
Instruction Manual

High Voltage Differential Probe SS-320

IWATSU

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Memo

Introduction

- ◇ Thank you for purchasing the Iwatsu's product. 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.

To ensure the Safety Operation

To ensure safe operation of this product 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 failure to observe the warning may result in death or serious injury.
● Cautions	Incorrect operation or failure to observe the caution may result in injury or damage to the product

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 product arises, contact Iwatsu office or our sales distributors.

Revision History

- ◇ June 2012: 1st edition
- ◇ August 2016: 2nd edition

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, immediately remove this product from a measured test point, power off the equipment connected with this product, and remove the power plug from the receptacle.**
Continued use under these circumstances may result in an electric shock or fire. Detach this product from the thing measured at once, and turn off the power supply of the equipment with which this product is connected, and remove the power plug from the receptacle, and then contact Iwatsu office or our sales distributors for repair. Do not attempt to repair the product yourself.
- **Never use this product for the measurement where a voltage or frequency to be measured exceeds the product specifications (below). If a frequency exceeds 2 MHz, be sure to consider the derating curve (section 2.4) when making measurement since the max common mode operating voltage decreases.**
The specifications of this product are as follows. If the measurement is done without considering the specifications and derating curve below, an electric shock or failure may occur.
 - Max common mode operating voltage
 $\pm 1400\text{ V (DC+AC peak) or } \pm 1000\text{ Vrms}$
 - Frequency bandwidth: DC to 100 MHz (-3 dB)A measured voltage or frequency close to the derating curve (Figure2.1 in section 2.4) may cause heat generation.
Therefore, long-time measurement should be avoided.
- **Never use this product for the measurement where a measured voltage to the earth to exceeds the product specifications (below).**
An electric shock or failure may occur.
 - 1000 V (CAT II)
 - 600 V (CAT III)

[Read the next page.]

Read the following safety information



Warnings

- **Make sure no water gets on or inside the product.**

Do not use the product if wet, otherwise an electric shock, fire, failure could occur. If water gets on or inside this product, detach this product from the thing measured at once, and turn off the power supply of the equipment with which this product is connected, and remove the power plug from the receptacle, and then contact Iwatsu office or our sales distributors for repair.

- **Do not use this product with wet hands.**

If not, an electric shock, fire, failure may occur.

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

Modification of it could result in an electric shock, fire, or failure. Repair of a modified product may be refused. Contact Iwatsu office or our sales distributors for repair.

- **Connect only the recommended power unit to this product.**

Modification of it could result in an electric shock, fire, or failure.

Refer to "Oscilloscope and probe power supply of the recommendation" of appendix 1 in the end of this manual for recommended power supply.

- **When handling the power cable and probe cable of this product, obey the following matters.**

This may result in electric shock or fire. If the power cable and probe cable are damaged, contact Iwatsu office or our sales distributors for repair.

- Do not attempt to fabricate the power cable and probe cable.
- Do not pull the power cable and probe cable.
- Do not twist the power cable and probe cable.
- Do not heat the power cable and probe cable.
- Avoid getting the power cable and probe cable wet.
- Do not bind the power cable and probe cable together.
- Do not place heavy objects on the top of the power cable and probe cable.

[Read the next page.]

Read the following safety information. (to be continued)



Warnings

- **Do not use this product in a location (For instance, in the bathroom etc.) with excessive humidity.**
If not, an electric shock may occur.
- **Do not put a container that water and the medicine, etc. entered or a small metallic thing near on this product.**
If not, an electric shock may occur. When it gets wet in water and the medicine or when a metallic thing etc. come in contact and abnormality is found, detach this product from the thing measured at once, and turn off the power supply of the equipment with which this product is connected, and remove the power plug from the receptacle, and then contact Iwatsu office or our sales distributors for repair.
- **When connecting this product to a measured item, remove this product from the equipment with which this product is connected.**
An electric shock may occur. When removing the BNC connector, power off a measured circuit and then disconnect the probe from the high voltage part of the measured circuit.
- **When beginning to thunder, pull out the power plug of the main unit from the outlet, detach this product from the thing to be measured, and do not use this product.**
If not, an electric shock or fire may occur.
- **Do not use this product when being failed.**
If not, an electric shock or fire may occur. For a failure, contact Iwatsu office or our sales distributors for repair.

