HIOKI

INSTRUCTION MANUAL

3270

CURRENT MONITOR

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing this Hioki 3270 Current Monitor. In order to use this product effectively and to ensure that it enjoys a long operational life, read this Instruction Manual carefully and then retain it for future reference.

Notes on Safety

⚠WARNING **This instrument is designed to prevent accidental shock to the operator when properly used. However no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurement. Failure to follow directions can result in a serious of fatal accident.**

Safety Symbols

This Instruction Manual provides information and warnings essential for operating this equipment in a safe manner and for maintaining it in safe operating condition. Before using this equipment, be sure to carefully read the following safety notes.

	This symbol is affixed to locations on the equipment where the operator should consult corresponding topics in this manual (which are also marked with the ⚠ symbol) before using relevant functions of the equipment. In the manual, this mark indicates explanations which it is particularly important that the user read before using the equipment.
	This symbol denotes a ground terminal.
	This symbol denotes a fuse.

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

⚠ DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
⚠WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
⚠CAUTION	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
NOTE	Denotes items of advice related to performance of the equipment or to its correct operation.

Inspection

When the unit is delivered, check and make sure that it has not been damaged in transit. In particular, check the accessories, panel switches, and connectors.
If the unit is damaged, or fails to operate according to the specifications, contact your dealer or Hioki representative.

Precautions

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

⚠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 Hioki representative.

Current Monitor (3270)

⚠WARNING

- **This unit is designed to be grounded through the three-wire power cord provided. In order to prevent electric shock, etc., connect this power cord to a grounded three-prong power receptacle.**
- **Before using a three-prong adapter, be sure to connect the green wire from the adapter to ground.**

⚠CAUTION

- When unplugging the power cord from the power receptacle or from the unit, grasp the plug, not the cord, in order to avoid damaging the cable.
- Several volts are generated at the output terminal when the power is turned on or turned off.

Clamp-On Sensor

⚠CAUTION

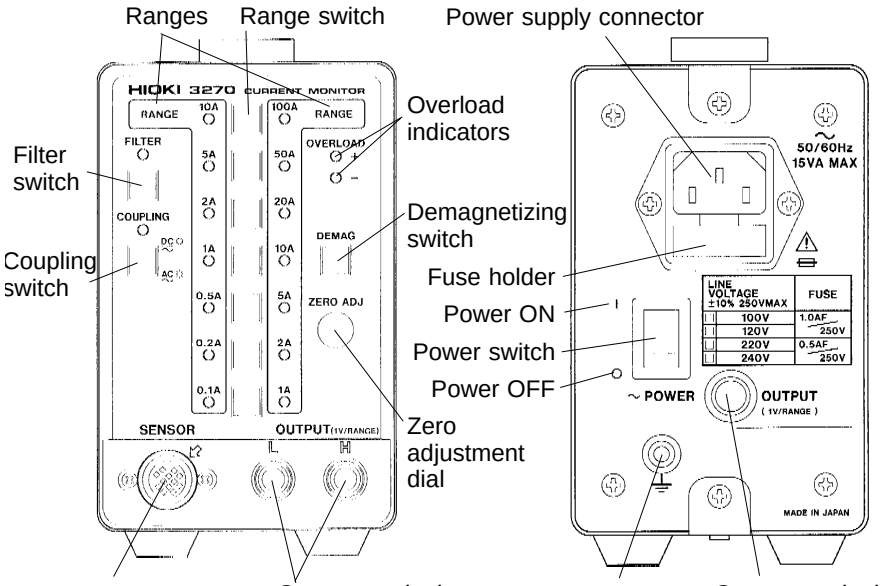
- If there is any type of dust or dirt on the core contact surfaces, measurements may be affected. Wipe it away gently with a soft cloth.
- Do not apply any sort of mechanical impact to the core section. Scratches on the core surfaces will make accurate measurements impossible.
- Do not bend or pull the sensor cables (especially where the cable connects to the sensor) in order to avoid damaging the sensor cables.
- When the power for the 3270 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.)
- Taking the sensor apart may damage the open-close mechanism that could result in an inoperative unit.

Chapter 1
3270 Current Monitor

1.1 Product Overview

This monitor is a seven-range amp designed especially for the 9273, 9274, 9275, and 9276 clamp-on sensors. When used in conjunction with any of the four sensors and connected to a recorder, oscilloscope, etc., this unit can be used to easily record and monitor current waveforms.

1.2 Identification of Indicators



Front **Rear**

1.3 Product Specifications

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

- ♦ Compatible sensors — 9273, 9274, 9275, 9276
- ♦ Output voltage — 1 V/range (front: Johnson terminals; rear: BNC terminal)
- ♦ Measurement ranges — 0.1/0.2/0.5/1/2/5/10 A (when using the 9273 or 9274)
  1/2/5/10/20/50/100 A (when using the 9275 or 9276)

♦ Zero adjustment	When the 9274 or 9276 is connected
♦ Demagnetizing	When the 9274 or 9276 is connected
♦ Filter functions	Switchable on/off (cutoff frequency is 100 kHz ±10 %)
♦ Coupling function	Switchable AC/DC
♦ Overload indicators	Turn on for each range when input is exceeded by factor of 5.5
♦ Amplitude accuracy	±0.5 %rdg. ±0.05 %f.s. up to 100 % input for range (DC, 45 to 66 Hz) ±1.2 %rdg. up to 200 % input for range (DC, 45 to 66 Hz)
♦ Frequency band	AC: 0.2 Hz to 10 MHz (-3 dB) DC: DC to 10 MHz (-3 dB) (see Figure 1)
♦ Noise	10 mVrms or less (when using filter: 2 mVrms or less) (with a voltmeter for up to 20 MHz)
♦ Temperature characteristics	±0.1 %/℃ or less
♦ Crest factor	5.5 or less versus the range value
♦ Output resistance	50Ω
♦ Operating temperature and humidity	0 to 40°C , 80 % RH or less (no condensation)
♦ Storage temperature and humidity	-10 to 50℃, 80 % RH or less (no condensation)
♦ Dielectric strength	1500 V AC for one minute (between power supply and case, and between power supply and output terminal)
♦ Insulation resistance	500 V DC, 100 MΩ or more (between power supply and case, and between power supply and output terminal)

- Power supply — 100 V AC (50 /60 Hz) (120, 220, and 240 V require specification)
- Power consumption — 15 VA max.
- External dimensions — Approx. 80(W) X 125(H) X 260(D) mm
- Mass — Approx. 1,750 g
- Accessories — Power cord, instruction manual, spare fuse (F1.0 A/250 V, 20 mm X 5 mm dia., in the fuse holder), 9177 Output cord

