

MultiPAS User's Guide

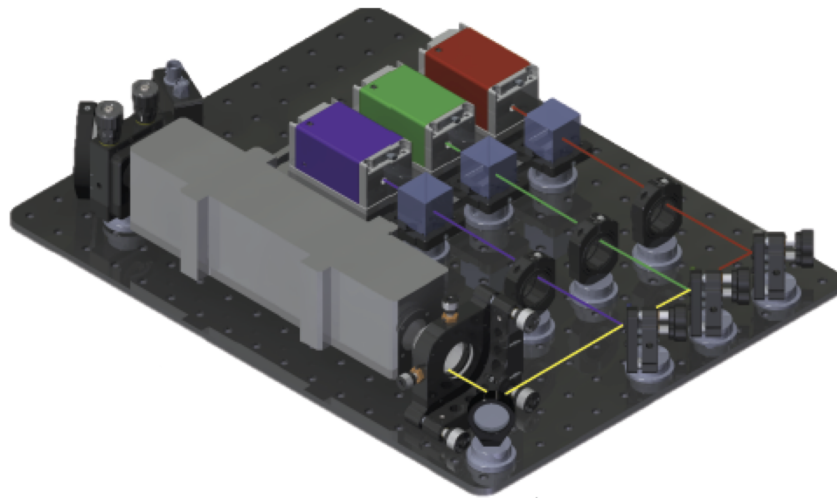
Al Fischer

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MultiPAS-III/IV

Multi-laser photoacoustic spectrometers



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Chapter 1

Safety Information

Placeholder

1.1 Symbol Definitions

1.2 Personal Safety Information

1.3 Instrument Safety

Chapter 2

Connecting the Instrument

Placeholder

2.1 Connecting the Control Box

2.2 Connecting the Microphone

Chapter 3

Quick Start

Placeholder

3.1 Installation

3.2 Powering On

