



uSPECTRUM PC Software

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uSPECTRUM PAR



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- * Per garantire la convalida della garanzia, inserire il timbro dell'agente nella casella e compilare la data di acquisto. Se non è possibile fornire il timbro dell'agente e la data di acquisto, il periodo di garanzia si baserà sulla data di fabbricazione del prodotto.
- * Para garantizar la validación de la garantía, coloque el sello del agente en la caja y rellene la fecha de compra. Si el sello del agente y la fecha de compra no se pueden suministrar, el periodo de garantía se basará en la fecha de fabricación del producto.

Original / Authorized Agent Stamp

Product Serial Number : _____

Purchase Date : _____

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PG200N

手持式分光光譜計・SPECTRAL PAR METER・ハンディタイプ分光光度計

User Manual

使用説明書

簡易取扱説明書

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To get more information related to operation, firmware upgrade and warranty terms; online application for correction and repair service, please visit www.uprtek.com to download the complete version.

1.1 Product Overview

Your Spectral PAR Meter PG200N is a palmtop photon meter that measures range of light sources in multiple modes. It may measure PPF(Photosynthetic Photon Flux Density) of plant light source Spectral PAR Meter PG200N comes with 4.3" touch control screen. User friendly smart interface enables fast and easy use of this product. Removable optical sensor design enables remote measuring and keeping measurements in SD card.

Automatic shutter function added to improve measurement accuracy. The optical sensor of the second generation Spectral PAR Meter is equipped with IP66 Ingress Protection Rating.

Connect this product to a PC by USB cable enables easy data management with exclusive software.

1.2 Package Contents

Please ensure the following are included in the package of this product: In case of any flaw and/or loss please call the dealer or this Company for help.



Case



PG200N
Spectral PAR Meter



User Manual



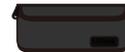
Power Adaptor



USB Cable



3M Type-C USB Cable
(remote measurement)



Protection Bag



Sensor Head Stand Bracket



Screen Wiper



MicroSD Card



Screwdriver



Screws



Warranty Card

1.3 Product Introduction



1. If the system crashes, press the power key for 3 seconds to turn off the system.
2. If the problem still can't be fixed, use a pen to press the reset key to turn off the system.

1.4 Annual Product Calibration

As the product is a high-precision instrument, please use it cautiously. To ensure the accuracy of measurements, annual calibration is recommended. Please consult the agent or the customer service department for the calibration service.

1.5 Product Notes and Precautions

1. PG200N Spectrometer is a high-precision instrument. Please unpack with care. Any vibration or collision may cause instrument damage. If the product doesn't work normally or needs repair, don't attempt any repairs. All repairs must be performed by the authorized customer service agent.
2. Most LCD screens have a very small and inconsequential defective pixel rate (usually less than 0.1%). This results in occasional pinpoints of white or other colors but will not affect the accuracy of measurements.



Precautions / Warnings

Please read the following precautions to avoid fire, excessive heat, chemical leakage and explosion :

- Do not disassemble or modify the battery.
- Do not expose the battery to heat (fire) or water/moisture.
- When disposing of used/old batteries, wrap with insulation tape to shield the battery from electrical contact with metallic objects, which might ignite a fire or explosion.
- If the unit is plugged into the power adapter and the battery seems to be overheating, or if there is smoke or peculiar odors emanating from the unit, unplug immediately to avoid the possibility of fire.
- Do not touch the cables if there is heat emanating from or near the cables as melted or deformed cables could expose wiring and result in burns or electric shock.
- Do not use cloth or anything to wrap or cover the equipment while charging – this could cause the unit to overheat, melting the casing or causing fire.
- If the unit is accidentally immersed in water, or if moisture has seeped inside, or metal objects have dropped into the casing, immediately remove the battery to avoid fire or electric shock.
- Do not operate or store the battery in high-temperature environments. This will cause battery leakage and/or shorten the life of the battery.
- Do not use paint thinner, benzene, or other organic solvents to clean the equipment. This may damage the exterior finish or touch screen and may even ignite a fire.

2.1 Preparing Before Use

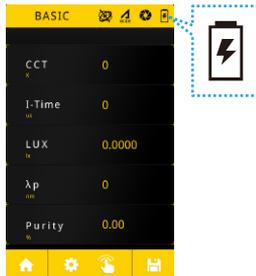
Charging method

Connect the charger and USB cable to the Type C USB port of this product to start charging.

1. While powered OFF, the red indicator will light up during battery charging; the red indicator will go off once the spectrometer is fully charged.



2. A flash symbol displays at upper right corner of the LCD screen during charging and disappears after it is fully charged.



1. Charge the battery for 6 hours before using it for the first time.
2. To prevent power outage during use, check whether the red light has turned off (fully charged) according to the instructions given on the next page (Item1). Once the spectrometer is turned on, keep an eye on the battery charge indicator at the upper right corner of screen.
3. If your battery drains quickly after being fully charged, it needs to be replaced. Please contact your dealer.
4. Battery life varies with battery age and usage. A new battery typically lasts about 5 hours after a full charge.

2.1 Preparing Before Use

Installing MicroSD card

Measurement data may be saved in Excel (xls) format and image data (spectrum and chromaticity coordinates diagram) may be saved in JPG format in the MicroSD card with capacity at 1GB or more.

Open the dustproof cover and insert the MicroSD card in the specified direction.



