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MMCX Probe Series with Universal BNC Interface

Up to 1 GHz, <4pF
 $\pm 42V_{pk}$, 60V DC

Instruction Manual



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Manufacturer

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

Warranty

PMK warrants this product for normal use and operation within specifications for a period of one year 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 covers defects in materials and workmanship only and does not cover wear and tear. PMK disclaims 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.

Declaration of Conformity

 PMK declares the conformity of this product with the actual required safety standards in accordance with the Low Voltage Directive (LVD) 2014/35/EU:

The basis on which conformity is being declared:

EN IEC 61326-1:2021	Electrical equipment for measurement, control and laboratory use – EMC requirements - Part 1: General requirements
EN IEC 61000-4-2:2008	Electromagnetic compatibility (EMC) –Part 4-2: Testing and measurement techniques –Electrostatic discharge immunity test
EN IEC 61010-031:2022	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test

WEEE/ RoHS Directives

 This electronic product is classified within the WEEE/ RoHS category list as monitoring and control equipment (category 9) and is compliant to the following EC Directives.

WEEE Directive 2012/19/EU	Waste Electrical and Electronic Equipment
RoHS Directive 2011/65/EU	Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment

Your help and efforts are required to protect and keep clean our environment. Therefore, return this electronic product at the end of its life either to our Service Department or take care of separate WEEE collection and professional WEEE treatment yourself. Do not dispose as unsorted municipal waste.

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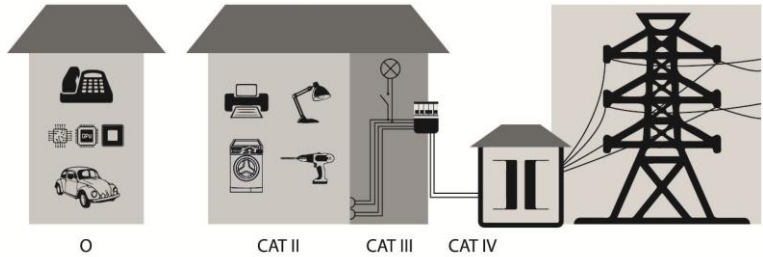
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IEC Measurement Categories

The probe is not rated for any measurement category. Do not use the probes in circuits with measurement category II, III or IV.

Definitions and Examples:



Overview of measurement categories according to IEC 61010-01
O = No Measurement Category (Other circuits that are not directly connected to mains)

IEC Pollution Degree

- | | |
|---------------------------|---|
| Pollution Degree 1 | No POLLUTION or only dry, nonconductive POLLUTION. NOTE: The POLLUTION has no influence. |
| Pollution Degree 2 | Only- nonconductive 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.

Safety and Handling Information

The overall safety of any measurement setup incorporating this probe is the responsibility of the user.

**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 MMCX ground contact 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 before connecting the probe's MMCX plug input to the MMCX socket test point in the circuit under test.

Disconnect the probe's MMCX input from the de-energized 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 case of a combination always the lower rating / measurement category applies to both probe and accessories connected to it.

**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.

About MMCX Probes

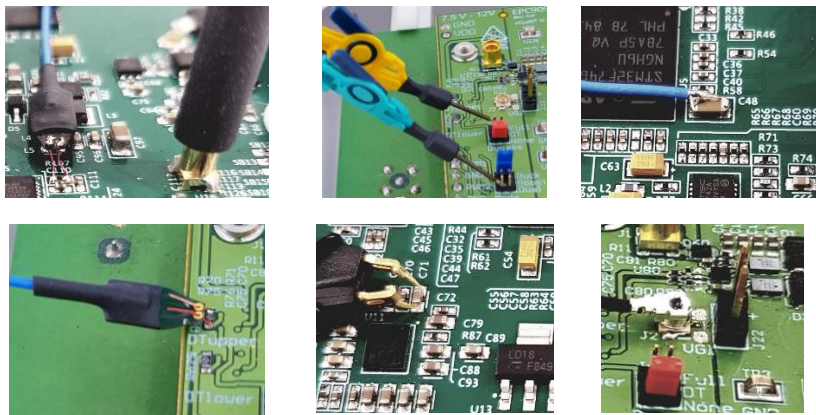
Over the last years MMCX has developed as the standard connectivity solution for repeatable measurements with highest signal fidelity, for example when measuring the gate voltage of switching devices.

