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H-1 Series Electric Resistivity Meter

HE-200R



■ Overview

- The HE-200R is designed to measure the electric resistivity (specific resistance) and temperature of an aqueous solution when used with an electric resistivity sensor of the ERF series. For the unit of electric resistivity, either the daily used unit or the International System of Units may be selected. The signal acquired from the sensor is processed to output electric resistivity as readout.

The measured value readout at the upper part shows electric resistivity, while the auxiliary readout at the lower part shows temperature.

The HE-200R has a new clipping capability added for electric resistivity. This capability ensures that no larger measured values than the setting value for clipping are displayed. Both readout and transmission output are clipped. For example, when clipping is set to 18.30 MΩ·cm in the range of 20 MΩ·cm, readout and transmission output will be clipped at 18.30. The clipping capability is available for each range. Clipping is canceled when the full-scale value is exceeded.

■ Measurement target

- Ultrapure water to deionized water

■ Measuring principle

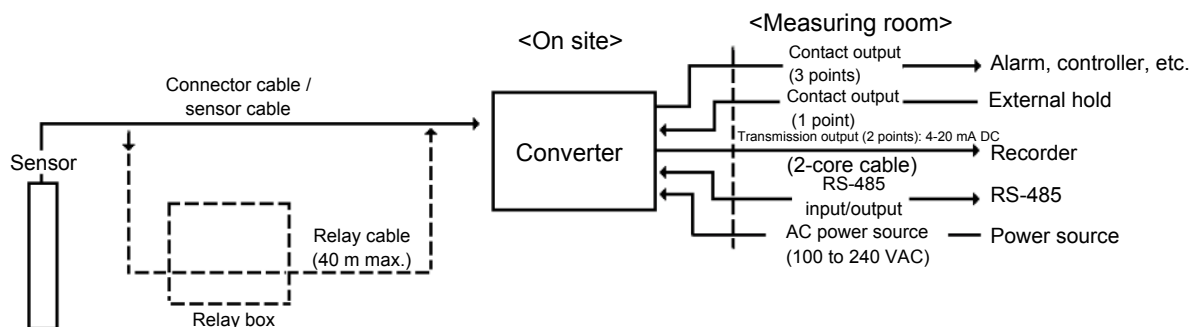
- AC bipolar
- The resistance value and temperature of a sample are measured with the electric resistivity meter. The measured values are used to calculate the electric resistivity with the equation stored in the HE-200R.

■ Intended use

- Control of ultrapure water

■ System configuration diagram

Standard specification



* The relay box and dedicated cable are used when 10m of sensor cable is not sufficient.

H-1 Series Electric Resistivity (Specific Resistance) Meter HE-200R Readout Converter

■ Features

- Outdoor installation type (drip-proof construction equivalent to IP65)
- Selectable simultaneous display of temperature
- All settings available with front keys
- Improved maintenance feature (self-diagnostic capability)
- Selectable transmission output range
- Backup of stored data
- Easy-to-read display (150% larger than former display)
- Improved operability of keys by using an emboss sheet

■ Instrument

The resistance value and temperature of a sample are measured with the electric resistivity meter. The measured values are used to calculate the electric resistivity with the equation stored in the HE-200R.

For temperature compensation, a new definition has been introduced. The electric resistivity value of ultrapure water is different between references; it differs depending on measurers. The HE-200R uses $18.23 \text{ M}\Omega\cdot\text{cm}$ as the reference to calculate electric resistivity. For any users who want other values, we offer two options of 18.18 and $18.234 \text{ M}\Omega\cdot\text{cm}$. When a value for electric resistivity is selected, the cell constant and the temperature characteristic of ultrapure water are internally adjusted.

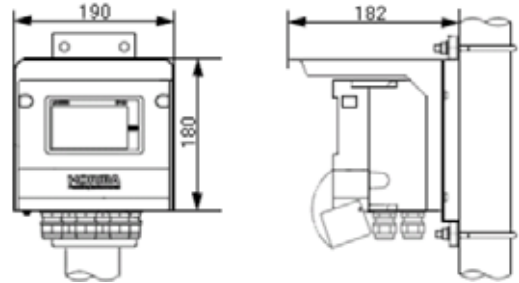
For electric resistivity values, temperature compensation is performed by a method specified by the user. Either ultrapure water compensation or no compensation may be selected. If ultrapure water compensation is selected, NaCl or an arbitrary value may be selected for the temperature characteristic of impurities other than deionized water. The temperature compensation range is between 0 and 100 .

■ Sensor

The sensors which are available for connection to the HE-200R are of the ERF-001 series. The cell constant for connectable sensors is 0.01 cm^{-1} . Sensors with temperature assay are also available.

The use of a new technique for temperature measurements has greatly improved the accuracy as a thermometer. The unique temperature circuit features its capability of minimizing the drift of the measured temperature value against changes in the ambient temperature. The use of a sensor with temperature assay allows you to correct the instrumental temperature error of the sensor by entering a value for deviation of the resistance-temperature detector (RTD) at 0°C marked on the label on the sensor. This enables you to achieve temperature measurement accuracy within $\pm 0.2^\circ \text{C}$ without performing temperature calibration. Even if no deviation is entered, temperature measurement accuracy within ± 0.5 can be achieved. To perform more accurate temperature compensation for the electric resistivity of ultrapure water, however, you need to enter a deviation to improve the temperature accuracy. Those sensors with no deviation of resistance value marked on the label on the RTD has a capability of performing calibration by making a comparison with the reference thermometer.

■ External Dimensions



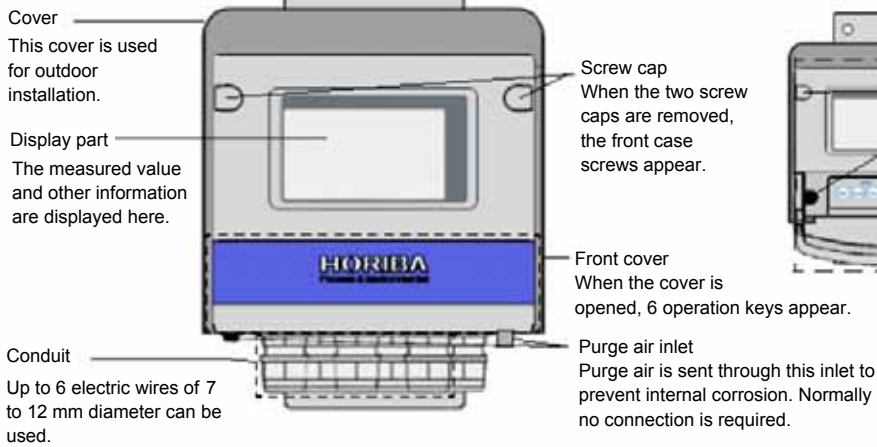
Unit: mm

For the RTD incorporated in the electric resistivity sensor, 1000Ω and 1385Ω are specified as the initial values at 0°C and 1385Ω (temperature coefficient: $3850 \text{ ppm}/^\circ \text{C}$), respectively. The electric resistivity sensors of the ERF series are used at $3850 \text{ ppm}/^\circ \text{C}$. A temperature coefficient for RTD may be entered numerically so that RTD with different temperature coefficients can be used. There is an additional capability available for correcting the resistance of the electric resistivity sensor cable by entering cable length of 50 m maximum.

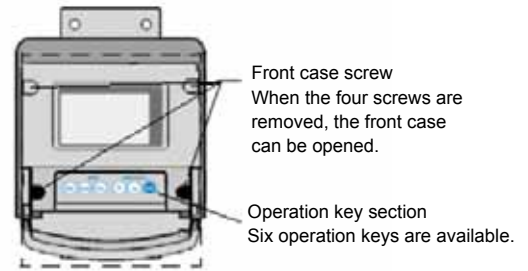
The cell constant is expressed by multiplying the order (0.01 cm^{-1}) by the correction coefficient. Enter both of them as cell-related information. Entering the correction coefficient allows you to correct the sensor's instrumental error for the cell constant.

■ Configurations

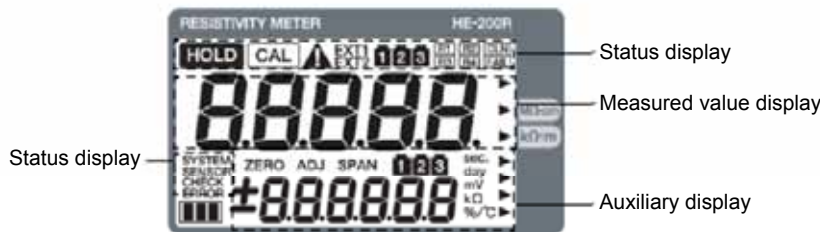
● Front



● With the front cover opened



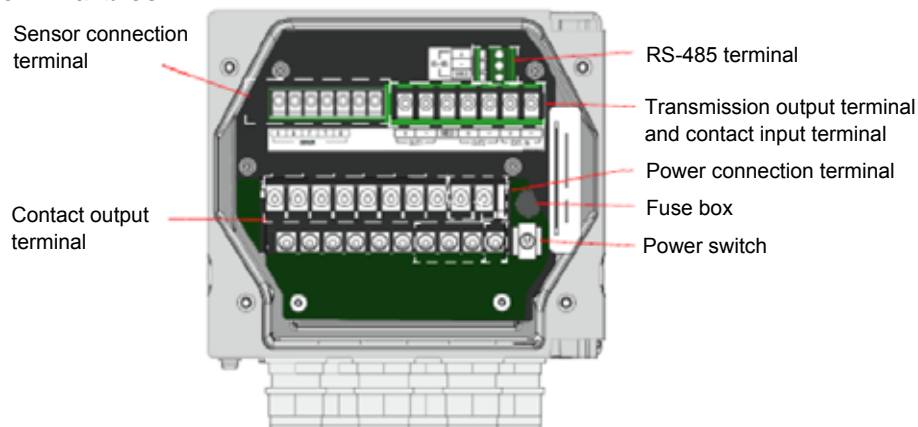
● Display part



● Operation key section

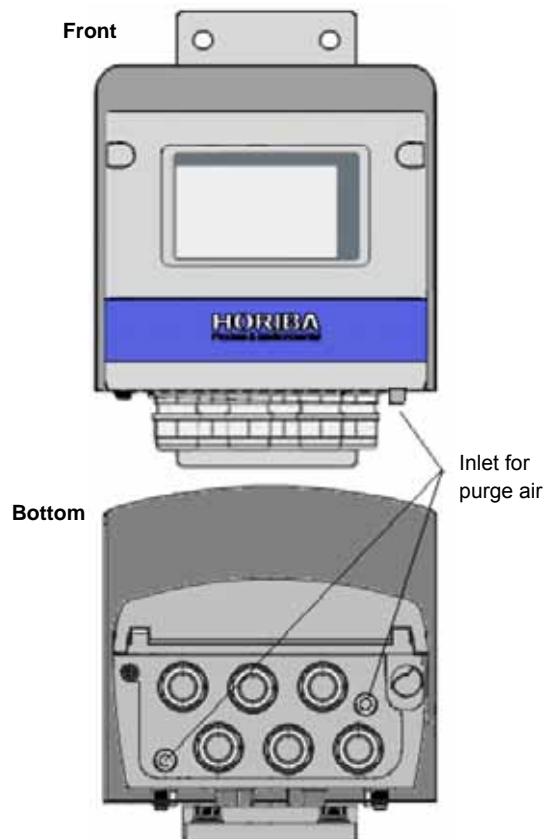


● Terminal block



■ Air purge

An inlet is provided for purge air which is used to prevent internal corrosion. To use the HE-20R in an environment where corrosive gas is generated, prevent corrosive gas from entering the inside by constantly sending instrument air.



