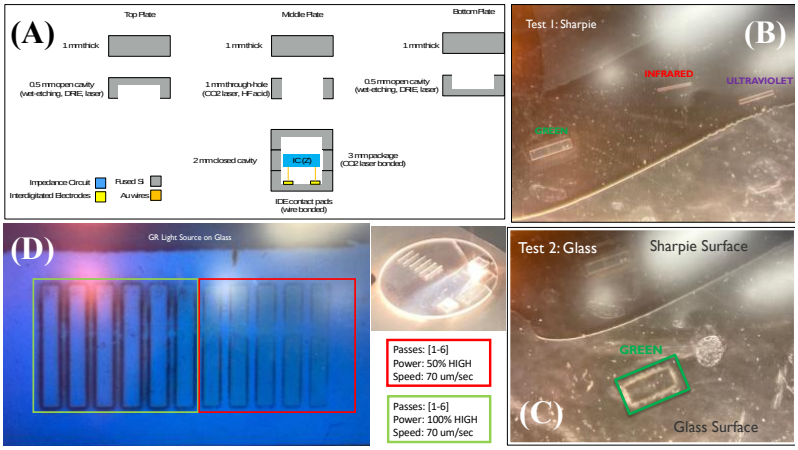


Fig. 1. Laser micromachining approach for fused silica material. (A) Hermetic packaging conceptualization using 3 layers of fused silica **[5]**. Top and bottom layers are micromachined to create a cavity housing the IC and biosensor system. (B-C) Multimodal laser micromachining on fused silica. Green laser source engraved the material surface (D) Green laser micromachining parametrization at 50 and 100% power with a varied number of passes.

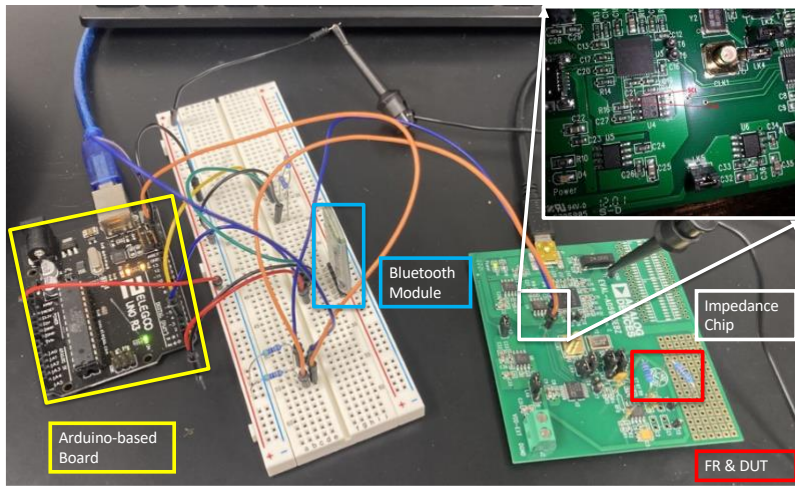


Fig. 3. Macrosystem integration of the data acquisition system. Main components: Arduino-based board, Bluetooth module, and AD5933 evaluation board. Miniaturized impedance converter system (Right). Communication protocol was I^2C, Rx/Tx established through SCL (clock) and SDA (data) signals. Feedback resistor (FR) is required for impedance measurements calibration, and device under test (DUT) was 1 kΩ resistor.

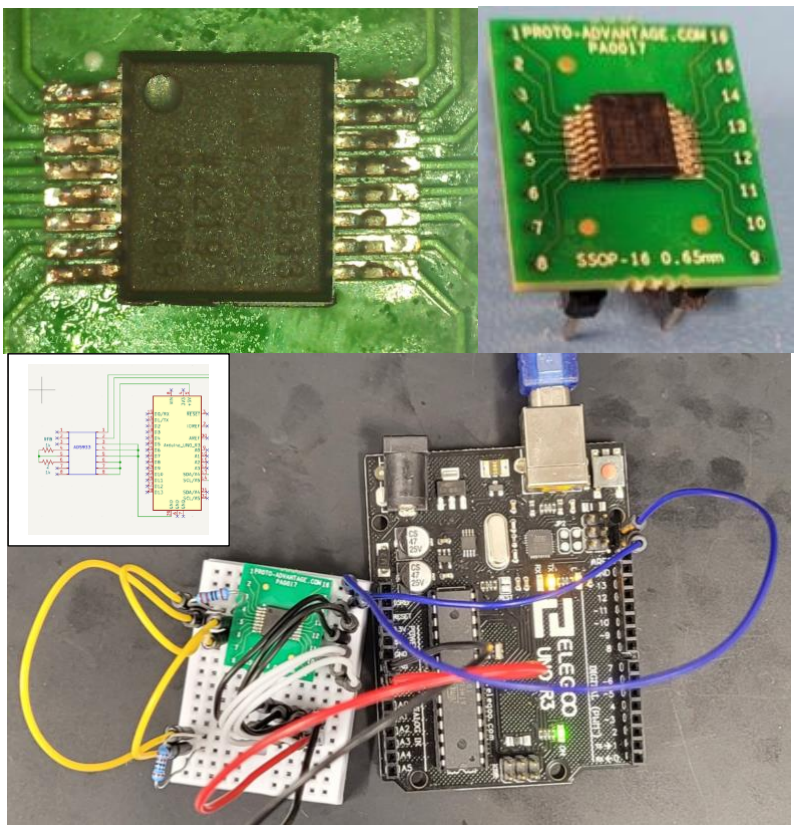


Fig. 4. Impedance converter miniaturization. AD5933 chip is isolated from evaluation board and programmed through Arduino-based board following the IC design (inset).

