



Probing Solutions.
Made in Germany.

EN



HORNET[®] Series

High Voltage Differential Probes
with Universal BNC Interface

$\pm 4000\text{ V}$, $>300\text{ MHz}$

PRELIMINARY

Datasheet



About HORNET® Probe Series

The state-of-the-art high voltage differential probe series HORNET® combines a $\pm 4000\text{V}$ differential and common mode voltage input range with a remarkable $>300\text{MHz}$ bandwidth, establishing itself as the best-in-class solution for the growing demands of wide bandgap power electronics design, e.g. double pulse testing of high-speed high-voltage switching devices of SiC technology, and IGBTs, thyristors, fast-switching HV diodes, and more.

The high voltage differential probe series HORNET® is not for handheld use and for integration into full-automated or manual test stations for high-voltage safety reasons. HORNET® is therefore used as a voltage-measuring component (permanently attached device) of a test system.

Key Features of HORNET®:

- **Unprecedented Voltage Capability:** HORNET®'s 4000V differential and common mode voltage capability provide engineers with the flexibility to tackle the most challenging high voltage applications in power electronics design.
- **High-Frequency Performance:** With a bandwidth exceeding 300MHz, HORNET® ensures accurate and reliable measurements for fast-switching wide bandgap, SiC, power electronics, making it an essential tool for engineers working on advanced designs having a protected test environment.
- **Precision in Every Detail:** HORNET® is engineered to deliver precise and consistent results, allowing designers to optimize the efficiency and performance of their power electronic systems with confidence.
- **Safety First:** PMK prioritizes safety, and HORNET® is no exception. The probe is designed with advanced safety features to safeguard both users and the equipment during high voltage measurements. HORNET® series probes are not for handheld use when placed in an energized circuit.

All HORNET® series probes are for installation in a safety test environment and are recommended to be controlled remotely. The „PMK Probe Control“ software provides the ability for the user to control the probe remotely via a computer, and provides the user with a graphical user interface. The software is free of charge and included with PMK's 2ch and 4ch power supplies PS-02 and PS-03, which are required to power the scope-agnostic probe. The PS-02 and PS-03 power supplies all have a USB interface and are available with optional LAN interface. ISO17025 calibration upon delivery or as re-calibration is available.

The HORNET® series probes have a universal BNC output connector and is compatible with any oscilloscope in the lab with 50Ω input impedance, or $1\text{M}\Omega$ input impedance and a 50Ω feed-through termination.

All models require a power supply, which is not included in the scope of delivery, and has to be ordered separately. Review the Ordering Information at the end of this document for more details.

Measurement Principle

The high voltage differential probe series HORNET® consists of two balanced precision attenuators, which are differentially matched. The attenuators scale the input voltage before passing into the differential amplifier. The output of the differential is fed over a driver stage to the 50Ω input of a measuring device.

Factory Calibration

All models are shipped with factory calibration certificates. Annual factory re-calibration is recommended. ISO17025 calibration upon delivery or as re-calibration is possible on request.

Specifications

Read the Instruction Manual before first use and keep it for future reference. A digital copy of the latest Instruction Manual revision can be downloaded at www.pmk.de.

Do not exceed the specifications. Allow the probe to warm up for 20 minutes. This probe comes with 1 year warranty. Each specification is determined at +23 °C ambient temperature. This probe series is not for hand-held use, and not rated for CAT II, III or IV.

Electrical Specifications

Electrical Specifications¹ that are not marked with (*) as guaranteed are typical.

Article number	HORNET4kV	
Attenuation* ($\leq \pm 1\%$ guaranteed)	1000:1, 500:1, 200:1, 100:1	
Bandwidth* (-3 dB)	$\geq 300\text{MHz}$	
Small Signal (guaranteed)		
Rise time (10 % - 90 %)	1000:1, 500:1: 1.0 ns	
Large Signal	200:1, 100:1: 1.1 ns	
Maximum Rated Input Voltages²		
No Measurement Category	4000 V rms + 4000 V transient overvoltage	
CAT Rating	not applicable	
Pollution Degree	2	
Maximum Differential Input Voltage (DC + AC peak)	1000:1 $\pm 4000\text{ V}$ 500:1 $\pm 2000\text{ V}$ 200:1 $\pm 800\text{ V}$ 100:1 $\pm 400\text{ V}$	
Common Mode Voltage	$\pm 4000\text{ V peak (2800 V RMS)}$	
DC Gain Accuracy ³	$\pm 1.5\%$ (preliminary)	
Propagation Delay ($\pm 0.5\text{ ns}$)	12 ns	
Noise (AC RMS) (Referred to Input)		
30MHz bandwidth	400V: 0.11 V, 800V: 0.11 V 2000V: 0.13 V, 4000V: 0.14 V	
Full bandwidth	400V: 6.2 V, 800V: 5.2 V 2000V: 1.2 V, 4000V: 0.63 V	
Input Impedance⁴		
Each Input to Ground	10 M Ω $< 5\text{ pF}$	
Differential Input Impedance	20 M Ω $< 2.5\text{ pF}$	
Common Mode Rejection Ratio (CMRR) *preliminary*	DC: $> 70\text{ dB}$ 100 kHz: $> 60\text{ dB}$ 1 MHz: $> 60\text{ dB}$ 3.2 MHz: $> 60\text{ dB}$	10 MHz: $> 50\text{ dB}$ 50 MHz: $> 40\text{ dB}$ 100 MHz: $> 30\text{ dB}$ 300 MHz: $> 25\text{ dB}$

