

Operating Instructions

MAVOSPEC **BASE**

Spectrometer



Thank you for selecting a ICS Schneider Messtechnik GmbH product.

You'll enjoy easy operation, top quality and precise measurement, as well as an extensive range of applications. Please check to make sure that all of the parts listed below have been included in the scope of delivery. If anything is missing, please contact your dealer.

- **MAVOSPEC BASE**
- **Cover cap, micro SDHC memory card (installed in the battery compartment), SD adapter**
- **V070A rechargeable battery, power pack and USB interface cable, Aluminum case, sheath, carrying strap**
- **Calibration report, printed instructions German / English**
- **Operating instructions German, English, French, Italian, Spanish and EXCEL files with several protocol templates and datalogger on memory card**

Outstanding MAVOSPEC BASE Measuring Functions and Features

- **Spectral power distribution** within a range of 380 to 780 nm (VIS)
- **Chromaticity, color coordinates** per CIE 1931 [x,y], CIE 1960 [u,v], CIE 1976 [u',v'], display of the CIE standard color table with zoom
- **Correlated color temperature CCT and color temperature difference relative to the Planckian locus Duv**
- **Color rendering indices Ra, Re, R1 through R15 and Gamut Area Index GAI**
- **Color rendering indices Rf, Rg** according IES TM-30-15 and related graphics
- **Purity, peak wavelength, dominant wavelength**
- **Flicker value as index, percentage [%], frequency [Hz] and curve, Lightscope, IEEE 1789 rating**
- **Illuminance** with cosine-corrected measuring probe in accordance with **class B per DIN 5032-7**
- **Irradiance Ee** in the range of 380 nm to 780 nm (VIS) and **Luminous Efficacy of Radiation LER**
- **Photosynthetic photon flux density PPF, PPF_UV, PPF_Blue, PPF_Green, PPF_Red, PPF_FR**
- **Large dynamic range** from 10 to 100,000 lx, highest resolution: 0.01 lx
- **Automatic or manual measured value storage** to an interchangeable micro SDHC memory card **Quick Load Funktion**
- **Reference mode** for comparing two light sources
- **Easy data transfer** thanks to CSV format
- **Documentation of measured values** via included Excel templates for evaluation
- **Data logging function** via included Excel template for data logging, **adjustable interval**
- **Universal USB port** for convenient data exchange, device control, firmware updates and battery charging
- **Individualized system integration** via open USB interface protocol
- **Sustainable device concept** thanks to update option via USB port
- **Ecological power supply** with rechargeable Li-ion battery, recharging via USB port and display of charging status and charge level
- **Long rechargeable battery operating time** of roughly 8 hours continuous operation, expandable by adjustable display and device shutdown
- **Outstanding measured value stability** thanks to automatic temperature compensation and zero-point correction
- **Individualized calibration** (photometric and radiometric), **calibration report included in scope of delivery**

Table of Contents		Page
Safety Precautions, Warnings and Other Notes		5
1	Initial Startup	
1.1	Inserting the Memory Card	8
1.2	Inserting the Rechargeable Battery	8
1.3	Charging the Battery	9
1.4	Default Settings	9
2	The Meter and its Controls	
2.1	Device Overview	10
2.2	Controls	11
2.3	Display	12
3	Functions	
3.1	Switching the Meter On	13
3.2	Measuring	13
3.2.1	Measured Value Windows	14
3.2.2	Spectrum	15
3.2.3	Report	15
3.2.4	CIE	16
3.2.5	TM30	17
3.2.6	CRI	17
3.2.7	Data	17
3.2.8	Flicker	18
3.3	Measuring in Reference Mode - Comparison Mode	18
3.3.1	Measured Value Windows in Reference Mode	19
3.4	Measured Value Memory	20
3.4.1	Saving Measured Values to Memory	20
3.4.2	Loading and Deleting Saved Measured Values	20
3.4.3	Quick Load Function	21
4	MENU	
4.1	Overview	22
4.2	Navigation – Setup	23
4.3	MENU – General	24
4.4	MENU – Settings	25

4.5	MENU – Measurements	26
4.6	MENU – Memory	27
4.7	MENU – Presentation	28
4.8	MENU – Information	29
5	USB Port	30
6	Firmware Update	30
7	EXCEL Templates	31
7.1	Documenting Measured Values	31
7.2	Data Logger	32
8	Practical Tips	32
9	Factory Calibration	33
10	Service	33
11	Error Messages	34
12	Technical Data	35

Safety Precautions

Please read these safety precautions carefully before using your meter. This will help you to avoid damaging the product and prevent personal injury.

Warnings



In the event of malfunctioning, switch the meter off immediately.

If the event that smoke develops or unusual odors become apparent, which are caused by either the meter or the power pack, disconnect from mains power immediately and remove the rechargeable battery from the device in order to prevent possible fire. Continuing to operate the meter or the power pack after such malfunctions have occurred may result in severe injury. Please contact your local dealer or ICS Schneider Messtechnik GmbH Service in order to eliminate malfunctioning. If you bring or send the meter in for repairs, make sure that the rechargeable battery has first been removed.



Do not use the meter in proximity to flammable gases.

Electronic devices should never be used in proximity to flammable gases. Danger of explosion and fire is otherwise immanent.



Never hang the device from children with the carrying strap.

Danger of strangulation exists if the carrying strap is hung around the neck of a child.



Store the meter at a location which cannot be accessed by children.

The meter and its accessories include parts which can be swallowed. Make sure that these parts (e.g. housing covers, rechargeable batteries etc.) do not fall into the hands of children who might swallow them. Otherwise, danger of suffocation prevails.



Use suitable cables only.

Use included, original ICS Schneider Messtechnik GmbH cables only for connection to external devices. ICS Schneider Messtechnik GmbH assumes no liability if other cables are used.

**Do not dismantle the meter.**

Never touch any parts inside the housing. Injury may result. Do not repair the meter yourself. Repairs may only be conducted by appropriately trained personnel. If the meter's housing is damaged due to dropping or other external influences, remove the rechargeable battery or power pack and contact your local dealer or ICS Schneider Messtechnik GmbH Service for repair.

**Avoid any and all contact with the liquid crystals.**

If the display is damaged (e.g. broken), danger of injury due to contact with glass shards or discharge of liquid crystals exists. Make sure that skin, eyes and mouth do not come into contact with the liquid crystals.

