HEC-45402



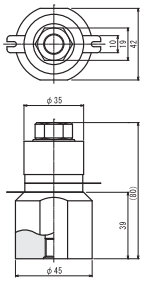
■HEC-45254M



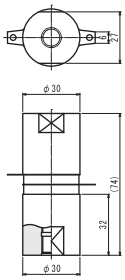
■HEC-30502



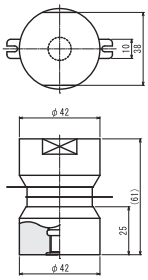
■HEC-45752



■HEC-301002



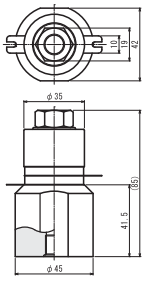
■HEC-421002
HEC-422002



brand name LEAD OFF™

### Lead-free type

■HEC-45282Z



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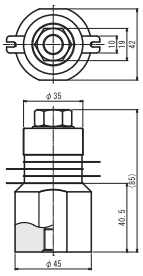

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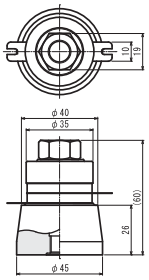
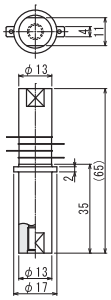
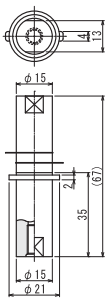


## Using piezoelectric ceramics in processing equipment

HEC-1340P4BF



HEC-1540P2BF



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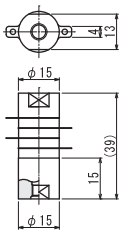

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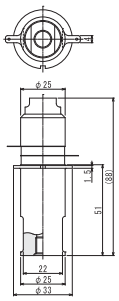

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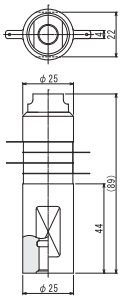

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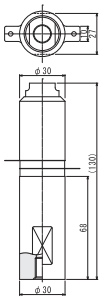

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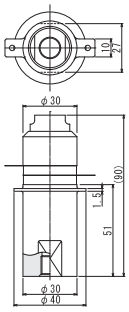

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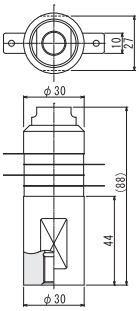

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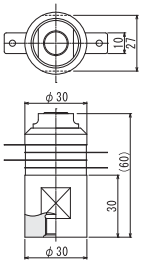

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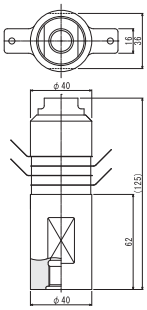

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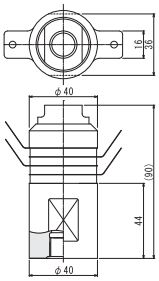

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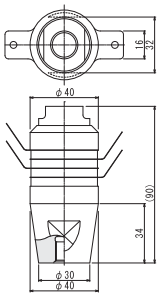

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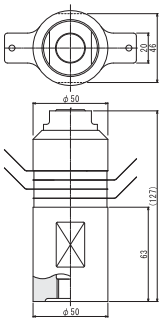

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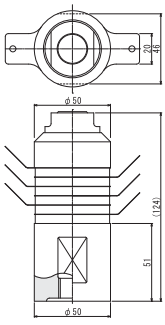

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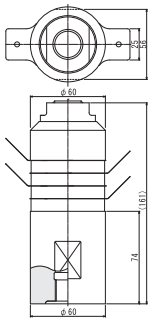

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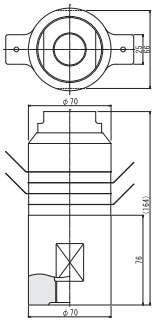

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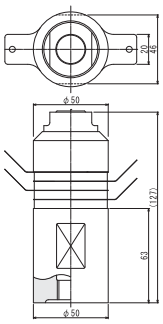

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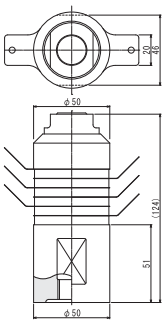

(Unit: mm)

