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## **FireFly® Series**

### **High Voltage Optically-Isolated Probes with Universal BNC Interface**

**>1.5 GHz, >180 dB CMRR**

**Instruction Manual**



## About FireFly® Series

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The FireFly® high voltage optically isolated probes offer industry leading performance that combines the ability to accurately resolve high bandwidth, small differential signals in the presence of large common mode voltages with its ultra-high common mode rejection performance across its entire bandwidth. With >1.5 GHz bandwidth, wide differential input range, unmatched common mode rejection ratio CMRR up to >180 dB (1 billion to 1 rejection), and a 60 kV common mode, FireFly® is the ideal measurement solution for both GaN and SiC device characterization and system level design development.

PMK's optically isolated interface and unique compact angled probe head design are the key attributes that set FireFly® apart from the other solutions in the market, providing very stable and accurate measurements over a wide temperature range and easy access to the measurement points in tight spaces.

The compact angled probe head design allows for shorter tip cables to be used, resulting in higher signal fidelity measurements and reduced stresses placed on the measurement test point. FireFly®'s wide selection of probe tip connections and accessories offer reliable, hands-free, high-fidelity connectivity to the measurement points. Using industry standard MMCX and square pins connections allow FireFly® to easily interface to test boards that have already been designed with these test points.

FireFly® has a universal BNC output connector and is compatible with any oscilloscope with a 50  $\Omega$  input impedance or 1 M $\Omega$  input impedance and a 50  $\Omega$  feed-through termination, allowing FireFly® to be used on any oscilloscope in the lab.

For accurate deskew, each probe's unique propagation delay is measured and added to each probe label.

The FireFly® probe head can be powered either with a power-over-fiber adapter for 24/7 continuous operation (FF-1500A-10m is not compatible with FF-POF-A01) or by an easy to change, rechargeable, industry standard 18650 battery that provides continuous operation for up to 30h at room temperature. The interface box is powered in both cases by the required PMK power supply. The multichannel power supplies all have remote control capabilities and therefore a USB interface and optional additional LAN interface. As an alternative for most flexible use, the 1 channel battery pack power supply AP-01 provides >8h of portable and isolated operation but has no software remote control.

FireFly® series has the capability to be controlled from either remote control, or the controls located on the interface box.

For remote control PMK offers the software "PMK Probe Control" with graphical user interface, which is shipped with any multichannel power supply, and is available for download at:

<http://www.pmk.de/en/products/probecontrol>

In addition, the Python package "PMK-probes" is available as a programming interface for controlling PMK's active probes. Installation instructions, examples and documentation can be found here:

<https://pmk-probes.readthedocs.io/en/latest/>

## 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](http://www.pmk.de)

Specifications that are marked with \* are guaranteed, others are typical. Do not exceed specifications. Allow the probe to warm up for 20 minutes. The probe head and tip cables are not for handheld use. The probe can be used without the probe tip. To achieve the most accurate measurement results, review the "Getting Started" section in the Instruction Manual. This probe comes with 1 year warranty.

### Electrical Specifications<sup>1</sup>

Observe adequate spacing between probe head components and earth ground. This product is not rated for CAT II, III or IV. Do not exceed the specifications. Use original PMK power supplies only.

#### Probe Head Specifications:

| Probe Head                 | FF-0600A                 | FF-1000A                 | FF-1500A              | FF-1500A-10m          |
|----------------------------|--------------------------|--------------------------|-----------------------|-----------------------|
| Bandwidth *<br>(-3 dB)     | 600 MHz                  | 1 GHz                    | 1.5 GHz               | 1.5 GHz               |
| Rise-Time *<br>(10 – 90 %) | < 580 ps **              | < 350 ps **              | < 250 ps              | < 250 ps              |
| Noise<br>(Input Referred)  | < 2 mV <sub>RMS</sub> ** | < 2 mV <sub>RMS</sub> ** | < 2 mV <sub>RMS</sub> | < 3 mV <sub>RMS</sub> |

