
**User's
Manual**

**701933
Current Probe**

User Registration

YOKOGAWA provides registered users with useful information and services. Please allow us to serve you best by completing the user registration form accessible from our website.

<https://tmi.yokogawa.com/support/>



Contact Us

If you want to resolve a technical support issue or need to contact YOKOGAWA, please fill out the inquiry form on our website.

<https://tmi.yokogawa.com/contact/>



Thank you for purchasing the 701933 Current Probe.

This user's manual contains useful information about the functions and operating procedures of the 701933 Current Probe as well as precautions that should be observed during use. To ensure proper use of the instrument, please read this manual thoroughly before beginning operation. After reading this manual, please keep it in a convenient location for reference whenever a question arises during operation.

List of Manuals

The following manuals are provided for the 701933 Current Probe.

Manual Title	Manual Number	Description
701933 Current Probe User's Manual	IM 701933-01E	This manual
701933 Current Probe	IM 701933-92	Document for China
701933 Current Probe	IM 701933-93Z2	Document for Korea
Safety Instruction Manual	IM 00C01C01-01Z1	Safety manual (European languages)

The "E", "Z1" and "Z2" in the manual numbers are the language codes.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document Number	Description
PIM 113-01Z2	List of worldwide contacts

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the product's performance and functionality. The figures given in this manual may differ from those that actually appear on your product.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of YOKOGAWA is strictly prohibited.

Revisions

1st Edition: November 2004
2nd Edition: October 2013
3rd Edition: October 2014
4th Edition: November 2015
5th Edition: January 2016
6th Edition: October 2017
7th Edition: June 2021
8th Edition: December 2021

Checking the Contents of the Package

If some items are missing or otherwise inconsistent with the contents description, please contact your dealer or nearest YOKOGAWA representative.

Current probe (model 701933) main body

Manuals 1 set

Soft case

Safety Precautions

This instrument is designed to be used by a person with specialized knowledge.

This instrument meets the requirements of IEC-61010.

The general safety precautions described herein must be observed during all phases of operation. If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. YOKOGAWA assumes no liability for the customer's failure to comply with these requirements. In addition, before using the probe, read the manuals of the measuring instrument to thoroughly familiarize yourself with its specifications and operation.

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.



Do not apply around or remove from HAZARDOUS LIVE conductors.

Notes about Usage



WARNING

- Do not clamp bare conductors to avoid short circuits or personal injury when the sensor head is open or measuring.
 - Be careful not to damage the insulation surface of the conductor under measurement.
 - Connect the power supply to the probe power terminal (option) of a waveform measuring instrument such as Yokogawa DL/DLM series, or use the power supply 701934 or 700938.
 - Be careful of electric shock when connecting the probe to the device under measurement.
 - Read and observe the safety precautions of the instruments to be connected to.
 - To avoid electric shock, do not get the instrument wet or use it with wet hands.
-

French



AVERTISSEMENT

- Ne serrez pas les conducteurs nus pour éviter les courts-circuits ou les blessures lorsque la tête du capteur est ouverte ou en mesure de mesurer.
 - Veillez à ne pas endommager la surface d'isolation du conducteur à mesurer.
 - Connectez l'alimentation à la borne d'alimentation de la sonde (option) d'un instrument de mesure de forme d'onde tel que la série Yokogawa DL/DLM, ou utilisez l'alimentation 701934 ou 700938.
 - Faites attention aux chocs électriques lors de la connexion de la sonde à l'appareil à mesurer.
 - Lisez et respectez les consignes de sécurité des instruments auxquels vous souhaitez vous connecter.
 - Pour éviter les chocs électriques, ne mouillez pas l'instrument et ne l'utilisez pas avec les mains mouillées.
-



