PMK

Probing Solutions.
Made in Germany.

PHV SERIES

High Voltage Passive Probes up to 400 MHz, 4000 V Peak

Instruction Manual

Manufacturer

PMK Mess- und Kommunikationstechnik GmbH
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Internet: www.pmk.de
E-Mail: sales@pmk.de

Warranty

PMK warrants this product for normal use and operation within specifications for a period of two years from date of shipment and will repair or replace any defective product which was not damaged by negligence, misuse, improper installation, accident or unauthorized repair or modification by the buyer. This warranty is applicable only to defects due to material or workmanship. PMK disclaim any other implied warranties of merchantability or fitness for a particular purpose. PMK will not be liable for any indirect, special, incidental, or consequential damages (including damages for loss of profits, loss of business, loss of use or data, interruption of business and the like), even if PMK has been advised of the possibility of such damages arising from any defect or error in this manual or product.

Safety Information

Prevent personal injury, fire and product damage.

To avoid personal injury and to prevent fire or damage to this product or products connected to it, review and comply with the following safety precautions. Be aware that if you use this probe assembly in a manner not specified the protection this product provides may be impaired. Only qualified personnel should use this probe assembly.

Use only grounded instruments.

Do not connect the probe ground lead to a potential other than earth ground. Always make sure the probe and the measurement instrument are grounded properly.

Connect and disconnect properly.

Connect the probe output to the measurement instrument and connect the ground lead to earth ground before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground lead from the circuit under test before disconnecting the probe from the measurement instrument.

Observe probe and probe accessory ratings.

Do not apply any electrical potential to the probe input which exceeds the maximum ratings of the probe or the accessories connected to it. In a combination always the lower rating / measurement category applies to both probe and accessories connected to it. Make sure to comply with the voltage versus frequency derating curve on page 22.

Keep away from hazardous live circuits.

Avoid open circuitry. Do not touch connections or components when power is present.

Do not operate with suspected failures.

Refer to qualified service personnel.

Indoor use only.

Do not operate in wet or damp environment. Keep the product dry and clean.

Do not operate the product in an explosive atmosphere.

IEC Measurement Categories

Definitions and Examples

No Measurement Category

not in CAT II, III or IV

Definition: Many types of test and measuring circuits are not intended not in CAT II, III or IV to be directly connected to the mains supply. Some of these measuring circuits are intended for very low energy applications, but others of these measuring circuits may experience very high amounts of available energy because of high short-circuit currents or high open-circuit voltages. There are no standard transient levels defined for these circuits. An analysis of the WORKING VOLTAGES, loop impedances, temporary overvoltages, and transient overvoltages in these circuits is necessary to determine the insulation requirements and short-circuit current requirements.

Examples: Thermocouple measuring circuits, high-frequency measuring circuits, automotive testers, and testers used to characterize the mains installation before the installation is connected to the mains supply.

Measurement Category II

Definition: MEASUREMENT CATEGORY II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage mains installation.

Examples: Measurements on MAINS CIRCUITS of household appliances, portable tools and similar equipment, and on the consumer side only of socket-outlets in the fixed installation.

Measurement Category III

CAT III

Definition: MEASUREMENT CATEGORY III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage mains installation. To avoid risks caused by the HAZARDS arising from these higher short-circuit currents, additional insulation and other provisions are required.

Examples: Measurements on distribution boards (including secondary meters), photovoltaic panels, circuitbreakers, wiring, including cables, busbars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment such as stationary motors with permanent connection to the fixed installation.