#### Probe Tips Specifications<sup>10</sup>:

| Probe Tips   | Bandwidth *<br>(-3 dB) | Rise time *<br>(10% - 90%) | Input<br>Attenuation | Input Impedance <sup>2</sup> |
|--------------|------------------------|----------------------------|----------------------|------------------------------|
| SMA Input    | See Probe Head Specs.  |                            | 1X                   | 200 kΩ    5.1 pF             |
| FF-MMCX-1V   | > 1.5 GHz              | <250 ps                    | 1X                   | 50 Ω <sup>3</sup>            |
| FF-MMCX-10V  | > 1.3 GHz              | <280 ps                    | 10X                  | 2 MΩ    3.4 pF               |
| FF-MMCX-25V  | > 1.3 GHz              | <280 ps                    | 25X                  | 4.9 MΩ    2.1 pF             |
| FF-MMCX-50V  | > 1.3 GHz              | <280 ps                    | 50X                  | 10 MΩ    2.0 pF              |
| FF-MMCX-100V | > 1.3 GHz              | <280 ps                    | 100X                 | 9.5 MΩ    2.1 pF             |
| FF-MMCX-250V | > 1.3 GHz              | <280 ps                    | 250X                 | 20 MΩ    2.1 pF              |
| FF-WSQ-500V  | > 1.0 GHz              | <300 ps                    | 500X                 | 40 MΩ    2.8 pF              |
| FF-WSQ-1000V | > 1.0 GHz              | <300 ps                    | 1000X                | 40 MΩ    2.9 pF              |
| FF-WSQ-1500V | > 1.0 GHz              | <300 ps                    | 1500X                | 40 MΩ    2.7 pF              |
| FF-WSQ-2500V | > 1.0 GHz              | <300 ps                    | 2500X                | 40 MΩ    2.5 pF              |

#### Maximum Rated Input Voltages <sup>4</sup>

| Common Mode Voltage <sup>5</sup><br>(Maximum Voltage to Earth) | ± 60 kV (DC + Peak AC)                                       |                                                                                   |
|----------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------|
| No Measurement Category                                        | Linear Input Voltage<br>Range<br>(DC + Peak AC) <sup>2</sup> | Maximum Non-Destruct<br>Differential Input Voltage<br>(DC + Peak AC) <sup>2</sup> |
| SMA Input                                                      | ± 1 V                                                        | 5 V                                                                               |
| FF-MMCX-1V                                                     | ± 1 V                                                        | 5 V                                                                               |
| FF-MMCX-10V                                                    | ±10 V                                                        | 50 V                                                                              |

See footnotes at end of Electrical Specifications section.

Electrical Specifications (Continued)

|                  |          |           |
|------------------|----------|-----------|
| FF-MMCX-25V      | ± 25 V   | 100 V     |
| FF-MMCX-50V      | ± 50 V   | 100 V     |
| FF-MMCX-100V     | ± 100 V  | 200 V     |
| FF-MMCX-250V     | ± 250 V  | 300 V     |
| FF-WSQ-500V      | ± 500 V  | 3000 V ** |
| FF-WSQ-1000V     | ± 1000 V | 3000 V ** |
| FF-WSQ-1500V     | ± 1500 V | 3000 V ** |
| FF-WSQ-2500V     | ± 2500 V | 3000 V ** |
| Pollution Degree | 2        |           |

