

Thank you for purchasing the Model 701978 Differential Probe. This user's manual explains usage, specifications, and the handling precautions of the 701978. To ensure correct use, please read this manual thoroughly before beginning operation. After reading this manual, keep it in a safe place.

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YOKOGAWA

IM 701978-01EN
3rd Edition

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.

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

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION

Calls attention to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note

Calls attention to information that is important for the proper operation of the instrument.

Safety Precautions

This product is designed to be used by a person with specialized knowledge. To use this product correctly and safely, the general safety precautions described herein must be observed during all phases of operation. YOKOGAWA assumes no liability for the customer's failure to comply with these requirements.

This manual is part of the product and contains important information. Keep this manual in a safe place so that you can refer to it immediately when using the product until you dispose of the product. In addition, before using the probe, read the manuals of the oscilloscope to thoroughly familiarize yourself with its specifications and operation.

The following symbols are used on this instrument.



Handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.



Risk of electric shock

Notes about Usage

WARNING

Purpose of the product

The product is used in combination with an oscilloscope to observe and measure electrical signals. Do not use for any other purpose.

Grounding of the measuring instrument

The protective grounding terminal of the oscilloscope must be connected to ground.

Check the grounding

Before connecting the probe input terminal to the device under measurement, ensure that the measuring instrument is grounded properly and that the probe's BNC connector is connected to the oscilloscope input.

Observe the maximum input voltage

Do not apply a voltage exceeding the input range specified in the specifications between an input lead and ground or between two input leads. Also, take the set attenuation ratio into account.

Be careful of electric shock

Never use the probe with wet hands or when the probe itself is wet. Doing so may cause electric shock. Be careful of electric shock when you connect the probe to the device under measurement.

Avoid exposed circuitry

To prevent electric shock, remove metal and jewelry such as watches and rings. Do not touch exposed connections or components when power is present on the device.

Precautions when connecting and disconnecting the probe

Do not disconnect the probe from the oscilloscope while the probe is connected to the device under measurement. Doing so may cause electric shock.

Do not operate in wet or damp conditions.

To prevent electric shock, do not operate the probe in wet or damp conditions.

Do not operate in explosive atmosphere

To prevent injury or fire hazard, do not operate the probe in an atmosphere of flammable or explosive gases or vapors.

Do not operate with suspected failures

Stop using the probe if you suspect that the probe is damaged. Consult your nearest YOKOGAWA dealer.

Do not operate with a damaged signal cable

If the signal cable is torn and the inner metal is exposed or if a color different from the outer sheath appears, stop using the cable.

Do not disassemble or modify

Do not disassemble or modify the product. YOKOGAWA assumes no liability if you disassemble or modify the product.

CAUTION

Application and design of the product

The product has not been designed or manufactured for applications in which high reliability is required over a long period of time.

Protective structure

The product is not dust or water resistant. Do not use it in areas with a lot of dust or near water.

Usage and storage environment

Avoid using or storing the product in an environment that does not meet the specifications, such as direct sunlight, high temperature and humidity, or condensation. Deformation or insulation deterioration can occur resulting in failure to retain the product specifications.

Handling the probe

Avoid vibration, shock, and static electricity when handling the probe. Do not bend or pull the cables excessively. Doing so may damage or disconnect the probe.

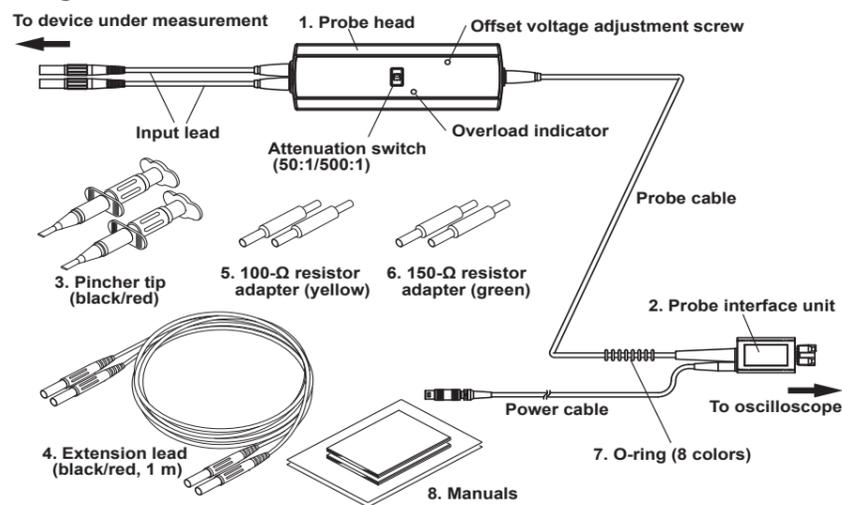
Operating environmental limitations

The product is a Class A (for industrial environments) product. Operation of the product in a residential area may cause radio interference in which case the user will be required to correct the interference.