Measurement Category IV

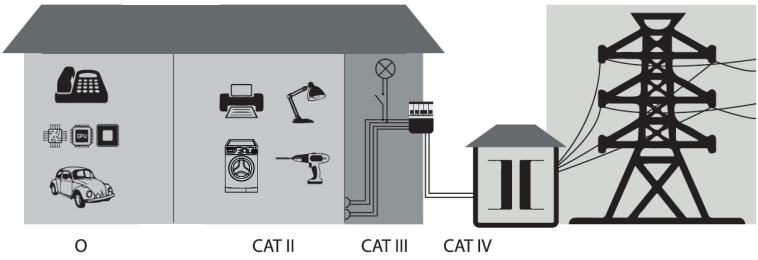
CAT IV

Definition: MEASUREMENT CATEGORY IV is applicable to test and measuring circuits connected at the source of the building's low-voltage mains installation. Due to these high short-circuit currents which can be followed by a high energy level, measurements made within these locations are extremely dangerous. Great precautions shall be made to avoid any chance of a short circuit.

Examples: Measurements on devices installed before the main fuse or circuit breaker in the building installation.

IEC Pollution Degrees

Definitions and Examples:



Overview of measurement categories according to IEC 61010-031

O = No Measurement Category (Other circuits that are not directly connected to mains)

Pollution Degree 1 No POLLUTION or only dry, non conductive POLLUTION. NOTE: The POLLUTION has no influence.

Pollution Degree 2 Only- non conductive POLLUTION. Occasionally, however, a temporary conductivity caused by condensation must be accepted.

Pollution Degree 3 Conductive POLLUTION occurs or dry, non-conductive POLLUTION occurs which becomes conductive due to condensation which is to be expected.

IEC Safety Symbols

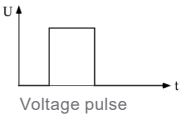
The following symbols may appear on the product or in this instruction manual:

Caution, risk of danger. Refer to manual.

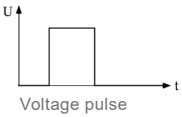
Caution, risk of electric shock.

Earth (ground) TERMINAL.

Specifications

	PHV 1000	PHV 1000-3	PHV 1000-5
Base model	PHV 1000 860-622-B00	PHV 1000-3 860-623-B00	PHV 1000-5 860-625-B00
Read-Out option	PHV 1000-RO 860-622-B02	PHV 1000-3-RO 860-623-B02	PHV 1000-5-RO 860-625-B02
Base model with complementary accessories	PHV 1000-C 86C-622-B00	PHV 1000-3 C 86C-623-B00	PHV 1000-5 C 86C-625-B00
Read-Out with complementary accessories	PHV 1000-C-RO 86C-622-B02	PHV 1000-3 C-RO 86C-623-B02	PHV 1000-5 C-RO 86C-625-B02
Electrical Specifications			
Attenuation Ratio (±2% at DC) (¹)	100:1	100:1	100:1
System Bandwidth (-3 dB)	400 MHz	250 MHz	120 MHz
Rise Time (10% - 90%)	900 ps	1.4 ns	2.4 ns
Voltage Coefficient (at DC)	0.00025 % / V	0.0005 % / V	0.00025 % / V
Input Resistance (System) (±1%)	50 MΩ	50 MΩ	50 MΩ
Input Capacitance (System)	7.5 pF	7.5 pF	9.5 pF
Compensation Range	10 pF - 25 pF	10 pF - 25pF	10 pF - 25 pF
Input Coupling of the Measuring Instrument	1 MΩ AC / DC	1 MΩ AC / DC	1 MΩ AC / DC
Maximum Rated Input Voltages, CAT II, CAT III (²)			
Pollution Degree	2	2	2
Measurement Category II	1000 V CAT II	1000 V CAT II	1000 V CAT II
Maximum Rated Input Voltages, No Measurement Category, not in CAT II, III, IV (²)			
Pollution Degree	2	2	2
No Measurement Category (²)	2000 V peak	2000 V peak	2000 V peak
Maximum Pulse Rating, No Measurement Category, not in CAT II, III, IV (²)			
Upulse (³)	Upulse 2000V (Step 0V to 2000V)  Voltage pulse		
Mechanical Specifications			
Weight (Probe only)	67 g	82 g	120 g
Cable Length	2 m	3 m	5 m
Probe Tip Diameter	5 mm	5 mm	5 mm

This product comes with 2 years warranty.
Specifications that are not marked as guaranteed are typical.

