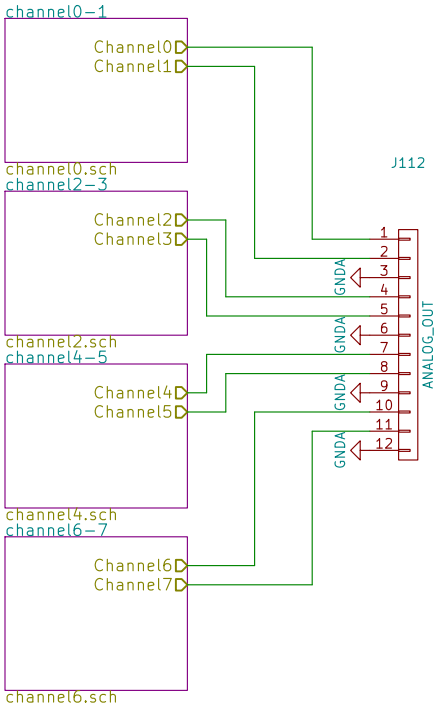
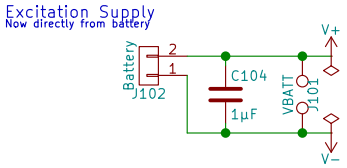
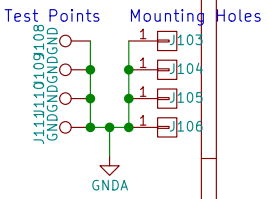
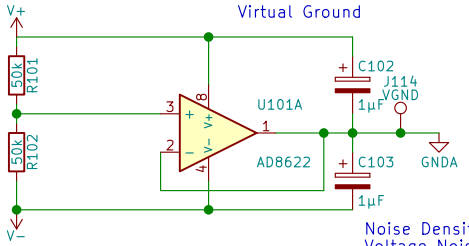
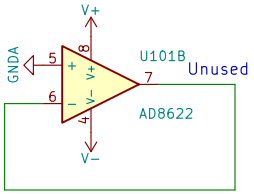








Noise Density: 12nV/√Hz
Voltage Noise (0.1-10Hz): 0.2uV p-p
Offset: <125uV
Drift: <1.2uV/°C



Notes:

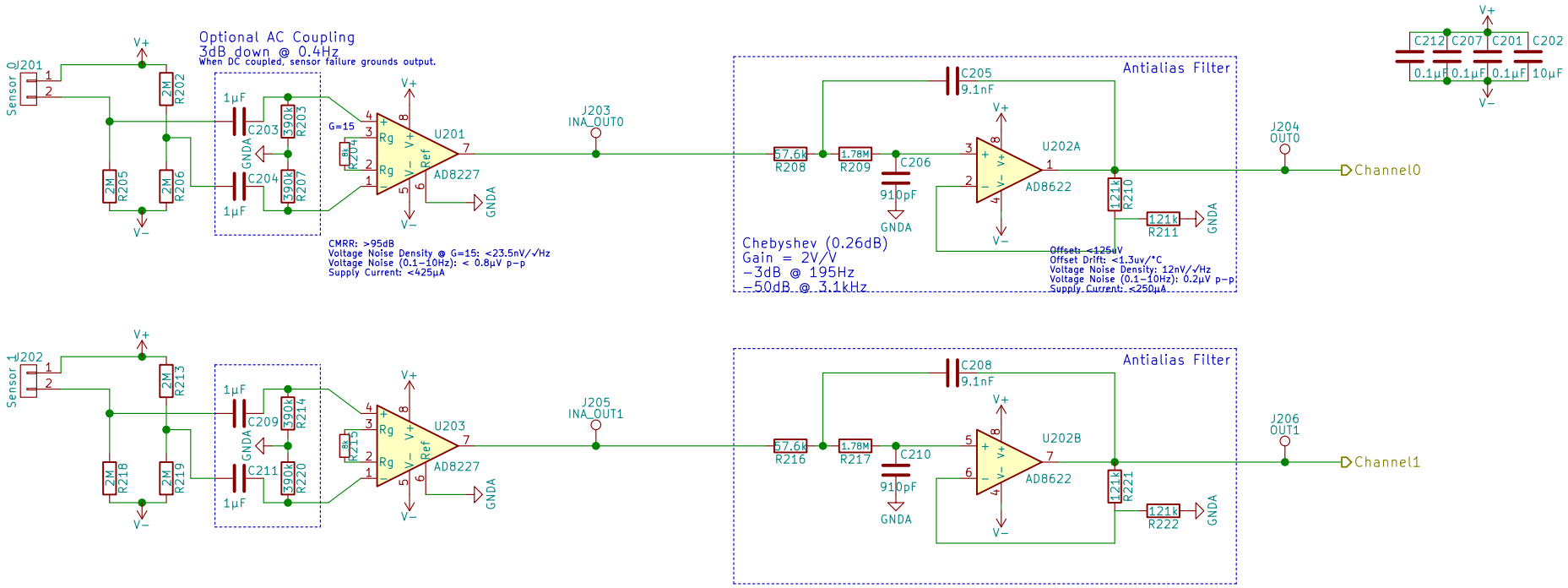
R101,R102: Resistor pack for good match

Monadnock Systems

Sheet: /
File: bmi-8ch.sch

Title: Polymer Sensor Amplifier

Size: USLetter	Date: 2017-03-26	**Rev: AB**
KiCad E.D.A. kicad 4.0.6		Id: 1/5



Notes:
Designed for +–Vbatt/2 Output (INA is only gain element)
May damage ADC if input range is <= +–VBATT/2

R204, R213: 0.1%
R208, R209: 1%
R202, R205, R206 & R203, R207: Metal Foil / Thin Film (Resistor packs preferred)
ALL C: 5%, 16V

Assumptions:
- (Initial) DAQ is MCC USB–1208FS (available at BMI)
  11–bit, max 6250 S/sec for each channel; sequential
- Target Bandwidth: 195Hz
- Sampling Rate 6240 S/s
- Sensor resistance 2MΩ
- Respiration motion changes sensor resistance by < –+10%

Problems:

- USB–1208FS has fixed single–ended range of +– 10V
  - Reduces ENOB to 11 if running on 5V supply
  - Drop in upgrade to USB–1608FS (16bit and variable range)
  - Can be substantially mitigated initially by running on 18V via two 9V batteries.

Open Questions:

1. Trimming the bridge.
   - Only makes sense w/ DC coupling
   - Bad tempco
   - Bad UX
   - Needed for significant gain

2. AC vs DC Coupling; both have advantages: AC is easier

3. Reducing R202,R203,R206,R207 to decrease Johnson noise: Probably useless.
   - Changing R202,R206 may break INAMP CMRR

4. Use chopper amps in signal path: Probably bad
   - Lower total noise for *extremely* small bandwidths (<5Hz?)
   - Lower offset (if DC coupled)

5. Driven shields for output: Probably useless
   - Reduce error due to leakage current
   - No analysis done to determine if this is significant
   - Current DAQ isn't likely to benefit

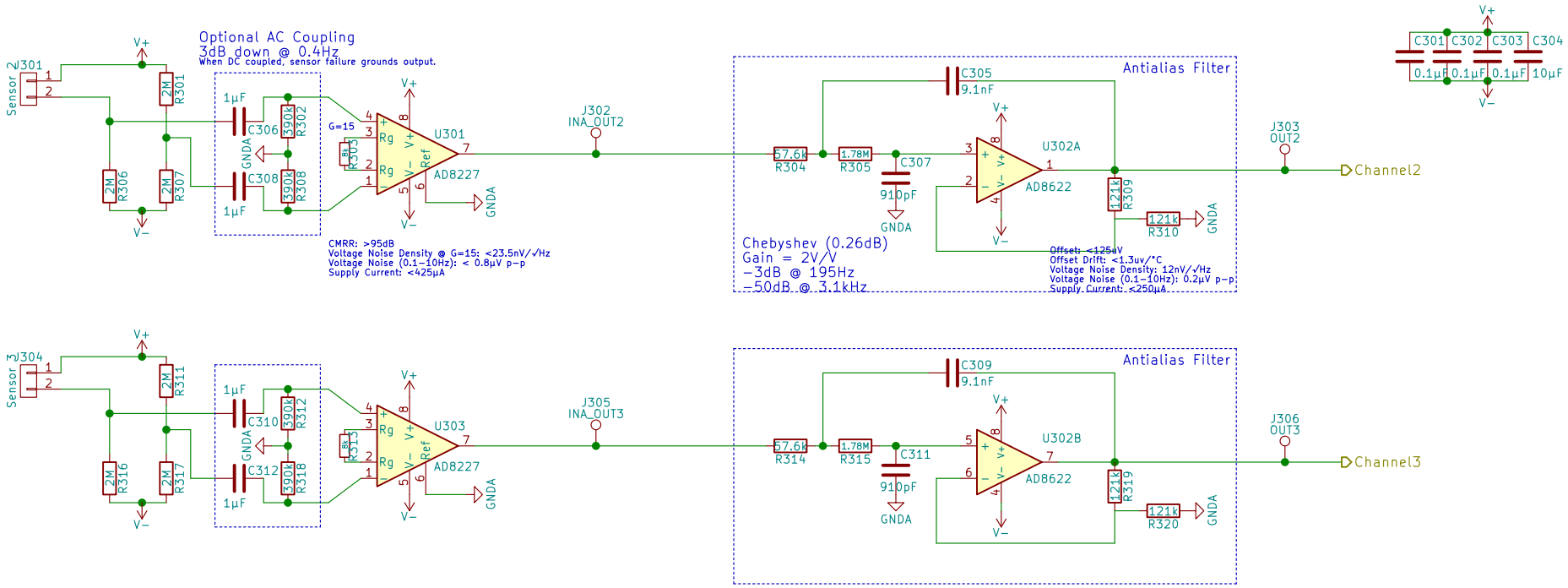
Analysis Notes:

1. Steep digital filter 0.4–175Hz
   - Respiration typically 0.25–0.33Hz
   - Narrower useful bandwidth likely, modeling needed.

2. Correct for temporal offset of sample due to sequential sampling.

3. 2x decimation for 13–bit (ENOB) and noise reduction

Monadnock Systems		
Sheet: /channel0–1/		
File: channel0.sch		
Title: Input Channel 0 & 1		
Size: USLetter	Date: 2017–03–26	**Rev: AB**
KiCad E.D.A. kicad 4.0.6		Id: 2/5



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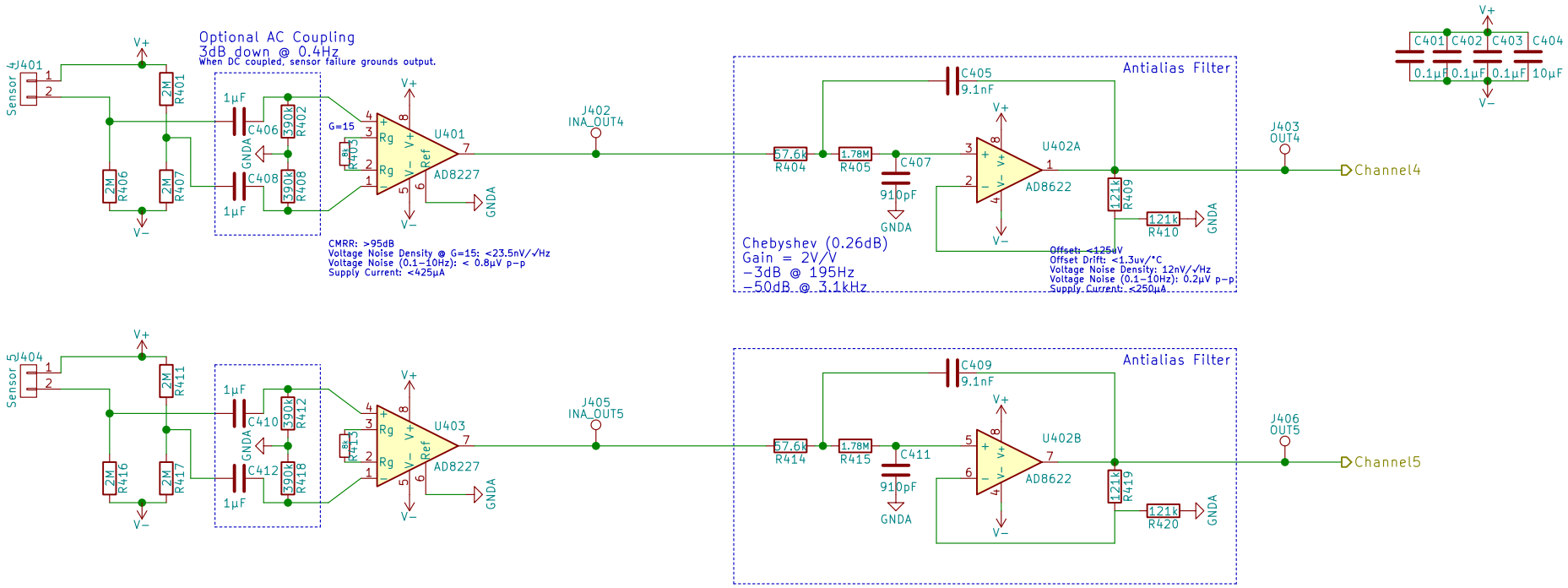
Monadnock Systems