Press to remove MicroSD card

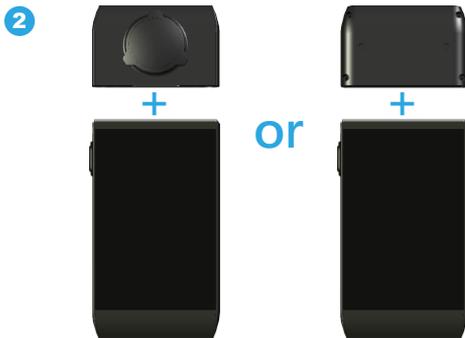
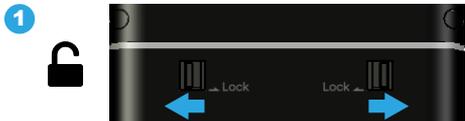


1. The SD card features a card latch design to prevent it from coming loose. You may feel that the SD card is stuck when it is inserted in or removed. In this case, pull or push it a little harder to get it in place or removed. To remove SD card: Press it as shown in step ① and pull it out after ejecting as shown in step ②.

2.1 Preparing Before Use

Connect optical sensor to console

To install the sensor head in the opposite direction, switch off the power before doing so. As in the figure below, unlock the sensor head and the body first by pushing the safety locks both outward. Turn the sensor head to the opposite direction and insert it to the body and then lock them by pushing the safety locks both inward. Switch on the power again after correctly installed.



2.1 Preparing Before Use

As shown in the figure below, when using the USB TypeC cable to perform long distant measurements, please switch off the power first before connect to the cable and tighten the screws of the cable connected to the sensor head.



1. Optical sensor and console are paired before shipment to you. DO NOT use either of the two with any other PG200N Spectrometer. If you have more than one PG200N Spectrometer, DO NOT swap optical sensor between instruments.
2. Power off the spectrometer before installing or uninstalling optical sensor from console.
3. Run background calibration after turning power on and before taking measurements.

2.1 Preparing Before Use



Precautions on optical sensor installation

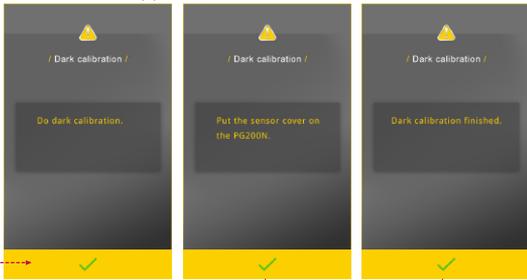
Make sure the optical sensor latch is well connected to console.

Dark calibration

- 1 Press the power button and the blue indicator will light up, and the boot screen will appear on the screen.



- 2 Perform dark calibration by following the steps displayed on the screen. When the "Dark calibration" dialog window appears, select the "✓" OK button.



- 3 Confirm that the cap is covered and then select the "✓" OK button.

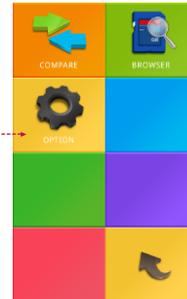
Once the message "Dark calibration finished" appears, click "✓" OK and you will be returned to the main menu.

4

2.1 Preparing Before Use

Set up date and time

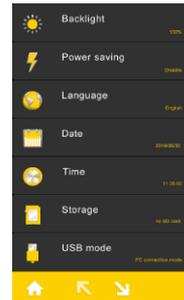
Set up date and time before taking any measurements.



- 1 Click "OPTION" icon.

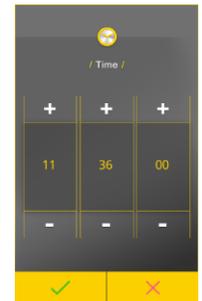


2



Press "Date" and "Time" to update settings.

- 3 Once date is set, press "✓" Yes to exit to setup option page.



- 4 Once time is set, press "✓" Yes to exit to setup option page.

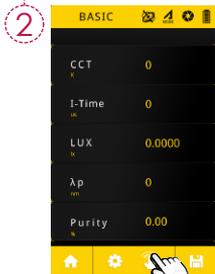
2.2 Basic Measurement

Measurement

Click "BASIC" mode to enter measurement page.



1 Point optical sensor to light source to be tested.



2 Press the measurement button at the bottom center of the LCD screen or the measurement key on the left hand side of the spectrometer to take a measurement (You can press measurement key at both sides).



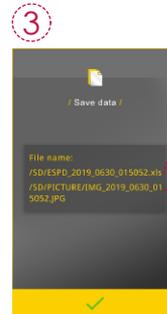
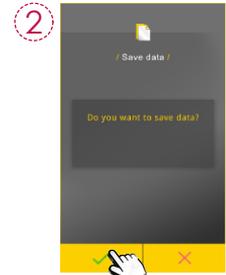
3 This product beeps once after measurement is done and displays results on screen.

2.2 Basic Measurement

Save measurement data



Press the "Save file" button at lower right corner.



Measurement data is now saved in the MicroSD card. You may note down file name if necessary.

EXCEL file name :
ESPDY YYY _ M M D D _ H H M M S S
 regular (year) (month)(day) (hour/min/seconds)

Model Name	PG200N
Serial Number	AXX10231
Time	2019/05/12_01:50:52
Memo	
LUX(lx)	15.336473
λc	1.425323
CCT(K)	13656

▲ You may save entire source data.

