
Instruction Manual

High Voltage Probe HV-P60A

IWATSU TEST INSTRUMENTS CORPORATION

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Introduction

- ◇ Thank you for purchasing the Iwatsu's instrument. We hope that it can be used for a prolonged period.
- ◇ We would ask you to thoroughly read this instruction manual before commencing the operation and keep it at a readily accessible location for future reference.
- ◇ This instruction manual mainly describes notes on use, compositions, basic operating procedure and specifications.

To ensure the Safety Operation

To ensure safe operation of this instrument and to prevent injury to the user or damage to property, read and carefully observe  warnings and  cautions in the following sections

Definition of  warnings and  cautions used in this manual

 Warnings	Incorrect operation or malfunction to observe the warning may result in death or serious injury.
 Cautions	Incorrect operation or malfunction to observe the caution may result in injury or damage to the instrument

Notes

- ◇ Parts of the contents of this manual may be modified without notice for improvements in performance and functions.
- ◇ Reproduction or reprinting of the contents of this manual without prior permission from IWATSU is prohibited.
- ◇ If any question about this instrument arises, contact Iwatsu office or our sales distributors.

Revision History

- ◇ May 2015: 1st edition

Read the following safety information



Warnings

- **Measure in accordance with operating procedure when using this instrument.**

Erroneous operating procedure (refer to “3. Adjustment of Probe” and “4. Measuring method”.) may result in an electric shock, fire or malfunction.

- **When connecting the object to be measured to the nose of the probe, firmly fix a measuring lead with an accessory Clamp.**

Incomplete clamping may result in an electric shock, fire or malfunction.

- **Do not bring a grounding lead into contact with an insulator or the nose of the probe.**

If the grounding lead is brought into contact with the insulator or nose of the probe, it may result in an electric shock, fire or malfunction.

- **Coating of the grounding lead is voltage resistant (approx. 10 kV, but a clip is not and should be used carefully.**

- **Do not apply a voltage higher than the specified one.**

If a voltage higher than the specified is applied, it may result in an electric shock, fire or malfunction. The maximum input voltage is 60 kV at DC to 20 kHz. If the frequency exceeds 20 kHz, the maximum input voltage will decrease (see “Fig.7 Maximum Input Voltage vs. Frequency”).

- **During or before measurement, make sure that no one or nothing come into contact around you.**

If you touch someone or something during measurement, it may result in an electric shock.

[Read the next page.]

Read the following safety information



Warnings

- **Do not use in an environment with explosive gases.**

It may cause an explosion.

- **If you notice smoke, foul odor or abnormal noise, stop measurement immediately.**

Continued use under these circumstances may result in electric shock, fire or malfunction. Immediately, turn off the power switch of the object to be measured and remove this probe from the object to be measured after confirming the thing that a high voltage has not gone out, and contact Iwatsu office or our sales distributors for repair. The customer should never repair the instrument because it is dangerous.

- **This instrument is not a waterproof. Make sure no water gets on or inside the instrument.**

If the instrument is used in the wet condition, it may cause an electric shock, fire or malfunction. If water is allowed in it, immediately turn off the power switch of the object to be measured and remove this probe from the object to be measured after confirming the thing that a high voltage has not gone out, and contact Iwatsu office or our sales distributors for repair.

- **Do not use this instrument when the drop of water adheres to it or the hand is wet.**

Otherwise electric shock, fire or malfunction could result.

- **Do not place this instrument on an unstable place, such as a shaky stand or an inclined place.**

If this instrument is placed on an unstable place, it may be fallen down or laid down, causing a personal injury or malfunction. It is recommended to use a probe stand SK-301 (option). If this instrument is fallen down or damaged, immediately turn off the power switch of the object to be measured and remove this probe from the object to be measured after confirming the thing that a high voltage has not gone out, and contact Iwatsu office or our sales distributors for repair.

[Read the next page.]

Read the following safety information



Warnings

- **Do not put a container that water, medicine, etc. has entered on this instrument.**

If not, an electric shock, fire or malfunction may result. If this instrument is wet with water or medicine, contact Iwatsu office or our sales distributors for repair.

- **Do not directly hold this instrument when using**

If the instrument is directly held by the hand, never hold it because it may result in an electric shock.

