Instruction Manual

Ultrasonic Cleaner

WA Series

WA-600-28/40, WA-1200-28/40

HONDA ELECTRONICS CO.,LTD.

Industrial Equipment Division

Table of Contents

1 Introduction

Thank you for purchasing this WA Series Ultrasonic Cleaner from Honda Electronics.

This manual contains important safety information for usage and also the standard specifications and procedures for installation and operation.

Be sure to read this manual to the end before use to ensure that the product is operated properly. Also, keep this manual in a safe place for future reference.

This Product

This product is a cleaner that applies vibrations from ultrasonic waves to water and solvents for effectively removing dirt from a wide range of cleaning objects, including metal parts. The main functions and features of this device are described below.

Main functions and features	Refer to
4 oscillation modes 1. DUAL mode Adjacent dual-frequency switching oscillation mode 2. F.M. mode Frequency modulation oscillation mode 3. SINGLE mode Single-frequency oscillation mode 4. PULSE mode Pulse oscillation mode	-
Output adjustment function The power setting dial on the oscillator front panel can be used to adjust the output power in the range from 20% to 100%. This enables you to set the optimum power for the cleaning application.	5.2
Automatic frequency tracking function/Constant power control function The state of ultrasonic waves generated in cleaning solution varies widely depending on fluctuations in the supply voltage and changes in loads such as the solution depth, solution type, decompression state, and object being cleaned. In response to these fluctuations, the built-in automatic frequency tracking function and constant power control function of this device can be used to apply oscillations at the optimum frequency and at a stable output power for providing stability in the generation of ultrasonic waves.	-
Error indicator function When an error occurs, one of six types of errors is indicated using the LEDs on the oscillator front panel. This function helps to identify the cause of the problem for quick resolution.	8.2

I/O functions 1. Remote control function Remote control operation can be used to start and stop ultrasonic waves. 2. Error output function When an error occurs in this device, error notification can be sent to a remote location. 3. Oscillation detection function Notification of whether ultrasonic waves are oscillating can be sent to a remote location.	6.1 6.2 6.3
4 to 20 mA output function Current from 4 to 20 mA can be output based on the output power (W).	6.4
Communication function (RS-485 Modbus RTU protocol) This device can use the Modbus RTU protocol to perform RS-485 communication. This function can be used to change the device settings and read the oscillation state.	6.5

Key

This manual provides information under the classifications "Note" and "Important" shown below.

Note

This contains useful information.

Important

This contains important information that the user should know.

If you notice any unclear points, errors, omissions, or other points in this manual, please submit them to us.

2 Before Use

To ensure safety, before using this product, be sure to read all provided information, and follow the instructions when operating.

2.1 Ensuring Safe Operation

Classification of Safety Signal Words

In this manual, important safety information is described by classifying the information based on the expected severity of the hazard as shown below.

	**Indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.**
	**Indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.**
	**Indicates a hazardous situation, which if not avoided, could result in minor injury or property damage.**

Pictograms Used in This Manual and on This Product

The following pictograms are used for this manual and this product to indicate instructions that must be followed, prohibited actions, and other important safety information.

	Indicates a prohibited action.		Products displaying this mark indicate that the operator must refer to the corresponding section in this manual.
	Indicates instructions that must be followed by the operator.		Disassembly prohibited
	Heating without solution is prohibited.		Danger of electrical shock
	Indicates locations where a ground must be properly installed.		

2.2 Safety Information

This section contains important information for preventing dangers to people, device breakdowns, and fires and other damage.
Be sure to carefully read this information, and follow it when using this device.

This device contains high-voltage components	
 Disassembly prohibited	Never attempt to disassemble or modify this device. This could result in a fire, electrical shock, or injury.
 Prohibited	Never insert your finger, pins, tools or other metal objects, or other foreign objects into the fan intake holes or outtake holes. This could result in an electrical shock or injury.

This device does not have an explosion-proof structure	
 Prohibited	Never use in locations where flammable gases or explosive gases are generated. Doing so could result in a fire or explosion.

This device emits strong ultrasonic waves	
 Prohibited	People who are using pacemakers must never use this device or perform work in the vicinity of this device.

Grounding required	
	Be sure to properly install a ground that will not become disconnected. Otherwise, a breakdown or electrical leakage could lead to an electrical shock or injury.
	Never connect to the ground wires of gas pipes, water pipes, lightning rods, or telephone wires. Doing so could result in a fire or explosion.

WARNING

	Use at a supply voltage that is within ±10% of the rated voltage. Usage at supply voltages outside the rating could result in breakdown or a fire.
	Electricity at a high voltage and high current flows through the transducer cable and power cable, and so be sure that the terminal connections and connector connections are properly fitted without any looseness. Otherwise, an electrical shock or fire could result.
Prohibited	In vibration plate-type transducer units, a high frequency, high voltage, and high current are flowing to the transducer, and so it is extremely dangerous to touch the transducer electrodes and cable connectors with your hand. Never touch these parts.
Prohibited	Never change the length of the transducer cable, use other types of cables, modify the crimped terminal mountings, or make other changes. Because a high frequency, high voltage, and high current are flowing, doing so could result in a breakdown or start a fire.
Prohibited	Never use while a hole is open in the ultrasonic wave vibration surface of the transducer unit. Doing so could result in a breakdown or fire. ※ In the ultrasonic cleaner, if the ultrasonic wave vibration surface is exposed to strong ultrasonic wave vibrations and cavitation action for an extended period of time, an erosion effect could occur where the metal surface becomes worn and porous.
Prohibited	Do not install the oscillator in a location where acidic, alkaline, or other corrosive gases are generated. Corrosion could reduce the lifespan of the oscillator, resulting in a breakdown.
Prohibited	Do not use combustible or flammable liquids for the cleaning solution used in this product.
Heating without solution is prohibited	Never operate this device without cleaning solution where the device is empty when heated. Doing so could result in a breakdown. ※ The solution depth should be at least 100 mm above the transducer radiating surface.

CAUTION

	Use the oscillator within the operating temperature range of 5°C to 40°C. Also, even if the indoor temperature environment is within the rated temperature range of 5°C to 40°C, this temperature could be exceeded in the area around the oscillator due to the installation conditions, and so install a thermometer for checking the ambient temperature, and implement measures to keep within the rated temperature range. Usage outside the temperature range could reduce the lifespan of the oscillator, resulting in a breakdown.
	The solution temperature range that can be used in the transducer unit is 5°C to 80°C for the immersible box type and 5°C to 100°C for the vibration plate/tank type. Usage outside the temperature range could reduce the lifespan of the transducer, resulting in a breakdown.
	When connecting the power supply, supply power by passing through a circuit breaker rated at 15 A or higher for each device. Also, use 15 mA or higher per device for the sensitivity current of the ground fault circuit interrupter.
	Be sure to clearly indicate the specific circuit breaker where this product is connected to enable the power to be cut off quickly in the event that a problem occurs in the product.
	Do not cover the ventilation openings on the front and rear panels of the oscillator. Also, install by providing at least 150 mm of clearance from the front and rear panels. Otherwise, the device internal temperature could rise, resulting in a fire or breakdown.
	Ensure that the cleaning object does not directly contact the ultrasonic wave vibration surface of the transducer unit. Direct contact could result in reduced cleaning efficiency and also a breakdown. ※ Use so that the cleaning object is positioned at least 50 mm above the transducer radiating surface.
	The oscillator does not have a waterproof structure, and so install it in a location where it is not exposed to liquids. Otherwise, the oscillator could break down.
	The oscillator and transducer unit are adjusted as a set. The transducer unit that is connected to the oscillator should be the transducer unit having the same ID number as the number in the ID label on the rear panel of the oscillator. If the wrong transducer is connected, a malfunction or breakdown could occur.

 Prohibited	Do not use acidic liquid (PH6 or less) as the liquid that comes into direct contact with the transducer unit. It may cause the transducer unit to malfunction. When using an acidic liquid (PH6 or less), use a double tank structure. If the liquid used on the inner of double tank splashes or drips into the outer tank, drain it immediately and clean the cleaning tank cleanly. When using a strongly alkaline liquid that comes into direct contact with the transducer unit, make sure that it does not affect the transducer unit before using it.
 Prohibited	Do not use by inserting the oscillator into an airtight box without ventilation openings. Otherwise, the device internal temperature could rise, resulting in a fire or breakdown.

2.3 Other Safety Information

Safety Information on Installation and Use of Transducer Cable and Power Cable

- Before connecting the transducer cable, power cable, and other cables, be sure that the primary-side power supply has been turned off.
- Always place the connectors for the transducer cable and power cable in a dry location that is not exposed to dampness.
- Do not connect the power cable using a multi-plug device in the outlet or using extension cables. Doing so could result in an electrical shock or fire.
- The transducer cable and power cable do not have a waterproof structure, and so install them in a location where they are not exposed to liquids.
- Do not use anything other than the supplied items for the transducer cable and power cable.
- Do not use the transducer cable or power cable while a strong force is being applied to the cable or while the cable is twisted.
- Do not put extreme bends into the transducer cable or power cable or bind the cable in small loops. This could cause noise to radiate from the cable or cause the cable to overheat.
- Do not make incorrect connections for the transducer cable or power cable. Doing so could result in an electrical shock or fire.

Safety Information on Installation and Use of Oscillator

- Install the oscillator in a location that is not exposed to large amounts of dust, dirt, mist, and other contaminants. Otherwise, the ventilation openings of the oscillator could become clogged by dust, dirt, mist, or other substances, which will reduce the ventilation cooling performance and could result in a breakdown.
- Install the oscillator in a location in the humidity range from 5% to 80% and, in particular, is not damp and is not exposed to water droplets. Otherwise, the lifespan of the oscillator could be shortened, resulting in a breakdown.
- Do not install the oscillator in locations exposed to direct sunlight or near sources of heat. Otherwise, the device internal temperature could rise, resulting in a breakdown.
- Periodically remove any dust adhering to the ventilation openings of the oscillator. Dust adhering to the ventilation openings can reduce the heat dissipating performance, causing overheating inside the device, and resulting in a breakdown.
- If the oscillator is installed in a location where the ambient temperature is high, put the oscillator in a box, and cool it using a cooler or other means to ensure that the temperature inside the oscillator does not rise.

- Install the oscillator in a flat location with sufficient strength and that is not exposed to vibrations. Vibrations could damage the internal parts, resulting in a breakdown.
- Do not install by stacking three or more oscillators on top of each other.
- This device has indoor specifications, and so be sure to always use it indoors.
- When the oscillator is left in the standby state, the fan is continuously running. For this reason, dust tends to adhere to the ventilation openings, and this can lead to fan deterioration.
  If not using for an extended period of time, disconnect the primary-side power supply.
- Before performing maintenance and inspection of this device, be sure to always turn off the power switch, and disconnect the primary-side power supply. This device includes high-voltage components that pose a risk of electrical shock.

Safety Information on Installation and Use of Transducer Unit

- In the vibration plate-type transducer unit, the oscillating element and wiring do not have a waterproof structure. Install and use in a location where they will never be exposed to liquids.
- Because the transducer sometimes holds high-voltage charges, before conducting installation or maintenance of the transducer unit, be sure to always temporarily short-circuit the positive and negative terminals of the transducer to discharge any residual charge.
  Connecting a measuring instrument between the terminals before they are discharged could result in a breakdown of the measuring instrument.
- Whenever lifting and transporting the transducer unit and heavy cleaning objects, either use two or more people or safe hoisting equipment.

Safety Information on Installation and Use of Signal Cables to I/O Terminals

- Use shielded cables within 10 meters (AWG 18 to 24) for the RS-485 signal cable, remote control signal cable, 4 to 20 mA output signal cable, oscillation detection signal cable, and error detection cable. Otherwise, noise could enter the oscillator and control system where the signal cable is connected, which could result in a malfunction.
- Do not route the signal cable for oscillator control or the signal cable for control of other devices in the vicinity of the oscillator power cable or transducer cable. Otherwise, noise could enter the oscillator and other control systems, resulting in a malfunction.
- When performing external control using a remote control device, connect so that one device is controlled using a single circuit. If multiple devices are used by connected in parallel or series, this could result in a malfunction or breakdown.
- Do not supply the power voltage to the signal cable. Doing so could result in a breakdown.

General Safety Information

- Do not carelessly touch the oscillator, transducer unit, cables, or other parts when your hands are wet.
- During ultrasonic cleaning, do not insert your hands into the cleaning tank without paying careful attention.
- Do not leave the cleaning solution in a dirty state. Dirtiness could accumulate on the vibration surface, resulting in a breakdown.
- When storing this product, store it in a location that is not exposed to direct sunlight and that has a temperature range from -15°C to 60°C, humidity range from 10% to 85%, and no condensation.
- Wipe off any moisture, cleaning solution, or dirt adhering to the oscillator and transducer unit using a dry cloth.
- If the oscillator is left running, the temperature of the cleaning solution could rise, causing it to vaporize. If operating when there is no cleaning solution, heating is performed in an empty state, which could cause a breakdown of the transducer.
- The oscillator case is made from ABS resin. Do not wipe the oscillator using any chemicals that are corrosive to ABS resin. Doing so could cause a breakdown of the oscillator.