■ Measuring the temperature

The RTD, an element to measure the temperature, uses a resistance-temperature detector which has resistance of 1000Ω at 0°C . This detector is characterized by increasing its resistance value as the temperature rises. Its resistance becomes 1385Ω (standard) at 100°C . Manufacturing variations at the resistance value at 0°C affect the temperature measuring accuracy.

In the algorithm for the HE-200R, which was not available in the past, variations in the temperature element are corrected. The resistance value of the temperature element at 0°C is assayed and then entered to correct the resistance values at all temperatures. For any RTD with a different temperature coefficient, the resistance values at all temperatures are corrected by entering that coefficient.

The use of this new algorithm for temperature measurements has achieved temperature accuracy of $\pm 0.2^\circ\text{C}$. Furthermore, the temperature calibration mode has been made available so that the temperature can be calibrated by making a comparison with a thermometer having even higher accuracy. In the temperature calibration mode, the resistance value at 0°C is corrected by making an adjustment to the reference temperature.

In order to reset the temperature calibration, the input to RTD at 0°C and the offset for the temperature calibration are individually retained. A sensor for which the resistance value of RTD at 0°C was not assayed may be used without correction. At this time however, the accuracy is $\pm 0.5^\circ\text{C}$.

As the cable becomes longer, the measured resistance value increases. However, a calculation is performed to cancel the resistance of electric wire by entering the cable length. An assay at 0°C is relative to a state (equilibrium state which is achieved when water and ice are agitated in atmosphere) rather than the thermometer.

■ Temperature compensation calculation

Electric resistivity is the inverse number of electric conductivity.
The principle of temperature compensation for electric conductivity is explained here.

• Property of deionized water

The electric conductivity of deionized water is measured as the sum of electric conductivity values due to the dissociation of water molecules and the ions of impurities:

$$C_{(T)} = F_{(T)} + G_{(T)}$$

$C_{(T)}$: Electric conductivity of solution at T

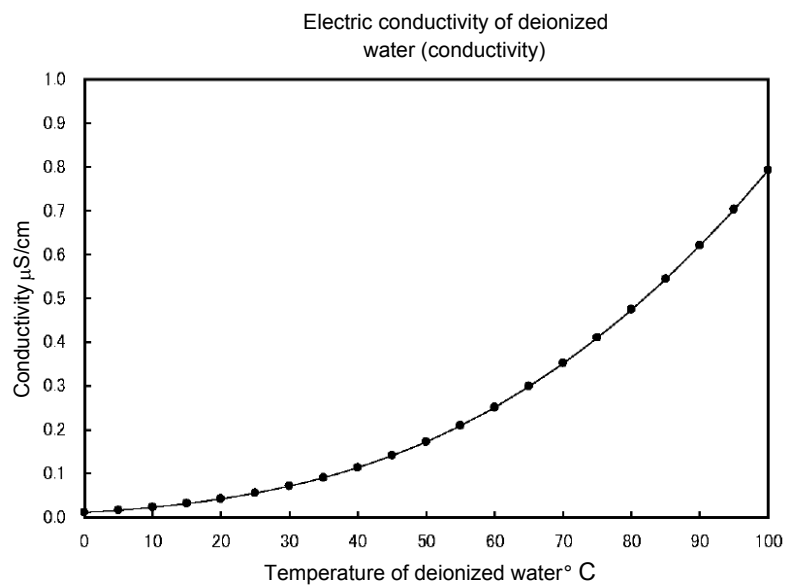
$F_{(T)}$: Electric conductivity of deionized water at T

$G_{(T)}$: Electric conductivity due to ions of impurities at T

• Electric conductivity of deionized water

The electric conductivity of deionized water results from dissociation of water molecules. The dissociation of water molecules is greatly affected by temperature changes.
The electric conductivity of deionized water is measured with successive temperature functions which have been prepared from tables in ASTM D 1125-91 and JIS K0130-1995.

Temp (°C)	Electric conductivity (μS/cm)
0	0.012
5	0.017
10	0.023
15	0.031
20	0.042
25	0.055
30	0.071
35	0.090
40	0.114
45	0.141
50	0.173
55	0.210
60	0.251
65	0.299
70	0.352
75	0.410
80	0.474
85	0.544
90	0.621
95	0.703
100	0.793



• Method using the characteristics of NaCl

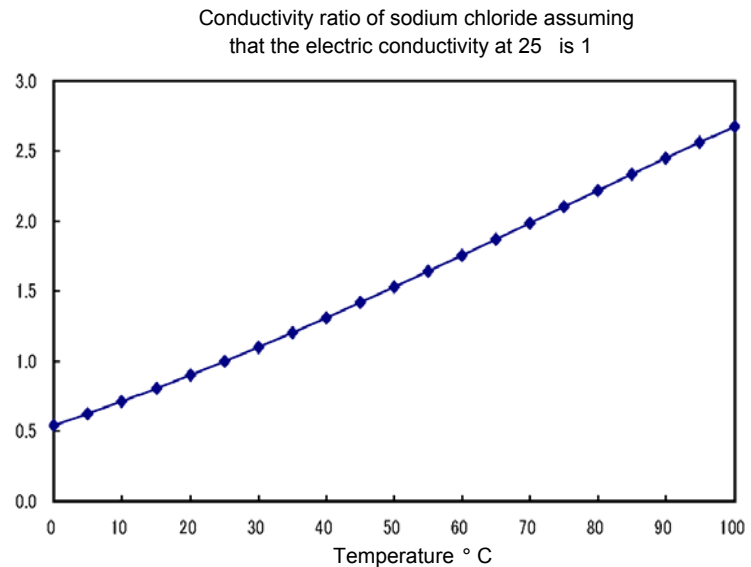
When the main component of salt included in the sample is sodium chloride, select the temperature compensation method using the characteristics of NaCl.

The electric conductivity of an aqueous solution of sodium chloride changes at the following ratio relative to the electric conductivity at 25 .

From this table, find the ratio at an arbitrary temperature to acquire the electric conductivity at 25 .

This table shows the results of our test.

Temp (°C)	NaCl Electric conductivity	Coefficient
0	0.542	1.845
5	0.626	1.597
10	0.715	1.399
15	0.806	1.240
20	0.902	1.109
25	1.000	1.000
30	1.101	0.908
35	1.205	0.830
40	1.312	0.762
45	1.420	0.704
50	1.531	0.653
55	1.643	0.609
60	1.757	0.569
65	1.872	0.534
70	1.987	0.503
75	2.103	0.476
80	2.219	0.451
85	2.335	0.428
90	2.450	0.408
95	2.564	0.390
100	2.677	0.374



•Temperature coefficient

The temperature coefficient may be changed.

The electric conductivity of an aqueous solution changes depending on the temperature. In general, when the temperature of the solution rises by 1 relative to the electric conductivity at 25 , the electric conductivity increases by about 2%. The approximate equation is shown below:

$$C(T) = C(25) \times (1 + 0.01 \times \alpha \times (T - 25))$$

C(T): Electric conductivity of solution at T

C₍₂₅₎: Electric conductivity (reference) of solution at 25

α: Temperature coefficient (unit: %) for electric conductivity

T: Arbitrary temperature T

The temperature coefficient differs depending on the kind and concentration of a solution and falls within a range between 0.5 and 2.5. The temperature compensation calculation to estimate the electric conductivity at 25 is performed by entering a temperature coefficient. Entering 2% for the temperature coefficient is applicable for almost all aqueous solutions.

If the temperature coefficient for the solution is known, enter that value.

When 0 is taken as the temperature coefficient, the raw electric conductivity without temperature compensation is obtained.

Power supply

The HE-200R has a power switch. For the HE-200R, use a free power source for rated voltage of 100 to 240 VAC.

If the ultrasonic cleaner is operated at non-rated voltage, it may malfunction. Check the power supply voltage. Carefully check that the power supply voltage fluctuations fall within a range of $\pm 10\%$.

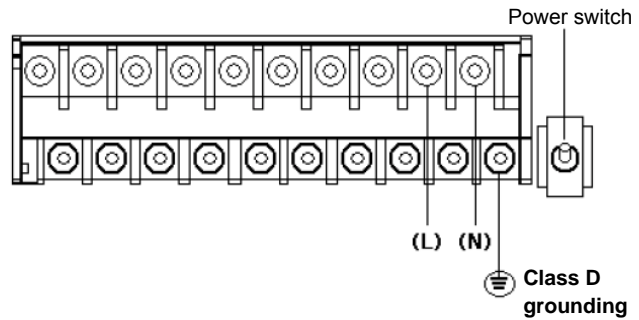
Major specifications

The terminal screw for the contact output is of M4.

The applicable electric wire is of 0.75 to 5.5 mm² (AWG18 to 10).

Provide the power switch in a place near the HE-200R so that the power can be turned ON/OFF. If lightning might strike, install an arrester on the output side of the HE-200R and on the side of receiving instruments.

Be sure to ground the grounding terminal (class D grounding). Separate this grounding from any other grounding for electric equipment such as a motor.



