

Thank you for purchasing the PBDH0150 Differential Probe (Model 701927). This user's manual explains the usage, specifications, and handling precautions. 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 701927-01EN  
8th 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 cause 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 instrument is designed to be used by a person with specialized knowledge. 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. In addition, before using the probe, read the manuals of the measuring instrument to thoroughly familiarize yourself with its specifications and operation. This manual is part of the product and contains important information. Store this manual in a safe place close to the instrument so that you can refer to it immediately. Keep this manual until you dispose of the instrument.

#### 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

##### Ground the oscilloscope

Make sure to connect the protective grounding terminal of the oscilloscope to ground.

##### Check grounding

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

##### 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 circuit under measurement.

##### Observe the maximum input voltage

Do not apply voltage exceeding 1400 V (DC + ACpeak) between an input lead and ground or between two input leads. The maximum input voltage is 1400 V (DC + ACpeak) regardless of whether 50:1 or 500:1 attenuation is used.

##### Do not touch exposed circuitry

To prevent injury, do not touch exposed live connections or components.

##### Connect and disconnect the probe properly

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

##### Do not use in damp places

To prevent electric shock, do not use the probe in damp places.

##### Do not use in an explosive atmosphere

To prevent fire and injury, do not use the probe in a flammable or explosive atmosphere or near steam.

##### Do not disassemble or modify

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

##### 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 immediately.

##### Stop use if you suspect damage

If you suspect that the probe is broken, consult your nearest YOKOGAWA dealer.



#### CAUTION

- This product has not been designed or manufactured for applications in which high reliability is required over a long period of time. This probe is not water or dust resistant. Do not use the probe in areas with a lot of dust or where water may be spilled.
- Avoid storing or using the probe in direct sunlight or in areas with high temperature, humidity, or condensation. Deformation and insulation deterioration can occur causing the probe to no longer meet the specifications.
- Avoid vibration, shock, and static electricity during shipping and handling. Take extra care not to drop the probe.

### Operating Environment Limitations

See below for operating environment limitations.