3 Names of Parts and Their Functions

3.1 Check of Packaged Items

In this product series, the oscillator and transducer unit consist of a single set.
The following four types of combinations with the transducer unit are available, and the type of transducer unit set selected by the customer is provided in the package.

- Immersible box type
- Vibration plate type
- Tank type
- Tank with heater type

Check that the main unit and accessories match.
If any items are missing or damaged, please contact the dealer where you made the purchase.

Oscillator

Packaged items	Quantity
Oscillator	1
Power cable (3.5 m)	1
Instruction Manual	1
Output cable (3.5 m)*1	1

*1 This is not included in sets with the tank type and tank with heater type transducer units.

Transducer Unit

Set name	Packaged items	Quantity
Immersible box type	Immersible box type transducer unit (standard product or special-order product)*1	1
Vibration plate type	Vibration plate type transducer unit (standard product or special-order product)*2 ＊The standard product comes with packing, auxiliary frame, and screws for vibration plate as standard.	1

Tank type	Tank type transducer unit*3	1
	Lid	1
Tank with heater type	Tank with heater type transducer unit*3	1
	Lid	1

*1 Transducer cable length 2.5 m (braided section 2 m)

*2 Transducer cable length 3.5 m (standard product)

*3 Transducer cable length 3.5 m

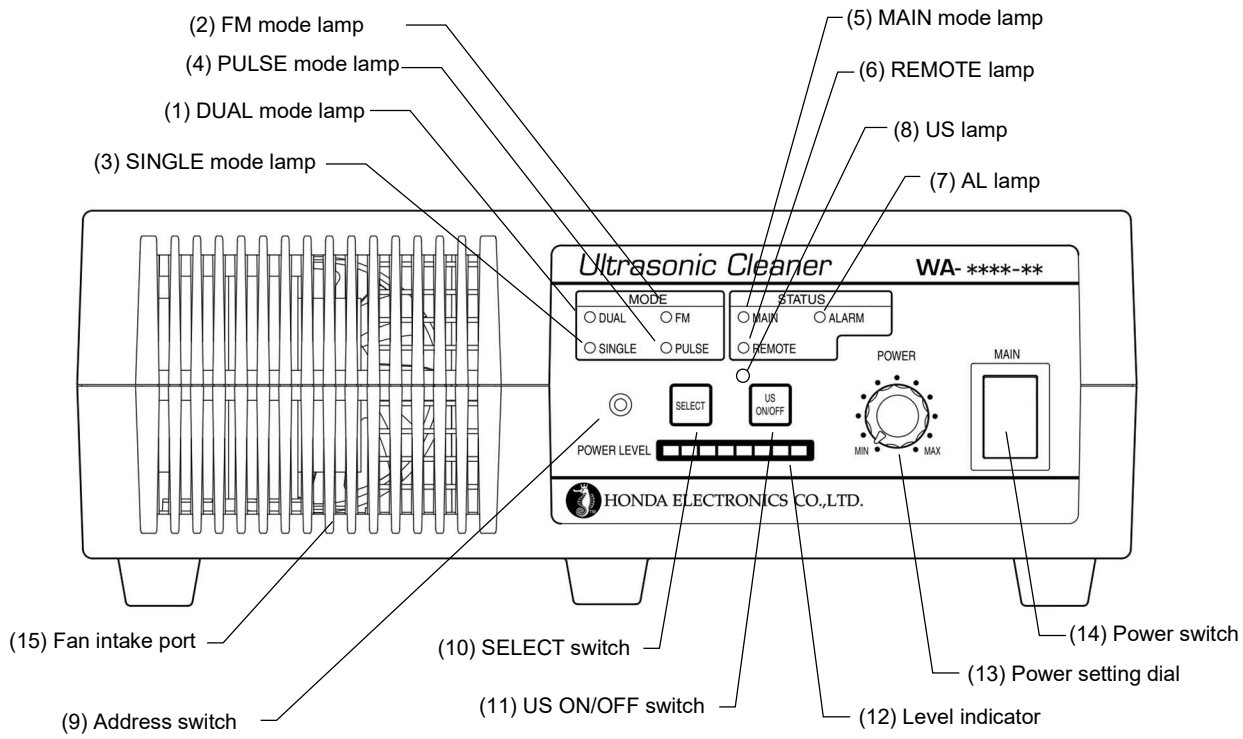
Items Sold Separately

Depending on the customer's order, the following items that are sold separately may be included.
Check the details of your order to confirm that any items sold separately are included.

Item name	Optional part
Oscillator	Transducer cable connection terminal block
Transducer unit *special-order product (Vibration plate type)	Vibration plate mounting packing
	Vibration plate mounting auxiliary frame
	Vibration plate mounting screws
Transducer unit (Tank type)	Washing basket (KG10F(600W), KG11T(1200W))
Transducer unit (Tank with heater type)	Washing basket (KG10F(600W), KG11T(1200W))

3.2 Names of Parts

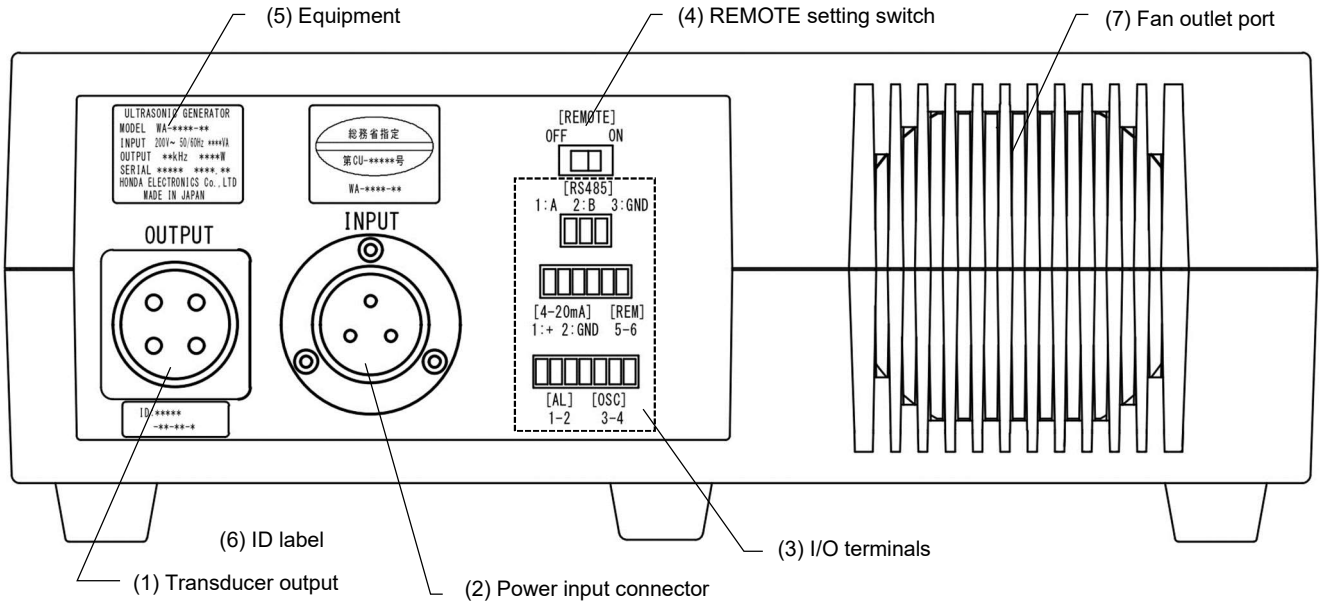
Oscillator Front Panel



No.	Name	Description
(1)	DUAL mode lamp	This lamp turns on when operating in dual frequency alternate switching oscillation mode.
(2)	F.M. mode lamp	This lamp turns on when operating in F.M. oscillation mode.
(3)	SINGLE mode lamp	This lamp turns on when operating in single-frequency oscillation mode.
(4)	PULSE mode lamp	This lamp turns on when operating in pulse oscillation mode.
(5)	MAIN lamp	This lamp turns on when the power switch on the oscillator front panel is set to ON and power is being supplied to the oscillator.
(6)	REMOTE lamp	This is lit solid when remote operation is enabled, and it blinks when RS-485 communication is enabled. When lit solid, US ON/OFF switch operation on the oscillator front panel is disabled. When blinking, the SELECT switch, US ON/OFF switch, and power setting dial are disabled.
(7)	AL lamp (ALARM)	This lamp is lit solid or blinks when an alarm occurs. The lamp blinks when an alarm related to transducer connections occurs, and the lamp is lit solid when an alarm related to an oscillator internal error has occurred.

No.	Name	Description
(8)	US lamp	This lamp turns on during ultrasonic oscillation.
(9)	Address switch	This is an address switch for RS-485 communication. Addresses 1 to 15 can be set.
(10)	SELECT switch	This switch is used to select the oscillation mode. Pressing the switch cycles the selections through DUAL, FM, SINGLE, and PULSE, in that order. The oscillation mode can be selected when RS-485 communication is disabled.
(11)	US ON/OFF switch	This switch starts and stops the ultrasonic waves. When pressed once, oscillation of ultrasonic waves is started in the oscillation mode selected using the SELECT switch. Pressing again stops the ultrasonic waves. Ultrasonic waves can be started and stopped when remote operation is disabled and the RS-485 communication function is disabled.
(12)	Level indicator	This shows the output power level. Also, when an alarm occurs, this level indicator shows the type of alarm by the number of lit lamps.
(13)	Power setting dial	This dial sets the output power. The adjustable power range is 20% to 100%. The output power can be set when RS-485 communication is disabled.
(14)	Power switch	This is the main power switch for turning on and off the primary-side power for the oscillator. It also includes a function that activates a protective shutoff when an excessive power current flows.
(15)	Fan intake port	This is a fan intake port for dissipating heat and cooling the inside of the oscillator. To ensure adequate ventilation, be sure to provide at least 150 mm of clearance at the front panel.

Oscillator Rear Panel



No.	Name	Description
(1)	Transducer output connector	This connector supplies power to the transducer when the supplied transducer output cable is connected. The transducer unit that is connected to the oscillator should be the transducer unit having the same ID number as the number in the ID label of the oscillator.
(2)	Power input connector	This connector supplies the power voltage when the supplied power cable is connected. Supply a power voltage that is within ±10% of the rated input value shown in the equipment nameplate.
(3)	I/O terminals	These terminals enable various functions by connecting signal cables. * The connectors for connecting the signal cable are directly attached to the each connectors on the I / O terminals on the rear panel of the oscillator.
	[1] [RS485]	This uses RS-485 communication to perform remote control of the oscillator.
	[2] [4-20mA]	This outputs a current of 4 to 20 mA based on the output power.
	[3] [REM]	This starts and stops ultrasonic waves by remote control from an external device. - Short-circuit between terminals: Starts ultrasonic oscillation - Open between terminals: Stops ultrasonic waves
	[4] [AL]	This sends notification of alarms to an external device. - When normal: Short-circuit between terminals - When alarm or power off: Open state between terminals

No.	Name	Description
	[5] [OSC]	This sends notification of the ultrasonic wave state to an external device. - During ultrasonic wave oscillation: Short-circuit between terminals - When ultrasonic waves are stopped: Open state between terminals
(4)	REMOTE setting switch	When this switch is set to ON, the remote control function using the REM terminal is enabled. When enabled, operation using the US ON/OFF switch on the oscillator front panel is disabled.
(5)	Equipment nameplate	This equipment nameplate shows the model, rated input, rated output, and device number.
(6)	ID label	This label shows the ID number of the transducer unit that can be connected to the oscillator.
(7)	Fan outlet port	This is a ventilation port for dissipating heat and cooling the inside of the oscillator. To ensure adequate heat dissipation and cooling, be sure to provide at least 150 mm of clearance at the rear panel.

4 Installation and Connections

This section describes the procedures for installation and connections for this product.

4.1 Installing the Oscillator

The oscillator is installed on a stable, flat location with sufficient strength that is not subjected to vibrations, and is not damp or exposed to water droplets.

Install in a location that meets the following environmental requirements.