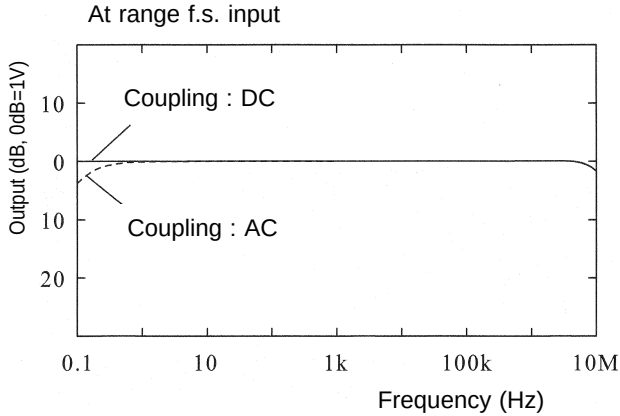


Figure 1 Frequency Band (example of characteristics)

1.4 Measurement Procedure

Before taking measurements, prepare this unit, the sensor and the other measuring equipment such as a recorder and an oscilloscope.

1.4.1 Preparation

> **⚠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 unit.

(1) Turn the power switch off and connect the power cord.

(2) Connect the sensor to be used to the connector on the unit.

(3) Turn the power switch on and confirm that the power indicator lights.

(4) Connect the output terminal on the unit and the input terminal of the measuring equipment, such as a recorder. (When using an oscilloscope, make the connections so that the GND terminal for the probe is connected to the L output terminal.)

1.4.2 Measurement

⚠ DANGER

- **To avoid short circuits and accidents that could result in injury or death, use clamp testers only with power lines carrying 600 V AC or less.**
- **To avoid short circuits and accidents that could result in injury or death, when the tip of jaws is open, do not use on bare conductors. The core and shield case are not insulated.**

⚠CAUTION

- Do not exceed the maximum allowable current input. The maximum input range differs, depending on the frequency of measured current. (Refer to specifications of the sensor.)
- If current exceeds the maximum allowable input, overheating of the sensor will trip the protective function for the internal circuitry, so the unit will no longer produce accurate output. If this happens, eliminate the input immediately (either by removing the sensor from the conductor being measured or by reducing the input current to zero.) (Wait until the sensor has had sufficient time to cool before resuming operation.)
- If the above situation occurs repeatedly, or if current in excess of the maximum input range is input continuously, the sensor could be damaged.
- Be sure to press only one range switch; avoid having none of the LEDs that indicate the range lit, or having two or more lit at the same time.

NOTE

- Depending on the measured current value and the frequency, however, some sound may be produced by resonation from the sensor, it has no effect on measurements.
- If a circuit carrying a large current is near to the sensor, measurements may be affected by external magnetic fields.

1.4.2.1 When Using the 9273

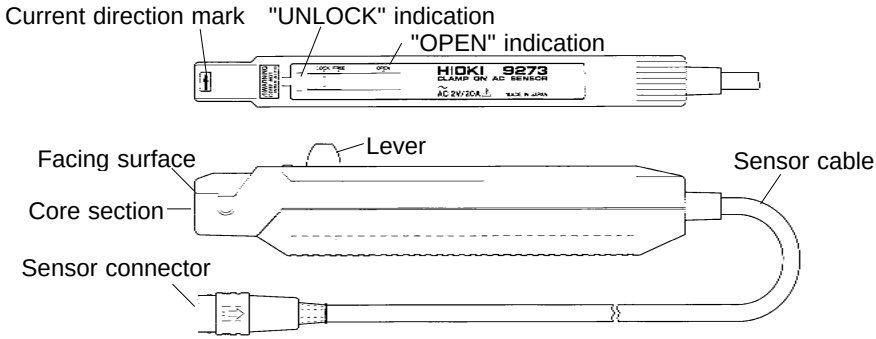


Figure 2 9273 Identification of Indicators

(1) Select both ranges of the 3270 and the measuring equipment according to the input current value. (Refer to Table 1 in Section 1.4.3.3.)

(2) Set the coupling switch to AC.

(3) Pull the lever of the sensor towards the "OPEN" indication to open the core section. (Refer to Figure 2, 9273 Identification of Indicators.)

(4) Position the sensor so that the current direction mark on the sensor part points in the direction of the load and so that the conductor being measured is centered, and then close the core section with the lever.

NOTE

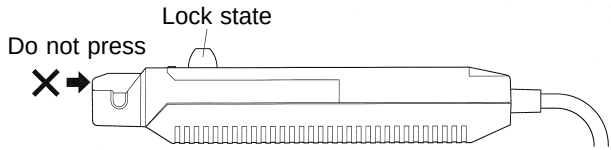
If the conductor being measured is not centered, the results may be affected by its position.

(5) Press the lever forward until the "UNLOCK" indication disappears, and confirm that the lever is completely locked.

NOTE Accurate measurement is not possible if "UNLOCK" is visible.

(6) The current waveform can now be recorded or monitored with the measuring equipment.

⚠CAUTION When opening the core section of the sensor, be sure to operate with the lever. If an upper core is forced to open, when the sensor is locked, the open-close mechanism can be damaged.



NOTE

- To eliminate noise and other high-frequency components, set the filter switch to "ON". (The cutoff frequency is approximately 100 kHz.)
- If it is necessary to go to 0.2 Hz or less, outside of the frequency band, then set the coupling to DC. (The offset voltage value for this unit is weighted as the DC component. The offset voltage values changes, depending on the range.)
- Immediately after the power is turned on and open or close sensor, depending on the condition of the internal circuitry, the output waveform will fluctuate up and down for approximately several ten seconds until it stabilizes. (However, a small amount of fluctuation will remain.)
- Accurate measurements are not possible when measuring overlapping DC components of several amperes or more.
- The zero adjustment dial does not function.

- If the demagnetizing switch is pressed during measurement, the output changes for approximately 1 second, but afterwards the measured value is not affected. (The demagnetizing function is not used when an AC sensor is connected.)