- **Do not drop the instrument or give strong vibrations or shock to it.**

A strong shock may damage the instrument and result in malfunction or an electronic shock. When this instrument is dropped or damaged, contact Iwatsu office or our sales distributors for repair.

- **Do not modify or disassemble this instrument.**

The repair and remodeling by the customer cause an electric shock, fire or malfunction. The user cannot repair this instrument. Contact Iwatsu office or our sales distributors for repair. Moreover, please note not responding to the repair when remodeling the instrument.

- **Do not use this instrument when it has failed.**

Using Probe body or cable may be a cause of an electric shock or fire. In the event of a malfunction, contact Iwatsu office or our sales distributors for repair.

[Read the next page.]

Read the following safety information



Warnings

- **Connect the playground of the probe body with the grounding potential (playground) of the object to be measured.**

When the playground of the probe body is connected with potential other than the playground of the object to be measured, it might cause an electric shock or malfunction (for the object to be measured, this instrument, and connected oscilloscope).

- **When thunder begins, pull out the power plug of the target or the oscilloscope to which this instrument is connected from the outlet. Then, detach this instrument from the oscilloscope or the object to be measured, and do not use it.**

If not, lightning may cause an electric shock, fire, or malfunction.

- **When the insulator is contaminated, wipe off contamination prior to using it.**

If the insulator is contaminated, a high voltage may leak and cause an electric shock, fire or malfunction. Apply a little amount of neutral detergent to soft cloth and wipe the insulator gently with it. Do not use highly volatile liquid such as benzene or thinner.

[Read the next page.]

Read the following safety information



Cautions

- **Always use or storage this instrument only within the rated operating range.**

The use of this instruction out of the rated operating range could result in malfunction. The temperature ranges that allow the use of this instrument are as follows.

- The range of operating or stored temperature
: -10 °C to +50 °C (no dew condensation)

- **Do not use or store this instrument in a location with direct sunlight, high temperature, high humidity, or dew condensation.**

An internal temperature might go up, and it cause an electric shock, fire or malfunction.

- **Do not put this instrument in a place exposed to lamp soot or steam generated by counters, humidifiers, etc.**

It may cause fire or malfunction.

- **For your safety, remove the oscilloscope and the target to be measured from this instrument before maintenance. In addition, wipe off with a dry cloth when water droplets are attached.**

If not, an electric shock or malfunction may occur.

- **Before transporting this instrument, pack the housed instrument in the packing material used at the time of purchase, or the equivalent or better.**

This instrument may fail if a large vibration or impact is applied during transportation, possibly causing an electric shock or fire. If you do not have a proper packing or shock-absorbing material for transportation, contact Iwatsu office or our sales distributors. If transportation is to be handled by a forwarding agent, display "Contains a precision machine" on each side of the packing box.

- **We recommend that you contact Iwatsu office or our sales distributors for periodic inspection and calibration about once a year.**

The measuring instrument might grow by the secular distortion the error margin of measurements, and not fill a prescribed performance.

(The check and the calibration are received for a fee.)

Checking packed materials

When receiving this instrument, check the packed materials while referring to the following “Components.” If there is a missing item or an item damaged during transportation, immediately contact Iwatsu office or our sales distributors.

Components

• Probe body	• • • • • • • • • • 1
• Accessories	
Output cable	• • • • • • • • • • 1
Clamp	• • • • • • • • • • 1
Tip	• • • • • • • • • • 1
Ground lead	• • • • • • • • • • 1
Adjusting screwdriver	• • • • • • • • • • 1
Carrying bag	• • • • • • • • • • 1
Instruction Manual	• • • • • • • • • • 1

Management of instrument

When disposing of this instrument, it must be recycled or disposed of properly in accordance with local laws or regulations. When disposing of it, request a recycling company to dispose of it in accordance with local laws or regulations.

Repair and sending instrument to be repaired

If a malfunction occurs, send this instrument to Iwatsu office or our sales distributors. Malfunctions that occur during the warranty period due to our responsibility will be repaired by us free of charge.

When sending an instrument to be repaired, clearly write the instrument name, serial number (in the label on the rear of this instrument), description of the malfunction, and the name, division, and telephone number of the responsible person.