- Location with an ambient temperature from 5°C to 40°C and that does not have condensation at a humidity of 80% or less
- Location where the ventilation openings on the front and rear panels of the oscillator will not be blocked
- Location that enables a clearance of at least 150 mm at both the front and rear panels

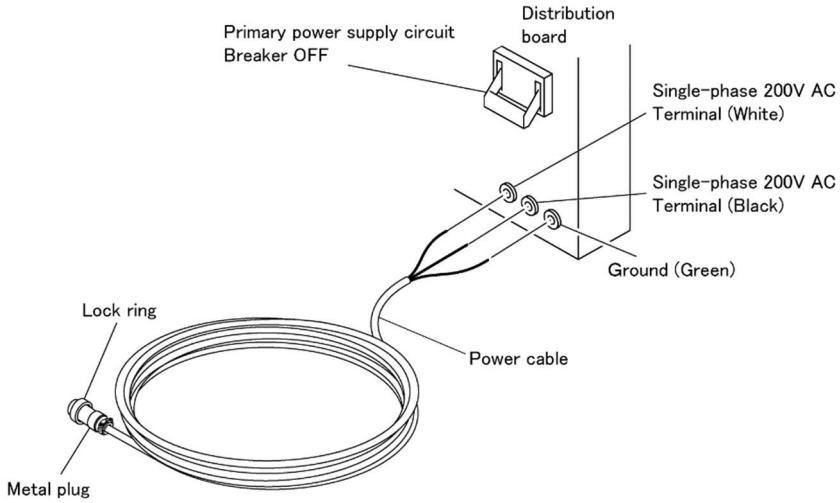
Reference: Securing the Oscillator in Place

Insert nuts (M4) are provided in four locations on the bottom panel for securing this device in place.
Use these insert nuts for securing this device if needed.

4.2 Connecting the Power Cable

Preparation

Connect the power cable to the power supply obtained beforehand by the customer.
Refer to the figure below.



Note

The connection polarity for the supplied power cable is shown below.

Green: Connected to ground, White: Connected to single-phase AC power supply, Black: Connected to single-phase AC power supply

Procedure

1. Connect the power cable to the circuit breaker side (single-phase 200 V to 240 V*1 AC, 50/60 Hz).
   *1 Selectable from 200 V, 220 V, 230 V, and 240 V when ordering. This must be the rated voltage.

- To prevent the risk of electric shock, before making any connections, be sure to always cut off the power supply to the circuit breaker, and check that the power switch of the oscillator is at the OFF position.
- Supply power by passing through a circuit breaker rated at 15 A or higher for each device. Also, use 15 mA or higher per device for the sensitivity current of the ground fault circuit interrupter.

2. Insert the plug of the power cable into the power supply connector on the oscillator rear panel, and screw in firmly until the lock ring no longer moves.

Be sure to disconnect the power supply before connecting the power cable to the oscillator.
If a power cable is connected when a voltage is applied while the oscillator power switch is at the ON position, a breakdown of the oscillator could result.

4.3 Installing the Transducer Unit

Preparation

The transducer sometimes holds a high-voltage charge. Before installing the transducer unit, be sure to always temporarily short-circuit the transducer positive and negative terminals to discharge any residual charge.
Then, install by following the procedure for the type that you are using.

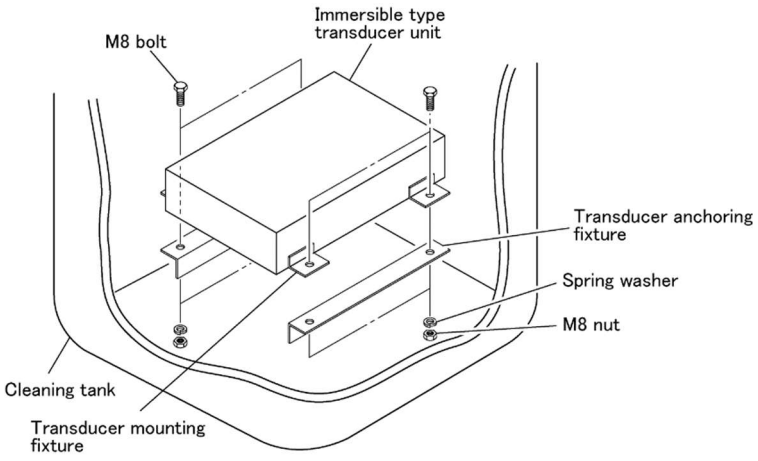
Note

For details on the installation and operating procedures for tank type transducer units and tank with heater type transducer units, see “7 Tank with Heater “.

Mounting Procedure Example (Immersible Box Type Transducer Unit)

1. Obtain a cleaning tank with sufficient strength and size for the weight and size of the immersible box type transducer unit.
2. Mount the transducer anchoring fixture to the cleaning tank.
3. To prevent wear between metals due to vibrations, insert Teflon resin or other cushioning material between the transducer mounting fixture and transducer anchoring fixture of the transducer unit (if there are other sections where metal parts could contact each other in the transducer unit bottom section, this also includes those sections).
4. Place the transducer unit on the anchoring fixture with cushioning material in between, and insert stainless steel*1 M8 bolts through the four anchoring hole locations, and use spring washers and nuts to firmly secure the transducer in place so that it does not become loose.

*1 The mounting parts (bolts, studs, washers, nuts, etc.) must be selected by the customer based on the cleaning solution that is used.



5. Pull out the transducer cable to the outside of the cleaning tank.

Important

If any liquids are splashed on the cable routing holes at the end of the braided hose tip, liquid could get inside the transducer unit, resulting in a breakdown of the transducer. Be sure to always install so that the transducer cable is outside the cleaning tank.

Route the braided hose so that it does not pass above the ultrasonic wave vibration surface.

6. Connect the transducer cable and output cable.

Note

For details on the connection procedure, see "4.4 Connecting the Transducer Cable".

Mounting Procedure Example (Vibration Plate Type Transducer Unit)

1. Obtain a cleaning tank that has sufficient strength to support the weight of the vibration plate and has a shape that matches the dimensions of the vibration plate.

Important

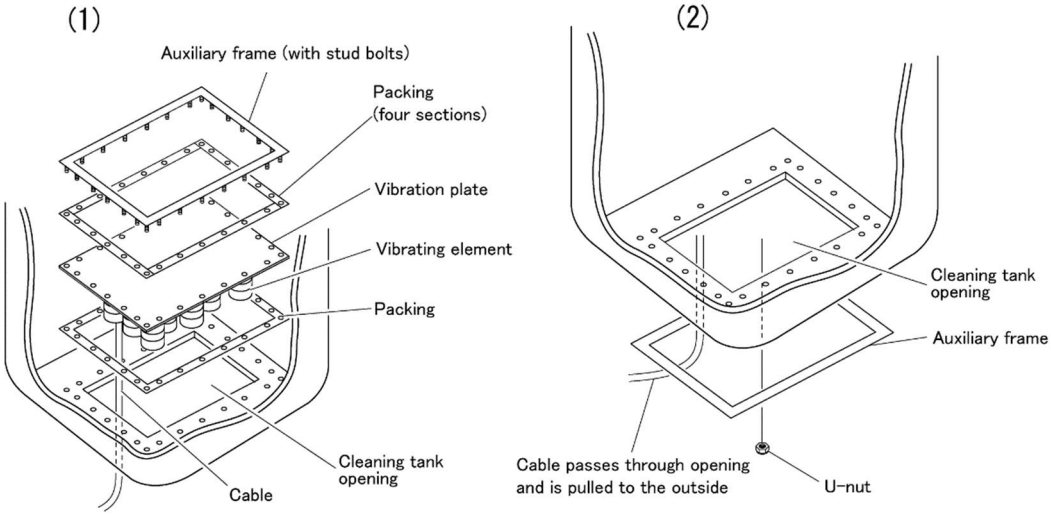
When carrying around and installing the vibration plate, handle it carefully to ensure that it does not become warped.

If the plate is warped, this will reduce the quality of the transducer attachment surface.

2. As shown in figure (1) below, stack the parts in the order of packing, vibration plate, packing, and auxiliary frame (with stud bolts).
3. As shown in figure (2) below, install the auxiliary frame from the bottom side of the cleaning tank, and secure using the U-nut.

Important

- Ultrasonic vibrations can cause looseness to occur after tightening. This looseness can lead to leakage of solution, and so be sure to always implement measures to prevent looseness.
- When mounting to the cleaning tank, the material of the packing that makes contact with the solution varies depending on the type of cleaning solution that is used. And so, select the material that matches the type of cleaning solution. If a material is used that does not match the solution, a solution leak can occur.



4. Pull out the transducer cable to the outside of the cleaning tank, and connect it to the output cable.

Note

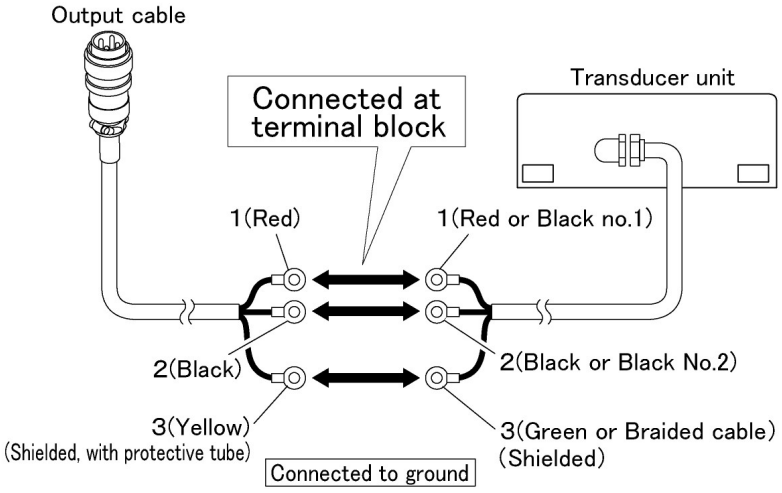
For details on the connection procedure, see "4.4 Connecting the Transducer Cable".

4.4 Connecting the Transducer Cable

Connecting the Transducer Cable and Transducer Unit Leader Cable

Connect the transducer cable and transducer unit leader cable by referring to the figure below.

Important
To ensure safety, be sure to always disconnect the power supply for the oscillator before making the connection.



●Connection polarity of supplied transducer cable

Supplied transducer cable side	Connected to
Red wire (terminal no. 1)	Transducer unit (+) red or brack No.1 wire (terminal no. 1)
Black wire (terminal no. 2)	Transducer unit (-) black or brack No.2 wire (terminal no. 2)
Yellow wire with protective tube (terminal no. 3)	Transducer unit (shielded)　[Connected to ground]

- Use a screw terminal block relay to firmly connect the supplied transducer cable and leader cable from the transducer unit. Use a screw terminal block having a rated voltage of 600 V or more and rated current of 20 A or more per device. Because a high frequency, high voltage, and high current are flowing, improper electrical contact in the connection could result in a breakdown or start a fire.
- Connect by following the correct connection polarity.
- The connection location for the supplied transducer cable and leader cable from the transducer unit must be housed in a relay box so that it will not be easily touched by users. Use a relay box that is made from flame-resistant materials equivalent to the V-0 flammability standard and that has a structure that cannot be opened unless a tool is used.

Connecting the Transducer Cable to the Oscillator

Insert the plug of the transducer cable into the transducer output connector on the oscillator rear panel, and screw in firmly until the lock ring no longer moves.

Important

Before connecting the transducer unit to the oscillator, be sure to check that the ID number affixed to the oscillator rear panel matches the ID number of the transducer unit.

Connecting a transducer unit with a different ID could result in a malfunction or a breakdown.

5 Operating Procedures

This section describes the basic operating procedures for this product.

Before using this product, check that the installation and connections were completed.

5.1 Preparation

1. Fill the cleaning tank with cleaning solution.

- Use with a solution depth that is at least 100 mm above the transducer radiating surface.
- The solution temperature range that can be used in the transducer unit is 5°C to 80°C for the immersible box type and 5°C to 100°C for the vibration plate/tank type.

2. Put the cleaning object into the cleaning tank.

- Use so that the cleaning object is positioned at least 50 mm above the ultrasonic wave vibration surface.
- Place the cleaning object so that its exposure to the ultrasonic wave vibration surface is as uniform as possible.
- Use a washing basket or similar object to ensure that the cleaning object does not directly contact the ultrasonic wave vibration surface.

Note

A special washing basket is available (sold separately) for the tank-type cleaning unit.

Please ask your Honda Electronics sales representative or dealer for more information.

3. Check that the power switch on the oscillator front panel is at the OFF position, and set the circuit breaker that is supplying power to the oscillator to the ON position.
4. Set the REMOTE setting switch on the oscillator rear panel to OFF to disable the remote control function.

If control is performed over an RS-485 connection or by remote control, check that operation is performed normally, and then make the settings.

This completes the preparation for operation.

5.2 Basic Operations for Oscillator

1. Set the power switch on the front panel of the oscillator to the ON position.
   i) After all the lamps on the front panel are lit solid, one of the DUAL, FM, SINGLE, or PULSE mode lamps and the MAIN mode lamp remain lit, and the other lamps turn off.
   ii) If the REMOTE setting switch on the rear panel is set to ON, the REMOTE lamp is also lit solid.
2. Press the SELECT switch to select the oscillation mode.
   i) Each time that the SELECT switch is pressed, the oscillation mode cycles through DUAL -> FM -> SINGLE -> PULSE, in that order.
   ii) If the SELECT switch is pressed in the PULSE state, the mode returns to DUAL.
3. Press the US ON/OFF switch to start cleaning.
   i) The US lamp turns on.
4. Turn the power setting dial to adjust the ultrasonic wave output (W).
   i) Turning the dial clockwise increases the ultrasonic wave output, and turning it counter-clockwise decreases the output.
   ii) The output power can be set from 20% to 100%.
5. Press the US ON/OFF switch to stop cleaning.
   i) The US lamp turns off.
6. After cleaning is completed, set the power switch on the oscillator front panel to the OFF position.
7. Set the power supply circuit breaker to the OFF position to disconnect the primary-side power supply.