CAUTION

- Do not subject the instrument to vibrations or shocks when transporting and handling it. Be especially careful to avoid dropping it.
 - Do not store or operate the instrument in an environment with direct sunlight, high temperature, high humidity, or condensation. The instrument may be deformed, or deteriorated in insulation, and it may not meet the specifications.
 - Before using the instrument, inspect and check the operation for malfunctions due to storage or transport conditions. If a malfunction is found, contact your dealer or YOKOGAWA representative.
 - The instrument is not dustproof or waterproof. Do not use it in a dusty or wet environment.
 - The sensor head is a precision assembly composed of a molded component, a ferrite core and a Hall effect element. Handle the instrument with care as it may be damaged by sudden changes in ambient temperature, mechanical stress or shock.
 - The matching surfaces of the sensor head are precision ground. Handle the instrument with care as scratches on the surfaces may impair performance.
 - Gently wipe off any dust or dirt on the matching surfaces of the sensor head with a soft cloth. It may generate resonance noise or impair performance.
 - Do not bend or pull the sensor cable or power cable to avoid damage due to disconnection.
 - Current sensors can be damaged by static electricity. Be careful not to apply static electricity to the instrument including the following cases.
 - Touching the sensor head with an object charged with static electricity
 - Touching the sensor head with an object with an electrical potential difference
 - A user charged with static electricity touching the core surface when cleaning the matching surfaces of the sensor head
(When cleaning the surfaces, take static electricity measures such as wearing an antistatic wrist strap.)
 - Gently wipe the instrument with a soft cloth moistened with a small amount of water or mild detergent. Do not use detergents containing organic solvents such as benzine, alcohol, acetone, ethers, ketones, thinners or gasoline. They may deform or discolor the instrument.
 - When the power is on, keep the sensor head closed, except when clamping the conductor under measurement. Leaving it open may damage the instrument.
-



ATTENTION

- Ne soumettez pas l'instrument à des vibrations ou à des chocs lors de son transport et de sa manipulation. Faites particulièrement attention à ne pas le laisser tomber.
- Ne stockez pas et n'utilisez pas l'instrument dans un environnement exposé à la lumière directe du soleil, à une température élevée, à une humidité élevée ou à la condensation. L'instrument peut être déformé ou détérioré au niveau de l'isolation, et il peut ne pas répondre aux spécifications.
- Avant d'utiliser l'instrument, inspectez et vérifiez que le fonctionnement ne présente pas de dysfonctionnements dus aux conditions de stockage ou de transport. En cas de dysfonctionnement, contactez votre revendeur ou représentant YOKOGAWA.
- Cet instrument n'est pas étanche à la poussière ou à l'eau. Ne l'utilisez pas dans un environnement poussiéreux ou humide.
- La tête de capteur est un assemblage de précision comprenant un composant moulé, un noyau de ferrite et un élément à effet Hall. Manipulez cet appareil avec précaution car il peut être endommagé par des changements brusques de température ambiante, des contraintes mécaniques ou des chocs.
- Les surfaces correspondantes de la tête du capteur sont rectifiées avec précision. Manipulez l'instrument avec précaution, car les rayures sur les surfaces peuvent altérer les performances.
- Essuyez délicatement la poussière ou la saleté sur les surfaces correspondantes de la tête du capteur avec un chiffon doux. Cela peut générer un bruit de résonance ou altérer les performances.
- Ne pliez pas et ne tirez pas sur le câble du capteur ou le câble d'alimentation pour éviter les dommages dus à la déconnexion.
- Les capteurs de courant peuvent être endommagés par l'électricité statique. Veillez à ne pas appliquer d'électricité statique à l'instrument, y compris dans les cas suivants.
 - Toucher la tête du capteur avec un objet chargé d'électricité statique
 - Toucher la tête du capteur avec un objet présentant une différence de potentiel électrique
 - Un utilisateur chargé d'électricité statique touchant la surface du noyau lors du nettoyage des surfaces correspondantes de la tête du capteur
(Lors du nettoyage des surfaces, prenez des mesures contre l'électricité statique telles que le port d'un bracelet antistatique.)