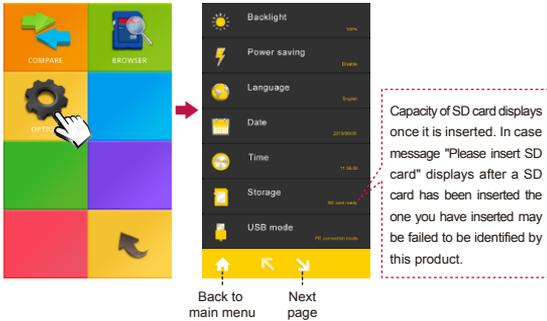
JPG file name :
IMGY YYY _ M M D D _ H H M M S S
 regular (year) (month)(day) (hour/min/seconds)



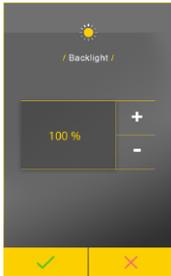
▲ You may save measurement screen in "BASIC mode", "SPECTRUM mode", "PPFD mode", "PPFD SPECTRUM mode" and "CIE 1931.1976 mode".

2.3 Setup Items in OPTION

Click OPTION icon in main screen to set up this product.



■ Backlight Setting



■ Power Saving Setting



■ Language Setting



■ Date Setting

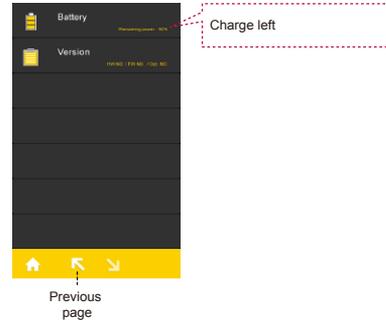


■ Time Setting



+ / - : Adjust key

2.3 Setup Items in OPTION



■ Check Storage Device



■ USB Mode Setting



■ Check Version



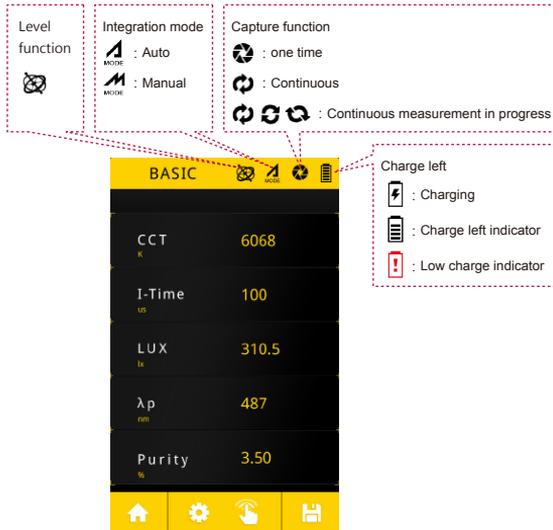
Please refer 5.2 for USB mode setup.



1. You cannot set up battery. The screen remains intact after you tap it.

3.1 BASIC Mode

Click “BASIC” icon in main screen to display measurement readings.

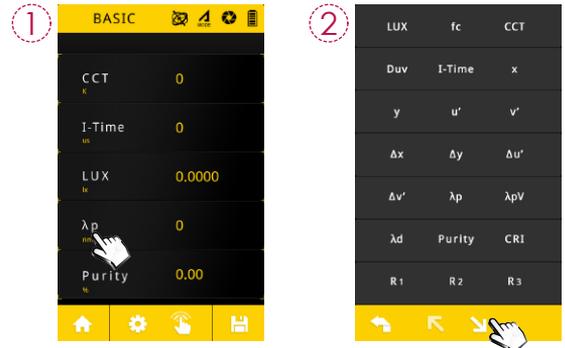


1. Please use PG200N Thermal-Hygro cable along with PG200N for temperature(°C) and relative humidity(%RH) measurements.

3.1 BASIC Mode

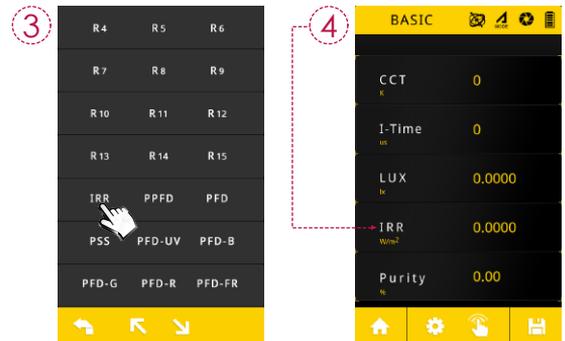
Customize the four measurement items in BASIC mode.

The 5 items on the Basic list can be customized with different units of measure according to your preference.



Click the item to be changed.

List of available items displayed, click down arrow key “ \downarrow ” to scroll down to next page.



Click items to be shown in position ①. Click “ \leftarrow ” key at bottom of screen to back to last page without selecting any item.

Default item changed. Follow the same steps to change other default items.

3.1 BASIC Mode

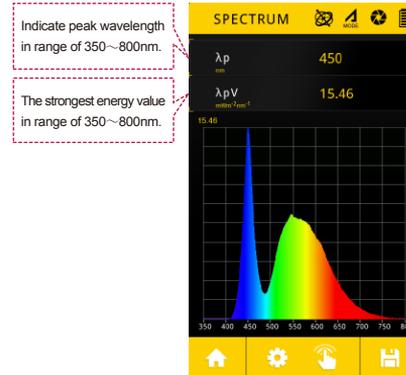
Level function

Click on the g sensor icon on the top-right of the screen to check the level status of the optical sensor.



3.2 SPECTRUM Mode

Click "SPECTRUM" icon in main menu to display spectrum in range of 350~800nm.



3.3 PPF Mode

Click “PPFD” icon in main menu to validate Photosynthetic Photon Flux Density (PPFD). Measuring range is 350~800nm. In addition, items and ranges to measure can also be customized; instructions are shown in the figure.

Customize the four measurement items in PPF mode.



Changeable measurement item

Click the item to be changed.