1.4.2.2 When Using the 9274

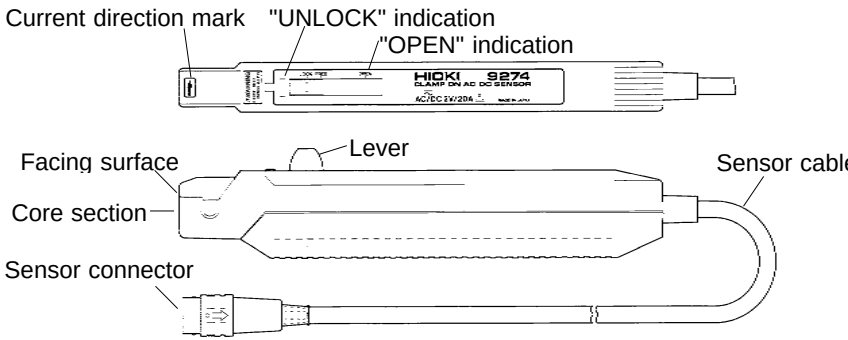


Figure 3 9274 Identification of Indicators

(1) Select both ranges of the 3270 and the measuring equipment according to the input current value. (Refer to Table 1 in Section 1.4.3.3.)

(2) Set the coupling switch to DC.

(3) Adjust the GND level of the measuring equipment (oscilloscope, etc.).

(4) Set the measuring equipment for DC coupling.

(5) Before clamping the sensor to the conductor to be measured, press the demagnetizing switch.

(6) Turn the zero adjustment dial and adjust the output voltage to zero (GND level).

(7) Pull the lever of the sensor towards the "OPEN" indication to open the core section. (Refer to Figure 3, 9274 Identification of Indicators.)

(8) Position the sensor so that the current direction mark on the sensor part points in the direction of the load and so that the conductor being measured is centered, and then close the core section with the lever.

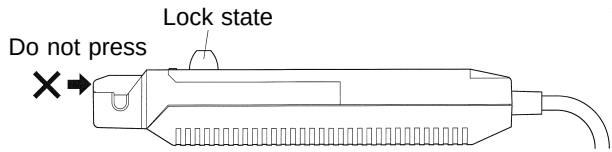
NOTE If the conductor being measured is not centered, the results may be affected by its position.

(9) Press the lever forward until the "UNLOCK" indication disappears, and confirm that the lever is completely locked.

NOTE Accurate measurement is not possible if "UNLOCK" is visible.

(10) The current waveform can now be recorded or monitored with the measuring equipment.

⚠CAUTION When opening the core section of the sensor, be sure to operate with the lever. If an upper core is forced to open, when the sensor is locked, the open-close mechanism can be damaged.



NOTE

- To eliminate noise and other high-frequency components, set the filter switch to "ON". (The cutoff frequency is approximately 100 kHz.)
- If the coupling of this unit is set to AC, or the coupling of the measuring equipment is set to AC, then components below the respective cutoff frequencies will be attenuated.
- Immediately after powering on, there may in some cases be a large offset drift caused by self-generated heat from this unit and the sensor.

- When performing continuous measurements, it is necessary to be aware that the offset voltage for this unit and the sensor drifts, depending on factors such as the ambient temperature.
- Always perform demagnetizing and the zero adjustment when taking measurements.
- The offset voltage value for this unit changes according to the range. If you change the range, be sure to perform the zero adjustment again.
- Perform the zero adjustment when there is no input and after performing demagnetizing. (The coupling setting must also be set to DC coupling.)
- Do not press the demagnetizing switch during measurement. (If the switch is pressed, the output will change for approximately 1 second. If you press the switch inadvertently, perform demagnetizing and zero adjustment again.)
- Before doing low current measurement, demagnetize the sensor heads and zero-adjust as follows. After opening and closing the sensor heads, the zero point may drift by an amount equivalent to several mA.
  1. Press the demagnetizing switch of the 3270.
  2. Open and close the sensor head clamps two or three times.
  3. Turn the zero adjustment dial of the 3270 to zero the output voltage.

1.4.2.3 When Using the 9275

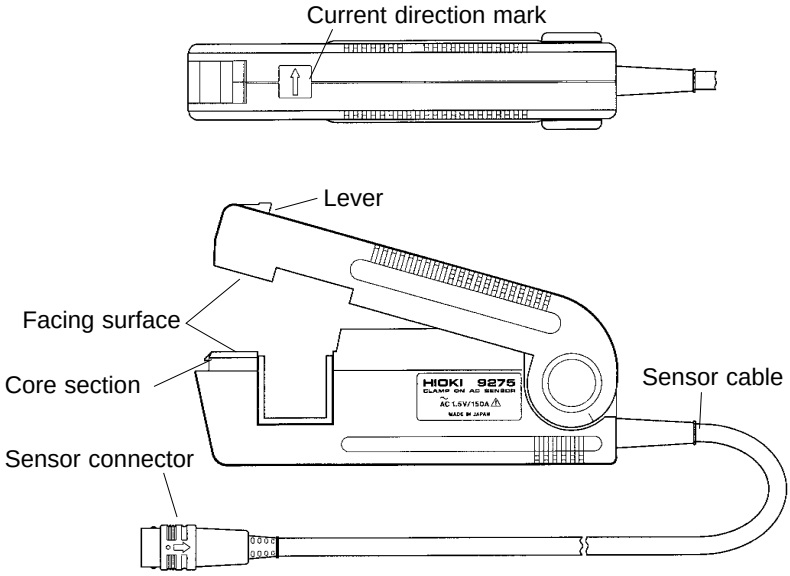


Figure 4 9275 Identification of Indicators

(1) Select both ranges of the 3270 and the measuring equipment according to the input current value. (Refer to Table 2 in Section 1.4.3.3.)

(2) Set the coupling switch to AC.

(3) Gently press the lever of the sensor to open the core section. (Refer to Figure 4, 9275 Identification of Indicators.)

(4) Position the sensor so that the current direction mark points in the direction of the load and so that the conductor being measured is centered, and then close the core section.

NOTE If the conductor being measured is not centered, the results may be affected by its position.

(5) Confirm that the lever is completely locked.

NOTE Accurate measurement is not possible if the sensor is not locked.

(6) The current waveform can now be recorded or monitored with the measuring equipment.

NOTE
- To eliminate noise and other high-frequency components, set the filter switch to "ON". (The cutoff frequency is approximately 100 kHz.)
- If it is necessary to go to 0.2 Hz or less, outside of the frequency band, then set the coupling to DC. (The offset voltage value for this unit is weighted as the DC component. The offset voltage values changes, depending on the range.)
- Immediately after the power is turned on and open or close sensor, depending on the condition of the internal circuitry, the output waveform will fluctuate up and down for approximately several ten seconds until it stabilizes. (However, a small amount of fluctuation will remain.)
- Accurate measurements are not possible when measuring overlapping DC components of ten and several amperes or more.
- The zero adjustment dial does not function.
- If the demagnetizing switch is pressed during measurement, the output changes for approximately 1 second, but afterwards the measured value is not affected. (The demagnetizing function is not used when an AC sensor is connected.)

