
**User's
Manual**

**700937
Current Probe**

IM 700937-01E

Introduction

Thank you for purchasing the 700937 Current Probe. This Instruction Manual contains useful information about the instrument's functions and operating procedures as well as precautions that should be observed during use. To ensure proper use of the instrument, please read this manual thoroughly before operating it. Keep the manual in a safe place for quick reference whenever a question arises.

Revisions

1st Edition : May 1999
2nd Edition : December 2000

The following symbol marks are used to attract the operator's attention.



Affixed to the instrument, indicating that for safety, the operator should refer to the User's Manual.

WARNING

Describes precautions that should be observed to prevent the danger of injury or death to the user.

CAUTION

Describes precautions that should be observed to prevent damage to the instrument.

Note

Provides information that is important for proper operation of the instrument.

Checking the Contents of the Package

If the wrong instrument or accessories have been delivered, if some accessories are missing or if they appear abnormal, contact the dealer from which you purchased them.

700937 Current Probe Main Body






Standard Accessories

- Instruction manual 1
- Soft case

Safety Precautions

This probe meets the Overvoltage Category I and Pollution Degree 2 requirements as given in the IEC-61010-1, IEC-61010-2-031, and IEC-61010-2-032 standards. The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired. Also, YOKOGAWA Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

The following symbols are used on this instrument.

-  To avoid injury, death of personnel or damage to the instrument, the operator must refer to an explanation in the User's Manual or Service Manual.
-  Functional grounding terminal (This terminal should not be used as a "Protective grounding terminal".)
-  Fuse
-  Both direct and alternating current
-  Alternating current

Precautions

In order to ensure safe operation and to obtain maximum performance from the unit, observe the cautions listed below.



WARNING

- To avoid short circuits and accidents that could result in injury or death, use the 700937 only with power lines carrying 300 V or less.
- If the voltage applied to the conductors being measured exceeds the safe voltage level *(measurements up to 300 V), make sure to use conductors that satisfy (1) Overvoltage Category I, (2) Basic Insulation requirements for Working Voltage of 300 V, and (3) Pollution Degree 2. This is to prevent short circuits and accidents that can occur while the tip of the sensor head is open or during measurements. For safety reasons, never clamp bare conductors to the sensors. This act is dangerous since the core and shielded case are not insulated.
- Be careful to avoid damaging the insulation surface while taking measurements.
- This instrument is made for use with the 700938 Power Supply . It is possible to use a Power Supply other than the 700938, provided that the connector and pin assignments match, and that voltage and other electrical specifications are satisfied. In the interest of safety, make sure that the Power Supply has a protective earthing with double-insulation construction.
- Make sure that the waveform measuring equipment connected to this unit's output terminal (BNC) is equipped with a protective earthing with double-insulation construction.
- If the waveform measuring instrument, which is connected to this unit's output terminal (BNC), is equipped with any other input terminal , take the following precautions to ensure that the other instrument does not form a bridge between the probe and any hazardous live of a part .
 - 1 Isolate the terminal to which the probe is connected from other terminals on the measuring instrument using basic insulation conforming to the overvoltage category, working voltage, and pollution degree requirements of the circuit being tested.
 - 2 If basic insulation requirements cannot be met between the terminal to which this unit is connected and other terminals of the measuring instrument, make sure that the voltage input to the measurement terminal does not exceed the safe voltage level*.
 - 3 Make sure to earth ground the measuring instrument.
 - 4 Beware of electric shock when connecting the probe to the item being measured. Do not remove the probe from the instrument while the probe is connected to the item.
 - 5 Before connecting the probe, check that the measuring instrument and power supply are properly earth grounded and that the output connector and power plug are connected to the BNC connector and power receptacle, respectively.
 - 6 Read and observe all warnings and precautions relating to electrical safety for the measuring instrument being connected to the probe.Refer to the following standards regarding the meanings of underlined terms.
 - IEC61010-1
 - IEC61010-2-031
 - IEC61010-2-032
- To prevent electric shock, do not allow the unit to become wet and do not use the unit when your hands are wet.

