OPTICAL POWER METER

MODEL **PM203**

USER HANDBOOK

iRRADIAN

Light Measurement Systems & Calibration

OPTICAL POWER METER

MODEL **PM203**

USER HANDBOOK

CONTENTS:

1. INTRODUCTION

The Irradian PM203 Optical Power Meter is a portable instrument designed for accurate measurement of monochromatic light radiation in Watts, dBm and dBr, covering the ultra violet visible and near infra red parts of the spectrum.

The meters comprise of a hand held display unit, with microprocessor control and a large led backlit 4½ digit liquid crystal display. The remote detector assembly includes a multi-range amplifier and digitiser for low noise measurements. The RS232 cable supplied allows connection to a COM serial port on a computer for remote control and data logging.

2. SPECIFICATION

DISPLAY UNIT

Controller:	80C51 8bit micro-processor with a 3.1684MHz clock.
Memory	On board non volatile RAM for calibration factors and set-up parameters.
Key Operation	8 switch key board with 9 LED indicators.
Power Switch	Microprocessor reset at switch on. Unit settings stored prior to shut down.
Serial Interface	Three wire RS232 serial interface. 4800 baud, no parity, 1 stop bit.
Integration Time	0.33s
Conversion Scale	17 bit
Accuracy:	Measurement accuracy ±1digit with a linearity error of <1%.
Display:	4½ digit lcd display. Character height 10mm.
Display illumination:	A LED back light can be switched on to illuminate the display for readings in low ambient light situations.
Power Supply:	9 volt PP3 battery.
Power Consumption:	Shut down mode <5µA Operating 10 - 20mA LED back light ~20mA
Battery Life	~ 50 hours without back light use.

2. SPECIFICATION (continued):

Standard Ranges:

> 5 full scale decades measuring from:
> 0 to 19.999 nW
> 0 to 199.99 nW
> 0 to 1.9999 µW
> 0 to 19.999 µW
> 0 to 199.99 µW
> Resolution 0.001 nW on range 1.

Extended Range Option:

> 5 full scale decades measuring from:
> 0 to 199.99 nW
> 0 to 1.9999 µW
> 0 to 19.999 µW
> 0 to 199.99 µW
> 0 to 1.9999 mW
> Resolution 0.01 nW on range 1.

Attenuators: Other measuring ranges are available when
                            the optical power meter is used in conjunction
                            with a calibrated attenuator or integrating
                            sphere.

Calibration   Absolute calibration is traceable to National
                            Standards.
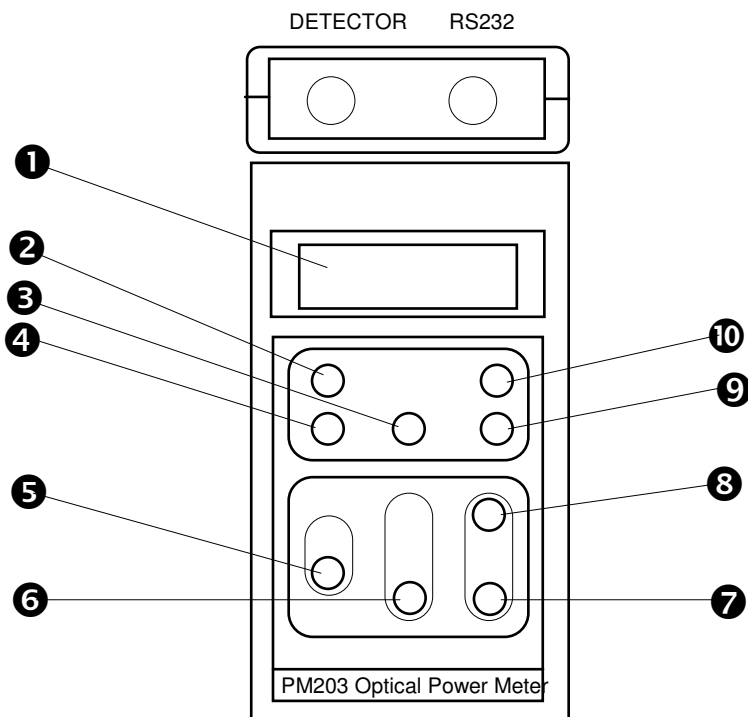   ±5% - 400 to 1100nm.
                            ±7.5% - 240 to 400nm.