The use of a digital filter with BW=400MHz is recommended.



The electrical specifications are valid for use in a controlled environment, like a semi-conductor tester or test setup with protective cover.

Notes:

¹ Determined when using a PS-02 power supply at +23°C ambient temperature.

² The rating is based on basic insulation in a controlled environment in accordance with IEC 61010-1.

Also observe the definitions on page **Error! Bookmark not defined.** and **Error! Bookmark not defined.**

³ Input voltage $> 25\%$

⁴ Including input leads, cables in parallel, measurement frequency 1MHz.

Mechanical Specifications

Parameter	Specification
Weight (Probe only)	370 g
Length	2 m
Probe Input ¹	4mm safety banana (male)
Output Connector	BNC (male)

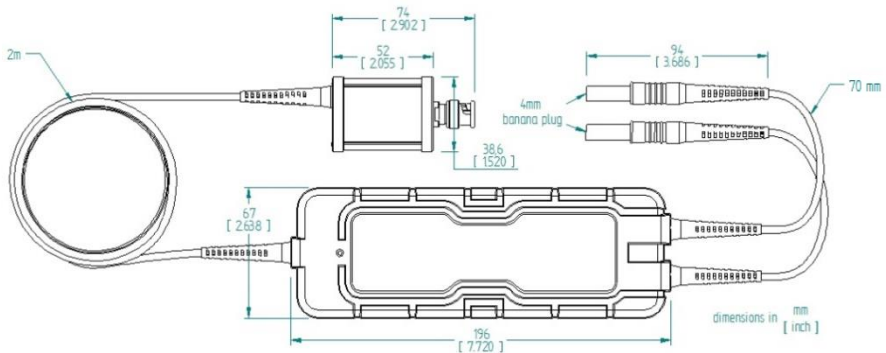
Notes:

¹ Different accessories for connectivity are available. Please review the section “Ordering Information”.

Environmental Specifications

Parameter	Specification	
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
Altitude	Operating	up to 2000 m
	Non-Operating	up to 15000 m

Dimensions



Probe's power supply pin assignment



Probe's power supply pin assignment “cable view”



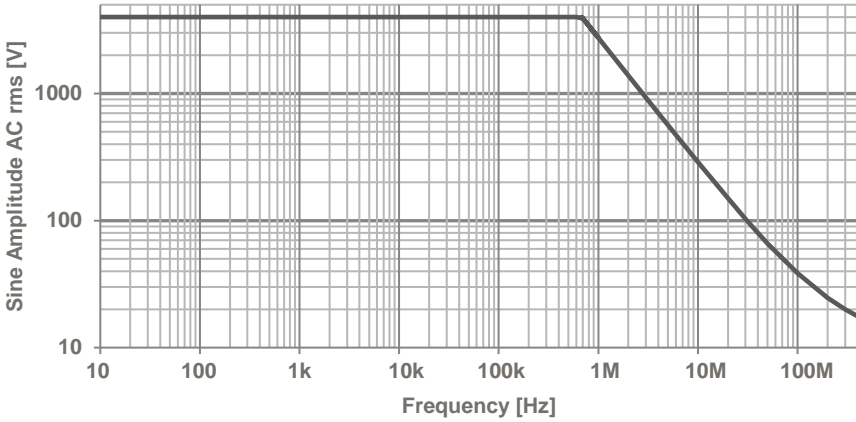
Observe the probe's power supply pin assignment.