# Optional Parts

## Options for ultrasonic cleaners

### Cleaning basket

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| KG03F |  195 x 105 x 50 | W-113MK Ⅱ | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |
| KG04F |  195 x 105 x 94 | WT-100-M | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |
| KG06F |  255 x 195 x 101 | WT-200-M | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |
| KG07F |  450 x 250 x 128 | WT-300-M | Mesh: 2.5<br>Pitch: 9 mm<br>SUS304 |
| KG08T |  370 x 310 x 208 | WTC-600-40 | Mesh: 2.5<br>Pitch: 9 mm<br>SUS304 |
| KG09T |  580 x 360 x 208 | WTC-1200-40 | Mesh: 2.5<br>Pitch: 9 mm<br>SUS304 |
| KG10F |  355 x 235 x 170 | WDX-600- Ⅰ<br>WA-600 Series | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |
| KG11T |  470 x 270 x 163 | WDX-1200- Ⅰ<br>WA-1200 Series | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |
| KG15F |  260 x 200 x 135 | WV-231S | Mesh: 4<br>Pitch: 5.45 mm<br>SUS304 |

### Lid

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| FT01 |  263 x 162 x 32 | WT-100-M | SUS304 |
| FT03 |  320 x 263 x 30 | WT-200-M | SUS304 |
| FT04 |  527 x 324 x 30 | WT-300-M | SUS304 |
| FT05 |  440 x 390 x 1.2 | WTC-600-40 | SUS304 |
| FT06 |  650 x 440 x 1.2 | WTC-1200-40 | SUS304 |

### Beaker rack

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| BR01 |  245 x 146 2 holes (ϕ 90.5) | W-113MK Ⅱ | PP<br>(Polypropylene) |
| BR02 |  255 x 155 2 holes (ϕ 90.5) | WT-100-M | PP<br>(Polypropylene) |
| BR03 |  315 x 255 4 holes (ϕ 90.5) | WT-200-M | PP<br>(Polypropylene) |
| BR04 |  520 x 315 8 holes (ϕ 90.5) | WT-300-M | PP<br>(Polypropylene) |
| BR06 |  270 x 215 x 169 (ϕ 90.5) | WV-231S | PP<br>(Polypropylene) |

### Stand

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| DA01 |  593 x 403 x 250 | WTC-600-40 | SUS304 |
| DA02 |  793 x 453 x 250 | WTC-1200-40 | SUS304 |

### I/O remote cable

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| |  5 m | WSC Series<br>WSC(M) Series | |

### Transducer connection terminal block

| Model No. | Compatible models | Remarks |
|---|---|---|
|  | WDX Series<br>WA Series<br>WSC Series<br>WSC(M) Series | |

### Beaker

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| BK02 |  ϕ 90.3 x 120 500 cc | W-113MK Ⅱ<br>WT-100-M<br>WT-200-M<br>WT-300-M | Beaker rack<br>(BR01～BR05) |

### Point sensing cover

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| PS01 |  Inner diameter: 7.5 mm | HUS-3 | Fluorine resin<br>Packing:<br>Perfluoro elastomer |

### Battery

| Model No. | Compatible models | Remarks |
|---|---|---|
| HBP-001  | HUS-3 | Lithium ion<br>polymer battery |

### Charging stand

| Model No. | Compatible models | Remarks |
|---|---|---|
| JS01  | HUS-3 | |

## Options for ultrasonic processing tools

### Blade

| Model No. | Compatible models | Remarks |
|---|---|---|
| HA04 | ZO-91 | 40 pcs<br>Material: SK-2 |
| Standard blade | | |
| HA07 | ZO-91 | 1 pc<br>Material:<br>Tungsten carbide |
| Carbide blade | | |
| ZH48 | ZO-91 | 1 pc<br>Material:<br>Zirconium ceramic |
| Zirconium ceramic standard blade | | |
| HA08 | ZO-91 | 1 pc<br>Material: SKH<br>*1 |
| Square blade | | |
| ZH10 | ZO-91 | 1 pc<br>Material: SKH<br>*1 |
| Long blade | | |
| ZH09 | ZO-91 | 1 pc<br>Material: SKH |
| Round tip blade | | |
| HA10 | ZO-91 | 1 pc<br>Material: SKH<br>*1 |
| Round tip blade | | |

*1 The effective length of the blade is 11 mm shorter when installed in the handpiece.