| Common Mode Rejection Ratio        | DC                                                                                                                                                                                             | 1 MHz  | 100 MHz | 200 MHz                                                        | 500 MHz | 1 GHz <sup>1</sup> |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|----------------------------------------------------------------|---------|--------------------|
| SMA Input                          | > 180 dB                                                                                                                                                                                       | 165 dB | 124 dB  | 122 dB                                                         | 121 dB  | 118 dB             |
| FF-MMCX-1V                         | > 180 dB                                                                                                                                                                                       | 153 dB | 113 dB  | 110 dB                                                         | 109 dB  | 107 dB             |
| FF-MMCX-10V                        | > 180 dB                                                                                                                                                                                       | 144 dB | 105 dB  | 100 dB                                                         | 97 dB   | 95 dB              |
| FF-MMCX-25V                        | > 180 dB                                                                                                                                                                                       | 137 dB | 91 dB   | 87 dB                                                          | 86 dB   | 86 dB              |
| FF-MMCX-50V                        | > 180 dB                                                                                                                                                                                       | 132 dB | 86 dB   | 83 dB                                                          | 80 dB   | 81 dB              |
| FF-MMCX-100V                       | > 180 dB                                                                                                                                                                                       | 126 dB | 80 dB   | 77 dB                                                          | 72 dB   | 70 dB              |
| FF-MMCX-250V                       | > 180 dB                                                                                                                                                                                       | 122 dB | 75 dB   | 71 dB                                                          | 69 dB   | 68 dB              |
| FF-WSQ-500V                        | > 180 dB                                                                                                                                                                                       | 101 dB | 63 dB   | 60 dB                                                          | 51 dB   | 49 dB              |
| FF-WSQ-1000V                       | > 180 dB                                                                                                                                                                                       | 94 dB  | 59 dB   | 56 dB                                                          | 46 dB   | 42 dB              |
| FF-WSQ-1500V                       | > 180 dB                                                                                                                                                                                       | 91 dB  | 55 dB   | 51 dB                                                          | 43 dB   | 35 dB              |
| FF-WSQ-2500V                       | > 180 dB                                                                                                                                                                                       | 89 dB  | 52 dB   | 45 dB                                                          | 41 dB   | 32 dB              |
| DC Gain Accuracy                   | < 2 % ± DC Offset voltage                                                                                                                                                                      |        |         |                                                                |         |                    |
| Noise (input referred)             | FF-0600A (2 m fiber cable):<br>SMA Input (1X): < 2 mV rms **                                                                                                                                   |        |         | FF-1000A (2 m fiber cable):<br>SMA Input (1X): < 2 mV rms **   |         |                    |
|                                    | FF-1500A (2 m fiber cable):<br>SMA Input (1X): < 2 mV rms                                                                                                                                      |        |         | FF-1500A-10m (10 m fiber cable):<br>SMA Input (1X): < 3 mV rms |         |                    |
|                                    | With tip cable: (SMA Input noise) x (Tip cable input attenuation) <sup>7</sup><br>scales proportionally to tip attenuation                                                                     |        |         |                                                                |         |                    |
| DC Offset Voltage (input referred) | SMA Input (1X): < 1.5 mV (After Auto-Zero) <sup>8</sup><br>With tip cable: (SMA Input offset voltage) x (Tip cable input attenuation) <sup>9</sup><br>scales proportionally to tip attenuation |        |         |                                                                |         |                    |
| Temperature Drift                  | < 0.05 %/°C                                                                                                                                                                                    |        |         |                                                                |         |                    |
| Propagation Delay                  | 2 m fiber cable: ~ 15 ns                                                                                                                                                                       |        |         | 10 m fiber cable: ~ 55 ns                                      |         |                    |
|                                    | The probe specific value is measured and printed on interface box label,<br>tip cable approx. 500 ps                                                                                           |        |         |                                                                |         |                    |
| Battery Life                       | > 30 h @ 22 °C – 25 °C, > 20 h @ 0 °C, >4 h @ 50 °C<br>Dependent on probe head operating temperature<br>(Continuous Operation)                                                                 |        |         |                                                                |         |                    |
| Output Termination & Coupling      | 50 Ω DC                                                                                                                                                                                        |        |         |                                                                |         |                    |
| Battery Type                       | Protected 18650 Li-Ion, Rechargeable, 3.7 V Certified                                                                                                                                          |        |         |                                                                |         |                    |
| Laser Certification                | Laser Class 1<br>IEC/EN 60825-1:2014, US 21CFR Part 1010, US 21CFR Part 1040                                                                                                                   |        |         |                                                                |         |                    |

## Notes:

\* Guaranteed specification

\*\* Preliminary specification

<sup>1</sup> Determined when using a PS-02 power supply at +23 °C ambient temperature.<sup>2</sup> For input voltage and input impedance derating graphs review the FireFly® instruction manual.<sup>3</sup> Terminated, 50  $\Omega$  transmission line.<sup>4</sup> As defined in IEC 61010-1. Rated for indoor, dry location use only.<sup>5</sup> Galvanically isolated FireFly® probe head through fiber optic connection.<sup>6</sup> CMRR performance is >180 dB below 100 kHz. See CMRR graph.<sup>7</sup> Example: 10x tip FF-MMCX-10V noise = 10x SMA input noise.<sup>8</sup> For long cable versions, the DC offset is more sensitive, so do not move the fiber cable during measurements.<sup>9</sup> Example: 10x tip FF-MMCX-10V offset = 10x SMA input offset.<sup>10</sup> Total bandwidth may be limited depending on FireFly model used<sup>11</sup> Only applicable for FF-1500A & FF-1500A-10m