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- Essuyez doucement l'instrument avec un chiffon doux humidifié avec une petite quantité d'eau ou de détergent doux. N'utilisez pas de détergents contenant des solvants organiques tels que le benzène, l'alcool, l'acétone, les éthers, les cétones, les diluants ou l'essence. Ils peuvent déformer ou décolorer l'instrument.
 - Lorsque l'appareil est sous tension, maintenez la tête du capteur fermée, sauf lors du serrage du conducteur à mesurer. Le laisser ouvert peut endommager l'instrument.

Note

- Accurate measurements may not be possible if operated within close proximity to strong magnetic fields such as those produced by transformers, circuits with large currents, and wireless devices.
 - Depending on the current frequency that is measured, oscillation may occur, but this has no effect on measurements.
-

Regulations and Sales in Various Countries and Regions

Waste Electrical and Electronic Equipment (WEEE)



(EU WEEE Directive valid only in the EEA* and UK WEEE Regulation in the UK)

This product complies with the WEEE marking requirement. This marking indicates that you must not discard this electrical/electronic product in domestic household waste. When disposing of products in the EEA or UK, contact your local Yokogawa office in the EEA or UK respectively.

* EEA: European Economic Area

Authorized Representative in the EEA (AR)

Yokogawa Europe B.V. is the authorized representative of Yokogawa Test & Measurement Corporation for this product in the EEA. To contact Yokogawa Europe B.V., see the separate list of worldwide contacts, PIM 113-01Z2.

Disposal

When disposing of YOKOGAWA products, follow the laws and ordinances of the country or region where the product will be disposed of.

Conventions Used in This Manual



Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

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 minor or moderate injury, or damage to the instrument.

French

AVERTISSEMENT

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

ATTENTION

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Note

Provides important information for the proper operation of the instrument.

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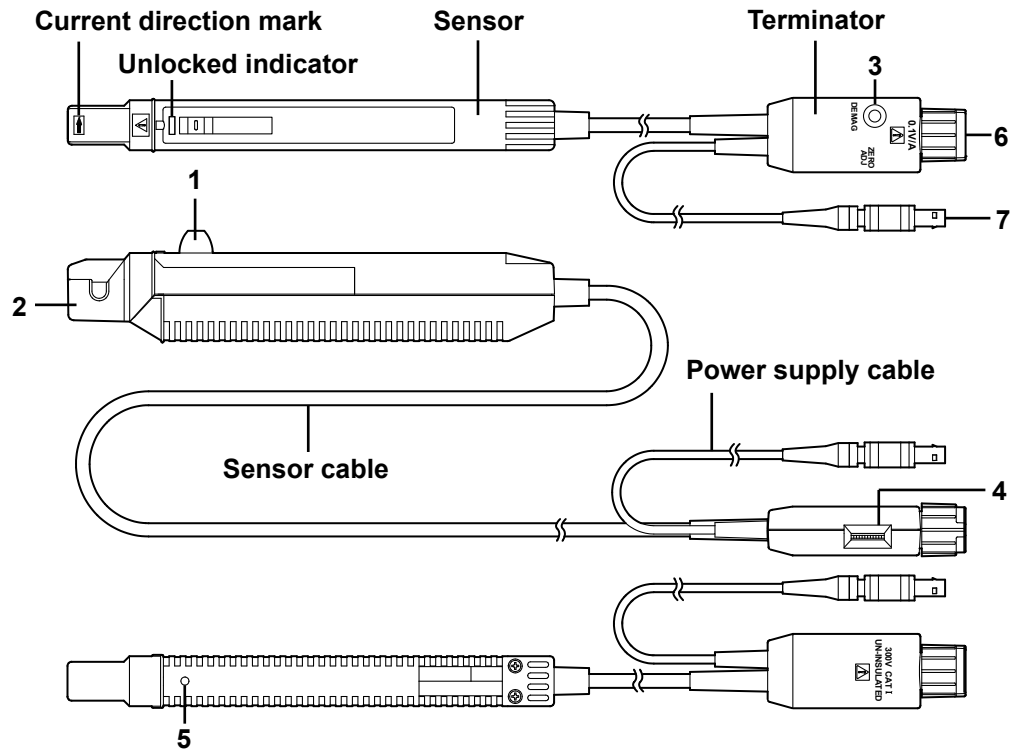
Product Overview

This probe can be directly connected to a BNC input connector of a waveform measuring instruments such as YOKOGAWA DL/DLM series. The probe can be used to easily observe current waveforms by simply positioning the clamp around the conductor under measurement.

