ULTRA VIOLET RADIOMETER

MODELS UV201*

HANDBOOK

Contents:

1 Introduction
2 Specification
3 Operation
4 Irradiance Measurements
5 Cosine Angular Response
6 Calibration Description
7 Care and Maintenance
8 Optional Accessories
9 Block Diagram

Handbook Ref No. MH095/Issue B
File ref: UV201V01.WPS

Handbook Update Log

Issue	Date	Comments
A	30/1/01	New Issue
B	12/10/05	Handbook update

1 INTRODUCTION

The Macam portable digital UV radiometer model UV201 is a versatile direct reading instrument designed specifically for measuring UV irradiance. It is supplied with an ultra violet A sensitive detector as standard, although detectors with other responses are available.

This instrument is especially useful for monitoring the ultra-violet emissions from high and low pressure mercury vapour lamps, metal halide lamps and ultra violet fluorescent lamps. A liquid light guide adaptor can be supplied for connecting the 8 mm ϕ series 300 liquid light guides to the detector. Other light guide adaptors are also available on request.

UV201 Series

Model	Detector	Peak Response	FWHM
UV201A	SD221A Cos	365 ± 2nm	35 ± 2nm
UV201B2	SD221B2 Cos	311 ± 2nm	19 ± 2nm
UV201-390	SD221-390 Cos	392 ± 2nm	23 ± 2nm
UV201-420	SD221-420 Cos	420 ± 2nm	82 ± 2nm
UV201-450	SD221-450 Cos	450 ± 2nm	48 ± 2nm

Note all detectors have a cosine angular response.

2 SPECIFICATION:

UV201* RADIOMETER

Range:	0 - 1999.9 mW.cm^{-2} (Other ranges available on request)
Standard Calibration:	The radiometer with detector / filter is calibrated at the detector's peak response with a monochromatic source.
Spectroradiometric Cal.	The radiometer with detector / filter is calibrated to match the measurement of a spectroradiometer for a particular source, e.g. mercury or metal halide discharge lamps or a fluorescent lamp.
Accuracy	Absolute calibration accuracy ± 7.5 % traceable to NPL standards.

UV201X DISPLAY UNIT

Front Panel Controls:

ZERO	Initiates a zero or background measurement routine
HOLD/RUN	Display is held at present reading until HOLD button is pressed again.
⏻	Power on / off button

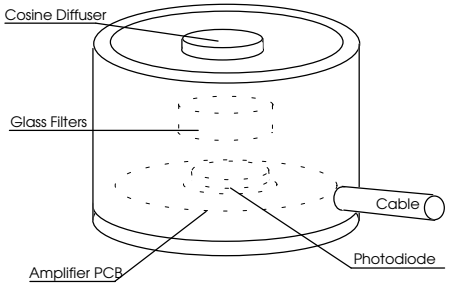
Controller:	80C51 based 8bit micro-processor with a 3.6864MHz clock.
Memory	On board non volatile RAM for calibration factors and set-up parameters.
Integration Time	0.33 s
Conversion Scale	17 bit
Conversion Accuracy:	Measurement accuracy ± 1digit with a linearity error of < 1 %.

2 SPECIFICATION (continued):

Display:	4½ digit lcd display. Character height 10 mm.	
Detector Connector:	8 pin mini DIN type detector connector.	
Power Supply:	9 volt 1200 mAh, PP3 Lithium Manganese.	
Power Consumption:	Shut down mode Operating	< 5 µA 10 - 20 mA
Battery Life	~ 50 hours.	
Temperature Range:	0 to 40 °C.	80 % RH.
Dimensions:	150 x 80 x 45 mm. High impact polystyrene.	
Weight:	approx. 270 g	

2 SPECIFICATION (continued):

SD221* DETECTOR



The SD221* Cos detector comprises of an aluminium housing, photodiode, glass filter, cosine corrected diffuser and PCB assembly.