PHV 2000	PHV 2000-3	PHV 2000-5	PHVS 2000	PHVS 2000-3	PHVS 2000-5
PHV 2000 870-622-A00	PHV 2000-3 870-623-A00	PHV 2000-5 870-625-A00	PHVS 2000 870-722-A00	PHVS 2000-3 870-723-A00	PHVS 2000-5 870-725-A00
PHV 2000-RO 870-622-A02	PHV 2000-3-RO 870-623-A02	PHV 2000-5-RO 870-625-A02	PHVS 2000-RO 870-722-A03	PHVS 2000-3-RO 870-723-A03	PHVS 2000-5-RO 870-725-A03
PHV 2000 C 87C-622-A00	PHV 2000-3 C 87C-623-A00	PHV 2000-5 C 87C-625-A00	PHVS 2000-C 87C-722-A00	PHVS 2000-3 C 87C-723-A00	PHVS 2000-5 C 87C-725-A00
PHV 2000 C-RO 87C-622-A02	PHV 2000-3 C-RO 87C-623-A02	PHV 2000-5 C-RO 87C-625-A02	PHVS 2000-C-RO 87C-722-A03	PHVS 2000-3 C-RO 87C-723-A03	PHVS 2000-5 C-RO 87C-725-A03
100:1	100:1	100:1	1000:1	1000:1	1000:1
400 MHz	250 MHz	120 MHz	400 MHz	250 MHz	120 MHz
900 ps	1.4 ns	2.4 ns	900 ps	1.4 ns	2.4 ns
0.00025 %/V	0.0005 %/V	0.00025 %/V	0.0005 %/V	0.0005 %/V	0.0005 %/V
50 MΩ	50 MΩ	50 MΩ	50 MΩ	50 MΩ	50 MΩ
7.5 pF	7.5 pF	9.5 pF	7.5 pF	7.5 pF	8 pF
10 pF - 25 pF	10 pF - 25 pF	10 pF - 25 pF	10 pF - 25 pF	10 pF - 25 pF	10 pF - 25 pF
1 MΩ AC / DC	1 MΩ AC / DC	1 MΩ AC / DC	1 MΩ AC / DC	1 MΩ AC / DC	1 MΩ AC / DC
2	2	2	2	2	2
1000 V CAT II	1000 V CAT II	1000 V CAT II	1000 V CAT II	1000 V CAT II	1000 V CAT II
2	2	2	2	2	2
4000 V peak	4000 V peak	4000 V peak	4000 V peak	4000 V peak	4000 V peak
Upulse 4000 V (Step 0 V to 4000 V)  Voltage pulse					
67 g	82 g	120 g	67 g	82 g	120 g
2 m	3 m	5 m	2 m	3 m	5 m
5 mm	5 mm	5 mm	5 mm	5 mm	5 mm

(1) Connected to oscilloscope with an input impedance of 1 MΩ ± 1 %.
(2) As defined in IEC 61010-031. See definitions explained on page 18 and 19.
(3) No overshoot permitted.

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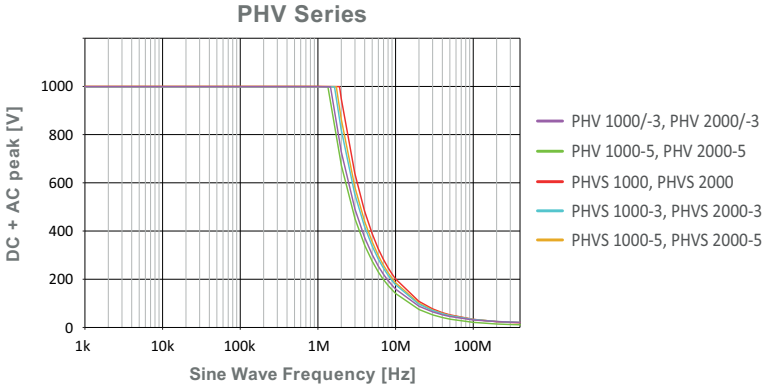
Typical Voltage Derating

Note that the maximum input voltage rating of the probe decreases as the frequency of the applied signal increases.