2. SPECIFICATION **(continued):**

DETECTOR   RS232

Figure 1

❶ 4½ digit LCD display   ❻ Measurement select button
❷ Display backlight button   ❼ λ select decrease button
❸ Background ZERO button   ❽ λ select increase button
❹ Mode RESET button   ❾ Display HOLD Function REF button
❺ Auto/manual RANGE button ❿ Power switch button

● 4

2. SPECIFICATION **(continued):**

Front Panel Controls:

RANGE	Select auto ranging or manual range control.
UNITS	Select between power in Watts (mW, µW and nW) and dBm or relative dBr.
ZERO	Initiates a zero or background measurement routine on all five ranges.
HOLD/REF	Display is held at present reading until HOLD button is pressed again. Select to set the reference level in dBr relative measurements.
RESET	Press to switch between 5nm λ Select and Preset wavelengths.
λ SELECT	Use the $\triangle \triangledown$ buttons to change the calibration wavelength in 5nm steps throughout the range of the detector or to select from the preset wavelength table.
①	Power on / off button
⊗	Display backlight on off button. Display backlight will switch off after a programmable delay, factory setting 60 secs.

Connectors: 8 pin DIN type detector connector.
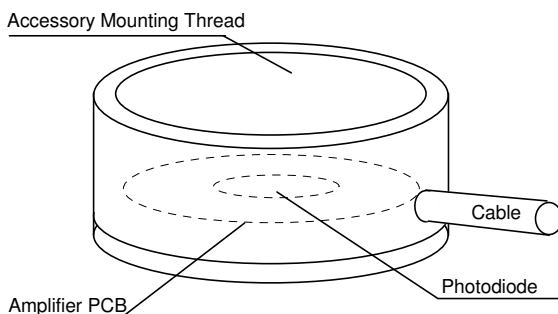   5 pin DIN type RS232 connector.

Temperature Range: 0 to 40°C.   80% RH.

Dimensions: 150 x 80 x 45mm.
                       High impact polystyrene.

Weight: 350g

2. SPECIFICATION (continued):

LABORATORY DETECTOR, DET203PM

The DET203PM laboratory detector comprises of an aluminium housing, photodiode and PCB assembly.

Detector: 100mm² silicon photodiode.

Spectral Response   Ref. Figure 2

Temperature Coefficient: ~0 %/°C from 300 to 940nm

Amplifier Gain 10^{8} V/A to 10^{4} V/A

Current to Frequency   0 - 0.5Mhz

Linearity Error: <1% from 1nW to 100μW

Temperature Range: Operation: 0 to +40°C
                                  Storage: -20 to +60°C

Detector Housing: Black anodised aluminium alloy housing.
                                  Each optical accessory screws into the detector
                                  housing on a 1.125" x 20 T.P.I.
                                  The detector amplifier is connected to the
                                  display unit via a multicore cable to a eight pin
                                  DIN type connector.

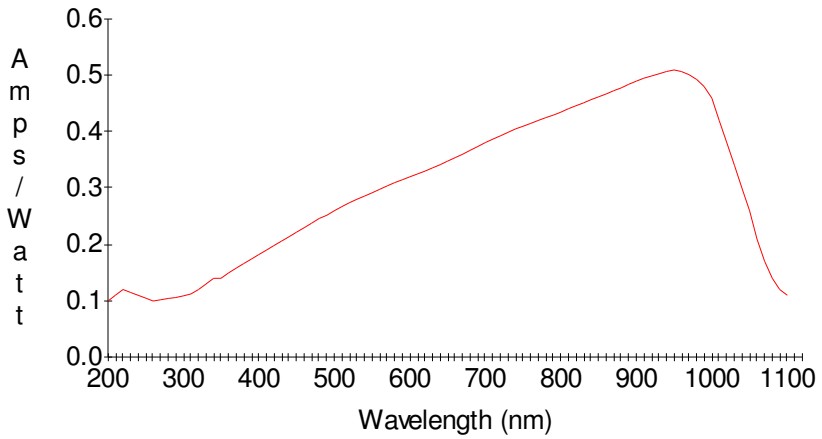# 2. SPECIFICATION (continued):

SPECTRAL RESPONSIVITY OF SILICON DETECTOR

Figure 2

3. OPERATION

SETTING UP

1) With the unit OFF, plug the detector 8 way connector into the socket on the top of the display unit.

2) Ensure the photodiode window is clean.

3) Press and release the power switch on the PM203 display key pad. The micro controller will initiate and search for the optimum amplifier range with the display momentarily showing:-

$$-OL-$$

Prior to displaying the power level the display will indicate the calibration wavelength. A typical display is shown below.

$$1030n$$

Two LED's will illuminate on the key pad to indicate the range units in either Watts, dBm or dBr and the λ Select in either Preset or 5nm Step mode. This will be the same settings prior to the last power off.
If the range was set to manual prior to switch off it may be necessary to RESET or manually range to give a correct display.
For dBr measurements the reference level is held in the non volatile memory prior to switch off and will only be updated when selecting the dBr with the UNITS button.

