

TECHNICAL DATA

# Fluke 393 FC CAT III 1500 V True-rms Clamp Meter with iFlex



**The world's only CAT III 1500 V current clamp**

The 393 FC CAT III 1500 V True-rms Clamp Meter with iFlex is designed for technicians who work in dc environments up to 1500 V: solar arrays, wind power, electric railways, data centers battery banks for uninterruptible power supplies. The clamp will measure up to 1500 V dc, 1000 V ac, and up to 999.9 A dc or ac through the clamp jaw. The included iFlex flexible current probe extended ac current measurements up to 2500 amps.

This clamp has a thin jaw, giving you access to cables in crowded combiner boxes. Test leads are designed with your work in mind, and are also rated to CAT III 1500 V.

**Other key functions:**

- IP54 rated, ideal for work outdoors on solar arrays and wind power systems
- DC power measurement, showing readings in kVA
- Audio Polarity indicator helps prevent accidental miswires
- Visual Continuity turns provide a bright green light in the display, ideal when working in dark and noisy environments
- Logging and reporting of test results via Fluke Connect software

When measuring ac current the included iFlex flexible current probe gives you unparalleled access to cable in tight spaces. The iFlex probe can be twisted through extremely small spaces and provide accurate current measurements.



**MEASURE SAFELY**  
CAT III 1500 V rated clamp meter

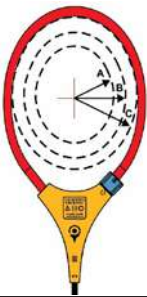
**VERSATILE CLAMP JAW**  
Thin jaw for access to cables in crowded combiner boxes, able to clamp around multiple cables

**IP54 RATED**  
Work outdoors in dusty or damp conditions

**MORE FUNCTIONS, AUTOMATIC SAFEGUARDS**  
Work efficiently with dc power measurement, audio polarity and visual continuity



## Specifications

General specifications																			
Maximum voltage between any terminal and earth ground	1000 V AC 1500 V DC																		
Batteries	2 AA IEC LR6 alkaline																		
Display	Dual display with backlight																		
Automatic power off	20 minutes																		
Electrical specifications																			
Accuracy	Accuracy is specified for 1 year after calibration, at operating temperatures of 18 °C to 28 °C, relative humidity at 0 % to 75 %. Accuracy specifications take the form of: ±[% of Reading] + [Number of Least Significant Digits].																		
Temperature coefficients	Add 0.1 x specified accuracy for each °C > 28 °C or < 18 °C																		
AC current: jaw																			
Range	999.9 A																		
Resolution	0.1 A																		
Accuracy	2 % + 5 digits (10 Hz to 100 Hz) 2.5 % + 5 digits (100 Hz to 500 Hz)																		
Crest Factor (50/60 Hz)	2.5 @ 600.0 A 3.0 @ 500.0 A 1.42 @ 999.9 A Add 2 % for C.F. >2																		
AC current: flexible current probe																			
Range	999.9 A 2500 A																		
Resolution	0.1 A (≤999.9 A) 1 A (≤2500 A)																		
Accuracy	3 % RD + 5 digits (10 Hz to 500 Hz)																		
Crest Factor (50/60Hz)	2.5 @ 1400 A 3.0 @ 1100 A 1.42 @ 2500 A Add 2 % for C.F. >2																		
Position sensitivity	<table border="1"> <thead> <tr> <th>Distance from Optimum</th> <th>i2500-10 Flex</th> <th>i2500-18 Flex</th> <th>Error</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.5 in (12.7 mm)</td> <td>1.4 in (35.6 mm)</td> <td>± 0.5 %</td> </tr> <tr> <td>B</td> <td>0.8 in (20.3 mm)</td> <td>2.0 in (50.8 mm)</td> <td>± 1.0 %</td> </tr> <tr> <td>C</td> <td>1.4 in (35.6 mm)</td> <td>2.5 in (63.5 mm)</td> <td>± 2.0 %</td> </tr> </tbody> </table> <p>Measurement uncertainty assumes centralized primary conductor at optimum position, no external electrical or magnetic field, and within operating temperature range.</p>			Distance from Optimum	i2500-10 Flex	i2500-18 Flex	Error	A	0.5 in (12.7 mm)	1.4 in (35.6 mm)	± 0.5 %	B	0.8 in (20.3 mm)	2.0 in (50.8 mm)	± 1.0 %	C	1.4 in (35.6 mm)	2.5 in (63.5 mm)	± 2.0 %
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DC current																			
Range	999.9 A																		
Resolution	0.1 A																		
Accuracy	2 % RD + 5 digits <sup>[1]</sup> <sup>[1]</sup> When using the <b>ZERO</b> function to compensate for offsets.																		
AC voltage																			
Range	600.0 V 1000 V																		
Resolution	0.1 V (≤600.0 V) 1 V (≤1000 V)																		
Accuracy	1 % RD + 5 digits (20 Hz to 500 Hz)																		