1. Overview

Model 701978 Differential Probe is a differential input active probe that supports high voltage up to 1.5 kV and high frequency inputs up to 150 MHz. It can be used for oscilloscopes with single-ended inputs. The attenuation ratio can be switched between 50:1 and 500:1

2. Configuration and Functions



No.	Standard Parts	Part No.	Optional Accessories (Sold separately)	Part No.
1.	Probe head	—	Long test clip	701906
2.	Probe interface unit	—	Alligator clip (dolphin type)	701954
3.	Pincher tip	B9852MM(black)/ B9852MN(red)	Fork terminal adapter	758921
4.	Extension lead	B8099LF(black)/ B8099LG(red)	Alligator clip (rated 300 V)	758922
5.	100-Ω resistor adapter (yellow)	B8099LJ	Alligator clip (rated 1000 V)	758929
6.	150-Ω resistor adapter (green)	B8099LK	Safety terminal adapter	758931
7.	O-ring (8 colors, attached to the probe cable)	—		
8.	Manuals (see below)	—		

Manual Title	Manual No.	Description
Model 701978 Differential Probe User's Manual	IM 701978-01EN	This manual. Explains usage, specifications, and the handling precautions of the 701978.
Model 701978 Differential Probe Safety Instructions	IM 701978-02FR	The warnings and cautions in French to supplement the IM 701978-01EN
Safety Instruction Manual	IM 00C01C01-01Z1	Safety manual (European languages)
Inquiries	PIM 113-01Z2	List of worldwide contacts

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

Power Supply

Power is supplied from the probe power terminal on the connected oscilloscope or the power supply unit (model 701934 or model 700938, sold separately) through the power cable of this cable.

Attenuation Switch

Switches the attenuation ratio between 50:1 and 500:1. When measuring a signal of 150 V or less, select 50:1 for measurement of higher resolution and less noise. When measuring a signal above 150 V, select 500:1.

Overload Indicator

When the differential input exceeds the following value, the indicator lights.

±150 V at 50:1 attenuation ratio.

±1500 V at 500:1 attenuation ratio.

Offset voltage adjustment screw

This screw adjusts the internal variable resistor. The residual offset voltage can be adjusted using an appropriate screwdriver.

3. Operating Procedure



WARNING

- Use this probe only with YOKOGAWA's oscilloscopes. Even with YOKOGAWA's oscilloscopes, this probe can be used only when specified as an accessory.
- Do not apply a voltage exceeding the maximum voltage values between the input and ground. Failure to follow this precaution may cause accidents, such as electric shock or damage to the instruments.
- To use the probe, first connect to the oscilloscope and then to the device under measurement. After use, turn off the power to the device under measurement, disconnect the probe from the device under measurement first, and then disconnect from the oscilloscope.

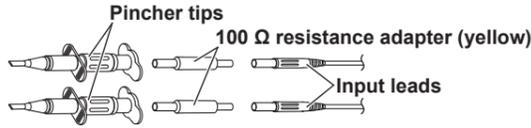
CAUTION

- This probe is designed to measure the voltage difference between two points on the device under measurement. It does not electrically isolate the device under measurement from the measuring instrument.
- When cleaning the probe, wipe with a piece of soft cloth to prevent damaging the probe. Do not immerse the probe body in liquid. Do not use abrasive cleaners or volatile solvents such as benzene on the probe.

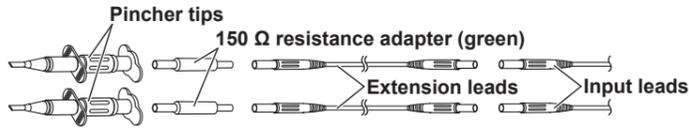
1. Connect the appropriate accessories to the probe input leads. See also below for connecting accessories.
2. Supply power from the probe power terminal on the connected oscilloscope or the power supply unit sold separately through the power cable. Warm up the probe for at least 30 minutes.
3. Connect the BNC output connector to the oscilloscope input terminal.
4. Select the appropriate attenuation ratio with the attenuation switch.
5. If the residual offset voltage is large, short the tips of the input leads, and turn the offset voltage adjustment screw using an appropriate screwdriver to adjust the offset voltage.
6. Connect the two tips of input leads to the two points of the device under measurement (differential measurement). Connect both tips since connecting only one tip will reduce performance.

Connecting Accessories

If using input leads and pincher tips, use the 100 Ω resistance adapters.



If connecting extension leads to input leads, use the 150 Ω resistance adapters.



Note

- Accurate measurements may not be possible near objects with strong electromagnetic fields such as transformers, large current circuits, or wireless equipment.
- Before use, operate the attenuation switch several times. The electrical contacts of the switch can weaken if not used for long periods of time.
- It is recommended to calibrate the probe once a year for accurate measurements.