Note

- When the remote control function is used, steps 3 and 5 are not needed.
- When RS-485 communication is used, steps 2 to 5 are not needed.
- If using DUAL or FM mode, to scan the center frequency, oscillation is performed at SINGLE for about 1 second when oscillation is started and when setting a specific output.
  *The scan process may repeat for certain positions of the power setting dial, and so if this happens, set the power setting dial to a different position.

6 I/O Functions

This section describes the operating procedures for the following functions that use the I/O terminals on the oscillator rear panel.

- Remote control function (ultrasonic wave output ON/OFF control)
- Device error output function
- Ultrasonic wave oscillation detection function
- 4 to 20 mA current output function
- RS-485 communication function

6.1 Remote Control Function

The remote control function can be used to start and stop ultrasonic waves.

Preparation

1. Connect the remote control signal cable to the [REM] terminal (6-pin connector, numbers 5-6) in the I/O terminals.

Note
Peel off the jacket of the signal cable, and use a precision screwdriver (flat-head) to connect to the terminal.

2. Set the REMOTE setting switch on the rear panel of the oscillator to the ON position.
   i) This enables the remote control function.
   ii) The REMOTE lamp on the oscillator front panel is lit.

Operation Procedures

Ultrasonic waves can be started and stopped by short-circuiting and opening the [REM] terminal (6-pin connector, numbers 5-6) using an external contact (non-voltage contact).
The relationship between the contact state and ultrasonic wave output state is shown in the table below.

State with [REM] terminal	Ultrasonic wave output state	Signal cables to be connected
Open	Stop	Remote control signal cable (2-core) *Shielded cable
Short-circuit	Oscillation	

Important

- For the external contact signal connecting the [REM] and [COM] terminals, use a non-voltage contact (switch, relay contact, etc.) with a contact rated 12 V DC and 0.1 A or more.
- Do not supply power when the REMOTE setting switch is set to ON and the [REM] terminal is short-circuited while there is no cleaning solution in the cleaning tank. This will heat the cleaning tank in an empty state, which could cause a breakdown of the transducer.
  Be particularly careful when setting the power switch to ON.
- To prevent malfunctions due to noise, use shielded cables within 10 meters (AWG 18 to 24) for the signal cables.
- To reduce induced noise, route the signal cables separately from power cables, transducer cables, and other driving cables.

6.2 Error Output Function

This function generates an error signal whenever an error occurs in this device.
One of six types of errors is indicated using the LEDs on the oscillator front panel.

Preparation

Connect the error detection signal cable to the [AL] terminal (7-pin connector, numbers 1-2) in the I/O terminals.

Note

Peel off the jacket of the signal cable, and use a precision screwdriver (flat-head) to connect to the terminal.

Operation Procedures

Check the contact state (open/short-circuit) with the [AL] terminal to enable monitoring of the oscillator state.
The [AL] terminal uses photorelay contact output.
The relationship between the contact state and the oscillator state is shown in the table below.

State with [AL] terminal	Oscillator state	Signal cables to be connected
Open	Error or power off	Error detection signal cable (2-core)
Short-circuit	Normal	*Shielded cable

Important

- The [AL] terminal photorelay contact rating is 30 V DC and 0.1 A. Do not use voltages and currents that exceed the rating. Doing so could result in a breakdown.
- To prevent malfunctions due to noise, use shielded cables within 10 meters for the signal cables.
- To reduce induced noise, route the signal cables separately from power cables, transducer cables, and other driving cables.

6.3 Ultrasonic Wave Oscillation Detection Function

This function monitors whether this product is performing ultrasonic wave oscillation.

Preparation

Connect the oscillation detection signal cable to the [OSC] terminal (7-pin connector, numbers 3-4) in the I/O terminals.

Note

Peel off the jacket of the signal cable, and use a precision screwdriver (flat-head) to connect to the terminal.

Operation Procedures

Check the contact state (open/short-circuit) for the [OSC] terminal to enable monitoring of the ultrasonic wave oscillation state.
The [OSC] terminal uses photorelay contact output.
The relationship between the contact state and the oscillator state is shown in the table below.

State with [OSC] terminal	Oscillator state	Signal cables to be connected
Open	Ultrasonic wave stop state	Oscillation detection signal cable (2-core) *Shielded cable
Short-circuit	Ultrasonic wave oscillation state	

Important

- The [OSC] terminal photorelay contact rating is 30 V DC and 0.1 A. Do not use voltages and currents that exceed the rating. Doing so could result in a breakdown.
- To prevent malfunctions due to noise, use shielded cables within 10 meters for the signal cables.
- To reduce induced noise, route the signal cables separately from power cables, transducer cables, and other driving cables.

6.4 4 to 20 mA Current Output Function

This function outputs a current of 4 to 20 mA based on the output power (W).

Preparation

Connect the 4 to 20 mA signal cable to the [4-20mA] terminal (6-pin connector, numbers 1-2) in the I/O terminals.

Note

Peel off the jacket of the signal cable, and use a precision screwdriver (flat-head) to connect to the terminal.

Operation Procedures

This outputs a current of 4 to 20 mA based on the ultrasonic wave output power.

- WA-600 4 mA: 0 W, 20 mA: 660 W
- WA-1200 4 mA: 0 W, 20 mA: 1320 W

[4-20mA] terminal	Signal cables to be connected
Pin no. 1: +	4 to 20 mA signal cable (2-core)
Pin no. 2: -	*Shielded cable

Important

- To prevent malfunctions due to noise, use shielded cables within 10 meters for the signal cables.
- To reduce induced noise, route the signal cables separately from power cables, transducer cables, and other driving cables.

6.5 RS-485 Communication Function

In this function, RS-485 communication using the Modbus® RTU protocol is used to change settings and read the oscillation state in this product.

RS-485 Specifications and Functions

●RS-485 Specifications

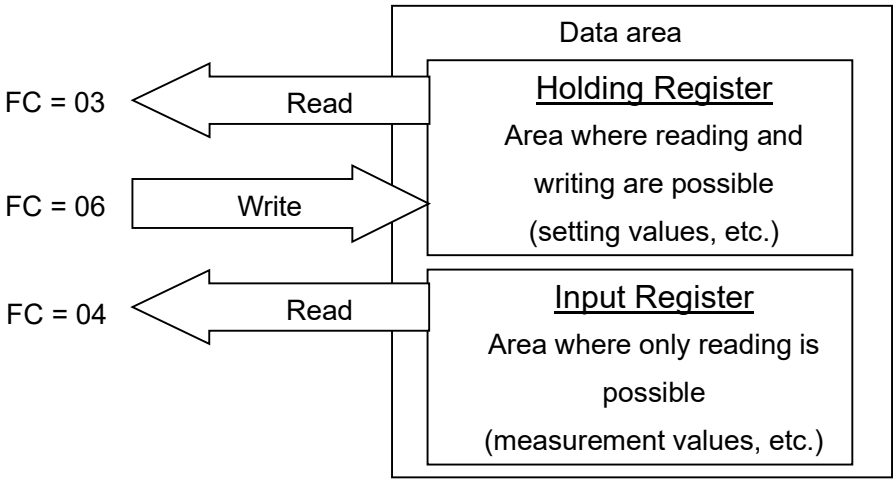
Item	Specifications
Communication standard	RS-485
Protocol	Modbus® RTU
Baud rate	57600 bps
Start bit	1 bit
Data length	8 bits
Parity	Even
Stop bit	1 bit
Handshake	None
Number of connections	Up to 15 devices
Device ID (address)	User-selectable from 1 to 15 *This is set using the rotary switch on the front panel. *The device ID is set to 1 in the default settings.
Error check	CRC

* Modbus is a registered trademark of Schneider Electric USA Inc.

●Functions

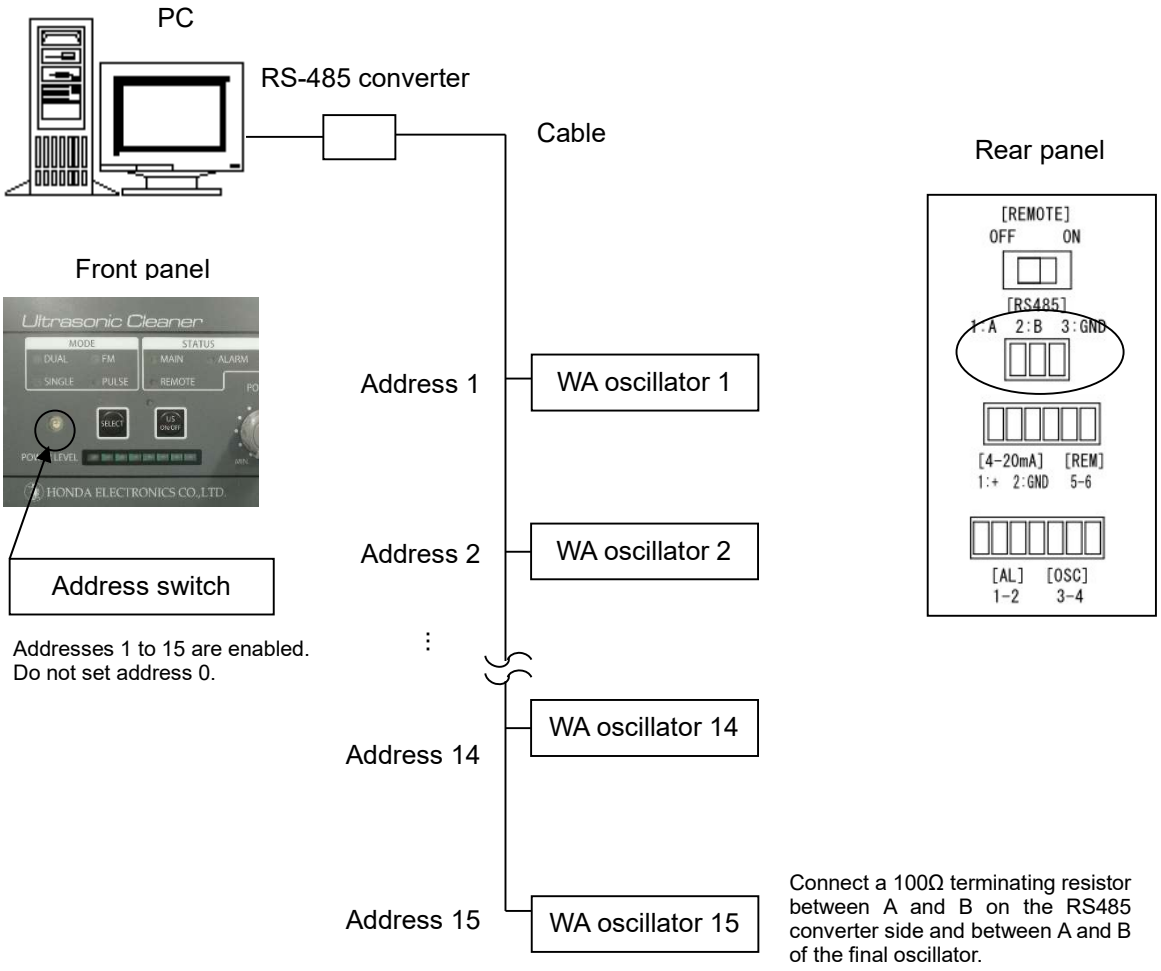
Function code	Function name	Function
03	Read Holding Register	Reads the content of the holding register.
04	Read Input Register	Reads the content of the input register.
06	Preset Single Register	Changes (writes) the content of the holding register.

●Relationship between data areas and function codes (FC)



Preparation

●Wiring diagram



1. Connect the RS-485 communication signal cable to the [RS485] terminal (3-pin connector, numbers 1-3) in the I/O terminals.

Note

Peel off the jacket of the signal cable, and use a precision screwdriver (flat-head) to connect to the terminal.

2. Connect the RS-485 converter A (+) terminal to all device A (+) terminals.
3. Connect the B (-) terminal to all device B (-) terminals.
4. Connect the GND terminal to the GND terminal of the RS-485 converter.

Important

- Do not connect the GND terminal to metal parts or the ground on the rear panel.
- When connecting multiple oscillators, connect a 100Ω (1 / 4W) terminating resistor between A and B on the RS485 side and between A and B of the final oscillator, and do not connect a terminating resistor to the oscillator in the middle.
- The RS-485 converter, signal cable, and terminating resistor must be obtained by the customer. A 3-core shielded cable is recommended for the signal cable.

Message Format (When Reading Data from Slave)

The function code specifies 03 or 04.