Click items to be shown in position ①. Click “” key at bottom of screen to back to last page without selecting any item.

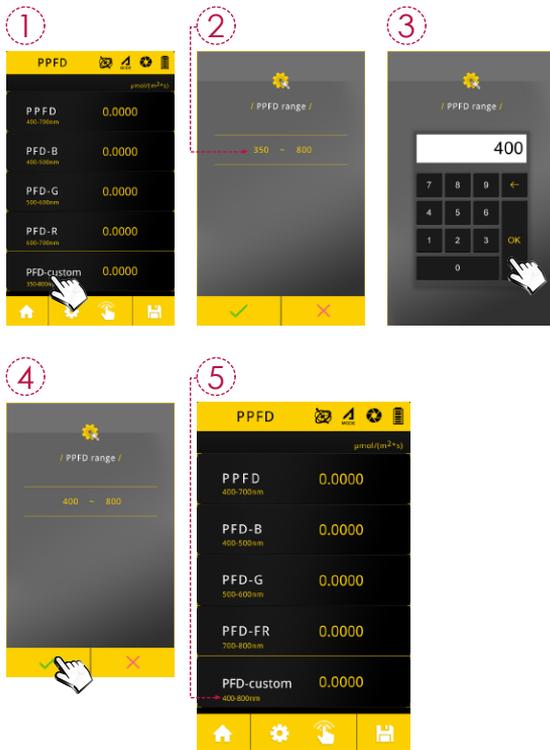


Default item changed. Follow the same steps to change other default items.

3.3 PPF Mode

Customizing measurement range

1. Press the “PFD-custom” item.
2. Select the start and end values in order to change the range.
3. Use the keyboard to input the values; press “OK” when completed.
4. Press the confirm button “✓” to complete the settings for changing the range.
5. Return to the measurement page and the yellow value under “PFD-custom” is updated based on the customized range.

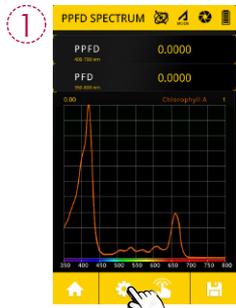


3.4 PPFD SPECTRUM Mode

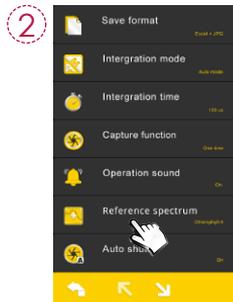
PPFD spectral mode provides five reference spectrums:

1. Chlorophyll a, 2. Chlorophyll b, 3. β -Carotene, 4. Phytochrome A-red and 5. Phytochrome A-far red. The range of the reference spectrums is 350~750nm.

Reference spectrum setting



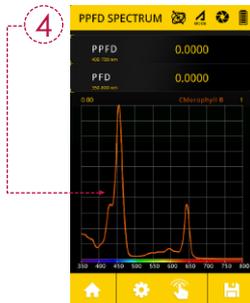
1 Press the “Settings” button at the bottom of the screen.



2 Enter the measurement setting screen and press the “Reference Spectrum” item.



3 Select the required reference spectrum and press “OK”.

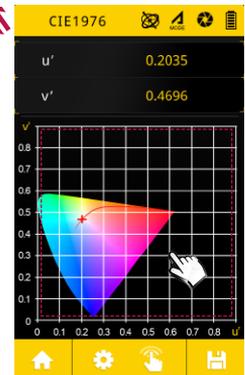
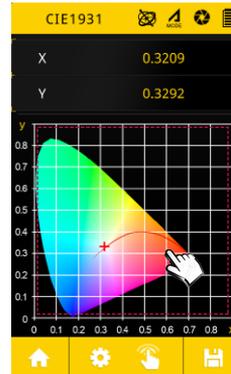


4 Return to the measurement page and the display of the reference spectrum has changed.

3.5 CIE Mode

Click “CIE” icon in main screen to validate CIE 1931 and CIE 1976 chromaticity coordinates chart.

Click chromaticity coordinates chart to switch between CIE1931 / CIE1976.

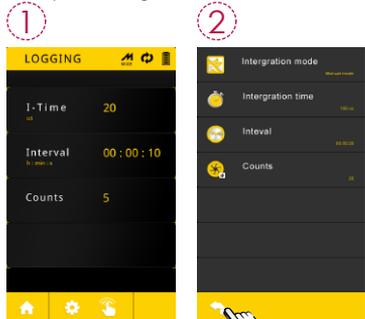


3.6 LOGGING Mode

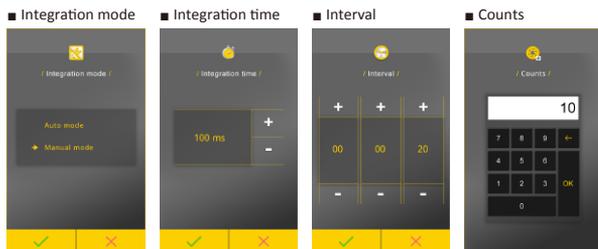
Uses continuous measurement to measure the various values and saves them automatically in Excel format.

Set up operation conditions

Press the “” setting button at the bottom of the screen to set the Integration mode, Integration time, interval and counts in order; press the “” button at the bottom of the screen when completed to return to the measurement screen and start performing measurement.



1
2
3
4 Setting complete; return to the measurement screen.



Exposure mode can have exposure time set up in manual mode only.

The range of measurement interval is 00 (hour):00 (minute):10 (seconds) ~23:59:59.

The range of continuous measurement count is: 1~9999999 times.

