

## MAVOPAD

Flicker Meter

1/11.22



Thank you for purchasing the MAVOPAD flicker meter from GOSSEN.

**Please read these operating instructions carefully before using the system for the first time, and keep them in a safe place for future reference.**

Your new flicker meter is designed for extremely fast and accurate measured value acquisition and is equipped with lots of computing power. This makes it possible to conduct extensive analyses involving time and frequency, which are prerequisites for the ascertainment of currently relevant measured quantities for flicker.

- **Excellent measuring accuracy** – 16-bit A-D converter resolution
- **Extremely fast sampling rate** – up to 1.6 MHz, as many as 4 measuring channels
- **Various assessment methods** – PstLM, SVM, flicker%, flicker index, modulation, dominant frequency, ASSIST Mp or IEEE 1789
- **Universal display** – display of measured values, time plot and frequency spectrum
- **V( $\lambda$ ) matching** – the spectral sensitivity of the VLP sensor is color corrected and corresponds to the spectral brightness sensitivity of the human eye V( $\lambda$ ).
- **Integrated data memory** – data can be stored to and retrieved from internal USB memory.
- **Test certificate** – included in the scope of delivery
- **Intuitive operation** – 4.3" touchscreen display with direct access to important functions





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## 1 Safety Precautions

### Explanation of Symbols

Signal words in warnings indicate the nature and severity of possible consequences if measures for the prevention of the respective hazard are not implemented. The signal words are defined below and may be used in this document.

 <b>Warning!</b>	Means that serious to life-threatening personal injury may occur
 <b>Caution</b>	Means that minor to moderately serious personal injury may occur
<b>Note</b>	Means that property damage may occur
	Identifies additional information without reference to danger for persons or property
	Identifies important information that should be read before the product is placed into service

 **Warning!**

- In the event of malfunction, switch the meter off immediately. If smoke or odors occur for which the meter or the mains power pack is the cause, immediately disconnect the power pack from the mains and switch the meter off – risk of fire and injury.
- Do not use or charge the meter in proximity to flammable or combustible gases – risk of fire and explosion.
- Never charge the meter unattended – risk of fire and injury.
- Keep the meter and all accessories out of the reach of children – risk of suffocation and strangulation due to parts which can be swallowed, as well as carrying straps and cables.
- Do not dismantle, modify or repair the meter – risk of injury, fire and electric shock.
- Do not expose batteries to moisture, high heat or open fire, and never short circuit batteries or attempt to open them. Use only batteries which are recommended for this meter and which demonstrate no apparent damage. Improper handling of batteries can result in fire, explosion, serious injury or environmental damage.

 **Caution**

- In the event of malfunction, switch the meter off immediately. If smoke or odors occur for which the meter or the mains power pack is the cause, immediately disconnect the power pack from the mains and switch the meter off – risk of fire and injury.
- Only use the included charger to charge the meter. The use of other chargers may damage the meter.
- When plugging in the sensor and the sensor extension cord, make sure that the plug and socket guides are correctly aligned and avoid the use of excessive force. An incorrect plug connection can damage the meter, the sensor or the sensor extension cord.
- Do not use the meter where it's exposed to moisture or rain, and do not immerse it in water. Avoid operation with wet or damp hands as well. This may result in electric shock or damage to the meter.
- Do not dismantle, modify or repair the meter. This may result in erroneous measurement results or damage to the meter.

## Note

As a signal word, **Note** identifies precautions or limitations with regard to use of the product. Please read all notes in order to avoid operating errors.

- Before starting one-time only measuring tasks, you should convince yourself beforehand that the meter is working properly by performing a test measurement.
- If the product is used in quality-relevant applications, for acceptance measurements or for assessments, check to make sure that the meter's calibration is still valid.
- If the meter is subjected to extreme temperature during transport, it requires at least 2 hours for acclimatization before it's switched on.

## **Limitations**

There are several safety precautions and limitations regarding the use of this product. Please read and understand the following before using the meter.

- GOSSEN does not accept any liability for damages, costs or lost profits resulting from malfunctioning of the meter, improper use or non-compliance with the safety precautions.
- GOSSEN reserves the right to make changes of any kind to products or documentation without issuing prior notice. The latest versions of the documentation, firmware and software can be downloaded from GOSSEN's website.
- Reproduction of product documentation or duplication of any excerpts therefrom necessitates the express consent of GOSSEN. This applies as well to duplication in any electronic format and translation into other languages.