Use the box with a packing box used when goods is delivered or an equal cushioning material to avoid the accident in transit when you send it. If you do not have a proper packing or shock-absorbing material for transportation, contact Iwatsu office or our sales distributors.

Cleaning of this instrument

To clean this instrument, wipe it gently with a soft cloth moistened with a small amount of water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners, or gasoline, as they can deform and discolor the case.

Storage

Do not store this instrument in the places below.

- Exposed to direct sunlight
- Dusty place
- Place with corrosive gas

Storage conditions of this instrument are as follows.

- Storage temperature: -10°C to +50°C

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1. General Description

This instrument is a passive probe to be connected to an oscilloscope to measure a high-voltage waveform. Its frequency bandwidth is DC to 50 MHz, maximum input voltage is 60 Kv, and attenuation ratio is 2000:1.

2. Name of each part and composition

2.1 Probe body and Accessories

This instrument is composed of a probe body of Figure 1(The output cable is contained.) and various accessories.

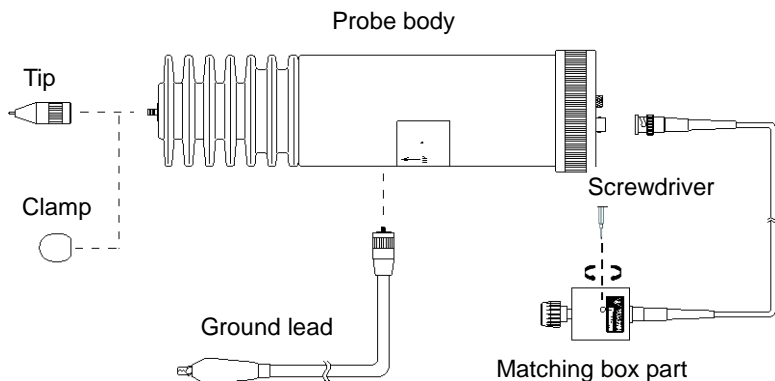


Figure 1. Probe body and Accessories

2.2 Carrying bag (accessory)

A probe body and various accessories are bundled to Carrying bag like Figure 2, and delivered. Moreover, the probe body and the accessory can be carried by putting it in Carrying bag after packing things are opened.

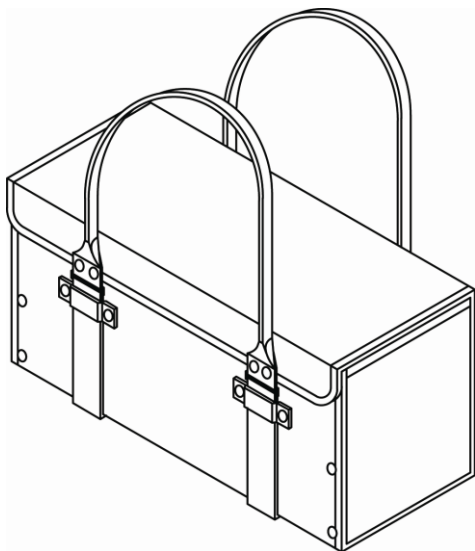


Figure 2. Carrying bag (accessory)

3. Adjustment of Probe

A waveform adjustment is necessary for this probe. A waveform adjustment of this probe adjusts the capacity of the variable capacitor that exists in this probe as the gain steadies for the frequency when the oscilloscope is combined with this probe. If this adjustment is not appropriately done, a correct measurement cannot be done.

Adjust the waveform of this probe when this probe is connected and used for the oscilloscope.

The waveform of this probe is adjusted with the following preparations according to the procedure.

3.1 Preparations

Prepare the signal generator that can generate the following signal specifications and the measuring instrument (oscilloscope) used for the measurement thereafter.

As for the example of the used equipment, it is not the following.

< Signal generator >

- Waveform : Square wave
- Frequency : 1 kHz or less
- Output voltage : 50 V to 100 V
- Rise time : 1 μ s or less
- Example of the used equipment
Example: KHT-1000 (PMK)

< Oscilloscope >

- Example of the used equipment
Example 1: DS-5400A series
(IWATSU TEST INSTRUMENTS CORPORATION)
Example 2: DS-5100B series
(IWATSU TEST INSTRUMENTS CORPORATION)

3.2 Adjustment

This instrument is connected and adjusted according to the following procedures.

