Annexure-1

Photodiode Driver Module

Introduction:

We are interested in observing a very fast decaying phenomenon of soot radiation. For this purpose, we need a response time of the order of 50ns or lesser. We need to acquire light signals at a speed of around 25MHz for this. When one trigger is given, we need to record around 20 frames at 25MHz. Trigger rate will be given from 10Hz to 6000Hz. This will be like a burst mode, but repeated bursts of recording. There is no camera fast enough and having enough sensitivity for this purpose. Thus only photo diode arrays can do this job. Thus we are interested in a photo diode array which can record data at these speeds, and store in a computer. We are looking for a turnkey solution for this application and not in assembling individual parts and matching them. The spectral response should be such that it can handle visible and near IR for use in radiation based temperature measurements at flame temperatures. Thus we are looking for a photo diode array, an amplifier and a suitable data reader and recorder which can be programmed using NI VI interface and easy to use as a packaged device.

Thus we need an assembled system with an 8x4 photodiode array, some amplifier to increase the signal level, and then a data recording system which are compatible with each other, all controlled using a single software through a Laptop (Windows system). The user should only have to connect a lens in front and focus the object, and then record the light level changes in time.

Specifications:

Photodiode array:

Spectral response range: 350 to 900nm or wider

Number of elements: 32 (2D array of 8x4)

Element per pitch: ≤ 2.75 mm

Operating Temperature: 10 to +60°C or wider

Peak sensitivity wavelength: near red (around 600 nm)

Quantum efficiency: > 60% in 400-900nm

Dark current: <15nA

Mount for a camera lens at the input side (before the PDA): C mount or F mount. Lens not required.

32 channel Preamplifier:

Bandwidth: 150 MHz per channel

TIA Gain: ≥ 10kV/A (Should be used adjustable for each channel)

Single housing for APD array and Preamplifier.

Saturation protection for each channel in preamplifier.

Data recording Specifications:

Bit resolution of data recording: ≥ 12-bits

Overall system must be able to measure 1μW of input light at ~500nm, and 1μW at ~600nm, (simultaneously half the array will see ~500nm light and half will see ~600nm light).

Interface : USB/ethernet. Must be able to transfer all the recorded data to the computer in a reasonable time.

Trigger IN: Yes

Onboard Data Storage : Yes

Sampling rate/per channel for data recording : ≥ 25 MHz

Number of input channel : 32

Burst mode: number of frames at 25MHz = upto 20, should be adjustable by the user.

Number of bursts to be recorded continuously: upto 1000 (each burst has above said number of frames). The onboard memory should have the capacity to record this. User must be able to change this number. It should be possible to extend this at a later time, by adding memory.

Burst frequency will be maximum of 6kHz.

Per channel gain adjustment through software.

Final output must be Time vs. intensity plot for each channel. Data should also be recorded in a file in excel or text format.

In detector parameter control software user should be able to change the gain of each photodiode. This data should also be written out in the output file, after recording.

Offset correction should be possible.

Power requirement: any power supply required should be provided.

Simultaneous 32 channel control should be possible.

Burst mode as well as DC operation should be possible for recording.

It should be possible to set delay after trigger for acquisition, controllable through software. Simultaneously trigger all 32 channels with a single external trigger.

Delays in acquisition should be controllable by user to a minimum of ~10 ns resolution.

Smallest exposure time or data acquisition time for measurement should be at least 50 ns, and adjustable by user.

Gain adjustments, Gain equalization across channels should be possible through software.

Data should be saved without losing time integrity

Focusing mode: The software should give a focusing mode option (~ 10Hz) for focusing the image onto the chip.

The vendor must be the official representative for the company from which the photodiode is obtained.

The vendor must have an office in India, and should provide after sales support for the product.