## Specifications (continued)

DC voltage	
Range	600.0 V 1500 V
Resolution	0.1 V ( $\leq 600.0$ V) 1 V ( $\leq 1500$ V)
Accuracy	1 % RD + 5 digits
mV dc	
Range	500.0 mV
Resolution	0.1 mV
Accuracy	1 % RD + 5 digits
Amps frequency: jaw	
Range	5.0 Hz to 500.0 Hz
Resolution	0.1 Hz
Accuracy	0.5 % RD + 5 digits
Trigger level	5 Hz to 10 Hz, $\geq 10$ A 10 Hz to 100 Hz, $\geq 5$ A 100 Hz to 500 Hz, $\geq 10$ A
Amps frequency: flexible current probe	
Range	5.0 Hz to 500.0 Hz
Resolution	0.1 Hz
Accuracy	0.5 % RD + 5 digits
Trigger level	5 Hz to 20 Hz, $\geq 25$ A 20 Hz to 100 Hz, $\geq 20$ A 100 Hz to 500 Hz, $\geq 25$ A
Voltage frequency	
Range	5.0 Hz to 500.0 Hz
Resolution	0.1 Hz
Accuracy	0.5 % RD + 5 digits
Trigger level	5 Hz to 20 Hz, $\geq 5$ V 20 Hz to 100 Hz, $\geq 5$ V 100 Hz to 500 Hz, $\geq 10$ V
DC power	
Range	600.0 kVA (600.0 V dc range) 1500 kVA (1500 V dc range)
Resolution	0.1 kVA 1 kVA
Accuracy	2 % RD + 2.0 kVA 2 % RD + 20 kVA
Resistance	
Range	600.0 $\Omega$ 6000 $\Omega$ 60.00 k $\Omega$
Resolution	0.1 $\Omega$ ( $\leq 600.0$ $\Omega$ ) 1 $\Omega$ ( $\leq 6000$ $\Omega$ ) 0.01 k $\Omega$ ( $\leq 60.00$ k $\Omega$ )
Accuracy	1 % RD + 5 digits
Capacitance	
Range	100.0 $\mu$ F 1000 $\mu$ F
Resolution	0.1 $\mu$ F ( $\leq 100.0$ $\mu$ F) 1 $\mu$ F ( $\leq 1000$ $\mu$ F)
Accuracy	1 % RD + 5 digits
Inrush trigger level	5 A

## Specifications (continued)

<b>Mechanical specifications</b>	
Size (L x W x H)	281 mm x 84 mm x 49 mm
Weight (with batteries)	520 g
Jaw opening	34 mm
Flexible current probe diameter	7.5 mm
Flexible current probe cable length (head to electronics connector)	1.8 m
<b>Environmental specifications</b>	
Operating temperature	-10 °C to 50 °C
Storage temperature	-40 °C to 60 °C
Operating humidity	Non-condensing (<10°C) ≤90 % RH (at 10 °C to 30 °C) ≤75 % RH (at 30 °C to 40 °C) ≤45 % RH (at 40 °C to 50 °C)
Operating altitude	2000 m
Storage altitude	12,000 m
Ingress Protection (IP) Rating	
<b>Electromagnetic Compatibility (EMC)</b>	
International	IEC 61326-1: Portable, Electromagnetic Environment, IEC 61326-2-2 CISPR 11: Group 1, Class A  Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself. <i>Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.</i> <i>Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.</i>
Korea (KCC)	Class A equipment (Industrial Broadcast and Communications Equipment) <i>Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.</i>
USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
<b>Safety</b>	
General	IEC 61010-1, Pollution Degree 2
Measurement	IEC 61010-2-032: CAT III 1500 V / CAT IV 600 V IEC 61010-2-033: CAT III 1500 V / CAT IV 600 V
<b>Wireless radio</b>	
Radio frequency certification	FCC ID: T68-FBLE, IC: 6627A-FBLE
Wireless radio frequency range	2400 MHz to 2483.5 MHz
Output power	<100 mW
SIMPLIFIED EU DECLARATION OF CONFORMITY Hereby, Fluke declares that the radio equipment contained in this Product is in compliance with Directive 2014/53/EU. The full text of the EU declaration is available at the following Internet address: _____	