* Safe voltage level: A voltage level that does not exceed any of the following values: 30 Vrms, 42.4 Vpeak, and 60 VDC.



CAUTION

- Do not subject the unit to vibrations or shocks during transport or handling. Be especially careful to avoid dropping the unit.
- Do not store the unit where it will be exposed to direct sunlight, high temperature, high humidity, or condensation. If exposed to such conditions, the unit may be damaged, the insulation may deteriorate, and the unit may no longer satisfy its specifications.
- Before using the unit, inspect it and check the operation to make sure that the unit was not damaged due to poor storage or transport conditions. If damage is found, contact your dealer or YOKOGAWA representative.
- This unit is not constructed to be waterproof or dustproof, so do not use it in a very dusty environment or in one where it will get wet.
- The sensor head is a precision assembly including a molded component, a ferrite core, and a Hall effect element. It may be damaged if subjected to sudden changes in ambient temperature, or mechanical strain or shock, and therefore great care should be exercised in handling it.
- The matching surfaces of the sensor head are precision ground, and should be treated with care. If these surfaces are scratched, performance may be impaired.
- If there is any type of dust or dirt on the matching surfaces of the sensor head, measurements may be affected. Wipe it away gently with a soft cloth.
- Do not bend or pull the sensor cable and Power Supply cable in order to avoid damaging the sensor cables.
- Gently wipe dirt from the surface of the unit with a soft cloth moistened with a small amount of water or mild detergent. Do not try to clean the unit using cleaners containing organic solvents such as benzene, alcohol, acetone, ether, ketones, thinners, or gasoline. They may cause discoloration or damage.
- When the power is on, keep the core section of the sensor closed, except when clamping them onto the conductor to be measured. The facing surface of the core section can be scratched while it is open.

NOTE

Accurate measurement may be impossible in locations subject to strong external magnetic fields, such as transformers and high-current conductors, or in locations subject to strong external electric fields, such as radio transmission equipment.

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Product Overview

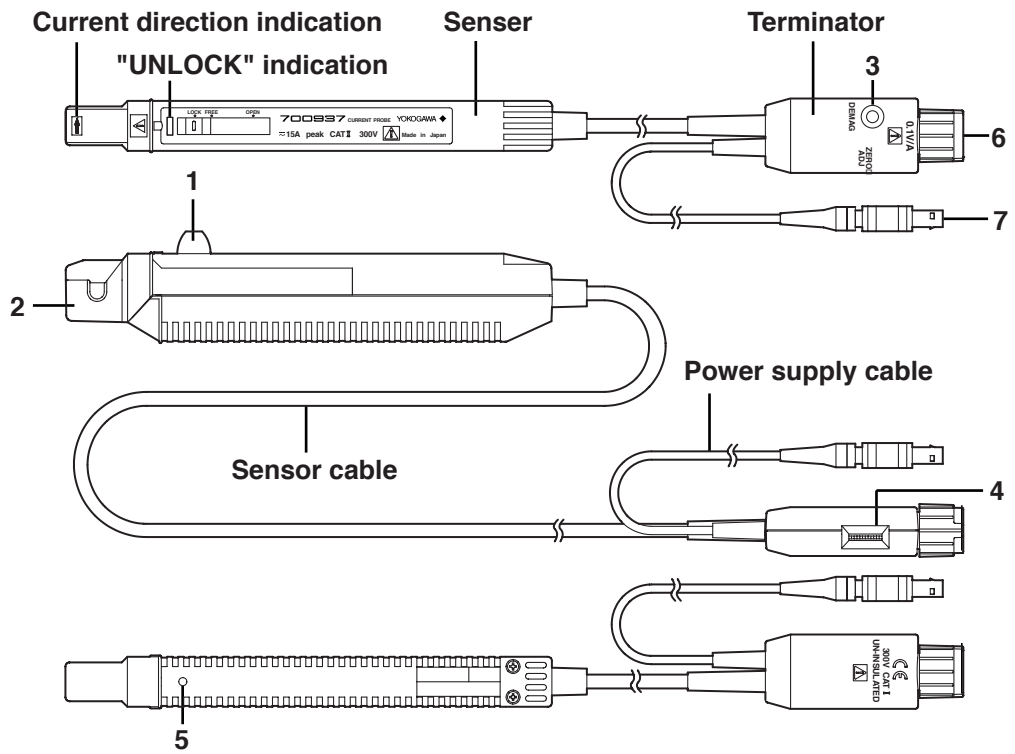
This unit can be directly connected to a BNC input connector of a waveform measuring instrument such as a Digital Oscilloscope or DL series, and by clamping on a conductor to be measured, allows the current waveform to be easily captured.