Features

- Highly accurate current detection
- Easy current measurement
- Wide frequency bandwidth (DC to 50 MHz)
- Small size enables measurement of small currents
- Convenient protection function for excessive input

Names of Parts



Description of Parts

1 Open/Close Lever

This lever opens and closes the sensor head. Always use this lever when opening and closing the sensor head.

2 Sensor Head

The sensor head clamp is positioned around the conductor under measurement to detect current. It is a precision-assembled component consisting of various parts including plastic molded parts, a ferrite core, and a Hall element. Take proper care when handling the probe to avoid damage as a result of sudden sharp changes in ambient temperature, mechanical stress, or physical shocks.

3 Demagnetization Switch (DEMAG)

This switch demagnetizes the core which can become magnetized when turning the power ON or OFF, or when applying excessive input. You must always use this switch prior to performing measurement. The time required for demagnetization is approximately one second. During demagnetization, a degaussing waveform is output.

4 Zero Adjust Dial (ZERO ADJ)

The zero adjust dial lets you compensate for effects including the probe's offset voltage and temperature drift. Before performing measurement, demagnetize the probe then carry out zero adjustment.

5 Coarse Adjustment Trimmer

This is used only when zero adjustment cannot be performed using the zero adjust dial alone.

6 Output Terminal

This terminal is connected to a waveform measuring instrument (of 0.1 V/A, input impedance 1 M Ω) and outputs the current waveform of the conductor under measurement at a constant rate. The terminal connects to the BNC input terminal of the waveform observation instrument.

7 Power Plug

Connect the power plug to the receptacle on the power supply (model 701934 or 700938) to supply power to the sensor and terminator.

Note

- The output from this probe is terminated internally. Use the probe with a waveform measuring instrument of high input impedance. Accurate measurement cannot be obtained at an input impedance of 50 Ω .
 - When using an input terminal other than the BNC terminal (for example via a BNC-to-banana plug or other adapter), make sure the polarity of the input terminal is correct.
 - Turn the connector until it clicks into place, and confirm that it is securely locked.
 - To adjust the coarse adjustment trimmer, use a non-metallic flat-blade screwdriver whose thickness is 0.4 mm, width is 1.8 mm, and length is 10 mm or longer.
 - Do not press or turn the coarse adjustment trimmer by force using a screwdriver. Doing so may damage the component.
-

Operating Procedure

Handling Precautions



WARNING

- Do not clamp bare conductors to avoid short circuits or personal injury when the sensor head is open or measuring.
 - Be careful not to damage the insulation surface of the conductor under measurement.
 - Do not short-circuit between the two measurement lines with the metal part of the sensor unit. It may lead to a serious accident such as the occurrence of an arc.
 - Connect the power supply to the probe power terminal (option) of a waveform measuring instrument such as Yokogawa DL/DLM series, or use the power supply 701934 or 700938.
 - Be careful of electric shock when connecting the probe to the device under measurement.
 - Read and observe the safety precautions of the instruments to be connected to.
 - To avoid electric shock, do not get the instrument wet or use it with wet hands.
-