**Ordering information**

**Fluke 393 FC CAT III 1500 V True-rms Clamp Meter with iFlex**

**Included**

- Fluke 393 FC CAT III 1500 V True-rms Clamp Meter with iFlex
- Test leads, CAT III 1500 V rated, right angle plugs, with safety caps
- iFlex 18 inch flexible current probe
- TPAK magnetic hanging strap
- Premium carrying case
- 3-year warranty



Visit [www.fluke.com](http://www.fluke.com) to get complete details on these products or ask your local Fluke sales representative.



Save all measurements, including dc power, to a smartphone and the cloud using Fluke Connect software.

**Preventive maintenance simplified. Rework eliminated.**

Save time and improve the reliability of your maintenance data by wirelessly syncing measurements using the Fluke Connect system.

- Eliminate data-entry errors by saving measurements directly from the tool and associating them with the work order, report or asset record.
- Maximize uptime and make confident maintenance decisions with data you can trust and trace.
- Move away from clipboards, notebooks and multiple spreadsheets with a wireless one-step measurement transfer.
- Access baseline, historical and current measurements by asset.
- Share your measurement data using ShareLive™ video calls and emails.
- The Fluke 1587 FC Insulation Multimeter is part of a growing system of connected test tools and equipment maintenance software. Visit the Fluke website to learn more about the Fluke Connect system.

Find out more at



All trademarks are the property of their respective owners. WiFi or cellular service required to share data. Smartphone, wireless service and data plan not included with purchase. First 5GB of storage is free.

Smartphone wireless service and data plan not included with purchase. Fluke Connect is not available in all countries.

**Fluke.** *Keeping your world up and running.*®

TECHNICAL DATA

# Fluke IRR1-SOL Solar Irradiance Meter



### HIGH PRECISION MONO-CRYSTALLINE SOLAR SENSOR

Instantaneous irradiance measurements up to 1400 W/m<sup>2</sup>

### TWO OPTIONS FOR TEMPERATURE MEASUREMENT

Use the built-in temperature sensor or the external suction mount temperature probe to measure ambient and panel temperature

### INTEGRATED COMPASS

Measure and document roof or site orientation

### INCLINATION SENSOR

Know roof and PV panel tilt when surveying, installing, or adjusting the installation

**Make the critical measurements needed for installing, testing, maintaining, and reporting on solar panels or photovoltaic systems with one, easy-to-use tool.**

The Fluke IRR1-SOL Irradiance Meter has been designed from the ground up to simplify the installation, commissioning, and troubleshooting of photovoltaic arrays, measuring irradiance, temperature, inclination and direction of the solar array in a single handheld tool. With a rugged, compact design, a protective carrying case, and an easy-to-read, high-contrast LCD screen to read measurements in direct sunlight, the IRR1-SOL can go where you go. The simple user interface, instantaneous solar irradiation measurements and built-in temperature sensor make it easy to meet the IEC 62446-1 requirements for testing, documenting, and maintaining photovoltaic systems. Additionally, the integrated compass and inclination sensor allow you to quickly measure and document roof and site orientation, pitch, and panel tilt while surveying, installing, or adjusting an installation.

Whether working on a roof-mounted system or on a large field installation, the IRR1-SOL is the single-handed solution that every solar installer and technician needs in their tool bag.

### Use the IRR1-SOL for:

#### Photovoltaic system design and surveying

To find the expected production at a site, determine your solar resource while taking shading into account. The solar resource is measured in peak sun hours: the number of hours per day with 1,000 watts generated per square meter of solar array. Location, time of day, season, and weather conditions all influence peak sun hours. Use the Fluke IRR1-SOL to determine the actual solar irradiance (Watts/m<sup>2</sup>) and shading at the site to develop a baseline.