3.3 Using the Software

3.4 Powering Off

Chapter 4

Calibration

Placeholder

4.1 Setup

4.2 Calibration Procedure

Chapter 5

Data Processing

Placeholder

5.1 Processing Data with R

5.1.1 The aeRo Package

5.1.2 Loading data into R

5.1.3 Exploring MultiPAS Data

5.1.4 Processing The Data

5.1.5 Plot data

Chapter 6

Flow System

Placeholder

6.1 Pull Mode

6.2 Push Mode

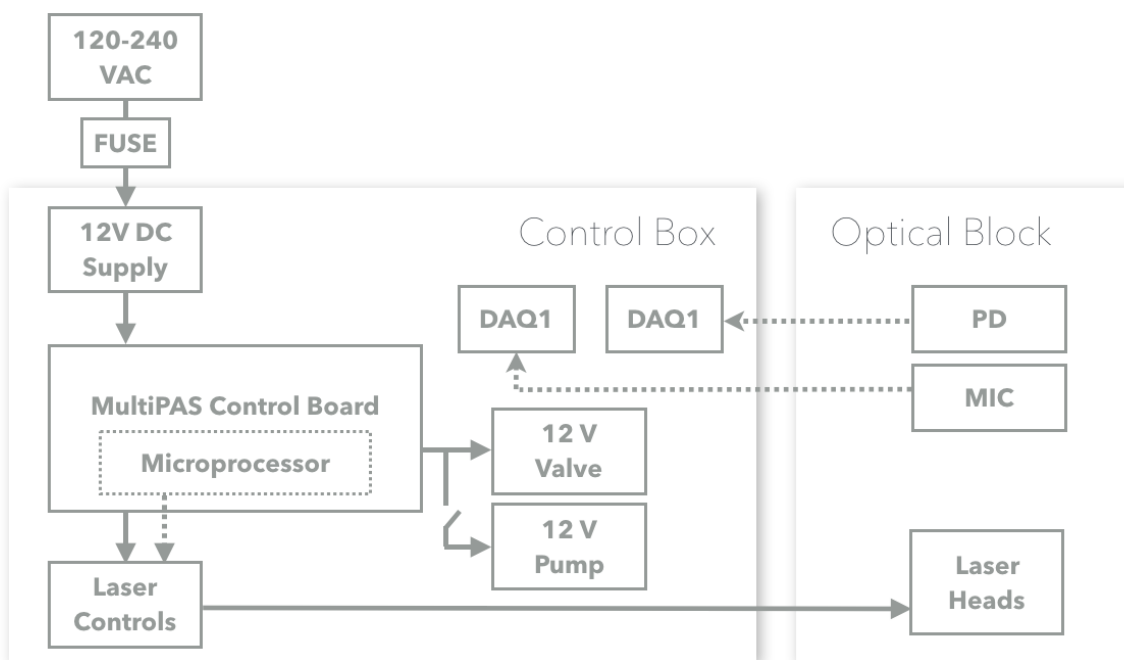
Chapter 7

Electrical



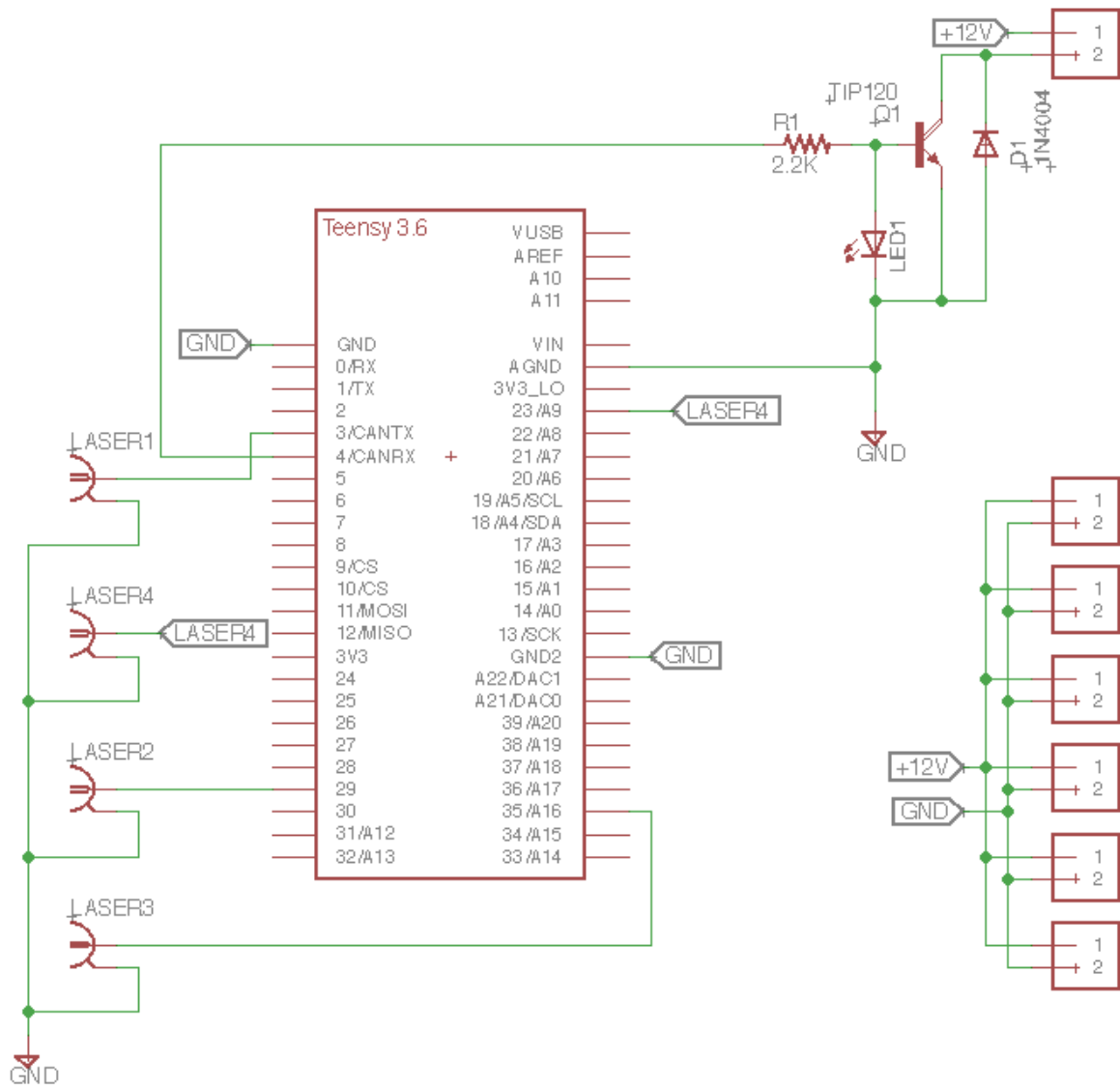
Unplug all power before any electrical work on the PAS or opening the control box!