## **Use for Intended Purpose**

The meter may only be used under the conditions and for the purposes for which it has been designed. In this respect, special attention must be given to safety precautions, technical data regarding ambient conditions and use in dry environments.

Only accessories and replacement parts which have been tested by GOSSEN are permissible for use in accordance with intended purpose. In case of alterations or modifications implemented by the user, operating safety can no longer be assured.



## 2 Disposal

Legal regulations regarding disposal and recycling of batteries and electronic devices are different in every country. Please inform yourself about the respectively valid specifications for environmentally friendly disposal in your country, and proceed accordingly.

In **European countries**, consumers must comply with the following regulations:

- **Batteries and rechargeable batteries** may not be disposed of with household trash. You are required to return used batteries to a municipal collection point or to your dealer. You can also return used batteries from our devices directly to us in quantities usual for end users, or send them to us for disposal after affixing sufficient postage.
- **Electrical and electronic equipment** may not be disposed of with household trash. At the end of its service life, you are required to return it to an authorized collection point for old equipment, to the dealer or to the manufacturer.

The above-mentioned products may contain hazardous substances which, if released, could result in severe environmental damage or health impairments. Compulsory return ensures environmentally friendly disposal, and raw materials contained in old equipment can be recycled.

**Identification** for Separate Collection of Recyclable Materials / Hazardous Waste **in European Countries**



This symbol indicates that the respective product must be disposed of separately, and not with household trash. The chemical symbols for cadmium (Cd), lead (Pb) or mercury (Hg) may also be included if their concentrations exceed permissible limits.

### 3 Initial Startup

#### 3.1 Charging the Battery

The MAVOPAD is equipped with a built-in lithium-ion battery which can be charged via the USB socket ❷ and the included 5 V / 1500 mA mains power pack. First connect the meter's USB socket to the USB socket on the mains power pack using the included USB cable, and then plug the mains power pack into an electric outlet.

The charge level LED ❹ on top of the meter indicates the charging status of the rechargeable battery. It lights up red as long as the battery is charging and goes out when the battery has been fully charged. If the charge level LED blinks once per second, an error has occurred during charging. If this is the case, immediately disconnect the meter from the charger. Charging time for a fully depleted battery is about 3 hours.



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If the meter is not used for a lengthy period of time, it should be recharged about once every 6 months. This ensures long battery life and retention of clock time and device parameters.

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#### 3.2 Connecting the Sensor

In order to measure flicker, the VLP light sensor has to be plugged into the sensor socket ❸. The sensor can also be connected to the MAVOPAD via the sensor extension cord with a length of 80 cm. The connected sensor is displayed under "Sensor Information" ❷ in the information and status display ❺.

## 4 Display Elements and Controls



Touchscreen functions:

- 5 Information and status display
  - 1 Page indicator
  - 2 Sensor information
  - 3 Y-axis scaling
  - 4 Metering signal level display
  - 5 Charge level indicator

6 Function keys:

- 1 **Menu**
- 2 **<< >>** Toggle keys for measured value display
- 3 **Save** key
- 4 **Settings** key
- 5 **Mode** key
- 6 **Run** key

7 Measured value display:

measured values<->time plot<->frequency spectrum

## 4.1 Switching On and Off

The MAVOPAD is switched on by pressing the On/Off key **1** and switched off by tapping Off in the menu **1**. If it's not possible to switch the meter off via the menu, it can be switched off by pressing and holding the On/Off key **1** for 5 seconds.

Various energy-saving and shutdown functions can be selected after tapping "Device Customize" in the menu **1**. If none of the keys are activated during the selected "Auto Power Off" time, or if battery capacity falls below the minimum level, the MAVOPAD is shut down automatically.

## 4.2 Information and Status Display **5**

### 4.2.1 Page Indicator **1**

The page indicator indicates which values or graphics appear at the measured value display.

Display	Measured Value Display
1/3	Measured values
2/3	Time plot
3/3	Frequency spectrum

### 4.2.2 Sensor Information ②




Sensor information indicates which sensor is connected to the meter. In addition to the VLP light flicker probe, other sensors will also be offered as options in the future.

### 4.2.3 Y-Axis Scaling ③

In addition to automatic Y-axis scaling, values of 200 lx, 2000 lx or 20,000 lx can also be permanently set in the settings menu for the VLP probe.