**Be careful when handling rechargeable batteries.**

Rechargeable batteries may leak or explode if handled incorrectly. Please adhere to the following safety precautions:

- Make sure that the meter is switched off before removing or inserting rechargeable batteries.
If the meter is used with a power pack, supply power must first be disconnected (pull the mains plug out of the electrical outlet).
- Only use rechargeable batteries which are recommended for this meter.
- Make sure that the rechargeable battery is correctly inserted.
- Never short-circuit rechargeable batteries, and never attempt to open a rechargeable battery.
- Do not expose rechargeable batteries to excessive heat or open fire.
- Do not expose rechargeable batteries to moisture and never immerse rechargeable batteries in water.
- After removing the rechargeable battery from the meter, close the battery compartment with the lid (e.g. if the meter will not be used for a lengthy period of time).
- Never store rechargeable batteries together with metallic objects which might cause short-circuiting.
- Danger of leakage exists, especially in the case of empty rechargeable batteries. In order to prevent damage to the meter, rechargeable batteries should be removed when fully depleted or in the case of lengthy periods of non-use.
- When not in use, rechargeable batteries should be stored in a cool place.
- Rechargeable batteries heat up during use and may become hot. Be careful not to burn yourself when removing rechargeable batteries. Switch the meter off or wait until it has shut itself down, and then wait a bit longer until the rechargeable battery has cooled down.
- Do not use rechargeable batteries which show any signs of damage such as discoloration or deformation of the housing.

Other Notes

- Reproduction of product documentation or duplication of any excerpts therefrom necessitates the express consent of ICS Schneider Messtechnik GmbH. This applies as well to duplication in any electronic format and translation into other languages.
- ICS Schneider Messtechnik GmbH reserves the right to make changes of any type without providing advanced notice.
- ICS Schneider Messtechnik GmbH assumes no liability for damages resulting from incorrect use of the product.
- Documentation for your ICS Schneider Messtechnik GmbH meter was prepared with the greatest of care. If you should nevertheless discover errors, or if you would like to suggest any improvements, ICS Schneider Messtechnik GmbH would be very pleased to hear from you.



Symbol for separate collection of recyclable materials / hazardous waste in European countries

This symbol indicates that this product must be disposed of separately. The following must be observed by users in European countries:

- This product may only be disposed of separately at a designated collection point. It may not be disposed of with household trash.
- For further information contact your local dealer or waste disposal authorities.

The following symbols are used in order to make it easier to find additional information.

!!	Important safety precautions: Please read these safety precautions before using the meter in order to avoid damaging your MAVOSPEC BASE.
!	Important information which you should also read before using your MAVOSPEC BASE
i	Tips: additional, useful information regarding use of your MAVOSPEC BASE
➔	Reference to other information included in these operating instructions
M	Individual functions which can be configured in the menu

1 Initial Startup

The MAVOSPEC BASE works with an interchangeable micro SD card for measured value storage and a device-specific, rechargeable lithium-ion battery. Use only the original V070A ICS Schneider Messtechnik GmbH rechargeable battery included with the meter, or available as an optional accessory, and the USB charger.

- Wait until your MAVOSPEC BASE has been shut down.
- Unlock the lid at the back of the meter with a Phillips head screwdriver, remove it and pull it down and away.

1.1 Inserting the Memory Card

- Remove the rechargeable battery from the battery compartment.
- Pull the micro SDHC memory card out of the included adapter.
- Insert the micro SDHC memory card into your MAVOSPEC BASE in the recess provided for this purpose in the battery compartment.
- Push the card into the slot in the meter in the indicated direction.



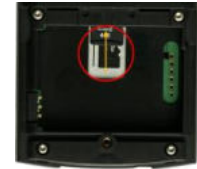
Unlock.



Remove the lid.



Pull micro SDHC card from adapter.



Insert micro SDHC card und push into the slot.



The MAVOSPEC BASE can also be operated without a memory card – all measuring and display functions are still available and only measured value storage at the meter is excluded.

1.2 Inserting the Rechargeable Battery

- Insert the battery into the compartment as shown in the figure. Make sure that the + and – poles are correctly connected!
- Close the battery compartment lid and secure it with the screw.



Insert battery.



Lock.

1.3 Charging the Battery

Connect the included USB cable first of all to the USB port on the meter and then to the USB socket on the power pack, and then connect the power pack to a mains outlet.

The LED in the housing top indicates the charging status of the rechargeable battery. It lights up red as long as the battery is charging, and changes to green when the battery has been fully charged. If the meter is switched on, a symbol appears at the battery display indicating that the device is being externally supplied with electrical power. Charging time for a fully depleted battery is about 1½ hours.



When connected to a PC, the device is switched to continuous operation and is supplied with electrical power from the PC's USB port.

The meter can be operated with or without an inserted battery when connected to a PC or to the power pack.

An additional or replacement battery (3.7 V / 890 mAh) can be purchased from ICS Schneider Messtechnik GmbH under order number V070A.

1.4 Default Settings

The MAVOSPEC BASE is shipped with default settings which, based on our own experience, fulfill the basic requirements of most users. A complete summary of the default settings and instructions on how to adapt them to your individual requirements are included in section 4 of these operating instructions. Entered settings are retained until they have been changed again, or until the meter is reset to its default settings as described in section 4.4.

2 The Meter and its Controls

2.1 Device Overview



2.2 Controls


DATA Key
DATA
Press key briefly: Storage of the last measurement, inactive in case of automatic storage
Press and hold: Retrieve stored measured values


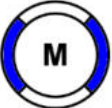
MENU Key
MENU
Open menu, exit menu

DATA + MENU Key
DATA MENU
Pressing and holding both of these keys simultaneously switches the device off.

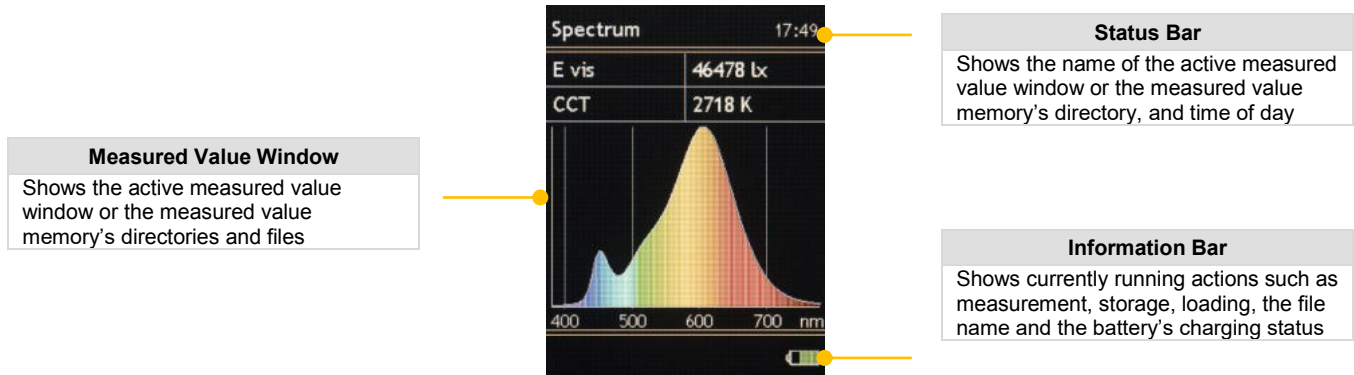
! After switching the device on, the settings used for the last work cycle are displayed.