The charts given here are valid for no measurement category, not in CAT II, III, IV (1).



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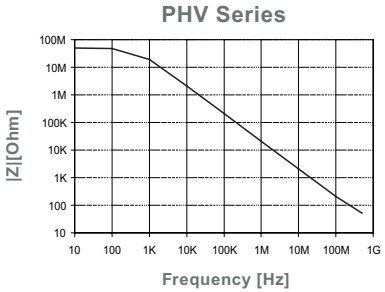
Typical Input Impedance

Note that the input impedance of the probe decreases as the frequency of the applied signal increases.

The charts given here are valid for no measurement category, not in CAT II, III, IV (1).



Environmental Specifications

Altitude	operating	up to 2000 m
	non-operating	up to 15000 m
Temperature Range	operating	0 °C to +50 °C
	non-operating	-40 °C to +71 °C
Maximum Relative Humidity	operating	80 % relative humidity for temperatures up to +31 °C, decreasing linearly to 40 % at +50 °C
	non-operating	95 % relative humidity for temperatures up to +40 °C

(1) As defined in IEC 61010-031. See definitions explained on page 18 and 19.

Handling

Handle with care especially when fitted with the extra thin and sharp spring contact tip to avoid any injury. Note that the probe cable is a sensitive part of the probe. Do not damage through excessive bending or pulling. Avoid mechanical shock to this product in general to guarantee accurate performance and protection.

Use ground lead only for connections to earth ground.

The accessories provided with the probe have been safety tested. Do not use any other accessories than those “originally” provided.

When using Keysight oscilloscopes, use the special read out for detection of correct divying factor, if this option was purchased.

Maintenance

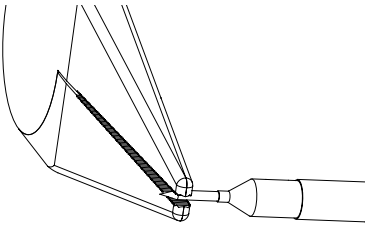
• Cleaning

To clean the exterior of the probe use a soft cloth moistened with either distillated water or isopropyl alcohol. Before use allow the probe to dry completely.

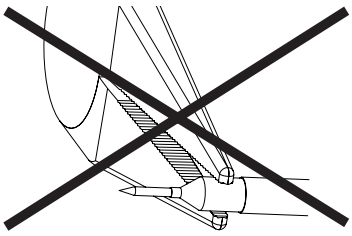
• Changing the Probe Tip

To change the probe tip use pliers to grip and pull it carefully straight out of its contact socket, along the axis of the probe. Do not grip the white plastic insulator or the housing with pliers, because the tip could be squeezed and cannot be removed and respectively the probe could be damaged. If the probe tip is removed, the new tip can be inserted with pliers into the contact socket, along the axis of the probe. In order to insert the probe tip completely into the housing, press the probe tip against a hard surface carefully.

Most oscilloscopes provide a build-in function generator to verify the passive probe is compensated correctly. After changing the probe tip always use the build-in function generator or other stand-alone instrument to make sure the probe is safe to operate.



Use pliers to grip and pull the probe tip carefully out of its contact socket.



Do not grip the white plastic insulator or the probe housing with pliers.

Adjustment Procedures

The probe can be adjusted for low frequency (LF) compensation and for high frequency (HF) compensation.

A factory calibration is possible at any time on request.

The trimmers are sensitive components. Too much mechanical pressure during adjustment might damage the trimmers.

• LF Compensation

When the probe is connected to the oscilloscope input the first time probes cable capacitance needs to be matched to the oscilloscope input capacitance. This matching assures good amplitude accuracy from DC to the probes bandwidth.