● Process request message format from Master (PC) to Slave (WA)

Name	Description	No. of bytes
Address	Specifies the slave address. Specify a number in the range from 1 to 15 (Set to match the address switch setting on the WA front panel).	1
Function code	Specifies 03 or 04. 03: Reads from holding register 04: Reads from input register	1
Register address	Specifies the starting address of the register that is read. Set an address that is one less than the actual register address. (To read register 4, specify 3. To read register 18, specify 17.)	2
Number of registers that are read	Specifies the number of registers that are read.	2
CRC	Error check section. For details, see page38 "CRC Calculation Method".	2

An example when reading the data for address 1, function code 03, and register address 21 for one register is shown below.

Process request message (hexadecimal notation)

Address	Function code	Register address		Number of registers that are read		CRC	
01	03	00	14	00	01	C4	0E

Note

The register address is sent as a value that is one less than the target address, and so this becomes 0x0014.

●Response Message Format for Slave (WA) to Master (PC)

A message when the slave is operating normally is shown below.

For a message when an error has occurred in the slave, see page 37 "Exception Responses".

Name	Description	No. of bytes
Address	This is the same numerical value as the address contained in the message that was sent from the master.	1
Function code	This is the same numerical value as the function code contained in the message that was sent from the master.	1
Number of bytes in readout data	This is the number of bytes in the data that was read.	1
Readout data	This is the data that was read.	2 to 254
CRC	Error check section. For details, see page 38 "CRC Calculation Method".	2

An example when a message was sent for address 1, function code 03, register address 4, and readout register 3 is shown below.

Response message (hexadecimal notation)

Address	Function code	Number of readout bytes	Readout data						CRC	
			Data 1		Data 2		Data 3			
01	03	06	01	F4	03	E8	00	02	90	C0

Message Format (When Writing Data to Slave)

The function code specifies 06.

● Process request message format from Master (PC) to Slave (WA)

Name	Description	No. of bytes
Address	Specifies the slave address.	1
Function code	Specifies 06. 06: Writes to single register	1
Register address	Specifies the register address where writing is performed. Set an address that is one less than the actual register address.	2
Writing data	Specifies the data that is written to the register.	2
CRC	Error check section. For details, see page 38 "CRC Calculation Method".	2

●Response Message Format for Slave (WA) to Master (PC)

If the slave is operating normally, the same message as that sent from the master is sent in response.

For a message when an error has occurred in the slave, see page 37 "Exception Responses".

An example for the address 21, register address 113, and writing data 333 is shown below.

Process request message (hexadecimal notation)

Address	Function code	Register address		Writing data		CRC	
15	06	00	70	01	4D	4A	A0

Note

The register address is sent at a value that is one less than the target address, and so this becomes 0x0070.

Response message (hexadecimal notation)

Address	Function code	Register address		Writing data		CRC	
15	06	00	70	01	4D	4A	A0

Exception Responses

When an error has occurred in the slave, an exception response is sent in response instead of the normal response message.
An exception response includes a number (exception code) that indicates the details of the exception.

Exception codes

Code	Name	Description
01	ILLEGAL FUNCTION	An unsupported function code was specified.
02	ILLEGAL DATA ADDRESS	The specified register address was not found.
03	ILLEGAL DATA VALUE	Data that cannot be written to the slave was specified.

●Response Message Format for Slave (WA) to Master (PC) (When Exception Occurs)

When it is detected that a slave (WA) made an improper request, an exception response is sent in response instead of the normal response message.

Name	Description	No. of bytes
Address	This is the same numerical value as the address contained in the message that was sent from the master.	1
Function code	This is a numerical value determined by adding 0x80 to the function code contained in the message that was sent from the master.	1
Exception code	This inserts a number indicating details about the exception. For details, see "Exception codes".	1
CRC	Error check section. For details, see page 38 "CRC Calculation Method".	2

An example is shown below when reading the data for address 1, function code 03, and register address 1000 for one register and then ILLEGAL DATA ADDRESS (specified register address was not found) was sent in response.

Process request message (hexadecimal notation)

Address	Function code	Register address		Number of registers that are read		CRC	
01	03	03	E7	00	01	34	79

Note

The register address is sent at a value that is one less than the target address, and so this becomes 0x03E7.

Response message (hexadecimal notation)

Address	Function code	Exception code	CRC	
01	83	02	C0	F1

CRC Calculation Method

The CRC is calculated using the section excluding the CRC for each message.
An example when reading the data for address 1, function code 03, and register address 21 for one register is shown below.

Section excluding CRC from process request message (hexadecimal notation)

Address	Function code	Register address		Number of registers that are read		CRC	
01	03	00	14	00	01	-	-

The CRC calculation method is shown below.
The CRC value is taken as X, and the initial value of X is 0xFFFF.

CRC Calculation Method

Step number	Calculation details	X value	Logical AND
1	The exclusive OR (XOR) is taken of the value of the 1st byte (address value: 01) and X, and the calculation result is substituted in X.	0xFFFE	-
2.1	The logical AND of X and 0x0001 is taken, and AND is saved at 0 or 1.	0xFFFE	0
2.2	X is shifted by 1 bit to the right, and the calculation result is substituted in X.	0x7FFF	0
2.3	Only if the result of AND in 2.1 was 1: The XOR is taken of X and 0xA001, and the calculation result is substituted in X.	0x7FFF	0
2.4	The process from 2.1 to 2.3 is repeated 8 times.	0x807E	-
3	Return to step 1, and repeat the process below to perform calculation for all values. Value for 2nd byte (function code value: 03) → Value for 3rd byte (register position upper byte value: 00) ...	-	-
4	The value of X is found.	0x0EC4	
5	The lower byte (C4) of the X value is the upper byte part of the CRC, and the upper byte (0E) of the X value is the lower byte part of the CRC.	-	-

The process request message that is actually sent is shown below.

Process request message (hexadecimal notation)

Address	Function code	Register address		Number of registers that are read		CRC	
01	03	00	14	00	01	C4	0E

Note on Communication Timing

After a response message from the slave (WA) is received by the master (PC), do not send a process request message to the WA from the PC until a wait time of 3.5 characters has elapsed.
The calculation method for the wait time and a calculation example are shown below.

●1-character data structure

Start bit	Data bit	Parity	Stop bit
1 bit	8 bits	0 or 1 bit	1 bit

●Wait time for response message

Address	Function code	Number of readout bytes	Readout data		CRC	
			Data 1			
01	03	02	00	01	79	84

●Wait time calculation formula and calculation example (for 3.5 characters)

Calculation formula

3.5-character wait time (msec) = Number of bits for 3.5 characters ÷ Communication speed (bps) × 1000

Calculation example

●When the communication speed is 57600 bps, parity is even, and stop bit is 1 bit

3.5-character wait time (msec) = 11 bits × 3.5 ÷ 57600 × 1000 ≒ 0.67 msec

*Make the wait time longer than 0.67 msec.

Registers

This section describes the handling of register values and the functions of each register.

●Handling of register values

A two-byte (16 bits) value consisting of an upper byte and lower byte is assigned to a register.

The way that values are handled varies by the register, but handling is divided into two types: 2-byte integer values and bit fields.

Many registers handle values as 2-byte integer values, but some registers handle values as bit fields.

If a value is handled as a bit field, this is indicated in the description field of the register.

The 2-byte values are shown below in the format [upper byte (hexadecimal), lower byte (hexadecimal)].

●2-byte integer value

This expresses a value by joining the upper byte and lower byte as two bytes.

The byte order is big endian.

Example: When value is [0x04,0x06] → [0x0406] → 1030

●Bit field

Each bit of a 2-byte value (16 bits) is used as a flag.

A role is set when the value for each bit is 0 or 1, and the bit value is switched between 0 and 1 based on the role.

There is no effect on operation even if a bit with no role is changed.

Example: For InputRegister, when the value for register 2 (Status) is [0x0180] (bit number is 0 to 15)

Bit no.	Value	State
0	0	(No role)
1	0	Temperature alarm has not occurred
2	0	Output exceeded alarm has not occurred
3	0	Over-current alarm has not occurred
4	0	Over-voltage alarm has not occurred
5	0	Short-circuit load alarm has not occurred
6	0	Open load alarm has not occurred
7	1	Ultrasonic wave oscillation in progress
8	1	Control over RS-485 communication is enabled
9-15	0	(No role)

●Input register (function code 04 read-only register) functions

Register	Item name	Initial value	Minimum value	Maximum value	Function
1	Version	-	-	-	This is the program version. Example: V1.000 → Readout value: 1000
2	Status	-	-	-	This is the status of the ultrasonic wave oscillator. This is used as a bit field. Bit 0: Not used Bit 1: Temperature alarm Bit 2: Output exceeded alarm Bit 3: Over-current alarm Bit 4: Over-voltage alarm Bit 5: Short-circuit load alarm Bit 6: Open load alarm Bit 7: Oscillation ON/OFF status Bit 8: RS-485 communication enable/disable Bits 9 to 15: Not used The meanings of the values and statuses are as follows. ● Bits 1 to 6 0: No error occurred 1: Error occurred ● Bit 7 0: Ultrasonic wave oscillation is stopped 1: Ultrasonic wave oscillation is in progress ● Bit 8 0: RS-485 communication is disabled 1: RS-485 communication is enabled
3	Power	-	-	-	This is the output power value (units: W). Example: 1200 W → Readout value: 1200
4	Frequency	-	-	-	This is the oscillation frequency (oscillation frequency/100 Hz). Example: 24.5 kHz → Readout value: 245
5	US TIME(s)	0	-	-	This is the cumulative time during ultrasonic wave oscillation (seconds).
6	US TIME(m)	0	-	-	This is the cumulative time during ultrasonic wave oscillation (minutes).
7	US TIME(h)	0	-	-	This is the cumulative time during ultrasonic wave oscillation (hours).

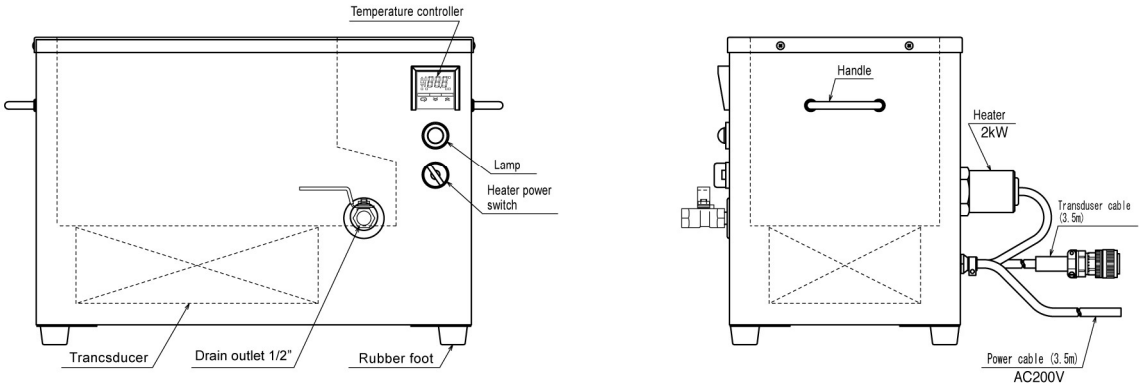
●Holding register (function code 03 (readout), 06 (write)) functions

Register	Item name	Initial value	Minimum value	Maximum value	Function
1	Connect	0	0	1	This selects enable/disable for control in RS-485 communication. 0: Control using communication is disabled*1 1: Control using communication is enabled *1 Control using the front panel and remote control is enabled.
2	Select	0	0	3	This is used to select the oscillation method. 0: DUAL 1: FM 2: SINGLE 3: PULSE
3	Control	0	0	1	This is used to select ON or OFF for ultrasonic wave oscillation. 0: Oscillation OFF 1: Oscillation ON
4	Set_Power	-	20	100	This is used to set the ultrasonic wave output in 1% units. Setting range: 20% (Min.) to 100% (Max.)

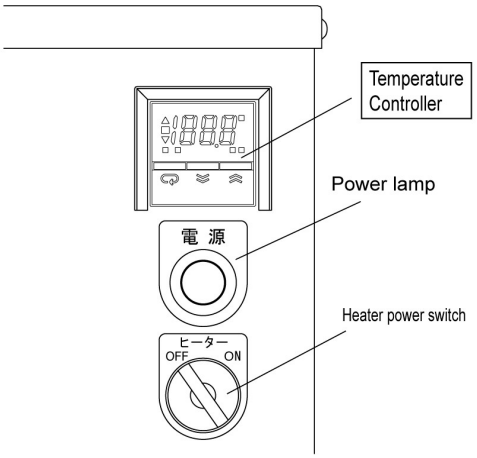
7 Tank with Heater

This section describes operation of the cleaning tank with heater and safety information that is particularly important.