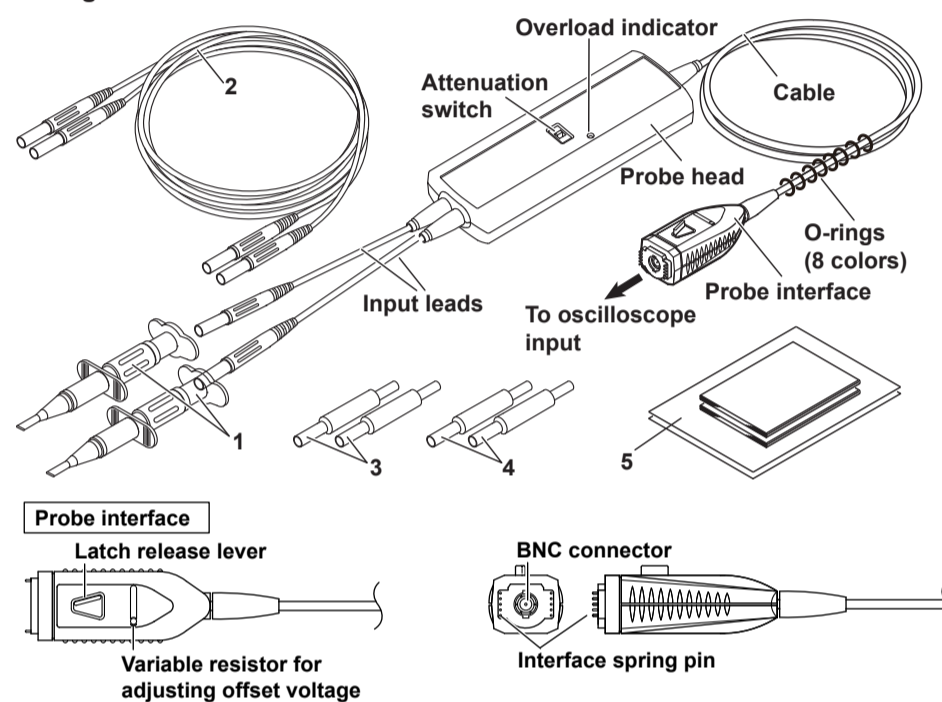
#### CAUTION

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

### 1. Overview

The PBDH0150 Differential Probe (Model 701927) is a 150 MHz bandwidth, high-voltage, differential input probe that is used in combination with DLM series or other digital oscilloscopes that have the YOKOGAWA probe interface (hereafter referred as oscilloscope with the probe IF).  
To use the probe, simply connect it to a BNC input terminal on an oscilloscope with the probe IF. Touch the device under measurement with the probe tip to observe the voltage waveform.

### 2. Configuration and Part Names



Standard Parts	Part No.	Accessories Sold separately	Part No.
1. Pincher tips	(Black) B9852MM (Red) B9852MN	Long test clip	701906
2. Extension leads (1 m)	(Black) B8099LF (Red) B8099LG	Alligator clip (dolphin type)	701954
3. 100 Ω resistance adapters x 2	(yellow) B8099LJ	Fork terminal adapter	758921
4. 150 Ω resistance adapters x 2	(green) B8099LK	Alligator clip adapter (rated 300 V)	758922
5. Manuals (see below)		Alligator clip adapter (rated 1000 V)	758929
		Safety terminal adapter	758931

Manual Title	Manual No.	Description
Model 701927 PBDH0150 Differential Probe User's Manual	IM 701927-01EN	This manual
Model 701927 PBDH0150 Differential Probe Safety Instructions	IM 701927-02FR	The warnings and cautions in French to supplement the IM 701927-01EN
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.

#### Attenuation Switch

Switches between 50:1 and 500:1 attenuation.

#### Overload Indicator

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

- ±140 V (DC + ACpeak) at 50:1 attenuation
- ±1400 V (DC + ACpeak) at 500:1 attenuation

#### Probe Interface

The section of the probe that connects to the digital oscilloscope input.

#### Interface Spring Pins

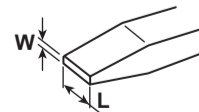
When the probe interface is connected, these pins touch the pad on the oscilloscope interface board. The probe's power is supplied through these interface pins. These interface pins are also used by the oscilloscope to automatically detect the probe attenuation setting.

#### Latch Release Lever

Releases the lock connecting the probe interface to the oscilloscope input.

#### Variable Resistor for Adjusting Offset Voltage

You can adjust the offset voltage using an appropriate screwdriver as described below.



#### Adjustment Screwdriver

Use an adjustment screwdriver that matches the adjustment groove. Using a screwdriver with a large grip or a screwdriver with a small head can damage the adjustment turn stop or groove.

Recommended adjustment driver bit dimensions

- Head thickness (W): 0.2 to 0.35 mm; head width (L): 1.3 to 1.5 mm;
- head shape: flat or Philips

### 3. How to Use



#### WARNING

- Turn off the power to the circuit under measurement when you connect or disconnect the probe from the circuit. Connecting or removing the probe while the power is on is dangerous. Do not touch the probe after turning on the power to the circuit under measurement.
- Do not disconnect the probe's BNC connector from the oscilloscope while the probe is connected to the circuit under measurement. Before disconnecting the BNC connector, turn off the power to the circuit under measurement, and disconnect the probe from the high voltage parts of the circuit.



#### CAUTION

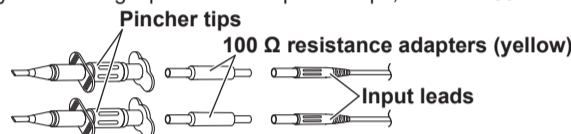
- This probe is designed to measure the voltage difference between two points on the circuit under measurement. It does not electrically isolate the circuit under measurement from the measuring instrument.
- Use a soft cloth to clean the probe. Be careful not to break the probe. Do not immerse the probe in liquid or use abrasive cleaners on the probe. Do not use benzene or other solvents on the probe.

