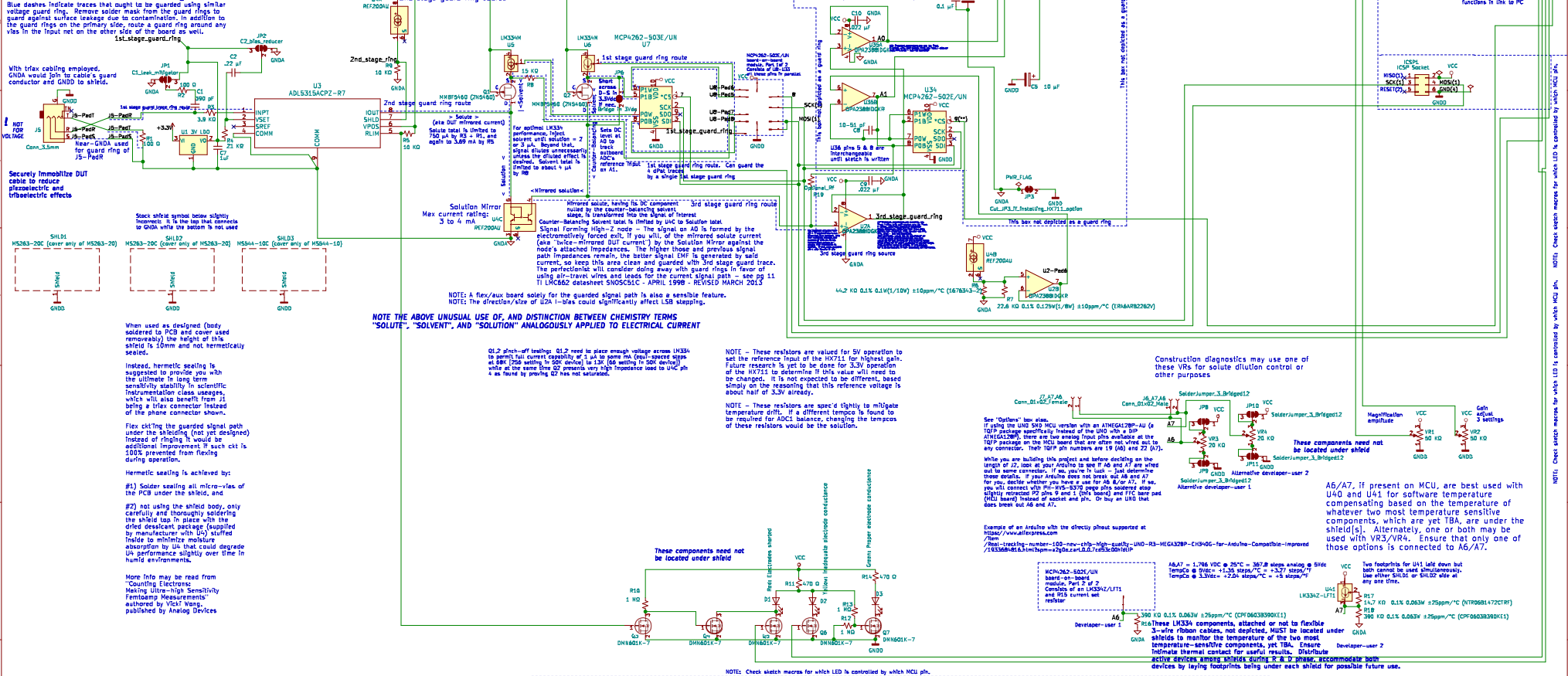


Options Box: 3 Vdc (Instead of 5Vdc) – Q2 unused, solder–short Q2 footprint D to S, possibly lower sensitivity result, verify ICSP1 power as desired  
HX711 – Use only for extreme sensitivity; will then require C5 and C6 and the specified PCB version  
A6 and A7 – These Analog Inputs are found on some of the better UNO Arduino boards, but all SMD UNO –AU boards have capability for the hacker who is willing to tap onto pins 19 and 22 of the ATMEGA328P–AU. Jumpers 7 & 12 allow purely optional name switch at P2 Power/Reset header.  
Triax cable from J5 – shield would be GNDD  
JP1 and JP2 – UNTESTED if either or both are changed to other side with cut and solder, they can prolong lives of C1/C2.  
HX–05 – UNTESTED and no code developed. Various wirings exist of this board. Ensure which jumper configuration for your style. Intended to allow an alternative to USB communications for plotting  
Alternative Op Amps – Careful: I–bias linearity of U2A is very consequential  
R19 Rf – Value might be in the G Ohms