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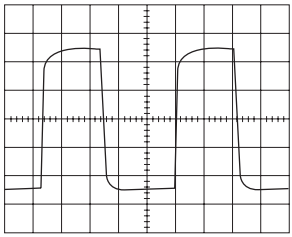
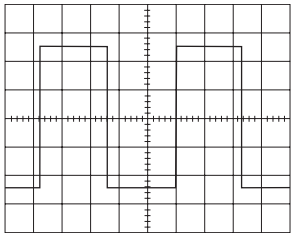
A poorly compensated probe clearly influences the overall system performance (probe + scope) and causes measurement errors resulting in inaccurate readings and distorted waveforms.

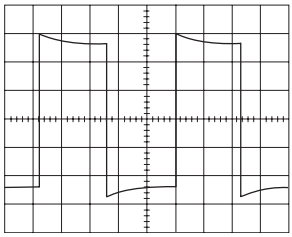
LF compensation is performed by connecting the probe to the CAL – output on the oscilloscope front panel and adjusting the LF compensation trimmer to optimum square wave response. For clarification see below figures.



undercompensated



optimum



overcompensated

Adjustment Procedures

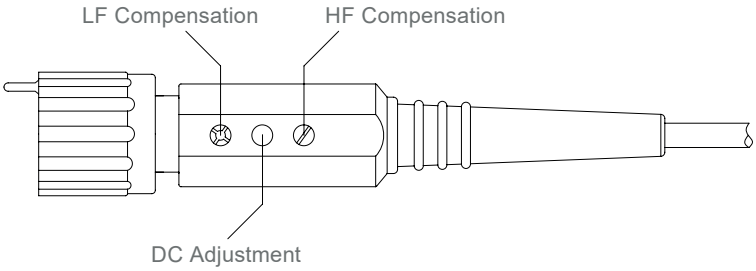
• HF Compensation

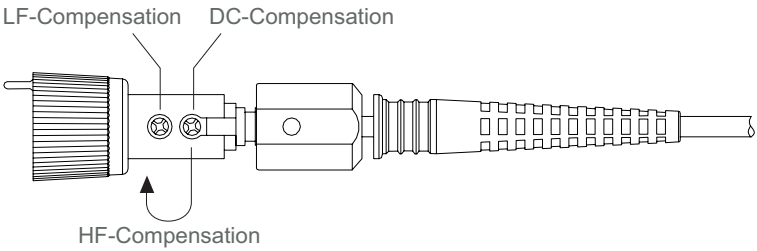
Overshoot doesn´t necessarily need to be adjusted when connecting the probe to your oscilloscope for the first time.

We recommend to use the following equipment for proper HF compensation:

Rectangular waveform generator with a rise time faster than 700 ps, 50 Ω feed through and probe BNC adapter. If you do not have the appropriate equipment we are pleased to help you. Simply send a message to our service department.

HF adjustment is performed by connecting the probe to the rectangular wave generator.





• DC Adjustment

DC compensation is executed while connected to the oscilloscope. Use a precision input resistance of 1 MΩ ±0.01 %.

Probe Accessories

The parts supplied are **"highlighted"**, see also "Scope of Delivery" on page 28.

890-400-104
Ground Lead 22 cm
to 2 mm Banana Plug

890-400-102
Ground Lead 22 cm
to 4 mm Banana Plug

890-450-220
HF Compensated
Ground Lead 22 cm

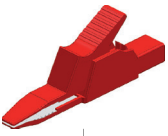
890-400-015
Ground Lead 15 cm

890-400-000
Ground Lead 22 cm

890-400-002
Ground Lead 30 cm

890-010-912
Set Coding Rings
3x4 colors

972405101 /
972405100 *
Safety Alligator
Clip (red / black)



890-221-002 /
890-221-000 *
Flexible Adapter 5.0-L to
4 mm Safety Banana Plug
(red / black)

890-321-020 /
890-321-000 *
Sprung Hook 5.0-L (red / black)

891-005-011
5x **Solid Tip 0.8 mm**

891-005-803
5x **Spring Tip 0.8 mm**

018-292-S22
5x **Protection Cap 5.0-L (black)**

891-292-027
5x **Insulating Cap 5.0-L**

890-700-006 *
PCB Adapter
5.0-L

018-210-003
BNC Adapter
5.0-L

018-292-007
Adjustment Tool T

Use ground lead only for connections to earth ground.

