MACAM OPTICAL POWER METER

MODELS PM203-Si, PM203-In & PM203 Ge

HANDBOOK

Contents:

1 Introduction
2 Specification
3 Operation
4 Battery Replacement
5 Calibration Description
6 Block Diagram
7 Programming via the RS232 Interface

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A	01/04/99	New Issue
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C	10/06/02	Programming update.
F	10/11/05	Programming update

1 INTRODUCTION

The Macam 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. Three models are available: PM203-Si with a silicon photodiode detector; PM203-In with an Indium Gallium Arsenide photodiode detector and PM203-Ge with a Germanium photodiode detector.

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 PC 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 1200mAh, Lithium Manganese battery.	
Power Consumption:	Shut down mode Operating LED back light	<5µA 10 - 20mA ~20mA
Battery Life	~ 50 hours without backlight use	

2 SPECIFICATION (continued):

Standard Ranges: (PM203-Si and PM203-In *models)*
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.

(PM203-Ge model *)*
4 full scale decades measuring from:
0 to 19.999 µW
0 to 199.99 µW
0 to 1.9999 mW
0 to 19.999 mW
Resolution 1 nW on range 1.

Extended Range Option: (PM203-Si and PM203-In *models)*
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):

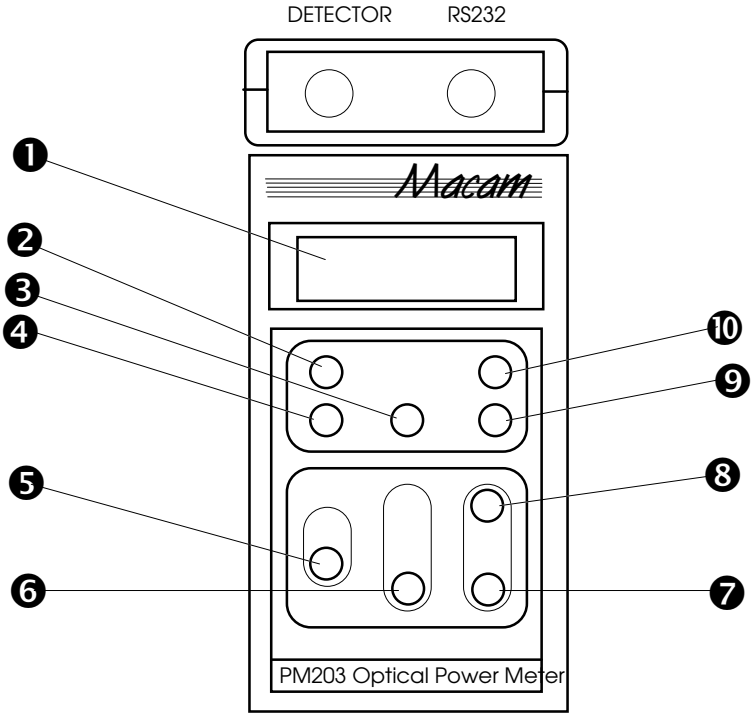


Figure 1

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

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 △▽ buttons to change the calibration wavelength in 5nm steps throughout the range of the detector or to select from the preset wavelength table.
⏻	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.

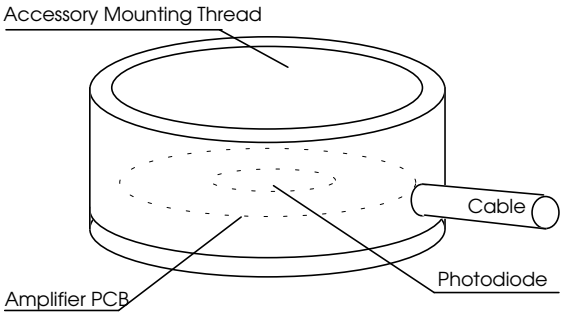
Temperature Range: 0 to 40°C. 80% RH.

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

Weight: 350g

2 SPECIFICATION (continued):

LABORATORY DETECTOR, Model SD222 UV

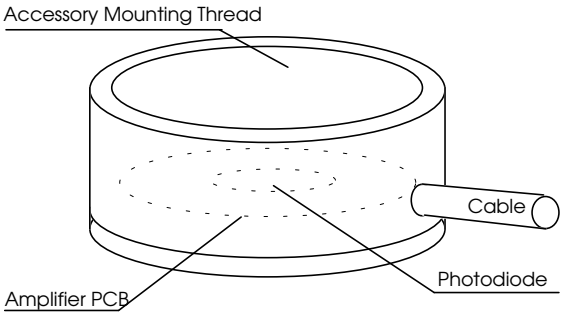


The SD222 laboratory detector comprises of a aluminium housing, photodiode and PCB assembly.

Detector:	33mm² 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 accessories 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):

LABORATORY DETECTOR, Model ID222



The ID222 laboratory detector comprises of a aluminium housing, photodiode and PCB assembly.

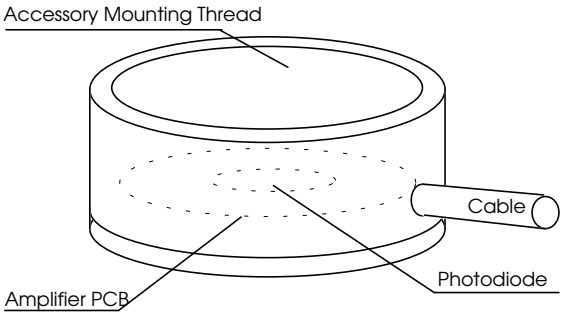
Detector:	1mm ϕ Indium Gallium Arsenide photodiode.
Spectral Response	Ref figure 3

Temperature Coefficient: ~0 %/°C between 900 and 1550nm.