Typical Voltage Derating



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

Typical Voltage Derating – HORNET4kV
No Measurement Category

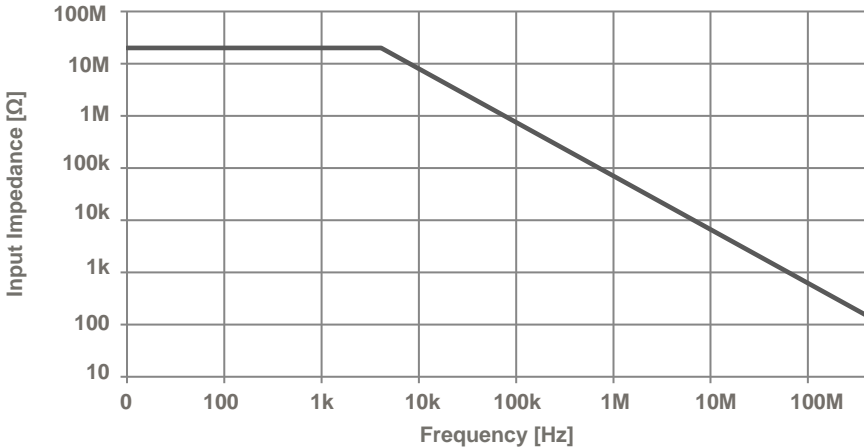


Typical Input Impedance

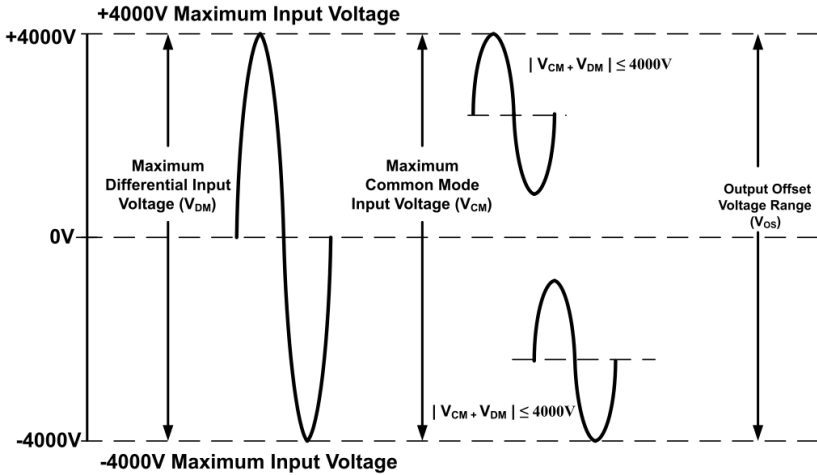


The input impedance of the probe decreases as the frequency of the applied signal increases.

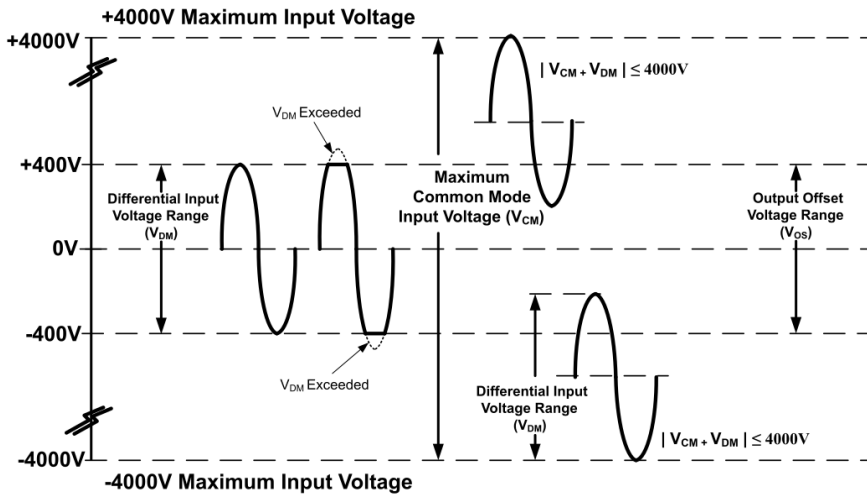
Typical Differential Input Impedance – HORNET4kV



Maximum Input Voltage, Example 4000V Model, 1000:1 Range



Maximum Input Voltage, Example 4000V Model, 100:1 Range



Scope of Delivery

A PMK power supply is required for all models. See chapter “Ordering Information” to review the selection.

Probe HORNET® series

Factory calibration certificate

Instruction manual



890-520-000

Power Supply Cable (0.5 m), 30VAC / 60V DC
(1.5m cable available as option)



890-880-103

Pair of Probe Tip Adaptors 4mm to 0.8mm (2x black) – spare part



2x **890-808-105**

2-Footer



890-880-102

Set of 4 Spring Tips (fine)



890-880-101

Set of 10 Contact Pins 0.64mm



890-880-110

Pair of Spade Terminals, narrow (black / red), 30V AC / 60V DC – spare part



890-880-107

Pair of Spade Terminals, wide (black, red), 30V AC / 60V DC – spare part



Ordering Information

Step 1: Select the Probe

HORNET4kV High voltage differential probe, 4000V, >300MHz, with four selectable dividing ranges, 1000:1, 500:1, 200:1, 100:1



Step 2: Select Additional Accessories

Note, that any additional accessory degrades the probe's performance. Always observe the lowest Maximum Input Voltage. Do not use any other accessories than recommended by PMK.