- (1) As shown in Figure 3(a), the ground terminal of the probe body is connected with the terminal GND of the signal generator.
- (2) INPUT of the oscilloscope is connected with the connector of the probe body with Output cable.
- (3) The output of the signal generator is connected with the tip of the probe body

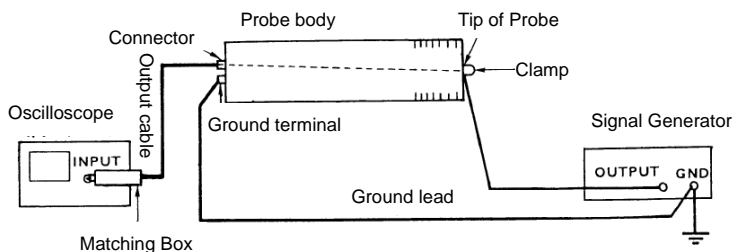


Figure 3 (a) Connection when probe is adjusted

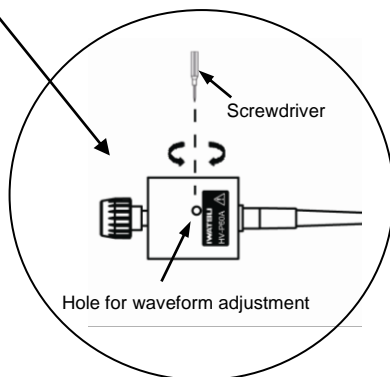


Figure 3 (b) Waveform adjustment of probe in matching box (closeup)

- (4) Adjust the input range of the oscilloscope, and display the waveform on the screen of the oscilloscope.
- (5) The driver for the adjustment is inserted in the adjustment hole of the Matching box (Refer to Figure 3(b)). The waveform of the probe is adjusted to become the ideal waveform like “Figure 3(e) Adequated” while seeing the waveform (following Figure 3(c) and Figure 3(d)) displayed in the oscilloscope.

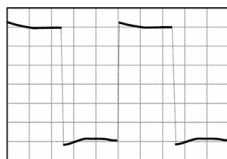


Figure 3(c) Overcompensated

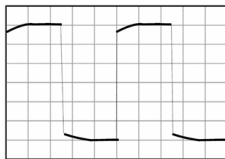


Figure 3(d) Undercompensated

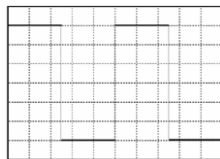


Figure 3(e) Adequated

4. Measuring method

4.1 Installation and connection

- (1) Connection and fixation of Probe body side
 - A. When Probe body is set up and used for the stand
 - * Refer to following 1) to 5) and Figure 4(a).
 - 1) The banana chip terminal (green) for the playground in the stand is inserted in the terminal GND of the bottom of Probe body.
 - 2) The output cable is passed from the hole plug on the stand side, and it is drawn out through the hole in the probe receiving part.
 - 3) The output cable is connected with the bottom of Probe body.
 - 4) Probe body is inserted in the probe receiving part and is tightened with two fixed screws to be fixed.
 - 5) Please connect the terminal GND of the probe stand with earth GND for safety.

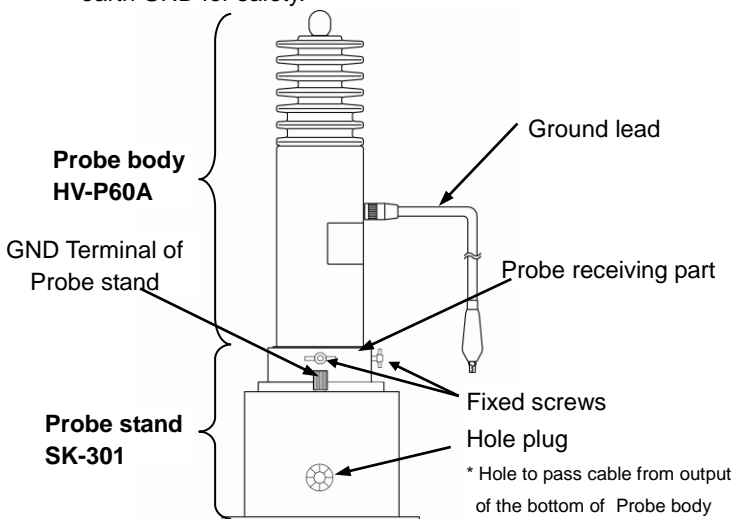


Figure 4(a) Probe body HV-P60A and Probe stand SK-301

B. When Probe body is set up horizontally or downward and used for the stand

* Refer to following 1) to 5) and Figure 4(a), (b) and (c).