Features

- Highly accurate current detection
- Easy current measurement
- Wideband frequency characteristics DC to 50 MHz
- Compact and permits measurement of low current levels
- Easy protect function at excessive input

Names of Parts

External view



Parts of the Sensor

1. Opening lever

Operating lever for opening the sensor head. Always use this lever to open the sensor head.

2. Sensor head

This clamps the conductor being measured, and carries out the actual current measurement. It is a precision assembly including a molded component, a ferrite core, and a Hall effect element. It may be damaged if subjected to sudden changes in ambient temperature, or mechanical strain or shock, and therefore great care should be exercised in handling it.

3. Demagnetizing switch (DEMAG)

This demagnetizes the core if it has been magnetized by switching the power on and off, or by an excessive input. Always carry out demagnetizing before measurement. The demagnetizing process takes about one second. During demagnetizing, a demagnetizing waveform is output.

4. Zero adjustment dial (ZERO ADJ)

Use the zero adjustment dial to correct for the effect of a voltage offset or temperature drift on the unit.

When beginning measurement, after demagnetizing always carry out zero adjustment.

5. Coarse adjustment trimmer

Use this only when adjustment is not possible within the range of the zero adjustment dial.

6. Output connector

The current waveform of the measured conductor is output at a constant rate (0.1 V/A in conjunction with the waveform measuring instrument with an input impedance of $1M\Omega$).

Connect to the BNC input connector of the waveform measuring instrument.

7. Power plug

Connect this to the 700938 Power Supply receptacle to supply power to the sensor terminator.

NOTE

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- The output of this unit is terminated internally. Use a high-impedance input to the measuring instrument. With an input impedance of $50\ \Omega$, accurate measurement is not possible.
 - If using BNC-banana plug adapters or similar to connect to input terminals other than BNC connectors, make sure the polarity is correct.
 - Turn the collar until it clicks, and check that it is locked securely.
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Measurement Procedure

Notes on Use



WARNING

- To avoid short circuits and accidents that could result in injury or death, use the 700937 only with power lines carrying 300 V or less.
- If the voltage applied to the conductors being measured exceeds the safe voltage level *(measurements up to 300 V), make sure to use conductors that satisfy (1) Overvoltage Category I, (2) Basic Insulation requirements for Working Voltage of 300 V, and (3) Pollution Degree 2. This is to prevent short circuits and accidents that can occur while the tip of the sensor head is open or during measurements. For safety reasons, never clamp bare conductors to the sensors. This act is dangerous since the core and shielded case are not insulated.
- Be careful to avoid damaging the insulation surface while taking measurements.
- This instrument is made for use with the 700938 Power Supply . It is possible to use a Power Supply other than the 700938, provided that the connector and pin assignments match, and that voltage and other electrical specifications are satisfied. In the interest of safety, make sure that the Power Supply has a protective earthing with double-insulation construction.
- Make sure that the waveform measuring equipment connected to this unit's output terminal (BNC) is equipped with a protective earthing with double-insulation construction.
- If the waveform measuring instrument, which is connected to this unit's output terminal (BNC), is equipped with any other input terminal , take the following precautions to ensure that the other instrument does not form a bridge between the probe and any hazardous live of a part .
 - 1 Isolate the terminal to which the probe is connected from other terminals on the measuring instrument using basic insulation conforming to the overvoltage category, working voltage, and pollution degree requirements of the circuit being tested.
 - 2 If basic insulation requirements cannot be met between the terminal to which this unit is connected and other terminals of the measuring instrument, make sure that the voltage input to the measurement terminal does not exceed the safe voltage level*.
 - 3 Make sure to earth ground the measuring instrument.
 - 4 Beware of electric shock when connecting the probe to the item being measured. Do not remove the probe from the instrument while the probe is connected to the item.
 - 5 Before connecting the probe, check that the measuring instrument and power supply are properly earth grounded and that the output connector and power plug are connected to the BNC connector and power receptacle, respectively.
 - 6 Read and observe all warnings and precautions relating to electrical safety for the measuring instrument being connected to the probe.