## Environmental Specifications

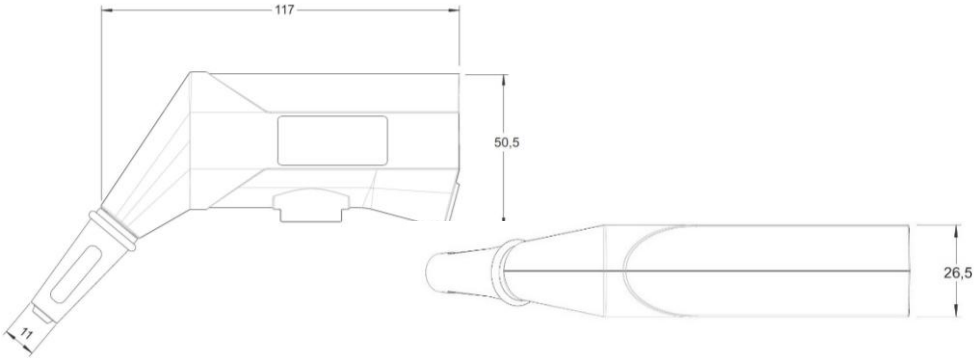
| Parameter                 | Specification |                            |                                                                                                              |
|---------------------------|---------------|----------------------------|--------------------------------------------------------------------------------------------------------------|
| Temperature Range         | Operating     | Probe Head                 | 0 °C to +50 °C                                                                                               |
|                           |               | Interface Box              | 0 °C to +40 °C                                                                                               |
|                           |               | Tip Cables & Adapters      | -40 °C to +85 °C                                                                                             |
|                           | Non-Operating | Probe Head & Interface Box | -20 °C to +71 °C                                                                                             |
|                           |               | Tip Cables & Adapters      | -40 °C to +85 °C                                                                                             |
| Maximum Relative Humidity | Operating     | Probe Head                 | 5 % to 85 % RH (relative humidity) at up to +40 °C, 5 % to 45 % RH above +40 °C up to +50 °C, non-condensing |
|                           |               | Interface Box              | 5 % to 85 % RH (relative humidity) at up to +40 °C, non-condensing                                           |
|                           | Non-Operating | Tip Cables & Adapters      | 5 % to 85 % RH (relative humidity) at up to +85 °C, non-condensing                                           |
|                           |               | Probe Head & Interface Box | 5 % to 85 % RH (relative humidity) at up to +40° C, 5 % to 45 % RH above +40° C up to +71° C, non-condensing |
| Maximum Altitude          | Operating     |                            | 3000 m (9843 ft)                                                                                             |
|                           | Non-Operating |                            | 15000 m (49213 ft)                                                                                           |

## Physical Specifications

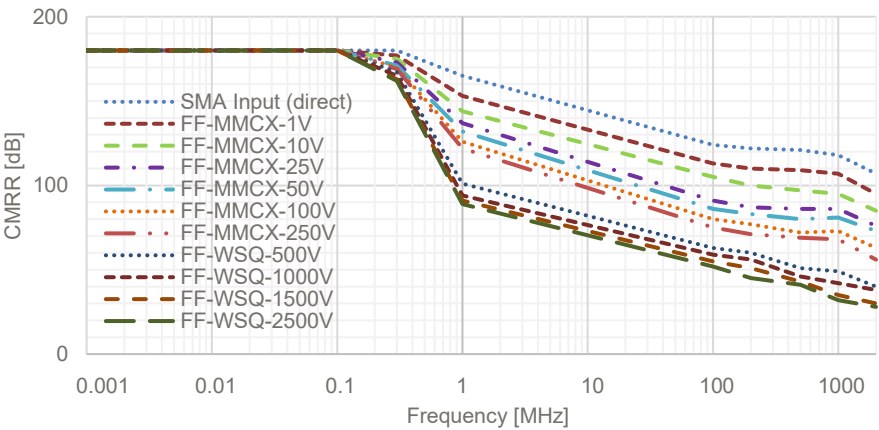
| Parameter  | Specification |                                                                        |
|------------|---------------|------------------------------------------------------------------------|
| Weight     | Probe         | 2 m: 325 g / 10 m: 625 g                                               |
|            | Tip Cable     | 11 g                                                                   |
| Length     | Tip Cable     | 9.5 cm (3.74")                                                         |
|            | Fiber Cable   | 2 m (6.56 ft) / 10 m (32.81 ft)                                        |
| Connectors | Probe         | Input: SMA (Female) – Probe Head<br>Output: BNC (Male) - Interface Box |