Where traditional passive probes have long ground leads meaning a high inductance causing a ground loop, the compact MMCX design overcomes these traditional obstacles.

PMK's MMCX probe series provides models with a very low capacitive loading of less than 4pF for least capacitive loading and highest signal fidelity with their direct MMCX input.

Different models are available up to >1GHz bandwidth and $\pm 42\text{V}$ input voltage making the MMCX probe series the modern and ideal solution for testing, debugging, and design validation.

Individual Connectivity Accessories for the Highest Signal Fidelity



Adapters to connect MMCX directly to square pin headers are available as well, with two or three inputs.

The MMCX probes series has a universal BNC output connector and is compatible with any oscilloscope in the lab. Active models MMCX-A require a 50Ω input impedance, or $1\text{M}\Omega$ input impedance and a 50Ω feed-through termination. Passive models MMCX-P require $1\text{M}\Omega$ input impedance.

The active probe 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.

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 rated for CAT II, III or IV.

Electrical Specifications

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

Model Number	Attenuation Ratio (± 2 % at DC)	Bandwidth (-3dB) ¹	Rise time (10%-90%) ¹	Input Impedance
MMCX-P0725	25:1	> 700 MHz	< 570 ps	14.9 MΩ < 4 pF
MMCX-P0610	10:1	> 600 MHz	< 630 ps	10 MΩ < 8 pF
MMCX-A1025	25:1	> 1 GHz	< 425 ps	19.5 MΩ < 4 pF

Each input accessory is lowering the probe's bandwidth. Please review the "Ordering Information" section for the bandwidth limitations of each accessory.

Referring derating over frequency graphs are available in the MMCX Probe Series instruction manual.

Model Number	Noise ^{2,3} (Input referred)	Propagation Delay	Compensation Range	Probe Type	Input Coupling of the Measuring Instrument
MMCX-P0725	n/a	< 5 ns	10 pF – 25 pF	passive	1 MΩ
MMCX-P0610	n/a	< 5 ns	10 pF – 20 pF	passive	1 MΩ
MMCX-A1025 ⁴	0.3 mV AC rms, 54.8 nV sqrt(Hz), (measured DC-30 MHz)	< 6 ns	n/a	active	50 Ω

The following specification is valid for all models:

Maximum Rated Input Voltage ± 42V peak, 30 V rms, ± 60 V DC
Pollution Degree 2

Mechanical Specifications

Parameter	Specification
Weight (Probe only)	45g (passive) / 110g (active)
Length	1.2 m
Probe Input	MMCX (Male)
Output Connector	BNC (Male) ⁵

Notes

¹ Determined with a Tektronix 6GHz MSO6B series oscilloscope

² Only applicable for active probe models MMCX-A

³ RMS noise [mV] at 500MHz bandwidth; noise in [nV/sqrt(Hz)] at 100MHz

⁴ A power supply is required and needs to be ordered separately.

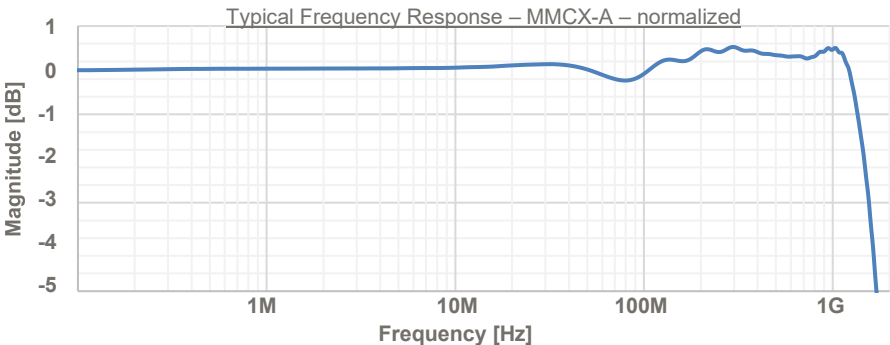
⁵ Depending on model, available with or without read-out

