QSD Monitoring Network
Multiple Thermocouple and Photodiode PCB

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In most cases, we will want to read in several thermocouples and photodiodes signals from different sources, all from the same microcontroller. For the temperatures, many of the MAX31855K breakout boards could be connected together. However, for a neater solution, custom PCBs were designed and assembled, as in Fig. 1. Each PCB allows x12 photodiodes, and x8 thermocouples. The latter makes the board useful when performing a vacuum bakeout, for example, when many locations on the chamber need to be simultaneously measured.
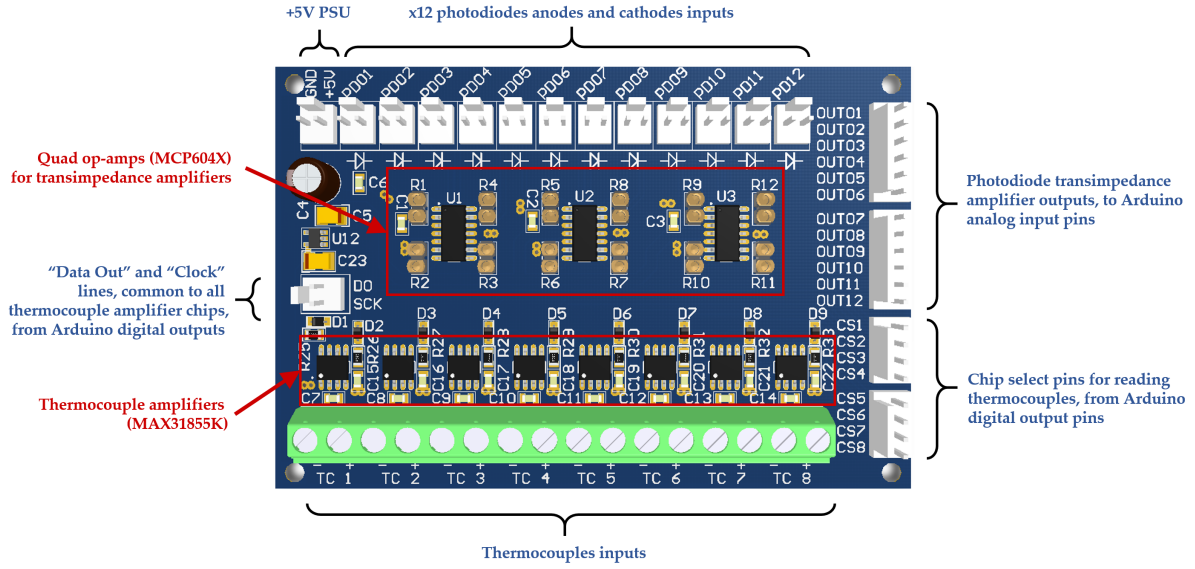

FIGURE 1: PCB for reading multiple temperatures and laser powers. The board allows x8 thermocouples and x12 photodiodes to be read.

The design is based on the MAX31855K breakout board, and incorporates independent amplifier chips - one per thermocouple. However, there is only a single +3.3 V regulator (*LP2981-N*) shared amongst all chips, along with a single set of decoupling power supply capacitors. All amplifiers also share common 'Data Out' (DO) and 'Clock' (SCK) lines, reducing the number of digital output pins required. Each amplifier chip still requires its own dedicated 'Chip Select' (CS) pin, which indicates to each one that it's time to read data. All thermocouple headers have 10nF capacitors across the terminals to reduce noise, as well as the digital pins having a resistor-diode combination to make the pins both 5 V and 3.3 V tolerant, for compatibility with different microcontrollers.

For the photodiodes, the PCB includes x3 MCP6044 op amps, which are quad versions, and therefore allows x12 photodiodes to be amplified. The op amps are configured in transimpedance configuration, as described in the documentation *Measuring Laser Beam Powers*, and have sockets for through-hole axial resistors to be swapped out easily for changing the amplifier gains.

Multiple Thermocouple and Photodiode PCB Schematics

Sheet Title: Photodiode Amplifier
Project: Photodiode and Thermocouple Amplifier.PrjPcb
Drawn By: T. Barrett   Size: A4   Sheet: 1 of 2   University of Sussex
File: Photodiode Amplifier.SchDoc   Rev. A   Date: 19/03/2018
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Sheet Title: Thermocouple Amplifier
Project: Photodiode and Thermocouple Amplifier.PrjPcb
Drawn By: T. Barrett   Size: A4   Sheet: 2 of 2   University of Sussex
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