- 1) The bottom of Probe body is fixed from the back of the probe receiving part by removing the probe receiving part from the stand, and using four screws of the attachment for the stand (Refer to Figure 4(b) and Figure 4(c)).
- 2) The banana chip terminal (green) for the playground in the stand is inserted in the terminal GND of the bottom of Probe body.
- 3) The output cable is passed from the hole plug (Refer to last page and Figure 4(a)) on the stand side, and it is drawn out from the hole in the probe receiving part.
- 4) The output cable is connected with the bottom of Probe body.
- 5) The probe receiving part is fixed to the stand with four make-up screws. (Refer to Figure 4(b))
- 6) The position in which the stand is installed is chosen, and the stand installation hole is fixed with the screw etc. (Refer to four places and Figures 4(b))

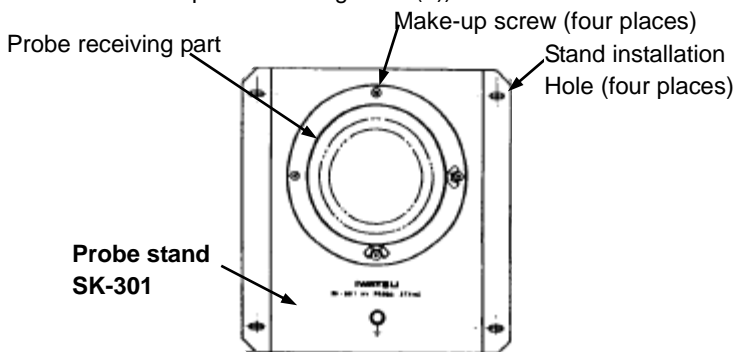


Figure 4(b) Probe stand SK-301 and Probe receiving part

Note

When buying it, probe stand SK-301 has installed the probe receiving part for HV-P30A. Replace the probe receiving part for HV-P60A and replace the top and bottom. (Refer to the manual of SK-301 for details.)

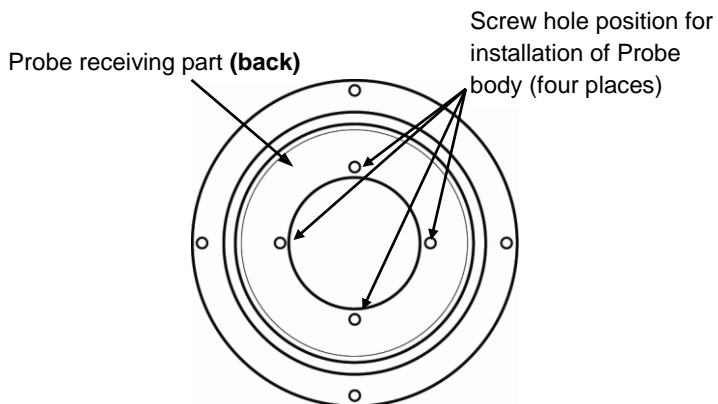


Figure 4(c) Screw hole position for installation of Probe body on Probe receiving part

- (2) Connection of oscilloscope and object to be measured
(Refer to Figure 5.)

1) The power switch of the object to be measured is turned off.

Caution !

Connect following 2), 3) and 5) with each terminal firmly so that there is no shake.

- 2) The ground terminal of Probe body is connected with the earth GND of the object to be measured and the terminal GND of the oscilloscope.

Connect the terminal GND of the stand with the earth of the object to be measured and the terminal GND of the oscilloscope when connecting the ground terminal of Probe body with the terminal GND of the stand by (1) on the page beforehand.

- 3) The connector of Probe body and INPUT of the oscilloscope is connected with the output cable.

Connect the output cable with INPUT of the oscilloscope when the connector of Probe body is connected with the output cable beforehand by (1) on the page beforehand.

- 4) The earth lead of the attachment is touched to the measurement part beforehand, and it is confirmed the voltage is not generated.