Refer to the following standards regarding the meanings of underlined terms.

IEC61010-1

IEC61010-2-031

IEC61010-2-032

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- * Safe voltage level: A voltage level that does not exceed any of the following values: 30 Vrms, 42.4 Vpeak, and 60 VDC.

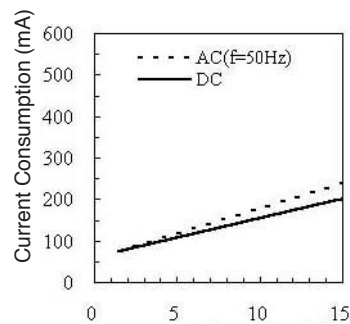
Preparations for Measurement



CAUTION

- Before turning on the power, make sure that the voltage of the power supply being used matches the supply voltage indicated on the rear panel of the 700938.
- When using the Current Probe (Model 700937), you can only connect as many active probes simultaneously to the Power Supply (Model 700938) or the DL Series rear panel probe power supply connector as allowed depending on the current value of the conductor.

The current consumption of the Current Probe (Model 700937) is dependent upon the measured current value. Do not let each active probe's total current consumption exceed the current regulated by the Power Supply (Model 700938) or the DL Series rear panel probe power supply connector (see figure below).



Current consumption* vs. current to be measured(typical)

* The sum total of a positive and negative current consumption.

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- 1 Have the 700938 Power Supply , and oscilloscope or recorder for waveform measurement ready.
 - 2 Turn the power switch off and connect the power cord.
 - 3 Connect the power plug of the 700937 to the power receptacle of the 700938.
 - 4 Turn the 700938 power switch on, and check that the front panel power indicator lights.

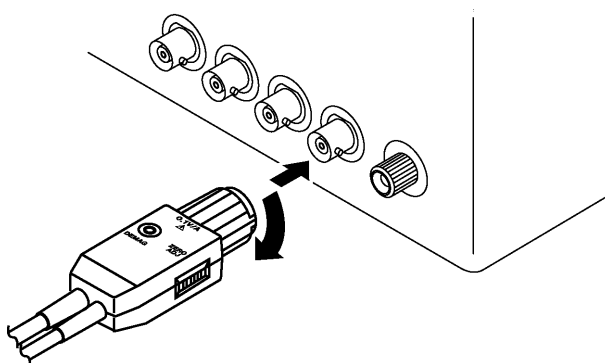
Demagnetizing and Zero Adjustment



CAUTION

- When disconnecting the output connector, be sure to release the lock, then pull the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable will result in damage to the terminator.
 - If using BNC-banana plug adapters or similar to connect to input terminals other than BNC connectors, make sure the polarity is correct.
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- 1 With the waveform measurement instrument input at ground, adjust the trace to the zero position.
- 2 Set the input coupling of the waveform measurement instrument to DC.
- 3 Connect the output connector of the 700937 to the input connector of the waveform measurement instrument. Turn the collar until it clicks, and check that it is locked securely.



- 4 Without clamping the conductor to be measured, press the opening lever until the "UNLOCK" indication disappears, and check that the sensor head is properly closed.
- 5 Press the demagnetizing switch (DEMAG) on the terminator.
- 6 Turn the zero adjustment dial on the terminator, to adjust the trace to the zero position.
- 7 If zero adjustment is not possible in step 6, turn the coarse adjustment trimmer to bring the trace within the range of adjustment by the zero adjustment dial.