[Read the next page.]

Read the following safety information



Cautions

- **When disconnecting the power cable from the probe power supply, pull it out with the connector part.**

When the power cable is pulled, it is damaged, resulting in a failure.
- **Do not apply rapidly-changing temperature, mechanical stress, or impact.**

It may damage the probe, resulting in a failure.
- **Do not use or store this product in a location with direct sunlight, high temperature, high humidity, or dew condensation.**

Operation or storage outside the ratings could result in deformation, deteriorated insulation, or a failure because of heat.
The ranges of guaranteed, operating, and storage temperature and humidity are as follows:

 - Guaranteed temperature : 0°C to +50°C, no dew condensation
 - Operating temperature : -10°C to +50°C, no dew condensation
 - Operating humidity : 80%RH or less (40°C)
 - Operating altitude : 2000 m or less
 - Storage temperature : -20°C to +70°C, no dew condensation
 - Storage humidity : 90%RH or less (65°C)
- **Do not place this product in a location with moisture and excessive dust.**

If not, an electric shock, fire, or failure may occur.
- **Do not put this product on the place where lamp soot and steam are hit by the counter and the humidifier etc.**

If not, fire or an electric shock may occur.
- **Do not apply an excessive vibration or impact on this product when transporting or handling it.**

If applied, the product may fail, resulting in an electric shock or fire. If you do not have a proper packing or shock-absorbing material for transportation, contact Iwatsu office or our distributors. If transportation is asked to a forwarding agent, display "Including a precision machine" on each side of the packing box.
- **Detach this product from the main unit and the thing to be measured for safety when you maintain it. Moreover, wipe off with a dry cloth when the drop of water attaches.**

If not, an electric shock or failure may occur.
- **Pull out the power cable from the probe power supply for safety when not using it for a long time.**

Checking packed materials

When receiving this product, check the packed materials referring to components below (for outside appearance, see below). If there is a lacked item or an item damaged during transportation, immediately contact Iwatsu office or our sales distributors.

Components

- Probe main unit 1
- Accessories (See the accessories table below.)

Accessories table

Items	Quantities
Crocodile clip (red, black)	Each one
Plunger clip (red, black)	Each one
Instruction manual (this document)	1
Vinyl bag	1

Management of product

When disposing of this product, it is necessary to recycle or dispose of it properly in accordance with a local law or regulation. When disposing of it, request a recycle company to dispose of it in accordance with a local law or regulation.

Repair and sending of repair goods

If a failure occurs, send the product to Iwatsu office or our sales distributors.

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

Cleaning of this product

To clean this product, 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.

Measurement categories

This product has suited IEC61010-031 Ed.1.1 (safety requirement of the probe assembly for an electric measurement and the examination) (Refer to "2.2 Certification")

To ensure safe operation of measurement products, IEC61010 -2-30 categorizes the safety standard into CAT II to CAT IV below as measurement categories:

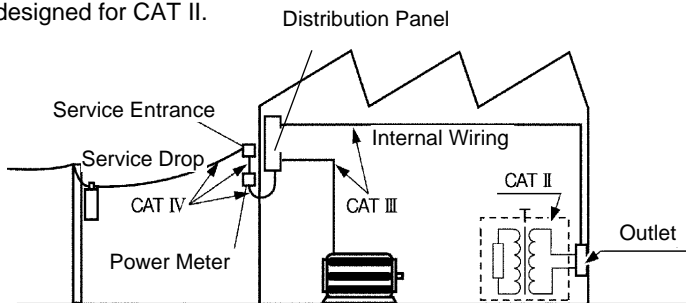
CAT II : Primary electrical circuits in equipment connected to a wall outlet via a power cord (portable tools, household appliances, etc.)