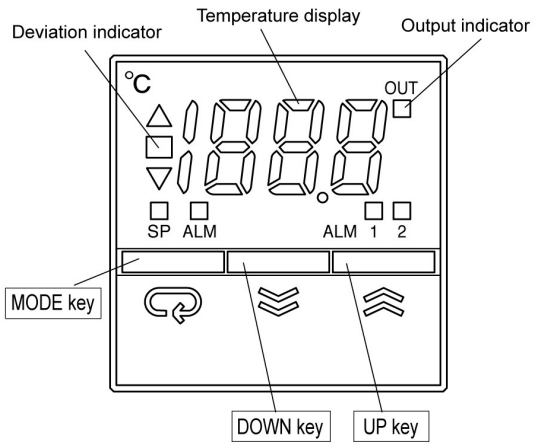
●Appearance of cleaning tank with heater



●Enlarged view of temperature setting controller section



Temperature Controller



7.1 Installation and Operating Procedures

This section describes the installation and operating procedures for the cleaning tank with heater.

The tank with heater can become extremely hot. Do not touch the tank with your hands or put your hands into the solution. Doing so could result in a burn.

- **Do not open the front door of the temperature setting controller and change the switch settings. Doing so could result in a breakdown.**
- **Be careful that water is not splashed on the heater electrode cover, cable routing holes, temperature setting controller, and voltage switches.**

Disassembly prohibited

Do not remove the heater electrode cover. Doing so could result in an electrical shock.

- The temperature can be set in the range from 0°C to 100°C, but for safety reasons, usage within the range from 5°C to 80°C is recommended.
- Rust can form on the heater flange during operation. This can reduce the cleaning performance for cleaning objects that are sensitive to rust.
- Cooling equipment is required for operating at a constant temperature.

Installation

A 3-core power cable is used for the heater.
Connect the green wire to the ground, and connect the other two wires to single-phase 200 V AC terminals.

Operation Procedures

1. Fill the cleaning tank with cleaning solution.
   i. To prevent the heater from heating while the tank is empty, always try to keep a solution level of about 70% or more in the tank.
2. Turn on the power switch for the heater.
   i. Check that the power lamp turns on.
3. Press the mode key of the temperature setting controller to set to temperature setting mode, and use the up key and down key to set to the desired temperature.
4. When the settings are completed, press the mode key to return to the current solution temperature indicator state.

5. When the setting temperature is reached, heater operation is automatically stopped, and the ■ lamp in the middle of the deviation indicator lamps turns on.
6. To change the temperature setting during operation, perform steps 2 and 3.

Additional Information

- When the solution temperature is above the setting temperature, the ▲ deviation indicator lamp turns on, and when the temperature is below the setting temperature, the ▼ deviation indicator lamp turns on. When the setting temperature is reached, the up and down arrow lamps turn off, and the middle ■ green lamp turns on.

8 Troubleshooting

If a problem occurs during operation of this product, read this troubleshooting information to inspect the problem area and take corrective action.
If the problem is still not resolved by inspecting and taking corrective action, immediately stop usage, and contact the dealer where you made the purchase.

Please note that Honda Electronics will not be liable for any damage that occurs as a result of measures taken by the customer other than those described in this manual.
Be aware that, in these cases, a fee will be charged for repair even if the warranty period is still valid.

The warranty period is 12 months from product shipping or 2,000 hours of operation, whichever is shorter.
However, the warranty does not apply to abnormal usage, dirtiness and adhesion of foreign objects on the transducer surface, problems due to damage arising from failure to follow the operating procedures, and erosion.

In the event that a problem occurs, if after consultation and analysis, it is found that the problem is the responsibility of Honda Electronics, we will provide repairs free of charge.

8.1 Error Indicator Function

This product includes a function for detecting and displaying the error states that have occurred in the device and for automatically stopping ultrasonic wave oscillation.
The error state is displayed as an error message on the display screen of the oscillator front panel.
If an error has occurred, check the error message, and take the proper corrective action by referring to the following table.

Errors Due to Transducer Connection

Front panel lamp indicators		Type of error that occurred	Cause	Corrective action
AL lamp	Level indicator			
Blinking ●⇔○	1 lamp blinking ■□□□□□□□	Short-circuit load alarm	A short-circuit has occurred somewhere along the transducer cable routing path between the oscillator and transducer unit.	Check that there are no short-circuits along the routing path for the transducer cable.
			Liquid is adhering to the transducer or terminal connectors due to condensation, solution leakage, or other cause, resulting in reduced insulation resistance.	Check that no liquid is adhering to the terminal connectors or elements of the transducer unit. Then, implement measures for solution leakage based on the situation or use in an environment with low humidity.
			The vibrating elements were damaged in short-circuit mode.	Replace with a transducer unit having the same ID number. *1
	2 lamps blinking ■■□□□□□□	Open load alarm	A broken wire or disconnection has occurred somewhere along the transducer cable routing path between the oscillator and transducer unit.	Check that there are no broken wires or disconnections along the routing path for the transducer cable.
			The transducer cable connector is not connected to the oscillator.	Connect the transducer cable connector to the oscillator.

*1 Please contact the dealer where you made the purchase.

Errors Due to Oscillation State

Front panel lamp indicators		Type of error that occurred	Cause	Corrective action
AL lamp	Level indicator			
Lit ●	1 lamp lit ■□□□□□□□	Excessive power alarm	A transducer unit with a different ID from the oscillator ID number is connected.	Check that the ID number matches the ID number of the transducer unit connected to the oscillator.
			The transducer has deteriorated or has broken down.	Replace with a transducer unit having the same ID number. *1
	2 lamps lit ■■□□□□□□	Over-current alarm	A transducer unit with a different ID from the oscillator ID number is connected.	Check that the ID number matches the ID number of the transducer unit connected to the oscillator.
			The transducer has deteriorated or has broken down.	Replace with a transducer unit having the same ID number. *1
	3 lamps lit ■■■□□□□□	Over-voltage alarm	A transducer unit with a different ID from the oscillator ID number is connected.	Check that the ID number matches the ID number of the transducer unit connected to the oscillator.
			The transducer has deteriorated or has broken down.	Replace with a transducer unit having the same ID number. *1
	4 lamps lit ■■■■□□□□	Temperature alarm	The ambient temperature of the oscillator exceeds 40°C.	Use by installing in an environment where the ambient temperature does not exceed 40°C.
			Ventilation is inadequate for cooling the oscillator.	Provide sufficient space for ventilation, and improve the flow of air.
			Dust, oil, or other objects are blocking the cooling ventilation openings.	Periodically remove any objects adhering to the ventilation openings on the front and rear panels of the oscillator for

				improving the flow of air. Also, avoid use in environments where large amounts of dust, oil, and other substances are produced.
			A transducer unit with a different ID from the oscillator ID number is connected.	Check that the ID number matches the ID number of the transducer unit connected to the oscillator.

*1 Please contact the dealer where you made the purchase.

8.2 Troubleshooting for Other Symptoms

No.	Symptom	Cause	Corrective action
1	Ultrasonic wave oscillation is not performed. → When the front panel LED does not turn on	The power switch on the front panel of the oscillator is at the OFF position.	Set the power switch on the front panel of the oscillator to the ON position.
		The primary-side power supply line is not connected properly.	Provide a supply voltage to the oscillator by referring to "4.2 Connecting the Power Cable".
		Problem due to internal part of the oscillator.	Please contact the dealer where you made the purchase.
2	Ultrasonic wave oscillation is not performed. → AL lamp is lit.	Because a problem has occurred, ultrasonic wave oscillation is not performed.	Check the details of the problem, and take the proper corrective measures by referring to "8.1. Error Indicator Function".
	Ultrasonic wave oscillation is not performed. → When ultrasonic waves are not started or stopped by the US ON/OFF switch	Start/stop operation by the US ON/OFF switch cannot be performed because the remote control function is enabled (REMOTE lamp is lit).	Set the REMOTE setting switch on the oscillator rear panel to OFF to disable the remote control function (REMOTE lamp turns off).
3	Ultrasonic wave oscillation is not performed. → When ultrasonic waves are not started or stopped by remote control	Start/stop operation by remote control cannot be performed because the remote control function is disabled (REMOTE lamp is turned off).	Set the REMOTE setting switch on the oscillator rear panel to ON to enable the remote control function (REMOTE lamp turns on).
		The remote cable has a broken wire or is not connected properly.	Check that the remote cable is connected to the COM terminal and the REM terminal on the oscillator rear panel I/O terminal block, and that the cables are connected properly to the customer's controller.
4	Ultrasonic wave oscillation is unstable. → Oscillation is repeatedly started and stopped when set to	The center frequency of DUAL or FM mode is scanned when starting oscillation and when set to a specific output.	Change the position of the power setting dial.

	DUAL or FM mode		
5	Ultrasonic wave oscillation output is weak.	The power setting is at MIN.	Turn the power setting dial clockwise to increase the output.
		Supply voltage is incorrect.	Supply a voltage that is within the oscillator rated voltage range.

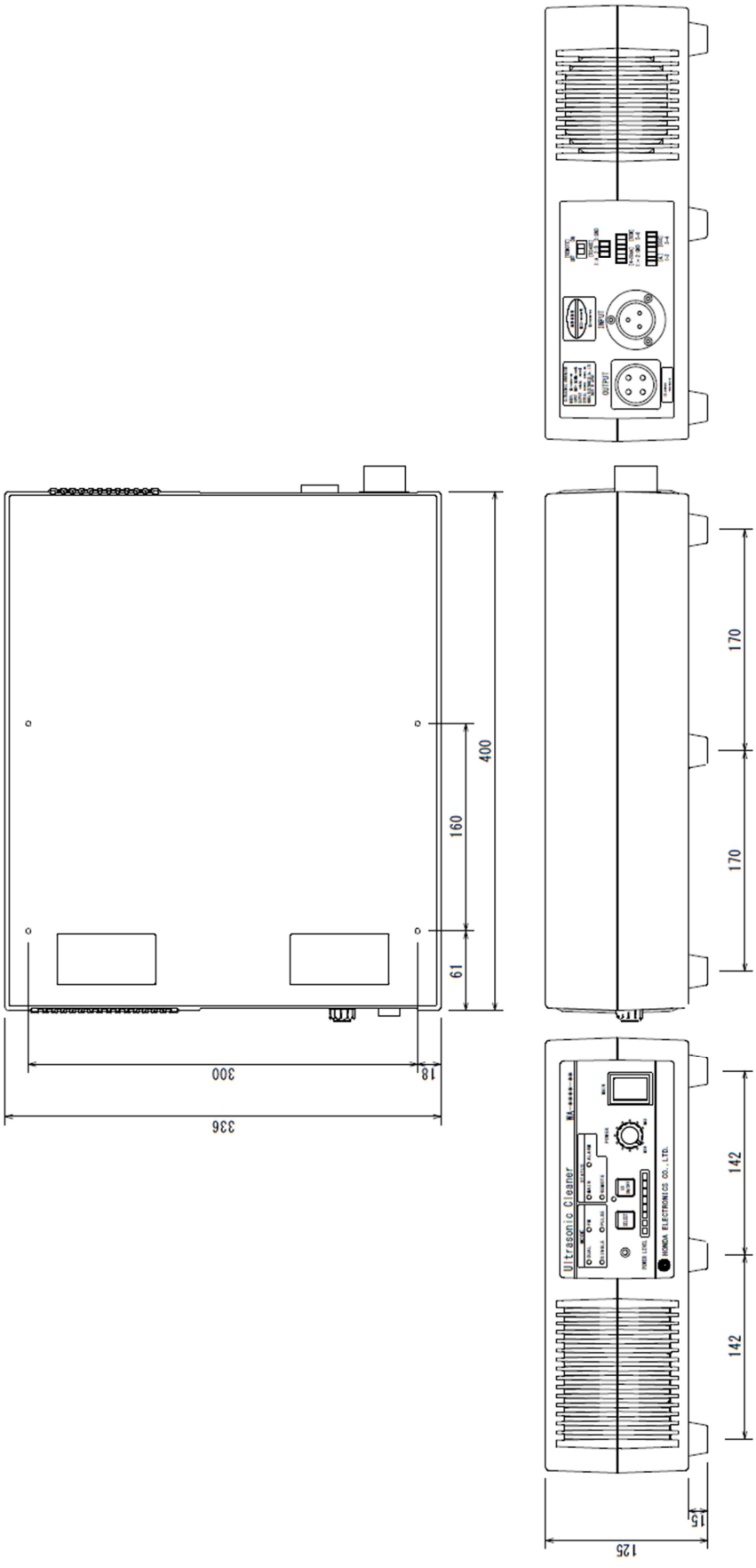
9 Specifications

9.1 Oscillator

●Specifications

Model		WA-600-28	WA-600-40	WA-1200-28	WA-1200-40
Oscillation modes		(1) Adjacent dual-frequency switching oscillation (DUAL) (2) FM oscillation (FM) (3) Single-frequency oscillation (SINGLE) (4) Pulse oscillation (PULSE)			
Rated output power	DUAL, FM	400 W		800 W	
	SINGLE	600 W		1200 W	
	PULSE	600 W		1200 W	
Output adjustment range		20% to 100%			
Nominal oscillation frequency		28 kHz	40 kHz	28 kHz	40 kHz
Power input		Selectable (at time of ordering) from single-phase 200 V , 220 V, 230 V, 240 V AC, 50/60 Hz			
		1200 VA		2400 VA	
When communication is not used	Remote function	- Short-circuit with REM terminal: Starts ultrasonic oscillation - Open circuit with REM terminal: Stops ultrasonic waves			
	Alarm function	Transducer short-circuit, Transducer open circuit, Excessive output, Over-voltage, Over-current, Overheating			
	Output function	Alarm lamp turns on when error occurs (alarm type can be identified based on the indicator LED state), Oscillation detection (photorelay output), alarm detection (photorelay output), Power (4 to 20 mA current output)			
Communication function		RS-485 Modbus protocol Settings: (1) Oscillation mode, (2) Ultrasonic wave oscillation ON/OFF, (3) Output setting (20% to 100%, 1% steps) Readout: (1) Oscillation mode, (2) Ultrasonic wave oscillation state, (3) Alarm type, (4) Output power, (5) Frequency			
Ambient operating environment		Temperature: 5°C to 40°C, Relative humidity: 5% to 80% RH (no condensation) Indoor use, Max. altitude 2000 m			
Dimensions (mm)		336 (W) × 400 (D) × 125 (H) (excluding protrusions and legs)			
Weight		Approx. 6 kg			