Detector:	5.2 mm² high stability GaAsP photodiode.
Spectral Responses:	Refer Figures 1 & 2
Visible & NIR Blocking:	> 10^5 from 420 to 1000 nm for UVA & UVB2 detectors
Angular Response:	Accurately cosine corrected to Lambert's Cosine Law. Maximum error is less than ± 5 % from true response to 70° from normal incidence, reference section 5.

Temperature Coefficient: -0.1 % per °C

Amplifier Gain	1x10^4 V/A
Current to Frequency	0 - 0.5 Mhz
Linearity Error:	< 1 % across range
Temperature Range:	Operation: -10 to +60 °C Storage: -20 to +70 °C
Detector Housing:	Black anodised aluminium alloy housing.
Cable:	1 metre cable to 8 pin mini DIN type connector
Weight:	approx. 140 g

2 SPECIFICATION (continued):

SD221A Cos Detector

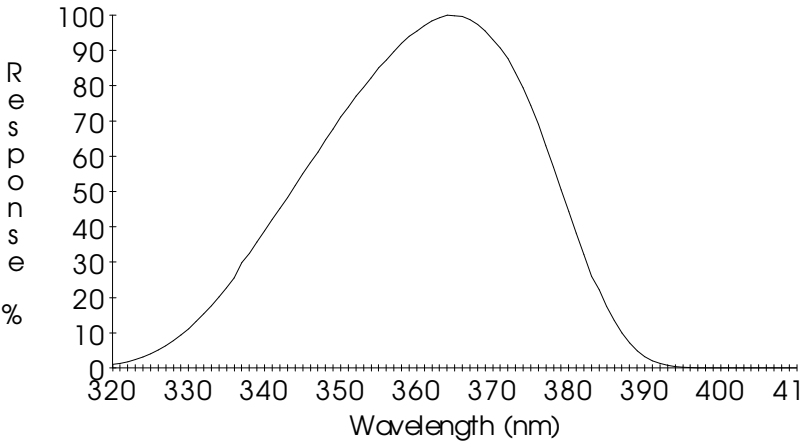


Figure 1

SD221B2 Cos Detector

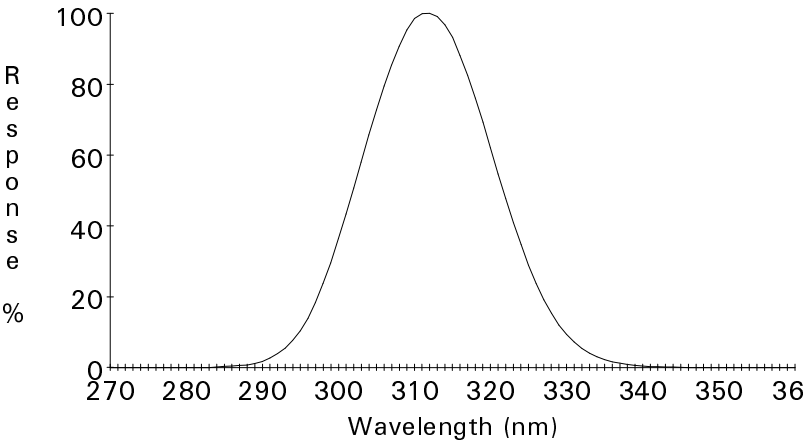


Figure 2

3 OPERATION

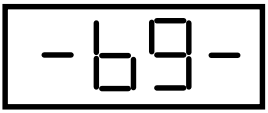
SETTING UP

1) With the unit OFF, plug the detector 4 way connector into the socket on the top of the display unit.

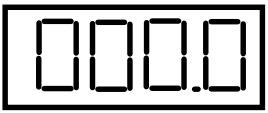
2) Press and release the power switch on the UV201 display key pad. The microcontroller will initiate, the display momentarily showing:-

The radiometer display will now change to show the $mW.cm^{-2}$ value. A typical display is shown below.