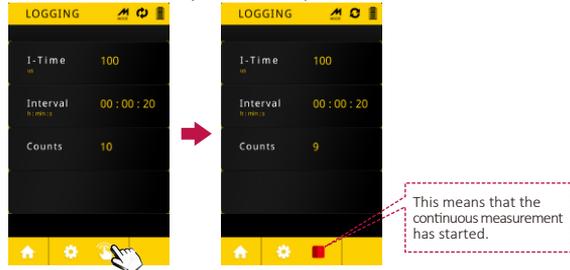
3.6 LOGGING Mode

Measurement

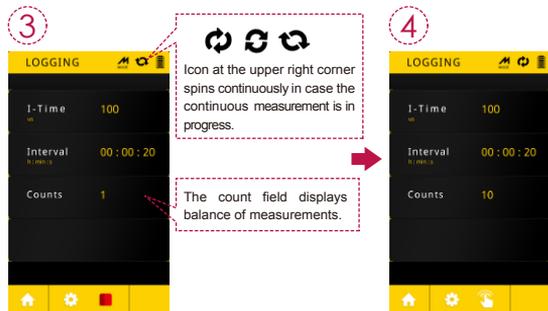
1 Point optical sensor to light source to be tested.



2 Press the measurement button at bottom center of screen or the measurement key at left hand side to measure. (You can press measurement key at both sides.)



This means that the continuous measurement has started.



3 To stop continuous measurement in between, please press the “” stop button.

4 The Count option will reset to its default settings after measurement is done.

3.7 GRID Mode

Click "GRID" icon in main menu to collect the data from different positions and provide the average, maximum, minimum, uniformity, and, diversity values on – Lux, PPFD, PFD, PFD-B, PFD-G, PFD-R, PFD-UV, and, PFD-FR.

ID number – the maximum number of data is 100.

The PPFD value of this ID

The PFD value of this ID

The average PPFD value of total measurements.

The average PFD value of total measurements.

GRID	
ID	100
PPFD <small>400-700nm</small>	9.611
PFD <small>350-800nm</small>	9.961
PPFD Avg	8.309
PFD Avg	8.576

3.7 GRID Mode

Measurement

After press the measurement button at bottom center of screen or the measurement key at left hand side, the ID filed will switch to the next ID number in sequence (1-100).

GRID	
ID	1
PPFD <small>400-700nm</small>	8.425
PFD <small>350-800nm</small>	8.607
PPFD Avg	8.425
PFD Avg	8.607

GRID	
ID	2
PPFD <small>400-700nm</small>	8.609
PFD <small>350-800nm</small>	8.765
PPFD Avg	8.517
PFD Avg	8.686

GRID	
ID	3
PPFD <small>400-700nm</small>	8.423
PFD <small>350-800nm</small>	8.619
PPFD Avg	8.486
PFD Avg	8.663

ID setting

1. Press the "ID" item.
2. Use +/- key to adjust the ID number.
3. Return to the measurement page, the ID number is updated.

1. Press the "ID" item.

2. Use +/- key to adjust the ID number.

3. Return to the measurement page, the ID number is updated.

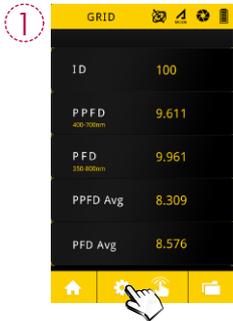
GRID	
ID	100
PPFD <small>400-700nm</small>	9.611
PFD <small>350-800nm</small>	9.961
PPFD Avg	8.309
PFD Avg	8.576

/ ID /	
4	+ -

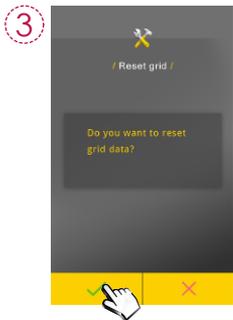
GRID	
ID	4
PPFD <small>400-700nm</small>	9.611
PFD <small>350-800nm</small>	9.916
PPFD Avg	8.672
PFD Avg	9.205

3.7 GRID Mode

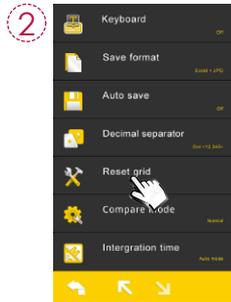
Reset the Grid data



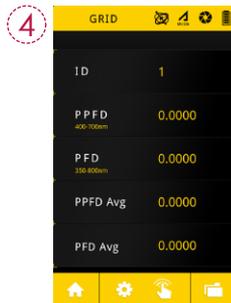
Press the “Settings” button at the bottom of the screen.



Press “OK” Yes to reset the grid data.



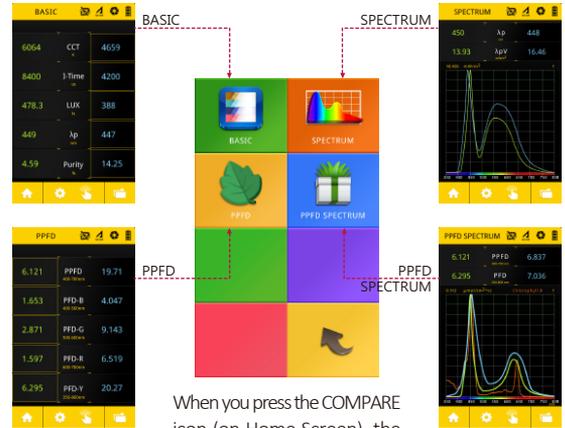
Enter the measurement setting screen and press the “Reset grid” item.



Return to the measurement page and the grid data is reset.

