# MultiPAS User's Guide

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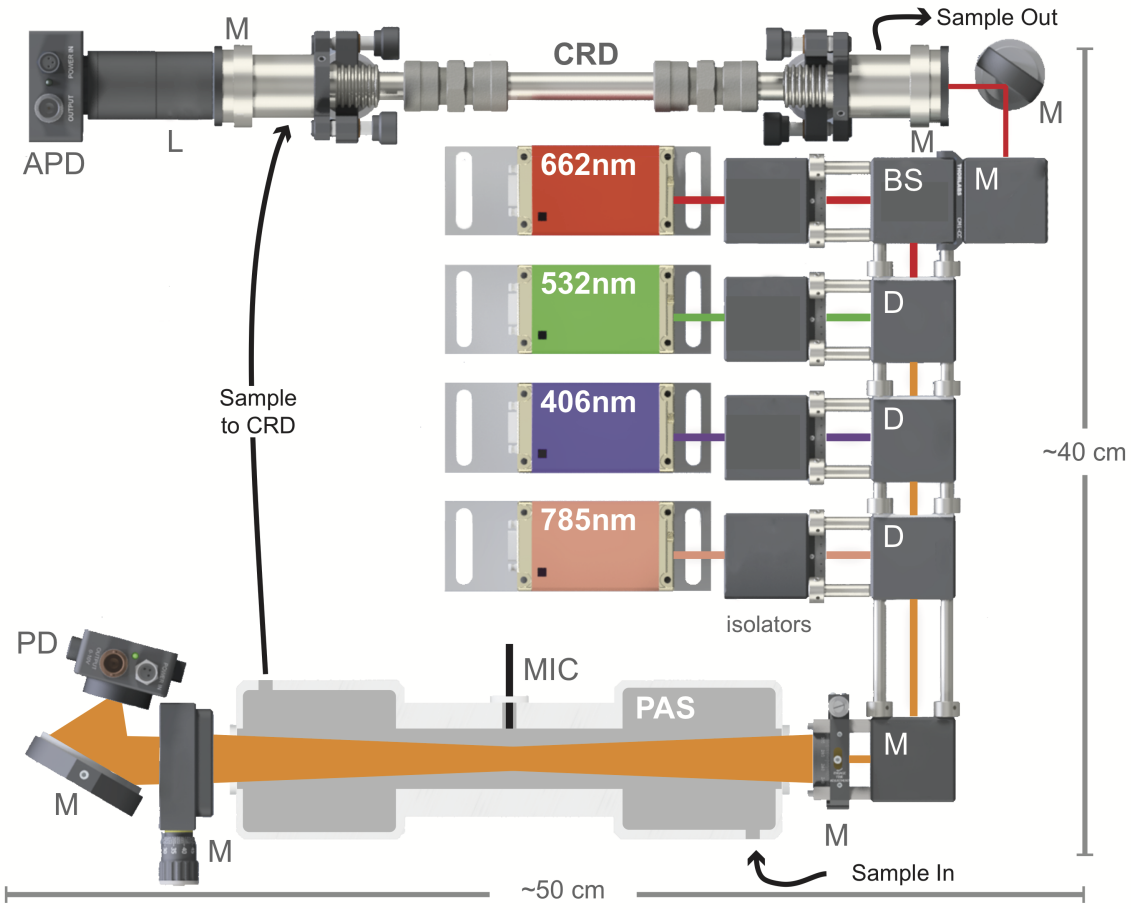
***MultiPAS-III/IV***