The accessories provided with the probe have been safety tested.
Do not use any other accessories than those "originally" provided.

* See ratings for these accessories on page 27.

Rating Accessories

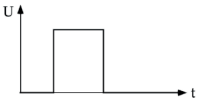
- **PCB Adapter 5,0-L**
  (890-700-006)

Maximum Rated Input Voltages, No Measurement Category, not in CAT II, III, IV [1]:

- Pollution Degree: 2
- No Measurement Category: 2000 V DC or AC peak

Maximum Pulse Rating, No Measurement Category, not in CAT II, III, IV [1]:

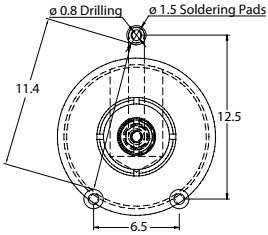
Upulse [2] = 6000 V (Step 0 V to 6000 V)



Voltage pulse

Drilling- / Soldering Template

The minimum distance between all solder pads of 11.4 mm (see adjacent template) must not be undercut under any circumstances. Undercutting this distance will void the rating.



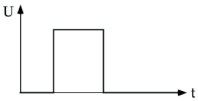
- **Sprung Hook 5,0-L**
  (890-321-020 / 890-321-000)

Maximum Rated Input Voltages, No Measurement Category, not in CAT II, III, IV [1]:

- Pollution Degree: 2
- No Measurement Category: 2000 V DC or AC peak

Maximum Pulse Rating, No Measurement Category, not in CAT II, III, IV [1]:

Upulse [2] = 6000 V (Step 0 V to 6000 V)



Voltage pulse

Maximum Rated Input Voltages, CAT II [1]:

- Pollution Degree: 2
- Measurement Category II: 1000 V CAT II

- **Safety Alligator Clip / Flexible Adapter 5,0-L to 4 mm Safety Banana Plug**
  (972-405-101 / 972-405-100) (890-221-002 / 890-221-000)

Maximum Rated Input Voltages, CAT II [1]:

- Pollution Degree: 2
- Measurement Category II: 1000 V CAT II

(1) As defined in IEC 61010-031. See definitions explained on page 18 and 19.
(2) No overshoot permitted

Scope of Delivery

Accessories delivered with each probe are highlighted in the graphical overview.

Items	Qty
Adjustment Tool T	1
Ground Lead 22 cm	1
Instruction Manual	1
Insulating Cap 5.0-L	1
Probe PHV	1
Protection Cap 5.0-L (1)	1
Readout for use with Keysight oscilloscopes (2)	1
Solid Tip 0.8 mm	1
Spring Tip 0.8 mm (3)	1
Sprung Hook 5.0 L	1
Additional items with complementary accessories option (-C)	
BNC Adapter 5.0 L	1
Environmental friendly cardboard box	1
Coding Rings (set) 3x4 colors	1
Flexible Adapter 5.0-L	1
Ground Lead 22 cm to 4 mm Bananaplug	1
Safety Alligator Clip (red)	1
Overview - Optional probe accessories	
See on page 26	
PHV(S) - Options	
Option	Expansion compensation range 65 pF
Option	Additional insulation of the probe cable with silicone hose (price per meter)
Option	Integrated steel wire as strain relief of probe cable (price per meter) Only possible in conjunction with additional silicone hose insulation
Option	Custom Probe attenuation ratio, for example: 200:1 on request

(1) plugged on probe (2) only included with models having read-out option
(3) installed in probe

Notes

Notes

Notes

Distribution in the UK & Ireland

Characterisation, Measurement & Analysis

Lambda Photometrics Limited
Lambda House Batford Mill
Harpenden Herts AL5 5BZ
United Kingdom
E: info@lambdaphoto.co.uk
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F: +44 (0)1582 712084