Electric power supplied	Voltage: 100 to 240 VAC Frequency: 50/60 Hz
Applicable power cable	0.75 to 5.5 mm ² (AWG18 to 10).

Output terminal

The HE-200R is provided with three contact outputs as standard.

Contact outputs such as transmission output hold and error alarm are available in addition to the upper and lower alarm contact outputs.

Major specifications

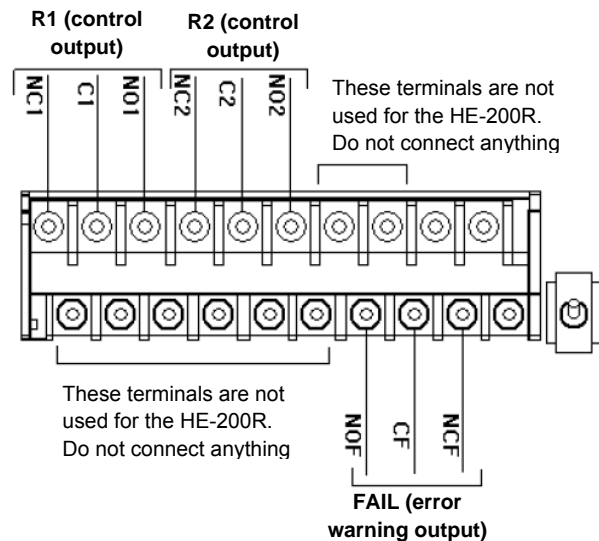
- The contact capacity is 250 VAC, 3 A maximum or 30 VDC, 3 A maximum for resistance load.
- The terminal screw for the contact output is of M4.
- The applicable electric wire is of 0.75 to 5.5 mm² (AWG18 to 10).

If noise is detected from the load, use a varistor or a noise killer. For the FAIL output only, NO and NC are reversed. When the HE-200R is normal (not in failure), the CF-NOF contact is open and the CF-NCF contact is short-circuited. When the power is OFF, the C-NOF contact is short-circuited.

The blank terminals are internally connect to each other. Do not connect anything.

To connect any load exceeding the contact capacity or any induction load (e.g., a motor or a pump), be sure to use a power relay exceeding the load rating.

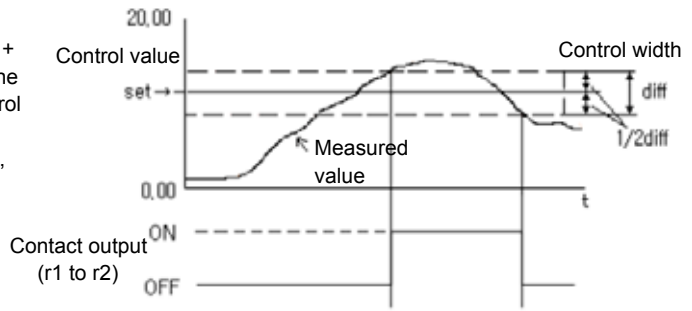
When the HE-200R is OFF, the C-NC contact for R1 to R4 is short-circuited. Therefore, be careful about the connection of load.



Contact point capacity	250 VAC, 3A max. or 30 VDC, 3 A maximum
Applicable power cable	0.75 to 5.5 mm ² (AWG18 to 10)
Kinds of alarms	Ctrl control output, alarm output Temperature alarm output, HOLD output

Ctrl: Control output

When the measured value becomes larger than (control value + control width × 1/2), the control output is turned ON. When the measured value becomes smaller than (control value + control width × 1/2), the control output is turned OFF. (These are the upper-limit actions. For the lower-limit actions, reverse them.)

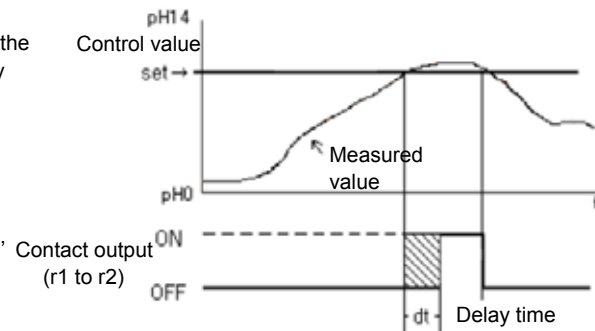


"AL": Alarm output

When the measured value becomes larger than the setting, the alarm output is turned ON to trigger the alarm after the delay time. When the measured value becomes smaller than the setting, the output is immediately turned OFF to cancel the alarm.

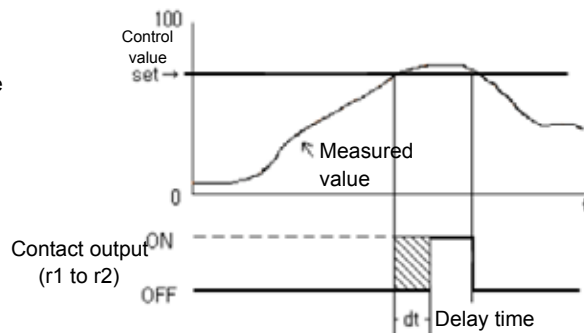
The setting of output delay time (0 to 600 seconds) is also possible.

These are the upper-limit actions. For the lower-limit actions, reverse them.)



"t": Temperature alarm output

When the temperature value is higher than the setting, this output is turned ON to trigger the alarm after the delay time. When the temperature value becomes lower than the setting, the output is immediately turned OFF to cancel the alarm. The setting of output delay time (0 to 600 seconds) is also possible. These are the upper-limit actions. For the lower-limit actions, reverse them.)



HoLd: Output during hold mode

When the measured value is held, this output is turned ON after the delay time. When the hold mode is canceled, the output is immediately turned OFF. The setting of output delay time (0 to 600 seconds) is also possible.

FAIL: FAIL output

This output is turned ON when over full-scale or system error occurs. It is also turned ON when the HE-200R malfunctions.

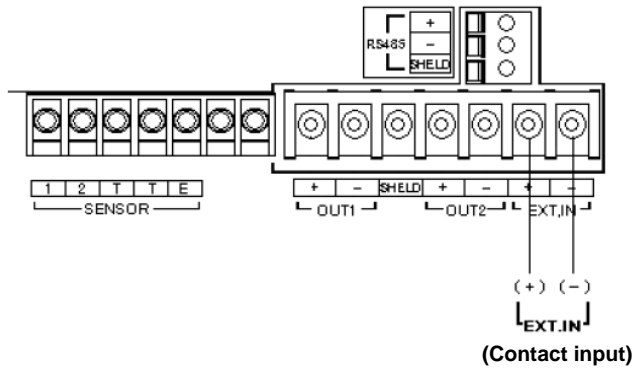
■ Contact input

The HE-200R is provided with contact input as standard.
The output value is held with an external signal.

Major specifications

- The terminal screws for the contact input is of M3.5.
- The applicable electric wire is of 2 mm² (AWG14) maximum.

For the transmission output cable, use a shielded cable.
When lightning might strike, install an arrester on the output side of the HE-200R and on the side of receiving instruments.
The resistor for the contact input shall be 100 Ω maximum.



Contact input resistance	100Ω/km max.
Applicable power cable	2mm ² (AWG14)MAX

■ Transmission output

The HE-200R is provided with two transmission outputs (4 to 20 mA DC).

Transmission output 1 outputs electric conductivity and transmission output 2 temperature.

For both outputs, the full-scale range of transmission output may be set freely within the full-scale setting for measured value. The setting of burn-out (transmission output: 3.8 or 21 mA) is also possible. The HE-200R allows you to select whether the output value is temporarily held at the directly previous value or the preset value when the transmission output is to be held with an external signal.

Example: Arbitrary setting of transmission output

When the measurable range of electric conductivity is between 0 and 20 MΩ • cm,

the transmission output of 4 mA may be set to 10 MΩ • cm and that of 20 mA to 20 MΩ•cm.

Example: Transmission output hold

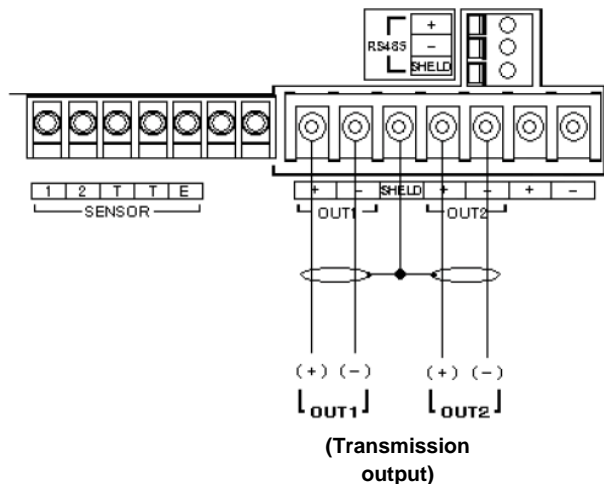
When the held value is set to the directly previous value:

If an external signal is received when the measured value shows 18 MΩ• cm, the transmission output maintains the output value of 18 MΩ • cm.

Major specifications

- The terminal screws for the contact input is of M3.5.
- The applicable electric wire is of 2 mm² (AWG14) maximum.

For transmission output, use a shielded cable.
When lightning might strike, install an arrester on the output side of the HP-200 and on the side of receiving instruments.
The negative terminals OUT1 (-) and OUT2 (-) for transmission output are internally connected and have the same electric potential.

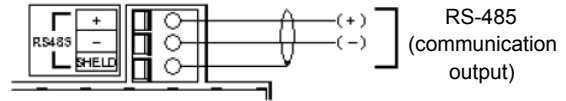


Maximum load resistance	900Ω
Applicable power cable	2mm ² (AWG14) MAX

■ RS-485

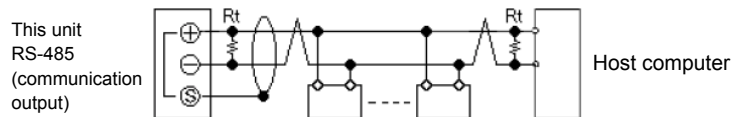
The HE-200R has an RS-485 communication terminal. To use this terminal, connect wiring.

- Applicable wire is 0.14 to 2.5 mm² (AWG 26 to 14).
- For the communication output cable, use a twisted shielded pair.
- Up to 32 connections can be made including one for the host computer. Set the address.
- The communication cable length is 500 m maximum.
- Use a terminating resistor (Rt: 120Ω) for any device at which the RS-485 communication line is terminated.



