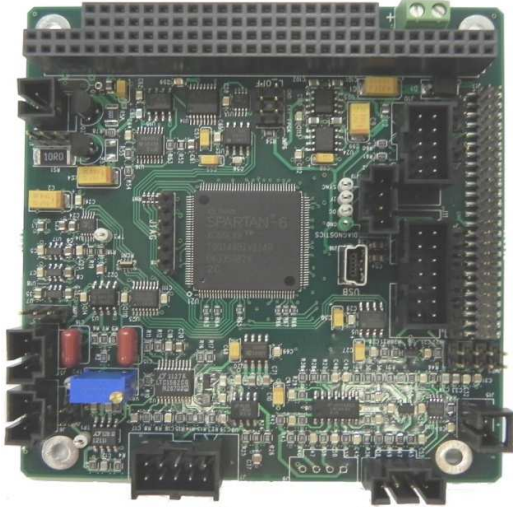


## Rugged, PC/104 format, all-digital (FPGA-based) Controller Board for Second Harmonic (2f) Gas Sensing using Tunable Diode Lasers



### Highly Integrated Board

The PCI-FPGA-1 is a complete, single-board 2f spectrometer controller containing preamplifiers compatible with both InGaAs and InAs detectors; an all-digital FPGA-based demodulator for 2f signal extraction; FPGA-based laser driver and waveform generator; laser power and 2f signal outputs; conditioning circuitry for pressure and temperature sensors, and trigger outputs for syncing to external data acquisition systems. All surface mount construction. Requires only a single +5 power source (no PC bus signals are used).

### Digital FPGA Benefits

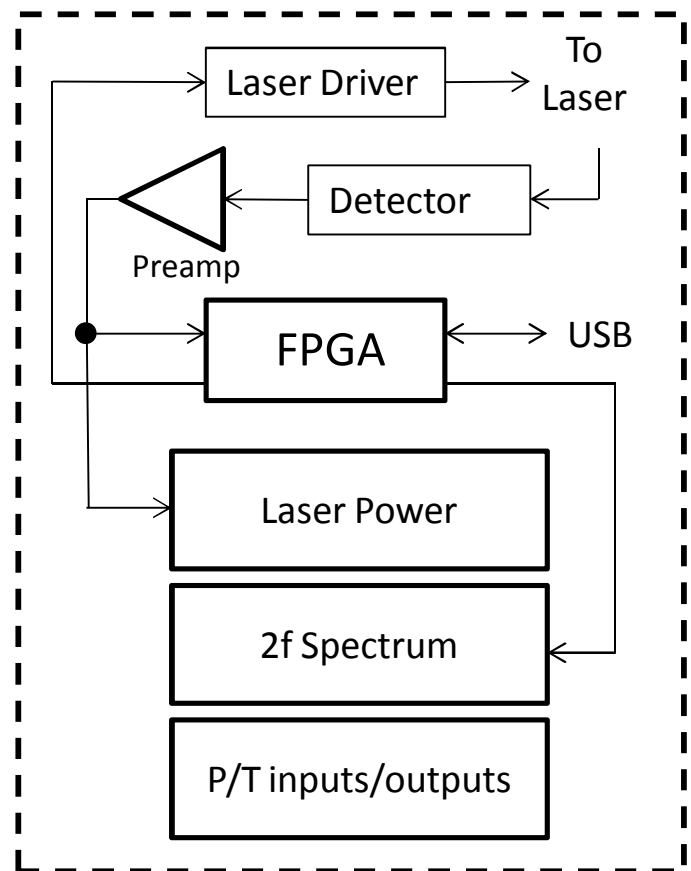
All-digital 2f signal chain eliminates problems due to drift of passive components over time and temperature. The result is highly stable 2f gain, phase, and 1f amplitude. Suitable for use in industrial and aircraft environments as well as general laboratory or field use.