●External dimensions (WA-600-28/40 and WA-1200-28/40) (Units: mm)

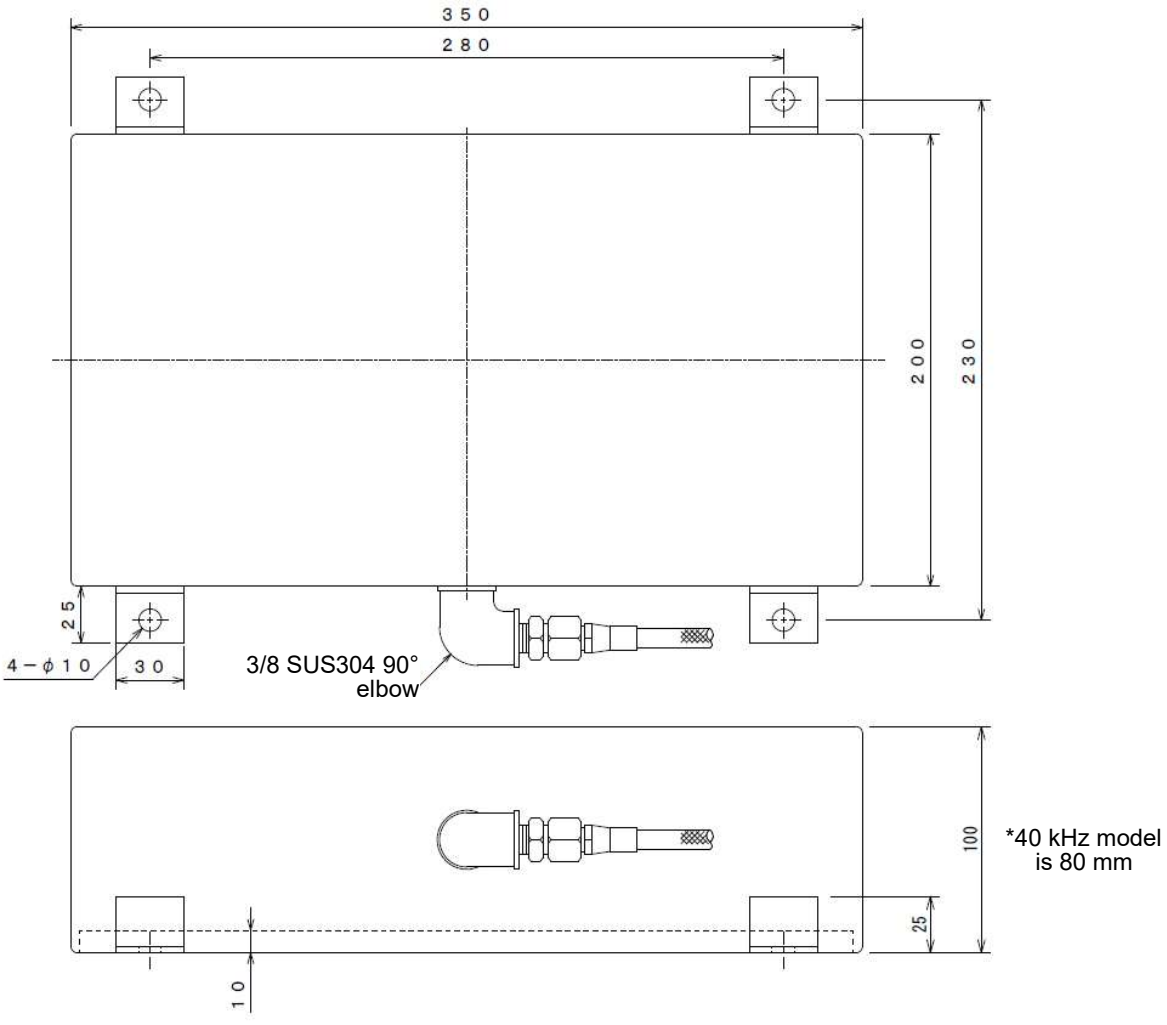


9.2 Transducer Unit

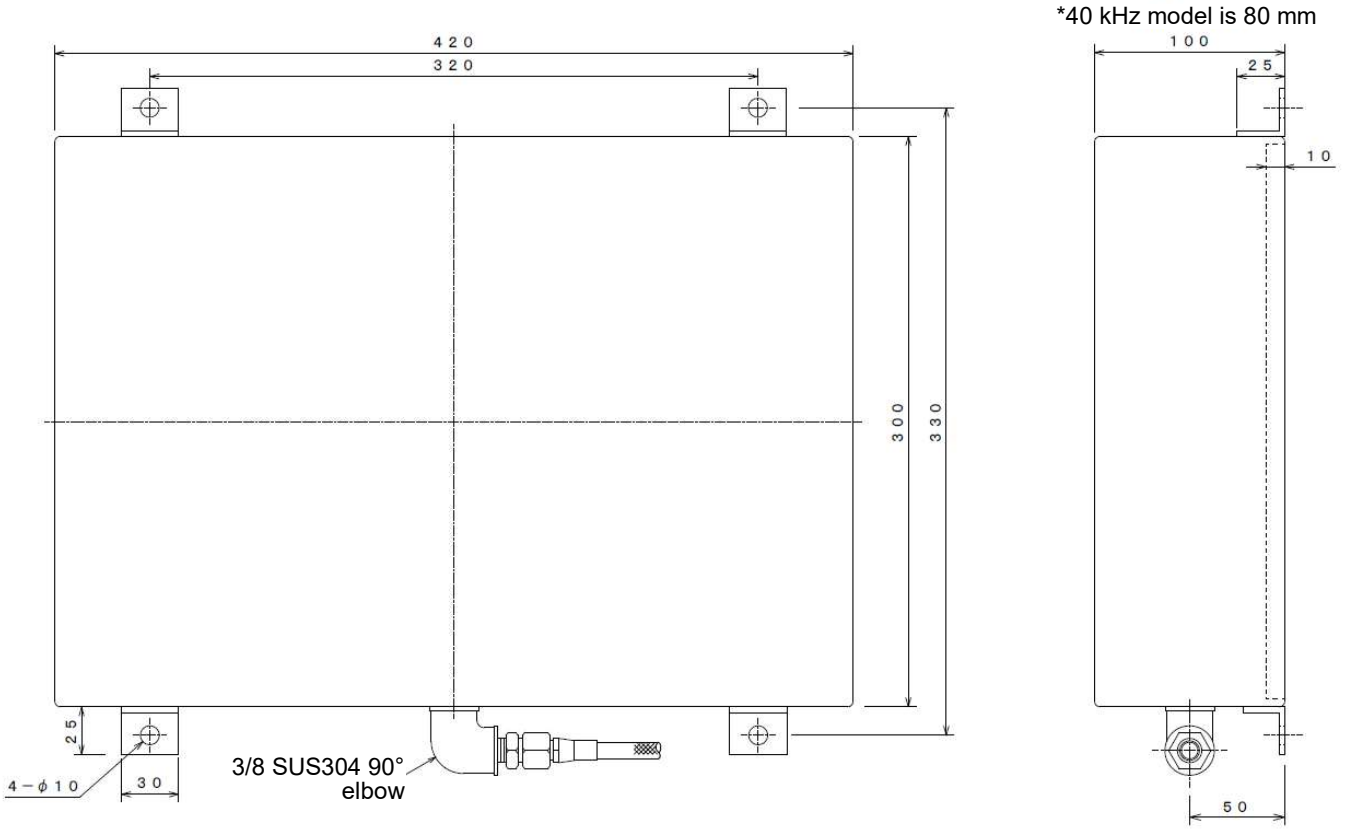
●Immersible box type: Standard specifications

Model	WA-600 type		WA-1200 type	
	N06-28A	N06-40A	N12-28A	N12-40A
Allowable input power	600 W		1200 W	
Nominal resonance frequency	28 kHz	40 kHz	28 kHz	40 kHz
Transducer	Bolt-clamped Langevin type transducer			
Usage solution temperature	5°C to 80°C			
Vibration plate material	Stainless steel SUS304 (SUS316L is also available by special order)			
Transducer radiating surface coating	Hard chrome plating			
Dimensions (mm) (W×D×H)	350×200×100	350×200×75	420×300×100	420×300×75
Weight	Approx. 14 kg	Approx. 11 kg	Approx. 18 kg	Approx. 14 kg
Transducer cable	2.5 m (braided section (2 m)) + Output cable 3.5 m			

●Immersible box type (N06-28A, N06-40A) : External dimensions (Units: mm)



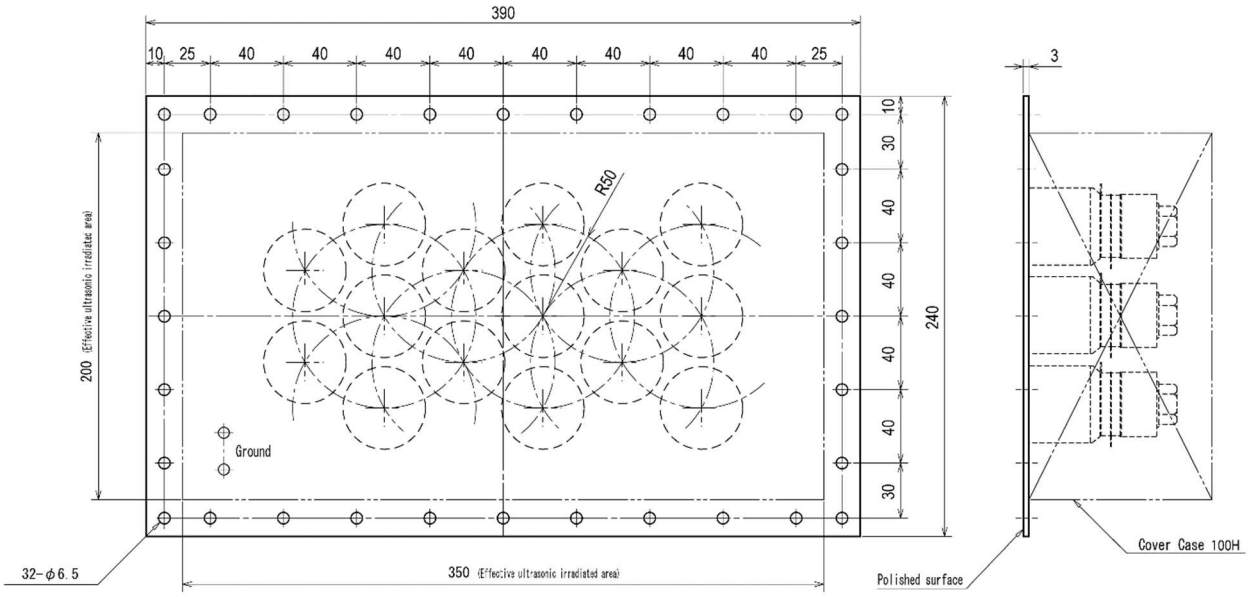
●Immersible box type (N12-28A, N12-40A) : External dimensions (Units: mm)