RS-485 communication conditions	Baud rate	19200 bps
	Character length	8 bit
	Parity	non
	Stop bit	1 bit

Example of external connection for communication

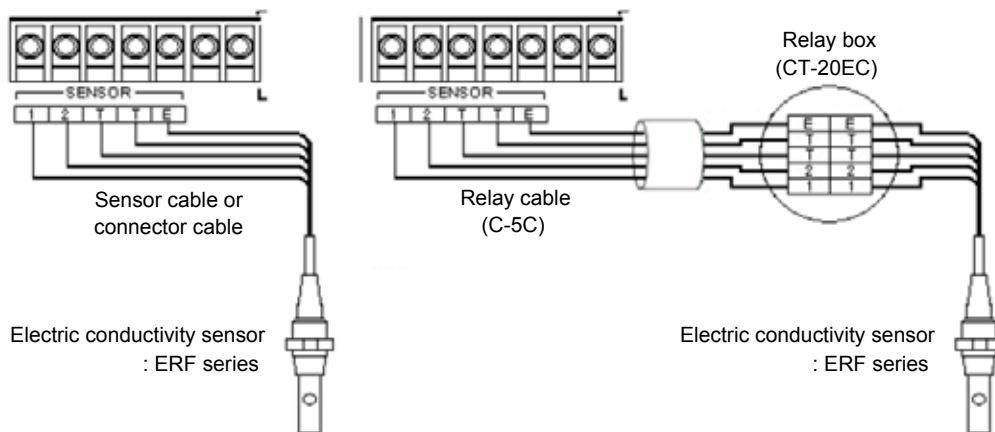


■ Sensor

The sensor cable is highly insulated. In handling this cable, pay attention to the following points:

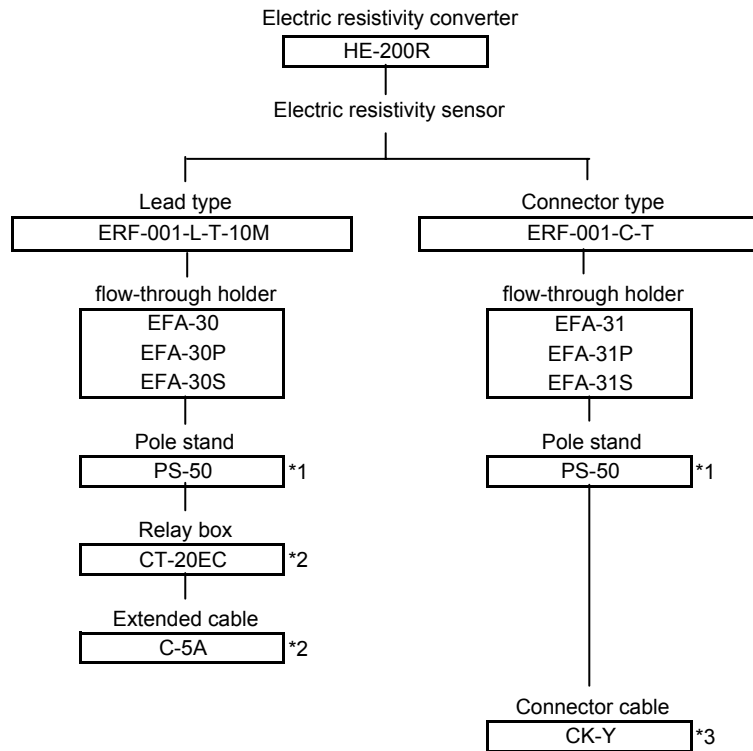
- Do not wet the terminals and terminal block for cables with water or the like or contaminate them with your hand or oil. The insulation will otherwise deteriorate.
- The decreased insulation can cause instable readings. Maintain the electrode cable in a dry, clean state.
- For the purposes of maintenance and electrode checks and replacement, carry out wiring with a margin given to the electrode cable length.
- In wiring the electrode cable and the relay cable, keep them away from inducting equipment such as a motor and is power cable.
- Be sure to use replay cable and relay box.

Electric resistivity sensor	1. Resistivity sensor 1 terminal
	2. Resistivity sensor 2 terminal
	T, T: Temperature compensation sensor terminal
	E: Shielded wire



■ Combinations

The possible combinations are shown below based on the specifications for the converter, electric resistance sensor and holder:
For the detailed specifications, see the items of each product.



*1: This is a pole stand to mount the converter and the CT-20EC relay box.

*2: To extend the cable exceeding 10 m, select the relay box and the C-5C extension cable.

*3: For a connector cable of the CK-Y series, select one of desired length.

<p>■ Specification 1</p>

Product Name	Electric resistivity converter for industrial use			
Model	HE - 200R			
Combination sensor	2-pole type electric resistivity sensor; cell constant: 0.01/cm (ERF-001 series)			
Measurable range	Electric resistivity (specific resistance)	MΩ·cm	0.000-2.000	0.00-20.00(*1)
		kΩ·m	0.00-20.00	0.0-200.0(*1)
	Temp	°C	0 to 100 (readout range: 10-110)	
Display resolution	Electric resistivity	As shown in the above table		
	Temp	0.01		
Performance	Electric resistivity	Repeatability	Within ±0.1% of full-scale value (with equivalent input)	
		Linearity	Within ±0.5% of full-scale value (with equivalent input)	
	Temp	Repeatability	Within ±0.1 (for equivalent input)	
		Linearity	Within ±0.5 (for equivalent input)	
Transmission output	Number of output points		2 (the negative terminals for transmission outputs are internally connected to each other and have the same electric potential.)	
	Output type		4 to 20 mA DC, input/output insulation type	
	Load resistance		900Ω max.	
	Repeatability		Within ±0.02 mA (output only)	
	Linearity		Within ±0.08 mA (output only)	
	Output range	Output 1	Electric resistivity: Freely specifiable within the measurable range	
		Output 2	Temperature: Freely specifiable within a range between -10 and 160	
	Error output		With burn-out capability (3.8 or 21 mA)	
	Hold capability		Select holding the previous value or an arbitrary value	
Output terminal	Number of output points		3 points	
	Output type		No-voltage contact output	
	Contact Form		Relay contact, SPDT (1c)	
	Contact point capacity		250 V AC 3 A, 30 V DC 3 A (resistance load)	
	Contact function	RI, R2	Select from upper limit alarm, lower limit alarm, USP assessment, and output holding.	
		FAIL	Error alarm (closed when normal; opened when an error occurs; opened when the power is turned OFF)	
	Description of alarm function	Description of output	Electric resistivity, temperature	
Description of settings		<ul style="list-style-type: none"> Setting range: Within the measurable range Delay time: 0 to 600 seconds 		
Contact input	Number of input points		1 point	
	Contact Form		Open collector, no-voltage a-contact	
	Conditions		ON resistance: 100Ω max. Open voltage: 24 VDC Short-circuit current: 12 mA DC	
	Contact function		External input for holding transmission output	
Communication function	Method		RS-485	
	Signal type		Two-wire, input/output insulated type (not insulated from transmission output)	
Temperature compensation	Applicable temperature element		Platinum resistive element: 1 kΩ(0C)	
	Compensation method		<ul style="list-style-type: none"> Select one of the following three options: Temperature characteristics of NaCl (reference temperature: 5C to 95°C) Input of arbitrary temperature coefficient (reference temperature: 5 to 96; temperature coefficient: ±3%/°C) No temperature compensation (For either NaCl or any arbitrary temperature coefficient, the temperature compensation for deionized water is automatically applied in the deionized water range.)	
	Temperature compensation range		0°C to 100°C (extensively calculated at less than 0°C or more than 100°C)	
Calibration	Electric resistivity		By entering a correction coefficient (parameter) for the cell constant	
	Temp		One-point calibration using comparison with reference thermometer	
Additional functions	Capability of selecting electric resistivity of ultrapure water		Selectable from 18.23 (standard), 18.18, and 18.24 MΩ·cm (selectable from 182.3, 181.8, and 182.4 kΩ·m)	
	Clipping capability		When the measured value falls in a range between the specified electric resistivity and the upper limit of the measurable range, that electric resistivity is displayed as the measured value.	