NOTE

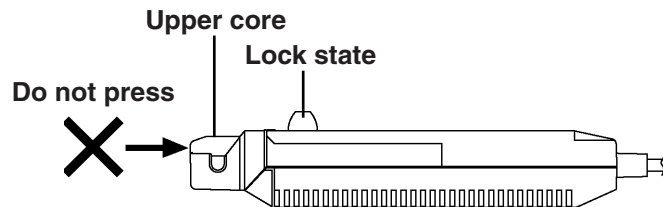
The output of this unit is terminated internally. Use a high-impedance input to the measuring instrument. With an input impedance of 50 Ω , accurate measurement is not possible.

Measurement Procedure



CAUTION

- The maximum continuous input range is based on heat that is internally generated during measurement. Never input current in excess of this level. Exceeding the rated level may result in damage to the probe.
- The maximum continuous input range varies according to the frequency of the current being measured. See the page 1-8, "Product Specifications".
- If excess current is input, generated heat activates a built-in safety function that blocks normal output. If this happens, remove the input immediately (remove the sensor from the conductor being measured, or reduce the input current to zero). Wait until the sensor has had sufficient time to cool before resuming operation.
- At high ambient temperatures, the built-in safety circuit may activate at current input levels below the rated continuous maximum.
- Continuous input of current exceeding the rated maximum or repeated activation of the safety function may result in damage to the unit.
- The probe is rated for maximum input under two conditions in addition to the input maximums shown in the Product Specifications. These are (1) 30 A_{peak}, for non-continuous input, and (2) 50 A_{peak} for pulse widths $\leq 10 \mu\text{s}$. (1) indicates an upper waveform response limit of 30 A_{peak}. Use the sensor at RMS current input levels that are within the rated continuous maximums. (2) indicates the upper response limit for a single input pulse.
- When opening the sensor head of the probe, be sure to operate with the opening lever. If an upper core is forced to open, when the sensor head is locked, the open-close mechanism can be damaged.

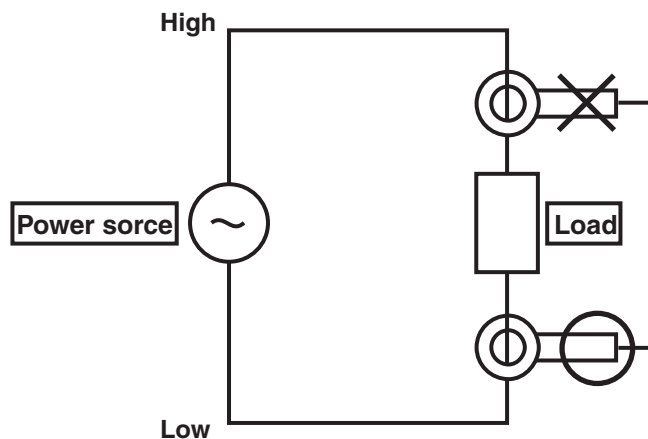


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- 1 Check that the system is safe, and that the preparations described in the preceding section have been carried out.
 - 2 Pull the sensor opening lever, so that the sensor head opens.
 - 3 Align the sensor so that the current direction indication corresponds to the direction of current flow through the conductor to be measured, and clamp so that the conductor is in the center of the sensor aperture.

-
- 4 Press the opening lever on the sensor head until the "UNLOCK" indication disappears, and check that the opening lever is firmly locked and the sensor head securely closed.
 - 5 It is now possible to monitor the current waveform. The output rate of the 700937 is 0.1 V/A. The current sensitivity can be derived from the voltage sensitivity of the waveform measurement instrument. For example, if the voltage sensitivity is 10 mV/division, the current sensitivity is 100 mA/division.