Preparing for Measurement

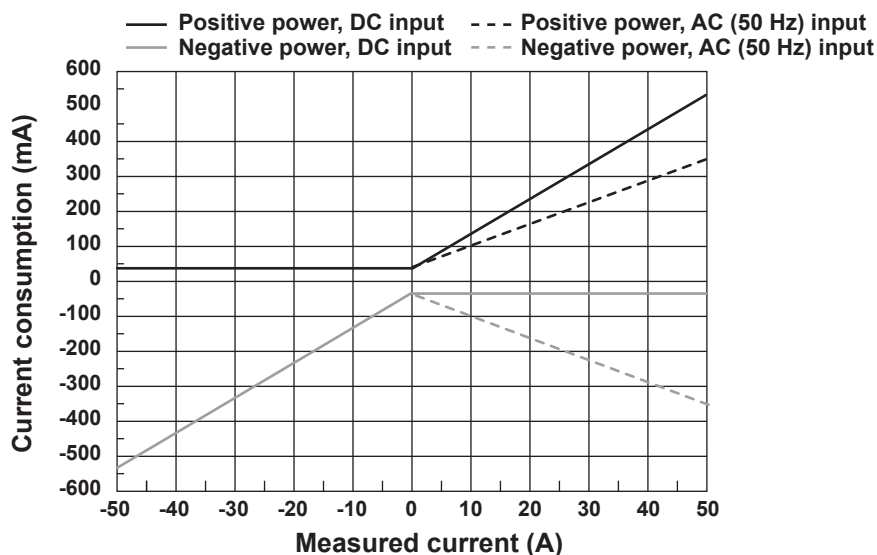


CAUTION

When using a 701933 current probe, it may not be possible to use multiple active probes at the same time with the 701934, 700938 power supply, or the probe power supply from a YOKOGAWA waveform measuring instrument. Make sure that the total current consumption of each active probe does not exceed the current specifications of the probe power supply. The current consumption of the probe depends on the measured current (refer to the figure below).

See the following YOKOGAWA website for the usage limitations for each measuring instrument.

<https://tmi.yokogawa.com/solutions/products/oscilloscopes/current-probes/>



Measured Current Values and Current Consumption of the 701933 Current Probe (Typical)

1. Prepare the probe, a power supply 701934/700938, and a waveform measuring instrument such as a digital oscilloscope or recorder.
2. Turn the power switch OFF, then connect the power cord.
3. Connect the power plug of the 701933 you are using to a power receptacle on the 701934/700938.
4. Turn ON the power switch to the 701934/700938, and confirm that the power indicator on the front panel illuminates.

Note

The output from this probe is terminated internally. Use the probe with a waveform measuring instrument of high input impedance. Accurate measurement cannot be obtained at an input impedance of 50 Ω .

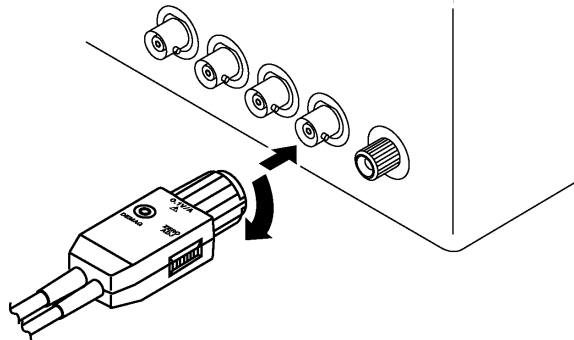
Demagnetization and Zero Adjustment



CAUTION

- When unplugging the output terminal, always release the lock first, then pull the terminal out while holding the connector. Damage can result if you forcibly pull the terminal without releasing the lock, or pull by the cable instead of the connector.
 - When using an input terminal other than a BNC terminal, make sure the polarity of the input terminal is correct.
 - Do not demagnetize the probe while the clamp is positioned around the conductor under measurement. The demagnetization procedure can inject current into the conductor under measurement, possibly resulting in damage to connected components. For the same reason, make sure that the probe clamp is not positioned around a conductor under measurement when supplying power to the 701933. A demagnetizing waveform can be generated when power is supplied.
-

1. Ground the input of the waveform observation instrument and adjust the trace to the zero position.
2. Set the input coupling of the waveform measuring instrument to DC.
3. Connect the output terminal of the 701933 to the input terminal of the waveform observation instrument. Turn the connector until it clicks into place, and confirm that it is securely locked.