Sheet: /channel2–3/
File: channel2.sch

Title: Input Channel 0 & 1

Size: USLetter	Date: 2017–03–26	**Rev: AB**
KiCad E.D.A. kicad 4.0.6		Id: 3/5



Notes:
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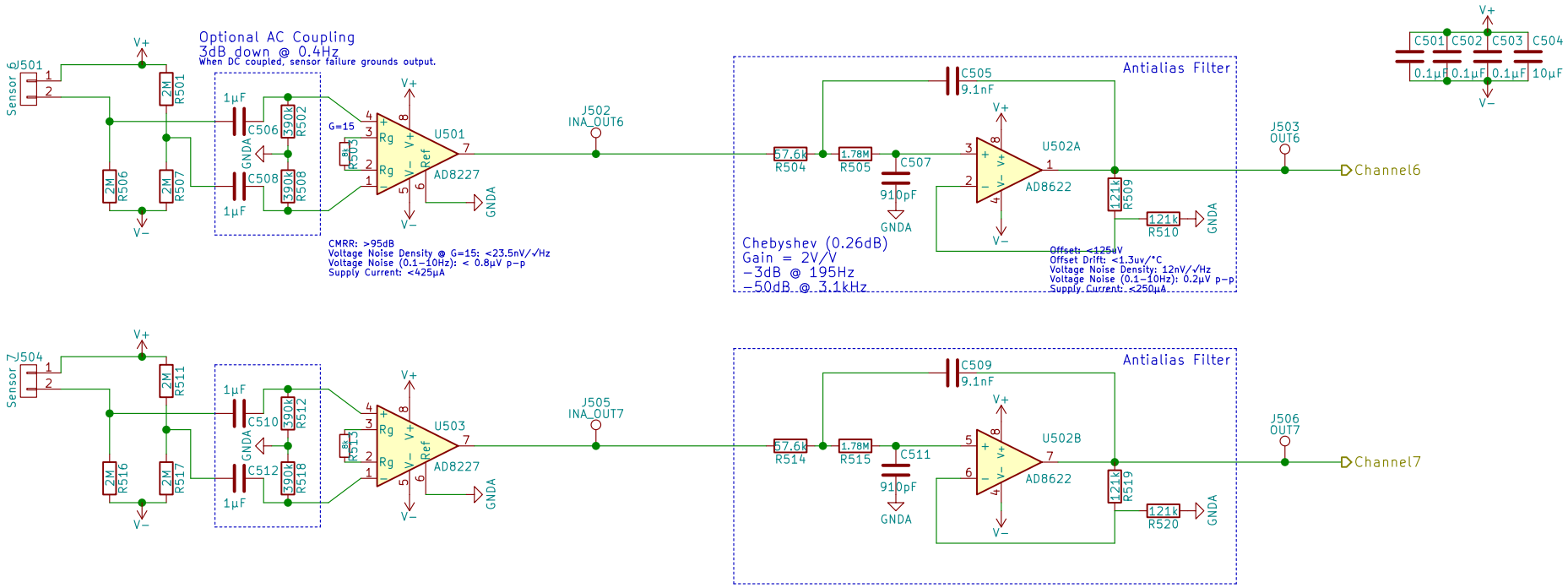
Monadnock Systems

Sheet: /channel4–5/
File: channel4.sch

Title: Input Channel 0 & 1

Size: USLetter	Date: 2017–03–26	**Rev: AB**
KiCad E.D.A. kicad 4.0.6		Id: 4/5



Notes:
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May damage ADC if input range is <= +–VBATT/2

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R202, R205, R206 & R203, R207: Metal Foil / Thin Film (Resistor packs preferred)
ALL C: 5%, 16V

Assumptions:
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Monadnock Systems

Sheet: /channel6–7/
File: channel6.sch

Title: Input Channel 0 & 1

Size: USLetter	Date: 2017–03–26	**Rev: AB**
KiCad E.D.A. kicad 4.0.6		Id: 5/5