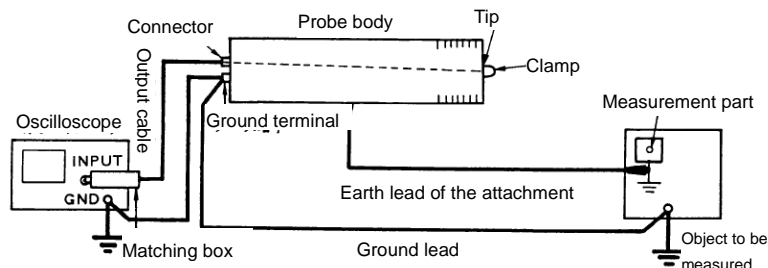


Figure 5 Example of connecting measurement
(object to be measured and oscilloscope)

- 5) The earth lead of the attachment is connected with the ground terminal of the object to be measured.
- 6) The lead wire is drawn out from the point to be measured, and connected with Tip of Probe. (Refer to Figure 6.)
When connecting the lead wire, it is tightened firmly with Clamp of the attachment.

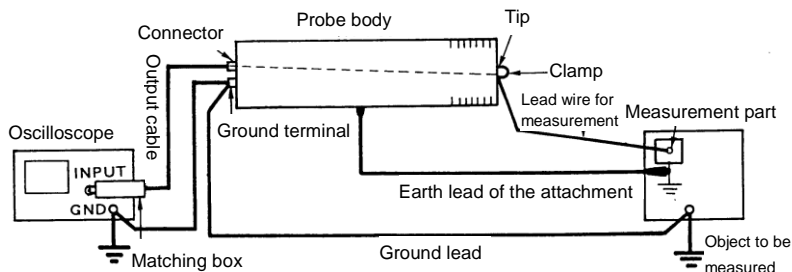


Figure 6 Connection of lead wire for measurement

4.2 Measuring Procedure

- (1) Confirm that the voltage of the object to be measured is within the range of the measurement of this instrument.
- (2) Confirm that there is neither person in surroundings nor something that touches.
- (3) The power supply of the object to be measured is turned on, and the measurement begins.

Note

When measuring, ringing and the overshoot might be caused. In addition, it is necessary to strengthen GND in addition to the earth lead of the attachment to decrease ringing and the overshoot. Prepare the metal with high electric conductivity (treatment device), tie to the earth lead joint, and strengthen GND. In that case, do not touch the probe point with GND.

As a concrete example, there are the following methods of etc.

- (1) The stick made of copper (about $\phi 5$ mm) is used.
- (2) The thin sheet copper is folded and used.

Example) The thin sheet copper plate of the width of 50mm is folded four times, and it is used by the width of 10mm.

* However, use together or substitute the earth lead of the attachment if necessary when you use the above-mentioned treatment device.

5. Specifications

5.1 Instrument specifications

Maximum input voltage

DC 60 kV

Continuous wave (sine wave) Refer to "Figure 7 Maximum input voltage and frequency" on next page.

Single-shot pulse 80 kV (Standard pulse wave: $1 \times 40 \mu\text{s}$)

Frequency bandwidth DC to 50 MHz (-3 dB)

Rise time 7 ns or less

[Note] Rise time T_r is a calculation value from the next expression.

$$T_r [\text{ns}] = 350 / \text{Band width} [\text{MHz}]$$

Attenuation ratio 2000 : $1 \pm 5 \%$

Waveform distortion $\pm 5 \%$ (10 °C to 35 °C)

[Note] Ringing and Overshoot are excluded.

Input RC

R 1000 M Ω $\pm 5 \%$

C 5 pF $\pm 2 \text{ pF}$

Output cable Approx. 4 m

Connector type BNC type

Input RC of oscilloscope that can be connected

R 1M Ω

C 10 pF to 40 pF

Dimensions Refer to 5.2 Appearance.

Weight

Probe body Approx. 2.0 kg

[Note] Output cable and Matching box are included.

Whole Approx. 3.2 kg

[Note] Accessories are included.

