

Developing a Scattered Light Detection Instrument using OEM-Ready USB-2533

Introduction

OSI Optoelectronics is a manufacturer of standard and custom photodiodes and optical sensors for a wide range of applications such as medical, commercial, military, x-ray products, and telecommunications.

The Challenge

OSI needed to develop a low-cost data acquisition system that can gather data from 48 separate detectors and transfer the digitized data to a PC over a USB bus. The 48 individual detectors are strategically placed on a mechanical frame to gather light scattered by an object. The scattered light intensity is very low and the detectors selected must have low noise and high sensitivity to low intensity light. Design time allowed for proof-of-concept prototype was 2 months.

OSI Optoelectronics had been using a PCI plug in data acquisition board for acquiring 48 channels of analog data from detectors exposed to low-intensity scattered light. OSI wanted to migrate from their PCI-based system to a USB-based DAQ solution. A quick software development cycle was required since a working prototype was wanted within 2 months. OSI needed to make a design change for the following reasons:

1. Implementation of highly sensitive detectors to get better response to low intensity scattered light
2. Eliminate the flat ribbon cable that connected 48 channels of analog data from the instrument to the PCI board in an external desktop PC
3. Reduce signal noise in the digitized signal by digitizing closer to the analog data source
4. Achieve a higher sampling rate to capture data from the individual 48 channels as close in time to each other as possible
5. Use a laptop instead of a desktop
6. Lower the cost of the data acquisition hardware

The Solution

For detectors, they selected high-sensitivity OSI Optoelectronics detectors from the photovoltaic DP-series which offer low capacitance, high responsivity at moderate response speeds, low noise and exhibit long term stability under wide temperature variations.



OSI developed their own analog interface board which mounts onto the USB-2533 header connectors

For the data acquisition electronics, the [USB-2533](#) from Measurement Computing was chosen to provide the 16-bit digitization and data transfer to PC over the USB bus. The USB-2533 was chosen based upon several factors. Its 1 MHz sample rate was higher than the current PCI board and provided minimal time between channels.

The board also provided needed cost savings and was 1/3 the cost of the current PCI hardware. The compact size of the [USB-2533](#) allowed OSI to place the board inside the instrument thereby digitizing signals more closely to the analog data source, minimizing noise and increasing the signal-to-noise ratio. The combination of high sensitivity detectors and the USB-2533 allowed the product to meet the goals needed.

A custom interface board was then designed by OSI to mount onto the [USB-2533](#) header connectors. This board provides an interface to the individual photo-detectors on the 48 analog channels.

Result

Support received from the Measurement Computing sales and engineering staff was invaluable. The sales team provided an evaluation [USB-2533](#) board and Universal Library™ software within three days of making a request. Support engineers provided sample application code in Visual C++®, which was the coding

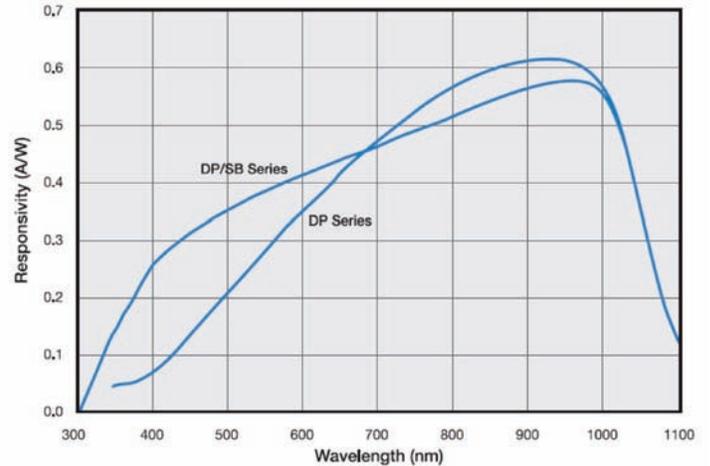
language of choice. The included sample code gave a head start on the development of the application code and allowed OSI to complete and deliver their prototype within the required time frame. The re-designed instrument provided higher acquisition speeds, allowing all detectors scanned to be closer in time and also provided improved accuracy due to the 16-bit A/D on the [USB-2533](#). More sensitive detectors (better responsivity at the desired wavelengths) provided better signal at low light levels thereby improving the imaging quality (signal-to-noise ratio).

The re-designed instrument was brought to market quickly, costs savings were achieved, and performance was improved.

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Typical Spectral Response



Above is a snapshot of the OSI Optoelectronics photovoltaic DP-series detectors spectral response to light at various wave lengths

MCC Product used in this application:



HIGH-SPEED MULTIFUNCTION OEM BOARDS **USB-2500 Series**

- 8 to 64 analog inputs
- 1 MS/s sampling
- 16-bit resolution
- 24 digital I/O, counters/timers (including quadrature encoders)
- Up to 4 analog outputs
- Ideal for OEM and embedded applications
- Included software and drivers