### Blade fixture

| Model No. | Compatible models | Remarks |
|---|---|---|
| ZH04 | ZO-91 | |

### Blade fixing screw

| Model No. | Compatible models | Remarks |
|---|---|---|
| HB03 | ZO-91 | |

### Hexagon wrench

| Model No. | Compatible models | Remarks |
|---|---|---|
| RR02 | ZO-91 | |

### Torque screwdriver set

| Model No. | Compatible models | Remarks |
|---|---|---|
| ZH25T | ZO-91 | |

### Cutting mat

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| CM02 | 150 x 200 x 3 | ZO-91 | |

### Maintenance set

| Model No. | Compatible models | Remarks |
|---|---|---|
| SB01 | ZO-91 | |
| SB02 | ZO-91 | Set only includes sandpaper for SB01 |

### Goggles

| Model No. | Compatible models | Remarks |
|---|---|---|
| ZH13 | ZO-91 | |

### Welder clasp

| Model No. | Compatible models | Remarks |
|---|---|---|
| YK01 | SONAC-37 | Standard |
| YK02 | SONAC-37 | For creating a tamper-evident seal |

## Options for ultrasonic measuring instruments

### Cable

| Model No. | Dimensions (mm) | Compatible models | Remarks |
|---|---|---|---|
| HD-002 | 30 m | HD350-A<br>HD353-A | |

# Shaping the future with ultrasonic technology

## Honda Electronics Co., Ltd, a pioneer in ultrasound

The company history of Honda Electronics Co., Ltd. began with the development of fish finders.
With ultrasound as our foundation, we have continuously developed new technologies, such as cylindrical transducers and precision echo sounders for ultra-shallow water.
All of the divisions within our company work together to share and combine their technologies to achieve synergy. We are actively engaged the development of ultrasound technology that is friendly to people, the Earth and our future.

Ultrasonic diagnostic scanner


High frequency ultrasonic cleaner

**Medical Division**

**Ceramics Division**

**Marine Division**

Ultrasonic cutter

**Industrial Equipment Division**


Ultrasonic interface level meter


Ultrasonic cleaner

## What is ultrasound?

It is widely known that in the animal world, dolphins use ultrasound to communicate with each other, and bats use it for navigating and hunting. Ultrasound is defined as sound that is inaudible to the human ear, at frequencies lower than 20 Hz or higher than 20 kHz.
Ultrasound at frequencies higher than 20 kHz is used in a broad array of technologies in a variety of fields.


Fish finders


Strategic Development Center Building (Headquarters)

## Company profile

| | |
|---|---|
| Company name : | Honda Electronics Co., Ltd. |
| Address : | 20 Oyamazuka, Oiwa-cho, Toyohashi, Aichi 441-3193, Japan |
| Founded : | 1956 (incorporated in 1960) |
| President : | Yosuke Honda |
| Capital : | 100 million yen |
| Number of employees : | 210 (as of April 2019) |
| Branches : | Tokyo, Osaka,<br>Representative office : Bangkok Representative Office (Thailand) |
| Products : | Fish finders, GPS plotters,<br>Ultrasonic diagnostic scanner,<br>Ultrasonic cleaner<br>Ultrasonic cutter, Ultrasonic welder,<br>Ultrasonic atomizer unit<br>Ultrasonic level meter, Ultrasonic flowmeter,<br>ultrasonic imaging equipment, ultrasonic microscopes,<br>piezoelectric ceramics, etc. |

## Industrial Equipment Division

The Industrial Equipment Division develops products based on our core technology of ultrasound, for applications such as cleaning, processing, and measurement. The products are used in a wide variety of fields, from semiconductor manufacturing and metal processing, to plastic molding and the food industry.

## Ultrasonic Science Museum


Fundamental principles of ultrasound technology are presented, along with our unique products.
Visitors are invited to learn about the history of ultrasound technology and look forward to future developments.

# HONDA ELECTRONICS CO.,LTD.


Headquarters: 20 Oyamazuka, Oiwa-cho, Toyohashi, Aichi 441-3193, Japan
Tel: +81-532-41-2511 (Main) Fax: +81-532-41-2093

Industrial Equipment Division: 20 Oyamazuka, Oiwa-cho, Toyohashi, Aichi 441-3193, Japan
Tel: +81-532-41-2774 (Direct) Fax: +81-532-41-2923

Bangkok Representative Office: Room 11, 2 Jasmine Bldg., 12 Fl., Soi Sukhumvit 23 (Prasanmitr), Sukhumvit Rd., North Klongtoey, Wattana, Bangkok 10110
Tel: +66-2-612-7311 Fax: +66-2-612-7399


English https://www.honda-el.co.jp/en/

ภาษาไทย https://www.honda-el.co.th

<Contact information>

Registered company for ISO9001and ISO14001 (except branches and representative office)

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- The information described in this catalog is current as of 1 December, 2019.
- The specifications and external appearances of products may be changed for the purpose of improvement without notice.
- The colors of actual products may differ from the images in this catalog due to the printing process.


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