Dimensions

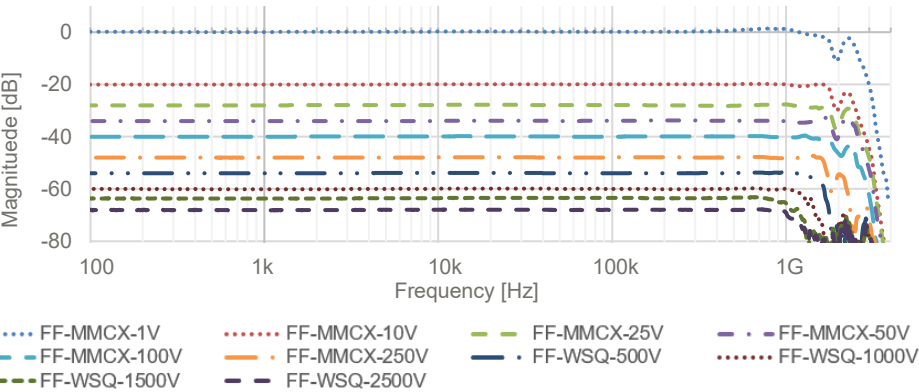
The dimensions shown are in mm. If a specific drawing is needed, please contact us via [sales@pmk.de](mailto:sales@pmk.de)



Typical Common Mode Rejection Ratio (CMRR)<sup>11</sup>



Typical Frequency Response<sup>11</sup>



<sup>11</sup> Valid for FF-1500A model only

## Typical Maximum Differential Input Voltage (CW)

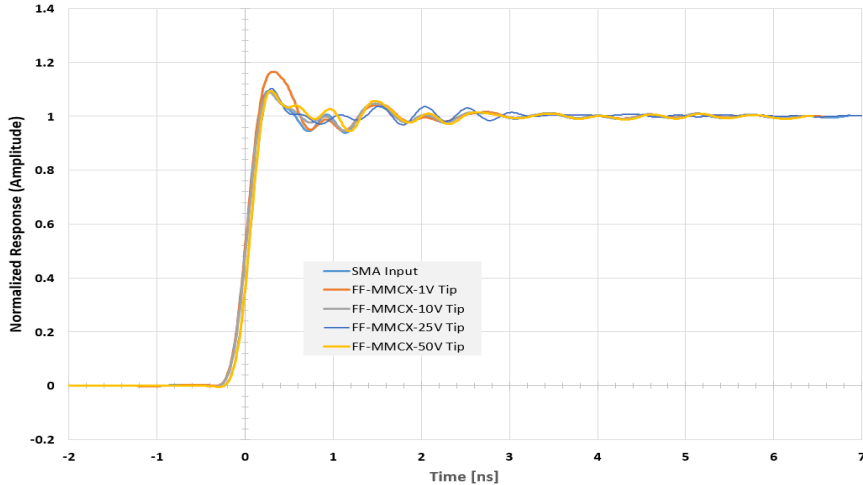


Note that the maximum input voltage rating of the probe decreases as the frequency of the applied signal increases.

*The maximum input voltage derating is coming soon.*

## Typical Pulse Response<sup>11</sup>

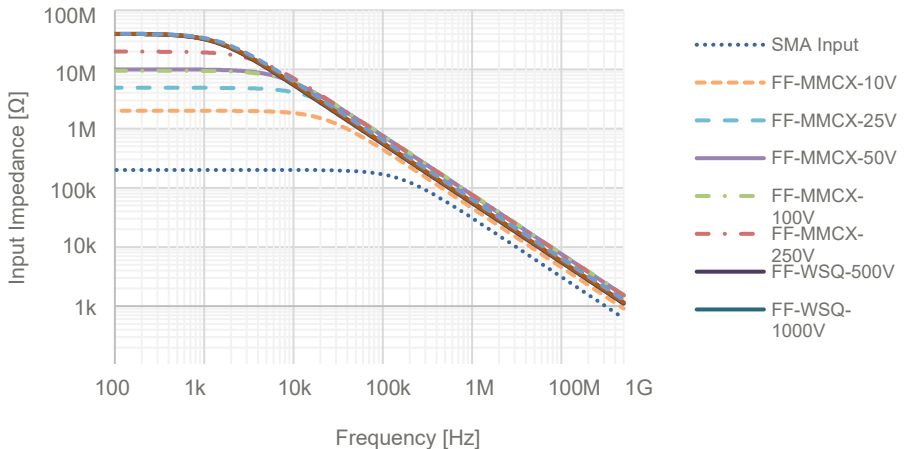
The graphs are normalized to 1 for better comparison.