NOTE

- The output of this unit is terminated internally. Use a waveform measurement instrument with an input impedance of at least 1 M Ω .
- Immediately after powering on, this unit may be subject to an appreciable offset drift due to the effect of self-heating. To counteract this, allow the unit to warm up for about 30 minutes before carrying out measurement.
- When performing continuous measurements, it is necessary to be aware that the offset voltage drifts, depending on factors such as the ambient temperature.
- Under certain circumstances, oscillation may occur if the probe is connected to the 700938 Power Supply while the power supply is on. This does not indicate a malfunction. Oscillation can be stopped and operation restored to normal by opening and closing the sensor head.
- Depending on the measured current frequency, however some sound may be produced by resonance, it has no effect on measurements.
- The reading may be affected by the position within the clamp aperture of the conductor being measured. The conductor should be in the center of the clamp aperture.
- When carrying out measurement, press the opening lever until the "UNLOCK" indication disappears, and check that the sensor head is properly closed. If the sensor head is not properly closed, accurate measurement will not be possible.
- At high frequencies, common mode noise may affect measurements taken on the high voltage side of circuits. If this occurs, reduce the frequency range of the waveform measuring instrument, or clamp onto the low-voltage side of the circuit, as appropriate.



- Accurate measurement may be impossible in locations subject to strong external magnetic fields, such as transformers and high-current conductors, or in locations subject to strong external electric fields, such as radio transmission equipment.
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Specifications

Product Specifications

Accuracy is guaranteed at 23°C ±3°C (73°F ±5°F) after the power has been on for 30 minutes.

Frequency range*	DC to 50 MHz (-3dB) (Characteristics shown in Page1-9 Fig.1)
Rise time*	7 ns or less
Maximum continuous input range	15 A _{peak} (AC + DC components) (Derating according to frequency shown in Page1-9 Fig.2)
Maximum peak current value	Non-continuous 30 A _{peak} ; at pulse width ≤ 10 μs, 50 A _{peak}
Output voltage rate*	0.1 V/A
Amplitude accuracy*	±0.5% rdg. ±1 mV (DC, and 45 to 66 Hz, input within continuous maximum input range)
Noise*	Equivalent to 2.5 mA rms or less (for 20 MHz band measuring instrument)
Insertion impedance	(Characteristics shown in Page 1-9 Fig.3)
Temperature coefficient for sensitivity*	±2% or less (within a range of 0 to 40°C, within a range of 32 to 104°F)
Maximum rated power	3 VA
Rated supply voltage	±12 V ±1 V
Operating temperature and humidity range	0 to 40°C (32 to 104°F), 80% RH or less (no condensation)
Storage temperature and humidity range	-10 to 50°C (14 to 122°F), 80% RH or less (no condensation)
Location for use	Indoor, altitude up to 2000 m (6562 feet)
Effect of external magnetic fields	Equivalent to a maximum of 20 mA (in a 60 Hz, 400 A/ m AC current magnetic field)
Maximum permitted circuit voltage	300 V, CAT I (insulated conductor)
Diameter of measurable conductors	5 mm dia. 0.2" dia.
Recommended calibration	6months
Cable lengths	Sensor cable Approx. 1.5 m (59.0") Power supply cable Approx. 1 m (39.4")
External dimensions	Sensor Approx. 175(W) × 18(H) × 40(D) mm Approx. 6.89"(W) × 0.71"(H) × 1.58"(D) Terminator Approx. 27(H) × 55(W) × 18(D) mm Approx. 1.06"(W) × 2.17"(H) × 0.71"(D)
Mass	Approx. 230 g Approx. 8.1 oz.
Accessories	Instruction manual, soft case

Standards Applying

Safety	EN61010-1:1993+A2:1995 EN61010-2-031:1994 EN61010-2-032:1995 Overvoltage category I (anticipated transient overvoltage 1500 V), Pollution Degree 2
EMC	EN50082-1:1992 EN55011:1991+A1:1997+A2:1996

* In conjunction with the wavvform measuring instrument with an input impedance of $1M\Omega$.