Environmental Specifications

Parameter		Specification
Temperature Range	Operating	-40 °C to +60 °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 +45 °C, non-condensing humidity
	Non-Operating	95 % relative humidity for temperatures up to +40 °C
Altitude	Operating	up to 2000 m
	Non-Operating	up to 15000 m

Typical Frequency Response

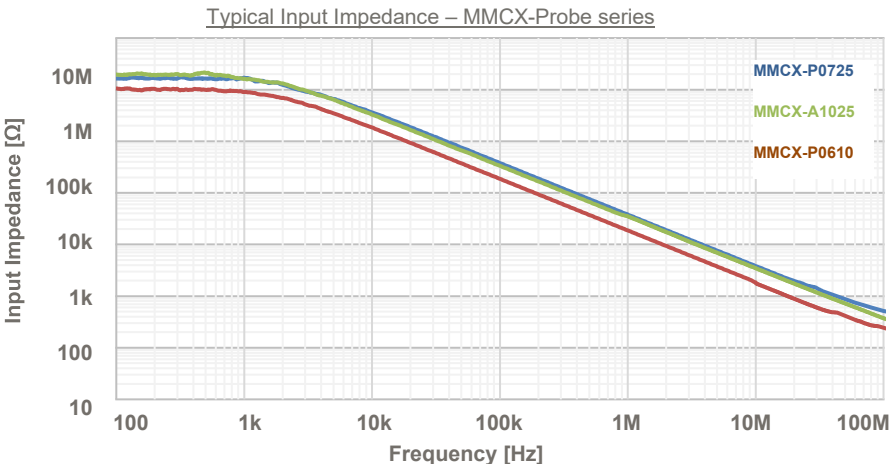
The frequency response plot shown here is for the active probe model, without any accessories. Frequency responses with specific accessories, or step responses are available on request.



Typical Input Impedance



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



Dimensions

Please review dimensions of standard MMCX connectors.

Probe Accessory Ratings

MMCX Adapter to 3x square pin holes (-) (+) (-), 2.54mm pitch each (018-294-270)



For high-frequency voltage measurements

Maximum Rated Input Voltage	42V peak, 30 V rms, 60 V DC
Pollution Degree	2



MMCX Adapter to 2x square pin holes (+) (-), 2.54mm pitch (018-294-276)



For high-frequency voltage measurements

Maximum Rated Input Voltage	42V peak, 30 V rms, 60 V DC
Pollution Degree	2



Factory Calibration

The active probe models are shipped with calibration certificate. For the passive probe models, the certificate is optional.

Annual re-calibration of the active probes is recommended. ISO17025 calibration upon delivery or as re-calibration will be possible on request.

Cleaning

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

Adjustment Procedures for passive probes MMCX-P

The passive probe MMCX-P models can be adjusted for low frequency (LF) compensation and for high frequency (HF) compensation.

A factory calibration is possible at any time on request.



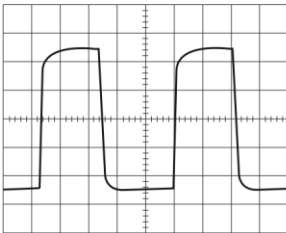
The trimmers are sensitive components. Too much mechanical pressure during adjustment might damage the trimmers.