4. Without positioning the probe clamp around the conductor under measurement, press the open/close lever until the unlocked indicator goes out, then confirm that the sensor head is securely closed.
5. Press the demagnetization switch (DEMAG) on the terminator.
6. Turn the zero adjust dial on the terminator to adjust the trace to the zero position.
7. If you are unable to adjust the trace to zero in the step above, turn the coarse adjustment trimmer until the trace comes within a range that can be zeroed using the zero adjust dial.

Note

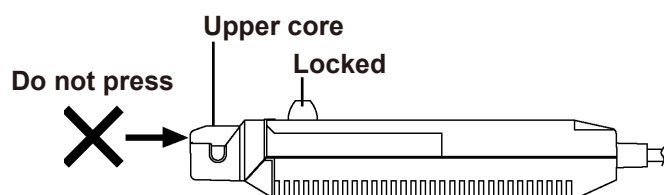
- The output from this probe is terminated internally. Use the probe with a waveform measuring instrument of high input impedance. Accurate measurement cannot be obtained at an input impedance of 50 Ω .
 - Oscillation may occur when you execute DEMAG, but this has no effect on measurements.
 - The positive side of the waveform that is generated when you execute DEMAG may not be symmetrical to the negative side, but this has no effect on measurements.
-

Performing Measurement



CAUTION

- The maximum continuous input range is determined from the rise in temperature resulting from self-heating during measurement. Do not input currents exceeding this range. Doing so can cause damage.
- The maximum continuous input range differs depending on the frequency of the measured current (see page 15, “Product Specifications”).
- If a current exceeding the maximum continuous input range is input the sensor will heat up, triggering the probe’s internal protection function which can interfere with normal output. Discontinue input immediately (remove the sensor from the conductor under measurement, or set the input current to zero). A sufficient cooling off period must be given until normal operation is restored.
- Heat generated by an input current whose frequency is 1 kHz or higher is mainly due to self-heating of the sensor head. In this case, the protection function is not activated. Therefore, be careful of burns, short circuits, and other accidents or sensor damage and the like caused by the temperature increase.
- The overcurrent protection function may activate under high temperatures, resulting in measured currents at or below the maximum continuous input range.
- If a current exceeding the maximum continuous input range is input continuously, the protection function can be activated repeatedly, potentially causing damage to the probe.
- Product specifications showing the maximum continuous input range also indicate a maximum peak current value of 50 A_{peak}, non-continuous. This shows that the upper limit of the waveform response is 50 A_{peak}. Ensure that the current (RMS) does not exceed the maximum continuous input range.
- When opening the sensor head, always use the open/close lever. If you press the Upper core while the sensor head is locked, the open/close mechanism can be damaged.
- Do not apply force to the sensor head in the direction indicated in the figure below.



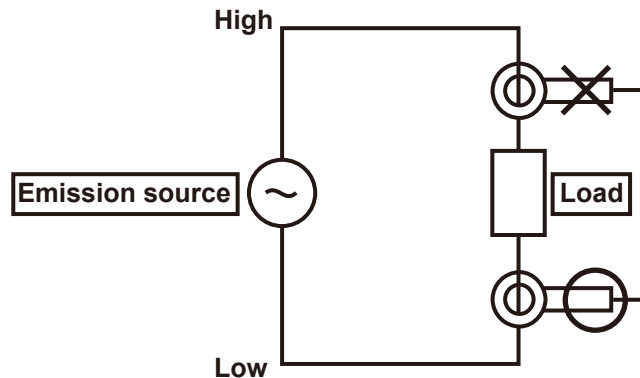
- To maintain the probe accuracy within the specifications and to verify that correct measurement results are being obtained, periodic calibration is necessary. The calibration period varies depending on your operating environment and the frequency of use. We recommend that you set a calibration period according to the frequency of use and ask us to calibrate it periodically.

-
1. Perform all safety checks, and ensure that the above-mentioned preparations for measurement have been taken.