## Typical Differential Input Impedance



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



<sup>11</sup> Valid for FF-1500A model only

Probe Accessory Ratings



Do not exceed any accessory rating or the ratings of other components of this product series.



For high-frequency voltage measurements

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

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



The following ratings are only valid for non-handheld use in the hazard zone:

|                              |                              |
|------------------------------|------------------------------|
| Maximum Rated Input Voltage: | 130 V DC + AC pk, 400V pulse |
| Pollution Degree:            | 2                            |

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

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



The following ratings are only valid for non-handheld use in the hazard zone:

|                              |                              |
|------------------------------|------------------------------|
| Maximum Rated Input Voltage: | 130 V DC + AC pk, 400V pulse |
| Pollution Degree:            | 2                            |

Extension lead for FireFly® HV tips (5.08 mm pitch) to 2x 4 mm safety (male) banana plugs (FF-WSQ-4mm-2, Set of 2)

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



The following ratings are only valid for non-handheld use in the hazard zone:

|                                |                                 |
|--------------------------------|---------------------------------|
| Maximum Rated Input Voltage *: | 2500 V DC + AC pk, 3000 V pulse |
| Pollution Degree:              | 2                               |

Extension lead for FireFly® HV tips (5.08 mm pitch) to Ø4 mm opening spades (FF-WSQ-SPADE-2, Set of 2)

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



The following ratings are only valid for non-handheld use in the hazard zone:

|                                |                                 |
|--------------------------------|---------------------------------|
| Maximum Rated Input Voltage *: | 2500 V DC + AC pk, 3000 V pulse |
| Pollution Degree:              | 2                               |



Observe the minimum required distance between contacts.

Notes:

\* Observe input voltage range of the FireFly probe tip. See Electrical Specification table in this document.

## Scope of Delivery

Not all required items are included in the scope of delivery of the base probe FireFly® FF-1500A/FF-1500A-10m. See Ordering Information to configure your individual probing solution and select a required PMK power supply. The following is included in the scope of delivery.

- **FF-0600A or FF-1000A or FF-1500A or FF-1500A-10m** FireFly® base probe,  $\pm 1$  V input range
- **890-520-900** Interface box probe connection cable (0.6 m)
- **FF-2FOOTER**A Probe head holder 2-Footer (Bi-Pod), strong magnetic holding force
- **891-102-CMRR** CMRR Noise Suppression Kit for Firefly®
- 2x 18650 rechargeable Lithium-Ion batteries
- USB Wall charger + USB cable (for battery charging) *Charger type may vary by region*
- Set cable coding rings (3x4 colors)
- Carrying case (black, plastic)
- Instruction Manual
- Safety Information
- Factory calibration certificate



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

## Ordering Information

### Step 1: Select Probe Head

|                     |                                                                                                                                                                                                                          |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FF-0600A</b>     | FireFly® optical isolated probe, 600 MHz, >180 dB, 2 m fiber cable (2 batteries and 2footer included, required power supply to be ordered separately)                                                                    |
| <b>FF-1000A</b>     | FireFly® optical isolated probe, 1.0 GHz, >180 dB, 2 m fiber cable (2 batteries and 2footer included, required power supply to be ordered separately)                                                                    |
| <b>FF-1500A</b>     | FireFly® optical isolated probe, 1.5 GHz, >180 dB, 2 m fiber cable (2 batteries and 2footer included, required power supply to be ordered separately)                                                                    |
| <b>FF-1500A-10m</b> | FF-1500A with 10 m fibre cable, (2 batteries and 2footer included, required power supply to be ordered separately)                                                                                                       |
| <b>FF-POF-A01</b>   | Power-Over-Fiber adapter for 24/7 continuous operation of a 2 m FireFly®'s probe head without using the 18650 battery at room temperature. One additional power supply channel is required. Any 2 m FireFly is required. |



The POF adapter is not compatible with the 10 meter FF-1500A-10m.