<p>■ Specification 2</p>

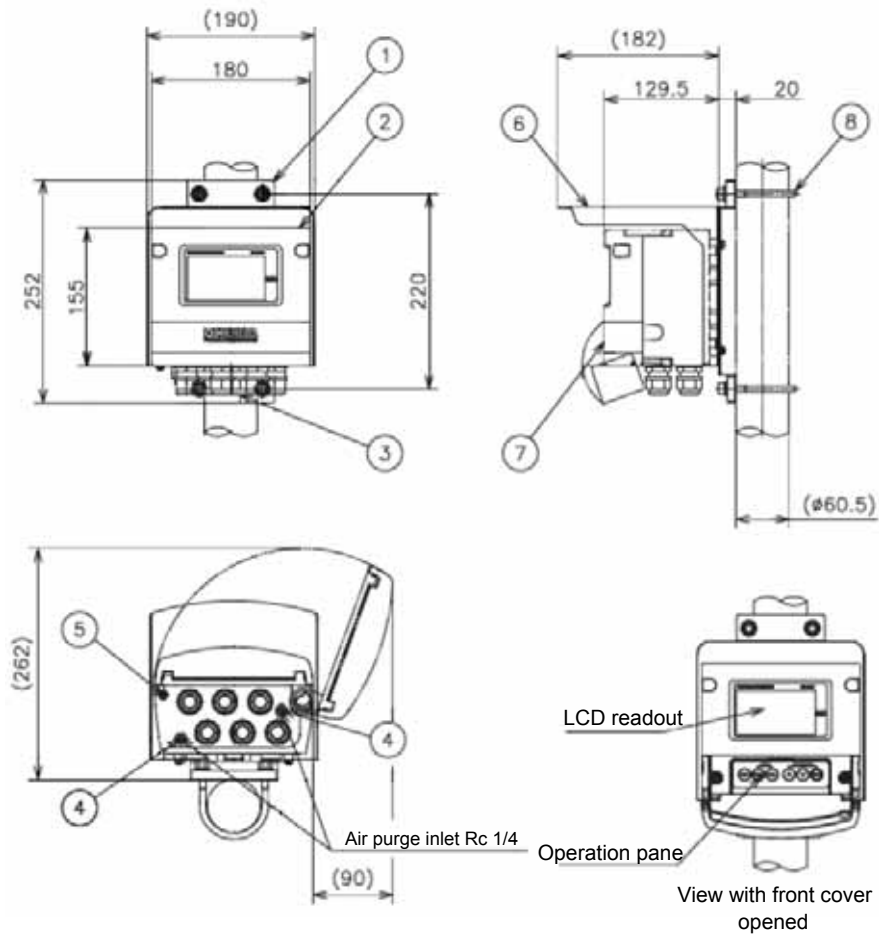
Self-diagnostics	Electrode diagnostic error	Temperature sensor short-circuit error, temperature sensor electrical discontinuity error and temperature calibration range error		
	Converter error	CPU error, ADC error, or EEPROM error		
Operating temperature range	-20 to 55°C (without freezing)			
Operating humidity range	Relative humidity: 5% to 90% (without condensation)			
Storage temperature	-25 to 65°C			
Power Source	Power supply voltage range	90-264 VAC 50/60Hz		
	Power Consumption	15VA(max)		
	Others	With built-in time lag fuse (250 V, 1 A) With built-in power switch for maintenance		
Applicable standards	CE marking	EMCDirective(2004/108/EC) EN61326-1:2006		
		Low Voltage Directive (2006/95/EC) EN61010-1: 2001		
	EMC	Immunity Industrial location	Electrostatic discharge	IEC61000-4-2
			Radiated radiofrequency electromagnetic field	IEC61000-4-3
			Electric fast transient/burst	IEC61000-4-4
			Surge	IEC61000-4-5 (*2)
			Conducted interference induced by radiofrequency	IEC61000-4-6
			Voltage dip, short-time power outage, and voltage fluctuator	IEC610000-4-11
	Emission ClassA	Radiated disturbance	CISPR 11 CLASSA	
		Noise terminal voltage	CISPR 11 CLASSA	
Low voltage	Contamination level 2			
FCC Rules	Part 15 CLASS A			
Structure	Installation	Outdoor installation type		
	Installation method	50 A pole or wall mounting		
	Protection Class	IP65		
	Case material	Aluminum alloy (coated with epoxy modified melamine resin)		
	Mounting bracket material	SUS304		
	Hood material	SUS304 stainless steel (coated with epoxy modified melamine resin)		
	Readout window material	Polycarbonate		
Readout element	Reflection type monochrome LCD			
External dimensions	180 (W) x 155 (H) x 115 (D) (excluding the mounting bracket)			
Mass	Body: Approx. 3.5 kg; hood and mounting bracket: Approx. 1 kg			

*2: When the 2-sensor cable, transmission cable, or contact input cable is extended to more than 30 m, the surge test in the EMC directive for CE marking is not applied.

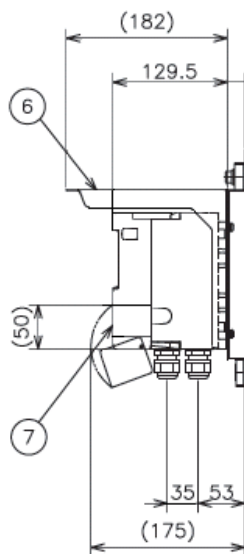
*3: For transmission output, contact input, and communication, an arrester (sparkover voltage: 400 V) is mounted. Yet install the most suitable surge absorption element on the connected line considering the ambient environment, the equipment installation situation, and the externally connected equipment.

■ External dimensions (HE-200R electric resistivity meter)

(pole-mounted)



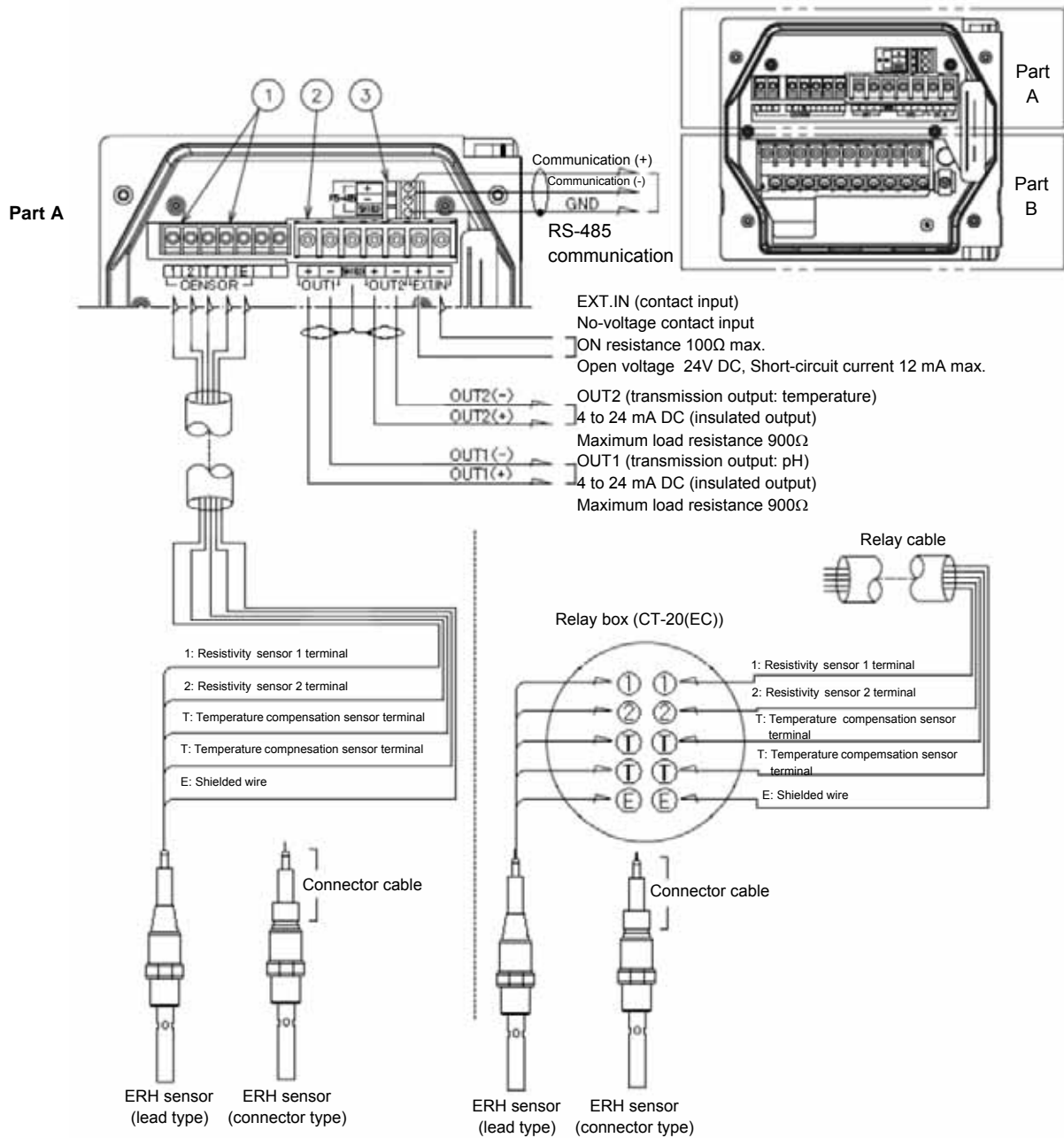
(wall-mounted)



	PARTS	NOTES
1	Mounting plate	SUS304
2	Case	ADC12
3	Wiring hole	O.DΦ7-Φ12cable
4	Plug	SUS304
5	Earth	SUS304 M4
6	Cover	SUS304
7	Front cover	ADC12
8	U bolt	SUS304 50A MB

Coated with epoxy modified melamine resin
 (Munsell 10PB/7/1)
 Approx. 4.1 kg
 IP65 (IEC60529, JIS C0920)

External connection diagram 1 (HE-200R)

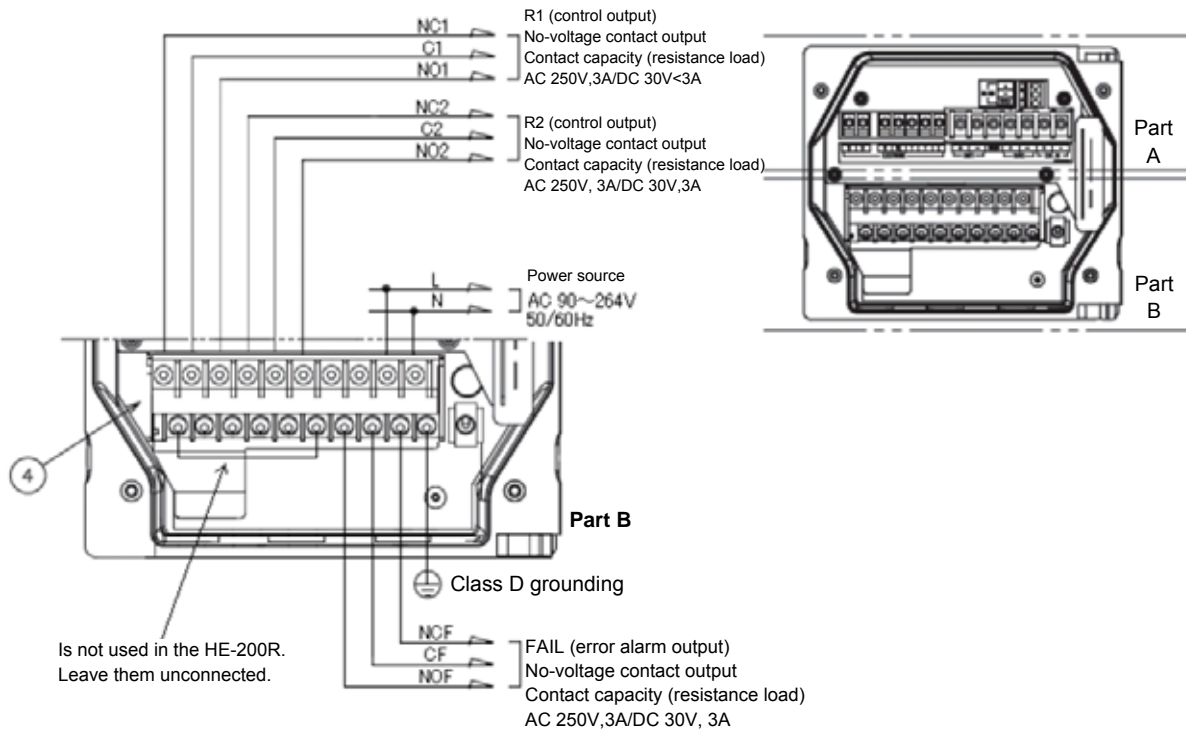


	Terminal screw	Applicable crimp-type terminal	Applicable electric wire	Screw tightening torque
①	M3	MAX6.5 MAX3.2 MAX6.2	1.25mm ² /MAX (AWG16)	0.8N·m
②	M3.5	MAX6.2 MAX3.6 MAX7.2	2mm ² /MAX (AWG14)	0.8~1.2N·m
③	M3		0.14~2.5mm ² (AWG26~14) Single or stand wire	0.5~0.6N·m

Note

- :The screws on the terminal block are designed as non-removable. To connect a cable to a terminal, loosen the screw until it is floated.
- :The negative terminals OUT1(-) and OUT2(1) are internally connected and have the same electric potential.
- :Do not use any blank terminal.