#### Measuring

Once your system is installed, make sure it is operating as designed by measuring its electrical characteristics and the actual power output of the array. The performance of a photovoltaic array is based on its current-voltage (IV) curve. Use the IRR1-SOL to obtain the amount of solar irradiance necessary to calculate the IV curve of the power output.

#### Comparing and diagnosing

Even when installed correctly, a photovoltaic system may not be producing the expected electrical output. In order to produce the expected output the system needs to receive the correct amount of irradiance energy to generate the DC voltage that is fed into the inverter.

## Specifications

Irradiance	
Measuring Range	0 to 1400 W/m <sup>2</sup>
Resolution	1 W/m <sup>2</sup>
Measuring Accuracy	± (5 % + 5 Digit)
Temperature Measurement	
Measuring range (°C)	-22 °F to 212 °F (-30 °C to 100 °C)
Resolution	0.2 °F (0.1 °C) / 1 °F @ > 100 °F
Measuring Accuracy	±2 °F (±1 °C) @ 14 °F to 167 °F (-10 °C to 75 °C), ±4 °F (±2 °C) @ -22 °F to 14 °F (-30 °C to -10 °C) and 167 °F to 212 °F (75 °C to 100 °C)
Note: Temperature measurement response time: ~30 sec.	
Inclination Angle	
Measuring Range	-90° to +90°
Resolution	0.1°
Measuring Accuracy	± 1.5° @ -50° to +50°, ±2.5° @ -85° to -50° and +50° to +85° ±3.5° @ -90° to -85° and +85° to +90°
Compass	
Measuring Range	0° to 360°
Resolution	1°
Measuring Accuracy	± 7°
Note: a) Measurements valid for device inclination between -20° and +20° to horizontal. Outside that range on LCD will be shown "----". b) Result is referred to magnetic north.	
Temperature	
Operating Temperature IRR1-SOL	-20 °C to 50 °C (humidity <80 %), noncondensing
Operating Temperature 8OPR-IRR	-30 °C to 100 °C
Storage Temperature	-30 °C to 60 °C (humidity <80 %)
Altitude	0 m to max. 2000 m
Electromagnetic Compatibility (EMC)	
International	IEC 61326-1: Portable Electromagnetic Environment CISPR 11: Group 1, Class A Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for radio frequency energy that is necessary for the internal function of the equipment itself. Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances. Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

**Specifications continued**

Korea (KCC)	Class A Equipment (Industrial Broadcasting & Communication Equipment) Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.
USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
<b>Protection</b>	
IP Protection	IP40
<b>Power Supply &amp; Battery Life</b>	
Batteries	4 AA Alkaline Batteries
Battery Life (typical)	50 hours (> 9000 readings)
Auto Power Off	30 minutes
<b>Dimensions</b>	
L x W x H	5.90 x 3.14 x 1.37 in (150 x 80 x 35 mm)
Weight	0.5 lb (231 g)

**Ordering information**

**Fluke IRR1-SOL Solar Irradiance Meter**

Includes: FLK-IRR1-SOL Solar Irradiance Meter, FLK-80PR-IRR External Temperature Probe with Suction Cup, C250 Carrying Case with Shoulder Strap, (4) AA Alkaline Batteries, User Manual.





**Model PVLEAD1**  
**Solar MC4 to 4mm Test Lead Set****Features**

- Set of black and red MC4 to 4mm adapter test leads for solar applications
- The black lead is a MC4 (female) to 4mm sheathed banana plug on a 60-inch test lead
- The red lead is a MC4 (male) to 4mm sheathed banana plug on a 60-inch test lead
- Allows for connections to test tools that accept 4mm sheathed banana plugs
- Ensures safe current and voltage measurements on Photovoltaic (PV) modules and systems
- Connect measuring devices to PV power plants, for use in regular tests, measurements, and troubleshooting on solar PV panels
- Nickel plated contacts

**Ratings**

Voltage: Complies to IEC / EN 61010-031  
CAT III 1000V / CAT IV 600V  
Do Not Disconnect Under Load