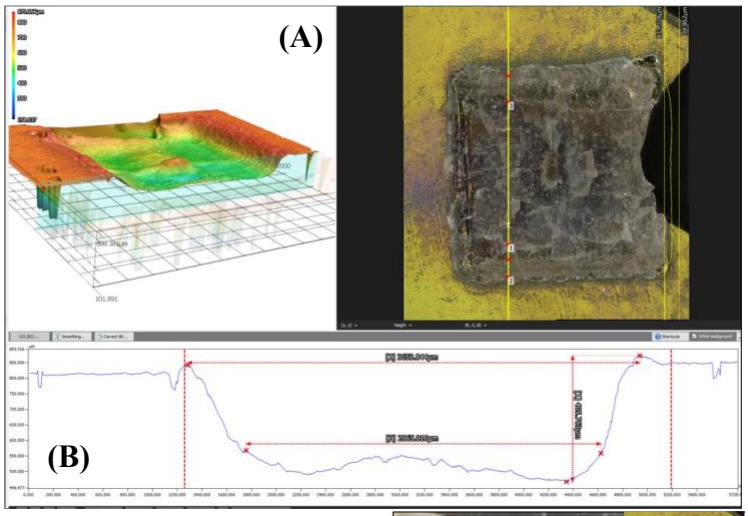
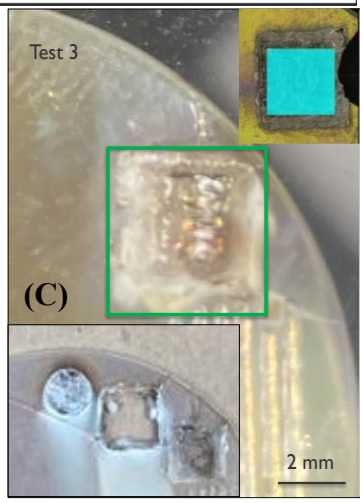


Fig. 2. Laser confocal characterization and fused silica micromachining using CO_2 laser technology. (A) 3D surface profile of a square cavity (~4 mm each side). (B) Vertical profile of cavity (Depth: 402 µm, Width_Top: 3818 µm, Width_Bottom: 2968 µm). (C) Fused silica processing results showcasing cavity engraving (square & circle) and through-glass via (TGV). Cavity surface roughness was also procured resulting in Sa: 33 µm (average), and Sz: 378 µm (max-min difference).

Feature: TGV
Mode: Engrave
Speed: 100
Power: 20
Lines/inch: 340
Pass: 2
Repetitions: 5

Feature: Cavity
Mode: Engrave
Speed: 500
Power: Full
Lines/cm: 180
Pass: 2



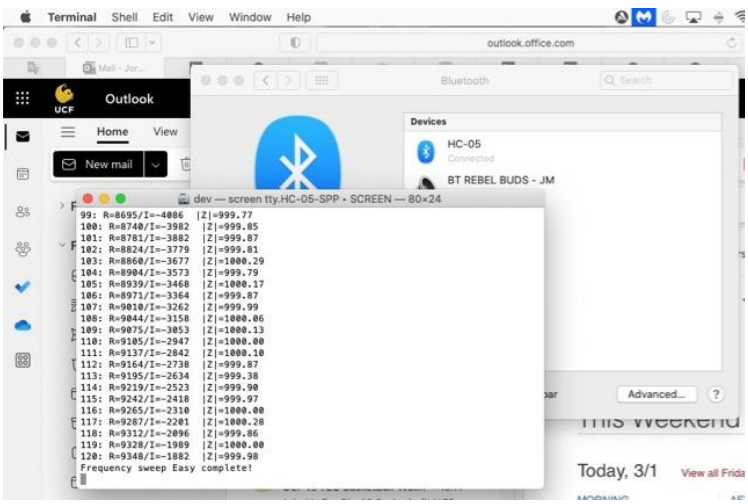


Fig. 5. Macrosystem impedance measurement testing for a 1 kΩ resistor. Laptop was connected to the system through Bluetooth communication (HC-05 device). After running the Arduino customized sketch **[6]**, real (R), imaginary (I), and magnitude (1Z1) are wirelessly sent, and continuously displayed in the computer terminal.

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[6] https://github.com/mjmeli/arduino-ad5933