3.8 COMPARE Mode

The Compare item allows you to compare two measurements side by side. You can compare two consecutive measurements or compare a measurement against historical data (SD card).



When you press the COMPARE icon (on Home Screen), the COMPARE Menu will display, which is similar to the Home Screen. You can tap any of the icons depending on what type of data you want to compare.



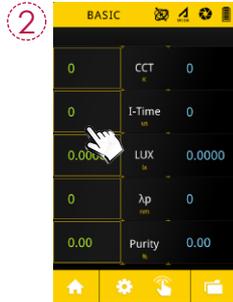
1. The examples in the following pages only describe how to compare data in the BASIC screens, - comparing SPECTRUM, PPFD, PPFD SPECTRUM data are similar.

3.8 COMPARE Mode

Compare two consecutive measurements



Select the BASIC icon. The left column and right column will represent the data you are comparing.



First, tap the left column. A yellow border will appear around the left column.

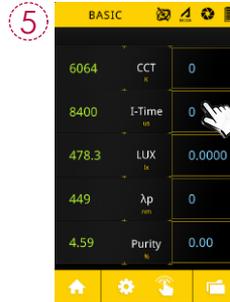


Point the PG200N to a light source and take a measurement.



The measurement data will fill the left column.

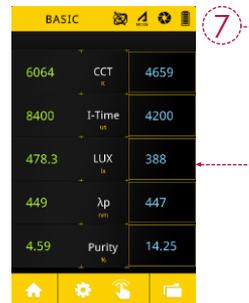
3.8 COMPARE Mode



Next, tap the right column. A yellow border will appear.



Take another measurement.

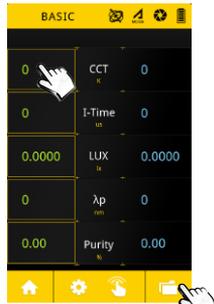


The new data will fill the right column. You can now compare the two measurements.

3.8 COMPARE Mode

Compare against historical data 1

To compare against historical data (saved on SD Card), first tap either the left or right column, and then tap the “  ” Folder icon in the lower right corner.



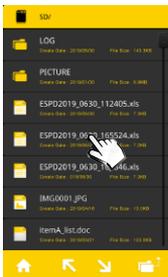
2 Press the “Folder” button at lower right corner.

3



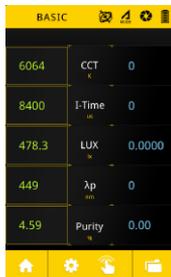
Select the “Load file” and press “OK”.

4



A file browser appears showing the files on the SD card. Select one of the Excel files.

5



The data will appear in the column you selected.



1. The list items in the COMPARE screen (e.g. CCT, CRI, LUX etc.) is the same list configured for the BASIC Screen. If you change the list items on the BASIC screen, it will also change on the COMPARE screen.

3.8 COMPARE Mode

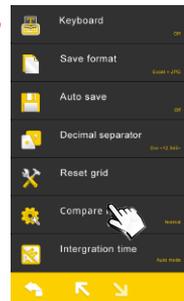
Spectrum data comparison settings 1

It is also possible to see the relative difference between the spectrum data between the first measurement and the second measurement.



Press the “Settings” button at the bottom of the screen.

2



Press the “Compare mode” item.

3



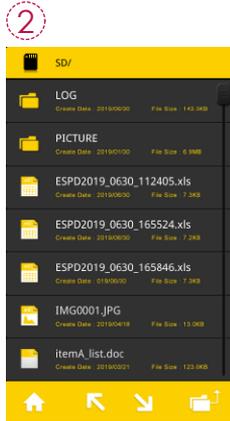
Press “OK” to save settings and exit to measurement setup page.

3.9 BROWSER Mode

The Browser (on Home Screen) allows you to review historical data that was previously saved to the MicroSD card.



Press the “BROWSER”icon.



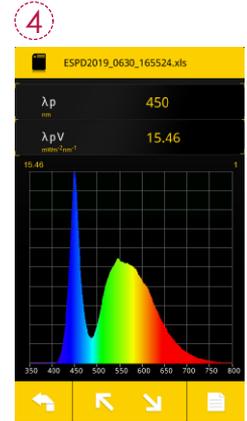
A file browser will show the files on the MicroSD card. If you select an excel file, a review menu will be displayed.

-  Back to main menu
-  Previous page
-  Next page
-  Return to the previous folder

3.9 BROWSER Mode



Press any of the icons to review the data.

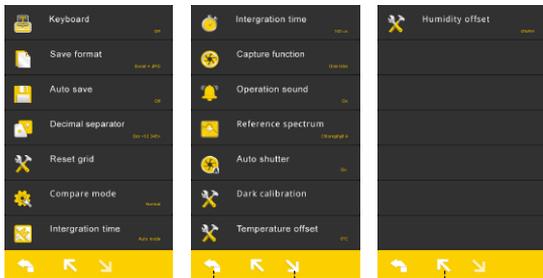
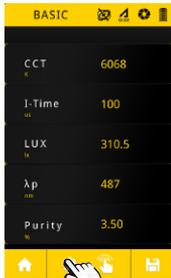


Displaying the data of excel file.

-  Back to select browsing mode
-  Previous file
-  Next file
-  Return to the MicroSD card file page

4.1 Measurement Settings

In mode of “BASIC”, “SPECTRUM”, “PPFD”, “PPFD SPECTRUM”, “CIE”, “GRID”, “COMPARE” you can press the “” setting button at the bottom of the screen to perform detailed settings.



Back to measurement page Next page

Previous page

4.1 Measurement Settings

■ Keyboard



This option is turned on can be file naming when you saving measured data.