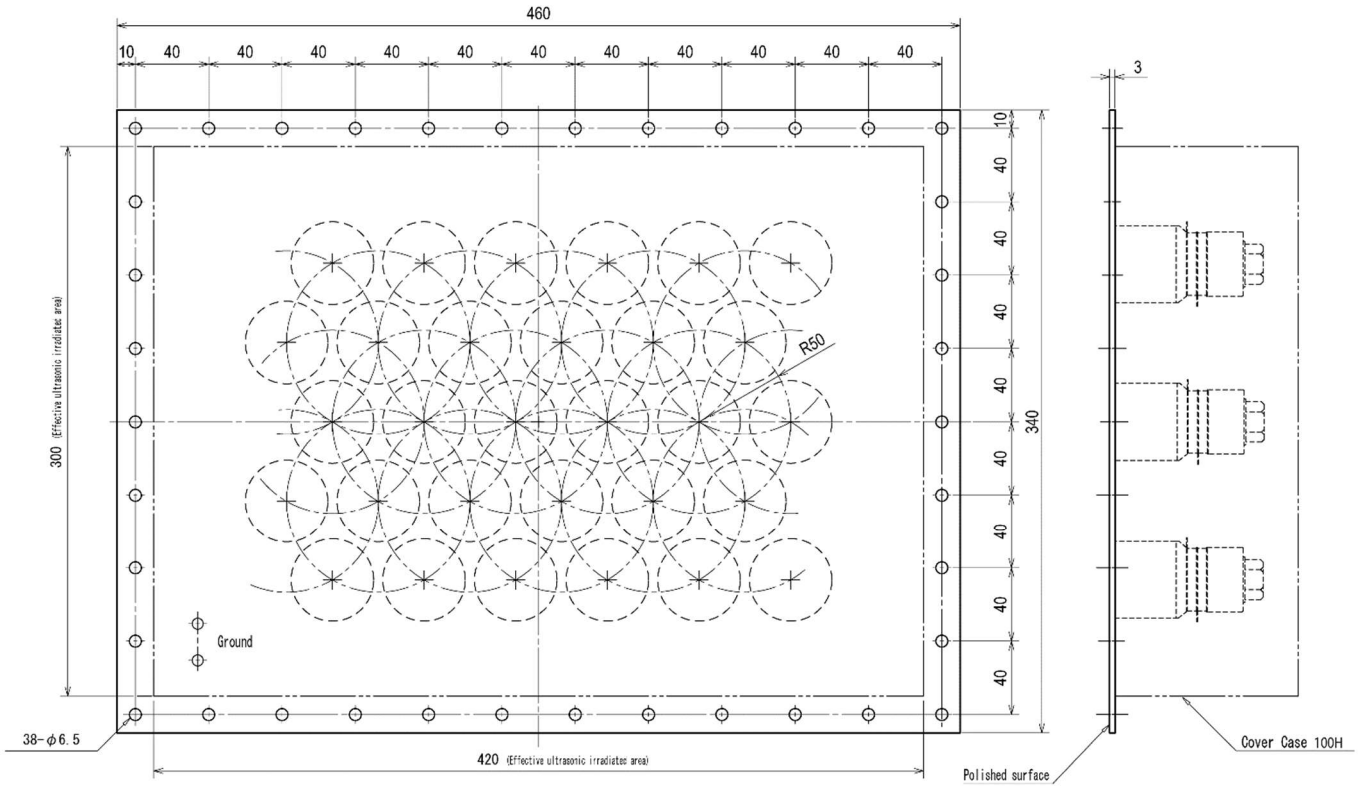
●Vibration plate type: Standard specifications

Model	WA-600 type		WA-1200 type	
	F06-28A	F06-40A	F12-28A	F12-40A
Allowable input power	600 W		1200 W	
Nominal resonance frequency	28 kHz	40 kHz	28 kHz	40 kHz
Transducer	Bolt-clamped Langevin type transducer			
Usage solution temperature	5°C to 100°C			
Vibration plate material	Stainless steel SUS304 (SUS316L and hastelloy are also available by special order)			
Transducer radiating surface coating	Hard chrome plating			
Dimensions (mm) (W×D)	390×240 (plate thickness: 3 mm)		460×340 (plate thickness: 3 mm)	
Weight	Approx. 10 kg	Approx. 8 kg	Approx. 16 kg	Approx. 13 kg
Transducer cable	3.5 m + Output cable 3.5 m			
Packing material	EPDM t = 3 mm (Viton and similar materials are also available by special order)			

●Vibration plate type (F06-28A, F06-40A) : External dimensions (Units: mm)



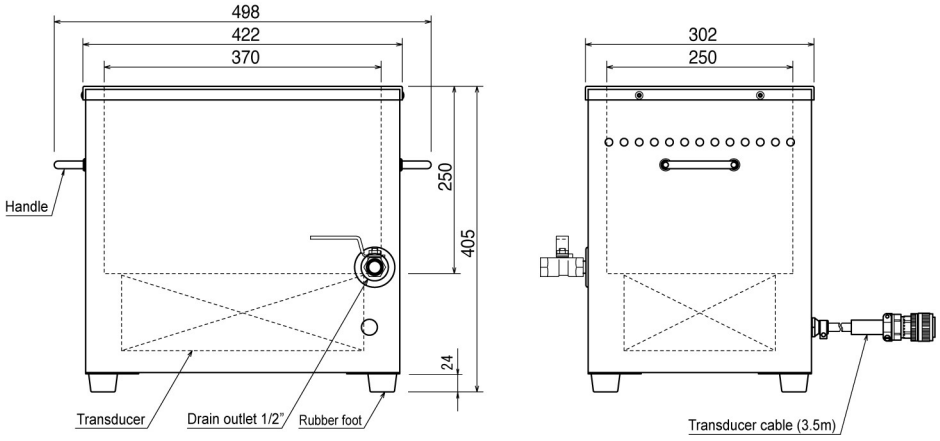
●Vibration plate type (F12-28A, F12-40A) : External dimensions (Units: mm)



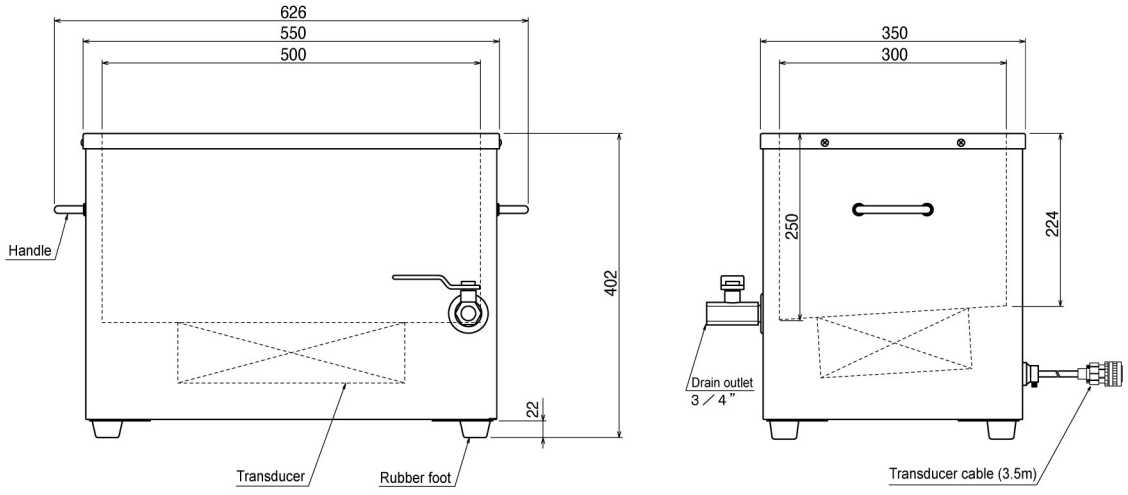
●Tank type: Standard specifications

Model	WA-600 type		WA-1200 type	
	S06-28A	S06-40A	S12-28A	S12-40A
Allowable input power	600 W		1200 W	
Nominal resonance frequency	28 kHz	40 kHz	28 kHz	40 kHz
Transducer	Bolt-clamped Langevin type transducer			
Usage solution temperature	5°C to 100°C			
Cleaning tank material	Stainless steel SUS304 (SUS316L is also available by special order)			
Tank internal dimensions (mm) (W×D×H)	366×246×248 (23 L)		500×300×250 (deepest section) to 224 (shallowest section) (35 L)	
Dimensions (mm) (W×D×H)	422×302×405 (including rubber feet)		550×350×402 (including rubber feet)	
Weight	Approx. 22 kg	Approx. 19 kg	Approx. 39 kg	Approx. 34 kg
Transducer cable	3.5 m			

●Tank type (S06-28A, S06-40A) : External dimensions (Units: mm)



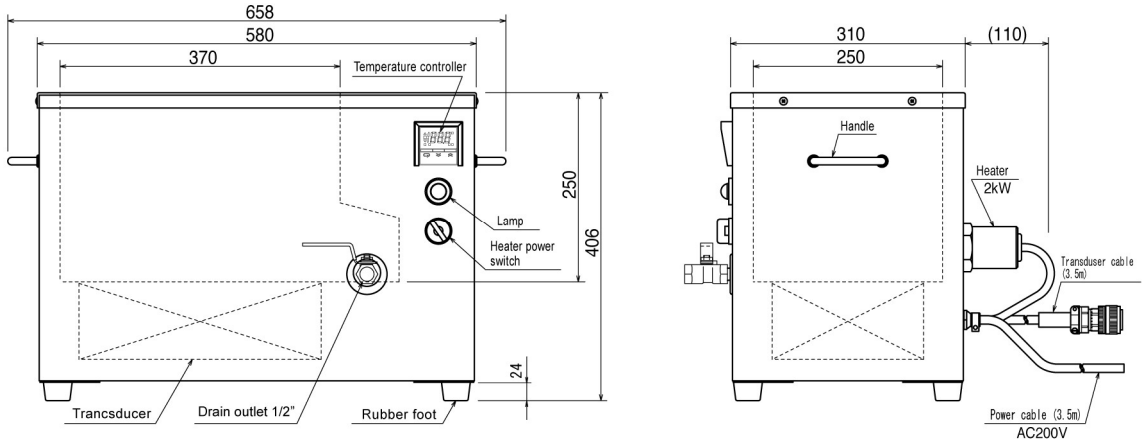
●Tank type (S12-28A, S12-40A) : External dimensions (Units: mm)



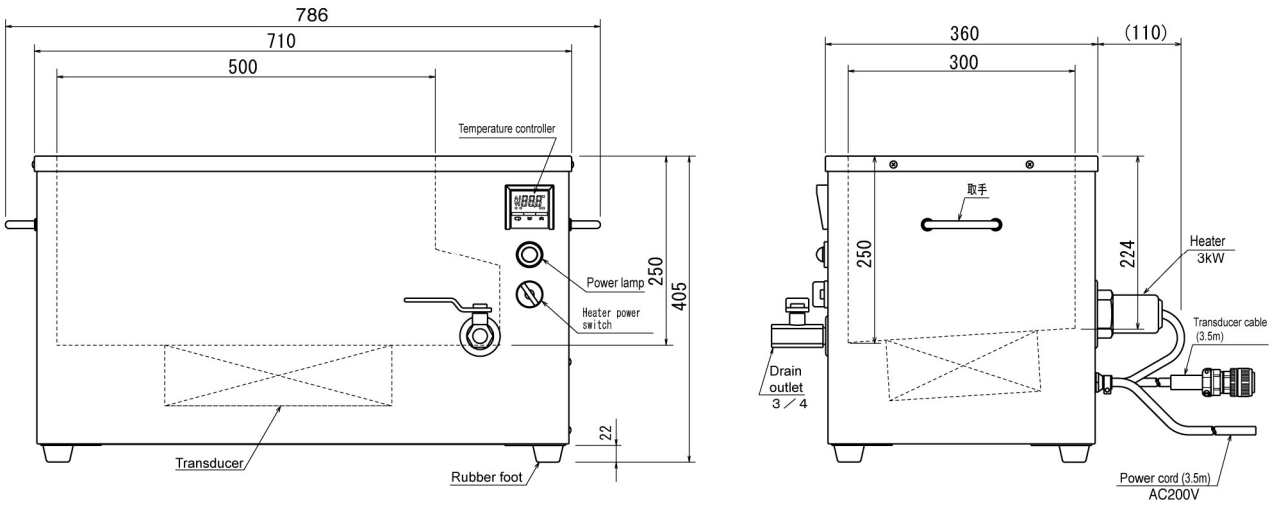
●Tank with heater type: Standard specifications

Model	WA-600 type		WA-1200 type	
	SH06-28A	SH06-40A	SH12-28A	SH12-40A
Allowable input power	600 W		1200 W	
Nominal resonance frequency	28 kHz	40 kHz	28 kHz	40 kHz
Transducer	Bolt-clamped Langevin type transducer			
Usage solution temperature	5°C to 100°C			
Cleaning tank material	Stainless steel SUS304 (SUS316L is also available by special order)			
Tank internal dimensions (mm) (W×D×H)	370×250×250 (23 L)		500×300×250 (deepest section) to 224 (shallowest section) (35 L)	
Dimensions (mm) (W×D×H)	580×310×406 (including rubber feet)		710×360×405 (including rubber feet)	
Weight	Approx. 28 kg	Approx. 25 kg	Approx. 46 kg	Approx. 40 kg
Transducer cable	3.5 m			
Heater capacity	2 kW		3 kW	
Heater supply voltage	200 V AC, single-phase 50/60 Hz			

●Tank with heater type (SH06-28A, SH06-40A) : External dimensions (Units: mm)



●Tank with heater type (SH12-28A, SH12-40A) : External dimensions (Units: mm)



◆ After sales service

When the after service such as the repair is required, please contact the seller of product with the detailed information about the malfunction.

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

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●This instruction manual is current as of April 2021.
●This information is subject to change without notice for the purpose of incorporating product improvements.

April 2021