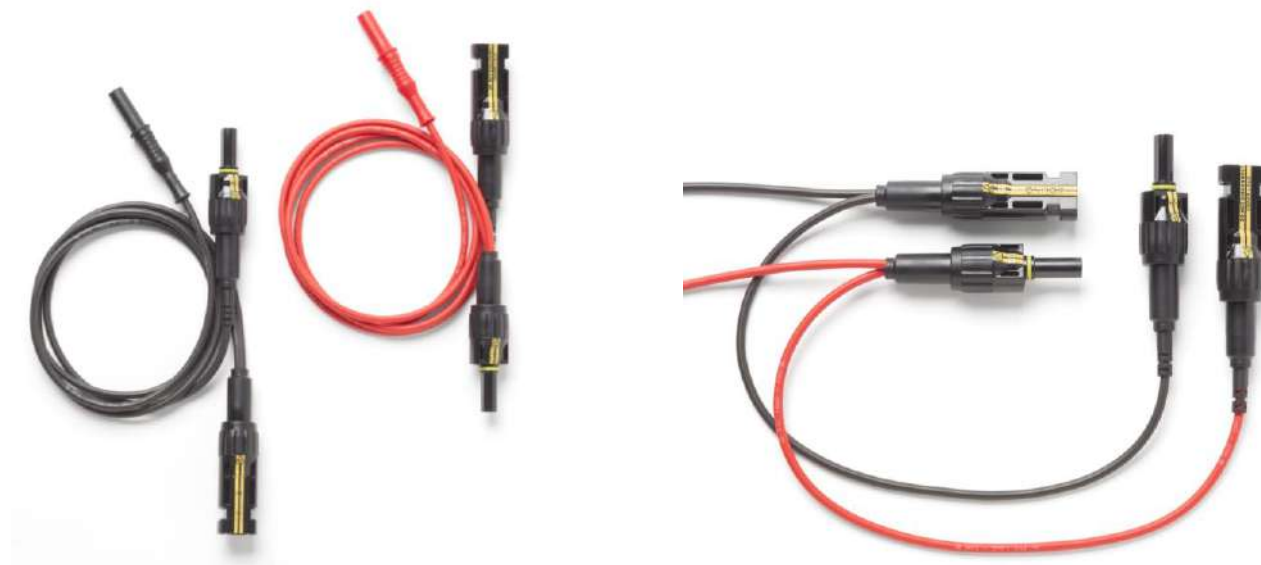
Current: 20A

Temperature Range: +5°C to +40°C (+41°F to +104°F)

**Ordering Information**

Model: PVLEAD1  
MC4 TO 4MM TEST LEAD SET, BLACK/RED

All dimensions are in inches. Tolerances (except noted): .xx = ±.02" (.51 mm),  
.xxx = ±.005" (.127 mm). All specifications are to the latest revisions.  
Specifications are subject to change without notice. Registered trademarks are  
the property of their respective companies.

**Model PVLEAD3**  
**MC4 Solar Clamp Test Lead Set****Features**

- Set of black and red MC4 Solar Power Clamp Test Leads
- The black test lead is a MC4 (male) breakout to 12-inch MC4 (female) and 36-inch 4mm sheathed banana plug test lead
- The red test lead is a MC4 (female) breakout to 12-inch MC4 (male) and 36-inch 4mm sheathed banana plug test lead
- Designed for use with Solar Clamp Meters that accept 4mm sheathed banana plugs
- Creates connection between the Solar Panel and Inverter for measuring with a Clamp Meter
- Ensures safe DC power measurements on Photovoltaic (PV) modules and systems
- Allows user to monitor solar PV circuits during operation for troubleshooting and maintenance of PV systems
- Nickel plated contacts

**Ratings**

Voltage: Complies to IEC / EN 61010-031  
CAT III 1000V / CAT IV 600V  
Do Not Disconnect Under Load

Current: 20A

Temperature Range: +5°C to +40°C (+41°F to +104°F)

**Ordering Information**

Model: PVLEAD3  
MC4 SOLAR POWER CLAMP SET

All dimensions are in inches. Tolerances (except noted): .xx =  $\pm 0.02$ " (.51 mm), .xxx =  $\pm 0.005$ " (.127 mm). All specifications are to the latest revisions. Specifications are subject to change without notice. Registered trademarks are the property of their respective companies.