Measurement Key

Measurement: Briefly press the measurement key.
Settings: Acknowledge selection.
Device in sleep mode: Switch device on.

Ring Controller		
	Up/down	Measured value view: Report, data: scroll through the measured value list. CIE: Switch amongst standard and zoom view TM30: Switch amongst color vector, fidelity index by HUE, chroma shift by HUE, Rf/Rg graphic Flicker: Switch amongst index, %, frequency, curve - Light Scope - IEEE1789 evaluation CRI: Switch amongst table - bar - spider.
		Spectrum in reference mode: Switch amongst spectrum measurement - reference - delta Menu view: Scroll through the parameters list.
		Measured value view: Switch amongst spectrum - report - CRI - TM30 - flicker - data - CIE
		Menu view: Menu item selection, parameter display, exit parameter display
	Left/right	

2.3 Display



The battery icon in the information bar shows the charging status of the battery, or indicates operation with mains power or power from the PC. Even when the device is switched off, the charging status LED indicates whether the battery is being charged or has already been fully charged.


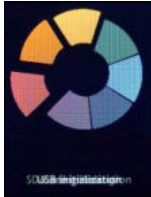

Icons in the Information Bar and the Charging Status LED

	Battery full		Operation with mains power or at PC
	Battery partially charged		LED blinks red – battery is being charged
	Battery nearly depleted – charge now		LED lights up green – battery is fully charged


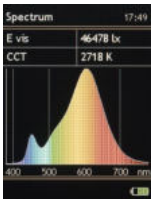
LCD brightness can be adjusted to meet your individual needs within a range of 50% to 100% in 10% steps. In order to further extend rechargeable battery operating time, display shutdown time can be adjusted after which LCD brightness is automatically reduced to 50% of the selected value. Unless the device has been fully shut down, LCD brightness is returned to its originally selected value each time a key is pressed. A complete summary of the default settings and instructions on how to adapt them to your individual requirements are included in section 4 of these operating instructions.





3 Functions

3.1 Switching the Meter On



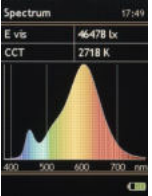

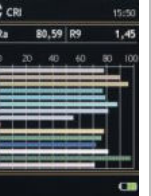
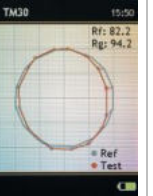
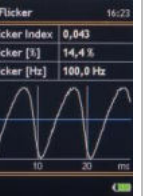
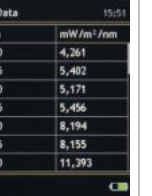
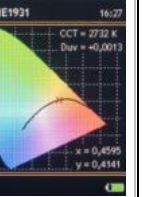

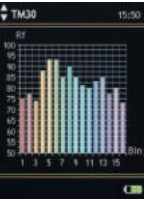

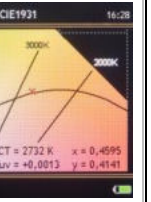


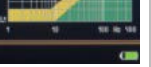
<p>Use the measurement key to switch the meter on.</p>		<p>The meter is initialized ...</p>		<p>... and the initial screen appears with an empty display field.</p>	
--	---	-------------------------------------	---	--	---

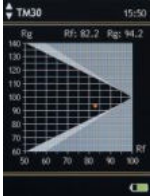
3.2 Measuring

<p>Press the measurement key to start.</p> <p>Possible from any measured value window.</p>		<p>A measurement is triggered and the measured values appear in the display field.</p>	
--	---	--	---

Configurable Individual Functions in the MENU			
M		Units of measure	lx / °C - fc / °F
		Decimal separator	Comma - point
		Auto int. time	on - off
		Int. time	10 to 3000 ms in 10 ms steps
		Averaging	1 - 2 - 3 - 4 - 5
		Notification	graphic - sound
		Reference mode	on - off
		Auto saving	on - off
		Spectrum	off - 5 nm - native
		Filename	time - number
	Flicker Trend	off - on	
	Spectrum	off - colored - simple	
	Report	display presetting	
	CRI	off - all - bars - table - web	
	TM30	on - off	
	Flicker	on - off	
	Data	off - 5 nm - native	
	CIE	off - 1931 - 1976	

3.2.1 Measured Value Windows

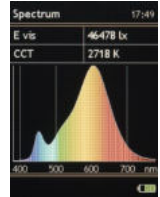
							
<p>After the measurement has been performed, results are displayed in the selected measured value window.</p>	<p style="text-align: center;">Spectrum</p>  <p style="text-align: center;">CCT, E vis</p>	<p style="text-align: center;">Report</p> 	<p style="text-align: center;">CRI</p>  <p style="text-align: center;">Ra, R9, Balken</p>	<p style="text-align: center;">TM30</p>  <p style="text-align: center;">Color Vector</p>	<p style="text-align: center;">Flicker</p>  <p style="text-align: center;">Index, %, Hz Curve</p>	<p style="text-align: center;">Data</p>  <p style="text-align: center;">380nm bis 780nm</p>	<p style="text-align: center;">CIE1931</p>  <p style="text-align: center;">CCT, Duv, x, y</p>
<p>The availability of the individual measured value windows und the parameters they contain can be adapted in a customer-specific fashion in the presentation menu (see section 4). Individual measured value windows or measured values which are not displayed can be activated there.</p>	<p>E vis, Ee, LER CCT, Duv CIE 1931 x CIE 1931 y CIE 1960 u CIE 1960 v CIE 1976 u' CIE 1976 v' CRI Ra CRI Re CRI GAI TM30 Rf TM30 Rg Apeak Adominant Purity Flicker Index Flicker [%] Flicker [Hz]</p>	<p style="text-align: center;">CRI</p>  <p style="text-align: center;">Ra, R1 - R15</p>	<p style="text-align: center;">TM30</p>  <p style="text-align: center;">Fidelity Index</p>	<p style="text-align: center;">Flicker</p>  <p style="text-align: center;">Lightscope</p>	<p style="text-align: center;">CIE1931</p>  <p style="text-align: center;">Zoom</p>		
<p>A new measurement can be triggered in each measured value window.</p>		<p style="text-align: center;">CRI</p>  <p style="text-align: center;">Spider Graph</p>	<p style="text-align: center;">TM30</p>  <p style="text-align: center;">Chroma Shift</p>	<p style="text-align: center;">Flicker</p>  <p style="text-align: center;">IEEE1789 Rating</p>			