4) Press and release the *UNITS* switch to select the units required.

5) It is recommended that the photometer amplifier is nulled periodically. Place the cover over the filter ring or the end of the field of view probe. Press and release the *ZERO* switch, the display will show:-

$$-b9-$$

3. OPERATION (continued):

6) The micro controller will now measure the amplifier offset on each of the five ranges and store these values in the non volatile memory. All subsequent measurements will first have one of these offsets subtracted before displaying the measurement.
At the end of the nulling sequence the display will show:-

Note if the photometer units are set to dBm the display will show approximately *-73.0*, in dBr mode the display will depend on reference level.

7) Remove the light cover from the detector. The equipment is now ready for use.

Notes:

i) 1mW = 0 dBm, 0.5mW = -3dBm

$$dBm = 10 \ log\frac{Reading \ (mW)}{1mW})$$

ii) To measure the power of a light beam the whole beam must be within the active area of the photodiode.

4. BATTERY REPLACEMENT

1) Switch off the photometer before changing the battery.

2) Slide open the battery compartment on the back of the photometer and pull out the battery. Disconnect from the battery clip.

3) Replace with a PP3 9 volt battery.

4) Place battery inside compartment and slide cover closed.

5) Note it will be necessary to switch on and off the photometer before normal operation will commence.
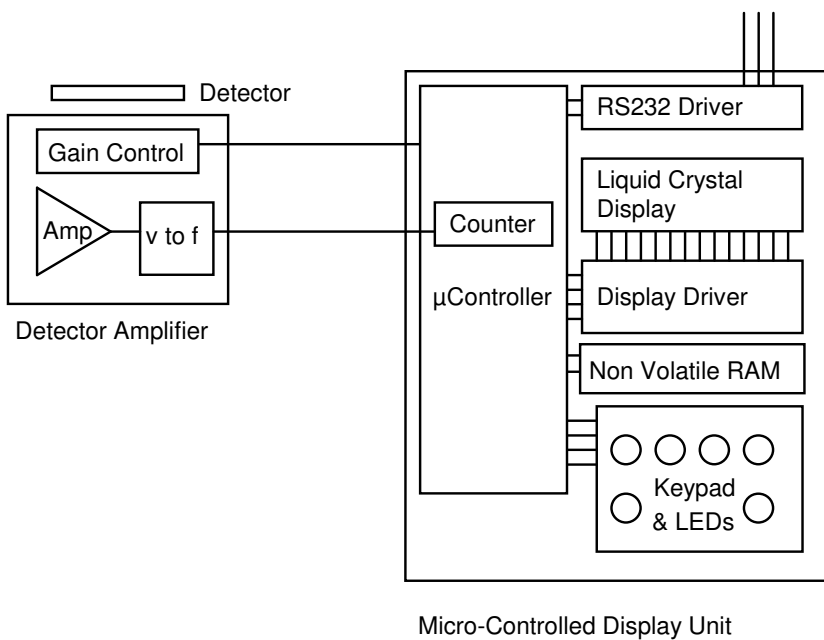
5. CALIBRATION DESCRIPTION

Irradian holds a number of tungsten halogen lamps, photometers and a silicon photodiodes which are routinely calibrated by the National Physics Laboratory in the UK.

Irradian estimates the absolute accuracy error in calibration of the PM203 optical power meter is ±5% from 400 to 1100nm for monochromatic light source.

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.

6. BLOCK DIAGRAM

Detector

Gain Control

Amp   v to f

Detector Amplifier

RS232 Driver

Counter

µController

Liquid Crystal Display

Display Driver

Non Volatile RAM

Keypad & LEDs

Micro-Controlled Display Unit

7. PROGRAMMING VIA THE RS232 INTERFACE

Serial Port Settings: 4800 baud, no handshaking

Single letter commands

S   Toggle through possible amplifier gain ranges (manual mode)
         Reset to autoranging mode with R command.

U   Toggle through possible units, Watts, dBm and dBr.

F   Increases calibration wavelength

I   Decreases calibration wavelength

H   Toggles hold/go

Z   Zeros light meter

R   Resets light meter

B   Toggles backlight

s   Sends data continuously via the RS232

o   Sends one set of data via the RS232

7. PROGRAMMING VIA THE RS232 INTERFACE
(continued):

10.1 Windows 3.1 & Windows 95

Setting up remote control via Microsoft TERMINAL.EXE

1) Connect the cable between the RS232 socket on the light meter and the COM port on the PC.

