Name of the technology: ***Calibrated Photodetector & its Monitoring Unit***

Summary: Photodetectors (PD) consist of photodiodes that sense optical power and convert it to an equivalent photocurrent along with this an electrical circuit is used to generate a voltage which is proportionate to the optical power. The electrical circuit is used to adjust the output voltage to a desired gain and also to filter out the unwanted ac noise coupled to the signal. The choice of the photodetectors, that is the sensor material and size of its active area, depends on wavelength of the light to be detected and its applications, respectively. The electrical circuit is in general simple for generic use of the photodetectors or can also be fairly complicated for specific applications. Nevertheless, photodetectors are widely used in various light based applications, for instance in industries as well as in experimental research starting from simply measuring of the light power to a precise use to detect single photons. The applications vary from simple monitoring of optical power to detection of signals for further scientific investigation or both of them simultaneously. This requires an additional hardware to display the measured optical power (*i.e.* corresponding calibrated electrical signal in unit of Volts) for monitoring, named as monitoring unit (MU), and that also facilitates buffered extraction of the detected signal for connecting an external device for example data acquisition system.
Keeping the extensive usage of PD and MU in mind, we have designed and fabricated a new compact design of these units which provide calibrated, fast, spatially filtered and electromagnetically shielded detection of optical signals.The photodetector, as shown in Fig. 1(a), is housed in a small (size 57.1 mm × 35 mm × 28.7 mm) metallic box for electromagnetic shielding of the detector from environmental noise. Fig. 1 (b) shows the monitoring unit which is housed in a standard 19" - 2U metallic box and accommodates four channels which have independent displays and outputs. It displays photodiode signals and also facilitates for the external usage.

Figure 1: Photographs of the photodetector (PD) and monitor unit (MU). PD is assembled in a small metallic casing and the lid is kept open in this picture to show inside of it. MU has four channels and in this picture one of them is connected with the PD.

The special features of PD and MU are as following;

Photodetector (PD):

- Compact design: can easily fit in any optical setup
- Standard mounting holes: PD can be oriented in any direction as suitable
- RJ45 Ethernet connectors: supply voltage to the PD and its output through single cable
- Powered up either from MU or from separate power supply
- Packaged in metallic box for electromagnetic shielding
- Pinhole on the metallic box for spatial filtering of the stray lights
- Easy to modify PD for fibre coupling of the light to the detector
- Any photodiodes with specified pin configuration and operational at ±15 V can be used
- Easily tuneable optical power (mW)-to-electronic signal (V) conversion gain by changing one resistance in the circuit.

Monitoring unit (MU):

- Packaged in a standard 19-inch rackmount metallic box, size 2U and 265 mm depth

- Powered up by 4 pin lockable microphone connectors to supply ± 24 V and 5 V through a single cable
- Four independent channels for simultaneous operation and monitoring of 4 PDs
- Photodiode signals are displayed and also buffered in parallel for any external usage
- 3.5 digit digital display with 12 mm seven segment red LEDs: visible from far distance
- Input to the display from 0 to 200 mV with adjustable gain to show from 000.0 to 999.9
- RJ45 Ethernet connectors: supplying ±15 V bias voltages to the PD from MU and acquiring photodiode signal in this unit.

Table 1: Specifications of the photodetector and monitoring unit

Specifications: Optical power-to-electronic signal calibration		
Wavelength	**Value (V/mW)**	**Comment**
• 399 nm	0.94(1)	These values are obtained when the resistances in the amplifier are chosen such that gain is 6.7
• 532 nm	2.30(3)	
• 633 nm	2.52(3)	
• 739 nm	2.74(2)	
• 935 nm	4.20(5)	
Max laser beam diameter	2 mm	Characteristics of Si photodiode
Incident angle	± 20° normal to the photodiode	Characteristics of Si photodiode
Temporal response of the photodiode	100 ns	Characteristics of Si photodiode
Spectral range	400 - 970 nm	Characteristics of Si photodiode
Filter cut off frequency	7.9 MHz	Characteristic of PD
Saturation voltage	15 V	
Display range	0.0 – 200.0 (set to)	0.0 – 999.9 (max.)

Choose the Readiness level of the technology:

Idea	Concept Definition	Proof of Concept	Prototype	Lab Validation	Technology Development	Technology Demonstration	Technology Integrated	Market Launch

Related Patents: Nil
Patent No: Know how
Country: Nil
Publication date: Nil
Grant Date: Nil
Year of Introduction: 2016-17
Broad Area/Category: Electronic instrumentation for optical subsystems

User Industries: Universities and research labs working with optical systems, industries using lasers, fibre optics communication, strategic applications such as defence and space.

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