016-397-049

Carrying Case with Foam Inlay (black)



890-880-103

Pair of Probe Tip Adaptors 4mm to 0.8mm (2x black) – spare part



890-880-106

Pair of Mini Spring Tip Probes 4 mm (black, red), 600V CAT II



890-808-105

2-Footer



890-880-102

Set of 4 Spring Tips (fine) – spare part



890-880-101

Set of 10 Contact Pins 0.64mm – spare part



890-880-110

Pair of Spade Terminals, narrow (black / red), 30V AC / 60V DC – spare part



890-880-107

Pair of Spade Terminals, wide (black, red), 30V AC / 60V DC– spare part



4mm-SMA-M

4mm safety banana socket to SMA plug adapter, for high-frequency voltage measurements, 500V DC + AC pk, 1000V peak pulse



4mm-SMA-F

4mm safety banana socket to SMA socket adapter, for high-frequency voltage measurements, 500V DC + AC pk, 1000V peak pulse



4mm-MMCX-M

4mm safety banana socket to MMCX plug adapter, for high-frequency voltage measurements, 250V DC + AC pk, 500V peak pulse



4mm-MMCX-F

4mm safety banana socket to MMCX socket adapter, for high-frequency voltage measurements, 250V DC + AC pk, 500V peak pulse



Continues on next page...

4mm-BNC-F

4mm safety banana socket to BNC socket adapter, for high-frequency voltage measurements, 750V DC + AC pk, 1500V peak pulse



4mm-WSQ-5.08

4mm safety banana socket to square pin adapter, 5.08mm, for high-frequency voltage measurements, 750V DC + AC pk, 1500V peak pulse



890-880-115

Pair of Clamps, Hook (black & red), 1000V CAT II



890-880-114

Pair of Clamps, Jaws (black & red) 1000V CAT III



890-880-113

Pair of Clamps, Rotating Grip Jaw (black & red) 1000V CAT II



890-880-108

Pair of Safety Alligator Clips, big (black & red), 1000V CAT III



890-880-111

Pair of Safety Alligator Clips, small (black & red), 600V CAT III



890-880-112

5x Pair of Rail Clip Connectors 4 mm (black, red), 600V CATIII



890-880-116

4 mm Coupler f-f (red), 30VAC / 60V DC



890-880-109

Pair of Magnet Connectors 4 mm (black/red), 30VAC / 60V DC



D010031

50Ω BNC feed-through for 1MΩ input oscilloscopes. >500MHz



Step 3: Select Power Supply

A PMK power supply is required, and available separately.

889-09V-PS2

PS-02, 2ch power supply, with USB interface for remote control, for 100 -240V AC / 50 - 60Hz mains *

889-09V-PS2-L

PS-02-L, 2ch power supply, with LAN and USB interface for remote control, for 100 -240V AC / 50 - 60Hz mains *

889-09V-PS3

PS-03, 4ch power supply, with USB interface for remote control, for 100 -240V AC / 50 - 60Hz mains *

889-09V-PS3-L

PS-03-L, 4ch power supply, with LAN and USB interface for remote control, for 100 -240V AC / 50 - 60Hz mains *

890-520-915

Power Supply Cable, 1.5 m (0.5m cable included I scope of delivery)

Observe Connector Pin-Out
for PMK power supply cables



The power supply pin assignment is different from other power supplies.
Use only original PMK power supplies with PMK probes.

Step 4: Select Positioning System

893-350-010

3D positioner with steel base, 200 mm span width, twin holder, ideal for reliable positioning when the probe's inputs is equipped with spring loaded tips



893-350-015

3D positioner with steel base, 200 mm span width and probe holder



893-350-014

3D positioner with steel base, arm with 200 mm span width and probe head holder, arm with 130 mm span width and twin holder, ideal for reliable positioning of a BumbleBee® or HORNET® series probe when the probe inputs are equipped with spring loaded tips



893-350-013

BumbleBee® or HORNET® series probe head holder – spare part, for use with PMK's SKID positioning system for PCBs and probes



890-880-104

Twin holder M6 – spare part, for use with PMK's SKID positioning system for PCBs and probes



Step 5: Select Accredited Calibration

KAL-DAKKS-HORNET4kV ISO 17025 (re-)calibration

KAL-HORNET4kV *Factory recalibration. Certificate included in scope of delivery.*



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