■ Save format



You may opt to save measurement data of Excel file only or both Excel and JPG files.

■ Auto save



Opt to select auto save measurements or not.

■ Decimal separator



Select dot/comma to set the decimal separator of the measurement data.

■ Reset grid



This function will only be displayed under GRID mode.

■ Compare mode



This function will only be displayed under COMPARE mode.



About auto save:

1. Measurements are auto saved (Excel + JPG) in case this operation is set on. In case there is no SD card inserted when measurement is running, this product prompts warning messages while keep on measuring.
2. Measurements are saved only by clicking Save icon in case this operation is set off.

4.1 Measurement Settings

■ Integration mode



Select auto or manual mode. Exposure time need be set in case manual mode is chosen.

■ Integration time



Exposure time may set in unit of microsecond (0.001 second). Valid range:100us~1000ms

The setting interval is ± 0.1 ms for 1ms or less

The setting interval is ± 1 ms for 1~10ms

The setting interval is ± 10 ms for 10~100ms

The setting interval is ± 100 ms for 100ms or above.

+ / - : Adjust key

■ Capture function



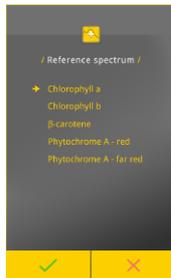
Select for one time or continuous measurement. In case continuous measurement is set, press Measurement/Local Measurement key to start auto measurement at frequency of once per 3 seconds. Press Measurement/Local Measurement key again to stop continuous measurement. (See Section 4.2: Continuous measurement for reference.)

■ Operation sound



Select to on/off operation sound. Set operation sound on to beep once after measurement operation (enabled by pressing the Measurement / Local Measurement key) completed.

■ Reference spectrum



This function will only be displayed under PPFID SPECTRUM mode.

■ Auto shutter



When users press the measure button on the screen/on the machine, dark calibration will be executed before the measurement.

4.1 Measurement Settings

■ Dark calibration



This product is default to run background calibration after power on. This operation enables running background calibration any time.

■ Temperature offset



The range of temperature offset is -5°C ~ +5°C.

■ Humidity offset



The range of relative humidity is -5%RH ~ +5%RH.

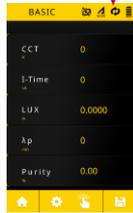


1. Please use PG200N Thermal-Hygro cable along with PG200N for temperature and relative humidity measurements.

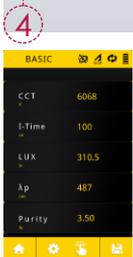
4.2 Continuous Measurement Settings

1 Press the “” setting button at the bottom of the screen and then press “Measurement Function” · “Continuous Measurement” · “” confirm button in order.

Click on the “” button at the bottom of the screen to return to the measurement screen, the ② icon changes to “”.



3 Point optical sensor to light source.



※ Status indicator spin continuously in case the continuous measurement is in progress.

Auto measurement at frequency of once every 3 seconds.



Press measure key or click measurement button at bottom center of screen to start continuous measurement.

Click measurement button or press measure key again to stop continuous measurement.



1. Users cannot save the measurement data while processing continuous measurement.
2. Adjust the integration time is only allowed in the manual mode.

5.1 Connecting with mobile device

1 APP Installation

Download and install uSpectrum PAR on the mobile device.



uSpectrum PAR

2 iOS system :

Turn on “Bluetooth” in Settings on the mobile device (Do not connect to PG200N_BT)

Android system :

Turn on “Bluetooth” in Settings on the mobile device and connect to PG200N_BT.



3 Measure



Bluetooth connection



1. Device connection symbol: Blue→Connected, Red→Not connected.
2. When connection failed, select the device connection symbol to perform connection again.

5.2 Connecting to uSPECTRUM

Install uSPECTRUM PC software

Please visit the UPRtek official website at <http://www.uprtek.com>; download the file and install it on your computer system to connect the computer and PG200N through USB and run uSpectrum to perform measurements.



Set USB PC connection mode

1. Select "OPTION".
2. Select "USB mode".
3. Select "PC connection" and press "✓" Yes.

Mass storage :

Save measurement data in MicroSD card of PG200N.

PC connection :

Connection PG200N to PC via USB cable for measurement use with uSPECTRUM.



5.2 Connecting to uSPECTRUM

Measure



5.3 Troubleshooting

In case of system failure or stuck (screen gets locked) please press and hold the power key for 3 seconds to shut down this product.

Confirm the condition after re-starting; if the fault still cannot be eliminated, follow the instructions in the figure below to re-set this machine. Open the dust-proof cover and insert a thin pencil vertically into the re-set button to re-set this machine.



1. DO NOT use sharp point objects with diameter less than 1mm (e.g., paper clip and ball pen) to press the key as it may lead to board circuit induction or damage and failure to this product.
2. DO NOT use pencils with broken point to press the key as the pigment core may jam the key for reset or lead to damage and failure to this product.