### 4.2.4 Metering Signal Level Display ④

Illuminance should be kept within the green range in order to assure precise measurement, i.e. between 1000 lx and 10,000 lx.

Display	Meaning
	Illuminance too weak for precise measurement (< 1000 lx)
	Illuminance within correct range for precise measurement (> 1000 lx ... < 10000 lx)
	Illuminance too strong for precise measurement (> 10,000 lx)

## 4.2.5 Charge Level Indicator ⑤

During operation, the charge level of the built-in lithium-ion battery appears at the charge level indicator ⑤ in the information and status display ⑤. The height of the green bar is proportional to the charge level. If the bar changes from green to red, the battery capacity is running out and it urgently needs to be recharged. Operating time depends to a great extent on device settings (e.g. brightness of display illumination) and can range from 5 to 20 hours with a fully charged battery.

## 4.3 Function Keys ⑥

Key	Function
Menu	Settings for the sensor and the meter and option for switching the meter off
<< >>	Toggle amongst various measured value displays ⑦
Save	Saves data for the last measurement
Settings	Quick menu for scaling the X and Y-axes
Mode	Quick menu for selecting sampling time and sampling mode
Run	Start measurement

### 4.3.1 Menu ①

The menu function key consolidates all of the information and basic settings for the connected sensor and the meter into the associated sub-menus. In addition, the meter can be switched off via the off key in the main menu.

<b>Menu</b>	→	<b>Probe</b>	→	Installed Probes		
		<b>Device</b>	→	General	→	Date / Time
						Factory Reset
				Customize	→	Signal Tone
						Backlight (%)
						Power Saving (minutes)
						Power Saving (%)
						Auto Power Off (minutes)
				Graphics	→	FFT Scale
						AC Mode
						Frequency Scale
						Time Scale
				User		User Data
				About		Device Info
		<b>Off</b>				

### 4.3.2 << >> ②

The << and >> keys can be used to switch back and forth amongst the various measured value displays ⑦.

Light Measurement	>> <<	Time Plot	>> <<	Frequency Spectrum
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### 4.3.3 Save ③

This function saves the data for the last measurement to the internal 32 GB data memory in CSV format.

Save	→	File name	Edit
		Protocol file (val)	on / off
		Paste user data	on / off
		Frequency file (fft)	on / off
		Raw data file (raw)	on / off



#### 4.3.4 Settings ④

Scaling of the measured value displays for time plot and frequency spectrum is specified in this menu item.

<b>Settings</b>	→	Y Scale	→	Autoscale
				20,000 lx
				2000 lx
				200 lx
		X Scale	→	10 ms/div
				100 ms/div
			→	50 Hz/div
				250 Hz/div

#### 4.3.5 Mode ⑤

Sampling time for the various flicker measurement methods is set with this menu item. 1 second must be selected for standard measurements, 2 seconds for ASSIST Mp measurements and 180 seconds for PstLM measurements. The highest time set in each case includes all measurement methods with a lower time.

<b>Mode</b>	→	Sample Time	→	1 sec
				2 sec ASSIST
				180 sec PstLM
		Sample Mode	→	Single

The sampling mode is permanently set to single.

#### 4.3.6 Run ⑥

Measurement is started by pressing the Run key.

## **5 Measurements**

### **5.1 Preparing a Measurement**

The VLP light sensor is connected to the meter as described in section 3.2. When measuring an individual light source, influence resulting from other light sources must be avoided. Avoid any movement or vibration of the sensor during measurement, especially when measuring the PstLM value for 180 seconds. We urgently recommend attaching the measuring probe to a tripod with a retainer. Depending on the application, suitable accessories can be purchased from retail photographic equipment dealers.

### **5.2 Performing Measurements**

First select required sampling time for the measurement by pressing the mode key:

- 1 second for standard measurements
- 2 seconds for the ASSIST Mp measurement
- 180 seconds for PstLM measurement

Press the Run key in order to start the measurement.

After measurement has been completed, the measured value display is opened or updated. Illuminance should lie within a range of 1000 to 10,000 lx in order to ensure precise measurement, which is confirmed by a green level indicator. Measured light and flicker values appear at the measured value display. Various display windows including measured values, time plot and frequency spectrum can be selected with the << and >> toggle keys.