#### Preparation

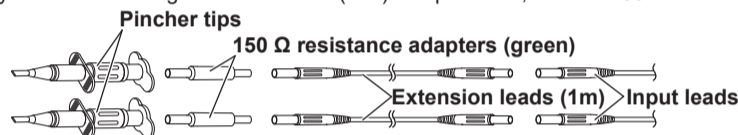
1. Have the probe and an oscilloscope with the probe IF ready.
2. Insert the probe interface completely into the oscilloscope input, and confirm that the BNC connector and interface pin are securely fastened. You will hear the latch click when the connectors lock into place.
3. When you connect the probe to an oscilloscope with the probe IF, the attenuation ratio and input coupling on the oscilloscope are set automatically. If you change the attenuation ratio of the probe using the attenuation switch, the attenuation ratio on the oscilloscope changes automatically.
4. If necessary, attach the provided extension leads, pincher tips, and resistance adapters to the input leads.

#### Connecting Accessories

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



If you are connecting extension leads (1 m) to input leads, use the 150 Ω resistance adapters.



#### Note

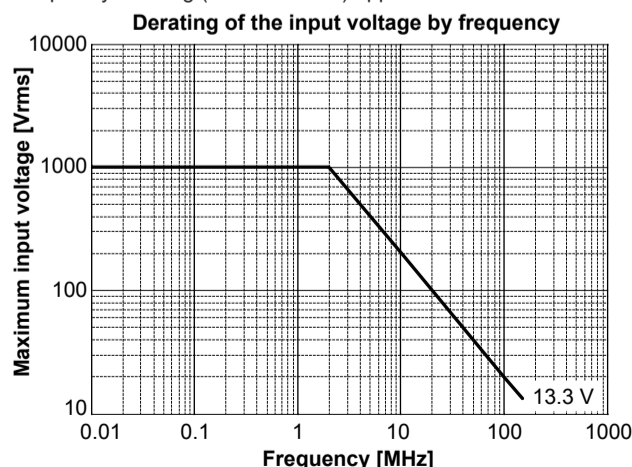
- Accurate measurements may not be possible near objects with strong electromagnetic fields such as transformers, large current circuits, and wireless equipment.
- Before use, flip the attenuation switch back and forth several times. The switch's electrical contacts can weaken if not used for long periods of time.
- To take accurate measurements, we recommend that you calibrate the probe once a year.

### 4. Specifications

#### Electrical Specifications

Item	Specifications
Frequency bandwidth <sup>1, 2</sup>	DC to 150 MHz (−3 dB) <sup>6</sup> Using the extension leads (typical) <sup>3</sup> : DC to 100 MHz (−3 dB) <sup>7</sup>
Input type	Balanced differential input
Attenuation	50:1 or 500:1, switchable
Input resistance and capacitance (typical) <sup>3</sup>	4 MΩ + 5 pF (to ground)
Allowable differential voltage (between + and − terminals)	±140 V (DC + ACpeak) at 50:1 attenuation ±1400 V (DC + ACpeak) at 500:1 attenuation
Allowable common mode voltage	±1400 V (DC + ACpeak) or 1000 Vrms
Maximum input voltage (to ground) <sup>4</sup>	±1400 V (DC + ACpeak) or 1000 Vrms
CMRR (typical) <sup>1, 3</sup>	−80 dB at 60 Hz, −50 dB at 1 MHz
Output voltage <sup>1</sup>	±2.8 V (DC + ACpeak) Value when the probe is used in combination with an oscilloscope whose input resistance is 50 kΩ or higher
Output impedance	Used on a 1 MΩ input oscilloscope
Noise (conversion to input, typical) <sup>3</sup>	50 mVrms at 50:1 attenuation 300 mVrms at 500:1 attenuation
Propagation delay (typical) <sup>3</sup>	13 ns at 50:1 attenuation 12 ns at 500:1 attenuation
DC gain accuracy <sup>1, 5</sup>	±2% when the common mode input voltage is ±400 V ±3% when the common mode input voltage is ±1000 V
Rated supply voltage	±12.3 V ±0.3 V Power is supplied through the dedicated probe interface.
Consumption current (typical) <sup>3</sup>	30 mA