6.1 General Attributes

Abbreviation	Full Name	Unit
CCT	► Correlated Color Temperature	K
The color radiated by a black-body radiator under different temperatures. CCT has the color that is the closest to the ideal black-body radiator.		
CRI (Ra)	► Color Rendering Index	
The average value of R1 ~ R8, where R1 ~ R8 represent the value of eight standard colors as defined by Commission International de l'Eclairage (CIE). A CRI value of 100 indicates the best quality of light for rendering color appearance, while a value of 0 indicates the worst quality of light for rendering color appearance.		
R1, R2, ..., R15	► Color Rendering Index Varieties	
Represents the quality of the light source with the indexes corresponding to 15 standard colors, including: R1: light grey-red; R2: dark grey-yellow; R3: saturated yellow-green; R4: middle yellow-green; R5: light yellow-green; R6: light blue; R7: light purple-blue; R8: light red-purple; R9: saturated red; R10: saturated yellow; R11: saturated green; R12: saturated blue; R13: white skin color; R14: leaf green; and R15: yellow skin color.		
Lux	► Illuminance	lx
Light flux received by each unit area.		
λ_p	► Peak Wavelength	nm
Wavelength with the highest intensity in the measured spectrum.		
λ_{pV}	► Peak Wavelength Value	mW/m ²
Intensity of the peak wavelength in the measured spectrum.		
λ_d	► Dominant Wavelength	nm
Used to express the color of the measured light. May be hybridized by the spectrum color of the wavelength and the standard illuminant E(x, y = 0.333, 0.333).		
I-Time	► Integration Time	us
Integration time measured by the spectrometer.		
x, y	► CIE1931 Chromaticity Chart Color Coordinates	
Light color with 2-dimensional plane coordinates (x, y) as defined in CIE Chromaticity Chart CIE1931.		
u', v'	► CIE1976 Color Coordinate	
Light color with 2-dimensional plane coordinates (u', v') as defined in CIE Chromaticity Chart CIE1976.		

6.1 General Attributes

Abbreviation	Full Name	Unit
Duv	► CIE1960 UV Color Coordinate Difference	
UV distance between CIE1960 plane coordinate(s) and Planck's blackbody radiation with the same color temperature. A value close to 0 indicates the color temperature and color are closer to that of the blackbody radiation. A positive value indicates it is above the blackbody radiation, while a negative value indicates it is below the blackbody radiation.		
Δx	► CIE1931 Color Coordinate Difference	
X difference between CIE1931 plane coordinates and Planck's blackbody radiation with the same color temperature.		
Δy	► CIE1931 Color Coordinate Difference	
Y difference between CIE1931 plane coordinates and Planck's blackbody radiation with the same color temperature.		
$\Delta u'$	► CIE1976 Color Coordinate Difference	
U' difference between CIE1976 plane coordinates and Planck's blackbody radiation with the same color temperature.		
$\Delta v'$	► CIE1976 color coordinate difference	
V' difference between CIE1976 plane coordinates and Planck's blackbody radiation with the same color temperature.		
fc	► Foot-candle	fc
Non-SI unit of illuminance defined as lumens per square foot (lm/ft^2).		
Purity	► Color Purity	%
Percent of the dominant wavelength in the standard illuminant. The closer the color purity is to 100%, the closer it is to the dominant wavelength.		
IRR	► Irradiance	W/m^2
Flux of radiant energy per unit area within the range of a specified wavelength.		
PPFD	► Photosynthetic Photon Flux Density	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
Number of photons per unit area per unit of time for photosynthetically-active radiation (400~700nm wavelength range).		
PPFD-R	► PFD in Red Field	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
PFD in the 600~700 nm wavelength range.		
PPFD-G	► PFD in Green Field	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
PFD in the 500~600 nm wavelength range.		

6.1 General Attributes

Abbreviation	Full Name	Unit
PPFD-B	► PFD in Blue Field	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
PFD in the 400~500 nm wavelength range.		
PFD	► Photosynthetic Photon Flux Density	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
Number of photons in range of 380~780nm subjected by unit area in unit time.		
PFD-UV	► PFD in UV field	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
PFD in range of 380~400nm		
PFD-FR	► PFD in FR field	$\mu\text{mol}/(\text{m}^2\cdot\text{s})$
PFD in range of 700~780nm		
PFD-B: G ratio	► PPFD ratio between the blue and green fields	
PPFD ratios within the 400~500nm range and 500~600nm range.		
PFD-R: FR ratio	► PPFD ratio between the red and far-red fields	
PPFD ratios within the 600~700nm range and 700~800nm range.		
Chlorophyll A		
Chlorophyll is a photosynthetic pigment that exists in plants, algae and cyanobacteria. Chlorophyll A is the pigment that mainly undergoes photoreaction, and that's why it is also called the primary pigment.		
Chlorophyll B		
Chlorophyll is a photosynthetic pigment that exists in plants, algae and cyanobacteria. Chlorophyll B can absorb light energy and sends it to Chlorophyll A for photoreaction; it is also called the accessory pigment.		
Beta-carotene	► β -carotene	
β -carotene is one of the carotenoids; it is widely found in the leaves, flowers and roots of plants.		
Phytochrome A red	► Phytochrome – Protein red	
Phytochrome A red is a pigment in plants; it is a protein. When it absorbs red light, it will change into a pigment that absorbs far-red light, Pfr. Plants mainly receive external light signals through phytochrome to adjust their own growths, developments and flowerings.		
Phytochrome A far red	► Phytochrome – Protein far-red	
Phytochrome A far red is a pigment in plants; it is a protein. When it absorbs far-red light, it will drive the pigment back into the form of absorbing red light, Pr. Plants mainly receive external light signals through phytochrome to adjust their own growths, developments and flowerings.		

6.1 General Attributes

Abbreviation	Full Name	Unit
PSS	▶ Phytochrome Photostationary State	
It is the ratio of the concentration of phytochrome A red to the total concentration of phytochrome.		

°C	▶ Temperature	
Temperature is a physical quantity that expresses hot and cold.		

%RH	▶ Relative Humidity	
Relative humidity, expressed as a percentage, indicates a present state of absolute humidity relative to a maximum humidity given the same temperature.		