*Multi-laser photoacoustic spectrometers*



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Placeholder

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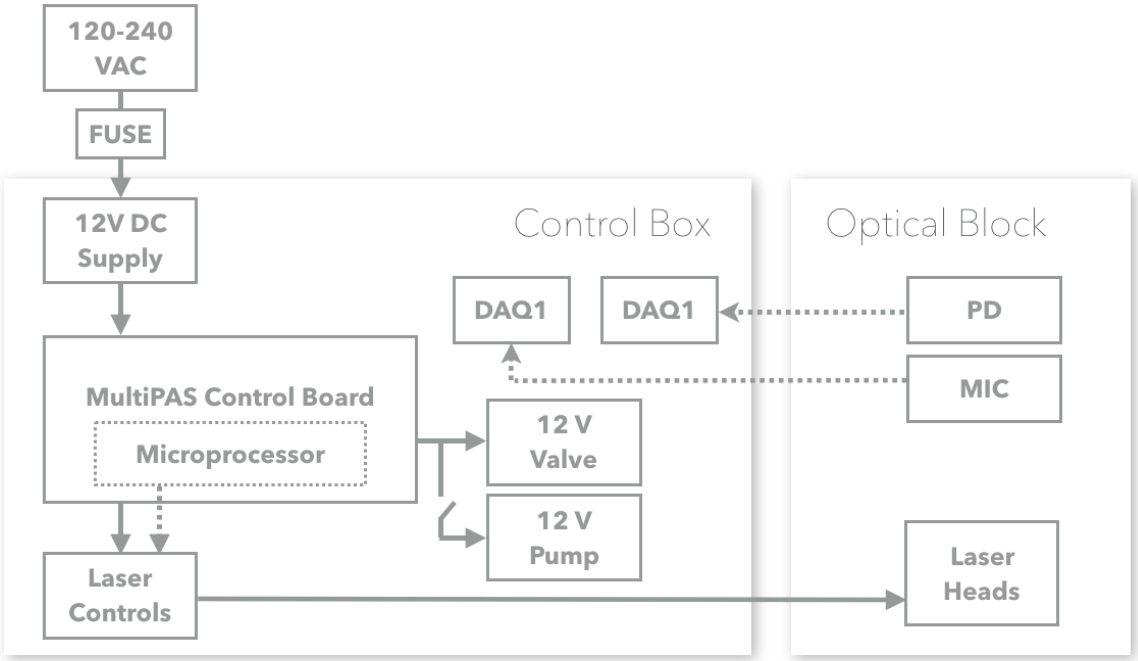
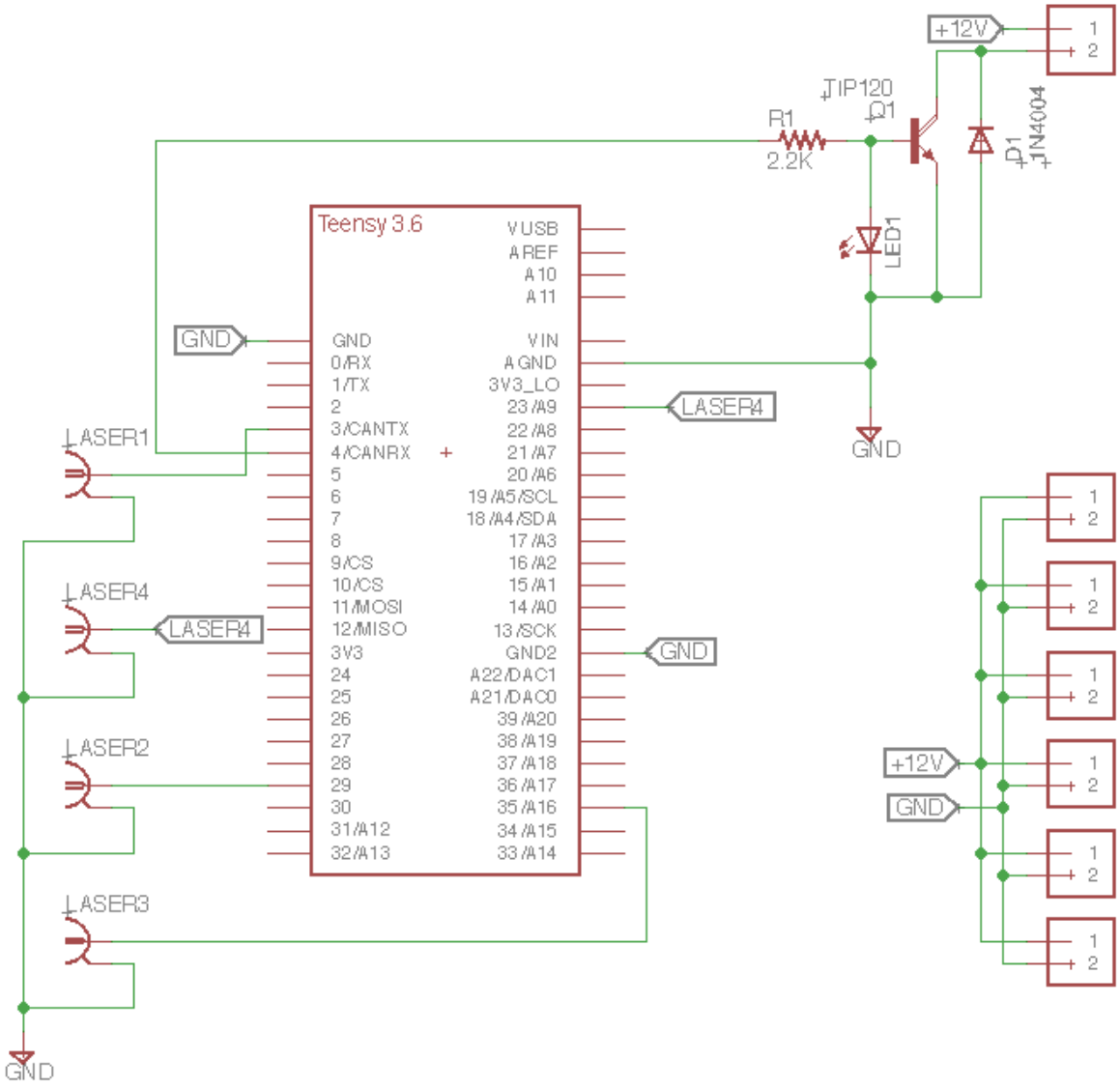
***Unplug all power before any electrical work on the PAS or opening the control box!***

A genralized 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.


Teensy 3.6
VUSB
AREF
A10
A11
GND
0/RX
1/TX
2
3/CANTX
4/CANRX
5
6
7
8
9/CS
10/CS
11/MOSI
12/MISO
3V3
24
25
26
27
28
29
30
31/A12
32/A13
VIN
AGND
3V3_LO
23/A9
22/A8
21/A7
20/A6
19/A5/SCL
18/A4/SDA
17/A3
16/A2
15/A1
14/A0
13/SCK
GND2
A22/DAC1
A21/DAC0
39/A20
38/A19
37/A18
36/A17
35/A16
34/A15
33/A14
GND
LASER4
GND
+12V
TIP120
Q1
R1
2.2K
D1
1N4004
LED1
GND
LASER1
LASER4
LASER4
LASER2
LASER3
GND
+12V
GND
1
2

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# 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 aquisition (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 realigment procedure.