2) Switch on the light meter.

3) Run *Terminal* programme.

4) Go to the *Settings / Communications* screen and set the baud to 4800 and the COM port to suit.

5) Go to the *Settings / Text Transfers* and select *Line at a time* with *1/10th second delay*.

6) Check the RS232 link by a switch to the manual range, LED on using the command 'S', (capital S).

7) Reset to the auto range, LED off using the command 'R', (capital R).

8) Type 'o' for one packet of data and 's' for continuous data. Type 's' to stop the data flow.

9) To save the terminal setup go to *File / Save As* and save the settings. When restarting the programme the settings can be reloaded with *File / Load filename*. Now actions 4 and 5 can be omitted.

Logging data continuously to a file using Microsoft TERMINAL.EXE

1) Run the Terminal programme with the correct settings.

2) Set up the radiometer and send the command 's' via Terminal to transmit data continuously from the radiometer.

3) Go to *Transfers / Receive Text File*. Enter filename for the stored data (e.g. log1.txt).

4) On entering the file name, Terminal will now store all the readings transmitted from the radiometer in a file *log1.txt*. The file is saved to the computer by pressing STOP on the terminal screen.

7. PROGRAMMING VIA THE RS232 INTERFACE
(continued):

10.2 Windows 95 & Windows 98

Setting up remote control via Microsoft HYPERTERMINAL.EXE

1) Connect the cable between the RS232 socket on the light meter and the COM port on the PC.

2) Switch on the light meter.

3) Run the *HyperTerminal* programme.

4) Enter a name for the session (e.g. UV203 etc.).

5) Select the type of connection required, either option 'direct to com 1' or 'direct to com 2' depending on which com port is to be used.

6) Enter the details for the serial connection: 4800 bits per second, 8 data bits, no parity, 1 stop bit and no flow control.

7) Click the properties icon or select via the *File / Properties* option to display the properties window.

8) Select the *Settings* tab and select Auto detect for the *Emulation* setting.

9) Click the *ASCII Setup* button. Enter 100 into the box marked *Line delay*. No other options are necessary. Click on OK to return to the main window.

10) Check the RS232 link by downloading a reading using the command 'o', (lowercase o). This also allows auto detect to correctly identify the meter settings, showing 4800 8-N-1 next to the Auto detect message in the status bar. A reading should appear in the main window if the connection has been made successfully.

11) To save the terminal setup go to *File / Save As* and save settings. When restarting the programme the settings can be loaded directly by double-clicking on the *.ht icon that has been created. Now actions 4 to 9 can be omitted.

7. PROGRAMMING VIA THE RS232 INTERFACE
(continued):

Logging data to a file using Microsoft HYPERTERMINAL.EXE

1) Run the HyperTerminal programme with the correct settings.

2) Set up the radiometer and send the command 's' via HyperTerminal to transmit data continuously from the radiometer.

3) Go to *Transfer / Capture Text*. Enter the filename for the stored data and the location to save to. (e.g. C:\HyperTerminal\Capture.txt).

4) Press the *start* button to store all the readings transmitted from the radiometer in a file *Capture.txt.* The status bar will now show a highlighted 'Capture' message. The file is saved to the computer by selecting *Transfer / Capture Text / Stop*.

5) Send the command 's' again via HyperTerminal to stop the continuous transitional of data from the radiometer.

8. ENVIRONMENTAL CARE, RECYCLING AND DISPOSAL

The purpose of the European Commission WEEE directive (Waste Electrical and Electronic Equipment; 2002/96/EC) is to ensure that electrical and electronic products are recycled using the best treatments, recovery and recycling techniques that are currently available. This is so that high health standards and a lasting environmental protection can be achieved and maintained.

This product has been designed and manufactured using high quality materials and components, many of which can be recycled and reused.

Please remember to observe the local regulations that govern both the disposal of the packaging materials accompanying this product and any used batteries.

DO NOT DISPOSE OF THIS PRODUCT IN YOUR GENERAL WASTE BIN.

Please inform yourself about your local WEEE collection system which is available for electrical and electronic products that are marked with the symbol shown here.

When disposing of this meter, please use one of the following options:

1) Use your local designated WEEE collection facilities to dispose of the complete product (including cables, detectors, filters & accessories).

2) Return the complete product back to Irradian, marking it clearly as intended for WEEE disposal.

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