External connection diagram 2 (HE-200R)



Terminal screw	Applicable crimp-type terminal	Applicable electric wire	Screw tightening torque
④ M4	MAX8, MAX4.7, MAX8.5	5.5mm ² /MAX (AWG10)	1.2~1.8N·m

Note

- :The screws on the terminal block are designed as non-removable. To connect a cable to a terminal, loosen the screw until it is floated.
- :The negative terminals OUT1(-) and OUT2(1) are internally connected and have the same electric potential.
- :Do not use any blank terminal.

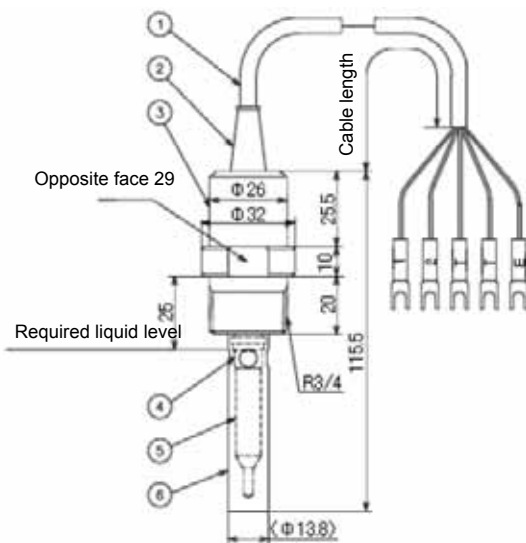
■ Specifications and shapes of electric resistivity sensors

Model	ERF-001-L-T-10M	ERF-001-C-T
Cell constant	Approx. 0.01/cm	
Wetted material	Pole	Titanium
	Body	PVDF
	Gasket	FKM
RTD	Pt1000Ω 3850ppm/°C	
Measuring liquid pressure	Pressure: 0 MPa to 0.5 Mpa	
Measuring liquid temperature	0-80°C	
Cable length	Lead type: 10 m; spade terminal (standard) Max. extension: 50 m *1	Connector type: 10 m (CK-Y10M), 20 m (CK-Y20M), and 30 m (CK-Y30M)
Mounting	Screwed type flange size: R(PT) 3/4	
Combination holder	Flow-through type holder: EFA-30, EFA-30P, and EFA-30S	

*1: For extension, use the relay cable (C-5C) and the relay box (CT-20EC).

■ ERF-001-L-T-Y10M/ERF-001-C-T

Electric resistivity sensor (ERF-001-L-T-10M)

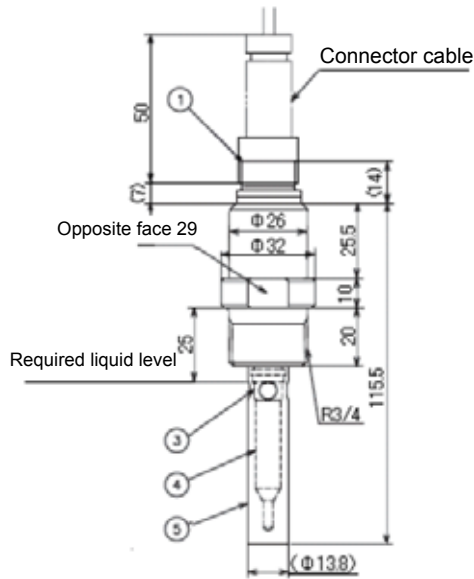


	PARTS	NOTES
1	Silicone	PVC
2	Cable	EPDM
3	Body	PVDF
4	Spacer	PVDF
5	Inner electrode	Titanium
6	Outer electrode	Titanium

Specifications

Cell constant	Approx. 0.01 (marked on individual products)
TRD	Pt1000Ω,3850ppm/°C
Measured liquid conditions	Temperature: 0-80°C Pressure: 0 MPa to 0.5 Mpa
Wetted material	Pole: titanium Spacer: PVDF Body: PVDF Seal: FKM
Cable length	10m

Electricity resistivity sensor (ERF-001-C-T)

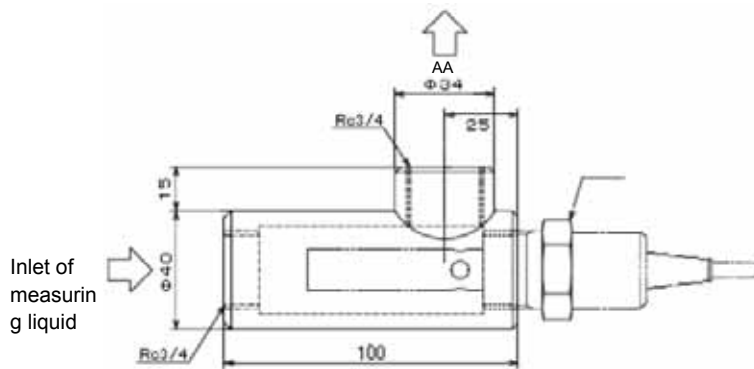


PARTS	NOTES
1 Connector	BS
2 Body	PVDF
3 Spacer	PVDF
4 Inner electrode	Titanium
5 Outer electrode	Titanium

Specifications

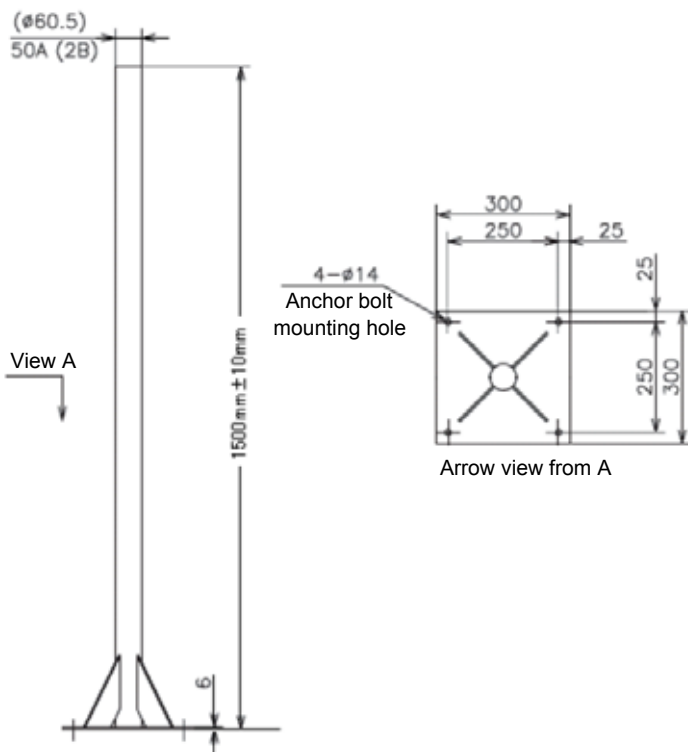
Cell constant	Approx. 0.01 (marked on individual products)
RTD	Pt1000Ω,3850ppm/°C
Measured liquid conditions	Temperature: 0-80°C Pressure: 0 MPa to 0.5 Mpa
Wetted material	Pole: SUS316 Spacer: PVDF Body: SUS316 Seal: FKM

EFA-30 series flow-through holder for electric resistivity sensor



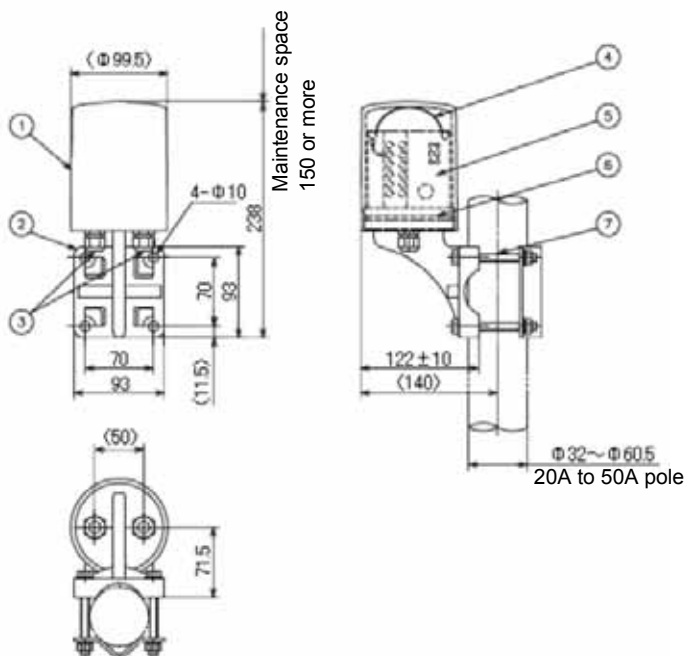
Model	EFA-30	EF-30P	EFA-30S
Materials of Liquid Junction Section	PVC	PVDF	SUS316
Measuring liquid pressure	Pressure: 0 MPa to 0.1 Mpa	Pressure: 0 MPa to 0.1 Mpa	Pressure: 0 MPa to 0.5 Mpa
Measuring liquid temperature	0-50°	0-100°C	0-100°C
Flow rate of liquid measured	0-10L/min		
Flange size of connection piping	Inlet: Rc (PT) 3/4, outlet: Rc (PT) 3/4		
Applicable sensor	ERF series		