1.4.2.4 When Using the 9276

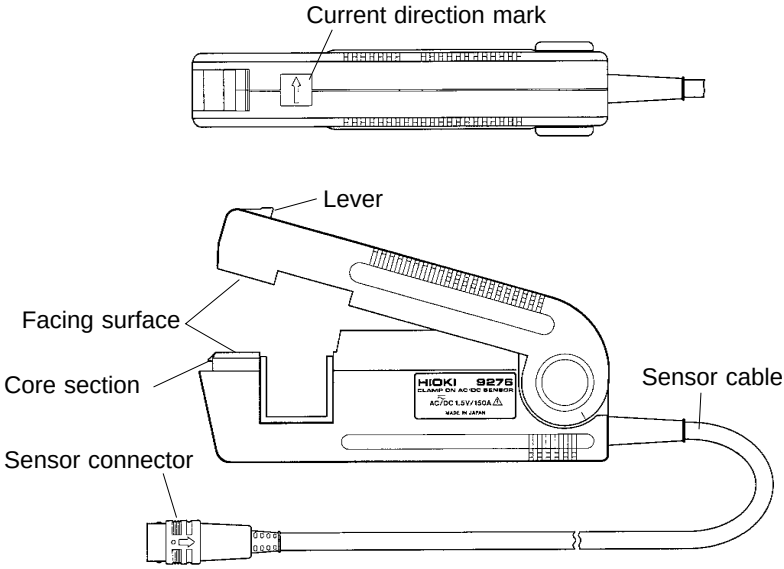


Figure 5 9276 Identification of Indicators

(1) Select both ranges of the 3270 and the measuring equipment according to the input current value. (Refer to Table 2 in Section 1.4.3.3.)

(2) Set the coupling switch to DC.

(3) Adjust the GND level of the measuring equipment (oscilloscope, etc.).

(4) Set the measuring equipment for DC coupling.

(5) Before clamping the sensor to the conductor to be measured, press the demagnetizing switch.

(6) Turn the zero adjustment dial and adjust the output voltage to zero (GND level).

(7) Gently press the lever of the sensor to open the core section. (Refer to Figure 5, 9276 Identification of Indicators.)

(8) Position the sensor so that the current direction mark points in the direction of the load and so that the conductor being measured is centered, and then close the core section.

NOTE If the conductor being measured is not centered, the results may be affected by its position.

(9) Confirm that the lever is completely locked.

NOTE Accurate measurement is not possible if the sensor is not locked.

(10) The current waveform can now be recorded or monitored with the measuring equipment.

NOTE

- To eliminate noise and other high-frequency components, set the filter switch to "ON". (The cutoff frequency is approximately 100 kHz.)
- If the coupling of this unit is set to AC, or the coupling of the measuring equipment is set to AC, then components below the respective cutoff frequencies will be attenuated.
- Immediately after powering on, there may in some cases be a large offset drift caused by self-generated heat from this unit and the sensor.
- When performing continuous measurements, it is necessary to be aware that the offset voltage for this unit and the sensor drifts, depending on factors such as the ambient temperature.
- Always perform demagnetizing and the zero adjustment when taking measurements.
- The offset voltage value for this unit changes according to the range. If you change the range, be sure to perform the zero adjustment again.
- Perform the zero adjustment when there is no input and after performing demagnetizing. (The coupling setting must also be set to DC coupling.)

- Do not press the demagnetizing switch during measurement. (If the switch is pressed, the output will change for approximately 1 second. If you press the switch inadvertently, perform demagnetizing and zero adjustment again.)

1.4.3 Explanation of Each Function

1.4.3.1 Connector

Connect any one of clamp-on sensors (9273 through 9276) to the connector.

⚠CAUTION

- In order to prevent damages of this unit and the sensor, never plug in or unplug the sensor connector when the power is turned on.
- Because ±12 V is output from the connector on the equipment to provide power to the sensor, do not plug anything into this connector except for the sensor connector.

1.4.3.2 Output Terminals

Output terminals are located on both the front and rear of the unit; signals are output from these terminals simultaneously.
Front: Johnson terminals (connect a shielded cord)
Rear: BNC terminal
The output resistance is approximately 50 Ω.

⚠CAUTION In order to prevent malfunctions, do not short the output terminal or input voltage to them.

NOTE

- Connect measuring equipment with an input resistance of at least 1 MΩ. When using the front and rear panel output terminals at the same time, make sure that the combined input resistance of both measuring equipments is 1 MΩ or more. (Accuracy is not guaranteed if the input resistance is less than 1 MΩ .)
- Note that the frequency band is not guaranteed if the load capacitance (the input capacitance of the measuring equipment and the capacitance of the output cord) is several hundred pF or more.
- Do not connect the GND terminal (L) of a recorder or an oscilloscope to the H terminal on this unit. (Accurate measurement may not be possible.)

1.4.3.3 Measurement ranges

The measurement ranges differ according to the sensor that is connected. (When a sensor is connected, the LED indicating the range lights.)
When using the 9273 or 9274: 0.1/0.2/0.5/1/2/5/10 A
When using the 9275 or 9276: 1/2/5/10/20/50/100 A
In each measurement scale, output of 1V is generated when input is at the top of the scale.
Determine the range to be set based on this unit's measurement ranges and the range of the measuring equipment (such as a recorder) being used. (Refer to Tables 1 and 2.)

⚠CAUTION Be sure to press only one range switch; avoid having none of the LEDs that indicate the range lit, or having two or more lit at the same time.

Table 1. Current value conversion table when the 9273 or 9274 (5 mm dia. type) is connected

Measuring equipment range/DIV	10 mV	20 mV	50 mV	100 mV	200 mV	500 mV	1 V	2 V
10 A range	0.1 A	0.2 A	0.5 A	1 A	2 A	5 A	10 A	20 A
5 A range	0.05 A	0.1 A	0.25 A	0.5 A	1 A	2.5 A	5 A	10 A
2 A range	0.02 A	0.04 A	0.1 A	0.2 A	0.4 A	1 A	2 A	4 A
1 A range	0.01 A	0.02 A	0.05 A	0.1 A	0.2 A	0.5 A	1 A	2 A
0.5 A range	5 mA	0.01 A	0.025 A	0.05 A	0.1 A	0.25 A	0.5 A	1 A
0.2 A range	2 mA	4 mA	0.01 A	0.02 A	0.04 A	0.1 A	0.2 A	0.4 A
0.1 A range	1 mA	2 mA	5 mA	0.01 A	0.02 A	0.05 A	0.1 A	0.2 A

*The values indicate the current value per DIV of the measuring equipment, such as a recorder.