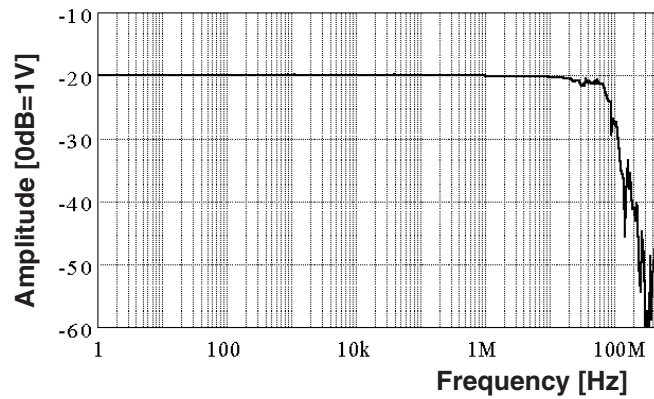


Figure 1 Frequency characteristics

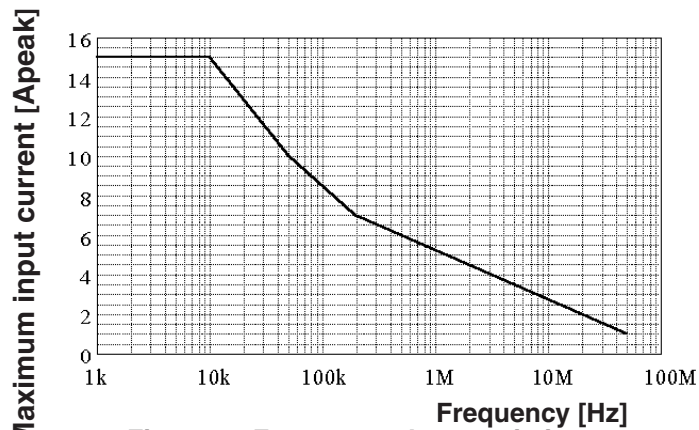


Figure 2 Frequency characteristics

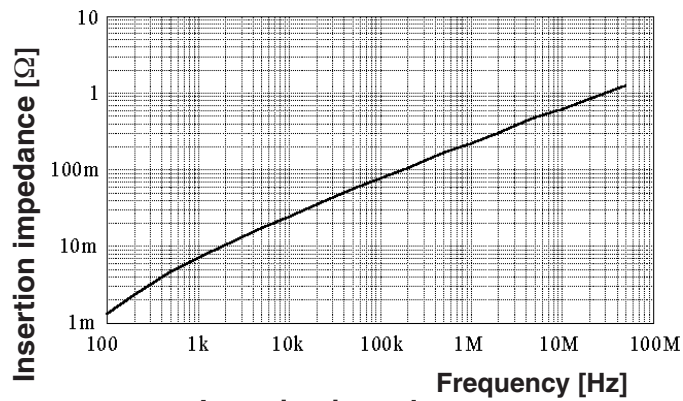


Figure 3 Insertion impedance (characteristics)

Corrective Action to be Taken in the case of an Abnormality

- If an message appears on the screen, refer to the following pages.
- If maintenance service is required, or if the instrument still does not operate properly even if the proper corrective action has been taken, contact your nearest YOKOGAWA representatives, listed on the back cover of this manual.

Symptom	Possible Cause	Corrective Action
Cannot make DC measurements (or at low frequencies up to few hundred Hertz) or the amplitude is small in the given frequency region.	Power is not turned ON.	Turn ON the power.
	The measurement instrument, such as an oscilloscope, is set to AC coupling.	Set the instrument to DC coupling.
	The sensor is not locked (it is not hooked securely).	Lock the sensor.
Cannot adjust to the zero level using the zero adjustment dial.	The sensor is magnetized.	Demagnetize the sensor before adjusting the zero level.
	The level is outside the range that can be adjusted using the zero adjustment dial (due to drifting, for example).	Use the coarse adjustment trimmer on the instrument.
The amplitude is small across all frequencies.	The input impedance of the measurement instrument, such as an oscilloscope, is set to 50%.	Set it to 1M%.