CAT III : Primary electrical circuits (fixed installations) connected directly to the distribution panel, and feeders between the distribution panel and outlets.

CAT IV : The circuit from the service drop to the service entrance, then to the power meter and to the primary over-current protection instrument.

If a measurement product with a smaller-numbered class of the measurement category is used to measure a location corresponding to a higher-numbered class, a serious accident may occur; therefore, such measurement must not be done.

In II to IV, Higher-numbered measurement categories correspond to environments with greater energy. So a measurement product designed for CAT III environments can endure greater energy than a product designed for CAT II.



Chapter 1 Overview

1.1 Description of product

Since input to the oscilloscopes is normally at the single end, it is necessary to calculate signals entered in two CHs of the oscilloscope when measuring the differential signals. In addition, since the normal oscilloscope cannot use the calculation signal to make a trigger, it is necessary to use either of differential signals to make a trigger.

Combination of this probe (SS-320), Iwatsu-recommended oscilloscope, and the probe power supply (PS-25) allows input to 1CH of the oscilloscope to observe the high-voltage differential signals. (For Iwatsu-recommended oscilloscopes, see Appendix 1 at the end of this document.)

1.2 Examples of use

This probe is used in combination with the Iwatsu-recommended oscilloscope and the Iwatsu probe power supply (P25) as shown in the examples (images) of use (1) and (2) below.

- (1) Example of combination of Iwatsu ViewGo II main unit and probe power supply option DS-579

In this example, use of the menu on ViewGo II main unit allows offset adjustment. For adjustment method and specifications, see the instruction manual of ViewGo II or that of the probe power supply option DS-579.

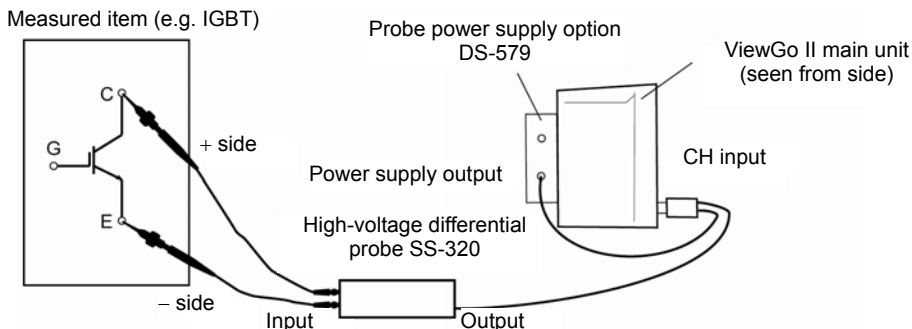


Figure 1.1 Example with Iwatsu ViewGo II

- (2) Example of combination of Iwatsu-recommended oscilloscope (see Appendix 1) and probe power supply PS-25

In this example, use of PS-25 allows offset adjustment. For adjustment method and performance, see the instruction manual of PS-25