Table 2. Current value conversion table when the 9275 or 9276 (20 mm dia. type) is connected

Measuring equipment range/DIV	10 mV	20 mV	50 mV	100 mV	200 mV	500 mV	1 V	2 V
100 A range	1 A	2 A	5 A	10 A	20 A	50 A	100 A	200 A
50 A range	0.5 A	1 A	2.5 A	5 A	10 A	25 A	50 A	100 A
20 A range	0.2 A	0.4 A	1 A	2 A	4 A	10 A	20 A	40 A
10 A range	0.1 A	0.2 A	0.5 A	1 A	2 A	5 A	10 A	20 A
5 A range	0.05 A	0.1 A	0.25 A	0.5 A	1 A	2.5 A	5 A	10 A
2 A range	0.02 A	0.04 A	0.1 A	0.2 A	0.4 A	1 A	2 A	4 A
1 A range	0.01 A	0.02 A	0.05 A	0.1 A	0.2 A	0.5 A	1 A	2 A

*The values indicate the current value per DIV of the measuring equipment, such as a recorder.

1.4.3.4 Demagnetizing (DEMAG)

Because demagnetizing is necessary after range settings when an AC/DC sensor (9274 or 9276) is connected, be sure to press the demagnetizing switch. (Press the switch when there is no input.)
Demagnetization is performed because there is a possibility the sensor will become magnetized when the power for the main unit is turned on/off or as the result of excessive input. (Accurate measurements are not possible if the sensor is magnetized.)
Demagnetization occurs in less than 1 second. In addition, because the signal lines are disconnected by internal circuitry during the demagnetization process, the output voltage changes.
If you inadvertently press the demagnetizing switch while taking a measurement, perform the demagnetizing process again while there is no input.

NOTE

- Always demagnetize before performing the zero adjustment.
- Because demagnetizing is only effective when an AC/DC sensor is connected, the demagnetizing function does not work when there is no sensor connected or when an AC sensor (9273 or 9275) is connected.

1.4.3.5 Zero adjustment (ZERO ADJ.)

When an AC/DC sensor (9274 or 9276) is connected, demagnetizing and zero adjustment are necessary after setting the range. (Perform zero adjustment while there is no input.)
Zero adjustment is performed in order to compensate for the offset voltage values of the unit and the sensors and for the drift of those values caused by the temperature.

Even when using an AC/DC sensor and setting the coupling to AC for measurement, first set the coupling to DC and perform the demagnetizing and zero adjustment procedures.
Turning the zero adjustment dial to the left decreases the output voltage, and turning the dial to the right increases the output voltage. (The lower the measurement range, the broader the zero adjustment range becomes.)

NOTE

Because zero adjustment is only effective when an AC/DC sensor is connected, the zero adjustment function does not work when there is no sensor connected or when an AC sensor (9273 or 9275) is connected.

1.4.3.6 Coupling (COUPLING)

The coupling method can be either AC or DC.

AC: Eliminates the DC component and outputs only the AC signal. (The cutoff frequency is 0.2 Hz.)

DC: Outputs all signals.

Pressing the coupling switch sets the coupling to AC. (The LED lights.)

1.4.3.7 Filter (FILTER)

Use the filter to eliminate noise and other high-frequency components. (The cutoff frequency is approximately 100 kHz.)
Pressing the filter switch turns the filter on. (The LED lights.)

1.4.3.8 Overload indicator (OVERLOAD)

This LED lights when the input (peak value) exceeds the range by a factor of 5.5.
When the LED is lit, the input exceeds the crest factor (maximum of 5.5 for each range value), resulting in waveform distortion. Adjust the range so that the LED goes off.

⚠CAUTION In order to avoid malfunctions, confirm the maximum measurable current range of the sensor being connected before beginning to take measurements. (Refer to specifications of the sensor.)

NOTE The LED may light immediately after an AC sensor (9273 or 9275) is connected or depending on the position of the zero adjustment dial when an AC/DC sensor (9274 or 9276) is connected.

1.5 Fuse Replacement

If the fuse blows, replace it as shown in Figure 6.

⚠WARNING

- **In order to prevent electric shock, always disconnect the power cord from the receptacle before replacing the fuse.**
- **Always replace the fuse with a new fuse of the specified rating.**
  Never use a fuse of other than the specified rating, and never short circuit the fuse holder to prevent an accident resulting in injury or death.
  100 V, 120 V : F1.0 A/250 V 20 mm X 5 mm dia.
  220 V, 240 V : F0.5 A/250 V 20 mm X 5 mm dia.

1. Unplug the power cord.
2. Remove the fuse holder, check the fuse and then replace.

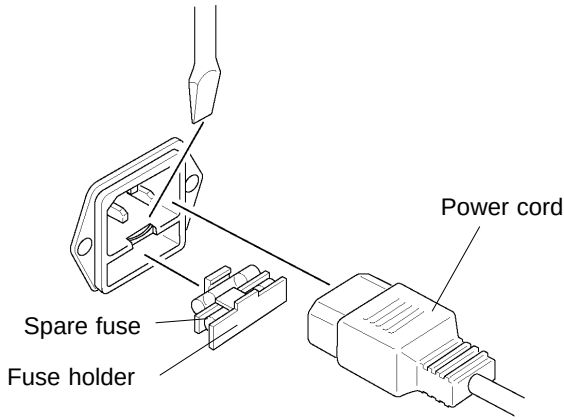


Figure 6 Fuse Replacement

Chapter 2
9273 Clamp-On AC Sensor

2.1 Product Specifications

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

- Rated current — 20 A AC
- Output voltage — 2 V AC/20 A AC
- Output resistance — 50 Ω
- Input impedance — 0.1 mΩ or less at 55 Hz (see Figure 7)
- Continuous maximum input range — 20 A (see Figure 8)
- Maximum peak current value — 50 A noncontinuous (peak value)
- Amplitude accuracy — ±0.5 % rdg. ±0.05 % f.s. (45 to 66 Hz)
- Phase accuracy — ±0.2° (45 to 66 Hz)
- Frequency band — 0.7 Hz to 10 MHz (-3 dB) (see Figure 9, example of characteristics)
- Frequency characteristics (Deviation from accuracy) — 2 Hz to 10 kHz: ±2.0 % or less; 10 kHz to 100 kHz: ±3.0 % or less
- Temperature coefficient for sensitivity — ±0.1 % f.s./℃ or less (within a range of 0 to 40 ℃)
- Noise — 1 mV rms or less (with a voltmeter for up to 20 MHz)
- Power consumption — 1.5 VA max. (with rated input)