2. Pull the open/close lever to open the sensor head.
3. Orient the probe so that the current direction arrow on the tip of the sensor points in the same direction as the flow of current in the conductor under measurement. Position the probe clamp around the conductor under measurement so that the conductor is centered in the clamp hole.
4. Press the open/close lever until the unlocked indicator goes out, then confirm that the open/close lever is securely locked and that the sensor head is securely closed.
5. You can now perform observation of the current waveform on the waveform measuring instrument. The output voltage rate of the 701933 is 0.1 V/A. Convert the voltage sensitivity on the waveform observation instrument to current sensitivity. For example, if the waveform observation instrument's voltage sensitivity is 10 mV/DIV, the current sensitivity would be 100 mA/DIV.

Note

- The output from this probe is terminated internally. Use the probe with a waveform measuring instrument having an input impedance of 1 M Ω or more.
- Immediately after turning the power ON, the probe may experience a large offset drift due to self-heating, but this will mostly stabilize after approximately 30 minutes.
- Please note that during continuous measurement, the offset voltage can drift depending on ambient temperature and other factors.
- In rare instances, connecting the power plug to a power supply that is ON can cause oscillations, but malfunctions will not occur. If this occurs, opening and closing the sensor head using the open/close lever will stop the oscillations and restore normal functioning.
- Resonance can be generated depending on the frequency of the measured current. This will not affect measurement.
- The position of the conductor under measurement within the clamp hole can affect measurement. Keep the conductor in the center of the clamp hole.
- During measurement, press the open/close lever until the unlocked indicator goes out, then confirm that the lever is securely locked and that the sensor head is securely closed. Accurate measurements cannot be obtained if the sensor head is not securely closed.
- In the high frequency domain, positioning the probe clamp on the high side of the circuit can introduce common mode noise. As necessary, limit the bandwidth of the waveform observation instrument, or position the probe clamp on the low side.



- Accurate measurements may not be possible if operated within close proximity to strong magnetic fields such as those produced by transformers, circuits with large currents, and wireless devices.

Specifications

Product Specifications

Accuracy of 23 ±3 °C, 30 minutes after turning ON the power.

Frequency band*	DC to 50 MHz (–3 dB) (see the typical characteristics shown on the next page, figure 1)
Rise time*	7 ns or less
Maximum continuous input	
	30 Arms (AC and DC components) (See the next page, figure 2 for derating according to frequency)
Maximum peak current	50 A _{peak} , non-continuous
Output voltage rate*	0.1 V/A
Amplitude accuracy*	0 to 30 Arms: ±1.0% of reading ±1 mV 30 Arms to 50 A _{peak} : ±2.0% of reading (DC, 45 to 66 Hz)
Noise*	Equivalent to 2.5 mArms or less (for 20 MHz band measuring instrument)
Insertion impedance	(See typical characteristics on the next page, figure 3)
Temperature coefficient for sensitivity*	± 2% (with 50 Hz, 30 Arms input in a range of 0 to 40 °C)
Propagation delay	
	13 ns (Typical)
Maximum rated power	5.6 VA (within maximum input)
Rated supply voltage	±12 V ±0.5 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)
Operating location	Indoor use, altitude up to 2000 m
Effect of external magnetic fields	
	Equivalent to a maximum of 20 mA (in a DC or 60 Hz, 400 A/m magnetic field)
Measurable conductors	Insulated conductors
Diameter of measurable conductors	
	φ 5 mm
Guaranteed accuracy period	
	1 year (10000 open and close operations)
Cable lengths	
	Sensor cable: approx. 1.5 m Power supply cable: approx. 1 m
External dimensions	Sensor: approx. 175 (W) × 18 (H) × 40 (D) mm Terminator: approx. 27 (W) × 55 (H) × 18 (D) mm
Weight	Approx. 230 g
Accessories	User's manual, soft case

* In conjunction with a waveform measuring instrument having an input impedance of 1 MΩ ±1%

Compliant Standards

Safety standards	EN 61010-1 EN 61010-2-032 Type D Pollution degree 2 * ¹
EMC standards	Emissions EN 61326-1 Class B EN 55011 Class B Group 1 EMC Regulatory Arrangement in Australia and New Zealand EN 55011 Class B Group 1
	Immunity EN 61326-1 Table 1 (Basic immunity requirement)
Environmental standards * ²	EU RoHS Directive compliant

*¹ Pollution degree applies to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity. Pollution degree 2 applies to normal indoor atmospheres (usually with only non-conductive pollution).