### Step 2: Select Probe Tip Cables

The probe tip cables are interchangeable without requiring any tools. The probe head SMA input range is  $\pm 1$  V with no attenuation. Also review our new ultra-fast current shunt series UFCS on [www.pmk.de](http://www.pmk.de).

|                    |                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>FF-MMCX-1V</b>  | FireFly® probe tip cable, MMCX, $\pm 1$ V, >1.5 GHz, 1x attenuation, 50 $\Omega$ terminated for shunt measurements |
| <b>FF-MMCX-10V</b> | FireFly® probe tip cable, MMCX, $\pm 10$ V, >1.3 GHz, 10x attenuation                                              |
| <b>FF-MMCX-25V</b> | FireFly® probe tip cable, MMCX, $\pm 25$ V, >1.3 GHz, 25x attenuation                                              |
| <b>FF-MMCX-50V</b> | FireFly® probe tip cable, MMCX, $\pm 50$ V, >1.3 GHz, 50x attenuation                                              |

**Select Probe Tip Cables (Continued)**

|                     |                                                                                   |
|---------------------|-----------------------------------------------------------------------------------|
| <b>FF-MMCX-100V</b> | FireFly® probe tip cable, MMCX, $\pm 100$ V, $>1.3$ GHz, 100x attenuation         |
| <b>FF-MMCX-250V</b> | FireFly® probe tip cable, MMCX, $\pm 250$ V, $>1.3$ GHz, 250x attenuation         |
| <b>FF-WSQ-500V</b>  | FireFly® probe tip cable for 5.08 mm square pins, $\pm 500$ V, $>1.0$ GHz, 500x   |
| <b>FF-WSQ-1000V</b> | FireFly® probe tip cable for 5.08 mm square pins, $\pm 1$ kV, $>1.0$ GHz, 1000x   |
| <b>FF-WSQ-1500V</b> | FireFly® probe tip cable for 5.08 mm square pins, $\pm 1.5$ kV, $>1.0$ GHz, 1500x |
| <b>FF-WSQ-2500V</b> | FireFly® probe tip cable for 5.08 mm square pins, $\pm 2.5$ kV, $>1.0$ GHz, 2500x |

**Step 3: Select Connectivity Accessories**

Observe the frequency derating of each accessory. Observe 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 2.54 mm pitch each (-) (+) (-)  
for high-frequency voltage measurements

Also available as packs: 10 pcs **018-294-270x10**, 25 pcs **018-294-270x25**

**018-294-276**

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

Also available as packs: 10 pcs **018-294-276x10**, 25 pcs **018-294-276x25**

**FF-SQ-MMCX5**

5x MMCX to 2x 0.025" (0.635 mm) socket,  $-40$  °C to  $+125$  °C

**FF-HTSPAD-MMCX3**

3x MMCX solder-in cable adapter HT, 50  $\Omega$  RF micro coax  
to flex solder-in pad,  $-40$  °C to  $+155$  °C (green = 0  $\Omega$ , yellow = 36  $\Omega$ , red = 75  $\Omega$ )  
Probe tip solder-in adapters have different damping resistor values to reduce  
eventually occurring ringing/oscillations:

0  $\Omega$  = no damping

36  $\Omega$  = light to medium damping

75  $\Omega$  = heavy damping

**FF-HTS-MMCX2**

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

**FF-UFL-MMCX2**

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

**FF-2XR-MMCX**

MMCX to 2x XR Mini-Hook

**FF-WSQ-4mm-2**

2x extension lead for FireFly® HV tips (5.08 mm pitch)  
to 2x 4 mm safety banana plugs (male), e.g. to use  
BumbleBee® series accessories

**FF-WSQ-SPADE-2**

2x extension lead for FireFly® HV tips (5.08 mm pitch)  
to spades ( $\varnothing 4$  mm opening)

**FF-MMCX-SPADE-3**

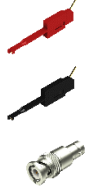
3x extension lead for FireFly® MMCX tips  
to spades ( $\varnothing 4$  mm opening)



**972416100** 2-pole test clip SMD for use with FF-SQ-MMCX5



- P25-2** Pico Hook™ red for use with FF-SQ-MMX5
- P25-0** Pico Hook™ black for use with FF-SQ-MMX5
- D010031** 50  $\Omega$  BNC feed-through for 1 M $\Omega$  input oscilloscopes



## Step 4: Select Shunt for Current Measurements

Each resistance model is available as single pack or as more cost-effective packs with 10 or 25 pieces.

The UFCS shunt needs 50 $\Omega$  termination, so an input tip cable with 50 $\Omega$  termination is required for use with these shunts, e.g. the 1X FF-MMX-1V. The Shunts all have a 50 $\Omega$  female SMA output, so an SMA to MMCX adapter is needed as well.