♦ Supply voltage	±12 V ±1 V
♦ Operating temperature and humidity	0 to 40°C ,80 % RH or less (no condensation)
♦ Storage temperature and humidity	-10 to 50°C ,80 % RH or less (no condensation)
♦ Effect of external magnetic fields	Equivalent to a maximum of 20 mA (in a 400 A/m AC current magnetic field)
♦ Effect of conductor position	Within ±0.2 %
♦ Dielectric strength	2200 V AC for 1 minute (between electric circuit and case)
♦ Insulation resistance	500 V DC, 100 M Ω or more (between electric circuit and case)
♦ Maximum permitted circuit voltage (insulated conductor)	600 V peak; (the core, shield case, and electrical circuits are not insulated.)
♦ Diameter of measurable conductors	5 mm dia.
♦ Cord length	Approx. 1.5 m
♦ External dimensions and mass	Approx. 175 (W) X 40 (H) X 18 (D) mm, approx. 170 g
♦ Accessories	Instruction manual, soft case

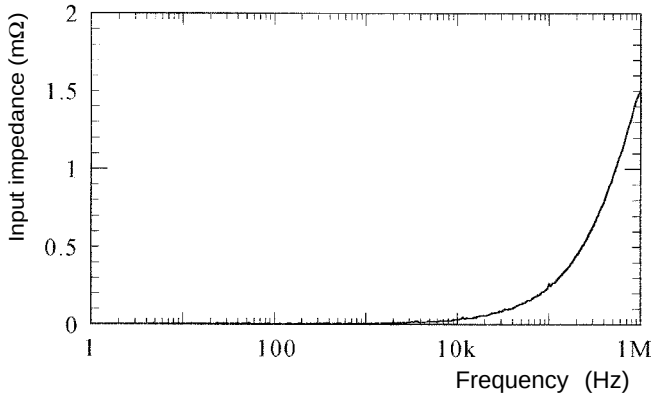


Figure 7 9273 Input Impedance

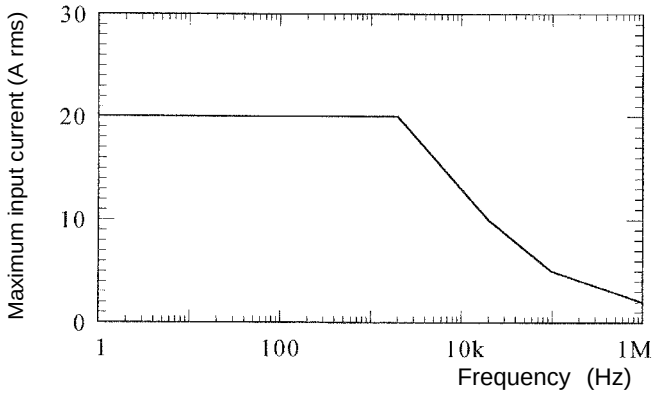


Figure 8 9273 Maximum Input Range

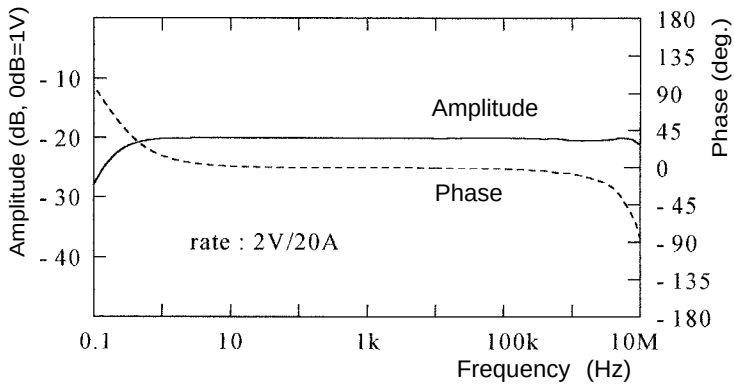


Figure 9 9273 Frequency Band (example of characteristics)

Chapter 3
9274 Clamp-On AC/DC Sensor

3.1 Product Specifications

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

- Rated current — 20 A (AC+DC)
- Output voltage — 2 V /20 A (AC+DC)
- Output resistance — 50 Ω
- Input impedance — 0.1 mΩ or less at 55 Hz (see Figure 10)
- Continuous maximum input range — 20 A (see Figure 11)
- Maximum peak current value — 50 A noncontinuous (peak value)
- Amplitude accuracy — ±0.5 % rdg. ±0.1 % f.s. (DC, 45 to 66 Hz)
- Phase accuracy — ±0.2° (45 to 66 Hz)
- Frequency band — DC to 10 MHz (-3 dB) (see Figure 12, example of characteristics)
- Frequency characteristics (Deviation from accuracy) — DC to 1 kHz: ±2.0 % or less; 1 kHz to 100 kHz: ±5.0 % or less
- Temperature coefficient for sensitivity — ±0.1 % f.s./°C or less (within a range of 0 to 40 °C)
- Noise — 1 mV rms or less (with a voltmeter for up to 20 MHz)

♦ Power consumption	1.5 VA max. (with rated input)
♦ Supply voltage	±12 V ±1 V
♦ Operating temperature and humidity	0 to 40 °C, 80 % RH or less (no condensation)
♦ Storage temperature and humidity	-10 to 50 °C, 80 % RH or less (no condensation)
♦ Effect of external magnetic fields	Equivalent to a maximum of 20 mA (in a 400 A/m AC current magnetic field)
♦ Effect of conductor position	Within ±0.2 %
♦ Dielectric strength	2200 V AC for 1 minute (between electric circuit and case)
♦ Insulation resistance	500 V DC, 100 M Ω or more (between electric circuit and case)
♦ Maximum permitted circuit voltage (insulated conductor)	600 V peak; (the core, shield case, and electrical circuits are not insulated.)
♦ Diameter of measurable conductors	5 mm dia.
♦ Cord length	Approx. 1.5 m
♦ External dimensions and mass	Approx. 175 (W) X 40 (H) X 18 (D) mm, approx. 170 g
♦ Accessories	Instruction manual, soft case