3) It is recommended that the radiometer amplifier is nulled periodically. Place the cover over the detector. Press and release the *ZERO* switch, the display will momentarily show:-



4) The micro controller will now measure the amplifier offset and store this value in the non volatile memory. All subsequent measurements will first have this offset subtracted before displaying the measurement. At the end of the sequence the display will show:-



5) Remove the light cover from the detector. Fit the liquid light guide adapter if required. The equipment is now ready for use.

6) At any time the measurement process can be halted by pressing the HOLD/RUN button. Pressing the button once again will resume the measurement process.

4 IRRADIANCE MEASUREMENTS

CAUTION: ULTRA VIOLET RADIATION IS HAZARDOUS TO BOTH THE EYES AND SKIN. TAKE CARE TO AVOID PERSONAL EXPOSURE DURING MEASUREMENTS.

Irradiance is the measurement of radiometric light per unit area, watts per metre, W/m^{-2}. The part of the spectrum to be measured is defined by the filter fitted onto the detector. Ideally this should be a filter with a square spectral response. In practice it rarely is and the filter is defined with a peak response wavelength and a full width half maximum, FWHM bandwidth. In all applications it is vital to know the part of the spectrum being measured by the detector and filter, and if possible to know the spectrum of the light source. In addition the radiometer should be calibrated to best suit the measurement conditions. It may even be necessary to have more than one calibration factor for the same detector / filter combination.

For most applications the measurement plane is horizontal and a cosine corrected diffuser is fitted to the front of the detector assembly. If the working surface is not horizontal then placing the detector on or parallel to the worktop is a more representative measurement of irradiance.

Note that all the light sources in the hemisphere above the detector will contribute to the measurement. The sources may be obvious, lamps or windows or even walls or other reflecting surfaces. Take care not to shadow the detector during all measurements.

ALL the SD221* detectors are cosine corrected. Measurement errors will increase as the angle of irradiance increases from the normal to the filter ring front surface.

5 COSINE ANGULAR RESPONSE

Irradiance is a measurement of the amount of light incident on a unit area (watts/m²). Any detector will measure this reliably when measuring a beam of light perpendicular to the detectors surface, however, when measuring scattered light or light from an extended source the sensor must have an accurate response over its 180° field of view. More importantly, this response should be proportional to the cosine of the angle of light incident on the detector. This comes from the fact that the projected area of any surface at an angle of i is proportional to cos(i).
To ensure that the integration of light from all angles is correct, the cosine diffuser matches the angular response so that response of the detector decreases with cos(i) as the angle between the source and detector increases from 0 to 90°.

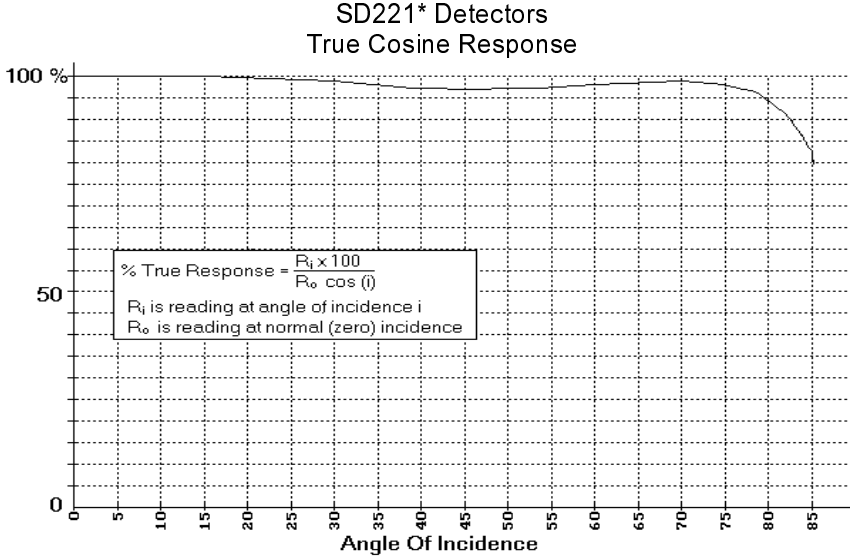


Figure 4

Macam's cosine diffusers are corrected to match the cosine response to within ± 5% up to angles of 70°. This ensures that the meter correctly reads illuminance or visible light flux density whether it is measuring light from an extended or a point source.