				TM30  Rf/Rg Plot			
--	--	--	--	---	--	--	--

3.2.2 Spectrum

This measured value window displays the spectral power distribution of a light source and also provides information concerning color temperature and illuminance. The window as well as the colored background for the spectral power distribution can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

- E vis Illuminance (lx/fc)
- CCT Correlated color temperature in Kelvin (K)
- Graphic Standardized spectral power distribution (mW/m²/nm) over the entire measured waveband



3.2.3 Report

This measured value window lists all measured values calculated by the device from the measured spectral power distribution. The window as well as the individual values can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

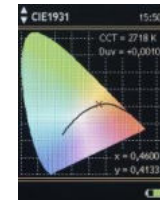
- E vis Illuminance (lx/fc)
- Ee Irradiance (W/m²)
- LER Luminance Efficacy Ratio (lm/W)
- CCT Correlated color temperature in Kelvin (K)
- Duv Delta uv – color temperature difference relative to the Planckian locus

Report	17:49
E vis	46478 lx
CCT	2718 K
CRI Ra	80.6
TM30 Rf	82.2
TM30 Rg	94.2
Flicker Index	0.042
Flicker [%]	14.8 %
Flicker [Hz]	99.9 Hz

CIE 1931 x	Color system standard CIE 1931, color coordinate x		
CIE 1931 y	Color system standard CIE 1931, color coordinate y		
CIE 1960 u	Color system standard CIE 1960, color coordinate u		
CIE 1960 v	Color system standard CIE 1960 color coordinate v		
CIE 1976 u'	Color system standard CIE 1976, color coordinate u'		
CIE 1976 v'	Color system standard CIE 1976, color coordinate v'		
CRI Ra	Color rendering index Ra - color rendering index		
CRI Re	Color rendering index Re - color rendering index		
CRI GAI	Gamut area index - color rendering index		
TM30 Rf	Fidelity index		
TM30 Rg	Gamut index		
λ peak	Wavelength (nm) of the maximum spectral radiant intensity (λ_p) – peak intensity		
λ dominant	Dominant wavelength		
Purity	Color purity		
Flicker index	Flicker index		
Flicker [%]	Flicker as a percentage		
Flicker [Hz]	Flicker frequency		
PPFD	Photosynthetic photon flux density PPFD	PAR range	400 - 700 nm
PPFD_UV	Photosynthetic photon flux density PPFD	UV range	380 – 400 nm
PPFD_Blue	Photosynthetic photon flux density PPFD	Blue range	400 – 500 nm
PPFD_Green	Photosynthetic photon flux density PPFD	Green range	500 – 600 nm
PPFD_Red	Photosynthetic photon flux density PPFD	Red range	600 – 700 nm
PPFD_FR	Photosynthetic photon flux density PPFD	Far Red range	700 – 780 nm

3.2.4 CIE

These measured value windows display the color coordinates in the respective CIE standard color system and depict chromaticity graphically in the associated standard color diagram. In addition the correlated color temperature CCT, the distance to the Planckian curve and the color coordinates are displayed. Furthermore, there is a zoom function on the Planckian curve. The window as well as one preferred standard color system can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

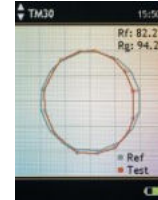


- CIE 1931 Standard color system, graphic – chromaticity in the standard color diagram, color coordinates x, y
- CIE 1976 Standard color system, graphic – chromaticity in the standard color diagram, color coordinates u', v'

3.2.5 TM30

These measured value windows displays the evaluation of the color rendering according the new IES standard TM-30-15. It shows information about the fidelity index Rf, the gamut index Rg and further information in the related graphics. The window can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

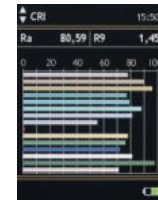
- Color vector graphic
- Fidelity index by HUE graphic
- Chroma shift by HUE graphic
- Rf/Rg plot



3.2.6 CRI

These measured value windows display color rendering index Ra and individual indices R1 through R15 in various formats. The window as well as all or one preferred display format can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

- Bars Color rendering indices R1 through R15 as a bar graph as well as Ra and R9 as numeric values
- Table Color rendering index Ra and color rendering indices R1 through R15 as numeric values
- Web Color rendering index Ra and color rendering indices R1 through R15 as a spider graph



3.2.7 Data

This measured value window displays irradiance either as original data from the sensor or as data interpolated to even 5 nm steps. The window as well as the preferred display format can be shown or hidden with the help of the corresponding function in the presentation menu (see section 4).

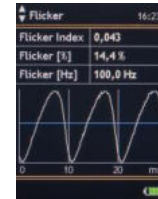
Wavelength (nm), associated irradiance (mW/m²/nm)



3.2.8 Flicker

These measurement windows represent the measured flicker values as well as the curve of the illuminance and make an evaluation according to IEEE1789. The window can be shown or hidden under MENU - Display (see section 4).

Flicker	Index, percent [%], frequency [Hz] and zoomed curve
Lightscope	Absolute curve of illuminance
IEEE 1789	Evaluation graph according IEEE 1789



3.3 Measuring in Reference Mode - Comparison Mode

With the reference mode, the data of two light sources can be compared with each other. For this purpose, it is necessary first to measure the light source to be used as a reference and to store the measurement result in the device. Then activate the reference mode under MENU - Measurement and load the saved file as a reference. This remains even after switching off the reference mode but only until the meter is switched off. After switching it on again, the measuring device will remain in normal measuring mode until the reference is reloaded.

Pressing the measurement key triggers a new measurement and compares it to the loaded reference. As soon as the reference mode is activated and a reference is loaded, only the measured value windows Spectrum, Report and CIE are available in modified form.