A generalized diagram of the PAS electrical system is shown below. Some components, such as photodiodes and the microphone, may require external power supplies, but the majority of the components are powered directly via the PAS control box.



The heart of the PAS electrical system is the Teensy 3.6 (PJRC.com) microcontroller that resides on the MultiPAS control board. The Teensy communicates with the software to control the modulation of the lasers and switch the background valve on and off. The same board distributes 12 V power to the system. The MultiPAS control board may be used with both 3- and 4-wavelength versions of the PAS. Three-wavelength versions may have a Teensy 3.2 instead of the 3.6 shown on the schematic; these are, however, mostly drop-in

compatible.



Chapter 8

Maintainance

Placeholder

8.1 HEPA Filter Replacement

8.2 Protection Filter Replacement

8.3 Cleaning the Orifice

8.4 Cleaning the Optics

8.5 Cleaning the PAS

8.6 O-ring Replacement

8.7 Fuse Replacement

8.8 Realignment

8.8.1 Multipass Cell

8.8.2 Beam Steering Optics and Lasers

Chapter 9

Troubleshooting

9.1 Common Software Errors

1. *VISA Read/Write: Device not found.* Either the incorrect COM ports have been selected or the USB communication has frozen. In the case of the latter, exit LabVIEW completely and reset the PAS by turning off the main power switch on the control box *and* disconnecting the USB cable. Reconnect and restart.
2. *VISA Read/Write: Device is valid but VISA cannot open it.* Another program is communicating with one of the PAS's components. Close other programs and restart LabVIEW.
3. *Valve will not switch and/or frequencies will not change.* USB communication broken – exit LabVIEW completely and reset the PAS by turning off the main power switch on the control box *and* disconnecting the USB cable. Reconnect and restart.
4. *WaveIO Device Not Found.* Known bug with unknown cause. To fix, stop the program, increase the PD and mic device ID's (under the Utilities tab) by 1 and start the program. Then, stop the program, set them back to their original values and start the program again. The errors should go away after the final restart.
5. *Extremely fast acquisition (x-axis) on PD or mic plots.* See *WaveIO Device Not Found*, above.

9.2 Common Hardware Errors

1. *No Signal or Excessive Noise.* Excessive noise or a cancellation of signal may occur if:
 - *There is an opening on the PAS cell.* Make sure the inlet and outlet are attached to the control box, a gas line, or plugged; check all fittings on the PAS cell to ensure they are tight.
 - *The pump is not set correctly or the orifice is missing.* Lower the pump speed with the trim pot on the pump and check that the orifice is in place.
 - *The flow rate is too high.* Lower the flow rate.
2. *High Background.* The cell may be dirty. See Cleaning the PAS.
3. *Low Laser Powers.* Low laser power may be observed if:
 - *The multipass alignment is bad.* Align the multipass cell.
 - *The optics are dirty.* Clean the optics.
 - *The optics are misaligned* Go through the realignment procedure.