Specifications and shape of PS-50 pole stand



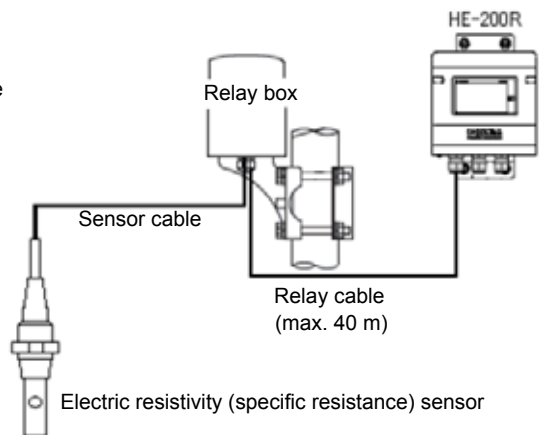
Model	PS-50
Materials	SUS304
Pipe diameter	50A

Specifications and external dimensions of relay box (CT-20EC)

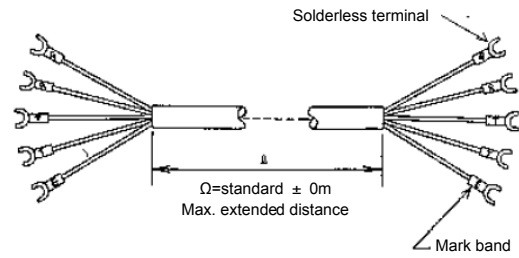


	PARTS	NOTES
(1)	Cover	ABS
(2)	Bracket	ABS
(3)	Wiring hole	
(4)	Spring	SUS304
(5)	Terminal board	ABS
(6)	O-ring	NBR
(7)	Bolt (provided)	SUS304 M8

- Be sure to use the relay box when the distance between the sensor and the converter is longer than the sensor cable length.
- For wiring, be sure to use the dedicated cable. Do not use any general cable or splice the cable.
- The relay box is designed as rainproof.
- Terminals 3 and 4 are blank.



External dimensions (C-5C extension cable)



Characteristics

Conductor resistance 63.2Ω/hm max.

Withstand voltage Shall withstand 1000 VAC for 1 minute.

Rated temperature 90°C

Capacitance 150 PP/m max.

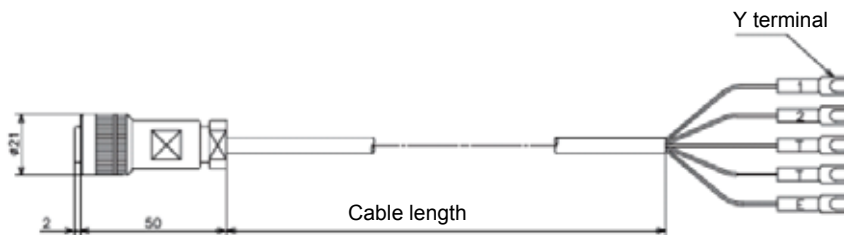
- Use this product when extending the cable to more than the standard 10 m using ERF-001-L-T-10M.
- For wiring, be sure to use the dedicated cable. Do not use the general cable or halfway splice the dedicated cable.
- Use the relay box when the cable is to be extended.
- The cable may be extended up to 43.74yd.

External dimensions (CK-Y series connector cable)



Model	Cable length	Shape of terminal
CK-Y10M	10m	Spade terminal
CK-Y20M	20m	Spade terminal
CK-Y30M	30m	Spade terminal

- Use the spade terminal when the ERF-001-C-T is used.
- For wiring, be sure to use the dedicated cable. Do not use the general cable or halfway splice the dedicated cable.



■ Installation (power source, transmission, etc.)

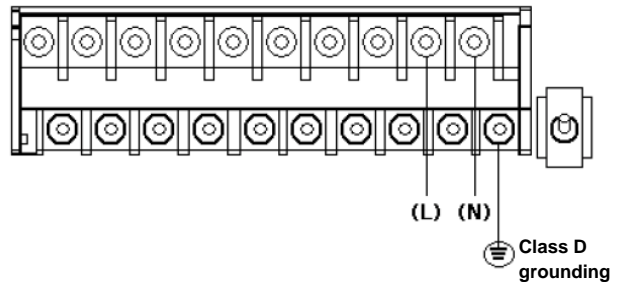
The description of the following installation (power source, transmission, etc.) assumes that the HE-200R is of the standard specification.

Carry out installation and execution of work while paying attention to the following points:

Power Source

- This ultrasonic cleaner has a power switch.
- Operation outside the rated range can cause a fault. Therefore, check the power supply voltage.
- Carefully check that the power supply voltage fluctuations fall within a range of $\pm 10\%$.
- Provide the power switch in a place near the HE-200R so that the power can be turned ON/OFF. If lightning might strike, install an arrester on the output side of the HE-200R and on the side of receiving instruments.
- Be sure to ground the grounding terminal (class D grounding).
- Separate this grounding from any other grounding for electric equipment such as a motor.

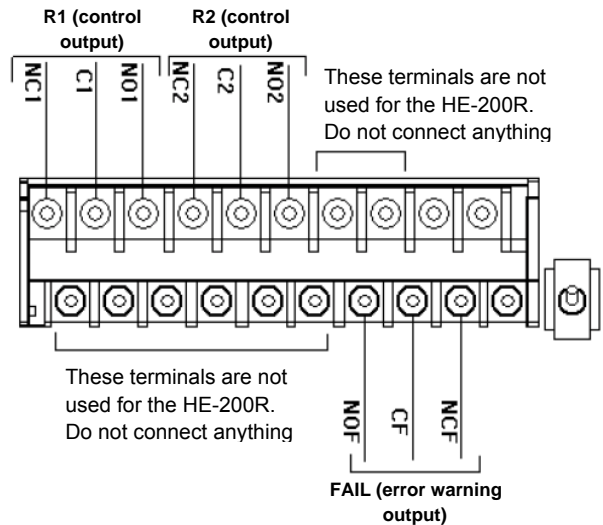
Electric power supplied	Voltage: 100 to 240 VAC Frequency: 50/60 Hz
Terminal screw	M4
Applicable power cable	0.75 to 5.5 mm ² (AWG18 to 10).



Contact point capacity	250 VAC, 3A max. or 30 VDC, 3 A maximum
Terminal screw	M4
Applicable power cable	0.75 to 5.5 mm ² (AWG18 to 10)

Output terminal

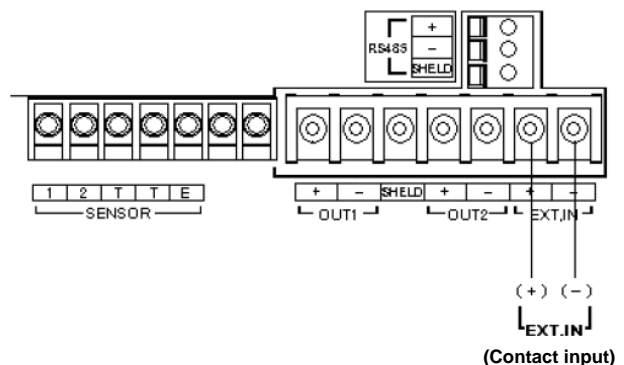
- If noise is detected from the load, use a varistor or a noise killer.
- For the FAIL output only, NO and NC are reversed. When the HE-200R is normal (not in failure), the CF-NOF contact is open and the CF-NCF contact is short-circuited. When the power is OFF, the C-NOF contact is short-circuited.
- The blank terminals are internally connect to each other. Do not connect anything.
- To connect any load exceeding the contact capacity or any induction load (e.g., a motor or a pump), be sure to use a power relay exceeding the load rating.
- When the HE-200R is OFF, the C-NC contact for R1 to R4 is short-circuited. Therefore, be careful about the connection of load



Contact input

- Use a shielded cable.
- When lightning might strike, install an arrester on the output side of the HE-200R and on the side of receiving instruments.

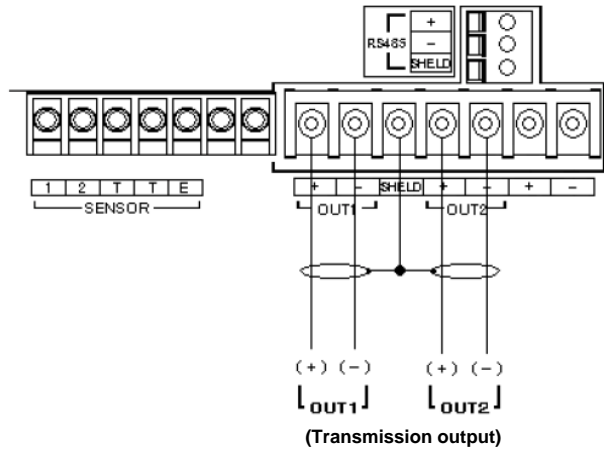
Contact input resistance	100Ω/km max.
Terminal screw	M3.5
Applicable power cable	0.75 to 5.5 mm ² (AWG18 to 10)



Transmission output

- For the transmission output cable, use a shielded cable.
- When lightning might strike, install an arrester on the output side of the HE-200R and on the side of receiving instruments.
- The negative terminals OUT1 (-) and OUT2 (-) for transmission output are internally connected and have the same electric potential.

Maximum load resistance	900Ω
Terminal screw	M3.5
Applicable power cable	2mm ² (AWG14) MAX



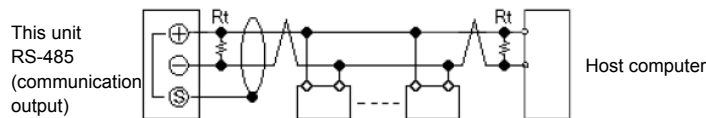
RS-485

- For the communication output cable, use a twisted shielded pair.
- The communication cable length is 500 m maximum.
- Use a terminating resistor (Rt: 120Ω) for any device at which the RS-485 communication line is terminated.
- Up to 32 connections can be made including one for the host computer. Set the address.