In the **spectrum window**, you can now switch between three specific measured value windows with the ring controller up / down:

Spectrum Measure	Measured values, colored spectrum measurement, spectral curve reference white
Spectrum Reference	Reference values, colored spectrum reference, spectral curve measurement blue
Spectrum Delta	Delta values, spectral curves reference white and measurement blue

In the **report window**, the display changes to two-line structure with delta value, reference value and measured value for the measured variables activated in the MENU display report.

In the **CIE window** additionally the reference value is displayed as a triangle.

3.3.1 Measured Value Windows in Reference Mode



After measurement, the result is displayed in the selected measured value window.

Between individual measured value windows is changed with ring controller.

The availability of individual measured value windows and the parameters contained therein can be adapted under MENU - Display customer specific, see chapter 4. If individual measured value windows or measured values are not displayed, they can be activated there.



A new measurement can be triggered in each measurement window.




	<p>Spectrum Measure</p> <p>CCT, E vis</p>	<p>Report</p> <p>E vis, Ee, LER, CCT, Duv, CIE 1931 x CIE 1931 y CIE 1960 u CIE 1960 v CIE 1976 u' CIE 1976 v' CRI Ra CRI Re CRI GAI TM30 Rf TM30 Rg Apeak λdominant Purity Flicker Index Flicker [%] Flicker [Hz] PPFD PPFD_UV PPFD_Blue PPFD_Green PPFD_Red PPFD_FR</p>	<p>CIE1931</p> <p>CCT, Duv, x, y</p>
	<p>Spectrum Delta</p>		<p>CIE1931 Zoom</p>
	<p>Spectrum Reference</p>		

3.4 Measured Value Memory













The MAVOSPEC BASE has an interchangeable micro SDHC memory card in the battery compartment to which measured values can be saved either automatically or manually. Manual saving is selected as a default setting. The respective memory modes can be selected in the memory menu (see section 4.6). Measured values are saved in the CSV data format, which can be opened with Excel and other programs for convenient further processing.

3.4.1 Saving Measured Values



	Manual saving	Briefly pressing the DATA key saves the values from the last measurement.
	Automatic saving	The value is saved automatically after measurement has been completed.

A CSV file using a continuous number  M_XXXXX.CSV or with the time of day as a file name  hh-mm-ss.CSV is saved to the respective day folder  yy-mm-dd. The selection of the file name type can be done in the MENU - Memory, see section 4.6.

3.4.2 Loading and Deleting Saved Measured Values

	The memory menu is opened or exited by pressing and holding the DATA key.				
micro SDHC card  yy-mm-dd	Navigate to the folder with the ring controller. 	 ..  hh-mm-ss.CSV  hh-mm-ss.CSV  hh-mm-ss.CSV	Navigate to file with the ring controller. 	Navigate with ring controller to command 	
	Briefly pressing measurement key opens the folder. 		Press the measurement key. The menu for loading or deleting the file appears. 	<table border="1" data-bbox="1193 723 1425 801"> <tr><td>load</td></tr> <tr><td>load as reference</td></tr> <tr><td>delete</td></tr> </table> ... and confirm by measurement key. 	load
load					
load as reference					
delete					
	Long pressing measurement key accesses the menu for opening or deleting the folder.			<u>load</u> : measurement will be displayed <u>load</u> measurement will be loaded <u>as ref.:</u> as reference <u>delete:</u> measurement will be deleted	







3.4.3 Quick Load Function

 + 	Quick Load Function	When the DATA key is held down, the stored measurements of the selected folder can be displayed one after the other via the ring controller in the measured value window. Thus, a simple view of the stored measurements is possible
--	---------------------	--





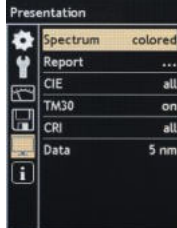

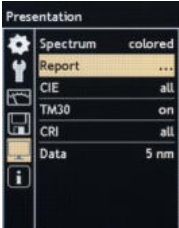








4 MENU

This chapter expands upon the above described functions and explains the great variety of options for default settings and presets offered by the MAVOSPEC BASE.

4.1 Overview

	General	Default Setting	Options		Information
	LCD Brightness (%)	100	100 - 90 - 80 - 70 - 60 - 50		Serial No.
	Display off (min.)	2	5 - 4 - 3 - 2 - 1 - 0.5 - off		Sensor No.
	Device off (min.)	4	10 - 5 - 4 - 3 - 2 - 1 - off		Software Rev.
	Language	English	English - German		Hardware Rev.
	Time / Date	00:00 01.01.2015			Product ID
	Settings				Temperature
	Units	lx / °C	fc / °F - lx / °C		Batt. Voltage
	Decimal separator	, (comma)	. (point) - , (comma)		
	Hour format	24h	24h - 12h		
	Date format	dd	dd.mm.yyyy - mm/dd/yyyy - yyyy-/mm/dd		
	Measurement				
	Auto Int. Time	on	off - on		
	Int. time		10 to 3000 ms in 10 ms steps		
	Averaging	1	1 - 2 - 3 - 4 - 5		
	Notification	sound	graphic - sound		
	Reference mode	off	off - on		
	Memory				
	Auto saving	off	off - on		
	Spectrum	5 nm	off - 5 nm - native		
	Filename	number	time - number		
	Flicker Trend	off	off - on		
	Presentation				
	Spectrum	colored	off - colored - simple		
	Report	E vis - CCT - CRI Ra - Flicker Index - % - Hz	E vis, Ee, LER, CCT, Duv, CIE1931 x, CIE1931 y, CIE1960 u, CIE1960 v, CIE1976 u', CIE1976 v', CRI Ra, CRI Re, CRI GAI, TM30 Rf, TM30 Rg, λ peak, λ dominant, Purity, Flicker Index, Flicker [%], Flicker [Hz], PPFD		
	CRI	all	off - all - bars - table - web		
	TM30	off	off - on		
	Flicker	on	off - on		
	Data	5 nm	off - 5 nm - native		
	CIE	1931	off - 1931 - 1976		

4.2 Navigation – Setup

<p>MENU</p>	<p>Press the MENU key to open the main menu.</p>				
	<p>Use the ring controller ...</p>  <p>to select the desired menu.</p>		<p>Use the ring controller ...</p>  <p>to navigate through the user settings.</p>		<p>Use the ring controller ...</p>  <p>to select a submenu.</p>
	<p>Use the ring controller ...</p>  <p>to display values.</p>		<p>Use the ring controller ...</p>  <p>to select the desired value.</p>		<p>Use the ring controller ...</p>  <p>to navigate through the value settings.</p>
	<p>Use the ring controller ...</p>  <p>to select the desired setting.</p>		<p>Use the measurement key ...</p>  <p>to acknowledge.</p>		<p>Use the ring controller ...</p>  <p>to return to the submenu.</p>
<p>MENU</p>	<p>Press the menu key to exit the main menu at any time.</p>				

4.3 MENU – General

LCD Brightness (%)

Display brightness can be adjusted to suit the respective requirements. Minimal display brightness results in low current consumption and increases availability of the meter during battery operation.