### Price/Performance Advantage

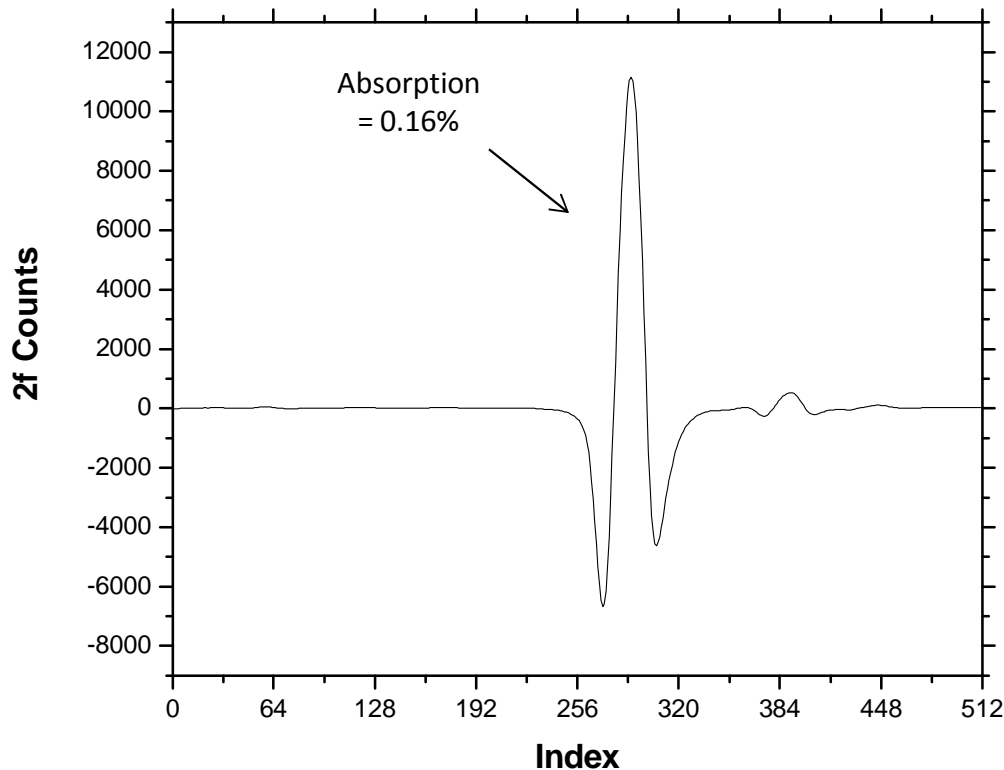
Combines all of the functions necessary to control a second harmonic spectrometer using tunable diode lasers or VCSEL lasers. Multiple pressure and temperature sensor inputs allow measurement of environmental and housekeeping parameters for spectrum analysis to extract gas concentration. Outputs compatible with all popular data acquisition systems.

- ▶ PC/104 format for ease of implementation
- ▶ Single (+5V) power supply operation
- ▶ Based on Xilinx Spartan-6® FPGA
- ▶ 31.4 KHz 1f modulation (62.8 KHz demod)
- ▶ Laser sweep rates from 0.1 Hz to 10 Hz
- ▶ Up to 200 mA DC laser current drive
- ▶ InGaAs and InSb detector inputs
- ▶ Laser power and 2f spectrum outputs
- ▶ Works with both amplified (0-5V) and unamplified (0-100 mV) pressure sensors
- ▶ Three thermistor inputs and one PRTD input
- ▶ Windows GUI interface for setup (adjustable laser sweep rate, 1f amplitude, demodulator gain, and full 0-360 degree phase adjust range)
- ▶ Linear or quadratic laser scan waveform with PC/GUI setup of waveform coefficients
- ▶ External TTL level trigger/synch output

### Block Diagram



## Example 2f Spectrum (1s acquisition)



### Benefits of 2f Spectroscopy

- ▶ Minimizes 1/f noise
- ▶ Removes sloping baseline
- ▶ Zero-based background
- ▶ Absorption measurements to 0.001%, and below
- ▶ Large dynamic range ( $10^5$ )
- ▶ Better fringe discrimination

*Laser power spectrum is provided simultaneously for 2f normalization, or for direct transmission processing at high gas concentrations allowing maximum dynamic range.*

## Specifications

**1f Modulation Frequency:** 31.4 KHz sine wave

**FPGA-based demodulation:** 62.8 KHz (2f)

**Auxillary Inputs:** 3 x Thermistor, 2 x Pressure, PRTD

**Input Power:** +5V DC at 160 mA (not incl. laser)

**Operating Temperature:** -25 to +75 C

**Output signal ranges:** 0-5V (all signals)

**Output signal resolution:** 16 bits into Analog R/C

**Spectrum noise levels after R/C:**  $\pm 2$  LSB

**Laser Current Range:** 0 - 200 mA (custom avail.)

**Detector Compatibility:** InGaAs, InSb, Si, custom

**Demodulator Gain:** 1 - 100 (selectable via GUI)

**Demodulator Output Time Constants:**  
0.66, 0.30, 0.20, and 0.09 ms (jumper selectable)

**Dimensions:** 3.78" x 3.55" (PC/104 format)

Second harmonic spectra are output continuously as the laser is repetitively swept over the selected wavelength range. Simultaneous output of the laser power (direct transmission) is also provided for normalization purposes, or to use direct transmission spectrum analysis for higher gas concentrations.

Can be interfaced with any data system capable of 0-5V inputs, including PC/104 format CPU boards, Labview-compatible I/O boards, or low-power microcontrollers for "headless" operation. Does not use the PC/ISA bus and can be supplied without the PC/104 bus connectors upon request.

Contact us for complete sensor solutions that include laser and detector, optics, gas cells and data acquisition.

## Ordering Information

**Part Number:** PCI-FPGA-1A

**Telephone:** 910-622-6486

**Fax:** 910-681-3756

**Email:** orders@portcityinstruments.com

**Purchase Orders:** (contact us for details)

Visa/Mastercard/Amex/Discover