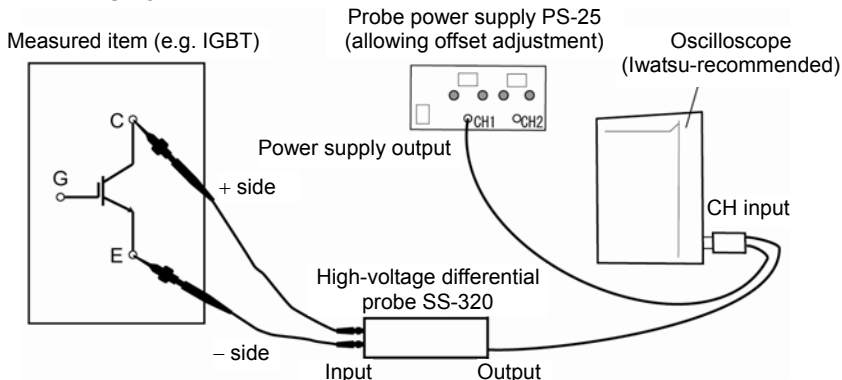
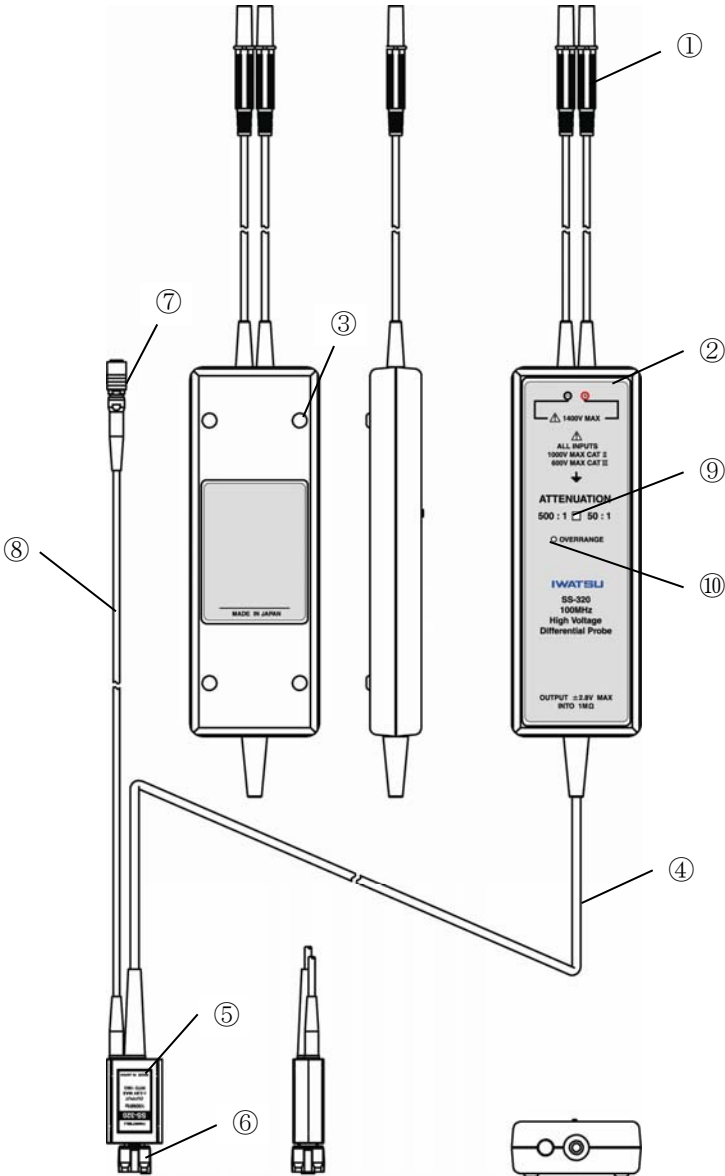


Figure 1.2 Example with Iwatsu oscilloscope

1.3 Appearance of probe

- Appearance



1.4 Name and outline of each part

The following describes the name and outline of each part (① to ⑩) in the previous section 1.3

① Input leads (red, black)

They are the input leads of the probe which connect to the measured item.

– Red lead: + side – Black lead: – side

The crocodile clip or plunger hook clip with the same color (red or black) is attached at the tip of each lead (see (2) and (3) in “2.3 Appearance.”).

② Main box (black)

The input signal is attenuated (50:1, 500:1), and amplified by the operational amplifier, and output to the probe cable (④).

The attenuation ratio switching switch (⑨) is provided on the front side.

③ Rubber legs

Four rubber legs are attached on the rear of the main box (②) to stabilize the entire probe.

④ Probe cable (gray)

It connects from the output of the main box (②) to the input of the waveform observation equipment to transmit the measurement signal.

⑤ Connector side box (gray)

It connects to the input CH of the waveform observation equipment.

The BNC connector (⑥) is attached at the output side.

⑥ BNC connector (gray)

It connects to the input CH of the waveform observation equipment.

⑦ Power supply connector

It connects to the probe power supply.