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 accessories 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):

LABORATORY DETECTOR, Model GD222



The GD222 laboratory detector comprises of a aluminium housing, photodiode and PCB assembly.

Detector:	2mm ϕ Germanium photodiode.
Spectral Response	Ref figure 4

Temperature Coefficient: ~ -0.5 %/°C between 800 and 1500nm.

Amplifier Gain	10^5 V/A to 10^2 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 accessories 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

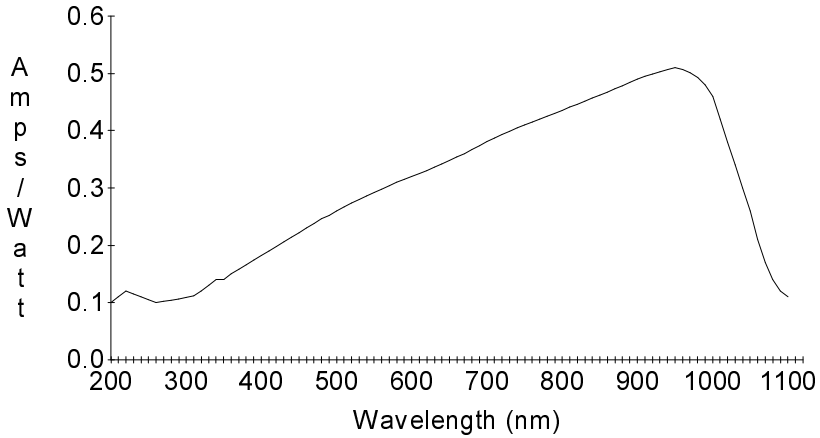


Figure 2

SPECTRAL RESPONSIVITY OF InGaAs DETECTOR

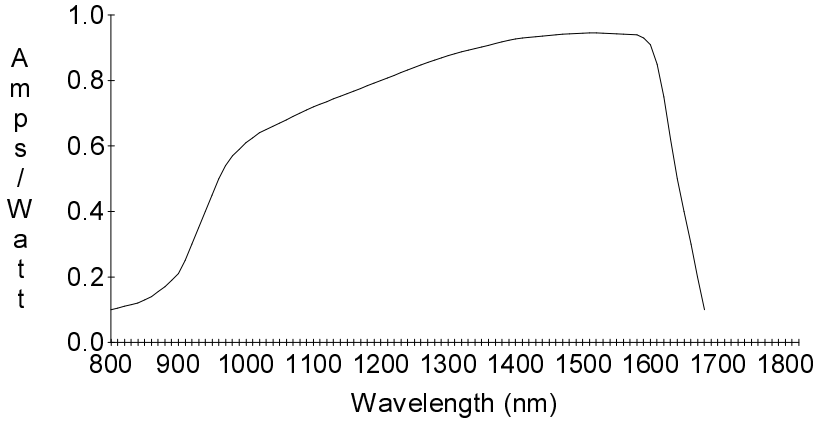


Figure 3

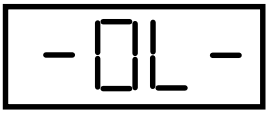
3 OPERATION

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:-



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

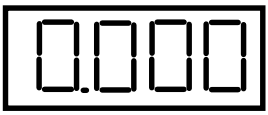
Two LEDs will illuminate on the key pad to indicate the range units in either Watts, dBm or dBr and the λ Select in either Preset or 5nm Step mode. This will be the same settings prior to the last power off.
If the range was set to manual prior to switch off it may be necessary to RESET or manually range 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 correct 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 momentarily show:-

3 OPERATION

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 is 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 Lithium Manganese size 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.

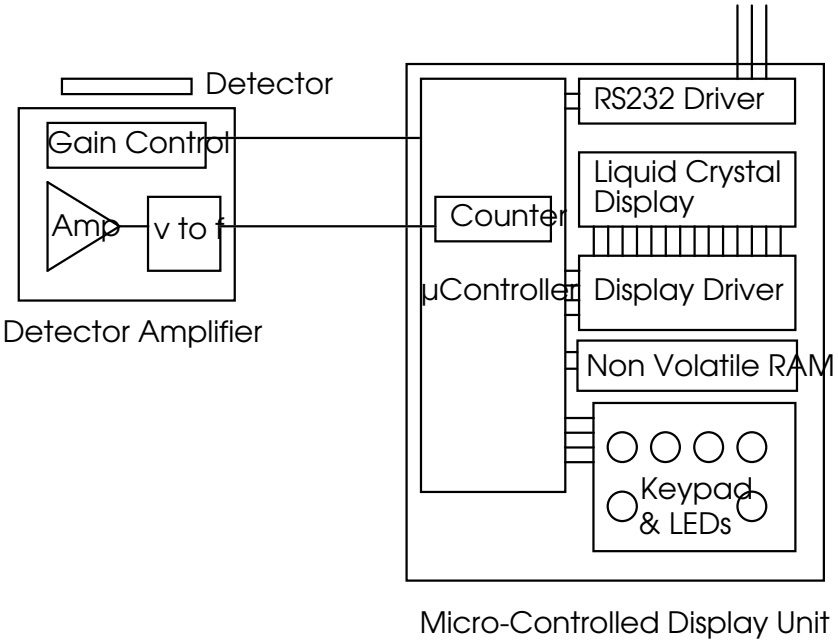
5 CALIBRATION DESCRIPTION

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

Macam estimate 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



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
l	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)

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 *1/10 th second delay*.

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

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

8. Type 'o' for one packet and 's' for continuous data, type 's' to stop.

9. To save the terminal setup go to *File / Save As* and save 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 (eg 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.

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