**NOTE: Except where indicated otherwise, component part numbers and vendors are suggested based on likely imperfect research of pricing and availability for the USA in the spring of 2019.**

## Helpful Parts Not In Circuit

- 1 mil Polyimide (Kapton) tape 3/8" wide 6' length or greater. Use as electrical insulator and place aside. P/N 3507 from Arrow or equivalent
- 30ga magnet wire for trace repairs. P/N 3522 from Arrow or equivalent
- Solder wick P/N TOL-09327 from Arrow or equivalent
- Soldering calphony (gine or gum ROSIN – NOT with zinc nor ammonium chlorides) flux (can make it yourself)
- RG16 Coaxial cable 5m/6ft min length
- Multi-conductor flat IDC /ribbon cable or hookup wire. P/N 2001 to 2006 or 119990044 made in China from Arrow
- Electrode clamps: one per leaf electrode. Having attachment means and gripping spring somewhere along hinge axis and having enough suspending points spread out to hold clamsell in any specific orientation needed.
- 2 Electrode clamps: custom made from white or ivory color "kayak"–both No nonsense inner high 100% nylon socks MADE IN USA /PNC 7001119323 (https://www.spindex.com/7001119323), partially filled with craft-spec styrofoam balls, aka "beads" or "beans", approx. 3mm dia. Per Kayser Robt Consumer Care: "You are able to order the Nonsense lines right on our online website nopsense.com. If you are wanting to order them locally you might be able to find them at a Shop–Rite, Walgreens, Rite–Aid, Food Lion, Harris Teeter, HEB, CVS, or local supermarkets around you. Yet I actually found them at Wal–Mart.
- Electrode suspension device of your own making that won't sink into ground and extends a guy springs hang both above DUT
- Carbon fiber tow, non–impregnated with a gold–plated transition pin per electrode (we have no source yet, but "non–impregnated" basically means "not the sticky type"). The transition pin will interface between the carbon fiber and wiring to the receptacle that receives the coaxial cable plug. Ensure that conductor material transitions are both (excitation/sense side and return sides of the coax cable) identical so the transitions' galvanic voltages cancel out.
- Blunt angled or bendable dispensing needle 18ga (eBay or dentists) with syringe body+finger–valved hole, tube, vacuum pump or modified aquarium pump working in reverse

NOTE – Very high temp solder (<100) not allowed on U4. The best solder will always be "No Heat SAC305" if you can find it, but you still MUST cleanse gold from leads. Avoid Pb (leaded) solder unless you understand the behavior of eutectics, how Pb ruins other solders, and how gold from EHC ruins Pb solder.

## NOTES FOR FABRICATION:

THIS DATA OVERRIDES ANSWERS GIVEN IN QUESTIONNAIRE:

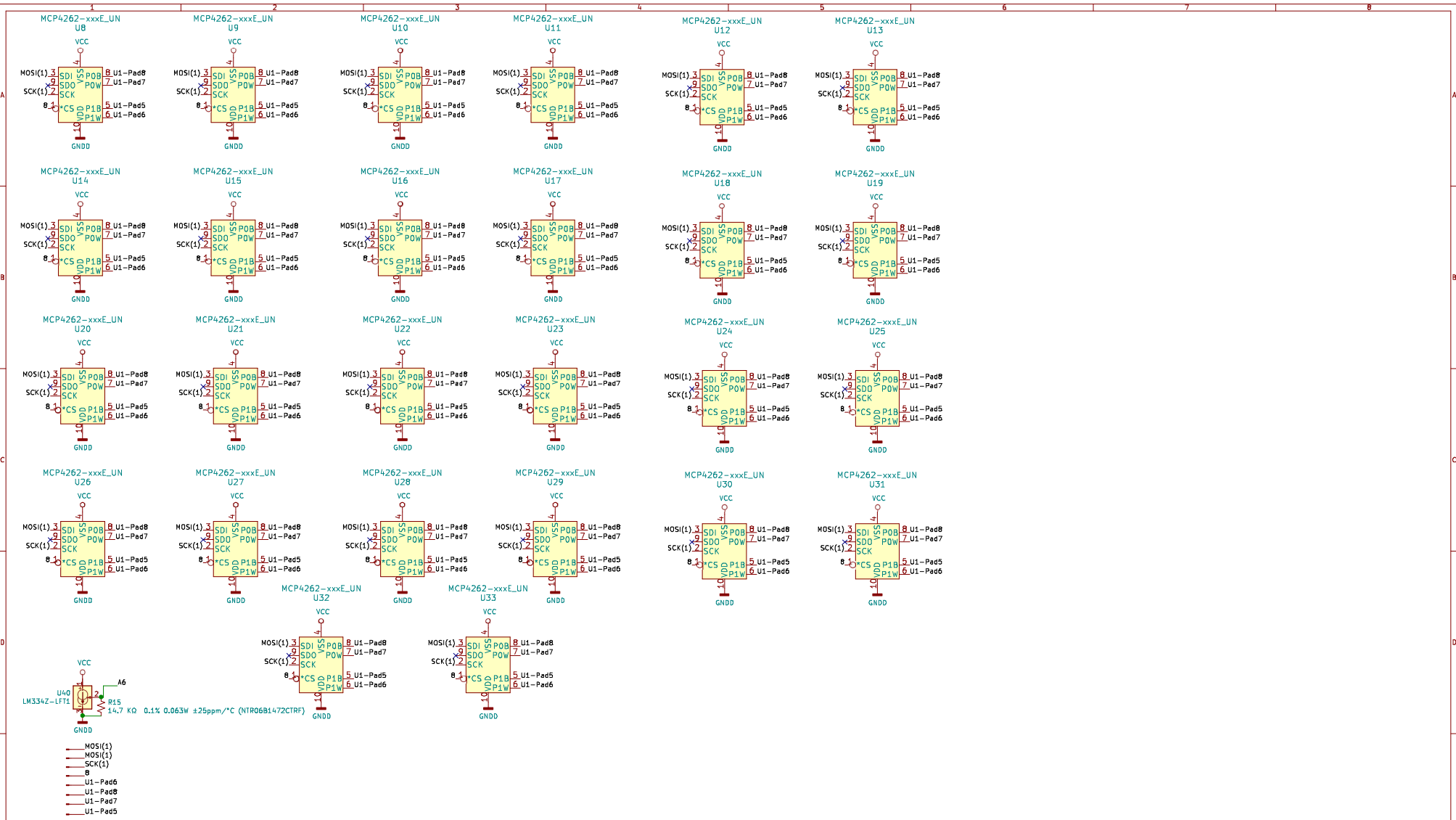
Layers = 2  
TG material is 170 or greater FR4  
Board thickness smaller section = .8  
Board thickness larger section = .8 to 1.6 as convenient  
Min hole size = .254 mm = 10 mil  
Min track spacing = .2 mm = 7.87 mil  
Default solder mask, both sides  
White silkscreen, both sides  
Not high frequency  
Not controlled impedance  
Not gold fingers  
Preferred surface = lead free HASL  
Cu weight = 2 oz

FOLLOW GERBERS EXACTLY INCLUDING:

- If this design has 2 mm holes shown between sections, those holes are not plated, and the number of layers is 1, 2, 3 for End User, not counted in above numbers
- off–center holes in pads,
- dangling net traces,
- a single sided Through Hole pad,
- silk screen on copper,
- solder mask customizations,
- solder paste customizations

## NOTES FOR ASSEMBLY:

- Number of unique parts: 27
- Number of SMT parts: 69
- Number of fine pitch parts: 29
- Number of leadless placements: 1 with bottom pad
- Resistors R6, R7, R15–18 are 0.1% values and minimal temperature co–efficients
- Leave assembly of U4, U40, U41 for End User, not counted in above numbers
- Leave assembly of Through Hole components for End User, not counted in above numbers
- Leave assembly of shield components for End User, not counted in above numbers



1 step MSB is 50000 ohms per device/256 steps per device = 195.3125 ohms = 195 ohms  
5000 ohms LSB:  
a single LSB device full resistance is 5000 ohms per device  
number of LSB devices to parallel together to make their full resistance value equal to 195 ohms is 5000 ohms per device/195 ohms = 25.6 devices  
cost = \$25 + flex board a little larger size  
Alternate design under consideration 1000 ohms LSB:  
a single LSB device full resistance is 1000 ohms per device  
number of LSB devices to parallel together to make their full resistance value equal to 195 ohms is 1000 ohms per device/195 ohms = 5.13 devices  
Equivalent 2 devices/package, so 3 packages @ \$6/pkg = \$18 for savings of \$7 or so and a much smaller flex board but with a different pinout of both the flex connector and the MCU connector from which it will consume one more digital pin.

Sheet: /Quantum_MCP4262-502_25x_expansion_new_flex_for_GWAAM-Sea_Aid/		
File: Quantum MCP4262-502 25x expansion new flex for GWAAM-Sea Aid.sch		
<b>Title:</b>		
Size: A3	Date:	Rev:
KiCad E.D.A.	KiCad 5.1.4-e60b26684ubuntu16.04.1	Id: 2/2