Environmental condition

Operating temperature range -10°C to +50°C

Storage temperature range -10°C to +50°C

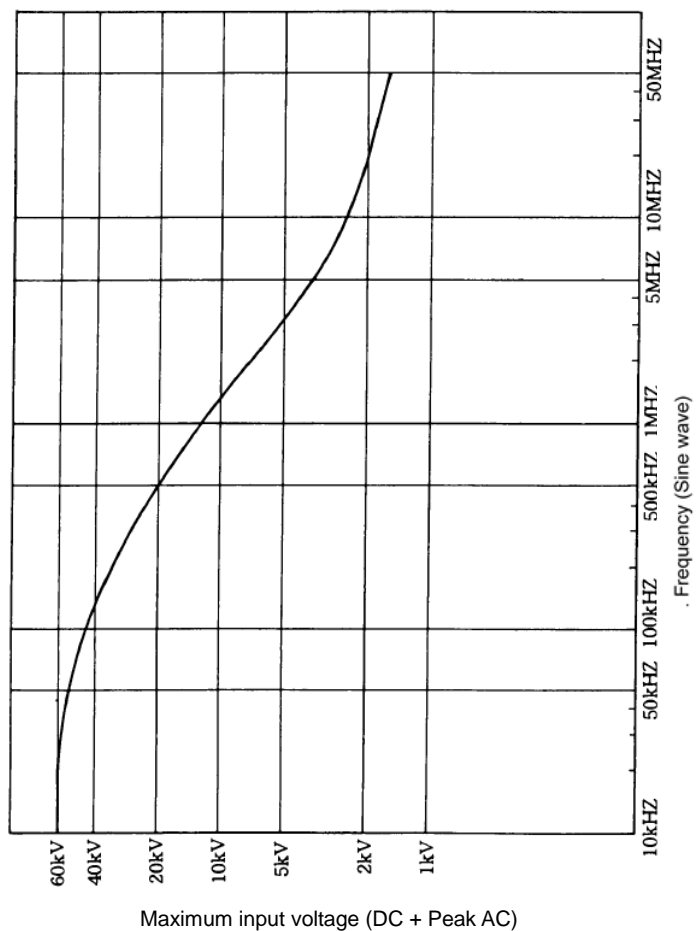
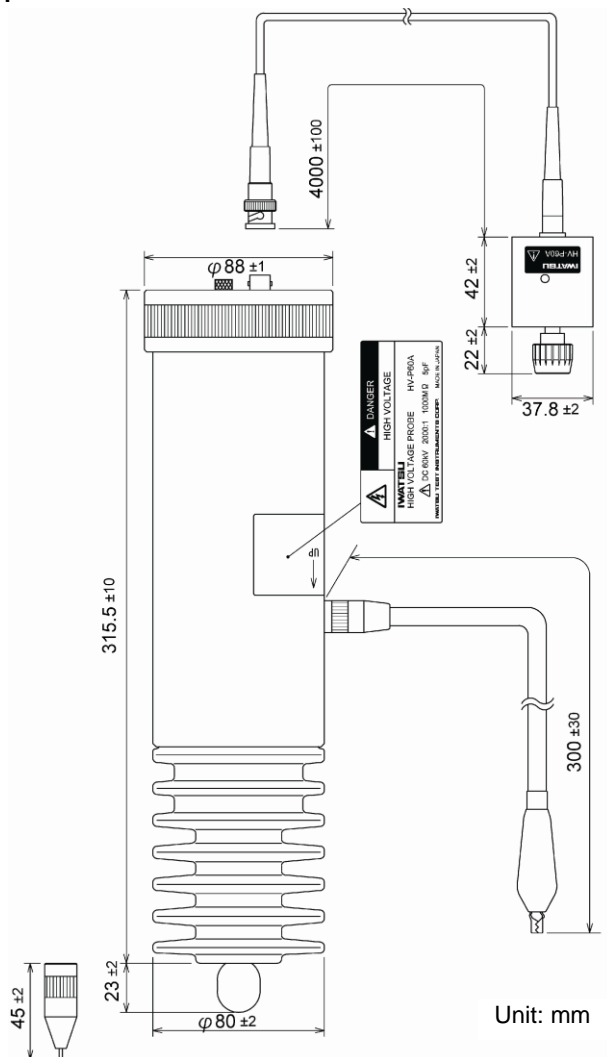


Figure 7 Maximum input voltage vs. Frequency (Sine wave)

5.2 Appearance



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HV-P60A

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