- 1 At an ambient temperature 23 ± 5°C, humidity 55% ± 10% RH, 30 minutes after the power is turned on.
- 2 The frequency bandwidth when combined with the oscilloscope.
- 3 Specifications of items with "typical" are typical or mean values. They are not strictly guaranteed.
- 4 Frequency derating (load reduction) applies.



- 5 The accuracy depends on the vertical axis accuracy of the oscilloscope. It is the sum of the DC gain accuracy and offset voltage.
- 6 Specification when the probe is used in combination with 100 Ω resistance adapters.
- 7 Specification when the probe is used in combination with 150 Ω resistance adapters and the extension leads.

#### General Specifications

Item	Specifications
Operating environment	Probe (excluding the pincher tip) 5°C to 40°C, 25% to 85% RH (no condensation) Pincher tip −40°C to 85°C, 25% to 85% RH (no condensation) Extension lead −40°C to 85°C, 25% to 85% RH (no condensation)
Storage environment	−30°C to 60°C, 25% to 85% RH (no condensation) (probe, excluding the pincher tip)
Operating altitude	2000 m or less
Storage altitude	3000m or less
Recommended calibration period	1 year
Warm-up time	At least 30 minutes
External dimensions	174 mm × 58 mm × 27 mm (excluding the connector and cable)
Total length	2420 mm ± 30 mm
Weight	Approx. 300 g (probe, excluding the pincher tip)
Compliant standards	Safety standards <sup>8, 9</sup> Probe (excluding the pincher tip) EN 61010-031 Measurement category II 1000 Vrms Pollution degree 2 Pincher tip EN 61010-031 Measurement category III 1000 Vrms Pollution degree 2 Extension lead EN 61010-031 Measurement category III 1000 Vrms Pollution degree 2 Probe and accessories EN 61010-031 Measurement category II 1000 Vrms Pollution degree 2
EMC standards	Emission <sup>10</sup> EN 61326-1 Class A EN 55011 Class A, Group 1 EMC regulations in Australia and New Zealand EN 55011 Class A, Group 1 Immunity EN 61326-1 Table 2
Environmental standards <sup>11</sup>	EU RoHS Directive compliant

- 8 This product is for measurement category II (CAT II). Do not use it for measurement category III (CAT III) or IV (CAT IV). When using devices with different measurement categories, the lower measurement category applies. Because the measurement category of the probe is lower than its accessories, when the probe and its accessories are used together, measurement category II (CAT II) applies.

Measurement Category	Definition
Measurement category "O" (Other)	Measurement category O (Other) 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.

- 9 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).
- 10 This product is a Class A (for industrial environments) product. Operation of this product in a residential area may cause radio interference in which case the user will be required to correct the interference.
- 11 For conformity to environmental regulations and/or standards other than EU, contact your local Yokogawa office.

#### 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.

#### Compliance with the Radio Waves Act (Republic of Korea)

This product complies with the Radio Waves Act (Republic of Korea). Note the following when using the product in Republic of Korea.

이 기기는 업무용 (A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point and use the product in a place except for home.)

Registration No:	KCC-REM-IMY-EEN335
Equipment Name:	Differential Probe
Trade Name:	Yokogawa Test & Measurement Corporation
Manufacturer:	Yokogawa Test & Measurement Corporation
Country of Origin:	Japan

#### 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)	×	○	○	○	○	○
线路板 ASSY	×	○	○	○	○	○

○: 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变, 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。