⑧ Power supply cable (gray)

It connects to the probe power supply.

⑨ Attenuation ratio setting switch (ATTENUATION)

This slide switch changes the attenuation ratios (50:1 and 500:1) on the front of the main box (②).

⑩ OVERRANGE lamp

The red lamp lights up if the signal level entered from the input lead to the main box exceeds the maximum differential operating voltage (see “2.1 Product specifications.”).

* Do not input the signal to which the OVERRANGE lamp lights.

Note that it may cause an electric shock or failure.

Chapter 2 Specifications

2.1 Product specifications

Frequency characteristics	DC to 100 MHz ^{Note 1} (–3dB)
	Note 1: See “2.4 Derating characteristics.”
Rise time	3.5 ns
	* Calculated value
Attenuation ratio	50:1 and 500:1
Accuracy	±2 % (20 °C to 30 °C)
	±4 % (0 °C to 20 °C, 30 °C to 50 °C)
	* If connected to oscilloscope with input impedance of 1 MΩ±1 %
DC CMRR	–70dB
	* At input voltage of 500 VDC
AC CMRR	–80dB (50 Hz/60 Hz)
	–50dB (100 kHz)
	–50dB (1 MHz)
Propagation delay	12.5 ns (500:1, typical value)
	13.5 ns (50:1, typical value)
Input R//C	
Each input to GND	4 MΩ or more// 7.0 pF or less
Between inputs	8 MΩ or more// 3.5 pF or less
Max. differential operating voltage	±1400 V (DC + AC peak, 500:1)
	±140 V (DC + AC peak, 50:1)
Max. common mode operating voltage	±1400 V (DC + AC peak) or
	±1000 Vrms
Max. non-destructive voltage	
Differential mode	±1500 V (DC +AC peak)
Common mode	±1300 Vrms or more
Derating start frequency	2 MHz ^{Note 2} or more
	Note 2: See “2.4 Derating characteristic.”
Max. output voltage range	±2.8 V
	*If connected to oscilloscope with 1 MΩ±1 %
	%

Output offset	Adjustable with other combined equipment
Noise referenced to input	Less than 300 mVrms (500:1) Less than 50 mVrms (50:1)
Connector	
Output side	BNC type
Power supply side	Special 6-pin connector
Total length	2000 mm \pm 30 mm * For shape, see "2.3 Appearance."
Power supply cable length	1000 mm \pm 20 mm
Input lead length	405 mm \pm 5 mm
Weight	450 g or less
Environment conditions	
Guaranteed temperature range	0 °C to +50 °C (no dew condensation)
Operating temperature range	-10 °C to +50 °C (no dew condensation)
Operating humidity	80 %RH or less (at 40 °C)
Storage temperature range	-20 °C to +70 °C(no dew condensation)
Storage humidity	90 %RH or less (at 65 °C)
Operating altitude	2000 m or less