*² For conformity to environmental regulations and/or standards other than EU, contact your local Yokogawa office (PIM 113-01Z2).

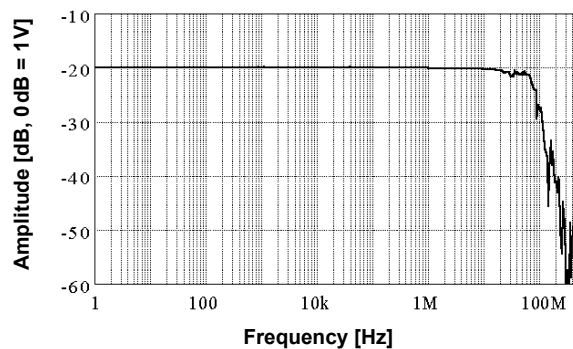


Figure 1 Frequency characteristics (typical)

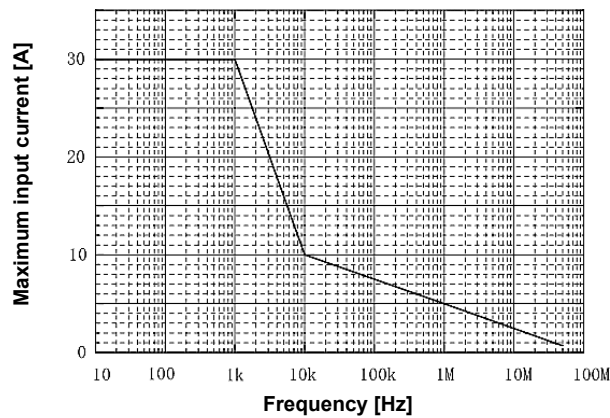


Figure 2 Derating according to frequency

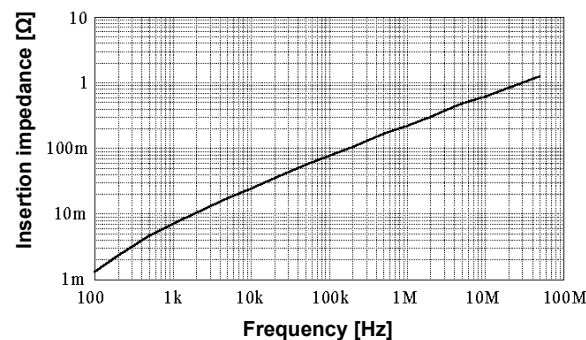


Figure 3 Insertion impedance (typical)

Malfunction? First, Investigate.

If you are unable to correct problems using the troubleshooting information in this section, servicing is required and you should contact the dealer from whom you purchased the instrument.

Description	Possible Problem	Corrective Action
Cannot measure direct current (or low frequencies of up to several hundred Hz), or the amplitude at that bandwidth is small.	Power is not ON.	Turn ON the power.
	The oscilloscope or other measuring instrument is set for AC coupling.	Set the instrument to DC coupling.
	The sensor is not locked (the closing mechanism is not properly aligned).	Lock the sensor.
Cannot zero the probe with the zero adjust dial.	The sensor is magnetized.	Demagnetize the sensor, and try the adjustment again.
	The zero adjust is out of range (due to drift or other causes).	Use the probe's coarse adjustment trimmer.
The amplitudes across all frequencies are small.	Input to the oscilloscope or other measuring instrument is 50 Ω .	Set for 1 M Ω or higher.