### 5.3 Saving Measurements

The MAVOPAD is equipped with internal data memory which can be accessed from a PC like a USB drive. After pressing the save key, a selection window appears with a filename for saving the measured values. The suggested filename is comprised of sensor type, date, time and file type. The filename can be changed via a keyboard which can then be displayed.

The following data can be saved in CSV format:

- val file type: measured value log (11 measured values)
- fft file type: frequency spectrum (0 ... 2000 Hz, 2001 values)
- raw file type: characteristic curve (1 sec., 8192 values)

## 6 Flicker Standards and Directives

<b>Standards, Directives</b>	<b>Title</b>
EU 2019/2020	Ecodesign requirements for light sources and separate control gear
IEC TR 61547-1	Equipment for general lighting purposes. EMC immunity requirements – Part 1: Objective light flicker meter and voltage fluctuation immunity test method
IEC TR 63158	Equipment for general lighting purposes – Objective test method for stroboscopic effects of lighting equipment
IEEE 1789	IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers
ASSIST	Flicker Metric Mp

## 7 Accessories

### 7.1 Scope of Delivery

- MAVOPAD
- VLP light flicker probe
- Sensor extension cord, 0.8 m
- Rechargeable lithium-ion battery (built-in)
- Power supply, input: 100-240 V ~, 50/60 Hz, 0.35 A, output: 5 V =, 1.5 A, 7.5 W
- Interface cable, USB type A to micro B, 1.8 m
- Touch pen
- Operating instructions
- Plastic transport case
- Test certificate

## 8 Service Notes

The device does not require any special maintenance if used in accordance with the operating instructions.

- If the outside of the device becomes contaminated during use, clean the surface of the housing with a slightly moistened cloth. Avoid the use of cleansers, abrasives and solvents.
- Make sure that the light receiver doesn't become dusty, dirty or scratched because this can affect measuring accuracy.

If at any time your meter doesn't function to your full satisfaction, send it to:

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Phone: +49 911 800621-0 | e-mail: [info@gossen-photo.de](mailto:info@gossen-photo.de)

[www.gossen-photo.de](http://www.gossen-photo.de)

Customers outside of Germany are requested to contact their authorized dealer, whose address can be found on our website at [www.gossen-photo.de](http://www.gossen-photo.de).

## 9 Technical Data

### 9.1 MAVOPAD

Operation	
Display	4.3" capacitive TFT touchscreen display
Display illumination	Brightness 10% to 100% in steps of 10% Power saving (minutes) 1 to 10 minutes in steps of 1 minute Power saving (%) 10 to 100% in steps of 10%
A-D converter	16-bit, 4-channel, sampling rate up to 1.6 MHz
Measured value memory	32 GB
Interface	USB 2.0 with micro B socket
Sensor detection	Automatic
Power Supply	
Battery	Rechargeable lithium-ion
Automatic battery monitoring	Battery voltage display
Automatic shutdown	Off: 10 to 60 minutes in steps of 10 minutes
Operating time	5 to 20 hours depending on device settings
Charging time	3 hours, charge every 6 months when not in use
Charging	Via USB socket with 5 V / 1500 mA mains power pack, LED charging indicator
Ambient Conditions	
Operating temperature	5° C ... 30° C
Storage temperature	0° C ... 40° C
Relative humidity	10 ... 70% (no condensation)
Mechanical Design	
Protection	IP 20
Dimensions	154 x 96 x 34 mm
Weight	350 g



## 9.2 VLP Light Flicker Sensor

<b>Measuring Functions</b>	
Spectral sensitivity	480 ... 660 nm
Spectral matching	V( $\lambda$ )
Illuminance	1 lx ... 20,000 lx, mean, maximum, minimum
Flicker Minimum illuminance	Dominant frequency, flicker%, flicker index, modulation > 200 lx
Flicker (frequency-weighted) Minimum illuminance	PstLM, SVM, ASSIT Mp, IEEE 1789 > 1000 lx
lux accuracy	< 5%, standard light type A at 1000 lx, $\epsilon$ 0°
PstLM accuracy	Per IEC TR 61547-1
SVM accuracy	Per IEC TR 63158
Flicker frequency	50 Hz ... 400 kHz
<b>Mechanical Design</b>	
Probe connection	Directly connectable or via 0.8 m probe extension cord
Protection	IP 20
Dimensions	18 mm dia. x 55 mm
Weight	30 g





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