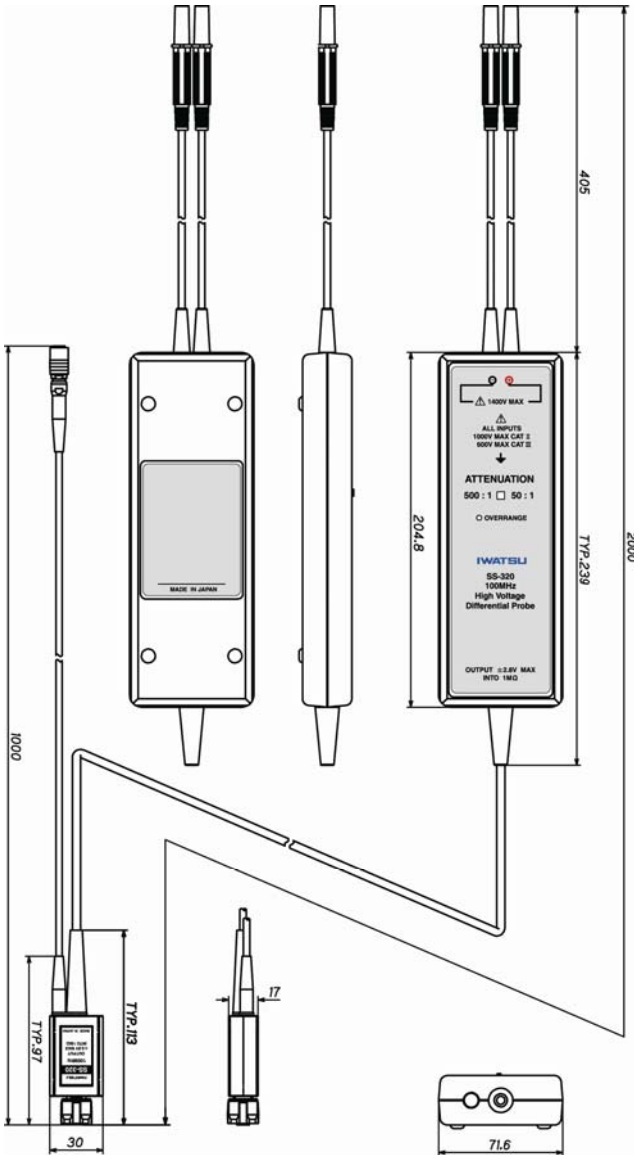
2.2 Certification

IEC61010-031 Ed.1.1 (Safety requirements for the hand-held type probe assembly for electric measurement and test) is satisfied under conditions below:

- (1) Measurement categories
 - CAT II 1000 V
 - CAT III 600 V
- (2) Pollution degree 2
 - * The pollution degree is based on IEC60664-1.
- (3) Attenuator for low voltage or probe assembly with divider (C type)