- LCD Brightness (%) 100 - 90 - 80 - 70 - 60 - 50

Display off (min.)

In order to further extend battery operating time, a display shutdown time can be selected. If none of the meter's controls are activated during this time, LCD brightness is automatically reduced to 50%. Activation of any key returns LCD brightness to the level selected as described in section 4.3.1. All measured values and settings are retained.

- Display off (min.) 5 - 4 - 3 - 2 - 1 - 0.5 - off

Device off (min.)

The meter is switched off if none of the controls are activated during the selected period of time. All measured values and settings are first saved and are retained until the meter is switched back on again by pressing the measurement key, M.

- Device off (min.) 10 - 5 - 4 - 3 - 2 - 1 - off

Language

The meter's menu can be set to the desired language.

- Language English - German

Time / Date

The meter displays time of day in the status line and uses it as a file name for the measured value memory, which additionally uses the date as a designation for the day file. If the battery is depleted or removed for the purpose of replacement, the integrated real-time clock continues to run for approximately 12 hours before it stops. In order to assure that date and time are retained for as long as possible, it's advisable to recharge the battery after lengthy periods of use.

- Time / Date 00:00 01.01.2016 to 23:59 31.12.2099

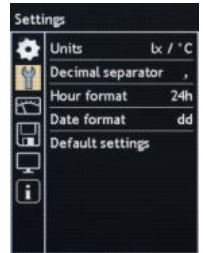


4.4 MENU – Settings

All settings apply to the display at the device as well as the stored measured value file. Where the decimal separator and date are concerned, country specific adaptation may be required in order to assure that the CSV file is read in correctly by the respective software program.

Units

Units of measure can be switched from the metric system to the imperial system. Illuminance in Lux (lx) is then changed to foot-candles (fc) and temperature is changed from degrees Celsius (°C) to degrees Fahrenheit (°F).



- Units fc / °F - lx / °C

Decimal separator

The decimal comma (,) is used in some countries as the decimal separator, and the decimal point (.) in others.

- Decimal separator . (point) - , (comma)

Hour format

Some countries use a 24 hour clock (24h), and others use a 12 hour clock (12h) together with the abbreviations a.m. (ante meridiem) for before noon and p.m. (post meridiem) for afternoon.

- Hour format 24h - 12h

Date format

The date is written differently in the various countries. The following settings are possible:

- Date format dd.mm.yyyy (day.month.year) - mm/dd/yyyy (month/day/year) - yyyy/mm/dd (year/month/day)

Default settings

The meter is reset to the default settings described in section 4.1 but date and time are retained.

- Default settings abort - reset

4.5 MENU – Measurement

The measuring range, and thus the sensitivity of the spectrometer, are controlled by means of integration time, i.e. the time during which the sensor collects light. The brighter the light source, the shorter integration time must be, and vice versa. In this respect it must be assured that the sensor is not saturated even during the shortest integration time. It may be necessary to increase distance to the light source.

Auto Int. Time

The meter can automatically adjust integration time, and thus the measuring range as well, to prevailing measuring conditions. Automatic determination of integration time should only be deactivated by experienced users, after which integration time must be selected manually.

- Auto Int. Time off - on

Int. Time

The integration time used for the last measurement is displayed in this menu, and is continuously overwritten if automatic selection of integration time has been activated. When automatic selection of integration time is deactivated, integration time is selected manually in this menu.

- Int. Time (ms) 10 to 3000 ms in 10 ms steps

Averaging

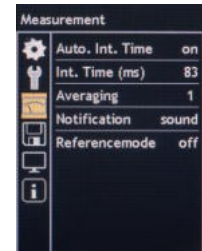
In the case of fluctuating light sources, averaging can be activated in order to obtain more stable measured values. The meter conducts the specified number of measurements and generates a mean value from all of the results. Measurement takes longer when averaging is activated.

- Averaging 1 - 2 - 3 - 4 - 5

Notification

The beginning of each measurement can be indicated by a brief acoustic signal, or by the appearance of a red hourglass at the display. A long acoustic signal is generated at the end of the measurement, or a green hourglass is displayed briefly. Sound or graphic can be selected depending on the respective requirements.

- Notification graphic - sound



Reference Mode

In reference mode you can compare two measurements.

- Reference mode off - on

4.6 MENU – Memory

Data storage to the micro SDHC memory card offers the following setting options.

Auto. saving

The measured values for the last measurement are saved either manually by briefly pressing the DATA key, or automatically after every measurement. The auto save function can be activated in this menu.

- Auto. saving off - on

Spectrum

Storage of the spectral power distribution to the file can be either deactivated, or it can be interpolated to 5 nm steps or with native sensor resolution.

- Spectrum off – 5 nm - native

Filename

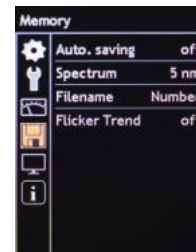
The measured values for the last measurement are saved either manually by briefly pressing the DATA key, or automatically after every measurement. As filename could be selected either the time hh-mm-ss.csv or a continuous number M_XXXXXX.csv.

- Filename Time - Number

Flicker Trend

Storing the flicker trend to the file can either be activated or deactivated.

- Flicker Trend off - on



4.7 MENU – Presentation

The content and the availability of the individual measured value windows can be adapted to the user's own specific requirements.

Spectrum

The following settings are available for the "Spectrum" measured value window:

- Spectrum off - colored - simple

Report

The individual measured quantities can be shown or hidden for the "Report" measured value window. For the CIE values, a change in one value affects both related values.