LF Compensation

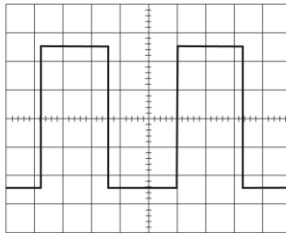
When the probe is connected to the oscilloscope input the first time, the probe's cable capacitance needs to be matched to the oscilloscope input capacitance. This matching assures good amplitude accuracy from DC to the probe's bandwidth.

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

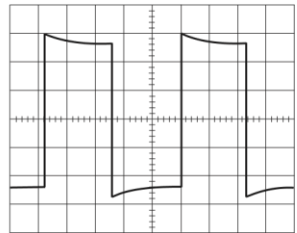
LF compensation is performed by connecting the probe to the CAL – output on the oscilloscope front panel and adjusting the LF compensation trimmer to optimum square wave response. For clarification see below figures.



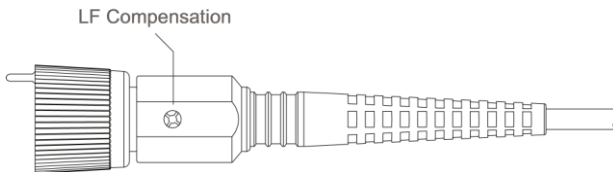
undercompensated



optimum



overcompensated



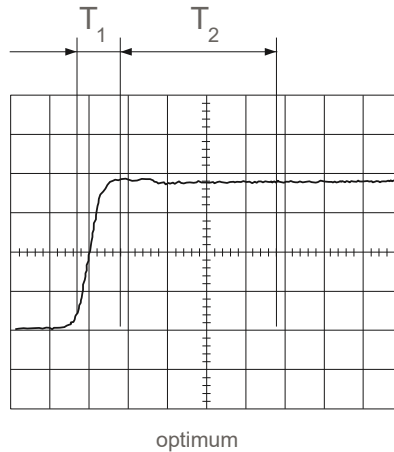
HF Compensation

Overshoot doesn't necessarily need to be adjusted when connecting the probe to your oscilloscope for the first time.

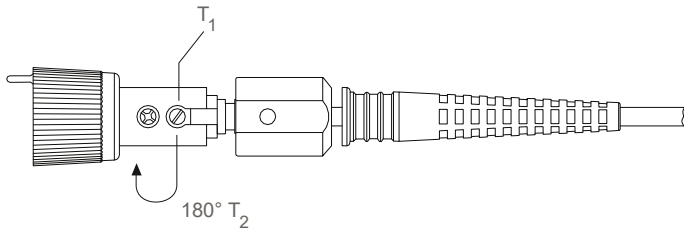
We recommend using the following equipment for proper HF compensation:

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.



Adjust trimmers (T_1 and T_2) for optimum square wave response.



T_1 and T_2 are used for HF compensation.

MMCX Handling Information

When using MMCX connectors, insert the probe's MMCX plug straight into the mating socket until a "click" sound occurs to indicate a proper connection between the plug and socket.



When removing the probe's MMCX input from the MMCX socket, make sure the circuit under test is de-energized.

Then grasp the probe's MMCX connector and pull straight out, taking care not to wiggling the connector side-to-side to prevent excessive stresses on the socket and its connection to the DUT.

Observe a disengagement force of <8N for longest MMCX connector lifetime.

Scope of Delivery

A power supply and referring connection cable are required for the active probe models only. See chapter "Ordering Information" to review the selection.

1x MMCX Probe	
1x Adaptor FF-SQ-MMCX MMCX to 2x 0.025" (0.635mm) socket, -40°C to +125°C	
1x P25-2 Pico Hook™ red, for use with FF-SQ-MMCX5	
1x P25-0 Pico Hook™ black, for use with FF-SQ-MMCX5	
1x Instruction Manual	n/a
1x <i>Factory Calibration Certificate (only with active probe model MMCX-A1025)</i>	n/a
1x <i>890-520-900 Power supply cable (0.6 m), (only with active probe model MMCX-A1025)</i>	



The accessories for this probe series have been safety tested.
Do not use any other accessories or power supplies than what is recommended.