- UFCS-R001** 1 m $\Omega$ , >600 MHz bandwidth, 120 pH insertion inductance, 1250 A maximum pulse current @ 100  $\mu$ s, SMA (F) output, 1 pc.  
Also available as packs: 10 pcs **UFCS-R001x10**, 25 pcs **UFCS-R001x25**
- UFCS-R005** 5 m $\Omega$ , >900 MHz bandwidth, 140 pH insertion inductance, 300 A maximum pulse current @ 100  $\mu$ s, SMA (F) output, 1 pc.  
Also available as packs: 10 pcs **UFCS-R005x10**, 25 pcs **UFCS-R005x25**
- UFCS-R011** 11 m $\Omega$ , >1GHz bandwidth, 110 pH insertion inductance, 105 A maximum pulse current @ 100  $\mu$ s, SMA (F) output, 1 pc  
Also available as packs: 10 pcs **UFCS-R011x10**, 25 pcs **UFCS-R011x25**
- UFCS-R024** 24 m $\Omega$ , >1GHz bandwidth, 140 pH insertion inductance, 70 A maximum pulse current @ 100  $\mu$ s, SMA (F) output, 1 pc  
Also available as packs: 10pcs **UFCS-R024x10**, 25 pcs **UFCS-R024x25**
- UFCS-R052** 52 m $\Omega$ , >900 MHz bandwidth, 150 pH insertion inductance, 50 A maximum pulse current @ 100  $\mu$ s, SMA (F) output, 1 pc  
Also available as packs: 10 pcs **UFCS-R052x10**, 25 pcs **UFCS-R052x25**
- 018-291-970** Adapter for use of UFCS series shunts with FireFly® series.  
SMA plug to MMCX socket, 50  $\Omega$



## Step 5: Select Positioning System

- FF-3DPOS200A** FireFly® 3D Probe Positioner for 10 kV Insulation with steel base (893-100-001), arm with span width 200 mm (893-200-200), FireFly® non-conducting probe holder (FF-HAL10kV-A), Wrench 7 mm, strong magnetic holding force
- FF-HAL10kV-A3** FireFly® non-conducting probe holder, max 10 kV for use with PMK's 3D Probe Positioning Systems and SKID Probes and PCB Board holder systems, strong magnetic holding force, pack of 3 – spare parts
- FF-2FOOTER A** FireFly® positioner 2-Footer (Bipod), non-conducting, strong magnetic holding force - included in probe's scope of delivery



## Step 6: Select Power Supply

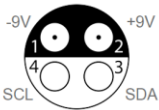
A PMK multi-channel power supply is required for using the probe, also when powering the probe head with the optional Power-over-Fiber adapter FF-POF-A01 instead of an 18650 battery.

|                      |                                                                            |                                                                                    |
|----------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>889-09V-PS2</b>   | 2ch power supply PS-02 with USB<br>for remote and offset control           |  |
| <b>889-09V-PS2-L</b> | 2ch power supply PS-02-L with LAN and USB<br>for remote and offset control |                                                                                    |
| <b>889-09V-PS3</b>   | 4ch power supply PS-03 with USB<br>for remote and offset control           |  |
| <b>889-09V-PS3-L</b> | 4ch power supply PS-03-L with LAN and USB<br>for remote and offset control |                                                                                    |
| <b>889-09V-PS6</b>   | 8ch power supply PS-06 with USB<br>for remote and offset control           |  |
| <b>889-09V-PS6-L</b> | 8ch power supply PS-06-L with LAN and USB<br>for remote and offset control |                                                                                    |
| <b>889-09V-AP01</b>  | 1ch Battery pack AP-01,<br>no remote or offset control capabilities        |  |
| <b>890-520-900</b>   | Power supply cable 0.6 m<br><i>Included with the probe</i>                 |  |
| <b>890-520-915</b>   | Power supply cable 1.5 m                                                   |                                                                                    |



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 7: Select Accredited Calibration

|                     |                            |
|---------------------|----------------------------|
| <b>KAL-DAKKS-FF</b> | ISO 17025 (re-)calibration |
|---------------------|----------------------------|

## Step 8: Select Additional Accessories

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| <b>D010031</b> | 50 Ω BNC feedthrough for use with 1 MΩ oscilloscope inputs, 0.5 W |
|----------------|-------------------------------------------------------------------|

If you need any non-published accessory, please contact us via [sales@pmk.de](mailto:sales@pmk.de)

## Notes

[illegible]

## Notes

[illegible]

## Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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Änderungen der Spezifikationen vorbehalten.