RS-485 communication conditions	Baud rate	19200 bps
	Character length	8 bits
	Parity	non
	Stop bit	1 bit

Example of external connection for communication

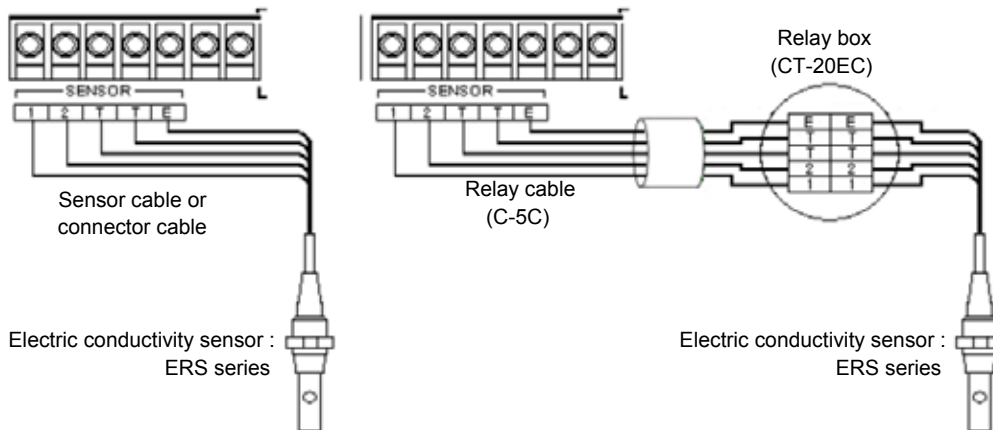


Sensor cable

The sensor cable is highly insulated. Exercise care in handling the sensor cable.

- Do not wet any cable terminal or the terminal block with water or the like; also do not soil it with dirt, oil, or the like. The insulation will otherwise deteriorate. The decreased insulation can cause instable readings. Maintain the electrode cable in a dry, clean state. If the electrode cable should be soiled, wipe it off with alcohol or the like and then well dry it.
- In wiring the sensor, give a margin to the sensor cable length for the purposes of calibration with standard solutions and of the checks and replacement of the sensor.
- Keep the wiring of the sensor cable and the relay cable away from electromagnetic induction devices such as a motor and their power cables.
- Be sure to use replay cable and relay box.

Electric conductivity sensor	1. Resistivity sensor 1 terminal
	2. Resistivity sensor 2 terminal
	T, T: Temperature compensation sensor terminal
	E: Shielded wire



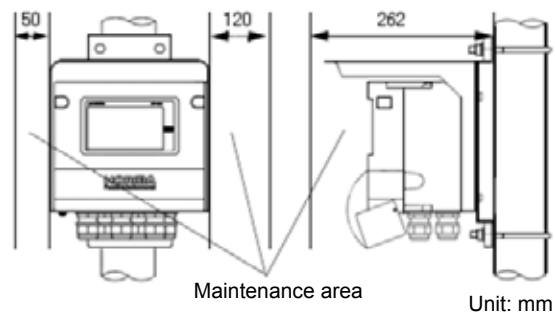
■ Installation (mounting)

The description of the following installation (mounting) assumes that the HE-200R is of the standard specification.

For the HE-200R, the optionally available cleaner may be installed.

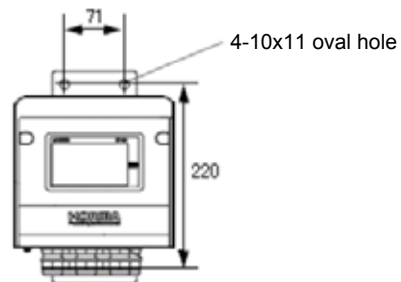
The installation of the HE-200R with the cleaner will be described in the section for the cleaner.

Body (for pole mounting)



- The body may be mounted on the pole or the wall.
- For pole mounting, use a 50A pole.
- In either case, mount the body considering maintenance space.

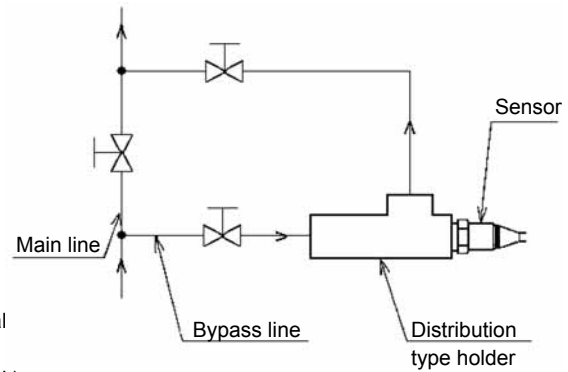
Body (to be wall-mounted)



Sensor plus flow-through holder

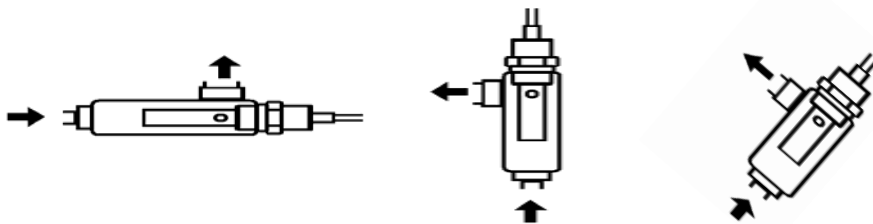
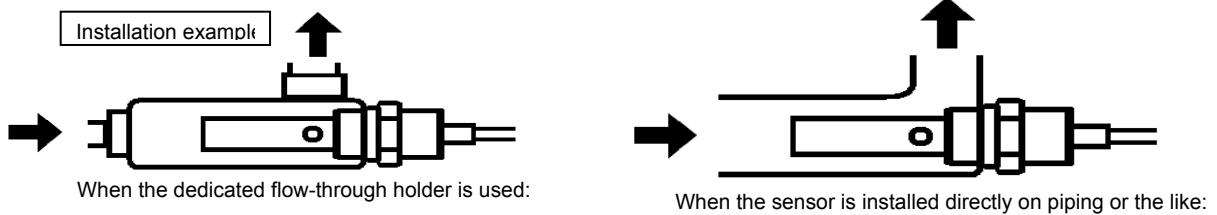
Precautions for sensor piping

The sensor cannot be installed directly to the 20A piping. To install the sensor on the piping line, provide a bypass line from the main line and use the flow-through type holder. Carry out piping so that the liquid under measurement is sent upward from the lateral side of the flow-through holder (from the leading end of the electric conductivity sensor).



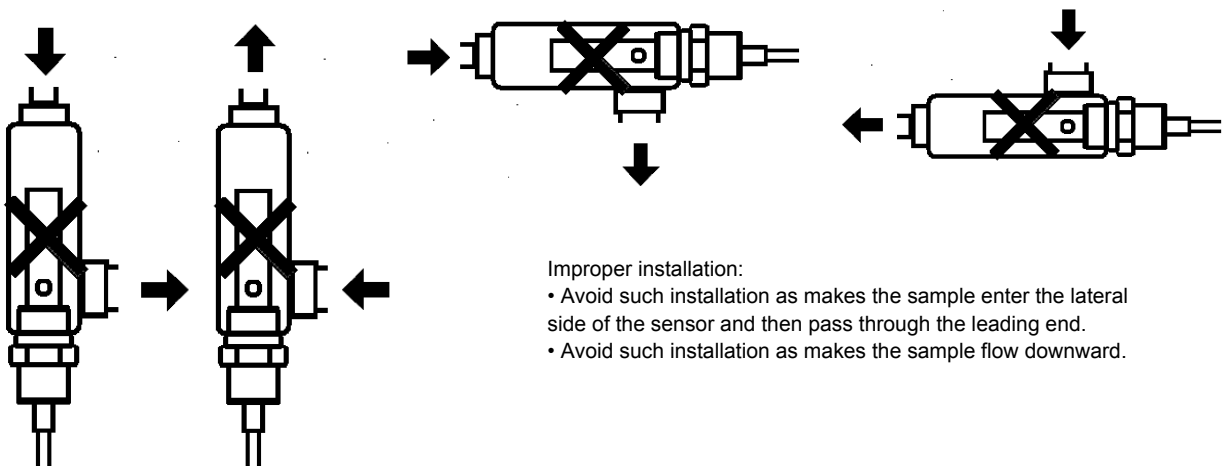
Installation conditions

- Flow rate 0 to 0.5 MPa (max.)
(The dedicated holder is dependent on the holder material)
- Temp 0°C to 100°C (maximum)
(The dedicated holder is dependent on the holder material.)
- Flow rate 10 L/min (maximum)
(Increase the flow rate as much as possible within 10 L/min.)



Proper installation: Ensure that the sample enters the leading end of the sensor and then passes through the lateral side.

* For vertical mounting, only the combination of the long sensor and the EFA-31 is available.



Installation and cleaning of sensor

In measurements of electric conductivity of 1 μ S/cm minimum, an error may result from generation of bubbles and contamination of the electrodes. If the sensor is contaminated, install the sensor in a removable state so that it can be periodically cleaned. In installing the sensor on the tank, take care to ensure that no sediment deposits on the sensor and that a readout error occurs from the stagnant sample. In cleaning the sensor, the use of alcohol, neutral detergent, or sodium hydroxide (about 3%) is effective for oily contaminant and the use of nitric acid for inorganic contaminant.

Installing the sensor for proper measurements

The basic condition for proper measurements is that the entire surface of the sensor shall be exposed to the well agitated sample without bubbles. In principle, measurements are not affected by the pressure and the flow rate, but they are affected secondarily by the dissolution of carbon dioxide or the generation of bubbles. The dissolution of carbon dioxide greatly affects measurements in the deionized water range; the existence and adhesion of bubbles affect the measured values for electric conductivity and specific resistance. In order to prevent bubbles from being generated in the line, it is effective to make measurements while applying pressure. The generation of bubbles can be prevented by providing a flow rate control valve downstream of the sensor and maintaining the sensor in a pressurized state. If the valve located upstream of the sensor is closed, measurements may be affected as the pressure around the sensor may decrease, causing the dissolved gas to become bubbles. The increased water temperature or the addition of salt may also cause dissolved gas to become bubbles. Those bubbles may adhere to the sensor, affecting the measured values. Determine the orientation of the sensor holder so that more bubbles can be released.

Installing the sensor for measurements of electric conductivity of deionized water

In principle, the electric conductivity is not affected by the flow rate. However, when the electric conductivity of a sample close to deionized water is measured, the dissolution of carbon dioxide in air may increase the value for electric conductivity (specific resistance may decrease). In particular, fluorine resin piping allows gas to easily pass it through. Therefore, the flow rate and pressure of the sample change the dissolved volume of carbon dioxide, affecting the measured values. For sampling, use piping of a clean material with low permeability to gases install the sensor as close as possible to the main, and then ensure an appropriate flow rate which is not too slow.