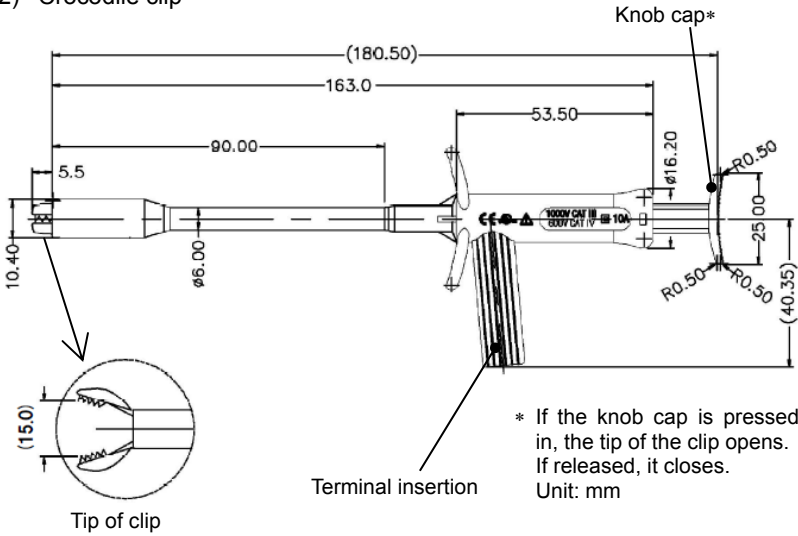
2.3 Appearance

(1) Probe main unit

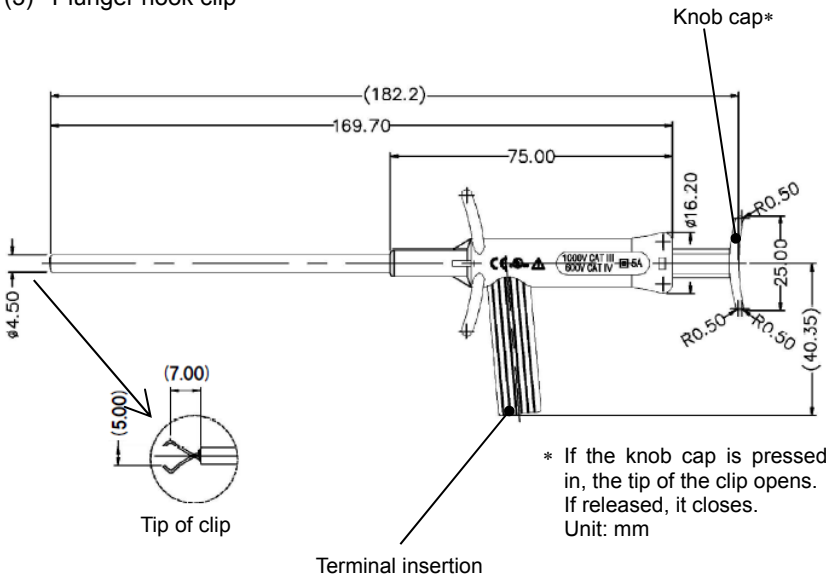


Unit: mm

(2) Crocodile clip



(3) Plunger hook clip



2.4 Derating characteristic

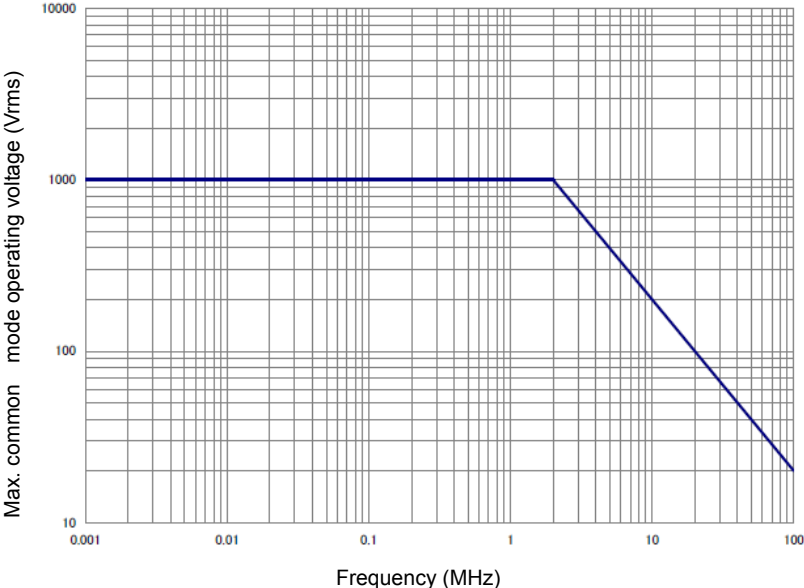


Figure 2.1 Derating curve of SS-320

Chapter 3 Measurement

3.1 Preparation of measurement

(1) For combination of waveform observation equipment and probe power supply PS-25

① Prepare this probe, waveform observation equipment, and PS-25 power supply.

* The waveform observation equipment is for example, Iwatsu-recommended oscilloscope (see Appendix at the end) or the recorder.



Caution

- Check that the power supply voltage to be used conforms to that of the waveform observation equipment and PS-25 before powering on them. Use of them out of the specified power supply voltage range may cause a failure on the PS-25 power supply.
-

② Mount the attached clip (red) and clip (black) on the probe.

Insert the input leads (red and black) of the probe into the termination insertions with the same colors of the clip. (See “2.3 Appearance (2) and (3).”)

* Select either of the crocodile clips (red and black) or the plunger hook clips (red and black).

③ While turning OFF POWER switch on PS-25, connect the power supply cord.

④ Connect the power supply plug of this probe (SS-320) to the power supply receptacle of PS-25.

⑤ Turn ON the POWER switch of the waveform observation equipment and PS-25 to power on them.

(2) For combination of Iwatsu ViewGo II and probe power supply option DS-579

- ① Prepare this probe and ViewGo II equipped with the probe power supply option DS-579.

Mount the probe power supply option DS-579 on the rear of ViewGo II main unit in advance. (The power of DS-579 is supplied from ViewGo II main unit through the AUX interface. For how to mount DS-579 on the ViewGo II main unit, see the instruction manual of DS-579.)