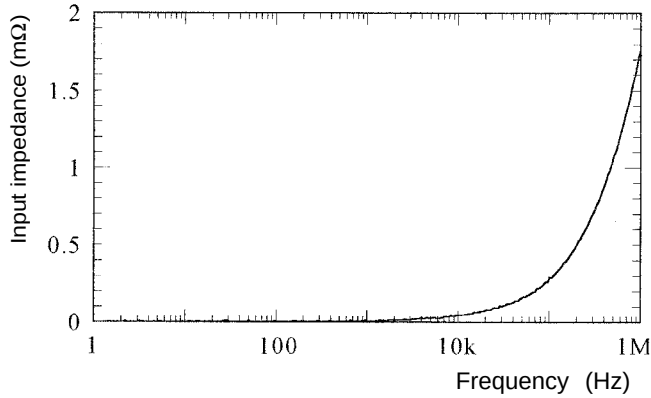


Figure 10 9274 Input Impedance

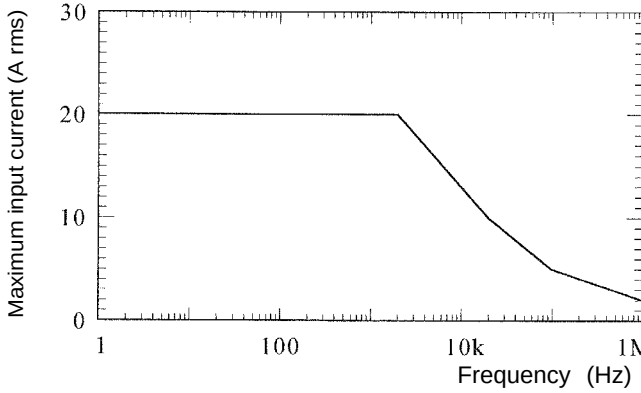


Figure 11 9274 Maximum Input Range

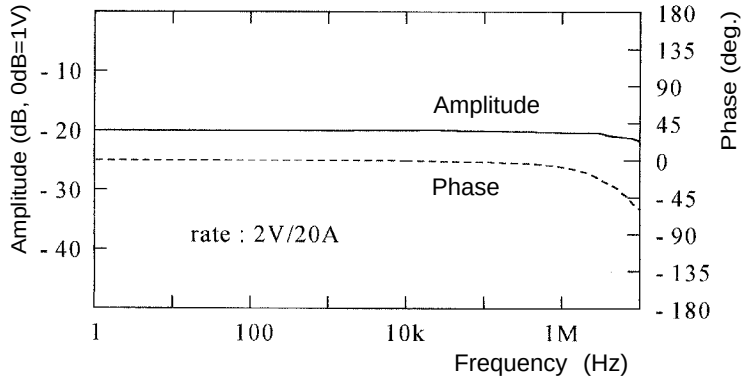


Figure 12 9274 Frequency Band (example of characteristics)

Chapter 4
9275 Clamp-On AC Sensor

4.1 Product Specifications

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

- Rated current — 150 A AC
- Output voltage — 1.5 V AC/150 A AC
- Output resistance — 50 Ω
- Input impedance — 0.02 mΩ or less at 55 Hz (see Figure 13)
- Continuous maximum input range — 150 A (see Figure 14)
- Maximum peak current value — 400 A noncontinuous (peak value)
- Amplitude accuracy — ±0.5 % rdg. ±0.05 % f.s. (45 to 66 Hz)
- Phase accuracy — ±0.2 ° (45 to 66 Hz)
- Frequency band — 0.5 Hz to 1 MHz (-3 dB) (see Figure 15, example of characteristics)
- Frequency characteristics (Deviation from accuracy) — 1 Hz to 10 Hz : ±3.0 % or less
10 Hz to 10 kHz : ±1.0 % or less
10 kHz to 100 kHz: ±3.0 % or less
- Temperature for sensitivity — ±0.05 % f.s./°C or less (within a range of 0 to 40 °C)
- Noise — 1 mV rms or less (with a voltmeter for up to 20 MHz)

♦ Power consumption	2 VA max. (with rated input)
♦ Supply voltage	±12 V ±1 V
♦ Operating temperature and humidity	0 to 40°C, 80 % RH or less (no condensation)
♦ Storage temperature and humidity	-10 to 50°C, 80 % RH or less (no condensation)
♦ Effect of external magnetic fields	Equivalent to a maximum of 1 A (in a 400 A/m AC current magnetic field)
♦ Effect of conductor position	Within ±1 %
♦ Dielectric strength	2200 V AC for 1 minute (between electric circuit and case)
♦ Insulation resistance	500 V DC, 100 MΩ or more (between electric circuit and case)
♦ Maximum permitted circuit voltage (insulated conductor)	600 V peak; (the core, shield case, and electrical circuits are not insulated.)
♦ Diameter of measurable conductors	20 mm dia.
♦ Cord length	Approx. 1.5 m
♦ External dimensions and mass	Approx. 145 (W) X 60 (H) X 33 (D) mm, approx. 300 g
♦ Accessories	Instruction manual, carrying case