4. Specifications

Item	Specifications ¹
Frequency band ²	DC to 150 MHz (-3 dB) (with 100 Ω resistance adapters) Using extension leads (with 150 Ω resistance adapters): DC to 100 MHz (-3 dB) (typical ³)
Attenuation ratio	50:1, 500:1 (switchable)
DC gain accuracy	Common mode input within 400 V: ±2 % Common mode input within 1000 V: ±3 %
Input capacitance	5 pF (to ground, typical ³)
Input resistance	4.1 MΩ ±3 % (to ground)
Rise time	2.34 ns (typical ³)
Delay time	50:1 14 ns (typical ³) 500:1 13 ns (typical ³)
Allowable differential voltage (between +/- terminals)	50:1 ±150 V (DC + ACpeak) 500:1 ±1500 V (DC + ACpeak)
Maximum input voltage (to ground) ⁴	±1500 V (DC + ACpeak)
Allowable common mode voltage	1000 Vrms
Maximum non-destructive input voltage	Differential mode: ±1600 V (DC + ACpeak) Common mode: 1300 Vrms
Overload range	50:1 150 V or more 500:1 1500 V or more
CMRR (typical ³)	-80 dB (60 Hz), -50 dB (1 MHz)
Output voltage	±3.0 V (offset voltage adjustable)
Input conversion noise	50:1 50 mVrms or less 500:1 300 mVrms or less
Length	Probe total 2430 mm ±30 mm Input lead 200 mm ±10 mm Power cable 1000 mm ±30 mm
Weight	Approx. 300 g
Power supply voltage	±12.0 V ±0.6 V
Consumption current	60 mA (typical ³)
Connector type	BNC
Operating environment	Temperature +5 °C to +40 °C (no condensation) Humidity 25 % to 85 %RH Altitude 2000 m or less
Storage environment	Temperature -30 °C to +60 °C (no condensation) Humidity 25 % to 85 %RH Altitude 3000 m or less
Warm-up time	30 minutes or more
Compliant standards	Probe only (excluding pincher tip) EN 61010-031 Measurement category III 1000 Vrms, Pollution degree 2 Pincher tip only (B9852MM/B9852MN) EN 61010-031 Measurement category III 1000 Vrms, Pollution degree 2 Extension lead (B8099LF/B8099LG) EN 61010-031 Measurement category III 1000 Vrms, Pollution degree 2 Combination of probe and the accessories above EN 61010-031 Measurement category III 1000 Vrms, Pollution degree 2
EMC standards	Emission ⁷ EN 61326-1 Class A EN 55011 Class A Group 1 Immunity EN 61326-1 Table 2
Environmental standards ⁸	EU RoHS Directive compliant

1 They depend on conditions of 23 ±5 °C, 55 ±10 %RH, and 30 minutes after power-on.
2 In combination with an oscilloscope
3 "Typical" values are typical or average values and are not strictly guaranteed.
4 Input voltage derating by frequency applies. See the following figure for details.

- 5 The equipment is for measurement category III (CAT III). Do not use it with measurement category IV (CAT IV). When using devices or accessories with different measurement categories, the lower measurement category applies. See below for definitions of measurement categories.

Measurement Category	Definition
Measurement category Other "O"	Measurement category Other "O" applies to measurement of a circuit that is not connected directly to the main power source.
Measurement category II (CAT II)	CAT II applies to measurement of electrical equipment that is powered through a fixed installation such as a wall outlet wired to a distribution board and measurement on such wiring.
Measurement category III (CAT III)	CAT III applies to measurement at the distribution level, that is, building wiring, fixed installations.
Measurement category IV (CAT IV)	CAT IV applies to measurement at the primary supply level, that is, overhead lines, cable systems.

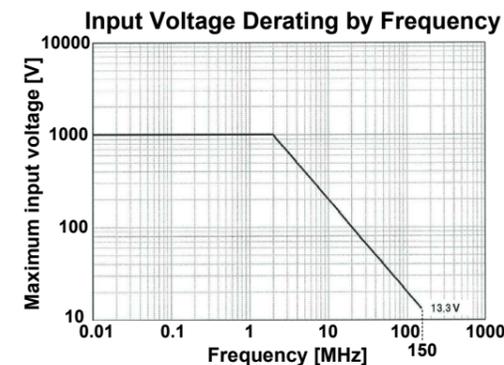
- 6 Pollution degree refers to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity. Pollution Degree 2 applies to normal indoor atmospheres (with only non-conductive pollution).
- 7 The product is a Class A (for industrial environments) product. Operation of the product in a residential area may cause radio interference in which case the user will be required to correct the interference.
- 8 For conformity to environmental regulations and/or standards other than EU, contact your local Yokogawa office.

Input Voltage Derating by Frequency



WARNING

As the frequency of the input signal increases, the maximum input voltage of the probe decreases.



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 Regulations 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.

产品中有害物质的名称及含量

This section is valid only in China.

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
框架 (塑料)	×	○	○	○	○	○
框架 (金属)	×	○	○	○	○	○
线路板部件组装	×	○	○	○	○	○
电缆	×	○	○	○	○	○
配件	×	○	○	○	○	○

○ : 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
× : 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

环保使用期限



该标识适用于 SJ/T 11364 中所述, 在中华人民共和国销售的电子电气产品的环保使用期限。
只要您遵守该产品相关的安全及使用注意事项, 在自制造日起算的年限内, 则不会因产品中有有害物质泄漏或突发变异, 而造成对环境的污染或对人体及财产产生恶劣影响。
注) 该年数为“环保使用期限”, 并非产品的质量保质期。零件更换的推荐周期, 请参照使用说明书。