Caution

- Check that the power supply voltage to be used conforms to that written on the rear panel of ViewGo II before powering on it. Use of it out of the specified power supply voltage range may cause a failure on ViewGo II.
-

- ② Mount the attached clip (red) and clip (black).

Insert the input leads (red and black) of the probe into the termination insertions with the same colors of the clip. (See “2.3 Appearance (2) and (3).”)

* Select either of the crocodile clips (red and black) or the plunger hook clips (red and black).

- ③ Set the POWER switch of ViewGo II to the stand by status and connect the power supply cord.

- ④ Connect the power supply plug of this probe (SS-320) to the power supply receptacle of DS-579.

- ⑤ Press the POWER switch of ViewGo II to power on it.

3.2 Connection to waveform observation equipment and offset adjustment

- ① Set the input of the waveform observation equipment to GND and set the offset to zero position.

* The waveform observation equipment is for example, Iwatsu-recommended oscilloscope (see Appendix at the end) or the recorder.

- ② Set the input coupling of the waveform observation equipment to DC1M Ω or AC1M Ω .

Note

Set the input coupling of the waveform observation equipment to DC1M Ω or AC1M Ω . If the input impedance is 50 Ω , correct measurement cannot be done.

- ③ Connect the output terminal of this probe (SS-320) to the input terminal of the waveform observation equipment.

- ④ While checking the monitor on the waveform observation equipment, adjust the offset to zero position on the waveform observation equipment.

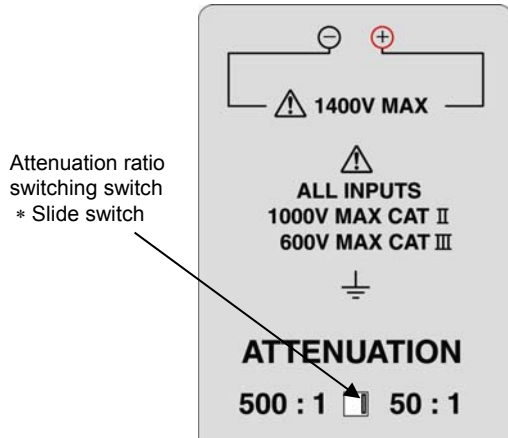
Moreover, refer to the manual for probe power supply PS-25 or probe power supply option DS-579 about the adjusting method of the offset.

* Normally, the offset for the output of this probe is set to about zero.

If precise measurement is required, make offset adjustment after at least 30-minute warming up time after powering on the waveform observation equipment and probe.

3.3 Measurement method

- ① Check that the safety is ensured and preparation in Section 3.1 and 3.2 is done.
- ② Select the attenuation ratio (50:1 or 500:1) on the attenuation ratio setting switch in the main box of this probe.



Caution

- Note that the product specification such as max. differential operating voltage varies depending on the attenuation ratio. For product specification see “2.1 Product specifications.”

- ③ Connect the input leads (red and black) to the + and – sides of the measured item.
If the knob cap of the clip is pressed, the clip at the tip opens.
If released, the clip closes.
For the clip, see “2.3 Appearance (2) and (3).”

Memo

Appendix

Appendix 1 Oscilloscopes and probe power supply of recommendation

- ◎ Iwatsu digital oscilloscope (probe power supply PS-25 not required)
 - ViewGo II series (equipped with probe power supply option DS-579)
 - * The option can be purchased separately.
- Iwatsu oscilloscopes (probe power supply PS-25 required)
 - ViewGo II series (not equipped with probe power supply option DS-579)
 - ViewGo series
 - DS-5100B series
- Probe power supply
 - PS-25

△ Iwatsu oscilloscopes

Products below are not sold currently but can be used.

<With power supply terminal for probe, PS-25 not required>

- SS-7840A
- SS-7847A
- SS-7830A
- TS-81000
- TS-80600
- TS-8500

<Probe power supply PS-25 required>

- SS-7821A
- SS-7811A
- SS-7810A

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