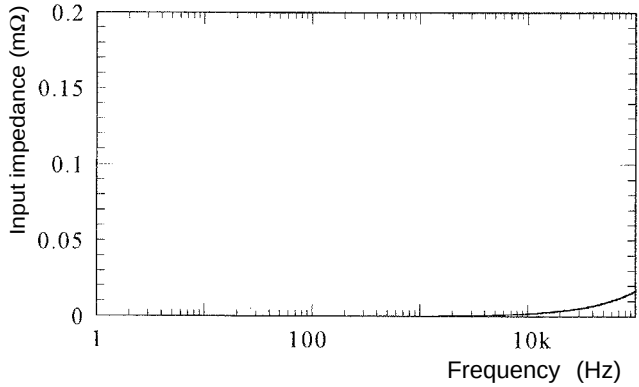


Figure 13 9275 Input Impedance

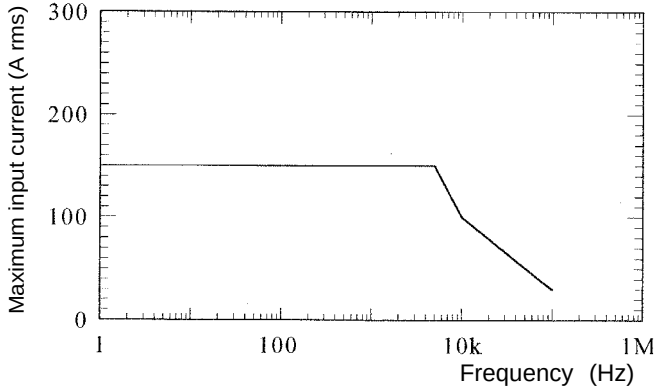


Figure 14 9275 Maximum Input Range

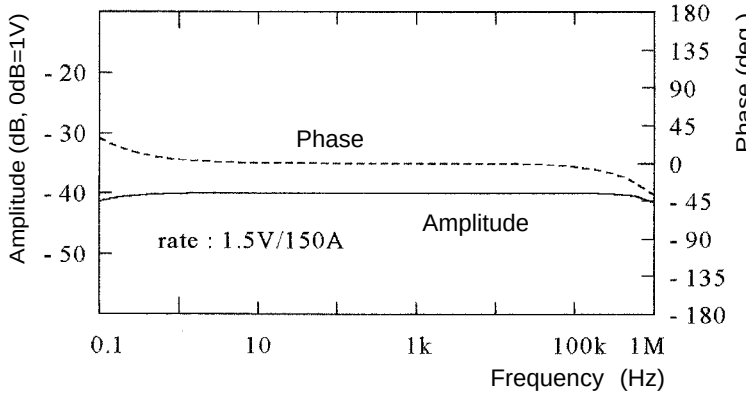


Figure 15 9275 Frequency Band (Example of Characteristics)

Chapter 5
9276 Clamp-On AC/DC Sensor

5.1 Product Specifications

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

♦ Rated current	150 A (AC+DC)
♦ Output voltage	1.5 V /150 A (AC+DC)
♦ Output resistance	50 Ω
♦ Input impedance	0.02 mΩ or less at 55 Hz (see Figure 16)
♦ Continuous maximum input range	150 A (see Figure 17)
♦ Maximum peak current value	400 A noncontinuous (peak value)
♦ Amplitude accuracy	± 0.5 % rdg. ± 0.1 % f.s. (DC, 45 to 66 Hz)
♦ Phase accuracy	± 0.2 ° (45 to 66 Hz)
♦ Frequency band	DC to 1 MHz (-3 dB) (see Figure 18, example of characteristics)
♦ Frequency characteristics (Deviation from accuracy)	DC to 10 kHz : ± 2.0 % or less 10 kHz to 100 kHz : ± 4.0 % or less
♦ Temperature for sensitivity	± 0.05 % f.s./°C or less (within a range of 0 to 40°C

♦ Noise	1 mV rms or less (with a voltmeter for up to 20 MHz)
♦ Power consumption	2 VA max. (with rated input)
♦ Supply voltage	±12 V ±1 V
♦ Operating temperature and humidity	0 to 40°C, 80 % RH or less (no condensation)
♦ Storage temperature and humidity	-10 to 50°C, 80 % RH or less (no condensation)
♦ Effect of external magnetic fields	Equivalent to a maximum of 1 A (in a 400 A/m AC current magnetic field)
♦ Effect of conductor position	Within ±1 %
♦ Dielectric strength	2200 V AC for 1 minute (between electric circuit and case)
♦ Insulation resistance	500 V DC, 100 MΩ or more (between electric circuit and case)
♦ Maximum permitted circuit voltage (insulated conductor)	600 V peak; (the core, shield case, and electrical circuits are not insulated.)
♦ Diameter of measurable conductors	20 mm dia.
♦ Cord length	Approx. 1.5 m
♦ External dimensions and mass	Approx. 145 (W) X 60 (H) X 33 (D) mm, approx. 300 g
♦ Accessories	Instruction manual, carrying case

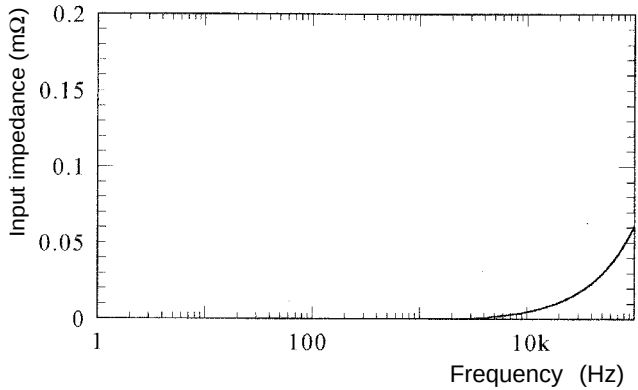


Figure 16 9276 Input Impedance

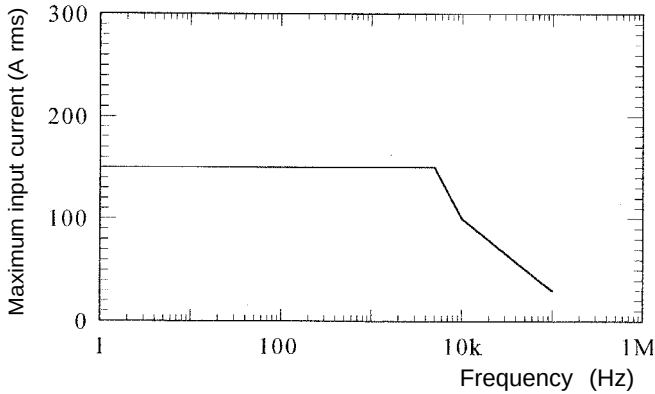


Figure 17 9276 Maximum Input Range

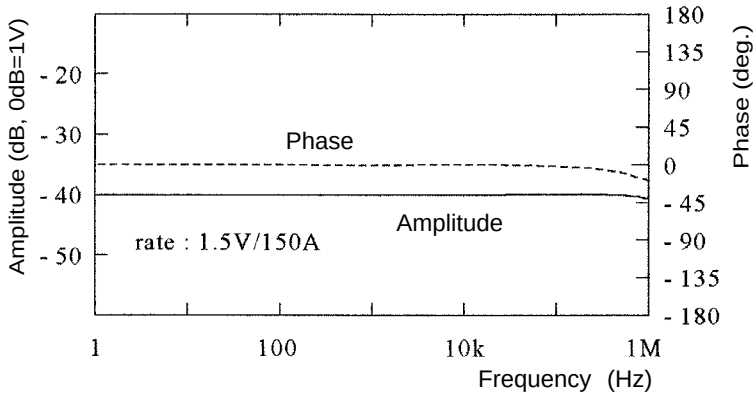


Figure 18 9276 Frequency Band (example of characteristics)