- E vis, Ee, LER, CCT, Duv, CIE1931 x, CIE1931 y, CIE1960 u, CIE1960 v, CIE1976 u', CIE1976 v', CRI Ra, CRI Re, CRI GAI, TM30 Rf, TM30 Rg, λ peak, λ dominant, Purity, Flicker Index, Flicker [%], Flicker [Hz], PPFD off - on

The calculation of TM30 after the measurement is a very complex procedure who needs approx. 3 s. If TM30 is not required, this time could be saved by deactivating the measuring values in the report as well as deactivating the measuring window.

CRI

Various display formats can be selected for the CRI measured value window. The measured value window can be hidden, all display formats can be shown, or just one selected display format can be shown.

- CRI off - all - bars - table - web

TM30

The measured value window TM30 includes several graphics and can be hidden or activated..

- TM30 off - on

The calculation of TM30 after the measurement is a very complex procedure who needs approx. 3 s. If TM30 is not required, this time could be saved by deactivating the measuring values in the report as well as deactivating the measuring window.



Flicker

The measured value window Flicker contains various display forms and can be shown or hidden.

- Flicker off - on

Data

The “Data” measured value window can be hidden, or spectral power distribution can be displayed either interpolated to 5 nm steps or with native sensor resolution.

- Data off – 5 nm - native

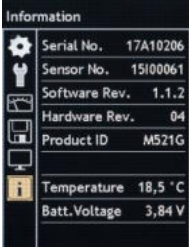
CIE

Various display formats can be selected for the CIE measured value window. The measured value window can be hidden, all CIE standard color systems can be shown, or just one selected CIE standard color system can be shown.

- CIE off - 1931 - 1976

4.8 MENU – Information

Important device information is summarized in this menu. It includes the sensor number, the serial number, the software version and the hardware version. This information is necessary if any questions regarding the product should arise, or if a malfunction should occur. Battery voltage and the temperature of the measuring probe appear in this menu as well.



Information	
Serial No.	17A10206
Sensor No.	15I00061
Software Rev.	1.1.2
Hardware Rev.	04
Product ID	M521G
Temperature	18,5 °C
Batt. Voltage	3,84 V

5 USB Port

The meter's USB port is located on the bottom of the housing. The meter is connected to a PC via the USB interface cable, and the PC detects the integrated micro SDHC memory card as a removable data storage medium. The measurement files stored in CSV format can then be easily opened, copied, moved or deleted. As long as the meter is connected to the PC, it's supplied with electrical power via the USB port and is not switched off.

If the meter is connected to the power pack via the USB interface cable, the integrated battery is charged as described in section 1.3. Charging via the PC's USB port takes a long time and is not recommended.

The open protocol for device control and data communication permits incorporation into the user's own applications. The interface description and an associated demo application can be downloaded from the MAVOSPEC BASE product page at www.ics-schneider.de.

6 Firmware Update

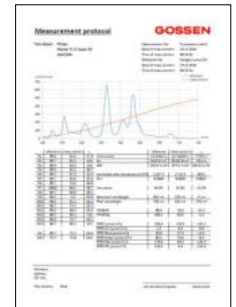
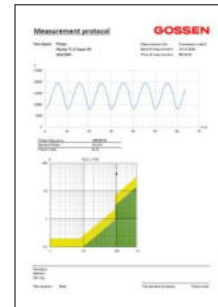
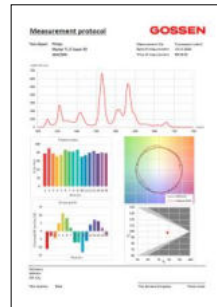
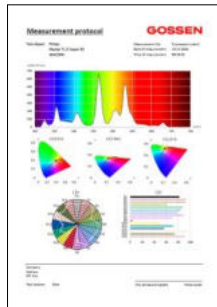
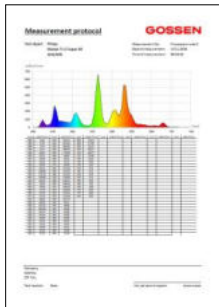
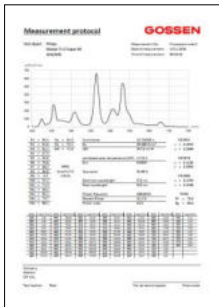
The sustainable device concept is open to future function expansions and amendments to the applicable standards. If necessary, new firmware versions will be made available by ICS Schneider Messtechnik GmbH, which the customer can install to the device himself. After updating the firmware, the meter is then fully up to date. User settings remain unchanged. Updating instructions and new firmware can be downloaded from the [MAVOSPEC BASE](http://www.ics-schneider.de) product page at www.ics-schneider.de.

7 EXCEL Templates

The built-in microSDHC memory card contains the following templates for Microsoft EXCEL. The current versions are available on the MAVOSPEC BASE product page at www.ics-schneider.de and can be downloaded from there. The templates are already supplied with sample data and can also be viewed without a connected device. The templates work under Microsoft Office for Windows 32-bit version, Excel. The execution of macros must be activated.

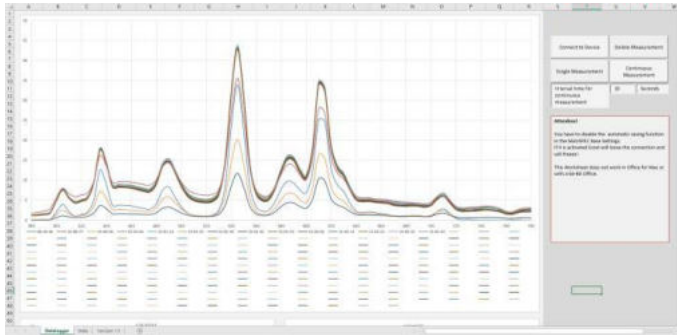
7.1 Documenting Measured Values

The Microsoft Excel template “Auswertung Vx.xx.xlms” provides various sample templates for reports. The individual elements can be adapted as desired, and new templates can be created. They access the “Data” spreadsheet, into which the stored measured value files can be read in automatically after clicking a button, or a measurement can be started with the connected meter. The reference comparison worksheet can additionally read in a measurement as a reference and then all read or executed measurements are compared with this reference and the deviations are displayed. The report can then be saved as a PDF file by clicking a button.



7.2 Data Logger

Das EXCEL template „Datenlogger Vx.xx.xlsm“ provides a data logger function. Either individual measurements or continuous measurements with adjustable measuring interval can be carried out and stored in the data worksheet. The respective spectral curve appears in the graphic display and below the positions are displayed in the CIE 1931 and CIE 1976 color space. The datalogger can be used in conjunction with the measuring device to record the measured values over the course of the day, which is particularly advantageous when checking luminaires or systems of biologically effective lighting (Human Centric Lighting) or in greenhouse lighting.