6 CALIBRATION DESCRIPTION

Macam Photometrics hold a number of tungsten halogen and deuterium lamps and a silicon photodiode which are routinely calibrated by the National Physics Laboratory in the UK.

During manufacture each filter ring and detector has its spectral response measured. Changes are made to the filter glasses if the peak wavelength or filter bandwidth exceed the specification limits. A graph of the final filter/detector response is provided. The data on a disk (IBM PC format) is also available on request for importing to a spreadsheet.

The radiometer with detector and filter is calibrated using monochromatic light at the peak wavelength of each filter or at a specified wavelength (ref calibration certificate). Other calibration techniques can be applied to suit the users application. For example matching the radiometer output to the output from a high accuracy spectroradiometer (SR9910) for a particular light source like PUVA tubes.

As with all measuring equipment a routine calibration is recommended, typically annually, but with frequent use by a number of different users a shorter recalibration period may be necessary.

7 CARE AND MAINTENANCE

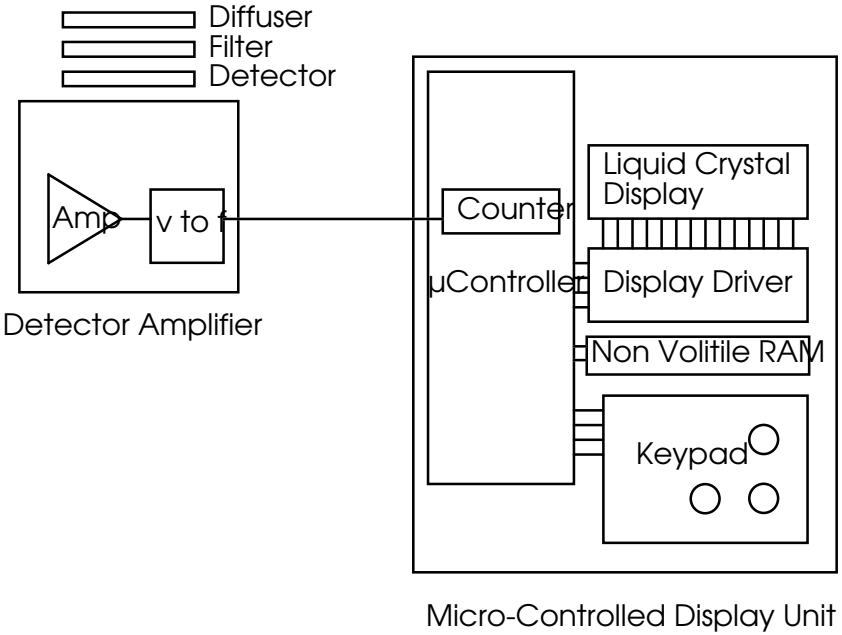
1. The UV201 display unit can be cleaned using a moist cloth with detergent. Do not use solvent or alcohol to clean surfaces.

2. The diffuser on each filter ring should be kept clean at all times.

3. The radiometer is a precision instrument, protect from shocks.

4. Avoid supporting the detector by the multi core cable.

9 BLOCK DIAGRAM



Macam Photometrics Ltd.
10 Kelvin Square
Houstoun Industrial Estate
Livingston
Scotland EH54 5PF

Telephone: 01506 437-391
Facsimile: 01506 438-543
E-mail: support@macam.com
Web: www.macam.com