Ordering Information

Step 1: Select Base Probe

MMCX-P0725	Passive probe with MMCX input, 700MHz, 42V peak, 25:1, 1.2m cable length, calibration certificate not included
MMCX-P0610	Passive probe with MMCX input, 600MHz, 42V peak, 10:1, 1.2m cable length, calibration certificate not included
MMCX-P0610-RO	Passive probe with MMCX input, 600MHz, 42V peak, 10:1, 1.2m cable length, calibration certificate not included, dividing factor read-out function
MMCX-A1025	Active probe with MMCX input, 1GHz, 42V peak, 25:1, 1.2m cable length, calibration certificate included, power supply and connection cable required and need to be ordered separately

Step 2: Select Additional Accessories

The specific frequency derating of each accessory is coming soon.

Note that any additional accessory degrades the probe's performance. Always observe the Maximum Input Voltage of the probe's input. Do not use any other accessories.

018-294-270

Adapter MMCX to 3x square pin holes with 2.54mm pitch each (-) (+) (-)
for high-frequency voltage measurements



018-294-276

Adapter MMCX to 2x square pin holes with 2.54mm pitch each (-) (+)
for high-frequency voltage measurements



FF-SQ-MMCX5

5x MMCX to 2x 0.025" (0.635mm) socket, -40°C to +125°C
(One adaptor included in scope of delivery)



FF-HTSPAD-MMCX3

3x MMCX solder-in cable adapter HT, 50Ω RF micro coax
to flex solder-in pad, -40°C to +155°C



FF-HTS-MMCX2

2x MMCX solder-in cable adapter HT, MMCX socket with
50Ω RF micro coax cable and open end, -40°C to +155°C



FF-UFL-MMCX2

2x MMCX cable adapter, MMCX socket with 50Ω RF micro
coax cable to UFL socket, -40°C to +125°C



FF-2XR-MMCX

MMCX to 2x XR Mini-Hook



972416100

2-pole test clip SMD for use with FF-SQ-MMCX5



P25-2

Pico Hook™ red for use with FF-SQ-MMCX5
(included in scope of delivery)



P25-0

Pico Hook™ black for use with FF-SQ-MMCX5
(included in scope of delivery)



890-502-130

SMD test grabber, 1 Pair, blue/red



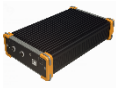
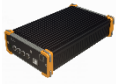
D010031

50Ω BNC feed-through for 1MΩ input oscilloscopes



Step 3: Select Power Supply (Active Models only)

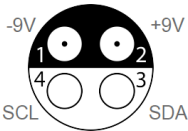
A wall plug power supply or multi-channel power supply with power supply cable are required for the models MMCX-A only, and available separately. The probe series has no functionality for remote control.

889-09V-PS2	2ch power supply PS-02 with USB for remote and offset control	
889-09V-PS2-L	2ch power supply PS-02-L with LAN and USB for remote and offset control	
889-09V-PS3	4ch power supply PS-03 with USB for remote and offset control	
889-09V-PS3-L	4ch power supply PS-03-L with LAN and USB for remote and offset control	
889-09V-PS6	8ch power supply PS-06 with USB for remote and offset control	
889-09V-PS6-L	8ch power supply PS-06-L with LAN and USB for remote and offset control	
889-09V-AP01	1ch Battery pack AP-01, no remote or offset control capabilities	
889-09V-PS5	International wall plug power supply PS-05, no remote or offset control capabilities, primary adapters for EU, UK und USA	
890-520-900	Power supply cable 0.6m <i>Included with MMCX-A probes</i>	
890-520-915	Power supply cable 1.5m	



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

Observe Connector Pin-Out
for PMK power supply cables



Step 4: Select Accredited Calibration

on request

ISO 17025 (re-)calibration

Notes

[illegible]



Mess- und Prüftechnik. Die Experten.

**Ihr Ansprechpartner /
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Änderungen der Spezifikationen vorbehalten.