The screenshot shows the data table from the data logger software. The table has columns for time (HH:MM:SS) and various measurement values. The data is organized into rows, with some rows highlighted in yellow. The columns represent different parameters measured over time, such as illuminance, color temperature, and spectral power distribution.

8 Practical Tips

A broad range of information regarding measured quantities, measuring methods, applications and photometry standards, as well as support in selecting a suitable meter, is included in the **Photometry Compendium**. It can be downloaded from the MAVOSPEC BASE product page at www.ics-schneider.de under Downloads Catalogs or requested as a printed version from ICS Schneider Messtechnik GmbH.

9 Factory Calibration

The MAVOSPEC BASE with intuitive user interface is one of the most accurate and reliable spectrometers in its class, and reflects the most up-to-date technology available on the market. Like all other precision light meters, this product also requires regular maintenance, recalibration and firmware updates in order to continuously fulfil performance capabilities within the tolerances and specifications stipulated by the manufacturer. Depending on conditions of use, a calibration interval of 12 to 24 months is recommended.

10 Service

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 or solvents.

If at any time your meter does not function to your full satisfaction, please contact us or send it to us at:

11 Error Messages

The error messages listed below may appear during operation and are displayed in the information bar.

Error Message	Situation	Cause	Elimination
Faulty calibration data	Initial window	Calibration data memory illegible or faulty	If this error occurs several times after a restart, please send the meter for repair.
Device not calibrated	Measured value window	No calibration data available	
SD card error	Initial window or save/load measurement	SD card cannot be accessed	Insert the SD card or examine it at the PC and reformat it if necessary (FAT16).
File error	Save/load measurement	File cannot be accessed	
Folder error		Folder cannot be accessed	
Saving not permitted	Save measurements	The measurement has already been saved or is outside of the valid measuring range.	
Signal too weak	After performing a measurement	The measurement signal is too weak.	Reduce distance to the light source.
Signal too strong		The measurement signal is too strong.	Increase distance to the light source.
Battery almost dead	Measured value window	Battery has not been charged on time.	Charge the battery or supply the device with electrical power from the power pack of the PC.
3 brief acoustic signals	Any time	Battery dead	

12 Technical Data

Sensor Technology, Measuring Uncertainty		
Sensor	CMOS image sensor, 256 pixels	
Diffusor light-entry surface	7 mm diameter	
Distance, diffusor to surface to be measured	25 mm	
Error limit, cosine correction	≤ 3% (comparable with the f2 failure of a class B device according DIN 5032-7)	
Spectral range	380 ... 780 nm	
Full width at half maximum (FWHM)	≤ 15 nm (typically 12 nm)	
Physical resolution	~ 1.72 nm	
Digital resolution	16 bit	
Wavelength reproducibility	± 0.5 nm	
Integration time	Automatic, manual, 10 ... 3000 ms in 10 ms steps	
Signal-to-noise ratio	1000:1	
Spurious light	-25 dB	
Dark stream compensation	Automatic with integrated temperature sensor	
Measurement uncertainty, illuminance	Standard light type A, 2856 K @ 1000 lx	± 3 %
Measurement uncertainty, chromaticity		± 0.0005
Reproducibility, chromaticity		± 2%
Measurement uncertainty, CCT		± 1.5%
Measurement uncertainty, TM30		± 1.5%
Measurement uncertainty, CRI		± 1.5%
Measurement uncertainty, flicker		± 1.5%
Photometry		
Measuring functions	Illuminance E _v	10 ... 100,000 lx
	Irradiance E _e	
	Luminous Efficacy Ratio LER	
	Color temperature (K)	1600 K ... 50000 K (D _{uv} ≥ -0,1)
	D _{uv} – color temperature difference relative to the Planckian locus	(1600 K ≤ CCT ≤ 50000K)
	TM30 Fidelity Index R _f , Gamut Index R _g	IES TM-30-15
	Color rendering indices R _a , R _e , R ₁ to R ₁₅	CIE 13.3
	Gamut Area Index	
	λ _{peak} – peak wavelength	
	λ _{dominant} – dominant wavelength	CIE 15
	Purity – color purity	CIE 15

36	Chromaticity coordinates	CIE 1931 [x,y], CIE 1960 [u,v], CIE 1976 [u',v']
	Flicker index	0.00 ... 1.00 (f < 400Hz und Flicker % > 1 %)
	Flicker as percentage (%)	1,0 % ... 100 % (f < 400Hz)
	Flicker frequency (Hz)	2 Hz ... 6000 Hz (Flicker % > 1 %)
Measuring function PAR	PPFD	µmol/m²s (400 - 700 nm PAR)
	PPFD_UV	µmol/m²s (380 - 400 nm)
	PPFD_Blue	µmol/m²s (400 - 500 nm)
	PPFD_Green	µmol/m²s (500 - 600 nm)
	PPFD_Red	µmol/m²s (600 - 700 nm)
	PPFD_FR	µmol/m²s (700 - 780 nm)
Units of Measure	lx / °C - fc / °F, selectable	
Operation, Interfaces, Memory		
Display	2.1" TFT color display, 320 x 240 pixels, brightness adjustable from 50% to 100%, shutdown adjustable from 0.5 ... 5 min. or off	
Controls	3 keys, ring controller	
Languages	German, English	
Interface	USB 2.0, data transmission, battery charging, open interface protocol	
Data storage	4 GB micro SDHC memory card, manual and automatic memory modes, CSV data format, memory occupancy per measurement: 2 kB, per thousand measurements: 2 MB	
Power Supply		
Mains power pack	100 ... 240 V AC (50/60 Hz) 0.15 A, USB socket: 5 V DC, 1 A	
Rechargeable battery	Li-ion, 3.7 V, 890 mAh, replaceable	
Charging time with power pack	1.5 hours	
Operating time with rechargeable battery	≥ 8 hours continuous operation	
General		
Dimensions	139 x 60 x 30 mm	
Weight	150 g (meter with battery and memory card)	
Operating temperature	+5 to +40° C	
Storage temperature	-20 to +70° C	
Scope of delivery	Meter, sensor cover cap, 4 GB micro SDHC memory card with SD adapter, V070A rechargeable battery, power pack, USB interface cable, aluminum case, neoprene sheath, carrying strap, calibration report, operating instructions in German and English	
Optional Accessories		
Replacement battery (V070A)	Li-ion, 3.7 V, 890 mAh	